Authors: Nikki Bell, Rebekah Sullivan
(Reviewed by N Bell & R Sullivan)

Chapter 10. Donkeys and hybrids

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Overview

Donkeys and hybrid species, which include mules and hinnies, are frequently kept as companion animals in the UK (Sullivan and Vogel, 2023) and occasionally as working animals, typically in the form of beach donkeys. As an equid species, donkeys and hybrids can be infected by the same helminths (Matthews and Burden, 2013), requiring equal consideration in helminth and pasture management programmes. Much of the text presented throughout these guidelines is equally applicable to donkeys, in particular the general advice in the human behaviour changes and environmental protection chapters, but there are also specifics which require individual attention. Note for purposes of this chapter, use of 'donkey' hereafter also refers to hybrid species. Hybrids are only mentioned separately if there is hybrid specific advice. As there is minimal donkey specific information, compared to the wealth available regarding horses, there is no separate section for foals and youngstock. Instead, any relevant comments are made alongside the text for adults.

A lack of preventative healthcare in donkeys within the UK is not uncommon (Barrio Fernandez *et al.*, 2020) and this can lead to issues relating to parasite control, such as a lack of monitoring tests and inadequate treatment regimes. Where donkeys are being treated with anthelmintics, the lack of familiarity with estimating their weight can sometimes lead to owners using inappropriate estimation tools resulting in inadequate dosages being administered. There are also fewer anthelmintics authorised for use in the donkey and no authorised products for hybrid species. Where there is not a suitable authorised product, prescription can only be made by following the cascade guidelines and owners should be referred to a veterinary surgeon, who should consider the guidelines for the profession, such as the BEVA Anthelmintic Toolkit.

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Chapter 10.1. Parasite species to consider in donkeys and hybrids

Cyathostomins (small strongyles)

Patent infections may be seen in all life stages of donkeys and there are no major differences from infections in horses in terms of exposure through grazing and larval development. Healthy adult donkeys may tolerate high burdens without clinical signs and can remain an important source of pasture contamination. Note that the clinical presentation of acute larval cyathostominosis may be less overt than in horses and diarrhoea is not a common finding (Matthews and Burden, 2013). Owners of donkeys with weight loss not attributable to dietary management for obesity, and/or recurrent colic signs, who are concerned about possible parasite burdens should be referred to a veterinary surgeon for advice. Young donkeys, geriatric donkeys and those with underlying health concerns may be more at risk from disease due to cyathostomin burdens but this risk is challenging to quantify.

Strongylus vulgaris (large strongyles)

To date, there has been no recent report of clinical disease in UK donkeys due to *S. vulgaris* infection. It is believed that the risk of re-emergence of *S. vulgaris* and exposure in the UK will be similar to that in horses. Reports of clinical disease are generally found in literature pertaining to working donkeys overseas. Due to the typically complex factors contributing to ill-health in such donkeys, it is difficult to definitively ascribe those clinical signs relevant to large strongyle infection, therefore clear guidance on how infection may present in donkeys in the UK is lacking. Clinical disease in horses is due to the migration of larval stages and it is assumed that similar clinical signs would be seen in donkeys, with the caveat that the latter typically do not demonstrate overt signs of pain behaviour associated with colic and disease may be more acute and severe than is initially realised.

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Dictyocaulus arnfieldi (lungworm)

Infection by the lungworm, *Dictyocaulus arnfieldi*, is rare in horses, consequently, there has been little mention of this parasite in previous chapters. Donkeys are the usual reservoir of this parasite (Lyons *et al.*, 1985; Solomon *et al.*, 2012), but horses can become infected when sharing pastures with infected donkeys (Nielsen and Anderson 1981), although horse-horse transmission has occasionally been documented (Clayton and Duncan 1981; Slocombe 1985; Boyle and Houston 2006). Adult lungworms live in the bronchioles of the lung (see Figure 1). In adult horses, lungworm rarely develop to sexually mature nematodes, although they may do so in foals (Clayton and Duncan, 1981; Boyle and Houston, 2006). In contrast, both donkeys and hybrids are permissive of the entire life cycle and can act as an important source of pasture contamination. Larvae are susceptible to desiccation and survive on pasture for only a limited period. High summer temperatures limit larval survival on pasture, whereas in in wet weather, they can survive longer. Increasingly mild/wet winters across the UK may lead to a prolonged risk period. Overwintered L3 may survive on pasture from autumn until late spring in sufficient numbers to initiate infection.

