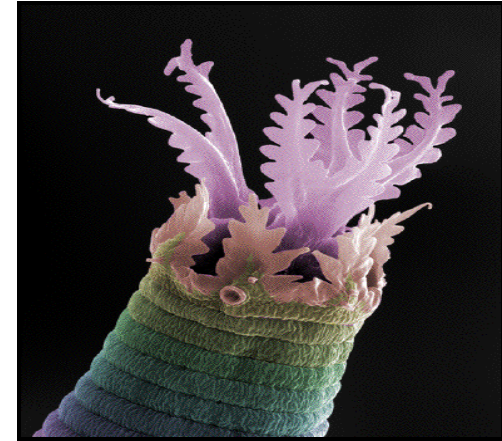
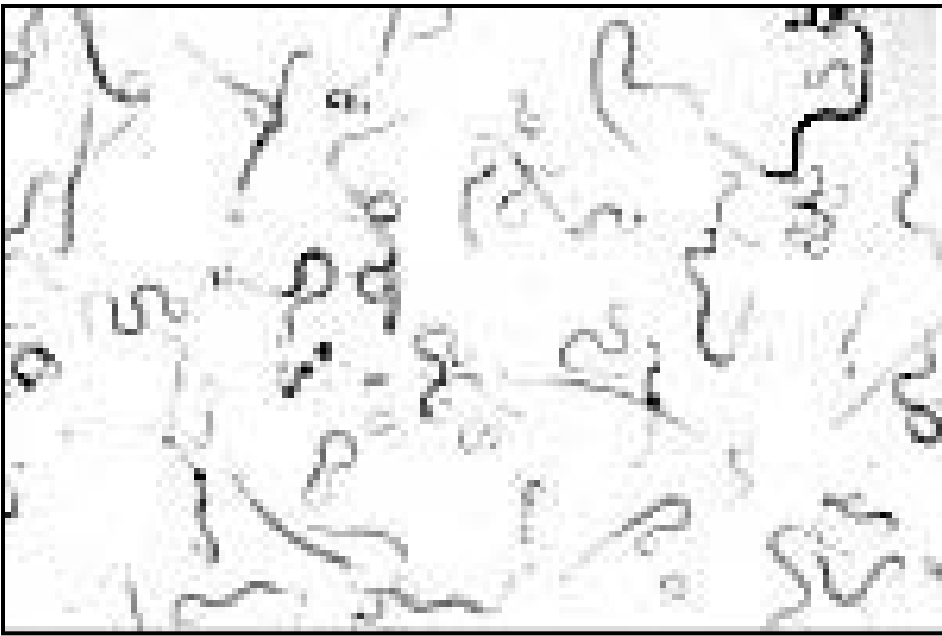


# Outline

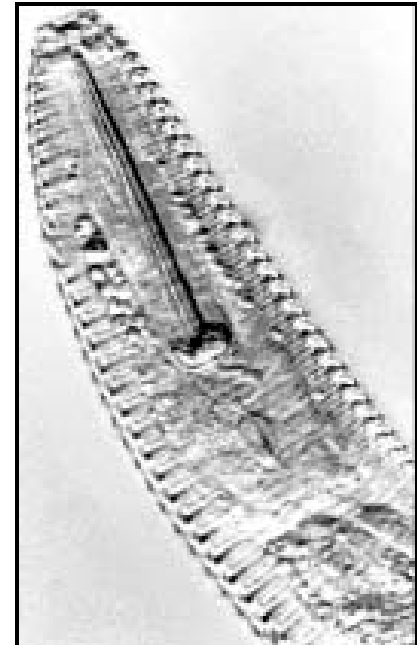
- Understand the risk
  - Nematodes – what are they?
  - Types of nematodes
  - Diagnosis and sampling
- Nematicides
- Factors and questions to consider
- Useful resources



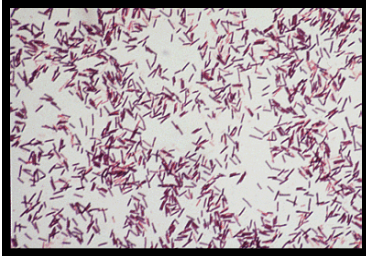
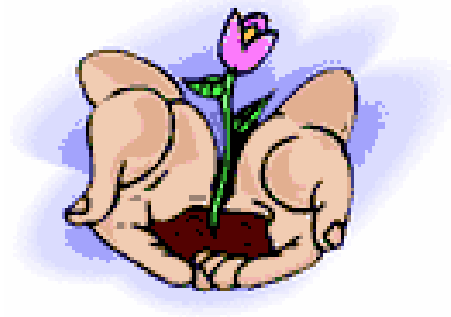
# Nematodes



