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Ascarids

Large Intestinal Roundworms

(aka Large Roundworms of the Small Intestine)

Ascarids, in general

Take Homes

Ascarids

- Ascarids are large nematodes that most often infest the small intestine of hosts
- Ascarids have very hardy & resistant eggs that stay in the environment for years, which makes control difficult and sanitation very important.
- General clinical signs are: young hosts, pot-bellied, diarrhea, unthrifty, abdominal pain, rough hair coat.

Ascarids: in general

Order Ascaridida

- Large Adult worms in small intestine.
  - non-bursate
  - mouth surrounded by 3 fleshy lips
- Host-specific, adult stage
  - *Toxocara canis** in dogs
  - *Toxocara cati** in cats
  - *Baylisascaris procyonis** in raccoons
  - *Parascaris equorum* in horses
  - *Ascaris suum* in pigs
  - *Ascaris lumbricoides* in humans

(* Larval stage can infect other hosts, including humans)

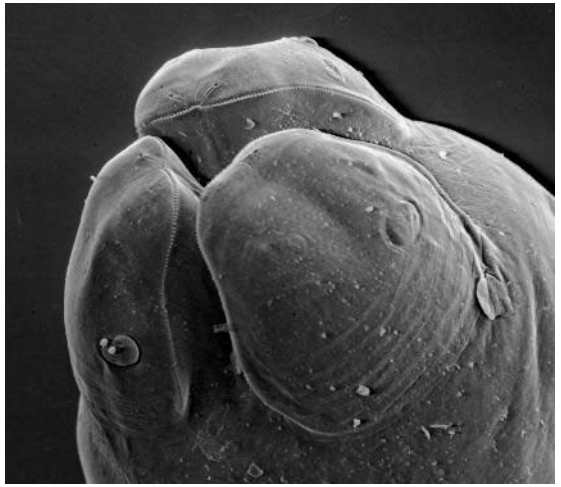
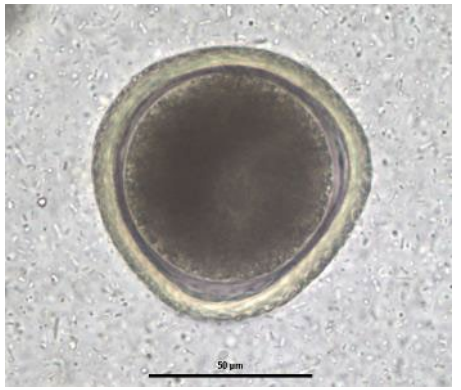


Figure 2. Ascaris lumbricoides passed by Patient SR

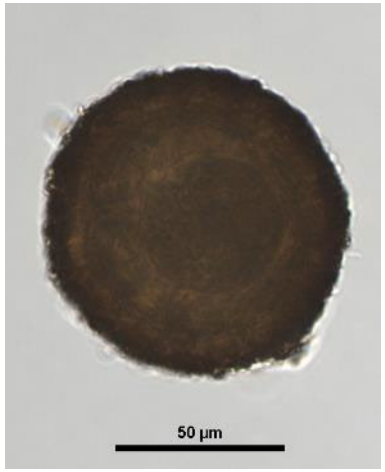
http://www.bioline.org.br/request?js09047

Ascarids: in general

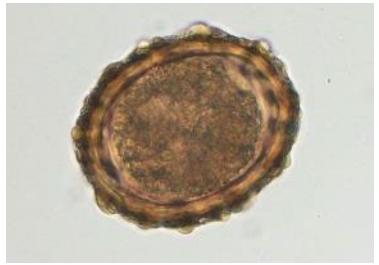
- Ascarid Eggs:
  - distinct appearance
  - Thick-walled, many have texture outer coat
  - Highly resistant
    - Can persist in soil for years!
    - How does this affect attempts at control ?
  - Female worms extremely fecund
    - Approx 200,000 eggs/day
    - Ascarids flood the environment with eggs to ensure infection of next host.



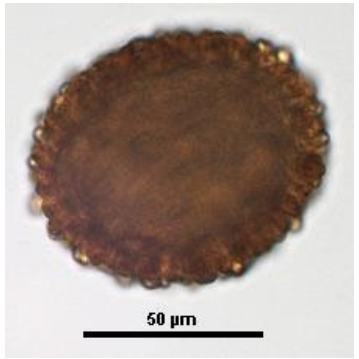
Toxocara canis



Parascaris equorum



Ascaris suum



Baylisascaris procyonis

Ascarids: in general

- Common Clinical Signs
  - Pot belly
    - Seen in puppies, kittens, piglets, foals, children
      - FYI only. Due to Transmural* eosinophilic enteritis: causing inflammation, intestinal wall thickening, distension, hypoproteinemia with ascites … (*Transmural = occurring across the entire wall of an organ.) FYI only.
  - +/- diarrhea, unthrifty, abdominal pain, rough haircoat

https://www.petethevet.com/tilly-12-week-old-jack-russell-terrier-puppy-swollen-belly/

← Worms

Not Worms →

[Search images: "Ascaris lumbricoides expelling"]

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Toxocara canis & Toxocara cati

Large Roundworms of Pets

Nematodes : Ascarids : Toxocara

Toxocara canis & T. cati

Take Homes

Toxocara canis & Toxocara cati

- Pathology: Enteritis, inflammations & hypersensitivity of the Small intestine --> diarrhea
- Clinical Signs: Disease of Puppies & Kittens, lack of growth, ill-thrift, dull coat, pot-belly, abdominal pain, fetid mucoid diarrhea.
- Contributor to Fading Puppy / Fading Kitten Syndrome.
- Diagnostics: Fecal Centrifugation & Fecal Antigen tests
- Zoonosis --> visceral larval migrans; ocular larval migrans, ingest infective egg, sanitary control

Toxocara canis

- Ascarid of the Small Intestine of Dogs
- Routes of infection and consequences:
  - Ingest infective egg
    - puppies --> tracheal migration --> adult worms in small intestine --> eggs in feces --> diagnosis and environmental contamination ---> sanitary control
    - adult dogs --> somatic migration --> larvae arrest in tissues ---> transuterine infection to next litter of puppies --> always assume puppies are infected
  - Transuterine (Major) to puppies --> always assume puppies are infected --> treat all puppies are 2 weeks old & every 2 weeks until HW preventative.
    - Treat female dog pre-parturition to decrease arrested larvae.
  - Transmammary (minor route of infection)
  - Adult dogs ingest Paratenic Hosts with arrested larvae --> adult worms in small intestine --> eggs in feces --> diagnostics, may confound efficacy of HW preventatives --> environmental contamination ---> sanitary control

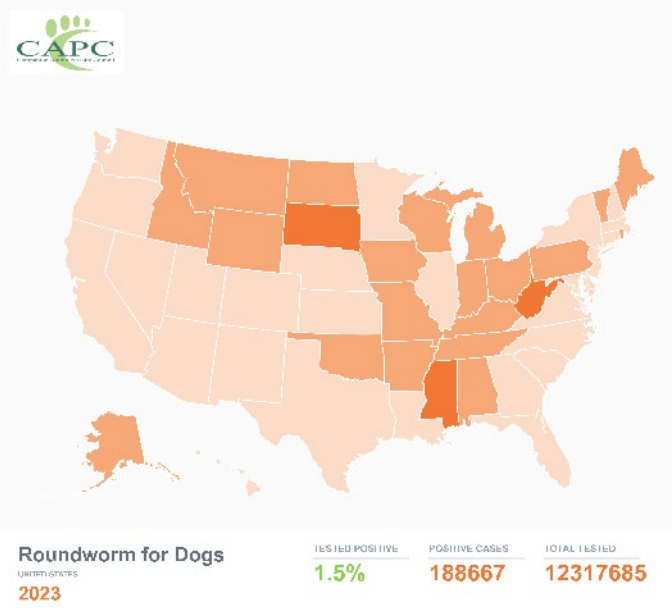
Toxocara cati

- Ascarid of the Small Intestine of Cats
- Routes of infection and consequences:
  - Ingest infective egg
    - Kittens --> tracheal migration --> adult worms in small intestine --> eggs in feces --> diagnosis and environmental contamination ---> sanitary control
  - (No Transuterine Route to Kittens)
  - Transmammary (minor route of infection)
  - Adult cats ingest Paratenic Hosts with arrested larvae --> adult worms in small intestine --> eggs in feces --> diagnostics, may confound efficacy of HW preventatives --> environmental contamination ---> sanitary control

Baylisascaris procyonis: raccoon ascarid, very aggressive zoonosis: ocular, visceral, neural migrans

