Parasitology

Practical labs

Content

Parasite1: E.coli

#Introduction:

- Classification of parasites
- Diagnosis of parasite (by stool examination , blood examination , x-ray ,…….)
- General stool examination (GSE)----- if the test is positive that means there are pathogenic parasites but when the test is negative that means there are non-pathogenic parasites or food particles or waste products in the stool
- Preparation of (GSE)----- (1)without iodine stain →to see the motile trophozoite (2) with iodine stain →to see dead trophozoite but it use to see cyst and eggs

#E.coli:

- non-pathogenic parasite
- 10%-20% of population have E.coli without any symptoms
- habitat : lumen of large intestine mainly in cecum
- route of infection : feco-oral route
- infective stage : cyst
- diagnostic stage : tropozoite (-)+ cyst
- morphology :

#Trophozoite:

- It has more granular endoplasm containing ingested bacteria and debris and food particles (no RBCs) .
- The ectoplasm is not clear. and it has short and wide pseudopodia.
- It has one nucleus contain large eccentric karyosome, and large chromatin granules arranged irregularly beneath nuclear membrane.
- size: 10-50 microns

#Mature Cyst:

- small , spherical to oval in shape , containing 4-8 nuclei , usually found in feces
- size: 10-30 microns
- nuclear morphology of the cyst is similar to that of trophozoite but they are smaller

#Immature Cyst:

- containing 2-4 nuclei
- chromatoid bodies
- glycogen

Parasite2: E. histolytica

#E. histolytica:

1- pathogenic parasite

2- trophzoite acute → هذه الاشياء هي سبب خطورة هذه المرحلة من الطفيلي

has :-1-pseudopodia for motile activity -2- centric karyosom and regular chromatin for protolytic enzymes and toxic sub.

3-infective stage : cyst

4-diagnostic stage : chronic→cyst acute→trophozoite

5-cyst and trophozoite diagnosis by : biopsy and stool examination and imaging study

6- diseases :

a. acute dysntric diarrhea يوجد فقط تروفوزويت

b. chronic diarrhea (perforation , ulceration of colon and peritoneal region)

يوجد تروفوزويت و سسست

c. toxic colon

d. liver abscess

e. lung and brain (rare)

7- route of infection :: feco-oral route (water-food-flies-carriers)

8- habitat : large intestine mainly in cecum

9- treatment : metronidazole - tinidazole

10- E.histolyic is epidemic because it infect only human

11- morphology :

#Trophozoite: ليس لديه شكل ثابت

1- Clear_ectoplasm .

2- Large finger – like pseudopdia

3- The endoplasm is granular and may contain RBCs.

4- It has one nucleous, contain small central_keryosome and fine chromatin granules arrenged regularly beneath nuclear membrane.

5- size: 30-50 microns

#Mature Cyst:

1- small , spherical in shape , containing 1-4 nuclei.Each nucleous contain similar nuclear morphology like the trophozoite but smaller , usually found in feces .

2- size: 10 microns

#Immature Cyst:

1- containing 1-2 nuclei

2- chromatoid bodies

3- glycogen

#For diagnosis of any parasite, depend on the following tests:

1- history (clinical presentation)

2- imaging technology

3- histological examination

4- serological examination

5- stool , urine and CSF examination

Parasite3: Giardia lambilia

#Giardia lambilia:

1- reproduction : by binary fission (in normal condition)

2- common in our society and it infect all ages ,, it make endemic diseases .

3- habitat : lumen of small intestine mainly in duodenum and in the biliary tree .

4- route of infection : feco-oral route

5- infective stage : cyst

6- diagnostic stage : tropozoite (-)+ cyst

7- morphology :

#Trophozoite:

1- small –> 12-15 micron

2- tear or piriform in shape

3- anterior rounded end and posterior tapered or pointed end

4- two large anterior nuclei with central karyosome .

5- has 2 axostyle

6- has 3-5 anterior flagella with single posterior flagella

7- has blepharoplast(sucking disc) and two parabasal bodies

8- dorsal convex surface and ventral flat surface

All these features is called ((ugly monkey face))

#Cyst:

1- small , oval in shape , containing 4 nuclei one pair on each side of the axostyle

2- size: 10-12 microns

3- has 2 axostyle

4- it contain the remaining parts of trophozoite

#The disease of Giardia lambilia:

1- steatorrhea

2- gallstones (sever case)

3- lactose tolerance (rare case)

4- diarrhea

5- weight loss

Giardia lambilia is mild but in rare conditions it make ((post giardial infection chronic fatigue syndrome)) which may lead to death

#The diagnosis of Giardia lambilia:

1- most common is stool examination for trophozoite or cyst but most of cases is lead to negative result with this examination

2- the best examination is by enterocapsule

3- endoscope

4- duodenal aspiration

#The treatment of Giardia lambilia:

1- metronidazole

2- tinidazole

Parasite4: Triechomonus

#Triechomonus:

1- T.vaginalis (for human)

2- T.tonex (in crural areas – make bad breathe odor – does not make infection)

3- T.hominis (nonpathogenic – but in large number in colon lead to diarrhea)

#T.vaginalis:

1-Morphology (of trophozoite)

1- undulating membrane

2- large single anterior nucleus

3- 18-20 microns

4- single posterior flagella with 3 anterior

5- has axostyle

6- has hydrogenosome

7- piriform shape

8- sometimes it contain viral particles (HIV)

2- no cyst stage (only trophozoite)

3- in female it infect the vagina but in male it infect the urethra and prostate

4- in female it secret toxic substances that make hemorrhage and damage to the epth. Of the vagina and make a lot of exudate

5- in male it make urgency and irritation of urethra and infertility and little exudate

6- Diagnosis of T.vaginalis

1- Swap from the wall of the vagina

2- Semen analysis

7- Infection route ::

1- sexual way (portal of entry is genitalia)

2- close contact to the patient

3- toilet

4- clothes

8- diagnostic and infected stage is trophozoite

9- The treatment of T.vaginalis:

1- metronidazole

2- tinidazole

Parasite5: Trypanosoma

#T. gambiense:

1- located in Africa

2- morphology of the trypomastigoid :

1-pointed anteriorly

2- centered elongated nucleus

3- kinetoplast (posterior)

4- flagella (anterior)

5- undulating membrane

6- length 15-30 microns

7- elongated and fusiform shape

3- life cycle :: from the biological vector (glossina tse tse fly {reveriena type}) to human

4- acute form (trypomasigoid) present in blood, lymph, bone marrow

5- chronic form present in C.S.F because it affect the C.N.S

6- it is (anterior station) because it multiple in the salivary gland of the insect

7- morphology of the epimastigoid : is the same as morphology of the trypomastigoid except :: kinetoplast become anterior to the nucleus

8- trypomastigoid located in human but epimastigoid located in insect and it found intracellular in human (we can see the epimastigoid in the insect and culture)

9- the culture is 3N media

10- infective stage :: metacyclic trypomastigoid { epimastigoid } that present in the saliva of insect and transmit to the human by bite

