

Ascaris lumbricoides (CC-1,U7.2)

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Ascaris lumbricoides is one of the most familiar endoparasites of man. It has also been reported from sheep, pigs, cattle etc. It inhabits the small intestine, more frequently of children than of adults, where it is supposed to feed on the semidigested food of the host.

Ascaris is **monogenetic i.e., it requires only one host to complete its life cycle and no intermediate host is required.** Man is the only known definitive host of *Ascaris lumbricoides*.

The various stages in the life cycle are described below:

Stage 1. Copulation and fertilization:

Copulation occurs in the small intestine of host (man) where the adult worm lives.

Stage 2. Eggs in faeces and structure of eggs:

The eggs are laid in the host's intestine which are deposited outside along with faeces of host.

A female *Ascaris* produces roughly about 2,00,000 eggs daily. When the eggs are passed in faeces, their further development is largely dependent on oxygen tension, moisture content and temperature of their environment. The fertilized eggs are round or oval in shape. They usually measure about 52-84 μm by 45-67 μm . The egg contains a very large conspicuous, unsegmented ovum. There is a clear crescentic area at each pole of the zygote.

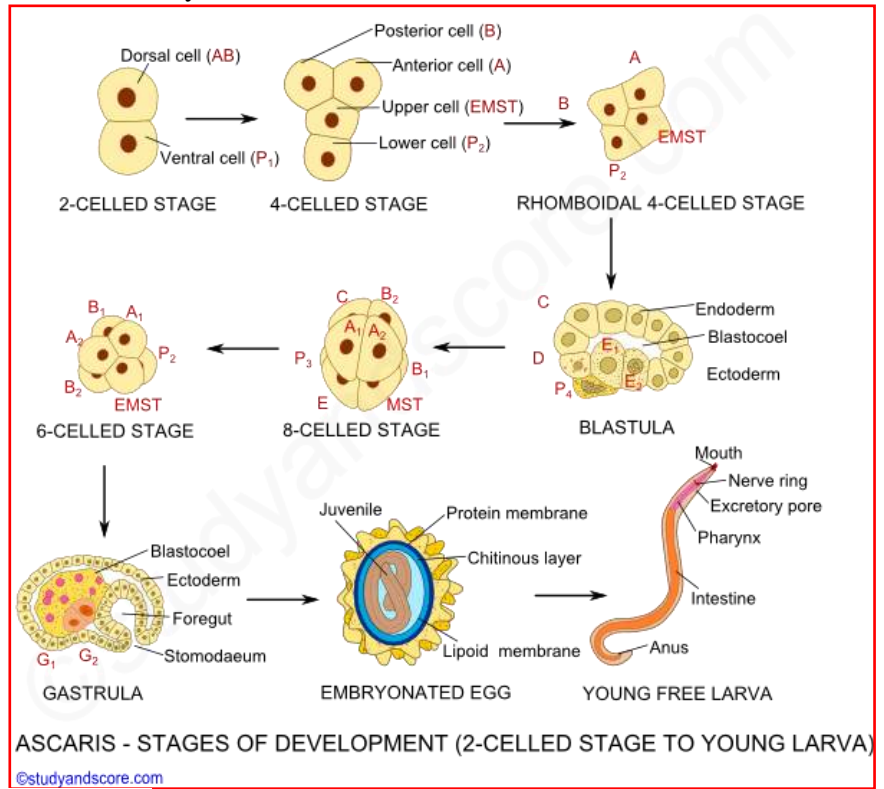
Stage 3. Cleavage (Segmentation of fertilised egg) and early development:

Cleavage of fertilised egg is of **spiral and determinate** type. The **first division** is **transverse** which results in a **dorsal cell** and a **ventral cell**. The **dorsal cell** divides **vertically** into an **anterior** and a **posterior** cell, while the **ventral cell** divides **horizontally** into an **upper** and a **lower** cell. The four celled embryo, thus formed, is **first T-shaped** in appearance.

In the next cleavages, the **4-celled embryo** becomes the **16-celled** embryo and attains the form of a **hollow ball**. It is termed as blastula containing the blastocoel. The blastula undergoes the process of invagination and becomes the gastrula. The juvenile is formed within 10-14 days from the onset of cleavage. It has an alimentary canal, a nerve-ring and a larval excretory system.

For its close resemblance with *Rhabditis* (a nematode found in the soil and human faeces), the juvenile is also termed as *Rhabditiform* larva. This larva of the first stage is **not infective**. In another week's time it undergoes moulting within the egg-shell and becomes the **second stage of Rhabditoid which is capable of infecting the host**. Under suitable conditions of moisture, oxygen and temperature, the

infective eggs are known to remain viable for about six years.



Stage 4. Infection of new host (man):

Man acquires infection when the egg containing Rhabditoid larva is swallowed by the host along with raw vegetables, improperly cooked vegetables or with the drinking water.

Stage 5. Migration through the lungs:

In the small intestine by the action of host's digestive juice the egg-shells dissolve and the juveniles hatch out. It performs active thrashing movements and bores through the intestinal epithelium to enter in the hepatic circulation which carries it to the liver. They remain in the liver for a few days and develop to the early third stage larva.

From the liver it finally reaches the heart through the post caval vein. Larvae are then carried to the lungs via pulmonary arteries. The larva generally remains in the lung for few days and gradually increases in size. Then it ruptures out of blood capillary and finally bores its way into the lung alveolus.

