

**Course Title: Nematode Phylogeny And Systematics**  
**Course Code: NEMA 601**  
**Credit Hours: 3(2+1)**

**Theory**

**UNIT I**

Phylogenetic systematics – Evolutionary systematics, Cladistics, phylogenetic trends (morphological) and molecular Phylogenetic framework for the phylum Nematoda, phylogenomics

**UNIT II**

Taxonomic characters, numerical taxonomy, morphometry, variations, statistics in taxonomic descriptions, description of new species, preparation of illustrations, keys and compendia for nematode species.

**UNIT III**

Identification of common species of root knot nematodes by esterase phenotypes and race/pathotypes of root knot/cyst/reniform nematodes by differential host tests.

**UNIT IV**

Recent advances in nematode identification- molecular, biochemical, immunodiagnostic, molecular characterization and DNA finger-printing techniques.

**Practical**

Detailed studies of morphological structures and identification of plant parasitic nematodes up to species level. Preparation of compendia and keys. Drawing and measurements using camera lucida and computer software. Procedures for identification of species/races of root-knot/ cyst/ reniform nematodes. Isozyme analysis for identification of common species of root knot nematodes. rDNA- RFLP for diagnosis of nematode species; Sequence analysis, alignment, phylogenetic analysis, preparation of phylogenetic tree and interpretation.

**Suggested Reading**

- Andrassy I. 1976. *Evolution as a basis for the systematization of nematodes*. Pitman Publishing Ltd, London
- Blackwelder RE. 1967. *Taxonomy - A Text and Reference Book*. John Wiley & Sons, New York.
- Chen ZX, Chen SY & Dickson DW. 2004. *Nematology: Advances and Perspectives. Vol. I. Nematode Morphology, Physiology and Ecology*. CABI, Wallingford.
- Fortuner R. 1988. *Nematode Identification and Expert System Technology*. NATO Science Series A: Springer US.
- Geraert E. 2006. *Nematology Monographs and Perspectives. Vol. IV*. EJ. Brill.
- Kapoor VC. 1983. *Theory and Practice in Animal Taxonomy*. Oxford & IBH, New Delhi.
- Mayr E. 1969. *Principles of Systematic Zoology*. Tata McGraw-Hill, New Delhi.
- Quicke DLJ. 1993. *Principles and Techniques of Contemporary Taxonomy*. Blackie, London.
- Stone AR, Platt HM & Khalil LF. 1983. *Concepts in Nematode Systematics, the Systematics Association Special Volume No. 22*, Academic Press, London & NY

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**Course Title: Nematode Disease Development And Host Resistance**  
**Course Code: NEMA 602**  
**Credit Hours: 3(2+1)**

**Theory**

**UNIT I**

Mechanisms of pathogenesis, cytological and biochemical changes induced by nematode feeding.

**UNIT II**

Plant defense systems, role of phytoalexins etc. against major plant parasitic nematodes.

**UNIT III**

Genetic basis of plant resistance to nematodes and identification of resistance genes against economically important nematodes.

**UNIT IV**

Application of biotechnological methods in the development of nematode resistant crop cultivars; resistance markers; incorporation of resistance by conventional breeding and transgenic approaches.

**UNIT V**

Influence of microorganisms on plant nematode interactions.

**Practical**

Microtomy for study of histopathological changes induced by important nematodes, screening techniques for assessment of resistance in crop germplasm against nematodes.

**Suggested Reading**

- Barker KR, Pederson GA & Windham GL. 1998. *Plant and Nematode Interactions*. CABI, Wallingford.
- Fenoll C, Grundler FMW & Ohl SA. 1997. *Cellular and Molecular aspects of Plant-Nematode Relationships*. Kluwer Academic Press, Dordrecht.
- Lamberti F, Giorgi C & Bird D. 1994. *Advances in Molecular Plant Nematology*. Plenum Press.

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**Course Title: Advances In Nematode Management**  
**Course Code: NEMA 603**  
**Credit Hours: 3(2+1)**

**Theory**

**UNIT I**

Isolation, identification, host specificity, mode of action, culturing and field application potential of promising bio-control agents- predacious and parasitic fungi; nematotoxic fungal culture filtrates.

**UNIT II**

Isolation, identification, host specificity, mode of action, culturing and field application potential of promising bio-control agents- parasitic and nematode antagonistic bacteria; predacious mites and predacious nematodes.

**UNIT III**

Mass culturing, formulation, quality control, bio-safety and registration protocols of bio-control agents.

