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COURSE → B.Sc. (P) Life Sciences

ROLL NO. → 22/23098

SUBJECT → DSE (Zoology) - Parasitology

TOPIC → 'Adaptations In Parasites'

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SUBMITTED TO → Dr. Manish Kumar Sachdeva Sir

Adaptations in Parasites

Parasites → A parasite is an organism which lives in or on another organism (called host) and benefits by deriving shelter and nutrients from them.

→ The parasitism is a type of negative ecological/biological interaction in nature where one organism gets benefited (the parasite) and the other is harmed (the host).

Adaptation → Any feature of an organism or its part which enables it to exist under conditions of its habitat is called adaptation.

→ The adaptations are mainly to withstand the adverse conditions of the environment and to use the maximum benefit of the environment.

Parasites show three level of adaptations :-

1. Structural adaptations (Morphological and anatomical adaptations)
2. Physiological adaptations
3. Reproductive adaptations

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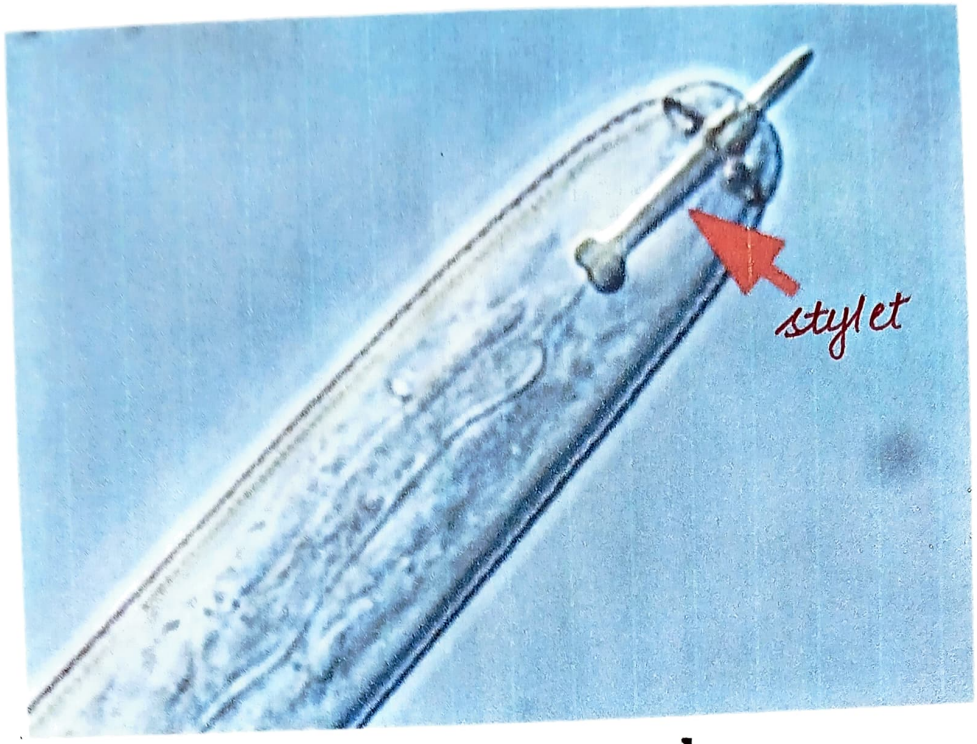
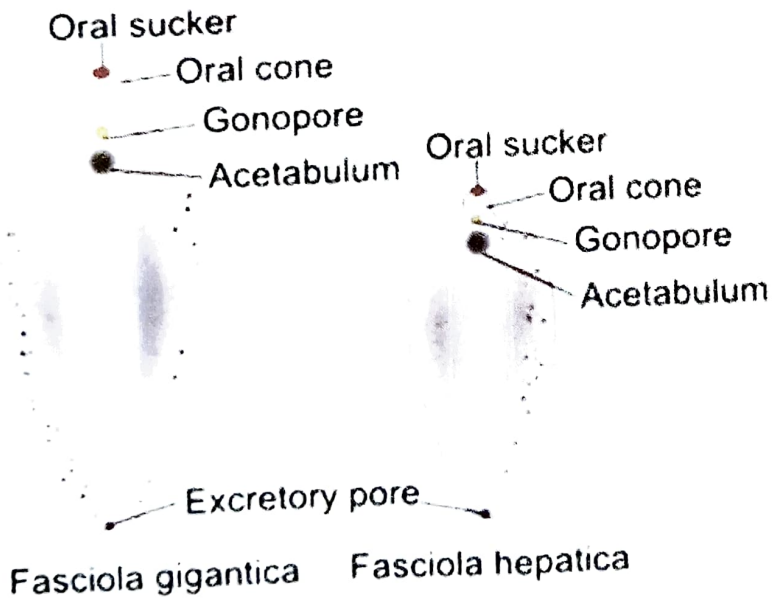
1. Morphological and Anatomical Adaptations.

