

Parasitology

Definitions

Parasitology : A term consist of two parts , parasite and logy (science), which means the science that deals with the parasites.

Parasite: A living organism depends in its biological activities on other living organism usually larger than it's and the period between them are long.

Parasitism: A relationship between different living organisms, the first-host- and the second –parasite- which spent a part or entire it's life cycle with the host and from which it obtains food and shelter. The majority of parasitic organisms are harmless to the hosts.

Types of parasites

- 1- Divided depends on the living methods:
 - a- Facultative parasites: this can live in free or parasitic life.
e.g. *Strongyloides*
 - b- Obligate parasites: this must be live in or on the host and without the host they will dead. E.g. *Ascaris*
 - c- Temporary parasites: These are visit and leave in the hosts in different stages for food. E.g. Ticks

- 2- Divided depends on the position of the parasite (in or on) the host.
 - a- External parasites: These are found on the external surfaces of the hosts . e.g. ticks and lice.
 - b- Internal parasites: These are found inside the hosts' bodies and observing in the alimentary tract, lung, liver, tissues and cells. E.g. *Ascaris* and protozoa.

- 3- Divided depends on the period between the parasite and the host.
 - a- Permanent parasites: These are stay with the host throughout all or most it's life. E.g. *Trichinella spiralis*
 - b- Temporary parasites: These are stay with the host in short period which visit the host for food.
e.g. ticks.

Types of hosts

- 1- Final (definitive) host: It is the host in which the sexual reproduction of the parasite will be occurs. E.g. dog act as a final host of *Echinococcus granulosus*.
- 2- Intermediate host: It is the host in which the asexual reproduction of the parasite will be occurs, and this hosts his represent a principal part

in indirect life cycle. e.g. mollusc that in which the larvae of liver flukes are develop.

- 3- Vector host: It's the host that which responsible for translation of the parasite from final host to another final host and there is no growth of parasite in which. E.g. arthropod.

*Note: If the translation is an essential of life cycle of the parasite the vector consider as a biological vector, where as if the translation isn't essential it is consider as a mechanical vector.

- 4- Reservoir host: It is a final host which act as external source or store of infection .e.g. dog act as reservoir host for human leishmaniasis .
- 5- Carrier host: It is the hosts in which the larvae of the parasite will be accumulate.
- 6- Accidental host: It is abnormal host of the parasite but the parasite appears in this host due to ingested of the intermediate host which contains the larval stage of the parasite. E.g. Appear of *Fasciola hepatica* in the dog, cat, and human.
- 7- Major host: It is the hosts in which the parasite was discovered for first time.

The routes of infection

- 1- The normal openings :
 - a- Mouth: throughout ingestion of contaminated food and water with eggs, oocysts or larvae . e.g. ingestion of mature cyst of *Giardia* .
 - b- External openings of reproductive organs: some parasitic infection transport throughout copulation process. e.g. *Trypanosoma equiperdum*.
 - c- Openings of respiratory system and anus: some infections occur through respiratory system and some of these infections occur through the anus opening. E.g. *Enterobius vermicularis*.
- 2- Skin: e.g. *Schistosoma* larvae
- 3- Other routes:
 - a- Placenta: The embryo can be infected throughout the placenta. E.g. *Toxocara canis*
 - b- Ovaries: The ticks ovaries infected with the second generation of *Babesia* (then transport the infection to the animals).

Life cycles:

1- Direct life cycle:

This life cycle need final host only, when the eggs or oocysts excreted they need a period of time for developing and growth and in case of worms' life cycle there are four moults , two of these occur inside the body and the other outside . There for the eggs need special climate like temperature, humidity (more than 95%) and oxygen for growthing .

Under the above conditions the eggs will be hatching to the larva 1 (L1) which then moulting to the (L2) which resemble the (L1) but it is larger. Then the (L2) moults to (L3) (infected phase) which enter to the final host ,and inside the host there are two moults will be occur to produce the (L4) and (L5), the later will give male and female phase and after coupling the new life cycle will be beginning.

2- Indirect life cycle:

Larval phase in this life cycle must be entering to the intermediate host.

Some of the nematodes and most of cestodes and trematodes require indirect life cycle.

The effect of the parasite on the host:

- 1- Consumption of human or animal food. e.g. *Diphyllobothrium latum* effect in the formation of vit. B12 which lead to leathal anemia for human.
- 2- Indirect effect on food converting efficiency, in addition to anorexia (loss of appetite).
- 3- Affect on mucous membrane of intestine which effect on the absorption of the food.
- 4- Some organisms cause mechanical affect on the organs and tissues by distribution of their larvae or by their suckers or spines.
- 5- The chronic infection of the parasite my lead to odema and loss of wool.

Classification:

Kingdom

Phylum

Class

Order

Family

Genus

Species

***Note:** sometimes there are subgroups may be additions like subphylum, subclass, etc.

****Note:** Generally the class end with letter (a), order (ea) and family (ae).

*****Note:** In case of written of the scientific name of the parasite, we must be put line under the genus and species and the genus must be beginning with capital letter whereas the species beginning with small letter.

e.g.:

Kingdom	Protista
Phylum	Apicomplexa
Class	Sporozoa
Subclass	Coccidiasina
Order	Eucoccidiorida
Suborder	Eimeriorina
Family	Sarcocystidae
Subfamily	Toxoplasmatinae
Genus	Toxoplasma
Species	<i>Toxoplasma gondii</i>

******Note:**The names of the parasites are derivative according to :

- 1-Name of the host, e.g. *Babesia bovis*
- 2- Discoverer ,e.g. *Chabercia*
- 3- Geographical place in which the parasite was discovered, e.g. *Leishmania aethiopica*
- 4- Infected organ, e.g. *Faciola hepatica*

The resistance:

- 1- Species resistance: The parasite stops for growth in some life stages when it infect non specific host.
- 2- Age resistance: Some of these parasites infect the old animals and the other infects the young animals.
- 3- Breed resistance: Some animals' breeds are more resistance than the others, e.g. local breeds of cattle are more resistance to the *Thieleria* than the foreign breeds.

*Note: Generally the parasites divided into four phyla:

1- Nematelminthes.

2-Platyhelminthes.

3-Protozoa.

4-Arthropoda.

Protozoa

Definition: A unicellular organism in which various activities of metabolism like locomotion, reproduction, nutrition, etc., are carryout by the organelles of the cell, and it is classified under the kingdom called protista.

Protista: A kingdom lies between plant and animal and divided in to two subkingdom called Eukaryotic and prokaryotic.

Eukaryotic: Organisms with nucleus enclosed in a membrane, like protozoa, algae and fungi.

Prokaryotic: Organisms with diffuse nucleus within the cytoplasm, like bacteria, blue-green algae, rickettsia, etc.

Protozoa= protos(first)+ zoan(animal) .

-Antony Vanhock was the first who discovered the protozoa at 18th century, when diccovered the *Eimeria stiedae* in rabbit, *Giardia lambelia* in human and *Trichomonas* in frog.

Shape of protozoa: The shape of protozoa is differing among spherical, semi-spherical, oval, spindle, pear shape and irregular.

Types of nuclei:

-When we study the typical form of protozoa, the important component in which was the nucleus, and there are several types of nuclei.

1- Vesicular type: Including two types:

A-Type contain endosome (nucleolus, karyosome) and the chromatin fibers lies between the nucleus membrane and nucleolus, this type is found in *Trypanosoma* and parasitic *Entamoeba*.

B- Type without endosome and the chromatin is distributed throughout the nucleus, and this type can be seen in apicomplexa like *Toxoplasma*.

2-**Compact type:** Which found in ciliate and there are two types of this nucleus called macronucleus and micronucleus.

Locomotion:

The protozoa move by several structures including:

- 1- **Flagella(flagellum)** : They are whip like organelles composed of a central axoneme and outer sheath , the axoneme arise from basal body., found in *Trypanosoma* spp.
- 2- **Cilia (cilium)**: They are an eyelash like organelles, like small flagellum in structure. e.g. *Balantidium coli* .
- 3- **Pseudopoda**: Temporary locomotors organelle, it is visible in *Entamoeba*.
- 4- **Gliding**: Visible in *Toxoplasma* and *Sarcocystis*.

Nutrition:

There are three types of nutrition in protozoa:

- 1-**Holophytic nutrition**: Which is a character of many flagellate, the CHO are synthesized by means of chlorophyll which carry in the body.
- 2-**Holozoic nutrition**: Food materials are ingested throughout a temporary or permanent mouth.
- 3-**Saprozoic nutrition**: Nutrition materials and fluids are absorbed throughout the body wall.

Reproduction:

1- **Asexual reproduction:**

A- **Binary fission**: The nucleus is divided in to two nuclei, and then the cytoplasm divided to produce two daughter cells.

B- **Multiple fission**: The nucleus is divided to many nuclei, then the cytoplasm are surrounded these nuclei like a vacuoles (with membrane).

C- **Budding**: Small daughter individual is separate from the side of mother cell, and then grow to full size (the budding may be eternal).

2- **Sexual reproduction:**

A- **Conjugation**: Two individual come together temporary and fused along part of them length and they exchange their nuclear materials, and then they separate from each other to divide by binary fission.

B- Syngamy: Two gametes are fused to form zygote, one of them male called microgamete and the other is female called macrogamete.

C- Excretion:

It is occur throughout the body wall or membrane by means of contractile vacuoles or through cytopage.

D-Encystment:

For protection from external environment.

References:

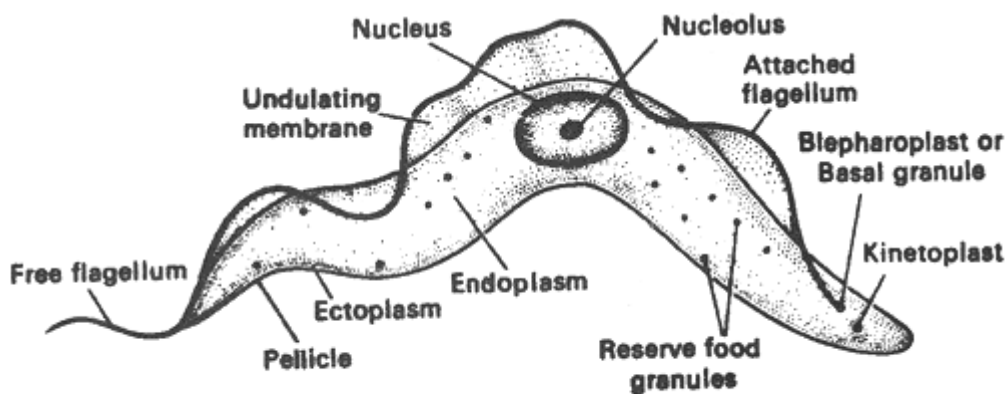
- 1- Soulsby (1981)
- 2- Veterinary parasitology (Urquhart, *et.al.*,1996)
- 3- Clinical Veterinary parasitology.
- 4- Veterinary Parasitology (Taylor, *et.al.*, 2007)

Kingdom: Protista
Subkingdom: Eukaryotic
Phylum: Protozoa
Class: Zoomastigophora
Order: Kinetoplastida
Family: Trypanosomatidae
Genus: 1-*Trypanosoma*
2-*Leishmania*

Family: Trypanosomatidae

Members of this family are leaf-like in shape or rounded, contain a vesicular nucleus, and flagella arise from a structure known as the kinetosome (basal granule). Posterior to the kinetosome is a rod or spherical in shape called the kinetoplast (parabasal body) which contains the DNA. When the flagellum contacts the cell wall, it forms the undulating membrane and continues to give the free part.

Most species in this family are parasites of man and animals and cause serious pathological changes that may lead to the death of the host. Most are transmitted by blood-sucking insects (biologically or mechanically), although sexual transmission can also occur.

