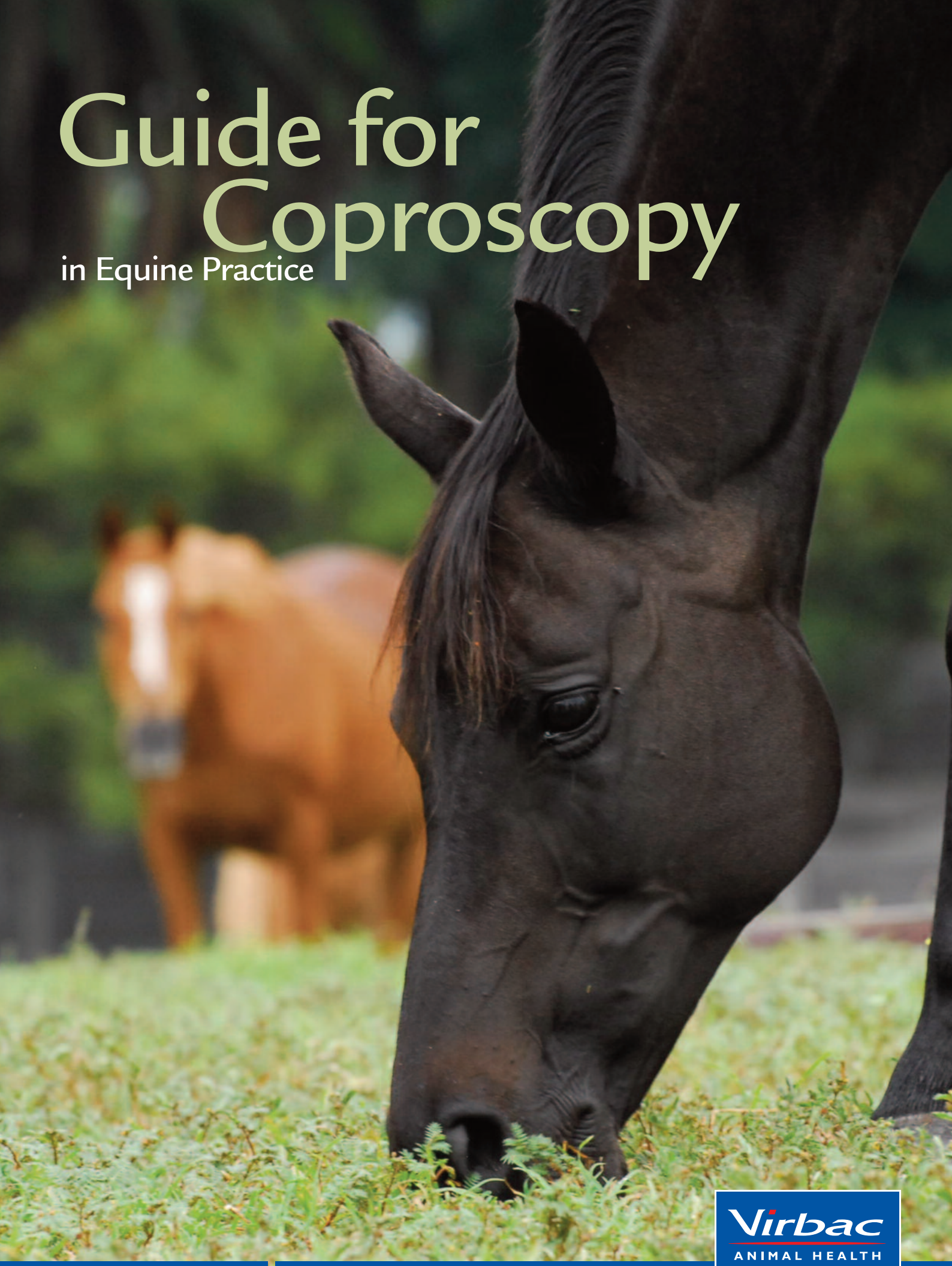
Guide for Coproscopy

in Equine Practice



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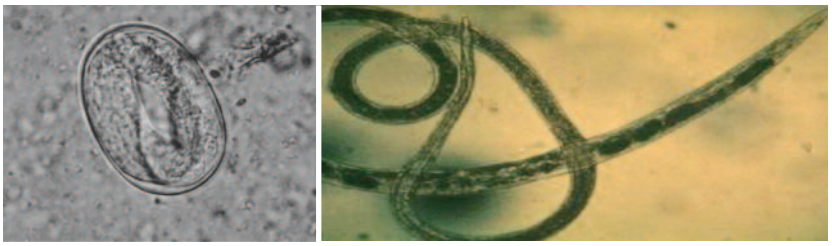
Overview of main parasites

