

The Cestodes

The Tapeworms

Cyclophyllidia = suckers are cup-shaped

Pseudophyllidia = suckers are shallow, bothria
mostly aquatic intermediate hosts

Echinococcus granulosus

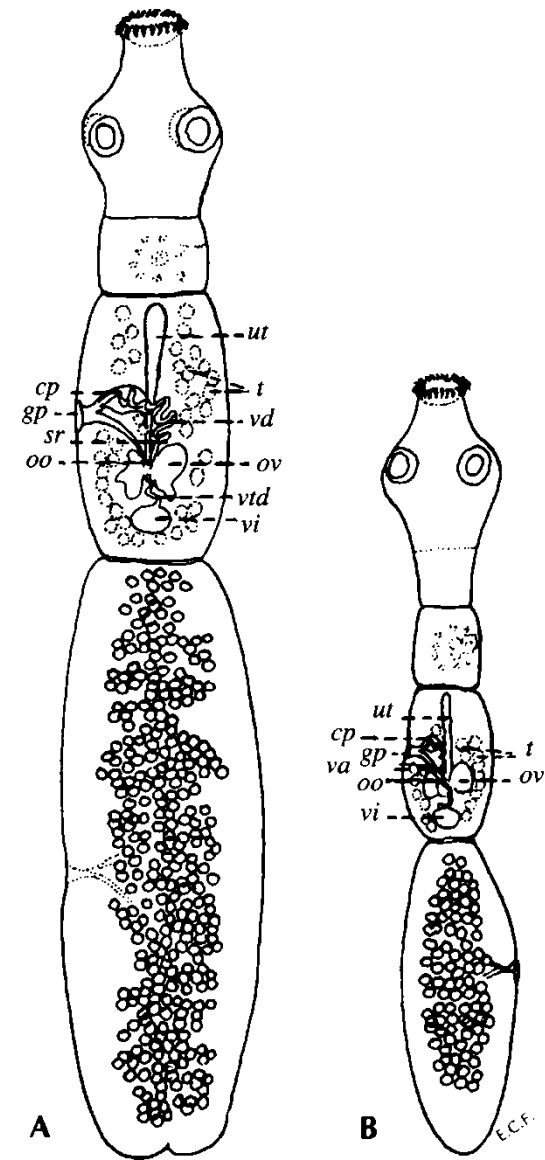
- Dog tapeworm
- Hydatid disease
- Hydatid worm
- Unilocular echinococcosis

Habit:

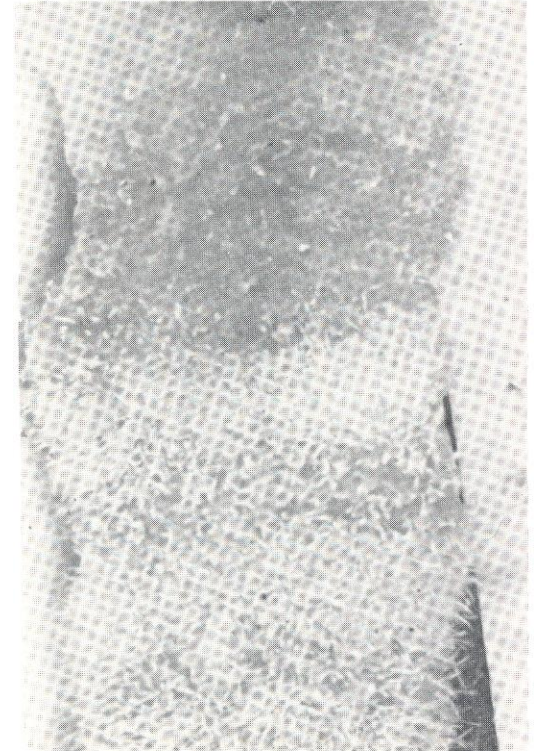
- Adult worms in small intestine of dog and other canine animals
- Dog is definitive host
- Larval form seen in man & other intermediate hosts (sheep, goat, cattle, pig & horse)

Morphology:

1. Adult worm 3- 6mm in length
 - **Scolex**-Armed with 4 suckers, 28-50 hooks
 - **Neck**- short and thick
 - **Strobila**- three segments
 - a. **1 immature** proglottid
 - b. **1 mature gravid** proglottids
 - c. **Terminal gravid** proglottids broadest and largest
uterus loosely twisted coil –
relatively few eggs
 - **worm longevity in dogs 5-29 months**



Echinococcus granulosus. Adult worms in the intestine of a naturally infected dog in Lebanon.



Morphology

2. **Eggs:** Indistinguishable from those of Taenia
3. **Larval form**
 - Found within the hydatid cyst which develops in the intermediate host

Life Cycle

- Passes its life cycle in two hosts
- Adult worm lives attached to the mucosa of SI of dog/canine
- Eggs discharged in faeces
- Swallowed by intermediate host while grazing
- Man acquires infection by direct contact with infected dog or

Life Cycle

- By allowing the dog to feed from same dish or ingesting contaminated water, food with dog faeces
- **Hexacanth embryos** hatch out in the duodenum
- Penetrate intestinal wall and enter the portal vein and carried to the liver
- **Liver acts as the first filter** where 60-70% of human infections are located

Life Cycle

- Some embryos pass through the hepatic capillaries and enter pulmonary circulation
- **Lungs act as second filter**
- Other embryos pass pulmonary circulation and enter general circulation and lodge in brain, heart, spleen, kidneys genital organs, muscles, bones etc

Life Cycle

- Some embryos escape destruction and develop into **hydatid cysts** (fluid filled bladder)
- From inner inside of cyst, brood capsules with a number of scolices are developed