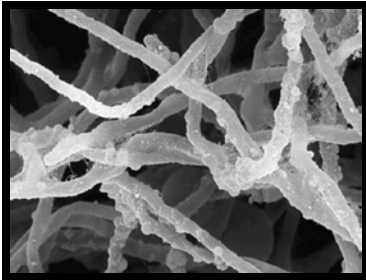
- Mesofauna/microfauna
- Most numerous animal on earth
- Found in all habitats



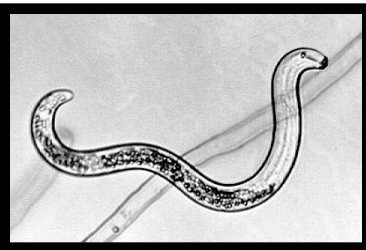
# in one...



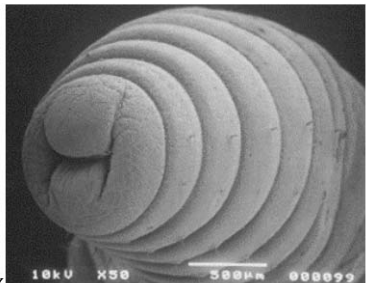
**300 million – 50 billion bacteria**



**500,000 – 100 million fungi**



**1,000 – 10,000 nematodes**



**0 – 2 earthworms**

# “Nematode” Does Not Just Mean...

- Soybean cyst nematode (*Heterodera glycines*)



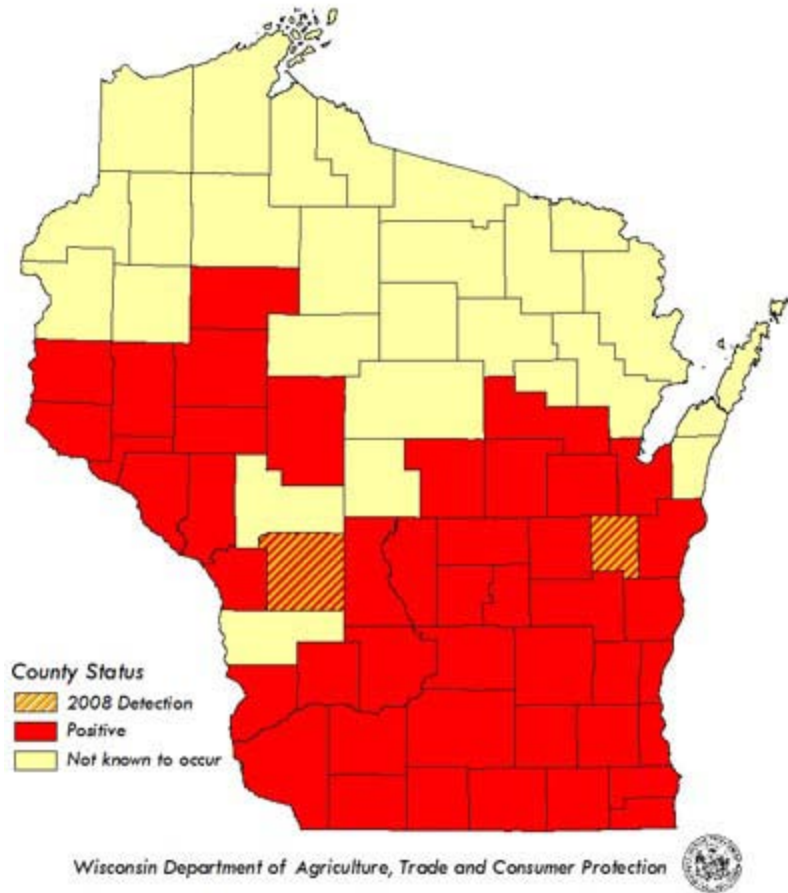
## Warning signs:

- Areas of stunted plants, and poor canopy
- Areas of chlorotic growth
- Areas where weed control is sub optimum
- White females (i.e. cysts) on roots



# SCN in Wisconsin

## 2008 Soybean Cyst Nematode Survey



- As of 2008, there are 46 counties in Wisconsin where SCN has been detected (Source: DATCP)
- Free testing program from the Wisconsin Soybean Marketing Board



# Corn Nematodes

Nematode pests of corn are common in the Midwest.

