

Ascaris lumbricoides

① Introduction : Ascaris lumbricoides (= Round worm) is one of the most familiar gastro-intestinal parasite of man, causing a disease named as Ascariasis.
It has also been reported from pigs, cattle, sheep and squirrels.

Prevalence of Ascariasis is greater in children than in adults.

② Systematic position

Phylum - Nematoda / Nematelminthes ✓
Class - Phasmida / Nematoda (only one class)
Order - Ascaroidea
Genus - Ascaris
Sps - lumbricoides

③ Distribution, cosmopolitan in distribution, but mainly found in India, China, Korea, Philippines - etc.

④ Colour - yellowish white in colour with a characteristic lustre due to the thick glistening cuticle.

⑤ Size and shape

① Body elongated, cylindrical and gradually tapering at both ends

② Marked with four longitudinal lines, of these one is dorsal at the anterior end is ventral, two others are lateral in position and are called lateral lines

③ The anterior mouth is bordered by three lips one median dorsal and two ventro-lateral

④ A little behind the anterior end on the ventral surface is the excretory pore.

⑤ Sexes are separate.

15-30cm long & 3.5mm wide

MALE 1. Smaller in size (meanly ~~6-8 mm in diameter~~)

2. posterior end curved

3. A pair of chitinous needle like structure called penial setae comes out from an opening which serves also as a reproductive aperture (= cloacal aperture) present at posterior papillae present to help in copulation.

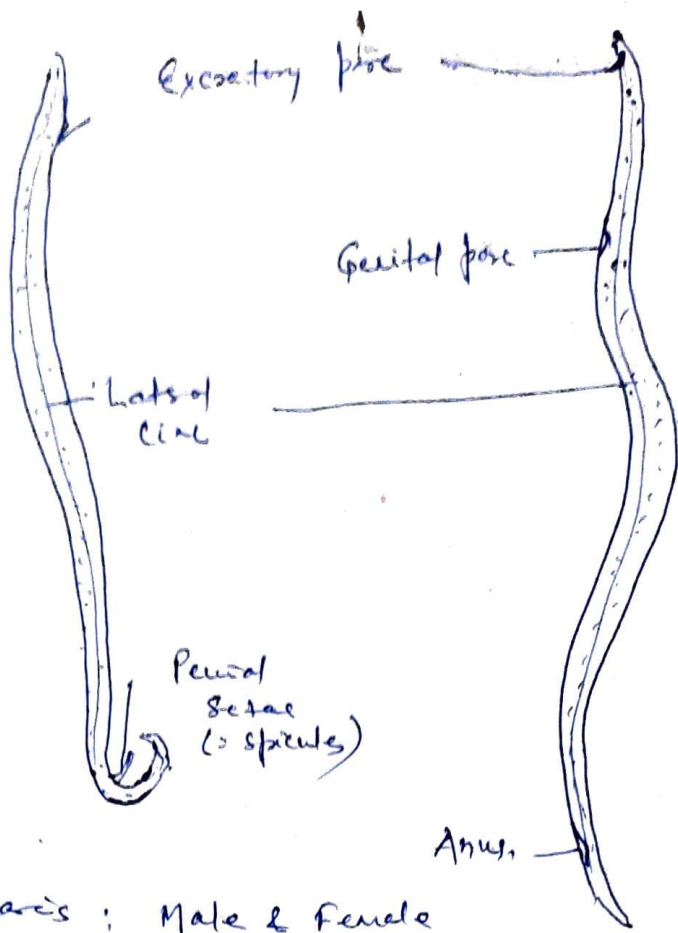
FEMALE 1. Larger than male (meanly ^{cm long} 20-40 ^{mm in diameter} ~~mm in diameter~~)
6-8 mm wide

2. posterior end straight

③ In female a little above the posterior end is a transverse aperture, the anus.

④ The gonopore is situated on the ventral surface at about $\frac{1}{3}$ of the total length of the body from the anterior end.

⑤ Cloaca and penial setae are absent



Ascaris : Male & Female

Body wall - Made up of three layers.

- a) outer cuticle
- b) Middle - Epidermis or hypodermis
- c) two layers of longitudinal muscles lining the body cavity.

