Golf Course Nematodes: Population Structure and Species Diversity in Central and Eastern Thailand

Phornthawon Phanbut

Department of Plant Pathology, Faculty of Agriculture, Kasetsart University, Thailand

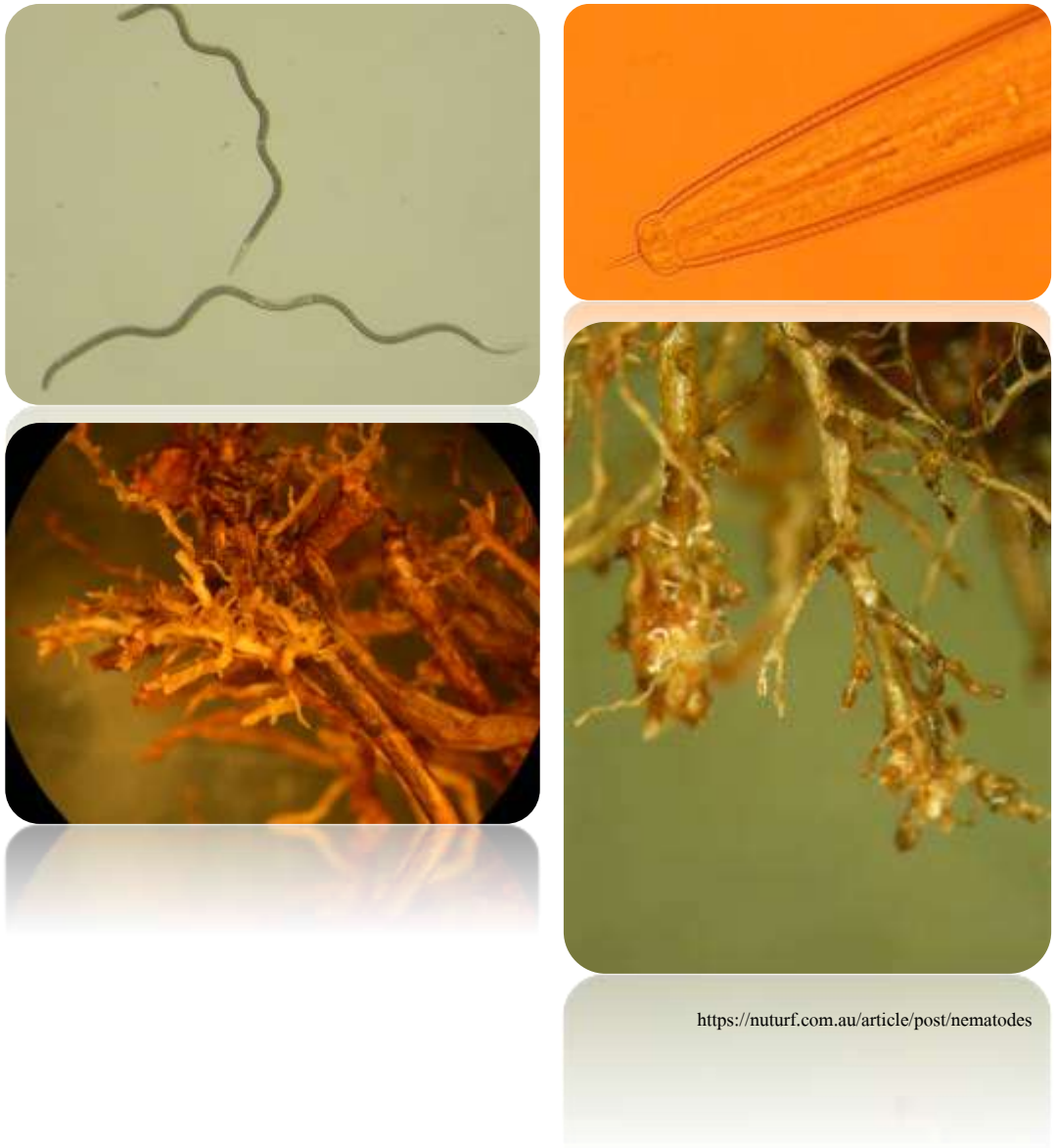
Nematodes

How to identify nematodes:

Plant-parasitic nematodes are microscopic roundworms that attack turfgrass roots. Key identification details:

- Extremely small: Measuring only 0.5–3 mm in length, depending on the species.
- Body Type: Translucent, worm-like (vermiform) bodies.
- Visibility: They cannot be seen with the naked eye; therefore, microscopic inspection or professional testing is required.
- Development: Their well-developed digestive and reproductive systems enable rapid population growth.

Because they live below ground and remain invisible without magnification, nematode issues are usually recognized by turf symptoms rather than by seeing the pest itself.



https://nuturf.com.au/article/post/nematodes

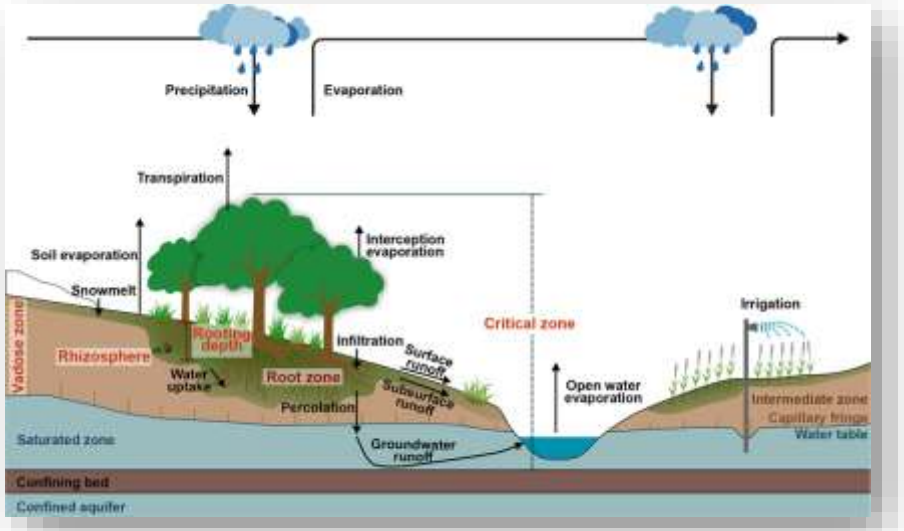
Nematodes

Biology & Lifecycle

Nematodes remain active below the soil surface, where they feed on and damage plant roots throughout their entire lifecycle. Their reproductive rates and overall activity levels are heavily dictated by the following environmental factors:

- Soil Temperature: Influences the rate of development and movement.
- Moisture Levels: Essential for survival and migration through soil pores.
- Host Turf Species: The availability and type of host plant affect population density.

