TAPEWORM DISEASES OF RUMINANTS, HORSES, LAGOMORPHS, POULTRY, RODENTS AND HUMANS

(**Anoplocephalidae**, **Hymenolepididae**, **Davaineidae**, **Dilepididae**) – the main species according the hosts, morphology, life cycles, epidemiology, pathogenesis, pathology, diagnosis, treatment, control.

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Family: Anoplocephalidae

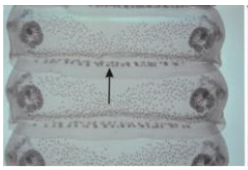
Genera:

Moniezia
Avitellina
Stilesia
Thysaniezia
Thysanosoma
Anoplocephala
Paranoplocephala
Cittotaenia

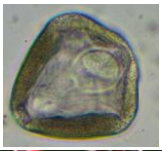
- Tapeworms of **ruminants, ungulates, hares and rabbits**.
- No rostelum with hooks is created on the scorex.
- Proglotids are wide and short.
- Polyedral eggs contain a pyriform apparatus in which the embryo (oncosphere) is located.
- LC: biohelminths: IH = mites (*Oribatei*) → cysticerkoid

Anoplocephalidae – tape worms of ruminants

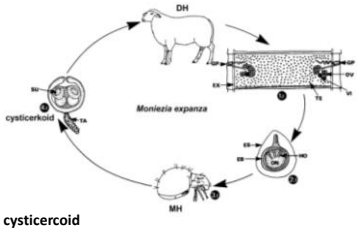
- ***Moniezia expansa***
  6 m long, 1.6 cm wide proglotids contain double set of genital organs (lambs)
- ***Moniezia benedeni***
  4 m long, 2.6 cm wide (calves)



Moniezia expansa



Moniezia spp. - Life cycle



- **IH - cysticercoid**
  Development in oribatid mites **4 months**
- **FH - prepatent period 37-42 days**
- **After 3 months the tapeworms spontaneously leave the host**

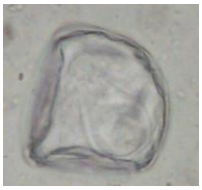
Moniezia spp. - epizootology

- marked seasonal occurence – infection of lambs and calves in **May – June**
- clinical symptoms in June
- Older animals – **infection is usually light**
- Life span of *Moniezia* spp. is 3 months

Moniezia spp. – pathogenesis, clinical signs

- **heavy infections** diarrhea, intestinal obstruction, enteritis, weakness, subcutaneous infiltrates; the lambs are weak, hard to stand up bending their backs and **painfully defecating**; anorexia, anemia, nerve disorders;
- **light and moderate** infections – little pathogenic effect, without clinical symptoms, proglotids in faeces;

Dg. *Moniezia* spp. - eggs


Therapy, prevention

- Niklozamid
- Praziquantel
- Bunamidine
- A wide range of benzimidazole compounds (±) (albendazol, febantel, fenbendazol, netobimin, oxfendazol)
- Preventive - alternating pastures;


Ruminant diseases caused by rare occuring tapeworms in our country


Avitellinosis

Avitellina centripunctata

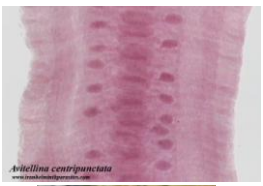
Similar to Monesia, 3 m The eggs are stored in parauterine capsules, without a pyriform apparatus

IH: mites
FH: sheep, goats, antelopes

Location: small intestine

Pathogenesis: enteritis, nerve symptoms, diarrhea

Geographical distribution: **Europe**, Africa, Asia



Stilesiosis

Stilesia hepatica

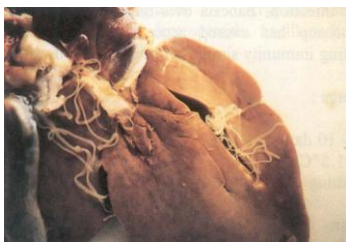
Morphology: 20-50 cm The **genitals are not duplicated, the eggs are in parauterine organs**

Location: ruminant bile ducts

Non-pathogenic species - no clinical signs (??)

