

**Objective**

To project the importance of nematodes in agriculture and impart basic knowledge on all aspects of plant nematology.

**Theory****UNIT I**

Characteristics of Phylum Nematoda and its relationship with other related phyla, history and growth of Nematology; nematode habitats and diversity- plant, animal and human parasites; useful nematodes; economic importance of nematodes to agriculture, horticulture and forestry.

**UNIT II**

Gross morphology of plant parasitic nematodes; broad classification, nematode biology, physiology and ecology.

**UNIT III**

Types of parasitism; nature of damage and general symptomatology; interaction of plant-parasitic nematodes with other organisms.

**UNIT IV**

Plant nematode relationships, cellular responses to infection by important phytonematodes; physiological specialization among phytonematodes.

**UNIT V**

Principles and practices of nematode management; integrated nematode management.

**UNIT VI**

Emerging nematode problems, Importance of nematodes in international trade and quarantine.

**Practical**

Studies on kinds of nematodes- free-living, animal, insect and plant parasites; nematode extraction from soil; extraction of migratory endoparasites, staining for sedentary endoparasites; examination of different life stages of important plant parasitic nematodes, their symptoms and histopathology

**NEMA 503**  
**STRUCTURAL AND FUNCTIONAL ORGANIZATION OF NEMATODES**  
**(2+1)**

**Objective**

Familiarization with structural organization of nematode body so as to enable the students to understand biology, physiology and classification of nematodes.

**Theory**

**UNIT I**

Introduction and general organization of nematode body; Morphology and anatomy of nematode cuticle, hypodermis, musculature and pseudocoelom.

**UNIT II**

Digestive system- structural variations of stoma, oesophagus, intestine and rectum in nematodes.

**UNIT III**

Reproductive system- Variations in female and male reproductive systems, types of reproduction, spermatogenesis and oogenesis.

**UNIT IV**

Types and structure of excretory-secretory systems; nervous system and associated sense organs.

**UNIT V**

Embryogenesis, Cell lineage and postembryonic development; Process of hatching and moulting.

**Practical**

Studies on variations in nematode shapes and sizes, morphological details of cuticle, cuticular markings and ornamentation, variations in stoma, oesophagus, rectum; types and parts of female and male reproductive systems, sense organs, and excretory system.

**Objective**

Understanding concepts in nematode taxonomy, development of skills in the identification of plant parasitic nematodes up to genera and species levels.

**Theory****UNIT I**

Gross morphology, principles of nematode taxonomy -levels of taxonomy, systematics vs. taxonomy, morpho-taxonomy, molecular taxonomy, identification, classification, taxonomic categories, taxonomic characters, morphometry, Zoological nomenclature, species concept and speciation (allopatric and sympatric).

**UNIT II**

Taxonomic position of nematodes and their relationships with allied groups; Classification and diagnoses of nematodes up to ordinal rank (Secernentea and Adenophorea)

**UNIT III**

Taxonomy of free living nematodes

**UNIT IV**

Classification of plant parasitic nematodes; Order Tylenchida and diagnoses of its sub-orders, super families, families and important genera; Order Aphelenchida, Dorylaimida and Triplonchida and diagnoses of their important genera.

**Practical**

Collection of soil and plant samples from different habitats, processing and preservation of samples; and preparation of temporary mounts, processing of nematode specimens and permanent mounts. Preparation of *en face* view and TS of nematodes, perineal pattern of root knot nematodes and cone-top structure for cyst nematodes. Identification of soil and plant nematodes from nematode suspension and mounted slides. Camera lucida drawing of nematodes, measurement of nematodes using traditional as well as image analyzing software. Procedures for PCR- Taxonomy

**Objective**

Understanding the principles, theoretical aspects and developing skills in nematological techniques.

**Theory UNIT I**

Principles and use of light, scanning and transmission electron microscopes, and other laboratory equipments.

**UNIT II**

Survey and surveillance methods; collection of soil and plant samples; techniques for extraction of nematodes from soil and plant material; estimation of population densities.

**UNIT III**

Killing, fixing, clearing and mounting nematodes; measurements, preparation of perineal patterns, vulval cones of cyst nematodes, en-face views and body section of nematodes.

**UNIT IV**

*In vitro* and *in vivo* culturing techniques of plant parasitic, bacteriophagous, mycophagus and omnivorous nematodes.

**UNIT V**

Staining nematodes in plant tissues; microtomy for histopathological studies; collection of plant root exudates and their bioassay; preparation of plant materials for exhibition.

**UNIT VI**

Application of molecular techniques in Nematology.

