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Chapter 2. Selecting and using anthelmintics appropriately

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Overview

The need for anthelmintics must be balanced carefully against the potential harms to the equine population through the promotion of resistance, and potential harms to the environment through the ecotoxic effects of many of the anthelmintics used. In general, the risk of parasitic diseases in adult horses is low and most well managed horses require little in the way of anthelmintic treatment. Parasite risk and the need to treat is determined by a number of factors (see Chapter 1.3. A risk assessment-based approach to equine parasite control in adult horses).

Knowledge and attitudes have changed dramatically since the anthelmintics currently used were first developed and registered. The sector should act in accordance with current best evidence as laid out in these guidelines. As resistance likely increases and new evidence comes to light, recommendations continually evolve; these guidelines will evolve to provide prescribers with a framework to follow.

It is no longer acceptable to dispense anthelmintics on an *ad-hoc* basis, they should only be prescribed as part of a planned and co-ordinated programme of parasite control that has management at its core and seeks to minimise the need for anthelmintics. The management on every property is different and there is no single correct way of integrating anthelmintics into parasite control that is appropriate for every situation. The need for anthelmintics should be reviewed in the plan that is developed for each property on an annual basis and should consider the results of monitoring tools and other appropriate tests in previous years, the risk factor table (see Chapter 1.3. A risk assessment-based approach to equine parasite control in adult horses), known patterns of resistance on the yard (informed by the results of annual faecal egg count reduction tests [FECRTs]), any known or suspected parasite-related disease and any anticipated changes in management on the property. Regular monitoring tests should be scheduled, and on obtaining the results, the need for treatment discussed with the owner in light of the yard plan, level of risk and wider management considerations.

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Where the yard plan for parasite control identifies the need for administration of an anthelmintic, this chapter aims to provide guidance regarding how to select and use that anthelmintic appropriately.

Chapter 2.1. Determining which anthelmintic to administer to adult horses

Cyathostomins (small strongyles)

All horses are likely to be infected with cyathostomins (Figure 1), and the aim of control is to keep burdens at a safe level whilst minimising the risk of disease. This is typically achieved through performing faecal egg counts (FECs) on all horses and only treating those horses that are excreting high numbers of eggs to limit the number of infective eggs on pasture (see Chapter 6. Reducing the dependence on anthelmintics, section on cyathostomin overdispersion). Based on the recommended FEC thresholds for consideration of treatment (see Chapter 1.2. Using monitoring tools effectively to determine the need for anthelmintic treatment), only a small proportion of horses should require treatment on any occasion.

Figure 1. Cyathostomins excreted in faeces

Anthelmintic classes authorised for treating adult cyathostomin infections in adult horses:

- Benzimidazoles (e.g., fenbendazole)

- Tetrahydropyrimidines (pyrantel salts)
- Macrocyclic lactones (ivermectin and moxidectin).

Resistance in cyathostomins (based on reduced FECRTs) to the benzimidazoles is widespread in the UK and resistance to the tetrahydropyrimidines class of anthelmintic has been detected on some premises. Evidence of reduced effectiveness of macrocyclic lactone anthelmintics (especially reduced egg reappearance periods after treatment) is also commonplace, with resistance, detected by the FECRT, demonstrated in some regions (Nielsen *et al*, 2022a).

Anthelmintic treatment during the grazing season

In view of the widespread resistance to the benzimidazole drugs in cyathostomins in many regions, including the UK, the routine use of this particular anthelmintic class for treatment of cyathostomins is not advised if FECRTs have not been performed to confirm that this active substance remains effective and there is no resistance. Indeed, tetrahydropyrimidine resistance has been recognised in some areas, so a FECRT for this drug class is also advised. If FECRT data for animals on that premises is not available, the choice of which drug to use can be based on other available information, for example that macrocyclic lactone products are most likely to reduce faecal egg shedding, albeit for a much shorter time than when the products were first authorised. However, there are concerns over the environmental impacts of macrocyclic lactones (see Chapter 7. Environmental considerations) and the recent emergence of reports of resistance in the UK (Table 1). Therefore, it is acknowledged that the use of the FECRT to inform anthelmintic selection is considered best practice and recommended.

