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Gastrointestinal parasites and their prevalence in the Arabian red fox (*Vulpes vulpes arabica*) from the Kingdom of Saudi Arabia

Abdulaziz N. Alagaili[a], Osama B. Mohammed[a,*], Sawsan A. Omer[b]

[a] KSU Mammals Research Chair, Department of Zoology, College of Science, King Saud University, P.O. Box 2455, Riyadh 11451, Saudi Arabia
[b] Department of Zoology, College of Science, King Saud University, University Centre for Women Students, P.O. Box 22452, Riyadh 11495, Saudi Arabia

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ABSTRACT

The gastrointestinal parasites and prevalence of infestation in the Arabian red fox *Vulpes vulpes arabica* Thomas, were investigated at the King Khalid Wildlife Research Centre (KKWRC) in Thumamah, Riyadh Province, Saudi Arabia. Faecal samples were collected from 58 wild caught foxes while under anaesthesia and examined for gastrointestinal parasites stages. Male and female foxes were infected with three major groups of parasites; cestodes, nematodes, protozoa as well as an acanthocephalan. Faecal analyses revealed that 22 foxes (37.9%) were infected with two different *Isospora* spp. and three (5.2%) with an undescribed *Eimeria* sp., 12 (20.7%). Nine individuals (15.5%) harboured hookworms, (*Trichosomoides* sp.), two (3.5%) were infected with *Trichuris* sp. (probably *Trichuris vulpes*) and one individual (1.7%) with *Taenia* sp. (probably *Taenia hydatigena*). Carcasses of five male and three female foxes were necropsied. Four of the necropsied carcasses yielded *Ancylostoma caninum*, two each harboured *Pterygodermatitis affinis*, *T. vulpes* and *Macracanthorhynchus catalinus*, in six foxes *Joyeuxiella echinorynchoides* was found. Five and four foxes were infected with *T. hydatigena* and *Diplopylidium nölleri*, respectively. The possible role of the Arabian red fox as an intercalary host essential for the life cycle of *Trichosomoides* sp., common to the Libyan jird, *Meriones libycus*, in particular and the importance of this species as a vector for zoonotic infections and in the spread of other parasites to wild and domestic animals in general is discussed.

1. Introduction

The Arabian red fox (*Vulpes vulpes arabica* Thomas) is the smallest of the red foxes, but is the largest and most common of the four species of foxes described from the Arabian Peninsula (Travaini and Delibes, 1995; Nader, 1990; Harrison and Bates, 1991; Macdonald et al., 1999; Lenain et al., 2004). Red foxes are primarily carnivores, but are considered as opportunistic omnivores since their food comprises invertebrates, small mammals, birds and fruits. In Thumamah area the preferred food for foxes consists of the Libyan Jird (*Meriones lybicus*), spiny mouse (*Acomys dimidiatus*), different gerbils (*Gerbillus* spp.), Lesser Jerboa (*Jaculus jaculus*), hare (*Lepus capensis*) and the eastern Skink, *Scincus mitranus* (Al-Sadoon, 1988; Al-Johany et al., 1997; Macdonald et al., 1999). The eastern Skink, *Scincus mitranus* is a favourite prey for the Arabian red fox in the Thumamah area where it is abundant (Al-Sadoon, 1988; Al-Johany et al., 1997).

The diet of the fox renders it a potential host for several gastrointestinal parasites which may be harmful to both man and animals (domestic and wild) alike (Willingham et al., 1996). Although common in Arabia, the role of the fox as a potential reservoir of human and animal diseases is yet to be documented. Macdonald et al. (1999) extensively investigated the behavioural ecology of the fox including the home range and food preference in the vicinity of Thumamah, Saudi Arabia (25°30′N, 46°30′E). The findings

* Corresponding author. Tel.: +966 504140713; fax: +966 14678514.
E-mail address: obmkkwrc@yahoo.co.uk (O.B. Mohammed).

