Competition and community interactions of the western tent caterpillar

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SECTION 1, Abstract

Competition is one of the fundamental structuring forces in most communities. Yet there are many aspects of how competition shapes intraspecific, interspecific, and community level interactions that are still unclear. The first two sections of my dissertation test if fitness and oviposition choice are affected by indirect competition between two destructive, tent and web-building caterpillars. The third section will test if arthropod communities are altered by a possible ecosystem engineer whose distribution is shaped by competition.

SECTION 2, Introduction:

Competition is one of the fundamental structuring forces in most communities (e.g., Volterra 1926, Lotka 1932, Gause 1934, Connell 1961, MacArthur and Levins 1967), yet indirect competition has been historically misunderstood and misrepresented (Kaplan and Denno 2007 and references therein). My dissertation research investigates not one, but three separate effects of competition in a single community. I study the intraspecific, interspecific, and community wide effects of competition between two generalist species.

While all organisms influence their communities, some species play a more prominent role. Ecosystem engineers are organisms that alter their environment and shape their community by drastically modifying their habitat (Jones et al. 1994). Ecosystem engineers transform their environment to fit their needs and in doing so create habitat diversity that has ripple effects through the entire community (Wright and Jones 2006). Megafauna may be the most visible ecosystem engineers, but organisms that impact microhabitat also have far reaching impacts on

communities (Marquis and Lill 2010). The first two sections of my dissertation test how competition drives host-plant use by competing organisms. The third section of my dissertation tests the community wide impacts of a potential ecosystem engineer mediated through competitive interactions.

Competition alters the distribution of host-plant use by the competitor species, which may alter the community of arthropods on those plants. One goal of my inter- and intraspecific competition experiments is to determine how competition shapes host-plant selection. Host-plant selection is often driven by either the chemical or visual cues associated with prior host-plant damage (Renwick 1989). Tent caterpillars can cause large-scale damage to their host-plants and build highly visible structures that alter the landscape of their host-plants (Fitzgerald 1995). These generalist caterpillar species may therefore act as ecosystem engineers (Jones et al. 1994) and affect the survival and distribution of all arthropods on CC, not just the other Lepidoptera herbivores. My experiments test how large-scale leaf damage and distinctive visual cues alter arthropod communities.

Western tent caterpillars (*Malacosoma californicum*; hereafter TC) are tent-building caterpillars that feed gregariously as larvae through their penultimate instar before dispersing. Larvae construct silk tents that last through the summer and, occasionally, into the next year. While TC can have large-scale impacts on tree health, they rarely kill their host-plants (Cooke et al. 2012). In midsummer, TC adult females oviposit all of their eggs in one group on a tree branch (Fitzgerald 1995). The eggs overwinter on the branch and hatch in the early spring. TC larvae are generalists when considered across their full geographic range, but frequently specialize at a local level (Powell and Opler 2009). My study takes place on the eastern slopes of

the Rocky Mountains in Colorado, where I have found that TC prefer chokecherry (*Prunus virginiana*; hereafter CC).

Management Contribution

TC are often considered a pest or nuisance species. Homeowners and managers may attempt to remove these animals because their webs are considered by some to be ascetically unappealing and because they can cause moderate damage to trees (USFS 2011). By learning about the factors affecting their distribution and survival, managers and private citizens can make better-informed decisions about their removal.

SECTION 3, Methods and Status

How does TC damage alter summer CC arthropod communities?

Experimental Approach: I conducted an arthropod survey in 2014 on CC with and without 2014 TC damage. This survey was intended as a preliminary test to assess the effect that TC have on arthropod communities as a whole. My initial results suggest that CC with TC damage have higher numbers of predators than trees without TC damage. I repeated this experiment with expanded treatments to assess the mechanism by which TC alter CC communities. I applied the following treatments to CC: CC trees with no TC damage and no tent treatment, CC trees with no TC damage to which I attached whole TC tents, CC trees with no TC damage with fake wool tents attached, CC trees with no TC damage that I covered in broken-apart TC tents, CC trees with TC damage and their tents removed, and CC trees with both TC damage and tents. I used wool to construct the false tents, as it most closely mimics the visual properties of the tents. The fake wool tents acted as a visual cue without chemical cues that could attract or repel arthropods.

The broken-apart TC tent treatment acted as a chemical cue from the tent, but not a visual cue. I searched each CC for arthropods for 10 minutes and collected all arthropods. In addition, I collected the tents and the false tents from all of the TC damaged trees in late summer and froze them. I am still processing and identifying the arthropods in these samples. I will remove all arthropods collected in the tents and identify them. I collected arthropods from a total of 30 CC for each treatment, for a total of 180 CC trees. Not all CC were on Boulder County property. I counted and collected voucher specimens of each arthropod species that I found; I will identify all arthropods to family, and to species when possible, and will categorize them into morphospecies. I will also classify them as predator, herbivore, or parasitoid.

How does TC damage alter overwintering CC arthropod communities?

Experimental Approach: My community survey suggests that arthropod predators use TC tents as shelter for extended periods of time during the summer. This experiment will allow me to determine if those predators overwinter in TC tents and thereby alter the number and type of predators found on damaged CC in the early spring when TC larvae emerge. I used an identical approach as in H1. All trees have been located and marked. Due to recent warm weather, I have not yet collected all of the samples in this experiment. I cannot collect my samples until there are at least 72 consecutive hours of temperatures 4°C or below at my field sites. I expect to collect them by mid to late November.

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