

## Short Paper

# Prevalence of parasitic infections in the red fox (*Vulpes vulpes*) and golden Jackal (*Canis aureus*) in Iran

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## Summary

Red foxes and golden jackals are the two most abundant wild carnivores of Iran which have the ability to adopt a variety of habitats and human proximity. Despite this, very few investigations on their helminth and none on their external parasites infections have been carried out in Iran. Between 2003 and 2004, a total of 79 jackals and 37 foxes were collected from 3 different climatic zones of Iran and examined for helminth and ectoparasite infections. A number of parasites including: *Mesocestoides lineatus*, *Taenia hydatigena*, *Dipylidium caninum*, *Diplopylidium nolleri*, *Ancylostoma caninum*, *Uncinaria stenocephala*, *Toxocara canis*, *Onicola canis*, *Dirofilaria immitis*, *Rhipicephalus* sp., *Ctenocephalides canis* and *Pulex irritans* were common parasites between jackals and foxes, whereas *Echinococcus granulosus*, *Spirocerca lupi*, *Rictularia affinis*, *Macracanthorhynchus hirudinaceus*, *Dermacentor* sp. parasitized jackals and *Jeuyoxiella pasquali*, *Ixodes ricinus*, *Haemaphysalis* sp. were collected only from foxes. All ectoparasites, *S. lupi* and *O. canis* reported from jackals and foxes in this study represent new host and distribution records.

**Key words:** Parasite, Fox, Jackal, Iran

## Introduction

Among the 29 species of wild carnivores reported from Iran (Ziaie, 1996) jackals and foxes are the two most abundant species with the ability to adopt a variety of habitats and human proximity. Therefore, they are a potential source for producing parasitic infections in other animals and man. Zoonoses with wildlife reservoirs represent a major public health problem affecting all continents, therefore the importance and recognition of wildlife as a reservoir is increasing. Study on the helminth infections of foxes and jackals, especially fox, have been the subject of several surveys around the world (Taira *et al.*, 2002; Smith *et al.*, 2003; Kruse *et al.*, 2004; Vervaeke *et al.*, 2005; Gorski *et al.*, 2006), and Iran

(Massoud *et al.*, 1981; Eslami, 2001; Dalimi *et al.*, 2002).

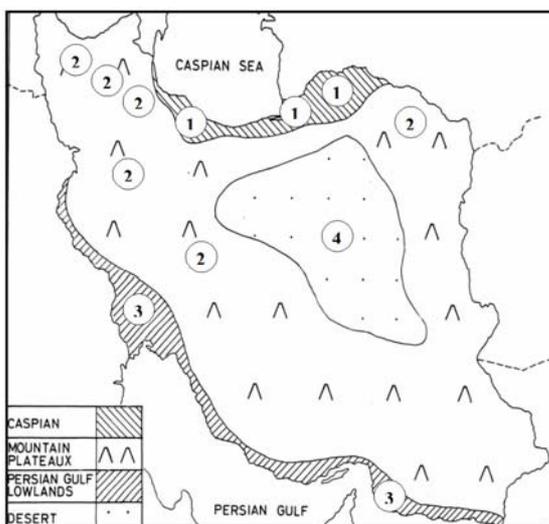
The purpose of the present study was to describe the parasitic infections of red foxes and golden jackals in three different zoogeographical regions of Iran.

## Materials and Methods

### Study Areas

Iran, as a semi-dry country can be climatologically subdivided into 4 different zones (Fig. 1). Beside the Central Desert (zone 4), an area not suitable for animal breeding, 11 provinces were selected in this study from 3 other zones as follows: Gilan, Mazandaran and Golestan (in zone 1) with 40-150 cm rainfall and of 8-26°C mean monthly temperature per year, East and

West Azarbaijan, Ardebil, Markazi, Isfahan, and Khorassan (in zone 2) with 20-50 cm rainfall and minus 5-29°C mean monthly temperature per year, and Khuzestan and Hormozgan (in zone 3) with 20-30 cm rainfall and 13-36°C mean monthly temperature per year.



**Fig. 1: Selected provinces in different climatic zones from Iran**

### Animals

Different numbers of animals under the auspices of Environmental Department including 27 jackals and 9 foxes from zone 1, 33 jackals and 25 foxes from zone 2 and 9 jackals and 3 foxes from zone 3 were humanly euthanized and transported in sealed bags to the laboratory for further studies.

From zone 1, 2 and 3 twenty seven jackals and 9 foxes, 33 jackals and 25 foxes and 19 jackals and 3 foxes were humanly euthanized and collected, respectively. The carcasses were transported to the laboratory in sealed plastic bags and were subjected to necropsy.

