Mechanisms of establishment of the non-native brown widow spider (*Latrodectus geometricus*) into a native spider community

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Introduction

When a non-native species is introduced into a novel ecosystem, it must undergo a series of restrictive filters in order to persist. After an introduction, the next step in the invasion process is establishment. When a population increases to where extirpation is unlikely, that population is considered established.

Many parasites and parasitoids are host-specific and can significantly limit population size of their host, but in a novel environment, a non-native organism can be released from these negative interactions.

When able to avoid predators and parasites, an organism can allocate more energy towards growth and reproduction, increasing its probability of establishment.

The brown widow spider (*Latrodectus geometricus*) (**Fig. 1**) was introduced into Texas in 1997. As of 2020, it is found in ≥22 counties.

Fig. 1 Brown widow spiders (*Latrodectus geometricus*) female (left) and male (right).

Fig. 2. Common widow spider egg sac parasitoids: eurytomid wasp, *Philolema latrodecti* (left) and chloropid fly, *Pseudogaurax signatus* (right).

Objective and Hypotheses

The objective of this research is to determine the underlying mechanisms that enabled the brown widow spider to establish in Texas.

Specifically, we hypothesize that:

1. Brown widows will have proportionally fewer egg sacs parasitized compared to their native congener, the southern black widow (*L. mactans*). Also, fewer parasitoid species (**Fig. 2**) will utilize the non-native brown widow's egg sacs as a host compared to the native black widow's egg sacs (**Fig. 3**).

2. Brown widows will produce fewer, larger eggs when food is limited and more, smaller eggs when food is abundant (**Fig. 4**). In relation to the black widow, brown widows will produce more, larger eggs over a lifetime.

Parasitoid Diversity

We will collect and dissect at least 1,000 egg sacs from both brown and black widows to determine the rates of parasitism and the species richness of parasitoids.

Egg sacs laid the same day by laboratory-raised brown and black widows will be paired up and left outside for approximately 10 days to determine parasitoid diversity.

Parasitoids within each egg sac will be counted and identified to genus, when possible.

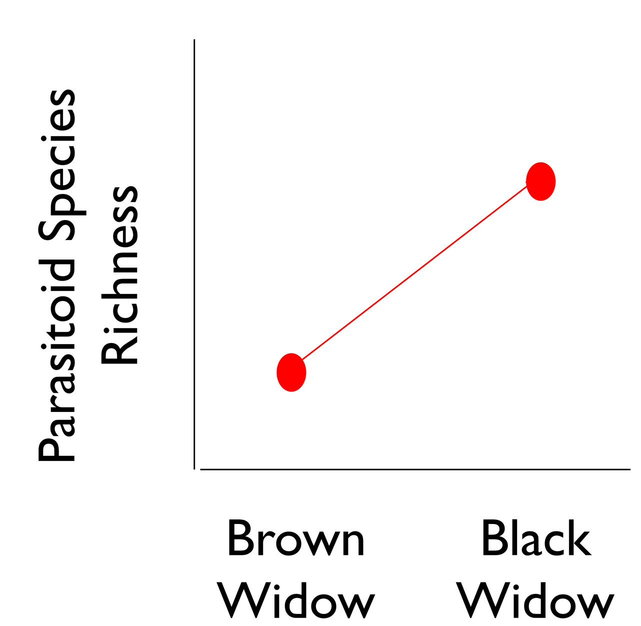

Fig. 3. Predicted outcome of species richness of parasitoids in egg sacs of the brown and southern black widow.

Life History Tradeoffs

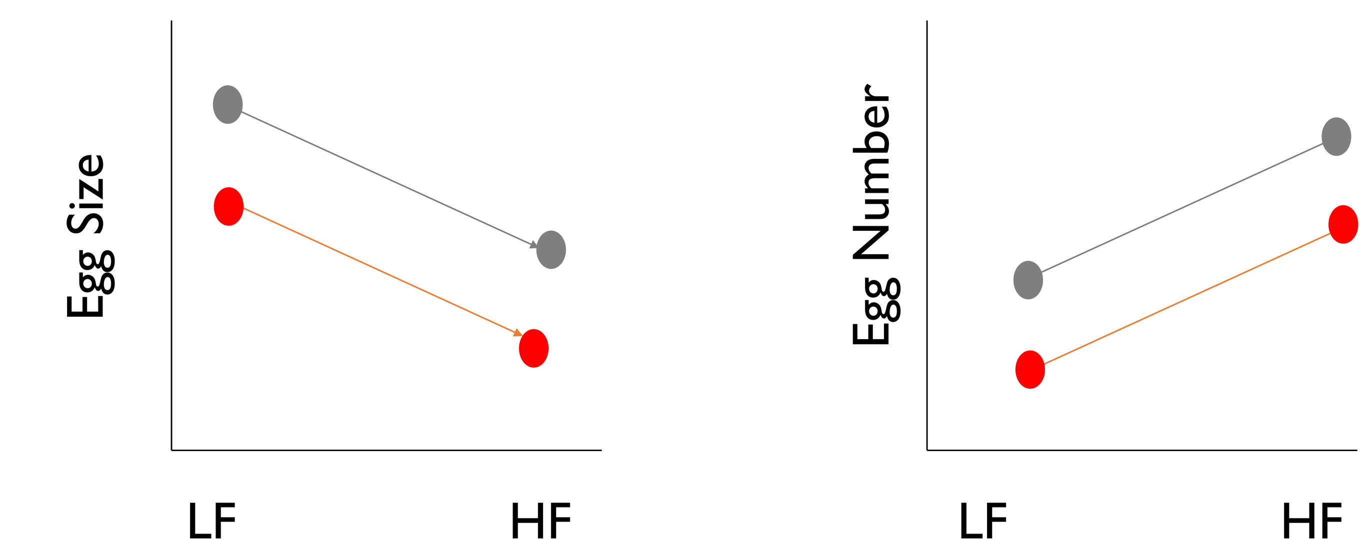

Fig. 4. Predicted outcome of low and high food availability treatments in relation to egg size and egg number of the brown widow (gray) and the southern black widow (red) over a lifetime.

Spiderlings of both widow species will be separated into two feeding groups: low availability (1x a week) and high availability (3x a week).

Once reproduction begins, eggs within each egg sac (**Fig. 5**) will be counted, weighed, and measured for the life of the spider.

Egg size and number will be compared between widow species to determine reproductive output between the native species and a non-native congener.

Fig. 5. Brown widow eggs approximately 24 hours after being laid.

Significance

Results will provide insight to the mechanisms that allow a non-native species to successfully establish in a novel environment through the context of reduced parasitoidism and life history tradeoffs in reproductive ecology.

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