**Needle**

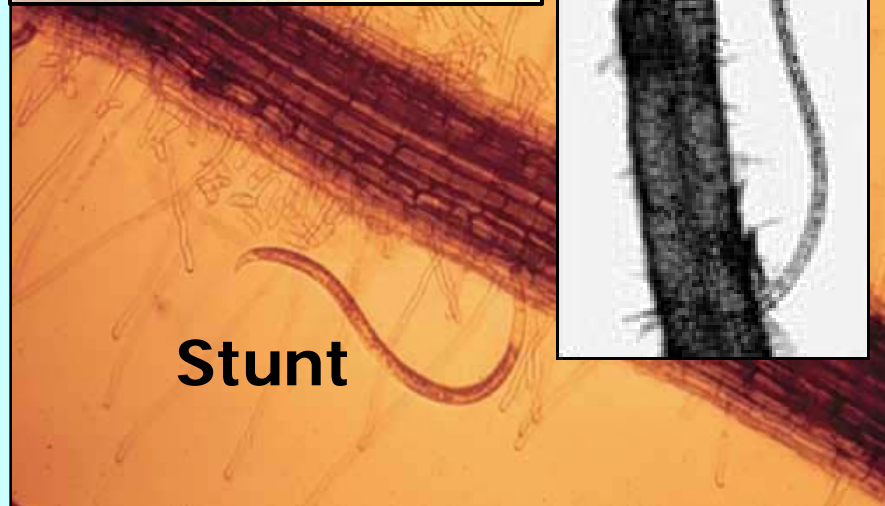
**Root Lesion**



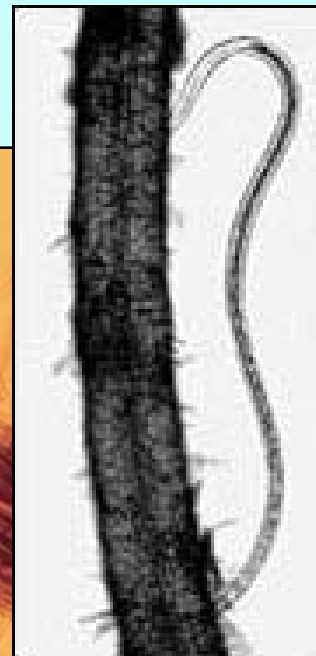
**Lance**



**Stunt**



