Preliminary Investigation of Nematodes Inhabiting Banana Fields in Hawaii and their Management Options

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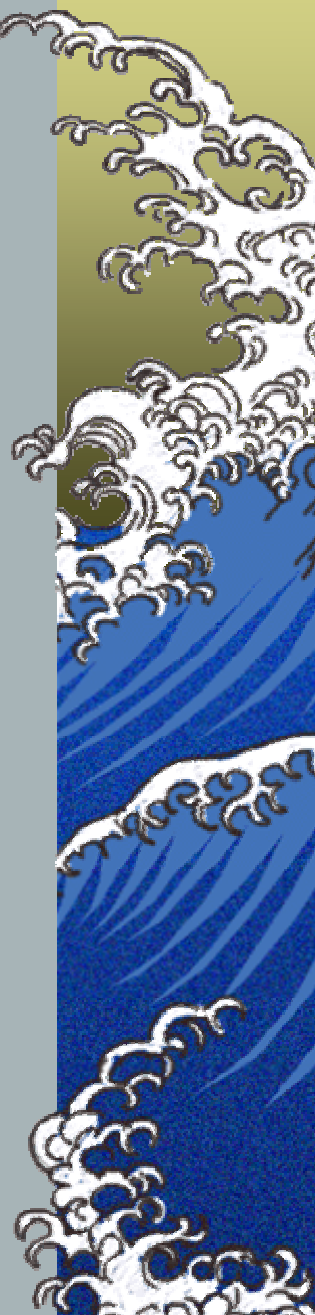
PEPS



Nematode: A Hidden Pest of Banana

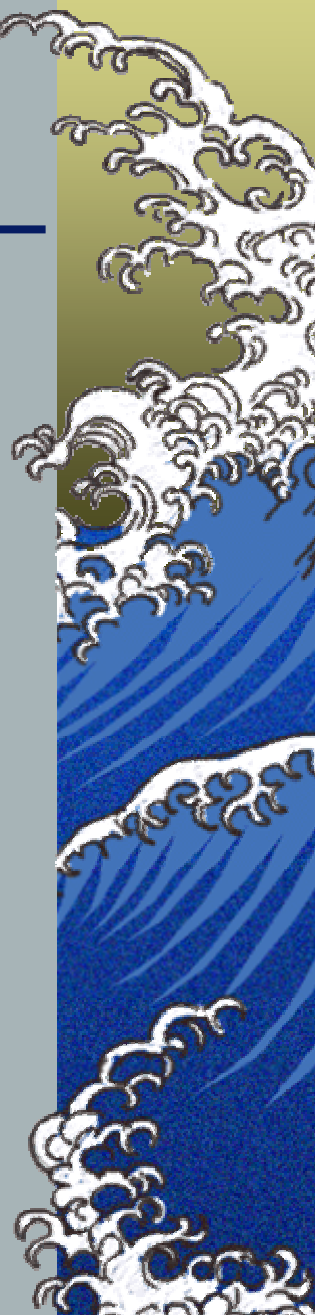
Crop losses of banana due to plant-parasitic nematodes:

Costa Rica	**30-50%**
Panama	**30-50%**
India	**30-60%**
Ghana	**56%**
Uganda	**58%**
Nigeria	**90%**

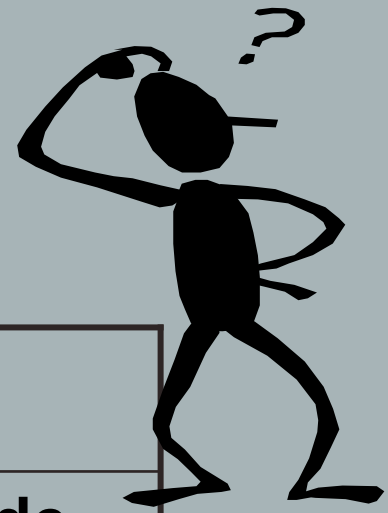
(Speijer and Fogain, 1999)

Outline

- Nematode parasites of banana
- Symptoms
- Nematode survey on banana farms in Hawaii
- Nematode management strategies