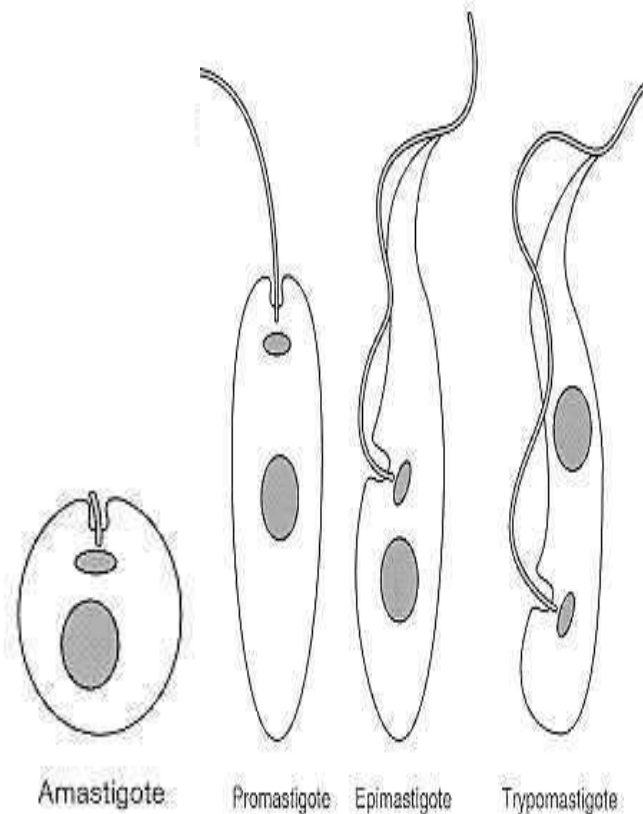


Trypanosoma gambiense

The family developmental stages:

The members of this family are characterized by the developmental stages and there are four developmental stages:

- 1- **Trypomastigote form:** It is spindle in form, have a kinetoplast, undulating membrane and free flagellum, and this form is found in (invertebrate) insects and (vertebrate) final host.
- 2- **Epimastigote form:** spindle in form, the kinetoplast is lies in front of the nucleus, small part of undulating membrane is present in addition to free flagellum, and this form is found in insects and final host.
- 3- **Promastigote form:** Leaf like in shape, the kinetoplast is lies in anterior end, no undulating membrane and there is free flagellum, this form is found in insects and media.
- 4- **Amastigote form:** Round in shape, no undulating membrane, no flagellum, present of kinetoplast, found in final host.



Genus: *Trypanosoma*

Members of this genus cause diseases known as sleeping sickness in man and animals. This parasite is visible in blood, lymph and organs of infected man or animal, and it is mainly transmitted by blood sucking insects.

There are two groups in this genus called salivaria and stercoraria group.

1- Salivaria group: The infected form of this group is transmitted through the saliva of insects, and the infected form called metacyclic form which character by blunt posterior end, kinetoplast is terminal or subterminal and the free flagellum is present or no.

Most of them are pathogenic and transmitted by inoculation, no specific to their hosts and characterized by antigenic variation that which occur through change of parasite form (polymorphism) and there are three forms in this phenomenon:

A- Cylinder form (type): Spindle shape, kinetoplast and undulating membrane are present.

B- Intermediate form: Semi-circle with short free flagellum.

C- Stumpy form: Circle shape without free flagellum.

Species of salivaria group:

Human species:

-*Trypanosoma gambiense*

-*T. rhodesiense*

Animals' species:

-*T. brucei*

-*T. congulense*

-*T. vivax*

These above species are found in Africa and not found in Iraq, and they transmitted by *Tse tse* fly.

-*T. evansi* (infect camels and equines, found in Iraq)

-*T. equiperdum* (infect equines, found in Iraq)

2-Stercoraria group: This group's parasites are transmitted through the feces of the insect to the intact host. For example *T. cruzi* which cause the Shagas' disease in South America which infect human and dog and transmitted by bugs called kissing bugs which put the feces on the mouth's corner of human during the sleeping and then the parasite will be penetrate the mucous membrane of the mouth and reach to the blood .

The disease may cause death due to present of the parasite in the heart cells and cause heart failure.

Species of stercoraria group:

-*T. cruzi* / infect man and dogs / transmitted by bugs.

-*T. lewisi* / infect rats / transmitted by fleas.

-*T. melophagium* / infect sheep / not pathogenic / transmitted by insects. -*T. theileri* / infect cow / not pathogenic / found in Iraq.

-*T. evansi*

Cause Surra disease that is an acute disease in horses and chronic in camels (three years before death).

Host: Camel, horse, donkey, mule, cattle, sheep,, goat, dog, and various wild animals.

Vector: Hematophagous insects like *Tabanus* and *Stomoxys*, through mechanical transmission.

There are other secondary routs of infection like hematophagous bats (in South America), placenta or through infected meat (not enter the stomach but by penetrate the mucous membrane of mouth).

Site of infection: blood stream

Clinical Signs:

- 1- Abdominal and behind legs odema.
- 2- Anemia.
- 3- The infected animals was isolated itself from the flock and toward to the sun.
- 4- Conjunctivitis.
- 5- Loss of appetite (anorexia).
- 6- Fall of hair.
- 7- Abortion.

Postmortem Sings:

- 1- Anemia.
- 2- Emaciation of visceral.
- 3- Enlargement of spleen and lymph nodes.
- 4- Petichial hemorrhage on liver and spleen.

Epidemiology:

The most important factor in the epidemiology of surra disease is present of the hematophagous insects.

T. equiperdum

Cause disease called Dourine, which is a venereal disease of horses, donkeys and mules.

Transmission:

The transmission manly occurs through the sexual contact and very rarely by blood sucking insects, and there is other transmission to the foals may occur through the contact of the conjunctiva with the vaginal discharges of infected mares.

Clinical Signs:

The disease in donkeys and mules is without observing clinical signs (asymptomatic), while in horses it is an acute and the incubation period 2-12 weeks(wks).

- 1- Odema: The first sign occur in genital organs and continue for 2-4wks
- 2- Ulcer with brownish spots appears in mucous membrane of penis and vulva, in addition to yellowish or colorless mucous discharges.
- 3- Urticarial plaques: Called Dollar spots appear on flank region (this spots contains a fluid filled with the parasites) these are continue 3-4 days and disappears.
- 4- Paralysis: Start with the muscles of the face and followed by general paralysis and death.
- 5- Frequency of urination, abortion of pregnant mares and weakness.

Pathogenesis: (*T. evansi* and *T. equiperdum*)

- 1- Odema: The odema of lower parts like abdomen, legs and genital organs, is due to the presence of prekallikrein enzyme, which is found in inactive form but when there is Trypanosoma infection the enzyme will be activated and lead to increase the blood vessel permeability and lead to odema.
- 2- Anemia: Occur due to:
 - A- R.B.Cs. lysis by complement due adhesion of parasite's coat with the R.B.Cs.
 - B- R.B.Cs. phagocytosis due to the same above reason.
 - C- Poisoning affect of the parasites on the bone marrow which lead to decrease the production of R.B.Cs.
- 3- Kidney damage: Due to deposition of immune complex (Ag-Ab complex) in kidney tissues and cause polynephritis (also may be occur in liver and kidney).
- 4- Paralysis (especially pathogenesis of *T. equiperdum*): Due to the toxin is librated by the parasite and affected on the nerves supply to the organs.

Diagnosis:

- 1- Clinical signs.
- 2- Blood smear (wet film or thick smear).
- 3- Animals' inoculation (to increase the parasitimia).
- 4- Serological tests.

Control:

- 1- Early diagnosis of disease and treating the infected cases.
- 2- Discard of chronic cases.

- 3- Testing the horse before copulation (Dourine).
- 4- Keep the camels far off the Tabanus presents region.
- 5- Use of insecticides.

Treatment:

- 1- Surramin (Naganol) .Horse, 4g/50kg B.W., I.V.
Camel, 1-2g/100kg B.W., I.V.
- 2- Antrycide 10% , 5mg/kg B.W., S/C.

Genus: *Leishmania*

This parasite cause disease called leishmaniosis , which is found in two forms visceral and cutaneous .

Host: man, dogs, rodents, and wide variety of wild animals (dog and rodents act as a reservoir hosts).

Vector: Sand fly (*Phlebotomus papatasi*), in which the parasite undergo morphological transformation and multiplication.

Site: The protozoa multiply within macrophages, which are eventually destroyed, the librated parasites entering other intact macrophages.

Species:

I-Visceral leishmaniosis / which cause by:

- 1- *Leishmania donovani* : causing black fever (Kala-azar, dum-dum), in man and dogs, and the infection being systemic, found in Iraq, India, Kenya, Sudan, and China.
- 2- *L. infantum*: Infected children under five years in old , found in Iraq.
- 3- *L. chagasi*: Infect human in all ages but more common in children, the dogs and fox act as a reservoir hosts, and this species is distributed in South America.

Clinical Signs: (Visceral leishmaniosis).

- A- Enlargement of abdomen due to enlargement of liver and spleen.
- B- Anemia.
- C- Intermittent fever.
- D- Good appetite.

II-Cutaneous leshmaniosis/ which caused by:

- 1- *L. tropica*: Causing dry oriental sore (dry cutaneous leshmaniosis), found in Iraq and called Baghdad boil, also distributed in Mediterranean area and in central and north India. This type called urban type.
- 2- *L. major*: Causing moist oriental sore, distributed in Middle East area and India This type called rural type.

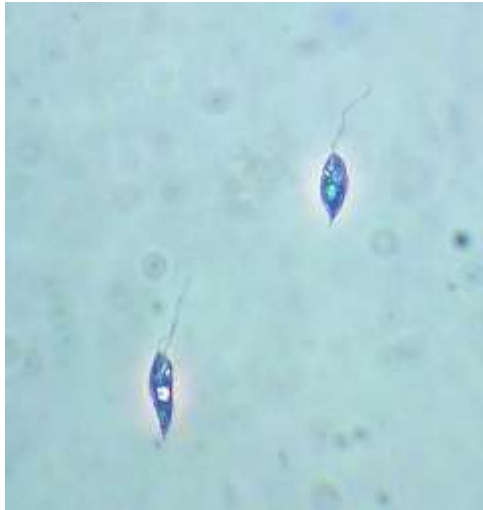
III- Mucocutaneous leishmaniosis (Espondia). Infect cutaneous and spread to mucosa of mouth, nose, pharynx, larynx, and ears, and caused by:

- 1- *L. brazilienses*
- 2- *L. aethiopica*

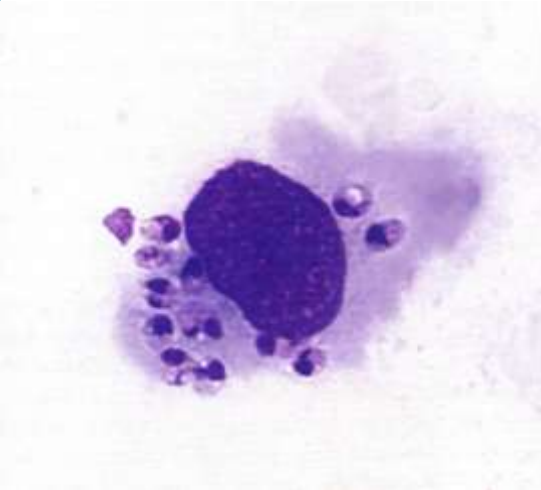
Life Cycle

The parasite passage in two stages during its life cycle which are:

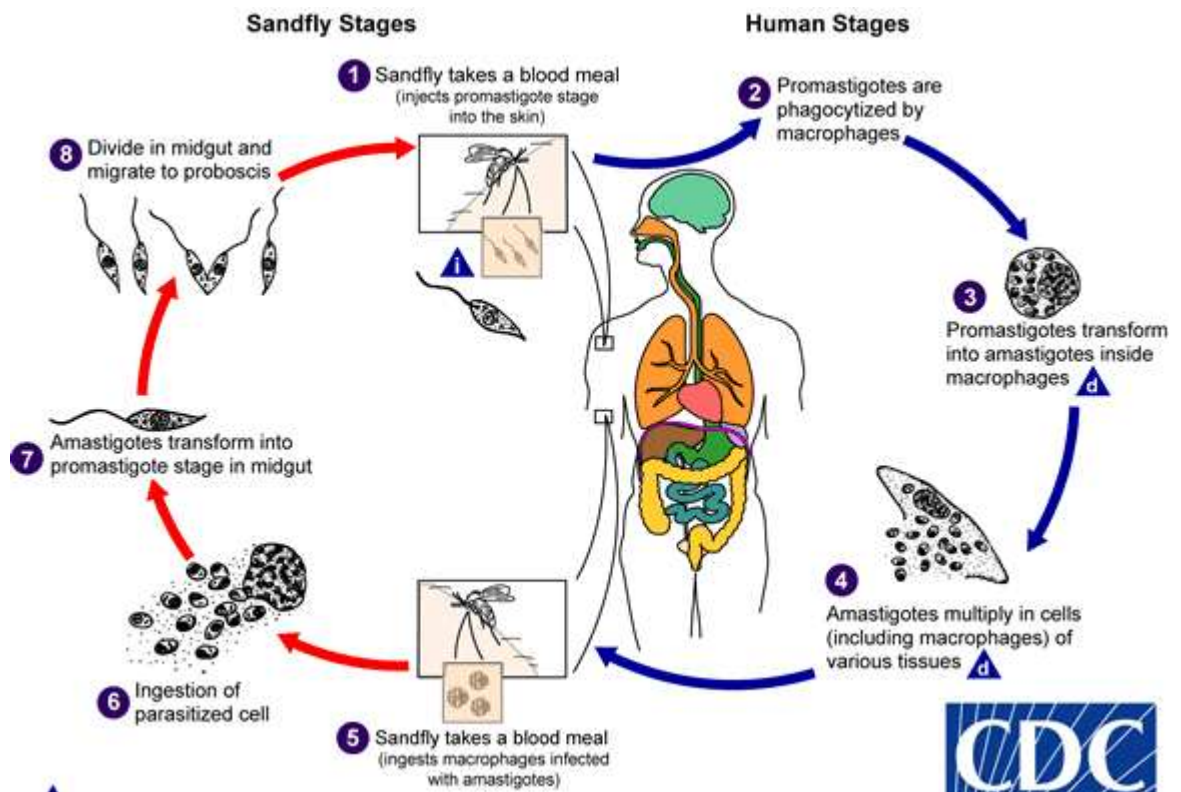
- 1- Amastigote form (leishman form): visible in vertebrates (man, dogs,etc).
- 2- Promastigote form (leptomonal form): visible in invertebrates (sand fly) and media.



