Ant Density Response to Fire in *Acacia drepanalobium*

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Introduction

An important mutualistic relationship between several species of ants and *Acacia drepanalobium* has been shown to exist in the savanna ecosystem. The ants receive a place to live in the galls of the tree while the tree is protected from herbivory by the ants. Studies have shown that megaherbivores display a significant preference for trees not defended by ants.[1] Research has also suggested that even though these trees need to put excess resources into housing the ants, the benefit of protection from herbivory outweighs the cost.[2]

Research has been done to better understand the behavior of various ant species in defending trees including *Tetraponera penzigi* (TP), *Crematogaster nigriceps* (BBR), *Crematogaster sjostedti* (AB), and *Crematogaster mimosae* (RRB). However, limited studies have considered the impact of fire on ant density in trees. This study attempts to explain the relationship between several ant species, *A. drepanalobium*, and fire.

Research Questions

- Does the density of *Acacia* ants differ in burned and unburned plots?
- Do certain ant species prefer to reside in trees within burned/unburned areas?
- How does gall type (new or old) impact ant density?

Materials and Methods

The data was collected in June 2013 from the KLEE plots at Mpala Research Centre, Laikipia where various exlosures have been established and some smaller plots were burned 3 months prior to this study. We sampled plots that allow mega herbivores, wildlife, and cattle to graze and browse. A total of ten *A. drepanalobium* were sampled from the control and fourteen from the burned plots.

Descriptive information about each tree such as height, diameter, and ant species was recorded. One branch was randomly selected on each tree and the lengths of new growth, old growth, and dead sub-branches were measured. The total new and old galls present on the branch were also counted and recorded.

Three new galls and three old galls were randomly selected throughout the tree and the holes were tapped before cutting them off the tree. In the lab, the number of ants and larvae present in each gall were counted and recorded.

The data collected was analyzed and averages were used to make comparisons considering factors such as ant density, gall type, and branch composition. P values were generated using JMP to identify statistical significance of the data.

Results

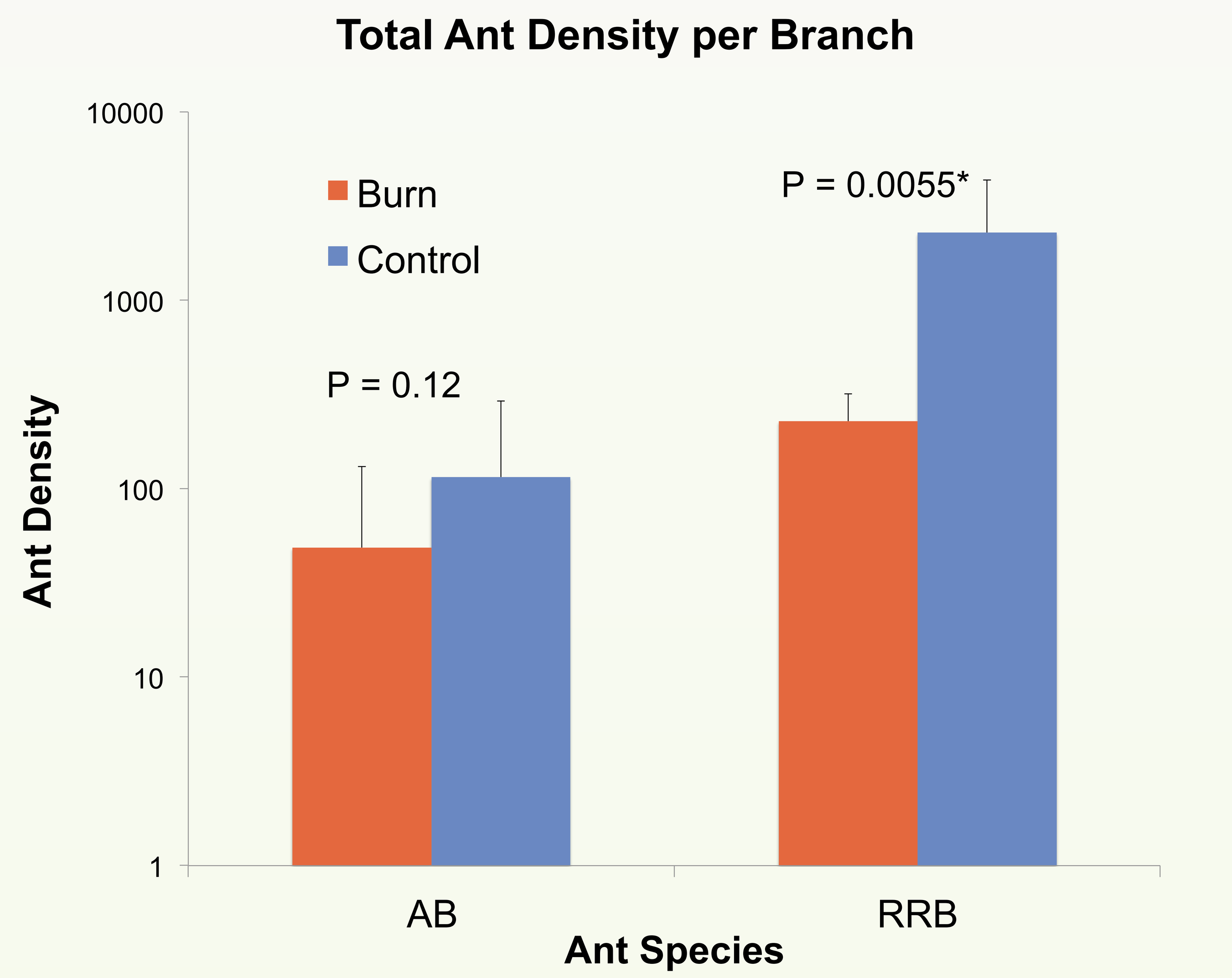

Fig. 1 Average ant density per branch of AB and RRB ants in burned and control (unburned) plots shown on a log scale. The difference in density of AB ants in the burned and control plots is not significant, but the density of RRB ants is significantly higher in the control plot than in the burn.

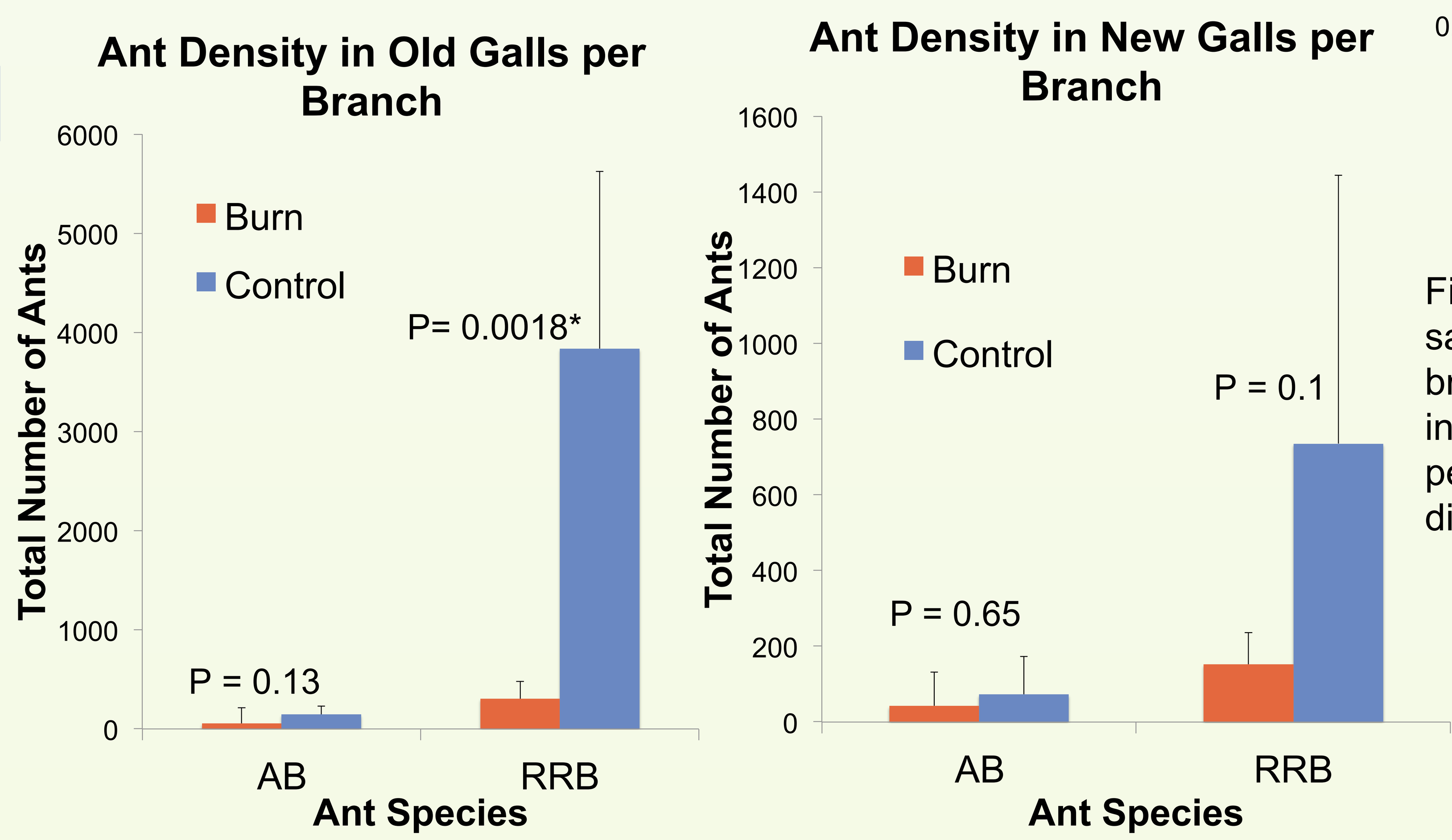

Fig. 2 Ant density in both new and old galls per branch. A higher number of ants are present in old galls in the control vs. the burn, however this is statistically significant in the RRB ants and is not in the AB ants. Overall, there are many more ants inhabiting old galls as seen in the different scales of the graphs.

