Prevalence of gastrointestinal helminth parasites of equids from organized farms of Mumbai and Pune

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Abstract A total of 1,304 faecal samples of different species of equids were examined for presence of helminthic eggs from five different centres in Mumbai and Pune regions of Maharashtra state from October 2011 to June 2012. Overall prevalence of helminthic infestation was found to be 20.63 % with higher rate of occurrence in monsoon (31.29 %) followed by winter (20.40 %) and summer (14.23 %). Four species of nematodes viz. strongyles (10.81 %), *Strongyloides westeri* (13.19 %), *Parascaris equorum* (0.23 %) and *Dictyocaulus amfieldi* (0.23 %); two species of trematodes viz. amphistomes (1.38 %) and *Schistosoma indicum* (0.31 %) and only one species of cestode viz. *Anoplocephala* spp. (0.07 %) were encountered in the study. Coproculture studies revealed that *Strongylus vulgaris* was predominant species (36.87 %) among strongyles followed by cyathostomes. Amongst equids, mules had the lowest prevalence of 14.80 % followed by ponies (20.61 %) horses (38.79) and donkeys (51.90 %).

Keywords Helminths · Prevalence · Season · Intensity · Species

Introduction

Gastrointestinal parasitism is responsible for a wide range of clinical syndromes in equids (Giles et al. 1985). The

clinical symptoms vary from impaired performance, anaemia, unthriftiness and diarrhea to colic and occasional deaths in heavy infection (Baker and Ellis 1981). Even light infections are known to hamper the development and performance of horses (Ogbourne 1978). Research over has showed that intestinal parasite infestation is one the major underlying causes of colic (Proudman 2006). Prevalence of clinical and sub-clinical parasitic diseases can be minimized through controlling the gastrointestinal parasites (Sattar 2003) mainly by regular deworming with anthelmintic drugs (Meara and Mulcahy 2002).

The present study was planned to assess the present status of GI parasites in equids with special reference to mules in Maharashtra state and to assess and compare the susceptibility of mule (*Equus mulus*) to GI parasitic infestations with other equids on the basis of prevalence.

Materials and methods

Location and geography of study area

Mumbai is a lying at latitude 18.9647°N and longitude 72.8258°E, covers a total area of 603.4 km² and many parts of the city lie just above sea level, with elevations ranging from 10 m (33 ft) to 15 m (49 ft). Mumbai has a tropical climate with average annual temperature is 27.2 °C (81°F) and receives an average annual rainfall of 2,167 mm. Pune is situated 560 m above sea level lies at latitude 18.5236°N and longitude 73.8478°E. Pune has a tropical wet and dry climate with average temperatures ranging between 20 and 28 °C (68–82°F).

Five centers namely Premium Serums and Vaccines Pvt. Ltd., Narayangaon, Pune; Vacc-Syn Biotech Private Ltd., Badlapur, Thane; Veterinary Dispensary, Titwala, Badlapur

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Fig. 1 Intensity of gastrointestinal helminth infection in equids

village and BSPCA hospital wards, Parel, Mumbai were screened in the present study. Faecal samples were collected from all the animal species of equids viz. mules, ponies, horses and donkeys of both the sexes once during each season of the year.

Collection of samples

A total of 1,304 faecal samples were collected and examined for gastrointestinal helminth parasites of equids from the above farms during all the three seasons viz. winter (November–December, 2011), summer (March–May, 2012) and rainy (June, 2012). Fresh faecal samples were collected directly from rectum using disposable polythene gloves, kept in plastic sachets, labelled and preserved at 4 °C in laboratory.

Faecal examination

The collected faecal samples were taken in clean petriplates and thoroughly examined for colour, consistency, presence of blood, mucus, tapeworm segments and dead worms which sometimes, provided an important clue about the parasitic infection. The samples were then examined microscopically by adopting qualitative techniques using sedimentation and floatation method for detection of parasitic material (Soulsby 1982). Randomly selected 30 faecal samples were examined in each season by quantitative technique using Stoll's dilution method, to determine the parasitic load i.e. eggs per gram (EPG) of faeces. The intensity of infection was categorized using standard scale

(Reinemeyer 2009). Coproculture examination was also performed using standard petri plate method and the larvae were identified under light microscope as per standard keys Soulsby (1965) (Fig. 1).