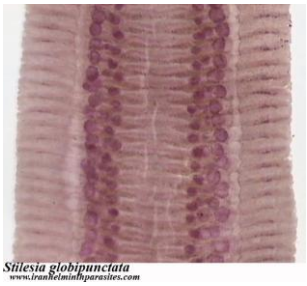
At the slaughterhouse inspection, confiscation of the affected baking

Geographic distribution: Africa, Asia



Stilesia globipunctata

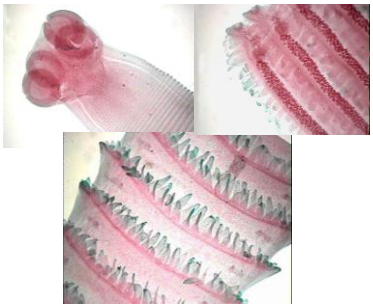
- Morphology: 45-60 cm
- Location: small intestine
- Pathogenesis: tapeworms attached to the junction of duodenum and jejunum,
- Skolex of immature tapeworms penetrates through the mucous membrane of the intestine, proliferative inflammation, desquamation of the epithelium, formation of nodules
- **A highly pathogenic species**
- Geographical distribution: **Europe**, Africa, Asia



Thysanosomosis

Thysanosoma actinoides (fringed tapeworm)

- Morphology: 15-36 cm;
- It has papillary projections at the back edge of the proglotids
- Location: bile ducts, pancreatic duct, small intestine
- Pathogenesis: tapeworms can clog bile ducts and pancreatic duct, digestive disorders, icerus
- Confiscation of baking (up to 46% sheep roasts in Texas)
- Geographical distribution: North and South America



Thysaniesiosis

Thysaniezia giardi

- Morphology: 2 m,
- Cells contain one set of genital organs
- Eggs - in parauterine capsules without piriform apparatus
- FH: **ruminants, pigs**
- Location: small intestine
- Geographical distribution: **Europe**, Africa, Asia and America

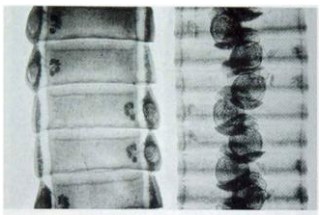
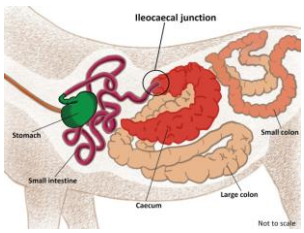
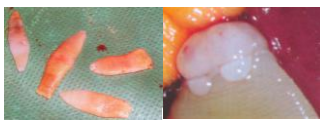


Fig. 301 Stained segments of *Thysaniezia ovilla* (left) and *Avitellina centripunctata* (right) [4]

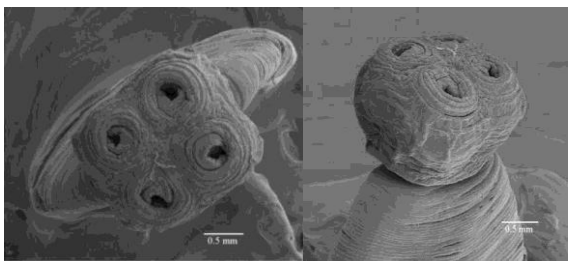
Family: Anoplocephalidae – tapeworms of horses



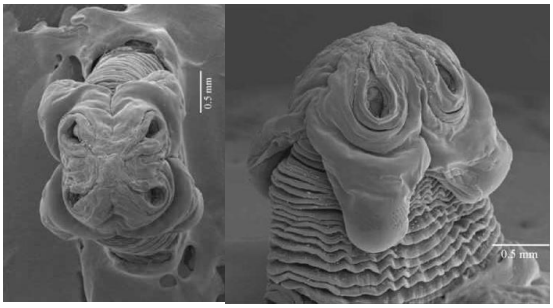
Anoplocephala perfoliata – **ileocaecal junction**, adults reach 5-8 cm in the length and 1.2 cm width, proglotids contain a **single set of reproductive organs**
Anoplocephala magna – jejunum, adults reach 80 cm
Paranoplocephala mamillana – small intestine, measure only 6-50 mm

