

Lecture 01 - Introduction

Nematology is an important branch of biological science, which deals with a complex, diverse group of round worms known as Nematodes that occur worldwide in essentially all environments. Nematodes are also known as eelworms in Europe, nemas in the United States and round worms by zoologists. Many species are important parasites of plants and animals, whereas others are beneficial to agriculture and the environment. Nematodes that are parasites of man and animals are called helminthes and the study is known as Helminthology. The plant parasitic forms are called nematodes and the study is known as Plant Nematology. The name nematode was derived from Greek words nema (thread) and oides (resembling).

Annual crop losses due to these obligate parasites have been estimated to be about \$ 78 billion worldwide and \$ 8 billion for U.S. growers. The estimated annual crop loss in Tamil Nadu is around Rs. 200 crores.

The soils in a hectare of all agro ecosystem typically contain billions of plant parasitic as well as beneficial nematodes. The damage to plants caused by nematodes is often overlooked because the associated symptoms, including slow growth, stunting and yellowing, can also be attributed to nutritional and water related disorders.

History of Plant Nematology

In light of the high population numbers of nematodes. N.A. Cobb (1915) who is considered to be the father of American Nematology, provided a dramatic description of the abundance of nematodes. He stated, “If all the matter in the universe except the nematodes were swept away, our world still would be dimly recognizable we would find is mountaintops, valleys, rivers, lakes and oceans represented by a film of nematodes. The statement “ sowed cockle, reaped no corn” in Shakespeare’s “Love’s Labour’s List” act4, scene 3, as suggested by Throne (1961) possibly the first record of plant parasitic nematodes in 1549. The nematode that Throne suspected to be in that reference actually was described by Needham in 1743. Subsequently, discovery of microscope and developments in various disciplines of science led to the discovery of plant parasitic nematodes and the disease caused by them. Some of the important milestones on the history of plant nematology are listed below in chronological order.

1743 – Needham – Discovery of wheat seed gall nematode *Anguina tritici*, the

first plant parasitic nematode to come to the attention of the early investigators.

- 1855 - Berkeley – Determination of root-knot nematode, *Meloidogyne* spp. to cause root galls on cucumber plants in greenhouse in England.
- 1857 - Kuhn – Reported the stem and bulb nematode, *Ditylenchus dipsaci* infesting the heads of teasel.
- 1859 - Schacht - Report of sugarbeet cyst nematode, *Heterodera schachtii* from Germany.
- 1873 - Butschli – Descriptions of the morphology of free –living nematodes.
- 1884 - deMan – Taxonomic monograph of soil and fresh water nematodes of the Netherlands.
- 1889 – Atkinson and Neal – Publication about the root-knot nematodes in the United States.
- 1892 – Atkinson-Report of root-knot nematode and *Fusarium* complex in vascular wilt of cotton.
- 1907 - N.A.Cobb – joined the USDA and considered to be the **Father of American Nematology**
- 1914 – N.A.Cobb – Contributions to the Science of Nematology.
- 1918 – N.A. Cobb – Development of methods and apparatus used in Nematology.
- 1933 – T. Goodey – Book on “Plant parasitic nematodes and the diseases they cause”
- 1934 – Filipjev – Book on “Nematodes that are importance for Agriculture” translated from Russian to English in 1941 by S.Stekhoven under the title “A Manual of Agricultural Helminthology”.
- 1943 – Carter-Description of nematicidal value of D-D which is used in the era of soil fumigation.
- 1945 – Christie – Description of the nematicidal value of EDB.
- 1948 – Allen – Taught the World’s first formal university course in Nematology at the University of California, Berkeley.
- 1950 – Oostenbrink – Wrote a Book of on “The Potato Nematode, A dangerous parasite to Potato Monoculture”.

1951 – Christie and Perry – Role of ectoparasites as plant pathogens. T.Goodey – Wrote a book on “Soil and fresh water nematodes”. Food and Agriculture Organisation of the United Nations organized the first International Nematology course and Symposium held at Rothamstead Experiment Station, England.

1955 – European Society of Nematologists founded.

1956 – Nematologica – The first journal published entirely for Nematology papers from The Netherlands.

1961 – Society of Nematologists founded in the United States.

1967 – Organization of Tropical American Nematologists founded.

1969 – Journal of Nematology was first published by the Society of Nematologists, USA.

1973 – Nematologia Mediterranea – published from Italy.

1978 – Revue de Nematologie published from France

1930s – 1990s – Barron, Duddington, Mankau, Linford, Sayre and Zuckerman – they provided an insight on the Biological control of plant – parasitic nematodes. Enhanced understanding of antagonists and related biology enhancing the potential for practical biocontrol.

1940-s – 1990s – Triantaphyllou – Provided advancement in Cytogenetics, modes of reproduction/sexually – and information data base for genetics/molecular research. Enhanced understanding of evolution and taxa interrelationships.

1950s – 1990s – Caveness, Jones, Oostenbrink, Sasser and Seinhorst – International programme such as International *Meloidogyne* project – They expanded educational base of nematologists world wide and provided ecological – taxonomic data base.

1960s- 1990s – Nickle, Poinar and Steiner – Biological control of insects with nematodes.

1960s- 1990s – Brenner, Dougherty and Nicholas – *Caenorhabditis elegans* developmental biology and genetics – model system – provided fundamental information on cell lineage, behavior, gene function ageing and overall genome for this model biological system.

In addition to the above, now the research advancement are in progress in the following areas in USA from the year 1990.

Molecular markers for resistance genes, which provide efficiency of breeding for resistance. Cloning of resistance genes- Elucidation of the molecular fundamental knowledge on mechanisms of pathogenesis. Cloning of resistance genes- Elucidation of the molecular

mechanism of resistance. Transgenic host resistance to plant parasitic nematodes – Great potential, but limited model system to date.