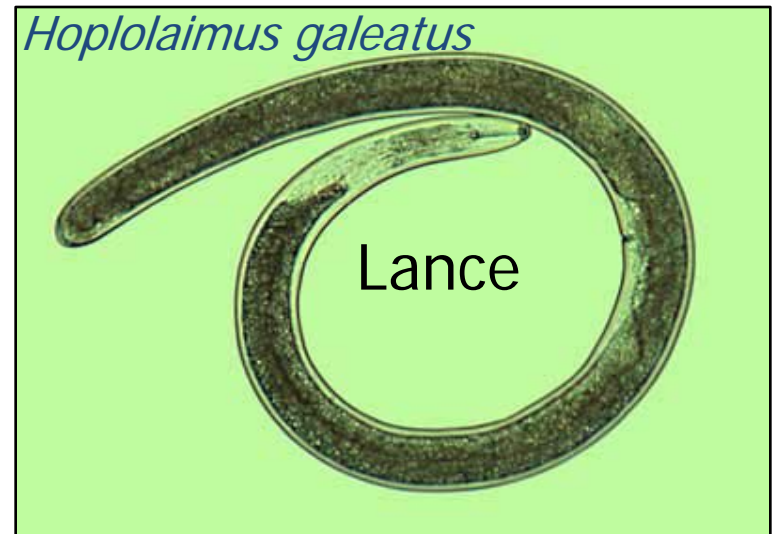
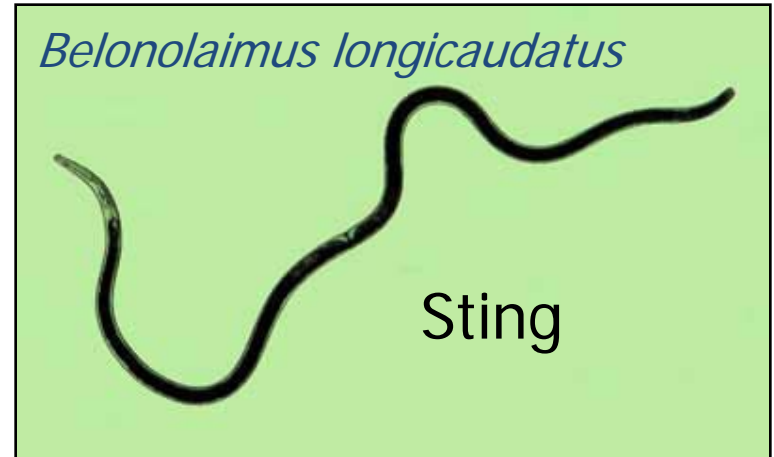
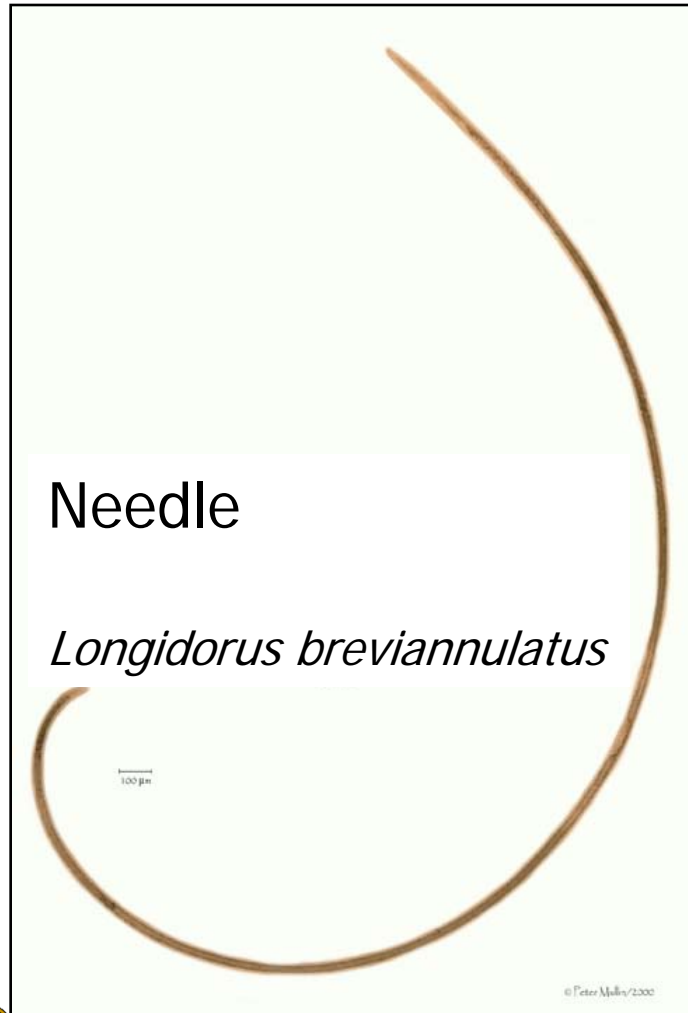
**Dagger**