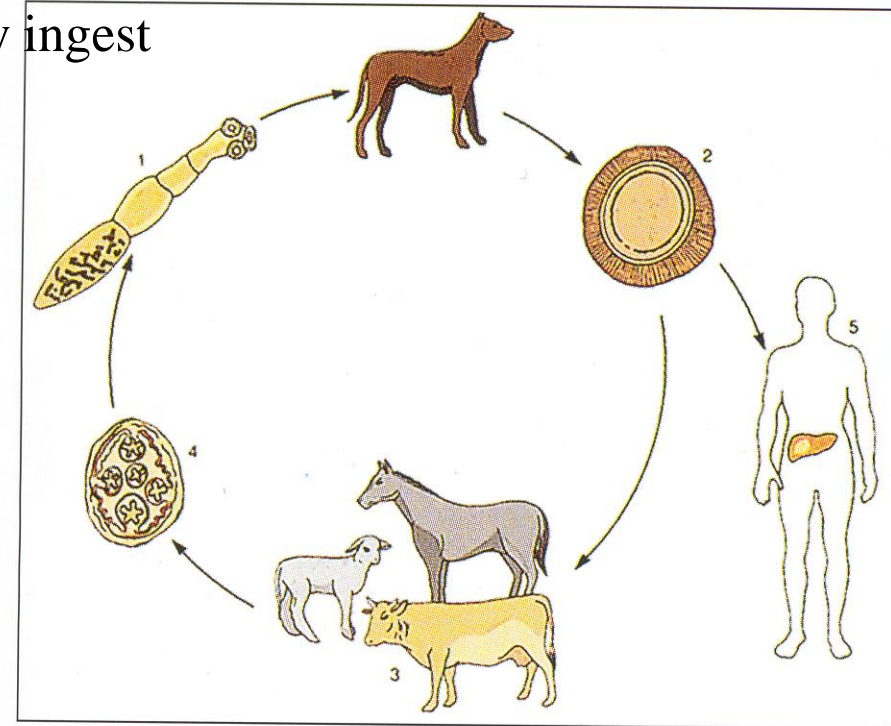
Life cycle of *Echinococcus granulosus*

- (I) The adult tapeworm inhabits the small intestine of dogs , eggs in the faeces
- (II) Eggs ingested by herbivores (
 - (2) Hatch in the duodenum, the hooked embryos entering the circulation where they are carried to various sites to develop into cysts
 - (3) Dogs become infected when they eat the cysts contained in contaminated offal.
 - (4) Humans are infected if they accidentally ingest eggs from infected dogs.

The liver is the commonest site for the cysts.

Nine distinct genotypes within the *E. granulosus* complex have been identified by molecular based procedures

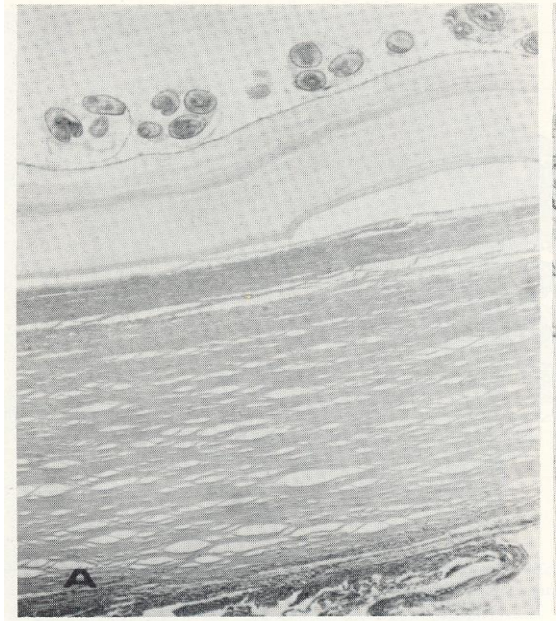
Their full epidemiological importance not yet been defined



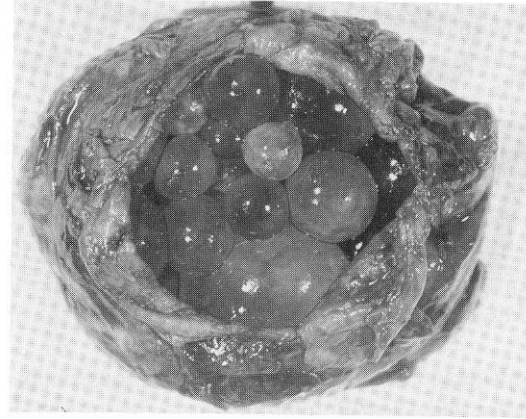
The Cyst: Intrinsic cyst wall differentiated into

1. Outer friable, milk-opaque, non-nucleated laminated layer
2. Inner nucleated germinal layer generally parasite cells budding into cystic cavity, vacuolated and on stalks

= Brood capsules containing protoscoleces, invaginated, mature fully, and become infective.



Echinococcus granulosus. Unilocular hydatid cyst, 12 cm in diameter and containing numerous daughter cysts ranging up to 7 cm in diameter, removed from the liver of a Greek seaman from whom two similar cysts had been removed 6 years earlier.

