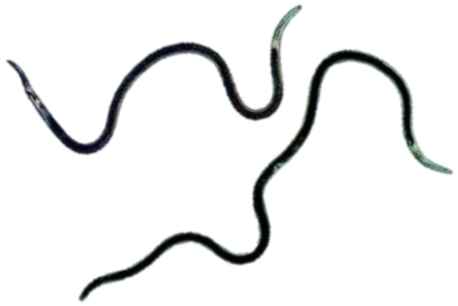


Nematodes Associated with Blackberry

In-Service Training (IST#: 32388)/ May 7, 2025

Johan Desaeger and Hung Bui

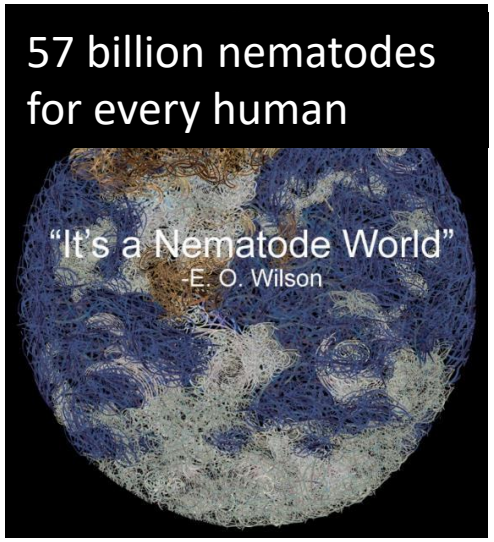
University of Florida /IFAS – Dept. Entomology and Nematology

Gulf Coast Research and Education Center, Wimauma, FL

jad@ufl.edu

Nematodes are (microscopic) roundworms

Soft, transparent, long and narrow



Nematodes parasitize every animal and plant

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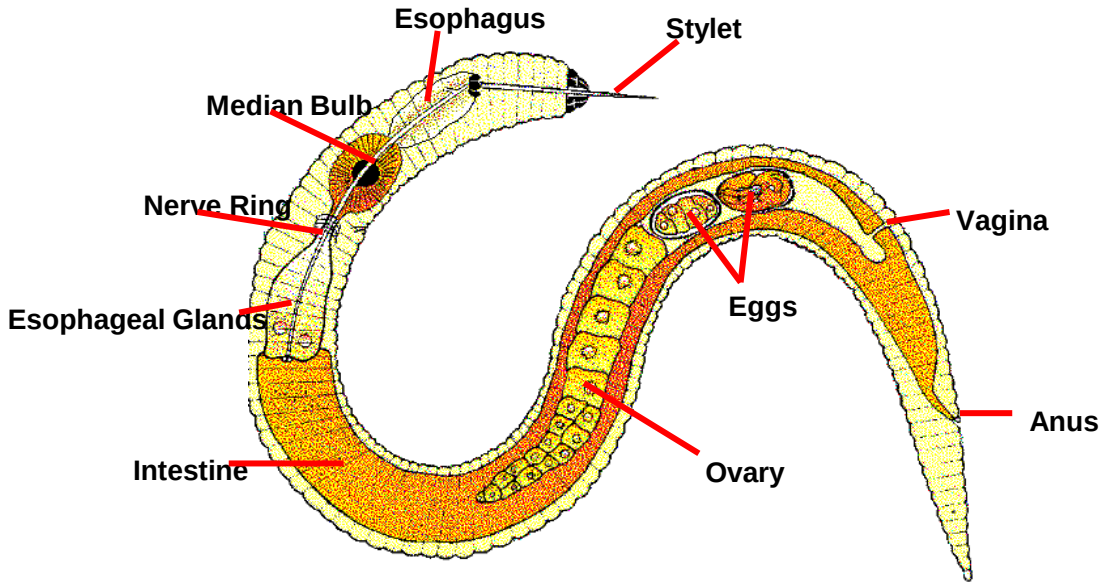
Plant parasitic nematodes cause significant crop damage



- > 100 billion US$/year
- Indestructible and unpredictable
- Very difficult to manage

•Transparent and microscopic ~ long, thin roundworms ('threadworms' or 'eelworms')
•At the head is a hollow mouth spear (~ hypodermic needle) called a stylet
•**Feed by piercing and sucking** - Punctures plant cells, withdraws food, secretes protein and metabolites

