

## PHYLUM NEMATODA (Roundworms)

- I. Characteristics.
- A. Phylogeny: derived from acoelomate common ancestor resembling some of the primitive flatworms.
  - B. Free living in soil or water while others are parasites of virtually every type of plant and animal; fill almost every kind of ecological niche (abundant over most of the world); economically significant via crop infestation and on domestic animals and humans; key role in decomposition and nutrient cycling.
    1. 15,000 species; believed there exists around 50,000 species.
    2. Parasitic members included with flatworms in helminthology.
  - C. Bilateral symmetry; triploblastic (3 germ layers); no true segmentation or appendages.
  - D. Body slender, cylindrical with tough, resistant cuticle.
  - E. Pseudocoelom: unlined body cavity between digestive tract and other organs filled with fluid; constitutes a "hydrostatic" skeleton.
  - F. Complete digestive system that carries nutrients and gases; unlined.
    1. Mouth; small buccal cavity; short, muscular sucking pharynx or esophagus to draw in food; nonmuscular narrow intestine for nutrient absorption; short rectum; anus; tube within a tube body plan.
  - G. Muscle system.
    1. Body wall and esophagus wall (longitudinal muscle fibers only: results in the worm's characteristic thrashing movement).
  - H. Excretory system.
    1. Excretory tubes (2) that empty through an excretory pore just posterior to mouth (may be 2, 1, or none).
  - I. No circulatory or respiratory organs; fluid of the pseudocoelom bathes the internal organs; internal transport.
  - J. Nerve ring around esophagus; 6 anterior nerves, and 6 (or more) posterior nerves; two nerve cords (one dorsal, one ventral).
  - K. Reproduction: dioecious usually.
    1. Ascaris (largest intestinal human nematode).
      - a. Male smaller than female (30 cm length); male with characteristic hooked or curved posterior end with spicules (hairlike bristles) for copulation.
      - b. Male reproductive tract opens into the rectum forming a cloaca; female tract opens via a separate genital pore; microscopic eggs with chitinous shell.
      - c. Internal fertilization; eggs stored in uterus until deposition.
      - d. NO asexual reproduction.
      - e. Life cycle of parasitic forms:
        - 1) Male and female worms copulate within hosts intestines.
        - 2) A large female may contain 27,000,000 eggs at a time laying 200,000 per day leaving host via feces.
        - 3) Eggs swallowed through eating or drinking by host and hatch into larvae in the intestines.
        - 4) Larvae burrow into veins or lymph vessels, travel to the heart to pulmonary capillaries of lungs continuing to grow in size.
        - 5) In a few days they break into air passages and move via the trachea, esophagus and stomach of host back to intestines to mature.
        - 6) Besides weakening effect of parasites, secretions toxic to the host are produced; intestinal obstruction, allergic responses and other organ damage
        - \* 7) No intermediate hosts are necessary.
  - L. Example pests to man, domestic animals, and farm livestock (consume 10% of all crops).
    1. Ascaris (intestinal roundworm): common in humans as well as wild & domestic animals (pigs, dogs, cats); adults live unattached in host's small intestines, although it does not parasitize the intestinal tissues; common in rural areas of Appalachia and the southeast U.S.
      - a. Ova may be eaten with uncooked vegetables or when children put soiled fingers or toys in their mouths; ova are extremely environmentally resistant surviving months to years.
      - \* b. Juvenile migration through intestinal wall, blood, heart to the lungs: time period of greatest host damage (pneumonia, fever, coughing spasms, asthmatic breathing and often allergic reactions).
      - c. Juvenile pass up the bronchi, trachea to the pharynx where they are swallowed so as to reach the intestines and grow to maturity.
      - d. In the intestines, Ascaris may cause intestinal blockage in large numbers, abdominal discomfort, and allergic reactions; called ascariasis.
    2. Trichina worms (Trichinella spiralis, tissue parasite): causes trichinosis in humans; 2-4mm (adult length) results from eating raw or poorly cooked pork or occasionally bear meat containing the calcified encysted juvenile; (one pink pork chop may have potentially up to 10,000 larvae); greatest damage done during

- migration; later encysts in muscles of the diaphragm, ribs, tongue, abdominal wall, biceps and deltoid; infest other mammals such as hogs, bears, cats, dogs, rats, humans (occasional in the U.S. as an accidental host).
- a. Produce live young.
  - b. Juvenile migrates from the intestines via the blood to the skeletal muscle (may live 10-20 years encysted).
  - c. Larval migration is accompanied by muscle pain, chills, weakness, respiratory distress and myocardial involvement.
  - d. When contaminated meat is eaten, the young matures in the intestines.
3. Hookworms (Necator americanus): juvenile enters the body by burrowing through the soft skin on the sides of the feet and between the toes (ground itch) to enter the bloodstream and lymph vessels ---> heart ---> lungs ---> up the bronchial tree ---> trachea ---> glottis ---> esophagus to the intestines for maturing and eventual reproduction of ova; ova passed via host's feces where juveniles hatch in the soil.
- a. Characteristic dorsally-curved anterior end resembling a hook; females up to 11mm long while males are 9mm.
  - b. Have large oral cutting plates using an anti-coagulant to feed on blood, lymph and mucous membrane of the host's intestinal mucosa.
  - c. Results in anemia, lethargy, and greater susceptibility to disease by the host; heavily infested children (100 or more adult worms) are retarded mentally and physically.
  - d. Common to southeastern U.S. in rural areas without proper sanitation and going barefooted.
4. Pinworms (Enterobius vermicularis): female has long, narrow and sharply pointed tail; adults are 25mm long; most common helminth parasite in the U.S.
- a. Common in children as is transmitted by eating with dirty hands
  - b. Insomnia, restlessness and scratching at night due to discomfort in anal region: females migrate to anal regions to deposit their eggs; adults live in the cecum of the large intestines.
  - c. Careful personal hygiene is necessary, especially in regard to cleanliness of hands and fingernails.
5. Filaria worms: transmitted to humans by a mosquito vector in tropical areas; blockage of lymphatic vessels leads to severe swelling in various parts of the body (lower legs, scrotal sac, arms); called elephantiasis (inflammation and obstruction of lymphatics).
- a. Dirofilaria immitis: heartworm in dogs of North America.
    - 1) Adults live in the host's heart muscle.
    - 2) Juveniles circulate in the blood where they are picked up and transmitted by mosquitos.