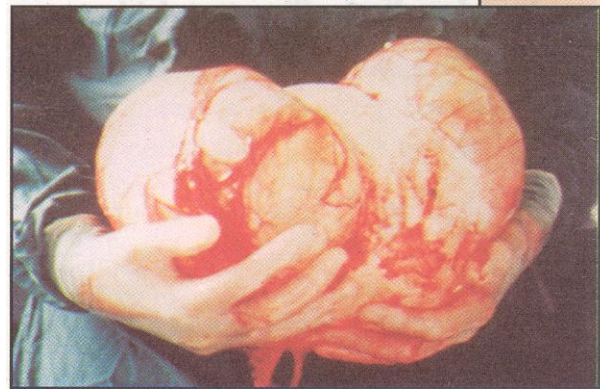
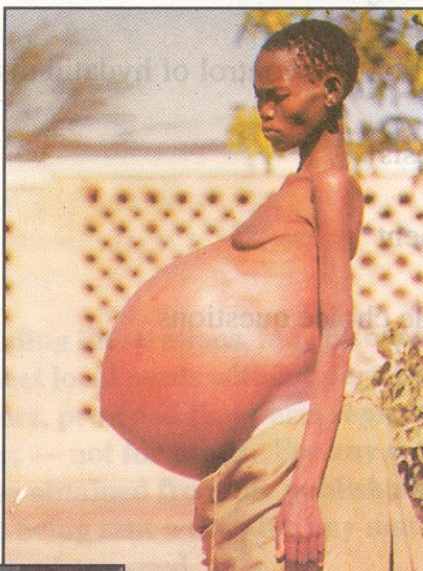


'Hydatid sand' The daughter cysts are attached to the parent cyst wall or may float free in its milky fluid contents as the so-called 'hydatid sand'. Rupture of a cyst into the tissues results in dissemination and further growth of the scolices.



Pathogenesis

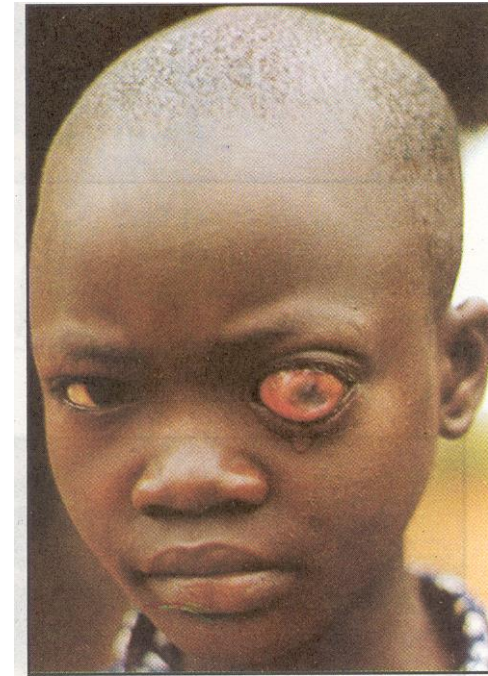
1. Mechanical – Abdominal masses impair functions of vital organs, or grow large, become physical burden and burst-
Anaphylactic shock, bones break.



2. Always serious disease Unilocular cyst, position

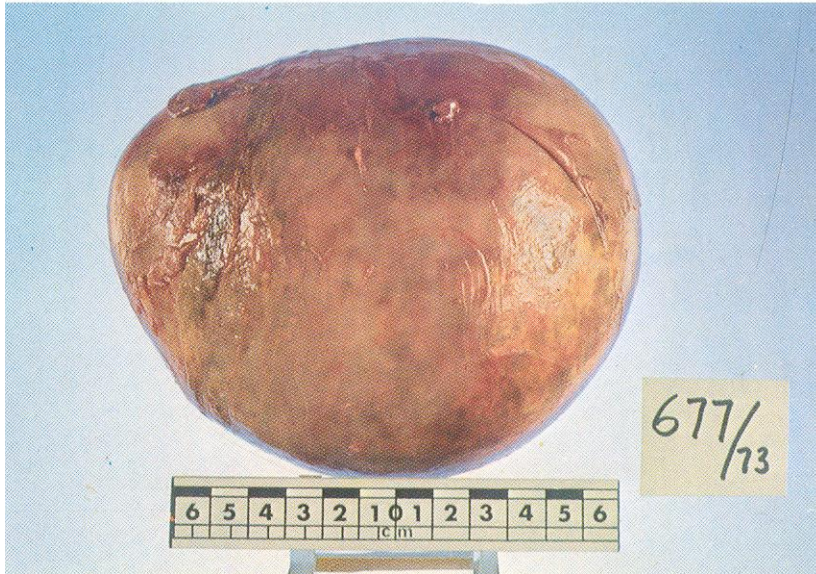
5-20 years later symptoms

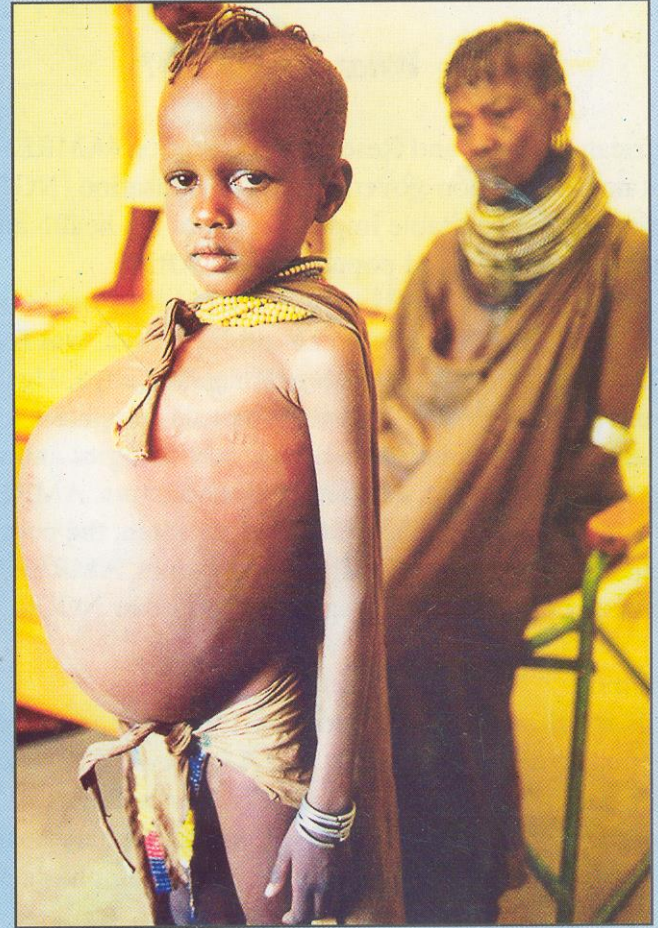
- incomplete insulation
- allergic, anaphylactic
- bronchial or biliary abscess
- arterial embolism – metastasis
- brain, orbital, capillary, heart valve
- Liver and pulmonary commonest