Target	Name	Prevalence (% of horses involved)	Sources of contamination	Location	Pathogenicity
Foals	*Strongyloides westeri* Threadworm	N/P	Milk	Small intestine	Acute colic and diarrhoea
Foals up to 2 years old	*Parascaris equorum* Ascarid	20%	Contaminated horses	Small intestine	Respiratory disorders, colic, diarrhoea, stunted growth (depleted calcium, trace elements, vitamins)
All equids	*Gasterophilus spp* Bots	>60%	Diptera eggs on hair	Stomach	Oral and gastric inflammation
All equids	*Anoplocephala* spp Tapeworm	>60%	Oribatid mites in pasture	Caecum	Colic, impaction, weight loss
Horses of all ages	*Strongylus* spp Large strongyles	30%	Pasture, stalls and paddocks	Colon & caecum	Verminous arteritis (arterial lesions), colic, lameness, anorexia & depression
Horses of all ages	*Cyathostomum* Small strongyles	>80%	Pasture, stalls and paddocks	Colon & caecum	Profuse diarrhoea, colic and poor performance
All equids	*Oxyuris equi* Pinworm	25%	Troughs, stalls and yards	Colon & caecum	Skin lesions & anal pruritus

Strongyloides westeri (Threadworm)



40-52 x 32-40µm. Oval egg, thin shell, with 'stout' larva

Threadworm can infest all equids, but particularly young animals one to four weeks old. Foals become infected by drinking contaminated milk from their dam. In adult horses, threadworm larvae enter via transcutaneous passage. The prepatent period of *S.westeri* is 8-14 days.

Symptoms:

This parasite may cause profuse acute diarrhoea leading rapidly to severe dehydration. This is soon accompanied by weight loss and possible death. Frequent lung disorders due to pulmonary migration during the life cycle of the parasite can occur.

Diagnosis:

In foals, coproscopic observation of fertile eggs and/or larvae. Eggs may be found in the foal's faeces before two weeks of age. In mares, coproscopy is often negative since larvae are present mainly in milk.

Treatment:

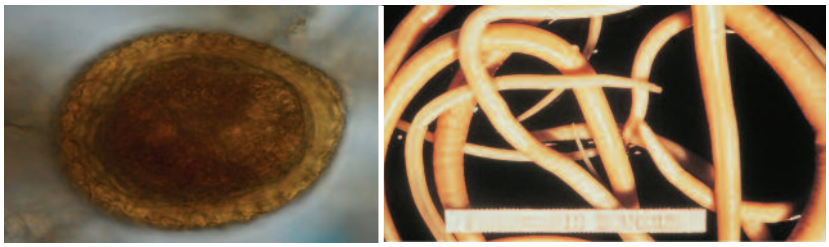
Avermectins (ivermectin or abamectin), at the standard recommended dose is effective against larvae and adults.

To prevent contamination of foals, worming can be recommended for mares two weeks prior to foaling or within 12 hours afterward.

When foals are found to be contaminated, it is necessary to associate the treatment of symptoms with worming twice a month until recovery.

Weekly removal of droppings and management of gestating mares in non-humid pastures help considerably reduce the risk of contamination.

Parascaris equorum (Ascarid or Roundworm)



90-100µm, dark spherical egg with rough thick shell, containing one cell

Ascariasis is very widespread among young equids under two years old. Since adults develop a certain degree of immunity against this parasite, they display few symptoms but represent a major source of contamination for their environment. The prepatent period of *P. equorum* is approximately three months.

Symptoms:

Frequent respiratory disorders appear during migration of larvae in the lungs. Adults developing in the small intestine cause colic, episodes of diarrhoea, dull coat, osteoarticular disorders and poor general condition. Most of these signs are due to calcium, vitamin and energy deficiencies, which inevitably cause growth disorders.

In case of major infestation, intestinal occlusion and even rupture can be observed due to the presence of large numbers of adults in the lumen.

Diagnosis:

With the great diversity of signs, only regular coproscopy to reveal eggs or digestive endoscopy to detect adults can assist in diagnosis. Eggs are spherical and brownish with a thick shell and outer pitted coat. Infected animals may also have low serum albumin levels.

Treatment:

Benzimidazoles, macrocyclic lactones and pyrantel are effective against both larvae and adults. Emerging resistance of *P. equorum* to macrocyclic lactones has recently been reported in several countries around the world. Faecal egg count reduction tests should be performed to identify whether ivermectin or moxidectin are effective on individual animals or properties. If in doubt, anthelmintics containing pyrantel or benzimidazoles should be used instead. Combination products such as Equimax® Elevation should be used to delay the onset of resistance.

It is also important to note that anthelmintics may have an incomplete effect on migrating larvae. This short-term efficacy may lead to a rapid return of clinical signs that must be distinguished from chemo-resistance.

Gasterophilus spp (Botflies)

Third stage larvae in the stomach

Infection with bots is common in horses. Adult botflies are robust dark flies 10 to 15mm long, resembling small bumblebees. The larvae are cylindrical, 16-20mm long and reddish orange in colour. As they develop inside the digestive tract, the parasitic bot larvae cause clinical signs in equids.

