Onderstepoort J. vet. Res., 55, 157–163 (1988)

FASCIOLA IN HORSES IN THE REPUBLIC OF SOUTH AFRICA: A SINGLE NATURAL CASE OF *FASCIOLA HEPATICA* AND THE FAILURE TO INFEST TEN HORSES EITHER WITH *F. HEPATICA* OR *FASCIOLA GIGANTICA*

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ABSTRACT

ALVES, REGINA M. R., VAN RENSBURG, L. J. & VAN WYK, J. A., 1988. *Fasciola* in horses in the Republic of South Africa: a single natural case of *Fasciola hepatica* and the failure to infest ten horses either with *F. hepatica* or *Fasciola gigantica*. *Onderstepoort Journal of Veterinary Research*, 55, 157–163 (1988).

The faeces of 11 horses were examined for *Fasciola* spp. eggs. One of them was positive for *Fasciola hepatica*, a finding which was confirmed *post-mortem*. The 10 negative horses were subsequently infested with either *F. hepatica* or *Fasciola gigantica*, each animal receiving orally from 500–9 500 metacercariae. No clinical signs were observed and no fluke eggs were detected in the faeces, and neither immature nor adult *Fasciola* worms were recovered from the horses slaughtered 16–26 weeks post-infestation with *F. hepatica* and 28–34 weeks post-infestation with *F. gigantica*, respectively. The results indicate that horses have a high level of resistance to both South African *Fasciola* spp. Factors which can probably explain the conflicting reports for the prevalences of fascioliasis in horses throughout the world and the varying results obtained in experimental infestations are briefly considered.

INTRODUCTION

Control of fascioliasis of domestic ruminants implies a sound knowledge of what reservoirs of infestation may exist and interfere with effective control, since these potential reservoir hosts commonly share the grazing with cattle and/or sheep.

One domesticated animal species of which *Fasciola* infestation has been recorded on numerous occasions is the horse, but very little is known about the occurrence of fascioliasis in horses in the Republic of South Africa. According to Neitz (1965), *Fasciola hepatica* occurs sporadically in horses in the eastern Cape Province. Furthermore, we found a single record of fascioliasis of a horse from Kokstad in Natal in 1929; and since 1960 fascioliasis has occasionally been recorded as a cause for the condemnation of equine organs at the Johannesburg Municipal Abattoir (Anonymous, 1960–1973). On the other hand, artificial infestations of horses with *F. hepatica* have apparently not previously been reported in South Africa and, in the case of *Fasciola gigantica*, there is apparently no reference to any trials locally or elsewhere in the world.

The susceptibility of horses to artificial infestations with both *Fasciola* spp. was tested to obtain an indication of the role horses could play as reservoirs of infestation in the epidemiology of fascioliasis in this country. While examining the faeces of the horses we acquired for use in this trial, we found a 3-year-old gelding to be naturally infested with *F. hepatica*.

MATERIALS AND METHODS

Metacercariae

The metacercariae of both *F. hepatica* and *F. gigantica* originated from strains maintained in sheep in the laboratory.

Seven batches[1] of metacercariae of *F. hepatica* and 5 of *F. gigantica*, all originating from the same respective groups of *Lymnaea columella* and *Lymnaea natalensis*, were available for the trial. From these, the 4 best batches of *F. hepatica* and the 3 of *F. gigantica* were selected on the basis of the biological test, carried out in mice, as described by Boray (1963). In addition, the viability of the metacercariae was confirmed by retesting all 7 of the selected batches (according to the method of Boray, 1963) at the time of infestation of the horses, at which time the metacercariae of *F. hepatica* varied in age from 10–13 weeks and those of *F. gigantica* from 11–14 weeks. Metacercariae of some of the unselected batches of *F. gigantica* were also used to infest sheep after the start of the present trial.

