

Chapter 5

Intestinal nematodes

5.1 General characteristics

Phylum _Nematyhelminthe

Class _Adenophorea: T.trichuris

T.spilaris

Secermentia: Hookworms

A. lumbricoides

Filarial wowms

S. stercolaris

D.medinensis

E.verminicularis

Most abundant and wide spread animal group, many species are free living in fresh and salt water, mud or soil. They are elongated, cylindrical, bilaterally symmetrical, unsegmented worms with tapering ends. Male is generally smaller than female and its posterior end is curved or coiled laterally. They have a body cavity with straight digestive tract with terminal mouth and posterior anus, circulatory system are absent

Excretory and nervous system sure rudimentary, sexes are separate (diecious)

They are multicololular and contain internal body system (pseudoacoelomate)

1. Oviparous(nematodes that lay eggs)

Laying unsegmented eggs - askaris and T. trichuris

Laying eggs with segmented ova - hookworms

Laying eggs containing larva - E. verminicularis

2. Viviparous (Nematodes which give birth to larva)

D.medinensis

W.bancrofti

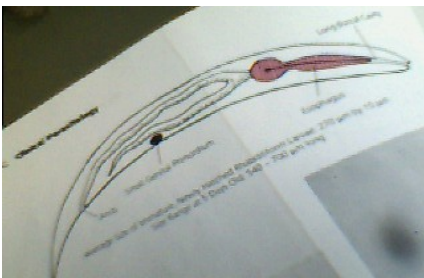
Brugia malayi

3. Ovo- viviparous(Nematodes laying eggs containing larva which immediately hatches

5.2 Necator americanus and strongyloides stercoralis(hookworms)

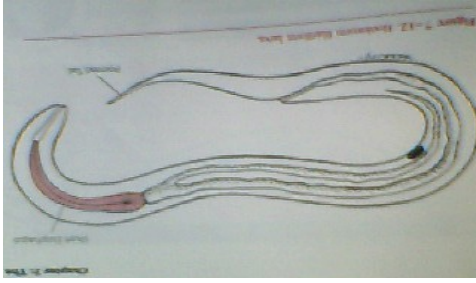
Eggs

Rhabditiform larva



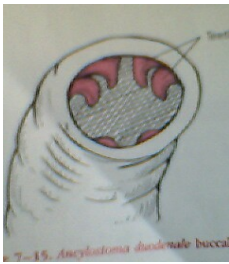
Immature, newly hatched, actively feeding and doubles in length when merely 5 days old. There is also presence of long buccal cavity and small genital primodium

Filariform larva



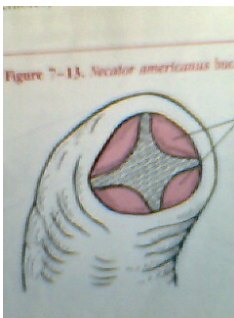
Infective, non-feeding emerges after molting of rhabditiform larva, has a slender larva with short esophagus and a pointed tail

Adult



A.duodenale

Buccal cavity/capsule of ancylostoma adult contain actual teeth



N.americanus

Buccal cavity of N.americanus adult contain cutting blades

5.2.2 Life cycle notes

3rd stage Filariform penetrate through the skin in unprotected feet, inside the body, Filariform migrate to the lymphatic and blood stream, larva is carried to the lungs, coughed up to the pharynx swallowed to the intestines. Matures to adult in the intestines and multiplies, adult female lays eggs which are passed in feces, within 24-48hrs under appropriate condition, worm moist soil, rhabditiform larva emerges, larva molts twice and 3rd stage larva results ready to begin new cycle

5.2.3 Epidemiology

Frequency is high in warm areas where inhabitants practice poor sanitation. Person at risk of contracting infection are those who walk bare feet and both parasites are found worldwide

5.2.4 Clinical symptoms

Intense allergic itching at the site of hookworm penetration (ground itch), migration to the lung can cause sore throat bloody sputum, wheezing, headache. Intestinal phase cause, vague GIT pain, slight anemia, weight loss, or weakness, Edema pain enteritis, mortality may result and loss of blood

5.2.5 Laboratory diagnosis

Recovery of eggs in stool samples through wet preparation and recovery and examination of buccal capsule

5.2.6 Prevention and control

Proper sanitation, proper fecal disposal, prompt and thorough treatment, protection of persons entering endemic areas and also cover your feet.