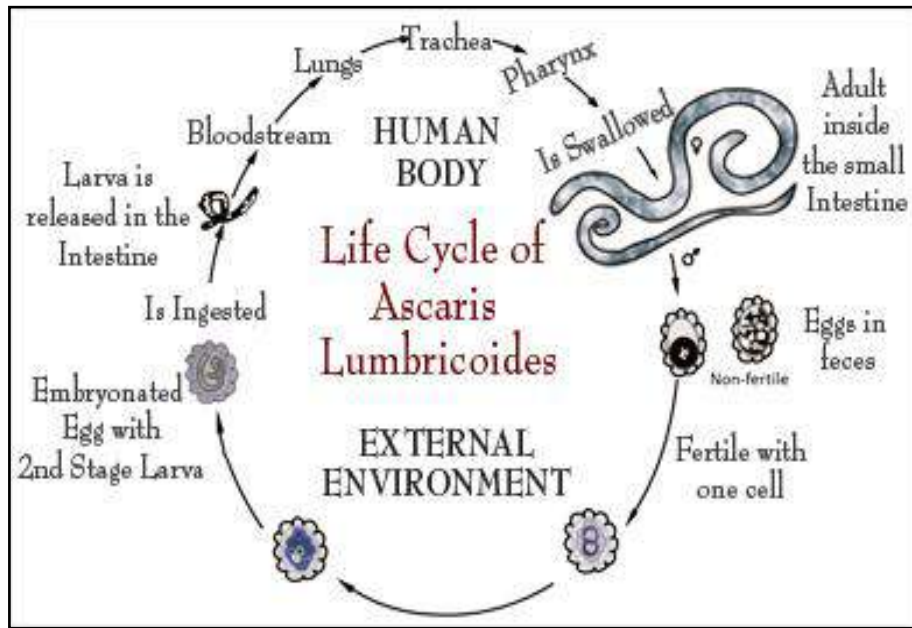
Stage 6. Re-entry into the stomach and the small intestine:

After about six days stay there, the larva moults there for the second time. Then they pass through the trachea with cough and when the cough is swallowed, pass to the oesophagus, stomach and finally to the intestine. The larva here undergoes moulting for two times and becomes adult. The period of migration from the time of infection to that of reaching the intestine is said to be about 10 days.

Stage 7. Sexual maturity and egg liberation:

The larvae on reaching their habitat grow into adult worms and become sexually matured in about 6-10 week's-time. The gravid female begins to discharge eggs in the stool of host (man) within about two months from the time of infection. The cycle of *Ascaris lumbricoides* is again repeated.

Within the intestine, the **larvae begin the third moult on the ninth day** and are in the fourth stage by the tenth day. **So in the life cycle of *A. lumbricoides* there are four moultings or ecdysis—one outside, while within the egg shell, one in the lung and two in the intestine.**



Both larvae and adults of *Ascaris lumbricoides* can cause disease in human beings. The disease is commonly called **Ascariasis**. The disease is generally asymptomatic during low infections. However, if the infection is severe, the host shows various pathological symptoms.

Pathogenicity:

Pathogenicity caused by migrating larvae

Migrating larvae in the human host can result in following pathogenic symptoms:

Intestine: During penetration through mucosal lining of intestine, larvae cause mechanical irritation, internal bleeding, fever and anaemia.

Liver: The presence of worms in liver results in the enlargement.

Lungs: When the larvae migrate to the lungs, they cause pneumonitis, also known as *Loeffler's syndrome*. It results in bronchial irritation, coughing and wheezing. The syndrome can appear even after four days to two weeks after infection. Some patients may also develop asthma, and the asthma attacks can persist until worms are removed.

General symptoms: These include fever, urticaria, malaise, nausea, vomiting, diarrhea, central nervous system disorders, and colic pain. Nutritional deficiency may develop that can lead to abnormal development in infected children.

Pathogenicity caused by adults

Adult worms present in the intestine cause constant mechanical irritation. The toxins released by worms result in -

- fever, abdominal cramps, nausea and vomiting
- indigestion, loss of appetite and protruding abdomen
- gastric ulcers, diarrhea, nervousness and convulsions

eosinophilia and severe anaemia

- poor physical and mental development

Sometimes when a large number of worms are present in the intestine, they entangle in a mass and block the intestinal lumen.

Prevention & control

The best way to prevent ascariasis is to always:

- Avoid ingesting soil that may be contaminated with human feces, including where human fecal matter ("night soil") or wastewater is used to fertilize crops.
- Washing of hands with soap and warm water before handling food.
- Teach children the importance of washing hands to prevent infection.
- Wash, peel, or cook all raw vegetables and fruits before eating, particularly those that have been grown in soil that has been fertilized with manure. Transmission of infection to others can be prevented by
- Not defecating outdoors.

- Effective sewage disposal systems.

Treatment

Anthelmintic medications (drugs that rid the body of parasitic worms), such as **albendazole and mebendazole**, are the drugs of choice for treatment of *Ascaris* infections. Infections are generally treated for 1-3 days. The drugs are effective and appear to have few side effects.

External Features of Sexual Dimorphism

| | Male | | Female |
|----|---|----|--|
| 1. | Body smaller, 15-30 cms. long and 3-5 mms. Wide. | 1. | Body larger, 20-40 cms, long and 6-8 mm. wide. |
| 2. | Tail end curved ventral wards. | 2. | Tail end straight. |
| 3. | Anus and genital pore common i.e., a cloacal aperture is present. | 3. | Anus and genital pore-separate. Genital pore midventral at about 1/3rd. body length behind anterior end. |
| 4. | A pair of needle-like penial setae in cloaca. | 4. | No penial setae. |
| 5. | Preanal and postanal papillae present to help in copulation. | 5. | No such papillae. |

