



Web-weaving spiders of Tom Swamp

Competition between spiders and pitcher plants? Prey availability and trophic interactions in bogs

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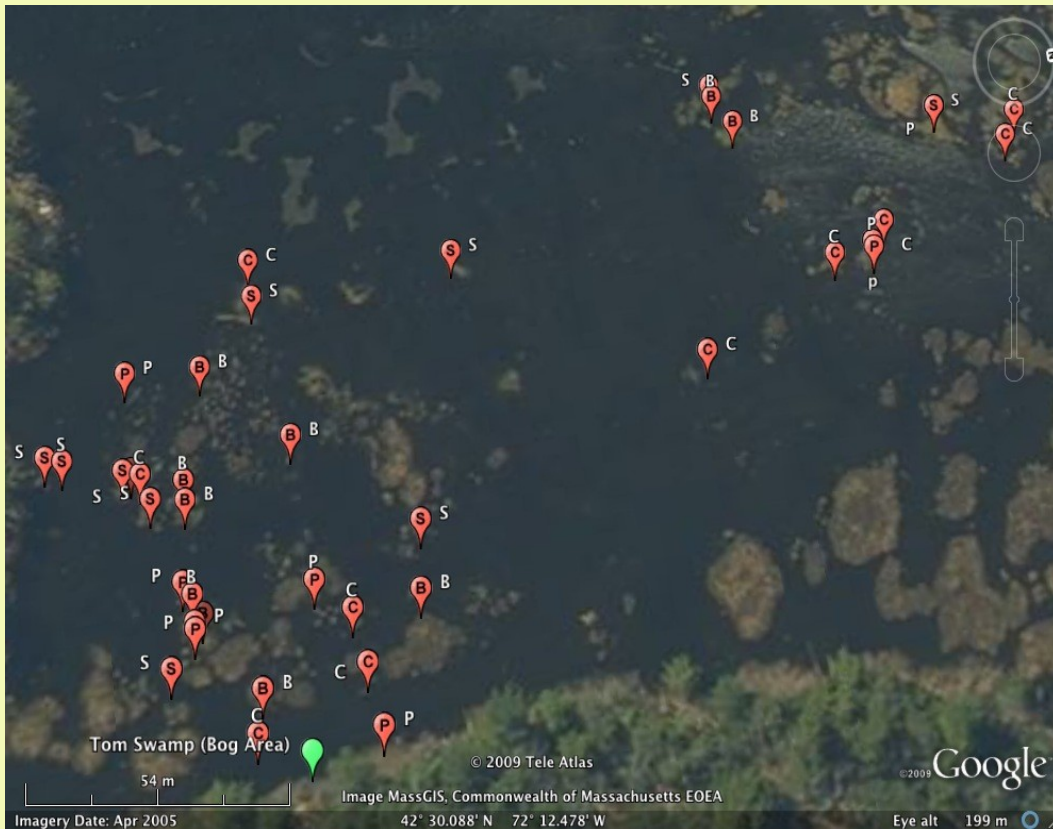


Sarracenia purpurea:
the northern pitcher plant

Background

In New England bogs, web-weaving spiders and northern pitcher plants are co-occurring sit-and-wait predators with shared arthropod prey. At the peak of the arthropod food web in our study site is a guild of four web-weaving spiders (shown at left) and two diverse families of hunting spider (shown below). These spiders have been shown to interact with the northern pitcher plant as kleptoparasites, as prey items, and as potential competitors. In this study, we hypothesized that the removal of web-weaving spiders would result in increased prey capture by pitcher plants.

Materials and Methods



Harvard Pond pitcher plant islands
42°30' N, 72°11' W

Forty 50cm x 50cm plots were established on the *Sphagnum* islands of Harvard Pond, a headwater stream bog complex in central Massachusetts. Four treatments were randomly assigned (Table 1) and monitored for 7 weeks, from June 10 to July 22, 2008.

For all plots, in addition to the spider/pitcher manipulations, five 50mL pitfall traps and five 2"x3" sticky traps were laid to observe background prey activity in the bogs.

The contents of pitfall traps, sticky traps, and unplugged pitcher plants were collected twice per week. Prey were identified to order, except spiders and ants, which were identified to species when possible.