Statistical analysis

The results were statistically analyzed as per Snedecor and Cochran (1994) and also online at Web Agri Stat Package developed by Ashok Kumar Jangam.

Results and discussion

A total of 1,304 samples of equids were examined and 269 (20.63 %) were found positive for one or the other helminth parasites. The overall prevalence rate of gastrointestinal helminths was found to be 14.80 %, 20.62 %, 38.795 and 51.90 % in mules, ponies, horses and donkeys, respectively.

The overall prevalence of gastrointestinal helminths recorded in the present study is in close proximity with the observations of Bhuvankumar and Satchidanadam (1989a, 1989b) who reported 22 % prevalence on a stud farm in Madras city and Pramod (2010) who also recorded similar trend (21.38 %) in horses in Nagpur region. In contrast, distinctly higher prevalence was reported by many workers viz. Khajuria et al. (2004), Pandit et al. (2008) and Maria et al. (2011) from Jammu and Kashmir; Kaur and Kaur (2008) from Punjab, Katoch et al. (2006) from Haryana, Sengupta and Yadav (1998) from Himachal Pradesh,

Plate 1 Eggs of different helminthes encountered during the present investigation by faecal examination

Sengupta and Yadav (2001b), Banerjee et al. (2002) and Pal (2002) from UP and Utrakhand. In general, prevalence is higher in north India as compared to other parts. This can be attributed to comparatively higher population of equids in the region which provide ample scope for gastrointestinal parasites to propagate easily from one individual to other.

Nematodes were most prevalent (24.46 %) followed trematodes (1.69 %) and cestodes (0.076 %). Among nematodes, *Strongyloides westeri* were found to be most

prevalent (13.19 %). Other nematodes found during study were strongyles (10.81 %), *Parascaris equorum* (0.23 %) and *Dictyocaulus arnfieldi* (0.23 %). Among trematodes, the prevalence of amphistomes was found to be 1.38 % followed by *Schistosoma indicum* (0.31 %) (Plate 1).

All the cases of mixed infestation involving two species of helminths were found to be infected with strongyles and *S. westeri*, both his could be attributed to the fact that the genera of roundworms have direct life cycle with their free

Table 1 Seasonal prevalence of gastrointestinal helminths of equids in Mumbai and Pune regions

Species of equids	Winter		Summer		Monsoon		Overall	
	No. of samples screened	No. of samples found +ve	No. of samples screened	No. of samples found +ve	No. of samples screened	No. of samples found +ve	No. of samples screened	No. of samples found +ve
Mules	299	51 (17.06)	321	27 (8.41)	164	38 (23.17)	784	116 (14.80) ^c
Ponies	131	19 (14.50)	108	21 (19.44)	86	27 (31.40)	325	67 (20.62) ^c
Horses	36	14 (38.89)	45	14 (31.11)	35	17 (48.57)	116	45 (38.79) ^b
Donkeys	29	17 (58.62)	25	9 (36.00)	25	15 (60.00)	79	41 (51.90) ^{a**}
Total	495	101 (20.40)	499	71 (14.23)	310	97 (31.29)	1,304	269 (20.63)

Figures in parentheses indicate percentage. CV = 5.219, CD(AxB) = 2.89 at 5 % & 3.85 at 1 % level of significance. Similar superscripts (^{a,b,c,d}) indicate the values at par

** Significantly higher values

living larvae having more or less same bionomics. Amphistomes and Schistosomes were also concurrently involved indicating water reservoir infested with *Indoplanorbis* spp. of snail which is a common intermediate host for the two species of trematodes. *S. westeri* was most predominant species of helminths of equids in the present study. This observation is in contrast with many reports from India. However, Vercruysse et al. (1986) from Burkino Faso, West Africa reported similar results. It is surprising that *Oxyuris equi*, one of the most prevalent and pathogenic species having ubiquitous presence in different parts of India was not seen in the present survey despite all precautionary measures.

