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Hidden Invaders: Gastrointestinal Parasites of Equines and Their Control

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Gastrointestinal (GI) parasitism remains one of the most important health challenges affecting horses worldwide. Although advances in anthelmintic therapy have significantly reduced the prevalence of highly pathogenic parasites such as *Strongylus vulgaris*, small strongyles (cyathostomins) have emerged as the predominant nematode parasites due to widespread anthelmintic resistance. Other important gastrointestinal parasites include *Parascaris* spp., *Oxyuris equi*, *Anoplocephala perfoliata*, *Strongyloides westeri*, *Habronema* spp., *Draschia megastoma*, *Gasterophilus* spp., and protozoan parasites such as *Cryptosporidium* spp. These parasites impair growth, feed efficiency, athletic performance, reproductive efficiency, and overall welfare of horses. Heavy infections may result in colic, intestinal obstruction, diarrhea, anemia, protein loss and even death. The emergence of resistance to benzimidazoles, tetrahydropyrimidines, and macrocyclic lactones has shifted parasite control strategies from routine interval deworming to evidence-based selective treatment. Modern parasite control relies on fecal egg count (FEC), fecal egg count reduction test (FECRT), targeted selective treatment (TST), pasture hygiene, grazing management, and preservation of parasite refugia. This review summarizes the epidemiology, biology, pathogenicity, diagnosis, treatment and integrated control of major gastrointestinal parasites affecting horses while emphasizing sustainable parasite management strategies to minimize anthelmintic resistance.

Keywords: Horse, gastrointestinal parasites, anthelmintic resistance, fecal egg count, targeted selective treatment.

Introduction

Parasitic infections of the gastrointestinal tract continue to be a major constraint to equine health worldwide despite the availability of highly effective anthelmintics. Horses are exposed continuously to infective parasite stages while grazing, making complete elimination of parasites impossible (Matthews, 2014). The impact of gastrointestinal parasites varies according to parasite species, age, nutritional status, immune competence, stocking density, and management practices (Nielsen et al., 2022).

Young foals and yearlings are particularly susceptible because of their immature immune system. Adult horses generally develop partial immunity to several parasites but remain important reservoirs of infection. Economic losses occur through reduced growth, decreased feed conversion efficiency, poor athletic performance, reduced fertility, increased veterinary expenses, and mortality in severe cases (Kaplan and Nielsen, 2010).

Historically, large strongyles (*Strongylus vulgaris*) were considered the most pathogenic equine parasites. However, decades of routine deworming have markedly reduced their prevalence. Today, cyathostomins (small strongyles) constitute over 95% of strongyle infections in horses worldwide and represent the greatest parasitic threat because of extensive anthelmintic resistance (Love et al., 1999; Nielsen et al., 2016).

Major Gastrointestinal Parasites of Horses

I. Nematodes

1. Small Strongyles (Cyathostomins):

The mature worms live free in the lumen of the caecum and colon (the large intestine) of equines.

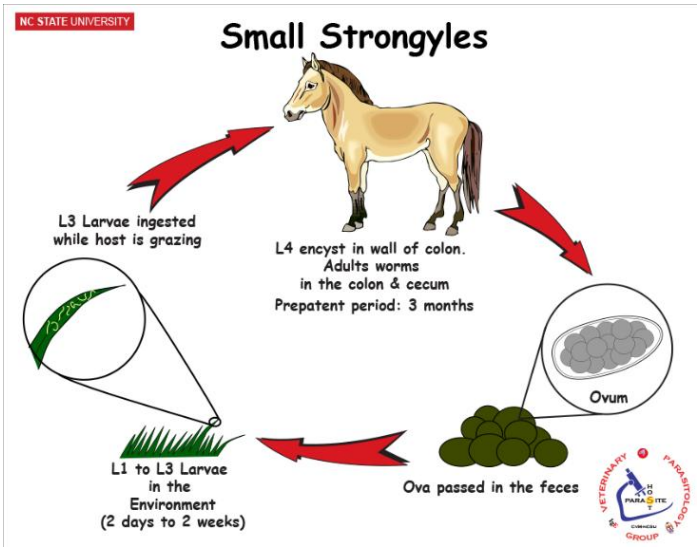
Species

More than 50 species including:

- *Cyathostomum*
- *Cylicocyclus*
- *Cylicostephanus*
- *Coronocyclus*

Life Cycle

Cyathostomins have a direct life cycle.



