Lab Hookworms

Phylum: Nemathelminthes

Class: Nematoda

Subclass:Phasmidia

Order : Strongylida

Family : Ancylostomatidae

Hook worm: *Necator americanus*

Ancylostoma duodenale

Ancylostoma caninum

Ancylostoma braziliense

The four species can cause infection in human beings, the first two species are more commonly.

Ancylostoma duodenale **(old world hookworm) causative agent of ancylostomaiasis**

Geographical distribution: cosmopolitan

Location in the host: the adult worms lives in the small intestine of man, particularly in the jejunum less often in duodenum , in heavy infection the worms may be present in ileum also.

Morphology

1-adult worms are small, grayish white or brown and cylindrical worms.
2- the anterior end is bent slightly dorsally – hence the name hook worm. The bend is the same direction as the general body curvature.
3- female longer (10-13mm in length By 0.6mm in width) than male (8-11mm by 0.4mm).
4-the anterior end of male and female consist of buccal cavity (buccal capsule) : elongated , pear shaped usually contain 2 pairs of ventral teeth and one pair of dorsal rudimentary teeth.
5- bursa of male consisting of 2 broad lateral lobs and a smaller dorsal lobe, contain 13 rays, dorsal tripartite, the needle like spicules longer and slender in shape (have simple tips and are never fused distally).
6- in female vulvae opening posterior to middle of the body, caudle spine in female is present . female produce 15000-20000 eggs in day and consider more pathogenicity.
7- there are 5 glands associated with digestive system one of which secretes anticoagulants substance.

Necator americanus (new world hookworm)causative agent of necatoriasis

Geographical distribution: USA , it is now more prevalent in India, srilanka and Australia.

Morphology:

-head bent in opposite direction to body.

-female longer (9-11 mm in length by 0.35mm in breadth) than male (7-9mm by 0.3mm).

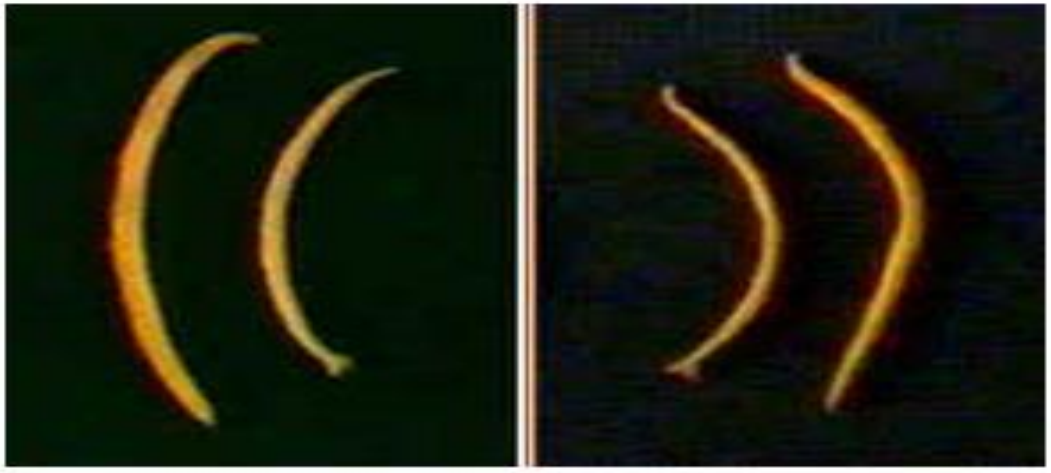
-anterior end of male and female consist of buccal capsule which all most spherical , contain 2 ventral and 2 dorsal cutting plates.

- bursa of male consisting of 2 broad lateral lobs and a smaller dorsal lobe contain 14 rays, dorsal ray bipartite (bifurcates), the needle like spicules have barbs at their tips and are fused distally.

-in female vulva opening anterior to middle of the body. Caudle spine in female is absent, female produce 6000-11000 eggs in day and consider less pathogenicity.