1. Feeding organs are usually absent in endoparasites.
2. Fluid feeding insects such as aphids have highly specialised mouth parts for the easy absorption of cell sap from the host.
3. The presence of well developed piercing device in some parasites enables them to invade into the host tissue
   Example → the stylet in nematodes.
4. Since endoparasites show restricted movements, the locomotory organs are generally absent or highly reduced in them.
   Example → gut parasites such as Fasciola and Taenia
5. The presence of attachment organs such as rostellum, hooks or suckers for the securely connecting to the organs of the host as in Fasciola and Taenia.
6. The outer covering of the endoparasite is resistant to the enzymatic digestion of the host.
   Example → Fasciola
7. Sensory organs are highly reduced in internal parasites since the environmental conditions of endoparasites are relatively constant.

The presence of well developed piercing device (stylet) in some Nematodes which enables them to invade into host tissue.



Stylet of Nematode



LIVER FLUKES-EXTERNAL STRUCTURE

The presence of attachment organs such as suckers in Fasciola for securely connecting to the organs of the hosts.

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8. The nervous system is highly reduced in most of the parasites.

9. Parasites usually have the reduced body size to occupy the niche in the internal or external surface of the host.

10. Most of the internal parasites are dorsi-ventrally flattened, which help the easy attachment to the host surface without any friction.

11. Some endoparasites such as ascaris have highly muscular pharynx for the easy absorption of food materials from the host.

12. Development of haustoria in some parasitic plants for the absorption of nutrients from the host.
Example → Cuscuta.

13. The haustoria in partial plant parasites (such as Loranthus) are attached to the xylem of the host to absorb minerals and water from them.

14. The haustoria in complete plant parasites (such as Cuscuta) are attached to the phloem of the host to absorb the prepared food material from them.

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2. Physiological Adaptations.

1. Parasites produce hydrolyzing enzymes to digest the host the tissue

Example → Fungi produce a variety of hydrolyzing enzymes such as cutinase, cellulose, hemicellulose and pectinase to digest the cell wall of the host plant.

