Root-knot Nematode Management in Vegetable Crops in Low Desert

September 29, 2022

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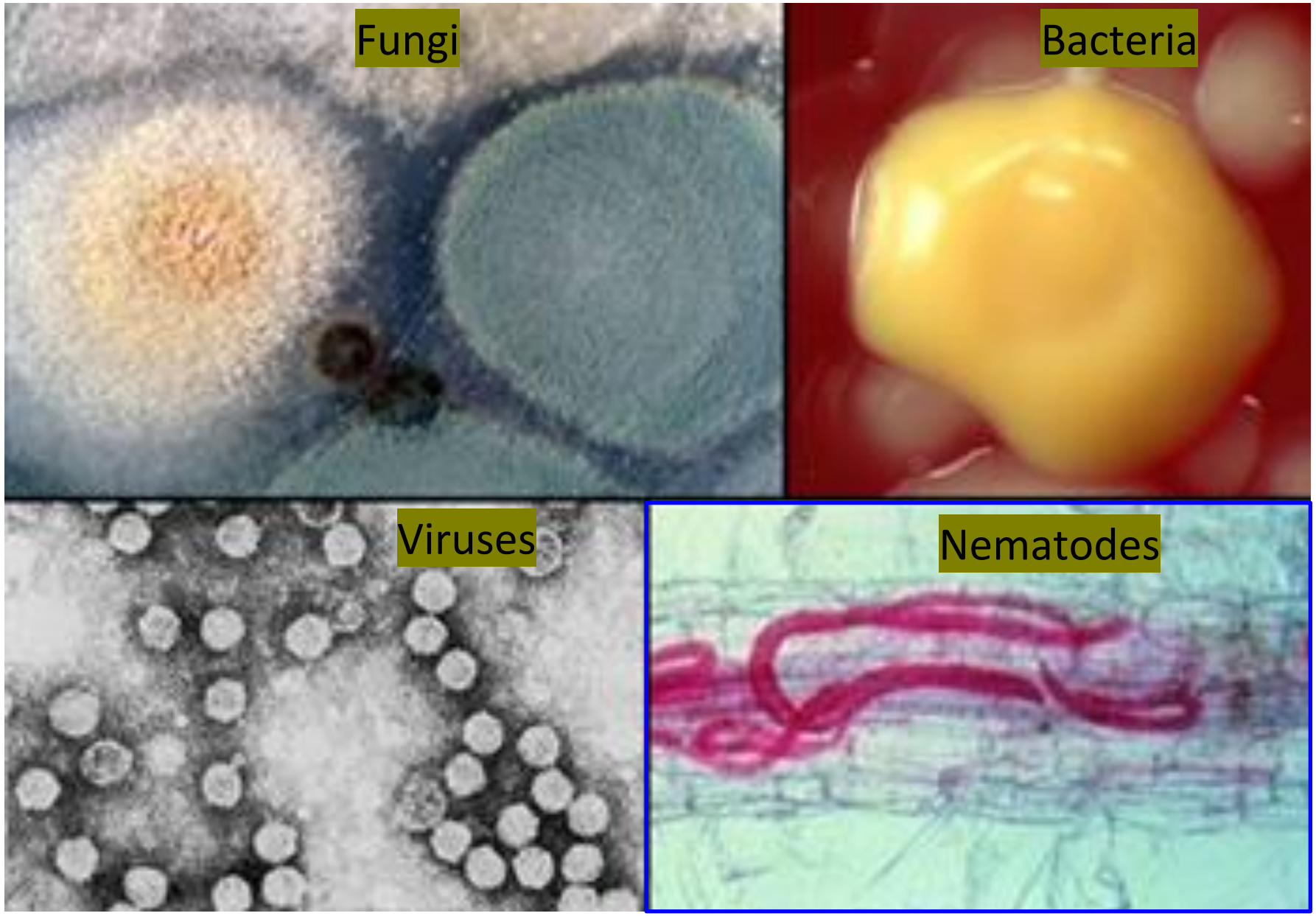
Major Plant Pathogen Groups



What are NEMATODES?

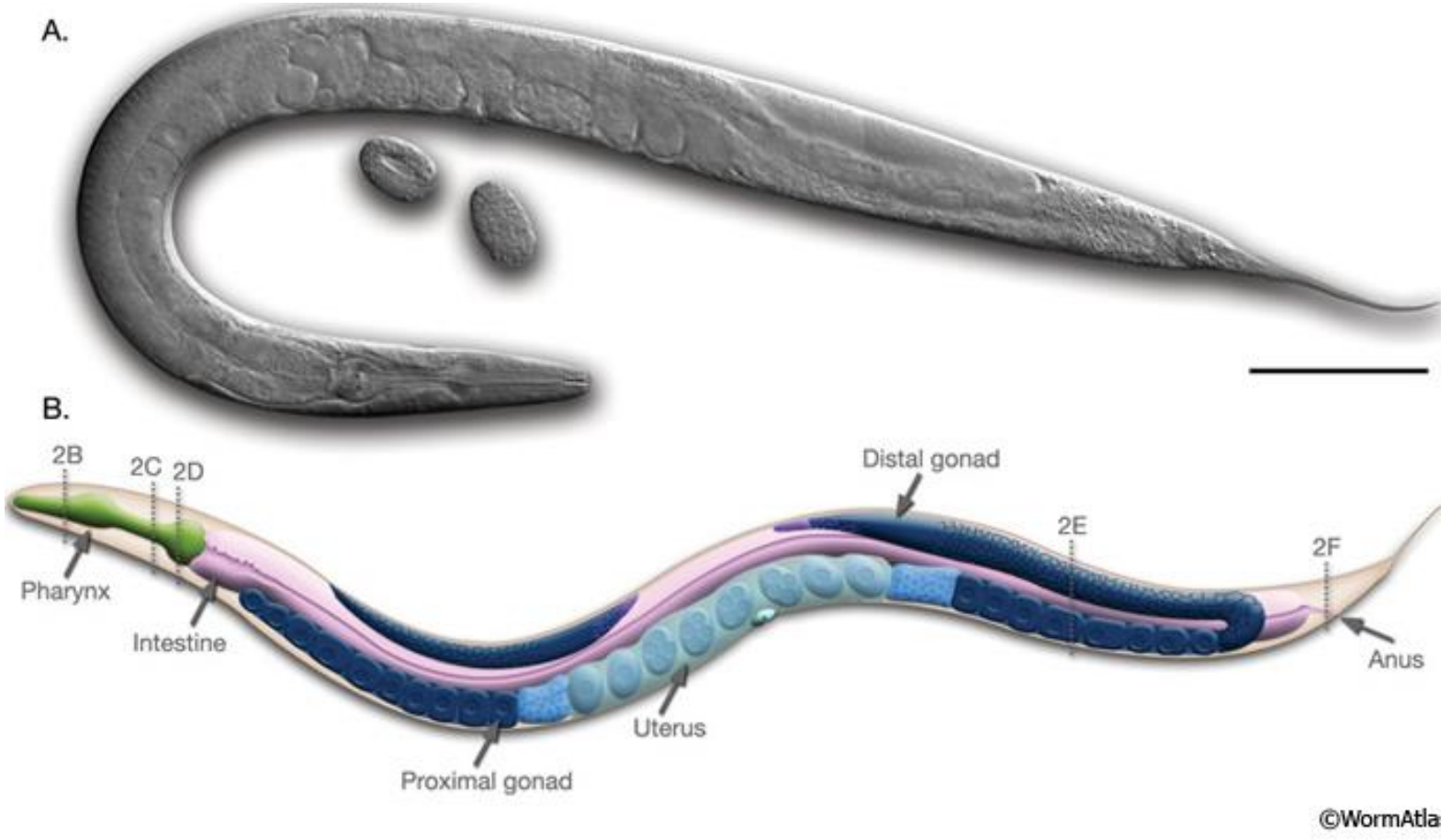
Microscopic (20-25 µm wide)

Unsegmented round worms

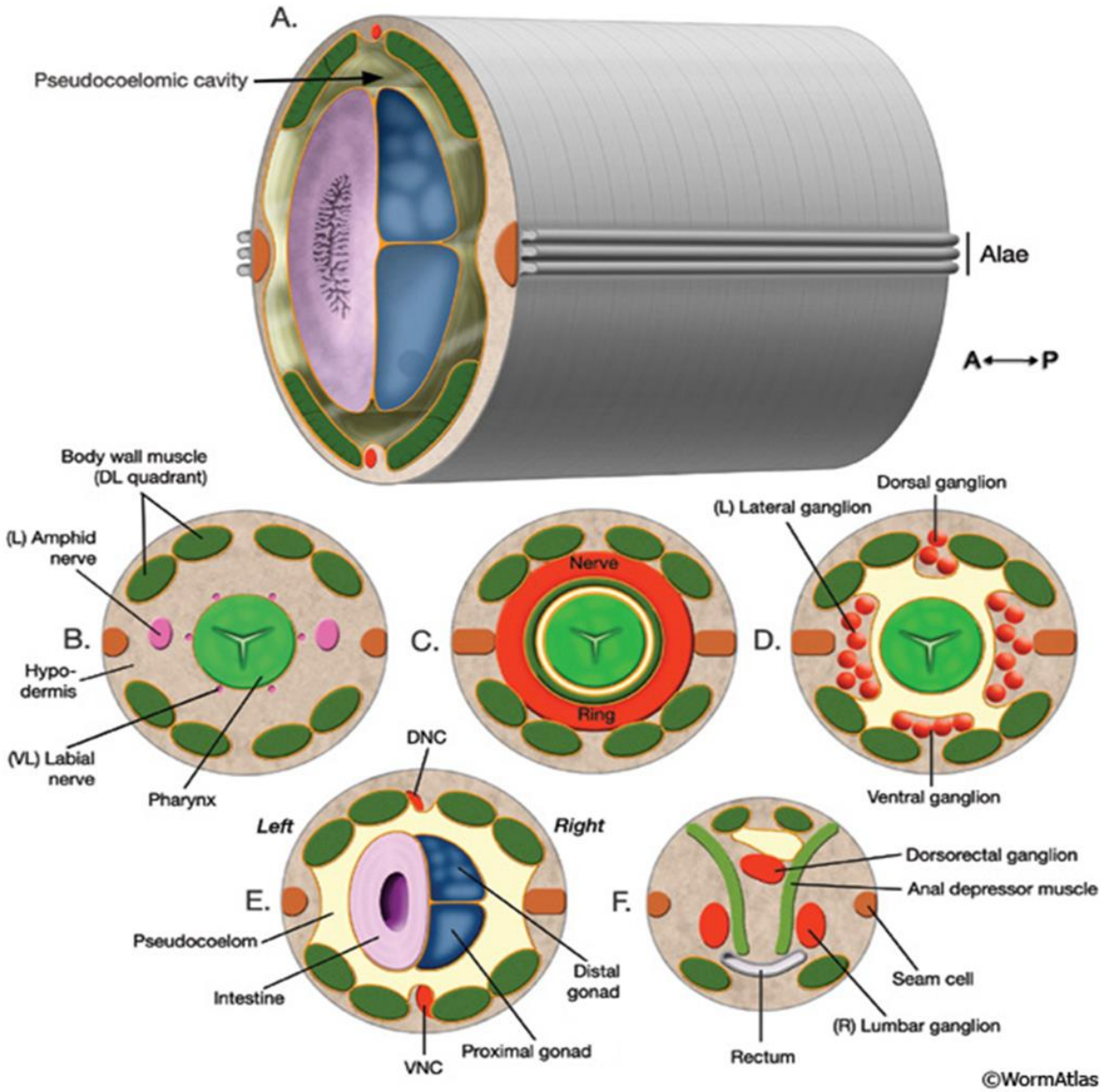
Thread-like (Vermiforms)

Bilaterally symmetrical

With digestive, nervous, excretory, reproductive, ~~circulatory~~, ~~skeletal~~, and ~~respiratory~~ systems

