

Nematodes associated with invasive insects, some potential cases of cryptogenic invasion of nematodes



← *Rhynchophorus ferrugineus*

↓ *Sagra femorata*



Natsumi Kanzaki^a

Ryusei Tanaka^{a,b}

Yuuri Hirooka^a

Toru Kitagami^c

^a Forestry and Forest Products Research Institute, Japan

^b Saga University, Japan

^c Mie Prefecture Plant Protection Office, Japan

Some invasive pest nematodes

Pine wood nematode, *Bursaphelenchus xylophilus*

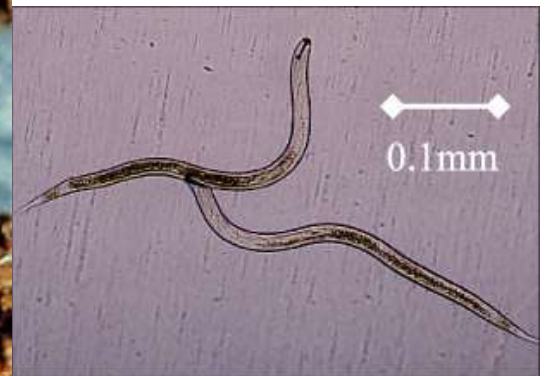
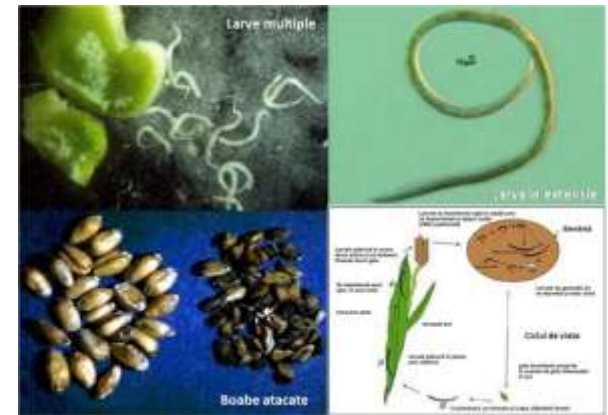
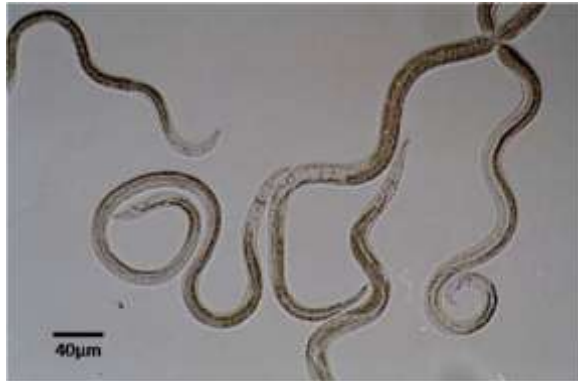
- Wood and wood boring cerambycids (*Monochamus* spp.) from N America

Wheat gall nematode, *Anguina tritici*

- Contaminated animal feed grains from China

Potato cyst nematode, *Globodera rostochiensis*

- Contaminated fertilizer from Peru



Cryptogenic invasion

No obvious economic damage (= difficult to recognize),
but potentially cause ecological disturbance and/or genetic
contamination on native fauna

They invade accompanying with

- Living plants
- Plant (wood) materials
- Soil (fertilizer etc.)
- **Introduced animals including pet insects**

Described in our
poster presentation

Purpose:

- 1) Survey of cryptogenic invasion of nematodes
- 2) Preliminary evaluation of their risk

as model cases

Objects: two species of introduced (invasive) pest insects

1. *Rhynchophorus ferrugineus* (red palm weevil: RPW)

