How do induced defenses differ under different antagonistic interactions?

Corina Godoy[1], Drake Mullett[2]
[1]Humboldt State University, Arcata, CA 95521 [2]Chicago Botanic Garden, Glencoe, IL 60022

Introduction

Antagonistic interactions take the form of herbivory, competition, and parasitism; these antagonistic interactions can put stress on an organism. Often, the level of stress that is brought on by these interactions is assumed to be of the same magnitude. If there is a difference in the amount of stress brought on from an antagonistic interaction, this information would be instrumental in reclaiming the prairie with wildflowers and reintroducing diversity as grasses are the dominant life form in prairies [1][4]. We measured the impact of these antagonistic interactions by comparing the effect of interspecific competition, intraspecific competition, and parasitism on the ability of *Koeleria macrantha* to express its induced mechanical defense of silica hair production. Silica hair in grasses are instrumental in deterring herbivory as it is one of their most effective defenses from herbivory [3].

K. macrantha is the focal species of our experiment, and is partnered with *Rudbeckia pinnata* (interspecific competition), *Agalinis tenuifolia* (parasitism), with another *K. macrantha* (intraspecific competition), and alone (null). These prairie species were chosen for their high success in germination trials and their history of use in prairie restorations. The root parasitic nature of *A. tenuifolia* makes them ideal for the parasitism portion of this experiment [2].

Koeleria macrantha

Agalinis tenuifolia

Rudbeckia pinnata

Hypotheses

We hypothesize that different antagonistic interactions affect silica hair production differently

- parasitism should impede production the most of the three
- interspecific competition should impede production the least
- intraspecific competition should impede production at a severity that is in between the other two antagonistic interaction

We also hypothesize that length will differ among the three antagonistic interactions

Methods

We observed interspecific competition (*K. macrantha* and *R. pinnata*), intraspecific competition (*K. macrantha* and *K. macrantha*), parasitism (*K. macrantha* and *A. tenuifolia*), and also no competition (*K. macrantha* alone).

- The focal Koleria from the 160 3"x3" low nutrient pots had their tallest blade removed 1 cm from the base of the plant
- Length, and width for both ends of the blade were measured for later analysis
- An incision made by razor blade allowed us to lift the epidermal layer and produce a peel
- From these peels, segments were cut, and dyed with safranin for photographing
- The viewfinder of the camera attached to the compound microscope served as a transect plot, where all fully visible silica cells within the transect were counted as in
- The photographs were taken at 200x magnification and then run through imagej to get measurements of length, width, diagonal length, and silica cell count of each blade

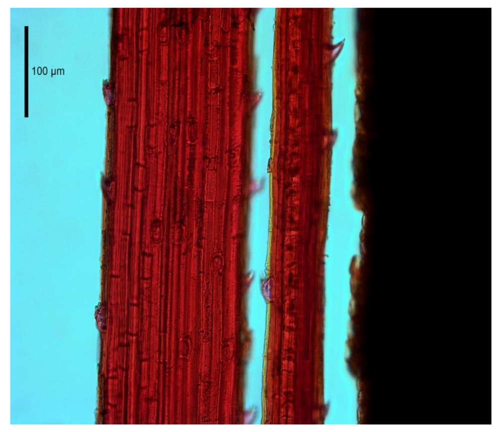

Fig. 1. Epidermal peels of *K. macrantha* showing silica cells and hairs, with an unsuccessful peel containing chloroplast on the right-hand side.

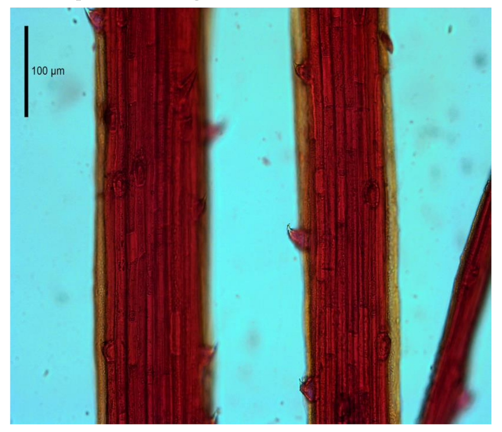

Fig. 2. Multiple epidermal peels of *K. macrantha* with silica cells and hairs present.