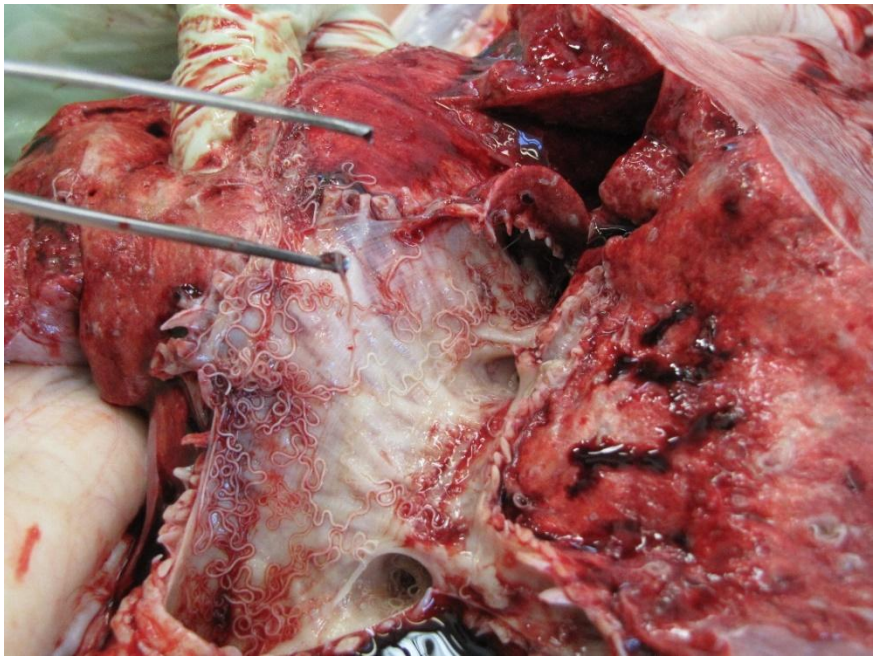

Figure 1. Lungworm in the trachea and bronchi of a donkey lung. Post-mortem examination specimen. Photo credit: Pathology department, The Donkey Sanctuary.

Although lungworm infection is rarely patent in adult horses, when patent, infection is often pathogenic, and can cause mucopurulent bronchitis manifested as a chronic

cough and nasal discharge (Slocombe, 1985; Boyle and Houston, 2006). Lungworm is considered to be a "normal" parasite of donkeys since it rarely causes clinical disease in this species (Rickards and Thiemmann, 2019). As a result of the small risk to horses, owners co-grazing horses and donkeys should be aware of lungworm infection.

Whilst clinical disease due to lungworm burdens in donkeys appears low, donkeys presenting with any history of respiratory compromise should be referred to a veterinary surgeon for further advice.

Case Study:

- A young (5 year-old) adult stallion donkey, known to have a very high lungworm burden was euthanised due to other health concerns.
- The post-mortem examination revealed large numbers of lungworm larvae (Figure 1).
- Histopathology identified focally extensive areas of lung with multifocal to coalescing chronic active to granulomatous inflammation, that according to the type of inflammatory cells and the few basophilic debris immersed in it, and the known ante mortem lungworm burden, was most likely a reaction against these parasites.
- This finding raises suspicion that lungworm can be pathogenic in some donkeys.

Fasciola hepatica (liver fluke)

The liver fluke, *F. hepatica,* can complete its life cycle in both ruminants and grazing equids, but donkeys and hybrids appear to be more permissive hosts than horses (Williams and Hodgkinson, 2017). Donkeys inhabiting wet pastures, which provide suitable habitats for the intermediate snail host, *Galba (Lymnaea) truncatula,* and particularly those co-grazing with ruminants, should be considered at risk.