2. *Sagra femorata*

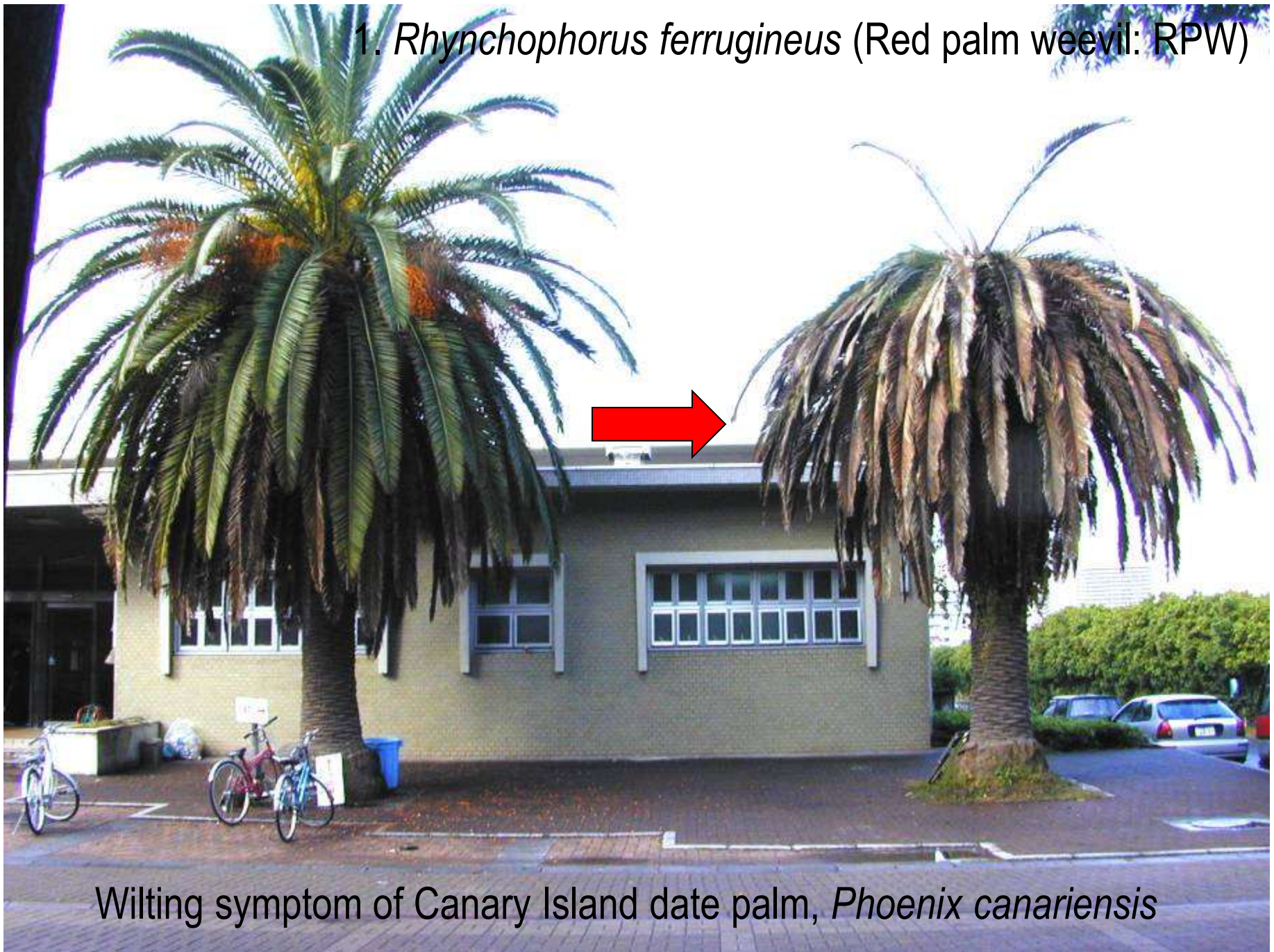


- Introduced from South/South-East Asia
- Feed only on street/garden-planted palm trees and kill them (= garden pest, but environmental risk may be small)



- Introduced from South-East Asia
- Feed on Japanese native plants, e.g., *Pueraria lobata*
- Could be a competitor for native insects (= could be an environmental risk)

1. *Rhynchophorus ferrugineus* (Red palm weevil: RPW)



Wilting symptom of Canary Island date palm, *Phoenix canariensis*

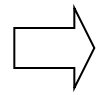


Red Palm Weevil,
Rhynchophorus ferrugineus



Common sense of nematologists:

- Palm wilt + *Rhynchophorus* = Red Ring Disease?
- Search for potential biological control agent.



Survey on nematode associates of RPW

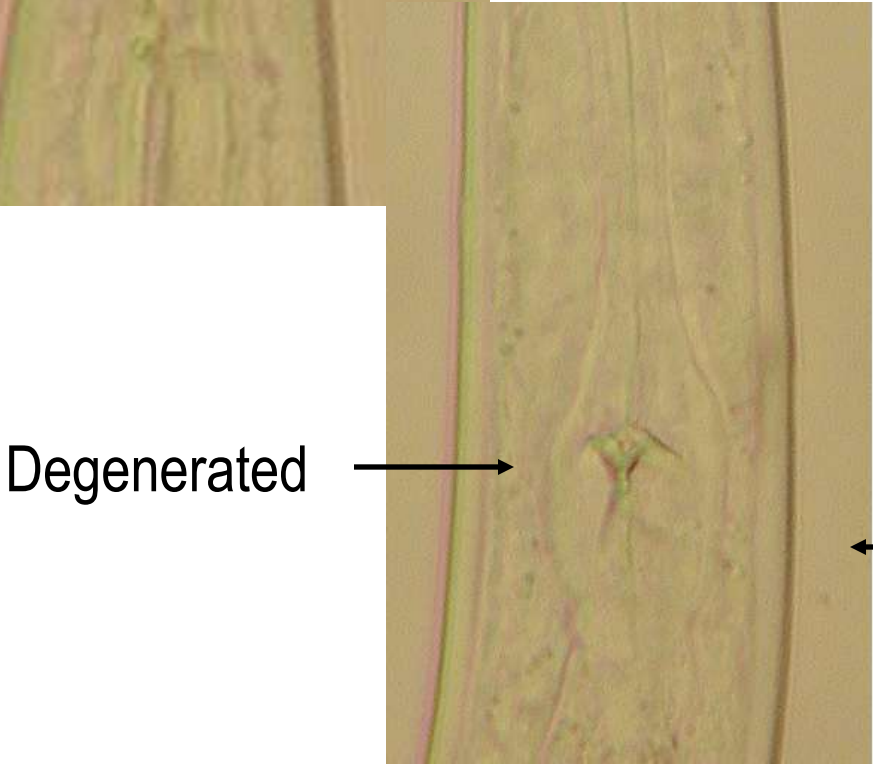
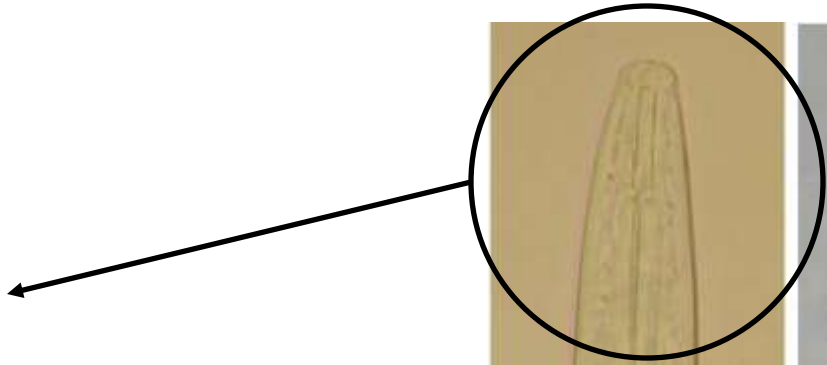
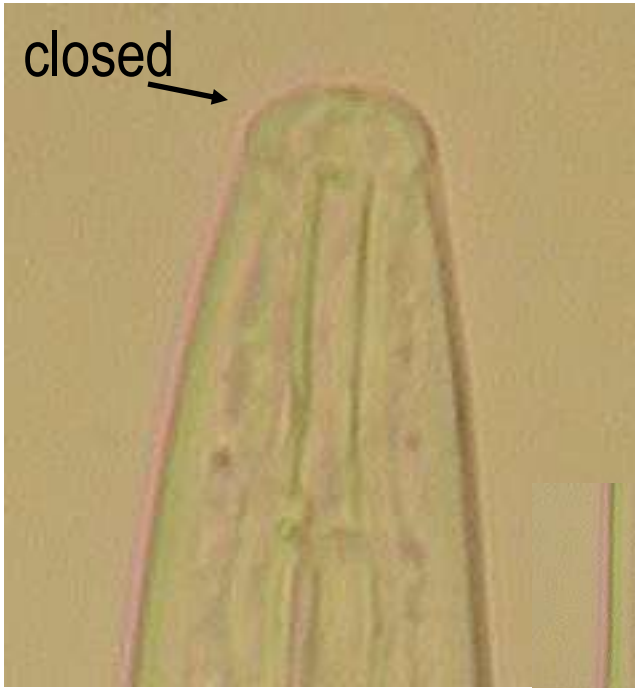