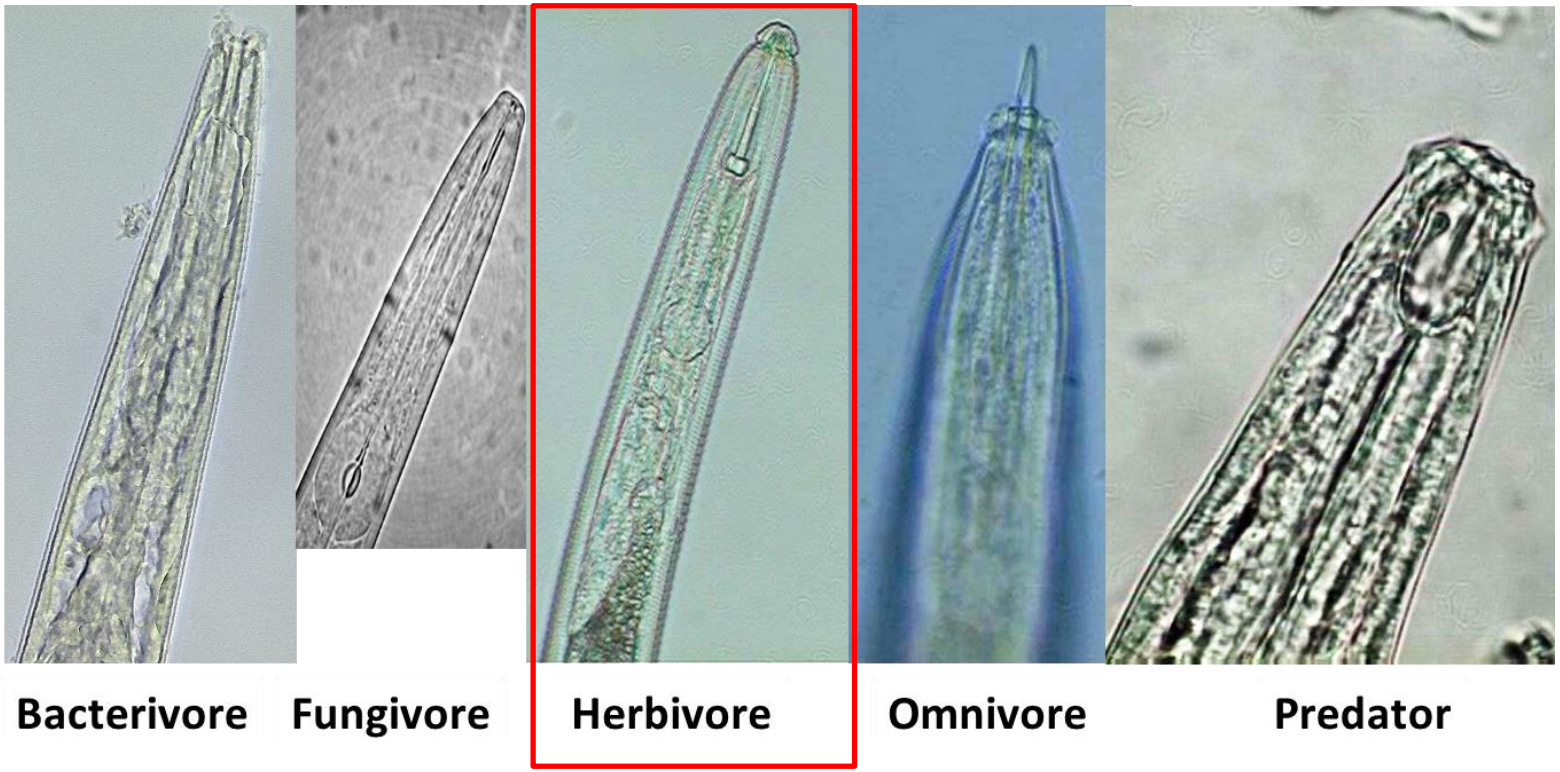


Pseudocoelom

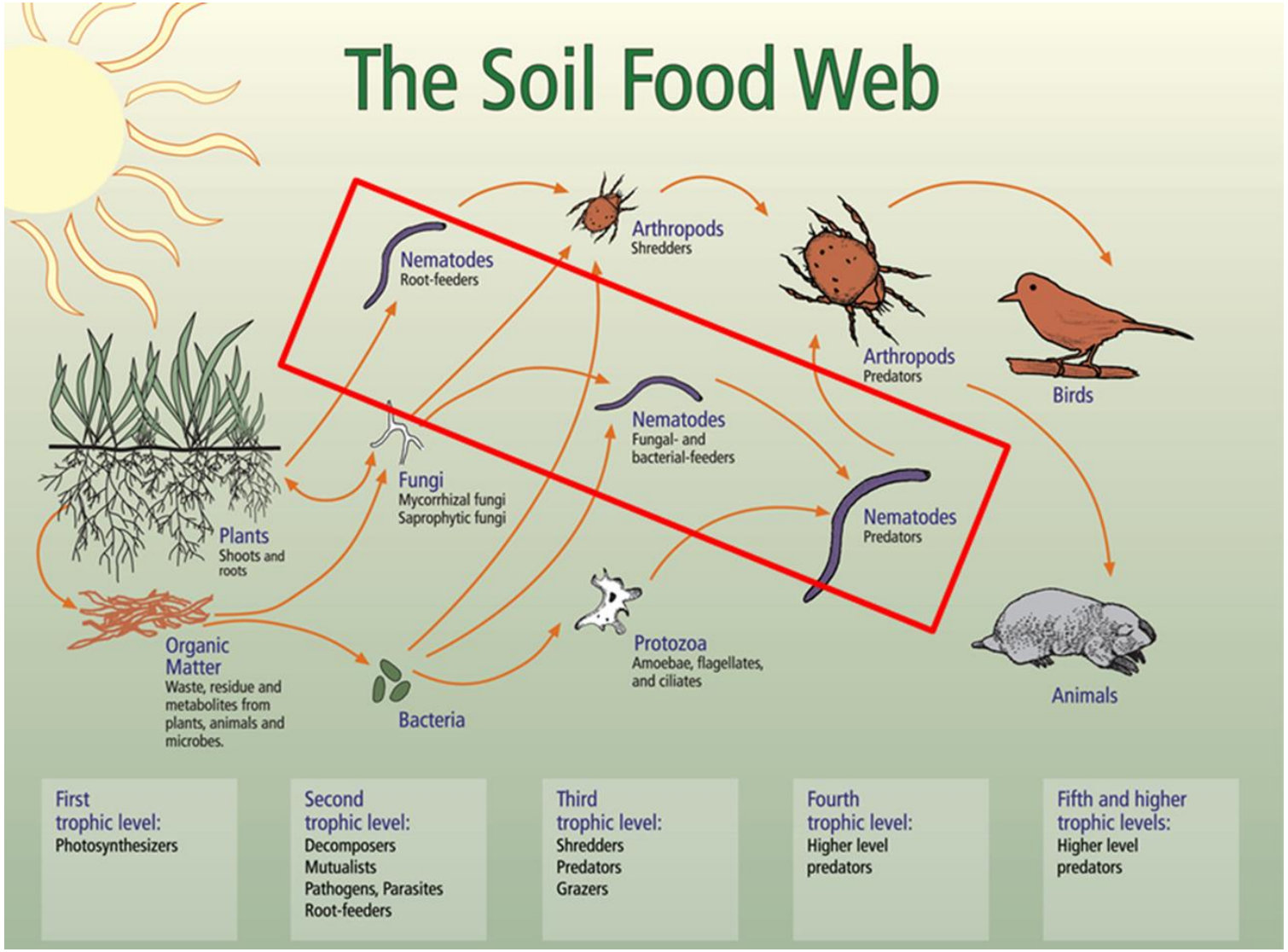


A fluid-filled body cavity lying inside the external body wall of the nematode that bathes the internal organs, including the alimentary and the reproductive systems.

Nematodes Community

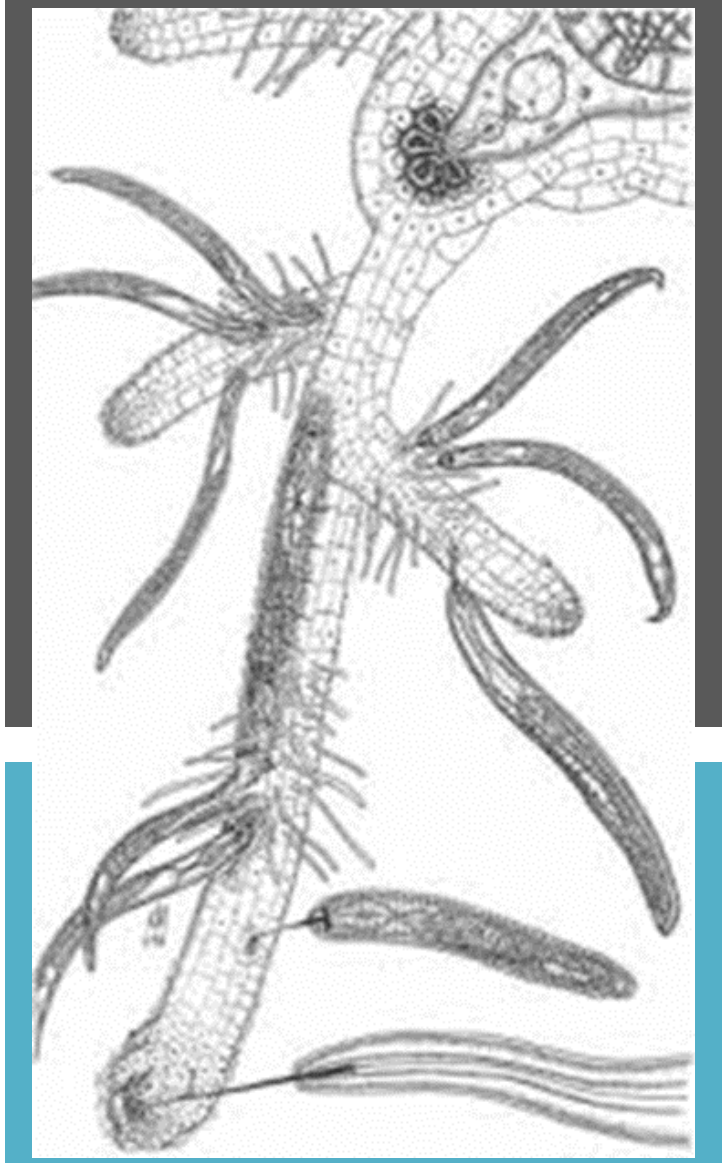


Nematodes Community



[Natural Resources Conservation Service - USDA]

Nematode feeding behaviors - Management decision



Ectoparasites (Stubby-root, needle)