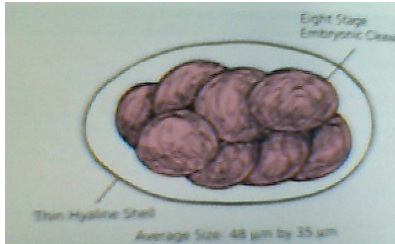
5.3 Culture methods

Culture of blood, bone marrow and tissue performed to recover leishmania and trypanosome, employs NNN(Novy- MacNeal Nicole) medium. Penicillin added to suppress bacteria growth. Specimen may also be inoculated in animals. Hamsters are animals of choice for the recovery of leishmania, Guinea pigs and mice for trypanosomes, mice and rats for confirming toxoplasmosis. TY1-S33 medium is for isolation of E.histolytica.

5.4 Strongyloides stercoralis (thread worm)

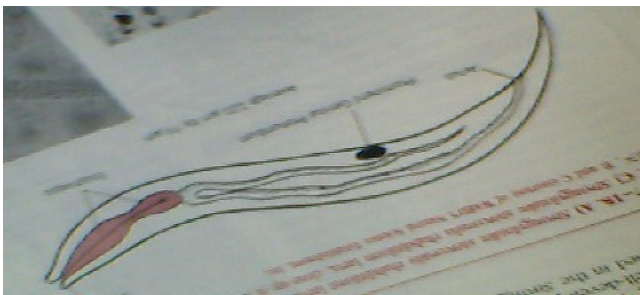
5.4.1 Morphology

Eggs



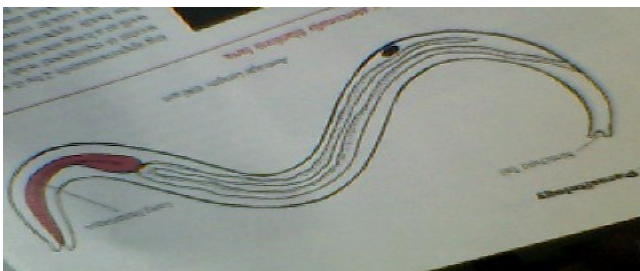
Considered indistinguishable from those of hookworm, slightly smaller than those of hookworm. Egg has 2, 4, 8 cell stage of embryonic cleavage surrounded by a thin hyaline shell

Rhabditiform larva



Actively feeding and has short buccal cavity and prominent genital primodium

Filariform larva



Long, slender, non- feeding resulting from molting of Filariform larva, has long esophagus and a notched tail

Adult

Female has short buccal cavity and long slender esophagus, colorless body that appear transparent and fine striated cuticle that cover the body

5.4.2 Life cycle notes

Life cycle mimics those of hookworm, additional cycle- indirect cycle where rhabditiform larvae are passed into the outside environment and matures into free-living adult. Female produces eggs develop into rhabditiform, transform to Filariform and start a new indirect cycle or become infective to humans. Autoinfection occurs when rhabditiform larva develop into Filariform stage inside intestines of human host.

5.4.3 Epidemiology

Parasite is predominantly in the tropics and sub tropics region, areas of poor sanitation where feces are poorly disposed is a risk factor of infection. People who come into contact with soil or people living in the institutions are at risk

5.4.4 Clinical symptoms

Include diarrhea, abdominal pain, urinary, eosinophilic, vomiting, constipation weight loss and anemia, Site of larva penetration becomes itchy, red recurring allergic reaction. Larva migrating to lungs develop pulmonary symptoms, secondary bacterial infections and possibly death ensues

5.4.5 Laboratory diagnosis

Diagnostic egg may be present in stool samples from diarrheas patients; stool concentration using zinc sulphate method may be used. Enterotest has proven successful in isolating larva and eggs. Sputum sample may also yield larva several serological tests may also be employed e.g. ELISA

5.4.6 Prevention and control

Proper sanitation, proper fecal disposal, prompt and thorough treatment, protection of persons entering endemic areas and cover your feet.

