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B.Sc. I yr

Phylum Nematoda

Unit - II

General characters

- Widely distributed, aquatic or terrestrial and parasitic or free living.
- Body is elongated, cylindrical, unsegmented, worm-like, bilaterally symmetrical and tapering towards both ends.
- Body is triploblastic with organ-system grade of organization.
- Body wall consist of three membranes - outermost cuticle, middle syncytial epidermis and only longitudinal muscle fibres internally.
- True coelome is absent. They are pseudo-coelomate
- cilia, circulatory system & respiratory system is absent.
- Digestive system is complete with mouth, muscular pharynx & non-muscular intestine. and posteriorly anus.
- Excretory system consist of glandular organs or canal or both. Flame cells absent.
- Nervous system with circum nerve ring.
- Sense organs poorly developed, in the form of small papillae and amphids near on two body ends.
- They are Dioecious, with sexual dimorphism. Male smaller than female. Gonads simple and coiled. Male genital

ducts leads into cloaca. Female genital ducts with a separate opening. Only sexual reproduction.

- Fertilization is internal.
- Development usually direct, with or without an intermediate host.

* Classification

Nematodes are among most numerous of any phylum. Nemades are classified into two classes —

i) Aphasmidia (Adenophorea)
ii) Phasmidia (Secernentea)

i) Aphasmidia

- phasmids (caudal sensory organs) are absent.
- Amphids (anterior sense organs) are of various type, rarely pore like. (or no pore like)
- NO ~~respiratory~~ excretory system. If present, poorly developed.
- caudal adhesive glands Present.

examples - Enoplus, Dorylaimus, Tylencholaimus, Metonchdiamus. ~~Rhabd~~ plectus.

ii) Phasmidia

- Phasmids present.
- Amphids are pore-like.
- Excretory system developed.
- No caudal adhesive glands.

Examples - Ascaris, wuchereria, Microfilaria, Necator.

Ascaris lumbricoides

★ structure

Ascaris lumbricoides is one of the most familiar endoparasites of man.

I] shape and size

- Body is elongated, cylindrical and gradually tapering at both ends, the anterior end being more slender than the posterior.
- Sexes are separate (dioecious) with a distinct sexual dimorphism.
- Female measures 20 to 40 cm in length and 4-6 mm in diameter. It has straight tail.
- It ha While male is smaller, upto 20 cm in length and 2-4 mm in diameter. Its tail is curved ventrally.

- The cuticle covering the body surface bears minute transverse striations, giving a pseudosegmented appearance to the worm.

II] Colouration

- Fresh specimens are light yellow to light pink in colour.
- Semitransparency of body wall enables some of the internal organs to be seen through it.

III] Longitudinal streaks or lines

- Running along the entire length of body are four longitudinal streaks or lines present - one mid-dorsal, one mid-ventral and two lateral.
- Dorsal & ventral lines appears pure white, while lateral lines which are more conspicuous, appears brown. These lines are simply the impressions of syncytial epidermis which are more thickened all along the length at the median dorsal, median ventral & two lateral positions.

- The excretory pore is situated mid-ventrally, a little behind the mouth.
- In female, the genital pore and anus open separately; the genital pore is situated mid-ventrally at about one-third distance from the anterior end.

IV] Anterior End

- Anterior end is rounded bearing a small terminal triradiate mouth aperture guarded by three broad lips or labia.
- One lip is mid-dorsal and two are sub-ventral or ventrolateral.
- Outer surface of each lip bears minute sensory papillae.
- Dorsal lip bears two double papillae, one on each side.
- Each latero-ventral lip bears one double papilla in its ventral portion & single papilla in lateral portion near which is an amphid.
- Amphids are probably chaemoreceptors.

V] Posterior End

- Posterior end of body shows clear sexual dimorphism.
- It is straight in female but curved ventrally in male. In female, a little in front of the tail end lies a mid-ventrally transverse aperture, or anus. Only digestive tube opens to outside through anus.
- Male have cloaca, a common aperture for digestive and genital tubes.
- Sometime, two chitinous spiculate processes of equal size are seen protruding out of the cloacal aperture, called as penial setae or spicules. which serve to transfer - sperms into female vagina, during copulation.