**UNIT IV**

Phytoalexins, allelochemicals, phytotherapeutic substances, novel nematicides, deployment of resistant varieties and non-host crops in nematode suppressive cropping systems, emergence of resistance breaking biotypes, recent regulatory provisions and methods, quarantine and disinfection.

**UNIT V**

Nematode management modules for integrated pest and disease management in cropping systems. Nematode management options and approaches for organic farming, precision farming and protected cultivation system. Application of GIS and GPS technology for surveillance and management.

**Practical**

Green-house experiments on the efficacy of fungal and bacterial bio-control agents, botanicals.

**Suggested Reading**

- Chen ZX, Chen SY & Dickson DW. 2004. *Nematology: Advances and Perspectives Vol.II. Nematode Management and Utilization*. CABI, Wallingford.
- Jana BL. 2008. *Precision Farming*. Research Books & Periodicals Pvt. Ltd., Delhi.
- Lillesend TW, Kiefer RW & Chipman JW. 1979. *Remote Sensing and Image Interpretation*. John Wiley & Sons, New York.
- Perry RN & Moens M. 2013. *Plant Nematology*. 2<sup>nd</sup> Ed., CABI, Wallingford, London.
- Poinar GO Jr & Jansson H-B. 1988. *Diseases of Nematodes*. Vols. I, II. CRC Press, Boca Raton, Florida. Scientific Publ., Jodhpur.
- Starr JR, Cook R & Bridge J. 2002. *Plant Resistance to Parasitic Nematodes*. CABI, Wallingford.
- Stirling GR. 2014. *Biological Control of Plant-parasitic Nematodes*, 2nd Ed., CAB International, UK
- Tarafdar JC, Priputhi KP & Kumar M. 2007. *Organic Agriculture*. Upadhyaya RK, Walia RK & Dubey OP. 2004. *IPM Systems in Agriculture. Vol. IX. Phytonematology*. Aditya Books, New Delhi.

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**Course Title: Physiological And Molecular Nematology**  
**Course Code: NEMA 604**  
**Credit Hours: 3(2+1)**

**Theory**

**UNIT I**

Cell biology- Structural and functional aspects; genetics and evolution in plant parasitism in nematodes.

**UNIT II**

*Caenorhabditis elegans*- a model system for gerontology, cytogenetics, physiology, nutritional, toxicological and pharmacological studies; *Heterodera glycines* as a model for biology, proteomic and genomic studies.

**UNIT III**

Chemoreception, neurobiology, and biochemical basis of communication in nematodes, molecular basis of host recognition, Nematode-associated molecular patterns (NAMPs), molecular pathways of plant-nematode interaction.

**UNIT IV**

Biochemical, genetical and molecular basis of plant nematode interaction; histopathological, cellular and molecular changes in host feeding cells, resistance genes, genome editing, sequencing of genome, Transcriptome and Proteome analysis of plant parasitic nematodes, RNAi technology,

**UNIT V**

Biochemical and molecular basis of survival strategies in nematodes, molecular mechanism of host resistance against plant parasitic nematodes, molecular and novel approaches for nematode management.

**Practical**

Isolation and quantification of proteins from nematode juveniles and eggs; molecular weight determination of nematode protein; buffer preparation for molecular techniques, PCR,  $\beta$ -esterase polymorphism in root-knot nematode; nematode DNA isolation from juveniles and eggs; RFLP of nematode DNA; nematode DNA amplification using PCR for nematode identification, RNAi technology.

**Suggested Reading**

- Chen ZX, Chen SY & Dickson DW. 2004. *Nematology: Advances and Perspectives. Vol. I. Nematode Morphology, Physiology and Ecology*. CABI, Wallingford.
- Fenoll C, Grundler FMW & Ohl SA. 1997. *Cellular and Molecular aspects of Plant-Nematode Relationships*. Kluwer Academic Publ., Dordrecht.
- Gommers EJ & Maas PW. 1992. *Nematology from Molecule to Ecosystem*. European Soc. of Nematologists.
- Lamberti F, Giorgi C. & Bird D. 1994. *Advances in Molecular Plant Nematology*. Plenum Press.
- Perry RN & Wright DJ. 1998. *The Physiology and Biochemistry of Free- living and Plant Parasitic Nematodes*. CABI, London.
- Riddle DL. 1997. *C. elegans II*. Cold Spring Harbor Press.
- Wood WB. 1988. *The Nematode Caenorhabditis elegans*. Cold Spring Harbor Press, US Zuckerman BM. 1980. *Nematodes as Biological Models*. Vols. I, II. Academic Press, New York.

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