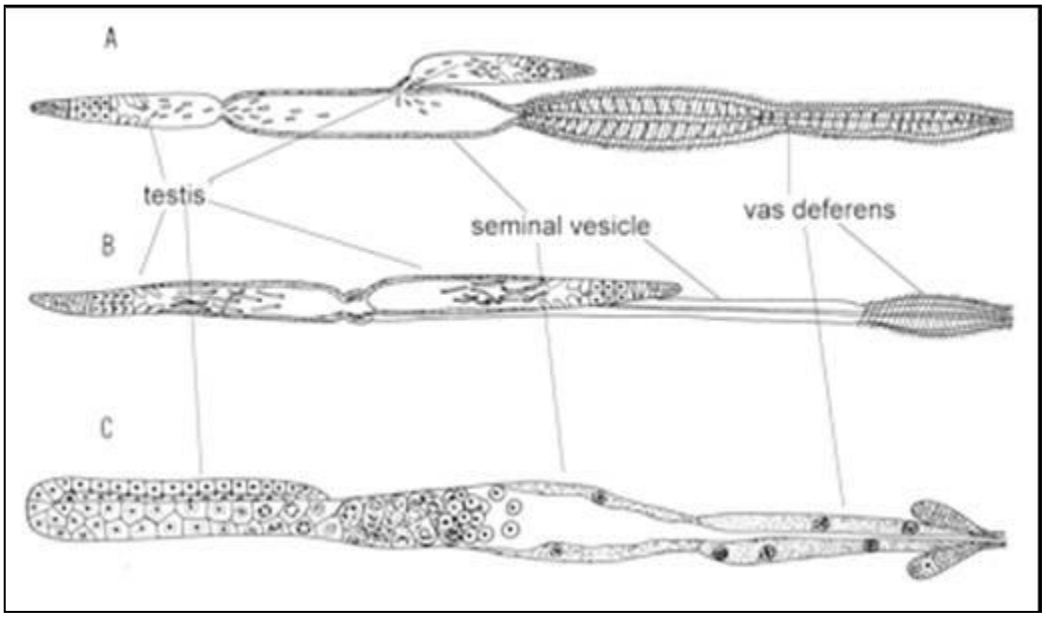
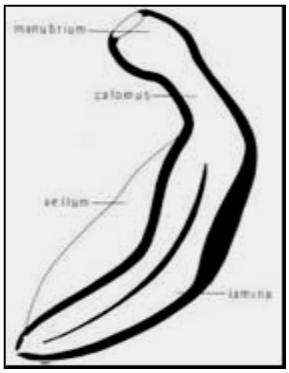
Lecture 06 - Male Reproductive System

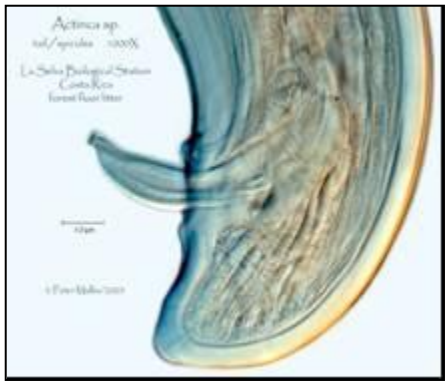
The production of sperms takes place in testis. In nematodes, whenever the number of testis is one, it is known as monarchic conditions and when they are tow in number, the condition is known which moves forward and backward with help of specialized muscles attached with its head region. Spicule is narrower at its tip. A cuticularised structure lying beneath the pair of spicule is known as guberrnaculum which helps and gives support in movement of the spicule. At the tail end, two filamentous cuticular expansions are found and they are known as bursa helps to hold the female during copulation. Plant parasitic nematodes can reproduce sexually where male and female copulate and give rise to off – springs. Sexual reproduction is also called as amphimetic reproduction. Parthenogenetic reproduction is also common phenomenon in *Meloidogyne* and *Tyelchulus semipenetrans*.