The pathogenicity of fluke burdens in horses is poorly understood (Howell *et al.*, 2020) and this is true for donkeys. Clinical and subclinical hepatopathy indicated by elevations in serum levels of gamma-glutamyl transferase (GGT) and glutamate dehydrogenase (GLDH) has been identified in donkeys with fluke burdens. Conversely,

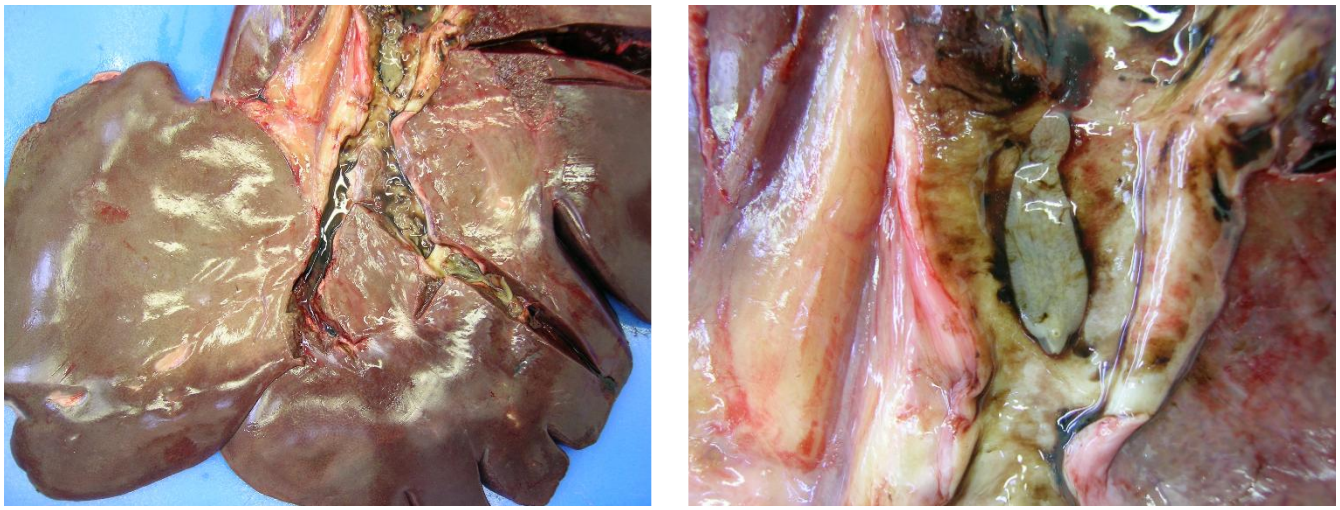

Figure 2. Adult fluke in a donkey liver found at post-mortem. Photo credit: Pathology department, The Donkey Sanctuary.

donkeys with known fluke burdens may also have normal blood biochemistry profiles. Therefore, the significance of fluke burdens in hepatopathy in donkeys is uncertain. As the evidence for liver fluke causing disease in donkeys or horses is limited, and there are no licensed flukicidal products, cases should be referred to a veterinary surgeon.

Tapeworms

In studied donkey populations, the prevalence of tapeworm during post-mortem examinations has been very low (Matthews and Burden, 2013). Treatment of tapeworms should therefore be considered on an individual basis. If an owner is concerned about tapeworm-associated colic signs, they should be directed to a veterinary surgeon for further advice.

Gasterophilus intestinalis ('bot')

Rarely a cause for concern, larvae may occasionally be seen in the mouth during routine dental examinations and in studied populations have occasionally been reported at post-mortem examination, in both donkeys and hybrids, but typically in low numbers (<10 larvae).

Oxyuris equi (equine pinworm)

Most cases produce few or no clinical signs, but persistent infection can lead to hair breakage and skin damage around the perineum and tail head (Matthews and Burden, 2013).

Parascaris spp. (ascarids)

Unlike in horses, where patent infections are usually only seen in foals, mature donkey and hybrids can harbour patent infections (Getachew *et al*., 2010) and otherwise healthy mature animals can act as a source of pasture contamination. The risk of *Parascaris*-related disease is increased if adult animals are compromised through work, ill health or poor nutrition (Matthews and Burden, 2013) but is rarely an issue in mature donkeys in well managed populations. As with horses, the main risk from clinical disease tends to be associated with large burdens in foals/youngstock.