Hydatid cyst in the eye

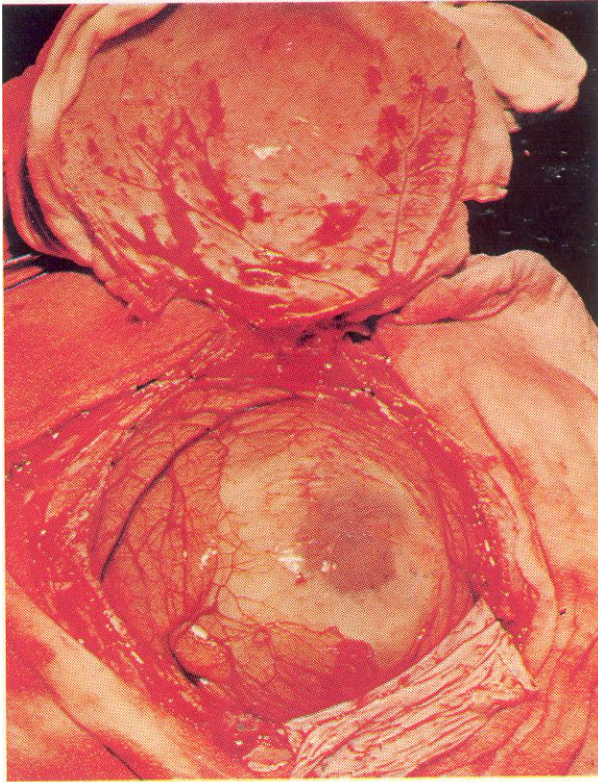
Hydatid cyst of liver From ingested eggs that hatch in the duodenum, the hooked embryos enter the circulation where they are carried to various sites. The liver is commonly affected. The hydatid cyst is usually unilocular, with a double wall comprised of an outer laminated layer, and an inner nucleated germinal layer. The figures show a 1150 g cyst





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Hydatid cyst in brain This cyst was found in the brain of a four-year-old girl.

Daughter cysts The germinal layer produces brood capsules, inside which grow scolices.

3. Osseous – erosion, multiple fracture and crumbling of bone :

- Sterile cysts no brood capsules caused by bacterial infection or calcification

acephalocysts brood capsules that do not produce protoscoleces 5-20cm, 2L fluid

Osseous hydatid – confinement in bone, laminated layer poorly developed organism grows along the bone canal as a naked protoplasm, eroding osseous tissue

4. Lung hydatid – intracapsular, prone to spontaneous rupture – rapid recovery or Asphyxiation
5. Calcification
6. Secondary infected

Prevention

1. Strict personal hygiene
eggs of *E. granulosus* resistant to disinfection
2. Don't feed dogs on offal's
3. Kill stray dogs
4. Treatment of dogs and working dogs
5. Abattoir control
6. Praziquantel – kills immature and adult stages
7. Public education

Prognosis of hydatid cyst

Fair in unilocular, operable site,
spillage into operative cavity – critical centres
– Grave

Marsupialization prevents spillage and
metastasis

Echinococcus multilocularis

=Alveolar hydatid Disease

Sterile – no protoscoleces

exogenous budding, bare

germinal layers

progressive invasion of

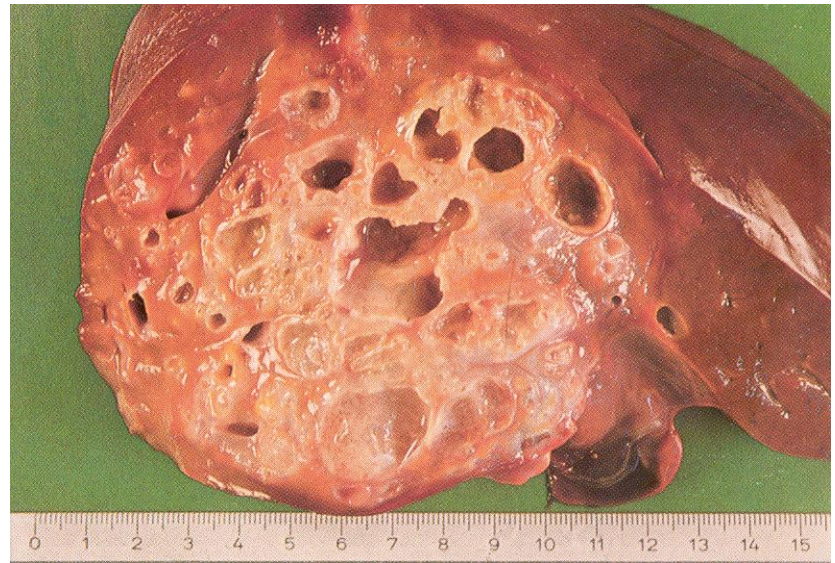
the organs 90% like

an invasive neoplasms

-Resemble carcinoma,

metastasis

-Hepatic



Hydatidosis in human liver Multilocular, or alveolar cysts, are caused by infection with *Echinococcus multilocularis*. The adult of this species is found in wild canines, and the usual larval hosts are rodents. The alveolar cyst in the human liver may mimic hepatic carcinoma, but it is usually only discovered post mortem,