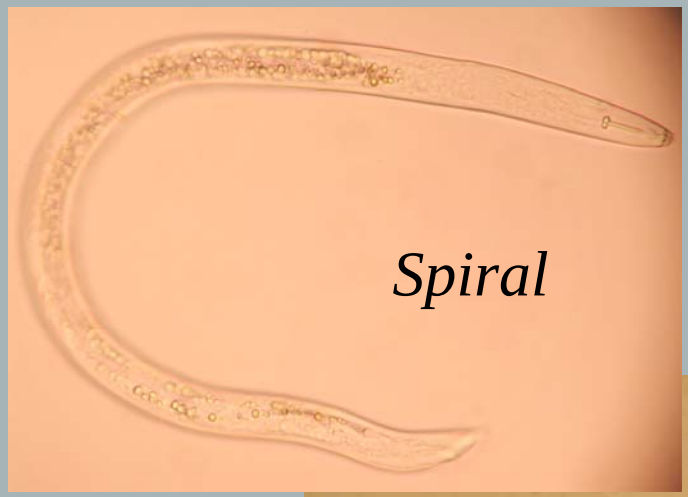
Key Nematode Pests of Banana

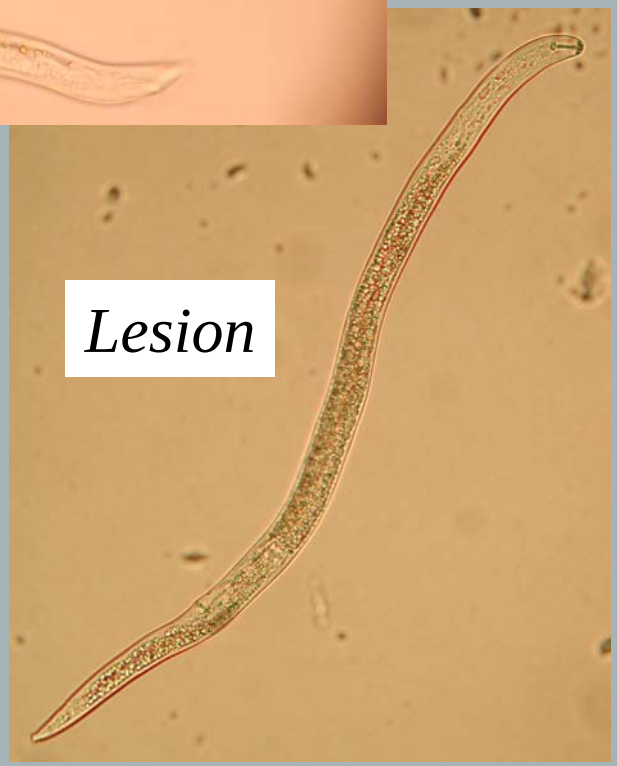


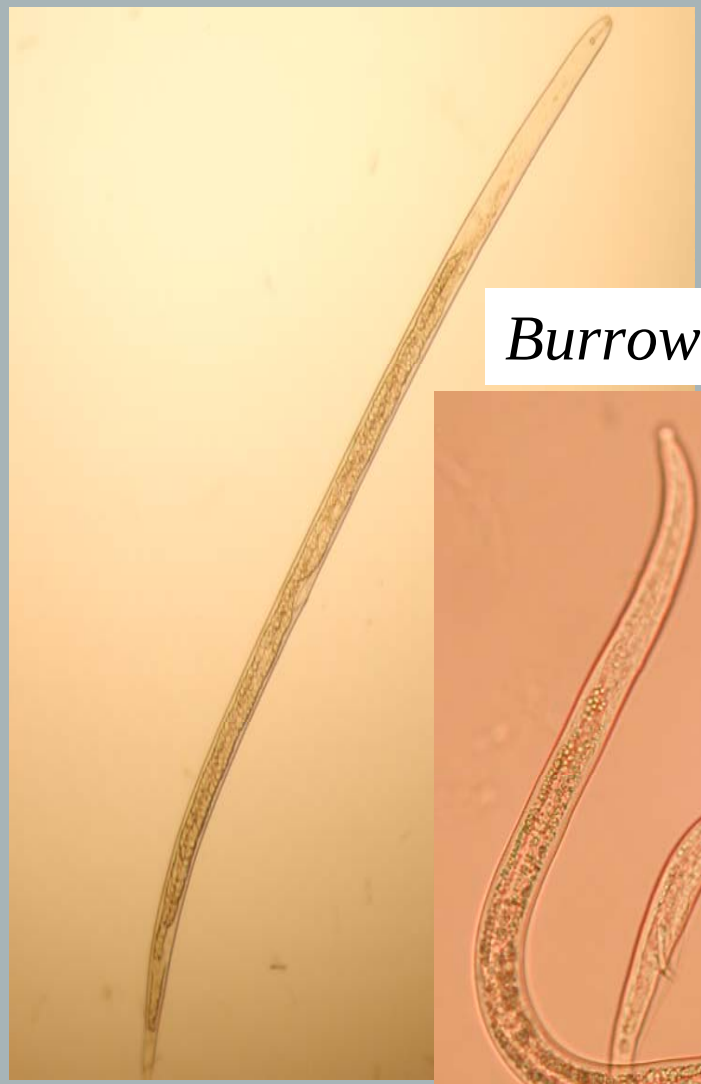
Worldwide	Hawaii
Burrowing nematode (***Radopholus similis***)	**Burrowing nematode** (***Radopholus similis***)
Spiral nematode (***Helicotylenchus multicinctus***)	**Root-knot nematode** (***Meloidogyne* spp.**)
Lesion nematode (***Practylenchus* spp.**)	**Reniform nematode** (***Rotylenchulus reniformis***)
Root-knot nematode (***Meloidogyne* spp.**)	**Spiral nematode** (***Helicotylenchus* spp.**)
Reniform nematode (***Rotylenchulus reniformis***)	**Lesion nematode** (***Practylenchus* spp.**)

Migratory Endoparasitic Nematodes

(Root-borrowing nematodes)







Symptoms

Root Lesions

- Dark red lesions on the outer part of roots.
- Lesions distributed throughout the cortex but not in the stele.
- Affecting the anchorage of the plant.

Symptoms
(Continue)

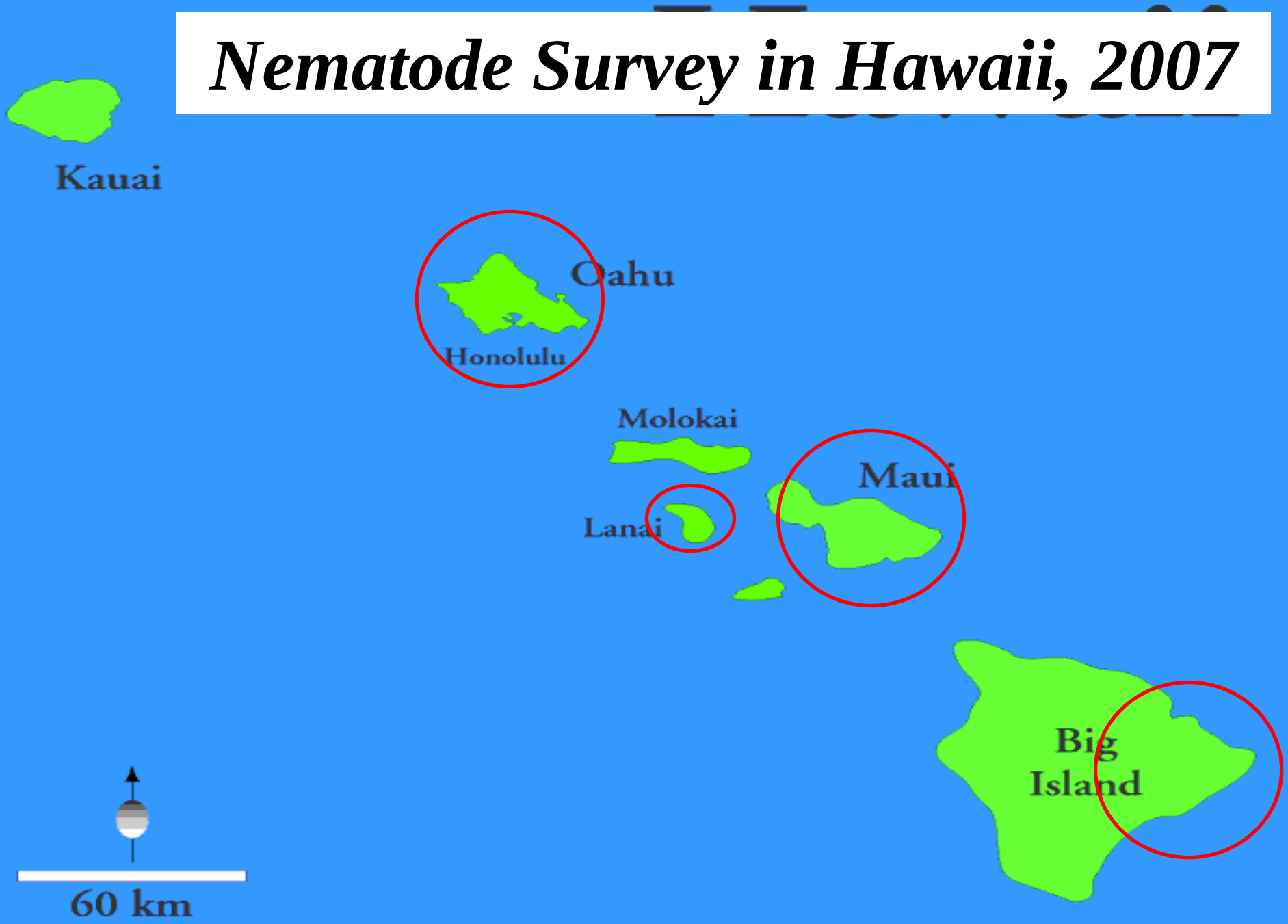
- Reduce capability of plants to uptake nutrients.
- Prolonging of the vegetative cycle.
- Drastic reduction in bunch weight.
- Open wounding could result in colonization of fungi or bacteria.
- Toppling disease.