2. These hydrolyzing enzymes are exoenzymes produced in the external surroundings of the parasite.

3. Blood feeding parasites produce anticoagulant to prevent the clotting of blood in the gut of parasites.

Example → Hirudinaria

4. Internal parasites have high chemosensitivity to find the best location in the host.

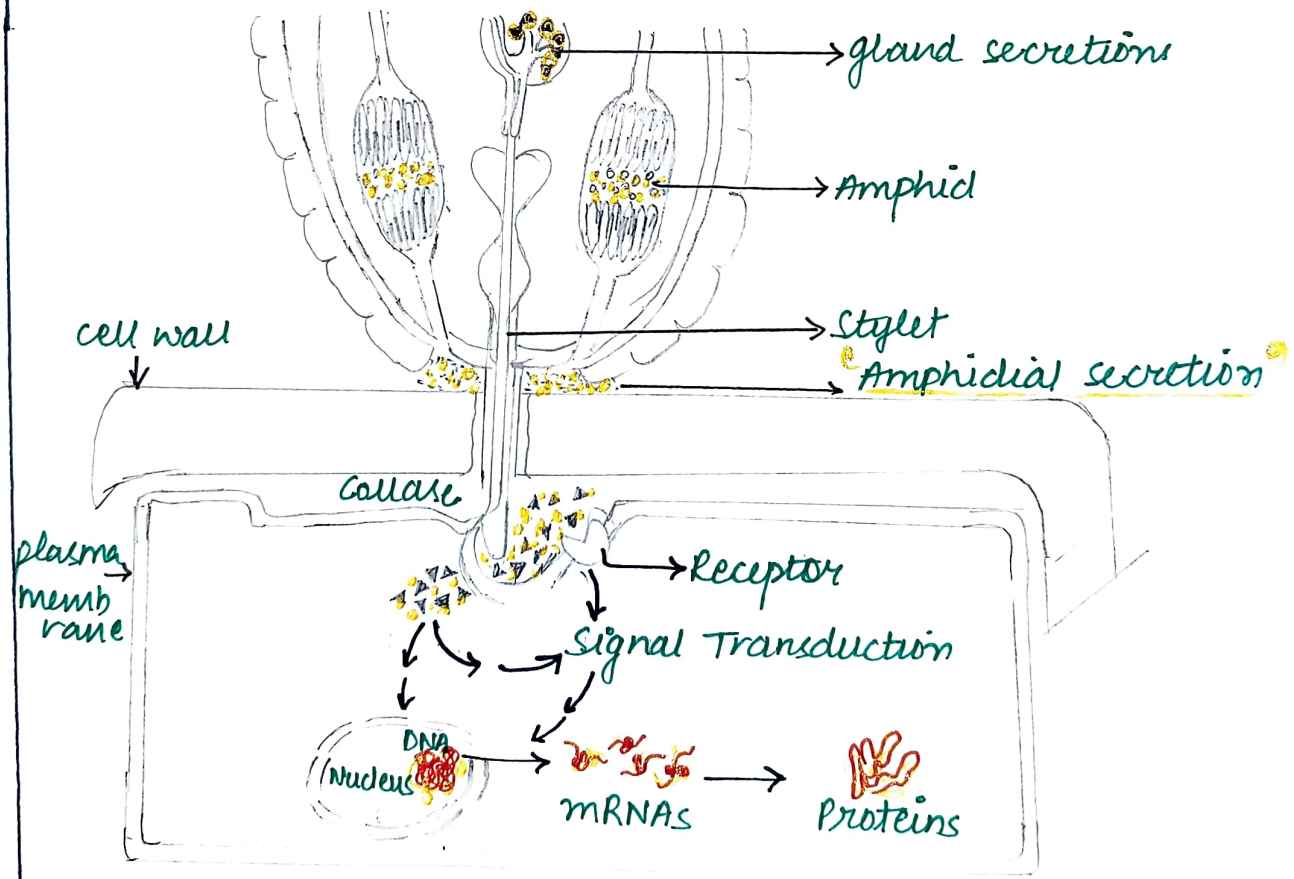
5. Internal parasites produce digestive enzymes for the penetration of host tissues or organs.

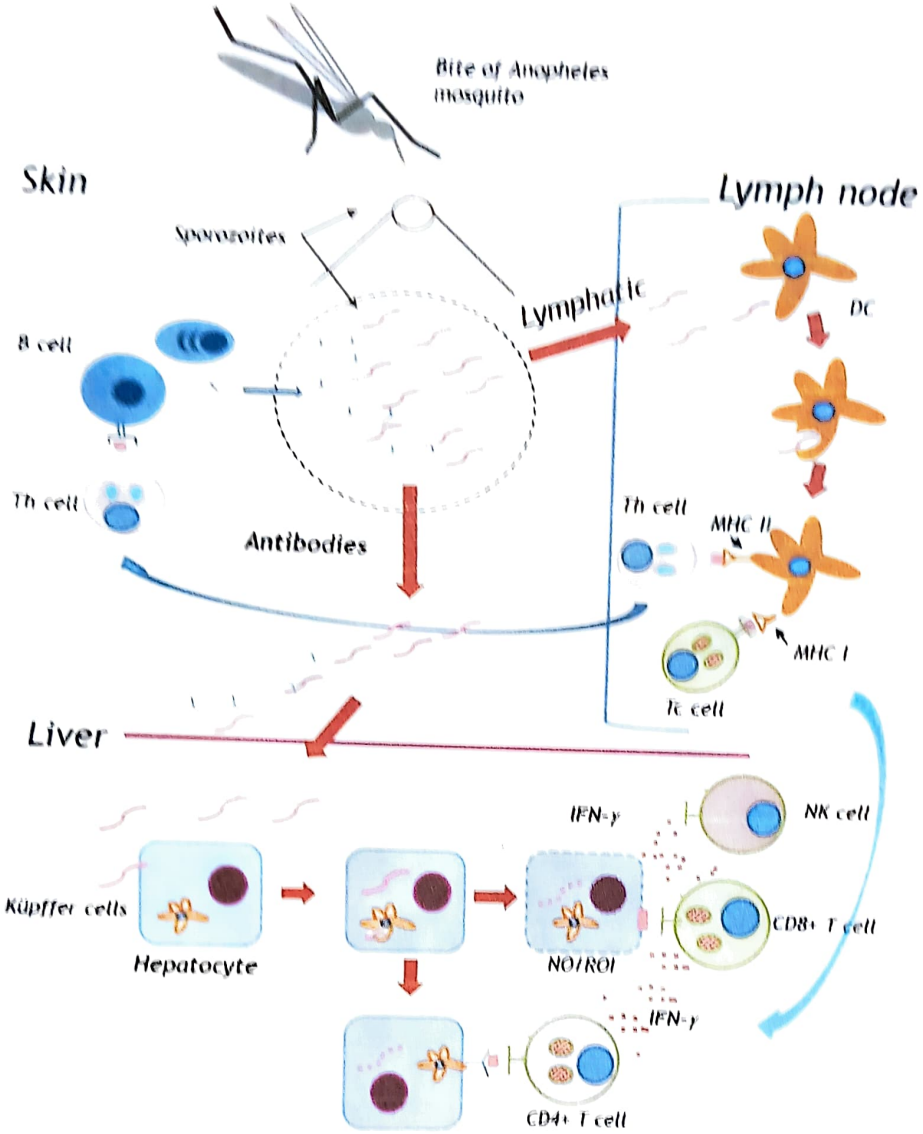
6. Internal parasites can respire anaerobically in the absence of oxygen or in anaerobic condition.