**Practical**

Collection of soil and plant samples; extraction of nematodes from soil by Baermann funnel, sieving and decanting, elutriation and sugar centrifugal methods; extraction of cysts from soil; extraction of nematodes from plant material; estimation of population densities; staining plant material for nematodes; killing and fixing nematodes, clearing nematodes by slow and Seinhorst's methods; preparation of temporary and permanent mounts; measurements, drawing, microphotography, special preparation of nematodes - perineal patterns, vulval cones, *en-face* and body sections; collection of root exudates, preparation of exhibits of nematode diseased plant material, *in vitro* culturing techniques of nematodes- callous culture, excised root and carrot disc techniques.

**Objective**

To impart basic knowledge about the causal organism, nature of damage, symptoms and control of nematode diseases of agricultural and horticultural crops.

**Theory**

Diagnosis of causal organism, distribution, host range, biology and life cycle, nature of damage, symptoms, interaction with other organisms, and management of nematode diseases in different crops.

**UNIT I**

Cereal crops- Ear-cockle and *tundu* diseases of wheat, *molya* disease of wheat and barley; rice root nematode, rice root-knot and cyst nematode problems, *ufra* and white tip diseases of rice; lesion nematodes, cyst nematodes of maize and sorghum.

**UNIT II**

Pulses, Sugar, Fibre, Fodder and Oilseed crops- Pigeon pea cyst nematode, root knot nematode, reniform nematode, lesion, lance nematode, sugarbeet cyst and soybean cyst nematode problems.

**UNIT III**

Vegetable crops- root-knot disease, reniform nematode, potato cyst nematode; stem and bulb nematode. Nematode problems of protected cultivation.

**UNIT IV**

Fruit crops- root-knot nematode, reniform nematode, slow decline of citrus. Flowers- root-knot nematode, foliar nematodes, bulb nematodes, Mushroom- nematode problems.

**UNIT V**

Plantation, medicinal and aromatic crops- burrowing nematode problem of banana, spices and condiments, root-knot and lesion nematode problems of coffee and tea, red ring disease of coconut. Forests- Pine wilt disease.

**Practical**

Diagnosis of causal organisms; identification of different life cycle stages; study of symptoms and histopathology of nematode damage in different crops, study tours for field diagnosis of nematode problems.

**Objective**

To impart comprehensive knowledge about the principles and practices of nematode management.

**Theory****UNIT I**

Concepts and history of nematode management; crop loss estimation, ecological and socio-economic aspects, cost-benefit ratios and pest risk analysis.

**UNIT II**

Chemical methods- nematicides, their types, classification, mode of action, applicators and application methods, antidotes, and economizing nematicidal use.

**UNIT III**

Cultural practices- crop rotations and cropping sequences, fallowing, flooding, soil solarisation, time of sowing, organic amendments of soil, bio- fumigation, antagonistic and trap crops, sanitation, etc.

Physical methods- use of heat, hot water treatment and other methods of disinfestations of planting material.

**UNIT IV**

Biological methods- concepts and terminology, use of predators and parasites as biological control agents, their mass multiplication and field use; phytotherapeutic methods – use of antagonistic plants and antinemic plant products.

**UNIT V**

Genetic methods- plant resistance; legal methods- quarantine regulations; integrated nematode management- concepts and applications.

**Practical**

*In vitro* screening of synthetic chemicals and plant products for nematicidal activity, and their application methods; methods for screening of crop germplasm for resistance against nematodes, laboratory exercises on biocontrol potential of fungal, bacterial parasites, and predacious fungi and nematodes.

**Objective**

To sensitize about the use of nematodes for the biological control of insect pests of crops, and application of some nematodes as biological models and as indicators of environmental pollution.

**Theory****UNIT I**

Beneficial nematode fauna - predators, parasites of insects, molluscs and other pests; Entomophilic nematodes- important groups, types of nematode- insect associations; taxonomic characteristics of nematode parasites of insects.

**UNIT II**

Host-parasite relations and life cycle of mermithids, entaphelenchids, thelastomids, sphaerularids and tylenchids.

**UNIT III**

Entomopathogenic nematodes- *Steinernema*, *Heterorhabditis*, *Oscheius* their morphological characteristics, taxonomic status, biology and mode of action.

**UNIT IV**

Entomopathogenic nematodes- mass multiplication techniques, formulations, field applications and efficacy, success stories.

**UNIT V**

Nematodes as biological models, nematodes as indicators of pollution, role of nematodes in organic matter recycling.

**Practical**

Isolation, identification, mass rearing and application methods of entomopathogenic nematodes.