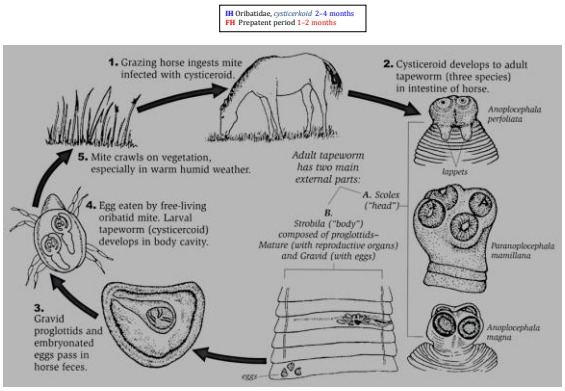


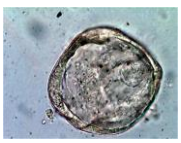
Anoplocephala magna

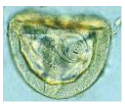


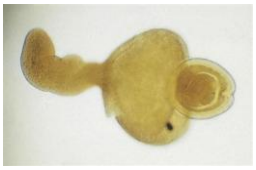
Anoplocephala perfoliata











IH in forage mites ***Oribatidae***
cysticercoids in 2 – 4 months

All age categories of horses are susceptible

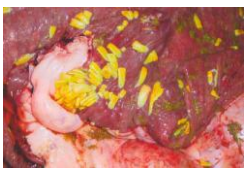
Seasonal dynamics: **lowest occurrence in spring, highest in winter**

Anoplocephala spp. – pathogenesis, clinical signs

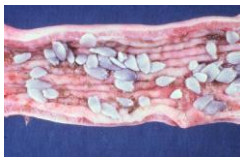
- Mild infection in horses without clinical signs
- Severe - enteritis, colic, intestinal perforation, death

A. perfoliata **–** in the ileocecal region of ulceration
Post mortem: small ulcerations, edema, partial blockage of the ileocecal opening**;**

A. magna **–** Larger amounts of tapeworms cause **catarrhal** to **hemorrhagic enteritis**;
Obstruction and perforation in massive infections by both tapeworms;



- Ileo-cecal constipation
- Spastic colic
- Intestinal necrosis



Diagnosis

- coprologic examination - concentration flotation methods - egg finding;
- coprologic methods - finding articles;
- Discontinuous proglotids excretion;

Coprological examination is not a reliable method for detecting tapeworm infestation and does not provide information on the degree of infestation.

Serological methods (ELISA) and molecular biology (PCR) methods have a higher detection rate.

Indirect methods for the detection of antibodies against tapeworms in serum, respectively, are increasingly being used. in the faeces (coproantigens) of horses.

Serological examination reliably determines not only the presence but also the intensity of the attack, which is of diagnostic value especially in **horses with recurrent colic.**

Antiparasitic treatment

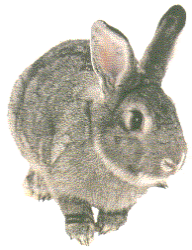
abamectin + praziquantel

ivermektin + praziquantel
ivermektin + moxidectin

Lagomorpha anoplocephalidosis - characterized by enteritis and disorders of unspecified

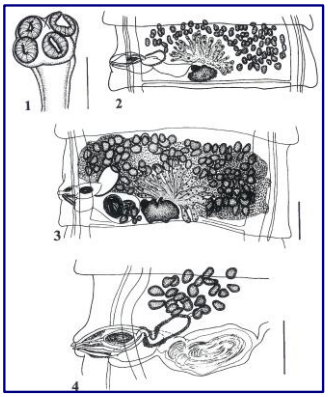
- round skolex, strong suckers, rostellum with hooks missing;
- mature proglotids are broad and short;
- *Cittotaenia ctenoides*, 80cm;
- *C. pectinata*, 5-8 cm;
- *C. denticulata*, 30-80 cm;
- *Andrya cuniculi*, 100cm;
- *A. rhopalocephala* 80 cm;
- *Mosgovoyia* (syn. *Cittottaenia*) pectinata americana, 5-18 cm;
- *Paranoplocephala wimerosa*, 1 cm;
- *Monoecocestus americana*, 5 cm.