Korimoto Campus of Kagoshima University

- Nematode extraction from
- Adult RPWs
 - Dead tissues of palms

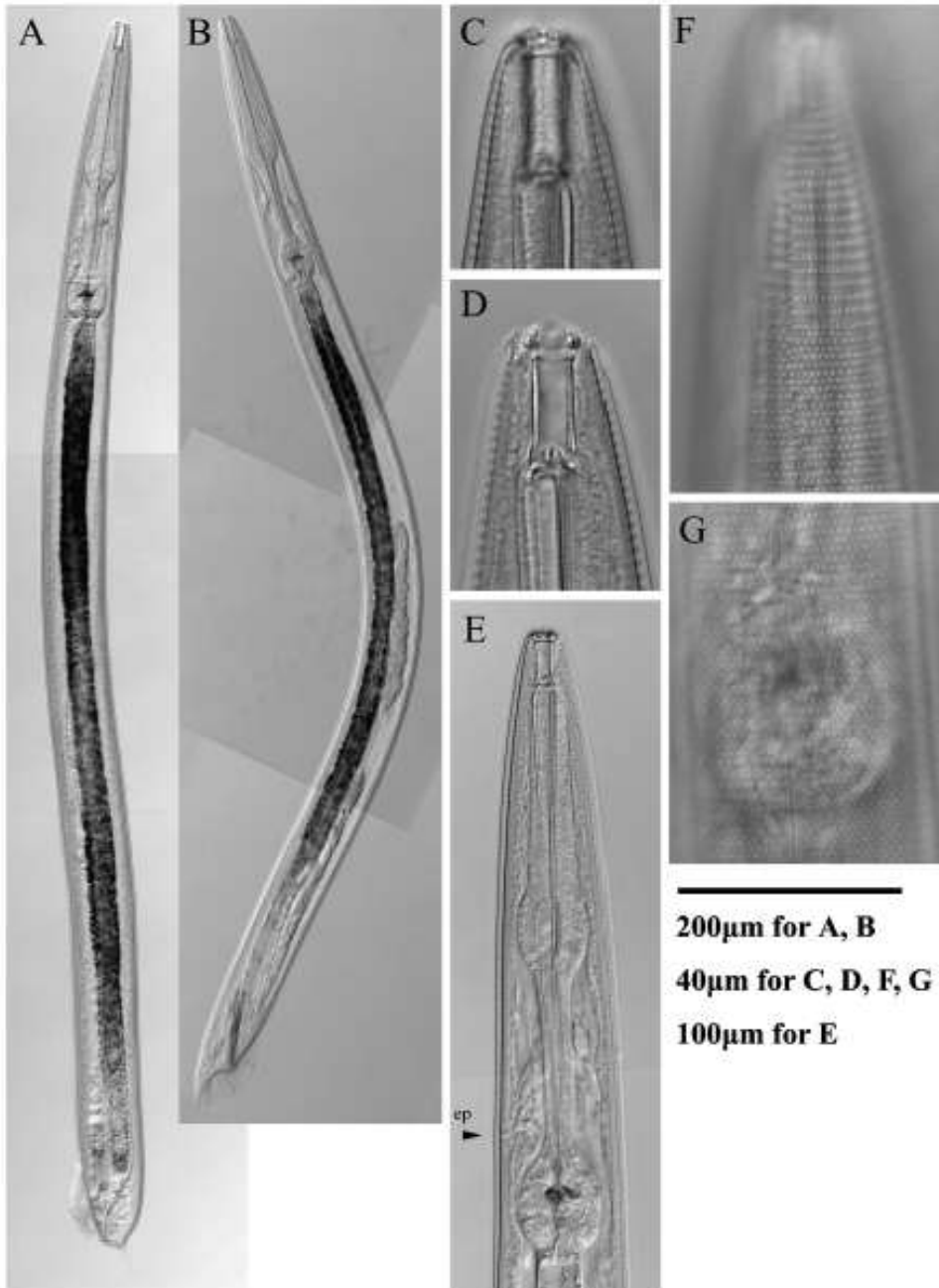
Korimoto Campus of
Kagoshima University
31 Oct. 2005