11- disease : it cause Gambian trypanosomasis or mid African sleeping sickness

12- Treatment : suramine (I.V)

#T. cruzi:

1- present in America

2- morphology: is the same as morphology of the T. gambiense except :: kinetoplast become very dominant (واضح جدا في الخلف) and sometimes it become u or c shape

3- vector : reduvid bug (Triatoma)

4- it is (posterior station) because it multiple in the hind gut of the bug and transmitted to human by the feces of the bug

5- diagnosis :: blood examination

6- Route of infection : reduvid bug bite – blood transmission

7- infective stage : metacyclic trypomastigoid { epimastigoid }

7- diagnostic stage : Trypomastigoid in the blood – amastigoide in the tissues

8- habitat : Acute : blood

Chronic : heart and GIT

9- disease : it cause American trypanosomasis or chagas disease

10 treatment : Nitrofurane

::::::ملاحظات هامة ::::::

1- endemic : المرض موجود في منطقة معينة طوال السنة

2- epidemic : يأتي المرض على شكل موجة الى منطقة معينة ثم يذهب

3- pandemic : المرض ينتشر في كل أنحاء العالم

4- sleeping sickness is endemic in Africa and America

5- thin blood film is used in this lab ::: the RBCs are clear and the parasite located between them and there are few WBCs

Parasite6: Lishmania

1-hemoflagellate (lishmania and trypanosoma) have Amastigote , promastigote , epimastigote and trypomastigote stages .

2- Lishmania :

-- L. Donovane. (kala azar, Visceral leishmaniasis)

-- L. Tropica. (Oriental sore, Baghdad boil, cutanous leishmaniasis)

-- L. barazerliensis (cutanous leishmaniasis)

-- L . Mexicana (cutanous leishmaniasis)

3- morphology of all Lishmania

1- Amastigote :: intracellutlar – round(ovale) – 2 to 4 microns – has nucleus and kinetoplast – short internal flagellat – not motile

2- promastigote :: spindle - has nucleus and kinetoplast – short external flagellate – motile – 15 to 25 microns

5- diagnostic stage is Amastigote ((in skin or RES))

6- infective stage is promastigote ((in the insect or the culture))

7- life cycle :: transfer from man as amastigote to the vector(insect) then developed into promastigote then transfer to man again

8- vector is sand-fly (phlebotomas)

9- reservoir is man

10 – route of infection ::: skin bite – blood transmission – congenital(rare)

11- diagnosis :: 1- smear from the margin of ulcer (see amastigote)

2- incubation in experimental animals

3- culture (nnn media)

4- biopsy from ulcer

5- serological test (PCR – skin test - ……)

12- treatment : antimonials (sodium stibogluconate)

13- habitat : in the RES (liver – spleen – L.N – B.M) and in skin

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ملاحظات :: ١- ال amastigote تكون صغيرة جدا جدا و تحتوي على غشاء رفيع جدا يحيط بها و بالوسط يوجد نقطتان هما النواة واللل kinetoplast

٢- ال promastigote تظهر احيانا على شكل وردة rosette

٣- اذا كانت ال amastigote موجودة في الskin فهذا يعني L.Tropica و اذا كانت موجودة بال spleen فهذا يعني other Lishmanias

Parasite7: P.vivax

#P.vivax:

1- Plasmodium has two stages : -1- Vertebrate host---asexual cycle---schizogony

-2- Invertebrate host---sexual cycle---sporogony

2- schizogony divided into two stages :

-1- exoerythrocytic stage (hepatic stage)(in the liver) ((not see in this lab))

-2- erythrocytic stage (in the RBCs) ((see in this lab))

3- infective stage is sporozoites which seen in the salivary gland of the insect only

4- diagnostic stage of p.vivax is ameboid stage

5- why we see large RBCs in p.vivax infection ???? because

-1- the merosoite enter inside the RBCs and cause swelling of them

- 2- vivax infect reticulocyte (large immature RBC)

6- the cycle (نفس النظري) -------

vivax→merozoite→enter the RBC→ring stage →formation of schuffiners dots(use for diagnosis of vivax)→active cytoplasm movement→ameboid stage→immature stage(nuclear division)→mature stage(cytoplasmic division)→formation of 12-16 merozoite→ repeat the cycle or lead to formation of gametocyte (female macrogametocyte and male microgametocyte)

7- vivax cause tertian fever (every three day)

8- diagnosis by :

-1-thick blood film : to recognize the presence of parasite (in lite infection and in endemic area because it is easy and fast)

-2-thin blood film : to differentiate between species

-3-serodiagnosis

9- malaria only occur inside the cells (intracellular)

10- you can not see multiple un-sequential stages in the same slide

لا يمكن رؤية عدة مراحل غير متسلسلة في نفس السلايد

11- route of infection: bite of female anopheles mosquito - sometimes blood transfusion

12- habitat : liver – RBC

13- the stages :::>>>

-1- ring stage : one nucleus + schuffiners dots { pink or red color }

-2- ameboid stage : one nucleus + schuffiners dots + irregular cytoplasm

-3- immature stage : more than one nucleus + schuffiners dots + irregular cytoplasm

-4- mature stage : multiple nucleus with their cytoplasm + schuffiners dots

Parasite8: P. malariae + P.falciparum

#P. malariae:

1- route of infection :: bite of female mosquito

2- it has no hypnozoite but p.vivax has hypnozoite

3- has dark brown to black malarian pigments

4- gametocyte are rounded

5- infective stage is sporozoites

6- diagnostic stage of p.malariae is band stage and rosette mature schzonite stage

7- it infect mature RBCs and the size of RBC still normal

8- the cycle:

malariae→merozoite→enter the RBC→ring stage (no schuffiners dots)(small and compact ring) →band stage (diagnostic stage) →immature stage(nuclear division)→mature stage(sometimes has rosette shape with malarian pigment in the center and the merozoite around it) →formation of 6-10 merozoite→ repeat the cycle or lead to formation of gametocyte (female macrogametocyte with compact nucleus and male microgametocyte with diffuse nucleus)

9- malariae cause quatrain malaria (every four day)

10- diagnosis by :

-1-thick blood film : to recognize the presence of parasite (in lite infection and in endemic area because it is easy and fast)

-2-thin blood film : to differentiate between species

-3-serodiagnosis

11- malaria only occur inside the cells (intracellular)

12 - erythrocytic sch. Cycle in P. malariae take 72 hours but in P.vivax take 42 hour

13 - exoerythrocytic sch. Cycle in P. malariae take 2 weeks but in P.vivax take 10 day

14- the stages :::>>>

-1- ring stage : small compact ring + no schuffiners dots + normal size RBCs

-2- band stage : diagnostic

-3- mature stage : 6-10 merozoite + sometimes rosette

#P. falciparum:

1- cause Malignant tertian + Subtertian malaria

2- infect all types of RBCs

3- sometimes multiple infection in single RBC

4- sometimes the ring stage has two nucleus

5- in the peripheral blood see the ring and gametocyte only but in sever state we can see the other stages