- The development of these tapeworms is indirect, the intermediate hosts are soil mites mainly from the family Galumnidae, in which the primitive larvocyst **cysticercoid** is formed.



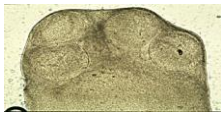
Andrya cuniculi

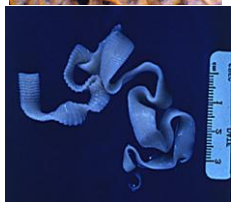
- 100 cm;
- Small intestine
- IH: land mites (Galumnidae)
- Sensitive especially young animals
- Enteritis, convulsions, growth retardation, weight loss, anemia
- Dg .: coprologically



Cittotaenia denticulata

- cca 45 cm
- Rostellum without hooks





Pathogenesis, clinical signs

- Severe infections cause **digestive disorders, enteritis, colic, weakening of the organism, even death**.
- Peritonitis in young animals.
- In older animals - subclinical course;
- Nervous manifestations - cramps, manege movements, etc.;
- The young are lagging in growth, poor; diarrhea, anemia; The abdomen is painful to feel.

- Dg. - ovoscopic examination of faeces
- **Therapy**: praziquantel, per os (10 mg / kg) or subcutaneous and intramuscular (5-10 mg / kg) preparations. Preparations containing nicklosamide (100 mg / kg) are also suitable.
- **Preventive** domestic rabbits do not give green pasture feed, which can access wild rabbits or hares.

TAPEWORM DISEASES OF GALLIFORMES

- **Family: Davaineidae**
- **Family: Hymenolepididae**
- **Family: Dilepididae**

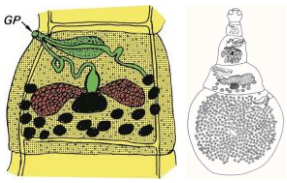
Family: Davaineidae
Genera: *Davainea, Raililetina, Cotugnia*

- These are small to medium – size;

- The rostellum is retractable and armed with numerous hummer-shaped hooks. The suckers are usually armed;

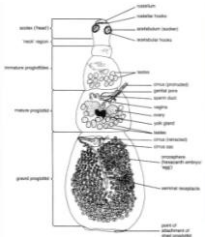
- Genital organs are usually single. The uterus is replaced by egg capsules;

- Adults are parasites of **birds (FH)**;
- **IH** - invertebrates, **cysticercoid**



Davainea proglottina

- The small tapeworm is one of the most common cestodes in poultry and pigeons;
- Small tapeworms are so small (1.5 - 4 mm) that they are overlooked in post-mortem examinations;
- They possess only 4 to 9 segments;
- The head is armed with 80 to 90 small hooks, arranged in 3 to 6 rows;
- The suckers bear 4 to 5 rows of hooklets;
- Small tapeworms are considered **the most pathogenic** of all tapeworms in poultry.



Life cycle

Davainea proglottina

The adult worm can live up to 3 years in its host.

Davaineosis

- cetodosis characterized by duodenitis and disorders of nervous system

Distribution: cosmopolitan in extensive poultry rearing (winter slugs); in Slovakia - 6% prevalence, especially in chickens;
Location: the duodenum of chickens;

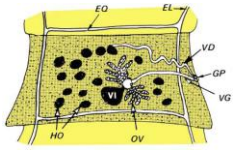
Pathogenesis and clinical signs: **the most pathogenic !!!**

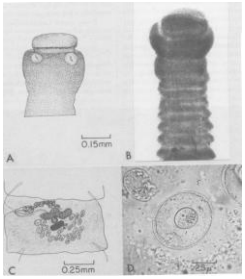
- The small tapeworms do great damage to the intestinal mucosa with their heavily armed scolex;
- necrosis of the mucosa with haemorrhagic inflammation;
- lose weight;
- fatal due to necrotic, haemorrhagic enteritis;
- In chronic infections the enteritis is associated with general weakness, and wasting leads to emaciation and even death of the birds.