Dauer juvenile of a rhabditid species isolated from underneath the elytra

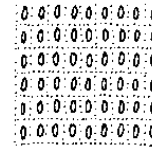


➡ Culture on AM agar

Teratorhabditis synpapillata

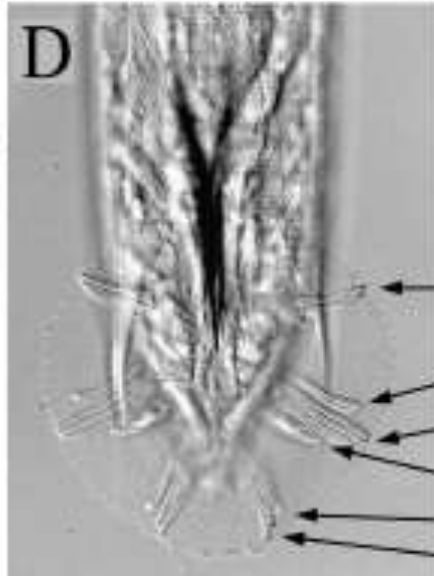
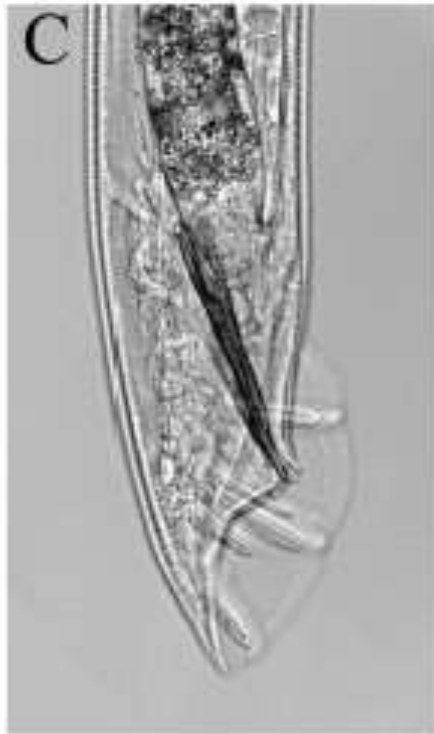
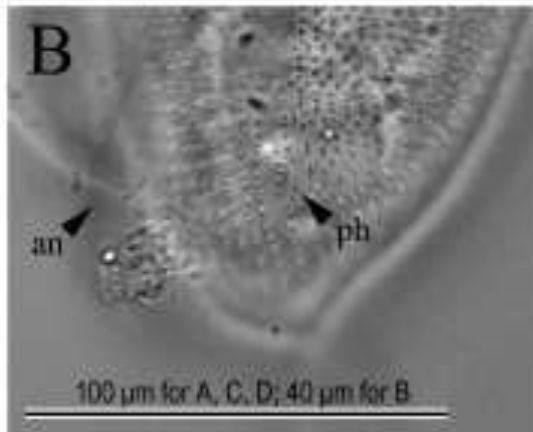


Morphological observation on cultured materials 1



- Middle-sized body
- Four lines of lateral field
- Body surface ornamentation
- Separated lips with cuticularized margin
- Very short esophageal collar

Teratorhabditis synpapillata



Morphological observation on cultured materials 2

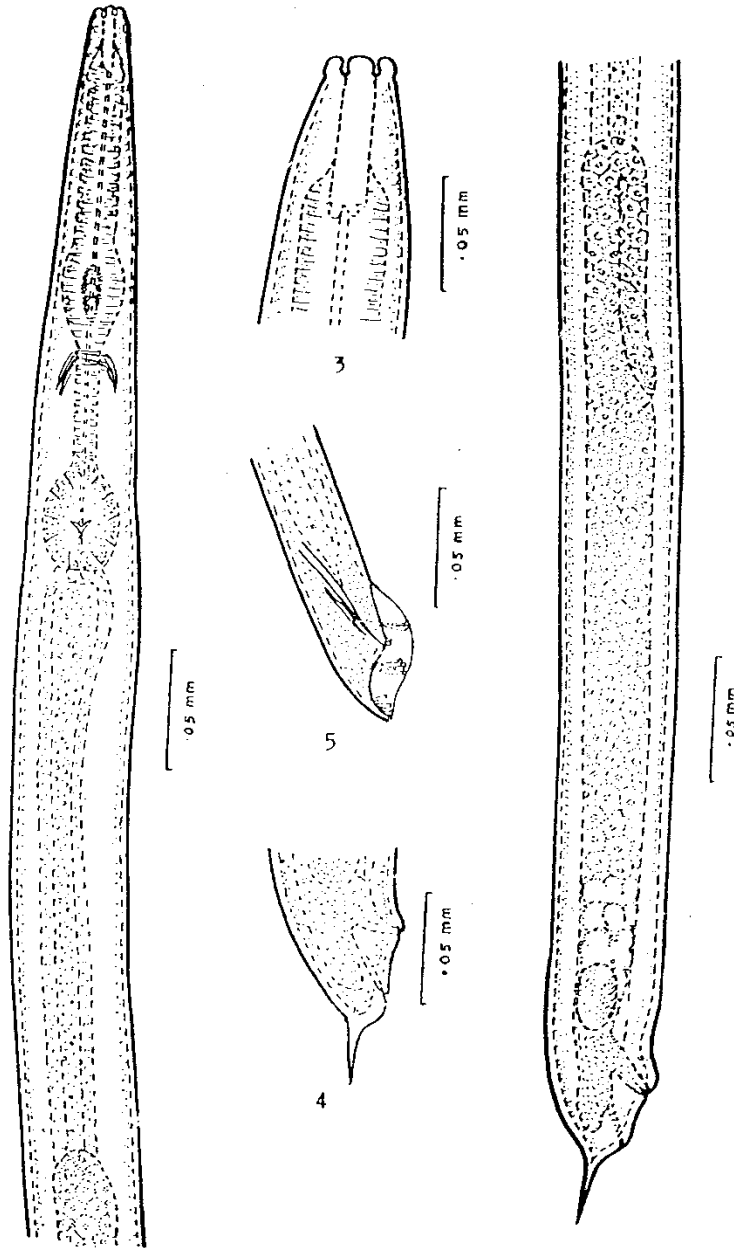
- Single ovary (monodelphic)
- Copulation plug
- 10 pairs of bursal limbs
- Peloderan bursa
- Long and fused spicule