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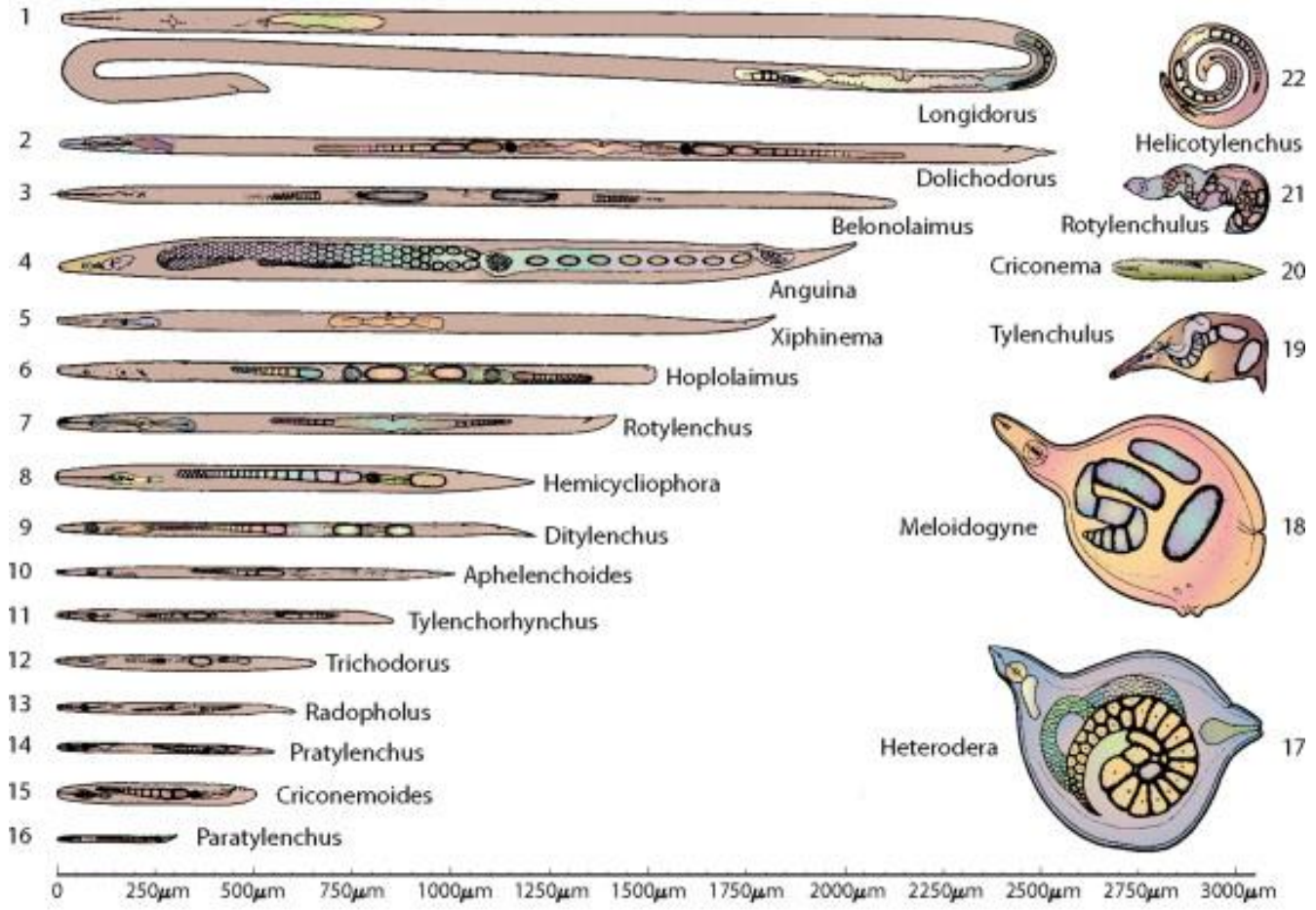
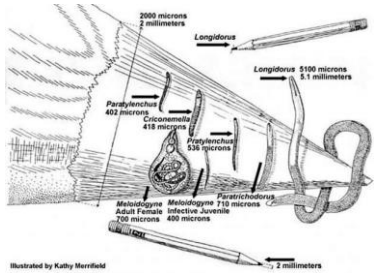
Relative sizes and body shapes of plant-parasitic nematodes

1/4 inch /
0.5 cm



1/60 inch
0.025 cm



credit Society of Nematologists

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Plant-parasitic nematodes that feed aboveground

Leaf nematodes (*Aphelenchoides* spp.)
Coconut palm nematodes (*Bursaphelenchus cocophilus*)
Pine wilt nematode (*Bursaphelenchus xylophilus*)
Seed and gall nematode (*Anguina* spp.)
Stem and bulb nematode (*Ditylenchus* spp.)
Beech leaf nematode *Litylenchus crenatae*

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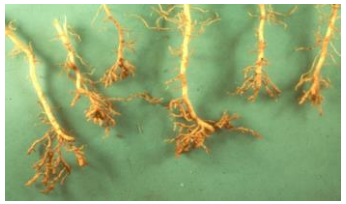





