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Testing Biological Controls for *Heliothrips haemorrhoidalis* (Thysanoptera: Thripidae), a Serious Pest of the Morris Arboretum Greenhouse Complex

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An independent study project report by The John J. Willaman and Martha Haas Valentine Endowed Plant Protection Intern (2017-2018)

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Disciplines
Botany

Comments
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ABSTRACT:

The greenhouse thrips (*Heliothrips haemorrhoidalis*) is a serious pest of fruits and ornamental plants. In the Morris Arboretum's greenhouse complex, this thrip has been prevalent, and could cause major damage to the young plants that are being propagated. The purpose of this project was to search for a suitable biological control of the thrips since chemicals have only been marginally effective. A predatory spider mite (*Amblyseius cucumeris*) and minute pirate bugs (*Orius insidiousus*) were chosen for the study. The results suggest that the minute pirate bugs are highly effective at hunting thrips, while the spider mites had no measurable effect.

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INTRODUCTION

The greenhouse thrips, *Heliothrips haemorrhoidalis* Bouche, is a serious pest of various ornamental and crop plants. Originally a native to South America, the insect was transported to Europe, and then North America via tropical plant movement. In the United States, the thrips can be found outdoors on wild and cultivated plants. In the northern states, however, the winter climate is too cold for the thrips to survive, thus they are more commonly found inside greenhouses or in other interior plantscapes (Stevens et al. 1999).

The larvae of *H. haemorrhoidalis* are pale yellow with red eyes. As they mature, they turn black bodied with yellow legs, and the fringed forewings visibly converge dorsally. Greenhouse thrips have piercing-sucking mouthparts that they use for sucking sap out of plant tissues (Polilov and Shmakov 2016). Another important characteristic of this thrip is that it excretes a black liquid that is often deposited on the surfaces of the leaves. When the population grows large, damage from these thrips cause the leaves to turn a silver or brown color, and in severe cases, can cause leaves to drop prematurely. On fruit crops, the thrips can cause rind blemishes and fruit drop (Stevens et al. 1999).

At the Morris Arboretum, this species of thrip has been one of the most serious pests to plague the greenhouse complex. The need for treatment is especially dire due to the amount of young plants that are propagated in the greenhouse. If left unchecked, the thrips can cause an entire plant to die. Chemical controls such as spinosad have been used with varying effectiveness, but nothing has been able to provide adequate control; the pest has always resurged after a few weeks. This is probably because getting thorough coverage of the leaves is difficult, and the eggs are protected by the thrips' excrement, rendering chemical controls ineffective against eggs. Biological controls may be a better case in this situation because predators or parasitoids can actively hunt for thrips and can possibly predate on multiple life stages.

So far, only one effective biological control exists, but it is not yet commercially available (McMurty and Badii 1991). There are other, more general biological controls that have been studied, but few have been evaluated for their effectiveness against greenhouse thrips specifically. Therefore, for this project, the goal is to evaluate different biological control treatments for these thrips to prevent further damage. This study could potentially benefit other gardens in which thrips have become a problem.

Methodology:

Part I: Rearing thrips for the study

For the first part of this project, sufficient numbers of the pest had to be reared. To do this, small camellia seedlings (*Camellia sinensis*) were dug up from a site at the Arboretum and potted. These plants were kept in small isolation chambers to prevent the spread of the pest. Over the course of several months, thrips from around the greenhouses were collected and transferred onto the camellia seedlings and left undisturbed, except for occasional transferring of thrips to other plants to promote a more even spread. Before the application of controls, the camellias were separated into three groups of eight reps, and the number of thrips on each plant was counted.