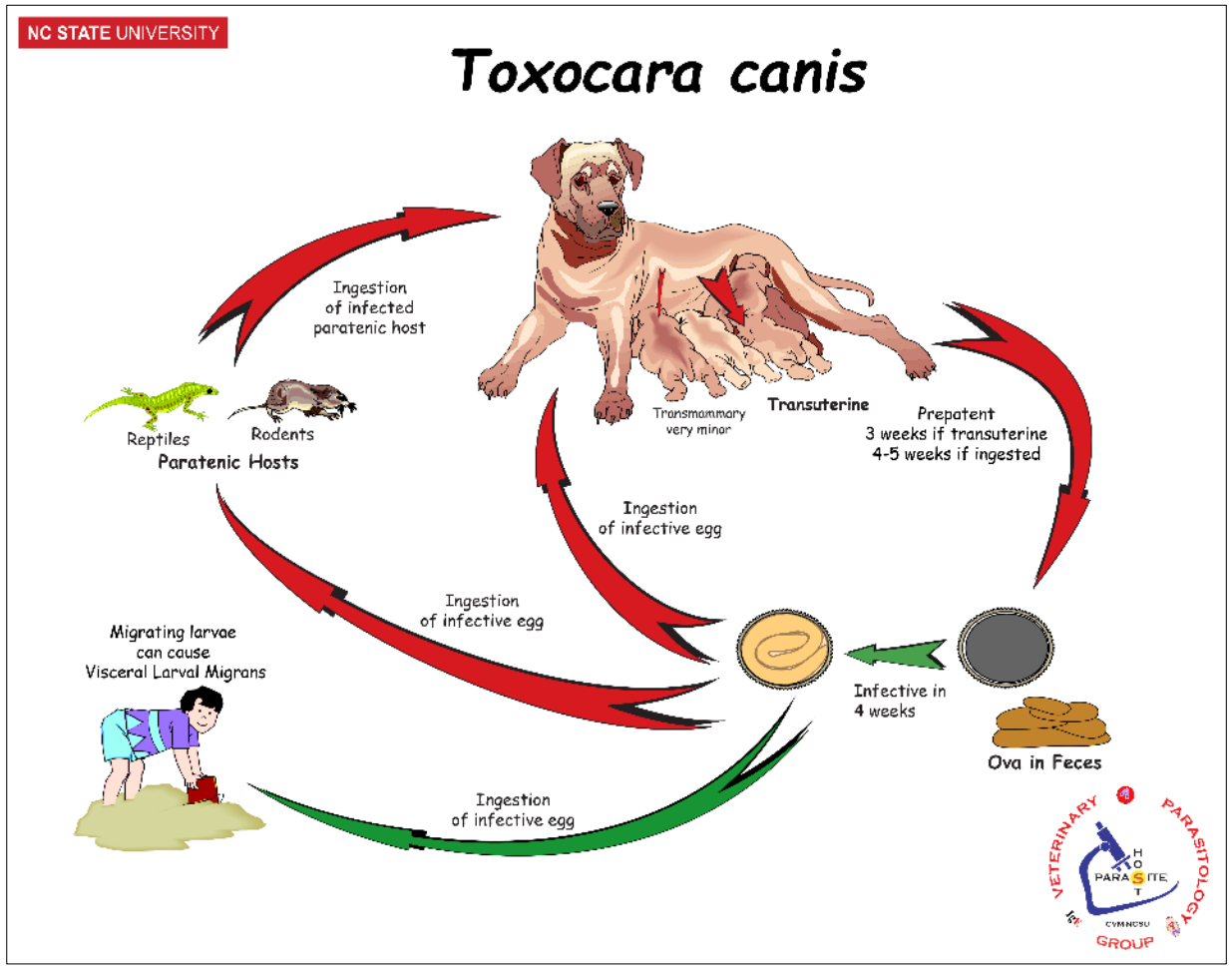
Toxocara canis

- Ascarid of the Small Intestine of Dogs
- Thick, white, large (10-15 cm) adult worms
- Anterior end: moderate cervical alae



https://capcvet.org/maps/#/2023/all-year/roundworm/dog/united-states

Toxocara canis
Life Cycle



- **Life Cycle notes:**
  - Adult worms in small intestine
  - ~4 weeks to infective egg
    - Plenty of time to clean up poop (but before it rains)
  - Routes of Infection
    - Ingest infective egg:
      - Puppy => tracheal migration
      - Mature dog => somatic migration
    - Transuterine to Pups (major)
    - Transmammary to Pups (very minor)
    - Paratenic Hosts to Adult dogs
  - PPP
    - 3 weeks transuterine
    - 5 weeks egg ingestion
  - Zoonotic: Visceral Larval Migrans

Routes of Infection

Toxocara canis

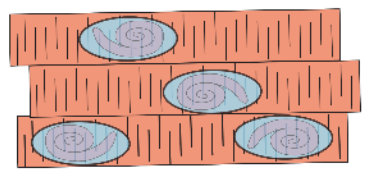
Puppies

Transuterine Infection of Pups → Larvae Migrate directly to Intestine and Develop to Adults Worms. → Ova Contaminate Environment (PPP = 3 weeks)

Ova Contaminated Environment → Ingest Infective Ova → Tracheal Migration → Return to Gut and Develop to Adult Worms → Ova Contaminate Environment (PPP = 5 weeks)

Paratenic Host

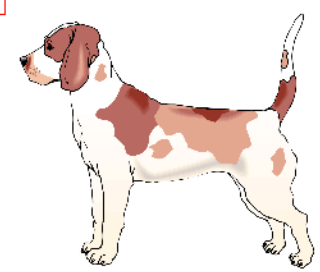
Ova Contaminated Environment → Ingest Infective Ova → Somatic Migration → Arrrested Larvae in Tissues



Adult Dog

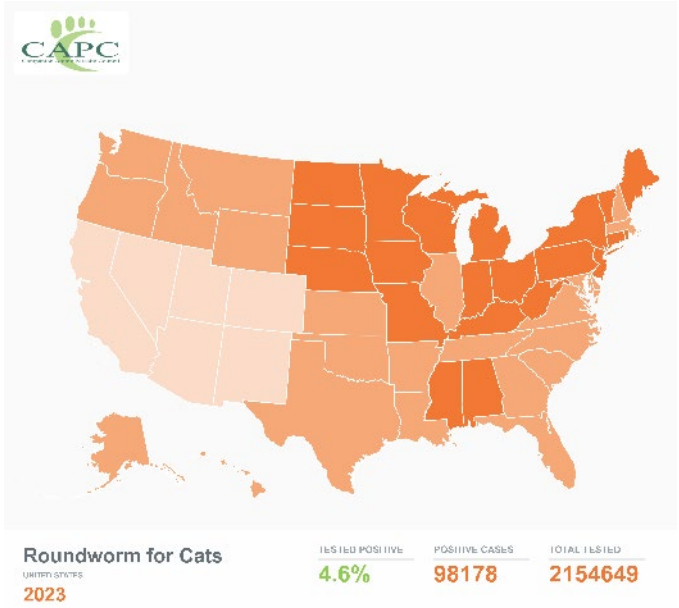
Ova Contaminated Environment → Ingest Infective Ova → Somatic Migration → Arrrested Larvae in Tissues → (Pregnancy) → Reactivation of Arrested Larvae → Transuterine Infection of Pups

Ingest Paratenic Host with Arrested Larvae → Larvae Develop directly to Adults Worms in Intestine (no migration) → Ova Contaminate Environment (PPP = 3 weeks)



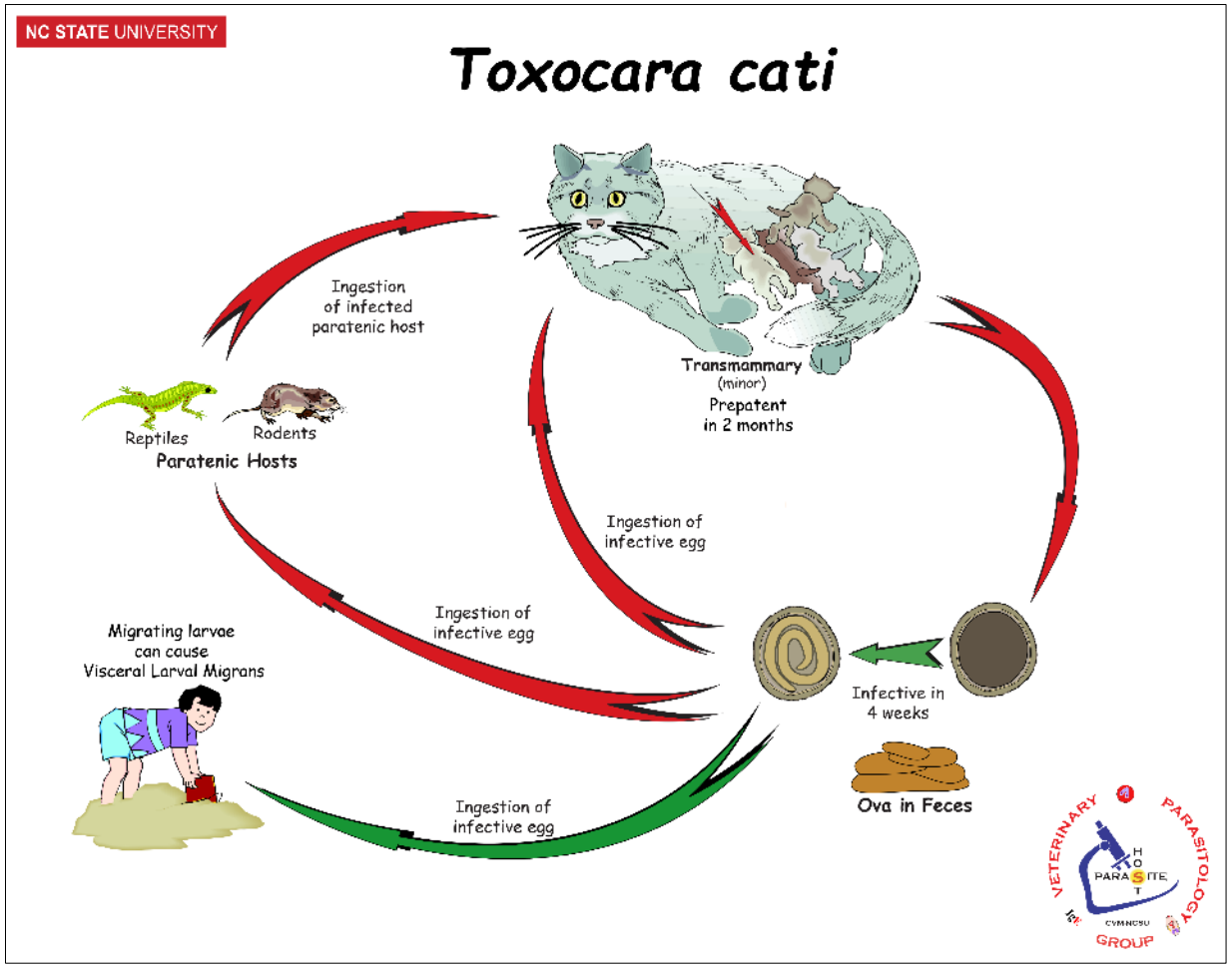
Toxocara cati

- Ascarid of the Small Intestine of Cats
- Thick, white, large 4-12 cm adult worms
- Anterior end: prominent cervical alae