① Cuticle - thick, tough, transparent and glossy layer secreted by the underlying epidermis.

Histologically, the cuticle is formed of several layers and can be distinguished into

- ① Lepid layer
- ② Cortical layer
- ③ Matrix layer
- ④ Fibre layer
- ⑤ Basement membrane.

It is believed that some anti-enzymes are also secreted by cuticle of Ascaris which neutralize the effect of digestive juices of host upon the parasite.

② Epidermis - It forms a syncytial layer below cuticle, which projects into the body cavity as four longitudinal cords and is covered by thick cuticular layer.

Fats and glycogen reserves are abundantly present in epidermis.

③ Longitudinal muscles - Beneath the ectoderm is a single layer of longitudinal muscles which is distinguished into four quadrants (two - dorso-lateral & two - ventro-lateral). The muscle cells are fusely specialized, spindle shaped and of two parts.

- ① Fibrillar - found wrapped around the protoplasmic part
- ② Protoplasmic region - rear part of the muscle cells, situated towards the posterior.

of cavity or pseudocoel - a distinct cavity is between body wall and visceral organs is found (= coelom) but it is not true coelom as

- 1) not lined by coelomic epithelium
- 2) no relation with reproduction and excretory organs
- 3) it develops from blastopore (between mesoderm & endoderm of embryo) = false coelom.

It is filled up with an odorless protein rich fluid = pseudocoelomic fluid.

Digestive System - Alimentary canal is a straight tube like

structure running from mouth to anus. It comprises

- 1) a short pharynx or oesophagus (= fore gut)
- 2) a long intestine (= mid gut)
- 3) a short rectum (= hind gut)

Mouth - triangular, bounded by a median dorsal and two lateral ^{dorsal} - ventral lips, leading into buccal cavity & ^{macro} muscular chamber leading to pharynx

pharynx 1) short, chitinous, cylindrical, thick walled & muscular

- 2) wall of pharynx consists of a syncytial epithelium
 - 3) lumen of pharynx is trisaccharate & is lined by cuticle
 - 4) pharynx opens by two branched set ventral oesophageal glands as branched dorsal oesophageal glands
- they are unicellular structures discharging their contents into the pharyngeal cavity.

Intestine 1. long thin walled ^{dorso ventrally flattened tube} devoid of muscle, ^{on internal wall is formed of single layer of columnar cells} lined externally by a basement membrane as a thin layer of cuticle

- 2) the free inner margins of columnar cells are produced into several finger like microvilli (increase the surface area for absorption)

Rectum 1) short dorsoventrally flattened

- 2) walls of rectum consists of tall columnar cells as is lined internally by cuticle & externally by muscle tissue.
- 3) In male rectum opens into cloaca, which also receives the ejaculatory duct.
- 4) In female rectum opens out through anus.

Food feeding at distha - blood or food is fluid form & the host's gut:

- 1) Sucked by the rhythmic pumping action of plume, &
- 2) Distha - Extracellular in distha.
- 3) food ~~is~~ is absorbed by the intestinal cells & distributed by the pseudocoelomic fluid.
- 4) Excess food is stored as glycogen & fat in syncytial epithelium.

Respiration - no respiratory organ, respire anaerobically by glycolysis, also able to consume free oxygen available in the host intestine.
According to Hyman, haemoglobin present in small amount in the pseudocoelomic fluid and body wall, serves to transport oxygen.

Excretory System (quite simple due to absence of flame cells)
Excretory system consists of two longitudinal canals running one in each lateral line, the two canals are connected anteriorly by a transverse canal in the form of network and open on the ventral side by a single excretory pore. These canals are thick walled and end blindly at the distal end.

Each canal represent an excretory in a single enormously elongated cell. In relation with the excretory canal a develop 4-6 large cells, these are tubular cells with numerous ramifications which pick up solid waste from the body cavity and help in excretion.

Nervous System - Hypodermis and consists of a circum-
pharyngeal nerve ring and the nerves.

