

LECTURERS IN VETERINARY PARASITOLOGY

INTRODUCTION, NEMATODA AND SYSTEMIC PLATYHELMINTHES

THIRD YEAR STAGE

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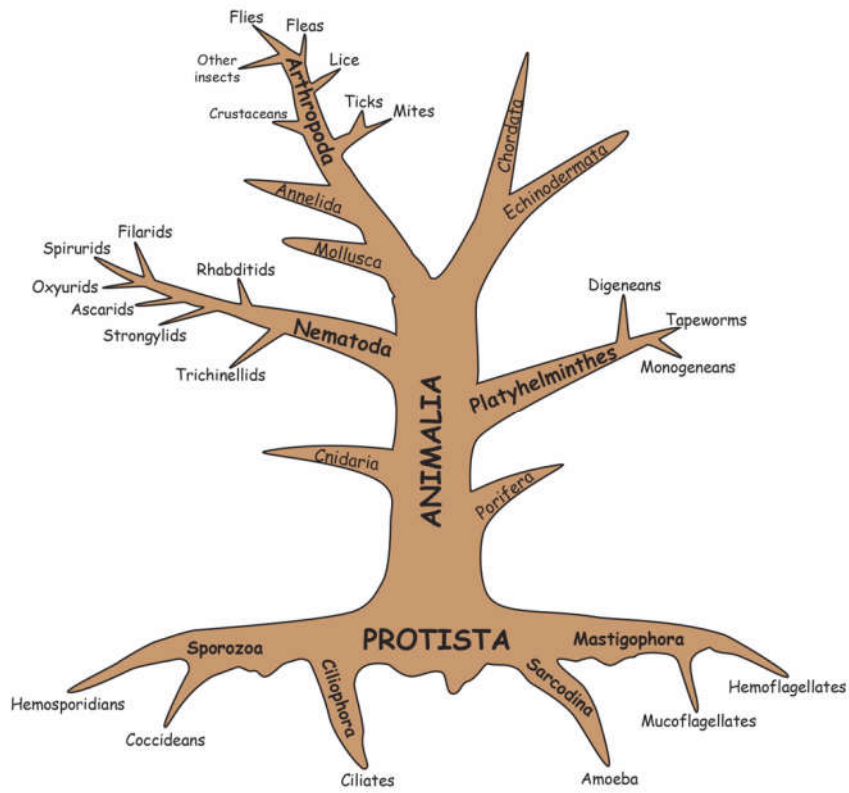
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CHAPTER THREE

SYSTEMATIC PLATYHELMINTHES

NC STATE UNIVERSITY



Characteristics of the Phylum Platyhelminthes:

Platyhelminthes one of the most important phylum with thousands genus at the world, the general characteristics:

1. bilaterally symmetrical; dorso-ventrally flattened
2. A celomate
3. cannot synthesize fatty acids
4. tegument (living external layer)
5. digestive tract incomplete or absent
6. excretory system protonephridia

The phylum Platyhelminthes consists of four classes:

1. CLASS: Turbellaria

mainly free-living flatworms, some as symbionts associated with echinoderms, molluscs, fish, cnidarians, etc. Although the majority are thought to be commensals, some are truly parasitic, few are commensals or parasites of invertebrates, free-living examples include *Planaria* spp. in aquatic environments and the giant terrestrial land planaria in the genus *Bipalium* spp.; commensal/parasitic forms include *Syndesmis* spp. in the intestines of sea urchins, *Bdelloura* spp. on the gills of horseshoe crabs, and *Stylochusfrontalis* in the valves of oysters.

2. CLASS: Monogenoidea (Monogenea)

All parasitic, most species on fish gills or skin; however, some internal in urinary bladder, nasal passages, cloaca, one host life-cycles, evolutionarily, appears to be more closely related to cestodes than trematodes, with two main "traditional" subclasses for this class:

1. **Subclass: Monopisthocotylea**
2. **Subclass: Polyopisthocotylea**

3. CLASS: Trematoda

All parasitic, mainly in digestive tract, most with suckers, most with 2-more host life cycles, with three subclasses:

1. **Subclass: Digenea (typical flukes)**
2. **Subclass: Aspidogastrea**
3. **Subclass: Didymozoida**

4. CLASS: Cestoidea

All parasitic; tapeworms, most with 2-more host life cycles, no digestive tract, most segmented.