https://capcvet.org/maps/#/2023/all-year/roundworm/cat/united-states

Toxocara cati
Life Cycle

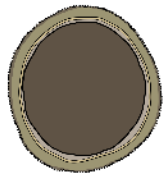


- **Life Cycle notes:**
  - Adult worms in small intestine
  - ~4 weeks to infective egg
  - Routes of Infection
    - Ingest infective egg:
      - Kitten => tracheal migration
      - Mature cat => somatic migration
    - [NO Transuterine]
    - Transmammary to Kittens (very minor)
    - Paratenic Hosts to Adult Cats
  - PPP: 8 weeks via egg ingestion
  - Zoonotic: Visceral Larval Migrans

What route of infection results in adult *Toxocara spp.* in the intestine of the adult dog or cat?

Toxocara cati

Kittens

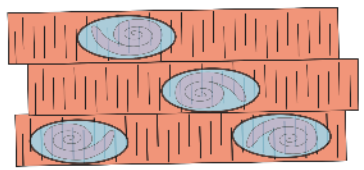


Transmammary Infection of Kittens → Larvae Migrate directly to Intestine and Develop in to Adults Worms. → Ova Contaminate Environment

Ova Contaminated Environment → Ingest Infective Ova → Tracheal Migration → Return to Gut and Develop to Adult Worms → Ova Contaminate Environment (PPP = 8 weeks)

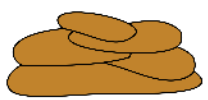
Paratenic Host

Ova Contaminated Environment → Ingest Infective Ova → Somatic Migration → Arrrested Larvae in Tissues



Adult Cat

Ova Contaminated Environment → Ingest Infective Ova **during Pregnancy** → Somatic Migration → Transmammary Infection of Kittens



Ingest Paratenic Host with Arrested Larvae → Larvae Develop directly to Adults Worms in Intestine (no migration) → Ova Contaminate Environment (PPP = 3 weeks)

Toxocara canis & Toxocara cati

Pathology

- Nutrient robbing (ingesting the host's food)
- Enteritis
  - Inflammation of the intestine.
  - Hypersensitivity
    - Ascarids & their excretions are hyper-allergenic
- Verminous pneumonia (rare)
  - Due to tracheal migration of larvae through the lungs causing traumatic damage with hemorrhage and inflammation
- Intestinal obstruction / intussusception (rare)
  - Due to very large burden of adult worms

Toxocara canis & Toxocara cati

Clinical Signs

- Often Subclinical, especially in adult pets
- Mainly disease of young puppies / kittens
  - Lack of growth, Loss of condition
  - Ill-thrift, dull coat
  - Abdominal pain, pot-bellied
  - +/- Fetid, Mucoid Diarrhea
  - Contributor to "Fading Puppy/Kitten Syndrome"

- Feline Variation: Pathology & Clinical Signs less severe in kittens than puppies.
  - Feline lack of Transuterine transmission ➔ less likely to have large numbers of worms.

Toxocara canis & Toxocara cati

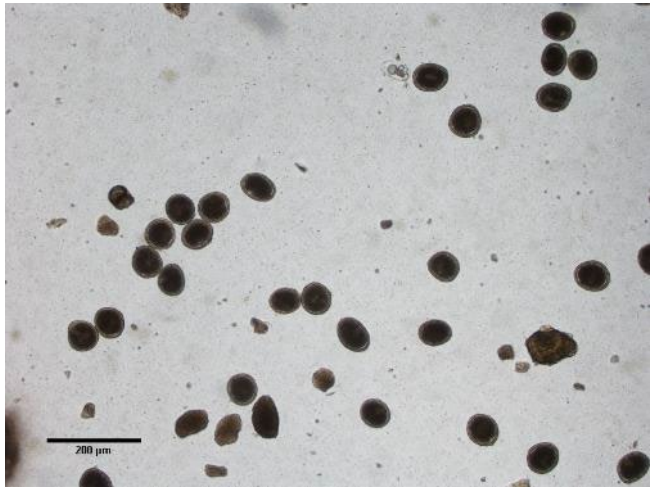
Diagnostics in Practice

Discovery Diagnostics

- To confirm a suspect infection
  - Observation of Clinical signs
  - Fecal Float w/ centrifugation
  - Fecal Antigen tests
  - Adult worms in vomit or in feces
    - (*Toxocara spp. v/s Physaloptera sp.*)

Fecal Egg Reduction Test (FERT)

- To verify reduction / elimination of an infection
- And confirm efficacy of specific dewormer v/s resistant worm population
  - Check fecal 7 to 14 days after treatment



Fecal Monitoring (CAPC)

- Confirm efficacy of deworming program (during routine health checks)
- Fecal Float w/ centrifugation and Fecal Antigen tests
- Puppies & Kittens: 4X during 1st year of life
- Older Dogs & Cats: 2X per year

Toxocara canis & *Toxocara cati*

Diagnostics Techniques

Fecal Float (+/- centrifugation)

- True Positives / True Negatives
  - Discovery diagnosis, anthelminthic efficacy, monitor control program
- False Positives
  - Misidentification of eggs due to coprophagy
    - Ex. Dog eats cat feces that contains *Toxocara cati* eggs
    - Ex. Dog eats horse feces that contains strongyle ova
- False Negatives
  - Prior to PPP
  - Intermittent egg shedders
  - Single-sex infection
  - Wrong floatation solution

FYI only

Fecal Antigen Tests (and PCR tests)

- True Positives / True Negatives
  - Detects Worm Antigen / DNA
  - Detects PPP infection
    - Allows for treatment prior to environmental contamination
  - Single-sex infections, intermittent shedders.
  - Confirm or refute Fecal Float
- False Positives
  - Residual antigen (or DNA) from post-treatment dead worms
- False Negatives
  - Antigen (or PCR) may be below levels detection
  - Host antibodies may overwhelm antigens available for detection

FYI only

CAPC recommends doing both Fecal Float Centrifugation & Fecal Antigen Test.

Toxocara canis & *Toxocara cati*

Treatment

Treat an Active Infection

- To eliminate an infection
  - Many dewormers against adult worms
  - Few effective dewormers against migrating or arrested larvae
- Treatment plan
  - 2 treatments
    - 1st to eliminate standing adult population
    - 2nd to eliminate recently matured adult worms (from previously migrating larval population).
  - Fecal Check 7-14 days after the 2nd treatment to confirm dewormer efficacy.
  - Warn owner about dead worms in poop (*Toxocara sp.*)
- Available Dewormers
  - https://capcvet.org/parasite-product-applications/

Prophylactic deworming

- Deworm female dog to decrease transuterine transmission
  - Fenbendazole can be given daily at 50 mg/kg starting at the 40th day of gestation and continuing until two weeks after whelping.

  OR
  - Selamectin effectively kills larvae that have migrated to puppies when mother is treated at or near parturition.
- Deworm newborn puppies / kittens* (Assume infection)
  - start at 2-3 weeks old, repeat every 2 weeks until 2 months old when a monthly (heartworm & intestinal worm) preventative is started.
    - Liquid Pyrantel is more palatable / preferred for nursing pups / kittens
  - Deworm nursing dams at same time as deworming nursing puppies / kittens to ensure no transmammary transmission.

**T. cati* can be treated later (at 6-8 weeks), but feline hookworms need to be addressed at 2-3 weeks.

Toxocara canis & Toxocara cati

Control Program

Environmental Control

- Good Sanitation Practices
  - Prompt disposal of feces
    - Before rains / dung beetles disperse feces and worm eggs.
  - Clean surfaces, dispose of feces
  - Wash hands thoroughly after handling (Zoonotic !)
- Restrict access to paratenic hosts
  - Note: 3-week PPP ➔ patent infections prior to monthly HW prophylaxis ➔ So dewormer appears to be failing.

Routine Fecal Checks

- Confirm Efficacy of Dewormer
- Check for Gaps in Control Program
- Check for Gaps in Owner Compliance.

