

HELMINTHOLOGY

CLASS: CESTODA



CLASS OF CESTODA

GENERAL DEFINITION: They are hermaphrodite, Cestodes are exclusively hermaphrodites; with both male and female reproductive systems in same body.

Platyhelminthes, whose bodies are dorso-ventrally pressed (flattened), generally elongated, without digestive, respiratory, circulation systems.

Their bodies consist of many similar units, known as proglottids

It is typically a four-sided knob, armed with suckers or hooks or both

Cestoda is a class of parasitic worms in the flatworm phylum (Platyhelminthes)

GENERAL SYSTEMATIC:

Phylum: PLATYHELMINTES

Class: CESTODA (CESTODEA = CESTOIDEA)

Subclass: CESTODARIA

Subclass: EUCESTODA (EUCESTODIA)

Subclass: CESTODARIA	Subclass: EUCESTODA
Monozoic (No Ring = No Segments)	Polyzoic (Ringed = Segmented) (Except Caryophyllidae)
Scolex = no head	Have scolex
There is 1 reproductive organs	Each unit (proglottids) has one or more sets of reproductive organs
There are 5 double-hooked larvae in their eggs (DECACANTH)	There are 3 pairs of anchor larvae in their eggs (HEXACANTH)
<u>Found in Fish and Amphibiums</u>	It is found in Fish, Amphibium, Reptil, Bird and <u>Mammals</u> .

Polyzoic cestode
Taenia pisiformis →

← **Monozoic cestode**
Amphilina foliacea

Subclass:

EUCESTODA

Order:

PSEUDOPHYLLIDEA

CYCLOPHYLLIDEA

Family:

Diphyllobothriidae

Family:

Anaplocephalidae

Taeniidae

Davaineidae

Dilepididae

Hymenolepididae

Mesocestoididae

DIFFERENCES BETWEEN THE PSEUDOPHYLLIDEA AND CYCLOPHYLLIDEA ORDERS

	Order: PSEUDOPHYLLIDEA	Order: CYCLOPHYLLIDEA
Egg	<ul style="list-style-type: none"> -Covered -3 pairs of hooked larvae (oncospheres) develop later. 	<ul style="list-style-type: none"> -Without cover -Oncospheres developed state (In the advanced state, it emerges from the host).
Morphology	<ul style="list-style-type: none"> -Scolex is almond shaped. -Adhesion organelle is BOTHRIUM (2 pieces). -Proglottids, immature → mature -The genital pore is on the <u>ventral</u> of the proglottid. -There is a uterine hole 	<ul style="list-style-type: none"> -Round, oval <ul style="list-style-type: none"> a) ACETABULUM (4 pieces) b) ROSTELLUM -Proglottid, immature → mature → gravid -<u>Laterally</u> (except Mesocestoididae) -No
Biology	<ul style="list-style-type: none"> -Uses 2 intermediate hosts -There are 3 larval shapes (coracidium→proceroid→plerocercoid) 	<ul style="list-style-type: none"> -Uses 1 intermediate host (except Mesocestoididae) -There are 6 larval shapes (cysticercus, coenurus, hydatid cyst, cysticercoid, strobilocercus, tetrathyridium)

- **DEFINITION:** Tapeworms - They are hermaphrodite Platyhelminthes, whose bodies are dorso-ventrally pressed (flat), segmented, elongated, ribbon-shaped, digestive systems absent.
- **SETTLEMENT PLACE IN THE LAST / FINAL HOSTS:** Mostly the cestodes settle in the **intestines** of the last hosts.
- It is rarely found in the bile and pancreatic ducts.



- **SIZES:** It vary from a few millimeters to meters in length.

Taenia saginata 4 – 12 m.

Taenia solium 2 - 4 m.

Echinococcus granulosus 2 – 6 mm.

Diphyllobothrium latum

3 – 10 m., 25 m.

Amoebotaenia cuneata 2–4 mm.

Davainea proglottina 1,5–5 mm

SEGMENT (PROGLOTTID) NUMBERS: Correlated with total body length.

Diphyllobothrium latum 2000-4000 proglottid

Taenia saginata 1200–2000 proglottid

Echinococcus granulosus 3 proglottid

Davainea proglottina 4–9 proglottid

BODY SECTIONS IN CESTODS (BODY SEGMENTATION)

A mature cestode has three different morphological and physiological parts.
These;

- 1) **Scolex** (Head):
- 2) **Proliferation zone** (Neck): right after the scolex
- 3) **Strobila / proglottids** (Chain): comes after the neck

- **1) SCOLEX (HEAD):** Located on the front end.
- Adhesion / hold organelles;
- 2 Bothrium (Bothria) in Pseudophyllidea
- 4 sucker (acetabula) and hooks (on rostellum, It has a different number of hooks) in Cyclophyllidea

Diphyllobothrium latum (2 bothria)

Taenia solium (4 sucker and Rostellum)

Taenia saginata (Rostellum
absent, 4 sucker)

Dipylidium caninum (There are
rostellum and sucker. Rostellum
moving back and forward, hooks
are not single-row. It may be 3 or
4 row).

- **2) PROLIFERATION ZONE (NECK):** It comes right after the scolex.
- It is the part that is not divided into proglottids, where the proglottids are formed from this part (proliferation zone).



- **3) STROBILA / PROGLOTTIDS (CHAIN):** It is the part that comes after the neck. And it consists of proglottids.
- Proglottids; Immature → Mature, in Pseudophyllidea order (**eggs of the parasite are released from the uterine pores and go out with feces from last host**).
- Proglottids are in the form of Immature → Mature → Gravid In the Cyclophyllidea order (**gravid proglottids separate from the parasite and go out from the last host**).
- **Immature proglottids:** These are the proglottids that come right after the neck, smaller than the other proglottids, and have not yet developed reproductive organs.
- **Mature proglottids:** It comes after the immature proglottids, in which the reproductive organs develop in a certain order. Generally, in the proglottids, the male organs first mature, the sperms are formed and stored, the female organs develop later and fertilization occurs. This is called PROTANDRY = ANDROGYNY.
- **Gravid proglottids:** The reproductive organs are atrophied in these proglottids. The proglottid is characterized by the uterus filled with eggs.