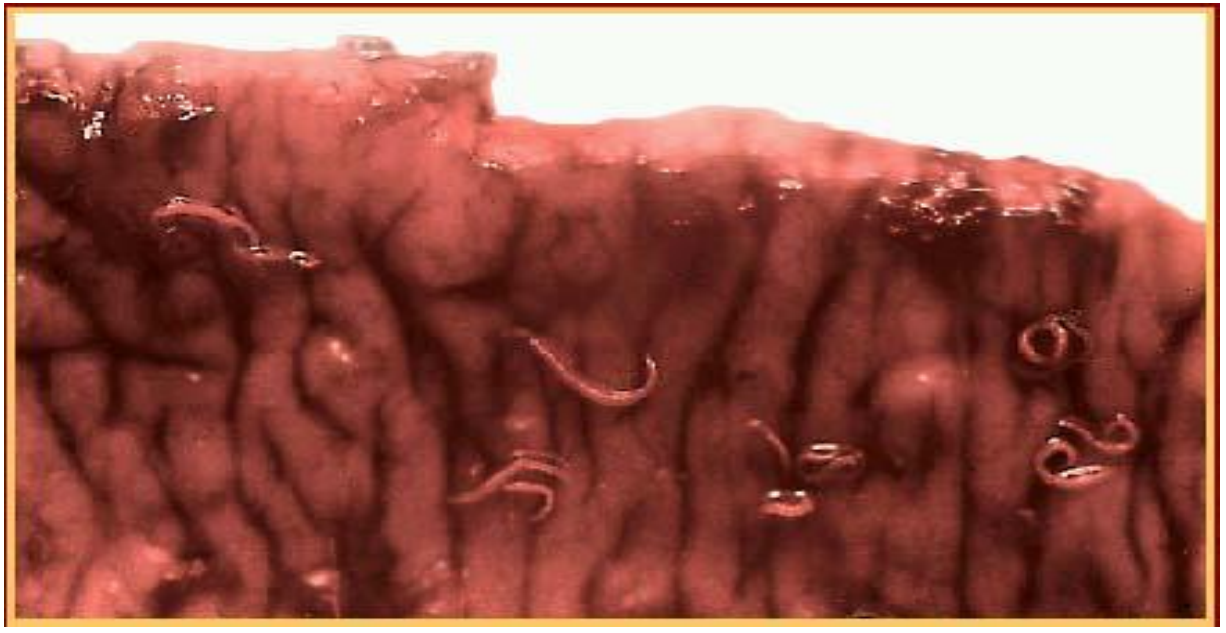
-egg: like the egg of others hook worm

Differences between two hookworms



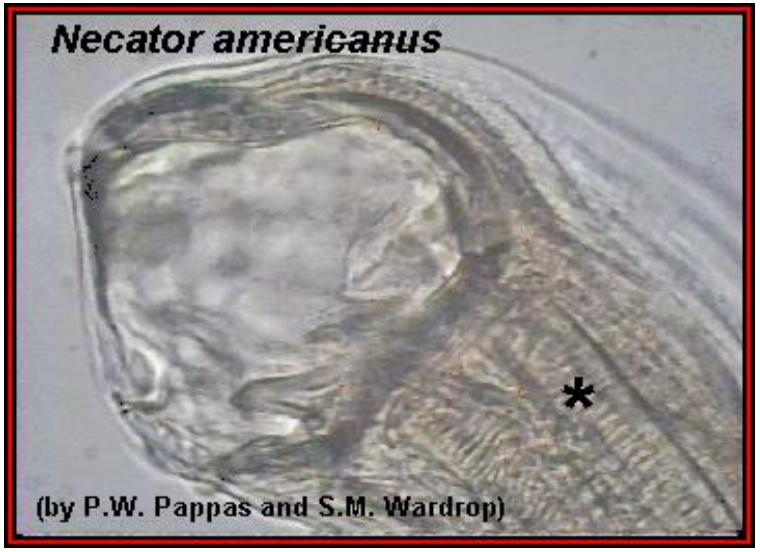
Adults of *A. duodenale* Adults of *N. americanus*