Diagnosis- as in E.granulosus

Treatment –

1. Surgical removal – resection
2. Mebendazole – works survival in hepatic hyadatosis – 14.5 yrs. – slow growth

Prevention:

1. Control of dogs and cats/children treat 20-30 days

Epidemiology of Hydatosis

only definitive hosts-dogs, cats, dingos

intermediate hosts- herbivores (sheep, cattle,
elephants, antelope,
carriboou, reindeer)

Reservoirs

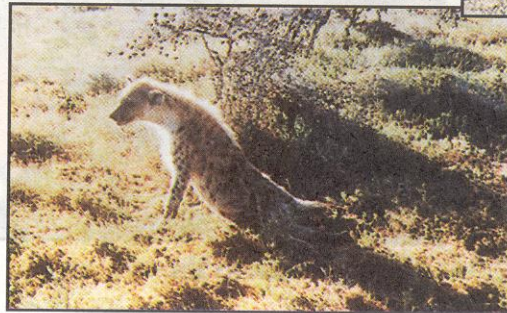


Dogs, hyenas and jackals are the final hosts of the adult tapeworms. The adult tapeworms release eggs through the feces of dogs, hyenas and jackals into the surrounding.

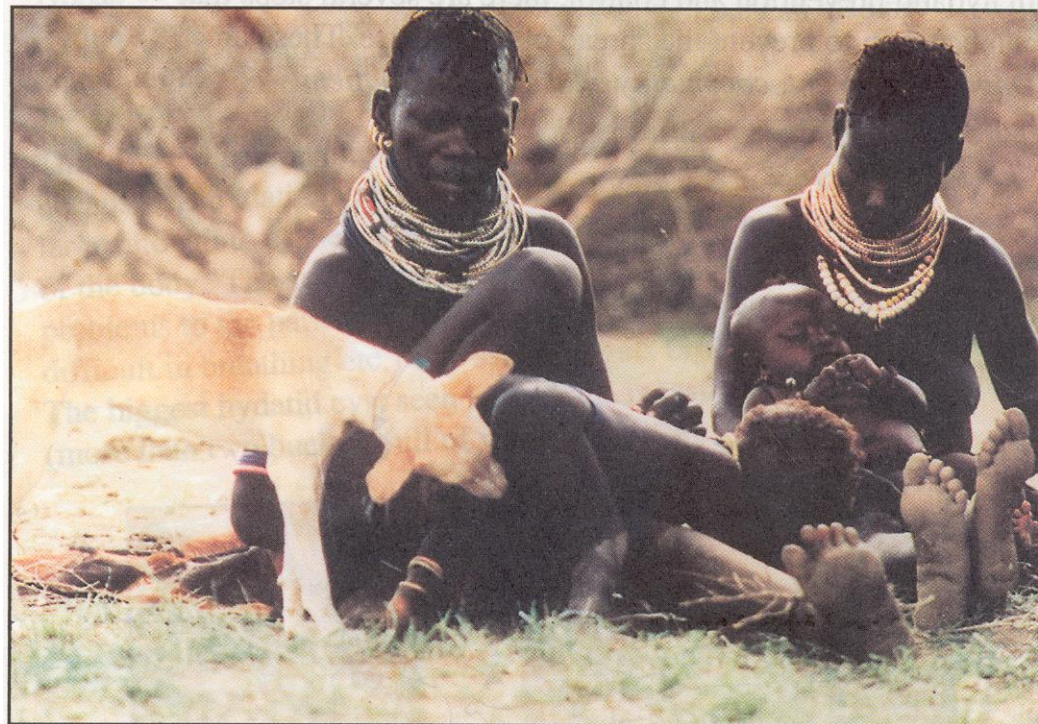
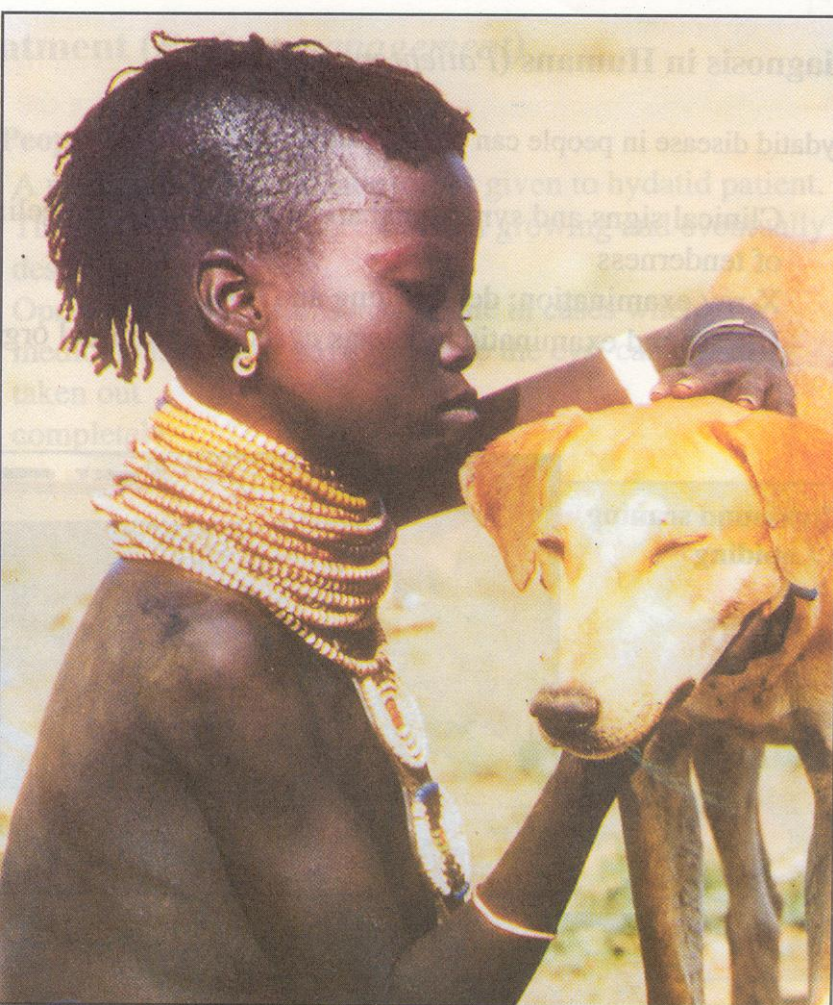