Promastigote form



Amastigote form



Diagnosis:

1- Samples:

A- Biopsy from spleen or bone marrow in case of visceral leishmaniosis.

B- Crushing from lesion edges and stained with gemsa.

2- Serological tests.

3- Culture.

4- Animal inoculation (especially golden hamster).

Control:

- 1- Treatment of infected cases.
- 2- Eradication the sand fly by using the insecticides.
- 3- Eradication the stray dogs and rodents (reservoir hosts).

Treatment:

1- Visceral leishmaniosis:

A- Antimonial 1mg/kg, I.V., 2-8 days.

B- Diamidine = , = , = .

C- Amphotricine B = , = , = .

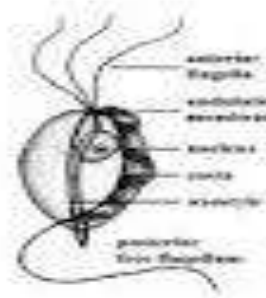
2- Cutaneous leishmaniosis:

Sodium antimony gluconate 600mg/day, 6-10 days.

Order: Trichomonadidea

Family: Trichomonadidae

Member of this family inhabit (live) in the digestive and reproductive organs, most of them are pear in shape, one nucleus, and number of free flagella (3-5) with flagellum return backward to formed undulating membrane in addition to a hyaline rod structure called axostyle with a skeletal function.



***Tritrichomonas foetus* :**

T. foetus is the most important pathogen in the genus of *Trichomonas* which is a venereal transmitted and cause disease called bovine trichomonal abortion or bovine genital trichomoniasis.



Host: cattle

Site: In cows, the uterus and intermittently the vagina. In bulls, the preputial cavity.

Distribution: Worldwide distribution.

Transmission:

- 1- Coitus.
- 2- Artificial insemination.
- 3- Gynecological examination.

Pathogenesis:

IN the bulls the principle is the preputial cavity and urethra. Muco-purulent discharges may be present and swelling of prepuce is seen, but these signs disappear after 1-2wks and the animal become carrier of the disease and act as a source of infection.

In cows, after 14-18 days of parasite entering ,there are vaginitis and muco-purulent discharges are seen and then the parasite is invade the uterus and lead to early abortion with complete expulsion of the foetus and fetal membranes. Spontaneous recovery (self cure) may be occur, but occasionally some of the placenta was retained in the uterus and lead to chronic catarrhal and purulent endometritis and the cow become sterile.

In some cases the dead foetus is not expulsion but it was macerated and this lead to pyometra (septicemia and lead to dead of cow).

Diagnosis:

- 1- Sample of vaginal mucous or exudates or saline washing from vaginal or preputial cavity and examined microscopically.
- 2- In case of abortion sample from foetal tissues (stomach) should be taken.
- 3- Serological test.
- 4- Culture of sample.

Treatment:

-Dimetridazole (Flagyl) 50mg/kg B.W. for 5 days orally or 10mg/kg B.W. for 5 days I.V.

T. vaginalis

Resemble *T. foetus* but it has 4 in front flagella and the 5th toward back and reach to the middle of the body. Also it is contain granules.

Host: human

Site: Vagina and urethra of women, seminal vesicle and urethra of men.

Transmission: Through sexual contact.

Clinical Signs: Man carries the infection but without clinical signs, while women are suffering from the following:

- 1- Intense inflammation with itching.
- 2- Profuse white vaginal discharges (leukorrea).
- 3- Not lead to abortion.

T. gallinae

This parasite has 4 in front flagella and the 5th return back to form the undulating membrane.

Host: Pigeon, turkey and chicken.

Site: Mouth, oesophagus, and crop of pigeon squabs.

Transmission: Through contaminated food and water or pigeon milk.

Clinical Signs:

- 1- Greenish to yellowish fluid or cheesy material around the mouth (peak).
- 2- Restless and ruffled feather.
- 3- Emaciation and death.

Lesion:

The lesion is start in the oral cavity and then distended to the oesophagus, crop, proventriculus, liver and lung. In P.M. we will see yellowish to grayish lesion in mouth, oesophagus and liver.

Diagnosis:

Swap from the mouth, C.S., P.M. and culture.

Treatment:

- 1- Dimetrinedazole 0.05% in drink water.
- 2- Furazolidone 25-30mg/day for 7 days in gelatin capsules.

Family: Monoceromonadidae

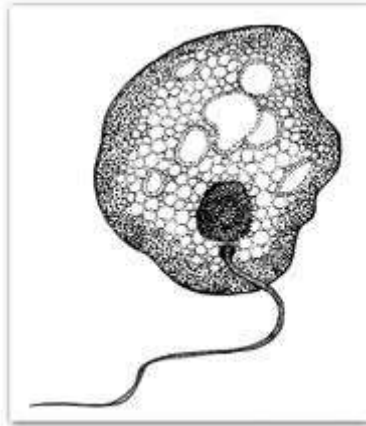
Genus: *Histomonas*

Species: *H. meleagridis*

H. meleagridis is the cause of turkey (especially young turkey) known as infectious enterohepatitis, histomonosis or black head.

Identification:

It is round or oval parasite, 6-20µm in diameter and has one flagellum.



Hosts:

Turkeys and occasionally pathogenic in chickens.

Transport host:

The adult and eggs of ascarid worm, *Heterakis gallinarum*.

Site:

The caecal mucosa and liver parenchyma.

Distribution:

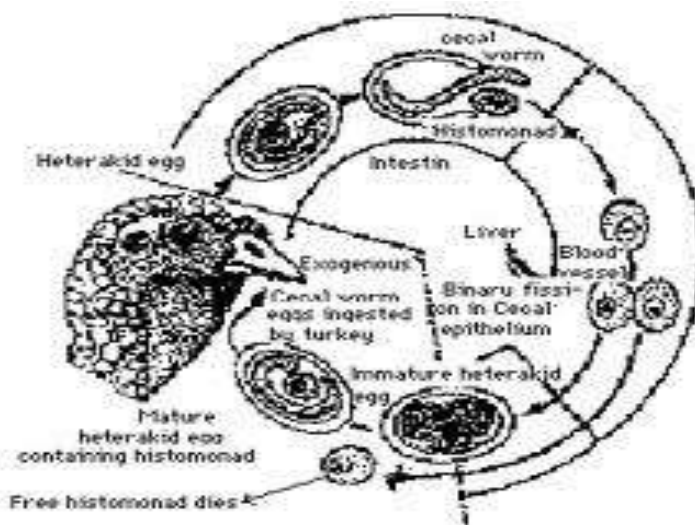
Worldwide.

Life Cycle:

Birds become infected by ingestion of the embryonated of the caecal worm, *Heterakis gallinarum*, the flagellate being carried in the unhatched larva. When the egg hatches, the histomonads are released from the larva and enter the caecal mucosa where they cause ulceration and necrosis. They reach the liver in the portal stream and colonize the liver parenchyma, producing circular necrotic foci which increase in size as the parasites multiply in the periphery of the lesion.

The *Heterakis gallinarum* become infected with *Histomonas meleagridis* by ingestion and then the protozoa reach to the ovary of worm.

The infection of the birds may also result from the ingestion of the earth worms which are transport hosts for *Heterakis gallinarum* eggs and larvae.



Clinical Signs:

- 1- Cyanosis of head and wattles (black head).
- 2- The bird is dull with ruffled feather.
- 3- Sulphur to yellowish faeces.

Diagnosis:

- 1- C.S.
- 2- P.M. (ulcers in caecum and necrotic foci in liver).
- 3- Swap from foci.
- 4- Culture.
- 5- Histological examination for liver and caecum.

Treatment:

- 1- Furazolidone 0.01-0.02% with food.
- 2- Nitrothiozole 0.02% with water or 0.25% with food.
- 3- Dimetrinedazole 0.05% with water.

Control:

- 1- The turkey should be not rear with chicken because the chicken acts as carrier to the disease.
- 2- Use of anthelamintics.
- 3- Discard of faeces.
- 4- Continuous low level of medication (that described above) especially with food.

Subphylum: Sporozoa

Protozoa within the subphylum sprotozoa are characterized by:

- 1- Parasitize intracellular.
- 2- Have apical complex structure at some stages of their development.
- 3- The trophozoites have no cilia or flagella.
- 4- Reproduction involves both asexual (Schizogony) and sexual (gametogony) phases. Following gametogony, a zygote is formed which divides to produce spores (sporogony).
- 5- The subphylum divides into three classes, among them two classes are most important coccidia (alimentary sporozoa) and piroplasmidia (blood sporozoa).

Class: Coccidia

This class has two important families which are Eimeriidae and Sarcocystidae.

Family: Eimeriidae

These are mainly intracellular parasites of the intestinal epithelium, schizogony and gametogony occur within the host and sporulation or maturation of the fertilized zygote; usually take place out with the host. This family involves three genera, Eimeria, Isospora and Cryptosporidium, the term coccidiosis usually reserved for infections caused by Eimeria and Isospora spp.

Genus: Eimeria

Hosts:

Poultry, cattle, sheep, goats, pigs, horses and rabbits.

Site:

Epithelial cell of the intestine except in two species occur in kidney and liver.

Species:

Species belong this genus are caused disease called coccidiosis (bloody diarrhea disease), and important species are:

E. tenella, *E. necatrix*, *E. brunette*, *E. maxima*, *E. mitis* and *E. acervolina*- chickens.

E. zuernii and *E. bovis*- cattle.

E. crandallis and *E. ovinoidalis*- sheep.

E. arloingi and *E. ninakohlyakimovae*- goats.

E. leuckarti- horses.

E. stiedae (liver)- rabbits.

E. truncata (kidney)- geese.

Distribution:

Worldwide

Oocyst: Contain four sporocysts each with two sporozoites.