Class: Monogenea

The general characteristics of class Monogenea as below:

1. hermaphrodites
2. normally ectoparasites on aquatic vertebrates

3. generally site specific on host and host specific
4. live a few days - years, depending on species
5. morphologically: Prohaptor (sometime present, anterior end that may bear adhesive or feeding organs). Eyespots sometime present, photoreceptors near two anterior ganglia. The tegument (living external layer).

Alimentary tract consist of:

1. mouth anterior, usually with Prohaptor
2. esophagus with muscular pharynx
3. intestine branches into caecae, often with diverticula
4. Monopisthocotylea feed mainly on epidermis and mucus;
Polyopisthocotylea mainly on blood, host cells, and mucus
5. blind-ended gut, regurgitate waste

Protonephridia [excretion] consist of:

1. 2 main lateral ducts, extend posteriorly; then curve and extend anteriorly
2. contractile bladders laterally
3. flame cells drive fluid within ducts

Reproductive systems consist of:

- **Male** : 1-200 testes (1-2 most common), testes - vas efferent - vas deferens - seminal vesicle - cirrus - gonopore; sometimes prostate

- **Female** : 1 ovary, normally anterior to testes, oviduct from ovary – ootype, Mehlis gland lubricates uterus, forms egg shell capsule, genital intestinal canal, only in Polyopisthocotylea; connects oviduct with right intestinal caecum for excess secretions discharge, 0-2 vaginas - sperm transfer; if none, use gonopore, sometimes a seminal receptacle, vitellarial secretions add to egg-shell formation; ducts fuse near oviduct, eggs pass through uterus, out gonopore; sometime a muscular metraterm

Development

- **eggs** shed, normally with filaments, filaments stick to host
- **oncomiracidium** ciliated, hooked posteriorly, about a 24 hr life, if eyespots, phototactic, some attracted to fish mucus, grow to adult directly

Opisthaptor which may be:

- suckers (=suckerlets)
- anchors (large hooks, sometimes called hamuli or central hooks)
- hooklets (left over larval hooks, sometimes called marginal hooks)
- bars (often called accessory sclerites; they support anchors)
- clamps (complex, muscular structures more advanced than suckers).

Figure 14.16

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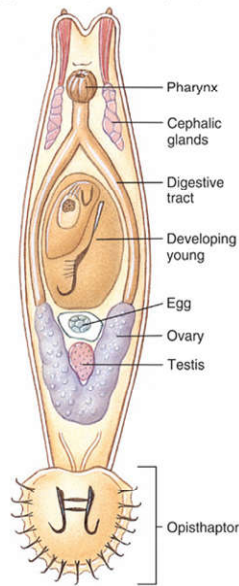


Figure (16): The Typical structure of Monogenea

Monogenea typically occur at low levels on fish and so do not inflict serious harm. However, in fish farms, infestations may become very heavy and lead to significant mortality.

Class: Digenea

Typically digenia with two suckers usually as an attach organs which was:

- A. oral (usually anterior) sucker. Surrounds mouth.
- B. acetabulum (ventral sucker).

And two or more hosts in life cycle. All but a few monecious (self or cross fertilize)

Types of adult flukes according to the sucker as name and position:

- 1- distome (most common; oral sucker and ventral acetabulum).
- 2- amphistome (oral sucker; posterior sucker, usually posterior to testes).
- 3-monostome (oral sucker only).
- 4-gasterostome (mouth in center of oral, ventral sucker)
- 5-holostome (forebody and hindbody; tribocytic organ posterior to acetabulum).
- 6-echinostome (collar of spines around anterior sucker).