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Pathogenesis

Encysted larvae cause minimal pathology during dormancy.

Mass emergence causes:

- Severe inflammation
- Protein-losing enteropathy
- Ulcerative typhlocolitis
- Diarrhea
- Weight loss

Known as larval cyathostominosis, this disease has mortality rates approaching 50% if untreated (Love et al., 1999).

Clinical Signs

- Chronic diarrhea
- Weight loss
- Poor performance
- Ventral edema
- Colic
- Rough hair coat
- Hypoproteinemia

2. Large Strongyles

Important species include:

- *Strongylus vulgaris*
- *Strongylus edentatus*
- *Strongylus equinus*

Strongylus species are large, blood-feeding nematodes. This remains the most pathogenic equine nematode. Adult *Strongylus* species (large strongyles) primarily inhabit the large intestine (cecum and colon) of equids such as horses, donkeys, and zebras. Larval stages migrate extensively through specific organs and blood vessels before maturing into adults in the gut. There are three primary pathogenic species of large strongyles in horses. The species of large strongyles, often red in colour and therefore, called red worms. Morphological identification of adult strongyles relies on size, presence or absence of teeth, shape of the teeth in base of buccal capsules, internal and external leaf crowns and its extra-chitinous support. The S. vulgaris has 1.5-2.5cm and two ear-shaped dorsal teeth; the S. edentatus has 2.5-4.5cm long, without teeth and cup shaped buccal capsule; S. equinus has 2.5-5cm with pair of sub-ventral teeth and dorsal tooth which is bifid at the tip.

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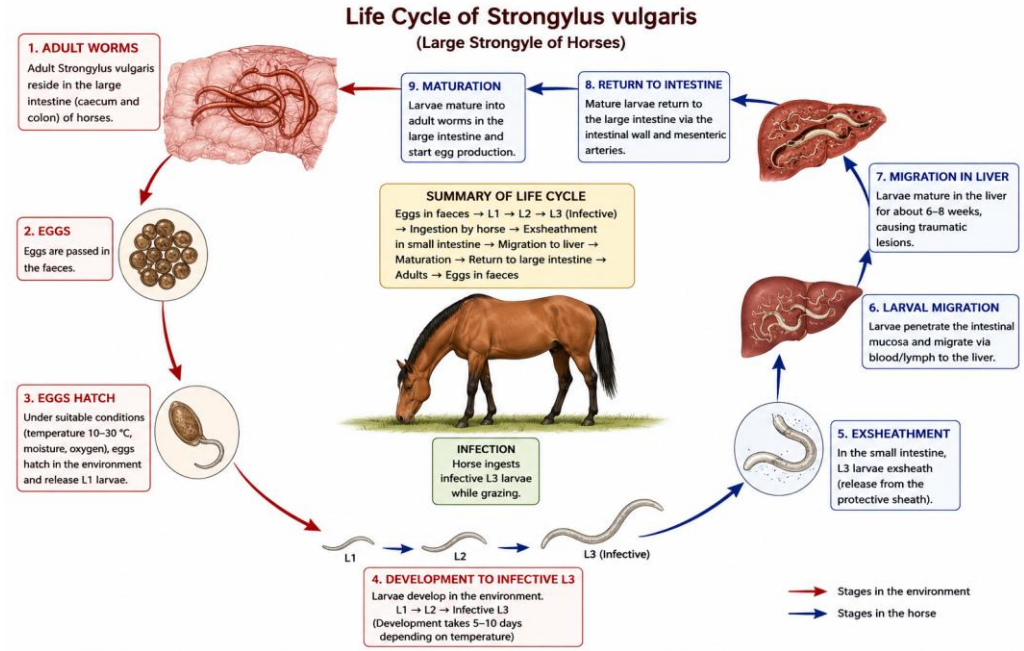
Life Cycle:



Pathogenesis:

***Strongylus vulgaris*:** This is considered the most pathogenic species. After L3 larvae are ingested and penetrate the intestinal wall, they enter the submucosal arteries and migrate up to the cranial mesenteric artery. Here, they induce severe inflammation, intimal thickening, and gross thrombosis. Pieces of these thrombi (emboli) can break off and block smaller blood vessels, potentially causing intestinal ischemia, necrosis, and fatal colic.