### Parasitological Methods

External parasites were preserved in 70% ethanol and 5% glycerin. At necropsy the alimentary canal of each animal was inspected for parasite. The large helminthes were collected from each part. Meanwhile the contents of each small intestine and its epithelial scraping were washed gently in a 100 mesh sieve and were investigated for parasite using a dissecting microscope.

The nematodes were cleared in lactophenol and the cestodes and acanthocephalans were stained using acetocarmine and haematoxylen, respectively for identification of the species. Hearts after opening and other organs after slicing into pieces were examined macroscopically for parasitic infections. Morphological characteristics described for helminths and external parasites were used for identification of the parasites (Yamaguti, 1961; Anderson, 1992; Walker, 1994).

### Statistical analysis

Chi-square test was used to compare the distribution of parasites in two studied carnivores in 3 zoogeographical zones.

### Results

Out of 79 jackals and 37 foxes, 66.7 and 33.3% harbored one or more species of parasites on skins, in alimentary tracts and hearts, respectively. The results are summarized in Table 1 and 2.

The data presented in Table 1 indicate that *M. lineatus* (15.2 to 21.5%) and *O. canis* (12.6%) in jackals (J) and *M. lineatus* (43.2 to 67.5%) and *T. canis* (10.8 to 32.4%) in foxes (F) were the most prevalent species.

*C. canis* and *P. irritans* were the most prevalent external parasite of jackals (17.7 and 21.5%) and foxes (8.1-32.4% and 2.7-10.8%), respectively.

The percentage of parasitic infections in jackals examined in 3 zones compared with those of foxes were significantly different ( $P = 0.007$ ). Meanwhile comparison between the species of parasite collected from jackals and foxes revealed a significant difference between cestodes and ectoparasites of the two animal species ( $P < 0.001$ ).

### Discussion

According to our findings, golden jackal and red foxes of Iran are host to 12 helminths and 4 ectoparasites and 10 helminths and 5 ectoparasites, respectively. This is in line with Dalimi *et al.* (2006) on jackal and fox in western Iran, and to some extent with Vervaeke *et al.* (2005) on foxes of Belgium.

All ectoparasites, *S. lupi* and *O. canis*

**Table 1: Prevalence of helminth infections in 37 foxes and 79 jackals of 3 zones of Iran**

Helminth	% Infection (No.)					
	Zone 1		Zone 2		Zone 3	
	J	F	J	F	J	F
<i>Mesocestoides lineatus</i>	-	43.2 (16)	21.5 (17)	59.5 (22)	15.2 (12)	67.5 (25)
<i>Taenia hydatigena</i>	-	-	2.5 (2)	5.4 (2)	5 (4)	-
<i>Echinococcus granulosus</i>	-	-	8.9 (7)	-	-	-
<i>Dipylidium caninum</i>	-	-	-	8.1 (3)	10.1 (8)	-
<i>Diplopylidium nolleri</i>	-	-	-	8.1 (3)	5 (4)	-
<i>Jeuyoxilla pasquali</i>	-	10.8 (4)	-	-	-	-
<i>Spirocerca lupi</i>	-	-	2.5 (2)	-	-	-
<i>Ancylostoma caninum</i>	-	-	2.5 (2)	5.4 (2)	-	-
<i>Uncinaria stenocephala</i>	-	-	6.3 (5)	8.1 (3)	-	-
<i>Dirofilaria immitis</i>	3.8 (3)	-	2.5 (2)	8.1 (3)	5 (4)	-
<i>Toxocara canis</i>	-	-	5 (4)	10.8 (4)	-	32.4 (12)
<i>Rictularia affinis</i>	-	-	-	-	5 (4)	-
<i>Macrocanthorynchus hirudinaceus</i>	-	-	-	-	5 (4)	-
<i>Onicola canis</i>	-	10.8 (4)	12.6 (10)	5.4 (2)	-	-

J = Jackal and F = Fox

**Table 2: The prevalence of external parasites in 37 foxes and 79 jackals in 3 zones of Iran**

Parasite	% Infection (No.)					
	Zone 1		Zone 2		Zone 3	
	J	F	J	F	J	F
<i>Ixodes ricinus</i>	-	-	-	5.4 (2)	-	-
<i>Rhipicephalus</i> sp.	-	-	-	2.7 (1)	5.1 (4)	-
<i>Ctenocephalides canis</i>	-	32.4 (12)	17.7 (14)	8.1 (3)	-	-
<i>Dermacentor</i> sp.	-	-	2.5 (2)	-	-	-
<i>Haemaphysalis</i> sp.	-	-	-	5.4 (2)	-	-
<i>Pulex irritans</i>	-	10.8 (4)	21.5 (17)	2.7 (1)	-	-

J = Jackal and F = Fox

represent new host and distribution records. Our results also showed that 8 species of helminthes including: *M. lineatus*, *E. granulosus*, *D. caninum*, *A. caninum*, *U. stenocephala*, *D. immitis*, *T. canis* and *M. hirudinaceus* and 2 species of ectoparasites: *C. canis* and *P. irritans* are of zoonotic importance.