6- gametocyte crescent in shape (diagnostic)

7- ring stage very small

8- mature schizonte has 8-32 merozoite

9- the stages :::>>>

-1- ring stage : very small

-2- gametocyte : crescent shape

Parasite9: Sexual cycle of malaria

1- definitive host :: female anopheles mosquito ----→ the male feed on plants not blood

2- intermediate host :: human

3- infective stage of all malaria :: sporozoite (present in the saliva of female anopheles mosquito)

4- the sexual cycle occur in the mosquito as follow ::: the mosquito bite the skin of infected human and take all stages of malaria inside the blood but all these stages are digested in the small intestine of the mosquito except the gametocyte which form the zygote and after one hour the zygote form the ookenite then it go to the gut of the mosquito to form the oocyst which go below the basement membrane of the gut and increase in number and make nuclear division then rapture and release the sporozoite which go to the body cavity then to the salivary gland then go to other human by bite of the skin to repeat the asexual cycle in the human

5- sexual cycle (sporogony) in the female anopheles mosquito

6- asexual cycle (schizogony) in human

7- the slides :::

-1- oocyst :: 50 microns ,, spherical ,, in the intestine of mosquito

-2- ookinete :: small ,, motile(the zygote is immotile) ,, contain vacuoles ,, central nucleus ,, anterior pointed end ,, posterior rounded end

-3- sporozoite:: elongated spindle shape ,, motile ,,central nucleus ,,10-15 micron

The differences between the sporozoite and the gametocyte of P. falciparum :::

Sporozoite	gametocyte of P. falciparum
Larger	smaller
Without RBCs	with RBCs
Contain vacuoles	no vacuoles
Central nucleus	elongated nucleus

Note :: هام للإمتحان

1- p.malariae ::: low degree of movement so it form band stage

2- p.vivax ::: high degree of movement so it form amoeboid stage

- P.vivax → Benign tertian malaria
- P.malariae → Quartan malaria
- P.falciparum → Malignant tertian malaria (Subtertian malaria)
- P.ovale → ovale tertian malaria (Benign tertian malaria)

#Drugs used in treatment and prevention of malaria:

1. Quinine
2. Chloroquine
3. Sulfadoxine + pyrimethamine (fansidar)
4. Primaquine
5. Mefloquine
6. Proguanil

Parasite10: B.coli + Toxoplasma

#Balantidium coli:

1- risk group :: farmers and people deals with farm product directly

2- Morphology ::

Trophozoite	**Cyst**
50-200 micron {largest protozoa infect man}	40-50 micron
Oval or bag shape	Spherical shape
Ciliated	Ciliated
Has phagosome	No phagosme

Kidney shape macro-nucleus	Kidney shape macro-nucleus
spherical shape micro-nucleus	spherical shape micro-nucleus
Retractile food vacuoles	Retractile food vacuoles
No wall	Thick cyst wall

3- B.coli present mainly in pigs and can be present in cattle

4- rare in our society

5- route of infection :: contaminated food and water from the farm by oral route

6- B.coli is the only ciliated parasite that infect human

7- the cyst contain thick wall for resistance of environmental factors

8- habitat :: large intestine of man and animals (mainly cecum)

9- diagnostic stage : cyst +/- trophozoite

10- infective stage : cyst

11- animals are reservoir for B.coli

12- it cause dysentery like that of E.histolytica but can not cause extra-intestinal disease

13- it cause acute illness in man but lead to death if it cause perforation of large intestine and the normal flora of the large intestine invade the peritoneum and cause acute abdomen

14- stool examination for cyst and trophozoite but in E.histolytica we see trophozoite

15- treatment :: tetracycline

16- under the microscope we see:: 1-foad vacuoles 2- macronucleus 3- micronucleus

#Toxoplasma gondii:

1- common disease in our society (40% to 50 % of people affected)

2- it is a benign parasite in immune-competent people but can cause death in immune-deficient people and in fetus

3- toxoplasma is intracellular parasite so it is more resistance to drug and cause more sever disease than extracellular parasite

4- tachyzoit :: present in the blood ,, has apecomplexia that is important receptor for the target cells + nucleus

5- bradyzoite :: present in skeletal mucles and C.N.S and it affect any nucleated tissue ,, it present in the tissue cyst

6- oocyst :: oval shape ,, two sporocyst (each contain 4 sporozoite)

7- acute phase of disease caused by → tachyzoite (7-20 days of parasitemia)

8- chronic phase of disease caused by → bradyzoite (for years)

9- habitat : 1-tachyzoite in blood 2- bradyzoite in Skeletal M. and C.N.S

10- definitive host ::: cat

11- intermediate host :: man + any animal (mammals – birds)

12- infective stage : all stages could be infective as follow :

- Oocyst → ingestion of contaminated food and water
- Tissue stage → ingestion of infected meat - organ transplantation
- Tachyzoite → raw goat milk – blood transfusion – congenital

13- diagnosis :: the best diagnosis is serological tests and it is the only test used in clinical diagnosis

14- it cause abortion and congenital anomalies in fetus if the mother infected during the pregnancy of before it for short time

15- treatment :: spiromycin – pyrimethamine

Parasite11: Ascaris + enterobius

#Ascaris lumbricoides : (roundworm ---- nematode):

1- Largest nematode :::: 35cm

2- Adult females about 20 to 35 cm. long ….. Adult male about 15 to 30 cm. long

3- morphology ::: from the lecture

4- life cycle :: من محاضرة النظري ولكن الهام في العملي هي النقاط التالية

1- habitat :: small intestine (in duodenum)

2- diagnostic stage :: egg pass in stool (contain non mature embryo)

3- Infective stage :: egg in soil (contain second stage larva)

4- route of infection :: oral route ((contaminated food-drink-hand-vegetables))

5- why larva rapture the capillaries in the lung ??? the diameter of larva is 0.02 mm and the diameter of capillaries is 0.01 so larva rapture the capillaries and go through the bronchial tree to the pharynx and swallowed again.

6- it take 2 to 2.5 months from infection to adult stage under optimum conditions

7- symptoms : loss of appetite , fever , wheezing , vomiting , dyspnea , abdominal pain , abdominal swelling , diarrhea .

8- very dangerous in children lead to intestinal obstruction

9- diagnosis :: 1- stool examination for egg ((round or oval ,, albumin layer in the wall Hyaline layer in the wall ,, non-mature embryo,, corticated))

2- worm in the stool or vomit

3- larva in gastric or respiratory secretions

4- eosinophilia (blood count)

10 – treatment :: mebensazol – albensazol

#Enterobius vermicularis (threadworm - seat worm - pinworm Oxyuris vermicularis):

1- The adult female has a sharply pointed posterior end, is 8 to 13 millimeters long

2- The adult male is smaller, measuring 2 to 5 millimeters long , and it has a curved posterior end ((we should differentiate between male and female))

3- diagnostic characters of it :::: the esophageal bulb in adult and D shape egg

4- the uterus in female is full with eggs

5- habitat :: cecum and adjacent parts of small and large intestine

6- it need air and low temperature → so it go to the perianal region during night

7- when it reach the perianal region it take 4 to 6 hours to become infective (egg containing larva)

8- group at risk :::: children

9- source of infection ((contaminated food , drink ,hand ……..))