Because nematodes typically aggregate in clusters, their presence often manifests as localized, patchy decline in the health of the turf.



https://www.researchgate.net/figure/Schematic-diagram-of-the-root-zone-in-terrestrial-hydrological-processes-and-atmospheric_fig1_384899188

https://lawnpride.com.au/blogs/lawn-care-guide/how-to-chose-the-right-turf-for-you--home?srsltid=AfmBOorJJs7iMS3nD4LIvc8NN6q42ySX9m0m2VHkIS3PbtPrjFDI7_MD

Nematodes

Signs of damage in turf

Nematode damage typically manifests gradually and often mimics symptoms of drought stress or nutrient deficiency. You may have a nematode infestation if your turf exhibits the following:

- Slow green-up in spring
- Chlorosis (yellowing leaves)
- Dieback of leaf tips/blades
- Poor growth and reduced vigour
- Thinning and stunting of turf
- Turf failing to respond to fertiliser or irrigation
- Damage forming expanding circular or irregular patches

Since nematodes weaken roots, above-ground symptoms worsen during heat, drought or wear pressure.

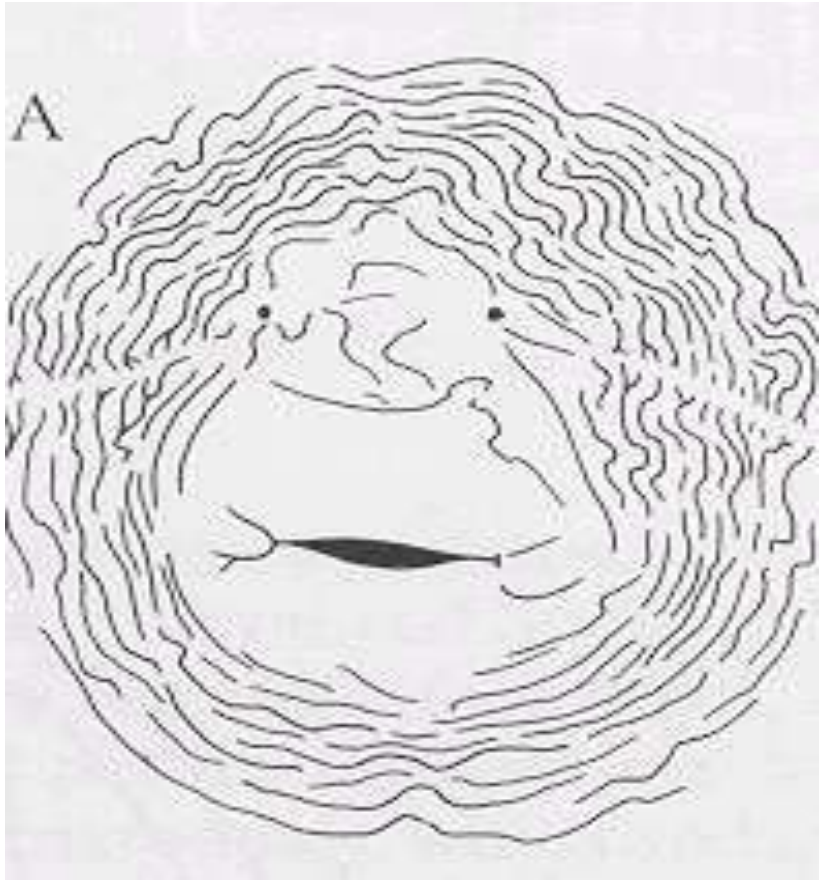
https://www.canr.msu.edu/pestid/uploads/images/Nem1-300x225.jpg

https://www.lsuagcenter.com/~/media/system/7/9/f/b/79fb757d4472d523c399f47efe101b01/spotty%20nematode%20injury%20in%20turfgrasspng.png

Root-knot nematode

Meloidogyne graminis

- First reported in St. Augustine grass (*Stenotaphrum secundatum*) as the cause of turf decline in Florida in 1962.
- Subsequently reported in California, Hawaii, New England, Carolina, and Kansas (McClure et al., 2012).
- Reports from Germany and the Netherlands in 1980; Venezuela (2006), China (2011), Brazil (2018), Malaysia (2019), and Turkey (2021).
- Reported to damage Bermuda grass, Zoysia grass, and Tall fescue.

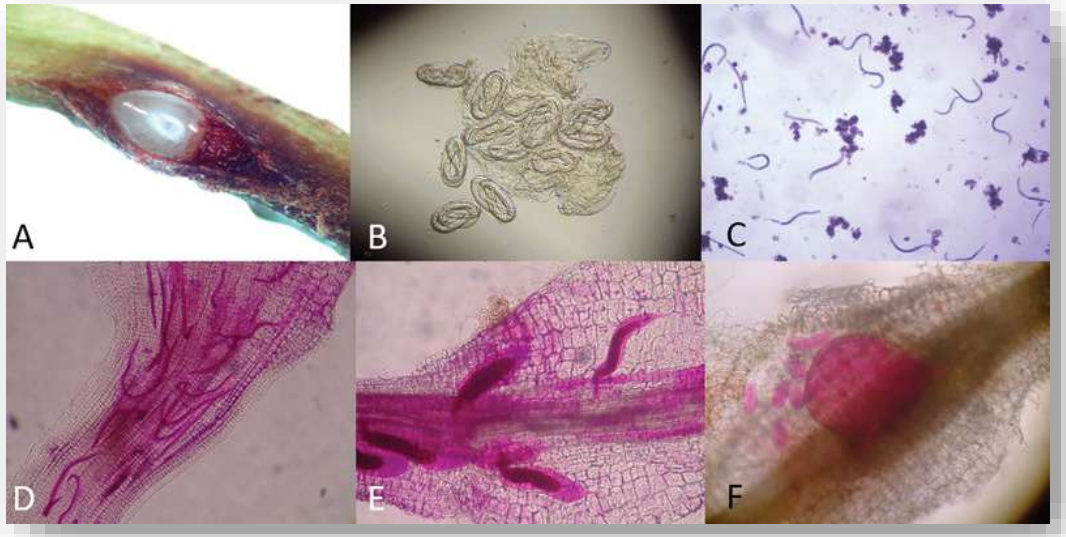


Perineal Pattern of *Meloidogyne graminis*

Root-knot nematode

Meloidogyne graminis

- *M. graminis* causes turfgrass roots to become darkened. Subsequently, the root cortex separates from the central vascular cylinder (stele).
- The exposed stele comes into direct contact with soil, resulting in dryness and increased brittleness.
- *M. graminis* produces elongated galls that occur in clusters, typically 3–4 mm in length.
- Root elongation and root branching are reduced. Affected turf becomes chlorotic, declines in vigor, and may eventually die.



Credit: William T. Crow, UF/IFAS

https://ask.ifas.ufl.edu/publication/IN1231

Symptoms of root-knot nematode infestation at Wang Noi Prestige Golf & Country Club.

Symptoms of root-knot nematode infestation at Treasure Hill Golf And Country Club.