7. There is a progressive tendency towards the reduction of the content of gut in some endoparasites since; many internal parasites have the capacity to absorb nutrients through the body surface.

Hirudinaria (Blood Leech)

Blood feeding parasites produce anticoagulant to prevent the clotting of blood in gut of parasites.





→ Different strategies by which parasites escape from the immunological reactions of host :-

- absorption of host antigen
- antigenic variation
- occupation of immunologically privileged sites
- disruption of the host immune response
- molecular mimicry of surface antigen

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8. Those internal parasites which don't absorb the nutrients through body surface will develop thick cuticle around the body protect from the host enzymes.

9. All parasites especially endoparasites have high resistance to toxins or metabolites of the host origin.

10. Internal parasites have the ability to escape from the immunological reactions of the host.

11. Parasites generally attach host proteins to its external surface to escape from the host immunological responses.

12. Some parasites such as HIV and Plasmodium often change their antigenic components to escape from the immunological reactions of the host.

13. Strategies by which parasites escape from the immunological reactions of the host are: absorption of host antigen, antigenic variation, occupation of immunologically privileged sites, disruption of the host's immune response, molecular mimicry and lose or making of surface antigens.

14. Endoparasites produce some anti-enzyme compounds which will neutralise or inactivate the digestive enzymes of the host.

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3. Reproductive Adaptations

1. Some parasites are hermaphrodites (bisexual). This allow them to self-fertilize in the absence of the opposite sex in the internal conditions.

2. The fecundity rate of parasites is very high since there is only a remote chance to find the correct host by the progenies.

3. Most of the protozoan parasites produce a large number of reproductive bodies such as egg or sperm or cysts than their free-living relatives.

Example 1. Taenia solium lays about 35,000 eggs/day.
2. Fasciola hepatica lays about 10,000 eggs/day.
3. Ascaris lumbricoides lays about 2,00,000 eggs/day.