Adults in intestinal mucosa

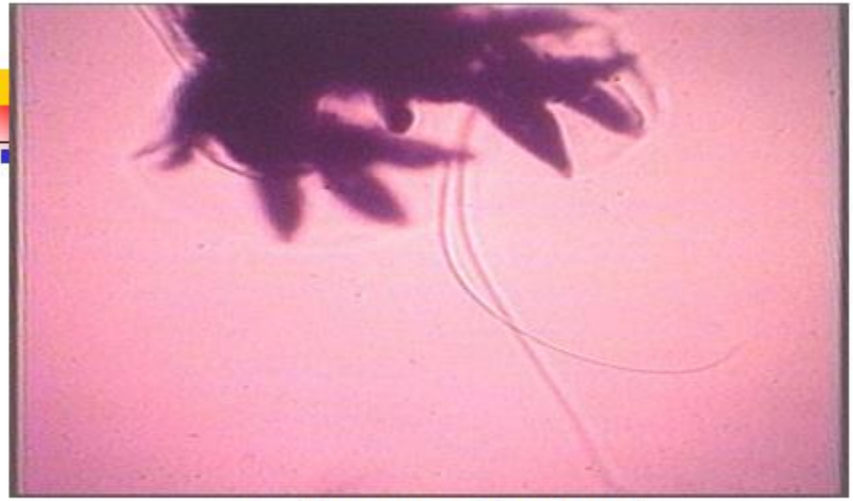


- Scanning electron micrograph of the mouth capsule of *Ancylostoma duodenale*, note the presence of four "teeth," two on each side.

- Scanning electron micrograph of the mouth capsule of Necator americanus, another species of human hookworm. Note the presence of two cutting "teeth".

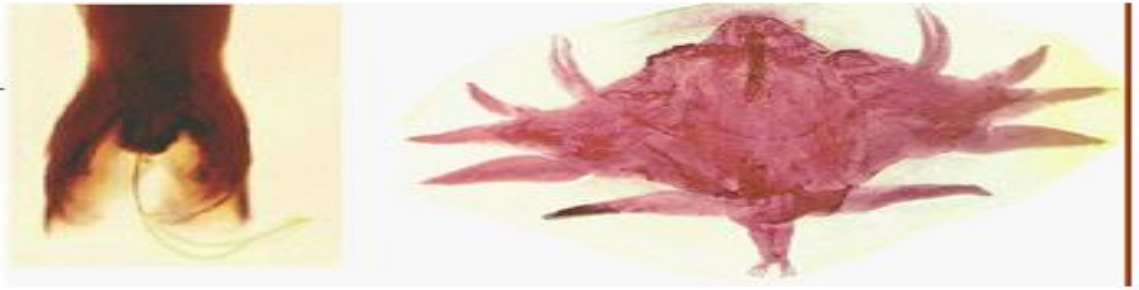


Anterior end (Buccal capsule) of A. duodenale with teeth and N. americanus with plate