Horses

Prior to the infestation of the experimental horses, 3 faecal worm egg counts were carried out to detect any naturally acquired *Fasciola* infestation. A hundred gram of faeces was washed through a sieve with apertures of 150 μm onto another sieve with 38 μm apertures. The contents of the latter sieve were subsequently subjected to a sedimentation technique consisting of repeated decantation in crystallizing dishes of 2,5 ℓ capacity and 18,5 cm diameter for worm egg recovery.

Eleven horses were available for the trial but one of them, originating from Jessyvale Forestry, was found to be naturally infested with *F. hepatica* and, therefore, excluded from the trial. Of the remaining 10 negative horses, originating from Onderstepoort or the adjacent Kaalplaas (both farms free from natural infestation with *Fasciola* spp.), 5 2–6-year-old horses were infested with metacercariae of *F. hepatica* and the other 5 (3–4-year-old) with *F. gigantica*.

Nematode egg counts were carried out by the McMaster technique to determine the possible influence of nematode infestation on the susceptibility of horses to *Fasciola* spp.

Experimental design

The horses were allocated to the 2 infestation groups of *Fasciola* spp. using tables of random numbers.

The metacercariae were placed in gelatine capsules and administered to the horses *per os* with the aid of a pill forceps.

Each horse was infested either with 500, 1 000, 2 000, 5 000 or 9 500 metacercariae of either *F. hepatica* or *F. gigantica*. They were housed on cement during the experimental period, under conditions that precluded unintentional exposure to *Fasciola* infestation.

[1] All the metacercariae collected on one occasion from a group of snails were regarded as a batch

Received 6 June 1988—Editor

Faecal examinations were carried out at weekly intervals from 9 and 10 weeks post-infestation for *F. hepatica* and *F. gigantica*, respectively, and the horses were regularly observed for clinical signs of infestation.

The horses were slaughtered from 16–26 weeks post-infestation *(F. hepatica)* and from 28–34 weeks post-infestation *(F. gigantica)*.

At necropsy the heart, spleen, kidneys and lungs were palpated before being cut lengthwise to examine for encapsulated ectopic flukes. The livers were examined for gross pathological lesions and were cut into approximately 1 cm thick slices, while gently compressing the cut surface of the liver for recovery of flukes; subsequently, these slices were further squeezed between the fingers before being incubated for 2–4 h in saline in a water bath (37 °C). After incubation the saline was washed through a 150 μm aperture sieve, and the contents of the sieve were carefully examined for flukes with the aid of a stereoscopic microscope.

RESULTS

The viability of the metacercariae in mice is shown in Table 1.

TABLE 1 Viability of *F. hepatica* and *F. gigantica* metacercariae in 20 mice per batch

F. hepatica			*F. gigantica*		
Batch No.	% infectivity		Batch No.	% infectivity	
	First test	Second test*		First test	Second test*
1	40	—	1	40**	—
2	70	70	2	25	18
3	60	75	3	50	20
4	75	50	4	21	—
5	80	85	5	40	17
6	60	—	—	—	—
7	40	—	—	—	—

* Carried out on the day of infestation of the horses

** This batch was not used in the trials because it contained too few metacercariae

The percentage development in 20 mice on the day of infestation of the horses varied from 50–85 % for *F. hepatica* and that of *F. gigantica* from 17–20 %[2] (Table 1).

While 2 of the 11 horses were found to be positive for *Gastrodiscus* spp., the faeces of the 10 used in the trials were negative for *Fasciola* ova prior to experimental infestation.

The nematode egg counts varied from 50–450/g of faeces in the case of the horses infested later with *F. hepatica* and from a mean of 400–1 000/g for those infested with *F. gigantica* (Table 2).

Neither fluke eggs nor clinical signs were observed in any of the horses throughout the experimental period.

At necropsy, no flukes were recovered from any of the 10 horses in the trial and, in the case of *F. gigantica*, no macroscopical lesions that could be ascribed to *Fasciola* infestation were observed in the liver or any other organ.