Male reproductive system

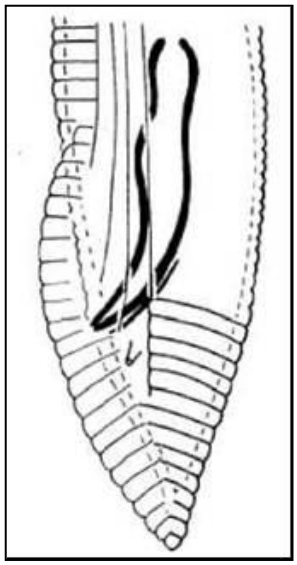


Spicule

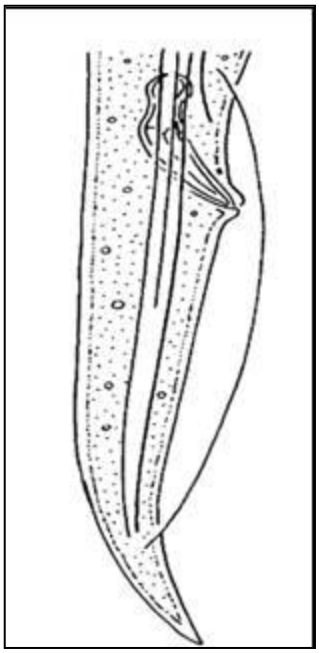




Caudal alae



Peloderan
Eg. *Hoplolaimus*



Leptoderan
Eg. *Hirschmanniella*

Inter sexes

In genera like *Meloidogyne* and *Ditylenchulus* inter sexes are found. In such cases one reproductive system act as male gonad and other one as female gonad.

Excretory System

The excretory system is not well developed in nematodes. The excretory pore is located in the anterior midventral line close to the nerve ring. The position of excretory pore may vary in different genera and even in different stages of the same species. In T. semipentrans the excretory. It secrets gelatinous matrix. The excretory system in nematodes are of two types. 1. Glandular type 2. Tubular type.

Glandular type

The glandular type consists of a single specilalised cell known as renette cell. It has a posteriorly located enlarged gland known as excretory gland or ventral gland. This gland is connected to the excretory pore by a duct that terminates in a pouch like structure known as ampulla. This type is found in members of the class Adenophorea.(Fig.7)

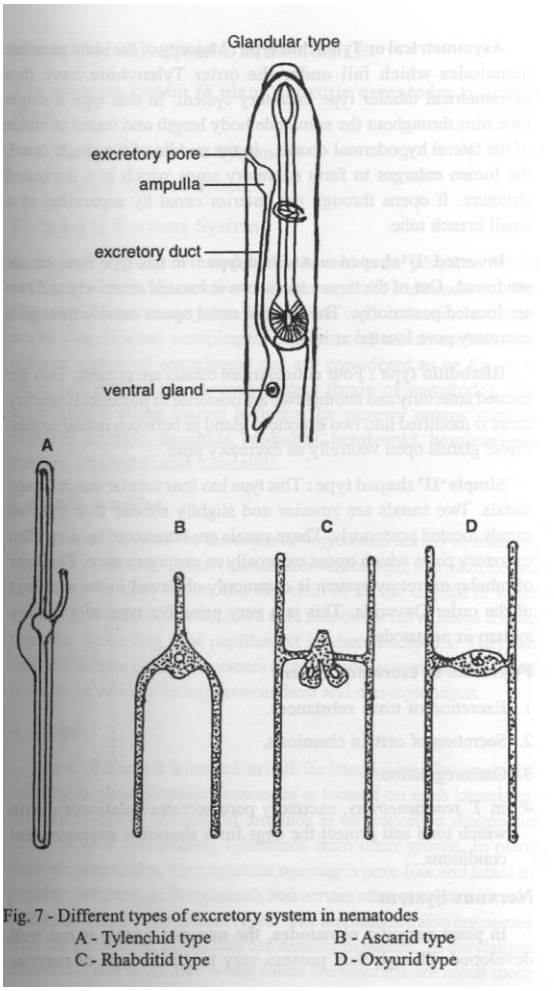


Fig. 7 - Different types of excretory system in nematodes
A - Tylenchid type B - Ascarid type
C - Rhabditid type D - Oxyurid type

Tubular type

The tubular type of excretory system consists of four – cuticularised canals. Two are anterior and another two are posterior canals. There is a pouch like structure in the middle which connects both the lateral canals. It is known as excretory pore. There are four types in tubular system.

1. Asymmetrical or Tylenchid type

2. Inverted ‘U’ shaped or Ascarid type
3. Rhabditid type
4. Simple’H’shaped or Oxyurid type.

Asymmetrictrical or Tylenchid type : Majority of the plant parasitic nematodes which fail under the order *Tylenchida* have this asymmetrical tubular type excretory system. In this type a single tube runs throughout the nematode body length and found in either of the lateral hypodermal chords. In the middle of the single canal, the lumen enlarges to form excretory sinus which is a nucleated structure. It opens through the anterior canal by separating as a small branch tube.