Root galls, root pruning, stubby roots, hairy roots, …

Most plant-parasitic nematodes feed on roots

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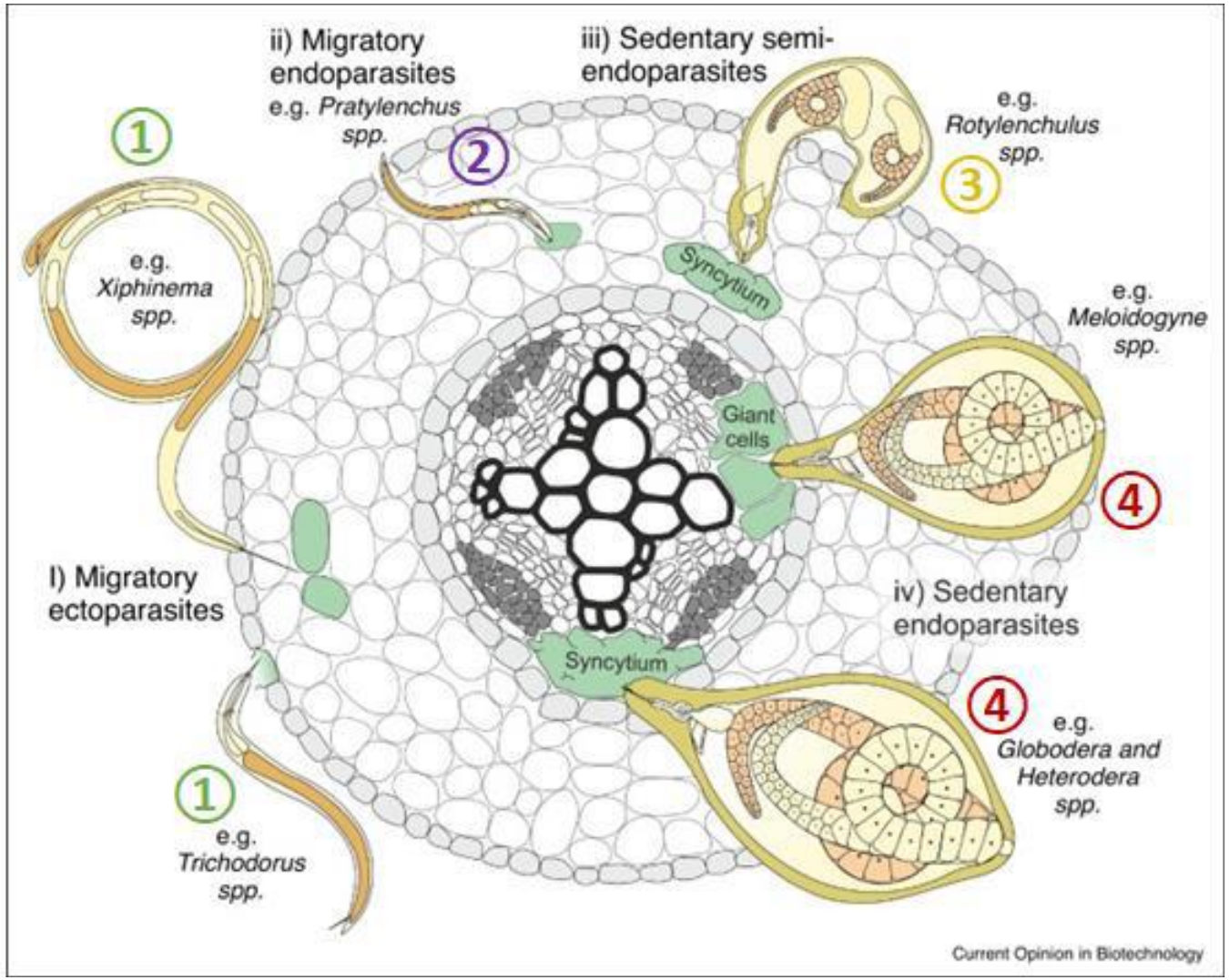
Nematodes Feed on Roots in Different Ways

- ① Migratory ectoparasites
- ② Migratory endoparasites
- ③ Semi-endoparasites
- ④ Sedentary endoparasites

  also stem, bulb and leave feeding (not in picture)



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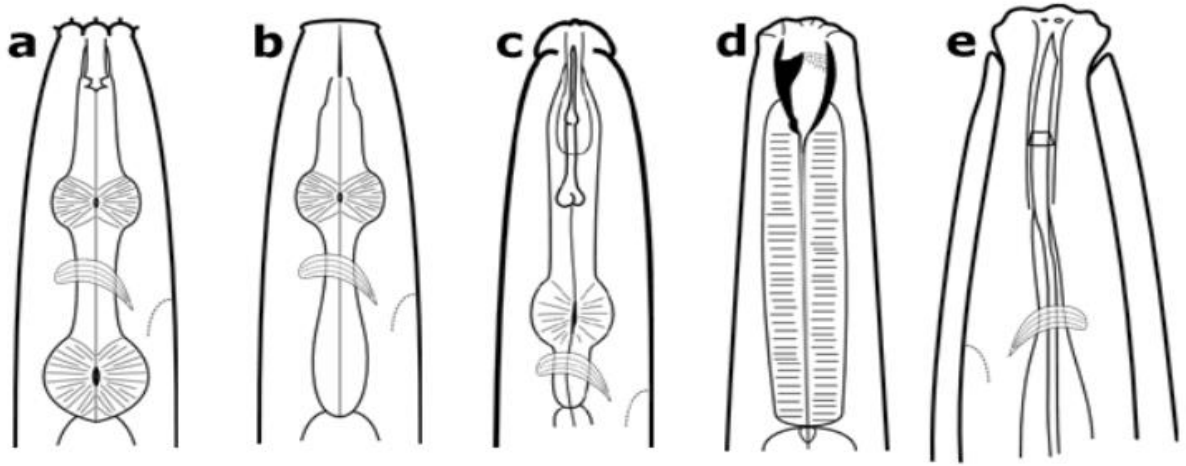
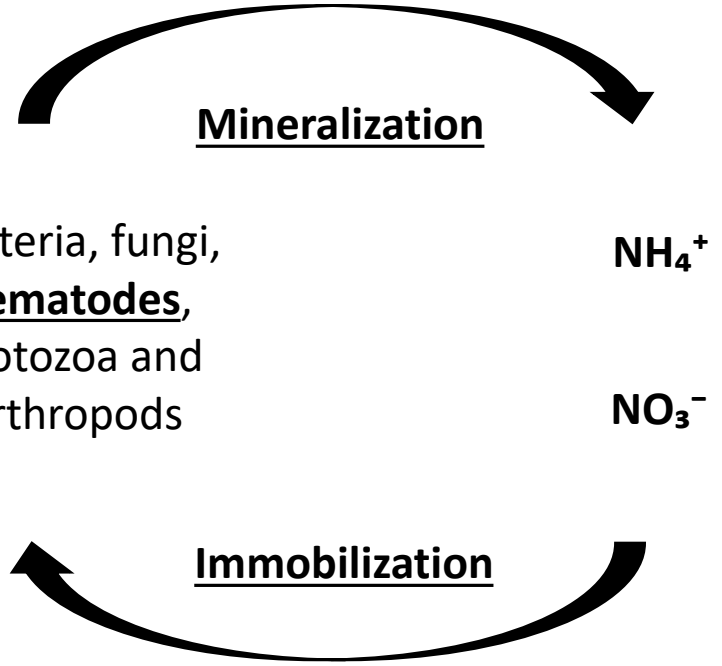
Most soil nematodes are beneficial





What roles do nematodes have in soil?