TABLE 2 Nematode egg counts

Horses infested with *F. hepatica*		Horses infested with *F. gigantica*	
Horse No.	E.p.g.*	Horse No.	E.p.g.**
1	450	6	400
2	100	7	1 000
3	50	8	417
4***	100	9***	700
5	400	10	833

* 11 days prior to the experimental infestation with *F. hepatica*

** The mean of 3 egg counts at weekly intervals, the last being 2 months prior to the experimental infestation

*** Infested with *Gastrodiscus* spp.

However, in the horses infested with *F. hepatica*, lesions resembling those caused by *Fasciola* spp. were seen in 2 horses, 1 of which was infested with 1 000 and the other with 2 000 metacercariae.

The naturally infested gelding shedding ova in the faeces showed no macroscopical lesions either on the surface of the liver or in the parenchyma, but 2 adult *F. hepatica* were recovered from smaller bile ducts that showed only a slight thickening but no signs of calcification.

DISCUSSION

Judging from the literature, equine fascioliasis presents a confusing picture.

To our knowledge, the present trial is the first report of experimental infestation of horses with *F. gigantica*. Neither flukes nor lesions were found in the animals exposed to infestation, and this, together with only 2 references to the recovery of this parasite from naturally infested horses (Alicata, 1938[3]; Farzaliev, 1950), seems to indicate that horses are very resistant or even refractory to *F. gigantica*. The same resistance seems also to apply to donkeys, since natural *F. gigantica* infestations in donkeys have been reported only twice in Chad (Guilhon & Graber, 1963; Graber, 1969) and once in Morocco (Everaert, Jawhari & Gaufreteau, 1974). However, Pandey (1983), in a study of fascioliasis in donkeys in Morocco, considers that "Everaert *et al.* (1974) were probably dealing with either larger or atypical specimens of *F. hepatica* which they misidentified as *F. gigantica*".

F. hepatica, on the other hand, is fairly common in horses throughout the world, its prevalence reportedly varying from an extremely low 0,02 % to as high as 85,7 % of horses examined (Table 3).

In South Africa, little is known of the occurrence of liver flukes in horses, as only sporadic cases have been mentioned from the eastern Cape (Neitz, 1965) and from the Johannesburg abattoir (Anonymous, 1960–1973), where the reported annual prevalence varied from 0,01–0,46 % (Table 4).

The present case, discovered by chance when we were preparing to test the susceptibility of horses to experimental infestation with local strains of *F. hepatica* and *F. gigantica*, is apparently the first reported instance in this country in which the infestation was diagnosed coprologically *ante mortem* and was confirmed at necropsy.

[2] While the viability of the metacercariae of *F. gigantica* appears to be relatively low, it is known that this parasite develops poorly in mice, Boray (1963) reporting only 3–6 % development in this host; Mango, Msngo & Esamal (1972) 3–13 %; and Gerber, Oguz & Hörchner (1974) a slightly higher development rate of 29 %. Furthermore, some of the metacercariae from these batches when dosed to sheep gave most satisfactory results

[3] Apparently erroneously reported as *F. hepatica* by Rowat (1894) from a horse in Hawaii