Lance nematodes

Hoplolaimus galeatus

It is one of the three most important nematode species affecting turfgrass in the USA.

- Grass Root-knot Nematodes (*Meloidogyne graminis* Whitehead)
- Sting Nematodes (*Belonolaimus longicaudatus*)
- Lance Nematodes (*Hoplolaimus galeatus*)

Credit: William T. Crow, UF/IFAS

https://edis.ifas.ufl.edu/publication/IN390

Lance nematodes

Hoplolaimus galeatus

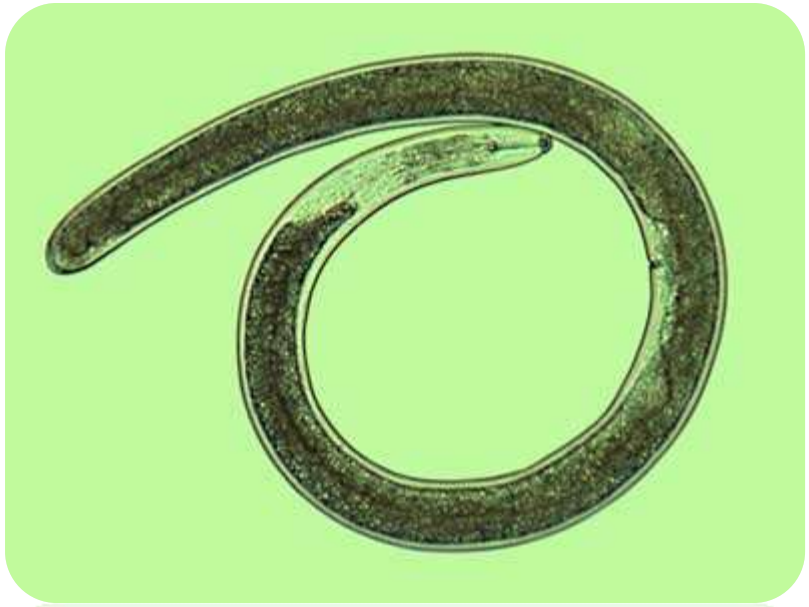
- It creates tunnels within turfgrass roots because it is a **migratory endoparasite**, continuously moving inside root tissues.
- It causes **wounds** on the roots, which serve as **entry points** for other pathogens to invade and further damage the turfgrass root system.

Credit: William T. Crow, UF/IFAS

https://edis.ifas.ufl.edu/publication/IN390

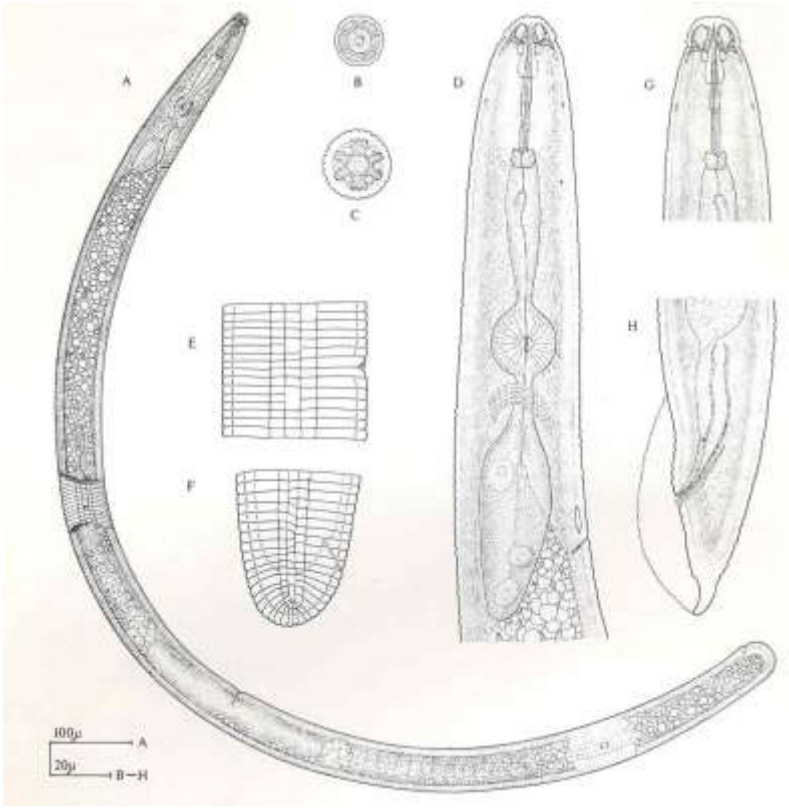
Lance nematodes

Hoplolaimus galeatus



https://nemaplex.ucdavis.edu/images/G063_small.jpg

- It is a relatively large nematode species, with a body length of approximately **1.5 millimeters**.



https://nemaplex.ucdavis.edu/images/G063S2_small.jpg

Symptoms of Lance nematode infestation at Lam Luk Ka Country Club - Resort West Course.

OBJECTIVES

01

To characterize the community structure of plant-parasitic nematodes in intensively managed turfgrass ecosystems.

02

To examine spatial (vertical) and temporal (seasonal) distribution patterns of nematode assemblages.