Inverted ‘U’ shaped or Ascarid type

In this type three canals are found. Out of the three canals, one is located anteriorly and two are located posteriorly. The anterior canal opens outside through a excretory pore located at its tip.

Rhabditid type

Four cuticularised canals are present. Two are located anteriorly and another two are posterior in position. Excretory sinus is modified into two excretory gland in between lateral canals.These glands open ventrally as excretory pore.

Simple ‘H’ shaped type

This type has four tubular cuticularised canals. Two canals. Two canals are anterior and slightly shorter than the two canals located posteriorly. These canals are connected by a swollen excretory sinus which opens externally as excretory pore. This type of tubular excretory system is commonly observed in the members of the order Oxyurida. This is a very primitive type of excretory system in nematodes.

Functions of excretory system

1. Excretion of toxic substances. 2. Secretion of certain chemicals. 3. Osmoregulation 4. In *T. semipenetrans* excretory pore secretes gelatinous matrix which bind and protect the eggs from abnormal environmental conditions.

The Nervous System

In plant parasitic nematodes, the nervous system is not well developed. Though they posses very primitive type of nervous system, they also respond to different stimuli.

The nervous system in plant parasitic nematodes is of two types

1. Peripheral Nervous System
2. Central Nervous System

Peripheral Nervous System

Located in the periphery which mainly includes body cuticle and also the cephalic and caudal regions. The parts of nervous system located are well connected with the nerve ring (circum oesophageal commisure) which encircles the thumus region of esophagus and are considered to be the most important part of the nervous system (brain of nematode). The peripheral nervous system includes the sensory organs such as cephalic paillae; amphids cephalids, hemizonid, hemisonions, deirids, phasmids and caudalids.

Cephalic paillae

Located on the cephalic region and are 16 in number, two each in – two sub – dorsal lips and sub – ventral lips; one each in two lateral lips in outer circle ; and one each in all the six lips in inner circle. These paillae are supplied with neurons or nerve fibres arising from the nerve ring. The papillae act as chemoreceptors. They are believed to take part in movement of nematode governing directions and also in differentiating between host and non – host plants

Amphids

A pair of amphids is located on both the lateral sides. The amphidial opening is pore – like and labial in position. The amphids are also connected with the nerve ring, hence they are sensory in nature.

Cephalids

These are found in cephalic region. A pair of cephalids is found, of which one is anterior and another is posterior in position. The exact functions of cephalids are not known. It is believed that they take part in transmitting massages to the centrally located nerve ring.

Hemizonid and Hemizonion

They are highly refractive, biconvex, semi – circular and may be anteriror or posterior to the excretory pore. Hemizonids is anterior to the excretory pore. Hemizonions are smaller than Hemizoinids and are located posterior to hemizonid. Hemizonoid and hemizonion are believed to be involved in nuerosecretion.

Deirids

These are a pair of small protuberance, one each in lateral side in the middle of the lateral field. These are located in the region of oesophagus at the region of excretory pore. They are also sensory organs.