***Strongylus edentatus*:** Larvae penetrate the gut wall and migrate via the portal vein to the liver, where they cause focal necrosis and hemorrhagic tracts. They then migrate under the peritoneum, forming large, purulent hemorrhagic nodules in the flank regions before returning to the large intestine to mature. [1, 2, 3]

***Strongylus equinus*:** Similar to *S. edentatus*, the larvae migrate through the liver but additionally invade the pancreas and peritoneal cavity, resulting in tissue destruction and peritonitis before establishing themselves as adults in the large intestine.

Clinical Signs:

Strongylus vulgaris: The most dangerous form of large strongylosis is caused by *S. vulgaris* larvae migrating through the cranial mesenteric arteries. This triggers verminous arteritis, thrombosis, and restricted blood supply to the gut. The signs include:

- Recurrent colic
- Fever
- Anorexia

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- Diarrhea
- Sudden death

Routine deworming has greatly reduced its prevalence in developed countries (Nielsen et al., 2012).

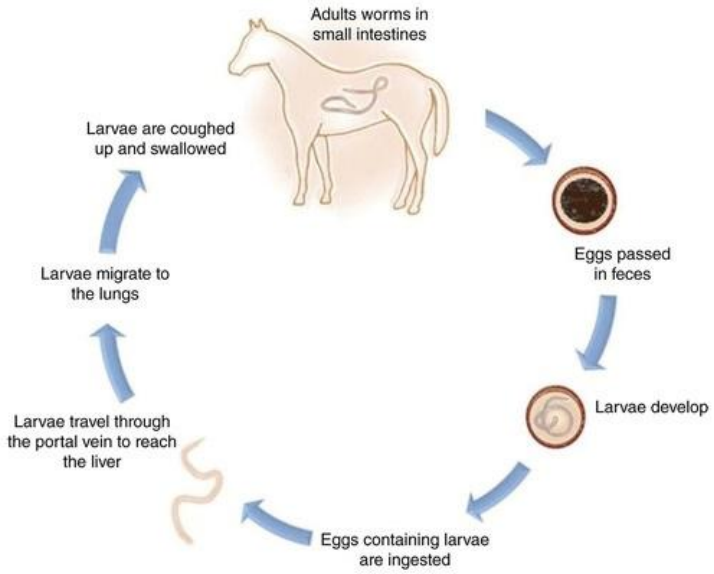
Strongylus edentatus: Larvae migrate extensively through the liver and flanks before maturing in the gut wall. Heavy migrations can cause liver damage, inflammation, and pain upon palpation.

Strongylus equinus: Larvae migrate into the liver and pancreas, leading to localized inflammation, granulomas, and pancreatic damage.

3. *Parascaris equorum*

Parascaris equorum is a large parasitic roundworm that resides in the small intestine of equids, including horses, donkeys, and zebras. It is cosmopolitan and found worldwide wherever horses live. Adult worms are large, whitish, opaque roundworms. Females are 18–50 cm long, 2–8 mm wide; posterior end straight and rounded. Males are 15–28 cm long, 3–6 mm wide; posterior end ventrally curved with two equal spicules (2.0–2.5 mm). Anterior end having three large, distinct lips with dentigerous ridges. Eggs are spherical to sub-spherical, 90–100 µm in diameter; yellow-brown, thick-shelled, finely pitted, and covered by a sticky protein coat that adheres to surfaces and the horse's hair.This parasite primarily infects foals below two years.

Life Cycle



Clinical Signs

- Pot-bellied appearance
- Coughing

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- Nasal discharge
- Poor growth
- Intestinal obstruction
- Colic
- Intestinal rupture

Heavy worm burdens are particularly dangerous after deworming because dead worms may obstruct intestines.

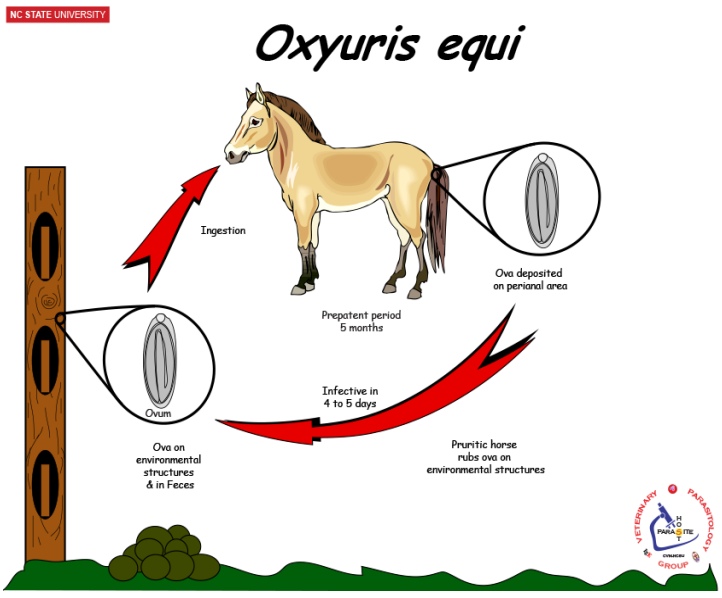
Resistance against ivermectin and moxidectin has become widespread (Nielsen, 2016).