Endoparasites

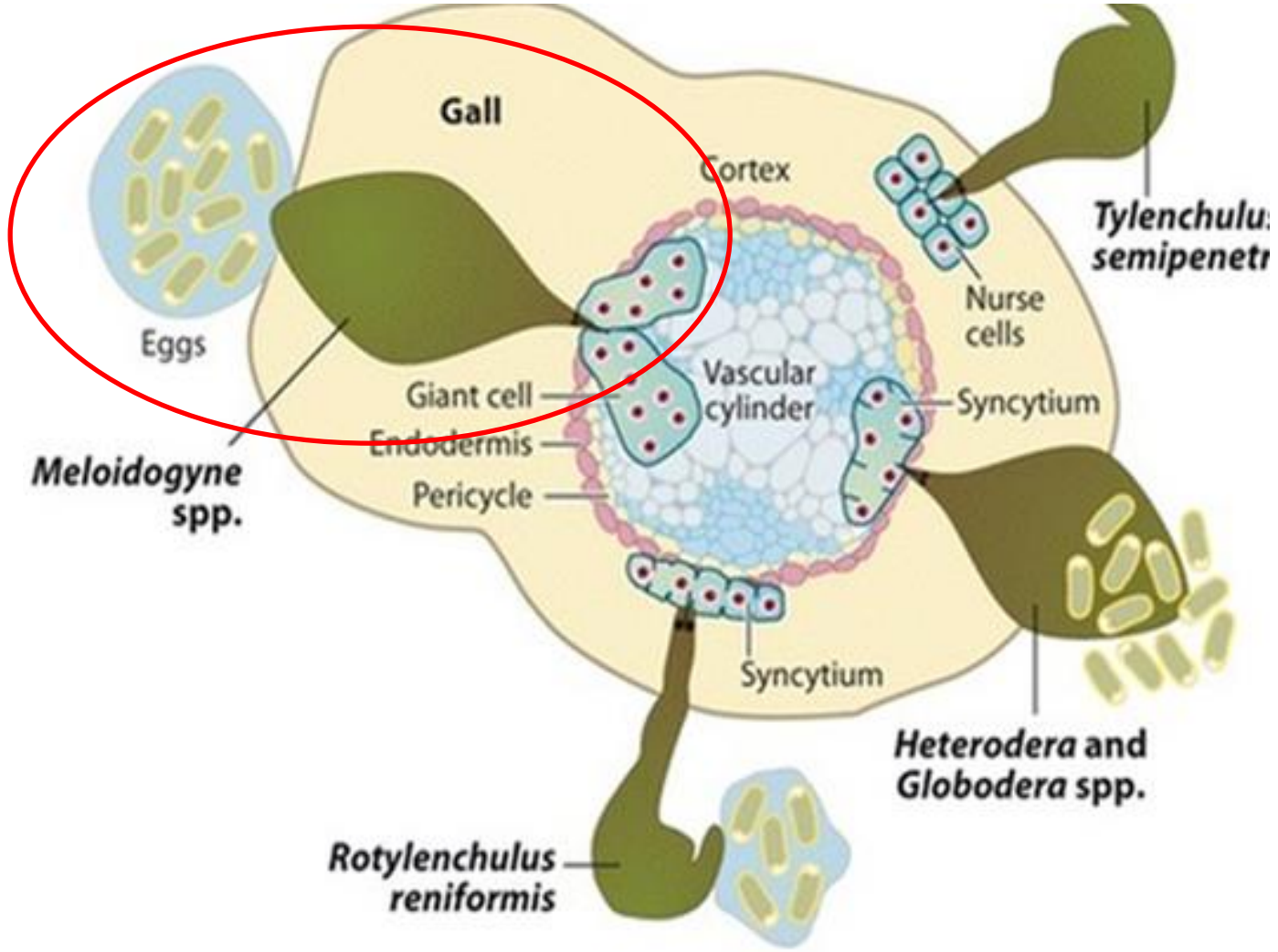
- *Sedentary (root-knot, cyst)*

- *Semi-endoparasite (citrus, reniform)*

- *Migratory (root-lesion, stem)*

- **Sedentary endoparasites**
- **Semi-endoparasites**

Cross-section diagram of an infected root



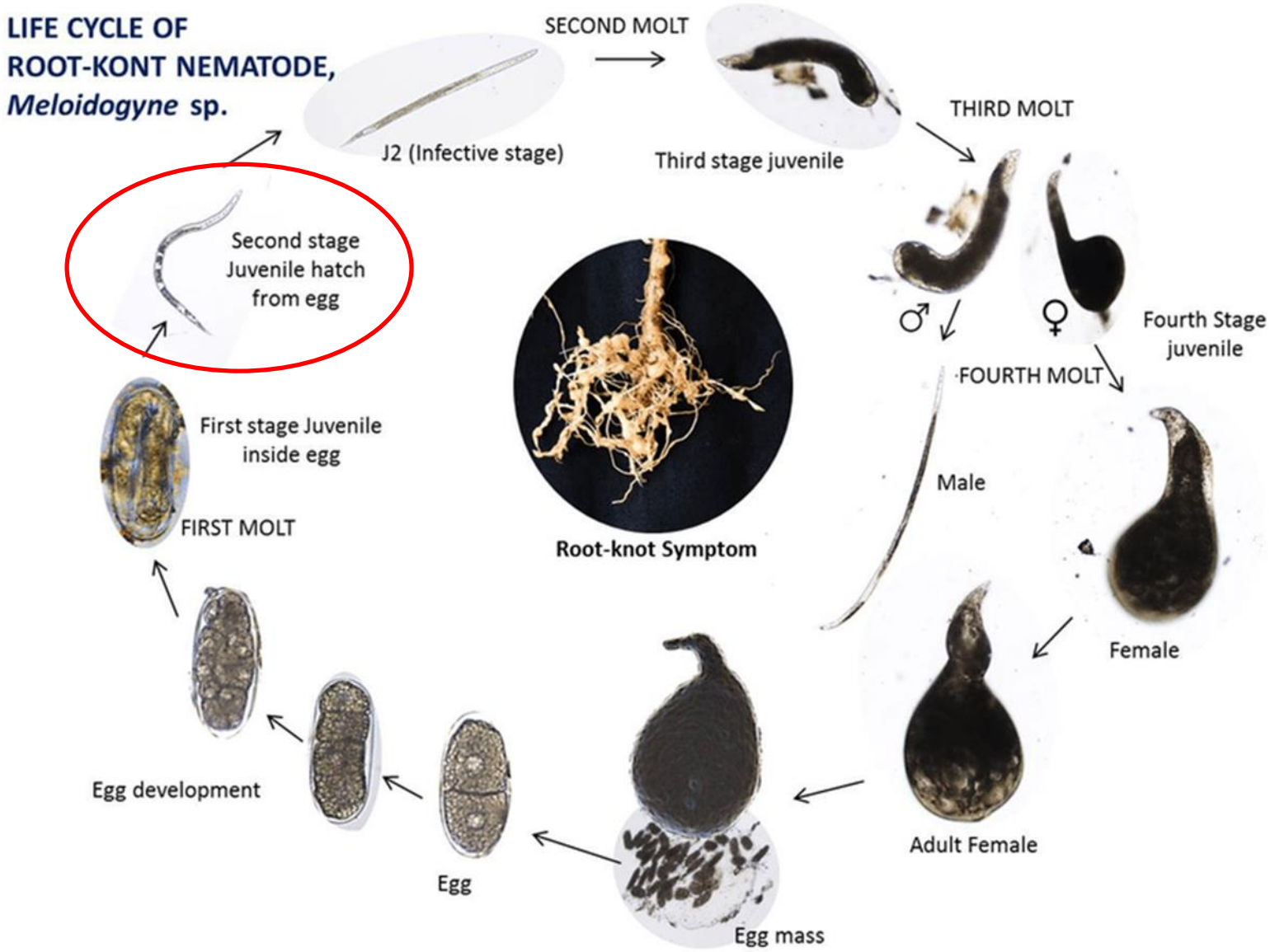
Mitchum MG, et al. 2012.
Annu. Rev. Phytopathol. 50:175–95

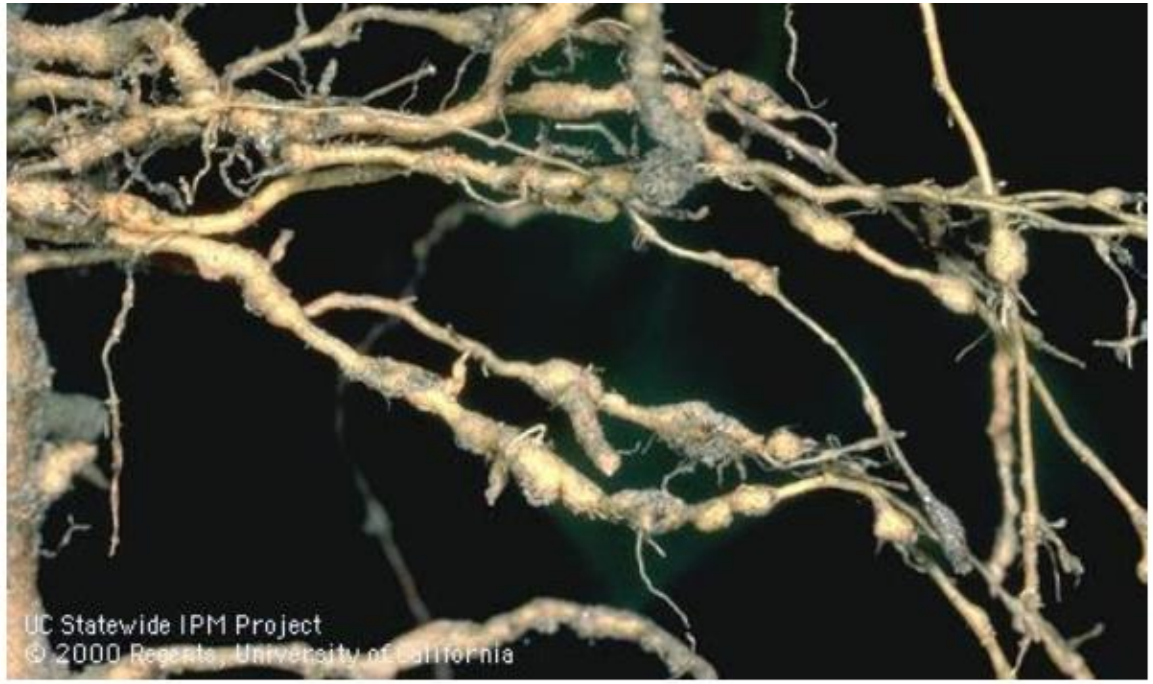
Life stages (sedentary nematodes)

1. Embryo – Embryogenesis (egg)
2. First-stage Juvenile (J1)
3. Second-stage Juvenile (J2)
4. Third-stage Juvenile (J3)
5. Fourth-stage Juvenile (J4)
6. Adult

Embryogenesis and Molting in nematodes

Root-knot nematodes *(Meloidogyne* spp.*)*





Root system heavily infested with root knot nematode

Photo by Jack Kelly Clark.