	PITCHER PLANTS ACTIVE (P+)	PITCHER PLANTS PLUGGED (P-)
WEB-WEAVING SPIDERS ACTIVE (S+)	Control (S+, P+)	Pitcher Removal (S+, P-)
WEB-WEAVING SPIDERS RELOCATED, WEBS REMOVED (S-)	Spider Removal (S-, P+)	All Removed (S-, P-)

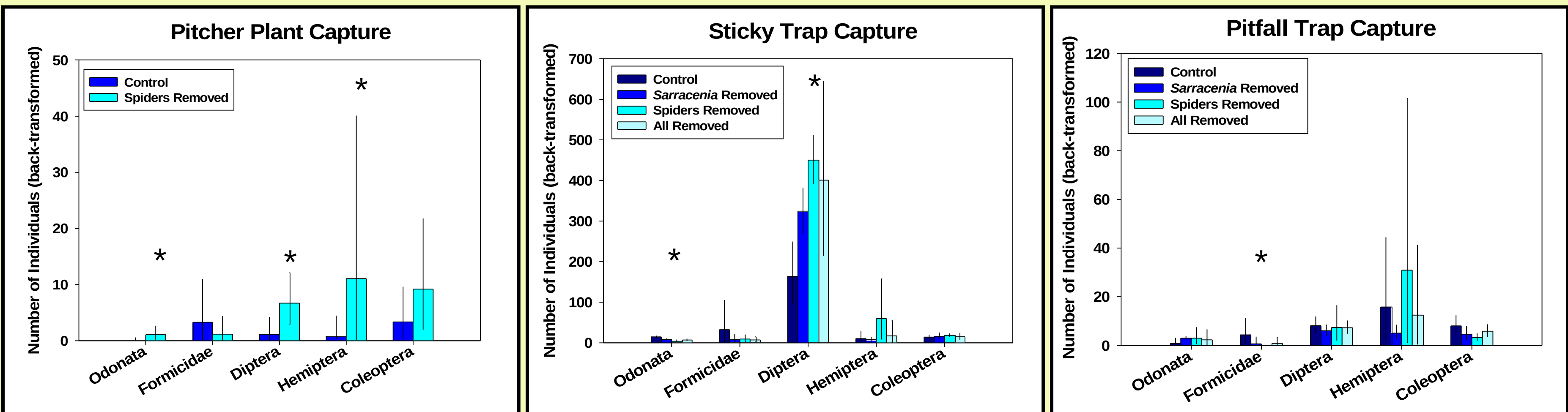
Table 1. Plot treatments (10 plots per treatment).

Results

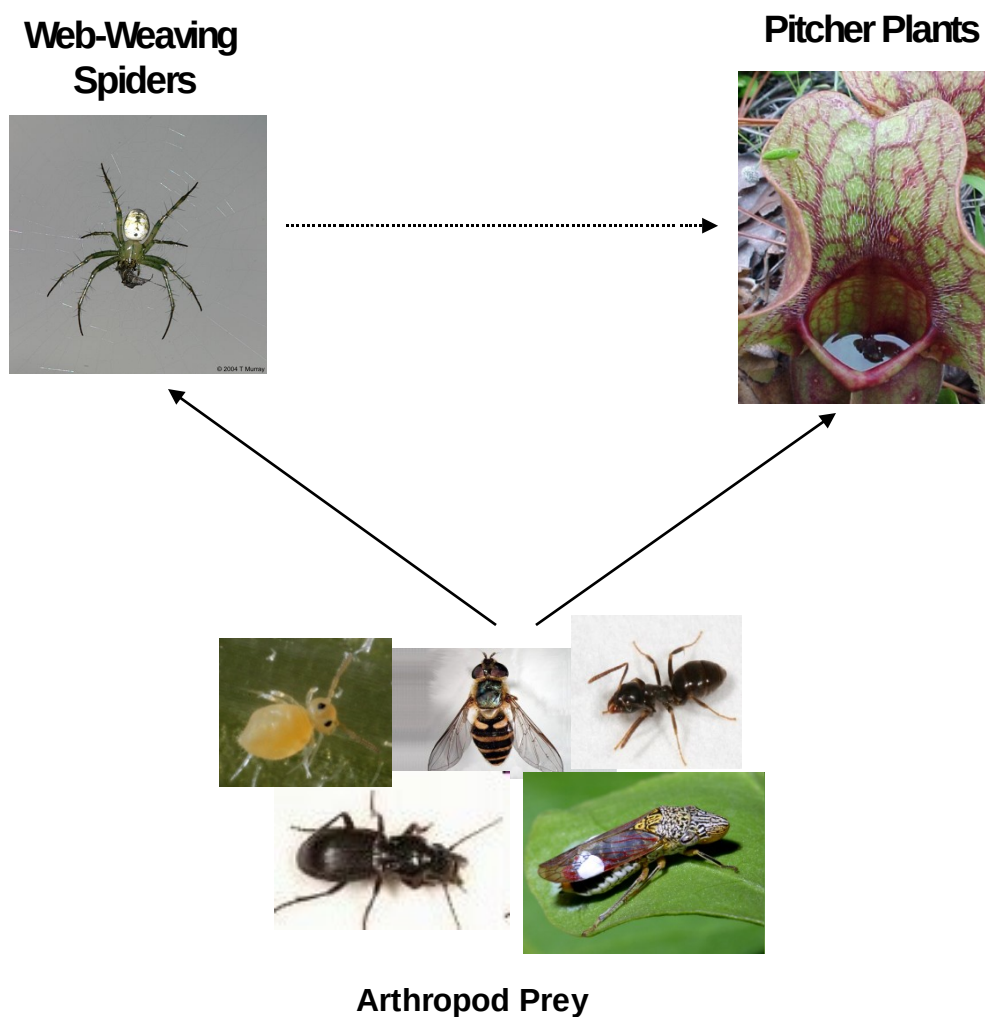
The removal of web-weaving spiders yielded the only significant results among individual taxa, while manipulating pitcher plants contributed only to interaction effects.