Routine Dewormer Control

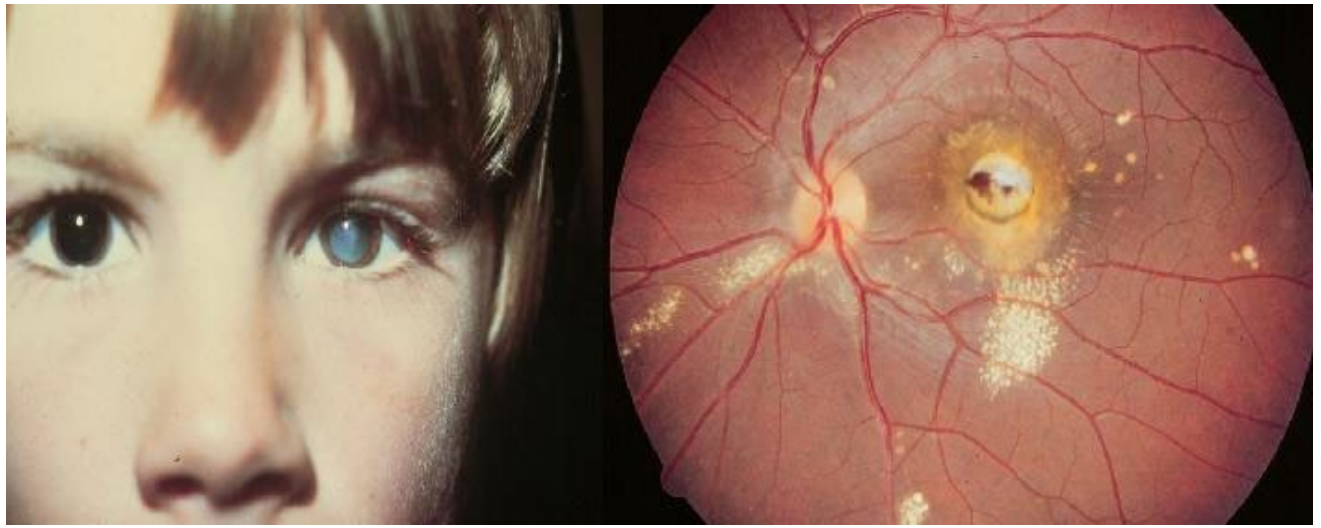
- Use Monthly (HW) Preventative that also has Efficacy against Intestinal Worms.
  - Eliminate worms prior to maturity / production of eggs that contaminate the environment.

Toxocara canis & Toxocara cati

Zoonosis

Visceral Larval Migrans

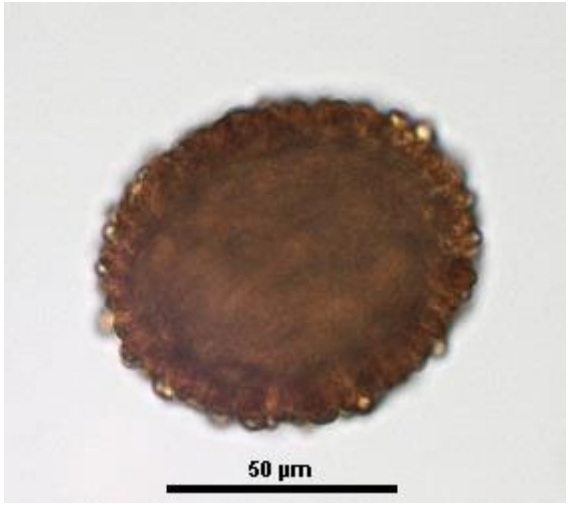
- Migration of larvae in tissues of aberrant host (ex. Humans)
- Ingestion of infective egg
  - Beware sand boxes & gardens
- Ocular larvae migrans
  - More often children
  - Larva may settle in the retina
  - cause granulomatous reaction
- 14% of people have antibodies to *Toxocara sp.*



Baylisascaris procyonis

Raccoon Ascarid

- Raccoons: definitive host
- Zoonotic to humans & other animals
  - Very aggressive zoonosis
  - Visceral larva migrans
  - Ocular Larval migrans
  - Neural larval migrans

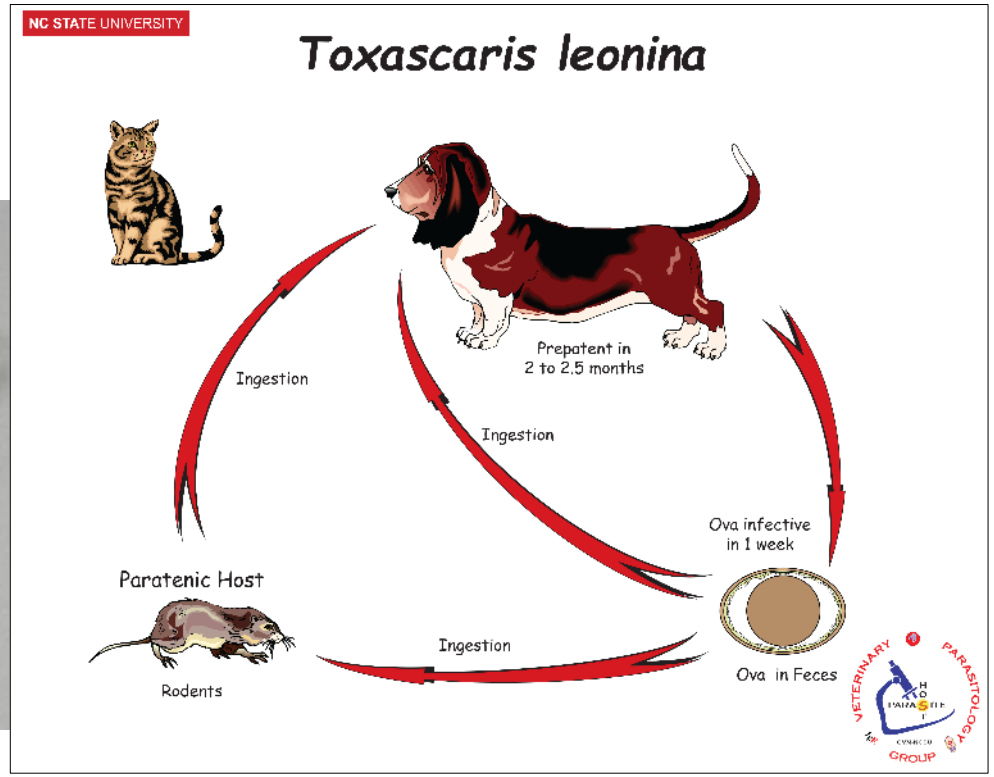


Rabbit with head-tilt from neural larval migrans

Toxascaris leonina

FYI only

- <1% prevalence - dogs, cats
- eggs oval, smooth shell
- Infection
  - ingestion of eggs
  - paratenic host
- PPP 8-10 weeks
- mild clinical signs
- not zoonotic
  - (no visceral larva migrans)



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Parascaris spp. & Ascaris suum

Large Roundworms of Livestock

Parascaris equorum & Ascaris suum

Take Homes

Parascaris & Ascaris

General: Very large worms, produce many long-lived hardy eggs that flood the environment; causing great and long-lasting contamination

Immunology & Pathology: Ascarids have very potent allergens that sensitize the host during the primary infection.

Subsequent infections cause inflammatory pathology. Incomplete acquired immunity develops in older hosts.

Older hosts are asymptomatic, with low chronic infections that contaminate the environment for young hosts.

Life Cycle: ONLY direct fecal-oral transmission. Ingestion of infective eggs. (No Transuterine. No Transmammary.) Hepato-tracheal migration only

Parascaris equorum

Equine hosts. Major pathogen of horses less than 2 years old.

Pathology:

- Larval migration through lungs --> lung pathology --> performance deficits
- Adults in SI – nutrient robbing, enteritis, potential ascites, obstruction, intussusception, impaction, (Ascarid-associated Colic), gut perforation, w/ peritonitis.

Clinical Signs: Young horse, respiratory signs, diarrhea, potbellied, stunted growth, rough hair coat

Diagnosis: Fecal Float for eggs

Treatment: Peak worm burden in foals @ 5-months old. Use Fenbendazole to avoid impactions. Know Why Fenbendazole & Not Ivermectin.

Control: Sanitation. Clean mare's udder & teats, Clean foaling stall.

Ascaris suum

Swine hosts. Most important helminth of swine, especially piglets.

Pathology:

- Larval migration through liver --> "milks pots" --> liver condemnation --> economic loss
- Larval Migration through Lungs --> lung damage --> "thumps"
- Adults in SI – nutrient robbing, enteritis, poor feed conversion, poor growth --> Economic loss. Potential obstruction & impaction.

Clinical Signs: piglets or naïve pigs moved to contaminated pasture. "thumps", diarrhea, potbellied, stunted growth.

Diagnosis: Thumps in prepatent piglets, Fecal float for patent piglets (2+ months). Worms on Necropsy.

Treatment: various dewormers v/s adult worms.

Control:

- Continuous in-feed dewormer to prevent infection.
- Clean farrowing huts & Stalls, deworm & wash sow before moving to farrowing hut
- Sanitation for confinement reared swine. No pasture.