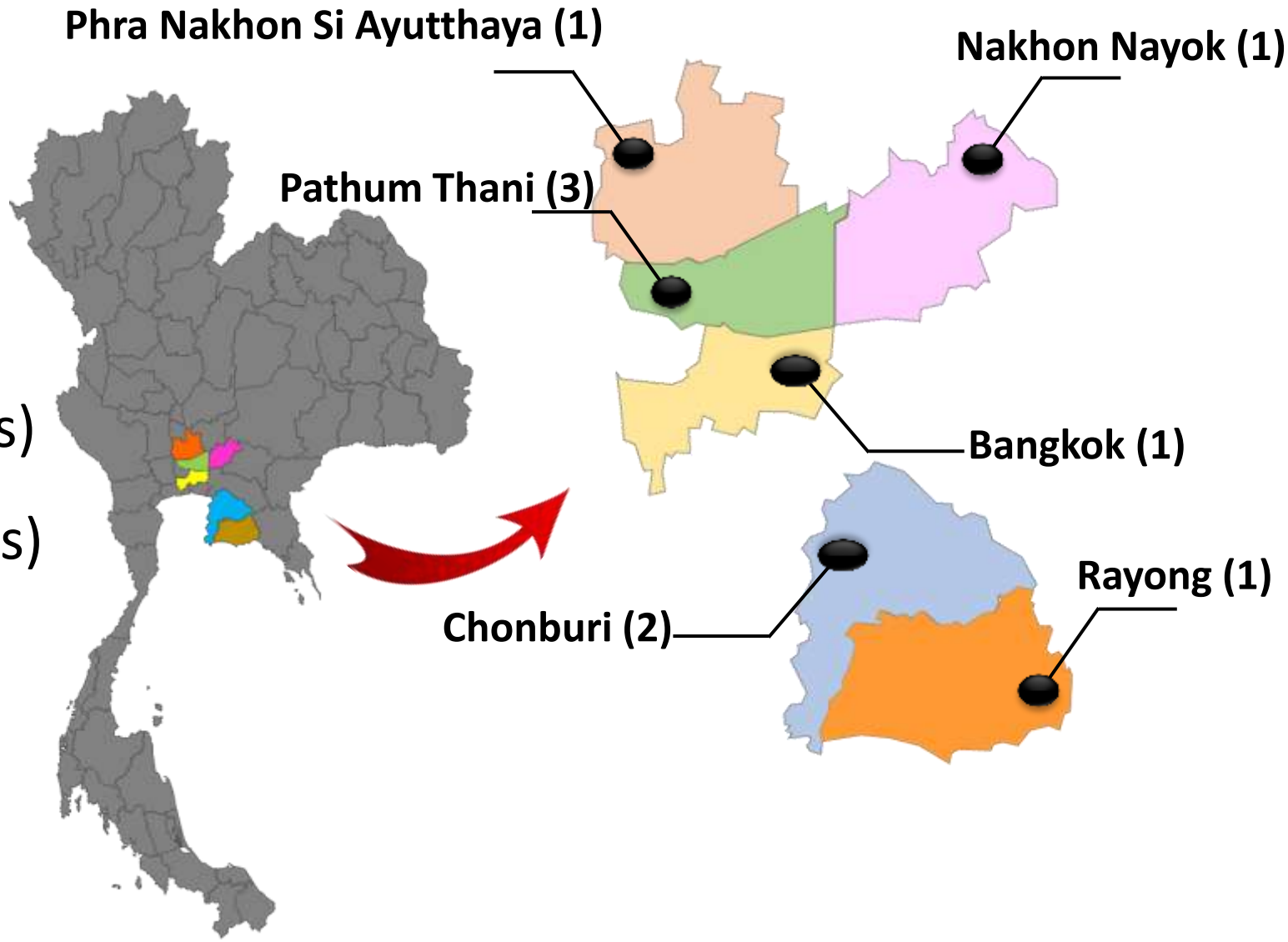
03

To identify environmental drivers influencing nematode distribution in golf course soils.

Study area and sampling design

Study sites

- Total of 9 golf courses
- Central Thailand (6 courses)
- Eastern Thailand (3 courses)



Regional classification follows Thailand's administrative regional grouping.

Study area and sampling design

Sampling frequency

- Soil samples collected **monthly**
- Duration: **12 months (1 full year)**

Study area and sampling design

Soil core collection

- Soil cores collected using a golf course sampling drill
- Two depth intervals:
  - 0–5 cm
  - 5–15 cm
- Depths processed separately for vertical distribution analysis

Environmental data recorded

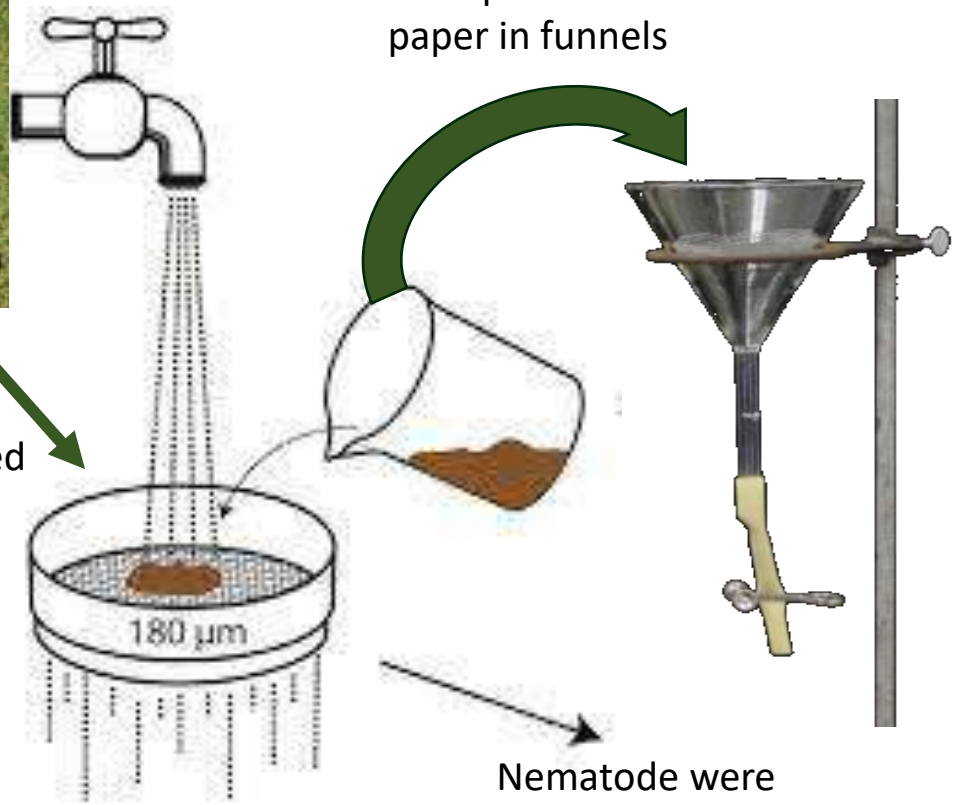
At each sampling event:

- Soil pH
- Soil moisture
- Soil temperature

Nematode extraction

(Tomar V. V. S., Baniyamuddin, & Ahmad, 2006)

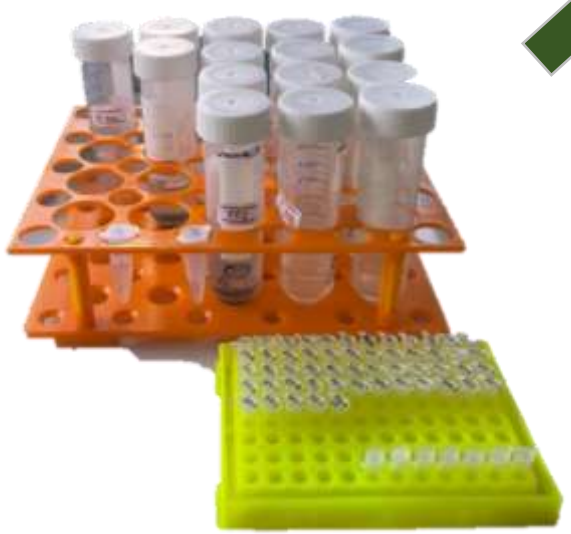
Soil samples were mixed with water and filtered through sieve with different mesh sizes