TABLE 3 Natural occurrence of *F. hepatica* in horses in various countries

Country in which fascioliasis was reported	Type of examination	Prevalence		Author
		No. of horses	Positive (%)	
Europe & Asia				
Belgium	Faecal	5 065	0,39	Cotteleer & Famerée (1981)
France	P.M.	159	1,2	Doby & Chiche (1965)
	IFAI	96	11,46	Moisant, Jolivet & Pitre (1972)
Germany	Faecal	4 195	0,5	Brem & Wojtek (1972)
	Faecal	163	30	Fischer (1982)
	Faecal	2 314	0,04	Bauer & Stoye (1984)
India	Faecal	N.s.*	N.s.	Dakshinkar (1982)
Ireland	Faecal	93	77,4	Kearney (1974) and Pers. Comm., 1975
Italy	P.M.	N.s.	N.s.	Garlanda (1958)
Netherlands	Faecal	3 340	0,6	Mirck (1978)
Rumania	Faecal	1 032	0,77	Olteanu (1973, cited by Cotteleer & Famerée, 1981)
Switzerland	P.M.	2 000	0,1	Benoit (1935)
	P.M.	200**	13,5	Benoit (1935)
Turkey	P.M.	N.s.	N.s.	Maskar (1935)
United Kingdom	Faecal	N.s.	0,1	Pankhurst (1963)
	Faecal	14	35,7	Owen (1977)
	P.M.	20	20	Flower (1975, cited by Owen, 1977)
USSR				
Lvov Region				
Adult horses	P.M.	74	25	Ugrin & Skovronski (1959, cited by Pantelouris, 1965)
Foals	P.M.	12	50	Ugrin & Skovronski (1959, cited by Pantelouris, 1965)
Uzbek SSR	P.M.	N.s.	74,2	Yakhontov (1976)
Yugoslavia	P.M.	100	12	Mikačić (1936)
Adult horses	N.s.	N.s.	20,08	Zuković (1957)
Foals	N.s.	N.s.	7,22	Zuković (1957)
	Faecal	N.s.	25	Miklaušic *et al.* (1971)
North America				
Mexico	Faecal	55	47,3	Haro Arteaga *et al.* (1977)
U.S.A.	P.M.	±5 000	0,02	Sinclair (1948)
South America				
Brazil	Faecal	7	85,7	Busetti *et al.* (1983)
Chile	P.M.	38 522	3,2	Rubilar & San Martin (1982)
	P.M.	5 781	4,6	Alcaíno *et al.* (1983)
	Faecal	N.s.	21,2	Diaz *et al.* (1979, cited by Rubilar & San Martin, 1982)
	Faecal	N.s.	8,2	Muñoz (1980, cited by Rubilar & San Martin, 1982)
Australia	Faecal	25	48	Boray (1969)

* N.s. = not stated

** He found *F. hepatica* eggs in liver nodules from 27 of 200 horses (13,5 %)

Earlier experimental infestations show that *F. hepatica* is able to develop in horses, but that the development is apparently erratic. Nansen, Andersen & Hesselholt (1975), who maintained that horses show "pronounced resistance to the establishment of a liver fluke infection" reported the development of *F. hepatica* in only 1 of 10 horses (10 %) infested orally and in both of 2 horses (100 %) infested intraperitoneally. All 3 horses developed a patent infestation after 13 weeks and the flukes were similar in morphology and size to those from other susceptible hosts. The percentages of development obtained by these authors were 3,2 % and 13,6–16 % in *per os* and intraperitoneal infestations, respectively. In contrast, Grelck, Hörchner & Wöhrl (1977) reported that a greater proportion of horses became infested after *per os* than after intraperitoneal infestation, in that all of 5 ponies (100 %) infested *per os* became infested compared with 3 of 5 (60 %) infested intraperitoneally. However, these authors also found a higher mean percentage of development with intraperitoneal infestations (14,3 %, with a range of 0–41,7 %) than with *per os* infestations (8,8 %, with a range of 0,2–21,5 %). They stated that while this large variation in the percentage of development was unrelated to the infective dose, more flukes were found in animals having more strongyles, than in more lightly infested animals. Furthermore, they found that the worms required 22 weeks to become sexually mature but failed to demonstrate any ova in the faeces of the single horse examined after the expected prepatent period.

The present trials showed a complete lack of development of both *F. hepatica* and *F. gigantica* in experimental infestations of horses. The viability of the metacercariae used in this study was confirmed twice in mice and was higher (50–85 %) than that obtained by Nansen *et al.* (1975) in rabbits and mice (15–44 %). Grelck *et al.* (1977) did not mention having tested the viability of their metacercariae. The method of administration in gelatine capsules has been well tested in sheep in our laboratory with consistently good results. While this does not prove the viability in horses when dosed in this way, it seems very likely that the metacercariae would have developed, had they been able to do so. Nansen *et al.* (1975) apparently administered the metacercariae in suspension, but Grelck *et al.* (1977) unfortunately failed to give the details of their method of infestation.