- Tail end of male Ascaris is characterized by the presence of genital papillae on ventral surface.
- There are 50 pairs of preanal papillae in front of cloaca, and 5 pairs of postanal papillae behind it. They help in copulation.
- Two anterior pairs of postanal papillae are double while the rest are single.

VI] Excretory Pore

A single excretory pore lies mid-ventrally at a distance of about 2 mm from the anterior end.

VII] Female Gonopore

- The genital pore or vulva of female lies mid-ventrally at about one-third distance from the anterior end. But the genital pore of male opens into cloaca.

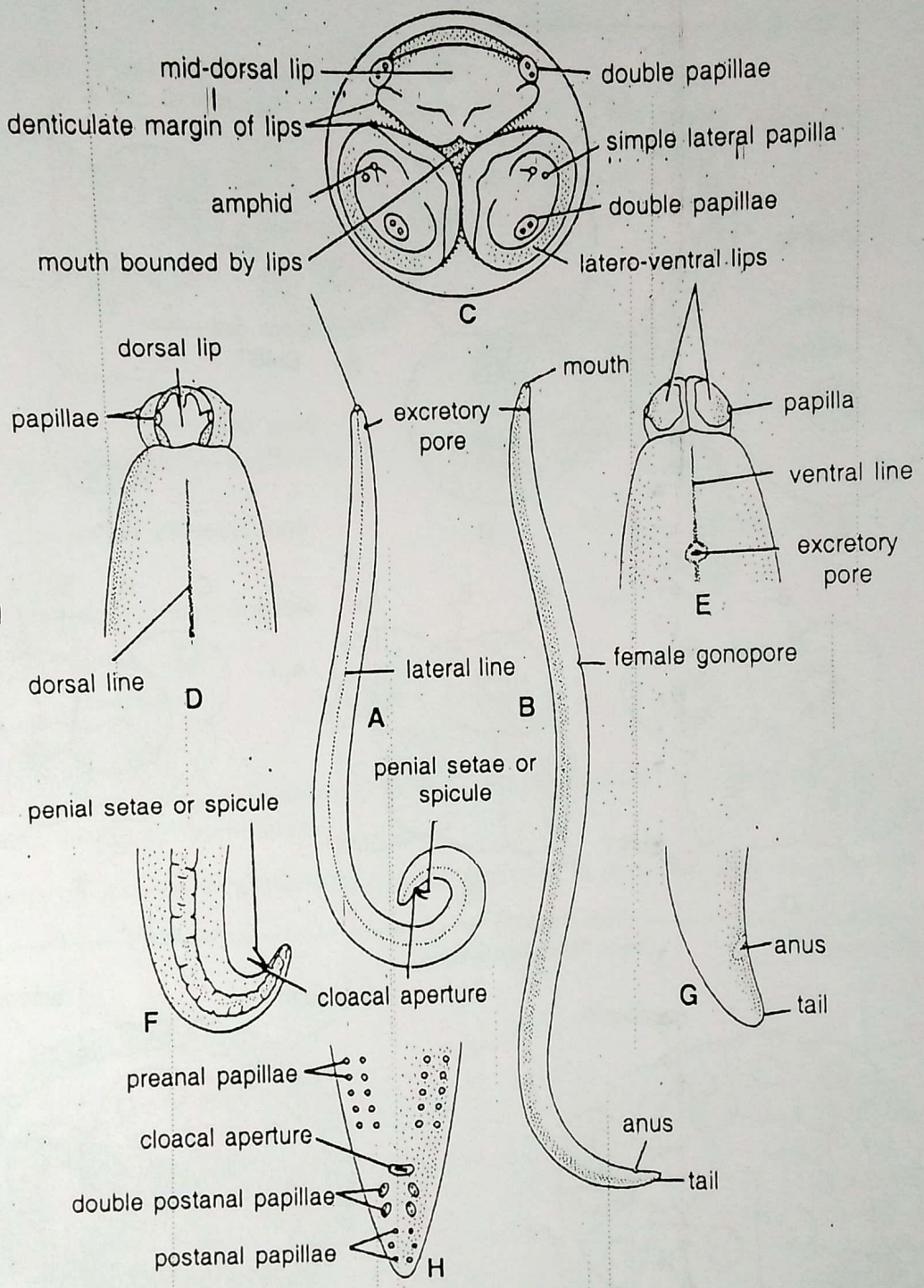


Fig. 30.1. *Ascaris lumbricoides*. A—Male; B—Female; C—Surface view of mouth and lips; D—Anterior end in dorsal view; E—Anterior end in ventral view; F—Posterior (tail) end of male, G—Tail end of female, H—Posterior end of male in ventral view showing papillae.