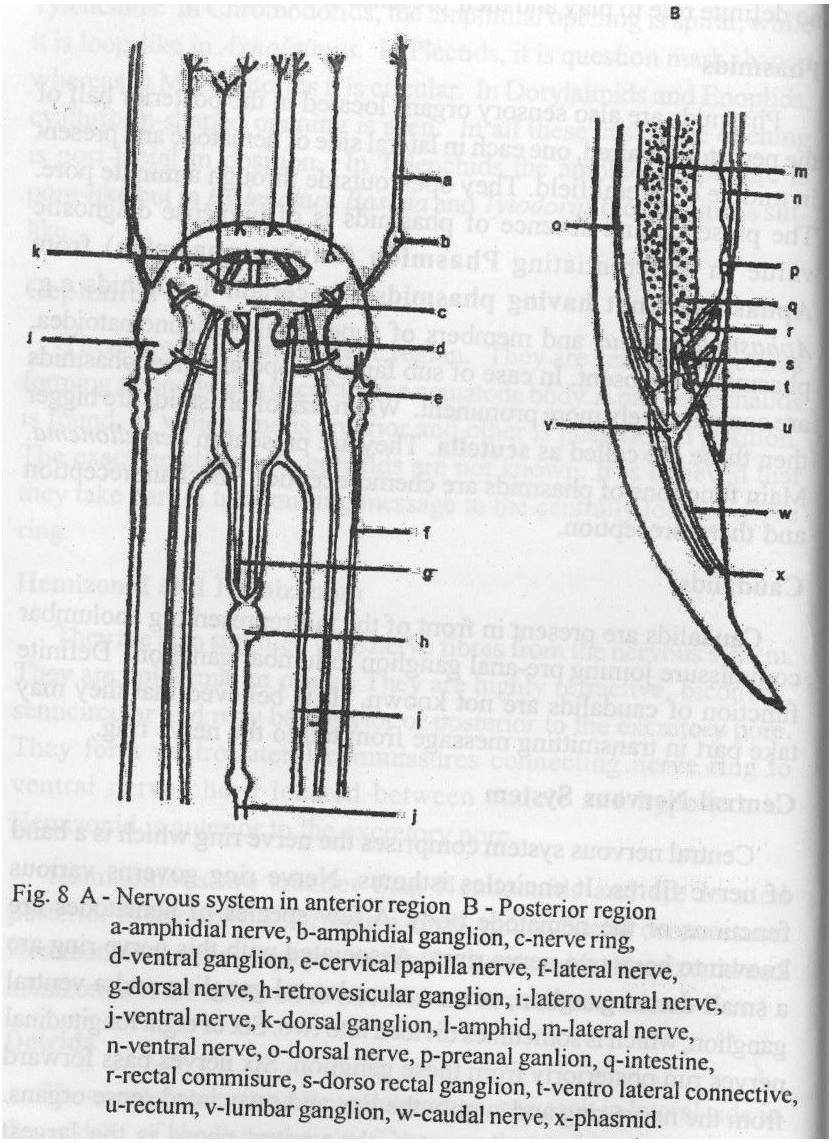


Fig. 8 A - Nervous system in anterior region B - Posterior region
a-amphidial nerve, b-amphidial ganglion, c-nerve ring,
d-ventral ganglion, e-cervical papilla nerve, f-lateral nerve,
g-dorsal nerve, h-retrovesicular ganglion, i-latero ventral nerve,
j-ventral nerve, k-dorsal ganglion, l-amphid, m-lateral nerve,
n-ventral nerve, o-dorsal nerve, p-preanal ganlion, q-intestine,
r-rectal commisure, s-dorso rectal ganglion, t-ventro lateral connective,
u-rectum, v-lumbar ganglion, w-caudal nerve, x-phasmid.

Phasmids

Phasmids are also sensory organs located in the posterior half of the nematode paired one ach in lateral side of nematode and present in middle of lateral field. They open outside through a minute pore. The presence and absence of phasmids is of immense diagnostic value having phasmids. When size of phasmids are bigger then these are called as scutella. They are present

in *Scutellonema*. Main functions of phasmids are chemoreception, mechanoreption and thermoreception.

Caudalids

Caudalids are present in front of the tail. It is believed that they may take part in transmitting massages from tail to the nerve ring.

Central Nervous System

Central nervous system comprise the nerve ring. Associated with this nerve ring are a small dorsal gangalion. Six or eight longitudinal nerves run posteriorly from these ganglion. Six nerves pass forward from the nerve ring and supply the lips and associated sense organs.

A pair of nerves runs forward from the lateral ganglion to the amphids at the anterior end of the nematode. The dorsal nerve is said to be chiefly motor and lateral nerves mainly sensory in function. The sub – median and the ventral nerves are partly motor and partly sensory. There is a system of three nerves in the pharynx, one in each sector, which are connected with one another by commissures and also with nerve ring. Nematodes are unique in that the muscle cells of the body are innervated by processes which pass from the muscle. It is claimed that the nerve muscle junction is similar to those found in other animals.(Fig.8)

Transmission along nerves

Nothing is known about the processes involved in the conduction of an impulse along nerves in nematodes. In Ascaris it is known that the pseudocoelomic fluid contains more sodium as compared with potassium ions. It is thus possible to speculate that the nerve axons in this species function as that of other animals in which the action cureent arises from an influx of external sodium ions.

Acetylcholine is apparently involved in nervous transmission in nematodes. Acetylcholine like substances have been detected in Ascaris. The head region of Ascaris was found to contain fifteen times more acetylcholine than that of the remaining body. Cholineesterase activity is observed to be more in the nerve ring, amphids, phasmids and other sense organs in nematodes.