- Nutrient cycling; immobilization and mineralization
- Regulate OM decomposition
- Food source for higher level predators
- Regulate microbial populations
- Environmental indicators
- Disease supression and development

* Tugel, A.J., A.M. Lewandowski, and D. Happe-vonArb, eds. 2000. Soil Biology Primer. Ankeny, IA: Soil and Water Conservation Society.

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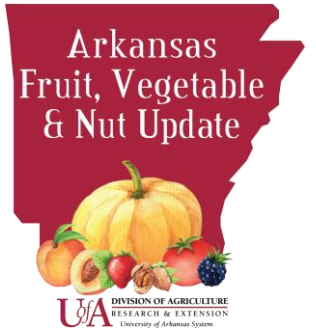
Nematodes on blackberries?

- https://www.uaex.uada.edu/farm-ranch/crops-commercial-horticulture/horticulture/ar-fruit-veg-nut-update-blog/posts/blackberry-nematode-trial.aspx



- **Lesion nematodes** (*Pratylenchus* spp.) directly impact blackberry by feeding on roots and reducing plant productivity, leading to reduced plant size, fruit quality and yield, while also impacting winter hardiness.

- **Dagger nematodes** (*Xiphinema* spp.) impact blackberry plantings by transmitting several plant viruses which can lead to blackberry yellow vein disease.

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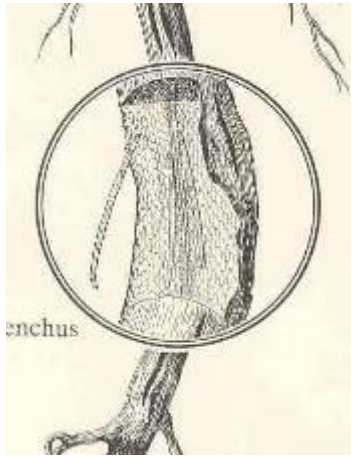
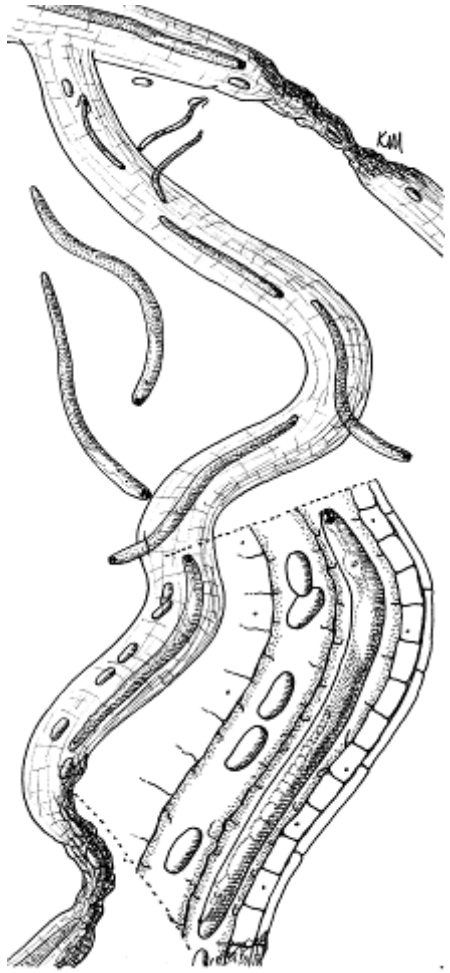
Lesion nematodes (*Pratylenchus* spp.) are migratory endoparasitic plant-parasitic nematodes

tunnel inside root but move back to soil and into new roots





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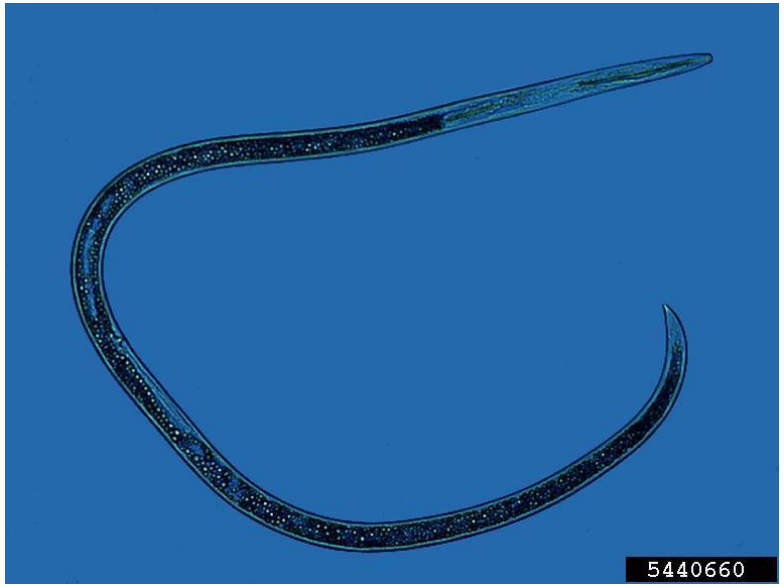
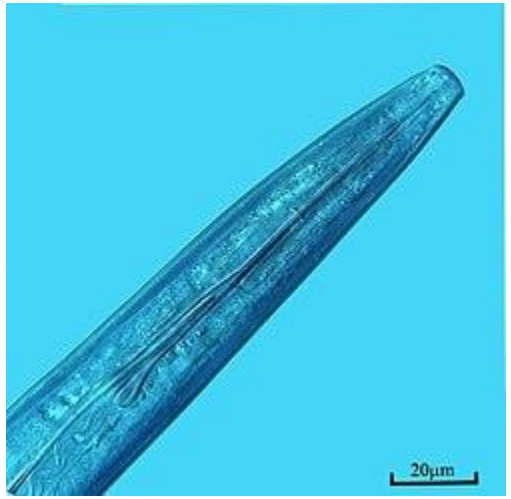
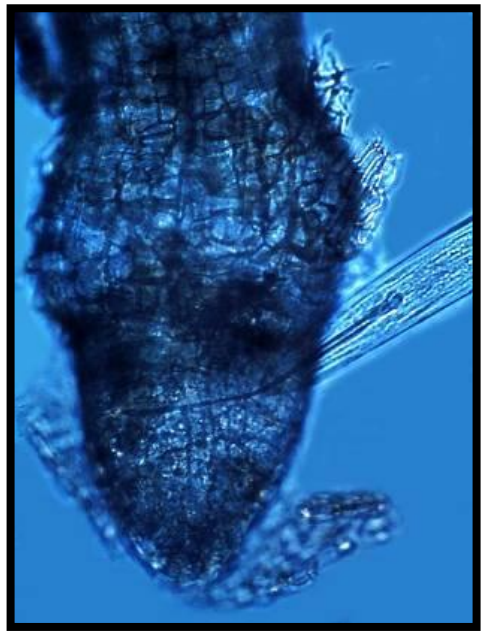
Dagger nematodes (*Xiphinema* spp.) are ectoparasitic plant-parasitic nematodes