Symptoms:

Adult botflies are most active in late summer and trigger frenzied behaviour in horses, mainly during egg laying. Once they reach the stomach (sometimes the duodenum), L3 larvae, often in very large numbers, cause gastritis and dyspepsia as well as occasional mild colic.

The symptoms are relatively discreet in winter, and tend to become more intense starting in late winter to early spring.

An abundance of these parasites can considerably reduce the volume of the stomach by as much as 50%, leading to stunted growth and poor fitness.

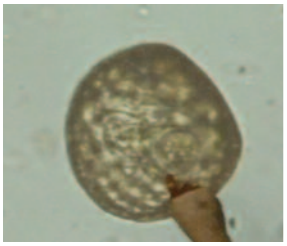
Diagnosis:

Gastroscopy is the only way of obtaining a clear diagnosis since neither coproscopy nor serology are effective in this case.

Treatment:

Removal of bots after they have accumulated in the stomach in late autumn or winter should effectively break the life cycle. Macrocyclic lactones at the standard dose rate have a high activity against developing bot larvae. Where possible, any bot eggs should be removed daily from the horse's coat.

Anoplocephala magna, perfoliata; Paranoplocephala mamillana (Tapeworm)



50-80µm semi-circular egg with hexacanth [embryo]

Tapeworms are a very common parasite in equids, contrary to what the lack of detection techniques have long led us to believe. Tapeworms have a significant role in the appearance of certain types of colic and intestinal disorders, as they usually accumulate around the ileocaecal junction.

Transmission of this parasite requires the presence of tiny forage mites *(Oribatidae* spp*)* which are ingested with the pasture and introduce the intermediate cysticercoid stage of the tapeworm directly into the digestive tract of the host. After ingestion of the mite, it takes one to two months for the cysticercoid stage to develop into adult tapeworms within the small intestine of the horse.

Symptoms:

Their importance is directly linked to the host animal's parasite load.
The parasites adhere preferentially in the ileocaecal junction, where they cause erosion of the mucosa and gradually obstruct the passage of bolus. This may cause intussusception, ileus and blockage of intestinal transit causing bacterial proliferation. All these symptoms appear very rapidly without prior clinical signs.

Diagnosis:

Since standard faecal flotation techniques only occasionally reveal the presence of typical eggs, absence of eggs cannot rule out presence of infection. Serological examination based on the detection of specific IgG can also be performed if necessary.

Treatment:

Total efficacy against all tapeworm species is possible only with praziquantel at the minimum dose of 1 mg/kg. Pyrantel or morantel are effective against *Anoplocephala* spp but not *Paranoplocephala mammillana*. Treatment for tapeworm is recommended at least every six months.

Cyathostomins (Small Strongyles or Redworm)

Grey-brown worm <5cm

The small strongyles (a group of over 40 species) currently represent the most common and most pathogenic intestinal parasites in equids. They are characterized by the presence of large numbers of adults and larvae in the small intestine. Larvae have the ability to become hypobiotic within the intestinal mucosa. The prepatent period is approximately two months.

Symptoms:

The major clinical signs associated with heavy infections in equids two to three years of age are unthriftiness, anaemia and diarrhoea. Signs such as abundant acute diarrhoea, weight loss, colic and oedema of the lowest parts of the body may be observed after mass emergence of hypobiotic L4 larvae, which may result in emaciation and death. In adults, colic is more frequent due to intestinal lesions.

Diagnosis:

Since coproscopy cannot differentiate between the eggs of large and small strongyles, examination of faecal matter often reveals the characteristic small red larvae (hence the term 'redworm').

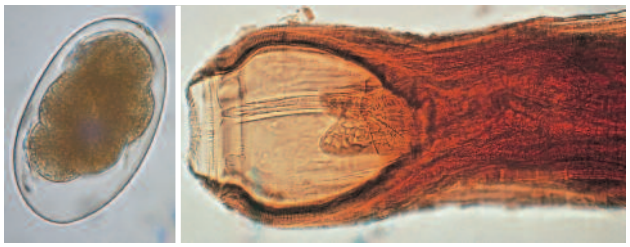
Treatment:

A single dose of moxidectin or ivermectin is effective against adult small strongyles at the manufacturers' recommended dose rates.

There is widespread resistance of small strongyles to benzimidazole anthelmintics (including fenbendazole at higher dose rates). Benzimidazoles should not be used routinely unless testing carried out on a particular property proves that these drugs are still effective.

The exception to this is Strategy-T®, in which the synergistic combination of oxfendazole and pyrantel has been proven to be as effective as ivermectin.

Strongylus spp, *Triodontophorus* spp (Large Strongyles)



70-90 x 40-50µm oval egg, thin shell, with an 8 to 16-cell morula

Large strongyles are not as prevalent as they once were 20 years ago due to widespread anthelmintic use, however, they are still the most pathogenic nematode parasite of horses. These parasites are responsible for colic and various organ lesions due to migration of larvae, and may also cause severe verminous arteritis. The prepatent period is over six months (depending on species).

