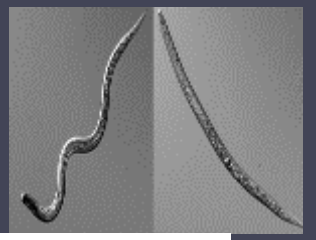
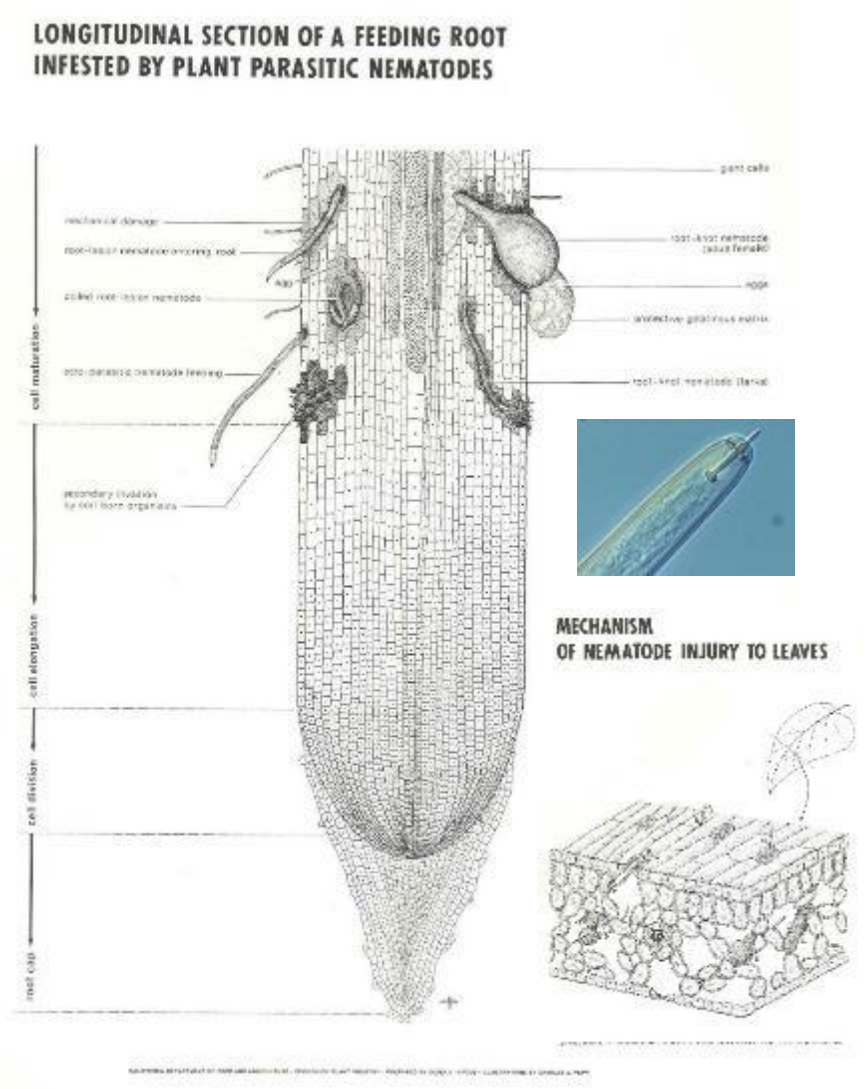


Are invasive nematodes putting squeeze on Florida strawberries?

Johan Desaeger (GCREC) and Joe Noling (CREC)
University of Florida

What Nematodes in FL strawberry fields?

1. Sting nematode –
   Belonolaimus longicaudatus
   Common in Florida, native
2. **Northern root-knot –**
   Meloidogyne hapla
   Less common, pr. introduced
3. **Northern lesion –**
   Pratylenchus penetrans
   Less common, pr. introduced
4. **Foliar nematodes –**
   ***Aphelenchoides* spp.**
   Uncommon, pr. introduced



How are nematodes introduced or spread?