Sedentary Endoparasitic Nematodes

Root-knot nematode

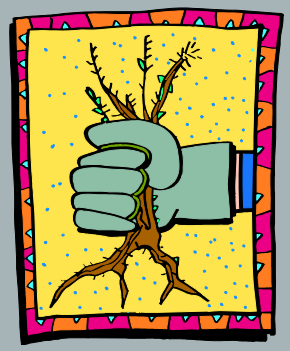
Reniform nematode

Nematode Survey in Hawaii, 2007



Nematode Sampling

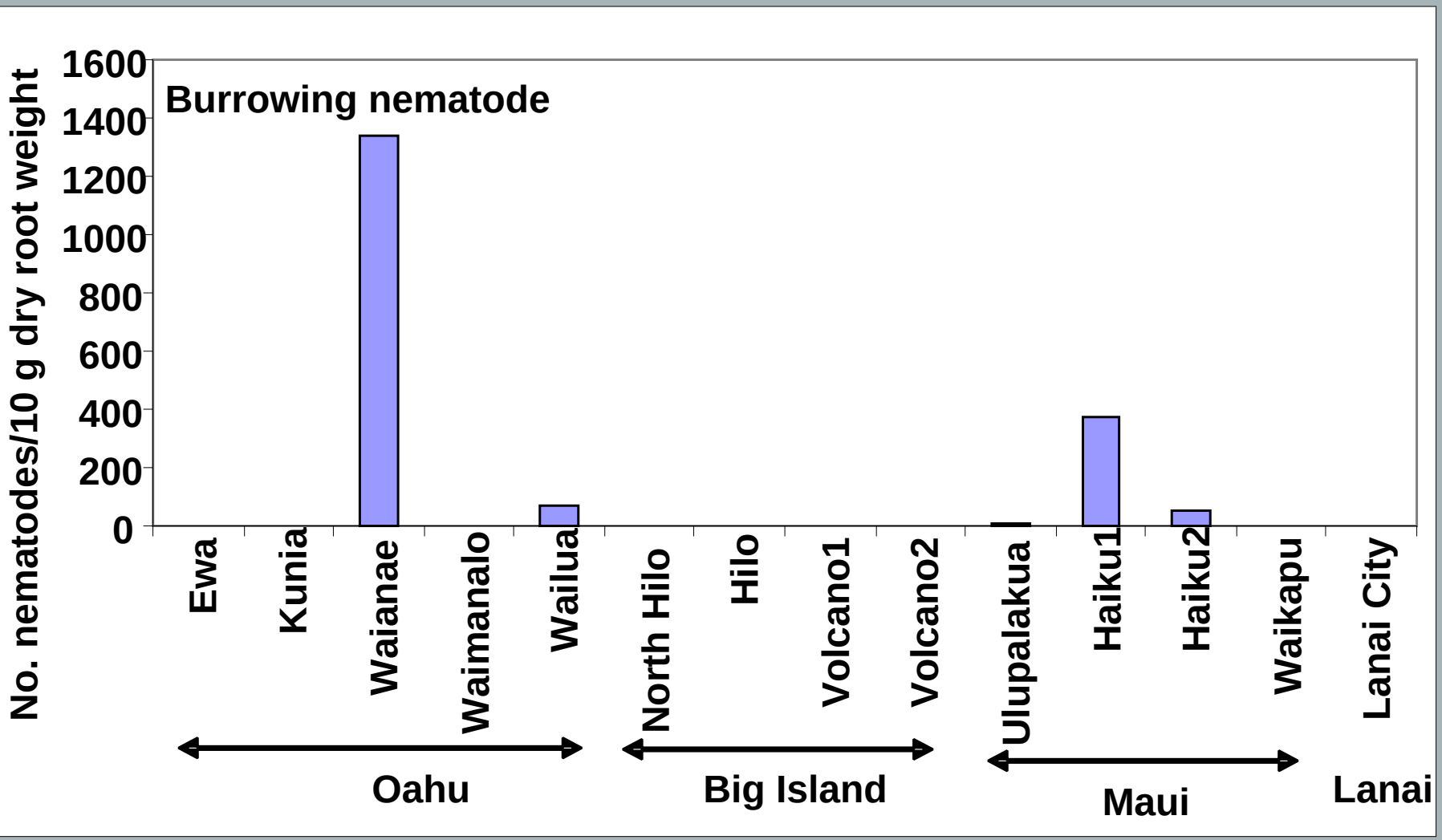
3 samples × 5 cores / farm



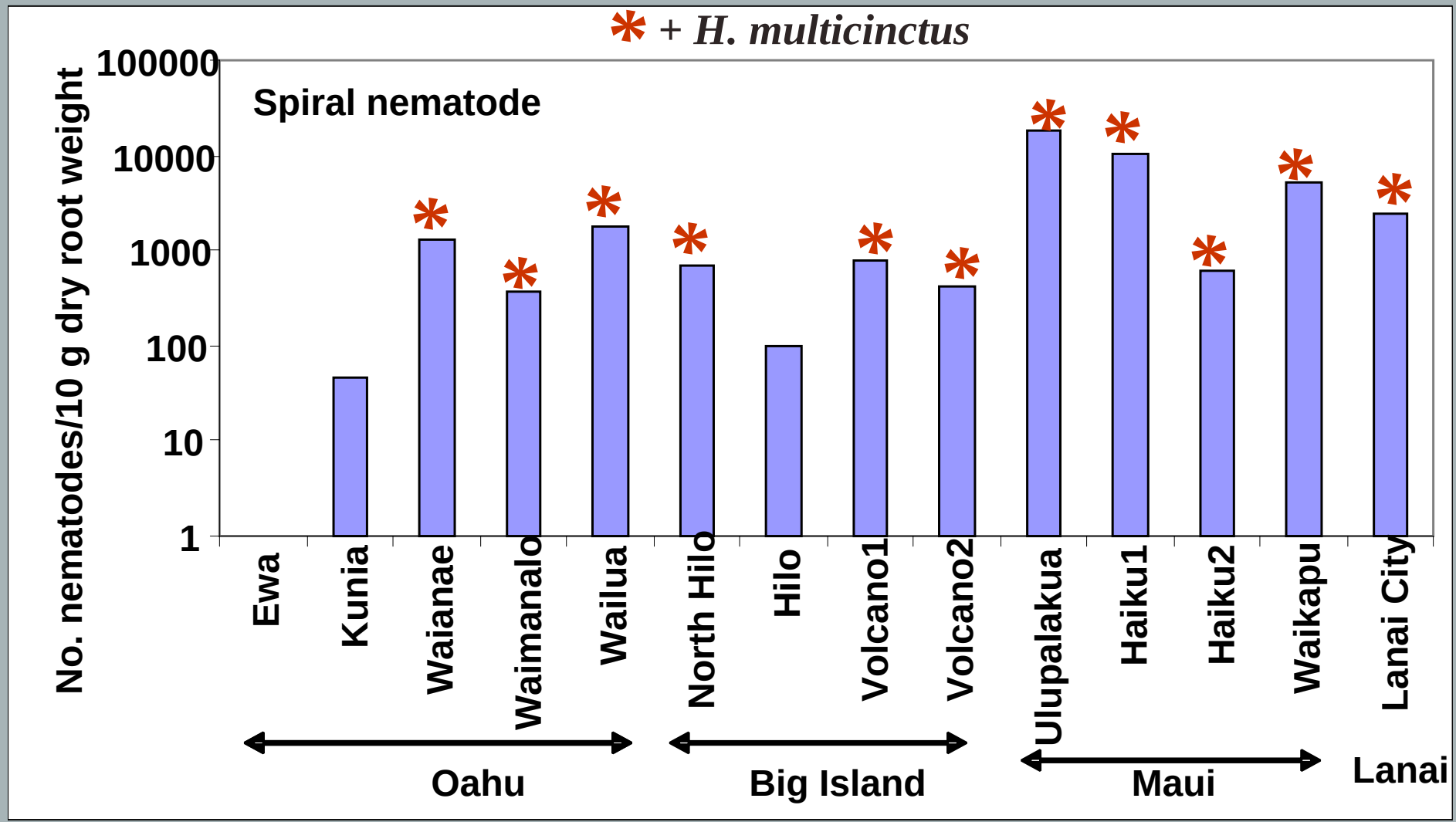
Mist chamber

Elutriation

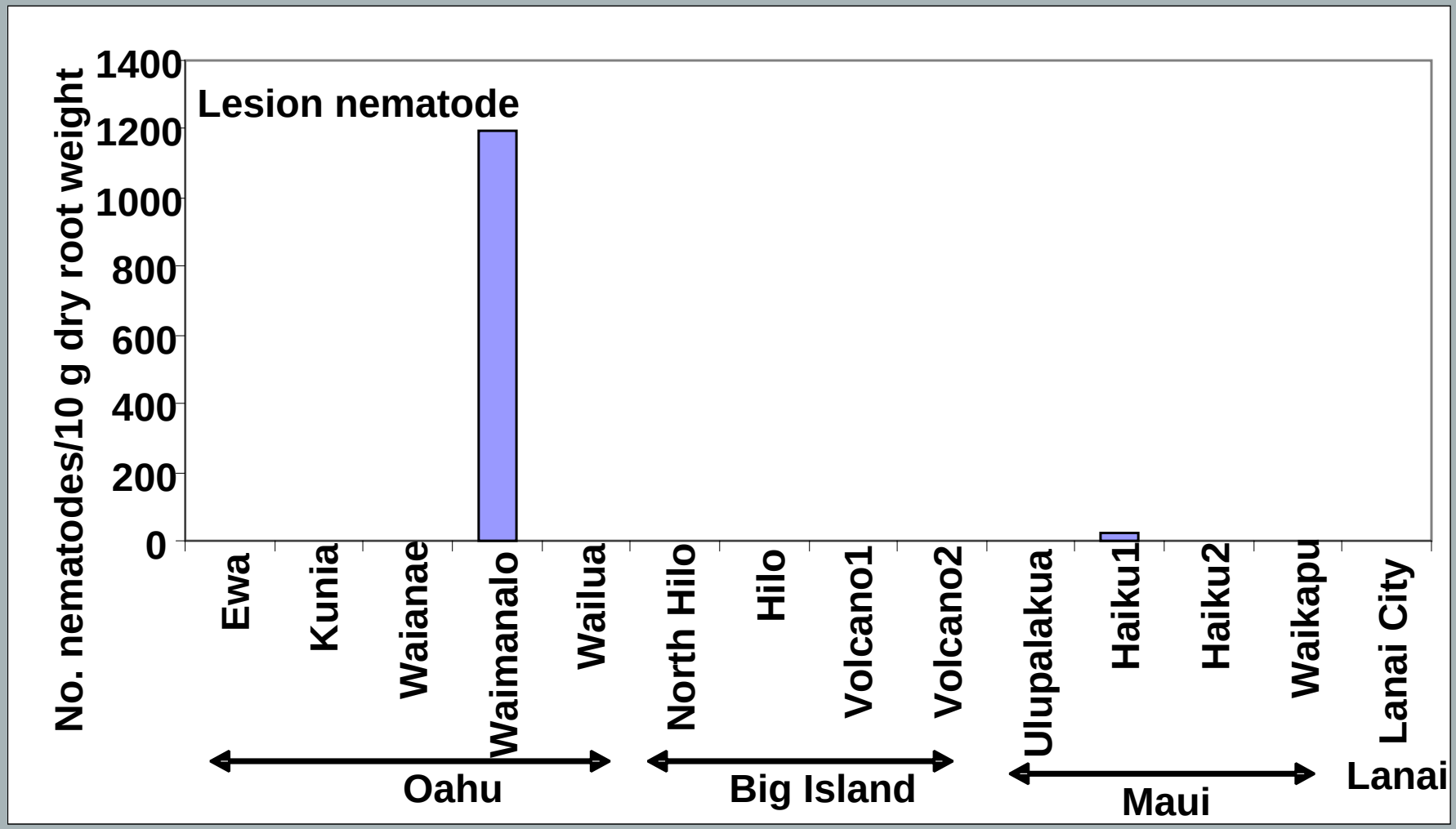
Burrowing Nematodes on Banana Roots



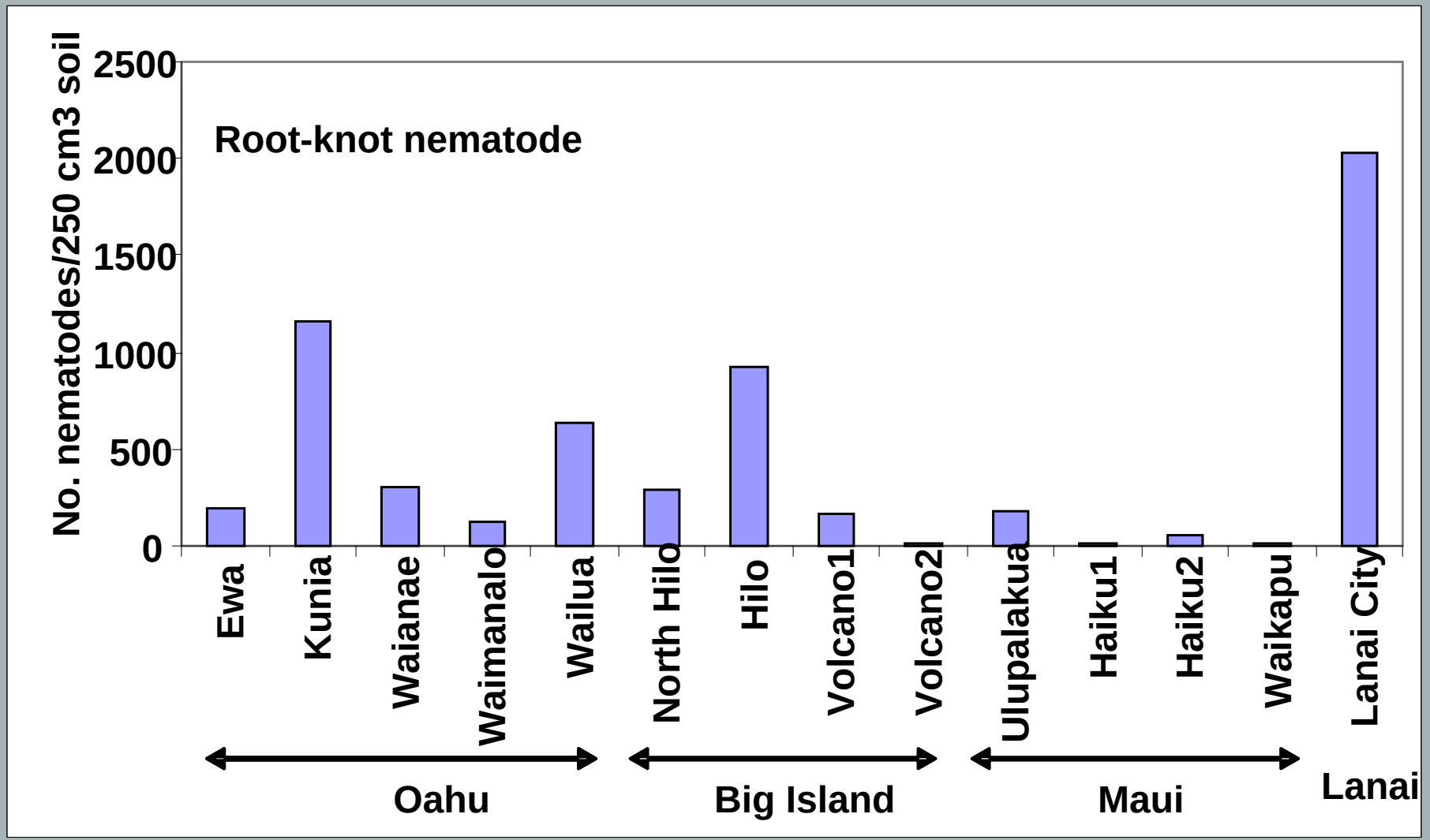
Spiral Nematodes on Banana Roots



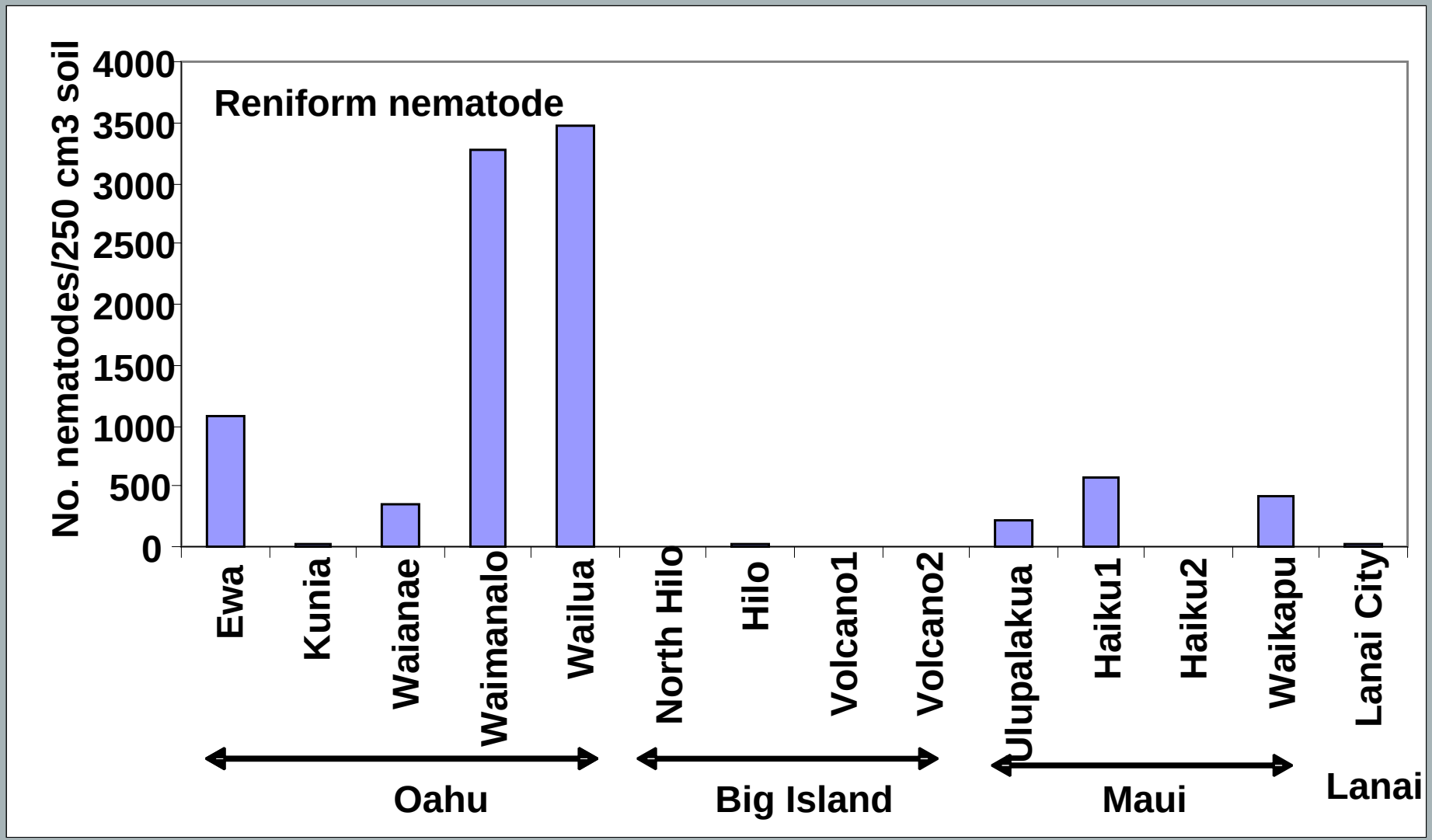
Lesion Nematodes on Banana Roots



Root-knot Nematodes in Soil of Banana Fields

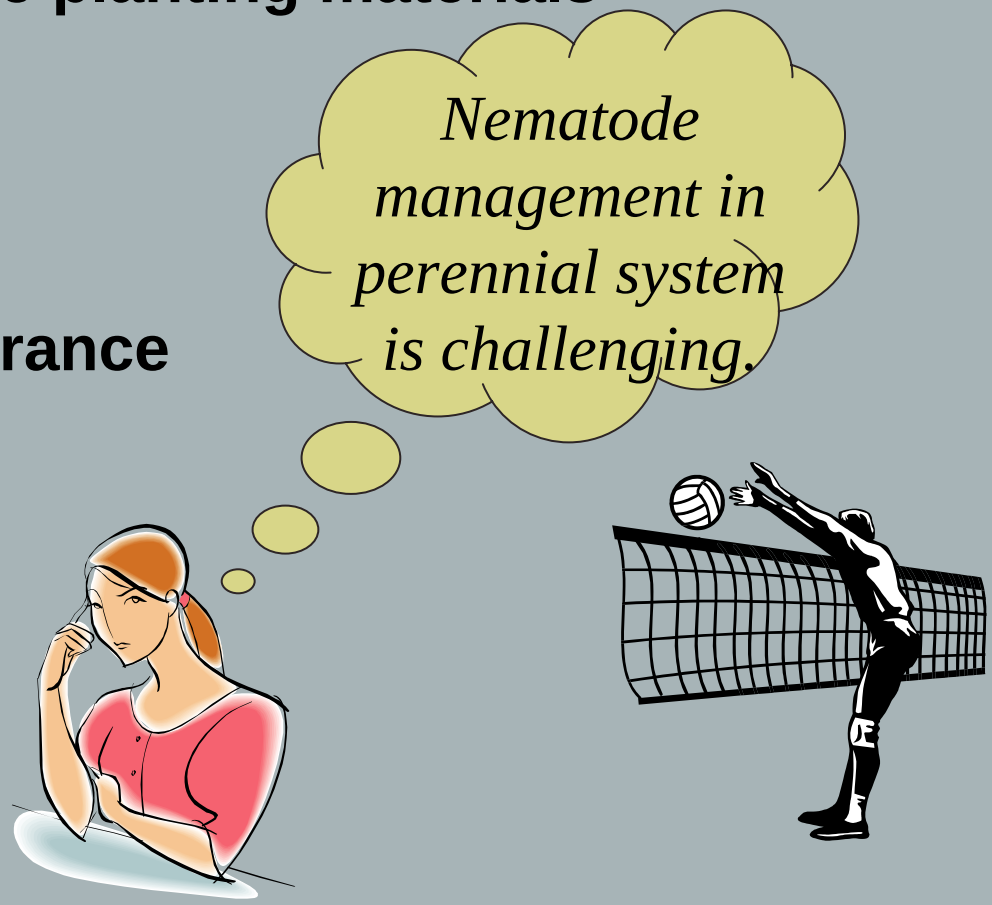


Reniform Nematodes in Soil of Banana Fields



Nematode Management Options

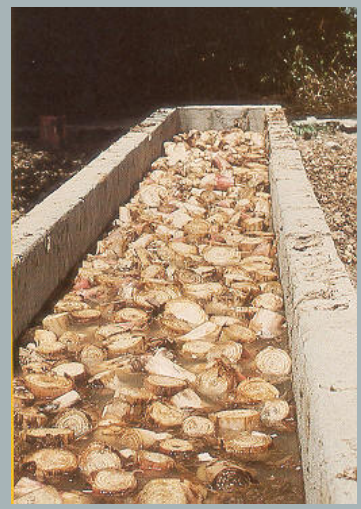
- **Using nematode-free planting materials**
- **Chemical control**
- **Cultural practices**
- **Crop rotation**
- **Resistance and tolerance**
- **Biological control**



Using nematode-free planting materials

- **Hot water treatment** (commercial practice in Australia and Central and South America)
- **Na-hypochlorite dip**
- **Tissue culture plantlets**
- **Root paring**

55°C for 20 minutes



Peeled banana corms

http://plpnemweb.ucdavis.edu/nemaplex

Nematode Management Options

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- Chemical control
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Chemical Control

- **Preplant fumigation (1,3-dichloropropene):**
  - **Too costly for small-scale farmers, potentially contaminate ground water.**
- **Post-plant nematicide:**
  - **Nemacur (fenamiphos): Special Local Needs label for Hawaii had expired on June 04, 2007.**
  - **Mocap (ethoprop): post-plant application.**
  - **DiTera: Biopesticide, hard to handle.**

Nematode Management Options

- Using nematode-free planting materials
  - Hot water treatment
  - Na-hypochlorite dip
  - Tissue culture plantlets
- Chemical control
- Cultural practices
- Crop rotation
- Resistance and tolerance
- Biological control

Fallow

- **At least 6 months to be effective.**
- **Essential that all banana roots and suckers are destroyed.**

Roundup injection

Martinique……..

Fallow/tissue culture plant regime has extended banana field longevity from 3-4 to 6-10 years, in some cases contaminated fields are totally freed from burrowing nematodes.


Propping of plants

Nematode Management Options

- Using nematode-free planting materials
- Chemical control
- Cultural practices
- Crop rotation
- Resistance and tolerance
- Biological control

Crop Rotation

Marigold

Tagetes patula

Tagetes erecta

Sunn hemp

Crotalaria juncea

Sorghum-sudangrass

Sorghum bicolor × S. sudanense

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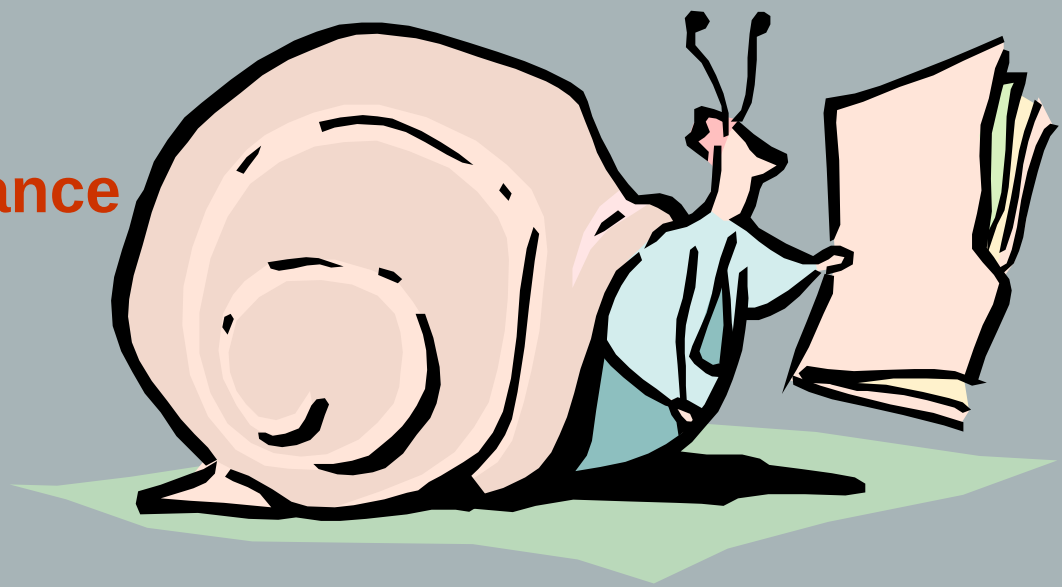

Resistance and Tolerance

- **No commercial variety is resistant to key nematode pests.**
- **Nematodes have never been the first priority for breeders.**
- **Panama disease epidemics led to the change of export cultivar from Gros Michel to Cavendish in Latin America exacerbated the problem of *R. similis* (Leach 1958).**
- **This led to the breeding work for resistance to *R. similis* in Honduras (FHIA) after the discovery of resistance in Pisang Jari buaya (Wehunt et al., 1978).**
- **Several lines were resistant (e.g. SH 3142) and tolerant to *R. similis* (FHIA -1).**

Nematode Management Options

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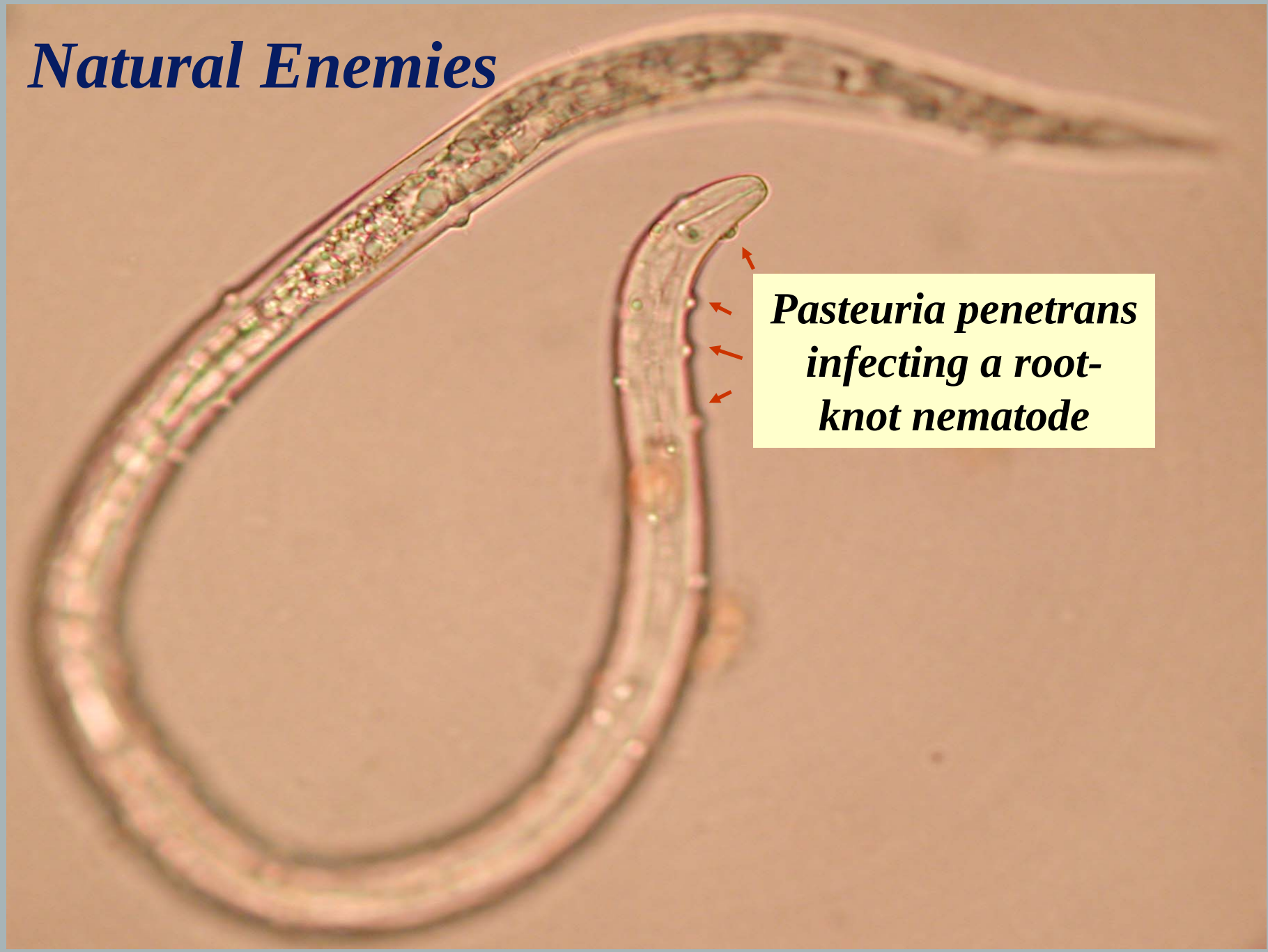
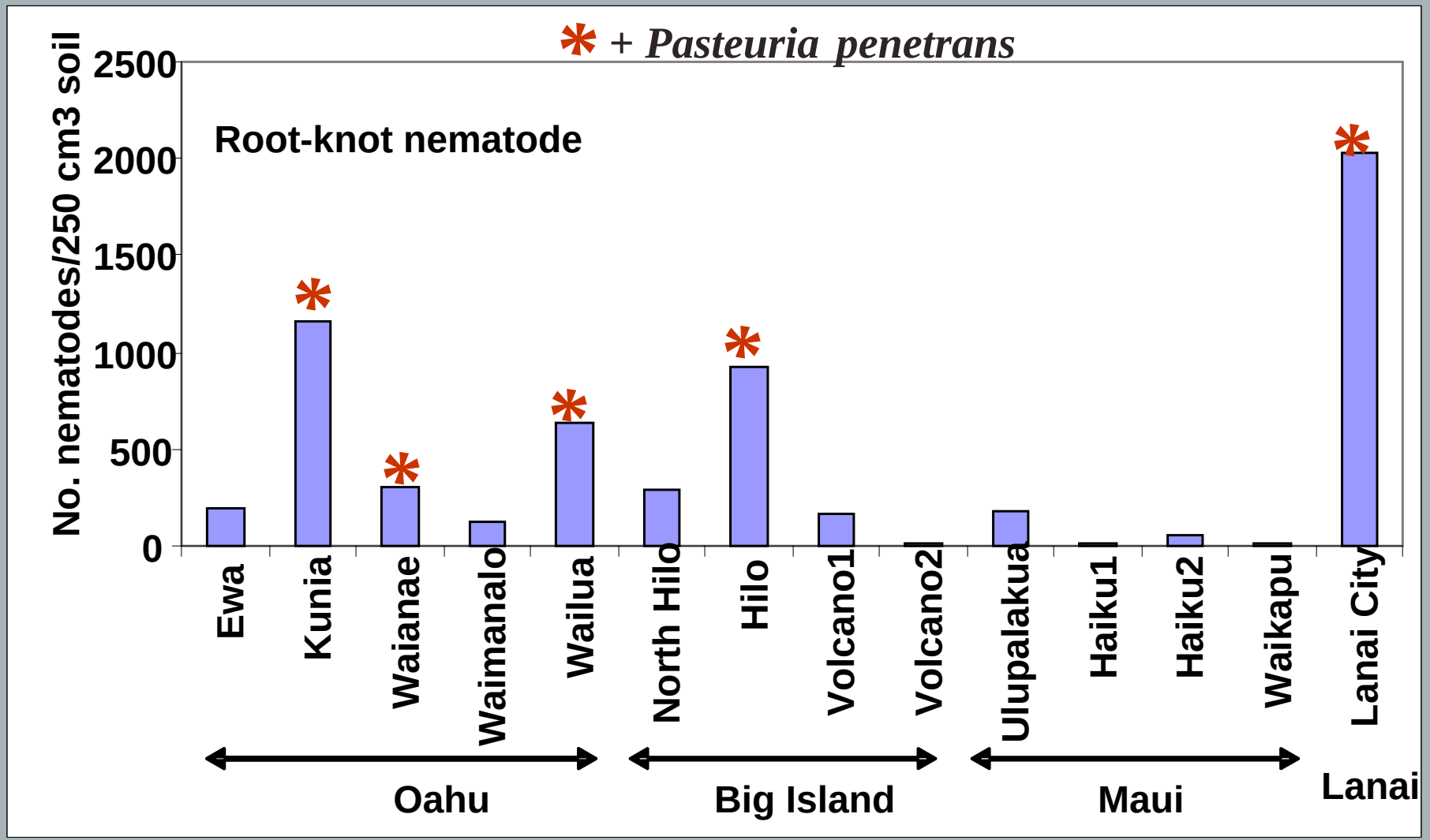
Natural Enemies

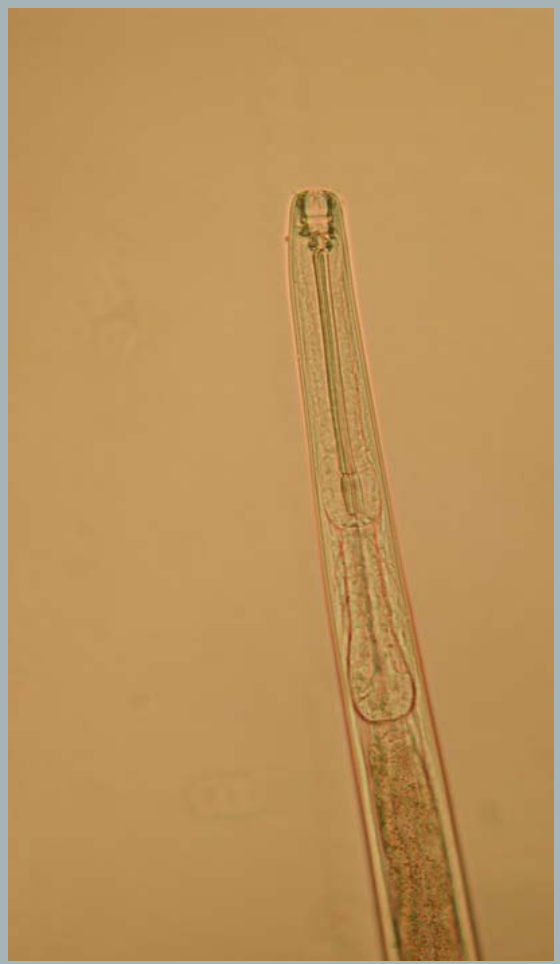


Pasteuria penetrans infecting a root-knot nematode

Root-knot Nematodes in Soil of Banana Fields

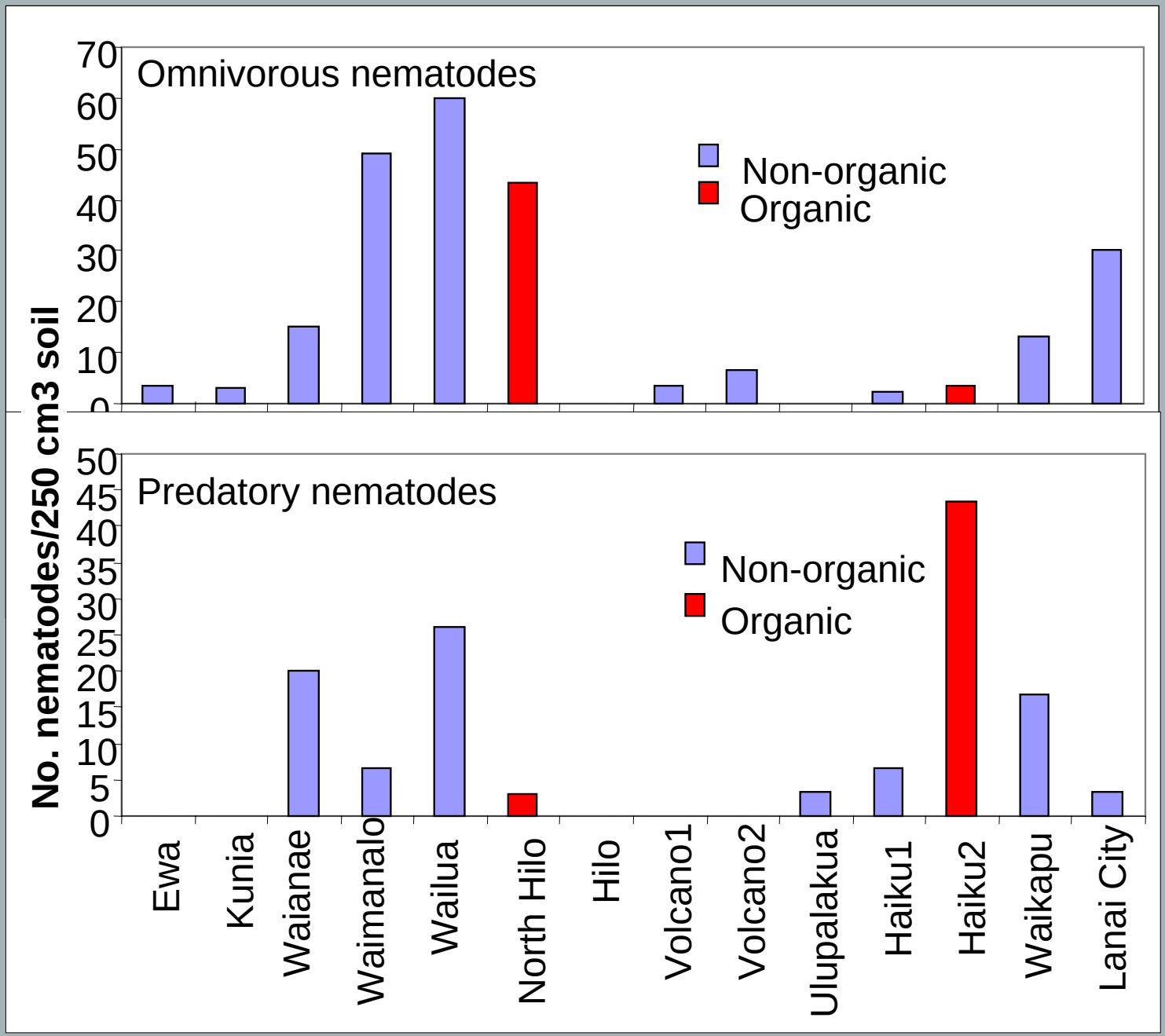


Predatory nematodes



Butlerius

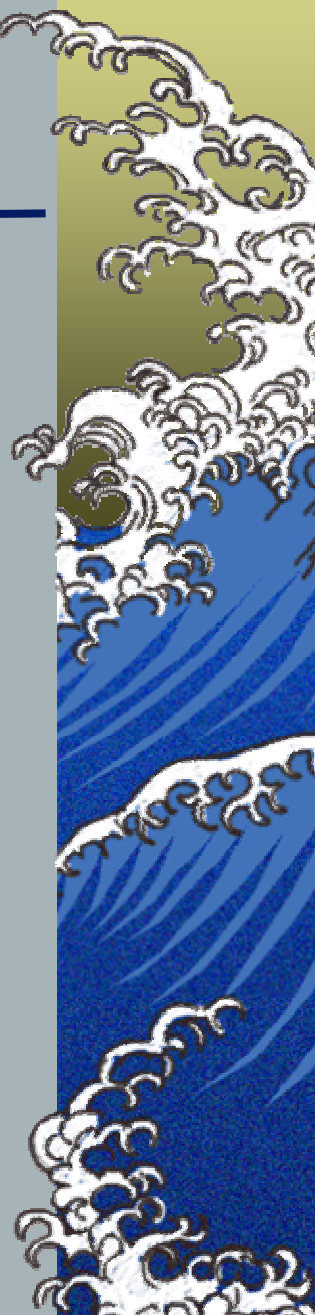
Omnivorous and Predatory Nematodes



Nematophagous Fungi

Summary

- **Spiral nematode, *Helicotylenchus multicinctus*, is a newly report nematode pest on banana plants in Hawaii. They occur in high abundance and high frequency.**
- **Burrowing and lesion nematodes are encountered less frequently.**
- **Natural enemies of root-knot nematodes are common in fields surveyed.**



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Root gall and Egg Masses of Root-knot Nematodes