feed outside of root, move cell-to-cell but do not enter root







Xiphinema on grape roots
(J. Eisenback)

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Main nematode of concern in other states: Dagger nematode (*Xiphinema* spp.) can transmit viruses

Nepoviruses like tomato ringspot, tobacco ringspot and grapevine fanleaf viruses

Virus symptoms on a blackberry plant, showing irregular drupelet size and leaf mottling. Picture by Keilah Barney, **University of Arkansas**

Leaves of Viking red currants showing symptoms of Tomato ringspotvirus transmitted by Xiphinema sp. (Joseph Postman, **USDA-ARS, Corvallis, Oregon**)

Symptomatic leaf and blackberries caused by tobacco ringspot virus, **NC State**

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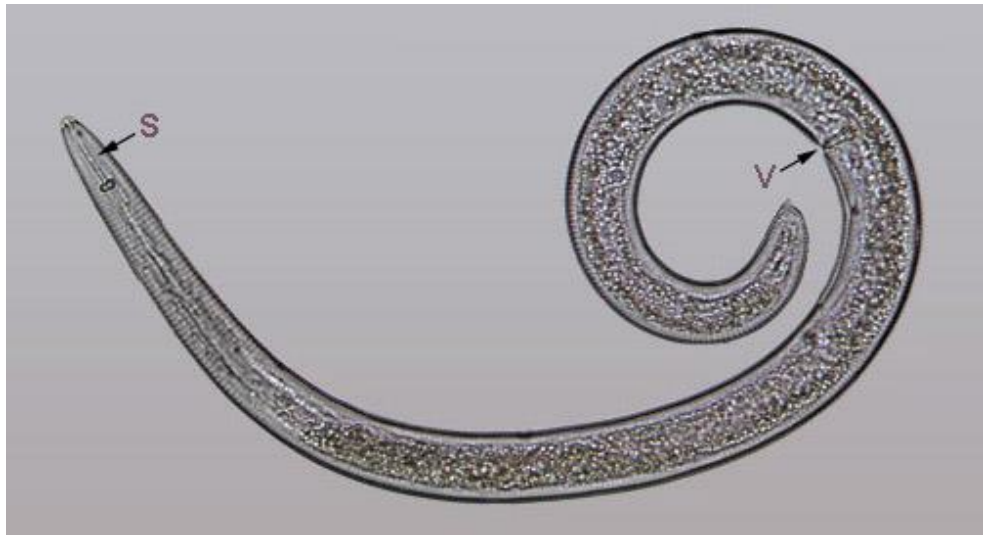
Blackberry nematode counts (100 cc soil) from commercial farm in Arkansas (2021-2024)

Field Number	2021					2024				
	Dagger	**Lesion**	Spiral	Stubby	Non par	**Dagger**	**Lesion**	Spiral	Stubby	Non par
Ritter 03	**0**	**8**	77	0	431	**1154**	**46**	654	0	200
Ritter 18	**0**	**0**	38	0	539	**647**	**562**	231	38	53
Ritter 36	**169**	**0**	938	0	1576	**1216**	**831**	393	0	223
Ritter 44	**38**	**8**	115	0	446	**176**	**269**	131	0	161
Ritter 49	**8**	**15**	231	0	792	**546**	**239**	46	38	246
Ritter 61	**0**	**38**	1046	0	1523	**161**	**323**	46	0	184
Ritter 63	**85**	**177**	1569	38	1200	**585**	**385**	308	0	252
Ritter 68	**0**	**216**	231	0	516	**469**	**184**	162	77	100
Ritter 70B	**46**	**31**	138	0	1085	**176**	**38**	38	0	408
Ritter 73	**0**	**38**	115	269	785	**108**	**38**	239	46	431
Ritter 78	**77**	**38**	1262	0	3315	**877**	**0**	192	115	439
Ritter 79B	**0**	**0**	1185	231	1531	**362**	**385**	230	0	685
Ritter 81B	**0**	**0**	77	38	792	**377**	**369**	1408	77	139
Ritter 82	**169**	**31**	1100	0	1384	**515**	**231**	38	77	423
Ritter 84	**38**	**0**	46	38	1661	**400**	**508**	1015	269	269
Ritter 87	**0**	**15**	154	0	1354	**200**	**354**	615	115	515

What about Florida?
First nematode sampling (Dec. 2021, GCREC, Dr. Deng orchard)



Spiral nematode (*Helicotylenchus* spp.)