Strongyloides westeri (threadworm)

The lifecycle and epidemiology of the threadworm in donkeys and hybrids is the same as in horses. Just as with horse foals, diarrhoea associated with *S. westeri* appears to be relatively rare. High *S. westeri* egg counts have been observed in otherwise healthy donkey foals. Donkey foals appear to build immunity with FECs decreasing over time without the need for anthelmintic treatment.

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Chapter 10.2. Using monitoring tools effectively

Monitoring levels of strongyle egg shedding

FECs can be used to monitor strongyle egg shedding as per the recommendations outlined for horses (in Chapter 1.2. Using monitoring tools effectively to determine the need for anthelmintic treatment). Routine egg counts throughout grazed periods should be a key component of any parasite control plan for donkeys and hybrids as with horses. All individuals within a group should be tested individually at the same time to identify high shedding individuals and determine which donkeys/hybrids require treatment. Frequency of testing will depend on the level of estimated strongyle transmission. Where pasture contamination is known to be high, more frequent testing should be performed.

Small redworm ELISA

The serum ELISA test for the detection of antibodies to adult and larval stages of cyathostomins has not been validated for use in donkeys and hybrids. Risk assessments should be used to decide whether targeted treatment of larval stages is needed.

Monitoring ascarid egg excretion

Although adult donkeys and hybrids can harbour patent infections, foals and youngstock should be the primary focus when monitoring ascarid egg excretion in well managed populations. Guidelines are similar to those outlined for horse foals/yearlings (in Chapter 1.2. Using monitoring tools effectively to determine the need for anthelmintic treatment) in that FECs are most useful in foals >4 months of age. As donkeys do not seem to develop immunity in the same way as horse foals, monitoring of ascarid burdens should be continued for a longer period.

Detecting tapeworm burdens

There are no accurate means of detecting tapeworm burdens in donkeys and hybrids. Standard FEC techniques are considered unreliable and neither of the ELISA tests that

are commercially available for use in horses have been validated for use in donkeys or hybrids.

Detecting lungworm

Donkeys/hybrids shed *D.arnfieldi* eggs that contain L1's and hatch quickly (in as little as a few hours [Cameron, 1926]). Using standard FEC methods to identify the presence of lungworm can be unreliable as even in relatively fresh samples, eggs may have hatched prior to analysis. Detection of lungworm in donkeys and hybrids can be made by assessing the presence of L1 using a sedimentation test such as the Baermann technique (Rode and Jorgensen, 1989). Testing faecal samples from horses is likely to be of limited use given that infection rarely reaches patency; however, veterinary advice should be sought if donkey faecal samples are lungworm-positive and are co-grazing with horses.

Detecting liver fluke

Unlike in livestock where both FECs and commercially available ELISA tests can be used to help detect liver fluke infections, for donkeys and hybrids detection is confined to the former using sedimentation tests. As FECs only give an indication of adult (egg laying) fluke being present, regular testing is warranted where animals graze high risk pastures. Consideration should be given to testing any co-grazing livestock and their parasite control programme.

Detecting pinworms

Tape tests can be used for donkeys and hybrids in the same way as for horses. As with any equid, an assessment of the animal's behaviour should be made beforehand to ensure the safety of the person taking the sample, particularly with donkeys or hybrids that may be unused to handling.

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Chapter 10.3. Risk based approach to parasite control for donkeys and hybrids

Sustainable helminth control programmes aim to limit levels of infection so that clinical disease does not occur. Every situation will be different but whether dealing with an individual hybrid, a pair of donkeys or larger groups, it is important to use a risk-based approach when making decisions on the need for anthelmintic treatments. Due to slight differences in parasites of importance in donkeys and hybrids and the differences in validated tests, the risk profile for horses shown (in Chapter 1.3. A risk assessment-based approach to equine parasite control in adult horses) has been adapted for donkeys and hybrids (see Table 1).

Assessing your donkey or hybrids parasite risk profile

Table 1. Criteria in different risk categories as applied to helminth control in donkeys or hybrids.