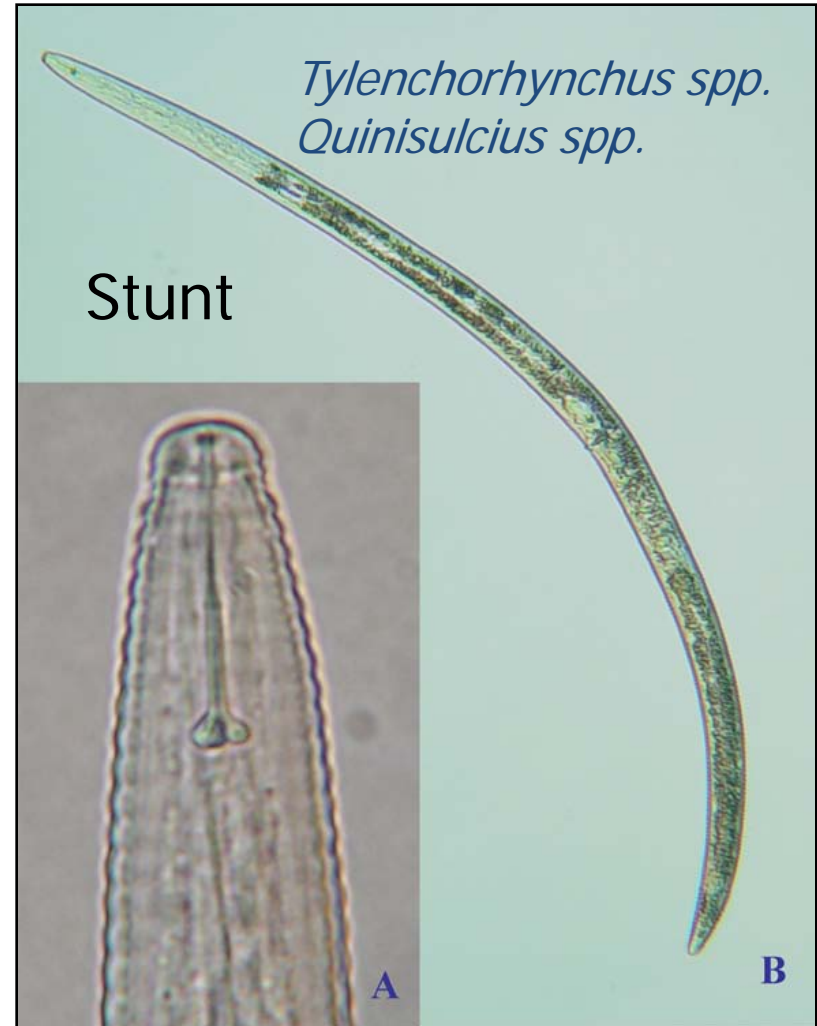
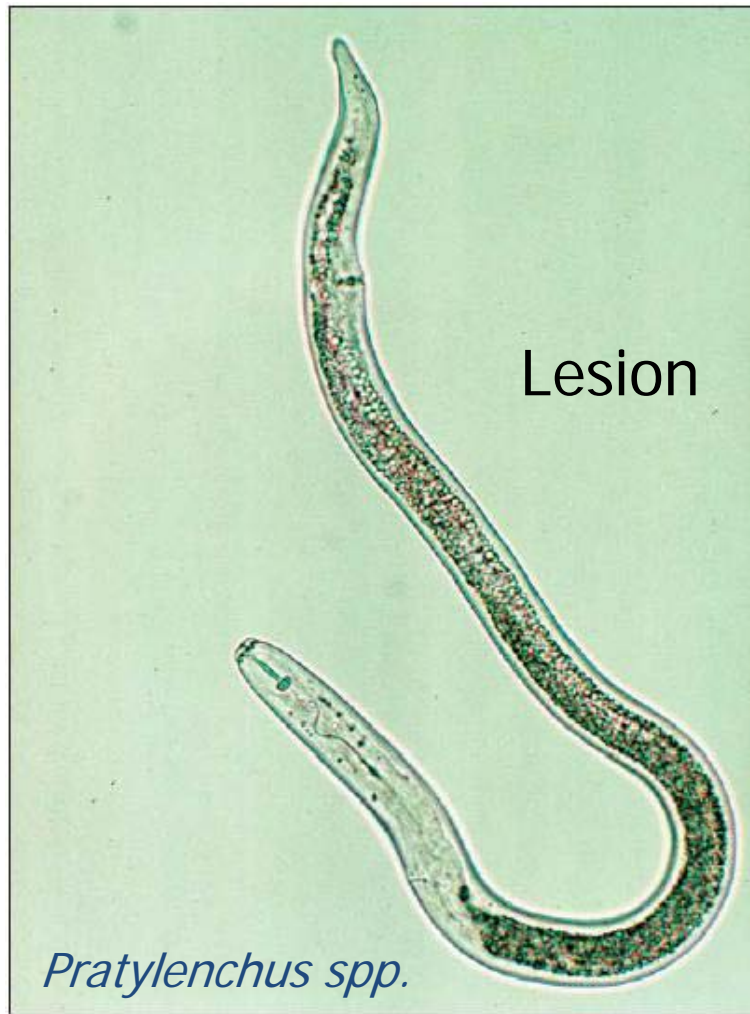
Root Lesion is the most common and Needle is the most damaging to corn.