10 – route of infection : -1- oral route -2- retro-infection -3- inhalation of the eggs

11- diagnosis :: 1- scotch test 90%

2- stool examination 5%

3- self-diagnosis

12- diagnostic stage :: egg (contain non mature embryo)

13 - Infective stage :: egg (contain larva)

#Important:

1- Ascaris :::: --- larva in the lung

--- adult (male and female) in the specimen

--- egg ((round or oval ,, albumin layer in the wall

Hyaline layer in the wall ,, contain larva,, corticated))

2- Enterobius ::: --- adult female ((larger – pointed posterior end – uterus full of egg - esophageal bulb))

--- adult male ((smaller – curved posterior end -- esophageal bulb))

--- egg ((D-shape – contain larva – smooth surface – translucent – thick outer shell))

Parasite12: A.duodenale + T.trichiura

#A.duodenale:

1-life cycle :: نفس النظري Filariform larva ((non feeding – 500 micron length))

Rhabditiform larva ((feeding))

2- habitat :duodenum

3- route of infection :: -- penetration of the skin -- contaminated food and drink

4- infective stage : Filariform larva

5- diagnostic stage : egg contain undeveloped embryo in stool or adult worm

6- morphology : 1- Adult female is about 9-13 mm

2- The male is smaller than female 8-10 mm

3- The anterior end have buccal capsule armed with two ventral pairs of teeth.

4- The posterior end of the male has copulatory bursa to attach the female during the copulation, females have simple conical tail

7- morphology of egg (لا يوجد سلايد)

- oval shape
- 50 micron
- outer thick shell
- inner translucent shell
- colorless
- segmented to 4-8 blastomeres

8- clinical picture (نفس النظري) in the late stage it cause anemia because it suck the blood by the pairs of teeth -→ it cause 0.25 ml/worm/day of blood (هام)

9- diagnosis :: stool examination ((see egg and adult worm))

10 – treatment : Mebendazole – Albendazole

#T.trichiura:

1- habitat : large intestine (cecum and ascending colon)

2- life cycle : بالنظري

3- infective stage : developed egg (contain larva)

4- diagnostic stage : egg in stool + adult

5- route of infection : feco-oral route

6- morphology : 1- female : 40-50 micron + anterior part like whip

2- male : 30-45 micron + anterior part like whip

3- posterior end : thick contain sex organ and intestine in female

pointed in male curved

7- morphology of egg (هام جدا) 1- lemon or barrel shape

2- 60 micron

3- two bulging (protuberance)

4- outer shell

5- embryo

8- clinical picture (نفس النظري) it cause anemia 0.005 ml/worm/day of blood (هام)

9- diagnosis ::

- stool examination ((see egg and adult worm))
- proctoscopy in rectal prolapse

10 - treatment : Mebendazole – Albendazole

Parasite13: Trichinella + wuchereria

#Trichinella spiralis:

1-life cycle :: swine eat uncooked garbage containing pork scraps → adult worm in intestine of swine → larva encysted in striated muscles of swine , bear , walrus → man eat raw or undercooked park → adult warm in man intestine produce larva → larvae carried in blood stream to muscles and other organs → larvae encysted in striated muscles

2- larva survive only in skeletal muscles but in other locations will destroyed

3- larva with calcified capsule can be recognized by the eye not by X-ray

4- adult have spear (رمح) projection in the end of the mouth that allow deep penetration in the muscles

5- the larva surround itself by cyst that developed in the skeletal muscles

6- man is the dead end of the cycle

7- it is intestinal nematode

8- man acquired the infection by → ingest the infected meat which contain larva

9- infective stage → larva

10- diagnostic stage → First stage-larva in the nest cells

11- site : from duodenum to the end of intestine

12- female is viviparous → that mean it give larva directly without egg (in 2 days)

:::Note ::: oviparous give egg ---- viviparous give larva directly without egg

13- early stage of disease → diarrhea

14- late stage of disease → generalized muscle pain

15- muscles affected by this parasite :: diaphragm – deltoid – calf muscles – extraocular muscles

16- man is intermediate host (because contain larva stage) and definitive host (because contain adult stage) …… pig ,dog ,cat and other animals also intermediate and definitive host ….. birds only definitive hosts……man also act as harbor .

17- diagnosis → the best method is muscle biopsy (100% result)….. other methods : serological test(ELISSA) , skin test and see larva by naked eye (adult male and female rarely seen)

18- treatment → barbiturate – corticosteroids – thiabendazole

#Wuchereria bancrofti:

1- habitat → large lymph vessels and lymph nodes

2- female : 8-10 cm …. Larger than male

3- human acquired the infection by bite of all species of mosquito … most common species are : culex , aedes and anophyles

4- life cycle : female lay microfilariae in the lymphatic of man → microfilariae penetrate the lymphatic and migrate to the blood vessels and enter the circulation → microfilariae ingested by mosquito → microfilariae penetrate the small intestine of mosquito → then migrate to the thoracic muscles where they develop → infective larva in the proboscis of the mosquito → larva deposited on skin near bite of mosquito → go to blood → larva enter lymphatic and developed to adult (from 6 months to 1 year)

5- infective stage → larva from mosquito (filariform larva L3)

6- diagnostic stage → microfilariae

7- microfilariae = prelarval stage (the number of microfilariae in night is 3 times more than day) → in the day the microfilariae go to the pulmonary and in night it go to the blood

8- female are viviparous

9- first stage → asymptomatic

10 –second stage → go to lymph nodes of lower limbs and external genitalia cause lymphangitis and cause elephantiasis

11- after death of Wuchereria bancrofti it also cause disease by its toxin

::: note ::: microfilariae present in the blood of human then converted to larva in the mosquito then to adult worm in the human ((human is definitive host))

12- diagnosis : 1- blood film (taken at night because number of microfilariae is increased)

2- blood centrifuge (if blood film is negative)

3- calcified cyst seen by naked eye

Parasite14: Taenia saginata

#Cestode (بشكل عام) : → morphology of adult ((head(scolex) – short neck – mature segment – immature segment – gravid segment))

#Taenia saginata:

1- cause Taeniasis (beef tapeworm infection)

2-life cycle :: adult in small intestine → embroynated egg → after few weeks egg in stool (or gravid segment in the stool) → egg hatch into larva (oncosphere) in the intestine and penetrate intestinal wall →oncosphere in the muscles and other tissues → after 3 months → oncosphere developed into cysticorcus bovis in the muscles → cysticorcus bovis eaten by man (in insufficiency cooked beef) → scolex attach to mucosa of small intestine and developed into adult worm → after 2-3 months →adult in small intestine → repeat the cycle

3- habitat : small intestine (jejunum)

4- route of infection : mouth (eating infected meat)

5- infective stage : cysticorcus bovis

6- source of infective stage : tongue of animals (cattle) that contain cysticorcus bovis and it prevented by good cooking and deep freezing

7- cysticorcus bovis enter the body as invagenated scolex then converted to evagenated scolex that attach to the small intestine .