Web-weaving spider removal did not reduce the total number of spiders caught in sticky traps, pitfall traps, or pitcher plants; this is because the five times as many hunting spiders as web-weavers were captured by these three methods. In the sticky traps, we observed a trend of increase in hunting spiders when web-weaving spiders were removed ($p=0.08$).

Arthropod capture data were square-root transformed and analyzed using two-way ANOVA. Removal of web-weaving spiders resulted in an increase in pitcher plant capture of Diptera (flies), Hemipterans (true bugs), and Odonata (dragonflies) ($p=0.002$, $p=0.03$, and $p=0.005$, respectively). Spider removal also increased sticky trap capture of Diptera ($p=0.004$), and showed a trend toward increase in capture of Hemiptera ($p=0.06$). In contrast, pitfall traps captured fewer Formicidae (ants) when spiders were removed ($p=0.02$).



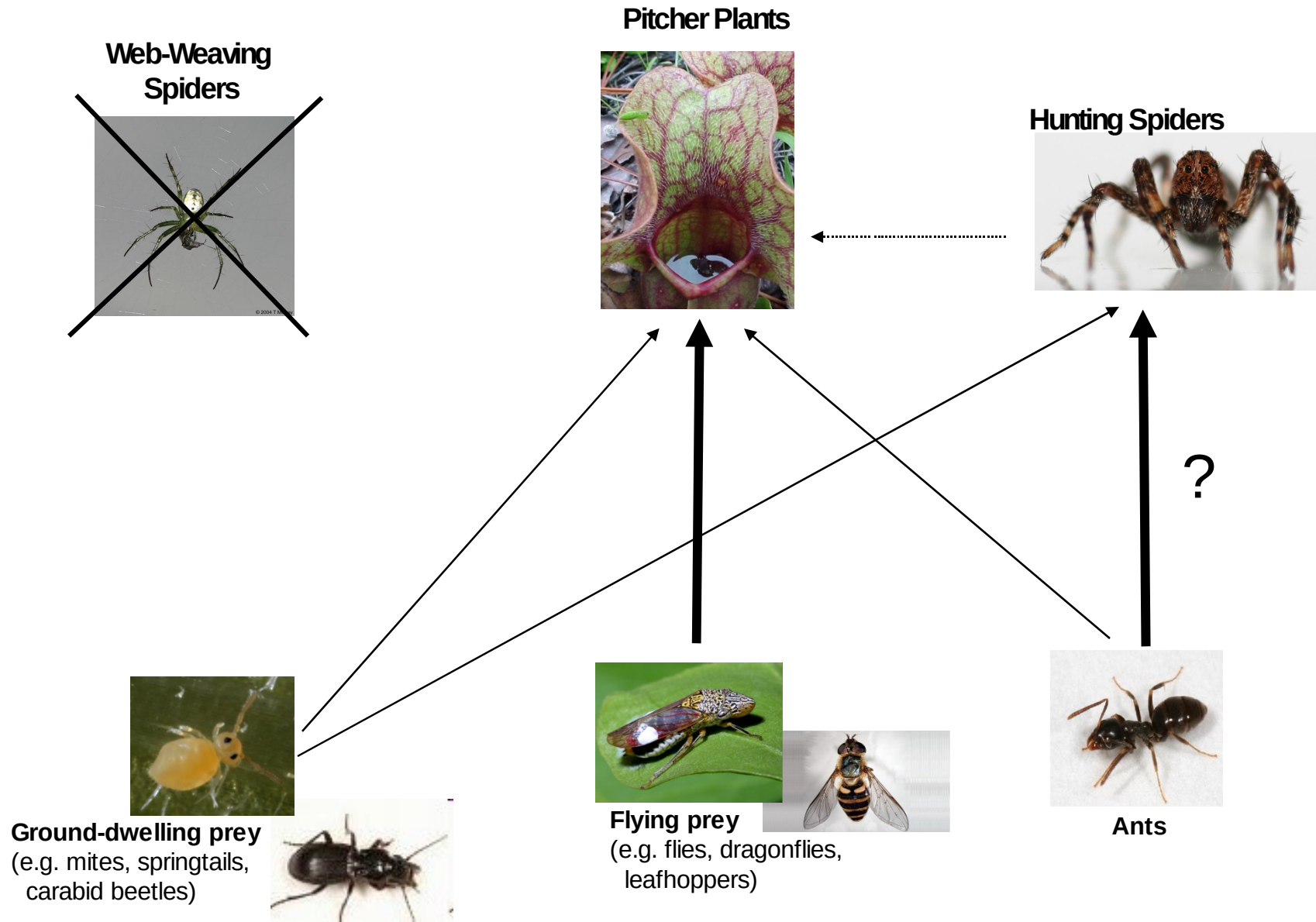
Hypothesized food web



Hypothesis

- All predators eat all prey.
- Prey capture increases for one predator when the other predator is removed.