Damage on cotton

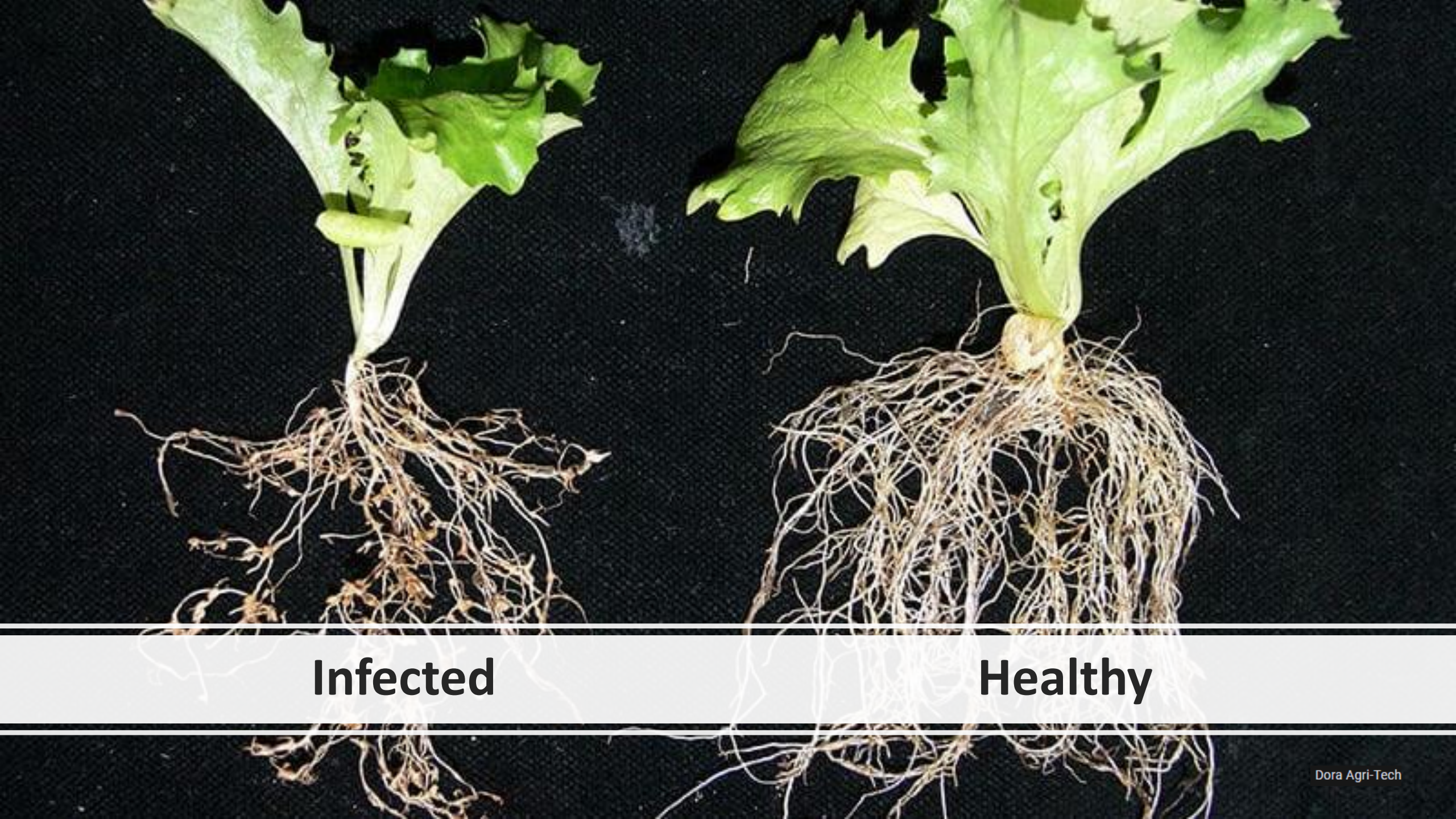
UC IPM - UC ANR

Damage on alfalfa

Damage on carrot

Healthy **Infected**

Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org


Infected
Healthy
Dora Agri-Tech

Healthy

Infected

Bell pepper

showing above-ground symptom

Antoon Ploeg and Jose L. Aguiar

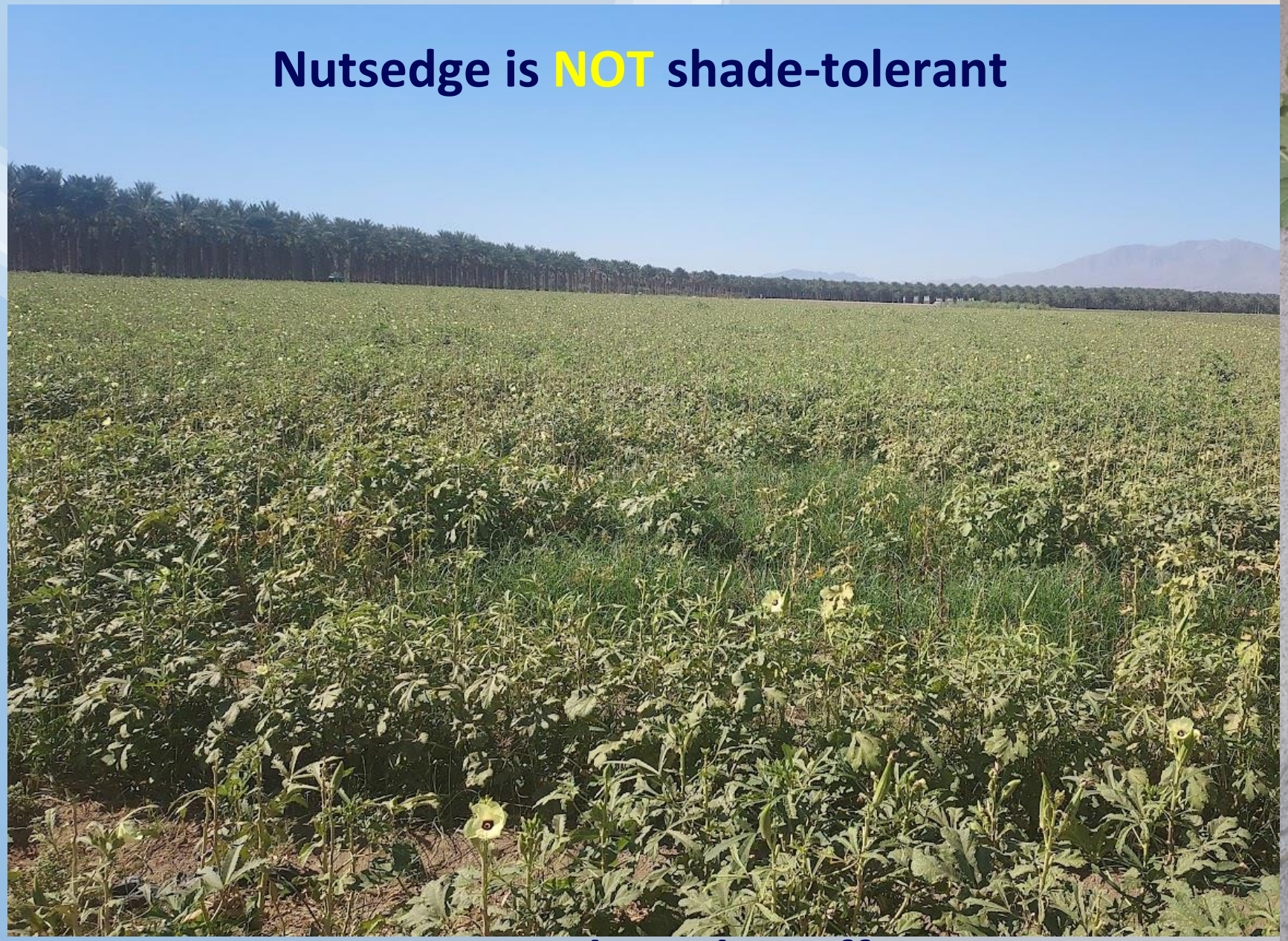
above ground

below ground

Infected

Healthy

Root-knot Nematode and Nutsedge



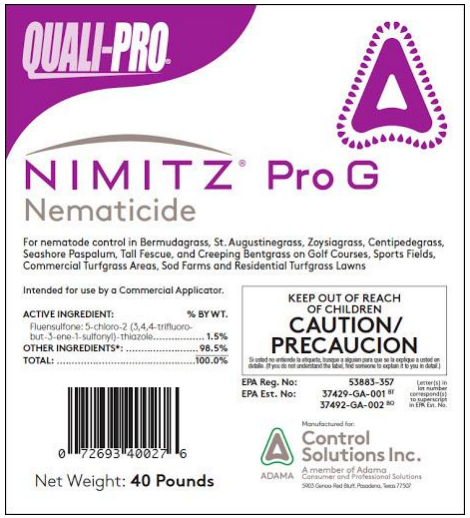
Nutsedge takes off

Management

- Chemical Control
- Cultural Control/Host resistance
- Biological Control
- Integrated Nematode Management