8- evagenated scolex only in human

9- invagenated scolex in cattle and animals

10- definitive host : human

11- intermediate host : cattle , cow , ……..

12- Diagnosis : stool examination (see egg , gravid segment)

13- clinical picture : abdominal pain , nausea , vomiting , intestinal obstruction and appendicitis

14- treatment : niclosmide

15- morphology :

A- Adult : 1- white-gray color

2- (5-6) meter long

3- head contain 4 suckers without rostelum and without niclaic

4- scolex --- a: invagenated : scolex inside the cyst (غير موجود بالمختبر)

b: evagenated : scolex outside the cyst (موجود بالمختبر)

5- mature segment : two lobe of ovary – uterus – testes

6- immature segment

7- gravid segment : uterus contain eggs – 15-30 uterine branches

B- Egg : 1- small size (30-40M)

2- spherical or oval shape

3- covered by thick outer sheath

4- contain hexacanth embryo

5- have 6 hooklets

6- radially straight wall

Parasite15: Taenia solium

#Taenia solium: ((pork tapeworm))

1- habitat : small intestine (jejunum)

2- definitive host : man only

3- intermediate host : pig , man , sometimes dog and other animals

4- human can be intermediate host for T.solium , but only definitive host for T.saginata

5- human become intermediate host by the following ways :

1- Peristalsis in opposite side : regurgitation of the egg to the stomach →Hcl→ intestine → bile → release of oncosphere(larva) {{autoinfection}}
2- Human is carrier of adult → poor hygiene →egg will contaminate the food (self infection)
3- Restaurants workers →poor hygiene → egg will contaminate the food

6- route of infection for man and animals : oral route

7- infective stage to animals : egg

8- infective stage to man : cysticercus cellulose in pork meat

9- life cycle :: adult in small intestine of man →emberyonated egg+ segments in feces → egg and gravid segment on soil eaten by swine or (man) → larva (oncosphere) → hatch in the intestine → penetration of the wall → go to blood → carried by blood to other tissue →cysticercus cellulose eaten by man (raw or insufficiently cooked)→evaginated scolex attach to mucosa →adult in small intestine of man

10-adult :: scolex + hooks + suckers + neck + gravid segment → when gravid segment separate from the body and go outside in feces so the egg will appear in the stool after the rapture of gravid segment

11- Hcl of stomach + bile pigment => lead to rapture of cysticercus cellulose and release of larva (oncosphere)

12- diagnosis : egg or gravid segment in stool

13- morphology :

1- Scolex : a- evaginated & invaginated

b- rostellum

c- double row of hooks

d- suckers

2- Gravid segment : 7-13 branch of uterus
3- Egg (like the egg of T.saginata)
4- Mature segment: a- square shape (but T.saginata = rectangle shape)
b- accessory lobe between the uterus and the other lobe
T.saginata→bi-lobed T.solium→tri-lobed

Parasite16: Echinococcus granulosus

#Echinococcus granulosus:

1- It is the smallest tape warm can infect the human (8-9mm or 1cm length)

2- definitive host : dog and other canidae

3- intermediate host : human , sheep ,goats , swine and others

4- habitat : adult worm in the small intestine of dog (definitive host)

5- infective stage to man : egg in the feces of infected dog

6- infective stage to dog : larval or cystic stages in sheep

7- life cycle غير هام ((The adult Echinococcus granulosus inhabit the upper part of small intestine of the definitive hosts, dogs or other canids(cats, foxes and wolves). → Gravid proglottids release

eggs that are passed in the feces as a diognostic stage for infected dogs → These eggs are infective stage to a suitable intermediate host (sheep, goat, cattle and man). →After ingestion, the eggs hatches in small intestine and releases an oncospher (emberyo) that penetrates the intestinal wall and migrates through the circulatory system into various organs, especially the liver and lungs. →In these organs, the oncosphere develops into a hydatid cyst that enlarges gradually, producing protoscolicis incide the cyst. →The dogs (definitive host)and other canids becomes infected by ingesting the H. cyst-containing organs of the infected intermediate host. After ingestion, the scolex evaginate, attach to the intestinal mucosa, and develop into adult stages in 30 to 80 days.))

8- human is dead end of the cycle

9- oncosphere cause diseases in the human → 70% in liver – 20% in lung – 10% other organs – when reach the C.N.S it may lead to death

10- The disease called (Hydatid disease (hydatidosis)): Is caused by the larval stages (hydatid cyst) ----> very common disease in Iraq ,Turkey, Syria and in country with sheep

11- This disease called belong to SOL (space occupying lesions) → this mean that the development of disease depend on the organ which contain the hydatid cyst . and it differ from organ to another (the parasite has no toxin)

12- Trauma and surgery lead to rapture of hydatid cyst → inflammation and hypersensitivity → death of the patient

13- Diagnosis :

1. History of patients in endemic areas.
2. X-ray picture, detection of the cyst mass in organ.
3. Ultrasound scan - MRI - CT scan.
4. Biopsy not recommended before operation, but is essential to confirm the diagnosis after surgical operation.
5. Serology tests (IHA- ELISA- PCR- Casoni skin test)

14- Treatment : surgical removal after 2 months of albendazole for shrinkage of cyst

15- morphology :

1— adult :

1- head : contain scolex (piriform shape)+ 4 suckers + two rows of hooks + rostellum (used to attach to intestinal mucosa)

2- Immature segment : small + not contain any differentiated organs

3- Mature segment : contain fully developed male and female sexual organs

4-Gravid segment : contain only uterus full with eggs.(10-15 uterine branches)

2— hydatid cyst : (size = 1cm and it may reach 50 cm)

1- Germinal layer: inner thin layer + cuboidal cells + it is primary layer of the parasite + continuously produce protoscolecis .

2- Hyaline layer: non-nucleated + used to maintain the shape of hydatid cyst .

3- Fibrous tissue layer: thick + formed as a result of the defense mechanism in the body against the hydatid cyst .

4- Outer host- tissue capsule: derived from the tissue that contain the hydatid cyst.

5- The sac : contain protoscolexs (invagenated scolecs called hydatid sand)

3— egg :

1- Spherical

2- 35-45um in diameter .

3- Hexacanth Embryo centrally located .