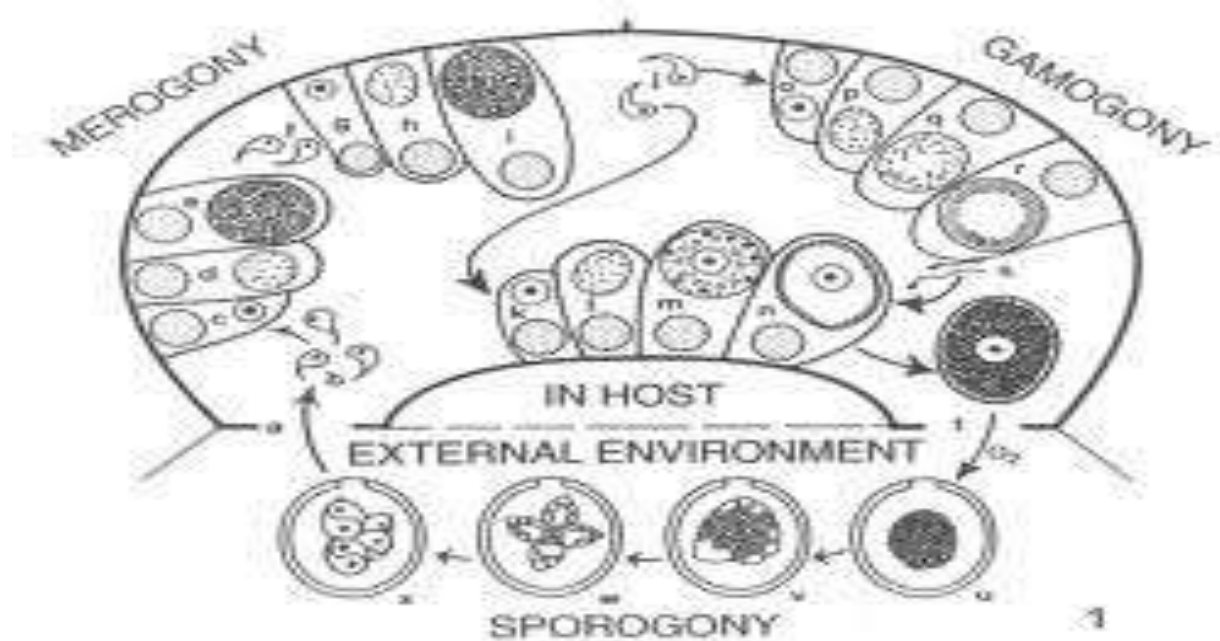
Mature oocyst



Immature oocyst

Life Cycle:

This is divided into three phases: sporulation, infection and schizogony, and finally gametogony and oocyst formation.



Factors affecting the pathogenesis of coccidiosis:

- 1- Site of the parasite growth: parasite grows in deep layers of the intestine is more dangerous than that grow in superficial layers.
- 2- Size of growing stage: The types with large growing stage (more than 5µm) are more dangerous than the others.
- 3- Numbers of ingested oocysts : If there is large numbers of ingested oocyst, there is more pathogenic affects.
- 4- Host age: The small ages are more susceptible than the older.
- 5- Viability of oocysts: Humidity, temperature and O₂ are affecting on the oocysts viability.
- 6- Animal breed: Local breeds are more resistant than the foreign breeds.
- 7- Bacterial and viral diseases: Which increase the coccidial affect because their affect on body immunity.

Bovine Coccidiosis:

Ocurs worldwide and usually affects cattle under one year old, but it is occasionally seen in yearling and adults. Out of 13 species are recorded, only two species are considering principal pathogens:

- 1- *E. bovis*: Infect small intestine, found in Iraq and pathogenic.
- 2- *E. zuernii*: Infect large intestine, found in Iraq, pathogenic, circle or semi circle oocyst.

Clinical Signs:

The calves with 3wks-6monthes of age are more affective, and the important C.Ss. are:

- 1- Bloody diarrhea.
- 2- Tenesmus.
- 3- Anemia.
- 4- The animal may be dead before it reaches to the oocyst stage.
- 5- Weakness with emaciation.
- 6- Death in not treated cases.

Ovine and caprine coccidiosis:

Several types of *Eimeria* are infecting the sheep and goats like:

- 1- *E. ovinoidalis*: Infect sheep, worldwide distribution, pathogenic, oval oocyst.
- 2- *E. parva*: Infect sheep and goats, worldwide distribution, pathogenic, circle or semi circle oocyst.
- 3- *E. crandallis*: Infect sheep and goats, sub-spherical oocyst.

Clinical Signs:

The young animals are more susceptible than the older and the important C.Ss. are:

- 1- Yellow-greenish or bloody diarrhea.
- 2- Abdominal pain.
- 3- Anorexia and Emaciation.

Treatment:

- 1- Amprolium 50mg/kg BW with water or food for 3-4 days.
- 2- Sulphaguanidine 2g/day for 3-4 days.
- 3- Nitrofurazone 7-10mg/kg for 3-4days.

Poultry coccidiosis:

Species and site of parasitize:

- 1- In front part of intestine (duodenum):
 - A- *E. mitis*
 - B- *E. praecox*
 - C- *E. acervulina*
 - D- *E. hagani*
- 2- In middle part of intestine(jejunum):
 - A- *E. necatrix*
 - B- *E. maxima*
 - C- *E. brunette*
- 3- In caecum:
 - A- *E. tenella*

The *E. tenella* and *E. necatrix* are more risky than other types.

Clinical Signs:

- 1- Bloody diarrhea.
- 2- Increase mortality.
- 3- Ruffled feathers.



Epidemiology:

- 1- The young birds are more susceptible to infection.
- 2- Number of ingested oocysts is playing an important role in the intensity of clinical signs.
- 3- Wild birds play role in the distribution of infection.
- 4- Veterinarians and workers are playing role in the distribution of infection.
- 5- Crowding and bad management help in occurring of infection.

Diagnosis:

- 1- C.Ss.
- 2- P.M.
- 3- Faecal examination (observe oocyst).

Treatment:

- 1- Amprolium 0.125% with food.
- 2- Sulfamethazine 0.2% with water or 0.4% with food.

Controle:

- 1- Use of anticoccidial drug with food.
- 2- Discard of faeces.
- 3- Entering of sun light to the rear station with good ventilation.
- 4- Avoid the crowding.
- 5- Prevent the wild animals from entering the rear stations.

Genus: *Cryptosporidium*

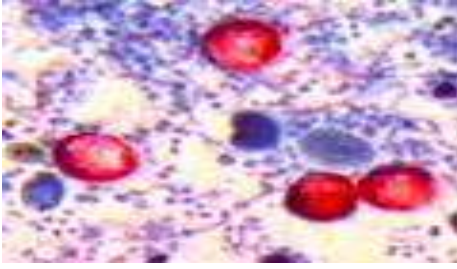
This parasite cause disease called cryptosporidiosis.

Site:

Microvilli of small intestine particularly in illume (unlike other member of Eimeriidae, *Cryptosporidium* does not enter the cells of the host, the schizonts and gametes develop in parasitophorous envelope apparently derived from microvilli).

Identification:

Oocyst contains 4 sporozoites without sporocysts.

**Transmission:**

The infection occurs through the contamination of food and water with the oocysts.

Species:

The cryptosporidiosis considers as a zoonotic disease between human and animals, and there are 19 types of this genus, for example:

- 1- *C. parvum* - calves
- 2- *C. muris* - mice
- 3- *C. meleagridis* – poultry, parasitize in the GIT and respiratory tract of poultry.

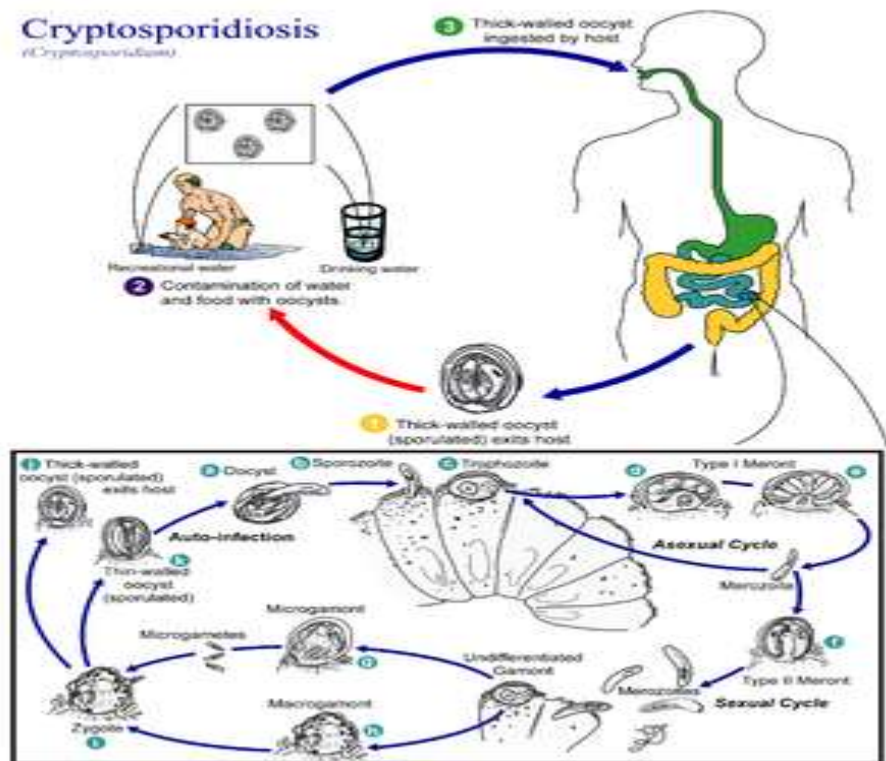
Distribution:

Worldwide

Life cycle:

Cryptosporidiosis

(Cryptosporidium)



Clinical Signs:

- 1- Severe diarrhea.
- 2- Loss of weight.
- 3- Emaciation and occasionally death.
- 4- Some time there is mixed infection with rota virus and E. coli bacteria; they increase the severity of the disease.
- 5- The young animals are more susceptible to the infection.

Diagnosis:

- 1- C.Ss.
- 2- Faecal examination to observe the sporulated oocyst.
- 3- Serological tests.
- 4- PCR technique.

Treatment:

There is no affecting treatment.

Class: Sporozoa

Family: Sarcocystidae

Genus:1-*Sarcocystis*
2-*Toxoplasma*

1-*Sarcocystis*

Species belong this genus are causing disease called sarcocystosis which is a zoonotic disease, and there are two types of *sarcocystis*, microscopic and macroscopic.

Final hosts:

Dogs, cats, wild carnivores and man.

Intermediate hosts:

Man, ruminant, horses, birds, reptiles,..

Site in the final host:

Small intestine

Site in the intermediate host:

Schizonts in the endothelial cells of blood vessels; large cysts containing bradyzoites in muscles.

Distribution:

Worldwide

Species:

1- Species that recognized with the dog as a final host:

a- *Sarcocystis bovicanis*

c- *S. ovicanis*

d- *S. capricanis*

e- *S. porcicanis*

f- *S. equicanis*

g- *S. fayri* (horse)

2- Species that recognized with the cat as a final host:

a- *S. bovifelis*

b- *S. ovifelis*

c- *S. porcifelis*

3- Species that recognized with the man as a final host:

a- *S. bovi hominis*

b- *S. porci hominis*

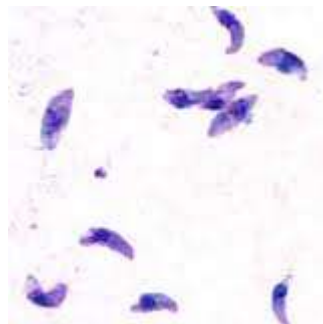
*Note: Most species that recognized with the dog as a final host give microscopic types except *S. fayri* which give macroscopic type whereas most species that recognized with the cat as a final host give macroscopic types.

Identification:

- 1- Oocysts: contain two sporocysts each sporocyst contains four sporozoites, the oocysts are sporulated mainly before excreted and the sporocysts found free in faeces, measured approximately 15x9 μm .



- 2- Tachyzoite: Is a banana shape like structure , appear in acute stage of infection and it's disappear when host immunity is increased to convert to bradyzoite.