Dog

Jackal



Hyena



Dog feces – human infections

Dogs infected by feeding on infected viscera

Geography: Australia, N. Zealand, Europe,
India, China Absent S. USA, N & S. America,
W. Africa

Enzootic/endemic regions: cattle grazing
countries e.g in New Zealand

0.1% infection rates in dogs

10% infection rates in ewe livers

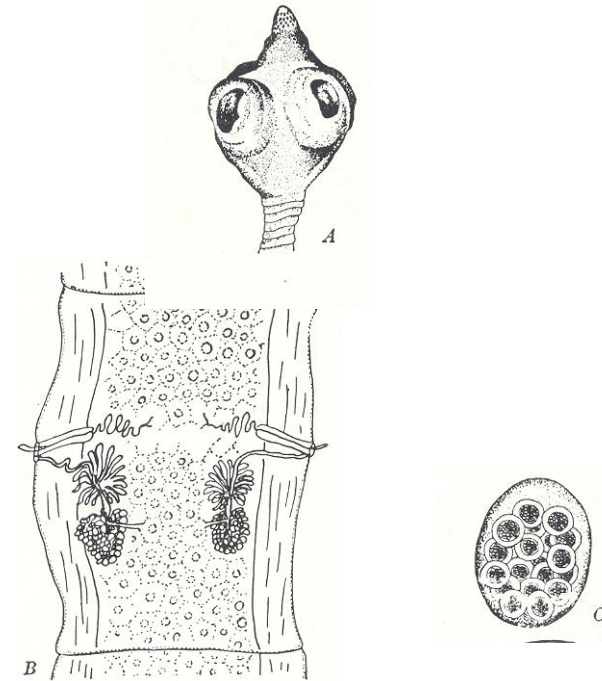
Dipylidium caninum: The dog tapeworm

of dogs and cats

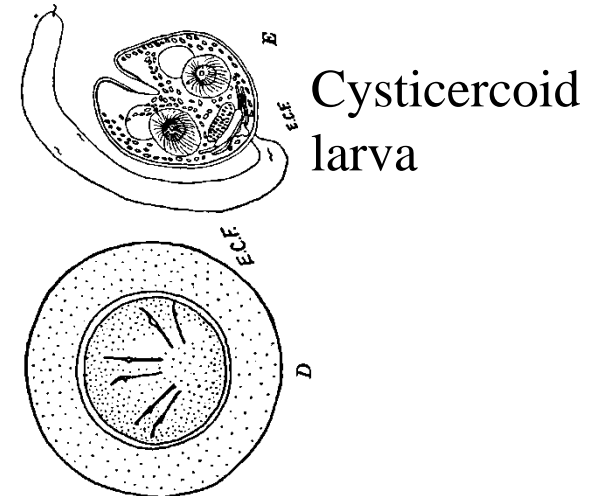
Habitat: intestinal

Morphology

1. 10-70c
2. Rhomboidal, small, scolex, armed, rostellum with 7 circlet of spines
3. Proglottids: double set of reproductive organs, mature and gravid proglottids shaped like pumpkin seed
4. Gravid proglottids filled egg chambers of 8-15 eggs, enclosed in embryonic membrane
5. Eggs hyaline brick red, tinge, thin shelled. Delicate hooklets



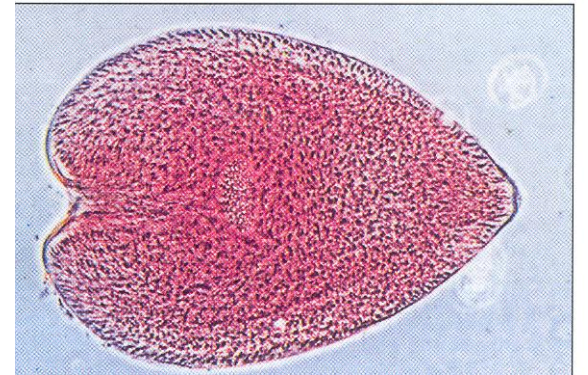
eggs in egg membrane



Cysticercoid larva

Life Cycle of *D. caninum*

1. Eggs in capsules or proglottids are ingested by larvae of dogflea – *Ctenocephalides canis*, or cat flea – *Pulex irritans*
2. Eggs hatch in insect intestine as oncosphere, develops into Proceroid, penetrate hemocoel, develops into Cysticercoid when flea larva pupates
3. Flea larva metamorphoses into adult, eaten by dog or man