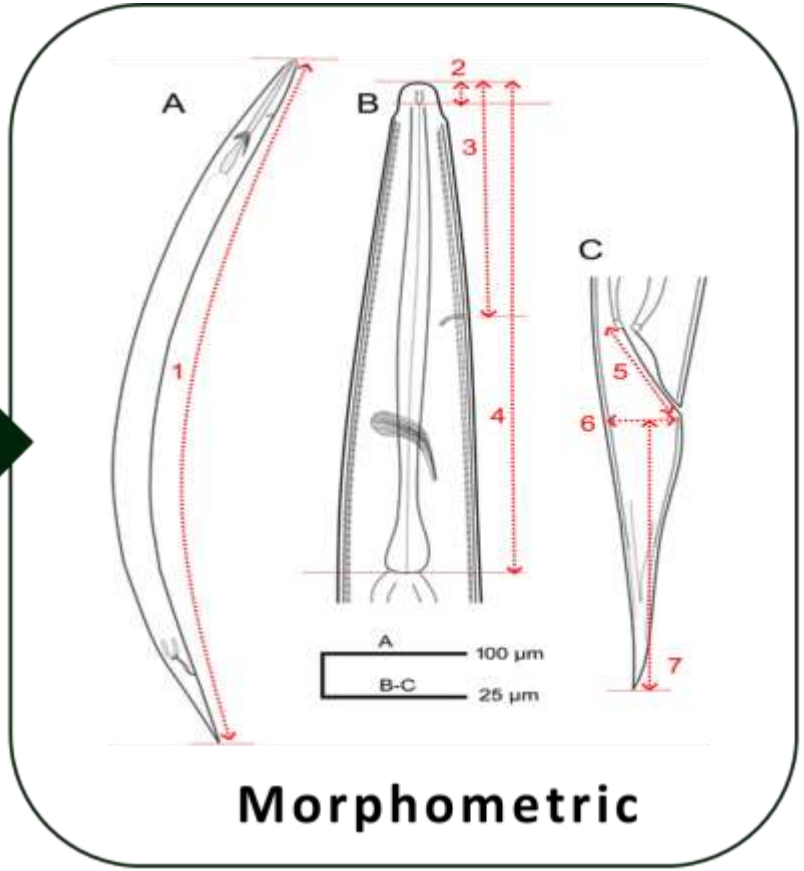
The nematode suspensions were then placed on tissue paper in funnels