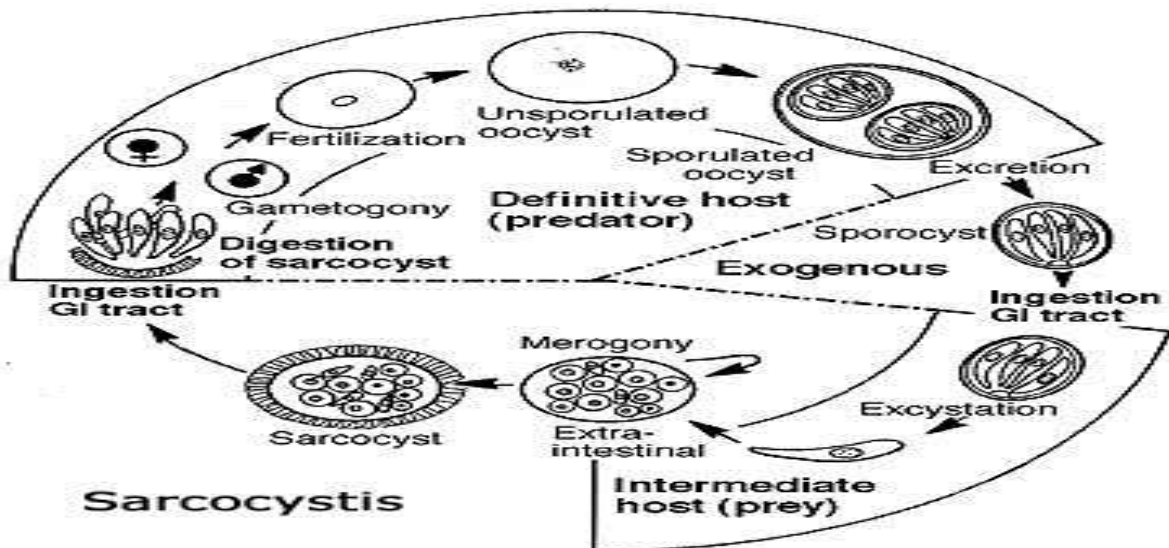
- 3- Bradyzoite: Is't like the tachyzoite in shape but it is contained in atissue cyst.

- 4- Tissue stage: In the intermediate host the schizonts found in the endothelial cells are quite small measuring 2-8 μm in diameter. In contrast the tissue cysts can be very large and visible to the naked eye as

whitish streaks running in the direction of the muscle fibers which measured from 0.5-5mm.



Life cycle:



Clinical signs:

- 1- Final host: *Sarcocystis* species usually non-pathogenic to their final host except some general clinical signs like anorexia and diarrhea.
- 2- Intermediate host:
 - a- Anemia.
 - b- Anorexia.
 - c- Diarrhea.
 - d- Weakness.
 - e- Hyper salivation.
 - f- Muscle twitching (2nd generation in brain and kidney).
 - g- Loss of hair.
 - h- Death.

Pathogenesis:

- 1- **Anemia due to:**
 - a- Haemolytic
 - b- Haemorrhage
 - c- Unknown metabolite release from parasite
 - d- R.B.Cs. count, Hb and PCV as much as 75% of normal values.
- 2- **Glomerulo-nephritis due to:** Immune complex cause distraction of renal glomeruli.
- 3- **Infraction of organs due to:** Blockage of blood vessels by parasites.
- 4- **Toxin:** The parasite release toxin called sarcocystine which affect heart, C.N.S. and adrenal gland.

Diagnosis:

- 1- Final host:
 - a- Faecal examination for sporocyst.
 - b- Serological test.
- 2- Intermediate host:
 - a- Serological tests.
 - b- C.Ss.
 - c- P.M. examination including:
 - 1- Trichnoscopy: By press piece of meat between to slides and examine under microscope.
 - 2- Squeezing method: By squeeze of piece of meat and examined the produced juice.
 - 3- Peptic digestion of meat: This method usually used for microscopic infection.

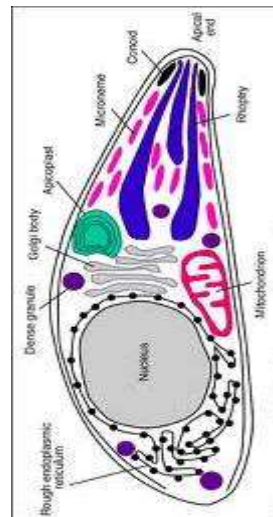
*Note: Macroscopic types can be seen by necked whereas the microscopic types are seen by microscopic only.

Control:

- 1- Eradication of stray dogs and cats.
- 2- Good cooking of meat.
- 3- Testing of meat in slaughter house.
- 4- Good cleaning for vegetables before eating.
- 5- Treating the animals with amprolium to prevent the C.Ss.

Genus: *Toxoplasma*

The genus *Toxoplasma* has a single species, *Toxoplasma gondii*, cause disease called toxoplasmosis which is a zoonotic disease between human and animals. Note, toxon meaning arch and plasma meaning form.



Species:

Toxoplasma gondii

Final host:

All felids. The domestic cat is the most important.

Intermediate hosts:

Any mammal, including man, or birds. Note that the final host, the cat, may also be an intermediate host and harbor extra-intestinal stages.

Site in final host:

Schizont and gamonts in the small intestine.

Site in intermediate host:

Tachyzoites and bradyzoites in extra-intestine tissues including muscle, liver, lung and brain.

Identification:

Oocysts: These are found in the faeces of cats, are unsporulated and measured $12 \times 10 \mu\text{m}$, when sporulated it take one to five days and become contains two sporocysts each one contain four sporozoites.



Intestinal stages:

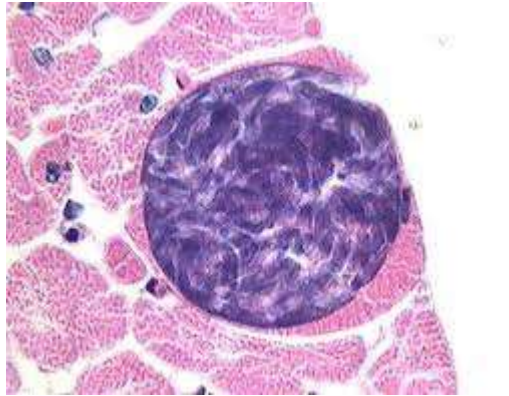
- 1- Schizonts: These occur mainly in jejunum and ileum, range in size from $4-17 \mu\text{m}$ in diameter and contain up to 32 merozoites.
- 2- Gamonts: These are most common in ileum and measure approximately $10 \mu\text{m}$ in diameter.

Extra-intestinal stages:

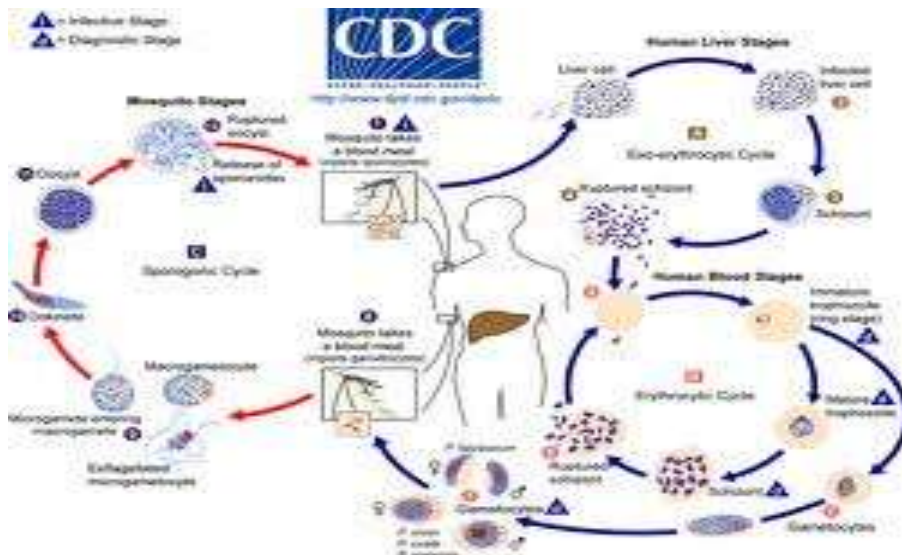
- 1- Tachyzoites: These are found developing in vacuoles in many cell types, for example, hepatocytes and myocardial cells. In any cells there may be 8-16 organisms, each measuring $6-8 \mu\text{m}$.



- 2- Bradyzoites: These are contained in cysts and occur mainly in the muscle, liver, lung and brain. The bradyzoites are lancet shape and several thousand may be present in one cyst which can measure up to $100 \mu\text{m}$ in diameter.



Life cycle:



Transmission of infection:

- 1- Ingestion of oocyst with contaminated food and water.
- 2- Ingestion of infected meat with bradyzoites.
- 3- Through placenta from mother to fetus.
- 4- Unpasteurized goat's milk may act as source of infection to human.

Clinical signs:

- 1- Abortion of infected females.
- 2- Anorexia, emaciation and ataxia.

Diagnosis:

- 1- Final host:
 - a- Fecal examination to visible the oocyst.
 - b- Serological tests.
 - c- Histological examination.
 - d- Polymerase chain reaction (PCR) technique.

- 2- Intermediate hosts:
 - a- Isolation of the parasite from blood, C.S.F., and tissues (placenta, lymph nodes, etc.).
 - b- Serological tests (Sabn-Feld man test).
 - c- Histological examination.
 - d- Polymerase chain reaction (PCR) technique.

Control:

- 1- Good cleaning of fruits and vegetables.
- 2- Good cleaning of hands after working in the gardens.
- 3- Good cooking of meats.
- 4- Pasteurization of milk.

Treatment:

- 1- Spiramycin 3g/3wks repeated after two wks for 3 interval wks (use for human but it is toxic for cats).
- 2- Pyrimethamine 0.5-1mg/kg of B.W. + Sulphadiazine 50-100mg/kg of B.W. + Folinic acid 5mg for 4-6 wks.

Class: Haemosporidia**Family: Plasmodiidae****Genus: *Plasmodium***

Species belong this genus cause malaria disease in human, birds, monkey and rodents.

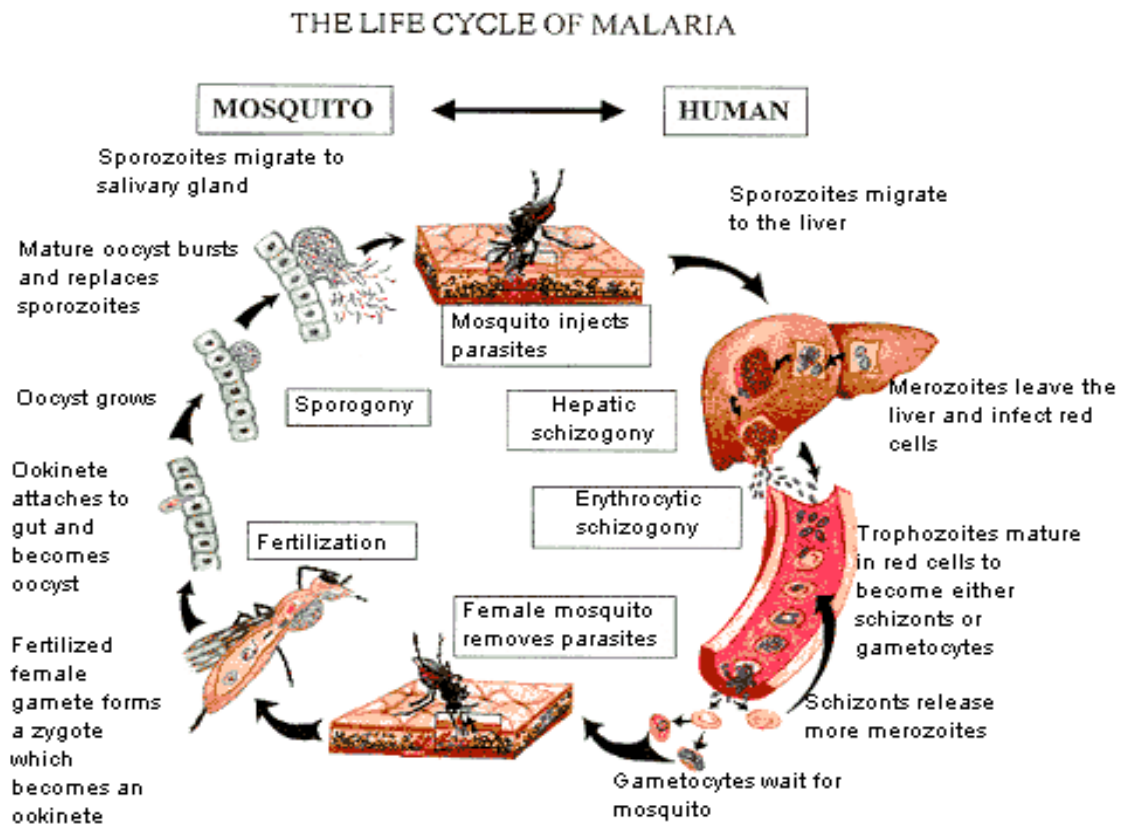
Species:

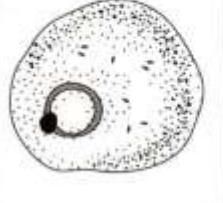
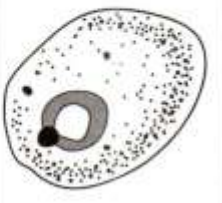
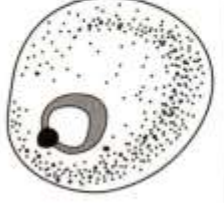









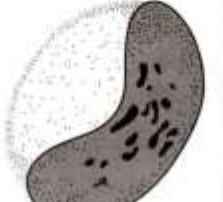



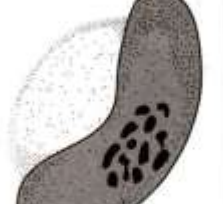
- 1- Human spp.
 - a- *Plasmodium vivax*

- b- *P. falciparum*
- c- *P. ovale*
- d- *P. malariae*
- 2- Birds' sp.
P. gallinaceum

Vector: Mosquitoes female, the *Anopheles* transmitted the infection to the human, while *Culex* transmitted the infection to the birds.