A "traffic lights" system – purple (high risk), orange (medium risk) and amber (low risk) – approach to assist prescribers in their decision-making process for assessing the need for anthelmintic treatment in adult donkeys and hybrids.

Risk factor*		**Factors indicating potential for helminth transmission LOW** **Risk category: Amber**	**Factors indicating potential for helminth transmission MEDIUM** **Risk category: Orange**	**Factors indicating potential for helminth transmission HIGH** **Risk category: Purple**
C	**C**linical history	No history of parasite-associated (gastrointestinal) disease in the last 24 months	History of suspected subclinical parasite-associated (gastrointestinal) disease, such as weight loss and ill-thrift, in the last 24 months	History of confirmed parasite-associated (gastrointestinal) disease in the last 24 months

A	**A**ge profile	Age profile 5-20 years, no concurrent parasite-associated disease or PPID[1]	Age profile – 5-20 years-old, concurrent parasite-associated disease or PPID[1]	Age profile - <5 years-old, >20 years-old, +/- concurrent parasite-associated disease or PPID[1]
N	**N**umber of equids	Low stocking density (>2 acres per pair of donkeys or per hybrid)	Moderate stocking density (1-2 acres per pair of donkeys or per hybrid)	High stocking density (<1 acre per pair of donkeys or per hybrid)
T	**T**est results	Tested for strongyle faecal egg shedding and results indicate consistently low egg shedding (<200 eggs per gram)	Tested for strongyle faecal egg shedding and results indicate moderate egg shedding (200-500 eggs per gram)	Tested for strongyle faecal egg shedding and results indicate higher egg shedding (>500 eggs per gram)
		Consistent negative faecal results for lungworm	One or more positive faecal results from new animals but housed, treated and re-sampled prior to t/out	One or more lungworm positive faecal results from within the herd whilst grazing
		Consistent negative fluke results via faecal egg count tests	One or more positive fluke results but low risk grazing	Repeated positive fluke results and high-risk grazing (wet marshy land and/or co-grazing with ruminants)
		Demonstrated efficacy of some/all anthelmintics by faecal egg count reduction test	Demonstrated efficacy of some anthelmintics by faecal egg count reduction test	Demonstrated lack of efficacy of some/all anthelmintics by faecal egg count reduction test
E	**E**nvironment	Closed herd or individuals/pairs that have restricted time at grazing (e.g., those kept on yarded/non-grass areas or housed for most of the time)	Occasional newcomers into herd	Frequent movements in and out of herd Specifically for fluke, wet/marshy pasture
		Good pasture management, including dung removal at least once per week	Moderate pasture management, for example dung removal less than once per week	Poor pasture management, for example very infrequent or no dung removal
		Animals frequently moved between grazing areas allowing sufficient rest/recovery periods	Animals moved around different grazing areas but with only a short period of rest in between	Animals continuously graze the same area year round
		Pasture regularly co-grazed or rotationally grazed with livestock	Grazing used by one equid species and occasionally rotated with livestock	Mixed equid species grazed together – no rotation of grazing with livestock

[1] PPID = Pituitary pars intermedia dysfunction

		*Note that co-grazing with livestock reduces risk for strongyles but may increase risk for liver fluke burdens		
		Well drained land that is unlikely to support the intermediate host of the liver fluke	Some wet/marshy areas which could support the intermediate host of the liver fluke, but mainly fenced off from grazing animals	Extensive areas of poorly drained wet/marshy grazing known to, or highly likely to, support the liver fluke intermediate host
		Effective quarantine procedures	Quarantine procedures inconsistent	Quarantine procedures non existent
R	**R**isk profile	Estimate the risk based on the number of factors that apply in each category		

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Chapter 10.4. Selecting and using anthelmintics appropriately

As with other equids, choosing an anthelmintic in donkeys should be based upon clinical need and results of any validated tests (i.e. coprological tests such as FECs and Baermanisation). There are a more limited number of products in each anthelmintic class that have specific authorisation for use in donkeys (see Table 2), for example only some of the pyrantel and ivermectin products are authorised for use in donkeys. The SPC of the anthelmintic should be checked carefully prior to final product choice and if selection of an appropriate anthelmintic constitutes cascade use this can only be prescribed by a veterinary surgeon.