Considerations when selecting a macrocyclic lactone to prescribe to adult horses during the grazing season:

- It is not considered practical to reserve the use of moxidectin for specific uses (e.g. to treat disease) when choosing which macrocyclic lactone to prescribe.
- Resistance may develop to the anthelmintic group, not the individual product/active.
- Ivermectin is in the same drug class as moxidectin (macrocyclic lactone), and therefore likely has a similar mode of action. As such, it may be inappropriate to

discourage the use of ivermectin to protect the use of moxidectin for specific uses, as there may not be other options available based on global drug resistance findings.

- Moxidectin preparations have marketing authorisation in the UK for the treatment of adults, and intraluminal and mucosal larval stages of cyathostomins (as assessed at 8 weeks post treatment), but the clinical benefit to the horse is unknown.
- Ivermectin is considered to be more effective for the management of bots (Reinemeyer *et al.*, 2015).
- Ivermectin is more ecotoxic than moxidectin (see Chapter 7. Environmental considerations).

Larvicidal anthelmintic treatment at the end of the grazing season

Anthelmintic classes authorised for treating encysted mucosal (L3 and L4) and encysted inhibited (L3) cyathostomin larvae in adult horses:

- Benzimidazoles (fenbendazole – 5-day course)
- Macrocyclic lactones (moxidectin).

In view of the ability of cyathostomin larvae to accumulate in the large intestinal wall and the role that these larvae play in the pathogenesis of acute larval cyathostominosis, it had become common practice for all horses to be administered an annual larvicidal treatment at the end of the grazing season (autumn/early winter). However, it is not currently known whether or not a strategic application of a larvicidal treatment to a group of horses with a variation in cyathostomin burdens in the autumn reduces the risk of disease. Therefore, it is important to perform risk assessments, and to monitor FECs throughout the grazing season to prevent the development of large larval burdens through targeted anthelmintic treatments to moderate-high egg shedding horses and appropriate pasture management, rather than relying on a routine larvicidal treatment at the end of the grazing season.

In many cases, routine larvicidal treatment is not considered necessary in mature horses and should be avoided in horses that are well managed and are at low risk of

disease (see Chapter 1.3. A risk assessment-based approach to equine parasite control in adult horses). In low-risk situations, the small redworm ELISA test can be useful to confirm that the horses do not require blanket larvicidal treatment, although false positives will occur, especially if a sufficient period (i.e. at least 4 months) has not lapsed since the last anthelmintic treatment (Lightbody *et al.*, 2024).

However, young horses and older horses with a higher risk of a high encysted larval burden (see Chapter 1.3. A risk assessment-based approach to equine parasite control in adult horses) should be considered for a routine treatment with larvicidal treatment in autumn/early winter.

Anthelmintic selection should be based on a case-by-case risk assessment (see Chapter 1.3. A risk assessment-based approach to equine parasite control in adult horses); if larvicidal treatment is required either moxidectin or a 5-day course of fenbendazole would be appropriate as there is no evidence that one is more efficacious than the other for larvicidal treatment. As there is widespread resistance to benzimidazole anthelmintics, however, a FECRT should be performed to confirm susceptibility of the target parasite population.

Tapeworms

Most horses tend to have relatively few tapeworms, which are unlikely to cause clinical signs. Infection can occur at any time of year and the traditional approach to treating over the winter (or spring and autumn) to break the parasite lifecycle is no longer thought to be appropriate (Rendle *et al.,* 2024). The risk of infection with tapeworms increases with access to grazing and is influenced by how horses are managed on the yard. There are effective tests for assessing exposure to tapeworms (see Chapter 1.2. Using monitoring tools effectively to determine the need for anthelmintic treatment) and it is not appropriate to treat without first performing a test to see whether treatment is required. The required frequency of testing should be determined through reference to the risk table (see Chapter 1.3. A risk assessment-based approach to equine parasite control in adult horses) as part of the development of the parasite control programme for the yard. For horses categorised as low risk, testing once per year is likely to be sufficient.