Tegument consist of two zones:

1. outer cytoplasmic syncytium with microvilli [mitochondria, ER, vacuoles, lipids, etc.] [pinocytosis; spines]
2. inner area of nucleated cell bodies - cytons
3. zones separated by basal lamina
4. also, circular & longitudinal muscle under basal lamina

Numerous chemicals in tegument

- mucopolysaccharides to inhibit host digestive enzymes
- acid & alkaline phosphatases, esterases, and aminopeptidases for digestion

Alimentary tract consist of:

- incomplete gut
- pharynx, when present, masticates food
- esophagus leads to 2 blind caecae
- entire gut secretion by cells along gut; proteases, lipases, etc.
- in caecae, absorption too

different species feed on different things: like: blood, mucus and epithelium cells.

Reproductive system consist of:

Male reproductive system consist of: usually 2 testes; taxonomic importance, vas efferens - vas deferens - cirrus pouch, cirrus pouch encloses seminal vesicle, prostate glands, and cirrus; some with external seminal vesicle outside of pouch, sperm stored in seminal vesicle and prostate secretes fluid to keep sperm alive.

Female reproductive system consist of: usually single ovary, 2ndry oocytes released, through short oviduct, into ootype, 3 organs enter into ootype: Mehlis gland, cluster of unicellular glands, enhance egg tanning by maintaining correct pH. Different cell types in gland, secretions cause release of shell globules from vitelline glands, secretes first membrane around egg into lubricates uterus and activates sperm, which are passed down ootype. Common vitelline duct (passage of vitelline gland secretions for eggshell

formation], Duct from seminal receptacle (absent in some species), Occasionally a fourth duct, vitelline reservoir, as diverticulum of vitelline duct.

Excretory system consist of:

- protonephridia (flame cells)
- excretory bladder in posterior, with excretory pore

Development:

- **Egg:** usually operculate, lid pops off during hatching (in Schistosomes, no lid; shell splits).
- **Miracidium:** hatches from egg - penetrates mollusc (rarely annelids), asexual stages from miracidium, with morphologic characteristics: apical stylet, apical papilla [where ducts from glands open; also nerve endings for chemoreception], apical gland [histolytic enzymes], cephalic glands [lytic enzymes], photoreceptors [eyespot], germinal mass [initiate asexual stages], cilia [locomotion], excretory pore, actively swim, chemoreception to snail mucus, attaches to snail with apical papillae; lytic enzymes dissolve tissues. About 30 min for penetration.
- **Sporocyst:** asexual stage, various shapes, no mouth or digestive system, absorbs nutrients through tegument, may produce rediae, daughter sporocysts, or cercaria.

- **Redia:** develop directly from miracidium, or from embryos generated from sporocysts, elongate; crawl actively, muscular pharynx, mouth, blind-ended sac caecum, 1-more ambulatory buds for movement often, because ingestion, many species cause extensive damage to host, will form daughter rediae or cercaria
- **Cercaria:** from redia or sporocyst, free-swimming, leaves snail and seeks host, miniature immature fluke with tail, penetrate skin of definitive host, encyst on vegetation as metacercaria, encyst as metacercaria in intermediate host or eaten by intermediate or definitive host or mesocercaria (unencysted juvenile) in tissues

Types, some systematic based on sucker placement of cercaria

- monostome

- a. 1 sucker only, anterior
- b. 2 eyespots
- c. long, simple tails
- d. develop from redia
- e. give rise to monostome adults

- amphistome

- f. posterior sucker, often anterior too
- g. eyespots
- h. develop from redia

- i. give rise to amphistome adults
- j. all in superfamily: Paramphistomoidea

- gasterostome

- k. mouth ventral
- l. develop into gasterostome adults
- m. all in family: Bucephalidae

- distome

- n. 2 suckers, one oral and one ventral
- o. most common type

Another classification, based on cercarial tail shape and other structures:

- pleurolophocercous
- furcocercous
- echinostome
- xiphidiocercariae
- ophthalmocercariae (with eyespots)