Chemical Control - Nematicides

BAYER
VELUM® ONE



MeloCon® LC
BIOLOGICAL NEMATICIDE
OMRI LISTED
For Organic Use - OMRI.org

BAYER
MOVENTO®

vapam® HL™

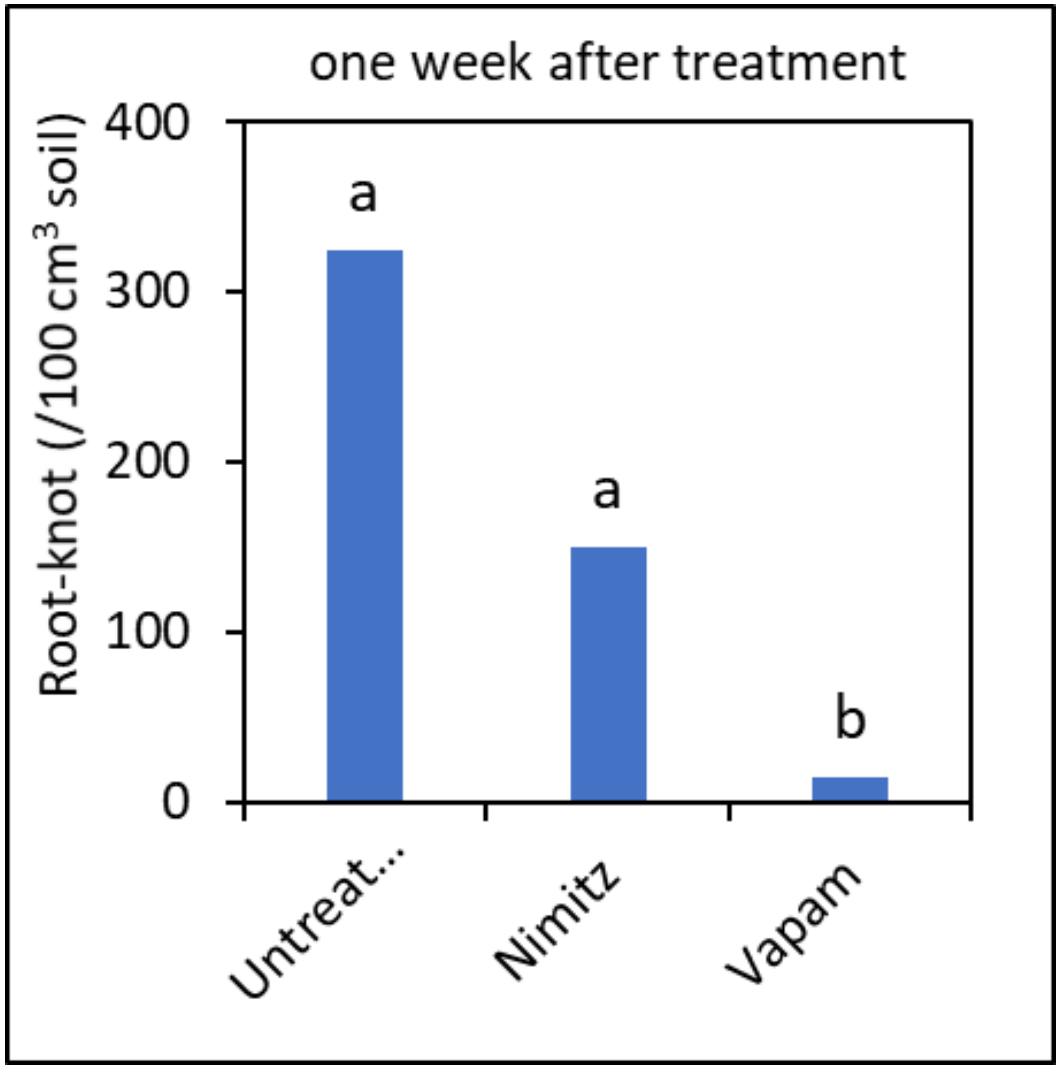
Salibro®
Reklemel® active
NEMATICIDE

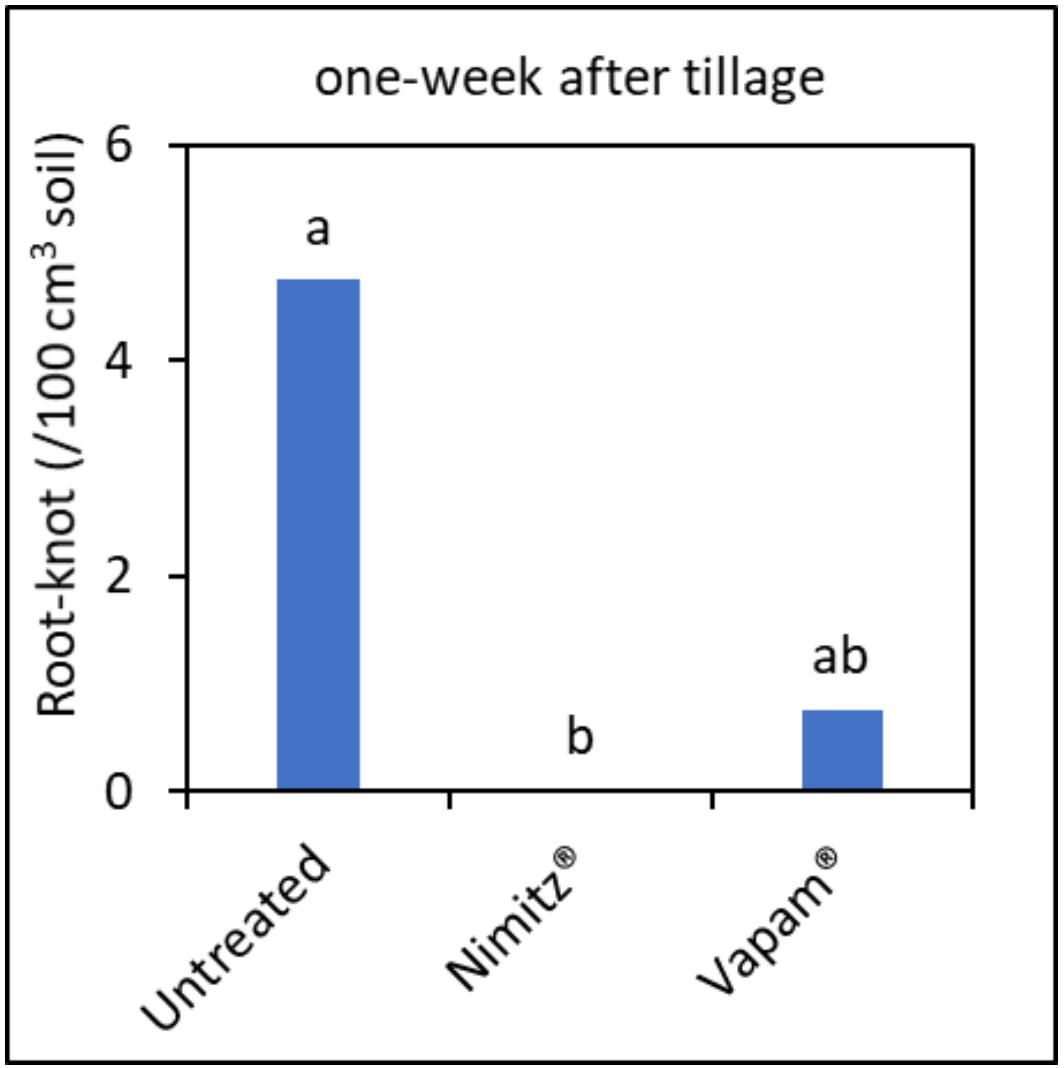
Cultural Nematode Control

Figure 3. Application of transparent polyethylene film to solarize a field on an organic vegetable farm in the San Joaquin Valley, California. (Source: University of California)

- Soil solarization
- Deep ploughing/tillage
- Wash equipment

Post-harvest Nematicide Treatment Effect

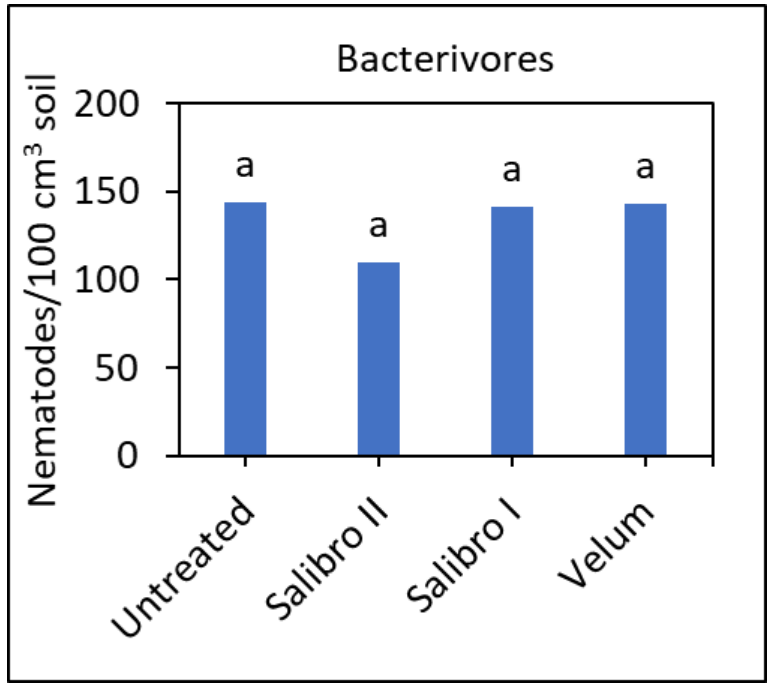


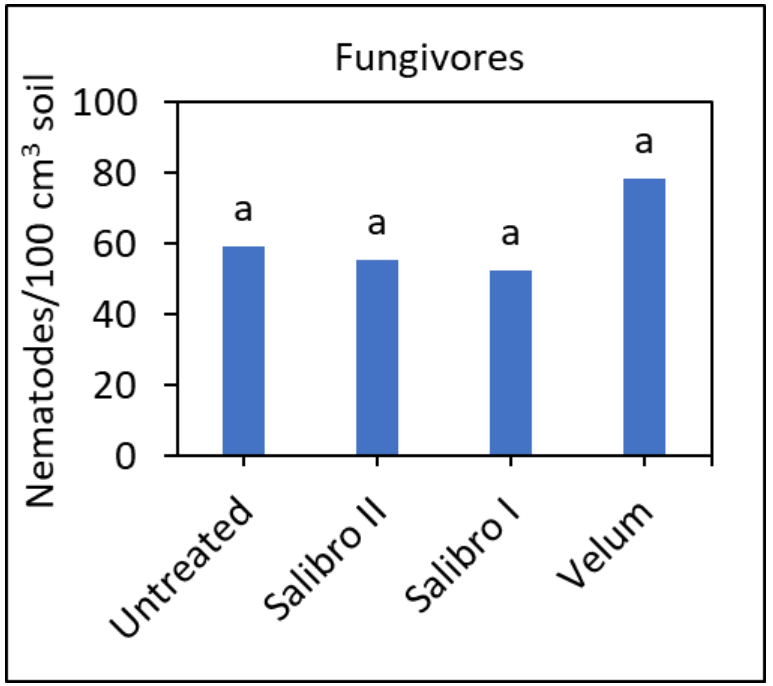


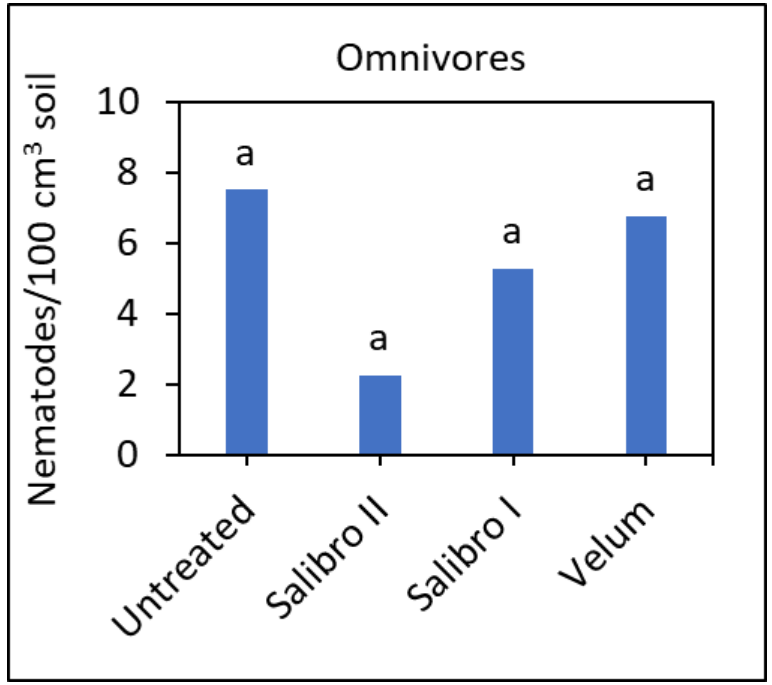
Field trial established on 08/08 - Salibro (Fluazaindolizine)

