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.
Life Cycle -- aquatic

- 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
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 westermani*
  - 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.
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
Nanophyetus salmincola
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*
Acantharium 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 ?

History ?

Diagnostics ?

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
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.
**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
Heterobilharzia americana
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
Eggs in Liver
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
  [http://vetmed.tamu.edu/gilab/service/assays/heterobilharzia-americana](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 Schistosomes

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

- **Bird Schistosomes** (*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 raccoon hunter from Asheville, brings in his best coonhound, which is presenting with bloody diarrhea, weight-loss and lethargy.

Worm differentials? History? Diagnostics?