Anthelmintic classes authorised for treating tapeworm (*A. perfoliata*) infections in adult horses:

- Tetrahydropyrimidines – pyrantel embonate (used at double the "normal" roundworm dose)
- Isoquinoline-Pyrozines – praziquantel*.

*Praziquantel is currently only available in authorised fixed-combination products also containing ivermectin or moxidectin (if activity against other parasites is also required). However, there is no single-active product containing praziquantel currently authorised for use in horses in the UK. Praziquantel, as a single active product, is available as an extemporaneous ('special') formulation upon request by a veterinary surgeon in the UK.

To date, there are no confirmed reports in the UK of resistance to either pyrantel embonate or praziquantel in tapeworms. Although there is anecdotal evidence of treatment failure of both actives against *A. perfoliata*, it has not been specifically investigated in the UK. Apparent treatment failure of praziquantel and pyrantel pamoate has been reported in the USA (Nielsen, 2023).

When identifying tapeworm infection, if there is no indication of a need to also treat for a concurrent nematode infection (cyathostomins or other species), either pyrantel used at double the "normal" roundworm dose or a praziquantel-only product would be appropriate choices of treatments as there is little difference in efficacy. It is acknowledged that use of a narrow spectrum anthelmintic (e.g. a praziquantel-only product) is considered best practice to spare selection pressure against other drugs that are needed for treating other parasites. Note that there is no longer an authorised praziquantel product, however a praziquantel-only product is available as an extemporaneous formulation that can be prescribed by veterinary surgeons.

Praziquantel in combination with a macrocyclic lactone, or pyrantel used at double the "normal" roundworm dose, would be appropriate treatments for tapeworm when there is a concurrent strongyle burden, depending on the resistance profile and other risk assessment factors such as time of year. Anthelmintic selection should be informed by FECRT data.

Oxyuris equi (equine pinworm)

See Chapter 9.1. Pinworms.

Parascaris spp. (ascarids)

Adult horses rarely need treating for *Parascaris* spp. unless indicated by positive FEC. Information on anthelmintics authorised for use against *Parascaris* spp. and their current resistance profiles can be found below in the foals and yearlings section on ascarids.

Strongylus vulgaris (large strongyles)

There is concern that the reduction or cessation of routine use of anthelmintics may be associated with an increased risk of disease associated with the migration of large strongyles through the abdomen. Prior to the routine use of anthelmintics, *Strongylus vulgaris* was associated with fatal cases of colic. In countries where use of anthelmintics has been legally restricted, the prevalence of *S. vulgaris*-associated disease (primarily non-strangulating intestinal infarction resulting in peritonitis with or without colic) has increased. The level of risk currently seems to be relatively small, however as the consequences are potentially grave, the annual use of ivermectin or moxidectin has been proposed as a means of reducing the risk of strongyle-related disease in horses at higher risk of disease (see Chapter 1.3. A risk assessment-based approach to equine parasite control in adult horses). The need for preventative treatment aimed specifically at *S. vulgaris* needs to be risk assessed in each case.

Anthelmintic classes authorised for treating *S. vulgaris* infections in adult horses:

- Benzimidazoles (fenbendazole)
- Tetrahydropyrimidines (pyrantel salts)
- Macrocyclic lactones (ivermectin and moxidectin), which have a license for the treatment of the pathogenic arterial stages.

Identification of patent *S. vulgaris* infections can be assessed using faecal larval cultures or PCR, but these tests cannot detect pre-patent infections by *S. vulgaris* larvae. If detected, the parasite should be sensitive to all anthelmintic classes, but

macrocyclic lactones are recommended due to their efficacy against the pathogenic migrating larvae (fourth and fifth stage larvae) of this parasite.

Management of bots

There is no evidence that the larvae in the stomach are associated with gastric ulceration or other disease, therefore no specific treatment is necessary. Specific treatment may be indicated where larvae are associated with oral lesions.

