

Helminth parasites of the wild boar, *Sus scrofa*, in Luristan province, western Iran and their public health significance

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Abstract

Seven helminth species were obtained from 12 wild boars (*Sus scrofa*) during a survey from 2000 to 2001 in Luristan province, western Iran. These species include the cestode larvae *Cysticercus tenuicollis* (25%), *C. cellulosae* (8.3%), the nematodes *Metastrongylus apri* (41.6%), *M. pudendotectus* (16.6%), *M. salmi* (8.3%), *Trichuris suis* (8.3%) and the acanthocephalan *Macracanthorhynchus hirudinaceus* (41.6%). No trematodes were found. Seven wild boars (58.3%) were identified as having at least one helminth species. A single infection was detected in 16.6% of cases, but a three species infection covered the highest rank (25%). All these helminths have been reported from other areas of Iran including the north, northeast and southwest, but not in Luristan. Among seven helminths identified, at least three species are transmissible to humans. The public health significance of these helminths is discussed.

Introduction

The European wild boar, *Sus scrofa*, is dispersed all over Eurasia (Groves, 1981). The subspecies, *S. scrofa attila* occurs throughout Iran, even in the desert lands of the southeast. No precise estimate of the wild boar population in Iran is known at present, nonetheless, owing to the abundance of diet in dense forests, wild boars occur frequently in the north, northwest and west of the country (Etemad, 1985). Their capacity of adaptation to diverse habitats allows wild boars to make use of different kinds of diets including seeds, reptiles,

amphibians, insect larvae, birds and their eggs and even carrion. However, in Iran the main diet is roots, bulbs, acorns, and beech nuts.

Previous researchers have studied distinct aspects of the helminth fauna of *S. scrofa* and its distribution (de-La-Muela *et al.*, 2001). In Iran, Afshar (1967) detected cysticercosis in wild boars in the littoral regions of the Caspian Sea. In a more recent study, Eslami & Farsad-Hamdi (1992) surveyed the helminth fauna of wild boar in some parts of Iran, but not in the west of Iran, including Luristan. The aim of the present study therefore was to verify the representative data on the helminth fauna of *S. scrofa* in Luristan and to evaluate the role of *S. scrofa* in the epidemiology of human helminthiasis in this part of Iran.

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Materials and Methods

Following authorization by the Iranian Environmental Protection Organization (IEPO), 12 wild boars (7 females and 5 males) from all parts of Luristan were shot from September 2000 to November 2001. Records were kept of their age (according to dental formula and physical appearance), gender and locality.

At necropsy, the trachea, lungs, heart, kidneys, intestinal tract, oesophagus, stomach, brain, liver, gall bladder, spleen, and urinary bladder of each animal were separated. The peritoneal cavity, sub-cutaneous tissues and muscles, including the tongue, were examined for taeniid larvae. All helminths were removed and placed in vials containing fixative (10% formalin for taeniid larvae and hot 70% alcohol for roundworms).

Helminths were processed according to the species, identified and counted. Scolices of taeniid larvae were cut and mounted in lactophenol. The shape, number, size, and the arrangement of rostellar hooks were used for identification according to Verster (1969) and Khalil *et al.* (1994). The metastrongylids were temporarily mounted in lactophenol. The shape and the length of spicules as well as the size and ray arrangement of the copulatory bursa were used to identify the metastrongylid species in accordance with Skryabin *et al.* (1952). Worm size and shape, together with the arrangement of the proboscis hooks were used in the identification of *Macracanthorhynchus hirudinaceus*.

The prevalence of infection in female and male *S. scrofa* was compared using the Fisher's Exact test.

Results

A total of seven helminth species were recovered from 12 wild boars examined: seven females and five males distributed over nine different parts of Luristan (table 1). Five of 12 wild boars were not infected. Concurrent infections were more frequent than single ones, and infections with one, two and three species were found in 2 (16.6%), 2 (16.6%) and 3 (25%) cases, respectively.

The most prevalent nematode species was *Metastrongylus apri* (41.6%). Five wild boars harboured *M. apri*, two wild boars harboured *M. apri* and *M. pudendotectus*, while

Table 1. Age and gender of wild boar, collected from nine localities in Luristan province, western Iran from September 2000 to November 2001.

Host gender	Host age (years)	Locality
Female	1.0	Boroujerd
	1.5	Khorramabad
	2.0	Khorramabad
	3.0	Aligoodarz
	3.0	Dorood
	4.0	Azna
	4.5	Koohdasht
Male	2.0	Noorabad
	2.0	Aleshtar
	2.0	Poledokhtar
	3.0	Khorramabad
	4.0	Aligoodarz

only one harboured *M. apri*, *M. pudendotectus* and *M. salmi* simultaneously. The other nematodes identified were *M. pudendotectus* (16.6%), *M. salmi* (8.3%) and *Trichuris suis* (8.3%) (table 2).