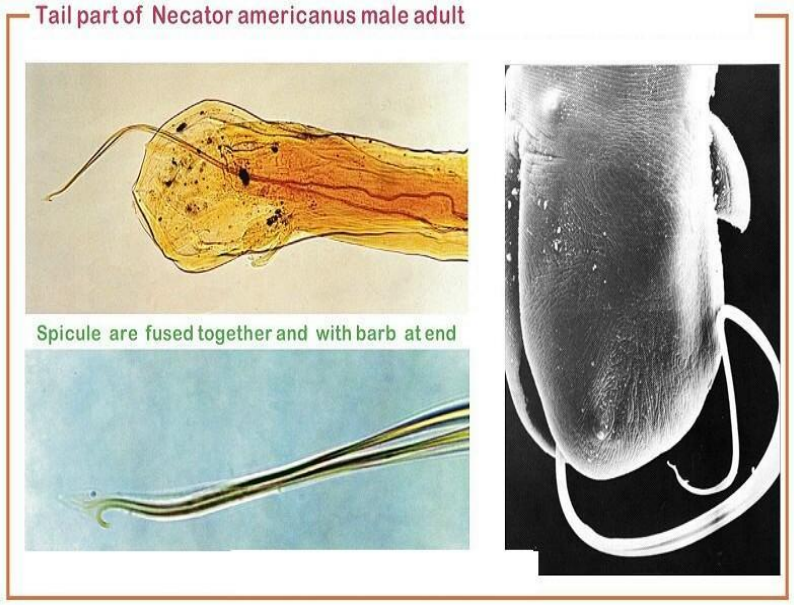


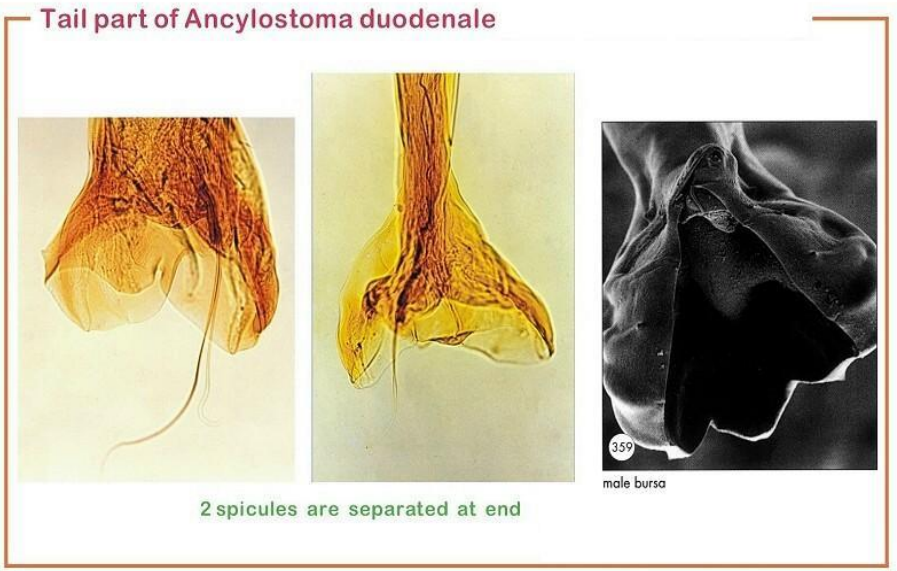
- ***Ancylostoma duodenale* - copulatory bursa and spines of male(a side view)**

- Copulatory bursa of N. americanus(a side view)

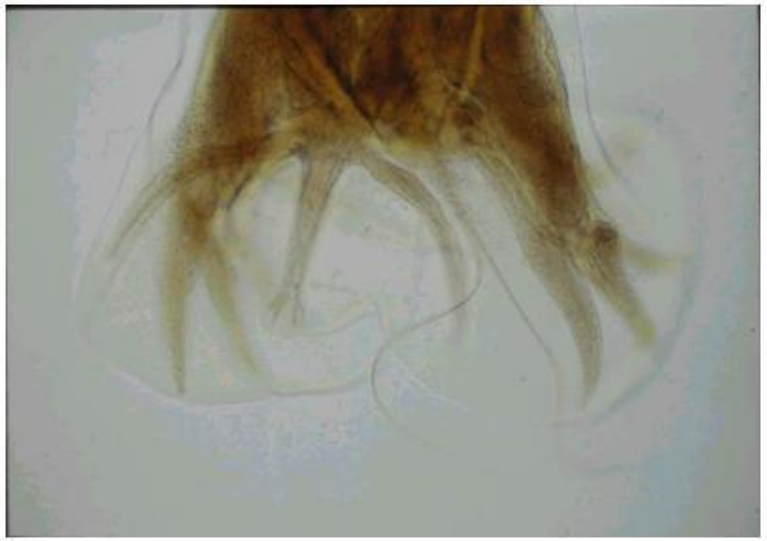


- Left picture: Copulatory bursa and spines of N. americanus(a side view);
- Right picture: copulatory bursa of A. duodenale(a top view)





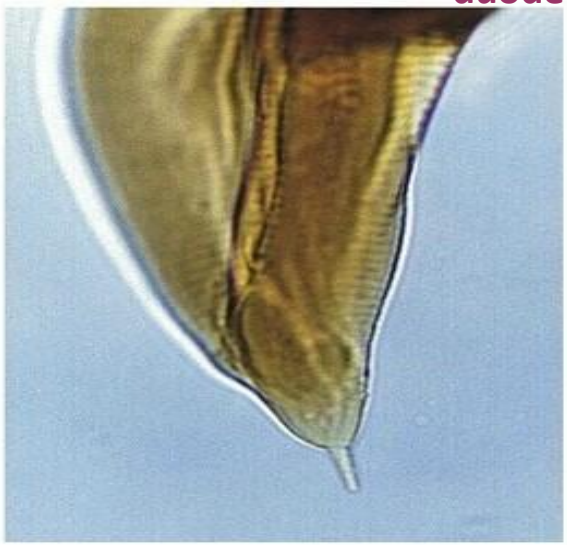
Posterior end in male (Bursa) of *N. americanus*