4. Pinworm (*Oxyuris equi*)

Oxyuris equi is a highly prevalent equine pinworm that infects horses, donkeys, and mules worldwide. Adults inhabit the large intestine. Adult Females are Whitish-grey, robust, and elongated worms reaching 100 to 150 mm in length. The most distinct feature is the long, filiform tail, which accounts for a large portion of the body and resembles a pin. They have an esophagus with a double bulb and anteriorly located vulva. Adult Males are much smaller, measuring only 9 - 12 mm in length. They possess caudal alae (fin-like structures) and a single, pin-shaped spicule. Eggs are Medium-sized eggs measuring roughly 80 - 95 µ m long by 40 - 45 µ m wide. They have a thick, smooth shell that is distinctly asymmetrical (flattened on one side) and contain an operculum. When deposited, they often hold an unsegmented morula or a developed larva.

Lifecycle:

Adult worms live in the horse's large intestine. The female migrates to the anus and deposits sticky eggs on the surrounding skin. These eggs develop into the infective stage in just 3 to 5 days.



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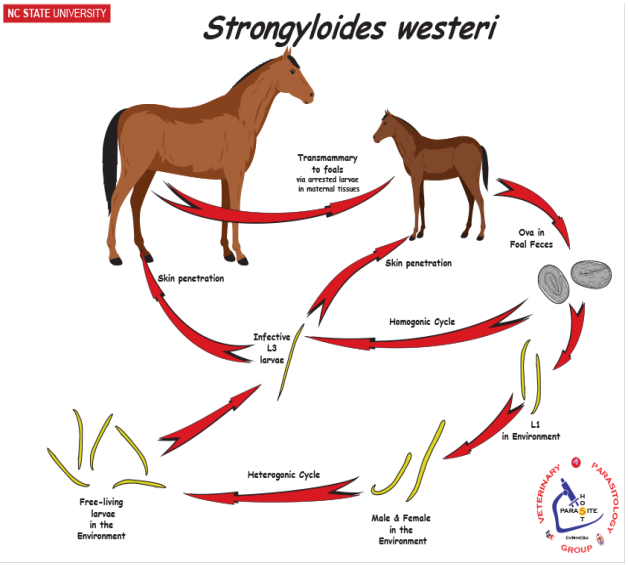
Clinical Signs

- Intense itching and irritation around the tail head and anus.
- Rubbing the rump against stall doors, fences, or trees.
- Hair loss and raw sores in the tail and buttock area.
- White or yellow gelatinous/sticky patches on the skin around the anus.

5. Strongyloides westeri

Strongyloides westeri, commonly referred to as intestinal threadworm, is a species of small nematode parasite in the family Strongylidae. Strongyloides are commonly found in the small intestine of mammals (generally horses and monkeys, specifically foals), that are characterized by an unusual lifecycle (Larvae II, III) that involves one generations of free-living adult worms. It occurs mainly in the foals.

Life Cycle:



Transmission occurs through:

- Colostrum
- Milk
- Skin penetration

Clinical Signs

- Diarrhea
- Dehydration
- Poor growth

Usually self-limiting after immunity develops.

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6. Stomach Worms

Habronema is a genus of stomach worms in horses (primarily *Habronema muscae, H. microstoma*, and *Draschia megastoma*). While adult worms live harmlessly in the stomach, fly-deposited larvae often migrate aberrantly into skin wounds or eyes. This causes severe, non-healing ulcerated lesions commonly known as "summer sores".

These parasites require flies as intermediate hosts.