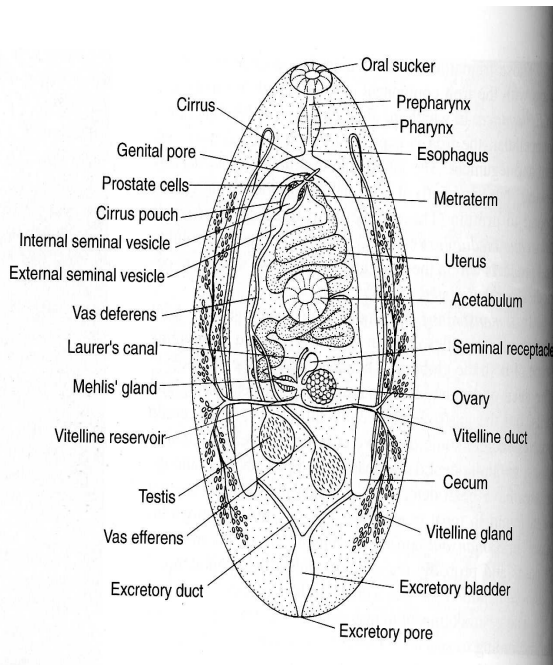


Figure (17): Typical structure of Digenea

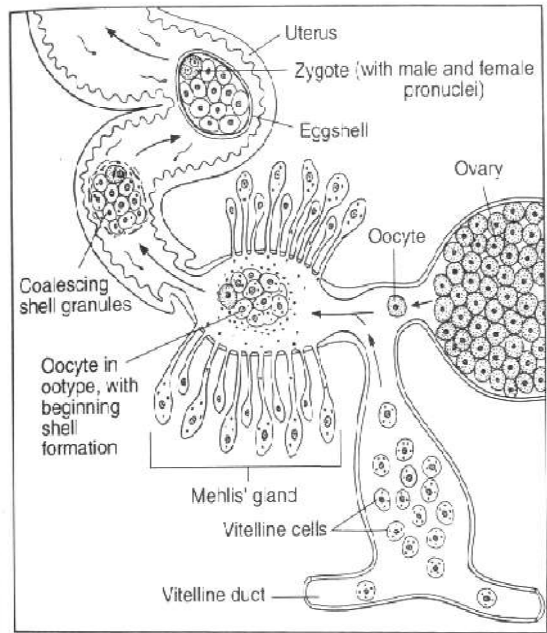


Figure (18): Typical structure of female reproductive system in

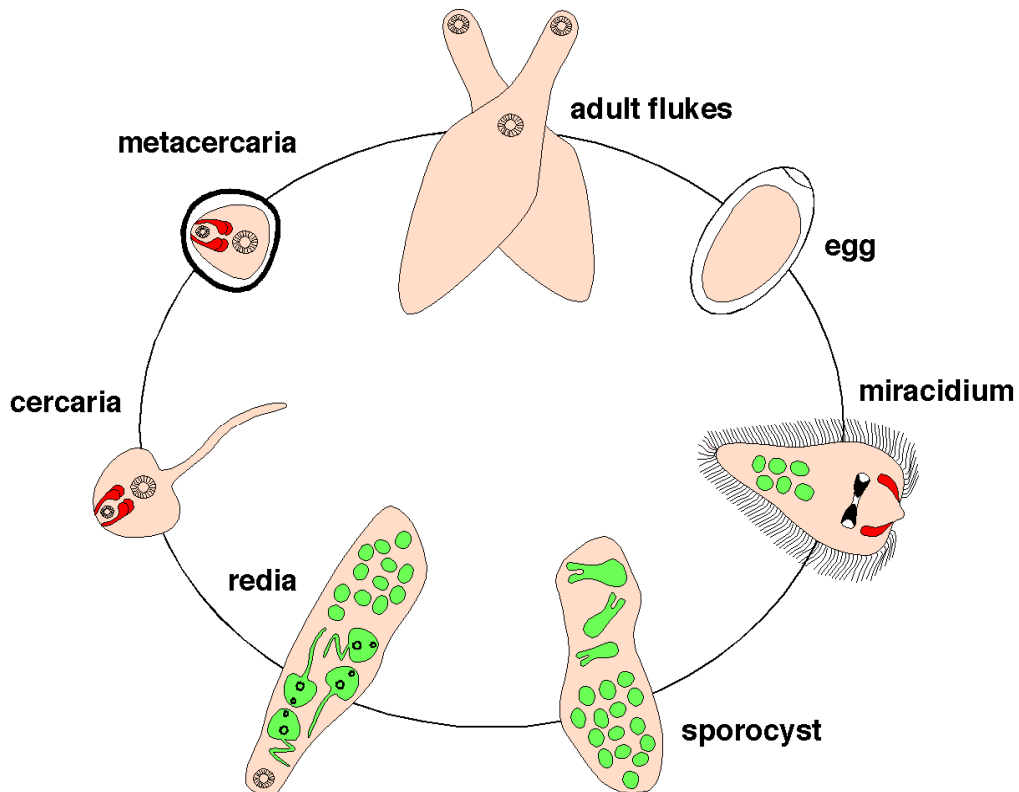


Figure (19): Typical larval stages and life cycle in Digenea