4- Radially staited shell

Parasite17: D.latum + H.nana

#Diphyllobothrium latum (fish tapeworm):

1- It is the largest human tapeworm 3-10 meters in length

2- definitive host : man , dog , cat

3- intermediate host : 1) first : freshwater crustacean (copepod)

2) Second : fresh water fish

4- habitat : small intestine (jejunum – ilium)

5- infective stage to man : plerocercoid larvae

6- diagnostic stage to man : egg and gravid (stool examination)

7- route of infection : eating raw or uncooked infected intermediate host fish

8- life cycle غير هام ((The adults of D. latum attach to the mucosa of small intestine by scolex →immature eggs are passed in feces, after maturation the oncospheres develop into a coracidia larvae → After ingestion of these larvae by a suitable freshwater crustacean (the copepod first intermediate host) →After ingestion of the copepod by a suitable second intermediate host(fresh water fish)→ the procercoid larvae are released from the crustacean and they develop into a plerocercoid larvae (sparganum) which is the infective stage to humans → Humans can acquire the disease by eating raw or uncooked infected intermediate host fish→ the plerocercoid develop into mature adult tapeworms in the small intestine. → Maturation of the parasites occurs within 20 days and the adult worm can release the eggs in the small intestine and pass with feces as a diagnostic stage))

9- morphology :

1- Scolex : almond-shape - spoon-shape - deep longitudinal grooves(dorsal and ventral) - no hooks - 1-2mm
2- mature segments : broader than long - contain both male and female organs

3- it has 3000 segment
4- egg : oval in shape with operculum at one end

10- Clinical Features: abdominal discomfort – diarrhea – vomiting - weight loss - Vitamin B12 deficiency -intestinal obstruction.

#Hymenolepis nana (dwarf tapeworm):

1- It is the smallest human tapeworm 15 to 40 mm in length

2- definitive host : man , mice , cat

3- intermediate host : none

4- habitat : small intestine (ilium)

5- infective stage to man : cysticercoids larva - egg

6- diagnostic stage to man : egg and gravid (stool examination)

7- route of infection : oral route - arthropod bite - autoinfection

8- life cycle غير هام ((The adult present in small intestine of human → The eggs pass as a diagnostic stage and are immediately infective when passed with the stool of patient → If the eggs are ingested by an arthropod intermediate host, they develop into cysticercoids larva(Infective stage), which can infect humans or rodents (Difinitive hosts) by ingestion and develop into adults in the small intestine → If the eggs are ingested with contaminated hands,food or water from infected feces the oncospheres (hexacanth emberyo) inside the eggs are released and penetrate the intestinal villus and develop into cysticercoid larva,which rupture the villus, then return to the intestinal lumen, and develp into adult worm which attached to the intestinal mucosa and develop into adults and start producing gravid proglottids))

9- morphology :

1- Scolex : 1-2 mm - 4 suckers – one row of hooks – rectictile rostellum
2- mature segments : broader than long - contain both male and female reproductive organs
3- neck
4- it has 200 segment
5- gravid segment : uterus with eggs

10- Clinical Features: weakness – headaches – anorexia - abdominal pain – diarrhea

Treatment : 1- Praziquantel is the drug of choice for Hymenolepis nana

2- Niclosamide is the drug of choice for Diphyllobothrium latum

Parasite18: Schistosoma haematobium

#Trematodes:

- Intestinal flukes → Heterophyes heterophyes
- Liver flukes → Fasciola hepatica
- Pulmonary flukes → Paragonimus westermani
- Blood flukes → Schistosoma

#Schistosoma haematobium:

1- definitive host : man

2- intermediate host : snail bulinus

3- habitat : vesical plexus (veins) around the bladder

4- infective stage to man : cercaria

5- diagnostic stage to man : egg (urine examination)

6- route of infection : skin penetration - oral route

7- life cycle غير هام ((adult in the intestine of man → embryonated egg in small intestine → embryonated egg pass into lumen of bladder , out with urine into water → Miracardium haches from egg , penetrate snail → in the snail mother sporocyst daughter sporocyst cercaria → cercaria leave snail into water → cercaria penetrate skin of man → carried by blood to the heart → lungs → heart → portal vessels → immature worm become mature worm → migrate back to vesical veins → repeat the cycle))

8- morphology :

- **Adult :**

1- Have separate sexes (male and female)
2- Elongated parasite , leaf shape
3- Anteriorly it is attached to the host by ventral suckers
4- Female : longer – narrower – smooth body
5- Male : shorter – wider – body has granulations – folded body
6- They have oral and ventral suckers – mouth – pharynx - esophagus – intestine
7- The intestine → end in blind loop
8- Black color of worm body → due to digestion of blood
9- GIT : have two branches that fuse to make one canal
10- Male : have 3-5 testes opposite to ventral suckers
11- Female : has ovary infront of the reunion of intestine (ovary located posteriorly – red color)
12- Female : from ovary to the end of the body there are vitellaire glands

- **Egg** :

1- Oval
2- Large
3- No operculum
4- Contain fully developed Miracardium
5- Have terminal spine

- **Miracardium:**

1. Swim very rapid searching for snails
2. Covered by cilia

- **Cerearia :**

1. Bifurcated tail
2. Has body
3. After penetration of skin , it will lose its tail
4. Could enter through mouth or skin

9 – Symptoms : Cough &hemoptysis - Febrile reaction - Eosinophilia - Terminal hematuria - Dysuria - frequency of micturition - Suprapubic pain - pyurea

10 - Diagnosis :

- Urine examination (see egg ----- do the test after exercise)
- Biopsy
- Clinical picture
- Blood examination (eosinophilia – increase WBC)
- Hatching test (examination of eggs for viability)
- Serological diagnosis
- X-ray
- UltraSound
- Intradermal Skin test

11 - Treatment : Metrifonate – Niridazole – Praziquantel

Parasite19: Schistosoma mansoni

1- definitive host : man

2- intermediate host : snail biomphalaria

3- habitat : mesenteric veins of man

4- infective stage to man :bifurcated tail cercaria (present in water)

5- diagnostic stage to man : egg (stool examination)

6- route of infection : skin penetration (head only enter, but tail stay out) - oral route

7- life cycle غير هام ((adult in the mesenteric veins of man → embryonated egg in small venule → embryonated egg pass into lumen of intestine , go out with stool → Miracardium haches from egg , penetrate snail → in the snail mother sporocyst daughter sporocyst cercaria → cercaria leave snail into water → cercaria penetrate skin of man → carried by blood to the heart → lungs → heart → portal vessels → immature worm become mature worm → migrate back to mesenteric veins → repeat the cycle))

((cercaria enter liver through the artery → develop to adult → leave the liver through the vein → go to intestine))

8- morphology :

- **Adult :**

13-Have separate sexes (male and female)
14-Male (oral suckers - ventral suckers - gynecophoric canal - 6-9 testes near the ventral suckers)
15-Female (ovary located anteriorly and it is pink in color) in S.hematobium → ovary located posteriorly or in the middle
   - S.hematobium female ovary → (بالنهاية) قريبة من الجهة الغامقة
   - S.mansoni female ovary → (بالبداية) قريبة من الجهة الفاتحة

- **Egg** :

6- Oval
7- Large
8- No operculum
9- Contain fully developed Miracardium
10-Have small , <u>lateral spine</u>

- **Miracardium:**

3. Swim very rapid searching for snails
4. Covered by cilia

- **Cerearia :**

5. Bifurcated tail
6. Has body
7. After penetration of skin , it will lose its tail
8. Could enter through mouth or skin

9 – Symptoms : pruritus - rashes - Cough &hemoptysis - fever - Eosinophilia - urticara - diarrhea - dysentery - weight loss - hepatospleenomegaly - anemia - abdominal discomfort

10 - Diagnosis :

- stool examination (see egg ----- do the test after exercise)
- liver Biopsy
- Clinical picture
- Hatching test (examination of eggs for viability – also use to check the following patients)

- Serological diagnosis
- Skin test
- Sigmoidoscopy and biopsy

11 - Treatment : oxamniquine – Niridazole – Praziquantel

Parasite20: F. hepatica + H. heterophyes

#Fasciola hepatica:

1- definitive host : man , sheep , cattle , ……..