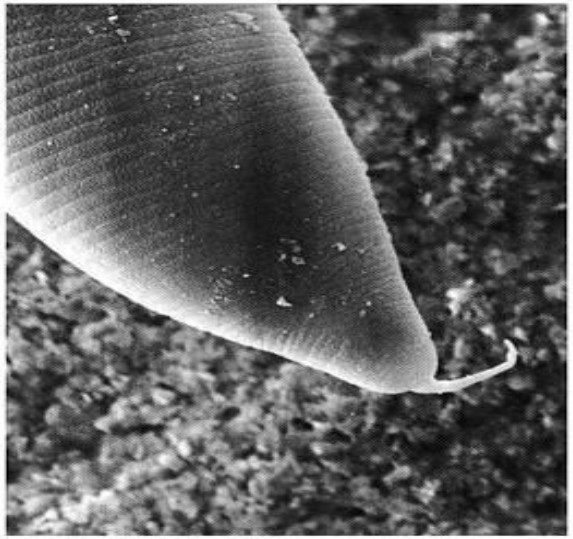


Posterior end in male (Bursa) of *A. duodenale*

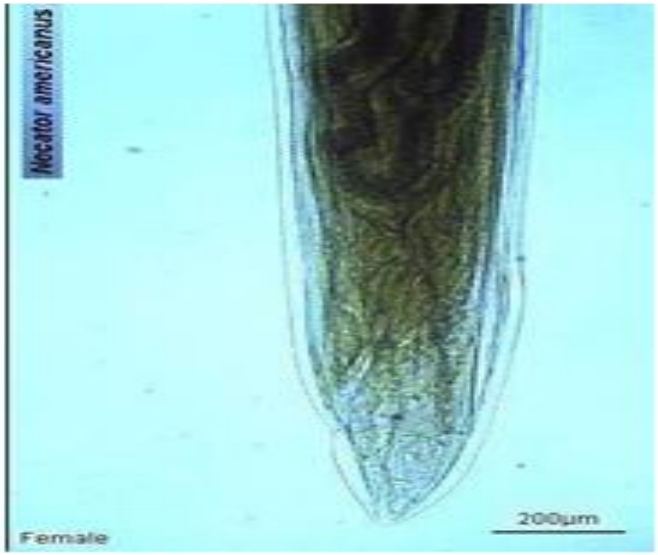
Tail part of Ancylostoma duodenale female adult