TABLE 4 Prevalence of fascioliasis in equines at the Johannesburg Municipal Abattoir (Anonymous, 1960–1973)

Year	Total slaughtered	Positive (%)
1960–61	10 817	0,46
1961–62	10 818	0,13
1962–63	11 475	0,17
1963–64	12 315	0,07
1964–65	13 772	0,03
1965–66	16 060	0,02
1966–67	15 458	0,14
1967–68	9 434	0,01
1968–69	8 216	0,06
1969–70	6 800	0,06
1970–71	6 256	0,02
1971–72	6 331	0,03
1972–73	8 874	0,02
1974....	N.a.	

N.a. = not available

Basing their conclusions on observations of naturally infested horses, some authors regard the horse as being very susceptible to *F. hepatica* (Ross, 1967; Kearney, 1974). According to Kearney (1974), "the apparent lack of resistance, the non-fibrous nature of the liver and the absence of gall bladder are probably important in the aetiology of the disease in horses and donkeys". Akahane, Harada, Oshima, Takayama & Ashizawa (1974) stated that "the horse, from which the flukes were scarcely found in nature was as suitable as cattle as the host for *Fasciola* worms", and Boray (1969) included horses and cattle in the same group of delayed resistance although later he included horses with pigs, that have a natural resistance to *Fasciola* infestation (Boray, 1971).

In naturally infested horses, Alcaíno, Gorman, Guevara & Fernández (1983) found that 65 % of 100 infested horses had less than 20 *F. hepatica* each, with a mean of 21 specimens and a range of 1–146; they consider these results low in comparison with those observed by them in other animal species. In contrast, high worm burdens were found by Ugrin & Skovronski (1959, cited by Pantelouris, 1965).

Low egg counts were observed by Boray (1969) and Dakshinkar (1982), and Fischer (1982) found egg counts/g of faeces to be below 1 in all the naturally infested horses examined by her. However, Kearney (1974) found faecal egg counts varying from 4–400 (mean 170) and from 19–1 301 (mean 310) eggs/g of faeces for horses and donkeys, respectively. In the only experimental infestation where patency was observed (Nansen *et al.*, 1975), no mention is made of the egg count.

Considering all these contradictory results both in natural and experimental infestations, it seems that the resistant status of the horse to *F. hepatica* infestations is still not clearly established.

If the horse is indeed relatively resistant to *F. hepatica*, this would explain the low prevalences reported (Table 3), as well as the low degree of infestation and low egg counts often found, although other factors, such as management, grazing habits and difficulty to diagnose the disease in horses can also play a role. On the other hand, infestation of horses with *F. hepatica* has been reported worldwide and the prevalence is high in certain areas, and large numbers of flukes and ova are sometimes found.

Some authors are of the opinion that the disease can be missed both with coprological examination and at necropsy, due to several reasons including:

— long prepatent period (Moisant, Jolivet & Pitre, 1972);
— sediment not examined for liver-fluke eggs in routine faecal examinations (Grelck *et al.*, 1977);
— possibility of intermittent shedding of ova, as happens in cattle (Owen, 1977);
— the low level of infestation leading to very low egg counts (Cotteleer & Famerée, 1981);
— macroscopical lesions absent or very few (Owen, 1977).

It is worthwhile to mention that in an abattoir survey of *F. hepatica* Alcaíno *et al.* (1983) found 16 % of 100 infested horses to be negative coprologically when using 5 g of faeces, and consequently warned against the possibility that false negative results can be expected if only one examination is carried out. Also, in the naturally infested horse found by us, only 8 *Fasciola* ova were found in an *in toto* examination of 500 g of faeces. Most routine coprological examinations would probably have missed this diagnosis because of the small amount of faeces usually examined for trematode ova. Moreover, this gelding showed no macroscopical lesions in the liver although 2 adult *F. hepatica* were present in smaller bile ducts. It seems unlikely, therefore, that this infestation would have been detected unless the liver had been cut, and even one section would probably not have demonstrated the infestation.