Parascaris spp. & Ascaris suum

Biology

- Very large worms
  - *Parascaris*: 10-20 cm long, 1 cm thick
  - *Ascaris*: 15- 40 cm long, 1 cm thick
- Adult worms in the Small Intestine
  - Female worms can produce 200,000+ eggs/day/ worm
    - "floods" environment to insure infection of other hosts.
    - Very high contamination potential
- Eggs very durable, long-lived (6-9 years) & sticky

Parascaris spp. & Ascaris suum

Acquired Immunity

- 1st larvae that migrate through liver & lungs do little damage but sensitizes host to potent ascarid allergens.
- Subsequent larvae elicit host immune reaction.
  - inflammatory response, hypersensitivity, much tissue damage.
- Incomplete acquired immunity limits reinfection, worm burdens, and pathology in older hosts.
  - Leads to small, asymptomatic, chronic burdens in adult hosts
    - Source of environmental contamination for neonates

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Parascaris spp.
Large Roundworms of Horses

Nematodes : Ascarids : Parascaris

Parascaris spp.

Taxonomic Issue

- ? ?Not *Parascaris equorum*??
  - 2 species originally described in 1883
  - Recent studies have found:
    - *Parascaris univalens* -"*uniformly found in horses all over the world*"
      - Predominant species
      - All GenBank deposits
    - *Parascaris equorum* – ?????
      - "may be quite rare"
      - Hasn't been confirmed since 1989

FYI

FYI

Nielsen, M.K., Wang, J., Davis, R., Bellaw, J.L., Lyons, E.T., Lear, T.L. and Goday, C., 2014. *Parascaris univalens*—a victim of large-scale misidentification?. *Parasitology Research*, *113*, pp.4485-4490.

von Samson-Himmelstjerna, G., Janssen, I.J.I., Ramünke, S., Goday, C., Borges, F.D.A., Koudela, B., Niedźwiedź, A., Tomczuk, K., Studzińska, M.B., Kornas, S. and Krücken, J., 2021. Very low intraspecific sequence variation in selected nuclear and mitochondrial Parascaris univalens genes. *Infection, Genetics and Evolution*, *95*, p.105035.

Parascaris spp.

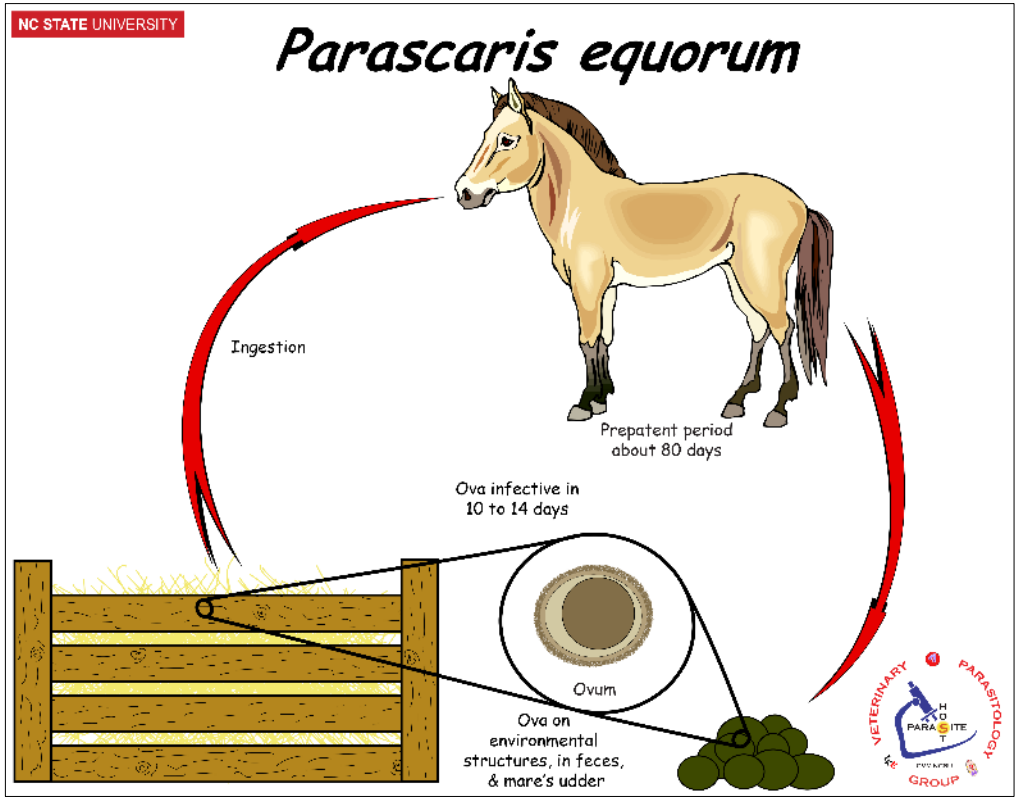
General

- The Ascarid of horses, donkeys, zebra
  - "practically ubiquitous on breeding farms" (AAEP 2024)
  - Prevalence
    - Foals < 1 year old ➔ up to 80%
    - Mature horses ➔ low to negligible
  - <u>Major pathogen of foals <2 years old</u>
  - Donkeys (of any age)
    - Don't mount an age-related immune response

Parascaris spp.

Life Cycle

- Freshly passed egg take ~10-14 days to develop an infective larva. (=> plenty of time to muck)
- Transmission: Direct Fecal-Oral Transmission **ONLY**
  - ingest infective egg only (Neonates, young animals, and adult animals)
- Tracheal Migration Only
  - Larvae migrate to liver, lungs, coughed up and swallowed, returning to the small intestine in 2-4 weeks after ingestion. (Neonates, young animals, and adult animals)
- Prepatent period: 2.5 – 3 months (~ 80 days)



Parascaris spp.

Immunology Specifics

FYI

Immunity v/s *Parascaris spp.*

- Adult worm population peaks at 5 months of age
  - most probable time for impaction (aka Ascarid-Associated Colic (AAC))
- After 5 months the immune system begins to clear infection
  - Essentially cleared by 1 year old
  - Acquired immunity protects adult horses from future large burdens.
- Practical consequences
  - Assume Foals <6months old are infected with *Parascaris* unless proven otherwise.
  - Weanlings & Yearlings do get reinfected but with few worms.
  - Adult horses rarely get reinfected.

FYI

Parascaris spp.

Pathology

- Larval Migrations (hepatotracheal migration)
  - Minor liver damage
  - Respiratory issues
    - Due to developing host immunity
      - allergic reactions / airway inflammation ➔ lung congestion (alveolitis, bronchiolitis, & bronchitis)
        - decreased lung capacity
        - performance deficits

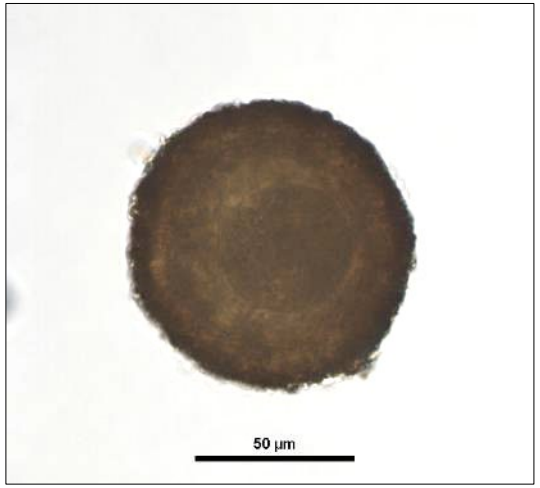
- Adult worms in Small Intestine Lumen
  - Large bodies
    - Nutrient robbing
    - catarrhal enteritis
    - hypoproteinemia -> ascites
    - obstruction, intussusception
    - perforation -> fatal peritonitis
  - Impaction [aka Ascarid-Associated Colic] (See below)

Parascaris spp.

Clinical Signs & Diagnosis

Clinical Signs

- Young horse
- Respiratory signs
  - Coughing
  - Nasal discharge
- GI signs
  - Diarrhea – odorous
    - May be prepatent
- Other signs
  - Potbellied
  - Rough hair coat
  - Suboptimal Growth



Diagnosis

- Clinical Signs
- Fecal Float
- Distinct Ascarid egg w/ granular outer coat.
- May be seen on McMasters

Parascaris spp.

Treatment

Foal with unknown deworming history

- Expect heavy infection in foals 3 – 6 months of age
- Use benzimidazole at labelled dose
  - Preferred for targeting *Parascaris spp.*
  - Metabolic mode of action
  - Worms die over 2-3 days
  - *Parascaris* has not shown resistance to benzimidazoles
  - Has not proven to be associated with impactions
- Don't use Macrocyclic lactone or Pyrantel
  - Paralytic mode of action
    - may result in an acute impaction colic requiring surgery.
    - aka "Ascarid-associated Colic"
  - Also, *Parascaris* resistance is common to these dewormers

Breeding Farm (AAEP Guidelines)

- Target *Parascaris* 2X before weaning
  - At 2 months old and 5 months old
  - Benzimidazole @ labelled dose
- FEC before & after 5 months
  - Determine *Parascaris* v/s strongyle levels
  - Guides one's priority to target *Parascaris* or strongyles
    - If infected with *Parascaris* & strongyles, then *Parascaris* takes priority for treatment.
- Do FECRT to evaluate dewormer efficacy

Exam Question: A 5-month-old foal with unknown history should be treated with _Fenbendazole_ to avoid potential impaction with *Parascaris equorum*.

A foal's peak *Parascaris* worm burden is when the foal is around 5 months old.

Parascaris spp.