Symptoms:

Adult worms live in the large intestine and ingest plugs of mucosa, causing ulceration and scarring of the intestinal wall, which in turn lead to fluid losses, hypoproteinaemia, anaemia and ill-thrift. However, the ingested larvae are much more pathogenic, causing endoarteritis of the mesenteric circulation. This results in colic and varying degrees of thromboembolic infarction of the large bowel. These infarctions may cause rupture of the arterial walls and haemorrhage. Other clinical signs may include diarrhoea, anorexia, fever, oedema and weight loss.

Diagnosis:

Detection of aneurysms of the mesenteric artery may be possible via palpation.

Diagnosis is based on the presence of typical oval, thin-shelled, strongyloid eggs. These cannot be differentiated from the eggs of other strongyle species, but may be cultured in order to detect L3 larvae and identify the species.

Treatment:

Most parasiticides are effective against this species at the manufacturers' recommended dose rates.

Oxyuris equi (Pinworm)

90 x 40µm, oval, often larvated egg; smooth relatively thick operculated shell; one side is flattened, the other curved

***Oxyuris equi* is a parasite of the caecum, colon and rectum, characterised by strong sexual dimorphism: females up to 150mm long; males only 9 to 12mm. These pinworms are specific to equids, so there is no risk of zoonosis. The prepatent period is five months.**

Symptoms:

Clinical signs are mainly perineal and anal pruritus due to the presence of female worms laying eggs in this region. This results in a dull hair coat, bare patches, inflammation, scaling and loss of hair around the rump and tail-head. The intense itching may also cause inappetence and restlessness. In extremely rare cases, very high infestation can cause mild colic.

Diagnosis:

Commonly greyish yellow eggs can be seen on the perineal skin, or female worms may be apparent in the faeces. Coproscopy is often negative in case of suspected pinworm infestation. The recommended method of detection is a perianal tape test, with observation under a microscope.

Treatment:

Virtually all internal parasiticides are effective against pinworms.

Since signs of pruritus can persist for up to two weeks after the administration of treatment, it is advisable to avoid assuming the existence of chemo-resistance.

Trichostrongylus axei (Stomach hairworm)

This nematode is not specific to horses and can also infect cattle, sheep, goats, deer, pigs, donkeys and occasionally man. The prepatent period is approximately four weeks in the horse.

Symptoms:
As the name suggests, *T. axei* lives in the stomach and causes gastritis in horses. Initial lesions are circumscribed areas of hyperaemic gastric mucosa which progress to become erosions. These lesions may be associated with necrosis. Over time a chronic proliferative inflammation with shallow ulcers develops.

Diagnosis:
Embryonated eggs can be indentified during routine faecal egg counts.

Treatment:
Most parasiticides are effective against this species at the manufacturers' recommended dose rates.

Dictyocaulus arnfieldi (Equine Lungworm)

The primary host for *D. arnfieldi* is the donkey, though horses grazing on the same pastures may also become infected. While patent infections are common in donkeys of all ages, in horses infection generally only occurs in youngsters. In older horses, the adult lungworms rarely reach sexual maturity. The prepatent period is two to three months.

Symptoms:
Overt clinical signs are rarely seen in donkeys despite widespread prevalence. On auscultation, slight hyperpnoea and harsh lung sounds may be heard. In foals, clinical signs are not usually found, though in older horses infections are often associated with persistent coughing, nasal discharge and increased respiratory rate.

Diagnosis:
In donkeys and foals where infections are patent, embryonated eggs or the first stage larvae can be recovered from fresh faeces. In older horses, diagnosis is made on the basis of clinical signs, contact with donkeys and response to treatment.

Treatment:
Lungworm can be treated successfully using abamectin, ivermectin or benzimidazoles at the standard dose rates.

Draschia spp *and Habronema* spp (Summer sores)

Both *Draschia* spp and *Habronema* spp are parasitic in the stomach of equids, though are important because they cause 'summer sores' or cutaneous habronematidosis in warm climates. The life cycle of both species relies on the fly as an intermediate host necessary for the development of the L3 larvae. Infected flies then pass the larvae from their mouthparts to the skin of the horse, particularly around the mouth, lips and nostrils, where they are swallowed. Development to adult worms takes place in the stomach mucosa within approximately eight weeks. Larvae deposited onto open sores can invade surrounding tissues causing granulomatous reactions, but do not complete their development into adult worms.

Symptoms:
Generally the presence of adult worms in the stomach causes very few clinical signs in equids of any age. There may be intense pruritis associated with cutaneous lesions. Non-healing reddish-brown granulomatous lesions may be up to 8cm in diameter and raised above the surface of the skin. Persistant conjunctivitis with nodular ulcers may occur if lesions are present around the eyes, particularly at the medial canthus.