Another factor that can probably influence the prevalence of the disease in horses, is the absence of a gall bladder. Benoit (1935) observed that although adult liver flukes occurred in the bile ducts of only 2 of 2 000 (0,1 %) horses examined, *F. hepatica* eggs were present in liver nodules from 27 of 200 horses (13,5 %). He believes that liver fluke ova become immobilized in the smallest bile ducts on account of a biliary reflux that exists only in animals without gall bladders. From these results it would appear that fewer liver fluke ova would be discharged than in animals that have gall bladders; and, furthermore, that ova may be recovered from the liver after the flukes have died and that, unless the liver nodules had been examined, the affected horses may have been regarded as unsusceptible to infestation.

Some factors that may possibly have produced such highly contrasting results are: contact with infested cattle and/or sheep in endemic areas of the disease, which can be expected to lead to a relatively high, continuous challenge of the horses; the age of the host at initial exposure; factors reducing the resistance of horses; differences in strains of *F. hepatica* in the various regions; the possibility that some of the ova previously found in the faeces of horses reported to be naturally infested, resulted from coprophagia and not actual infestation; the number of challenge infestations required for development of patent infestations.

In fact, the highest prevalence in horses is reported from areas where the disease is endemic and horses share the grazing with highly infested cattle and/or sheep. This was found to be the case in Ireland (Kearney, 1974), Brazil (Busetti, Paske, Thomaz & Ruis, 1983), Chile (Rubilar & San Martin, 1982) and Australia (Boray, 1969). In Mexico, Haro Arteaga, Tay, Quintero & Salazar Schettino (1977) found even a higher prevalence in horses than in cattle and sheep. Moreover, Alcaíno *et al.*, (1983) found a lower prevalence than that reported by previous workers in the country (Chile) and ascribed this to the fact that their studies included horses originating from different regions of the country, while those of the previous workers consisted only of animals originating from areas of the country registering the highest percentages of infestation due to *F. hepatica*.

Owen (1977) is of the opinion that contact with infested cattle or sheep is more important than the type of land on which horses are grazing, and Fischer (1982) suspected that high prevalences occur only if horses are grazing in heavily infested pastures grazed by cattle and sheep.

Fischer (1982) postulated that, for patent infestations to occur, horses require a higher threshold value of metacercariae on the grazing than is required by ruminants. According to this author, the low rate of development in horses may necessitate high concentrations of metacercariae before patency is possible. On the other hand, it need be pointed out that Nansen *et al.* (1975) did place 3 experimentally infested horses on apparently heavily infested pastures grazed by cattle showing a high infestation rate *(F. hepatica)* but, when the horses were killed, no flukes could be demonstrated. According to these authors, the marked resistance of horses to liver fluke "is the main factor explaining the low incidence of the infection in horses grazing liver fluke contaminated areas".

It is possible that horses need to be exposed to the infestation, possibly from a young age, before an appreciable percentage of them will develop patent infestations. Fischer (1982), for example, found a higher prevalence of natural infestation in younger than in older horses (43,3 % in foals, 30,2 % in yearlings, 34,3 % in 2-year-old horses and 20,0 % in older animals). This was confirmed by Alcaíno *et al.* (1983), who found a significantly higher prevalence in horses younger than 5 years of age ($P<0,025$) in an abattoir survey. They consider this as a further reason why the prevalence recorded by them was lower than that reported by other authors in the country: the majority of horses killed at abattoirs are apparently older than 5 years and they usually show a lower infestation rate than younger animals. However, as regards experimental infestation, Nansen *et al.* (1975) used horses 1–2½ years of age, except for 1 aged 4 years; the horses that became positive were 1, 2 and 4 years of age. The horses used by Grelck *et al.* (1977) ranged in age between 5 months and 1¾ years and all, except 2 which were infested intraperitoneally, did become infested. In the present trials, where horses between 2½–6 years (2½, 4½, 5½ and 6) of age were used, there was a complete lack of worm development.