Life Cycle:



Malaria					Babesia
	<i>Plasmodium vivax</i>	<i>Plasmodium ovale</i>	<i>Plasmodium malariae</i>	<i>Plasmodium falciparum</i>	
Ring form					
Schizont					
Microgametocyte					
Macrogametocyte					

IG 10-1 Characteristics of malarial and babesiosis parasites.

Pathogenesis:

P. gallinaceum is with high affect to the birds which may cause highly morbidity , and the important pathogenic affect is the anemia which result from destruction of R.B.Cs. in addition to paralysis and nervous signs due to blockage of capillary blood vessels in the brain by 2nd generation of schizonts.

Clinical Signs:

- 1- Anemia.
- 2- Paralysis.
- 3- Interrupted fever.

Diagnosis:

- 1- C.Ss.
- 2- Blood smear and stained with gemsa stain.
- 3- Serological tests.
- 4- PCR

Treatment:

- 1- Chloroquine 5mg/kg.
- 2- Pyrimethamine 0.3mg/kg.

Control:

- 1- Eradication of mosquitoes by use of insecticides.
- 2- Eradication of mosquitoes' larvae by mechanical or biological methods.
- 3- In human in addition to above methods we can use vaccination and dermal ointment.

Class: Piroplasmidia

Types belong this class cause disease called piroplasmosis, *pirum* = pear, *plasma* = form.

Family: Babesiidae**Genus: Babesia**

* Babes (1888) was the first who discovered the parasite in cow's blood in Romania when he saw these cow were suffered from hemoglobin urea and fever.

*At first time the disease diagnosed as bacterial disease , then Kilborn (1893) observed the disease in cows in Texas state and he was called it Texas fever and at this time the causative agent was discovered as parasite but not bacteria.

* *Babesia* are inra-erythrocytic parasite of domestic animals and are the cause of anemia and haemoglobinuria .

* The disease called babesiosis, red- water disease or Texas fever.

* The disease is one of the zoonotic disease.

Transmission:

The disease is transmitted from sick to intact animal by hard ticks of the family Ixodidae through two ways:

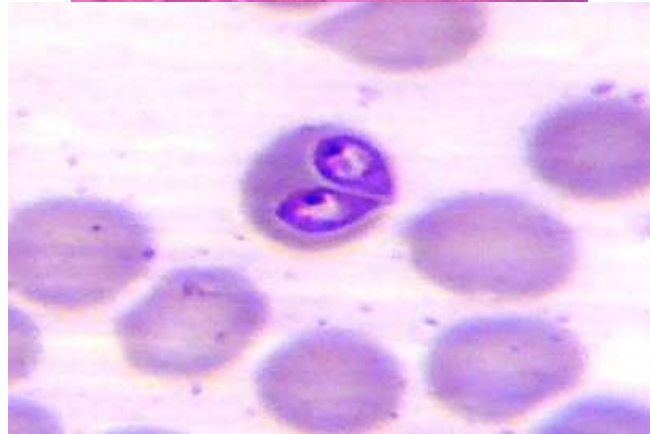
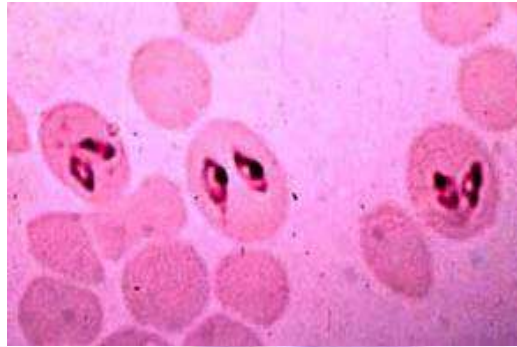
- 1- Transoverian transmission: In which the protozoan passes transovarially(via the eggs) from one generation of tick to the next.
- 2- Transtadial transmission: In which the parasite persist from one stage to the next of the ticks feeding on different hosts.

Host: All domestic animals and some time man.

Site: The organisms lie singly or in pairs inside the red blood cells.

Identification and Morphology:

Typically the parasite is in pyriform (pear shape), but may be rounded , elongated or cigar shape. The various species are grouped in to small *Babesia* whose measured are 1-2.5 μ m and large *Babesia* which are 2.5-5 μ m long.



Species:

1- In cattle:

- a- *Babesia bigemina* - large size ,found in Iraq ,pathogenic.
- b- *B. major* - large size, found in Iraq
- c- *B. divergens* - small size
- d- *B. bovis* - small size

2- In sheep & goats:

- a- *B. motasi* - large size, in Iraq, moderate affect
- b- *B. ovis* - Small size

3- In equines:

- a- *B. caballi* - large size, in Iraq, little affect
- b- *B. equi* - small size, virulent

4- In dogs:

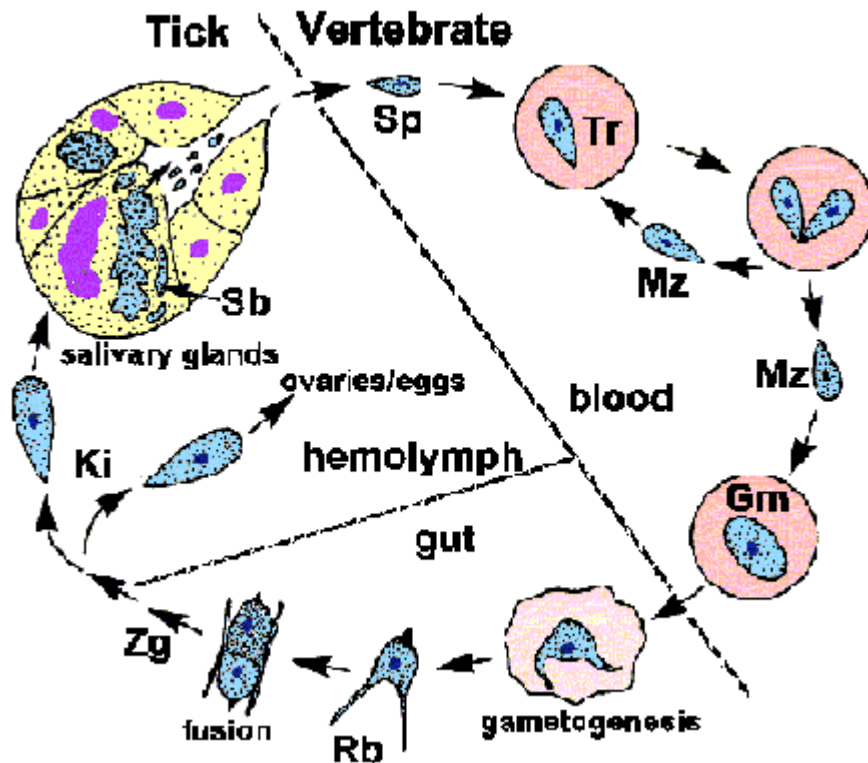
- a- *B. canis* - large size (largest type of *Babesia*), in Iraq.
- b- *B. gibsoni* -Small size

5- In cats:

- B. felis* - large size

Life Cycle:

The life cycle of *Babesia* within the final host is very simple because there is only multiplication by simple fission with highly destruction of R.B.Cs. (70%).



Clinical Signs:

The C.Ss. is depend upon parasite species, strain and vertebrate host, the incubation period 1-2wks , and the important C.Ss. are:

- 1- Fever 40-41c°.
- 2- Bloody urea (hemoglobin urea).
- 3- Ectric mucous membranes.
- 4- Anemia.
- 5- Anorexia.
- 6- Death of untreated cases.

**P.M.:**

- 1- Pale and yellowish carcasses.
- 2- Enlarged of liver and spleen.
- 3- Enlargement of gall bladder.
- 4- Bloody urea in urinary bladder.

Pathogenesis:

- 1- Anemia: due to destruction of R.B.Cs.
- 2- Convert of inactive prekallikrein enzyme to active prekallikrein which lead to blood vessels dilatation that will lead to slow blood flow and clot formation that will lead to blockage of capillary blood vessels especially in C.N.S. and appearance of nervous signs particularly in *B. bovis* and *B. canis*.
- 3- Decrease number of R.B.Cs. lead to decrease of O₂ that causing tissues anoxia and damage of organs especially liver and kidney.
- 4- Kidney damage due to immune complex.

Epidemiology:

- 1- Movement and transport of infected animals from place to another lead to spread of infection.
- 2- Environmental factors like temperature and humidity have effect on multiplication and distribution of vectors (in Iraq the ticks proliferate in spring season –in March- and clinical signs appear after one month.
- 3- The older animals are more susceptible to infection than the small age animals.
- 4- Infection by other like bacteria and viruses lead to increase the susceptible to infection with *Babesia*.
- 5- Stress factors and bad nutrition increase the susceptible to infection.
- 6- Splenectomy increase the susceptible to infection.
- 7- Local breeds more resistant to infection than the foreign breeds.

Diagnosis:

- 1- Clinical signs (bloody urea, ectric,...).
- 2- Blood smear (thin or thick) and staining with gamsa stain.
- 3- Serological tests.
- 4- PCR test.

Control:

- 1- Use of insecticide throughout dipping the animals.
- 2- Treating the infected cases.
- 3- Use of vaccine.

Treatment:

- 1- Imidocarb 0.5-1mg/kg I.M. or S/C.
- 2- Berenil 2-3mg/kg deep I.M.
- 3- Diampron 10mg/kg I.M. or S/C.

Family

Theileriidae

Genus/*Theileria*

Species belong this genus cause disease called theileriosis which infected cattle , buffaloes , sheep and goats

*Koch (1898) was the first who discover the parasite in cow's blood , but he thought that is babesia

*Theiler (1906) was refer to that is new genus and called it *Theileria*

Vector/ticks by transterial transmission only

The parasite have two phase:-

- 1) blood phase /in which the parasite present in the blood (inside the R.B.C) and It is take several shapes like ring , rod , comma and oval shape
- 2) lymph phase / which can see in lymph node and called koch's blue bodies which represented the schizont of parasite

There are two types of schizonts, macroschizont which number about 8-12 and microschant which numbers are more than that in macroschizonts.