Life Cycle:

Adult worms in the stomach shed eggs that are passed in the horse's manure. These eggs are ingested by fly maggots (especially houseflies and stable flies). As the fly matures, the worms develop into infective larvae. Instead of being deposited near the horse's mouth to be swallowed, the flies deposit these larvae when feeding on moisture around open wounds, the eyes, or the genitals. The trapped larvae cause a hypersensitive inflammatory reaction that prevents normal healing.

Clinical Signs:

Skin (Cutaneous Habronemiasis): Raised, ulcerated, and red granulation tissue that is very itchy. The lesions often contain small, yellow, calcified, rice-sized granules. Common sites include the lower legs, sheath, and inner corner of the eyes (medial canthus).

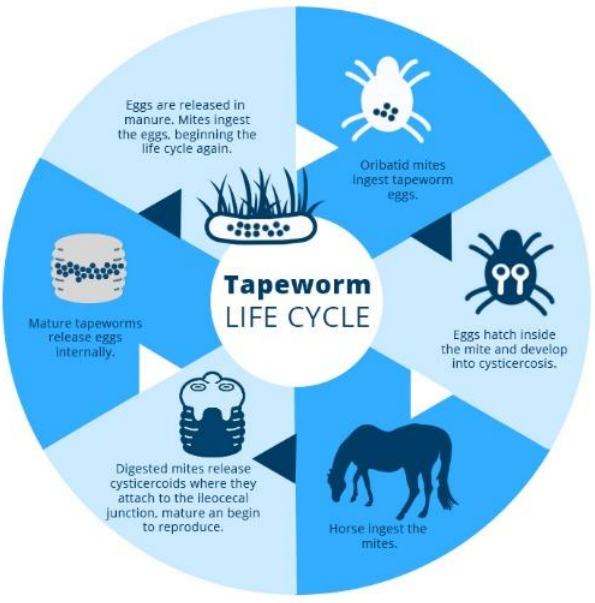
Eyes: Redness, swelling, and conjunctivitis.

Stomach (Gastric Habronemiasis): Usually mild and asymptomatic, though severe cases can cause gastritis, weight loss, and ulcers.

II. Cestodes:

Three species of tapeworms are known to infect horses:

1. *Anoplocephala perfoliata*: The most common and clinically significant tapeworm in horses. It typically attaches in dense clusters at the ileocecal junction, causing localized ulceration and irritation.



2. *Anoplocephala magna*: Resides in the small intestine, primarily in parts of Europe and Australia.

3. *Anoplocephaloides mamillana*: Also known as the dwarf tapeworm, found sporadically in the small intestine.

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Clinical Signs

- Spasmodic colic
- Ileocecal intussusception
- Ileal impaction
- Poor performance

Diagnosis is difficult because eggs are shed intermittently.

III. Stomach Bot Flies (*Gasterophilus* spp.)

Horse bots are the parasitic larvae of botflies (*Gasterophilus* spp). In general, bots are considered benign, even though they may cause some pathology. Bots can be identified during oral inspection or gastroscopy.

Bots are extremely common in horses, and several species can infect horses. The two most common species are *Gasterophilus intestinalis* and *Gasterophilus nasalis*. Other species are known to infect working, feral, and wild equids but are rarely, if ever, encountered in sport and leisure horses. By far the most common and abundant species to infect horses is *G intestinalis*.

The adult botfly glues eggs onto hairs on the horse's body. *G intestinalis* eggs tend to be found on the distal legs and around the neck and withers; *G nasalis* eggs are typically found in the submaxillary region. Bots are eventually ingested through grooming and can cause inflammatory reactions during migration within the oral cavity and by attachment to the stomach wall.

With *G intestinalis*, hatching is stimulated by licking or grooming; *G nasalis* eggs hatch spontaneously. With both parasites, larvae find their way to the horse's mouth and enter the oral cavity. They first migrate within the tissues of the tongue for up to 21 days; after that, they can be found in periodontal pockets surrounding molars and premolars.

After approximately 4 weeks in the oral cavity, bots relocate to the stomach as second instars, where *G intestinalis* attaches in the nonglandular portion surrounding the margo plicatus, and *G nasalis* attaches in the pylorus. Larvae develop into third instars (see third-instar image) before they are passed out in feces.

Altogether, *Gasterophilus* larvae can spend up to 8–10 months within the horse. Outside of the horse's body, they pupate in the soil for 3–5 weeks before adult botflies emerge.