Control

- Clean environment
  - mare: clean teats & udder
  - clean stall, paddock, etc.
  - Clean thoroughly
    - Steam clean if possible
    - Remember eggs are very sticky and very durable
- Good control practices
  - Composting
    - Temps ranging from 35 to 55°C eliminates *Parascaris* ova in 6-8 days.
- (Hot summers reduce *Parascaris* contamination, while winter allows eggs to overwinter and target spring foals.)

- Bad control practices
  - Spreading manure on pasture
  - Using deep litter in stalls
    - Just covers up eggs until stirred to the surface by mare & foal

Parascaris spp.

FYI

Ascarid-Associated Colic (impaction)

- General
  - Rare (<0.5% of colics due to ascarid impactions)
  - Guarded Prognosis
- Signalment
  - Expect around 5 months old (@ peak of *Parascaris* worm burden)
  - No history of prior deworming
  - Recently dewormed with a paralytic dewormer
    - Causes acute intestinal impaction
    - AAC has not been shown to be associated with benzimidazole deworming
- Clinical Signs of colic
  - Increased heart rate
  - Dehydration
  - hyperperistalsis or hypoperistalsis
  - gastric reflux
  - hyperemic mucus membranes
  - clear signs of pain
  - limited response to analgesics
- Diagnosis
  - Transabdominal ultrasonography
    - Dilates SI loops, thickened walls of SI, hyperechoic worms clearly visible
  - Fecal is positive for ascarid eggs
    - Only qualitative -- does not correlate to impaction risk.

FYI

- Primary Treatment
  - Most cases require surgery.
  - Acute presentation with gastric reflux
    - Enterotomy for removal

    OR
    - Intense palpation to push worms into cecum
- Alternative Treatment
  - In case of no gastric reflux then one can try a deworming alternative
    - Benzimidazole at full labeled dose + Mineral oil + Spasmolytic + Fluid therapy
    - (Do not use paralytic dewormers)
    - Check for gastric reflux every 3 hrs for 24-48 hrs or until patient stabilizes
    - Monitor progression with frequent ultrasonography
- Always provide supportive care
  - Fluid therapy, pain medication, correct acidosis or alkalosis, anti-inflammatory therapy, antibiotics

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Ascaris suum
Large Roundworms of Swine

Nematodes : Ascarids : Ascaris

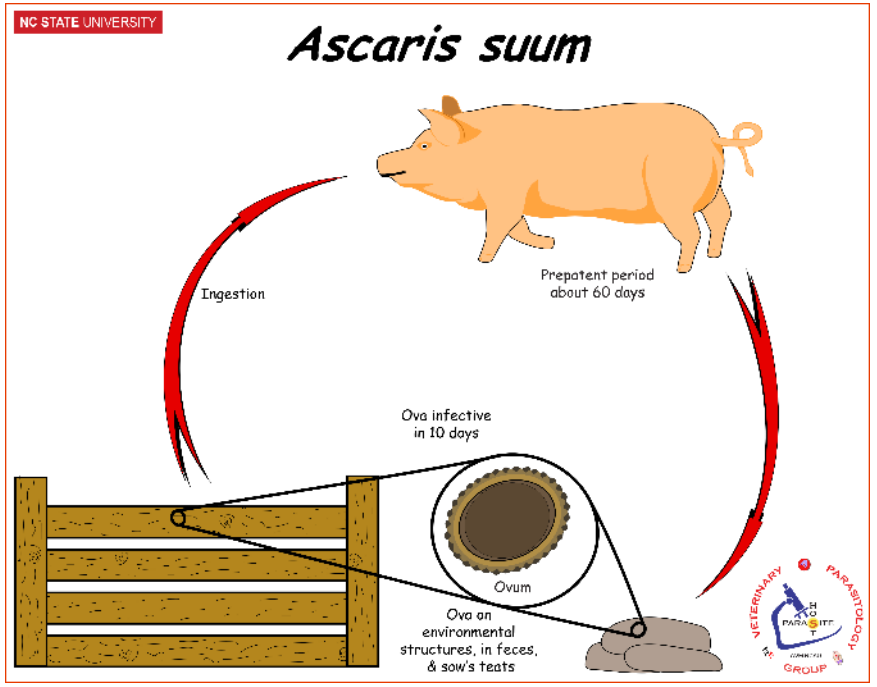
Ascaris suum
General

- The ascarid of swine worldwide
- Most economically important helminth of swine
- Extremely close to the human ascarid, *Ascaris lumbricoides*
- ??Zoonosis??

Ascaris suum

Life Cycle Specifics

- Freshly passed egg take takes 2 to 4 weeks to develop an infective larva. (=> plenty of time to muck)
- Transmission: Direct Fecal-Oral Transmission **ONLY**
  - ingest infective egg only (Neonates, young animals, and adult animals)
- Tracheal Migration Only
  - Larvae migrate to liver, lungs, coughed up and swallowed, returning to the small intestine.
    - (Neonates, young animals, and adult animals)
- Prepatent period: 40 to 53 days (some report 60 days)



Ascaris suum

Pathology

Dose Dependent Pathology

- mild v/s heavy infections

Age Dependent Pathology

- Piglet more serious v/s adult pigs
  - Some Acquired immunity

Larval Migrations

- Liver
  - inflammatory response --> fibrotic lesions = "Milk spots"
    - liver condemnation at abattoir -> economic loss
- Lung
  - inflammatory rxn & lesions --> pulmonary congestion
  - "Verminous pneumonia" → "thumps"
  - Exacerbates viral & bacterial pulmonary infections

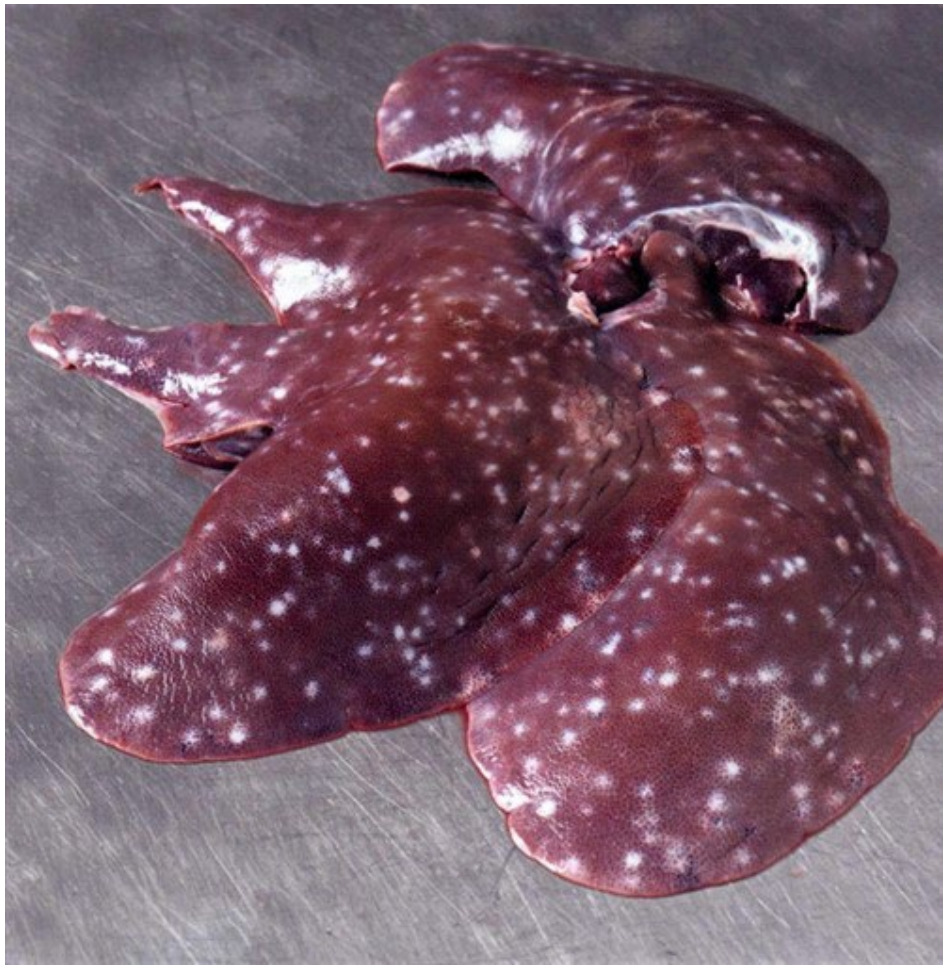
Adult Worms

- Small Intestine
  - Nutrient robbing
  - Inflammatory response --> thickened gut wall
    - Potbelly
  - Interfere with absorption
    - Reduced Growth performance
    - Stunted growth
    - Poor feed conversion
    - **All result in Economic Loss**
  - Impaction

Ascaris suum

Pathology

Intestinal Impaction



"Milkspots"

Ascaris suum

Clinical Signs & Diagnosis

Clinical Signs

- Mainly Piglets or naïve pigs moved to heavily contaminated pen or pasture.
- Respiratory signs
  - Persistent cough, dyspnea
    - rapid, shallow breathing -- aka "thumps" (audible expiratory effort)
    - https://mediaspace.msu.edu/media/Verminous+Pneumonia/1_emaizuxn
- Intestinal signs
  - Diarrhea w/ heavy infections,
    - may be seen before patency
  - Stunted growth, poor feed conversion