- Only spiral nematodes were found
  - up to 1,300 / 200 cc soil
  - rarely considered a major pest

- No root-knot, sting, lesion nematodes (most damaging nematodes in Florida) were found

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Recent sampling (GCREC 2022-25), also sting nematodes found (#/200 cc soil)

Year	Plant age	Symptoms	Root-knot	Sting	Lesion	Spiral	Stubby	Sheath
2022	Older	Some yellowing	0-3	**0-12**	0	74-1170	0-6	0
2024	Older	None / weedy*	41*	**1**	5	140	0	0
	Older	**Yellowing**	2	**50**	0	1	0	0
	Older	No yellowing	0	**0**	9	40	0	0
	New plants	Yellowing	0	**0**	0	0	0	0
	New plants	No yellowing	0	**0**	0	0	0	0
2025	Older	**Yellowing**	1	**4**	0	0	24	4
	Older	**Yellowing**	0	**2**	0	0	12	1
	Older	**Yellowing**	1	**21**	0	0	6	0

2025 leaf samples were analyzed for nematode-transmitted and common blackberry viruses, but no viruses were detected (Scott Adkins and Sal Lopez, USDA/ARS Ft Pierce)

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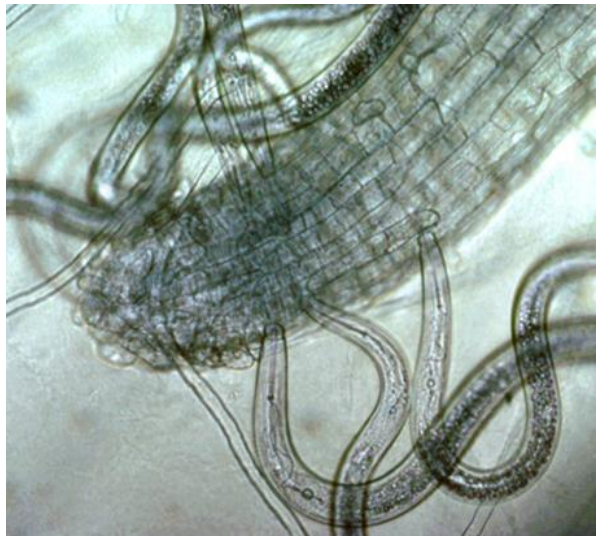
Sting nematode (*Belonolaimus longicaudatus*) on strawberry



- Plants won't grow – severe root pruning - no root growth
- Ectoparasite, feeds on root tips, only in sandy soil (FL native)
- One of the largest plant-parasitic nematodes
- Wide host range (fruits, vegetables, corn, peanut, citrus, turf, …)

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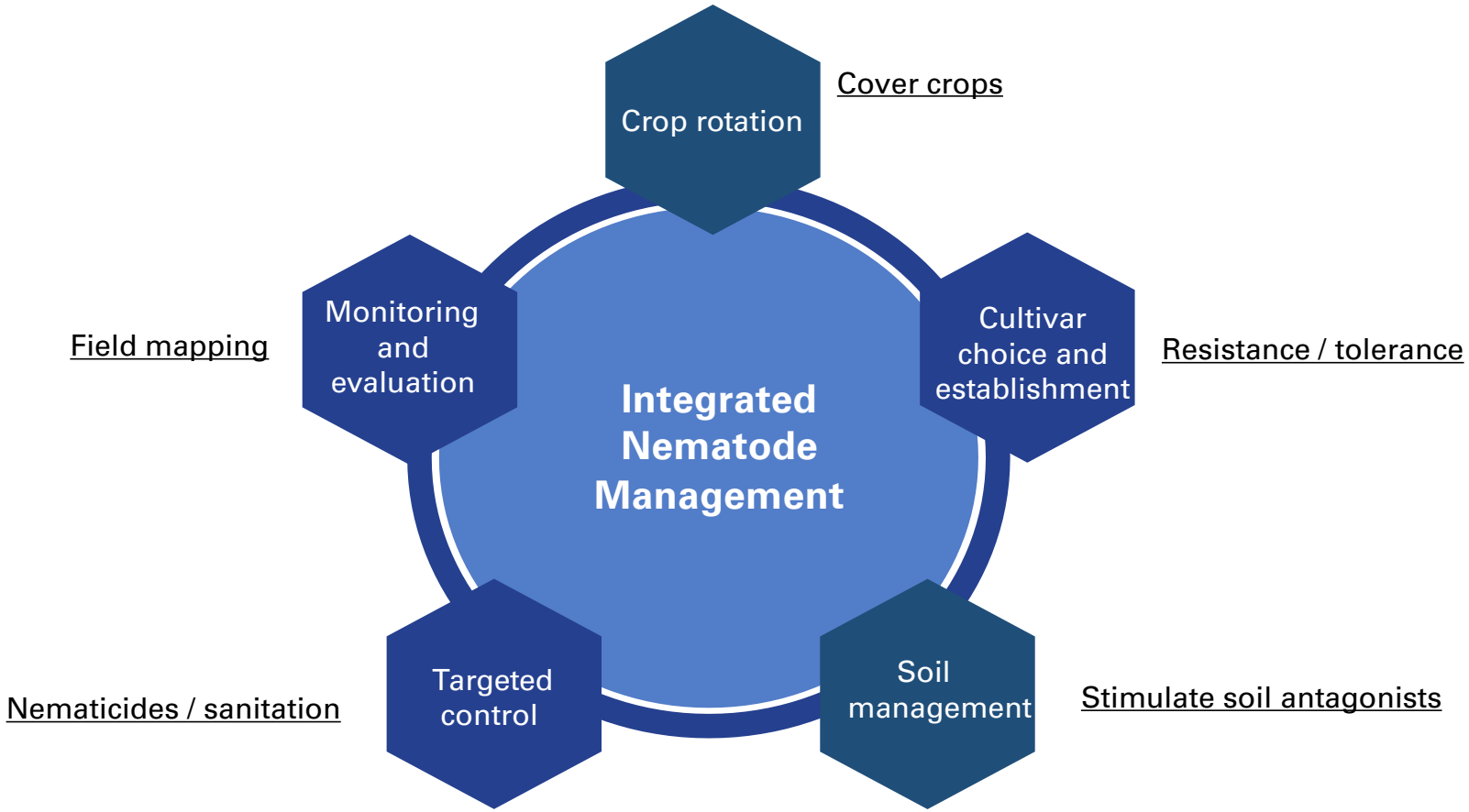
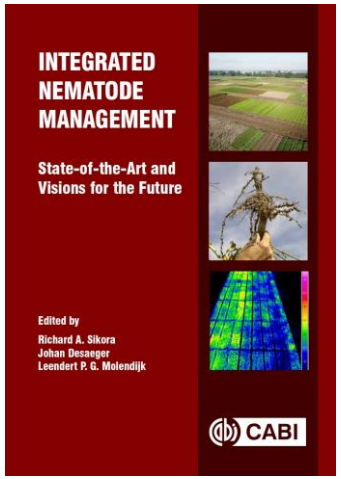
How to best manage plant-parasitic nematodes?