As per the seasonal occurrence, in general highest infection rate of 31.29 % was recorded in monsoon followed by 20.40 % in winter and 14.23 % in summer respectively (Table 1). Mules showed highest prevalence rate of gastrointestinal helminths in monsoon (23.17 %) followed by winter (17.06 %) and summer (8.41 %) while as ponies showed highest prevalence in monsoon (31.40 %) followed by summer (19.44 %) and winter (14.50 %). Horses revealed an overall 48.57 % prevalence of gastrointestinal helminth parasites in monsoon followed by winter (38.89 %) and summer (31.11 %). The prevalence rate of gastrointestinal parasites in donkeys was highest in monsoon (60 %) followed by winter (58.62 %) and summer (36 %). the degree of intensity of worm infection was found lowest in summer and showed rising trend in winter and monsoon. This could be attributed to the favorable climatic conditions for free living infective stages of helminths with direct life cycle as well as for intermediate hosts (snails) of the helminths with indirect life cycle. Similar results have earlier been showed by many researchers (Hass 1980a, b; Sengupta and Yadav 2001a; Raman et al. 2004; Saeed et al. 2010; Maria et al. 2011). The details of season wise prevalence are given in

Tables 1, 2 and 3. The present study appears to be the first report of occurrence of schistosomes from western India in equids particularly mules and ponies.

The prevalence of mixed infection was (5.44 % of screened population (Table 2). It was highest in monsoon (6.45 %) followed by winter (6.06 %) and summer (4.2 %) details shown in Table 2. In mules highest prevalence of mixed infection was in winter (4.68 %) followed by summer (1.56 %) and monsoon (0.60 %). Ponies showed 3.82, 3.7 and 3.49 % prevalence rate of mixed infections in winter, summer and monsoon season, respectively. Mixed infections in horses showed a prevalence of 22.87, 13.33 and 8.33 % in monsoon, summer and winter season respectively. Highest prevalence of mixed infections in donkeys was observed in monsoon (32 %) followed by winter (27.59 %) and summer (24 %). Pramod (2010) reported much lower prevalence rates from Nagpur, Maharashtra while Mahfooz et al. (2008) and Khajuria et al. (2004) support the present study.

Regarding sex-wise prevalence rate of gastrointestinal parasites [male equids (20.93 %) and females (19.49 %)] no statistically significant difference between n horses and donkeys. These results corroborate with the observations made by Umur and Mustafa (Umur and Mustafa 2009) On the other hand, in mules and ponies the prevalence was higher in females. As earlier reported by Ahamed et al. (1996) and Francisco et al. (2009).

Strongyloides westeri and *D. arnfieldi* showed moderate type of intensity with load of 100–1,200, 100–1,600 and 500–700 EPG respectively (Table 3). The observations of the present study are in line accordance with Saeed et al. (2010), Yoseph et al. (2005), Banerjee et al. (2005). Irrespective of the seasons, the highest egg output recorded in the present study was of *S. westeri* followed by strongyles. In contrast Pilania et al. (2012) reported highest EPG of *P. equorum* followed by strongyles and *Strongyloides* spp.

Table 2 Prevalence of mixed helminthic infestation in equids during different seasons

Species of Helminthes	Winter				Summer				Monsoon				Total	
	MUL		PON		MUL		PON		MUL		PON		Total	
	Total	DNK	HRS	PON	Total	DNK	HRS	PON	Total	DNK	HRS	PON	Total	DNK
SNG + SLD	14 (46.66)	08 (26.66)	03 (30.00)	05 (16.66)	30 (23.80)	06 (28.57)	06 (28.57)	04 (19.04)	21 (05.55)	06 (44.44)	08 (44.44)	01 (05.55)	18 (97.18)	08 (44.44)
SNG + SLD + AMPH	-	-	-	-	Nil	-	-	-	Nil	-	-	01 (100.00)	01 (01.40)	-
SNG + SLD + SCH	-	-	-	-	Nil	-	-	-	Nil	-	-	01 (100.00)	01 (01.40)	-
Total	14	08	03	05	30	06	06	04	21	06	08	03	20	08

Figures in parentheses indicate percentage. Chi Square Statistic is significant at both 5 % and 1 % level of significance

SNG strongyle, SLD *strongyloides westeri*, AMPH amphistomes, SCH schistosomes

in a study, conducted on animals participated in fair at Pushkar, Rajasthan which may have high population of foals.