# Some Corn Nematodes are Usually Represented by a Single Species



# Other Corn Nematodes are Actually Several Species

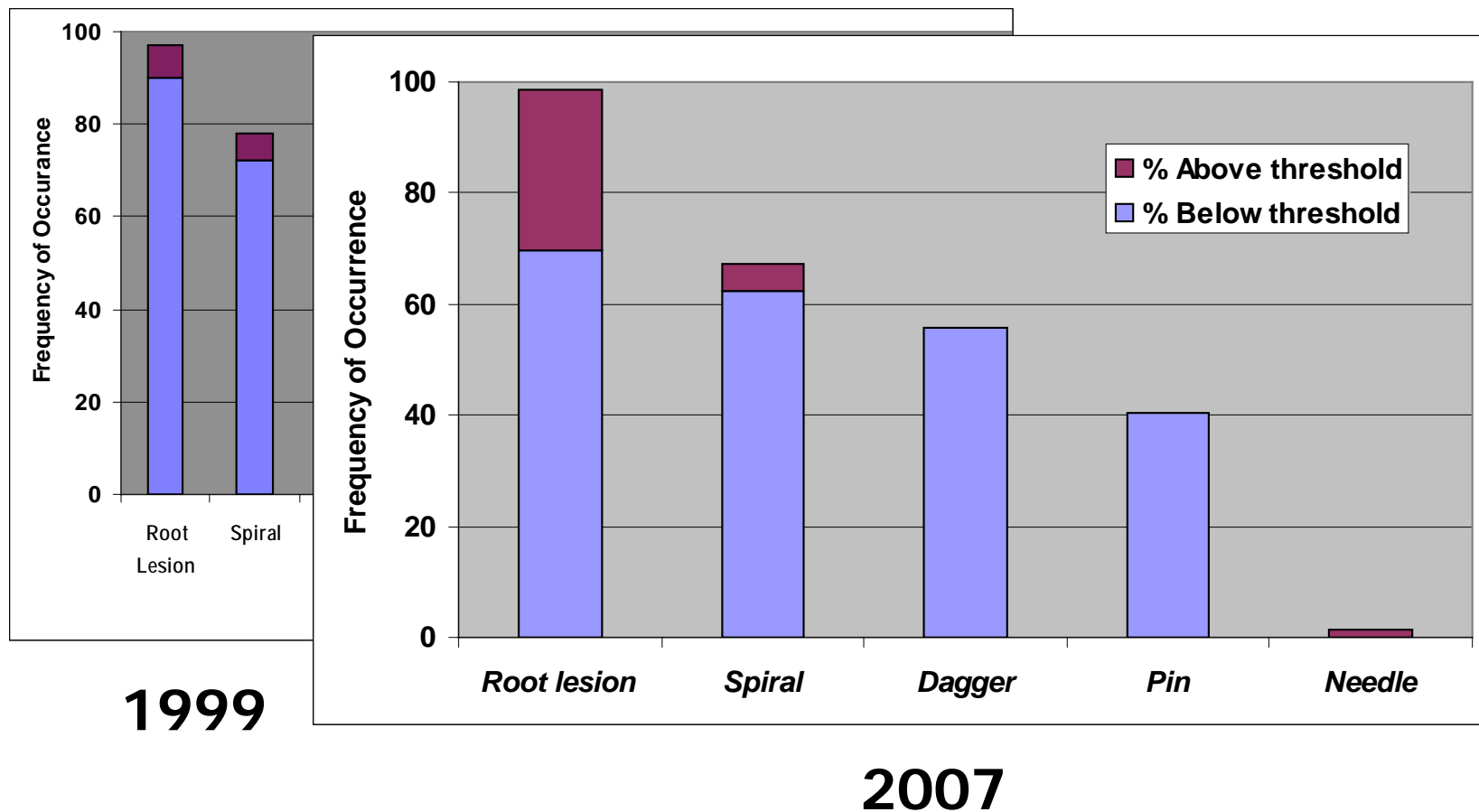


Tom Forge



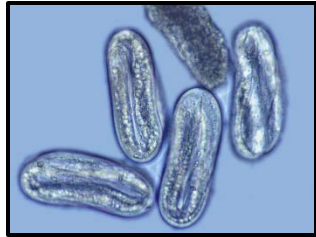
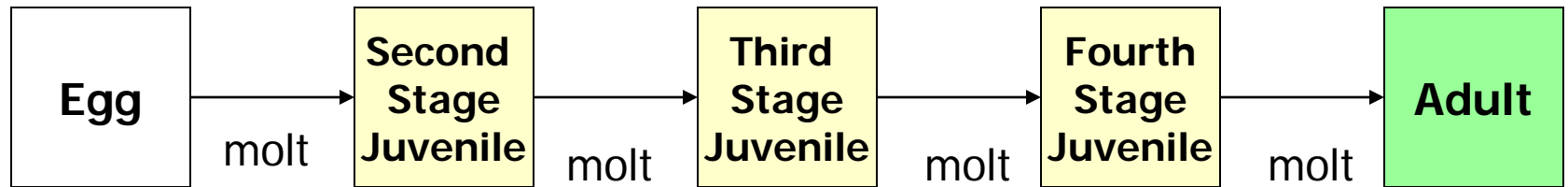


# Corn Nematodes, Particularly Root Lesion, Appear to be Increasing in Wisconsin



Corn Survey for Wisconsin (~ 150 fields randomly selected)

**Nematodes may have different adaptations and strategies, but all have a similar life cycle that is completed in about 30-35 days.**



Eggs of SCN are the overwintering stage and do not hatch until a host plant is present. Corn nematodes overwinter as all life stages that can feed on a wide range of plant species.



Nematodes cannot develop unless they feed on live roots. Corn nematodes are able to move and find new feeding sites their entire life. SCN stay at one feeding location inside roots.



Adults of corn nematodes remain worm-shaped and lay eggs in roots and in soil. Adult female SCN are swollen and lay eggs in a cluster outside their body or retain eggs that remain inside their body, even after death (cyst).

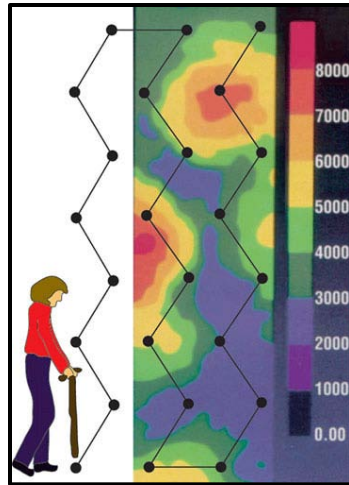


# Diagnosing a Nematode Problem...

- **Site history:** declining yields, or consistent failure to reach full yield potential
- **Field appearance:** patches of stunted plants or weeds
- **Soil assay:** high numbers of known plant pathogenic nematodes

# Soil Sampling is Critical for Accurate Diagnose of Corn Nematodes and SCN

- Before or at planting: baseline for product evaluations / predict yield
- One month after planting: diagnosis for this year
- Mid-season: predict yield / diagnosis for next year
- At or post harvest: Change in nematode population (nematode reproduction continues after the crop dies)



Bulk soil cores from each management zone.

Collect samples close to the rows, 6-9" deep.



# Sampling Issues:

## Not All Genera of Corn Nematodes are in the Same Place at the Same Time

Depth of Sample	Nematodes per 100 cm <sup>3</sup> Soil			
	May 21		September 12	
	Needle	Root-Lesion	Needle	Root-Lesion
0 - 3.5"	<b>25</b>	<b>124</b>	<b>3</b>	<b>440</b>
3.6 - 6"	<b>14</b>	<b>105</b>	<b>8</b>	<b>279</b>
6.1 - 9.5"	<b>10</b>	<b>127</b>	<b>17</b>	<b>222</b>
9.6 - 12"	<b>4</b>	<b>40</b>	<b>15</b>	<b>32</b>
12.1-15.5"	<b>1</b>	<b>27</b>	<b>4</b>	<b>30</b>

Needle and root lesion nematodes showed a different pattern of vertical distribution in a corn field in Wisconsin.

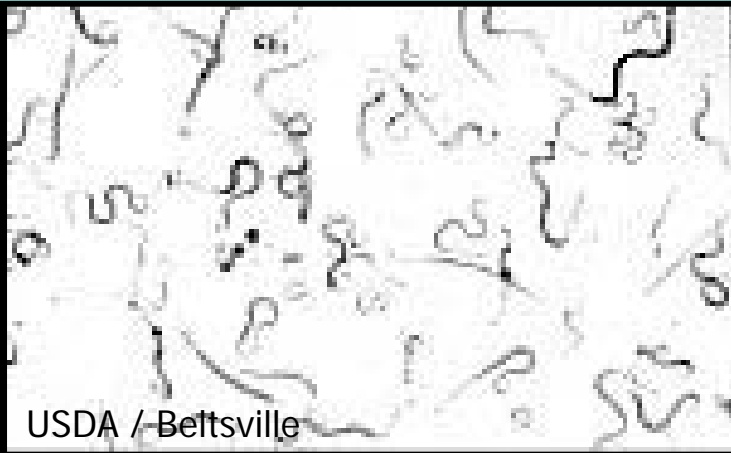




Juvenile nematodes are recovered from soil along with everything else of similar size and density and must be identified.

# Nematode assay

Water is added to the soil sample and poured over sieves of different mesh sizes (large to collect cysts / smaller for corn nematodes).



# Nematicides

- These are agents, usually a chemical, that may kill a nematode
- Challenging proposition for many reasons
  - Efficacy and delivery of product
    - Economic benefit?
  - Environmental and safety questions
  - Check the label closely...if its not labeled as a nematicide it won't be effective
- Some examples:
  - Counter 15 G (Terbufos)
  - Mocap 15 G or Mocap EC (Ethoprop)
  - Telone II (Dichloropropene)



# Seed Treatments Nematicides (Examples)

- Avicta® (Syngenta, 2010)
  - Avicta® Complete Corn (Avicta Duo Corn, Cruiser, Apron XL, Maxim XL, Dynasty)
  - AI: Abamectin (Insecticide = thiamethoxam)
  - MOA: interferes with signal transmission between nerve cells inside nematode at a novel target site; contact nematicide
- VOTiVO™ (Bayer CropScience, 2011) – biological seed treatment for corn and soybean



# Factors and Questions to Consider

- Management depends on proper diagnosis
  - Field symptoms may be due to other issues
  - In corn...may be the most overlooked disease
- Recognize that nematodes are broader than SCN (especially in corn)
- Many products claim to control nematodes...but be sure and ask questions!



# Factors and Questions to Consider – Cont.

- Sampling can be done at any time...focus on the purpose for taking a soil sample
  - For SCN: Wisconsin Soybean Marketing Board sponsors a free testing program
- Most nematodes that attack corn do not attack soybean
- Corn, small grains, alfalfa, and red clover are nonhost crops of SCN
- Crop practices like continuous corn (or soybean) can increase populations





# Nematicide Efficacy and Necessity

**Paul Esker, Field Crops Extension Plant Pathologist**

Co-Authors: Shawn Conley (Agronomy) and Ann MacGuidwin  
(Plant Pathology)



# Factors and Questions to Consider – Cont.

- Soil samples for corn nematode analysis need to be treated gently (roots and root pieces are important)
- For corn nematodes, it's the numbers that matter
- Management depends on proper diagnosis...did I already say that one...?





**Once plant parasitic nematodes are established in a field, they rarely disappear. Nematode infestations should be added to the list of field characteristics when making decisions about production and land management.**



# Resources

- Plant Disease Diagnostic Clinic:  
<http://pddc.wisc.edu>
- Soyhealth:  
<http://www.plantpath.wisc.edu/soyhealth>
- Field Crops Plant Pathology:  
<http://www.uwex.edu/ces/croppathology>
- Soybean Agronomy: <http://coolbean.info>

# Resources – Cont.

- “Nematodes in corn production: A growing problem?”:  
<http://www.ipm.iastate.edu/ipm/icm/2007/2-12/nematodes.html>
- “Ten things you should know about corn nematodes”:  
[http://agronomyday.cropsci.illinois.edu/2008/tours/corn\\_nematodes/](http://agronomyday.cropsci.illinois.edu/2008/tours/corn_nematodes/)
- “Nematodes”:  
<http://pdc.unl.edu/agriculturecrops/corn/nematodes>