① Circumpharyngeal nerve - consists of a number of cephalic ganglia
these are

- (a) Six papillary ganglia
- (b) two ventral ganglia
- (c) Two sub-dorsal ganglia
- (d) Two dorsal ganglia

② The Nerves - 6 of the nerves are issued anteriorly from the nerve ring
2 extend rostrally and 2 posteriorly from the nerve ring.
these are

- (a) 1 dorsal nerve (b) 1 ventral nerve (c) Paired dorsoventral nerve
- (d) Paired ventro lateral nerves (e) Paired lateral nerves.

the only sense organs are the sensory papillae and amphid present on the oral lips.

Reproductive System: Only Sexual reprod., occurs in Ascaris.
Sexs are separate and there is distinct sexual dimorphism between male and female Ascaris.

Male reproductive system - includes

a) testis b) a vas deferens c) a seminal vesicle, 1) an ejaculatory duct, e) cloaca and 4) penial setae

a) Testis 1) single, long, thin and coiled tube like structure.

2) has a cavity lined by a single layer of cuboidal cells.

3) acts as 'Growth zone'

4) central axis of testis is in the form of a solid cytoplasmic rachis around which are clusters of amoeboid sperm in various stages of development.

b) Vas deferens - Testis continues into a vas deferens; which is a shorter and less coiled tube than testis.

c) Seminal vesicle - long, straight and relatively thicker tube into which the vas deferens opens. It serves to store the mature sperm.

d) Cloaca - last part of rectum, located behind the opening of ejaculatory duct - serves as cloaca, because it receives both feces and sperm. It opens out by the cloacal aperture.

e) Ejaculatory duct - Terminal part of seminal vesicle narrows to form a highly muscular ejaculatory duct. It joins rectum to form the cloaca. Contains prostatic glands where secretions help in copulation.

f) Penial setae - Two small contractile penial sacs open into the cloaca on dorsal side. Each sac secretes a small needle like penial or copulatory setae or spicule of cuticle. Protractors or retractors muscles serve to protrude or retract the contained spicule through the cloacal aperture. Spicules help in opening the female gonopore for copulation.

Female reproductive system - includes ovaries, oviducts, uterus and vagina.

1. Ovaries 1) Two; long, thread like much twisted and blind tubule.

2) its wall consists of a single layer of cuboidal epithelial cells lined externally by peritoneal membrane.

3) its central axis is in the form of a cytoplasmic rachis, around which are groups of ova; no lumen.

2) Oviducts - Each ovary leads into a long and coiled oviduct.

3) Uterus - oviduct leads into a much thicker and long uterus. The uterine wall is thick and formed of a layer of tufted secretory cells, surrounded by muscular layer.

It serves to store the eggs after fertilization.

4) Vagina - The uterus opens into short and narrow vagina. The wall of vagina is quite muscular and contractile. The vagina opens out by slit-like female pore or vulva.

LIFE CYCLE

These parasites have a direct life cycle with no intermediate hosts. The adult parasite lives in the lumen of the small intestine of man, usually only feeding on the semi-digested contents of the gut, although there is some evidence that they can bite the intestinal mucous membrane and feed on blood and tissue fluids.

The female parasite is highly prolific, laying an estimated 2 million eggs daily. In the intestine there are clusters, an embryonated mass of cells, differentiation occurring outside the host. This requires a temperature less than 30°C , moisture and oxygen, before the development of the young L1 (larva) after approximately 14 days.

Eggs containing the L2 larvae take another week to develop before they are infective to man, and may remain viable in the soil for many years if conditions are optimal.

Infection occurs on ingestion of raw food such as fruits or vegetables that is contaminated with these infective eggs. The eggs then hatch in the small intestine, to release the L2 rhabditiform larvae (near 15μ in size).

They do not simply grow into the adult form in the intestine, but must then undergo a migration through the body of their host.

The L2 larvae penetrate the intestinal wall, entering the portal blood stream, and then migrate to the liver, heart or the lungs (between 1 to 7 days).

Here, they moult twice to form L4 (1.5mm long) the burrow out of the blood vessels, entering bronchioles.

From here, they migrate up through the air passages of the lungs to trachea.

They then enter the throat and are swallowed, finally entering into the small intestine where they mature and mate to complete their life cycle.