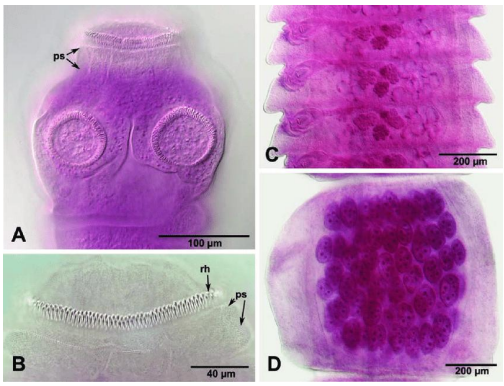
Diagnosis: coprologically - movable cells in the faeces;
Therapy: Birds (pigeons) can be individually dewormed with 5 mg/kg **praziquantel, niclosamide** 50 mg/ kg, and repeat in 10 – 14 days
Prevention: environmental sanition (molluscicides ???)

Genus: ***Raillietina***

- More than 200 species; small intestine of birds (Galliformes), and pigeons;
- *Raillietina tetragona* – up to 25 cm, small scolex, rostelum with hooks, oval suckers with spines, eggs in capsules (6 – 12);
- *Raillietina echinobotrida* – up to 20 cm, rostelum with hooks, sherical suckers, with spines;
- *Raillietina cesticillus* – up to 15 cm, large scolex, broad rostellum with 400-600 hooks, suckers without spines, capsules with one egg;

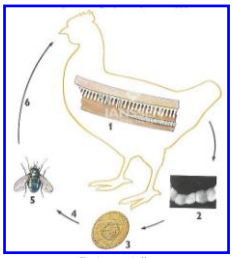




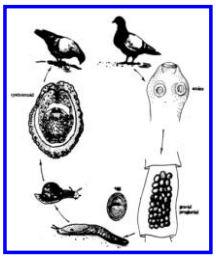


Life cycle

Rallilletina **(*R. cesticillus; R. echinobothrida; R. tetragona*)**



Raillietina cesticillus



Raillietina bonini

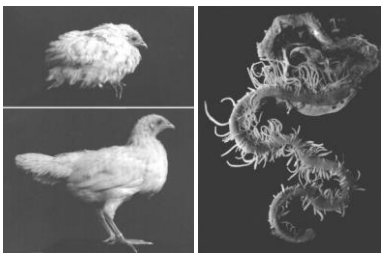
Railietinosis

cetodosis characterized by enteritis and NS disorders

Pathogenesis and clinical signs
➢The symptoms are non-specific, such as **weakness, unthriftiness, poor growth and diarrhoea;**

➢ Inflammation and degeneration of the villi occur but only severe infections can bring about marked clinical effect;
➢ Such infections can cause caseous nodules in the intestinal wall at the site of attachment and hyperpalstic enteritis can occur;

➢ Dg .: Coprologic Examination - Detection of Articles and Eggs of Tapeworms; post mortem - finding adult tapeworms in the intestine;



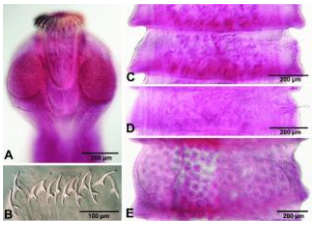
Raillietina cesticillus

Prevention and treatment

- Chickens and turkeys can be dewormed with flubendazole 60 ppm mixed into the feed for 7 days.
- When repeated treatment is required, the interval between treatments should be reduced to **18 days**.
- mebendazole, fenbendazole, oxfendazole, praziquantel, niclozamide are also effective

Family: Dilepididae

- Small to medium sized tapeworms of birds and carnivores.
- Scolex has rostelum with several rows of hooks.
- In each proglotid there is a double set of genital organs that open laterally.
- The eggs are placed in capsules.
- Larvocyst is of the cysticercoid type and develops in invertebrates (flea, scorpion, slugs, etc.).