Clinical Signs

- Oral irritation
- Gastritis
- Gastric ulceration

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- Poor body condition

Diagnosis:

Oral inspection to observe second instars

Gastroscopy to visualize second and third instars attached to gastric mucosa

Oral inspection of horses with *Gasterophilus* spp infection can show larvae within the diastemata between molars and premolars. Lesions at the base of the tongue can also be observed. Gastric stages are easily visualized with gastroscopy. In addition, bots can sometimes be observed in feces. However, fecal flotation and fecal egg counts are not useful to diagnose this parasite.

Observation of botfly eggs glued onto a horse's hair can indicate infection. However, such observation documents only general exposure of the herd, because horses are likely to acquire infection from each other while grooming.

IV. Protozoa

Eimeria leuckarti: The only significant species of *Eimeria* that infects equines. It causes equine coccidiosis, which is characterized by the shedding of large, thick-shelled oocysts in the feces. While generally self-limiting and often asymptomatic in adult horses, heavy infestations can lead to mild diarrhea and poor thrift. Foals are more susceptible.

Giardia duodenalis: A zoonotic flagellate protozoan that lives in the small intestine. Horses typically contract it by ingesting cysts from contaminated water or feed. Signs include intermittent diarrhea and weight loss.

Cryptosporidium spp.: This protozoan is rarely associated with clinical disease in adult horses, but it can trigger outbreaks of severe, acute diarrhea in immunocompetent or crowded foals.

Clinical Signs:

- Mild to chronic diarrhea
- Weight loss and a failure to thrive
- Lethargy and reduced appetite
- Dehydration due to fluid loss

Diagnosis:

- Standard fecal flotations or McMasters egg counts can help identify *Eimeria* oocysts, while Giardia is often detected using zinc sulfate centrifugal flotation or commercially available ELISA tests
- Modified Ziehl-Neelsen staining for oocysts of *Cryptosporidium parvum*.
- PCR

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Diagnosis of Gastro Intestinal parasitism:

Accurate diagnosis of gastrointestinal (GI) parasitism in horses is essential for effective parasite control, prevention of anthelmintic resistance, and maintenance of equine health. Diagnosis involves a combination of clinical examination, laboratory techniques, and advanced diagnostic methods.

1. Clinical Diagnosis

Clinical signs vary depending on the parasite species, burden, age, and immune status of the horse.

Common clinical signs include:

- Weight loss and poor body condition
- Dull hair coat
- Reduced growth in foals
- Diarrhoea or intermittent colic
- Pot-bellied appearance (especially in foals)
- Poor performance and reduced stamina
- Anaemia (hookworm infections are rare in horses)
- Ventral oedema (heavy parasitic burden)

Clinical signs alone are not sufficient for diagnosis because many infected horses remain asymptomatic.

2. Faecal Examination

Faecal examination is the most commonly used method for diagnosing GI parasites.

a) Direct Faecal Smear

- Fresh faeces are examined microscopically.
- Useful only in heavy infections.
- Low sensitivity.

b) Faecal Flotation Technique

- Detects nematode and ascarid eggs using flotation solutions.
- Commonly identifies:
    - Strongyle eggs
    - *Parascaris* eggs
    - Oxyurid eggs (occasionally)

Advantages:

- Simple
- Inexpensive

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- Suitable for routine screening

Limitation:

- Strongyle eggs cannot be differentiated to species level.

3. Quantitative Faecal Egg Count (FEC)

Measures the number of parasite eggs per gram (EPG) of faeces.

Common techniques

- McMaster technique
- Mini-FLOTAC
- Wisconsin method

Interpretation:

Egg Count (EPG)	Infection Level
<200	Low shedder
200–500	Moderate shedder
>500	High shedder

Applications:

- Identify horses requiring treatment.
- Monitor pasture contamination.
- Targeted selective deworming.

4. Faecal Egg Count Reduction Test (FECRT):

The gold standard for detecting anthelmintic resistance.

Procedure:

- Perform FEC before treatment.
- Treat with an appropriate anthelmintic.
- Repeat FEC after:
    - 14 days (benzimidazoles and pyrantel)
    - 14–17 days (macrocyclic lactones)

Interpretation:

- ≥95% reduction: Drug effective
- <95% reduction: Suspected resistance

5. Coproculture

Strongyle eggs are cultured to develop third-stage larvae (L3), which are identified morphologically.

Uses:

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- Differentiate large and small strongyles.
- Epidemiological studies.
- Monitoring parasite populations.