Cestode larvae were found in four of 12 wild boars. The prevalence of *Cysticercus tenuicollis*, the larval stage of *Taenia hydatigena*, was 25%. Each of the three infected wild boar harboured only one larva. The number of rostellar hooks was 29, 28 and 31. The larval form of *T. solium*, *C. cellulosae*, was observed in one heavily infected wild boar (8.3%), mainly in the fore and hind limbs. The average number of rostellar hooks was 26–28, the large ones measuring 172–176 μm and the small ones 136–139 μm .

Trematodes were not recovered from any of wild boars examined.

The giant thorny-headed worm, *Macracanthorhynchus hirudinaceus*, was recovered from five of 12 wild boars (41.6%) examined, with worms measuring up to 40 cm in length.

Overall, the prevalence of helminth infections was higher in females than in males (table 3). No significant differences in sex distribution were observed.

Discussion

In the present study, two larval taeniids were identified, with *C. tenuicollis*, the larval stage of *T. hydatigena*, being the most prevalent (25%). In Iran, several domestic and wild mammals are known to be the intermediate hosts of *T. hydatigena* (Eslami *et al.*, 1981). In addition, the high prevalence of strobilar stages in the canids of Iran is well documented (Sadighian, 1969; Mobedi *et al.*, 1973a; Eslami & Mohebbi, 1988).

Human *T. solium* infections have been reported in some countries, especially in Latin America, Mexico, Peru, and southeastern Asia, where people eat cured or insufficiently cooked pork (García-Noval *et al.*, 1996; Rodriguez-Canul *et al.*, 1999).

To date, human infections with *T. solium* have not been reported in Iran, although Afshar (1967) found that 0.2% of pigs and 4% of wild boars in littoral regions of the Caspian Sea harboured *C. cellulosae*. In a recent survey undertaken in the north, northeast, and southwest of Iran, 4% of wild boars were infected with *C. cellulosae* (Eslami & Farsad-Hamdi, 1992), whereas in the present study, only one aged female (8.3%) from Koohdasht was severely infected.

According to Islamic instructions, the breeding and eating of pigs and wild boars are prohibited. After the Islamic revolution in 1979 in Iran, all commercial piggeries and pork-sausage factories ceased production and pig-raising was no longer allowed. However, some ethnic minorities, such as Christian Armenians and gypsy tribes hunt wild boar illegally using its meat in the preparation of a half-cooked delicacy. The infected boar was hunted near a gypsy temple, where undercooked wild boar meat is ceremonially eaten. It is interesting to note that, in Iran, contrary to other countries, wild boar is the solitary reservoir host for human taeniasis solium.

Four species of nematodes were identified, with the highest prevalence recorded for *Metastrongylus apri* (41.6%). Different species of earthworms, which form

Table 2. The occurrence of helminth parasites in wild boars from Luristan province, western Iran during September 2000 to November 2001.

Helminth species	No. of wild boars infected (%)	Total worm recovery	Range	Mean worm burden \pm S.D.
<i>Cycticercus cellulosae</i>	1 (8.3)	NC*	NC*	NC*
<i>Cycticercus tenuicollis</i>	3 (25.0)	3	1	1 \pm 0
<i>Trichuris suis</i>	1 (8.3)	8	8	8 \pm 0
<i>Metastrongylus apri</i>	5 (41.6)	74	1–22	14.8 \pm 8.4
<i>Metastrongylus pudendotectus</i>	2 (16.6)	21	5–16	10.5 \pm 7.7
<i>Metastrongylus salmi</i>	1 (8.3)	7	7	7 \pm 0
<i>Macracanthorhynchus hirudinaceus</i>	5 (41.6)	80	1–30	16 \pm 12.7

* Not counted.

part of the diet of wild boars, act as intermediate hosts for this nematode species, and this could result in a high prevalence of infection among *S. scrofa*. Human infections with *M. apri* have been reported on three occasions (Beaver *et al.*, 1984), probably through the accidental ingestion of contaminated earthworms along with soiled foodstuffs. Because of the relative high prevalence of *M. apri* in the wild boar in Luristan and also the close proximity of farmers to the farmlands, the possibility of infection with this species should not be ruled out in rural communities.