★ Life cycle of Ascaris

I] Copulation and fertilization

- Copulation takes place in the small intestine of host (man) where the adult worm live. The
- The man orients its body at right angles to that of female in such a way that its cloacal aperture apposes the vulva of female.
- Penial setae of male help in the copulation.
- Fertilization occur in the female gonad, it result into zygote formation.

II] Zygote

- Unfertilized egg contains globules of glycogen and fat.
- Immediately after fertilization, glycogen & fat globules migrates to the surface and form a fertilization membrane, which hardens into a thick, clear & chitinous shell. Next fat globules form a thin lipid layer below it.
- Fertilized egg or zygote move toward the uterus.
- Uterine wall secretes around zygote, a thick hard wavy surface. Now at this stage fertilized egg become elliptical.
- These leave the mother's body through genopore into host's intestine and finally pass out with the host's faeces.
- Shelled egg are remarkably resistant and remain alive in moist soil for several years under adverse conditions.

III] Cleavage and Early Development

- cleavage is spiral and determinate type.
- under suitable conditions of temperature, moisture and oxygen, eggs undergo cleavage and develop into the infective larva.
- optimum temperature for development is 85°F. Below 60°F development stops and above 100°F the eggs gradually degenerate.
- cleavage results into blastula formation with blastocoel cavity.
- Then gastrula is formed. & then grows in length to become an active juvenile, in 10-14 days from the start of cleavage.
- Juvenile has an alimentary canal, a nerve ~~net~~ ring & a larval excretory system.
- It is not infective.
- In another week time, it moult within egg shell ~~cell~~ and becomes the second stage rhabditoid, which is infective.

IV] Infection of New Host

- There being no intermediate host, man acquires infection by directly ingesting Ascaris eggs, containing the infective second stage of larva or Rhabditoid larva., with contaminated water & food.
- In the small intestine, by the action of host's digestive juices, the egg shells dissolve and the juveniles (second stage larva) hatch out.

[V] Later Development and migration

- After hatching, it performs active thrashing movements and bores through the intestinal wall & starts its migration in host's body.
- Larva enters the hepatic portal vein & enter into liver.
- From liver it enters into heart through post-caval vein.
- From heart it transported to the lung via pulmonary artery.
- Larva generally remains in lung for few days and increases in size. Then it ruptures out of the blood capillaries & finally bores its way into ~~second sta~~ alveoli.
- After 6 day's it convert or moult into the third stage of larva.
- After 4 days it moult & results into the fourth stage of larva.
- Fourth Stage of larva leaves its temporary home in lung alveoli & through trachea reaches the pharynx, from where it is caught up and then swallowed for the second time into gut.

- In intestine it moults & last time it become an adult.
- adult attains sexual maturity with 8-10 weeks.
- The average life-span of Ascaris in human host is about 9-12 months.

- ~~Some~~
- After maturity they continue their life cycle.
- Sometimes larva of Ascaris does not follow its usual migration path & reaches brain or spinal cord or any such organ. Larva is not able to survive in these organs and a calcareous cyst is formed around it.

Ascariasis

Infection -

Disease caused by Ascaris is commonly called Ascariasis. Man get infection by consuming food and water contaminated with infective eggs. Infection of Ascaris is greater in children than in adults.

Pathogenesis

- Larvae often prove more injurious than adult worms by causing haemorrhages.
- They bore through intestinal epithelium and enter general circulation, which may land them in some vital organ like kidneys, spinal cord, brain or muscles where they may cause serious injuries.
- Haemorrhagic condition develop in lungs.
- Inflammation of alveolar tissue followed by oedema.

