

Classification of nematodes

Course: B.Sc. Agriculture

Sem II

Subject: Introductory nematology

Unit: 2

Unit 2

- Classification of nematodes upto family level with emphasis on groups containing economically important genera.
- Classification of nematodes by habitat. Identification of economically important plant nematodes upto generic level with the help of keys and description.

ECOLOGICAL CLASSIFICATION OF NEAMATODE (BY HABITAT)

There are two major classes

I. Above ground feeder

II. Below ground feeder

I. Above ground feeder

a. Feeding on flower buds, leaves and bulbs

i) Seed gall nematode: *Anguina tritici*

ii) Leaf and bud nematode: *Aphelenchoides*

iii) Stem and bulb nematode: *Dictylenchus*

b. Feeding on tree trunk

i) Red ring nematode: *Rhadinaphelenchus cocophilus*

ii) Pine wilt nematode: *Bursaphelenchus xylophilus*

II. Bellow ground feeder

It is again classified in to three classes

- I) Endoparasitic nematodes
- II) Semiendoparasitic nematodes
- III) Ectoparasitic nematodes

a) Endoparasitic nematodes

The entire nematode is found inside the root and the major portion of nematode body found inside the plant tissues. They are two types

- 1) **Migratory endoparasite:-** These nematodes move in cortical parenchyma of host root. While migrating they feed on cells, multiply and cause necrotic lesion. Example, *Pratylenchus spp.*, *Radopholus spp.* and *Hirschmanniella spp.*
- 2) **Sedentary endoparasite:-** the second stage larvae penetrate the root lets and become sedentary throughout the life cycle, inside the root cortex. Examples, *Heterodera spp.* and *Meloidogyne spp.*

b) Semiendoparasitic nematodes

The anterior part of nematode, head and neck being permanently fixed in the cortex and the posterior part extends free into the soil. Examples, *Rotylenchulus reniformis* and *Tylenchulus semipenetrans*.

c) Ectoparasitic nematodes

These nematodes live freely in the soil and move closely or on the root surface, feed intermittently on the epidermis and root hair near the root tip. They are two types,

1) Migratory ectoparasites:- These nematodes spend their entire life cycle free in the soil, feeding externally on the host plants, deposit eggs in soil. When the roots are disturbed they detach themselves. Examples, *Criconemoides spp.*, *Paratylenchus spp.* and *s spp.*, etc.

2) Sedentary ectoparasites:- In this type of parasitism the attachment of nematode to the root system is permanent but for this, it is similar to the previous one. Examples, *Hemicycliophora arenaria* and *Trichodorus spp.*, etc.

IMPORTANT PLANT PARASITIC NEMATODES

1) Root-knot Nematode, *Meloidogyne* spp.

Systematic Position:-

Order - Tylenchida

Sub order - Tylenchina

Super family - Tylenchoidea

Family - Heteroderidae

Sub family - Meloidogyninae

Genus - *Meloidogyne*

Species -

i) *incognita*

ii) *javanica*

iii) *arenaria*

iv) *hapla*

Parasitism & Habitat:-

- i) Females and III& IV stage of larvae are Sedentary endoparasites.
- ii) Males and II stage larvae are migratory.

Morphological characters:-

- i) Body - Elongate larvae and male Typically saccate, spheroid with a distinct neck in females.
- ii) Stylet - In males, Strong with rounded knob & In females, more slender than males.
- iii) Oesophagous - With large median bulb followed by short isthmus.
- iv) Excretory pore - Often seen with part of excretory tube in the area between posterior part of stylet knobs and opposite to median bulb.
- v) Vulvas & anus - Females typically opposite to neck and surrounded by a pattern of fine lines like human fingerprint.(Perennial pattern)
- vi) Spicule - Very near the terminus of males Bursa is absent.

Symptoms:-

- Yellowing of leaves
- Stunted growth
- Reduced vigor
- Reduced size & number of fruits
- Gall formation

- **Multinucleate cell – Giant cell (Nurse cell)**
- **Hypertrophy – Enlargement of cell**
- Hyperplasia – Multiplication of cell**

Control:-

- Two to three deep Ploughing
- Rotation with cereal crops
- Apply carbofuron (Furdan 3G) @ 7 g/m²
- Resistant varieties of Tomato eg. Hisar Lalit, PNR 7

2) Reniform Nematode, *Rotylenchulus reniformis*

Systematic Position:-

Order - Tylenchida

Sub order - Tylenchina

Super family - Hoplolaimoidea

Family - Hoplolaimidae

Sub family - Hoplolaiminae

Genus - *Rotylenchulus*

Species - *reniformis*

Parasitism & Habitat:- Females are Semiendoparasitic on many plants.