Non- human hookworm

5.5 Ancylostoma Brazilians

Hookworm of dogs and cats in Brazil, India and malaise, adult worm is smaller than those of *A. duodenal*. Buccal capsule has a small orifice and dental plate contains one pair of large teeth, eggs resemble those of *A. duodenale* and Filariform larva are not able to penetrate below the skin hence unable to negotiate their way into blood vessels

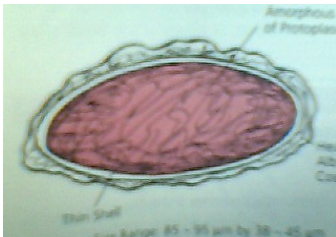
5.6 Ancylostoma ceylanicum

One of the smallest species of the genus, it occurs in the intestines of the cats and their wild relatives in Asia. May cause intestinal infection in dogs and man. Parasite is broader and lateral rays are curved.

5.7 Askaris lumbricoides

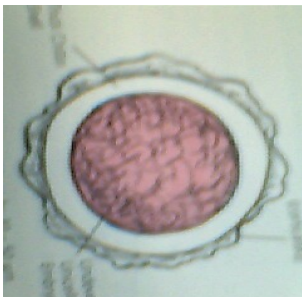
5.7.1 Morphology

Unfertilized egg



Oblong in shape, thin shell protect inner amorphous mass and the egg is corticated

Fertilized egg

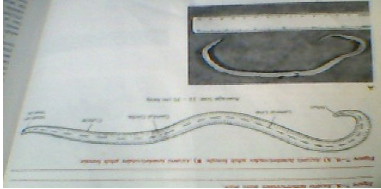


More rounded than unfertilized, inner amorphous mass is transformed to

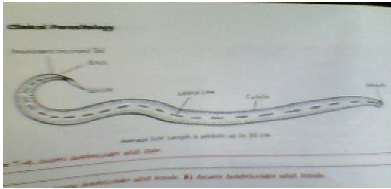
Underdeveloped unicellular embryo. Has thin chitin shell is sandwiched between embryo and the cortical and decorticated fertilized egg may also be present.

Adult

Female



Male



Usually assumes cream white color with a tint of pink, fine striation usually visible on the cuticle. It is the Largest known intestinal nematodes where male is slender with a prominent incurved tail and female is longer & pencil lead in thickness

5.7.2 Life cycle notes

Ingestion of infected eggs begins infection; larva completes liver-lung migration Larva is finally ingested when coughed out to the mouth, swallowed and maturation occurs in the intestines. Adult multiply and produce eggs which are passed in feces Soil provides necessary condition for the eggs to embryonate where they remain viable in soil, fecal matter or water. Embryonate eggs may be infective to new host

5.7.3 Epidemiology

Most common helminthes in the world, warm climate and area of poor sanitation where feces are used as fertilizer is a culprit and the population at risk is children

5.7.4 Clinical symptoms

Secondary bacterial infection may occur following perforation of the intestines

Vague abdominal pain, vomiting, fever, mature worms may entangle into mass and obstruct intestines, appendix, liver and bile duct. Pulmonary symptoms such as cough, eosinophilic, and asthmatic reactions

5.7.5 Laboratory diagnosis

Specimen of choice is stool, other specimens are from the intestines, gall bladder, liver and appendix, adult may be present in stool, vomited up or removed from external nares where they attempt to escape. ELISA is also available

5.7.6 Prevention and control

Avoid use of human waste as fertilizer, proper sanitation, and proper fecal disposal, prompt and thorough treatment. Protection of persons entering endemic areas and also cover your feet.

