Strongyloides stercoralis :

Nematodes. It's a very small nematode 2-3 mm in length, has separate sexes, males and females are present, it has a parasitic state and a free-living state. In the parasitic state there are only females, yet they still produce eggs which are fertile.

This is known as parthenogenesis

Humans are the principle host

They lay eggs in the villi of the small intestines and the eggs quickly hatch to produce larvae which escape into the lumen. Larvae appear in the feces, which differentiates it from hookworms in which you can find eggs in the feces(important for diagnosis).

Larvae escape with the feces, go into the soil and then enter the free-living state.

3 life cycles \3 ways to continue their life cycle :

1-Direct cycle: the same as the hookworms. Larvae are present in the soil(known as rhabditiform larvae), feed for a few days from bacteria and mature. They then become infective filariform larvae. They are attracted to the skin of feet *Thigmotaxis* (barefoot people), they go to the skin and penetrate the subcutaneous tissues to blood, to lungs, where they get stuck in capillaries and break into the alveoli, up to the trachea and then to the mucus. They will be swallowed again and go into the small intestines to become adult worms.

2-Indirect cycle: Rhabiditiform instead of changing into filariform larvae, they turn into adult worms and stay in the soil. This is known as the free living cycle. They will copulate in fresh air. In this stage there are males and females, while there are no males in the intestines. They produce eggs which produce larvae and become adult worms and the cycle can be repeated until at a certain stage the larvae can become filarifrom larvae that penetrate the skin and so on .

3- This is known as auto infection Larvae inside the lumen will change into filarifrom larvae directly instead of going outside. They then penetrate the small intestines and develop into other worms.

This is an exception to the rule that helminthes don't multiply within the body. Protozoa can multiply by binary fission and increase their number. However, worms can't increase their number unless you ingest more eggs.

This kind of multiplication of the number of worms inside is known as hyper- infection syndrome(larvae wandering all over the body produces lesions and inflammatory reactions all over the body which might lead to death.). This is more evident in people on steroids*immune-compromised*.

Diagnosis:

Examination of feces and checking for the presence of larvae.

Symptoms:

If you have a small number of worms the patient may not have any symptoms.

If there's an increase in the number the patient might have abdominal pain, diarrhea, nausea, weight loss, skin rashes ... we also get eosinophilia in 10-20 % of the cases but not in the hyper-infection syndrome

In cases of hyper infection the patient will have inflammatory regions all over the body which is fatal and might lead to death.

By this the doctor finished the nematodes.

Visceral Larvae Migran:

Toxocara canis and cati :

Toxocara : is the dog's or cat's ascaris worm .

Ascaris that can affect cats and dogs. If a human eats the eggs of a non-human ascaris they will try to develop in his body but can't really mature because the environment of the human body is differentfrom that ofa dog or a cat. They will produce inflammatory reaction and eventually die. This is known as toxocariasis or visceral larvae margin because larvae travel to different viscera of the body. This is important because sometimes they can settle in parts of the body(eye, brain, liver, etc...)

In the eye it can produce blindness

Cutaneous Larvae Migran:

Hookworms that belong to animals can invade a human's skin. However, they can't travel far due to the strange environment. They will not mature any further. They produce inflammatory reaction and die.

Due to the migration under the skin it might produce itching – skin rash .

Tapeworms (Cestodes)

The structure of tape worms : they are made of units called proglottids , anteriorly they have scolex that have suckers or hooks and a neck region. The first third contains immature eggs the second third contains mature eggs and the last third is called the gravid proglottids (has fertilized eggs)

-Two main tape worms affecting humans :

Taenia Saginatum, Taenia Solium.

1-Taenia Saginatum:

Intermediate host is the cattle, and the primary host is the human being.

2-Taenia Solium

Intermediate host is the pig and the primary host is human .

They are very common.

Taenia solium not common in our countries because people don't eat pork on a usual basis.

Morphological Differences:

1) scolex

-Saginatum has 4 suckers but no hooks (rostellum)

-Solium 4 suckers with hooks

2)mature proglottids

Mature proglottids are square for saginatum and rectangular for solium

3)Sexual Organs:

Solium has 3 ovaries while Saginatum has only 2

4)Cysticercus and eggs are the same for both .

Striated border and inside it the embryo has 6 hooks (hexacanthes). Same in both worms.

5)Gravid proglottids: uterus full of eggs.

Can be differentiated by counting the number of lateral branches .Saginatum has more brances(15-30)

solium has 7-15.