With a caudal spine at end





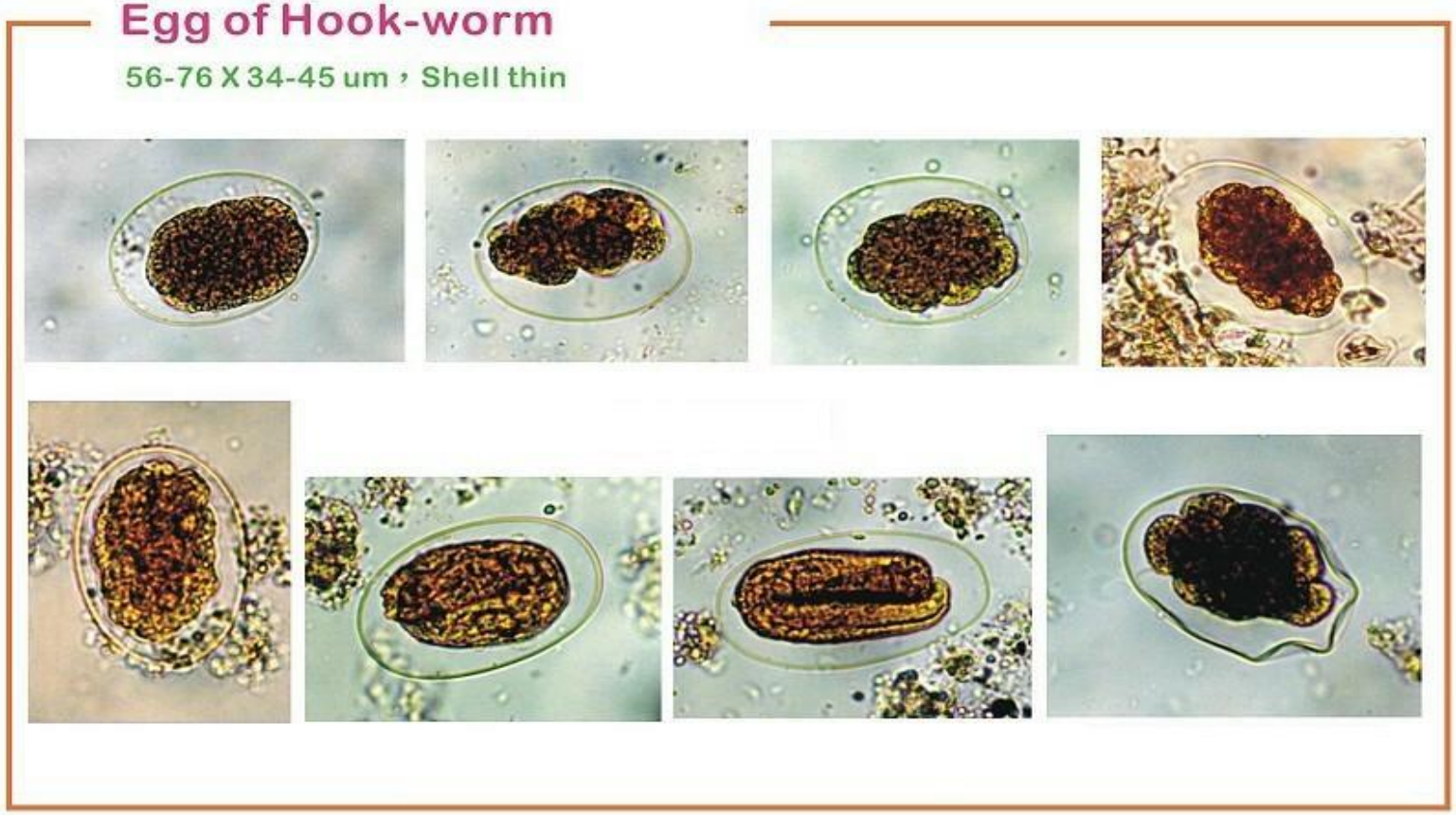
Posterior end in female of A. duodenale

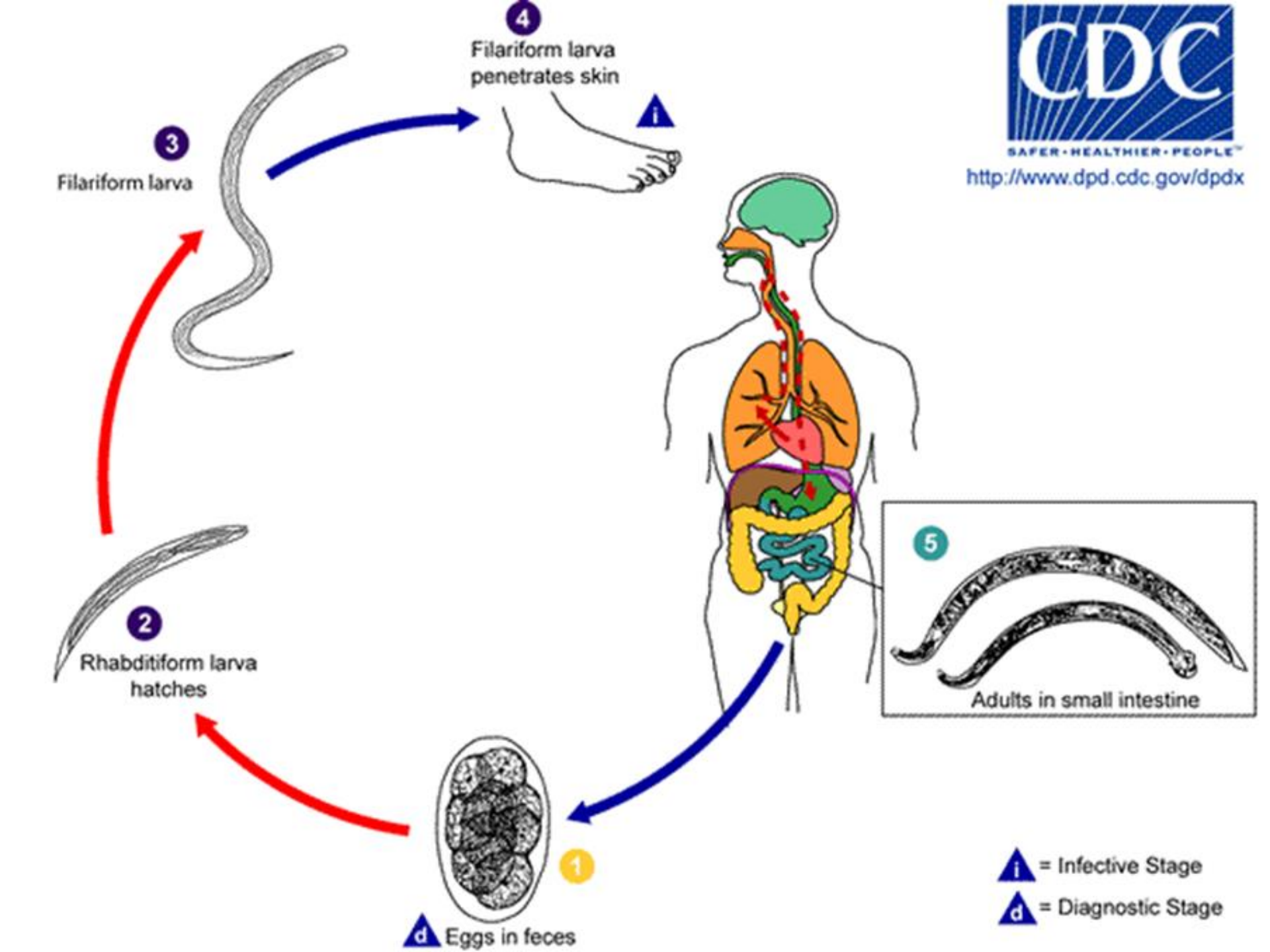


Posterior end in female of *N. americanus*

- Egg: oval or elliptical in shape and 65 um long by 40 um broad, colorless, surrounded by transparent hyaline shell membrane, and contain unsegmented ovum or in early segmentation (usually 4 blastomeres) has clear space between the egg and the segmented

ssed..




4
Filariform larva
penetrates skin
i
3
Filariform larva
2
Rhabditiform larva
hatches
5
Adults in small intestine
1
d
Eggs in feces
i = Infective Stage
d = Diagnostic Stage
CDC
SAFER · HEALTHIER · PEOPLE™
http://www.dpd.cdc.gov/dpdx

Life cycle:

- Eggs are passed in the stool , and under favorable conditions (moisture, warmth, shade), larvae hatch in 1 to 2 days. The released rhabditiform larvae grow in the feces and/or the soil , and after 5 to 10 days (and two molts) they become filariform (third-stage) larvae that are infective . These infective larvae can survive 3 to 4 weeks in favorable environmental conditions. On contact with the human host, the larvae penetrate the skin and are carried through the blood vessels to the heart and then to the lungs. They penetrate into the pulmonary alveoli, ascend the bronchial tree to the pharynx, and are swallowed . The larvae reach the small intestine, where they reside and mature into adults. Adult worms live in the lumen of the small intestine, where they attach to the intestinal wall with resultant blood loss by the host . Most adult worms are eliminated in 1 to 2 years, but the longevity may reach several years.