Diagnosis:
Only low numbers of eggs or larvae are generally present in the faeces, so diagnosis of gastric infections is difficult. Occasionally eggs may be identified in samples taken by gastric lavage via a stomach tube. Larvae may be identified in granulomatous skin lesions, where they can be recognised by the shiny knobs on their tails. Warm weather and the presence of flies increase the likelihood of diagnosis.

Treatment:
Most available anthelmintic preparations can be used to treat worms in the stomach of infected horses. Ivermectin or abamectin at the manufacturers' suggested dose rates should be used for cutaneous lesions.

Onchocera spp (Summer mange)

The life cycle of *Onchocera* spp involves microfilariae that occur in the tissue spaces of the skin rather than the peripheral bloodstream. Predilection sites include the connective tissue of the flexor tendons and suspensory ligament of the fetlocks. Biting midges (*Culicoides* spp) feed in these areas and ingest the microfilariae, which then take three weeks to develop into the infective stage within the midge intermediate host. The midge then feeds on another equine host and transmission of the infective L3 occurs.
The prepatent period is 12-16 months.

Symptoms:
While there is very little evidence of infection with adult worms, the presence of microfilariae causes a chronic seasonal dermatitis which is severe in summer and absent in winter. Signs are often indistinguishable from *Culicoides* hypersensitivity (Queensland Itch) and include alopecia, scaling and crusting, often accompanied by secondary excoriations and ulceration due to self-trauma. Soft, palpable, painless swellings often occur in the lower limbs, which become small fibrous nodules.

Diagnosis:
Microfilariae can be identified from thick sections of skin taken from affected areas.

Treatment:
Ivermectin and abamectin have good activity against the microfilarial stages when used at the recommended dose rates.

Coproscopy in equine practice

Purpose

- Detection of parasite infestation due to adult parasites in the digestive tract (also, though less often in the respiratory tract)
- Monitoring of the condition of an individual or group with respect to parasites
- Checking the efficacy of worming
- Guide to preparing a well-reasoned worming plan

It is important to emphasize that a horse's general condition is only very rarely correlated with its parasite load. An apparently healthy looking horse may carry a large number of strongyles, which means it can seriously contaminate its environment.

1. Taking samples:

a. Harvesting

Ideally individual (be certain to identify each sample clearly); if collective, it is necessary to homogenize the sample as completely as possible. For screening, it is possible to group several samples just before proceeding with coprological analysis to determine whether a particular batch of animals excrete strongyle eggs. This provides for initial screening before proceeding with individual analysis of animals in a batch identified as 'excreting'.

Samples may be collected *per rectum* (preferred method) or simply excreted (though may be contaminated by environmental nematodes). Collect samples in specimen jars, ziplock bags or sampling gloves tied at the tops.

Approximately 500g sample is required for a standard test.

b. Storage

Aim to limit the evolution of parasite stages, or even cause their degradation, while reducing the risk of contamination.

Promote anaerobiosis by expelling air from the glove, ziplock bag or any other container.

If sample taking and coproscopic analysis are performed separately, it is necessary to limit the development of parasites by:

- refrigeration at +4°C
  This preserves the sample for a maximum of two to three days, reduces adulteration of structures and provides for subsequent faecal culture.
- freezing at -10°C (partial destruction of eggs may occur)
  This is useful for long-term preservation, but there is a risk of certain structures bursting. The sample cannot be used for faecal culture.
- dilution in an 8% solution of formaldehyde in water
  This is good for long-term preservation, but precludes quantification (dilution) and faecal culture.

NB: If lungworm infection is suspected, analysis must be made immediately.

2. Analysis

a. Macroscopic - *see Appendix "Identification of Macroscopic Elements"*

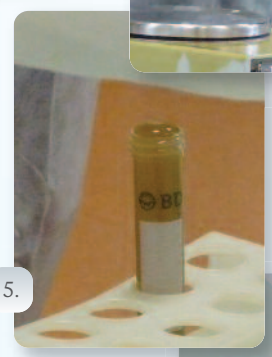
2. Analysis

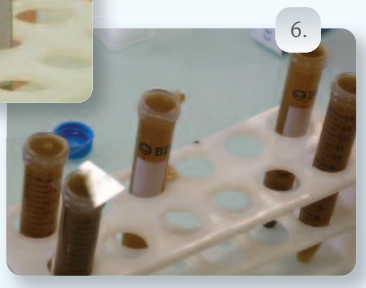
b. Microscopic (flotation method)

In the flotation method, the sample is diluted in a high-density solution to enable the parasitic elements to rise to the surface of the liquid.