6) grossly :

Saginatum is longer (4-6 meters) than solium (2-4 meters).

7)Number of proglottids is different:

saginatum has 2000 while solium has 1000.

Life cycle :

Life Cycle:it's the same for both solium and sagninatum

Defecation- proglottids in the grass-release eggs-eaten by the intermediate host (pigs or cattle depending on the organism) hexacanthes are released- attach to the wall of the small intestines and penetrate it and distribute all over the body(skin, muscle, brain, etc...)-change to cysticercus –present in the flesh of an intermediate host -(a balloon full of a clear yellow fluid and a rudimentary scolex invaginated into it)-somebody eats the intermediate host's meat without cooking it-cysticercus go to the small intestine and the rudimentary scolex goes out of the balloon and stick to the wall of small intestines by the suckers- proliferates from the neck region producing proglottids to produce a fully grown tapeworm.

In Solium's Life Cycle ONLY :

Humans can become intermediate hosts. This is known as Cysticercosis(if you eat the eggs they can become cystecerci in your body due to similarities between humans and pigs' tissues.)and settle in the muscles or brain causing a serious damage . in case of sagnitum if you ate the eggs , the hexacanth will be released but it will eventually die because of the strange environment inside the human's body .

Symptoms

Usually you find one worm in the intestines. (So named solium =single)

Can stay in the body for 15-20 years you may have more worms but as a rule one wormis present

Abdominal pain might be present or the patient might not have any symptoms at all(many patients have had them for years without any symptoms).

Proglottids Can move and pass into the feces and this will attract the patient's attention.

In some very rare cases there will be a rupture of the intestines or obstruction.

Diagnosis: Examination of feces and looking for proglottids

3-Diphyllobothrium Latum :

Fish tapeworm.

Largest tapeworm(up to 10 meters) that can infect humans.

Two elongated suckers instead of rounded suckers.

No hooks and rostellum.

3000 or more proglottids(immature-mature-gravid).

Lives in small intestines and produces eggs:

The eggs are Morphologically distinct: similar to those of trematodes >ovoid operculated (لها غطاء) on one end with a thickening on the other end. This is due to the adaptation that is needed to live inside aquatic interemediate hosts (Copepod in this case).

Embryo: ciliated so that it can swim in water (Ciliated Coracidium) .

Life Cycle:

Defecation-pass the eggs into water-intermediate hosts(water creatures)-the operculum opens and releases coracidium-swims and is eaten up by creatures known as Cylcops(copepod)- coracidium travels to tissues and matures there-fresh water fish eat cyclops and this will release larvae which will invade the flesh of the fish and settle there.

Two intermediate hosts:

1-Cyclops

2-Fresh water fish

Human eats the undercooked fresh water fish and the worms will develop in the small intestine and stick to the wall and proliferate to a full adult fish tapeworm.

Symptoms:

present as 1 worm

live up to 20 years

Very minor symptoms

Deficiency of vitamin B12 these worms extend to the ileum and compete with the absorption of vitamin B12 (Megaloblastic anemia might occur)

Diagnosis:

Examination of feces(proglottids and the typical heads of the organism)

Hymenolepis nana :

THE smallest tapeworm in human beings.

2 cm long.

Number of proglottids: 200 very thick.

Scolex :4 suckers and rostellum retric type(it can be retracted inside). (مثل الكركعة)

Eggs have distinct morphology: 2 membranes: inner membrane and outer membrane.

The inner membrane has 2 thickenings on each end knwon as polar thickenings and from these thickenings,filaments radiate(polar filaments).

In the middle you can see the hexacenth.

Lives in the small intestines.

Dont' need an intermediate host(an exception)

Eggs are released inside the body and get out by defecation, they don't live long in feces unless they are eaten by another human(oral-fecal contamination related to bad hygienic behaviors). Eggs release the hexacanth which enters the villus and mature there and then break out into the lumen as an adult worm. So you can say that the villus acts as an intermediate host(state). It's a direct life cycle(no need for an intermediate host) and sometimes you can reinfect yourself by eating your own eggs. Some of the eggs inside the intestines hatch and reinfect tissues. The patient may have lots of worms inside his body unlike other tapeworms.

Symptoms:

If the number of worms is low you won't have important symptoms.

But If a patient has lots of worms by re-infections, he'll have some problems(abdominal pain, diarrhea, etc....)

Diagnosis:

Examination of feces for eggs(very characteristic).

They don't live long in feces(few weeks-months). Life span is not long like other tape worms.