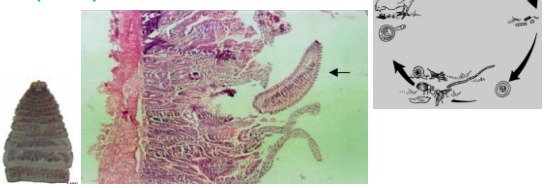


Dilepis undula

Amoebotaenia cuneata (*A. sphenoides*)

- Small intestine of domestic fowl
- Up to 4 mm, rostellum is armed, genital organs are single
- The uterus is sac-like and slightly lobed
- Enteritidis

Life cycle
IH earthworms
Prepatent period 4 weeks



Family: Dilepididae

Genus: ***Choanotaenia:*** *Choanotaenia infundibulum*

- IH – house fly, and dung beetles, grass-hoppers, carabids; **cysticercoid** (2 weeks)
- Prepatent period **4 weeks**

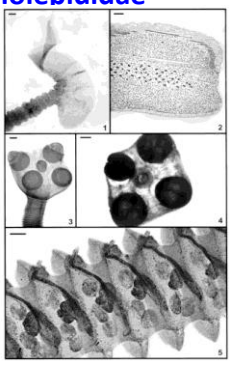
Therapy: fenbendazole, oxfendazole, praziquantel;

Family: Hymenolepididae

Species	IH or PH (paratenic host)	FH/organ localisation
Drepanidotaenia lanceolata Up to 25 cm;	IH: small crustaceans: Cyclops; PH: freshwater snails	Goose, duck, other waterfowl, rarely chicken; Small intestine
Echinolepis (syn. *Hymenolepis*) ***carioca*** 3-8 cm;	IH: dung beetles	Chicken, other galliformes; Small intestine
Fimbriaria fasciolaris Up to 40 cm;	IH: small crustaceans: Cyclops;	Goose, duck, other water birds, chicken; Small intestine
Gastrotaenia spp. Up to 13 cm;	IH: small crustaceans: Copepods;	Duck, swan; Gizzard, partly distal oesophagus and glandular stomach

Family: Hymenolepididae

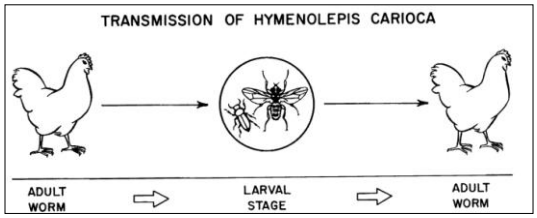
- Small to medium-sized tapeworms parasitic in the intestines of birds (galliform and aquatic), rodents and humans.
- Scolex has four suckers and rostellum with hooks.
- The mature proglotids contain one set of genital organs.
- Invertebrates are invertebrates where cysticercoid is formed.



Galliform poultry

Genus: *Hymenolepis* (syn. *Echinolepis*) – ***Hymenolepis cantaniana*** **(1,2-2 cm),** ***H. carioca*** **(8 cm)**

- rudimentary rostellum;
- low pathogenic species, no clinical manifestation;
- Catarrhal enteritis, diarrhea, death -> 1000 adult tapeworms in the intestine



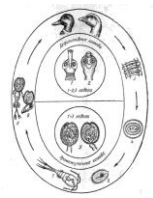
prepatent period: 3 – 4 weeks

TAPEWORM DISEASES OF WATER BIRDS

Characterized by enteritis and disorders NS

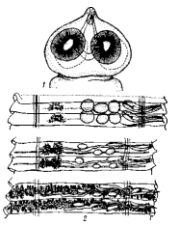
Scolex with rostellum and hooks

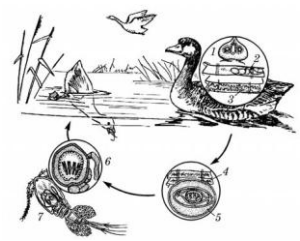
Diorchis stefanskii (20 cm)
Sobolevicanthus gracilis (12-27 cm)
Dicranotaenia coronula (7-27 cm)
Fimbria fasciolaris (40 cm)
Drepanidotaenia lanceolata (3-13 cm) – **the most pathogenic**; prepatent perióda – 3 weeks;
Hymenolepis lanceolata
Hymenolepis nyrocae



Drepanidotaenia lanceolata

- Copepods (Cyclops, Diaptomus) are intermediate hosts.