Morphological characters:-

- i) Body - Males and immature females are slender and small, adult females are kidney shaped
- ii) Oesophagous - Dorsal oesophageal glands opens about one stylet length posterior to stylet knobs.

Symptoms:-

Yellowing of leaves, delayed germination, reduced plant growth and vigor, stunted growth, browning of roots due to penetration of nematode are the general symptoms of this nematode. Young and tender plants are more vulnerable to nematode attack.

3) Root-lesion Nematode, *Pratylenchus spp.*

Systematic Position:-

Order - Tylenchida

Sub order - Tylenchina

Super family – Tylenchoidea

Family - Pratylenchidae

Sub family - Pratylenchinae

Genus - *Pratylenchus*

Species - i) *coffae* - *Citrus, Banana & coffee*

ii) *zeae* - *Maize*

iii) *thornei* – *Pulses*

Parasitism & Habitat:-

- Migratory endoparasites
- Feeding on root cortex of many crop/plant
- All stages found in root or soil.

Morphological characters:-

- i) Body length - 0.4-0.8 mm.
- ii) Lip region - Slightly set-off from body.
- iii) Stylet - Typically short, strong with massive knob.
- iv) Ovary - Monodelphic
- v) Vulva - Posterior fourth of the body (75-80%).
- vi) Tail - Nearly round to pointed and in males, the tail has bursa.

Symptoms:-

Late emergence of seedlings, less germination and stunted growth with necrotic lesions on the root surface which are initially small coalesce at the later stage and cause death of the rootlets. Root system is reduced.

Control:-

- Raise nursery in nematode free soil
- Pull and burn infected plants

4) Spiral Nematode, *Helicotylenchus spp.*

Systematic Position:-

Order - Tylenchida

Sub order - Tylenchina

Super family - Tylenchoidea

Family - Hoplolaimidae

Sub family - Rotylenchoidinae

Genus - *Helicotylenchus*

Parasitism & Habitat:- Endoparasitic and ectoparasitic on many plants

Morphological characters:-

i) Body - Arcuate to 'C' shape when relaxed

ii) Stylet - Moderately long, typically located more than one half stylet length posterior to stylet knobs.

iii) Ovaries - Two (didelphic)

iv) Vulva - Posterior to middle of body (60-70%)

v) Tail - In females, rounded to nearly pointed often with short projection on ventral side and In males, tail is short with bursa.

Symptoms:- The nematodes attack root cortex and produce necrotic lesions.

5) Cyst Nematode, *Heterodera spp* & *Globodera spp*.

Cyst means any abnormal membranous sac or blister like pouch containing fluid.

Systematic Position:-

Order - Tylenchida

Sub order - Tylenchina

Super family - Tylenchoidea

Family - Heteroderidae

Sub family - Heteroderinae

Genus - i) *Heterodera*

ii) *Globodera*

Species of *Heterodera* -

- i) *avenae* - Cereal cyst nematode (wheat & barley) found in north India
- ii) *zeae* - Maize cyst nematode
- iii) *cajani* - Pigeon pea cyst nematode (tur, mung, Udid & cowpea)
- iv) *oryzicola* - Rice cyst nematode (rice & banana) found in Kerala, M.P., Orissa & West Bengal.

Species of *Globodera* -

- i) *rostochinensis* - Potato cyst nematode or Golden nematode
- ii) *pallida*

Host plants - Potato, Tomato & Brinjal

Parasitism & Habitat:-

Parasitic on many plants mostly in temperate zone (Notably potatoes, sugar beets, oats & other grains, clover, soybean & various cruciferous).

Morphological characters:-

- i) Body - Slender in males (1.0-2.0 mm) and larvae (0.3-0.6 mm) In females, typically swollen, lemon shaped (0.5-0.8 mm)
- ii) Colour - White or yellow, cyst dark brown, lemon shaped (0.8 mm long & 0.5 mm wide) or nearly same shape as that *Meloidogyne female*.
- iii) Stylet - Short in males with rounded basal knobs & in larvae, more than 0.02 mm long.
- iv) Oesophagous - With well-developed median bulb & lobe extending back & overlapping the intestine.
- v) Spicule - Near the posterior end of males

Globodera - Similar to *Heterodera* spp. slight difference in adult females are globular (rounded) in shape and hence the genus is named as *Globodera*.

Symptoms:-

Heterodera - The diseased plants show yellowing of leaves, stunted growth, reduced tillering. Earheads if formed are very small known as '**Molya**' disease'

Globodera - Typical symptoms of heavy infestation are stunted plants with unhealthy foliage, premature yellowing, poor development of root system, reduction in size and number of tubers. Such plants exhibit temporary wilting during hotter part of the day.

Control:-

Heterodera

- Two- three summer ploughing at 10-15 days interval.
- Rotation with Mustard, chick pea
- Apply Carbofuron @ 1-2 kg a.i./ha.

