# Digenean Groups

In general, flukes are grouped by location in definitive host.

## Large Animals

**Liver Flukes or Bile Duct Flukes**
- *Fasciola* (ruminants)
- *Fascioloides* (ruminants)
- *Dicrocoelium* (ruminants)

**Intestinal Fluke**
- *Acanthatrium* (bat/horse)

## Small Animals

**Bile & Pancreatic Duct Flukes**
- *Platynosomum* (cats)
- *Eurytrema* (cats)

**Lung Fluke**
- *Paragonimus* (dogs, cats)

**Intestinal Fluke**
- *Nanophyetus* (dogs)

**Blood Fluke**
- *Heterobilharzia* (dogs)
**Paragonimus kellicotti**

- Lung Flukes
- Oval, thick. Ventral sucker located mid-ventral.
- Lobed Opposite Testes Posterior, Lobed Ovary lateral to mid-ventral genital pore.
Definitive Hosts: lungs - Dogs & Cats (Pigs, Raccoon, Mink, etc)
Ova in the lung mucus & sputum, swallowed then passed in the feces.
Miracidia develop & hatch in water
Molluscan 1st Intermediate Host
- Pomatiopsid lotic snails (Sporocysts -> Redia)
Cercaria
2nd Intermediate Host
- Crayfish (Metacercaria)
Young Flukes
- Young flukes migrate from intestine through the peritoneal cavity, across the diaphragm & into the lung parenchyma.
- Flukes pair-up & mature in cysts with bronchiole connections.
- Prepatent period: about 4 weeks
Paragonimus kellicotti
Geographic Distribution

- Throughout North America
- Found in North Carolina (dogs, cats, mink, raccoons, bob cats)
Pathology

- Bronchiolar inflammation and eosinophilic granulomas in the lung parenchyma.

- Rare instances of acute Pneumothorax & sudden death
Diagnosis

- Clinical signs: lethargy, chronic intermittent cough, "rusty" sputum.
- Fecal Sedimentation
- Sputum Smear
- Thoracic radiographs 3-4 four weeks post-infection
- History of possible access to crayfish.
Treatment

- **Praziquantel (Droncit)**
  - 23 mg/kg TID for 3 days
- **Fenbendazole (Panacur)**
  - 50 mg/kg daily for 10-14 days
- **Albendazole**
  - 25 mg/kg BID for 10 days
Control

- **Snail Control**
  - Molluscicides: check government restrictions

- **Environmental Control**
  - Restrict access to crayfish (streams, creeks, rivers)
Zoonosis

- *Paragonimus westermanni*
  - human lung fluke in orient
- *Paragonimus kellicotti*
  - Wildlife lung fluke in North America
  - Zoonosis has been reported.
Nanophyetus salmincola

- Minute intestinal flukes.
- Ventral sucker located mid-ventral.
- Posterior Testes: Oval, Opposite. Spherical Ovary Anterior to Testes.
Life Cycle -- aquatic

- **Definitive Hosts - Small Intestine**
  - Dogs, cats
  - Fox, Coyote, raccoon, opossum, otter, mink, lynx, etc.
- **Ova passed in the feces.**
- **Miracidia develop & hatch in water**
- **Molluscan 1st Intermediate Host**
  - Pleurocerid lotic snails. (Sporocysts & Redia)
- **Cercaria**
- **2nd Intermediate Host**
  - Salmon & Trout (Metacercaria)
- **Flukes mature in the small intestine.**
  - Prepatent period: 5 to 8 days
Geographic Distribution

- Only in Pacific Northwest
  - Specifically northern CA, OR, WA
Pathology

- Flukes alone
  - Minor to no pathology.
- Flukes carrying the rickettsia, *Neorickettsia helminthoeca*
  - "Salmon Poisoning"
  - Severe pathology (50% to 90% mortality)
  - Only affects canids (dogs, fox, coyote)
  - 5 to 7 day incubation period
  - Sudden onset of fever & loss of appetite.
  - Later hemorrhagic enteritis with ocular discharge, profuse diarrhea, marked vomiting, swelling of lymph nodes.
- Those that recover are immune for life.
Diagnosis

- Fluke infection: Ova in feces (sedimentation).
- Salmon Poisoning:
  - Clinical signs (diarrhea, vomiting, ocular discharge, etc.)
  - Demonstration of rickettsia in fluid aspirated from mandibular lymph node.
- History of possible access to raw salmon or trout.
Other Notes

Treatment

- Fluke infection: Injectable Praziquantel (*Droncit*)
  - 7mg to 38 mg SC or IM
- Salmon Poisoning: Broad Spectrum Antibiotics

Control

- Prevent access to raw fish (streams, creeks, rivers)

Zoonosis

- Fluke Infection: Yes
- Salmon Poisoning: No
Acanthatrium oregonense

- **Life Cycle** -- aquatic
  - Bats (small intestine)
  - Stream snails
  - Caddisflies & Mayflies

- **Pathology**
  - **Horse:** *Potomac Horse Fever*
    - *Neorickettsia risticii* - in tissue of fluke
    - Colitis — diarrhea, fever, depression
  - Accidental ingestion of caddisflies &/or mayflies infected with fluke metacercariae that is infected with *N. risticii*
Acanthatrum oregonense
(Vector for Neorickettsia risticii
Potomac Horse fever)
1. A cat lover, from Chapel Hill has brought in her 5 year old cat to your clinic. She has noticed that her cat has developed a chronic cough and lately has become significantly less rambunctious.

Differentials?

How infected?

Diagnostics?
2. A Durham business woman rushes in to your office with her 2 year old golden retriever. She is extremely concerned because the dog developed severe vomiting and bloody diarrhea late last night.

