

**DEFINITION OF PARASITE, TYPES OF
PARASITES, TYPES OF HOSTS, PARASITIC
ADAPTATION, HOST SPECIFICITY IN
RELATION TO SPECIES, BREED, AGE, SEX
OF HOST AND LOCATION**

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Definition of Parasite

Parasites are the organisms, which lives at the metabolic cost on other the organisms., e.g., *Fasciola gigantica* is a trematode parasite of ruminants, *Taenia solium* is a tapeworm parasite of human being, *Ascaris suum* is a nematode parasite of pig, *Babesia bigemina* is a haemoprotozoan parasite (parasite that lives in blood) of cattle, *Boophilus microplus* is an arthropod parasite of cattle.

Types of Parasites

Parasites can be classified into different types based on duration, habitat, host specificity, degree of parasitism, pathogenicity, type of host required, development in the host, size of parasite, transmission pattern, invasion of the host tissue, and other aspects.

A. Depending upon the duration on the host:

a) Temporary parasite

Parasites which visit the host time to time but do not remain with the host all the time. e.g. flies(*Musca domestica*, *Musca conducens*, *Stomoxys calcitrans*), mosquitoes(*Anopheles*, *Culex*) etc.

b) Permanent parasite

Parasites which remain in or on the host all the time. and do not leave the host at any time e.g. lice (*Haematopinus suis*, *Trichodectes canis* etc.), helminth parasites (*Fasciola gigantica*, *Taenia solium*, *Ascaris suum* etc.).

c) Periodic (sporadic) parasite

Parasites which make short visits to their hosts, e.g., mosquitoes (*Anopheles*, *Culex* etc.). In this example, mosquito may be a temporary as well as a

periodic parasite also.

B. Depending upon the habitat of parasite:

a) Ectoparasite (external) parasite

Parasites which are found on the external surface of the body of the host may be attached to skin, hairs and feather etc., e.g., flea, lice, ticks.

b) Endoparasite (internal) parasite

Sometimes also known as endozoa, these parasites are found inside the body of the host, which may be gastrointestinal tract, body cavity, lungs, liver, pancreas, kidney etc. Such parasites live a completely parasitic life in its host. There are again four different categories of internal parasites :-

i) Intracellular parasite

These types of parasites are found inside the cells of the host, e.g., *Babesia bigemina*, *Theileria annulata* found inside the red blood cells.

ii) Intercellular parasite

These types of parasites are found in between the cells or in the cavities or lumens of different organs of the host e.g., *Trypanosoma* (Fig. 1), *Fasciola* , *Toxocara* etc.

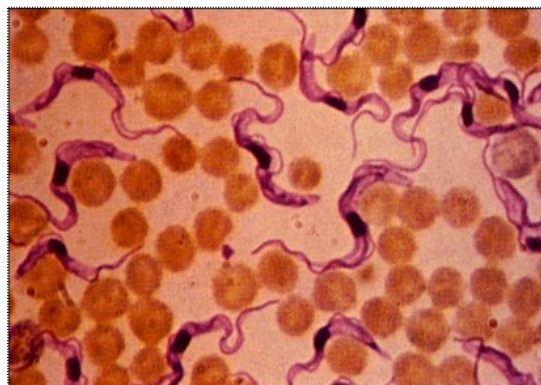


Fig. 1. Showing intercellular parasite, Trypanosomes in a blood smear

iii) Erratic or aberrant parasite

Endoparasites found in organs which are not its normal habitat in the host , e.g, *Fasciola* in lungs. The normal habitat of *Fasciola* is the liver of the host. If the parasite erratically infects other organ, than this particular parasite is known as erratic or aberrant parasite

iv) Incidental parasite

Endoparasite in a host which generally is not found in that host, e.g, *Ascaris lumbricoides* in sheep. *Ascaris lumbricoides* is a parasite of human being.

C. Depending upon host specificity :

a) Host specific parasite

Parasites whose host range is confined or limited to one species of the host or closely related species of the host. , e.g, *Plasmodium vivax* is specific to human being , *Taenia solium* is specific to human being.

b) Non-host specific parasite

Parasites whose host range is not confined to one species of host or closely related species, rather show a large host range and can develop in a large number of unrelated hosts. *Toxoplasma gondii* , *Fasciola hepatica* etc.

D. Depending upon degree of parasitism:

a) Facultative parasite

Parasite which absolutely do not depend upon a parasitic life, but

retain a power of leading a free living life, e.g., *Toxoplasma gondii* , maggots of flies .

b)Obligatory parasite

Parasites which have adopted a completely parasitic life e.g., Cestodes and metacestode (Fig. 2) or larval stages (*Echinococcus granulosus*, *Raillietina tetragona*, *Moniezia expansa* etc.), Filarid worms (*Dirofilaria immitis*, *Stephanofilaria assamensis* etc.)