Nematode were collected from the bottom of the funnel after 48 hours

Microscopic observation

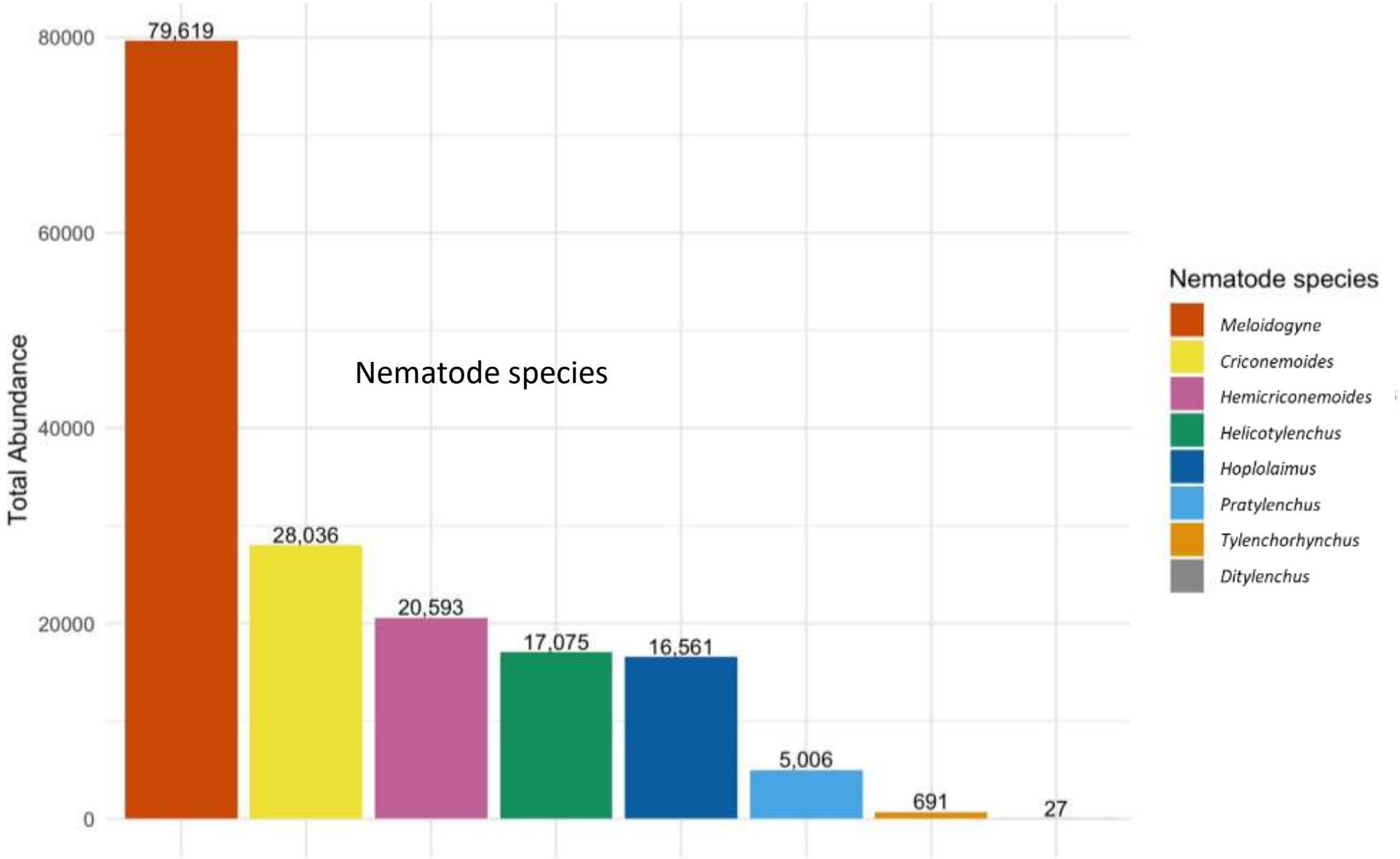


Morphological identification

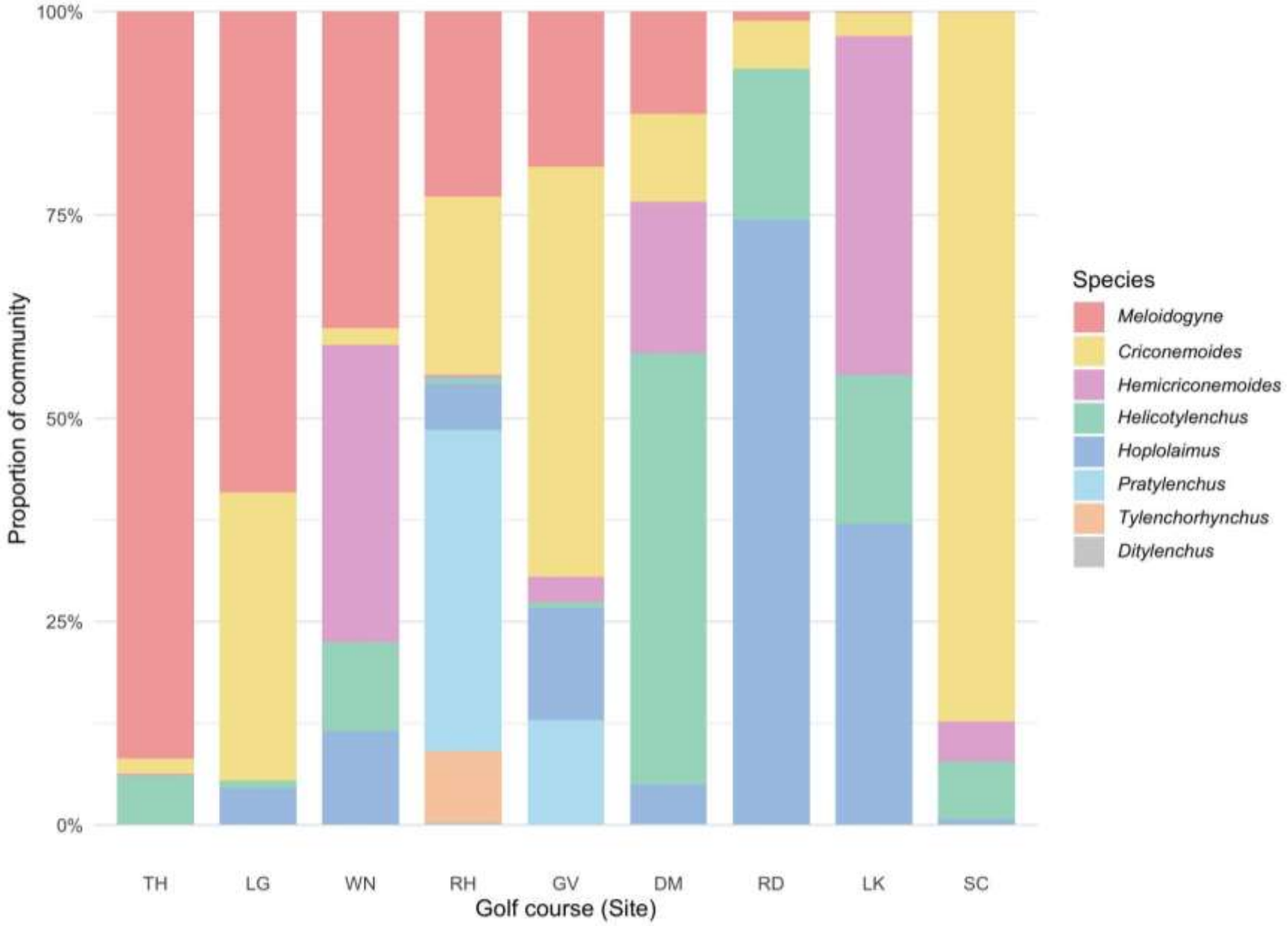


https://extension.uga.edu/publications/detail.html?number=C834&title=guide-for-interpreting-nematode-assay-results