Equipment required:

Mortar and pestle
Digital scale
Tea strainer
Graduated glassware
Graduated cylinders or Erlenmeyer flasks
Test tubes
Agitators
Slides and coverslips
Willis solution (saturated aqueous NaCl solution, d=1.20) or MgSO4





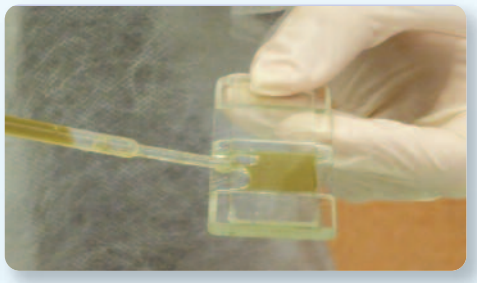
Procedure:

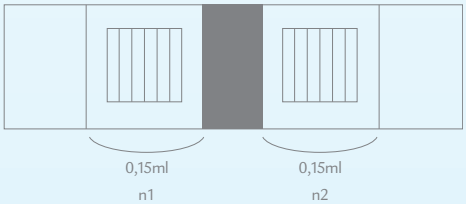
1. Homogenise the sample as much as possible.
2. Carefully weigh 5g of droppings.
3. Add to 75ml of Willis solution in a graduated cylinder and homogenise.
4. Filter the mixture through a tea strainer.
5. Pour some of the mixture into a test tube to the brim to obtain a convex meniscus.
6. Place a coverslip on top of the tube, avoiding the formation of air bubbles.
7. Let stand for approximately 20 minutes.
8. Remove the coverslip and place it on a microscope slide.

Quantitative evaluation:

1. Homogenise the sample as much as possible.
2. Carefully weigh 5g of droppings.
3. Add to 75ml Willis solution in a graduated cylinder and homogenise.
4. Filter the mixture through a tea strainer.
5. Take up approximately 1ml of liquid using a syringe.
6. Fill the 2 compartments of the McMaster cell* with this liquid (see picture to right).
7. Let stand for approximately 10 minutes, enough time for the eggs to stick to the surface of each McMaster cell compartment.
8. Observe each compartment through a x10 lens.
9. Count the eggs in each of the two small squares (n1 and n2).
10. Calculate the mean: m = (n1 + n2)/2 then multiply by 100 to obtain the EGP (egg count per gram) for the total sample.

If no eggs are observed in the cells, extend the observation to the entire McMaster slide and calculate the EPG value by multiplying the total number of eggs counted by 15.





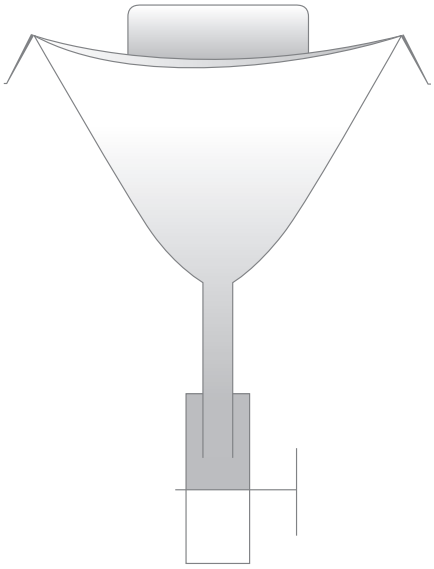
*Description of McMaster slides:

Slide made up of two 0.15ml chambers separated by a partition. A 1cm square, divided into six columns 1.7mm wide, is etched on top of each chamber.

3. Faecal culture (10 to 15 days)

1. Place samples of fresh droppings inside small containers (Petri dishes).
2. Maintain the hygrometry in the Petri dishes between 50 and 80% (with water-soaked cotton).
3. Keep these samples at room temperature away from light.
4. Make certain they are oxygenated daily.

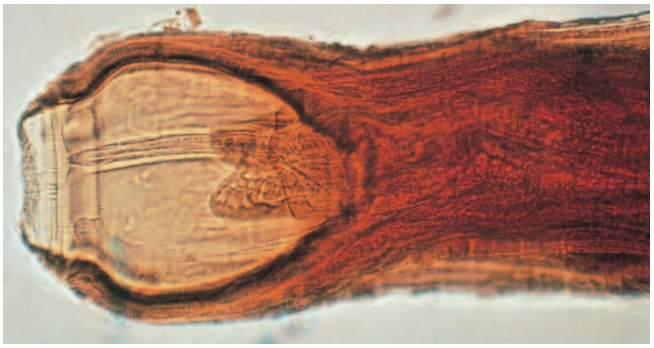
Trapping larvae (Baermann funnel):