It is possible that factors (such as poor nutrition) which decrease the immune status of horses, may be involved in the differences observed. Grelck *et al.* (1977), for example, believe that horses with heavy nematode infestations and in poor condition are more easily infested with *F. hepatica* than animals in good condition. However, in our trials, the 2 horses in which suspected *F. hepatica* lesions were observed had the lowest and the highest nematode egg counts.

It seems unlikely that the strain of the parasite can be responsible for the large differences observed. In South Africa, for example, experimental infestation with a local strain of *F. hepatica* failed, but 1 horse out of a total of only 11 examined (9 %) was found to be naturally infested and there have been repeated reports of equine organs condemned because of fascioliasis.

The possibility that some of the ova, detected by various authors in the faeces of horses grazing with infested cattle and sheep, may have resulted from unintentional coprophagia (with vegetation) and not from fluke infestation of the horses, does not seem to have been considered by them. No reports have been found of the fate of *Fasciola* ova administered orally to horses, but it does not seem unreasonable that these may pass through the alimentary tract of the horse and be indistinguishable from ova laid by flukes infesting the host. This possibility should obviously be investigated. Nevertheless, in the very light natural infestation described in the present paper, ova were indisputably demonstrated on 4 out of 5 occasions on which the faeces were examined, and coprophagia can be excluded, as the horse had not run with fluke-infested animals for approximately 11 months. Therefore, these worms can decidedly produce ova in the horse, and these ova can be detected in the faeces.

One important factor that apparently was not investigated in the experimental work carried out so far, is the effect of repeated infestations. Therefore, it may be worthwhile investigating infestation of foals from a younger age and continuing with regular exposures for a period of time since this is probably what happens in nature.

As far as the pathogenicity of *F. hepatica* to horses is concerned, the opinions are also contradictory. While some authors found no clinical signs (Boray, 1969; Fischer, 1982), the natural disease in horses can apparently lead to various clinical signs and some pathological changes in both the acute form of the disease (Kralj, Srebočan, Maržan, Turner & Wikerhauser, 1960), as well as in its chronic form. Owen (1977), for instance, found, among others, signs of lowered performance, loss of condition and diarrhoea; Garlanda (1958) reported an uncommonly severe hepatitis and cholangitis in a horse heavily infested with *F. hepatica*, while Ugrin & Skovronski (1959, cited by Pantelouris, 1965) observed no enlargement of the livers and no signs of cirrhosis even in heavily infested horses with hundreds of flukes in the bile ducts. In the single naturally infested horse described in the present paper, we found neither clinical signs nor macroscopical lesions. In experimentally infested horses, Nansen *et al.* (1975) and Grelck *et al.* (1977) found very moderate lesions.

According to Owen (1977), the demonstration of even a single *Fasciola* ovum in the faeces of a horse warrants treatment. In contrast, Kearney (1974) considers that the "parasite is very well tolerated and that equines are very susceptible hosts for *Fasiola hepatica*". Perhaps spurious infestation may play a role in this contradiction, as suggested above.

Considered in the light of the high prevalence reported in numerous previous studies of naturally infested horses (Table 3) and also the large numbers of flukes and ova that may sometimes be present (Kearney, 1974), it would appear that, at least under certain circumstances, the horse may be an important reservoir host for *F. hepatica* and may perhaps keep the infestation going in the absence of cattle and/or sheep. In fact, according to the faecal egg counts observed by Kearney (1974), a single horse producing only 10 kg of faeces per day will pass up to 4 million ova. In conclusion, whatever the prevalence or extent of the infestation in horses may be, it is of paramount importance to investigate the viability of the ova voided in the faeces of horses in order to determine whether these can indeed develop and be a source of infestation of domestic ruminants, so that the role of the horse as a possible reservoir of infestation for ruminants can be resolved.

ACKNOWLEDGEMENTS

The authors wish to thank Prof. Anna Verster and Mr A. J. Morren for their help with the manuscript. Mr H. M. Gerber is also thanked for assistance with the infestation of the horses.

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