Non -human askaris

5.8 Visceral larva migrans

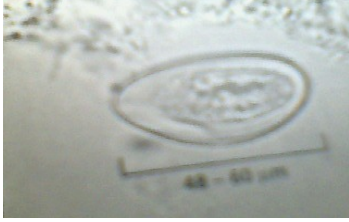
This is a syndrome caused by *Toxocara canis* (dog roundworm) and *T. cati* (cat roundworm), Larva hatch in the small intestines and penetrate and migrate to the liver

May move to the lungs and other body parts. Other round worms are *Angiostrongylus cantonensis*, *Gnathostoma spinigerum* and *Anisakis simplex* where larva settle, they are attached by phagocytic cells. From lungs, to the intestines, in human body, they do not convert to adult worm

5.9 Enterobius vermicularis

5.9.1 Morphology

Egg



Measures 48-60um in length, oval and flattened on one side and consist of developing larva surrounded by double layered thick walled colorless shell

Adult

Yellow white in color, equipped with digestive, intestinal and reproductive structure
Poses clear, pointed tail resembling pin- head

5.9.2 Lifecycle notes

Human only known host of *E.verminicularis*, ingestion of infective eggs initiate infection, eggs migrate to the intestines, they hatch and matures to form adult. Adult reside in the colon, appendix and caecum. Following copulation, female migrate outside the body to the perianal region and deposit eggs, eggs achieve infectivity within 4-6 hrs. The adult and eggs cause intensive scratching of the anal area by infected person, egg takes residence in dust, sandboxes linen and clothing and become airborne

Ingestion of these infective eggs initiate new cycle. Retro infection occurs when infective egg migrates back into the host body and reproduces and auto infection occurs if the infective eggs are ingested

5.9.3 Epidemiology

Found world wide in temperate areas, transmission occurs primarily by hand to mouth contamination. May be responsible for transmission of *Dientamoeba fragilis*

5.9.4 Clinical symptoms

Enterobiasis (pinworm infection) includes itching and inflammation of anal vaginal areas, intestinal irritation and mild nausea, vomiting, difficult sleeping, minute ulcers intestinal inflammation

5.9.5 Laboratory diagnosis

Cellophane tape preparation is the specimen of choice collected in the perianal region to isolate the eggs and adult female, eggs and/or adult female may be recovered from stool samples

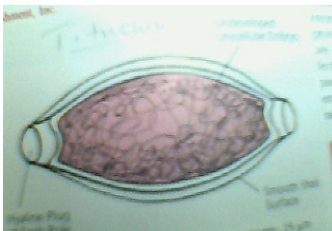
5.9.6 Prevention and control

Proper personal hygiene and hand washing, apply ointment to the affected areas to prevent dispersion to the environment, avoid scratching infected areas and clean contaminated environment surface e.g. linen

5.10 Trichuris trichura

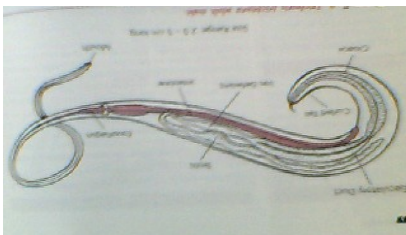
5.10.1 Morphology

Egg



Barrel shape, underdeveloped unicellular embryo surrounded by smooth shell retaining a yellow-brown color from its contact with bile and prominent hyaline polar plug visible at each end

Adult



Posterior is pinkish gray in color consisting of intestines reproductive system Posterior end resembles a whip of a handle, anterior end small and resembles a whip itself. Anterior appear colorless and contain slender esophagus

5.10.2 Lifecycle notes

Ingestion of infective egg containing larva initiate human infection, larva emerges from the egg in s/intestine and resides in colon embedded in mucosa. Following copulation, female lay underdeveloped eggs which are passed via feces, within 1 month outside the body, egg embyonate and become infective and ready to initiate new cycle

5.10.3 Epidemiology

Occurs where the inhabitant practice poor sanitation such as defecating directly into soil or use human waste as fertilizer. Persons at risk are children, mentally ill, and institutionalized.

5.10.4 Clinical symptoms

Heavy infection causes ulcerative colitis, chronic dysentery, severe anemia growth retardation, inflammatory bowel disease, abdominal tenderness, pain, weight loss, weakness, mucoid and bloody diarrhea

5.10.5 Laboratory diagnosis

Specimen of choice for the recovery of egg is stool, adult worm visible upon microscopic examination

5.10.6 Prevention and control

Educating children and institutionalized, proper personal hygiene and hand washing
Avoid defecating direct in soil or avoid using human feces as fertilizer, avoid putting infective hands into mouth and treatment of infective person.