Alongside choosing an appropriate anthelmintic for the target parasite(s), it is important to remember that there are differing minimum age restrictions on anthelmintic products. The SPC should always be consulted prior to prescription to ensure that it is for use at the age of the animal for which it is being prescribed.

Table 2. Active ingredients in products with specific authorisation for donkeys (note that the SPC of individual products must be checked carefully)

	FBZ	PYR	IVM	MOX	PRAZ
Adult small strongyles	✓	✓	✓	X	X
Encysted small strongyles	✓ (5d)	X	X	X	X
Large strongyles (adults)	✓	✓	✓	X	X
Large strongyles (larvae)	✓ (5d)	X	✓	X	X
Large roundworms (ascarids)	✓	✓	✓	X	X
Tapeworm	X	✓ (DD)	X	X	X
Pinworm	✓	✓	✓	X	X
Lungworm	X	X	✓	X	X
Liver fluke	X	X	X	X	X
Threadworm	✓	X	✓	X	X
Bots	X	X	✓	X	X

Key:
FBZ = Fenbendazole; PYR = Pyrantel; IVM = Ivermectin; MOX = Moxidectin; PRAZ = Praziquantel
5d – dose given for 5 consecutive days
DD – double dose
✓ Green – authorised for use in donkeys
X Purple - not authorised for use in donkeys

General guidelines on the selection of anthelmintics can be found (see Chapter 2. Selecting and using anthelmintics appropriately) but additional donkey specific information regarding the choice of products and any known resistance issues is mentioned below.

Cyathostomins (small strongyles)

There are three active ingredients authorised for the treatment of cyathostomins in donkeys (fenbendazole, pyrantel and ivermectin) and whilst the efficacy remains reasonable for some products within certain populations (Napoli *et al.*, 2013; Veneziano *et al.*, 2013; Gokbulut *et al.*, 2014; Papini *et al.*, 2020), suspected or confirmed cases of resistance have been reported in others (Trawford and Burden, 2009; Lawson *et al.*, 2015; Buono *et al.*, 2018; Fessaha *et al.*, 2020; Okaiyeto *et al.*, 2022). It should be noted that careful interpretation of efficacy results in donkeys is warranted, as most of the evidence to date has been based on extra label use of anthelmintics licensed for use in ruminants, rather than through use of products with specific authorisation in donkeys. If ivermectin is selected, it is worth noting that donkeys and hybrids may be more likely to develop signs of neurotoxicity (Mendoza *et al.*, 2019) and care must be taken to dose accurately. Estimation of efficacy can be achieved through the use of FECRTs (see Chapter 4. Testing for anthelmintic resistance). Whilst the WAAVP FECRT tool is not targeted specifically to donkeys, the horse option can be selected as the target efficacy should be similar.

Strongylus vulgaris (large strongyles)

See general advice on treating large strongyles in horses. To date, there has been no evidence published to suggest anthelmintic resistance in this parasite in donkeys.

Parascaris spp. (ascarids)

Where ascarid infections are identified, these should always be treated with an anthelmintic, both to reduce the risk of clinical disease in the individual donkey and to prevent further pasture contamination. Fenbendazole, pyrantel and ivermectin are all licensed for the treatment of *Parascaris* spp. in donkeys and, whilst resistance concerns have been reported in some UK donkey populations, particularly to

ivermectin and pyrantel (Matthews and Burden, 2013), published evidence remains scarce. Post treatment follow up checks are therefore recommended.

Oxyuris equi (equine pinworm)

As with horses, treatment should be approached on a case-by-case basis. There are limited published reports on the efficacy to the main actives authorised for the treatment of pinworm in donkeys (ivermectin, pyrantel and fenbendazole) but anecdotal evidence suggests a lack of response to ivermectin and pyrantel (Matthews and Burden, 2013) so fenbendazole tends to be the preferred treatment of choice. Excellent hygiene should be practiced to reduce the level of infective eggs within the animal's environment.