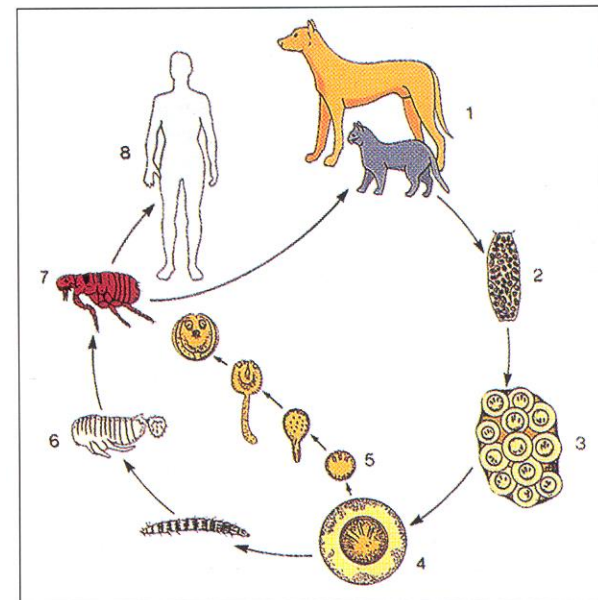
Immature cysticercoid
from dog flea



First instar larvae

Life cycle of *Dipylidium caninum*

- (1) The adult cestode in the small intestine of dogs, cats or wild canids,
- (2) Proglottids or clusters of encapsulated eggs passed in feces
- (3). Oncospheres hatching from eggs ingested by flea larvae remain undeveloped until the larvae pupate, whereupon they develop into cysticercoids
- (5). The cysticercoids undergo a complicated metamorphosis in the body cavities of the pupal flea
- (6) Infected adult fleas (7) and (8, I) pass into the small intestine of the definitive host when it accidentally ingests the fleas, there everting the hooked rostellum to attach to the gut wall where it will mature into an adult.



Pathogenesis:

1. Slight intestinal disturbance, indigestion, loss of appetite
2. Mostly children, proglottid migration from anus causes anxiety.

Diagnosis: eggs and proglottid identification

Treatment: Niclosamide

Epidemiology: all in children, exposure or tolerance, Zoonosis, cosmopolitan

Hymenolepis nana –

The dwarf tapeworm
= Vampirolepis nana

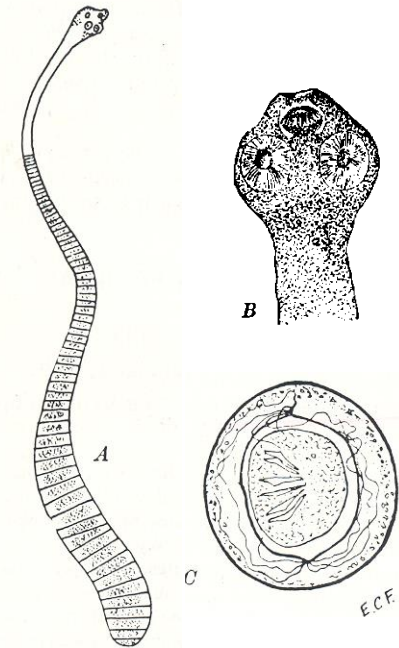
Morphology

40mm,

small scolex armed with 20-30
spines

Egg – oncosphere enclosed in
inner membrane, 2 polar
thickenings, 4-8 polar
filaments

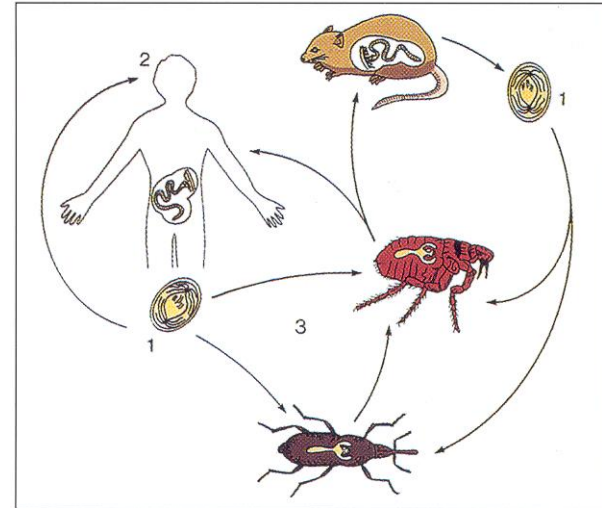
Oncosphere with 3prs lancet-
shaped hooklets



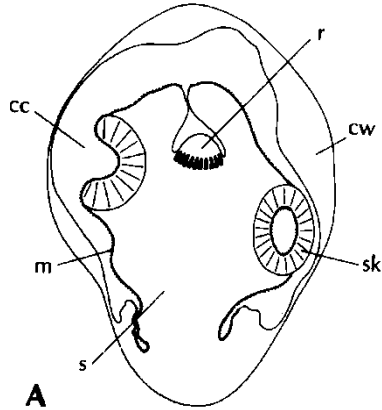
A, Complete strobila.
B, Scolex,
C, Egg.