The lack of some parasites in jackals and foxes from zone 1 does not rule out their existence, because the majority have been reported from jackals and foxes of the western part of Iran (zone 2 in the present study) (Dalimi *et al.*, 2006). The same situation has been observed in north European countries with a similar climatic condition, where *Mesocestoides* sp. was absent in the red foxes of Belgium (Vervaeke *et al.*, 2005), although prevalent in red foxes of Germany (Pfeiffer *et al.*,

1997), Austria (Lassing *et al.*, 1998) and Poland (Ramisz *et al.*, 2004).

All helminths collected from foxes and jackals in this study have been reported previously from sheep, dogs (Eslami and Mohebali, 1988), and stray cats (Bahadori *et al.*, 2004). Red foxes and jackals can serve as a potential source of infection for humans and domestic animals because of their free roaming in residential areas. Several studies have been carried out on the endoparasites of stray dogs and wild carnivores in order to show their zoonotic importance (Smith *et al.*, 2003; Kruse *et al.*, 2004; Vervaeke *et al.*, 2005; Dalimi *et al.*, 2006). Zoonoses with a wildlife reservoir represent a major public health problem affecting all continents. Accordingly, 62% out of 1415 known human pathogens in the world (Taylor *et al.*, 2001) and 41 (80.4%) out of 51 parasites reported from human beings in Iran (Eslami, 2005) are common between man and their animals. In Khuzestan, south west of Iran, *Heterophyes heterophyes* was collected from both jackal and man (Massoud *et al.*, 1981). Several intestinal helminths and some ectoparasites of foxes and jackals of Iran such as *E. granulosus*, *T. canis*, *U. stenocephala*, *D. caninum*, *D. immitis*, *M. lineatus*, *M. hirudinaceus*, *C. canis* and *P. irritans* are of zoonotic importance.

Echinococcosis-hydatidosis is considered as the most problematic parasitic infection for both public health and livestock in Iran. The prevalence of *E. granulosus* in

jackals (8.9%) is in accordance with MacPherson *et al.* (1983) in jackals of Kenya, but is in contrast with Dalimi *et al.* (2006) in Iran, who could not find it in jackals. The presence of *E. granulosus* in foxes (Dalimi *et al.* 2006) and hydatid cyst in wild sheep confirms the sylvatic cycle of echinococcosis-hydatidosis in Iran. The relation of this cycle to the domestic cycle operating in different regions of Iran is unclear and requires further investigation. Cystic echinococcosis is endemic in Iran and is responsible for approximately 1% of all admission to surgical wards (Rokni, 2008). Therefore, in any control program the role of wildlife should also be taken into consideration.

Ocular dirofilariasis (Athari and Rohani, 2006), *T. canis* the causative agent of visceral larval migrans (Rokni, 2008) and *U. stenocephala* (Ghadirian, 2007) collected from jackal and fox in this study are reported from humans in Iran. None of the ectoparasites found in red foxes and jackals have been reported from domestic carnivores of Iran, although all of them have been quite prevalent among ruminants (Mazlum, 1971). The importance of ectoparasites in most animals including carnivores is their involvement in the transmission of protozoans and viruses to humans and animals. *C. canis* and *P. irritans* can transmit a number of viruses to man (plague, marine typhus) but are important principally as an intermediate host for *D. caninu* and *P. irritans*. *Ixodes ricinus* can act as a vector of ehrlichiosis, lyme disease, spotted fever and babesiosis and transmit the disease to man, carnivores and ruminants. *Babesia canis* and *B. gibsoni* have been reported from dog and foxes in Iran, respectively (Palmer *et al.*, 1998). A naturally infected dog was collected near forest areas where wild carnivores (fox and jackal) were abundant. It is possible that these animals provide a reservoir for the infection of domestic dogs. *Haemaphysalis* sp. may transmit *B. canis* and *B. major* and tick born encephalitis caused by several viruses belonging to the tick encephalitis (Palmer *et al.*, 1998).

Finally, it can be concluded that fox and jackal harbor several parasites, among which some are of public health importance as the

larval stage of some produce economic losses in ruminant, while others can act as intermediate host or transported host for some diseases.

Our findings revealed that jackal and fox of Iran can act as final and intermediate hosts for several parasites harmful to animal and human health.

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