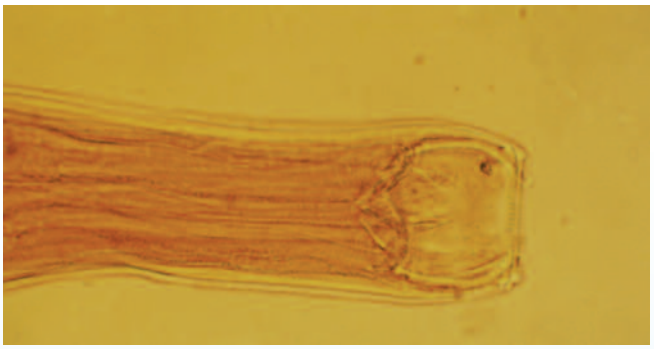
1. Place 20g of droppings in gauze on a sieve.
2. Connect the funnel with a rubber tube equipped with a tap or clamp.
3. Position the sieve at the upper end of the funnel and fill the funnel with water until the sieve is in contact with the water (wetting the gauze).
4. Leave in place at least eight hours.
5. Harvest the first 5ml of the solution obtained by opening the tap or clamp.
6. Observe the larvae under a binocular microscope.
7. To identify them, take samples with a pipette and place each one under the microscope. Lugol can be used to kill them, which also facilitates identification.

This method is recommended in cases of suspected larval cyathostomiasis (Olsen *et al.* 2003) as well as for identifying the different strongyles present in the sample.

Large strongyle:



Small strongyle:



4. Interpretation

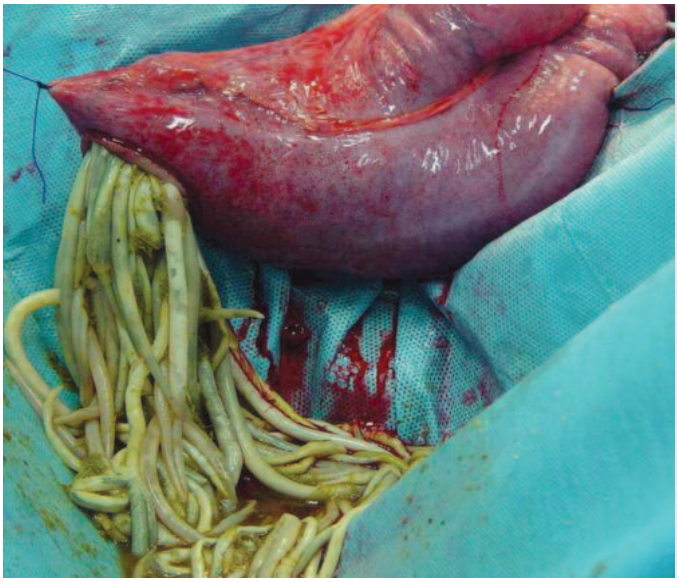
Although coproscopy is unable to detect parasite infestation due to encysted or immature larval stages, it remains reliable nonetheless for identifying parasites in horses. It is also useful for quantitative evaluation of those horses excreting the largest amounts of strongyle eggs in a herd, in order to administer targeted treatment.

In the absence of other clinical signs, animals having an EPG <200 may not require treatment. This threshold value is the collectively accepted limit, but it must be remembered that there is no correlation between egg count and number of adult strongyles present in the large intestine.

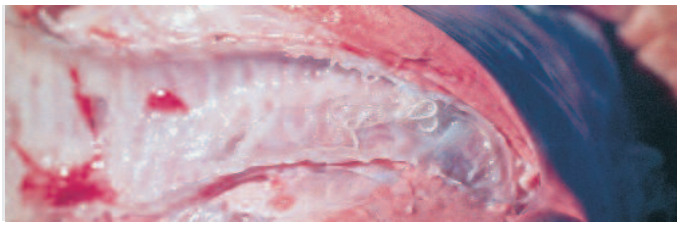
It seems a trend can be observed (at least for strongyles): horses excreting a small amount of eggs in an initial coproscopic examination tend to excrete a limited number of eggs over time, while heavily infested horses remain so and excrete large numbers of eggs in the long term.

For certain parasites – *D. arnfieldi* in all horses, and *P. equorum* in young horses - the detection of eggs even in very small amounts requires specific treatment.

Similarly, the identification of *S. vulgaris* in faecal culture, even in small amounts, justifies treatment.



Impaction colic in a foal caused by *P. equorum* infestation



D. arnfieldi in the trachea of a horse

Pinworms

Rarely found in droppings, pinworm eggs naturally adhere to the external peripheral area of the anus.

They may be diagnosed by applying a piece of transparent adhesive tape around the anus, then sticking this to a slide for observation under a microscope (x10 or x40 lens). To enhance transparency, it is advisable to add a drop of water under the adhesive tape before observation.

NB: It is recommended that the area of the sample be carefully cleaned the day before to reduce the presence of foreign material.

Anoplocephala

The presence of a single *Anoplocephala* egg characterized by its virtually triangular shape, thick shell and the presence of a hexacanth inside, indicates the presence of this parasite in the horse from which the sample was taken.

Conversely, the absence of eggs is no guarantee that the parasite is not present, because of its irregular egg-laying patterns. If anoplocephalosis is suspected, serology is preferable to coproscopy.