Anthelmintic classes authorised for treating bots:

- Macrocyclic lactones (ivermectin and moxidectin).

Moxidectin appears to be less effective than ivermectin (Reinemeyer, 2015). Fly control may reduce the risk of infection but may be associated with detrimental ecotoxic effects. The bright yellow eggs of *G. intestinalis* (the common bot) are easy to see and can be removed with regular grooming to reduce the numbers of eggs ingested.

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Chapter 2.2. Current resistance profiles of the classes of anthelmintics

Table 1 provides a summary of the classes of anthelmintics that are authorised for use in horses and their current resistance profiles. Note that there are fewer anthelmintics authorised for use in donkeys (see Chapter 10. Donkeys and hybrids). Not all products containing the actives in Table 1 will be indicated for these parasite species, therefore, prior to final product choice the SPC and product literature should be referred to.

It is important to check the effectiveness of anthelmintics in parasite populations regularly to assess whether the administered products have the expected effect (See Chapter 4. Testing for anthelmintic resistance). Consistent reporting of all cases where there is suspected lack of efficacy is essential to ongoing monitoring of veterinary medicines (See Chapter 5. Reporting lack of efficacy).

Key for Table 1:

	Remains effective for indicated use
	Resistance emerging or suspected – FECRT should be performed where possible
	Some resistance reported – FECRT should be performed
	Resistance common – should only be used with supportive FECRT results
	Not indicated for use for treatment

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Table 1. Current resistance status of the active substances for treatment of key parasites of concern in equines

		Fenbendazole	Pyrantel	Ivermectin	Moxidectin	Praziquantel
Cyathostomins	Adults	**Resistance is common** Should only be used with supportive FECRT results	**Resistance reported** FECRT should be performed to confirm efficacy	Complete resistance considered uncommon but **shortened egg reappearance periods** are now a common finding	**Shortened egg reappearance periods** are now being reported and resistance recently reported in the UK	Not indicated
	Encysted larvae	5-day course **Resistance is common** and use for 5 consecutive days does not overcome it Should only be used with supportive FECRT results	Not indicated	Not indicated Effective against luminal larvae	**Shortened egg reappearance periods** are now being reported and resistance recently reported in the UK	Not indicated
Strongylus spp.	(adults)	Assumed to remain effective	Assumed to remain effective	Assumed to remain effective	Assumed to remain effective	Not indicated
Parascaris	spp.	**Some resistance** now reported FECRT should be performed	**Some resistance** now reported FECRT should be performed	**Resistance is common** Should only be used with FECRT	**Resistance is common** Should only be used with FECRT	Not indicated

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	Fenbendazole	Pyrantel	Ivermectin	Moxidectin	Praziquantel
Strongyloides westeri	Assumed to remain effective	Not indicated	Assumed to remain effective[1]	Assumed to remain effective	Not indicated
Anoplocephala spp.	Not indicated	Effective when used at double the "normal" roundworm dose **Resistance status undetermined** – reports of resistance emerging from the US	Not indicated	Not indicated	**Resistance undetermined but suspected** but generally appears to remain highly effective – reports of resistance emerging from the US
Oxyuris equi	Considered the most effective treatment Clinical responses may still be poor	Considered effective Clinical responses are often poor	**Resistance documented** Clinical responses are often poor	**Resistance documented** Clinical responses are often poor	Not indicated
Dictyocaulus arnfieldi	Not indicated	Not indicated	Effective against adults and larval stages[1]	Not indicated	Not indicated
Gasterophilus	Not indicated	Not indicated	Effective Specific treatment is not considered necessary	Less effective than ivermectin	Not indicated

[1] Not all authorised products have this indication

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Chapter 2.3. Determining which anthelmintic to administer to foals and yearlings

Alongside choosing the appropriate anthelmintic for the target parasite(s), it is important to remember that there are differing minimum age restrictions on anthelmintic products (summarised below). The SPC of the anthelmintic should always be consulted prior to prescription to ensure the product is authorised for use in the age of the foal in question (New Chapter 11 – Foals, weanlings, yearlings and youngstock).