Limitations:

- Time-consuming (7–14 days).
- Requires expertise.

6. Perianal Tape Test

Used specifically for *Oxyuris equi* (pinworm).

Procedure:

- Transparent adhesive tape is pressed against the perianal region.
- Eggs are examined microscopically.

Indication:

- Horses showing tail rubbing and perianal irritation.

7. Larval Culture and Identification

L3 larvae recovered from faecal cultures are identified based on morphological characteristics.

Useful for:

- Identification of strongyle genera.
- Research and surveillance.

8. Molecular Diagnosis:

Polymerase Chain Reaction (PCR)

Detects parasite DNA in faeces.

Advantages:

- Highly sensitive and specific.
- Differentiates parasite species.
- Detects mixed infections.

Quantitative PCR (qPCR)

- Measures parasite DNA load.
- Useful for research and epidemiological investigations.

Loop-mediated Isothermal Amplification (LAMP)

- Rapid.
- Field applicable.
- Does not require a thermal cycler.

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9. Serological Tests

Enzyme-linked Immunosorbent Assay (ELISA)

Useful for:

- Detecting exposure to migrating larvae.
- Particularly valuable for **Strongylus vulgaris** infections.

Limitations:

- Detects antibodies rather than active egg shedding.

10. Haematological and Biochemical Examination

Supportive diagnostic tests include:

- Complete blood count (CBC)
    - Eosinophilia
    - Anaemia (occasionally)
- Serum protein estimation
    - Hypoproteinaemia
    - Hypoalbuminaemia
- Increased fibrinogen in severe inflammatory conditions

These findings are supportive rather than confirmatory.

11. Post-mortem Examination

Necropsy remains the definitive method for confirming parasite species.

Findings may include:

- Adult worms in the gastrointestinal tract.
- Larval migration lesions.
- Intestinal inflammation.
- Mesenteric arterial lesions caused by *Strongylus vulgaris*.
- Intestinal obstruction due to *Parascaris* spp.

Treatment:

Common anthelmintics include:

Drug	Target parasites
Fenbendazole	Strongyles, ascarids
Pyrantel	Strongyles, pinworms, tapeworms (double dose)
Ivermectin	Strongyles, bots, stomach worms
Moxidectin	Encysted cyathostomins

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Drug	Target parasites
Praziquantel	Tapeworms

Drug selection should always be based on FEC results.

Anthelmintic Resistance

Resistance has become the greatest challenge in equine parasite control.

Documented resistance includes:

- Benzimidazoles → cyathostomins
- Pyrantel → cyathostomins
- Ivermectin → *Parascaris* spp.
- Moxidectin resistance emerging

Routine blanket deworming is no longer recommended (Nielsen et al., 2022).

Integrated Parasite Control:

1. Targeted Selective Treatment (TST):

Treat only horses shedding >200–500 EPG.

Benefits:

- slows resistance
- reduces drug use
- preserves refugia

2. Pasture Management

- Remove manure twice weekly.
- Avoid overstocking.
- Rotate grazing.
- Mixed grazing with cattle or sheep.
- Rest contaminated paddocks.

3. Foal Management

- Monitor ascarid infections closely.
- Deworm based on age and FEC.
- Avoid repeated ivermectin use.

4. Quarantine

New horses should:

- Undergo FEC
- Receive appropriate deworming
- Remain isolated before entering pasture.

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5. Refugia

Maintaining untreated parasite populations reduces selection pressure for resistant worms and prolongs anthelmintic efficacy (Van Wyk, 2001).

6. Regular Monitoring

Perform:

- FEC every 3–4 months
- FECRT annually
- Maintain farm parasite records

Conclusion

Gastrointestinal parasites continue to pose a significant threat to equine health, welfare, and productivity. Although the prevalence of highly pathogenic large strongyles has declined substantially due to effective control programs, cyathostomins and *Parascaris* spp. remain major concerns because of their widespread distribution and increasing anthelmintic resistance. Sustainable parasite control should no longer rely on routine interval deworming but instead integrate fecal egg count monitoring, fecal egg count reduction testing, targeted selective treatment, preservation of refugia, pasture hygiene, strategic grazing management, and biosecurity measures. Such evidence-based approaches help maintain horse health while slowing the development of drug resistance. Future advances in molecular diagnostics, precision livestock management, and vaccine research are likely to further improve equine parasite control and ensure the long-term effectiveness of available anthelmintics.

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