Summary table of internal parasites (nematodes and platyhelminths) present in equids in Australia

Parasites	Prevalence in Australia	Clinical signs
Cyathostomes	High	Chronic diarrhoea, weight loss, stunted growth, acute larval cyathostomiasis, hypoproteinaemia, possible anaemia
Ascarids *(P. equorum)*	High (foals and young horses)	Diarrhoea, weight loss, colic, risk of occlusion, intussusception and perforation of the small intestine
Large strongyles *(incl S. vulgaris)*	Low to medium	Thromboembolic colic, anaemia
Tapeworm	High	Risk of colic
Bot fly *(Gastrophilus)*	High	Mild colic
Threadworm *(S. westeri)*	Medium	Diarrhoea in very young foals
Pinworm *(Oxyuris)*	Medium to high	Anal pruritus
Stomach hairworm *(T. axei)*	Medium	Moderate gastritis
Lungworm *(D. arnfieldi)*	High in donkeys	Rare but pronounced respiratory symptoms in horses
Habronema, Drashia, Onchocera	Rare	Skin lesions

5. Assessing anthelmintic resistance

At present there is no direct method for identifying anthelmintic resistance in horses. The only test available at present to verify the efficacy of an anthelmintic is the *Faecal Egg Count Reduction Test.*

The test may be practised as follows:

- the efficacy of an anthelmintic is assessed through the percentage of egg count reduction per gram of faeces before and after anthelmintic treatment.
- results cannot be interpreted on an individual level: the efficacy of treatment must be tested.
- faecal matter is sampled just before and 10 to 14 days after anthelmintic treatment and the reduction is calculated according to one of the following formulas:

$$\text{Reduction} = \frac{(\text{egg count/g before treatment}) - (\text{egg count/g after treatment})}{(\text{egg count/g before treatment}) \times 100\%}$$

(Formula from Powers et al. 1982)

$$\text{Reduction} = (1 - T/C) \times 100$$

where T and C are arithmetic means obtained before and after treatment, respectively.

(Formula from Coles et al. 1992)

The mean of the percentages obtained must then be calculated. The threshold value of the percentage of egg-count reduction varies with the compounds involved (95% for fenbendazole, ivermectin and moxidectin; 90% for pyrantel). Below these values, an anthelmintic is considered to display less efficacy and resistance phenomena are suspected.

It is possible to confirm some forms of resistance with *in vitro* tests performed by specialized laboratories.

Because of the growing risk of resistance, it is advisable to **perform at least one efficacy test a year.**

It is also possible to assess the efficacy of treatment more roughly through faecal analysis 10 to 14 days after treatment (without counting the eggs before treatment).

Appendices:

IDENTIFICATION OF MACROSCOPIC ELEMENTS

- Rigid pupa >1.5cm → *Gasterophilus* spp
- Worm, circular in section
  - Whitish
    - Constant diameter of the worm → *Parascaris equorum*
    - Long pin-like tail → *Oxyuris equi*
  - Grey, brownish, splinter-like shape <5cm → *Strongylus* spp (adult)
  - Red to pinkish
    - >5cm with long pin-like tail → *Oxyuris equi*
    - *Capillaria* in large numbers → Trichonema larvae (cyathostomin)
- Flatworm, segmented, small segments broader than they are high (Anoplocephalidae)
  - T>5cm → *Anoplocephala magna*
  - 2cm<T<5cm → *Paranoplocephala mamillana*
  - T<2cm → *Anoplocephala perfoliata*

IDENTIFICATION OF EGGS AND CYSTS

- Very small spherical elements <15µm
- Worm, circular in section
  - Refringent shell, 2 to 4 nuclei and residue of flagella → *Giardia equi*
  - Sporulated oocyst, <6µm → *Cryptosporidium parvum*
- Large Elements (>25µm)
  - Spherical egg, thick shell, pigmented, single cell → *Parascaris equorum*
  - Semi-spherical egg, thick shell, hexacanth → Anoplocephalidae
  - Oval egg
    - Unoperculated egg

      With larva
      - Very elongated egg → *Habronema* spp
      - More ovoid egg (Length/Height<4)
        - Stout larva → *Strongyloides westeri*
        - Thin larva → *Dictyocaulus arnfieldi*

      With no larva
      - Thin shell, morula *in situ* → Large and small strongyles
      - Very thick brown shell, presence of a micropyle → *Eimeria leuckarti*

    - Operculated egg

      With larva → ***Oxyuris equi***

      With no larva
      - Thick shell, non-parallel edges → *Oxyuris equi*
      - Thin smooth shell, >100µm → *Fasciola hepatica*

IDENTIFICATION OF LARVAE

- Rhabditoid larva (280µm) → ***Strongyloides westeri***
- Strongyloid larva
  - > 400µm, presence of intestinal granulation → *Dictyocaulus arnfieldi*
  - > 110µm, presence of anterior spine → *Habronema* spp

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