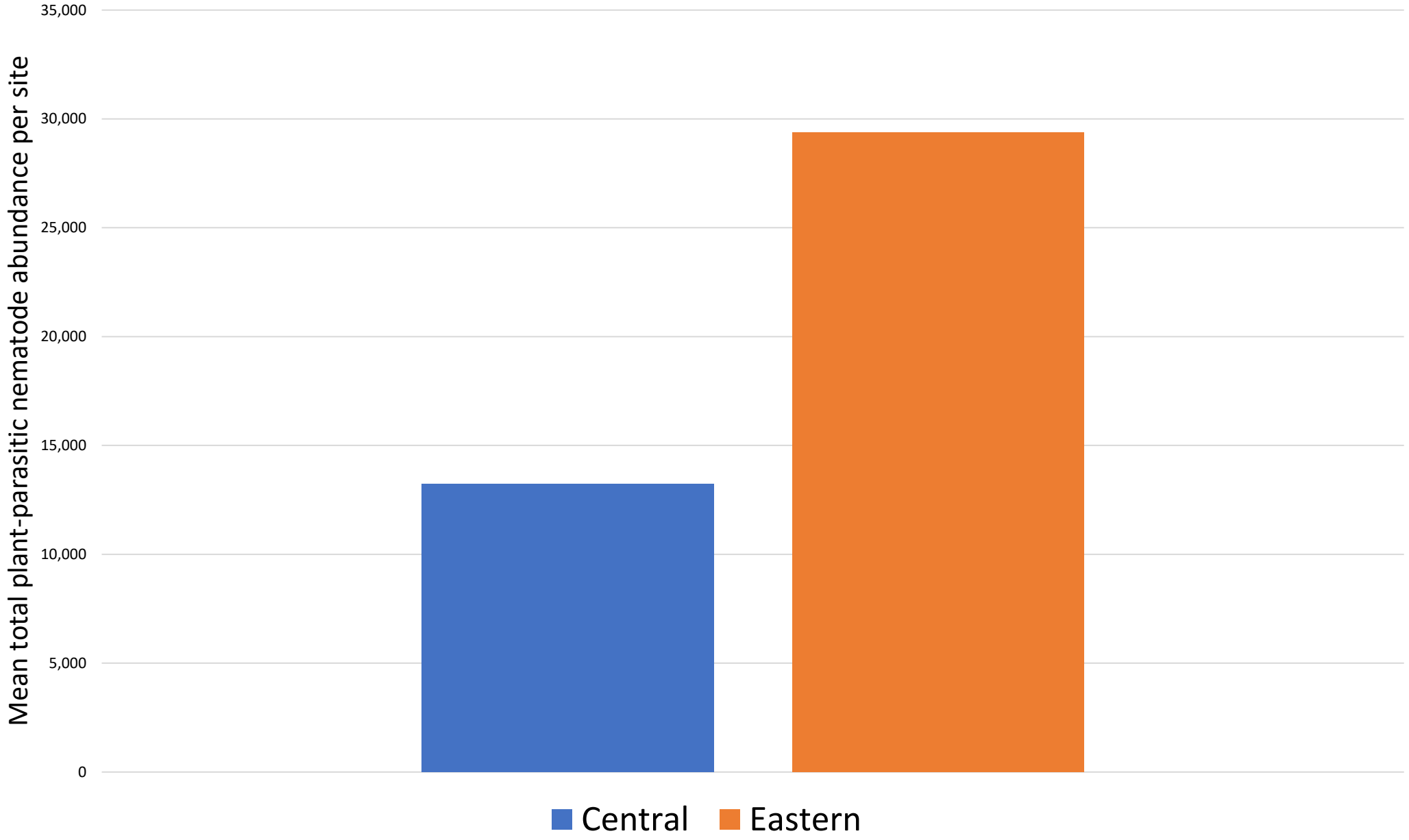
Relative abundance of nematode species



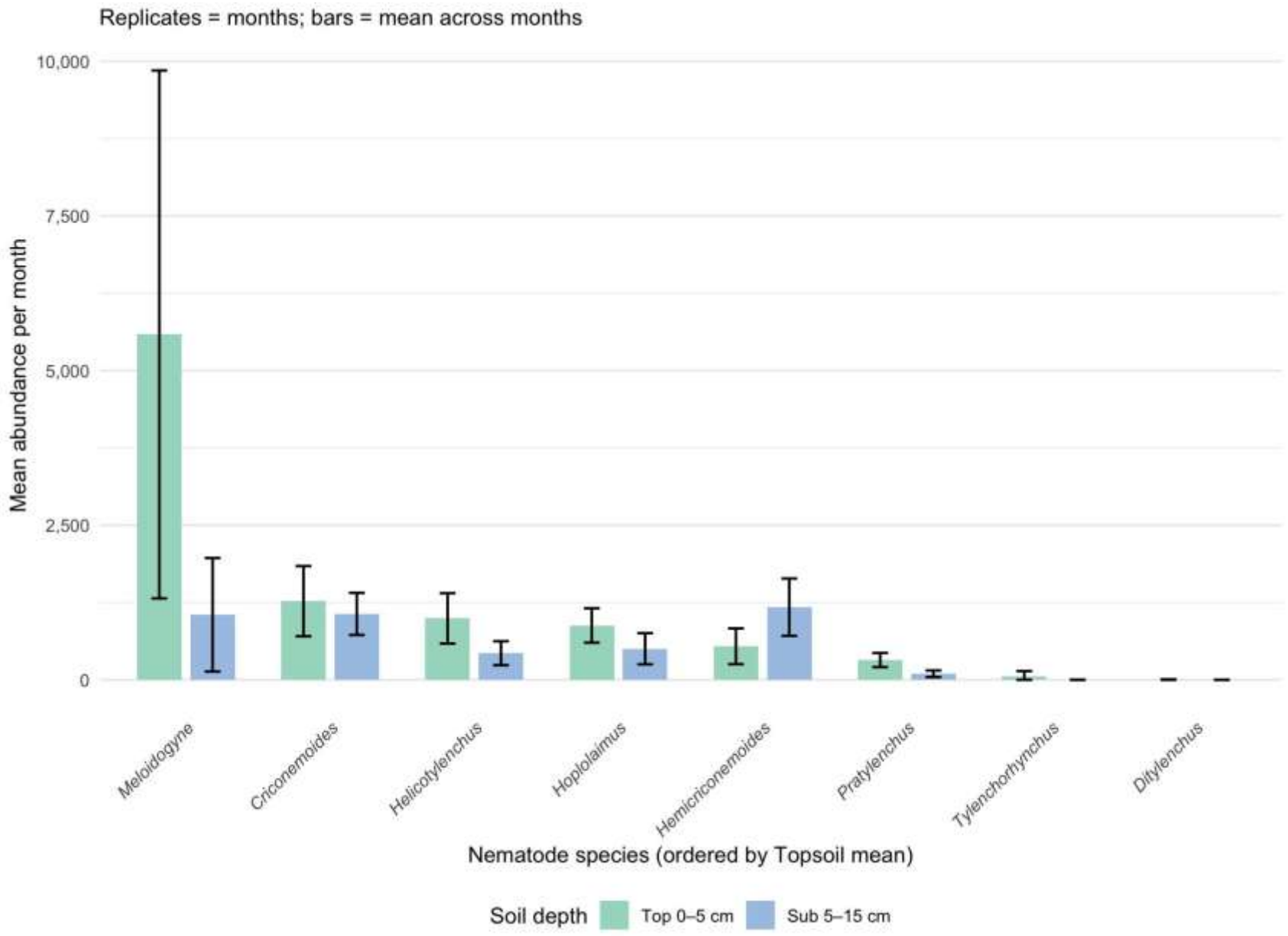
Species composition by golf course (order by % *Melodogyne*, high → low)



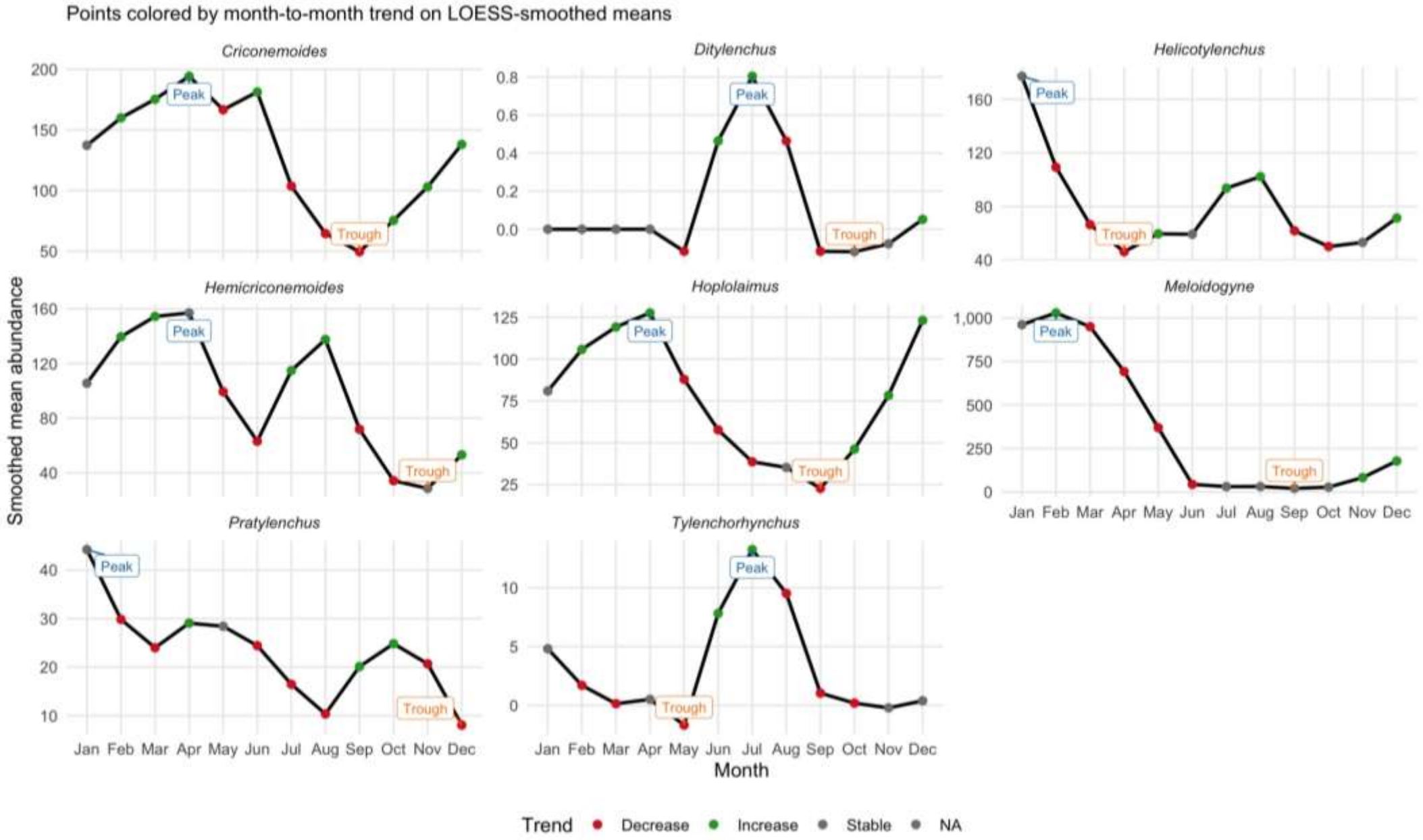
Regional comparison of total plant-parasitic nematode abundance