Clinical signs and pathogenicity

- **Clinic:** digestive disorders, diarrhea - greenish to gray faeces, inappetence, feeling thirsty, lagging in growth, nerve symptoms - impaired stability (falling on the side, tail and back) and mobility, mortality;
- In older poultry - no signs;
- Dg.: finding articles in the faeces and post mortem;
- Therapy: Praziquantel, - repeated after a month;

TAPEWORM DISEASES OF RODENTS AND HUMANS

Family: Hymenolepididae

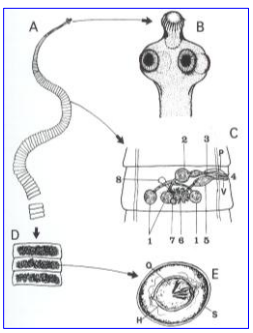
Hymenolepis **(syn. *Rodentolepis*)** ***nana***
Hymenolepis diminuta
Hymenolepis microstoma

- Small to medium size tapeworms parasitic in the intestines of rodents and humans (> 200 species).
- IH are invertebrates (crustaceans, insects, molluscs) where cysticercoid (reservoir habitacionism) is formed.

Hymenolepis nana

Morphology:
- small tapewarm up to 15 – 40 mm
- scolex with 4 suckers, rostellum with 24 - 30 hooks
- Eggs: 50 – 70 x 36 – 50 µm

Location: small intestine



Hymenolepis nana

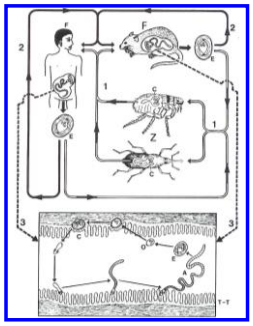
- Definitive Host: Humans, rodents
  - Most common tapeworm of humans in the world
  - 1% rate of infection in the southern U.S.
  - 97.3% rate of infection in Moscow, Russia
- Intermediate Host: Larval and adult beetles (but optional)
  - Larval stage, cysticercoid, can develop in D.H. if it eats the eggs
    - Probably a recent evolutionary event

Hymenolepis nana

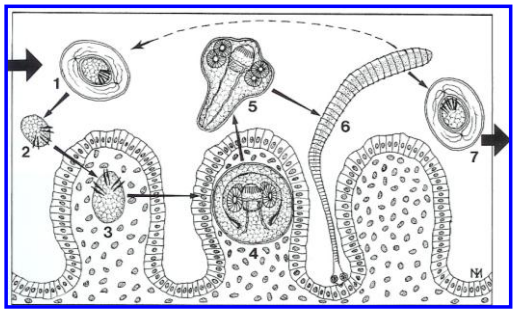
- Geographic distribution: Cosmopolitan.
- Mode of Transmission:
  - **Ingestion of infected beetle**
  - **Ingestion of food contaminated with feces (human or rodent)**
  - **Fecal/oral contact**
- Pathology and Symptoms: Generally none because worm is so small (about 40 mm). Heavy infections can result in verminous intoxication.

Life cycle of *Hymenolepis nana*

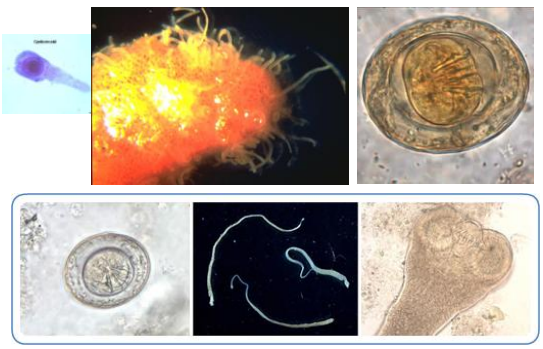
- **Indirect life cycle**
- **Direct life cycle** – without IH - external autoinfection
- **Autoinfection** (internal)



