



Examining two *Dicyphus* species (Hemiptera: Miridae) for their potential use as biological control agents on greenhouse tomato.

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BACKGROUND

Greenhouse tomato cultivation represents a major component of Canada's horticultural production, valued at \$666 million in 2021¹. Threats to this crop include the greenhouse whitefly, western flower thrips and two-spotted spider mites, all generalist pests with impacts on multiple greenhouse crops. For these pests, biological control can represent an effective control strategy and a way to mitigate both resistance to pesticides^{2,3} and their impacts on other beneficial arthropods. Generalist omnivores can both control a diverse range of pests and persist on host plants in the absence of prey⁴. Furthermore, application of native predators eliminates biosecurity concerns posed by introductions of exotic biocontrol agents. There are already a number of different mirid biocontrol agents worldwide, including *Dicyphus hesperus* in Canada. Thus in the context of this research, we explored the biocontrol potential of two native Ontario mirids; *Dicyphus discrepans* and *Dicyphus famelicus*.

To assess the potential for these predators to control tomato pests, we will:

1. Determine their maximum feeding capacity in cup assays
2. Compare their longevity and fecundity on a variety of host plants
3. Measure the dynamics of their populations on whitefly-infested greenhouse tomato crops.



Dicyphus discrepans



Dicyphus famelicus

MAXIMUM FEEDING CAPACITY

Maximum feeding capacity is a measure of the number of pest individuals consumed within a 24-hour period under controlled environment conditions. In cup assays, the feeding capacity of *D. discrepans* and *D. famelicus* will be determined using greenhouse whitefly, two-spotted spider mites and western flower thrips. *D. hesperus* will be used as a positive control. Predators were:

1. Starved for 24 hours
2. Provided excess prey in a feeding arena
3. Allowed to feed for 24 hours

Following the feeding period, consumed prey were counted.



Dicyphus hesperus
positive control



Greenhouse
Whitefly



Two-spotted
Spider Mite



Western
Flower
Thrips

PRELIMINARY RESULTS:

- *D. hesperus* consumed more adult spider mites ($p=0.00003$) and immature whitefly ($p=0.0103$) relative to *D. famelicus*.

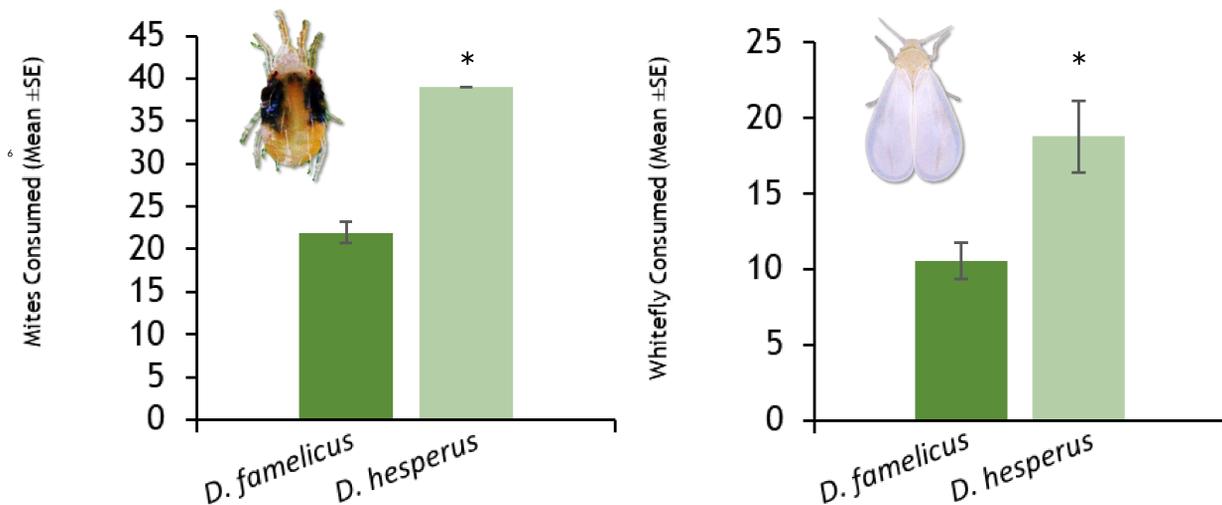


Figure 1: Average individuals consumed by female *D. hesperus* and *D. famelicus* adults.

LONGEVITY AND FECUNDITY ON VARIOUS HOST PLANTS

In previous studies, *D. hesperus* was able to reproduce at low levels on mullein in the absence of prey⁵. Work is currently underway to determine the longevity and fecundity of *D. discrepans* and *D. famelicus* on known mirid host plants:

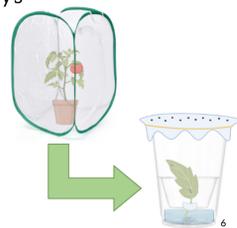
- mullein, a host plant of *D. hesperus*
- tomato, the crop of interest
- raspberry, the host of *D. discrepans* and *D. famelicus* in field surveys

These hosts were assessed in cup assays by:

1. Introducing mating pairs reared on the same host
2. Counting the number of eggs laid and observing their emergence
3. Recording predator longevity

PRELIMINARY RESULTS:

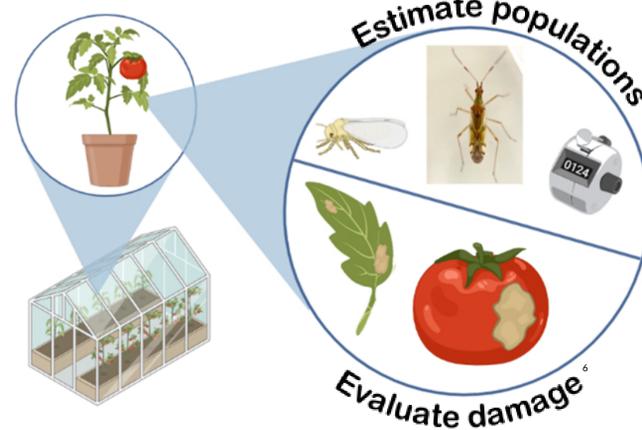
- *D. famelicus* was unable to establish on either tomato or mullein in the absence of a source of pest prey



GREENHOUSE ESTABLISHMENT

The population dynamics of native mirid predators and their impact on whitefly-infested tomato plants will be assessed in greenhouse cage experiments. In these trials, we are:

1. Establish whitefly on caged tomato plants
2. Introduce mirid predators
3. Take weekly measures of predator and pest population density
4. Assess predator feeding damage and grade fruit quality



IMPLICATIONS AND NEXT STEPS

- *D. famelicus* consumes spider mites and immature whitefly, and preliminary assays show that it can also feed on thrips.
- The feeding capacity of *D. discrepans* will be assessed in 2023, but preliminary assays also demonstrate that it can feed on all three pests.
- Assessment of host plants can illuminate the possibility of using banker plants to establish predators prior to pest infestations.
- Greenhouse experiments will elucidate the potential for pest control and crop injury by these mirids; both important parameters in the commercial development of biocontrol agents in Canada.

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6. Figures created using Biorender