Anthelmintic classes authorised for use in foals and yearlings:

Single active products

- Benzimidazoles (fenbendazole) – young foals can be safely treated with fenbendazole
- Tetrahydropyrimidines (pyrantel salts) – **not for use in foals less than 4 weeks of age**
- Macrocyclic lactones (ivermectin and moxidectin) – **moxidectin is not authorised for use in foals less than 4 months of age**, however ivermectin can be used in foals over 2 weeks of age
- Isoquinoline-Pyrozines – praziquantel[2].

Combination products

- Moxidectin and praziquantel combinations are not authorised for use in foals less than 6.5 months of age
- Ivermectin and praziquantel combinations can be administered to foals over 2 weeks of age.

[2] Note there is no single-active product containing praziquantel currently authorised for use in horses in the UK. Praziquantel, as a single active product, is available as an extemporaneous ('special') formulation upon request by a veterinary surgeon in the UK. However, recommendations cannot be made regarding the minimum age for safe use of this extemporaneous preparation for use in foals and yearlings.

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Integrating anthelmintics to prevent parasite-related disease in foals and yearlings

The approach to anthelmintic selection in foals and yearlings differs somewhat from that in adult horses due to additional parasitic considerations (including *Parascaris* spp. which are parasites of significant clinical importance and *Strongyloides westeri* which is occasionally associated with disease), minimum age restrictions on anthelmintics and timings for when testing is appropriate.

Additional parasites to consider in foals and yearlings

Parascaris spp. (ascarids)

Anthelmintic classes authorised for treating ascarid infections:

- Benzimidazoles (fenbendazole)
- Tetrahydropyrimidines (pyrantel salts)
- Macrocyclic lactones (ivermectin and moxidectin), but resistance common.

Resistance to anthelmintics is now very common among ascarids and ascarid-related disease in foals appears to be increasing. Resistance in *Parascaris* spp. to ivermectin and moxidectin is more common than resistance to pyrantel, and then to fenbendazole (Nielsen 2022). However, resistance patterns are not predictable and FECRTs should be performed in foals, especially on studs, to establish local resistance patterns. FECs can be used to assess and limit pasture contamination, but as foals are more susceptible to parasite-related disease, most will require some strategic treatments with an anthelmintic that is effective against the local ascarid population. Although routine treatment of all foals is recommended, it has the consequence of increasing the risk of resistance. The prescriber should therefore develop a plan that is specific to the stud and its local resistance patterns.

Strongyloides westeri (threadworm)

Strongyloides westeri is occasionally associated with mild to moderate gastrointestinal disease in foals. Treatment should therefore be reserved for foals with clinical signs of diarrhoea where high levels of *Strongyloides* eggs are being shed. A veterinary surgeon should be consulted to ensure there are no other causes of diarrhoea. Preventative

treatment is not warranted in the absence of clinical signs in foals with high levels of *Strongyloides* egg shedding unless there is a history of associated clinical disease in foals on the premises. Routine treatment of mares prior to foaling used to be practiced on some studs, but the clinical impact of such treatments has not been proven and is likely to contribute to the development of resistance in other parasites.

Anthelmintic classes authorised for treating *Strongyloides westeri* infections:

- Benzimidazoles (fenbendazole)
- Macrocyclic lactones (ivermectin and moxidectin).

Not all products containing these actives will be indicated for *S. westeri*, therefore, prior to final product choice the SPC and product literature should be referred to.

Utilising an age-based approach to guide the use of monitoring tools and anthelmintic selection in foals and yearlings

Foals up to 4 months-old

To target *Parascaris* spp., foals **up to 4 months-old** should be administered an effective anthelmintic such as fenbendazole (single standard label dose) at 2-3 months. This anthelmintic is recommended because of the possibility of resistance to macrocyclic lactones, and the risk of moxidectin toxicity in foals.