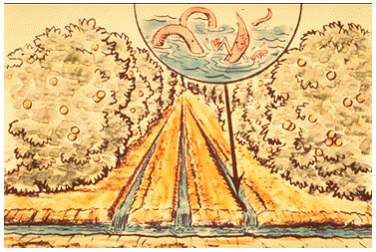
Within a field: short distance

Active movement in soil water and/or leaves – (Foliar nematodes – 12" overnight; Root-knot –vertical 20" in 3 days)



Across fields: longer distance

Passive movement with water, wind, animals, farm equipment, plant and root debris


Across states/countries:

Passive movement via shipments of plants, tubers, bulbs, seeds, soil, wood






Foliar nematode, Plant City, Nov. 2016

Smaller plants, tight, stunted, compact crowns; curled, puckered, distorted leaves, hard and rough to the touch; > 150 foliar nematodes per g leaf

Foliar Nematodes – different types

SPECIES	Host Range	Symptoms	INSIDE LEAF	OUTSIDE LEAF	Survival
A. fragariae Life Cycle 10-11 days 3500 eggs/female Can reproduce on Fungi	Wide	Plant stunting, with Leaf Blotch, reddening of veins and foliage, shoot twisting, undersized crinkled leaves, particularly inner crown.	In hosts other than strawberry	X	**Quiescence**- Dormancy w/in Infected leaves (600 days)
A besseyi Life Cycle 8-12 days (above 13.3^{0}C-80DD) Can Reproduce on Fungi	Wide	Plant stunting, with Leaf Blotch, reddening of veins and foliage, shoot twisting, undersized crinkled leaves, particularly inner crown.	X	X	**Anhydrobiosis**- dehydrated w/in soil & plant tissue
A ritzemabosi Life Cycle 10-13 days 3500 eggs /female Can reproduce on fungi	Wide	Plant stunting, with Leaf Blotch, reddening of veins and foliage, shoot twisting, undersized crinkled leaves, particularly inner crown.	X	X	**Quiescence**- Dormancy w/in Infected leaves (600 days)

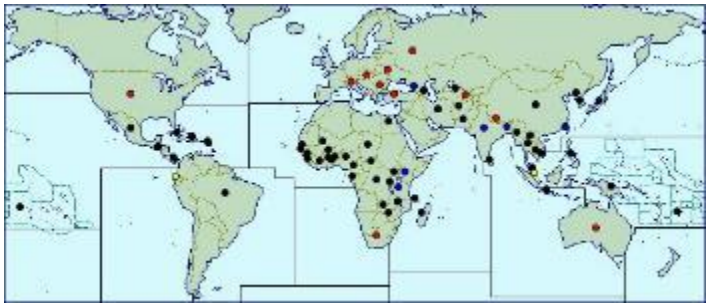
Summary

- Spread quickly in moist conditions
- Global distribution with WIDE host range
- Life Cycle is SHORT: 2-3 weeks
- Symptoms similar among 3 species
- Feeding can occur both inside and outside of plant tissue
- Resistant to desiccation

Foliar nematode in Plant City, FL:

Aphelenchoides besseyi – "Strawberry Crimp Disease" 1929

- **White tip disease of rice (world)**
- **False angular leafspot of beans (CR)**
- **Crimp or dwarf disease of strawberry (SE US, AU)**
  - **Dr. Brooks, Plant City, 1929**
  - **Few recent cases; 2014 (1), 2016 (6)**
  - **Biology on strawberry in Florida??**



Where do foliar nematodes feed on strawberry plants? *Leaf surface, mostly within the folded crown*

Outer leaves - few nematodes

Inside crown - most nematodes

Inflorescence- few nematodes

Infected runner

Present in soil, but none in the roots
Plants have healthy roots

Did foliar nematodes spread during the season? Possibly …

End of season, March 2017

Infected plants stand out, are taller, having plenty leaves, but produce few flowers and little or no fruit

Dramatic change in plant response to foliar nematode during season

DID THE FOLIAR NEMATODE SPREAD WITHIN THE FIELD?

Maybe … rain, dew, irrigation, … picking!

Late November 2016

December 2016

March 2017

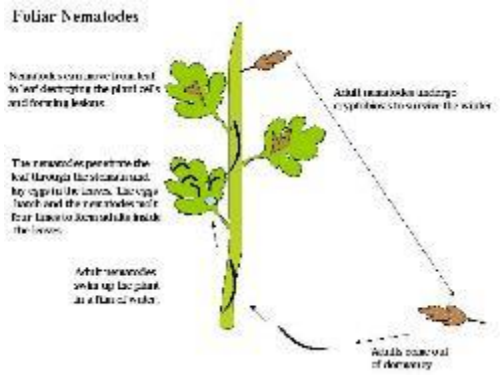
The best way to spread foliar nematodes within a field……..

Pay a Harvesting Crew to drag their hands through plants up and down rows within a field ☺

- *Make infested fields the last field of the day to be harvested*
- *Encourage pickers to clean hands and or discard issued gloves*
- *Spray between harvests*

Can the foliar nematode survive FL summer?

- Most information on foliar nematodes in strawberry is for the 2 other species
  - can survive in dead leaves, soil, weeds, dormant buds
- Not much known on survival capability of *A. besseyi* in Florida …
  - Will crop destruction kill foliar nematodes on plants?
  - What about the ones in the soil?
    - Can they survive thru summer/re-infect next crop
- We are monitoring the situation and will continue to do so into the next seasons



Prevention / Management of foliar nematodes

- Clean planting material
  - Test plants for nematodes prior to shipping
- Transplant treatments
  - Nematicides / Vydate label for transplants?
  - Hot water treatment at 115°F for 10 minutes
- Limit overhead irrigation / contact between plants
  - Avoid the formation of water film on leaf surface
- Rogue and burn infested plant material
- Rotate with grain crops such as barley and rye

NORTHERN ROOT KNOT NEMATODE (*Meloidogyne hapla*) On Florida Strawberry

Field symptoms:
wilting, stunting, discoloration
galling, plant mortality

Root Knot Nematode has come again ! Spring 2016

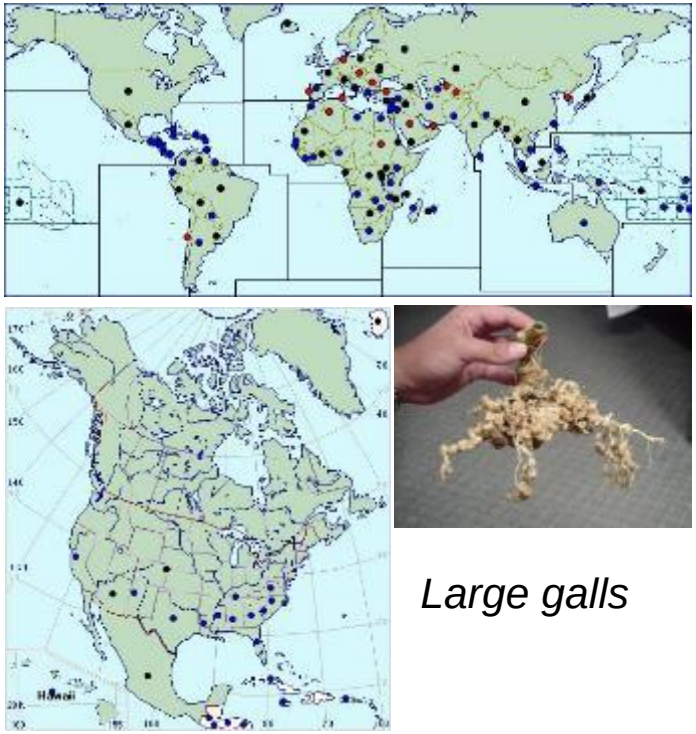
Canadian bare root source of Radiance ***North Carolina bare root source of Radiance***

70% end of season plant collapse

RYFarm, March 22, 2016- Radiance and watermelon collapsing from *Meloidogyne hapla*

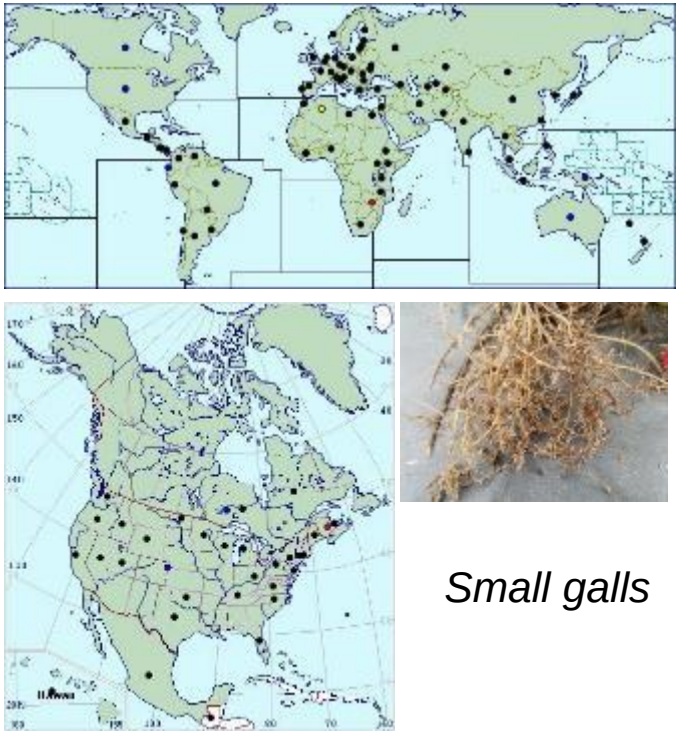
Can northern root-knot nematode survive in FL?

***Tropical southern root-knot** M. incognita*



Large galls

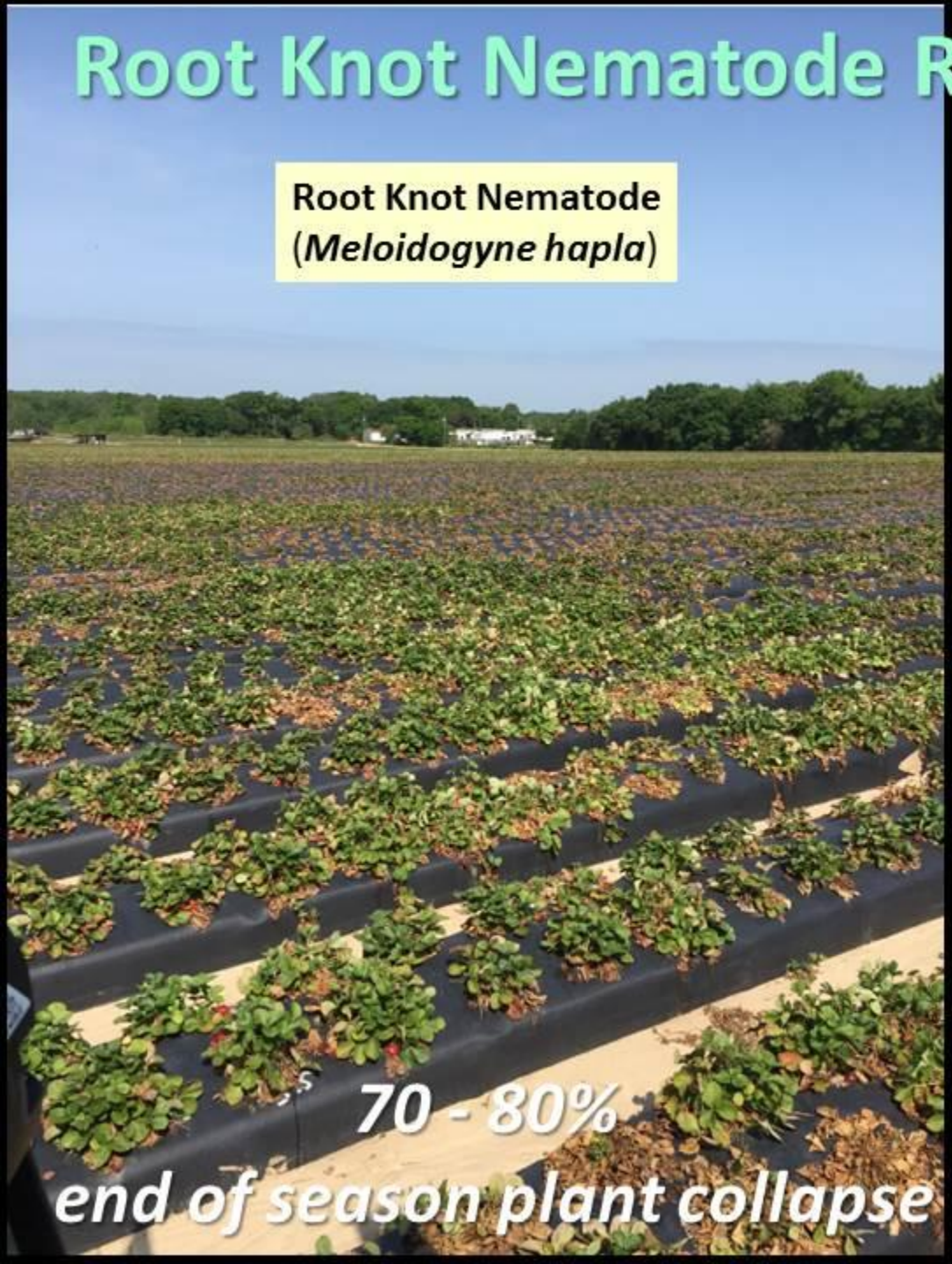
***Temperate northern root-knot** M. hapla*



Small galls

Unlike many root knot nematodes, *M. hapla* can withstand cold, eggs and juveniles surviving field temperatures below 32 F. However, it seems to be less tolerant of high temperatures than *Meloidogyne incognita*. Optimum temperature for invasion and growth of *M. hapla* is in the range 70-75°F, a mean temperature of 80°F being inimical to development.

Root Knot Nematode Rearing Ugly Head!



Bare root Transplant Source

?

When or From Whom !

Does it Survive from One Crop to Next ?

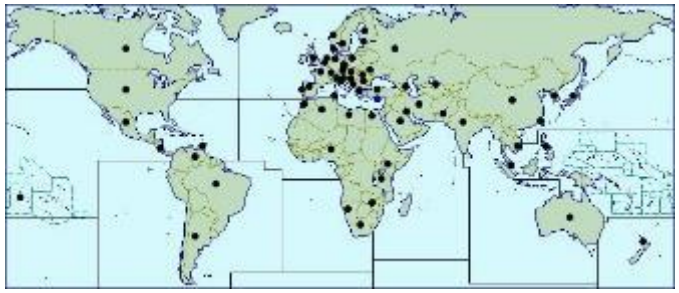
YES !

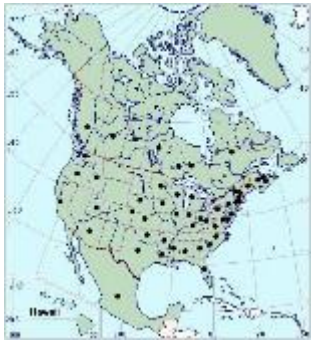
Obvious delay when nematode not Introduced / established w/in transplant

Several farms with *M. hapla* damage March 2017 – strawberries and double-crop cantaloupe, watermelon, …

Pratylenchus penetrans – northern lesion nematode

- Tunnel and feed inside roots - endoparasitic
- Very common in NE US and Canada
- Wide host range, almost every species of cultivated plant + many weeds
- Predisposes plants to invasion by pathogens (black root rot disease complex of strawberry)
- Common at FSGA farm > 1000 nematodes/g root



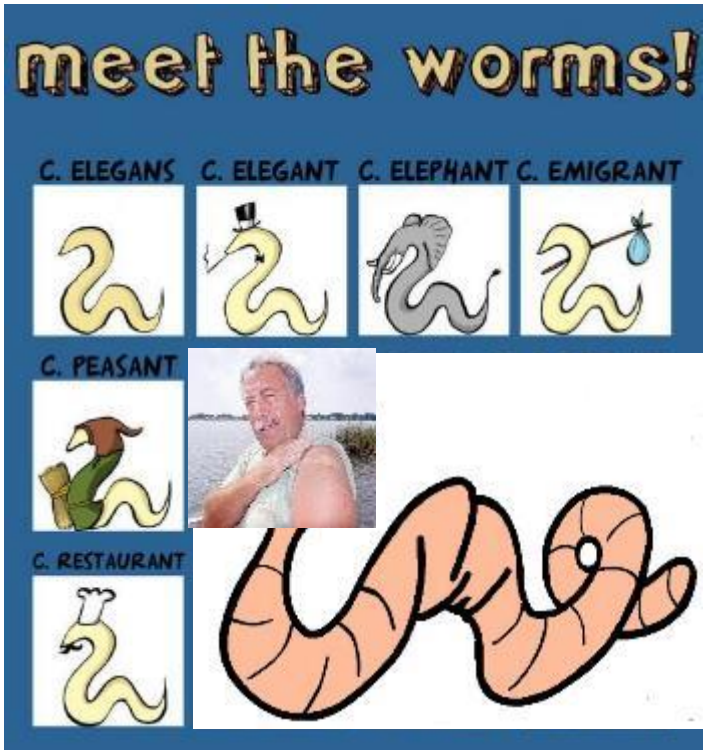


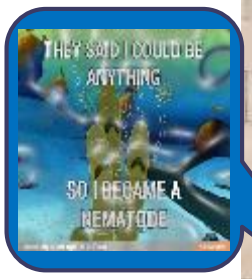
Are foliar, root-knot and lesion nematodes invasive and putting squeeze on FL strawberries?

- How widespread? … need to study!
- Can they survive in Florida? … probably
- Threat? … definitely foliar and root-knot
- Management? … not many options, testing ongoing

Florida Strawberry Growers Association

http://floridastrawberry.org/





Questions?

jad@ufl.edu