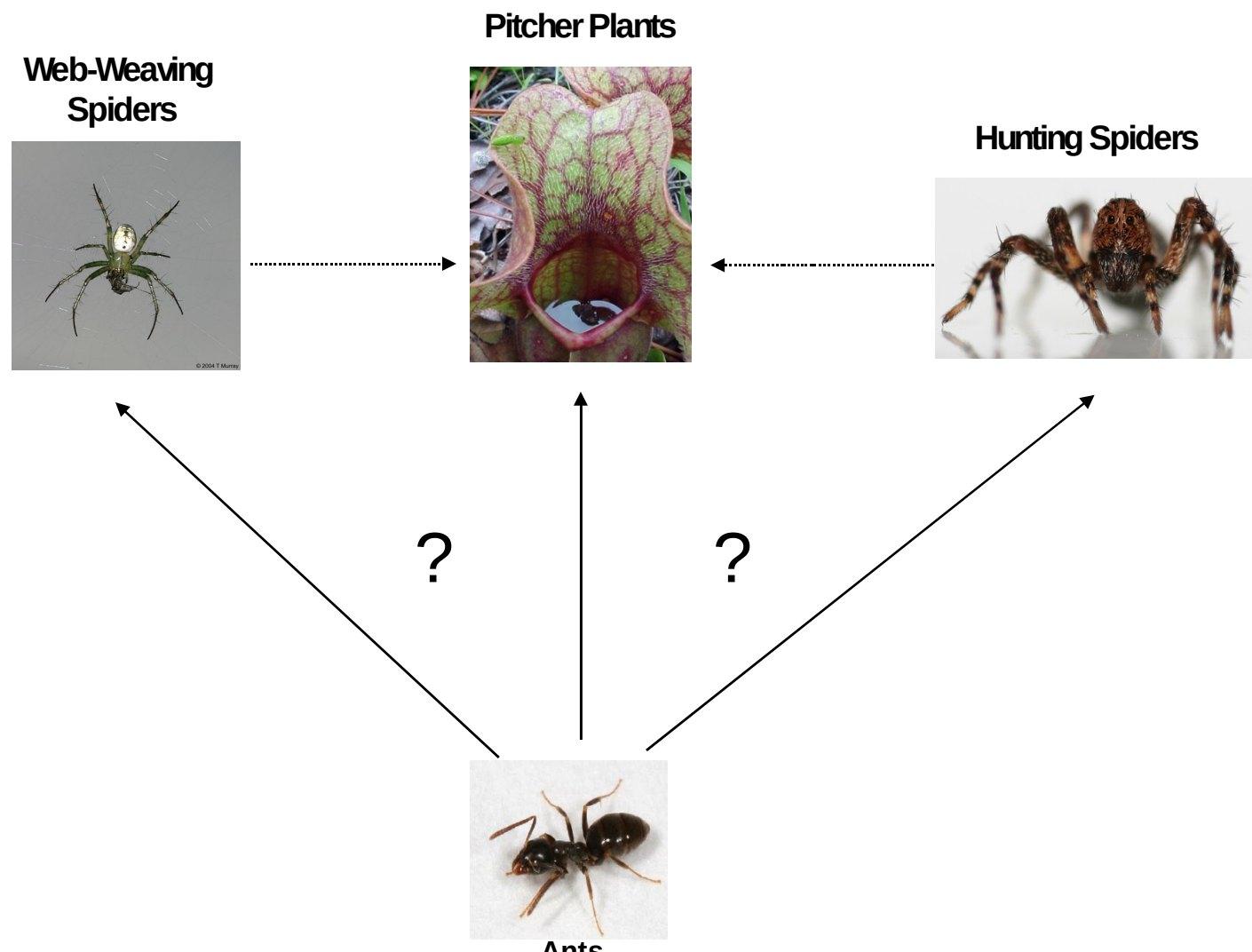
Web-weaving spider removal results



Results suggest

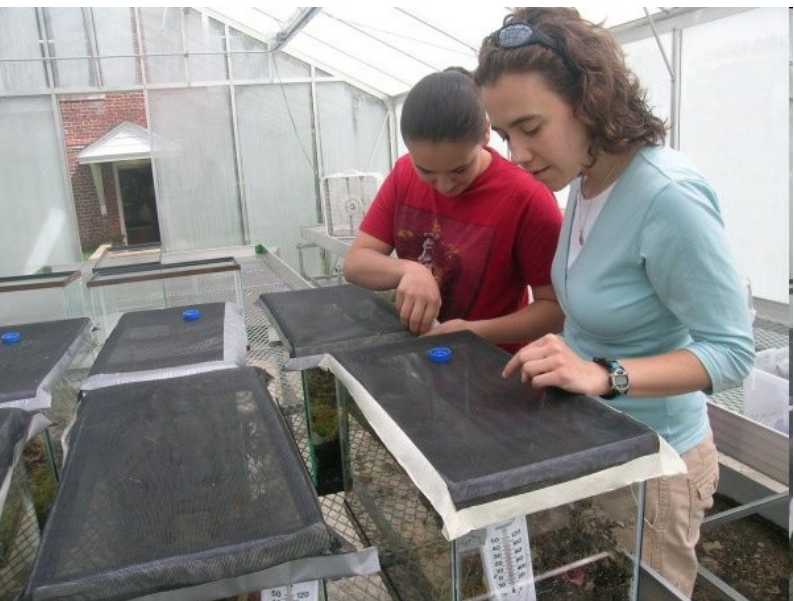
- Flying prey normally caught by web-weaving spiders increases in pitcher plants due to a release of competition pressure.
- For ground-dwelling prey, hunting spiders fill the predatory gap left by the removal of web-weaving spiders.
- Ant activity decreases either as a result of hunting spider predation or simply the risk of it.

Future Work



In Progress

We've established terraria with manipulations of ant nests, hunting/web-weaving spiders, and pitcher plants. Pitfall traps and pitcher extractions, as well as direct behavioral observations of the ants and spiders, will be employed to determine the mechanisms driving the patterns observed in our field experiment.



References

Schmitz, Oswald J., Beckerman, Andrew P., and Kathleen M. O'Brien. 1997. Behaviorally mediated trophic cascades: effects of predation risk on food web interactions. *Ecology* 78(5): 1388-1399.

Acknowledgements

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