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:

- 900 plant species
- 40 Specie 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.

DNA analysis: A 724 bp portion of COI mitochondrial DNA was PCR amplified and sequenced from individual measured nematodes.

Results

- Mesocriconema amoplex
  - A parasite of woody plants, found on sumac in 9 Mile
- Lobocriconema nsp
  - A new species, host unknown
- Mesocriconema curvatum
  - Prairie endemic, host unknown
- Oogma dicoileus
  - Associated with prairie dropseed
- Mesocriconema nsp
  - Host unknown

Morphospecies

- Mesocriconema curvatum haplotype diversity on 9-Mile and Spring Creek Prairies.
- Letters refer to unique haplotypes, numbers designate specimen numbers per haplotype.

Conclusions:

1. The distribution of COI haplotypes from 9-Mile and Spring Creek Prairies 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 the 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 morphospecies.