https://www.cabi.org/bookshop/book/9781789247541/

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Soil disinfestation before planting

Soil fumigation standard practice in Florida since 1970s for many crops

Simultaneous control of soil-borne pathogens, plant-parasitic nematodes and weeds

Different alternative practices – soil steaming, flooding, **solarization, anaerobic soil disinfestation**

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Soil solarization

- Covering soil with clear plastic 1 month or more
- Irrigate soil before covering with plastic (or after if drip tapes)
- Need clear skies, clouds reduces efficacy
- High temperature (50 C or more) will kill nematodes > mostly effective in top-soil > nematodes move downwards to escape heat

Anaerobic Soil Disinfestation (ASD)

- Biological Soil Disinfestation or Reductive Soil Disinfestation first developed in Japan and the Netherlands (2000) – variation of flooding

- How? 1. **Incorporate organic amendments** w/ high amounts of labile carbon (molasses, rice bran, …) - 2. **Cover soil with impermeable film** that limits gas exchange - 3. **Irrigate soil** to field capacity – 4. **Wait 2-3 weeks** and plant

(Rosskopf et al. 2020).

Figure 2. Aerobic and anaerobic conditions

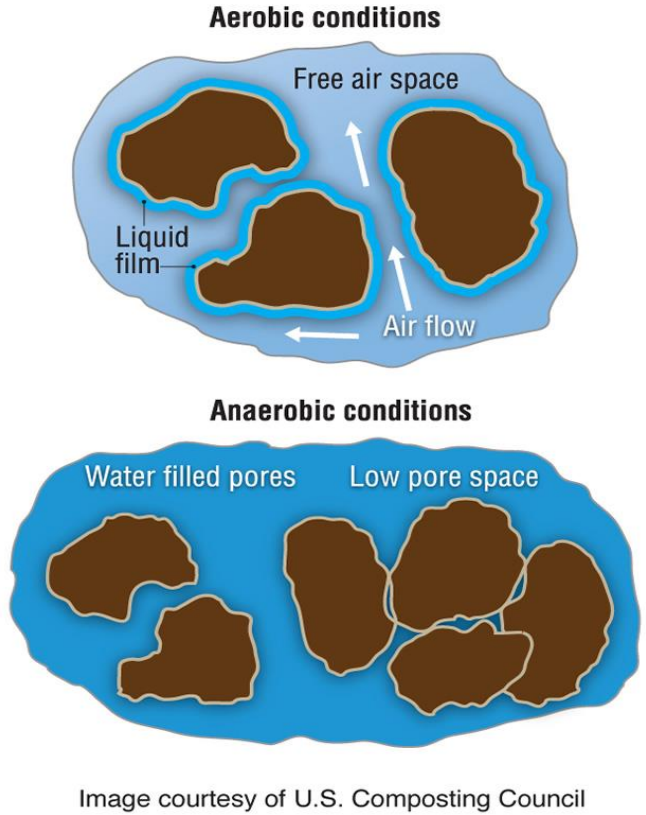

Image courtesy of U.S. Composting Council

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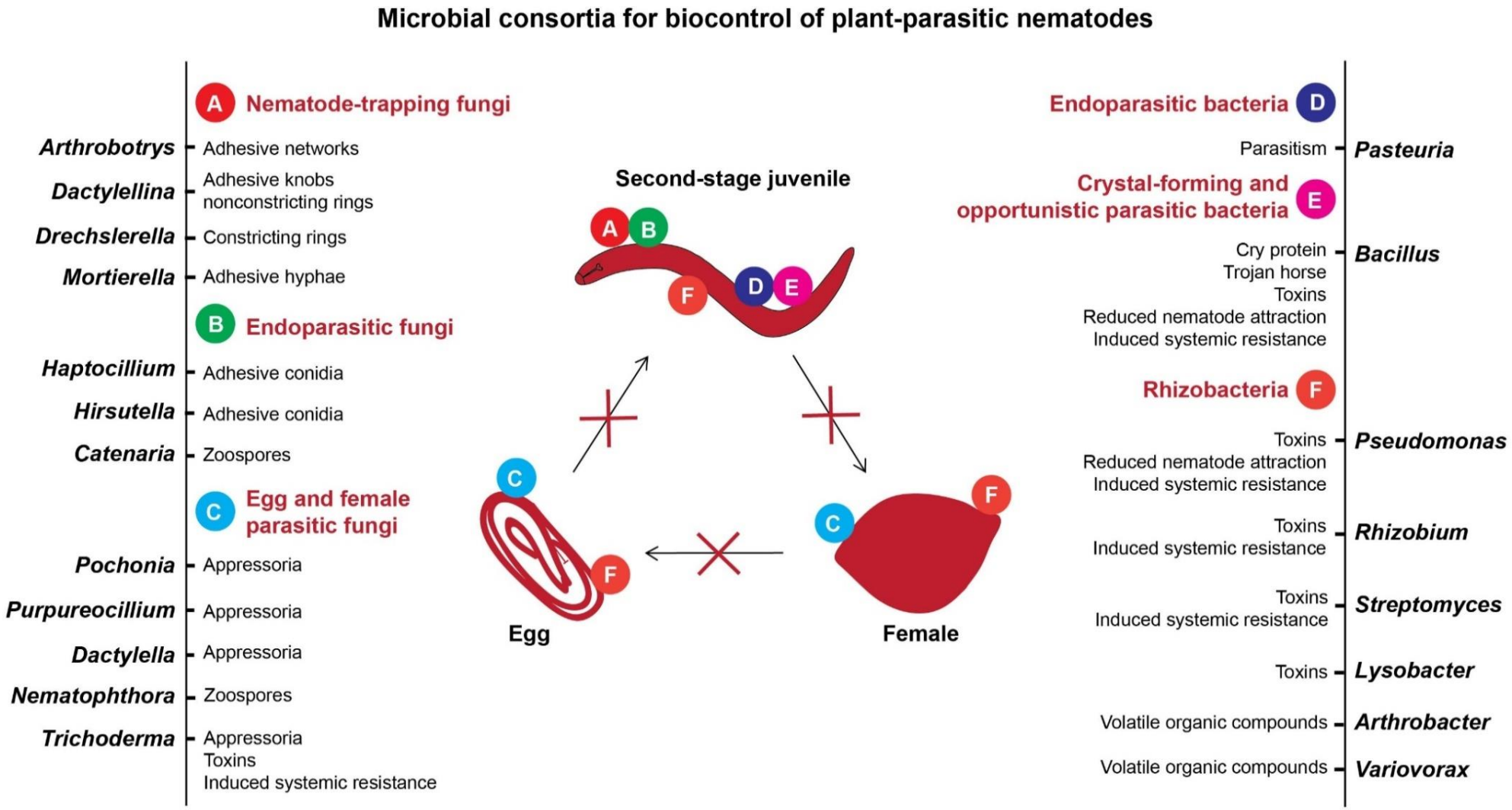
Soil amendments – organic matter

- Increasing soil organic matter reduces nematode damage (Linford hypothesis, 1933) “amendment-induced nematode suppression”
  - stimulation of nematode parasites and antagonists and increasing non-parasitic nematodes like omnivorous and predatory nematodes
- Organic amendments with lower C/N ratios generally considered to be more nematicidal
- Often contradictory results - amendments cause a positive crop growth response, but not so much actual nematode suppression