Targeted treatments for *Parascaris* spp. informed by FEC testing are **not** recommended in **foals up to 4 months-old** because this parasite has a prepatent period of 10 weeks or over and the larval stages can be pathogenic.

Foals 4-9 months-old

At **4-9 months old**, the foal should be treated according to the predominant type of helminth egg seen when performing the FEC. For example, fenbendazole or pyrantel to treat *Parascaris* species. Care should be taken when administering tetrahydropyrimidines (pyrantel salts) since the mechanism of action involves paralysis of the parasites, which might predispose to intestinal impactions by ascarids in foals with high burdens of *Parascaris* spp. To treat cyathostomins, if FECRT data are available for pyrantel and it has good efficacy on that farm, this compound could be an appropriate treatment of choice against cyathostomins, however if FECRT data are not

available, the treatment of choice would be dependent on which active is most likely to have good efficacy, which would be a macrocyclic lactone. The decision on which macrocyclic lactone to select (i.e. ivermectin or moxidectin) would depend on whether there is likely to be a high larval burden that would need to be treated to possibly reduce that burden; the clinical benefit and need for larvicidal treatment for the foal should be considered as there is mixed evidence of EL3 development in this age group. The decision to treat with moxidectin in this age group should be based on a risk assessment and a veterinarian assessment (note - moxidectin should not be used in foals less than 4 months of age). As for adult horses, treatments for tapeworm infections in foals and yearlings should be targeted based on monitoring test results as levels of infection can vary between yards or farms, with testing commencing at 6 months of age. Pyrantel used at double the 'normal' roundworm dose can be administered to foals over 4 weeks of age. Whilst a single-active extemporaneous preparation of praziquantel can be obtained and prescribed by veterinarians, recommendations cannot be made regarding the minimum age for safe use of this preparation.

Foals 9-12 months-old

At **9-12 months old**, further anthelmintic treatment should be considered and guided by FEC testing; in the UK, however, many foals will reach this age in autumn/early winter and a cyathostomin larvicidal treatment may be considered at this time in animals of this age group. The advisor who is in regular contact with the stud and has extensive knowledge of the management practices applied would be best placed to advise on whether a larvicidal treatment is required, based on a risk assessment.

Yearlings to young horses

Attention should be paid to potential cyathostomin larval burdens in autumn/winter, particularly in 1–3-year-olds. As exposure may be high and animals of this age are considerably more susceptible to developing acute larval cyathostominosis than adult horses, an annual larvicidal treatment is recommended in late autumn/early winter. In premises where there is current evidence or previous history of disease in young horses due to larval cyathostominosis, a further larvicidal treatment in late winter/early spring

may be warranted to target potentially high larval burdens. However, there should be a strong emphasis on effective control and re-evaluating management practices to reduce parasite transmission and reliance on a larvicidal treatments to resolve the problem. If horses have positive FECs pre-treatment it is meaningful to conduct a FECRT to check egg shedding post-treatment, ideally applied at 2 weeks. Strongyle egg reappearance analysis could be considered as these are often shortened in younger horses (Nielsen *et al.*, 2022a; Relf *et al.*, 2013).

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Chapter 2.4. Administering anthelmintics appropriately

Under-dosing of anthelmintics may contribute to the development of anthelmintic resistance, therefore it is important that the equid receives the full dose. Estimating of weight by eye is often inaccurate and typically results in under-dosing therefore it is important that the horse has its weight determined using a validated weigh tape or weigh scale prior to treatment. Weigh tapes are cheap and easy to use. Many prescribers will supply weigh tapes and some veterinary practices also have weighbridges that can be used either at the practice or sometimes on the yard to get a precise weight. If a weigh-tape is being used to estimate weight it is recommended that the dose is increased by 10% to prevent under-dosing. The benefit of a slight overdose ensures efficacy outweighing the risk of underdosing which is known to contribute to poor efficacy and an increased risk of resistance. For horses that are difficult to medicate directly into the mouth, there are tablet or in-feed preparations that can be used as an alternative – as above always ensure the correct dose is calculated and consumed.