Direct Life cycle of *Hymenolepis nana*



Hymenolepis nana



Hymenolepidosis = contact helminthosis

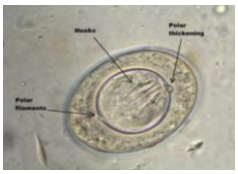
Distribution: cosmopolitan; in particular, rats are heavily infected and spread in the human population;

H. nana - **faecal-oral transmission (human-human) contamination of water, food, hands and the like.**
- most commonly dg tapeworm of people (children), especially in areas of low hygiene;

Pathogenesis and clinic:
- mild infection - no symptoms;
- **severe infection** (> 100 specimens) - mucosal inflammation, anorexia, vomiting, abdominal pain, diarrhea-constipation, in mice - retardation of pup growth and weight loss;

Hymenolepis nana

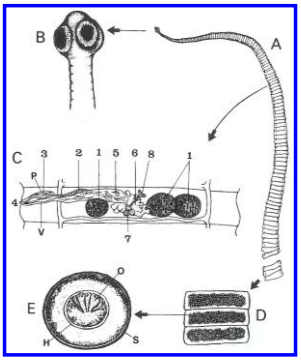
- Diagnosis: Eggs in feces. Eggs have polar filaments.
- Treatment: niclozamide, praziquantel; (control after treatment for 3 months; family or group retreatment recommended);
- Prevention: removal of rats from house



Hymenolepis diminuta

Morphology:
Up to 10 – 60 cm, no rostellum and hooks!!
Eggs: spherical 60 – 85 um
Location: small inestine
Hosts (FH): rodents, human
IH = insects (fleas, butterflies, grasshopers)
Mode of Transmission to D.H.:
Ingestion of infected beetle.

60 – 85 µm



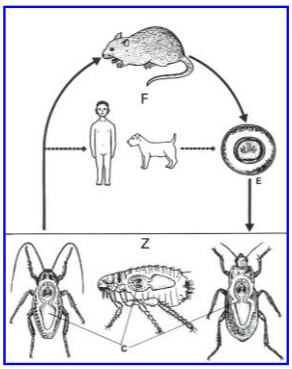
Life cycle

FH : rat, rodents, occassionally human, hamster, dog

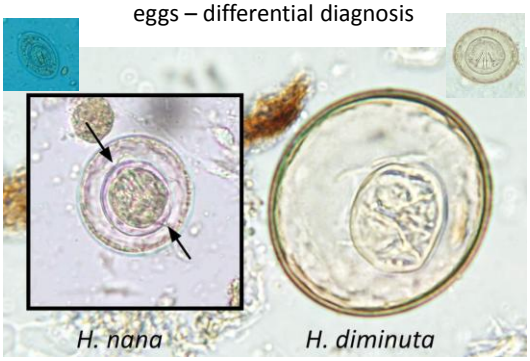
IH: insect one week
cysticercoid

Prepatent period 20 days

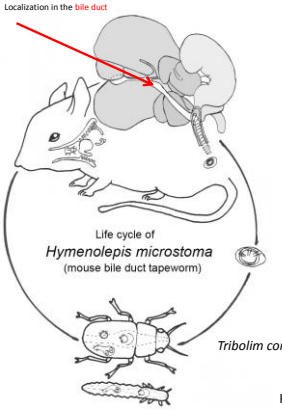
- Diagnosis: **Eggs in feces**. Eggs do not have polar filaments.
- Treatment: **Praziquantel**
- Prevention: **Remove rats from home.**
- Notes: **Easily maintained in laboratories so has been used as the "model" tapeworm to study metabolism, reproduction, genetics, physiology, etc.**



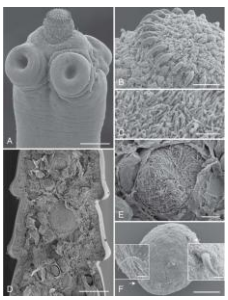
Hymenolepis nana and ***H. diminuta***
eggs – differential diagnosis



Localization in the bile duct



Hymenolepis microstoma



Tribolim confusum – IH – cysticercoid
(1 week)

Prepatent period: 12-14 days;