Species:-

1) *T. parva* , pathogenic , in America and Africa .infect the cows and buffaloes

Vector, ticks = genus: *Rhipicephalus*

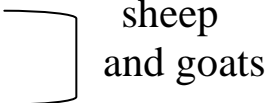
2) *T. annulata*, infected cow and buffaloes , in Iraq

Pathogenic

Vector/ticks → Genus = *Hyalomma*

3) *T. mutans* → infect cow, less virulent

4) *T. hirci* pathogenic, in Iraq
5) *T. ovis* less pathogenic

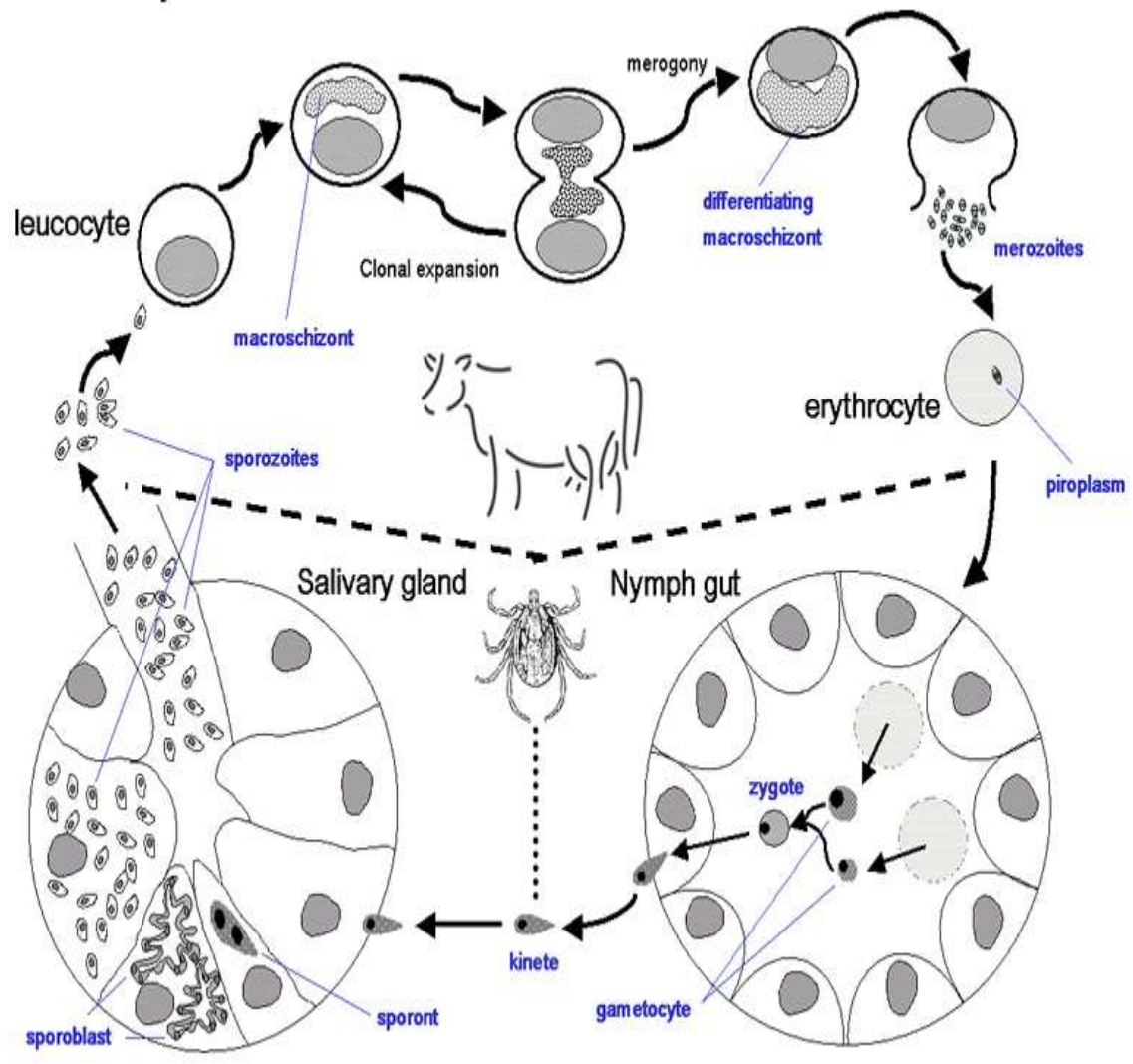


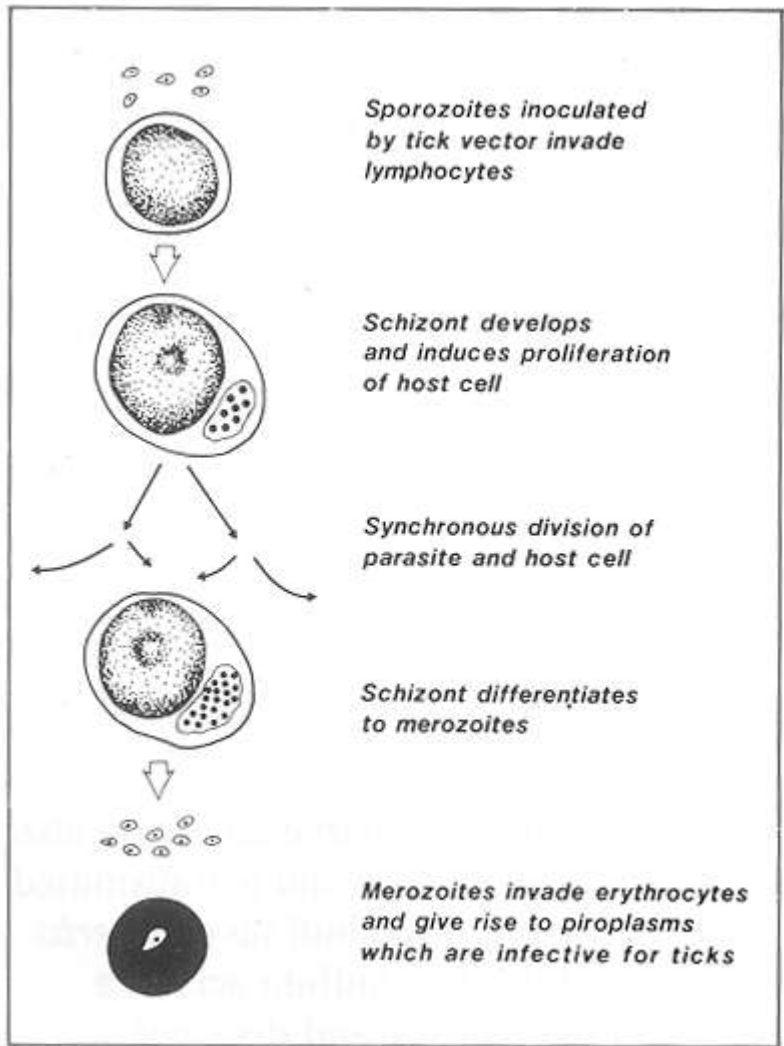
sheep and goats

6) *T. Camelensis* in Egypt and Somali

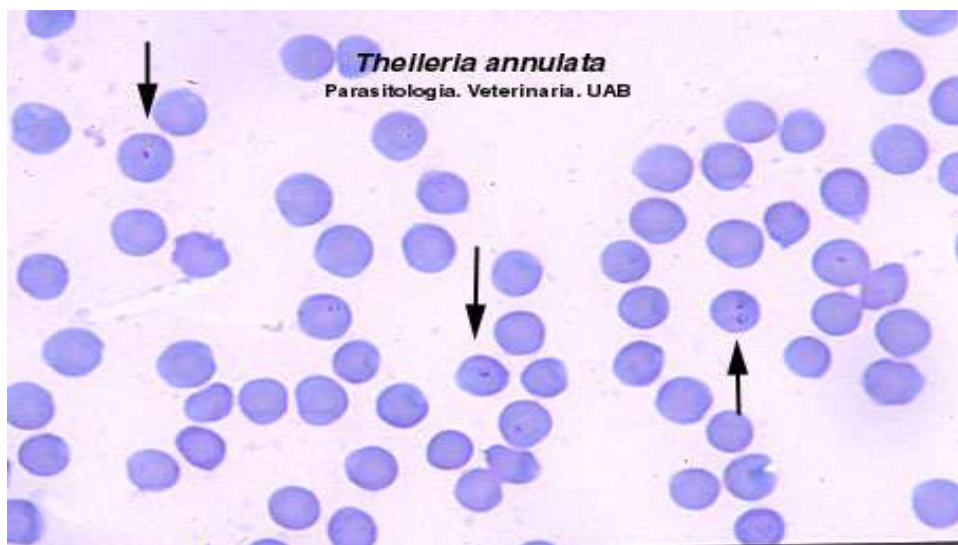
Life cycle:

The life-cycle of *T. annulata*





*incubation period 14 days



***Clinical signs:-**

- 1) Enlargement of prescapular lymph nodes
- 2) Fever more than 41 c°
- 3) Increased respiratory rate
- 4) Nasal and eyes discharges
- 5) Constipation and diarrhea
- 6) Anorexia
- 7) Abortion
- 8) Jaundice
- 9) Before death the infected animal take the dog setting position.
- 10) Increased mortality especially in foreign breeds (29-50%) where as in local breeds (2%).

P.M.:-

- 1) Enlargement of lymph nodes (speciau) pre scapular lymph nodes.
- 2) Enlargement of spleen and liver with petichial hemorrhage.
- 3) Congestion of lung with emphysema in lower part.
- 4) Abomasums petichial hemorrhage (important signs).

Immunity against parasite:-

Infection with *T. parva* give sterile immunity and the parasite will be disappear completely where as the infection with *T. annulata* the carrier and act as source of infection

Diagnosis:-

- 1) Lymph smear
- 2) blood smear
- 3) serological
- 4) clinical signs.

Treatment:-

-chlortetracyclin or oxytetracyclin 12mg /kg, 5days I.M.
-Menoctone 5mg / kg I.V.

Control:-

- 1) Use of insecticide (by dipping of animal).
- 2) Quarantine and testing of in ported animal to our country.

- 3) Vaccination.
- 4) Slaughter of carrier and emaciated animals.
- 5) Control on wild animals.
- 6) Treated the infected animals.

Order / Rickettsiales:-

The organisms initially thought to be proto zoo but are now know to be rickettsia.

Family / Anaplasmatidae:-

Genus / *Anaplasma* :-

There organism found in the red cells of cattle, cause disease called Anaplasmosis.

Transmission:-

- 1) Ticks.
- 2) Biting insect.
- 3) Contaminated needle or surgical instruments (no.2 Biologically, 2 and 3 mechanically).

Host:-

Cattle wild ruminants and perhaps sheep may act as reservoirs of infection.

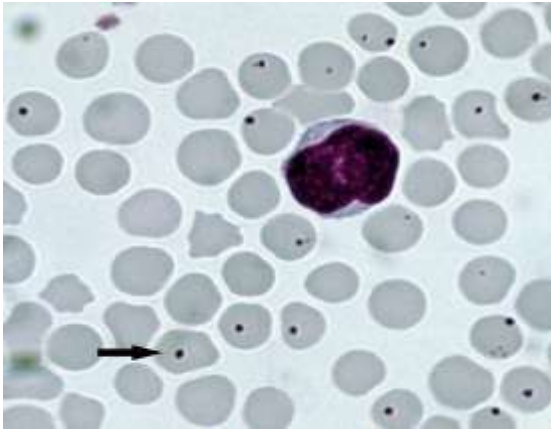
Intermediate host:-

Ticks (*Boophilus* spp)

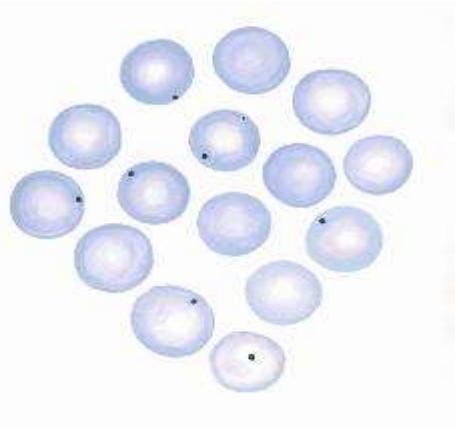
Species:-

Anaplasma marginale pathogenic

Anplasma centrale moderate



A. marginale



A. centrale

Site: in R.B.C.

Clinical signs:-

- 1) Infected the older animal which infect more than 18 month in ages.
- 2) Incubation period 15-36 days.
- 3) Fever
- 4) Anemia
- 5) Jaundice

Diagnosis:-

- 1) Blood smear.
- 2) Serological tests.

Control:-

- 1) Use of insecticide (control on ticks).
- 2) Discard of infected animals.