4. Reproductive bodies are tough and resistant when they are external to the host.

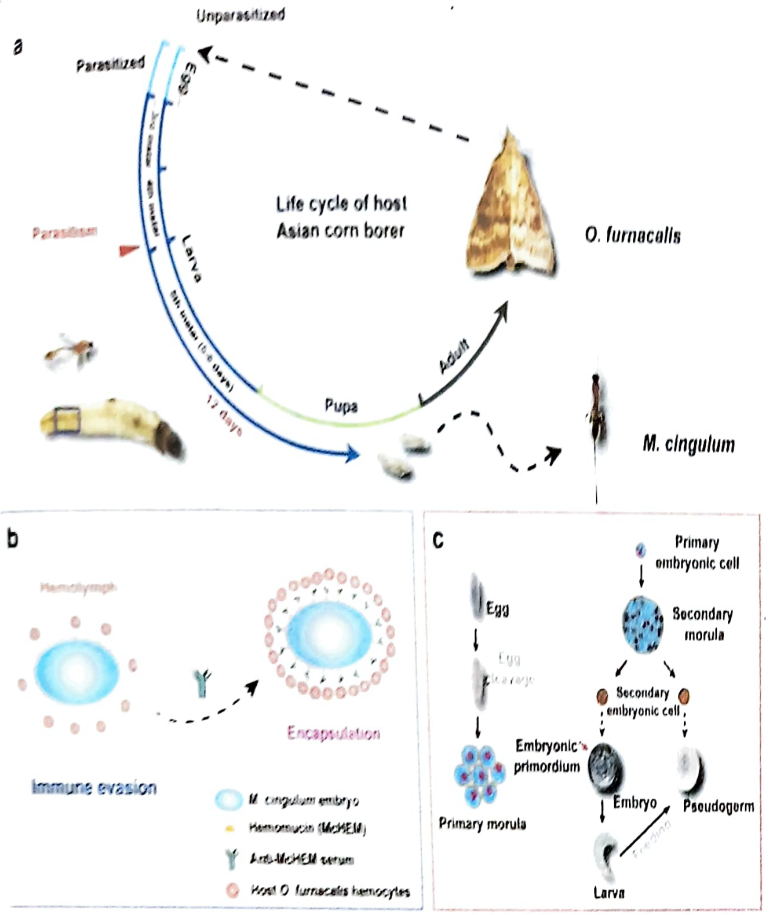
5. The reproductive particles that secrete out of the host body are protected with very thick coat to prevent dessication as in cysts.

6. Some parasites have highly complicated and specialised reproductive cycle.

Example → Life cycle of Malarial parasite Plasmodium

7. Most of the endoparasites show one or more larval stages with more multiplication capacity (due to polyembryony) to increase the number of progenies.