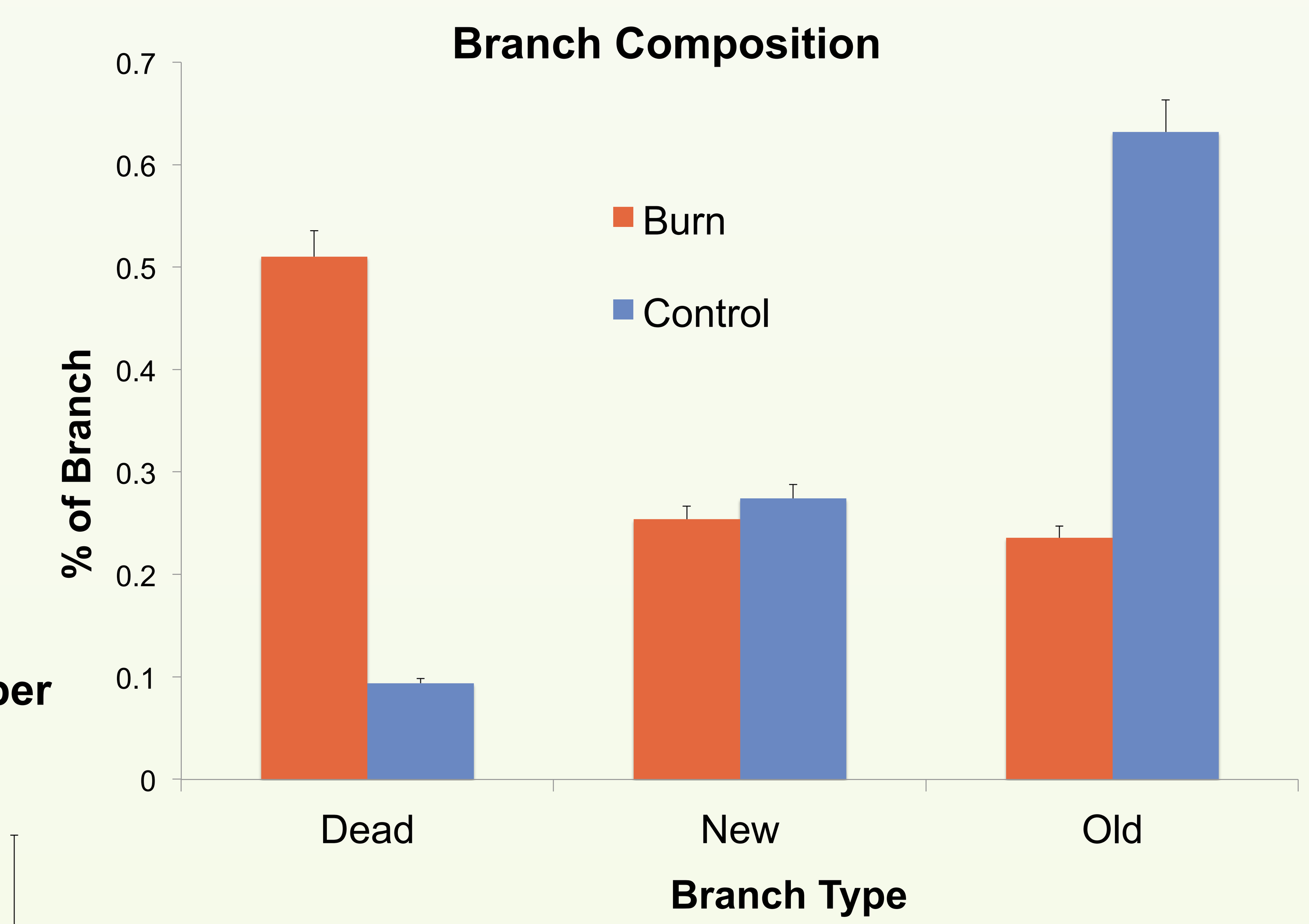

Fig. 3 The percent of dead, new growth, and old branches in the sampled trees. Trees in the burn have a higher percentage of dead branches and a lower percentage of old and new branches. However, in the control there is a higher percentage of old branches. The percentage of new branches in the burn and the control does not display to same contrast as the dead and old branches.

Discussion

The data shows that there are more ants present in *A. drepanalobium* in unburned areas than in burned areas. Figure 1 shows that RRB ants were significantly more numerous in unburned areas with almost seven times the number found in burned. There is not a significant difference in numbers of AB ants between the burn and control possibly because they live in tree stems in addition to the galls. The data suggests that AB ants do not have a preference for trees in burned or unburned areas.

When comparing the density of ants between new and old galls, both the RRB and the AB ants have higher numbers in old galls than in new galls (Fig. 2). This could be contributed to the overall larger diameter of old galls and higher numbers of old galls in the branch compared to new galls. Specifically in the old galls, there is a significant different in the number of RRB ants between the burn and the control.

These trends in ant density are in part correlated with branch composition (Fig. 3). This is because trees from burned areas have more dead branches which don't have habitable galls. In the control area, tree branches have a higher percentage of old sub-branches which contain galls for ants to live in. The percentage of new branch lengths are relatively close in the burn and control which was unexpected. This might be explained by a larger number of short new growth in the burn and fewer, longer new growth in the control as a result of fire that encourages new growth after rain.

This study indicates that fire reduces the overall number of ants living in trees as well as the density of ants per gall. However, BBR and TP ants were not included in the data analysis because there were minimal replicates so conclusions including these species couldn't be drawn. The data from this study was only collected over a few days, therefore these conclusions may not apply in some cases. Further research might consider how these ant-tree dynamics change over time immediately after a burn.

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References

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