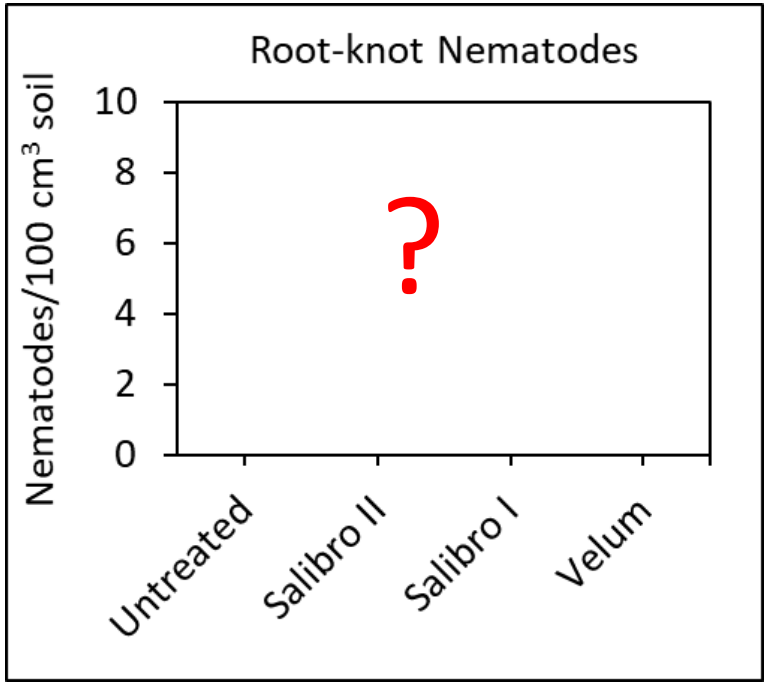
Four weeks post-treatment

Pre-treatment/ 2 weeks post-plant

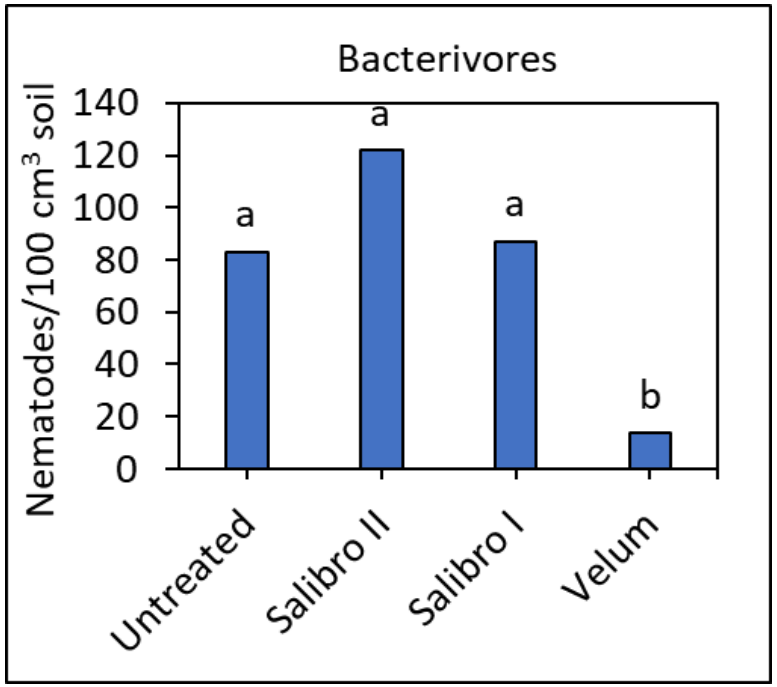


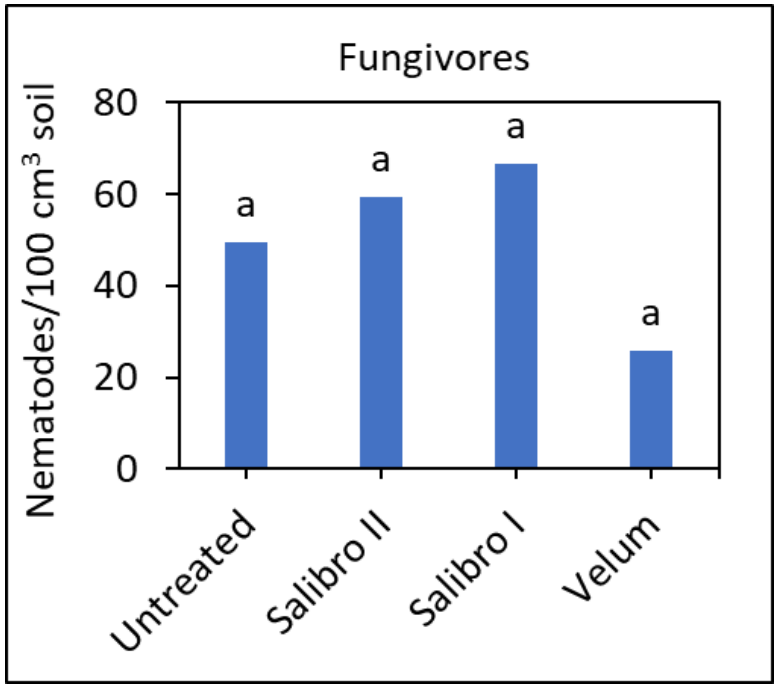


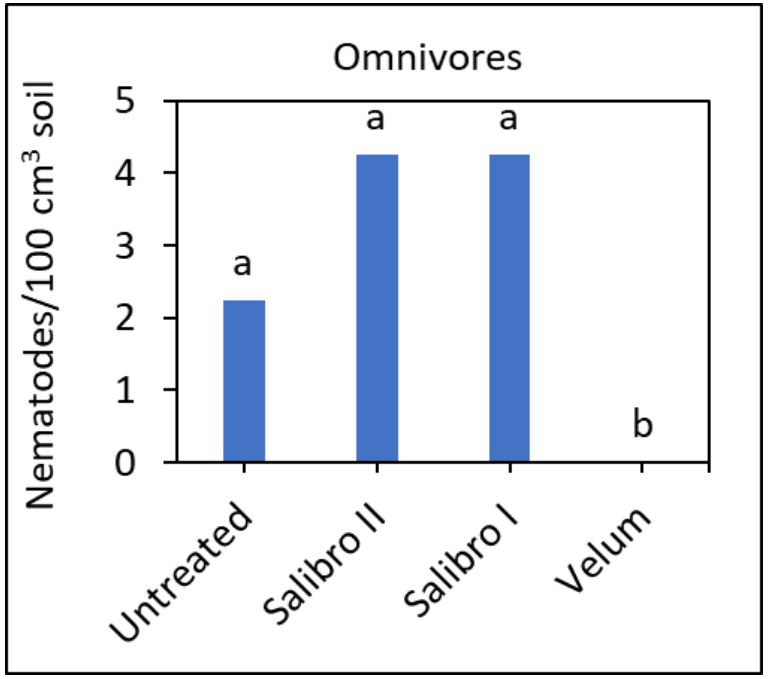


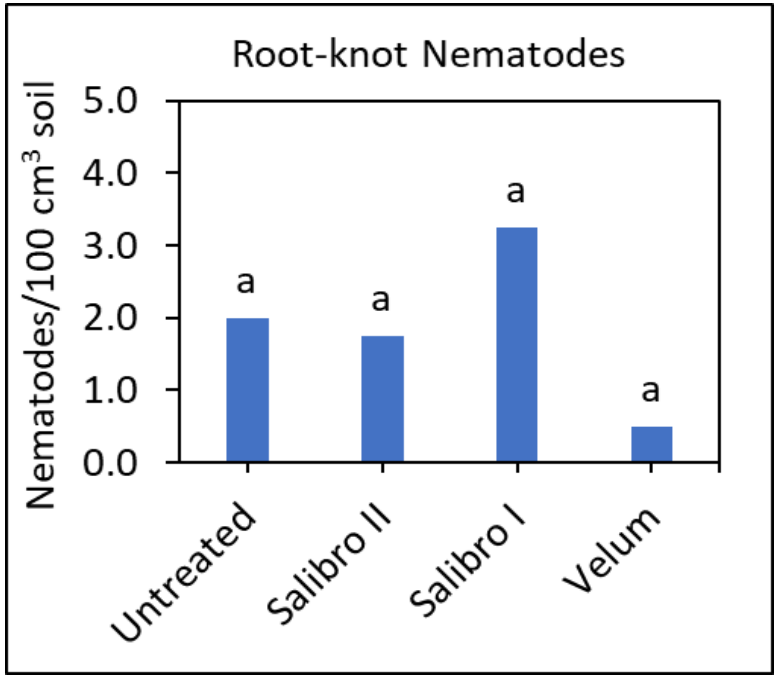


Four weeks post-treatment

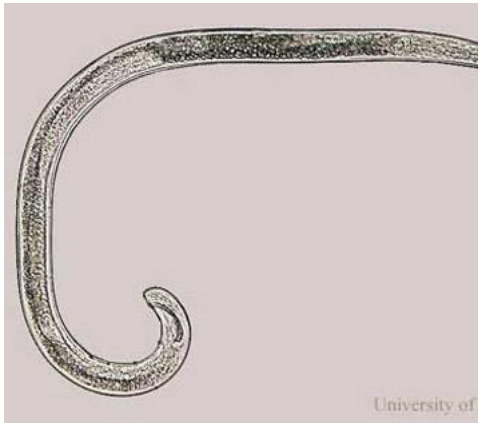




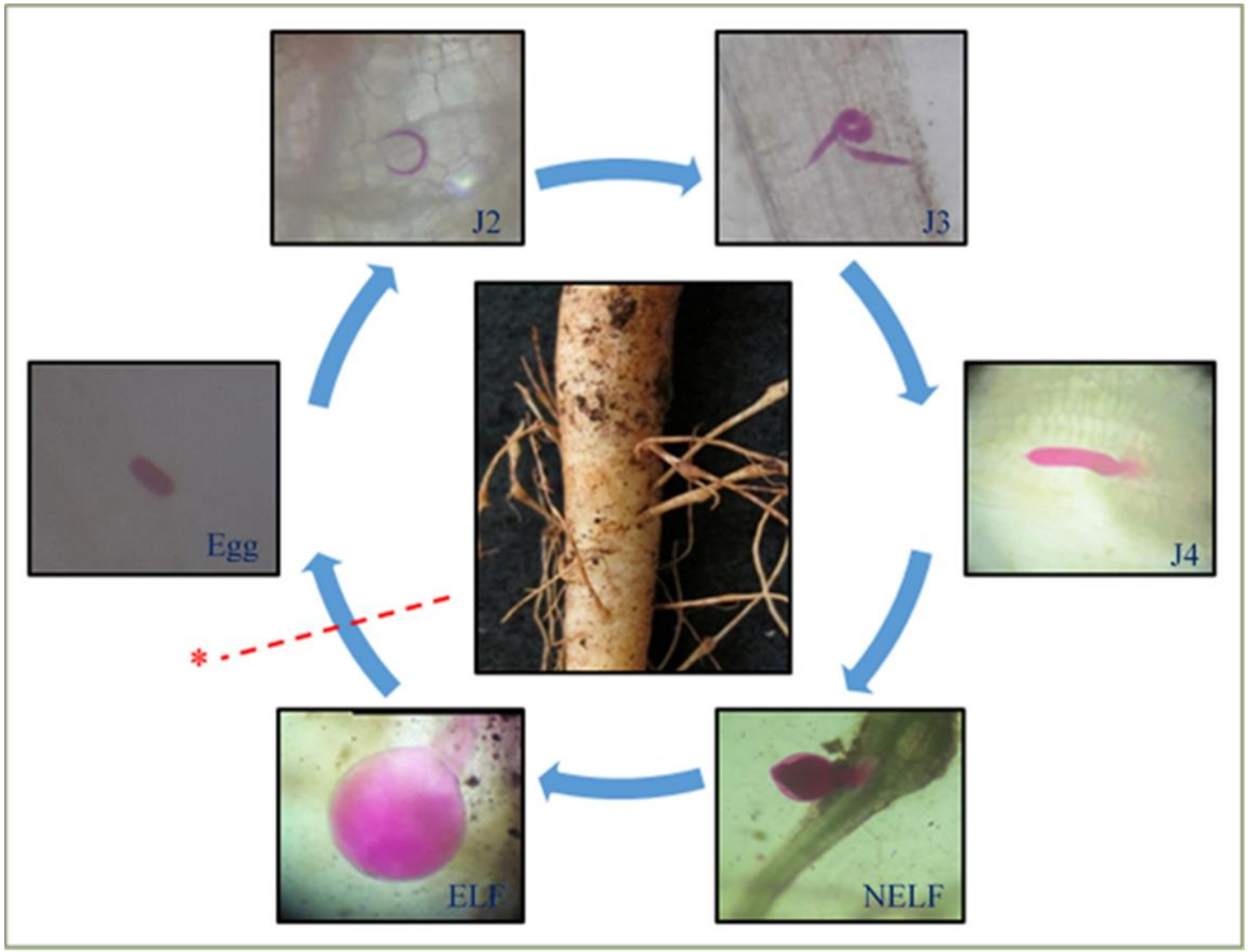




- Salibro efficacy trial in Brawley, Imperial Valley.



Triggering egg hatch is Critical to Control



Cultural Control – Crop rotation/Cover Crops

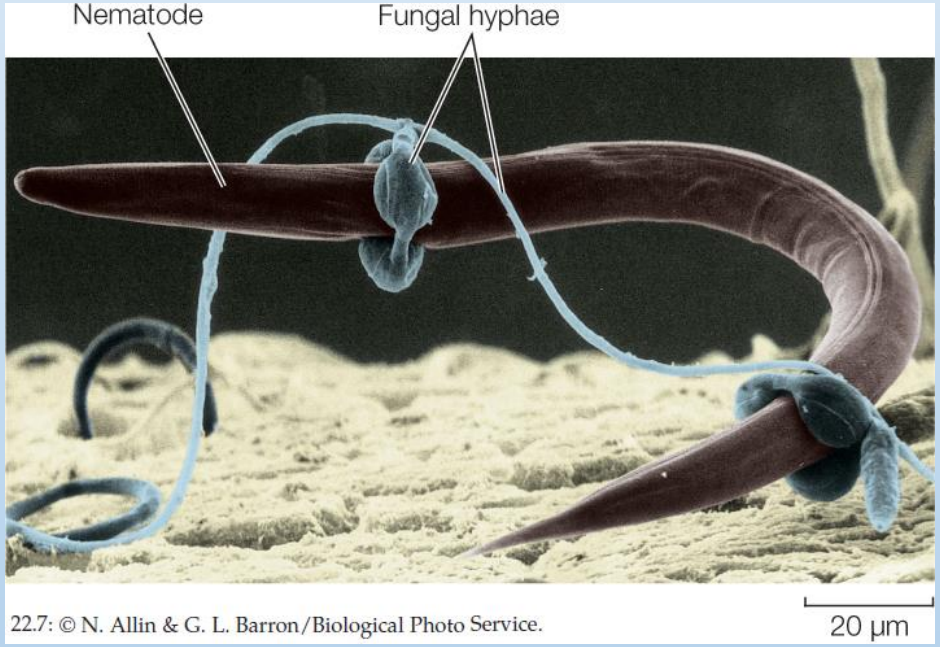
Cover Crops with Allelopathic Effects - Biofumigation