Life cycle of *Vampirolepis nana*

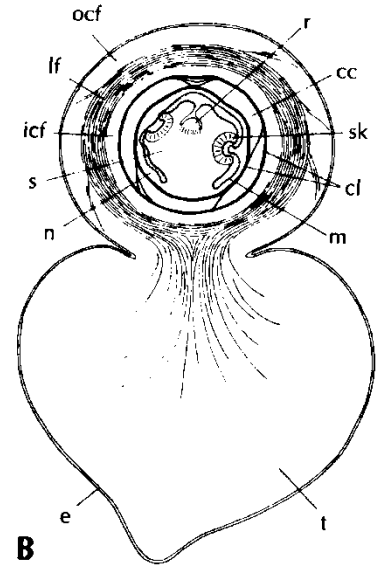
(1) Eggs released from mature proglottids in the upper ileum are passed in the faeces. (2) If ingested by another person, they hatch to yield hexacanth oncospheres, which burrow into the villi of the small intestine. There they mature into tailless cysticercoids (cercocysts), which migrate towards the ileum where the scolices become attached to commence the formation of leave the villi, move further down the gut and become attached to other villi where they mature to adult tapeworms. proglottids. (3) Eggs that are ingested by such insects as fleas, beetles or cockroaches hatch to form tailed cysticercoids, which remain unmodified as long as they are within the insect's body cavity. If infected insects are accidentally ingested, the cysticercoids pass down the intestine to establish themselves in the ileum of the new vertebrate host. In this way rodents, as well as humans, may be infected,



Hymenolepis nana: cysticercoids.



A, From intestinal villus of a mouse.



B, From insect host.

Transmission of H.nana

1. Ingestion of infected fleas
2. Internal autoinfection in immunosuppressed.
3. Person to person, and institutional groups

Pathogenesis

1. Infection well tolerated,
2. Allergic reaction
3. Dizziness, pruritus ani, diarrhea, anorexia, epileptiform convulsions

Diagnosis: eggs in feces

Treatment: Niclosamide, Praziquantel

Prevention: personal hygiene

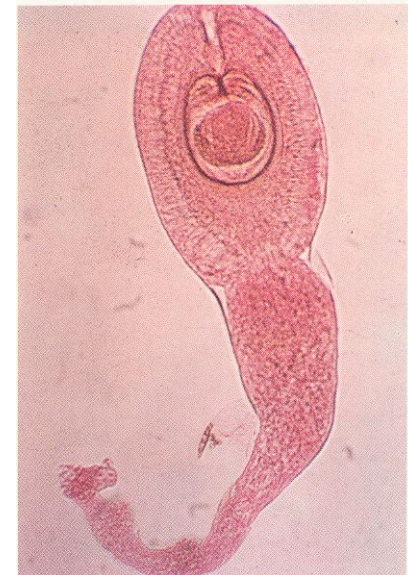
Hymenolepis diminuta – rat tapeworm

- 20-60 cm
- Un armed rostellum
- Eggs inner membrane has 2 polar thickenings but no polar filaments
lanceolate hooklets arranged in fan pattern
- Arthropods obligatory intermediate hosts
especially coprophagic
- Occasionally man is infected by accidentally swallowing infected arthropods
- Non pathogenic
- Niclosamide and Praziquantel

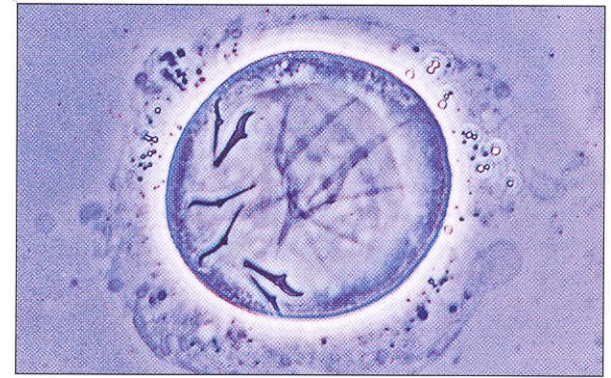
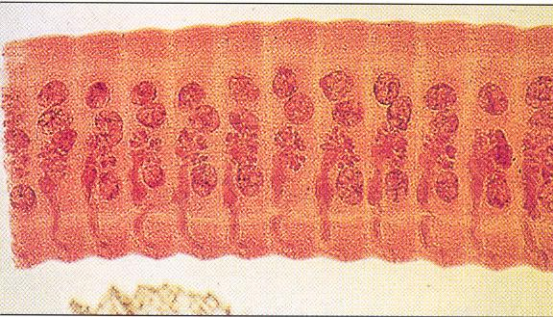
Hymenolepis diminuta (Rat Tapeworm)

Tribolium confusum These grain pests are typical intermediate Hosts of *H. diminuta*.

Cysticercoid of *H. diminuta* in arthropod
An intermediate



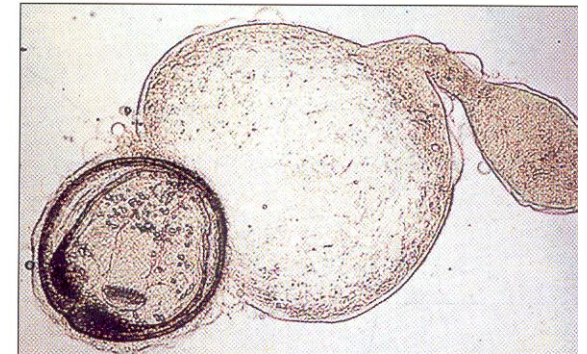
Mature proglottids-Dwarf Tapeworm



Hexacanth oncosphere



Cercocyst in intestinal villi: oncospheres penetrate into the villi of the small intestine. There they mature into tailless cysticercoid (cercocysts), these become adults later



Cysticercoid in insect