As far as species is concerned, overall prevalence of gastrointestinal helminths was highest in donkeys (51.90 %) followed by horses (38.80 %), ponies (20.62 %) and mules (14.80) as shown in Table 1. Overall prevalence data in different equids indicated that the lowest host species preferred is mules followed by ponies (20.61 %) but the difference was statistically non-significant ($p \geq 0.5$). Highest preference was seen in donkeys followed by horses which also stand apart from all other equids. The most prevalent nematodes viz. *Strongyloides* spp. and *S. indicum* have shown lowest infection rate in mules as compared to ponies. *D. arnfieldi* which was reported in ponies (0.61 %) was not found in mules and preference of strongyles and amphistomes did not show statistically significant difference between mules and ponies. Among different helminths only strongyles and strongyloides were reported from donkeys. Similar trend was observed in horses except a single case of *P. equorum*. Studies of pedigrees of larger mammals have provided the evidence for significant genetic influences on helminthic infections (Williams-Blangero et al. 1999). Crossing between two species change the genetic configuration of the offspring and eventually this would separate mules from its parents as far as host susceptibility is concerned and may influence their susceptibility to different pathogens.

Coprocultural evaluation

Amongst the strongyle infestation, irrespective of the species of equids, the highest contribution was by *Strongylus vulgaris* (36.87 %), followed by cyathostomes (27.66 %), *Strongylus equinus* (14.18 %) and *Strongylus edentatus* (14.18 %) (Table 4). This is in congruous with observations of Vercruysse et al. (1986), Sengupta and Yadav (1997), Sengupta and Yadav (2001b) and Raman et al. (2004). Taking host species in consideration, *S. vulgaris* held the major share of 41.07 % and 50.00 % in mules and donkeys respectively while in ponies and horses, cyathostomes were predominant species contributing 50 and 41.94 % of total strongyle infestations. However, other two species of large strongyles viz. *S. equinus* and *S. edentatus* were lowest contributors among strongyles and showed statistically significant difference between each other in all equine species except donkeys. Sengupta and Yadav (1998), Sengupta and Yadav (2001b) and Raman et al. (2004) reported high prevalence of large strongyles as compared to small strongyles (cyathostomes) while studies conducted by Banerjee et al. (2002), Sharma et al. (2011) and Maria et al. (2011) differ from the present study.

Table 3 Intensity of gastrointestinal helminths of equids in different seasons

Parasitic species	Winter			Summer			Monsoon			Range EPG (min–max)
	Low = 100	Moderate 200 to ≤ 500	High > 500	Low = 100	Moderate 200 to ≤ 500	High > 500	Low = 100	Moderate 200 to ≤ 500	High > 500	
No. of infected equids with respective helminth species										
Strongyles	2	21	10	3	14	7	2	4	7	100–1,200 (S)
<i>Strongyloides westeri</i>	1	20	9	0	3	17	1	31	19	100–1,600 (S)
Amphistomes	1	5	0	1	0	0	4	6	0	100–300 (W)
<i>Parascari sequorum</i>	1	1	0	0	1	0	0	0	0	100–200 (W)
<i>Anoplocephala</i> spp.	1	0	0	0	0	0	0	0	0	–
<i>Dictyocaulus arnfieldi</i>	0	0	0	0	1	2	0	0	0	500–700 (S)
Schistosomes	0	0	0	0	0	0	0	3	0	100–200 (M)

W winter, S summer, M monsoon

Table 4 Species differentiation of strongyle larvae and its correlation with different equids

Species of strongyles		No. of equids infected with strongyles				
		Mules	Ponies	Horses	Donkeys	Overall
Large strongyles	<i>S. vulgaris</i>	23 (41.07)	06 (25)	08 (25.80)	15 (50.00)	52 (36.87)
	<i>S. equinus</i>	06 (10.71)	04 (16.67)	07 (22.58)	03 (10.00)	20 (14.18)
	<i>S. edentatus</i>	11 (19.64)	02 (8.33)	03 (09.68)	04 (13.33)	20 (14.18)
Small strongyles	Cyathostomes	16 (28.57)	12 (50.00)	13 (41.94)	08 (26.67)	39 (27.66)
	SE/SD	6.36/12.73	8.80/17.60	6.63/13.26	9.07/18.15	5.55/11.09
	Total	56/784	24/325	31/116	30/79	141/1,304

Value in parenthesis indicates percentage

SE standard error of mean, SD standard deviation

Conclusion

It can be concluded that maximum infection rate was observed in monsoon season and mules were least susceptible to gastrointestinal helminth infection as compared to horses, donkeys and ponies.

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