Diagnosis

- Recognize Clinical Signs
- < 2 months old piglet (prepatent)
  - necropsy --> pulmonary hemorrhage, interstitial pneumonia
- > 2 months old (patent)
  - fecal float: many eggs in feces
  - Sometimes worms in feces
  - Necropsy:
    - emaciation, interstitial pneumonia, milk spots, adult worms in SI

Ascaris suum
Treatment

Anthelmintics

- Adult worms only
  - Piperazine
- Adult worms & larvae
  - Dichlorvos, Fenbendazole, Levamisole, Ivermectin
- Newly hatched larvae in gut
  - Pyrantel tartrate - Continuous in-feed

Supportive Care

- During lung phase
  - antibiotics v/s secondary bacterial infections

Ascaris suum
Control

Integrated Control

- Anthelminthics and Sanitation
- Primarily to protect Piglets
- Prevention more Effective than Treatment

Confinement Operation

- Sow:
  - Deworm Sows prior to farrowing
  - Wash sows before moving to sanitized farrowing area
- Piglets:
  - Scrub farrowing area frequently
  - Wean piglets early
- All in / all out management with thorough cleaning b/w groups (don't mix groups)

Pasture Operation

- Extremely difficult to control *Ascaris* (& *Trichuris*) in Pasture Operations
- Same recommendations as for Confinement, but also:
  - Deworm prior to moving to pasture
  - Rotate pastures
  - Rest pastures for several years
  - Till pastures b/w uses

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Ascaridia sp. & Heterakis sp.

Ascarids of Poultry

Nematodes : Ascarids : Ascaridia

Ascaridia, Heterakis, Physaloptera

Take Homes

Ascaridia galli

Large Ascarid of poultry, small intestine, fecal-oral of infective egg, enteritis, diarrhea

Heterakis gallinarum

Cecal worm of poultry, cecum, fecal-oral of infective egg & paratenic Hosts (bugs & earthworms)

Adult worms are non-pathogenic.

But carries *Histomonas meleagridis* protozoan pathogen --> causes Black-Head DZ in Turkeys

Physaloptera spp.

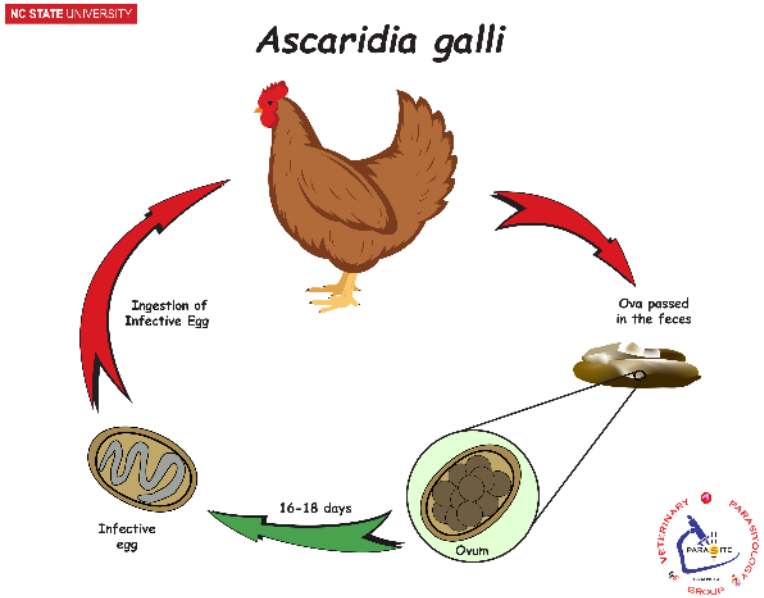
Stomach worm of wildlife & pets. Dung Beetle IH, various Paratenic hosts.

Gastritis & Ulcers.

Sedimentation for eggs, adult worms in vomitus, endoscopy

Ascaridia galli
Ascarid of Chickens

- Adults inhabit the Small intestine
- Only route of infection is by ingestion of infective eggs
- Pathology is in young birds (< 3 months)
  - Enteritis, diarrhea, +/- hemorrhagic
  - blockage with heavy burdens



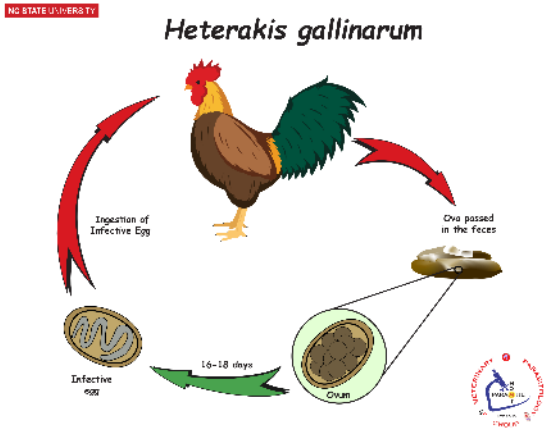
***Ascaridia* in small intestine of a chicken**

Heterakis gallinarum
Cecal Worm of Poultry

Cecal Worm

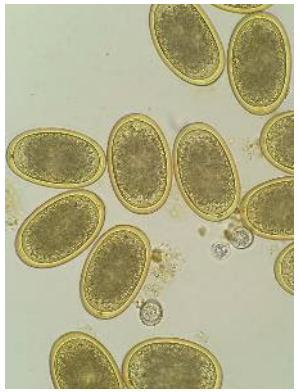
- Adult worms in cecum of chicken, turkeys, etc.
- Birds are either infected by ingestion of:
  - egg containing infective larva

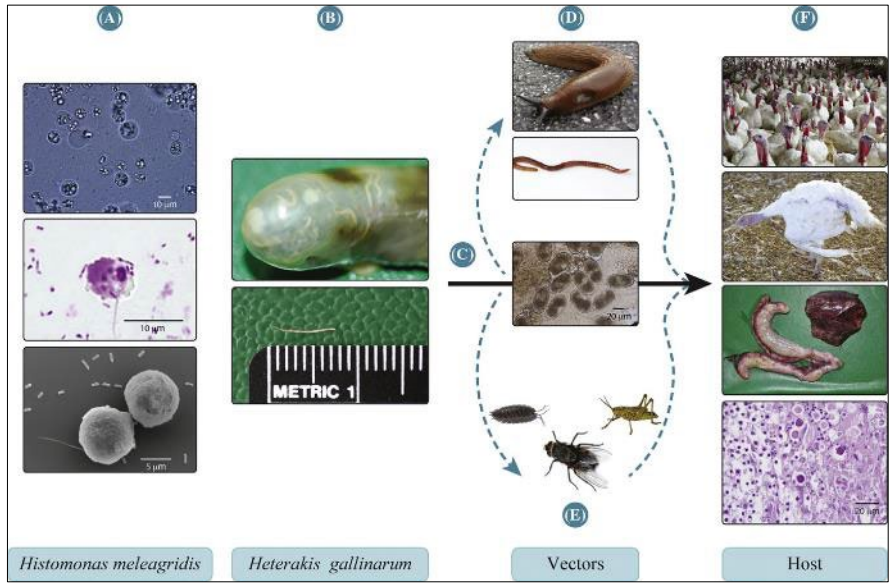
  OR
  - infected transport host - earthworm
- *Heterakis* is NON-pathogenic
  - But can carry the protozoa (*Histomonas*) which causes "BlackHead" DZ in turkeys which is deadly for turkeys.



Blackhead disease in turkeys only

- Pathology
  - Inflammation & necrosis of cecum & liver
  - High mortality
  - Doesn't affect chickens
- Epidemiology
  - Etiological agent = *Histomonas meleagridis* (protozoan)
  - *Heterakis* eggs and larvae are carriers of *Histomonas*.
- Control Blackhead
  - Must control *Heterakis* nematode infections:
    - Deworm
    - Clean up the environment
    - Don't house turkeys with chicken, or use areas that previously used by chickens





https://www.sciencedirect.com/science/article/pii/S1471492220300088

Ascarids

Ascarids (Host)	Transmission	Pathology	Clinical Signs	Diagnostics	Treatment	Control
Toxocara canis (Dog) Small Intestine	Transuterine Transmammary (minor) Ingestion of Ova Paratenic host	Enteritis, Verminous pneumonia (minor)	Diarrhea, Pot-belly, rough coat, unthrifty	Ova Centrifugation Float; Fecal Antigen Tests	@ 2 weeks old & every 2 weeks until HW meds	Sanitation, No paratenic hosts, Treat mother periparturient
Toxocara cati (Cat) Small Intestine	Transmammary (minor) Ingestion of Ova Paratenic host	Enteritis	Diarrhea, Pot-belly, rough coat, unthrifty	Ova Centrifugation Float; Fecal Antigen Tests	@ 2 weeks old & every 2 weeks until HW meds	Sanitation, No paratenic hosts, Treat mother periparturient
Parascaris spp. (Horse) Small Intestine	Ingest Ova only	Enteritis, Verminous pneumonia, Impaction	Diarrhea, Pot-belly, rough coat, unthrifty, Cough, Colic	Ova Centrifugation Float;	@ 2 months and 5 months then by FEC	Sanitation, Treat mother periparturient
Ascaris suum (Swine) Small Intestine	Ingest Ova only	Enteritis, Verminous pneumonia	Diarrhea, Pot-belly, rough coat, unthrifty, "thumps", Milk spots	Ova Centrifugation Float; Necropsy	Various adult worm deworms, In-feed deworm that kills incoming larvae	Sanitation, Treat mother periparturient
Ascaridia galli (Chicken) Small Intestine	Ingest Ova only	Enteritis	Diarrhea	Ova Centrifugation Float; Necropsy	----------	----------
Heterakis gallinarium (Chicken, turkey) Small Intestine	Ingest Ova Mechanical Transport hosts	Chicken: Non-Pathogenic Turkey: *Histomonas melagridis* = blackhead DZ	----------	Ova Centrifugation Float; Necropsy	----------	----------

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Physaloptera spp.