Fig. 2. Computerized tomography (CT) scan of a human spleen(right) showing a hydatid cyst of *Echinococcus granulosus* with brood capsules inside

E. Depending upon pathogenicity of the parasite:

a) Pathogenic parasite :

Parasites which have the potential to cause much harm, damage of tissue, and produce clinical diseases in host, e.g., *Haemonchus contortus*, *Trichostrongylus*, *Trichuris* sps. (Fig. 3) , *Ancylostoma caninum* (Fig. 4) etc.

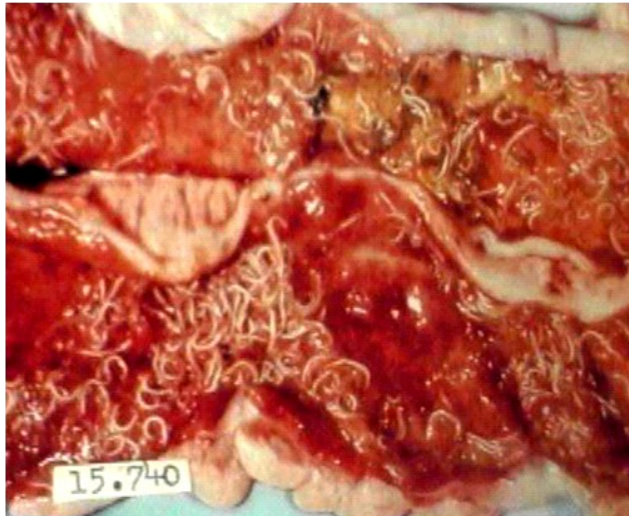


Fig. 3. *Trichuris* sps. in the caecum of dog.



Fig. 4. Lesions in the small intestine of dog due to *Ancylostoma caninum* infection .

b) Non-pathogenic parasite

Parasites which do not cause much harm, damage of tissue, and produce clinical disease in host, e.g., *Entamoeba coli*.

F. Depending upon the type of host in the life cycle of parasite:-

a) Monoxenous parasite

Monoxenous parasites live on only one type of host during the course of their normal life cycle, e.g., amoeba (*Giardia intestinalis*), hook worms (*Ancylostoma caninum*, *Bunostomum* sps. etc.), coccidia (*Eimeria tenella*, *Isospora canis* etc.) etc

b) Heteroxenous parasite

Heteroxenous parasites live in two or more types of hosts during the course of their life cycle, e.g., tape worms (*Taenia solium*, *Taenia saginata*, *Echinococcus granulosus* etc.), trematodes (*Fasciola gigantica*, *Fasciola hepatica* etc.), malarial parasites (*Plasmodium vivax*, *Plasmodium falciparum* etc.).

c) Stenoxenous parasite

These parasites have narrow host range, e.g., coccidia, malarial parasites etc.

d) Euryxenous parasite

These parasites have a wide host range, e.g., trypanosomes, *Dracunculus* sps. etc.

G. Depending upon the development of parasite in the host:

a) Proliferous parasite

The parasite enters the host as a single unit, then it grows, multiplies and produces a number of daughter individuals. These daughter forms further multiplies and repeats the process, e.g., *Theileria*, *Babesia* etc.

b) Non-proliferous parasite

In this case, the parasite enters the host as one individual and grows.

The daughter individuals do not multiply in the host in whom they are born. They must get into another host before they can multiply. Thus the host infected with one parasite will never have more than one in his body , e.g., helminth parasites (*Fasciola gigantica*, *Ascaris suum* , *Taenia solium* etc.).

H. Depending upon the size of parasite :

a) Macroparasite

Parasites which can be seen by naked eye are macroparasites.

b) Microparasite

Parasites which cannot be seen by naked eye, but can be revealed through microscope are microparasites.

I. Depending upon the transmission to man and animals:

a) Zoonotic parasite

Zoonotic parasites are transmissible from animals to man and *vice-versa*, e.g., *Taenia solium*, *Fasciolopsis buski*, *Echinococcus granulosus* etc.

b) Non-zoonotic parasite

Non-zoonotic parasites are transmissible from one animal to another. They complete their life cycle without involving man, e.g., *Ascaridia*, *Oesophagostomum* sps. etc.

J. Depending upon the invasion of the tissue of the host :

a) Histozoic parasite

Histozoic parasites live within the tissues of the host. e.g., coccidian parasite lives within the intestinal mucosa of the animals and birds , *Giardia* sps.(Fig. 5)

etc.