Morphologically identical to original description

Molecular profiles of **Japanese** *Teratorhabditis synpapillata* population:

Near full length SSU and D2/D3 LSU of Japanese population was **almost identical** to those of **Indonesian** population

Habitat and insect association



- Reported as an associate of *R. ferrugineus* from India

← (Muthukrishnan, 1971)

- Found from sewage, compost and nutrient-rich soil in the Thailand, India and Indonesia

(Sudhaus, 1985)

Biological characters and potential environmental risk of *Teratorhabditis synpapillata* as an alien species

- 1) **Bacteria feeder,**
- 2) **insect phoretic (*R. ferrugineus* = introduced species)**
- 3) **found from sewage, compost and nutrient-rich soil in the Southern/South-Eastern Asia**

= 1) not plant parasitic/pathogenic

= 2) not insect parasitic/pathogenic, and not compete for phoretic host with native species

= 3) prefers rather rich (and probably warm) condition and hopefully not compete with native species for feeding resource and habitat

Environmental risk of the species seems rather small at current condition

2. *Sagra femorata*



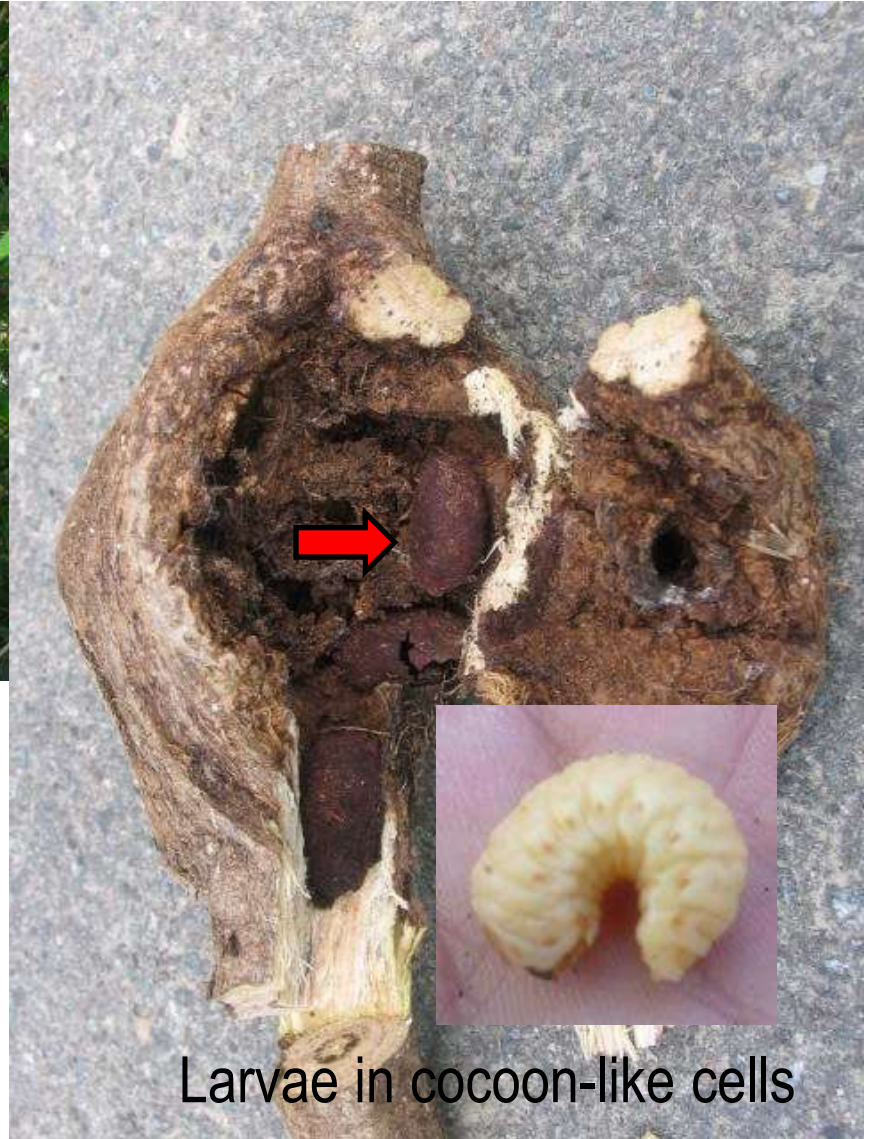
Pueraria lobata

- Suspected to be artificially introduced by insect collectors....
- The primary feeding resource of the beetle at current status is *Pueraria lobata*, a Japanese native weed species.
- The beetle also feeds on other Leguminosae plants and Rutaceae (citrus) plants (= potential economic risk species).