Stomach worm of pets & wildlife

Nematodes : Spirurids : Physaloptera

Order Spirurida
General

What Parasites are in this Order?

Discuss Now w/ GI issues
- Physaloptera - stomach worm of dogs, cats.

Discuss Later w/ Integument issues
- Dracunculus insignus – subcutaneous.
- Habronema & Draschia - stomach of horses.
- Onchocerca - ligaments of horses.
- Dipetalonema - subcutaneous in dogs.

Discussed previously w/ Cardiac/Respiratory issues
- Dirofilaria - dog heartworm.

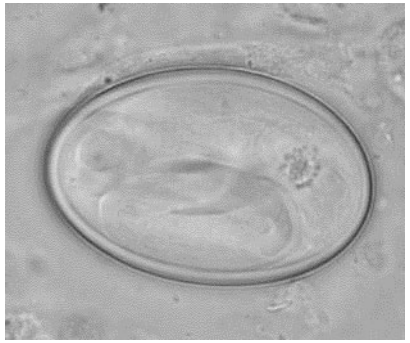
General Features
- **Arthropods are required intermediate host.** (Indirect LC)
- Routes of infection:
  - ingestion of infected arthropod
  - ingestion of a paratenic host that ate the infected arthropod.
  - infective larvae delivered to host when arthropod feeds on the host.

Physaloptera spp.

Stomach worm

Morphology

- Worm
  - Thick-bodied up to 4 cm long with anterior collar
  - don't confuse with *Toxocara*.
- Egg
  - Larvated w/ smooth thick shell



Physaloptera

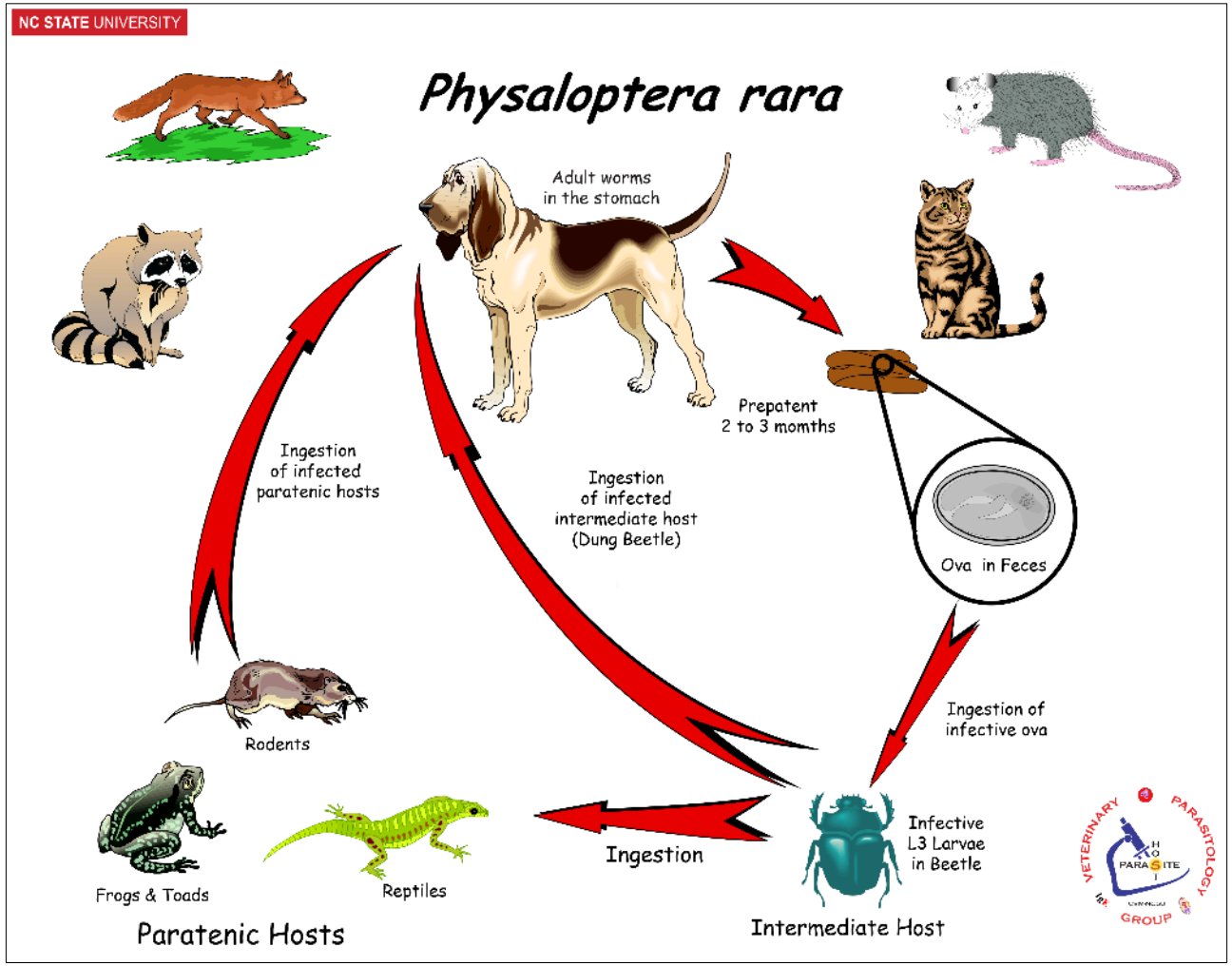
Toxocara

Physaloptera spp.

Stomach worm

Life Cycle

- Adults in stomach of:
  - Wildlife Reservoir hosts
    - Raccoons, Opossum, Fox
  - Pet Hosts
    - Dogs and Cats.
- Beetles are the intermediate hosts
  - but rodents can be paratenic hosts.



Physaloptera spp.

Stomach worm

Pathogenesis

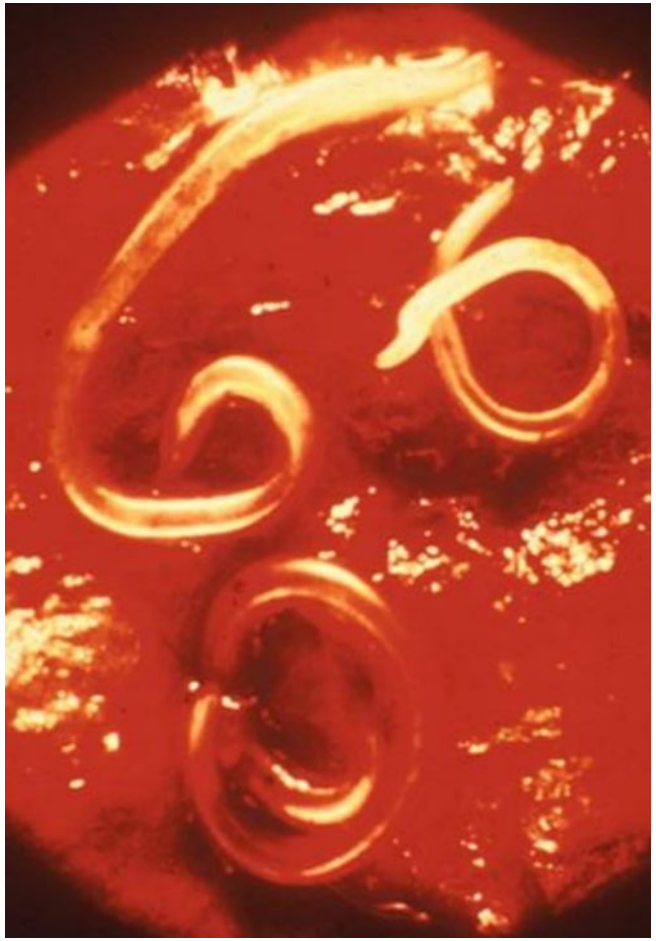
- gastritis, ulcers, bleeding.

Diagnosis

- Sedimentation
  - difficult to float eggs.
- Vomited worm (don't assume *Toxocara*.)
- Endoscopic exam.

Treatment

- Pyrantel at 20mg/kg, repeated if vomiting persists.
- Other anthelmintics effective as well.



Physaloptera spp

Physaloptera (Host)	Transmission	Pathology	Clinical Signs	Diagnostics	Treatment	Control
Physaloptera Dog, cat, raccoon, wildlife. Stomach	Ingest intermediate host (dung beetle); Paratenic host (rodent, reptile, frog)	Gastritis, gastric ulcers	Signs of gastritis, vomiting, vomiting worms	Ova Sedimentation Identify worms from Vomit Endoscopy	Various dewormers; repeat treatment	Pest control: Avoid dung beetles & paratenic hosts


VETERINARY
PARASITOLOGY
HOST
PARASITE
IgE
CVM-NCSU
GROUP