Results

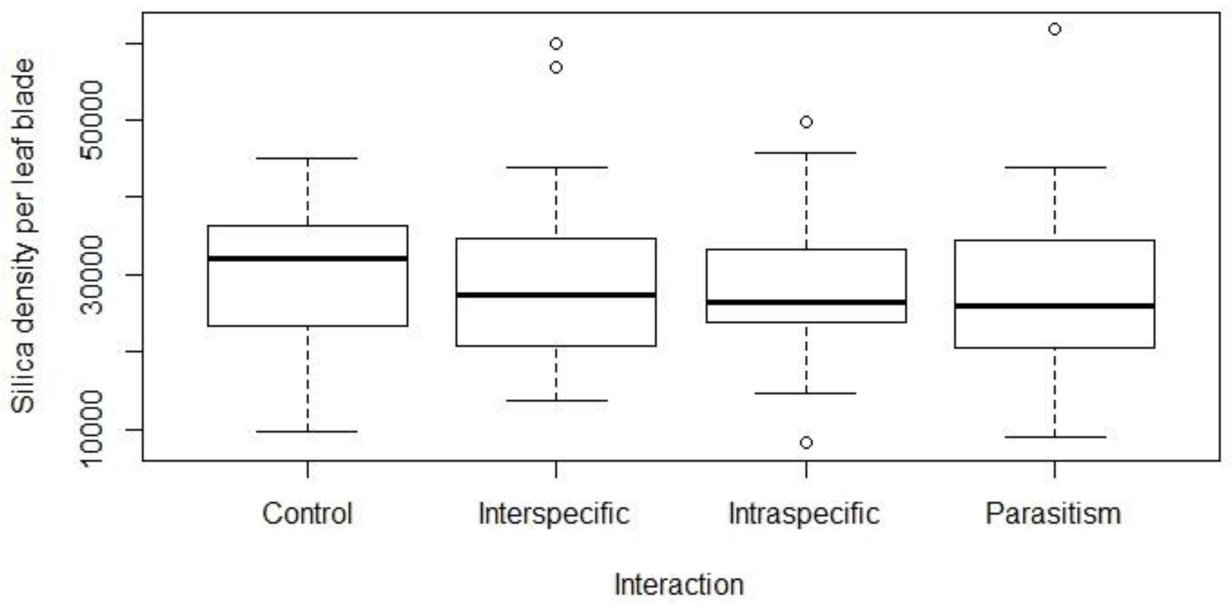

Fig. 3. Silica density per blade of *K. macrantha* under uniform low-nutrient conditions. P-value = 0.84

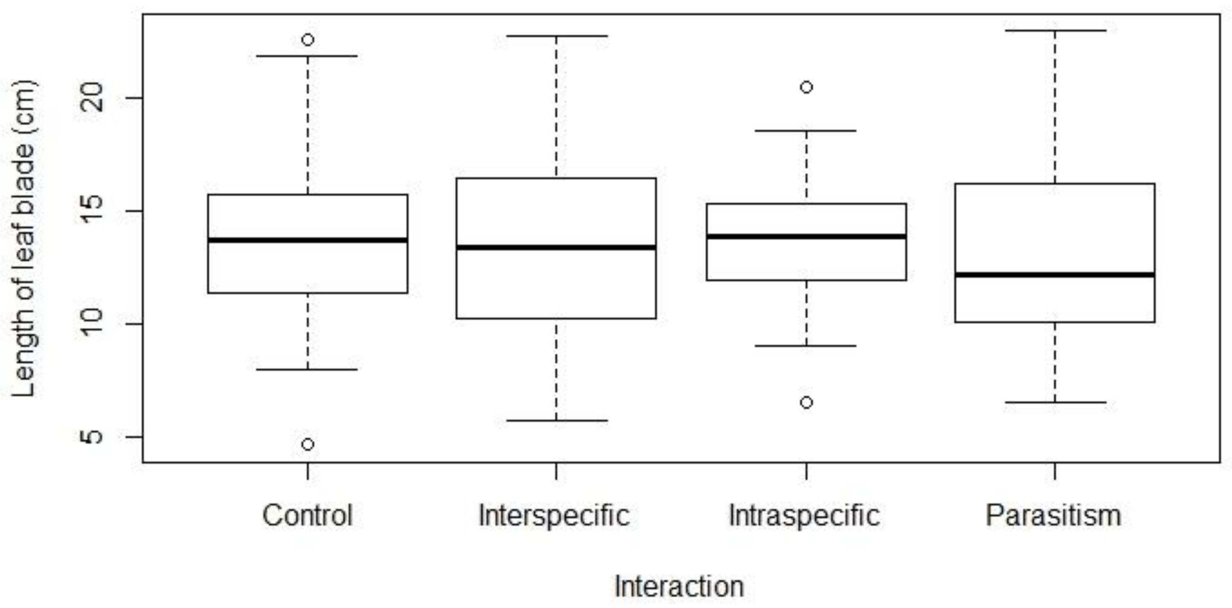

Fig. 4. Length of tallest blade of *K. macrantha*, analysis is based on comparison of initial measurements and measurements taken at time of harvesting blades for epidermal peels

We hypothesized that there would be a difference in the induced defense of grasses under different antagonisitic interactions and also, that length would be reduced under the three antagonistic interactions. However, our results show that there is no relationship between antagonistic interaction and the density of silica hairs per leaf blade (P-value = 0.84). Nor is there a relationship between the antagonistic interactions and the length of the leaf blades. (P-value = 0.78).

Discussion

The lack of a difference between the control and the two types of competition interactions indicates that our experiment, which lasted 28 days, likely did not run long enough; otherwise we would expect to see that competition impedes the growth of the grasses when compared to a control grown alone. Alternatively, our results could indicate that the lack of wildflower presence within the prairie landscape may be from the superior competitive ability of *K.macrantha*. Since *K. macrantha* behaved similarly in antagonistic interactions as when it grew alone. However, the antagonistic events may be causing stress that is not visible in above ground growth. Investigation into the effects on underground biomass may reveal where the stress is manifesting in the plant.

References

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