- In severe infection, they may cause acute pneumonia.
- Frequently infection is immediately followed by increase in temperature, anaemia, leucocytosis and esosinophilia.

- Adults usually cause enteritis & through their migration into vermiform appendix, gall bladder and common bile duct, may cause inflammation of these structures.

- worm produce toxins which may cause irritation of mucous membrane.
- Ascaris larvae may go in the brain & cause headache, coma, nervousness.

- A substance produced by parasite combines with trypsin, this affect the protein digestion which leads to protein deficiency & hence stunted growth especially among children.

Therapy

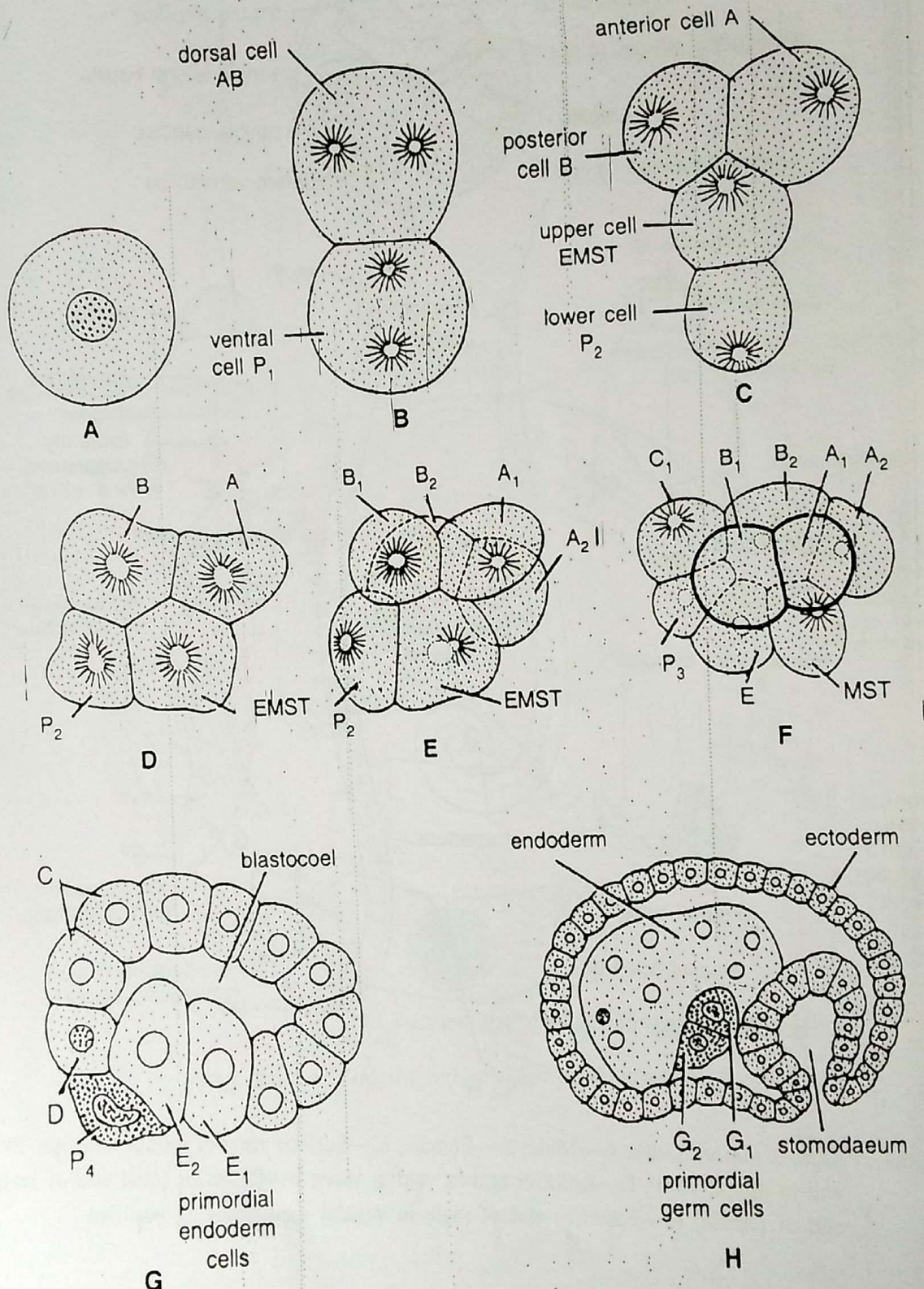
- Infection is may be diagnosed by examining the stool for Ascaris eggs.
- Infection can be treated with a dose of hexylresorcinol crystals in gelatin capsule after about 12 hours fasting.
- Some antihelminth drugs, like oil of chenopodium, are very effective.