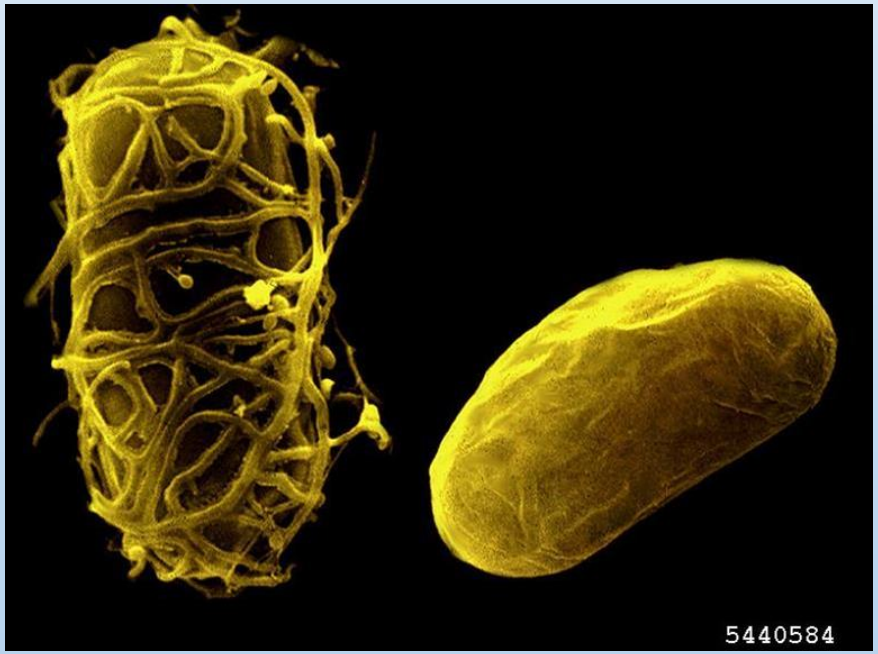
Cover Crops - Conservation Biological Control

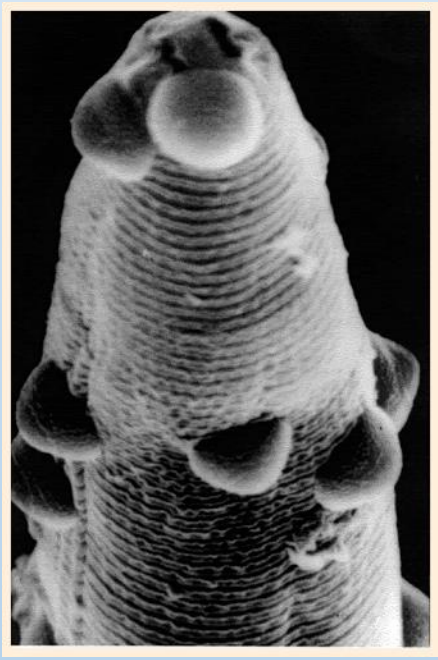
- Bacteria
- Fungi
- Nematodes (predators)
- Arthropods (mites)

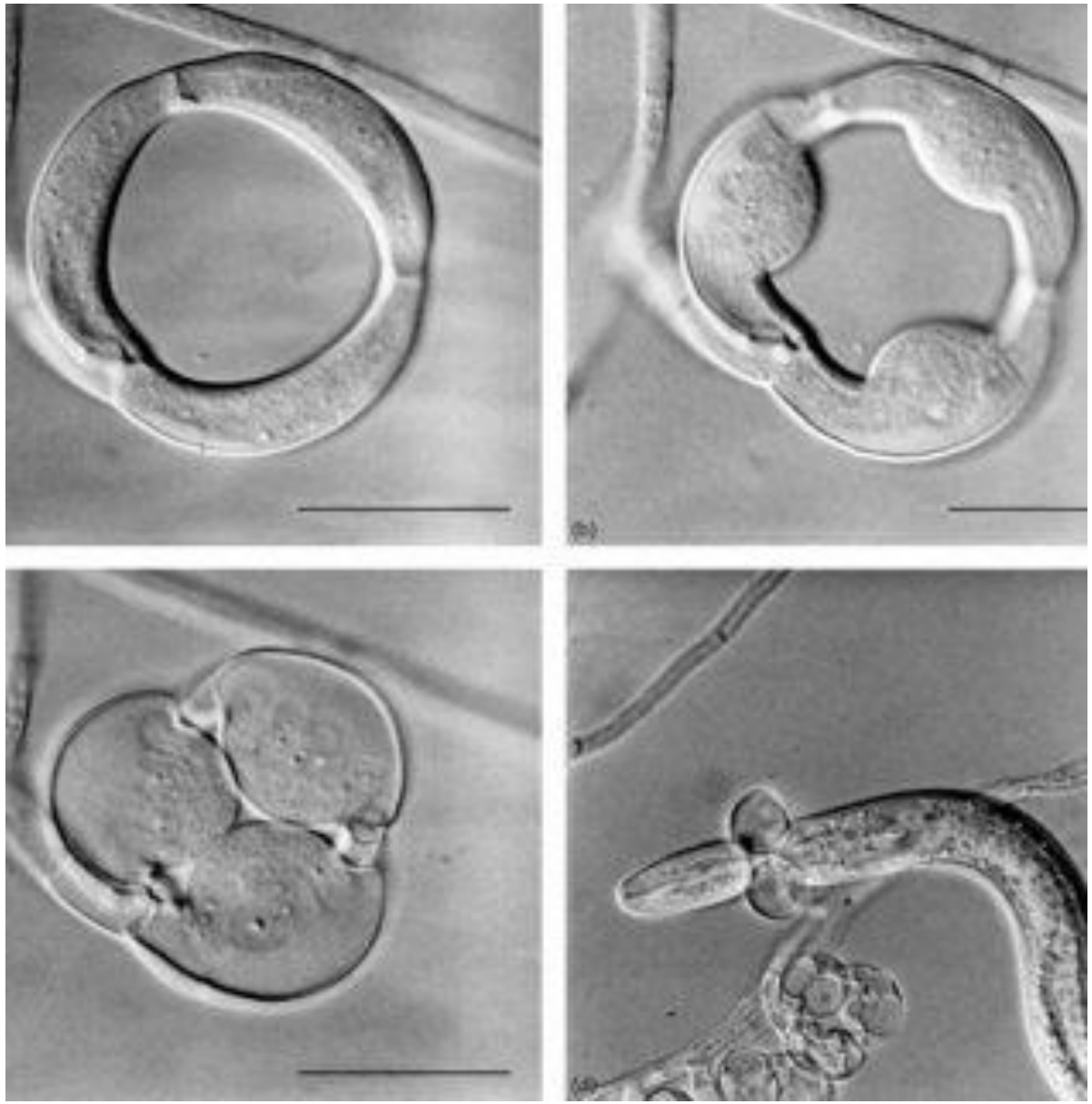
Natural enemies

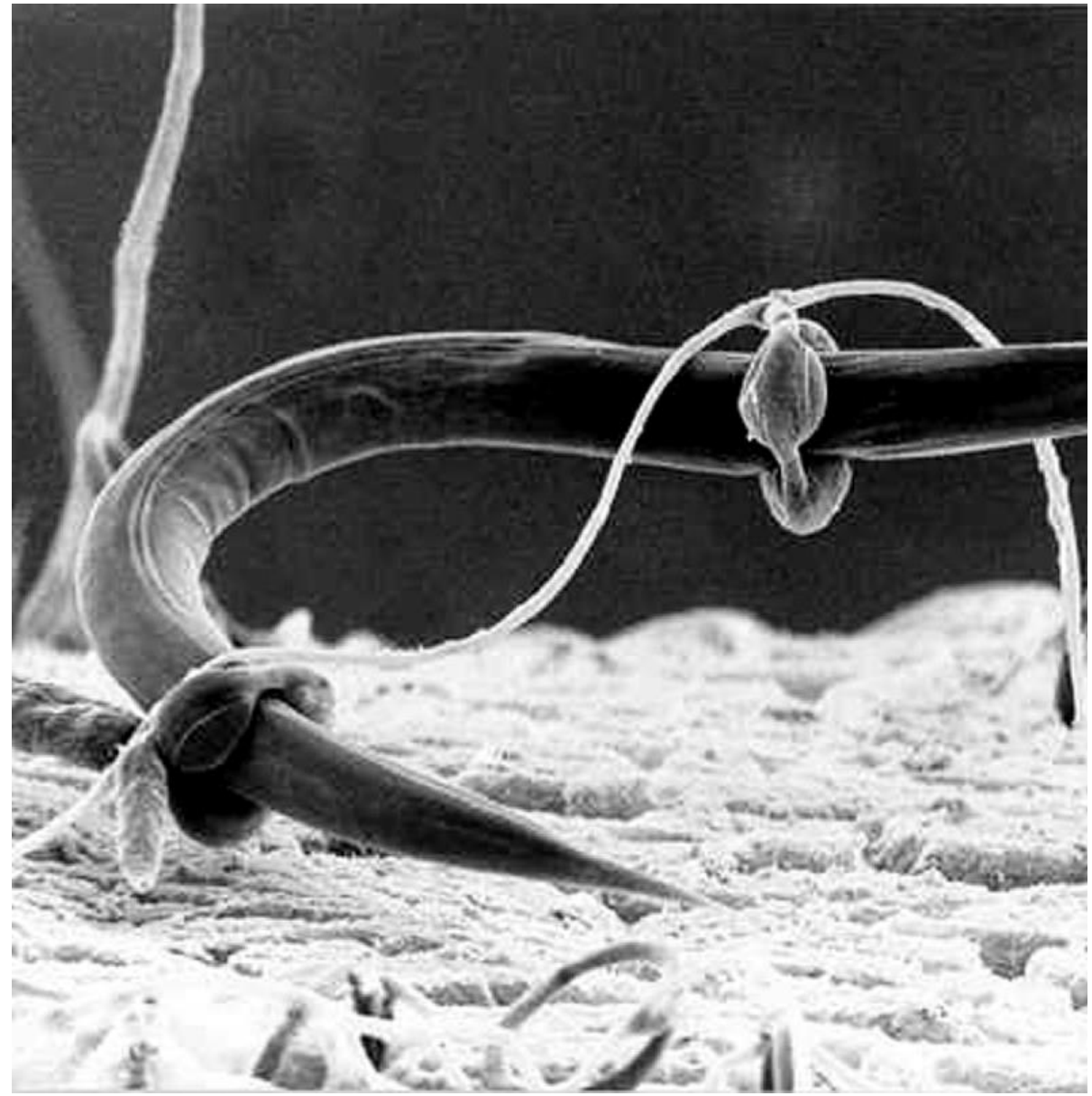
- **Classical biocontrol**
- **Augmentative biocontrol**
- **Conservation biocontrol**