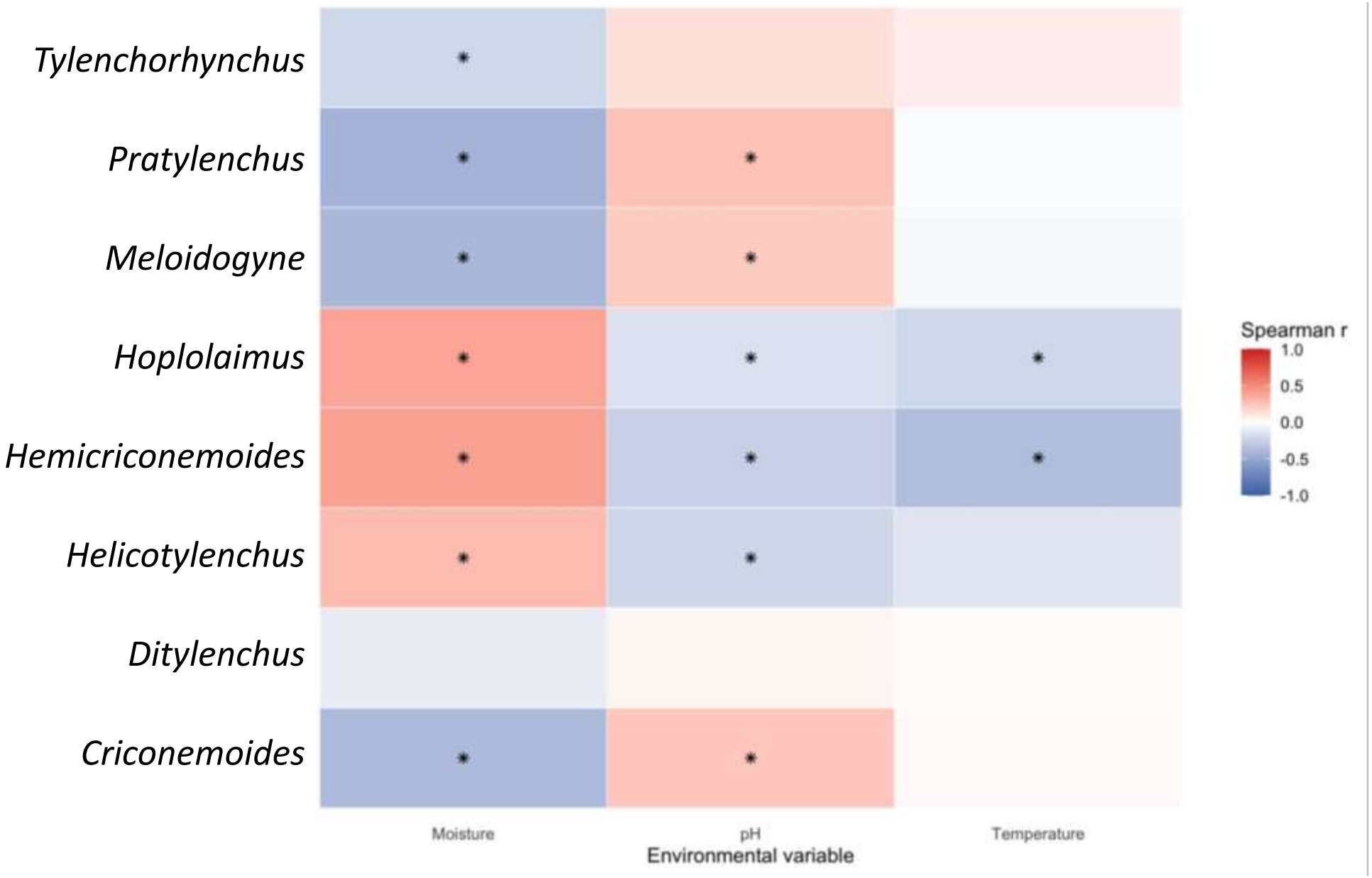
Mean monthly nematode abundance by species and soil depth (±95% CI)



Seasonal population dynamics by species



Species–environment correlation (* = FDR < 0.05)



Summary

- **Diversity of nematode species:** Golf course greens in Central and Eastern Thailand harbor a diverse range of plant-parasitic nematodes.

- **Key pathogenic species:** *Meloidogyne graminis* and *Hoplolaimus galeatus* are identified as the primary species responsible for turfgrass damage.

- **Population stratification and seasonality:** Nematode densities vary significantly across different soil depths (0–5 cm vs. 5–15 cm) and are subject to seasonal fluctuations.

Summary

- **Environmental determinants:** The spatial distribution of these populations is primarily influenced by edaphic factors, including soil temperature, moisture content, and pH levels.

- **Mechanisms of turf decline:** Turfgrass degradation is a multifactorial process; it results from the synergistic interaction between nematode-induced root damage and environmental stressors, rather than being a direct function of population density alone.

Thank You

Dhupatemiya Golf Course
ร.อ.อภินันท์ อุดร

Riverdale Golf Club
คุณสราวุธ วิวัฒนสิเนศวร

Wang Noi Prestige Golf & Country Club
คุณกิตติศักดิ์ หล้าภิละ

Royal Hills Golf Resort & Spa
คุณบรรจบ นระสิงห์

Lam Luk Ka Country Club - Resort West Course
คุณประสิทธิ์ บุษบงก์

Legacy Golf Club
คุณปุณิกา ปุณขันธ์

Rayong Green Valley Country Club
คุณดุสิต บุตรเวียงพันธ์

Treasure Hill Golf And Country Club
คุณณัฐกิจ น้อยอินวงศ์ และ คุณสมบัติ บูรณะเวช

Siam Country Club Pattaya Old Course
คุณบุญธง งามสะพรั่ง และ คุณบัณฑิต กิตติวรรณ