Part II: Implementing the controls

The next part of the project involved applying biological controls. Two control agents: *Orius insidiousus* (Hemiptera:Anthocoridae) and *Neoseilus cucumeris* (Acari:Phytoseiidae) were chosen based on their affinity for thrips. Activity of the control agents was measured based on how many thrips were on the camellia seedlings from week to week. The minute pirate bug, *Orius insidiosus* is a voracious predatory insect that purportedly has an affinity for thrips. The predatory mites, *Neoseilus cucumeris* have also been said to be effective predators of different thrips.

Results:

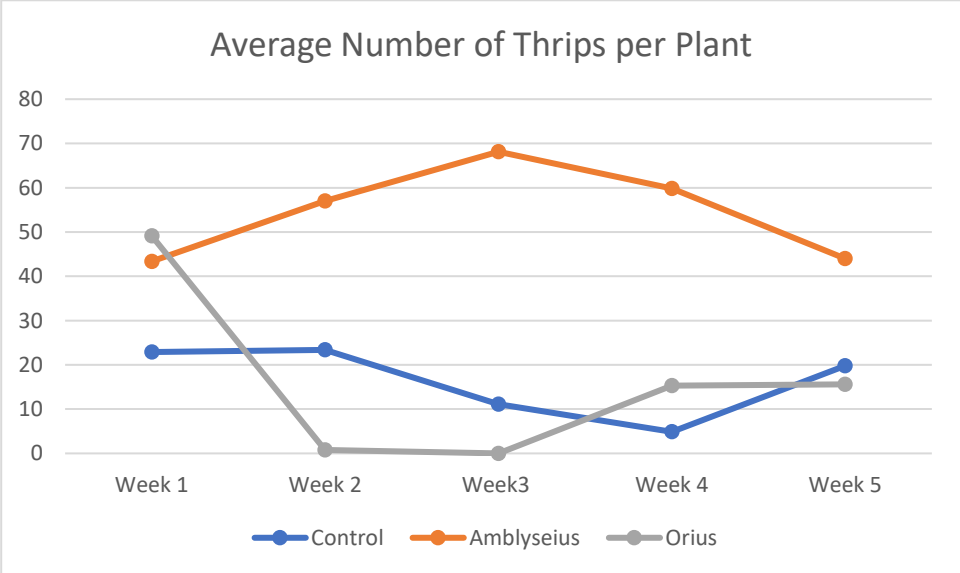
Table 1: Total sum of thrips for each week

	Week 1	Week 2	Week 3	Week 4	Week 5
Control	183	187	89	39	158
Amblyseius	347	456	545	419	308
Orius	393	6	0	107	109

Table 2: Average number thrips/plant

	Week 1	Week 2	Week 3	Week 4	Week 5
Control	22.875	23.375	11.125	4.875	19.75
Amblyseius	43.375	57	68.125	59.857	44
Orius	49.125	0.75	0	15.285	15.571

Figure 1: Rate of thrips population growth based on average number of thrips per trial



The results suggest that the minute pirate bugs, *Orius insidiousus* were the most effective biological control. This control method had a 100% success rate after two weeks of activity. The population of thrips started to resurge after week three, but that is likely due to the pirate bugs dying, and another application would swiftly take care of the problem. The spider mites seemed to have no effect on control of thrips at all, and the population continued to grow after the application of the mites.

Discussion:

While this project is a good start for managing greenhouse thrips, there are still several limitations for the project that time did not allow to explore. There were also limitations to the amount of reps that could be completed due to time and resource constraints. Having more reps would make for a more statistically valuable study. The rearing process was problematic because it was difficult to get the insects to spread evenly across all the plants and the damage caused by the thrips would often cause the plants to die or completely defoliate within the incubation period.

There are also many research opportunities that can be explored beyond the scope of this project. For instance, using a combination of control methods is very important, as the insects can quickly develop resistance to just chemical controls. However, figuring out which chemical and biological controls are compatible with each other can be difficult and time consuming. Should this project be carried on further, one should create a program that combines different chemical and biological controls for more efficient control. Plus, there would need to be a more long-term monitoring program, since the pest can often resurge after some time.

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