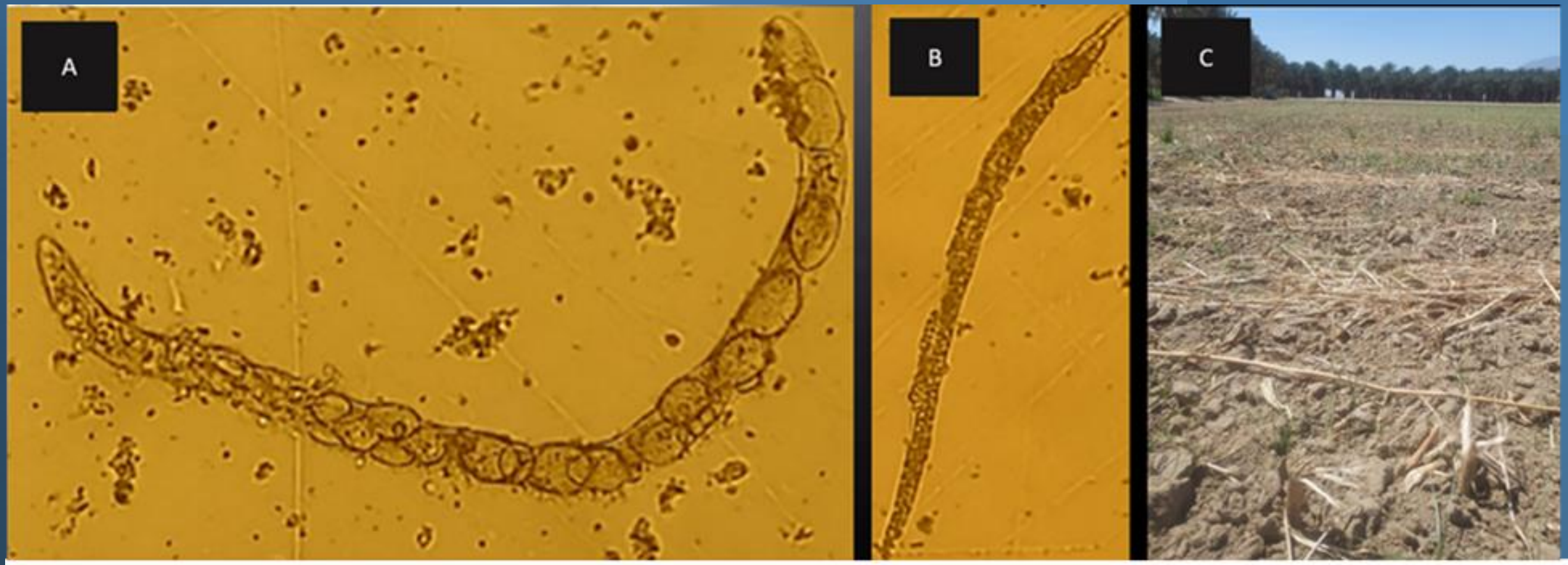
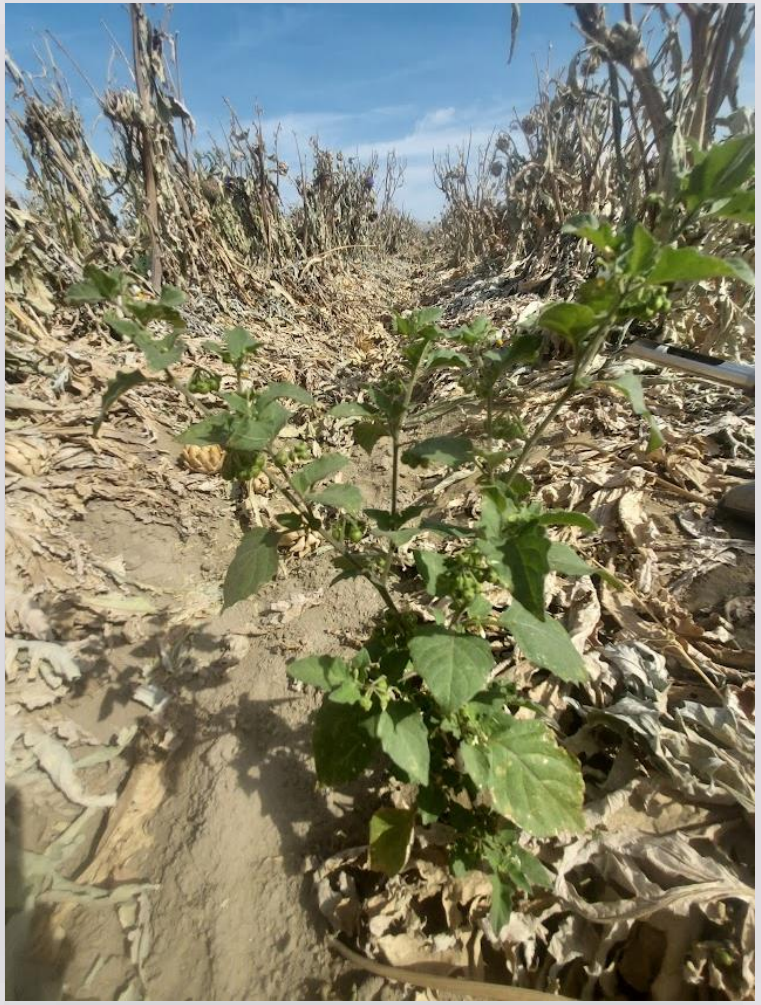
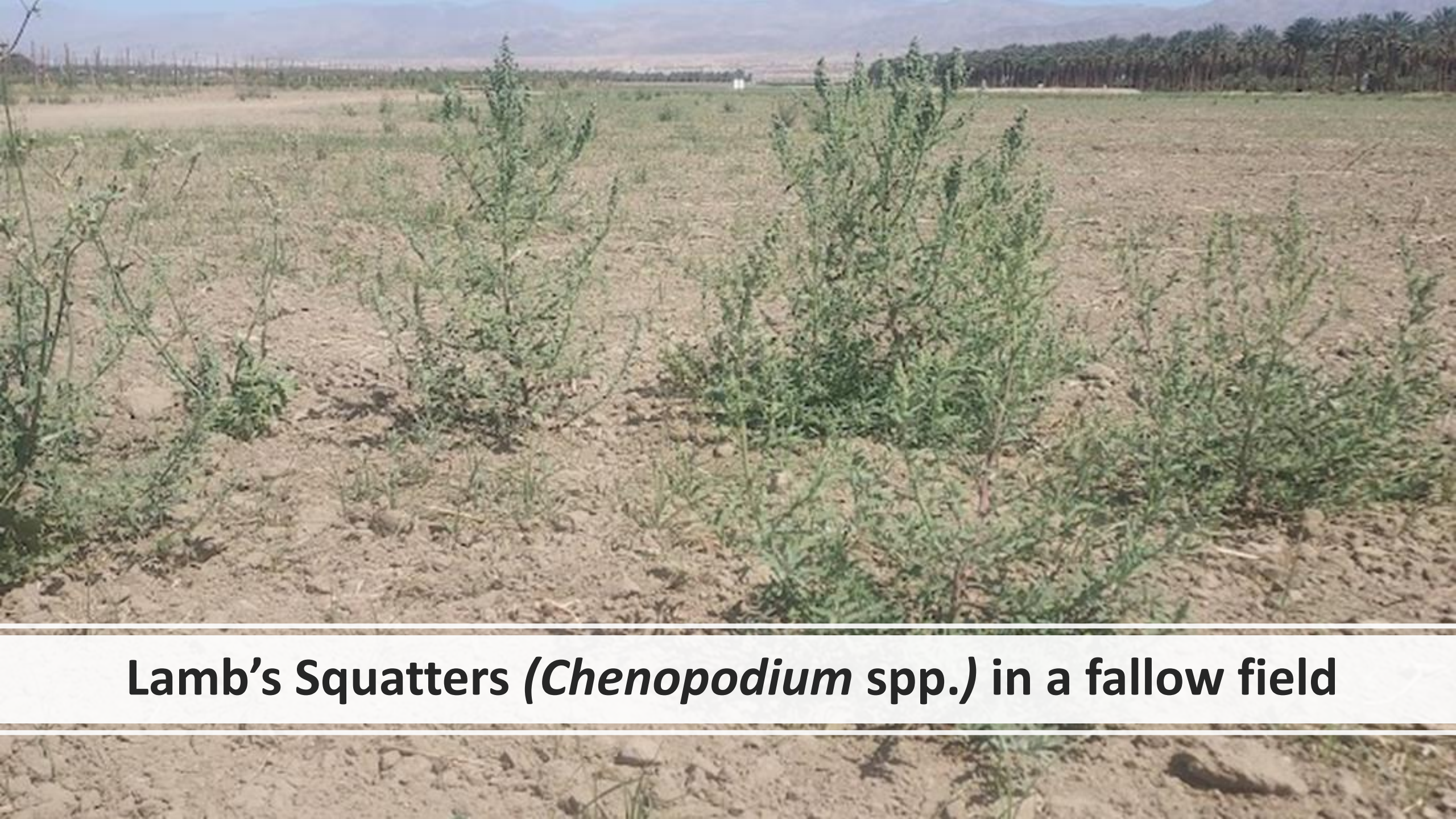


Figure 4. Biological control agents attacked and disintegrated A) omnivorous nematode and B) *Meloidogyne* juvenile (×100 magnification); C) A fallow field showing minimally tilled field and okra crop residue from the previous crop.

Some Weeds Are Good Hosts of Rook-knot Nematodes





Lamb's Squatters *(Chenopodium* spp.*)* in a fallow field

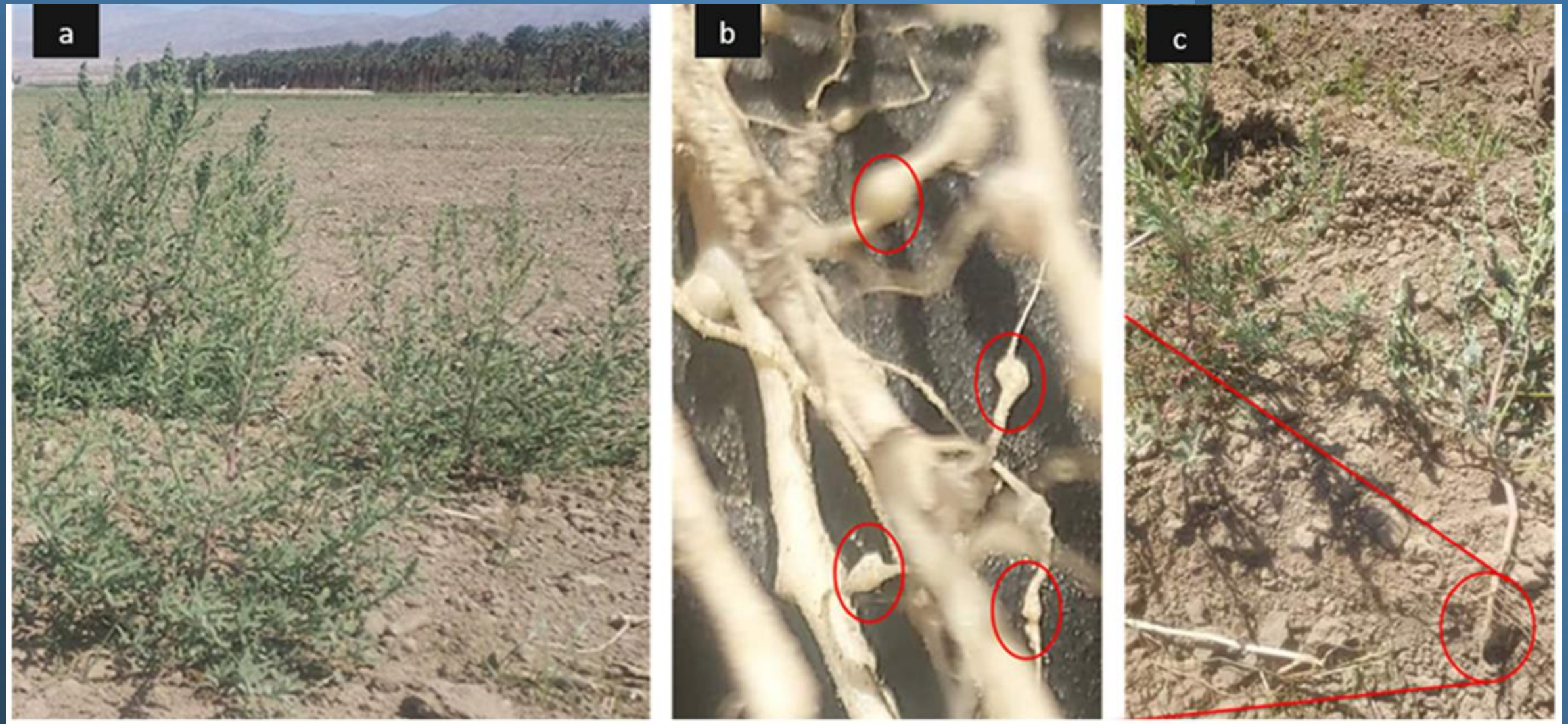
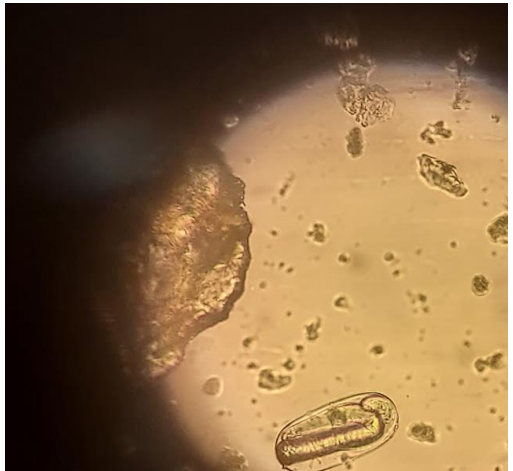


Figure 2. Lamb's quarters (*Chenopodium album*) a) plants colonized in a fallow field; b) roots exhibiting characteristic galls induced by *Meloidogyne* infections; and c) plant being uprooted and observed for *Meloidogyne*-



Thank you