Scolex ↓

Proliferation zone ↓

Immature proglottids ↓

Mature proglottids ↓

Gravid proglottids

- The formation of young proglottids from the anterior (neck area) is called **STROBILATION**. And the proglottid moves posteriorly to the end of the segment / proglottid, replacing another one. Therefore, those close to the neck are the youngest, and those at the end of the proglottids are the oldest.
- The gravid proglottid/ proglottids are located on the posterior end of cestodes. And these are filled with eggs. The gravid proglottids are separated from the cestode, they passed out with the feces (*E.g.: Taenia spp.*) or shredded, the eggs are mixed with the feces and removed (*E.g.: Hymenolepis spp.*). This event is called **APOLYSIS**.
- Since there are no gravid proglottids in some cestodes (*E. g.: Diphyllbothrium spp.*), in mature proglottids, eggs are released from the uterine pore and go out with feces. In these, the proglottid is thrown out when it gets tired or old. This is called **PSEUDOAPOLYSIS**.
- Rarely, in some cestodes, the proglottids leave the chain early before they mature, and mature while in the intestines. This is called **HYPERAPOLYSIS**.

- **BODY LAYERS:** The body of cestodes is covered with a cuticle layer just like trematodes. This is called a tegument.
- There are microscopic finger - like protrusions on the tegument. These are also called MICROTRIX = MICROVILLUS.
- Tasks:
 - 1) By increasing the absorption surface, it ensures the intake of more digested foods.
 - 2) In addition to attractants or similar structures, it has an effect to increase adhesion by coming into contact with microvilli on the mucosa cells of the host intestine.



- **DIGESTIVE SYSTEM:** None.
- They supply their nutrients by osmotic absorption on the whole body surface.

- **RESPIRATORY SYSTEM:** None.

- **CIRCULATION SYSTEM:** None.

- **NERVOUS SYSTEM:** Not well developed.
 - 1) The group of ganglion that we can call the nervous system center.
 - 2) It consists of nerves.

➤ **EXCRETORY SYSTEM:** This is also called **osmoregulator system**.

The residues in the parenchyma are collected by protonefridium type cells called FLAME CELLS, and are connected to the main collector channels by joining them into small channels.



- **REPRODUCTION SYSTEM:** Each proglottid has one or two sets of reproductive organs. They are hermaphrodite (with both male and female reproductive systems in same body) and there is protandry.

Therefore;

In the same proglottid of a cestode's

Between the separate proglottids of a cestode's

Fertilization can occur between the proglottids of two cestode's.

Though they are sexually hermaphroditic and cross-fertilization is the norm, self-fertilization sometimes occurs and makes possible the reproduction of a worm when it is the only individual in its host's gut. During copulation, the cirri of one individual connect with those of the other through the genital pore, and then spermatozoa are exchanged.

MALE REPRODUCTIVE ORGANS

Testis

Vasa efferentia

Vas deferens

Vesicula

Cirrus sac

Genital atrium

FEMALE REPRODUCTIVE ORGANS

Ovary

Oviduct

Ootype

Uterus

Vagina

Genital atrium

CESTOD EGGS

-Layers

- Capsule
- Outer layer
- Inner layer
- Embryophore
- Oncosphere membrane

Diphyllobothrium

Moniezia

Hymenolepis

- ▶ There isn't three pairs of hooked **oncosphere** in cestod eggs of the order Pseudophyllidea.
In cestodes of the order Cyclophyllidea, there is three pairs of hooked **oncosphere** inside the egg.

Taenia

Dipylidium

Joyeuxiella

Choanotaenia

➤ **DEVELOPMENT OF CESTODS:**

- They develop indirectly (except *Hymenolepis nana* ← This cestode develops both directly and indirectly.)
- *Pseudophyllidea* order's cestodes have to use 2 intermediate hosts for development.
- *Cyclophyllidea* have to use 1 intermediate host in development (except for *Mesocestoides* ← This cestode uses two intermediate hosts.)

➤ **CESTODE LARVAE TYPES (in Pseudophyllidea Order):**

Pseudophyllidea

Egg → 1) Coracidium → 2) Proceroid → 3) Plerocercoid

1

2

3

➤ **CESTOD LARVAE TYPES (in Cyclophyllidea Order):**

Cyclophyllidea

- Egg → Cysticercus
- Egg → Coenurus
- Egg → Hydatid cyst
- Egg → Cysticercoid
- Egg → Strobilocercus
- Egg → Tetrathyridium

Cysticercus

e.g.: *Taenia saginata* (human – intestine)

Cysticercus bovis (cattle – muscle)

Coenurus

e.g.: *Taenia multiceps* (dog – intestine)

Coenurus cerebralis (ruminants – brain)

Hydatid cyst (Cystic Echinococcus)

e.g.: *E. granulosus* (dog – intestine)

Hydatid cyst (mammalian – liver, lung)

Cysticeroid

e.g.: *Dipylidium caninum* (dog - intestine)

Cysticeroid (flea, louse)

Strobilocercus

e.g.: *Taenia taeniaeformis* (dog - intestine)

Strobilocercus fasciolaris (rodent - liver)

Tetrathyridium

e.g.: *Mesocystoides lineatus* (carnivor - intestine)

Tetrathyridium elongatum (different vertebrate)

(2. larvae types)