2- intermediate host : snail lymnea

3- habitat : bile duct and biliary passages

4- infective stage to man : metacercaria (present in water vegitations)

5- diagnostic stage to man : egg (stool examination)

6- route of infection : oral route (eating uncooked watercress)

7- life cycle غير هام ((adult in biliary passages → egg in stool → miracidium → in snail lymnea sporocyst – radia – cercaria → cercaria leave snail → encyst as metacercaria on grass , watercress → eaten uncooked by man → penetrate intestinal wall , liver capsule , biliary tree → repeat the cycle))

8- morphology :

- **Adult :**

16-Leaf shape with branched intestine , testes , vitallariae
17-Large (2-3 cm in length)
18-Has shoulders (shouldered appearance)
19-Anteriorly wider than posteriorly
20-Oral , ventral suckers
21-Ovary
22-Short convoluted uterus (with eggs)

- **Cerearia :**

9. Not - bifurcated tail
10. Has body

9 – Symptoms : pruritus - fever - Eosinophilia - urticara – epigastric pain – jaundice – hepatomegaly - cholangitis - biliary obstruction

10 - Diagnosis :

- stool examination (see egg)
- duodenal aspirate
- skin test
- Serological diagnosis

11 - Treatment : bithionol

#Heterophyes heterophyes:

1- definitive host : man , cat , dog , animals that eat fish

2- intermediate host : first → snail pirenella // second → fish (mugil fish)

3- habitat : small intestine

4- infective stage to man : metacercaria (present on the scales , tail , gills , fins of fish)

5- diagnostic stage to man : egg fully empryonated (stool examination)

6- route of infection : oral route (eating uncooked fish)

7- life cycle غير هام ((adult in small intestine → egg in stool fully empryonated → first intermediate host snail sporocyst , radia , cercaria → cercaria encyst to metacercaria on scales , tail , gills , fins of mugil fish second intermediate host → man eat raw fish → metacercaria escape → become adult in week → repeat the cycle)

8- morphology :

- **Adult :**

1. Very small (1-2 mm)
2. Pyriform shape (posterior end more rounded than anterior end)
3. Large oral sucker anteriorly
4. Large ventral sucker (behind oral sucker)
5. Genital suckers (behind and lateral to the ventral sucker)
6. 2 ovoid testes posteriorly
7. Ovary (anterior to testes – oval shape – red color)
8. Polygonal Vitellarial glands (posterior and lateral)
9. Intestine
10. Convoluted uterus (with eggs)

- **Cerearia :**

1. Not - bifurcated tail
2. Has body and head

9 – Symptoms : irritation - diarrhea - colicky pain - abdominal discomfort - tenderness - eosinophilia

10 - Diagnosis :

- stool examination (see egg)

11 - Treatment : praziquantel

Parasite21: Mosquito + sand-fly + fleas

#Mosquito:

1- only two are important → Anopheles and Culex

2- morphology :

- one pair of wings
- three pairs of legs
- head (circular – one pair of eyes – contain proboscis and antennae and maxillary palp)

3- medical importance → it is a vector for :

- Malaria (parasite)
- Filariasis (parasite)
- Yellow fever + Denque (viral disease)
- Viral encephalitis

	Anopheles male	**Anopheles female**	**Culex male**	**Culex female**
Hair	More hairy	Less hairy	More hairy	Less hairy
Antennae	Plumose	Pilose	Plumose	Pilose
Maxillary palps	End as club shape	As long as proboscis	Turned upward	Short

#Sand-Fly:

1- only one is important → phlebotomus papatassi

2- morphology :

- one pair of wings (V shape on resting position)
- very hairy (over all the body)
- small (3 mm size)
- yellowish in color
- 16 joined antennae (with one long pair of antennae)

3- medical importance → it is a vector for :

- Leishmania (barazilliasis – kala azar)
- sand-fly fever (viral)
- bartonellosis (bacillus disease)

#Fleas:

1- only one is important → Siphonaptera

2- morphology :

- small size (2 - 2.5 mm)
- wingless
- 3-4 pairs of strong legs (help the fleas to jump)
- Compressed laterally
- Mouth part and antennae are short
- Small head

3- medical importance → it is a vector for :

- Plaque
- Endemic typhus ((epidemic typhus transmitted by lice))
- Number of bacterial and viral diseases

Parasite22: Sarcoptes scabiei + lice + Ticks

#Sarcoptes scabiei:

1- morphology:

- Tow separated sex.
- Oval in shape
- Has mouth part
- Gray-yellow color
- Have dorsal bristles.
- Four pairs of leg (tow anterior pair and tow posterior pair).
- Larval stage (nymphs) has same morphology of adult except it has one posterior pair of leg, in case of nymph develop to male only one stage will occur, but if nymph develop to femal two stage will occur.

2- habitat : live in stratum corneum (feed on keratinized cells – make tunnels in skin)

Female	Male
0.4 mm	0.25 mm
Have long bristles	Have short bristles
Have cup like sucker in the anterior pair of leg	Have cup like sucker in anterior & posterior pair of leg

3- Life cycle :

- Start → adult parasite make tunnels in the epidermis and eat the dead cells → mating of adult male and female → give 50 eggs daily → eggs develop to larva → nymph → adult → repeat the cycle
- female :: adult → egg → nymph 1 → nymph 2 → adult
- male :: adult → egg → nymph → adult

4- diagnosis :

- Clinically.
- Scarping test. ((invasive scraping of the skin until bleeding))
- Ink test (easy & non invasive).
- Laboratory test (very rare & invasive).
- serology test are not found.

#Lice:

- Head louse : pediculus humanus capitis
- body louse : pediculus humanus corporis
- pubic louse : phthirus pubis

1- morphology :

- small
- ectoparasite
- wingless
- dorsoventrally flattened (compressed dorsoventrally)
- claw at the end of each leg (3 pairs of legs)
- composed of head , thorax and abdomen
- have mouth part (adapted for piercing and sucking the blood from the host)
- pubic louse → compact body (abdomen plus thorax) + small size(0.25 mm) + large claw on the legs so it called crab louse (crab = سلطعون) → the claw help the lice to catch the hair

2- area of isolation :

- Head louse : found on scalp (feed on human blood when need)
- body louse : found on clothing (feed on human blood when need)
- pubic louse : found on pubic hair (it is one of the major STDs)
- lice present in crowded area and low hygiene (handy cape -metal retarted patient)

3- clinical importance :

- lead to bleeding
- STD (pubic louse)
- Body louse is vector for : Epidemic typhus – Relapsing fever – Trench fever
- Head and pubic louse not vectors

#Ticks:

1- Hard ticks (Ixodidae spp.)