Dictyocaulus arnfieldi (lungworm)

Clinical disease associated with lungworm infections are rare; however, to prevent re-infection, particularly where donkeys or hybrids co-graze with horses, treatment would be advised if positive test results are seen in donkeys or hybrids. Ivermectin is the only drug licensed for treating lungworm in equids, including donkeys. See the earlier notes in the cyathostomin section regarding careful dosing when administering ivermectin. Suspected resistance to ivermectin has been observed within some donkey populations in the UK so follow up checks should always be carried out to check efficacy of treatment.

Fasciola hepatica (liver fluke)

Treatment decisions should be based on risk and only considered alongside test results. There are currently no flukicides authorised for targeting liver fluke in equids so treatment decisions would need to be made by an attending veterinary surgeon with prescription of an anti-fluke anthelmintic under the cascade if deemed appropriate.

Tapeworms

Of the two available anthelmintics to treat tapeworm in horses, only double dose pyrantel is authorised for use in donkeys. Given that the prevalence of tapeworm in studied donkey populations is low and the incidence of clinical disease associated with tapeworm infection low, it would be advisable to discuss intentions to treat for

tapeworm with a veterinary surgeon. The resistance status of tapeworm to pyrantel has not been studied within UK donkey populations and without an accurate means of detecting infections in live animals, this remains difficult.

Gasterophilus intestinalis ('bot')

Although gasterophilosis has been cited as a major cause of rectal prolapse in working donkeys overseas (Getachew *et al*., 2012), clinical signs of disease associated with 'bot' infestation have not been reported in the UK, therefore the need for treatment is likely to be rare. Ivermectin is the only licensed product for treatment of *Gasterophilus* in donkeys.

Authors: Nikki Bell, Rebekah Sullivan
(Reviewed by N Bell & R Sullivan)

Chapter 10.5. Recording treatment decisions

Maintaining accurate records of test results and treatment details is an important part of any parasite control plan whether dealing with donkeys, horses or their hybrids. Templates to aid recording of such details, (such as those shown in Chapter 3. Recording treatment decisions), may need adapting for donkeys and hybrids to account for the different parasite species likely to be present and the difference in validated tests. An adapted version is shown below (see Table 3):

Table 3. Template for recording test results for an individual donkey or hybrid

	Date	Strongyles	Ascarids	Lungworm[2]	Liver Fluke	Comments
Faecal egg count result in eggs per gram (EPG)						

[2] Note that eggs hatch soon after deposition

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Chapter 10.6. Reducing infection pressure on pasture

Guidance is similar to that described for horses (see Chapter 6. Reducing the dependence on anthelmintics); however, a couple of additional points are worth consideration. Where pastures contain areas likely to be suitable habitats for the intermediate host of the liver fluke, consideration should be given to fencing animals away from the highest risk areas or drainage options should be investigated. Where livestock have been found to be positive for liver fluke and treated prior to grazing donkey/hybrid pastures, a post treatment efficacy check should be carried out to reduce the risk of livestock contaminating the grazing with resistant parasites. Where owners are considering co-grazing for the first time, careful introductions are advised as both donkeys and hybrids have been known to attack smaller animals like sheep and goats. Rotating grazing between donkeys/hybrids and livestock may be a safer option than co-grazing.

The other main point relates to the management of ascarids, especially where mixed age groups are grazing together. As adult donkeys may harbour patent infections, they can remain an important source of pasture contamination. A zero-tolerance approach to ascarids is recommended in donkey populations to avoid heavy pasture contamination and cycling of this parasite in both young and mature donkeys. Assessment and treatment of new arrivals for ascarids is essential as is the collection and proper composting of dung on premises known to have ascarids present.

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Chapter 10.7. Quarantine

As for horses, it is recommended to consider a period of quarantine before introducing new donkeys to pasture and any extant equid inhabitants. A risk-based approach should be adhered to (see Chapter 12. Quarantine for new arrivals). Please note that stabled donkeys may be at increased risk of the clinical syndrome of hyperlipaemia, which can be associated with any sudden changes in management. Owners should be advised to contact their veterinary surgeon if a donkey shows any reduction in appetite or demeanour.