Order Strongylida - general morphology

- “Bursate worms”: males have a distinctive copulatory bursa. Lobes supported by rays.
Order Strongylida - general morphology

• Buccal area (mouth): use to subdivide these worms into 4 superfamilies.
  1. Trichostrongyloidea - very small **buccal cavity**, in ruminant abomasum or sm. intest.
Order Strongylida - general morphology

2. Strongyloidea - very large buccal cavity with leaf crown on buccal capsule, in equid large intestine.
Order Strongylida - general morphology

3. Ancylostomoidea (hookworms) - buccal cavity is bent dorsally, **buccal capsule** has teeth or cutting plates at anterior opening.
Order Strongylida - general morphology (cont.)

4. Metastrongyloidea - lacks buccal cavity, worms found in lungs or nervous system.
Order Strongylida - general life cycles

• Three superfamilies have free-living larval forms that must develop to infective L₃ outside of the host.
• Strongyle type egg, with exceptions of those that develop larvae before passed in feces.
• Metastrongyloidea superfamily is the exception in that its genera require mollusk or annelid intermediate hosts.
Order Strongylida - general life cycles (cont.)

- Routes of infection:
  1. Ingestion with herbage while grazing is the only significant route for Trichostrongyloidea (trichostrongyles) in ruminants and Strongyloidea (strongyles) in horses.
Route of Infection for Trichostrongyles and Strongyles

Fecal Mass or "Dung Pat" Containing Nematode Eggs

Dung Pat Serves as "Incubator"
Providing: 1. Moisture
2. Warmth

Larvae Develop and Hatch

Dung Pat Provides Food For Larval Growth

In Dung Pat Larvae Develop to Infective Stage

Dry, protective crust

Dung Pat Serves as Shelter and Protection for Larvae
Order Strongylida - general life cycles (cont.)

• Routes of infection (cont.):
  2. Skin penetration or ingestion, including lactogenic, is used by Ancylostomoidea (hookworm).
Order Strongylida - general life cycles (cont.)

- Routes of infection (cont.):
  3. Ingestion of infected intermediate host is used by Metastrongyloidea genera.
Superfamily Trichostrongyloidea commonly trichostrongyles

- *Haemonchus, Ostertagia, Trichostrongylus* (HOT) plus *Cooperia* are the genera that infect the abomasum and duodenum of grazing ruminants.
- Sheep and goats are most severely affected by *Haemonchus contortus*.
- Cattle are most severely affected by *Ostertagia ostertagi*. 
Trichostrongyles (cont.)

- *Trichostrongylus axei*. Adults are less than 7 mm long.
Trichostrongyles (cont.)

- *Trichostrongylus axei* - found in the abomasum of ruminants and stomach of horses. *Trichostrongylus colubriformis* - found in the small intestine of ruminants.
- Both *Trichostrongylus sp.* also infect rabbit, pig and man (be careful where you graze).
Trichostrongyiles (cont.)

• Rarely causes clinical disease alone, but in association with *Ostertagia* or *Haemonchus*. Exception: horses can develop clinical disease. Risk of pasture with sheep.
Trichostrongyles (cont.)

- *Ostertagia ostertagi* - most important helminth parasite of cattle.
  
- *Teladorsagia (O.) circumcincta* - infects sheep, goats and llamas.
  
Host species specific. Does not cross infect.

Common name - brown stomach worm.
Trichostrongyles (cont.)

- *Ostertagia sp.* Adult worms are 7 to 14 mm long, brown in color.
- Fecal egg counts above 200 indicate high worm burden.
Trichostrongylides (cont.)

- *Ostertagia sp.*
  - Pathogenesis:
    - 1. $L_3$ ingested from pasture enter the gastric glands and develop to $L_4$ then emerge to gastric lumen or are hypobiotic in glands.
    - Prepatent time is 3 weeks.

[Image: Emerging, metabolically active $L_4$. Hypobiotic, arrested $L_4$.]
Trichostrongyles (cont.)

Trichostrongyles (cont.)

- *Ostertagia sp.* pathogenesis (cont.):
  4. Leaky mucosa causes loss of protein and fluid to abomasal lumen.
  5. Systemically there is increased protein catabolism and nitrogen excretion in urine.
  6. Hypoproteinemia.
Trichostrongyles (cont.)

- *Ostertagia* clinical signs:
  1. **Anorexia** - loss of appetite.

  calves showing no interest in grazing
Trichostrongyles (cont.)

- 2. **Diarrhea** - watery diarrhea in calves.
- 3. **Edema** – due to protein loss.
Trichostrongylus (cont.)

- 4. Decreased weight gain, poor growth due to anorexia and protein catabolism.
- 5. Subclinical effects revealed by anthelmintic therapy.
Trichostrongyles (cont.)

- *Haemonchus contortus*: most important helminth parasite of sheep and goats. Reports of *H. contortus* infecting cattle, but not as pathogenic as in sheep.
- *Haemonchus placei*: species specific-cattle.
- Common name = barber pole worm.
Trichostrongyloides (cont.)

- Found in the abomasum, adults up to 30 mm long, blood-filled worm gut and twisted reproductive tract gives red & white barber pole affect.
- Fecal egg counts above 1000 indicate high worm burden.
Trichostrongyles (cont.)

- *Haemonchus* pathogenesis:
  1. prepatent (3 weeks) and adult worms in lumen of abomasum are **blood feeders**.
  2. **loss of blood** leading to anemia and hypoproteinemia can be severe within one week of ingestion of large number of infective larvae.
Clinical Signs

- Black tarry feces, not diarrhea
- Edema of lips
- Intramandibular edema
- Pale conjunctiva, FAMACHA score?
Trichostrongyles (cont.)

- *Haemonchus* clinical signs:
  1. Signs of **blood loss anemia** - pale mucous membranes, low hematocrit, rapid shallow breathing and high heart rate, prostrate. Body condition may be good in acute infections.
  3. Edema of lips, intramandibular region, limbs.
Other trichostrongyles

- *Cooperia* and *Nematodirus* are trichostrongyles that infect the proximal small intestine of ruminants.

- *Cooperia* drug resistance is a growing concern in cattle.
Other trichostrongyles

• As with *Trichostrongylus*, they are important as mixed infections with *Ostertagia* or *Haemonchus*.