Metastrongylus salmi is another cosmopolitan respiratory metastrongylid of wild boars, although in the current study, only one female (8.3%) was found to be infected and this low prevalence level is consistent with a 14% infection recorded by Eslami & Farsad-Hamdi (1992). A similar low prevalence value (of 16.6%) for *M. pudendotectus* was recorded in two female wild boars in the present study. This metastrongylid species and *M. salmi* do not appear to infect humans.

The swine whipworm *Trichuris suis* is a cosmopolitan intestinal nematode of pigs and wild boars (Pattison *et al.*, 1980), and is identical to the human whipworm *T. trichura* with respect to life cycle, morphology, location and interaction with the intestinal mucosa (Holland, 1987). Additionally, the successful experimental transmission of *T. suis* of pigs to human has been reported (Beer, 1971). In the present study, one adult female (8.3%) was infected

and this again is consistent with a low prevalence value of 4% reported by Eslami & Farsad-Hamdi (1992).

Macracanthorhynchus hirudinaceus, the giant thorny-headed worm, is another widely distributed helminth parasite occurring in a diversity of canid and suid hosts and also in humans (Schmidt, 1971; Leng *et al.*, 1983). In Iran, *M. hirudinaceus* has been frequently found in a variety of canids and in wild boars (Eslami & Farsad-Hamdi, 1992; Arbabi *et al.*, 2001), although no human infections have been reported. Definitive hosts may be infected through the ingestion of different species of dung beetles (Scarabaeidae) harbouring cystacanths. Dung beetles are abundant in the rural areas of Iran, especially in the warm months of late spring and summer (Mobedi *et al.*, 1971). In the present study, five of 12 (41.6%) of the wild boars were infected, suggesting that boars could play an important role in the epidemiology of *M. hirudinaceus* infection in humans in Iran, mainly in the rural areas.

Although hydatidiasis is hyper-endemic in Iran, it was not found in any wild boar in the present study, and this is likely to be due to Iranian farmers, for religious reasons, preferring not to feed their dogs on wild boar carrion. Nevertheless, there are numerous reports of hydatid cysts being recovered from sheep and cattle, domestic pigs, buffaloes, camels, donkeys and wild ungulates in Iran (Mobedi *et al.*, 1970; Eslami *et al.*, 1981; Eslami & Nadalian,

Table 3. The prevalence and intensity of infection of helminths in wild boars relative to host sex.

Helminth species	Prevalence (%)			Intensity of infection \pm S.E		Fisher's exact test for comparison of prevalence in females and males
	Total	Females	Males	Females	Males	
Nematodes						
<i>Metastrongylus apri</i>	41.6	55.5	20.0	14.5 \pm 4.83	16.0 \pm 0.0	n.s.
<i>Metastrongylus pudendotectus</i>	16.6	28.5	–	10.5 \pm 5.5	–	n.s.
<i>Metastrongylus salmi</i>	8.3	14.2	–	7.0 \pm 0.0	–	n.s.
<i>Trichuris suis</i>	8.3	14.2	–	8.0 \pm 0.0	–	n.s.
Cestodes						
<i>Cycticercus tenuicollis</i>	25	28.5	20.0	1.0 \pm 0.0	–	n.s.
<i>Cycticercus cellulosae</i>	8.3	14.2	–	n.d.	n.d.	n.s.
Acanthocephalans						
<i>Macracanthorhynchus hirudinaceus</i>	41.6	55.5	20.0	13.5 \pm 6.6	26 \pm 0.0	n.s.

n.d., not done; n.s., not significant.

1987) but in Luristan province, wild boar appears not to be the main reservoir for human hydatidiasis.

Trichinella spp. occur worldwide, but mostly in areas where hogs are fed with uncooked garbage containing pork (Markell *et al.*, 1999). In some parts of the world, sporadic outbreaks occur due to the consumption of the meat of wild boars and warthogs (Nelson *et al.*, 1961; Rodriguez-Osorio *et al.*, 1999). Although trichinellosis frequently occurs in a wide variety of canids in Iran (Mobedi *et al.*, 1973b), only two of 4950 (0.04%) wild boars examined by Afshar & Jafarzadeh (1967) in the northern regions of the country were infected with *Trichinella* larvae. In the present study, no wild boars were infected.

The present results therefore indicate the relative high prevalences of two indirect transmitting helminthiases (*M. apri*, *M. hirudinaceus*). Although rare, both species can be transmitted to humans. Wild boars are likely to be involved in the epidemiology of helminth zoonoses by acting as reservoir hosts for parasites that could survive in sylvatic cycles, independent of the domestic cycle. Man is the only definitive host for *T. solium*, and human infections with this taeniid in Iran are entirely of wild boar origin. Hence, national and provincial health authorities should seriously consider the role of the wild boar in the epidemiology of human helminthiases in Iran.

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