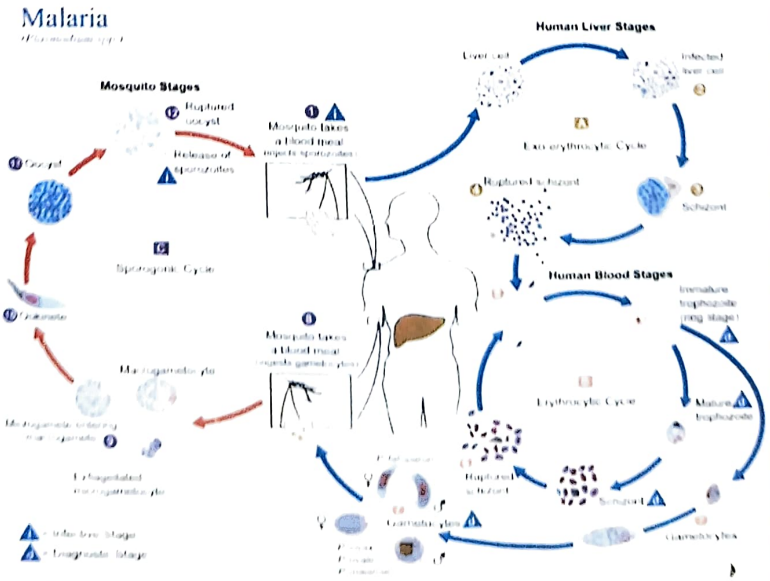
Example → Nematodes



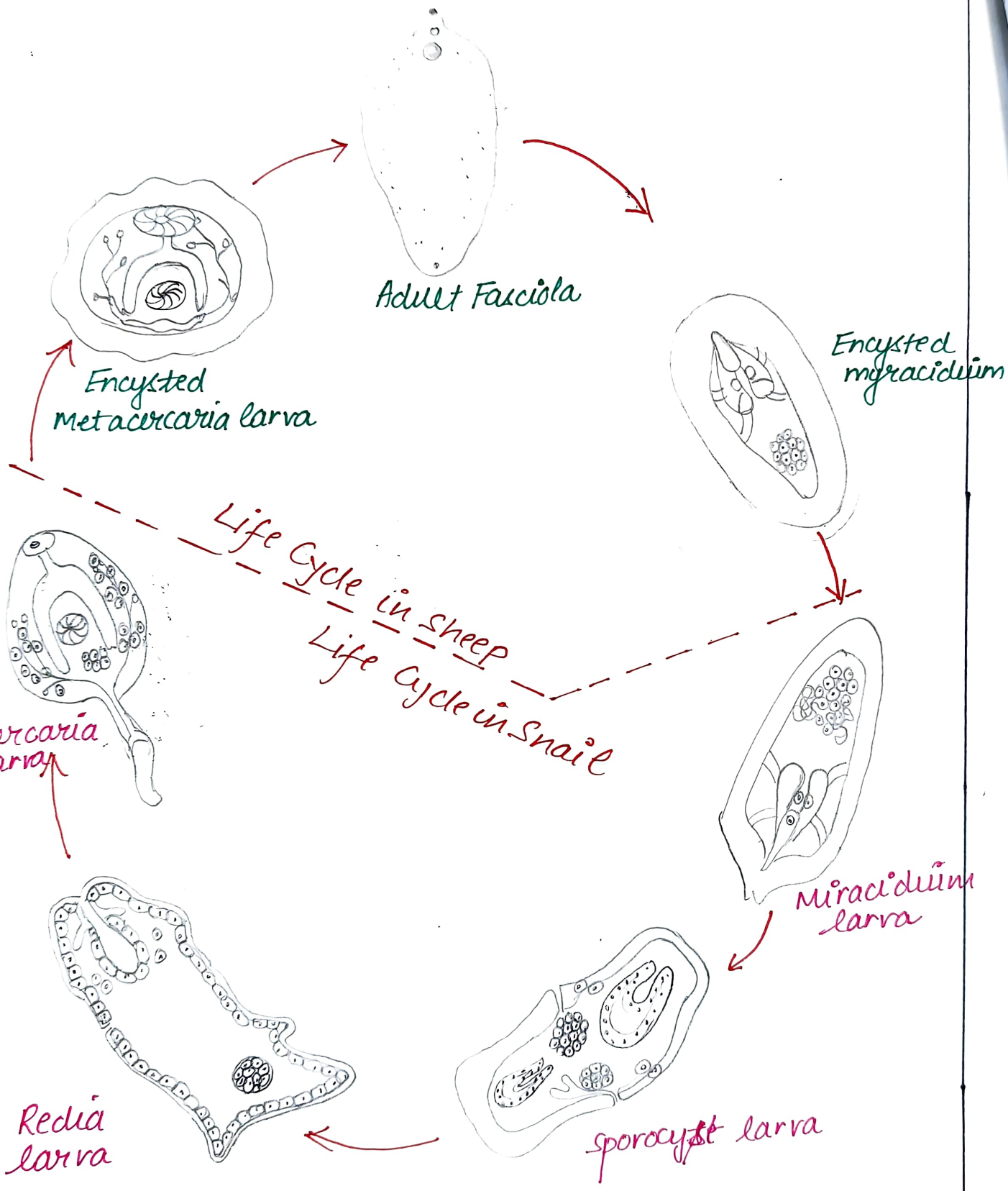
Endoparasites or ectoparasites show one or more larval stages with more multiplication capacity (due to polyembryony) to increase the number of progenesis.

Parasites do have also highly complicated and specialized reproductive cycle.

Life cycle of malarial parasite "Plasmodium"



Fasciola hepatica with different larval stages in its complete Life cycle



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Hermaphrodism

→ This is a form of sexual reproduction. Some parasites don't have separated sexes. Trematode/cestode has one or more (two) sets of reproductive organs. Each cestode (proglottid) is hermaphrodite with one or two sets of reproductive organs.

Trematodes - Fasciola sp. Both cross and self-fertilization between parasites may occur.

Cestodes - T. saginata one set of genital organs
- D. caninum two sets of genital organs.

Both self and cross-fertilisation between proglottids may occur.

→ To overcome the problem of reaching the mate in some nematodes, male and female worms are permanently in copulation forming a Y shape (S. trachea in trachia).

→ Male carry the female parasite in the gynaecophoric canal of its inside the body (Schistosoma in blood vessels).

→ There is asexually reproduction in larval stages of some parasite (called polyembryony) occurs in a few trematodes and cestodes. In addition to the production of enormous numbers of eggs, there will be multiplication of larval stages resulting in the production of several infective forms.

Example - Fasciola sp. (trematode) include 5 larval stage (miracidium, sporocyst, redia, cercaria and metacercaria).

11/04/24

Include only Parasite adaptations of animals not of plants.

09/10

Vaishnavi

Teacher's Sign .....