Plant gall induced by *Sagra femorata*

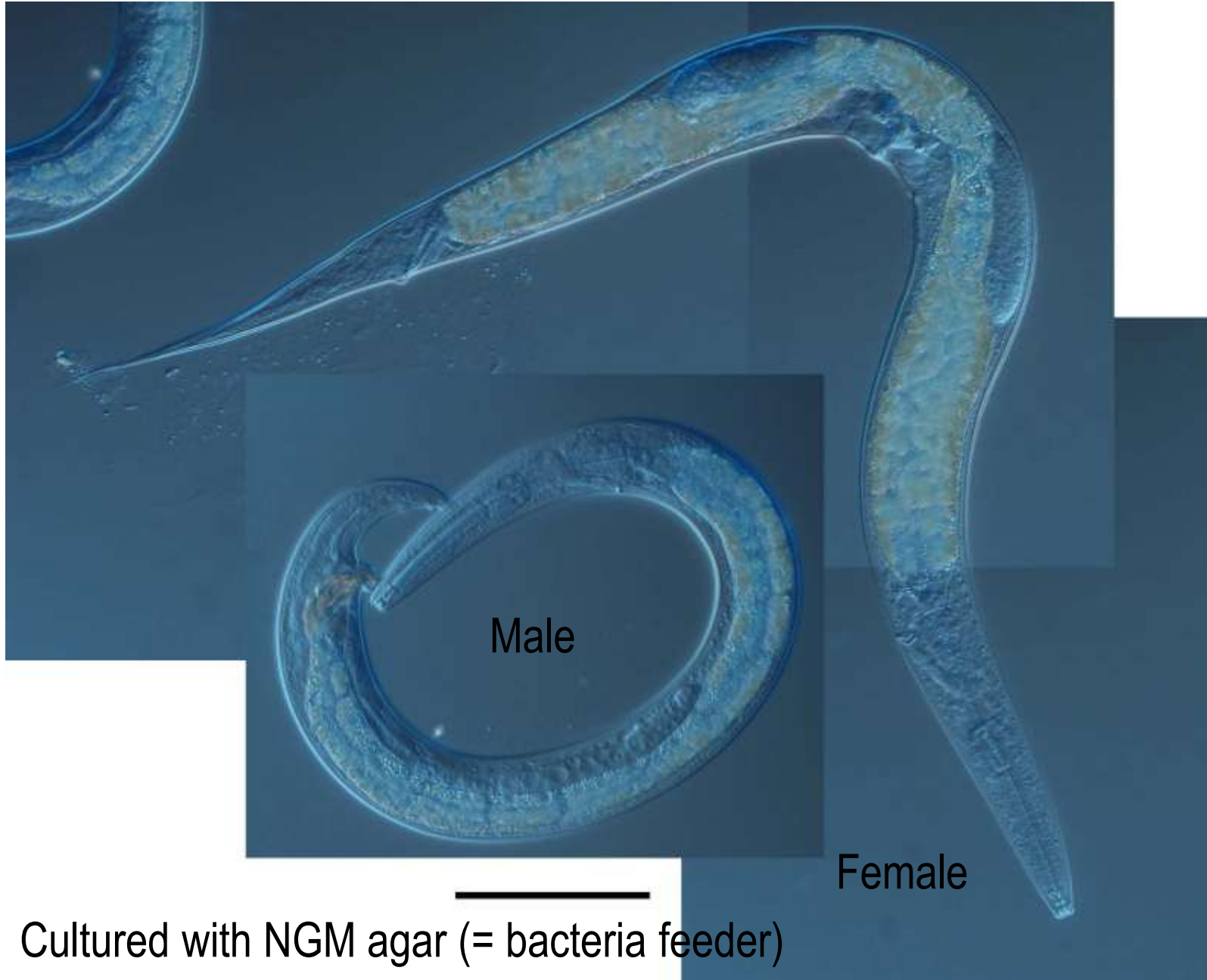


Nematodes:
Diplogastrid dauers were associated
with insect larvae (found from the
body surface and body folding)