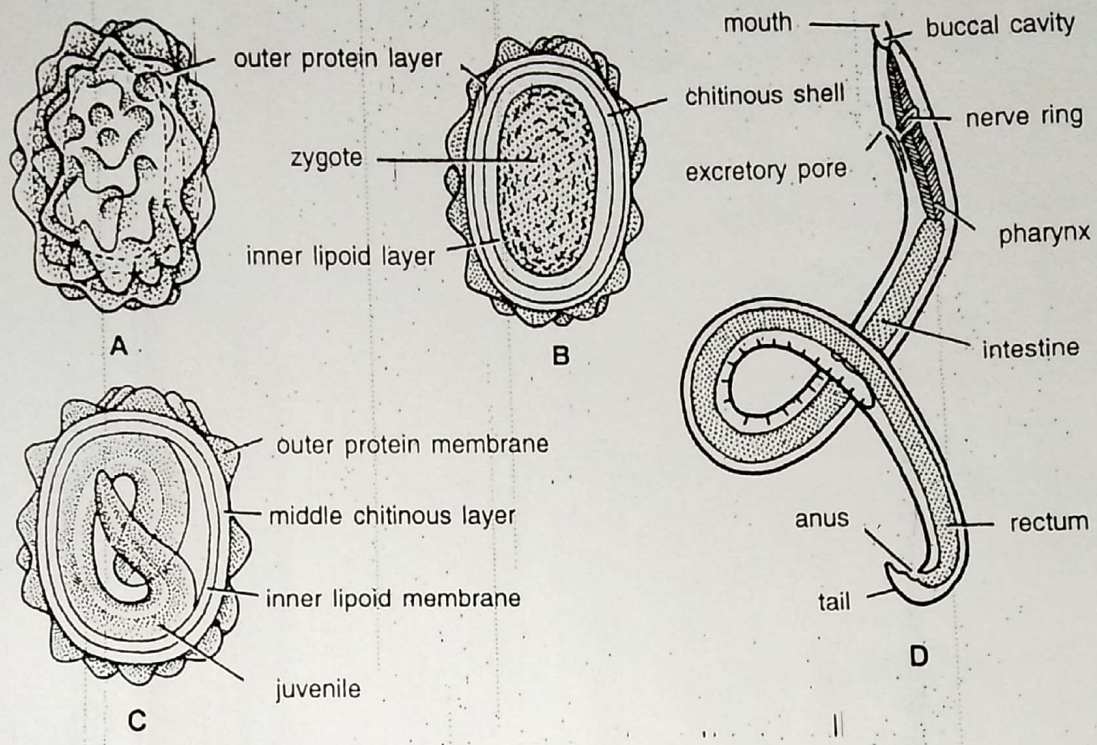
- Mixture of tetrachloroethylene and oil of chenopodium is also very effective.

- Some modern successful anthelminth drugs for Ascariosis are Mebendazole, piprazine and Albendazole.

Preventive measures

- Soil pollution, being the chief source of infection should be prevented.
- People specially children, should be made to observe sanitary habits.
- vegetables grown in polluted soil should be ~~made to observe sanitary habits~~.
- throughly washed and boiled before consumptions.
- Finger nails should be regularly cut to avoid accumulation of egg below them & hands should be properly soap-washed before eating.





ig. 30.18. *Ascaris*. A—An entire mammilated egg; B—T.S. of a mammilated egg; C—Embryonated egg in section; D—Rhabditiform larva.

The life-history of *Ascaris lumbricoides* can be depicted in a cyclic way as follows: