Exploring Tallgrass Prairie Diversity in the Nematode Family Criconematidae

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Introduction

Tall grass prairies are known to harbor high levels of aboveground biodiversity, especially compared to disturbed grasslands. 9 Mile Prairie is a 230 acre tract of virgin tallgrass prairie located in Lincoln, Nebraska. Spring Creek Prairie, located in Denton, Nebraska is a 600 acre native tallgrass prairie. While the aboveground diversity of prairies is well documented, little is known about the belowground diversity. This research explores the relationship between above ground plant diversity and below ground nematode communities.

Research Question:

How does Criconematid diversity differ among central tallgrass prairies?

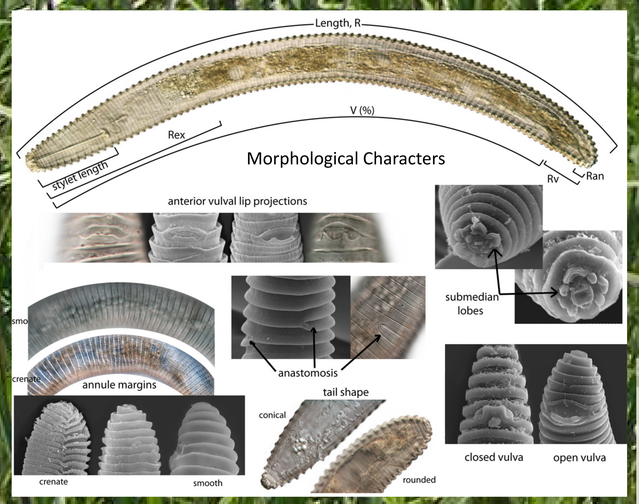
Study Organism
Nematodes in the family Criconematidae of which there are over 600 described species . The family is worldwide in distribution with species that exhibit high endemicity, lack specialized survival and dispersal capabilities, and often are sensitive to soil disturbance

Study Sites
9-Mile Prairie
History: Purchased by the University of Nebraska Foundation in 1983 and managed by committee of university and agency biologists, the site has not been grazed since 1968 and has never been plowed, with the exception of section C
Aboveground Community:
•390 plant species
•80 Species of birds
Management Strategies: Springtime burning, periodic haying and herbicidal weed/brush control
Sampling Strategy: 9 Mile is composed of 7 management sections. Four samples were taken from each section: a 40mx40m grid, and three focal prairie plants, switchgrass, leadplant, and prairie dropseed. Samples were soil cores at a depth of 10-20 cm.
Site: Spring Creek Prairie
History: Purchased by the Audubon in 1998 ,the prairie has history of grazing, with many areas that have never been plowed
Aboveground Community:
- 370 plant species
- 215 species of birds

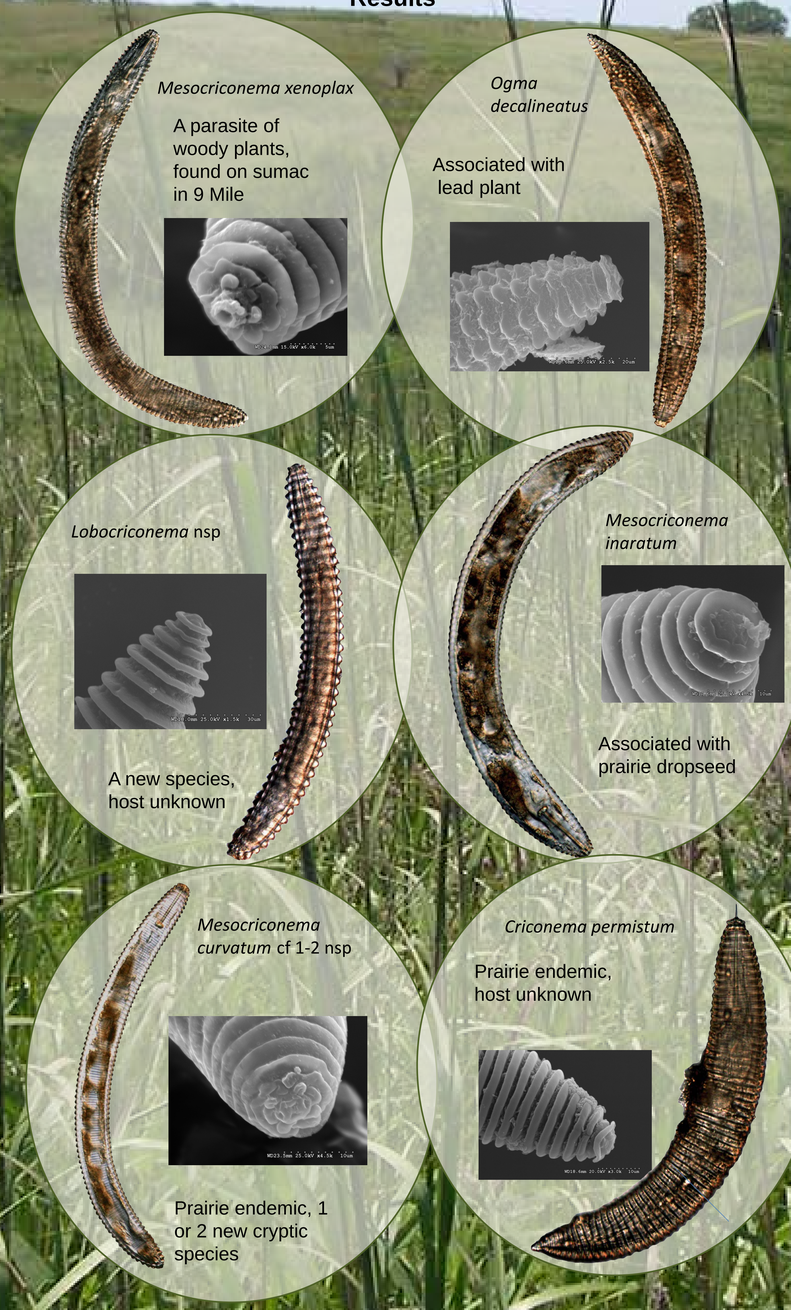
Management Strategies: Burning and grazing
Sampling Strategy: Three 40 x 40 m sampling sites
Site 1: Low plant diversity site
Site 2: High plant diversity site.
Site 3: Overgrazed and formerly cultivated site.

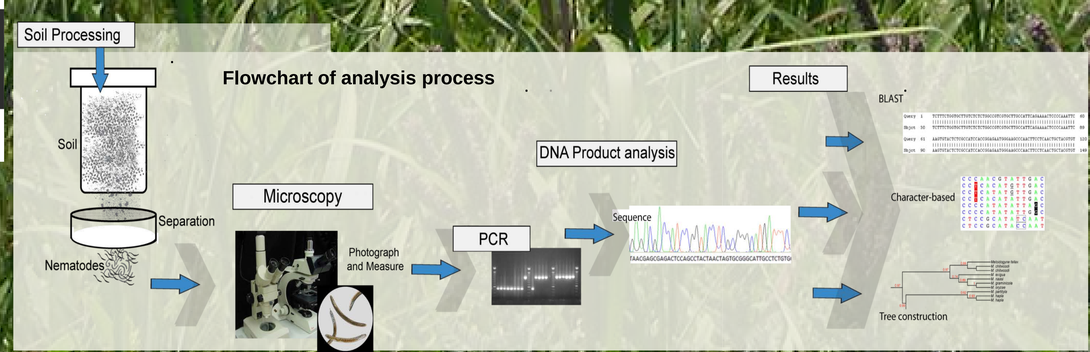
Nematode Extractions: Soil sieves and centrifugation

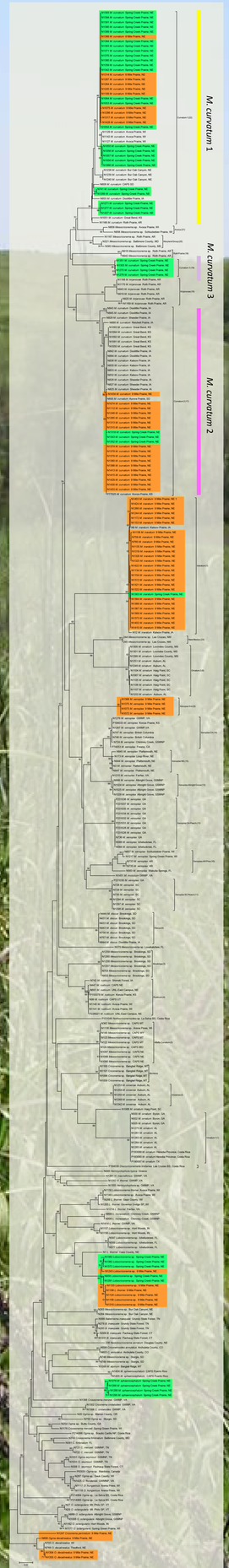
Morphological Analysis: Nematodes from 200cc of soil were counted using a dissecting microscope. Nematodes in the suborder Criconematina were measured and photographed using a light microscope with DIC.
DNA analysis: A 724 bp portion of COI mitochondrial DNA was PCR amplified and sequenced from individual measured nematodes.



Results

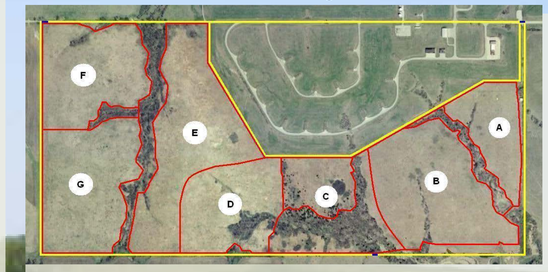






Evolutionary tree depicting nematodes from 9 Mile Prairie and Spring Creek Prairie

9-Mile Prairie Management Areas

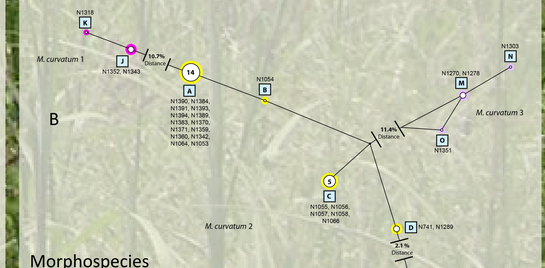


Nematode Occurrence by Management Area

	9-Mile Prairie Management Areas						
Nematodes per 100 cc of soil	A	B	C	D	E	F	G
Total # Nematodes	490	178	211	382	506	1287	240
# Crico Morphospecies	7	5	2	5	6	3	7
% Cricos	21	24	4	15	11	10	9
Number confirmed plant species			74		68		

A .

Haplotype		Found at:
A	*M. curvatum* 1	Nine-mile Prairie, Spring Creek Prairie
B	*M. curvatum* 1	Spring Creek Prairie
C	*M. curvatum* 1	Spring Creek Prairie
D	*M. curvatum* 1	Spring Creek Prairie
E	*M. curvatum* 1	Spring Creek Prairie
F	*M. curvatum* 1	Nine-mile Prairie
G	*M. curvatum* 1	Nine-mile Prairie
H	*M. curvatum* 1	Nine-mile Prairie
I	*M. curvatum* 1	Nine-mile Prairie
J	*M. curvatum* 2	Nine-mile Prairie, Spring Creek Prairie, Aurora Prairie, Konza Prairie
K	*M. curvatum* 2	Spring Creek Prairie
L	*M. curvatum* 2	Nine-mile Prairie
M	*M. curvatum* 3	Spring Creek Prairie
N	*M. curvatum* 3	Spring Creek Prairie
O	*M. curvatum* 3	Spring Creek Prairie



Morphospecies
Mesocriconema curvatum haplotype diversity on 9-Mile and Spring Creek Prairies. Median-joining networks by SplitsTree4
A) 9-mile Prairie, B) Spring Creek Prairie. Letters refer to unique haplotypes, numbers designate specimen numbers per haplotype

Conclusions:

1. The distribution of COI haplotypes from 9-Mile and Spring Creek Prairie show broad phylogenetic representation on the evolutionary tree
2. Some species of Criconematid nematodes were commonly associated with a specific plant host
3. Section C of 9-Mile suggests that soil disturbances leave a belowground historical legacy of reduced Criconematid species diversity well after aboveground plant diversity has recovered
4. Spring Creek and 9-Mile Prairies share 2 out of 15 M. curvatum haplotypes found on both prairies. The prairies differ in the number of observed haplotypes and abundance of shared haplotypes