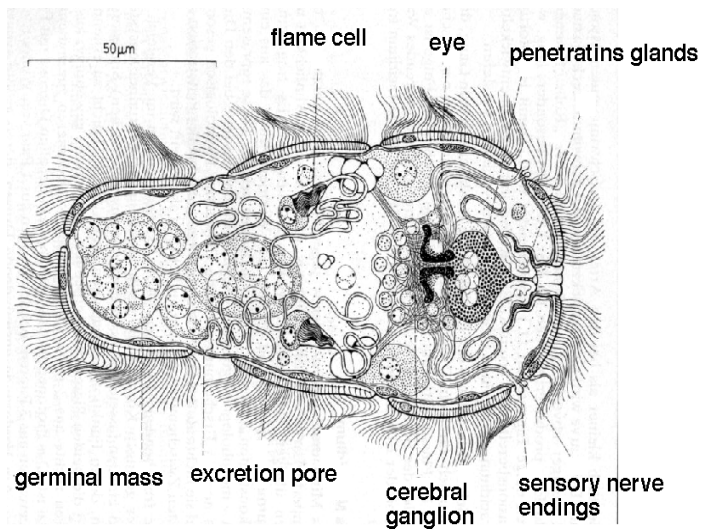


Figure (20): Typical structure of miracidium in Digenia

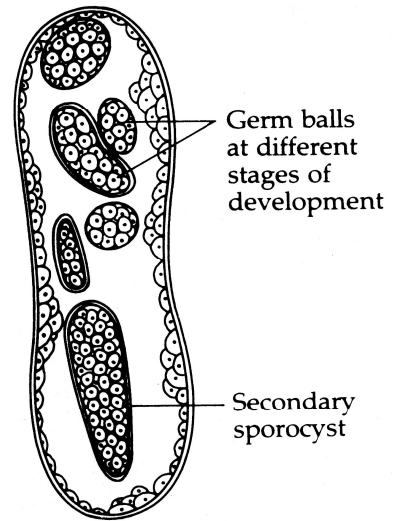


Figure (21): Typical structure of sporocyst in Digenia

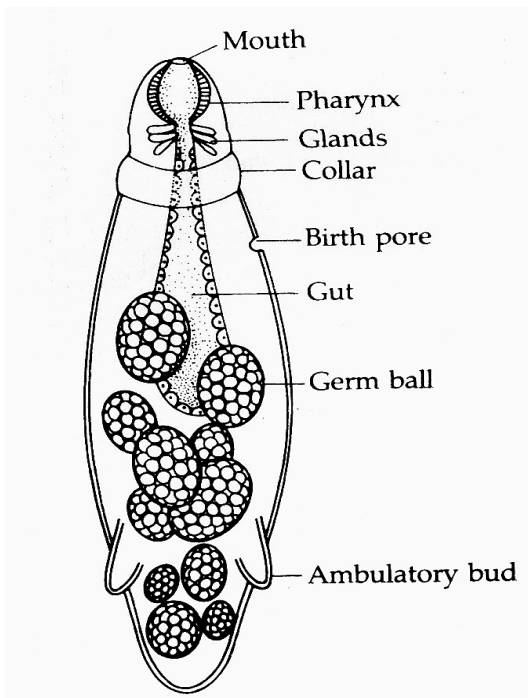


Figure (22): Typical structure of redia in Digenia



Figure (23): Metacercaria in Digenia