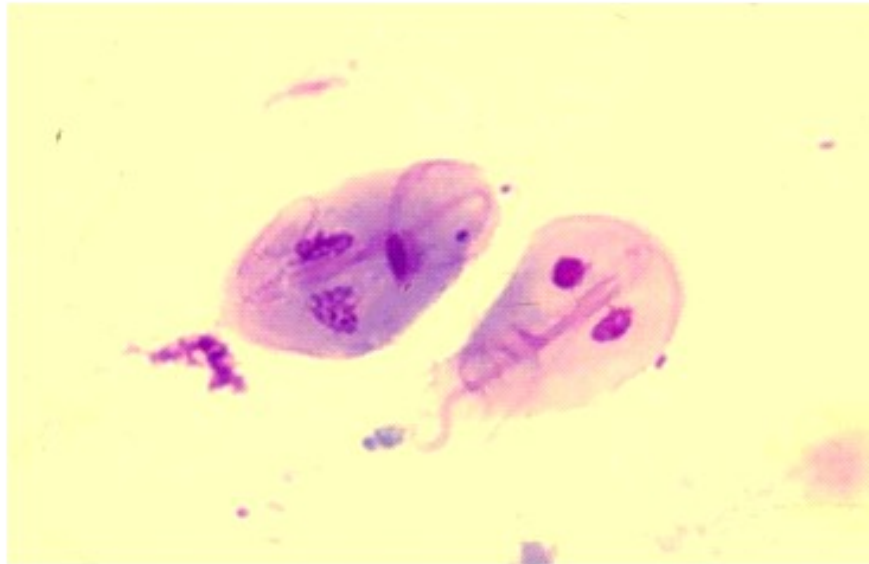


Fig. 5. Histo zoic parasite, *Girardia* sps.

b) Coelozoic parasite

Coelozoic parasites are found in the lumen of the intestine or other hollow organs of the hosts, e.g., *Ascaris suum* in the small intestine of pig.

K. Depending upon laying stages by the parasite:

a) Oviparous parasite

The females lay eggs, e.g., *Ascaris suum*, *Ascaridia galli*, *Ancylostoma caninum* and others

b) Ovo-viviparous parasite

Females lay eggs which contain fully developed larvae to hatch, e.g., *Habronema* species.

c)Viviparous parasite

Eggs are hatched in the uterus of the female and larvae passed out ,
e.g., Filarial worms (*Dirofilaria immitis*)

d)Pupiparous parasite

In these type of parasite, the eggs are hatched, and the larvae develop in the uterus and when passed outside they are ready to pupate, e.g, *Hippobosca capensis* , *Melophagus ovinus* , *Pseudolynchia canariensis* etc.

Hyperparasite :

Parasites which parasitizes over the other parasite, e.g., *Histomonas meleagridis* in the eggs and larvae of *Heterakis galinarum* a nematode parasite of poultry.

Pseudoparasite :

Are the objects or materials, which are mistaken for parasites, e.g., small white thread for *Strongylodes* species.

Host :

Host is an organism or animal which harbors or provides shelter the parasite.

Types of hosts :

a) Definitive host or final host

It is a host in which the adult or sexually matured stage of the parasite is found. For example, cattle, sheep or goat are the definitive host or final host of the parasite *Fasciola giantica*, *Fasciola hepatica* etc.

b) Reservoir host

It is a host in which the disease occurs naturally and does not produce any harm to the host. Reservoir hosts serve as source of infection of the parasite for other definitive or final host in which the parasite produces the disease, e.g., *Balantidium coli* is commonly found in pigs. Pig, in this example, is the reservoir host of *B.coli*.

c) Intermediate host

In the intermediate host the larval stages of the parasite develop. For example, in the species of aquatic snail *Lymnaea acuminata* var. *rufescens*, the larval stage of the trematode parasite *Fasciola gigantica* develops. Hence, *Lymnaea acuminata* var. *rufescens* is the intermediate host of *F.gignatica*. Similarly, for the tapeworm species *Taenia solium*, the intermediate host is domesticated pigs.

Intermediate hosts may be:-

i) First intermediate host

It is the first intermediate host in the life cycle of a particular parasite. For example, water flea or cyclop species *Mesocyclops leuckarti* is the first intermediate host of *Gnathostoma spinigerum* (Fig. 6), a nematode parasite of dog. Similarly, a land snail species *Zebrina detrita* is the first intermediate host of the trematode parasite *Dicrocoelium dendriticum*.

ii) Second intermediate host

It is the second intermediate host in the life cycle of a particular parasite. The second intermediate host is parasitized by the larval stages at a later period in the life cycle, developed in the first intermediate host. These larval stages in the second intermediate hosts further develop and normally reach the infective stage of the parasite. For example, *Opiocephalus punctatus* a fish species is the second intermediate host of *Gnathostoma spinigerum* (Fig. 6). Similarly, ant of the genus *Formica* is the second intermediate host of *Dicrocoelium dendriticum*.