Differentials?
Diagnostics?
History?
Prognosis?
Platynosomum fastosum

- Bile duct fluke.
- Ventral sucker in anterior half of body.
- Lobed Opposite Testes Posterior to the Ventral sucker, Lobed Ovary posterior to testes.
Life Cycle -- terrestrial

- **Definitive Hosts** – Bile Ducts -- Cats & Opossum
- Ova passed in the feces.
- Miracidium develops in ova
- Ova ingested by snail host
- **Snail 1st Intermediate Host**
  - Terrestrial snails. (sporocysts only)
- **Sporocysts w/ mature cercaria are released in slime balls ingested by 2nd intermediate host**
- **2nd Intermediate Host**
  - Terrestrial Isopods = Roly-poly bugs, pill bugs (metacercaria)
- **3rd Intermediate hosts**
  - Lizards (Anoles, geckos, skinks) & Toads (metacercaria)
- **Young Flukes**
  - Young flukes migrate from intestine into the bile ducts.
  - Prepatent period: 8 to 12 weeks
Platynosomum fastosum
Geographic Distribution

- Malaysia, South America, Central America, Caribbean, West Africa
- Florida, Hawaii
Pathology

- Does not normally cause pathology
- May cause mild, temporary inappetence with hepatic dysfunction
- Severe cases are rare, but cause progressive icterus and possibly death. ("lizard poisoning")
Diagnosis

- **Clinical signs:** diarrhea, jaundice, vomiting (possibly continuous in severe terminal stages).
- **Fecal Sedimentation**
- **History of possible access to lizards or toads.**
- **History of travel to endemic areas**
Other Notes

Treatment:
- Praziquantel *(Droncit)* @ 20 mg/kg
- Albendazole (is suggested)
- Surgical removal has also been suggested.

Control
- Restrict access to roly-polys, lizards, toads
  (especially when in endemic areas like Florida)

Zoonosis - No
Eurytrema (Concinnum) procyonis

- Pancreatic duct fluke.
- Ventral sucker in anterior half of body.
- Lobed Opposite Testes Posterior to the Ventral sucker, Lobed Ovary posterior to testes.
Eurytrema procyonis

Diagram showing the lifecycle of Eurytrema procyonis, including stages in cats, raccoons, grasshoppers, and snails.
Notes

Definitive Hosts & Distribution
- Cats - pancreatic duct - (fox, raccoons)
- Sporadic (New York, Connecticut, Maryland, Kentucky, North Carolina)

Pathology
- Pancreatic duct fibrosis
- Pancreatic atrophy

Diagnosis
- Vomiting & chronic weight loss
- Ova in sedimentation

Treatment
- Fenbendazole (Panacur) 30 mg/kg daily for 6 days.

Control
- Restrict outdoor access (no grasshoppers / crickets)
In-Class Questions

One of your very responsible clients (i.e. maintains vaccines, and flea & HW prevention) brings their cat in because of vomiting and weight-loss. What are your differentials & how would you confirm or eliminated each?
Heterobilharzia americana

- Dioecious elongate blood flukes.
- Female resides in the gynecophoric canal of the male.
**Life Cycle -- aquatic**

- **Definitive Hosts**
  - Dogs – mesenteric veins
  - Raccoons, wild canids, bobcat, nutria, etc.

- **Ova with miracidia passed in the feces.**
- **Miracidia hatch as soon as egg enters freshwater**
- **Snail 1st Intermediate Host**
  - Pond / puddle snails. (Sporocysts only)
- **Cercaria penetrate skin of definitive host**
- **Young Flukes or Schistosomula**
  - Young flukes migrate to the lungs then to the liver and finally to the mesenteric vessels to mature.
  - Prepatent period: 68 days
Geographic Distribution

- Gulf Coast States, Georgia, South Carolina & North Carolina

- North Carolina: More prevalent in eastern counties.
**Pathology**

- **Adults**
  - Minor to no pathology.

- **Ova**
  - Lodge in mesenteric venules or transported to other organs.
  - Granulomatous reaction
  - Destruction & fibrosis of intestinal mucosa.
  - Intestinal dysfunction that leads to wasting and death.
Eggs in Blood Vessels
Eggs in Intestinal Epithelium
Diagnosis

- **Fecal saline sedimentation or smear.**
- **Miracidial Hatching**
- **Clinical signs:** lethargy, anorexia, intermittent vomiting, bloody liquid diarrhea, dehydration.
- **Laparotomy**
- **PCR fecal test from Texas A&M**
  
  [Link](http://vetmed.tamu.edu/gilab/service/assays/heterobilharzia-americana)
- **History of possible access to water habitats while in endemic areas.**
- **Water Loving Breeds**
Ovum & Miracidium

**Egg**

**Miracidium**
Other Notes

- **Treatment:**
  - Fenbendazole (*Panacur*): 40 mg/kg daily for 10 days
  - Praziquantel (*Droncit*): 25 mg/kg daily for 2-3 days

- **Control:**
  - Prevent access to freshwater habitats (ponds, lakes, streams, creeks, rivers, ditches, etc.)

- **Zoonosis**
  - “Swamp itch” or Swimmer’s itch”
Infested Habitat (Confirmed)
Other Schistosomiasis

- *Schistosoma sp.*
  - Human blood flukes one of the 6 major human parasitic diseases
  - Occurs in the tropics
  - Also a Bovine Blood fluke.

- **Bird Schistosomiasis** (*Trichobilharzia sp.*, etc.)
  - Causes "Swimmer's Itch"
  - Important in Great Lakes and other areas where migratory birds congregate.
"Swimmer's Itch"
In-Class Discussion

It is mid-October and one of your clients, a coon hunter from Asheville, brings in his best coonhound, which is presenting with bloody diarrhea, weight-loss and lethargy.

Worm differentials? History? Diagnostics?