- Hard skeleton of keratinized material cover the body (in female 1/3 of the body is covered - in male whole body is covered) this hard skeleton called <u>scutum</u>
- Oval in shape
- 4 Pairs of legs
- We can see mouth part from both dorsal and ventral surface
- See it brown in color

2- soft ticks (ornithodoros spp.)

- Leather texture (lack of scutum)
- rounded in shape
- 4 Pairs of legs
- Not see mouth part from dorsal surface
- It is the biggest insect in low-power

3- ticks feed on blood (it not need human blood but human affect accidentally)

4- clinical importance :

- Neurotoxin : it is anesthetic material (to prevent human from sense the bite)
  More than 5 adult ticks produce neurotoxin will reach the C.N.S (may lead to death) …….
  Sometimes lead to paralysis

- Vector for :
  1. Tularemia (bacterial)
  2. Hemorrhagic fever (viral)
  3. Babesia (parasitic) …… malaria like parasite that destroy the R.B.Cs

Summary: By Ameer Saadallah

	Habitat	Diagnostic Stage	Infective Stage	Route of infection	Diagnosis
Entamoeba coli	Large intestine mainly in cecum	Trophozoite +/- cyst	Cyst	Feco-oral contamination of hands & food.	Stool examination
Entamoeba histolytica		Acute : trophozoite Chronic : cyst			-Stool examination -Biopsy & fluid aspirate -Imaging study
Giardia lamblia	Small intestine mainly duodenum, and biliary tree	Trophozoite +/- cyst	Cyst	Feco-oral contamination of hands & food.	-Stool examination -Entero-capsule
Trichomonas vaginalis	Female: Vagina Male: urethra & prostate	Trophozoite		Sexual Toilets & fomites	-Vaginal swab -Semen analysis
Trypanosoma gambiense (Epimastigote form is found in insect & culture)	**Acute**: blood , lymph node & bone marrow **Chronic** : CSF	Trypomastigote	Metacyclic Trypomastigote	Tse-Tse fly Glossina (Reveriena) bite of skin (Anteroir station)	Blood & CSF smear
Trypanosoma cruzi	Acute : blood Chronic : heart & GIT	Trypomastigote in blood Amastigote in tissues	Metacyclic Trypomastigote	Feces of Reduviidae (Triatoma) bug through damaged skin (Posterior station)	Blood smear
Leshmania (Promastigote form is found in insect & culture)	RE cells in skin or spleen	Amastigote	Promastigote	Sandfly Phlebotomus bite of skin	-Smear from edge of skin lesion -Bone marrow, or spleen biopsy
Plasmodium vivax	RBC & hepatocyte – hypnozoite	Ameboid stage or mature schizont	Sporoziote	Female anopheline mosquito bite of skin	Repeated thick and thin blood films
Plasmodium malariae	RBC & hepatocyte	Band stage or mature schizont			
Plasmodium falciparum	RBC & hepatocyte	Crescent gametocyte or ring stage			
Balantiduim coli	Large intestine mainly in cecum	Cyst in formed stool Trophozoite in diarrhea	Cyst	Feco-oral contamination of hands & food.	Stool examination
Toxoplasma gondii	Skeletal muscles , CNS ,& fetus	Parasite in (biopsy, buffy coat cells, or CSF)	Fecal oocyst (containing sporoziote) ,tissue cysts (containing bradyzoite) , and congenital (tachyzoite)		Serology

	Habitat	Diagnostic Stage	Infective Stage	Route of infection	Diagnosis
Ascaris lumbricoides	Small intestine	Eggs containing undeveloped embryo	Egg in soil containing 2nd stage larvae	Orally through soil contaminated food	-Stool examination for eggs. -Worms in stool or vomit.
Enterobius vermicularis (Pin worm , Seat worm)	Large intestine mainly in cecum	Eggs containing undeveloped embryo	Eggs containing larvae	Feco-oral , Inhalation of eggs , or retro-infection	-Scotch adhesive tape -observing eggs in perianal area
Ancylostoma duodenale (Hook Worm)	Small intestine	Eggs are segmented to 4-8 blastomeres	Filariform Larvae	Penetration of skin or orally	Stool examination for eggs.
Trichuris trichuria (Whip worm)	Large intestine mainly in cecum & ascending colon	Eggs containing undeveloped embryo	Eggs containing larvae	Orally through soil contaminated food	-Stool examination for eggs -Proctoscopy in rectal prolapse.

	Habitat	Diagnostic Stage	Infective Stage	Route of infection	Diagnosis
Trichinella spiralis	Small intestine	Encysted 1st stage larvae in striated muscles		Eating undercooked meat	-Muscle biopsy -ELISA
Wuchereria bancrofti	Lymph node & lymph vessles	Microfilariae (prelarval stage)	Filariform larvae (L3)	Depositions near the bite of mosquitos commonly Anopheles , Culex , or Aedes	-Blood film (at night) -Blood centrifuge -Calcified cyst in specimen
Taenia saginata (Beef tapeworm)	Small intestine	Eggs or gravid segments	Cysticercus bovis	Eating undercooked beef	Stool examination
Taenia soleum (Pork tapeworm)			- Cysticercus cellulosae - Eggs (accidentally)	-Eating undercooked pork -Eating eggs accidentally -Autoinfection	
Echinococcus granulosus	Adult worm in small intestine of dog	Hydatid cyst (larval stage)	Eggs	Feco-oral contamination of hands & food	-History of patients in endemic areas -U/S , CT , MRI , X-ray -Serology
Diphyllobothrium latum (Fish tapeworm)	Small intestine	Eggs or gravid segments	Plerocercoid larvae (Sparganum)	Eating undercooked fish	Stool examination
Hymenolepis nana (Dwarf tapeworm)	Small intestine	Eggs or gravid segments	-Cysticercoid larvae -Eggs	- Feco-oral contamination of hands & food -Autoinfection	Stool examination
Schistosoma haematobium	Vesical plexus (bladder veins)	Eggs	Cercaria	-Skin penetration -Orally	Urine examination (Best after exercise)
Schistosoma mansoni	Mesenteric Veins				Stool examination (Best after exercise)
Fasciola hepatica	Bilitary tree	Eggs	Metacercaria	Eating undercooked watercress	Stool examination
Heterophyes heterophyes	Small intestine	Eggs (fully embryonated)	Metacercaria	Eating undercooked Mugil fish	Stool Examination

+Morphology +Life cycle +Characteristic diseases caused by these parasites

Note: It's better to print this in colors through: muhadharaty.com/parasitology

http://www.muhadharaty.com/parasitology