Larvae in cocoon-like cells

Culturing and identification of nematode



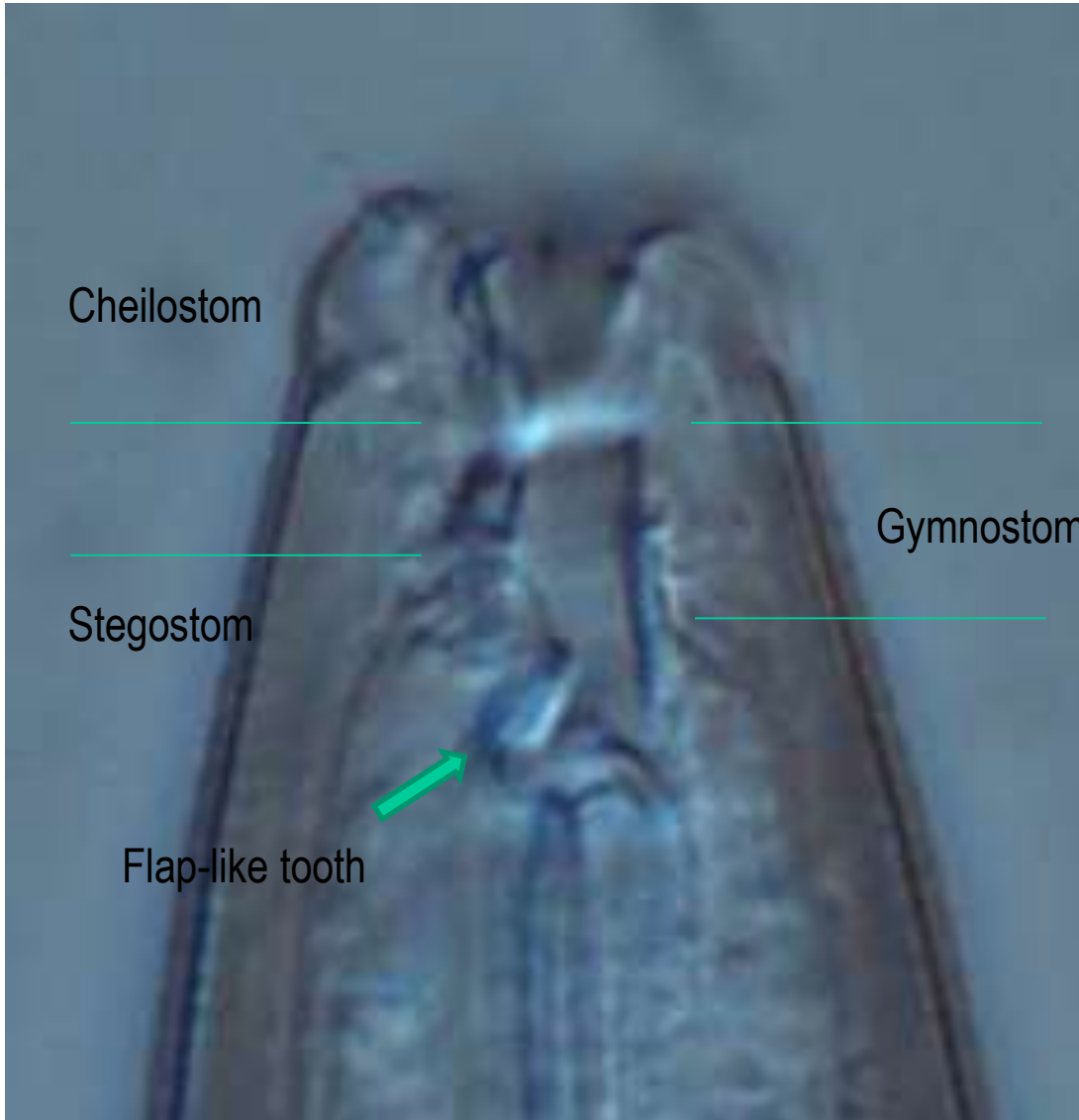
Male

Female

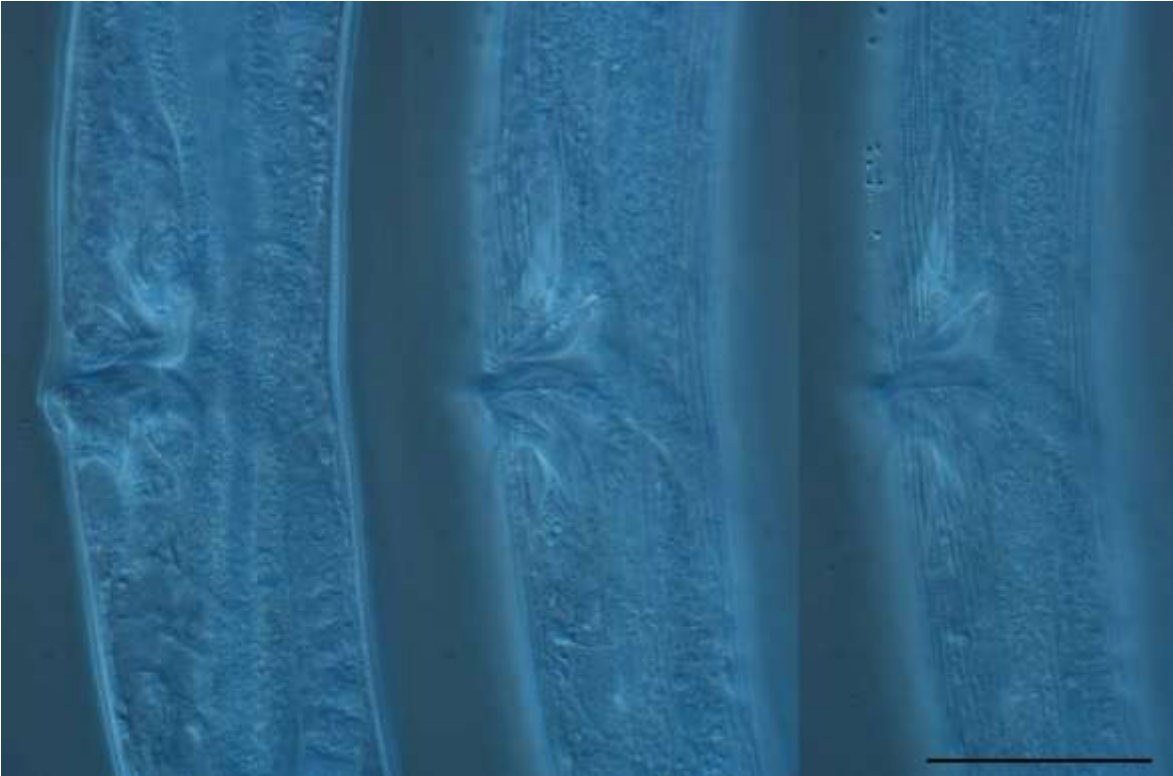
Cultured with NGM agar (= bacteria feeder)

Acrostichus sp.:

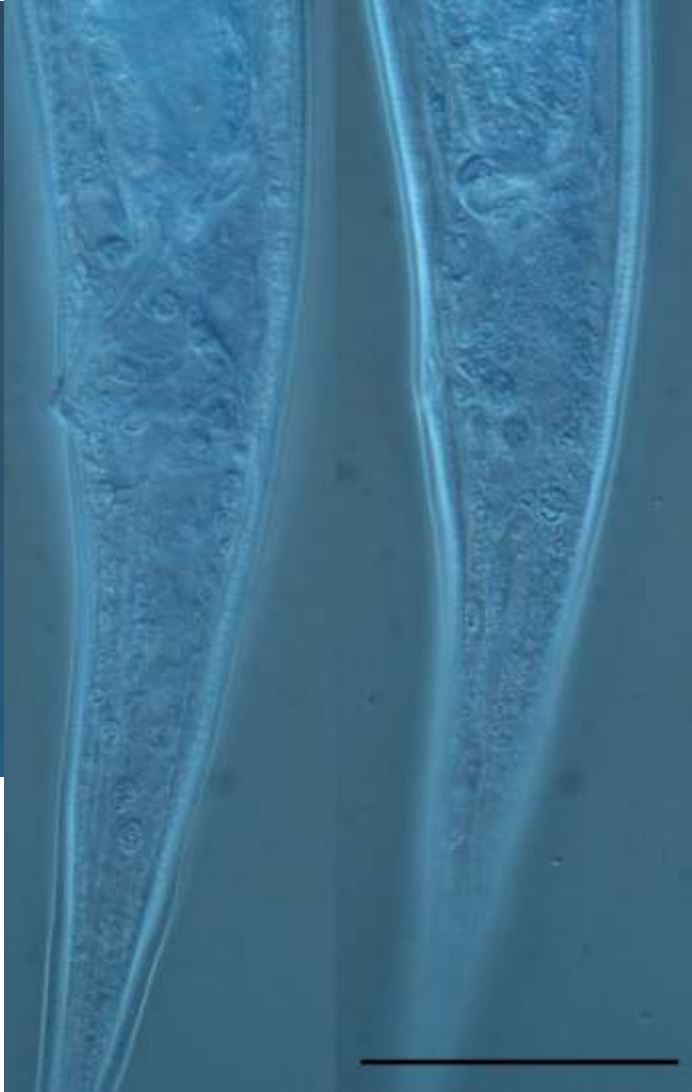
Typical insect-phoretic bacteria feeder / omnivore (facultative predator)



Acrostichus sp.: Female morphology

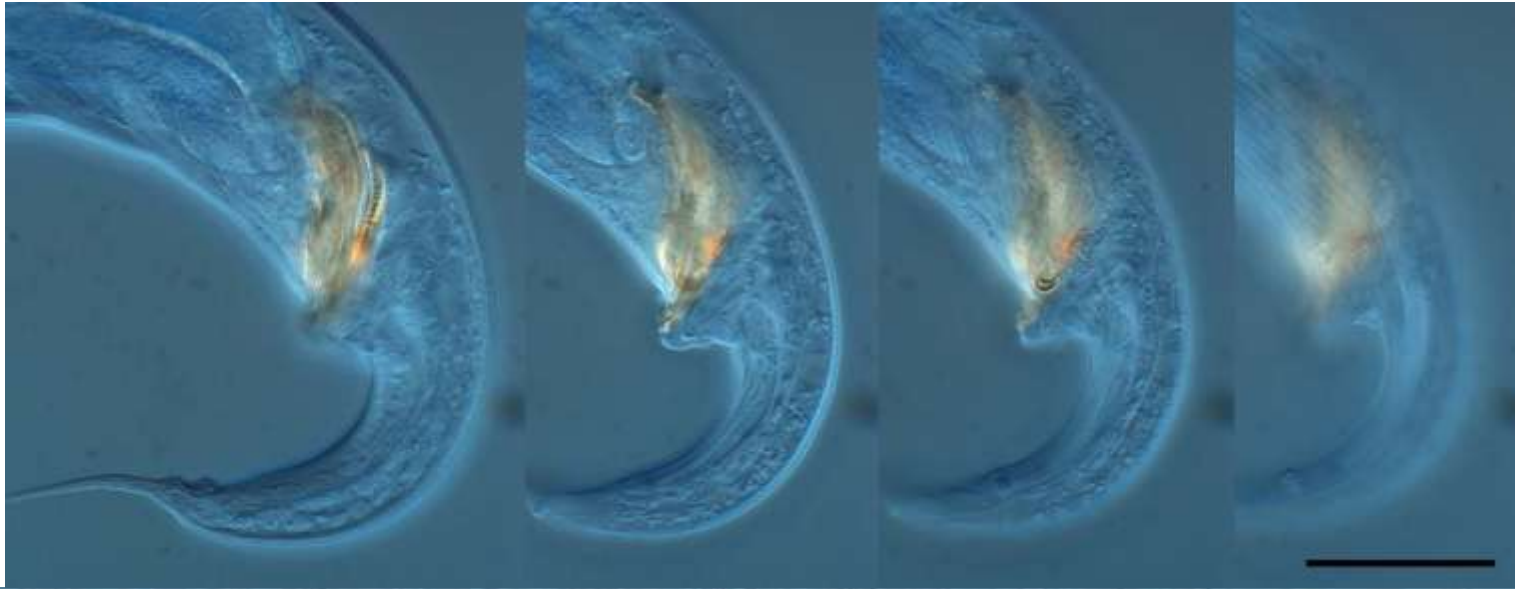


↑ Vulval region



Tail →

Acrostichus sp.: Male morphology



Characteristic massive, horn-like gubernaculum

Biological characters and potential environmental risk of *Acrostichus* sp. if it is an alien species*

*Currently, the nematode is **POTENTIAL** alien

Generally, the genus *Acrostichus* is

- 1) Phoretically associated with various insect groups, e.g., bark beetles, longhorn beetles and bees, and carrier specificity unknown
= not insect parasitic/pathogenic, but not clarified whether it can switch the carrier and compete for phoretic host with native species
- 2) Mostly bacteria-feeder, and contains some facultative predators (this species seems simple bacteria feeder)
= not plant parasitic/pathogenic, and does not seem prey native species

Biological characters and potential environmental risk of *Acrostichus* sp. as an alien species

3) Found in dead wood (plant) and environments surrounding carrier insects

= the distribution seems limited at current condition, but necessary to monitor its carrier switching and expansion

Environmental risk of the species seems rather small at current condition

Summary and remarks

Cryptogenic invasion: How/What we have to do?

- Aware the possibility:
 - We have to know how the alien species invade
- Basic information about native fauna:
 - We have to distinguish alien species from native ones
e.g., *Acrostichus* sp. in this presentation...
- Evaluate the risk:
 - Although all alien species are potential risk for native environment,
risk analysis for each species is necessary
- Monitoring
 - Monitor the spread of alien species, and eliminate/control them