Globodera

- Rotation with pea, cabbage, carrot, cauliflower during autumn season.
- Grow resistant varieties of potatoes - Kufri Swarna, Kufri Thenmalai

6) Daggar Nematode, *Xiphinema spp.*

Systematic Position:-

Order - Dorylaimida

Sub order - Dorylaimina

Super family - Dorylaimoidea

Family - Longidoridae

Sub family - Xiphineminae

Genus - *Xiphinema*

Parasitism & Habitat: - Migratory ectoparasites

Morphological characters:-

- i) Body - Females elongate, cylindrical, forming open spiral with a greater curvature in posterior half.
- ii) Stylet - Typically long..
- iii) Ovaries - Monodelphic or didelphic.
- iv) Vulva - Situated at middle of body.
- v) Tail - Bluntly rounded or with projections on ventral side in both males and females.
- vi) Males extremely rear, not essential for reproduction.

Symptoms: - Attacked roots show necrosis, lack of laterals, terminal swelling, root galling etc.

7) Rice stem Nematode, *Dictylenchus angustus*

Systematic Position:-

Order - Tylenchida

Sub order - Tylenchina

Super family - Tylenchoidea

Family - Anguinidae

Sub family - Anguininae

Genus - *Dictylenchus*

Species - *angustus*

Morphological characters:-

i) Body - Females swollen, when relaxed 'C' shaped.

ii) Stylet - Small with delicate knob.

iii) Oesophagous - Basal oesophageal bulb not overlapping the intestine, cardia absent.

iv) Vulva - Situated in posterior region of body.

v) Ovary - Single Prodelphic.

vi) Tail - Elongate.

vii) Males similar to females but more slender caudal alae subterminal.

Disease Caused:- Alfa disease of Rice.

Symptoms:-

At vegetative phase, yellowing or white splash pattern of leaf sheath where margins become concorted. Later splash patterns develop brownish stains and internodes and stems turn black.

At the reproductive phase, the nematode collects around the floral primordia and feed upon the developing earheads. Earheads emerges as crinkled or twisted with empty spiklets (**ripe ufra**) or does not emerge at all (**swollen ufra**).

8) Citrus Nematode, *Tylenchulus semipenetrans*

Systematic Position:-

Order - Tylenchida

Sub order - Tylenchina

Super family - Criconematoidea

Family - Tylenchulidae

Sub family - Tylenchulinae

Genus - *Tylenchulus*

Species - *semipenetrans*

Parasitism :- Endoparasitic on roots of citrus and other plants.

Mature females are semiendoparasitic.

Morphological characters:-

- i) Body - Small all stages. Mature females swollen.
- ii) Stylet - Small in larvae and males, well developed in mature females.
- iii) Oesophagous - With distinct posterior bulb in larvae young males and immature females.
- iv) Vulva - Prominent in posterior end of young and adult females.
- v) Excretory pore - Typically situated posteriorly in protuberance just anterior to vulva.
- vi) Anus - Absent or difficult to see in immature stages.
- vii) Bursa - Absent.

Symptoms:-

The diseased trees show reduction in growth and vigor with yellowing of leaves. Such trees show gradual dieback symptoms starting from the uppermost portion. Roots of infected trees appear larger in diameter and darker than the healthy trees mainly due to adherence of soil particles to the gelatinous matrix excreted by the adult females. Cortex of highly infested feeder roots decays and gets sloughed off easily.

9) Burrowing Nematode, *Radopholus similis*

Systematic Position:-

Order - Tylenchida

Sub order - Tylenchina

Super family - Tylenchoidea

Family - Pratylenchidae

Sub family - Pratylenchinae

Genus - *Radopholus*

Species – *similis*

Parasitism: - Endoparasitic on roots of Banana and citrus.

Morphological characters:-

- i) Body - 0.4-0.9 mm in length.
- ii) Lip - Rounded in females, set off and knob like in males.
- iii) Stylet - Short and stout in females, slender and rudimentary in males.
- iv) Oesophagous - Forming a lobe, dorsally overlaps to intestine.
- v) Vulva - Located at middle of the body.
- vi) Ovaries - Didelphic
- vii) Tail - Blunt end in females and male long tail with bursa.

Symptoms:-

In banana, bearing plants show poor growth and small fruit size, prone to toppling over under high wind pressure. The nematode causes wounding of roots resulting in reddish brown cortical lesions which are clearly visible by splitting the affected roots longitudinally. Purplish streaks on the young roots. The lesions lead to the formation of tunnels and cavities in the roots. The infection spreads to young suckers also in which necrotic tissues develop.

Web reference:

<http://www.agri.kkwagh.edu.in/Theory%20N/ENTO-364.pdf>