Beyond the macro: Exploring the role of micronutrients in Orthopteran communities

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What is the point?

Insect herbivores are important components of grassland ecosystems, but currently we cannot accurately predict their abundance and diversity. Macronutrients (i.e., nitrogen and phosphorus) have long been considered to be important in limiting herbivore populations, but only nitrogen and phosphorus have been examined, thus overlooking a potential role for micronutrients.

The Prather lab is interested in studying the effects of these micronutrients on the coastal tallgrass prairie of Texas.

Soil nutrient concentrations were manipulated in large plots (30mx30m) with every possible combination of micronutrients (Ca, K, Na) and macronutrients (N and P combined), and replicated eight times (16 possible combinations, for a total of 128 plots).

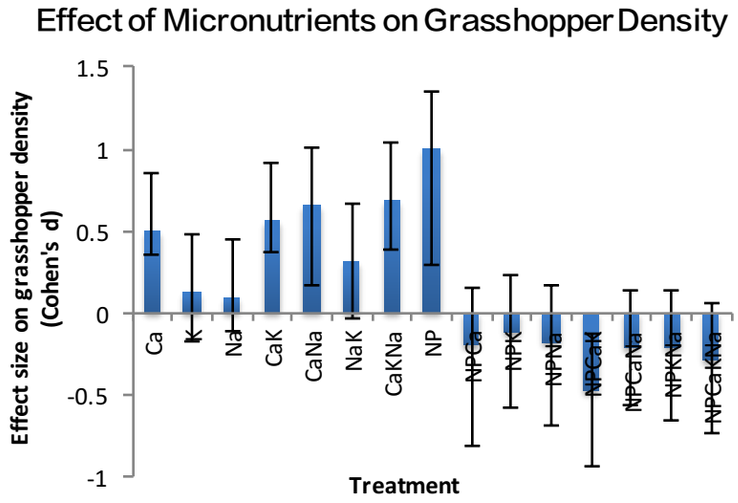
Why hoppers?

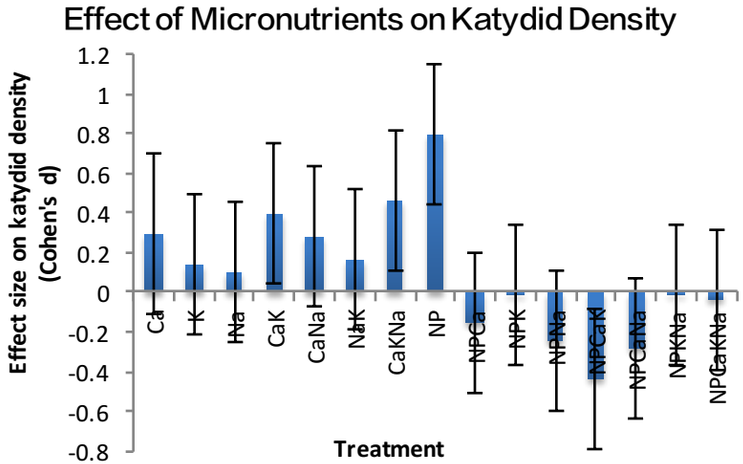
Orthoptera are an order of insects characterized by mandibulate mouthparts, large compound eyes, and elongated hind legs.

Grasshoppers and katydids were used because they are large, relatively easy to catch, and heavily researched.

What we found so far:

Preliminary data has shown that a species of grasshopper (*Melanoplus bispinosus*) and multiple species of katydid (*Orchelimum concinnum* and *Orchelimum vulgare*) were particularly responsive:





Treatment	Orthopteran density	Species richness	1/d	E
Ca	0.50	-0.40	-0.30	0.35
K	0.13	0.00	0.10	0.29
Na	0.09	-0.28	-0.20	0.33
CaK	0.56	-0.28	-0.23	0.10
CaNa	0.66	0.07	0.11	0.45
NaK	0.32	0.00	-0.21	0.41
CaKNa	0.69	-0.25	-0.29	0.58
NP	1.00	0.00	-0.01	0.13
NPCa	-0.20	0.26	0.25	0.07
NPK	-0.12	0.00	0.09	0.28
NPNa	-0.18	0.16	0.22	0.19
NPCaK	-0.48	0.45	0.54	-0.15
NPCaNa	-0.21	0.12	0.42	-0.55
NPKNa	-0.21	0.90	0.81	-0.41
NPCaKNa	-0.29	0.30	0.29	-0.08

This table displays the relationship between orthopteran density and each of the micronutrient treatments.

Where do we go from here?

Preliminary data has shown that certain species respond strongly to treatments of micronutrients, but the nature of this relationship is purely correlational and currently unclear whether this data is due to direct grasshopper preference of micronutrients or due to the indirect changing of grasshopper preference due to the changing plant composition of the area (from micronutrients).

To test for direct effects, grasshoppers will be placed in a cage with the choice of a leaf that has been grown in soil in treatments that affected the species and a leaf grown in unamended soil (controls) cut from plants in the field experiments

To test for indirect effects, grasshoppers will be placed in a mason jar with a gathering of leaves that represent the relative abundance of plant species in a particular treatment, and other individuals will be placed with leaves that represent the relative abundance of plants in the control treatments (n=8)

Future plans

These results would set a framework for further study on controlling factors in orthopteran communities and have important implications for the management of rangeland ecosystems where orthopteran are pest species.

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Insect Ecology Lab