Treatment:-

- Oxytetracycline 6-10 mg/kg
- Imidocarb 0.5-1 mg/kg

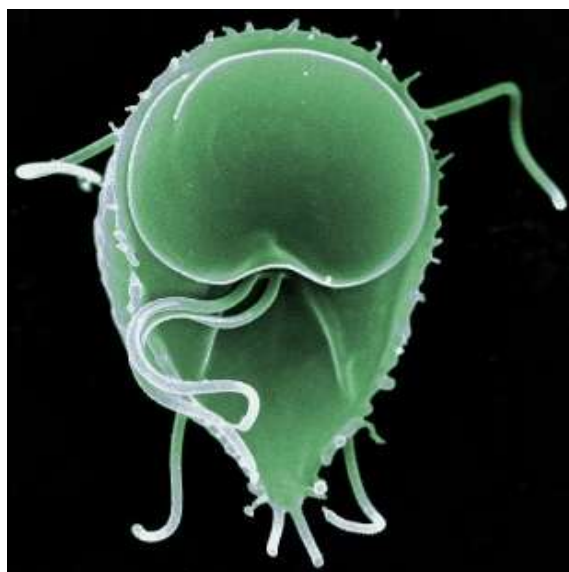
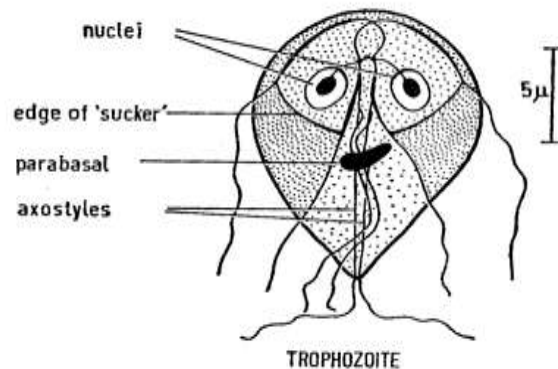
Family:- Trichomonadidae

Genus:- *Giardia*

Species :-*G. lamblia*

This parasite cause disease call Giardiasis, It is live in upper part of small intestine, the disease is consider as one of the zoonetic diseases.

The organism is bilaterally symmetrical and also possesses eight flagella, six of which emerge as free flagella at intervals around the body; it is unique in possessing a large adhesive disc on the flat ventral surface of the body which facilitates attachment to the epithelial cells of the intestine mucosa. The organism passed as multi-nucleated cyst in which the flagella may be visible, and occasionally the trophozoite may be seen in feces.



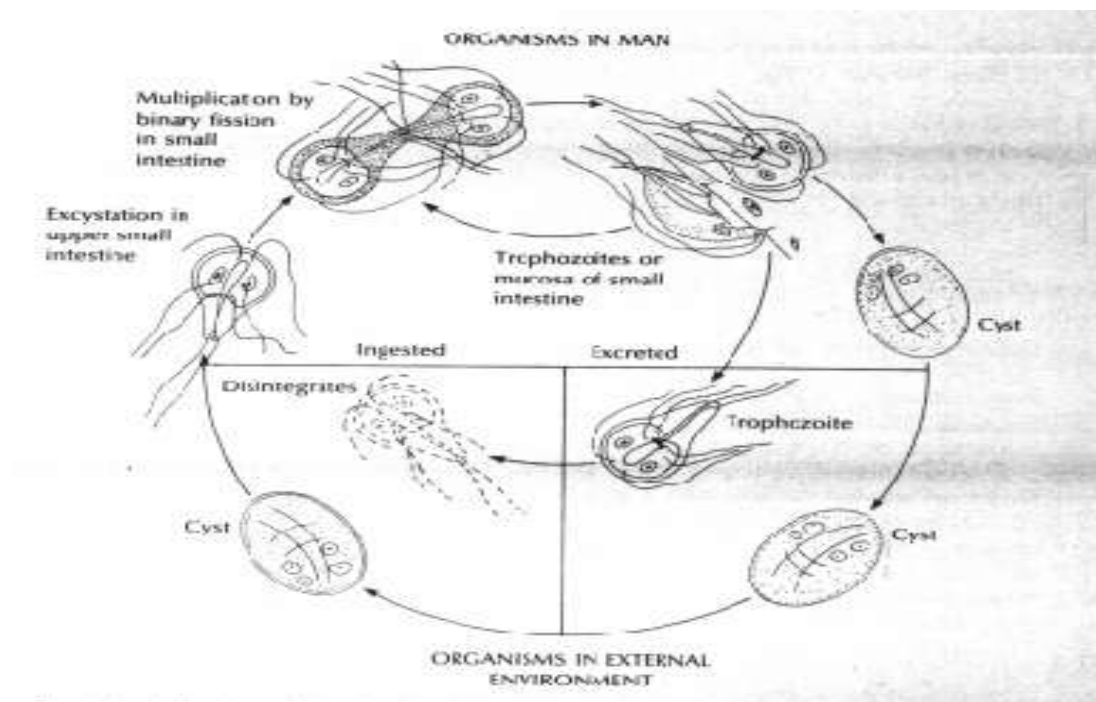
Trophozoite



Cyst

Life cycle:-

cyst → intestine → lysis of cyst wall → upper part of intestine → give two trophozoite → four trophozoite → adhesive to the epithelial cells → cyst



Clinical signs:-

- 1) Fatty diarrhea
- 2) Vomiting
- 3) Lost of weight
- 4) abdominal pain

Pathogenic affect:-

- 1) Affect on fat of vit.(A) absorptive in intestine
- 2) Enteritis due to adhesive of parasite to the epithelial cells

Diagnosis:-

- 1) Fecal examination
- 2) Serological tests

Treatment:-

-Metronidazole (flagel) 250 mg / 3 times daily
-Quinacriue 250 mg / 5-10 days (for 3 times daily)

Genus:-*Entamoeba*

Spp:-*E. histolytica*

E. coli

***E. histolytica*:-**

Cause disease called Amebiasis, and this parasite live in large intestine specially in cecum.

Parasite forms:-

The parasite pass in four forms during it is life cycle which is:-

1)Trophozoite 2)precyst 3)cyst 4)metacyst

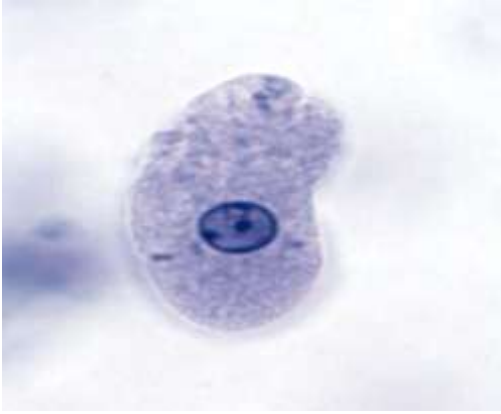
Morphology:-

Trophozoite//irregular form (due to the pseudoopoda) , transparent external cytoplasm of granular internal cytoplasm and granular internal cytoplasm , food vacuoles contain R.B.C.

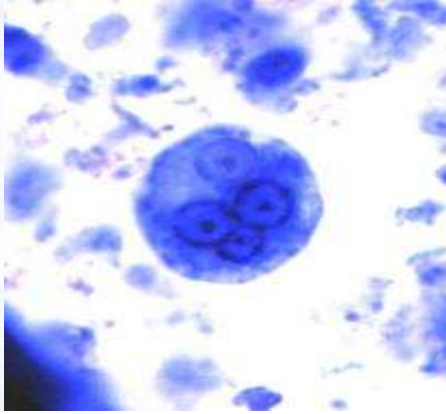
Precyst form//circle or oval in shape, disappearance of pseudopodia of food vacuoles, and contain one nucleus.

Cyst form //circle, contain four or more than nucleus and one or more chromatid body.

Metacyst form//formed directly after ingestion of cyst with contaminated food of water , than the cyst wall will be lysis and librated of the nucleus which directly divided by simple fission to formed eight new trophozoites.



Trophozoite



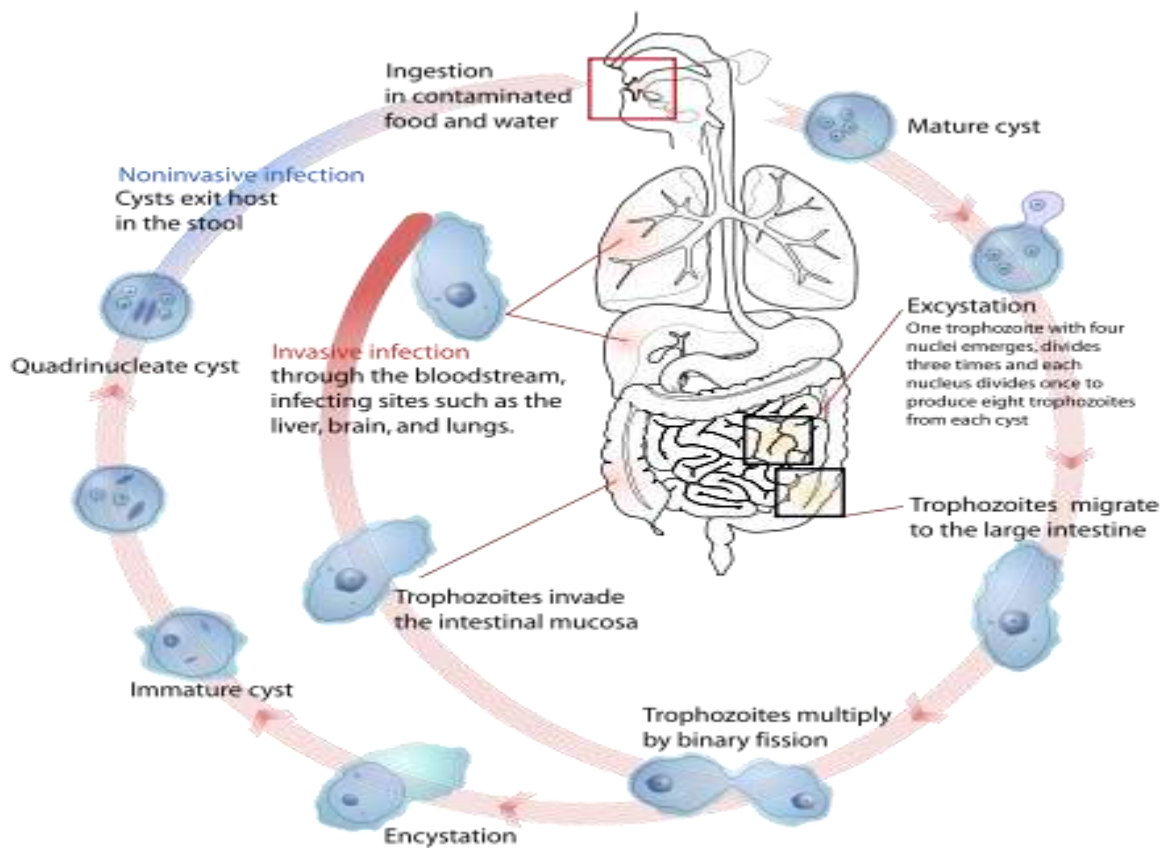
Cyst of *E. histolytica*



Cyst of *E. coli*

Lifecycle:-

The cyst can be live for two days in faeces in temperature about 37 c° and can be still alive for 9 days in 22 c° where as can still alive for 60 days under the zero c° but it killed in dehydrated, high temperature of strong sun light conditions.



Clinical signs:-

- 1) Severe diarrhea with drops of blood and mucus
- 2) Acute abdominal pain
- 3) Fever
- 4) Loss of weight

Pathogenic effect:-

- 1) Mucosa necrosis as a cup ulcer may lead to penetrate the intestine with amoebiasis granuloma observes usually in cecum, colon or rectum.
- 2) Amoebic hepatitis which lead to liver abscess
- 3) The *Entamoeba* may be transported through the caudal vena cava to the right side of heart and then to the lung and causing pulmonary amoebiasis which lead to pulmonary abscesses.
- 4) May be transported to the brain and causes brain abscess
- 5) May be transported to the uro-genital system and the cutaneous causing cutaneous amoebiasis.

Diagnosis:-

- 1) Fecal exam
- 2) Serological tests
- 3) Biopsy or aspiration of abscess of examined by haemagglutination test.

Treatment:-

- 1) Metronidazole 3 mg /kg for 5-10 days
- 2) Dilodohydroxyquine (diodoquine) 650 mg /3time daily for 20 days.

E. coli:-

Live in lumen of large intestine and it is non-pathogenic.

**Differentiation between
E.coli & *E.histolytica***

	<i>E.coli</i>	<i>E.histolytica</i>
1	Thophozoite 15-50 μ	Thophozoite 10-60 μ
2	Cyst form 10-35 μ	Cyst form 6-20 μ
3	Food vacuoles contain bacteria	Food vacuoles contain R.B.C
4	Nucleus contain un central body	N. contain central body
5	Irregular move and	Move infrontly

	slowly	
6	Wide pseudopoda	Narrow pseudopodia
7	Cyst contain 8 nucleus	Cyst contain 4 nucleus
8	Cyst have no chromatid bodies	Cyst have chromatid bodies