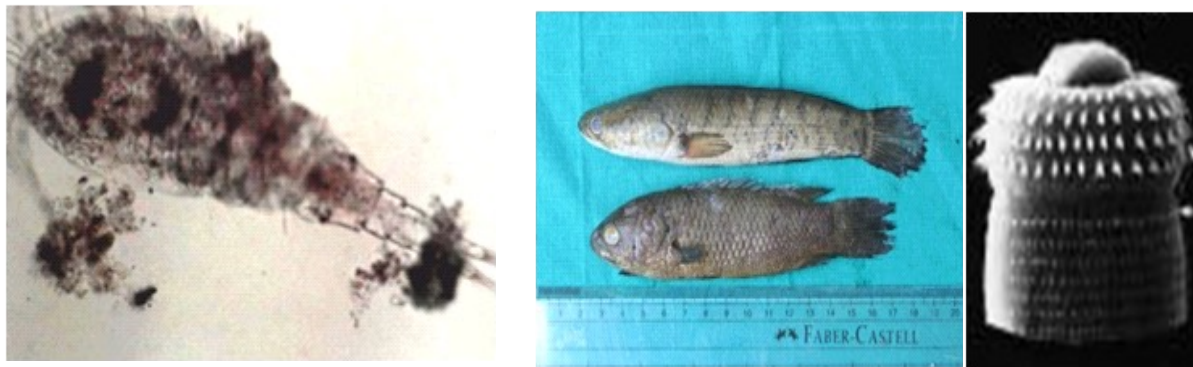


Fig. 6 . Cyclop species *Mesocyclop leuckarti* (left), the first intermediate host; fish species *Opiocephalus punctatus* (middle, top), *Anabas scandens* (middle, below), the second intermediate host of the parasite *Gnasthostoma spinigerum* (right).

d) Transport host

It is a second or third intermediate host in which the larval or immature stage of the parasite does not undergo any development and remain in the same stage. Later on they are voided out from such host. For example, earth worm act as transport host of *Ascaridia galli* of poultry.

e) Paratenic host

It is like the transport host, but in this case the immature stage of the parasite gets encapsulated in the tissues of the host. Hence, they cannot be voided out and remains encysted until the definitive host eats the paratenic host, lizards act paratenic host of *Spirocerca lupi* a nematode parasite of dog.

f) Carrier host or Carrier

Carriers are those hosts which have a light infection with some parasites but are not harmed by it , usually due to immunity resulting from previous exposure , but it serves as a source of infection for susceptible host.

Example : Adult birds rarely suffers from coccidiosis because they have recovered from a clinical or sub-clinical attack and remain as in coccidiasis and continuously release infection to susceptible young birds.

Vector :

Vector means bearer. The vector of a parasite or disease agent is an arthropod , mollusk or other agent which transmits the parasite from one vertebrate host to another it is very much like intermediate host . there are two types of vectors :-

a. Biological vector:

Those vectors in which the parasite develops or multiplies and makes it infective for susceptible host are called biological vector. All intermediate hosts of helminths are biological vectors but all biological vectors are not necessarily intermediate hosts. For example, mosquitoes for malarian parasites, ticks for *Theileria*, *Babesia* , *Anaplasma* etc.

b. Mechanical vector :

Those vectors in which the parasite does not develop or multiply and transmit the parasites in the short period are called mechanical vector , e.g., Tabanid flies for *Trypanosoma evansi* infection.

Host specificity:

Host specificity is defined as the natural adaptability of a species of the parasite to a certain species of or group of hosts. It is seen that the helminths are highly selective in their choice of host, as they are adapted to parasitism in a particular species of hosts or in a single species. If there are more number of hosts they are usually closely related. Very few parasites have the capacity to parasitize many hosts even though they are unrelated to each other. The parasite will not survive on a different

host. For example, the parasites in horses, cattle , dogs or human are most likely to be found in their respective hosts. Moreover, parasites of the intestine , the liver or tissues occur with marked regularity in these locations. This condition is designated as host specificity , organ specificity or tissue specificity as the case may be. The mechanism of host specificity is not fully known and are undoubtedly complex.

Factors affecting host specificity :-

1. Physiology : Some parasites are morphologically indistinguishable found in different hosts but essentially differ physiologically
2. Geographical distribution: Morphologically similar species of the parasite utilize different intermediate host in different areas
3. Compatibility of the parasite to its host : It is an important mechanism which governs the host specificity .In this the host specificity depends on the host response to the invading parasites.
4. Biochemical agents: Certain biochemical agents play important role in determining the host specificity , for example the bile composition of different mammalian hosts varies greatly in respect of bile salts conjugation of bile salts, fatty acids, pigments, and rate of secretions.
5. Some physical factors like pH , temperature and salt concentration may play an important role in determining the host specificity.
6. Immunologic factor.
7. Chemotropic factor
8. Nutrition

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