  - Maybe not nematode abundance but nematode virulence is affected through changes in soil and root microbiome

Soil microbes that are nematode parasites / antagonists



Topalovic et al, 2020 https://doi.org/10.3389/fmicb.2020.00313

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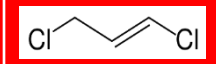
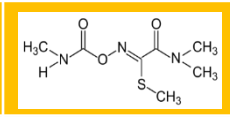
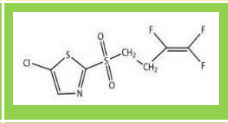
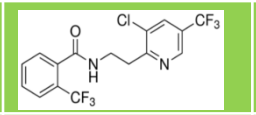
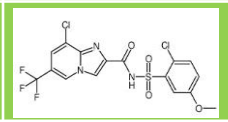
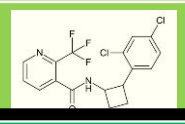
Different types of nematicides (available in US)

Chemical name	Trade name	Structure	Soil movement / solubility (ppm)	Soil residual / Soil ½ life	Mode of Action	Toxicity Category
Fumigants (1,3-D, metam, chloropicrin)	Telone, Kpam, Pic		Good- Gas	Short < 14 d	Multi-site	Danger
Oxamyl	Vydate		Good- 240,000	Short 7 – 14 d	AChel	Danger
Fluensulfone	Nimitz		Medium- 545	Medium 15 d	Unknown	Caution
Fluopyram	Velum		Poor – 10	Long > 200 d	SDHI	Caution
Fluazaindolizine	Salibro		Medium - 2000	Medium 30 d	Unknown	Caution
Cyclobutrifluram (later 2025)	Tymirium		TBD	Long	SDHI	Caution
Purpureocillium lilicanum	Several strains		Poor	Short	Parasitism	OMRI
Bacillus spp.	Many products		Poor	Short	Unknown	OMRI
Plant extracts	Oils (neem, thyme, mustard, garlic), saponins		Poor-medium?	Short	Unknown	OMRI

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In summary:

1) Several plant-parasitic nematodes are associated with blackberries:
   - Lesion, dagger, spiral and stubby root nematodes
   - Dagger nematodes likely most problematic as they transmit (nepo)viruses in blackberries ('blackberry yellow vein disease' BYVD)
2) In Florida, root-knot nematodes do not appear to be a problem, but sting nematodes have been found with declining plants
3) Nematode management in blackberries
   - pre-plant soil disinfestation / nematicides (fluopyram, abamectin)
   - soil management / amendments
   - stimulating inherent plant defenses
   - Resistant and tolerant cultivars? (screening)

Email: jad@ufl.edu