- Some *A. duodenale* larvae, following penetration of the host skin, can become dormant (in the intestine or muscle). In addition, infection by *A. duodenale* may probably also occur by the oral and transmammary route. *N. americanus*, however, requires a transpulmonary migration phase.

Pathogenesis and Clinical Manifestations

- 1. Larval migration
  (1) Dermatitis
  (2) pneumonitis (allergic reaction), Loeffier's syndrome

2. Adults in small intestine

(1) Epigastric pain as that of a duodenal ulcer.

(2) A large worm burden results in

microcytic hypochromatic anemia

hypoprotinemia

pallor

- Diagnosis
- 1-clinically the disease is highly suggestive in endemic area, in patients with : sever anemia, edema, and black tarry stool.
- 2-definitive diagnosis is made by:
- a- recovery of eggs in fresh stool sample within 30 minutes so that not confuse with strongyloides
- b. larvae in sputum
- c. larvae in gastric washout
- d. serology
- 3-occult blood in stool and presence of charcot-leyden crystals may be present in stool

What causes cutaneous larva migrans?

- Zoonotic hookworms are hookworms that live in animals but can be transmitted to humans. Dogs and cats can become infected with several hookworm species, including:
- *Ancylostoma brazilense*, *A. caninum*, *A. ceylanicum*, and *Uncinaria stenocephala.*
- The eggs of these parasites are shed in the feces of infected animals and can end up in the environment, contaminating the ground where the animal defecated.
- People become infected when the zoonotic hookworm larvae penetrate unprotected skin, especially when walking barefoot or sitting on contaminated soil or sand. This can result in a disease called cutaneous larva migrans (CLM) or (creeping eruption), when the larvae migrate through the skin and cause inflammation.

Cutaneous Larva Migrans