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have raised concerns of the red fox as a possible reservoir of zoonotic parasitic diseases in this area harbouring such infestations as Ancylostomosis and Toxoplasmosis. Lenain et al. (2004) have studied the ecology and diet of the *Vulpes vulpes arabica* and *Vulpes rüeppelli sabea* in the Mahazat as-Sayd protected area in western Saudi Arabia. Macdonald et al. (1999) live trapped foxes and fitted them with neck collars containing radio transmitters, these were subsequently released at in the vicinity of where they were trapped. In conjunction with this practice, we took the opportunity to collect faecal material from sedated foxes and performing necropsies on a small number of dead animals which were collected from Thumamah. The samples collected were examined in the laboratory in order to determine the identity and the prevalence of gastrointestinal parasites present in the Arabian red fox.

2. Materials and methods

This study was undertaken in Thumamah area (25°30′N, 46°30′E), an arid stone and gravel desert, 70 km north of the Riyadh City, Saudi Arabia. Within this area, the King Khalid Wildlife Research Centre (KKWRC) was established in 1986 to breed endangered antelopes species indigenous to the Kingdom for reintroduction into the wild where their numbers have decreased over the years.

Thirty-five male and 23 female Arabian red fox (*Vulpes vulpes arabica* Thomas), were anaesthetized using a combination of xylazine hydrochloride (Rompun®, Bayer, Leverkusen, Germany) at a dose of 2 mg/kg body weight and ketamine (Imalgéne®, Rhône Mérieux, Lyon, France) at a dose of 5 mg/kg body weight. Fresh faecal samples were collected from the rectum of each fox and placed into numbered plastic bags.

The faecal samples were analysed using floatation and sedimentation techniques (Anonymous, 1986). Protozoan oocysts were sporulated in 2.5% potassium dichromate solution ($K_2Cr_2O_7$) in Petri dishes (Mohammed and Hussein, 1992). Faecal cultures were also examined using a Baermann apparatus (Anonymous, 1986) for the recovery of nematode larvae. Third stage larvae were identified using the criteria in Soulsby (1982) and Anonymous (1986).

Five male and 3 female Arabian red fox carcasses were recovered from their home ranges and near their dens and autopsied. The alimentary canal was removed from each animal. The oesophagus, stomach, duodenum, jejunum, ileum, colon, caecum and rectum were placed individually into a separate white enamel tray. Each was opened and thoroughly washed with physiological saline. The washings of each gut compartment was transferred to a Petri dish and examined under a stereoscopic microscope for parasites. Adult nematodes and cestodes were collected and subsequently preserved in 5% glycerin alcohol. The worms were cleared in lactophenol (lactic acid crystals 100 g, phenol crystals 100 g, glycerine 200 ml, distilled water 100 ml), examined microscopically and were identified according to Yamaguti (1959, 1961, 1963) and Schmidt (1986). The identification of the parasites was confirmed by the International Institute of Parasitology, St. Albans, UK.

The intestinal mucosa was scraped using a sharp scalpel blade for the release of protozoan and other parasitic stages. Sporulated protozoan stages were identified with reference to Levine and Ivens (1981), Dubey and Beattie (1988) and Dubey et al. (1989).

Table 1
Results of coprological investigations from 58 faecal samples collected from the Arabian red fox (*Vulpes vulpes arabica*) around Thumamah area, Saudi Arabia.

Parasite stage	Number of faeces with parasites	Percentage infestation (%)
Isospora sp. (17–22 μm) oocysts	17	29.3
Isospora sp. (46–50 μm) oocysts	10	17.2
Eimeria sp. oocysts	3	5.2
Hookworm eggs	12	20.7
Trichuris eggs	2	3.5
Trichosomoides eggs	9	15.5
Taeniid eggs	1	1.7

Table 2
Adult nematode and cestode helminths recovered from the Arabian red fox (*Vulpes vulpes arabica*) ($n = 8$) autopsied at King Khalid Wildlife Research Centre and their level of infestation.

Worm species	Number positive	Worm infestation (range)
Ancylostoma caninum	4	7–11
Pterygodermatitis affinis	2	23–35
Trichuris vulpes	2	4–6
Joyeuxiella echinorynchoides	6	5–17
Diplopylidium nölleri	4	3–7
Taenia hydatigena	5	5–14
Macracanthorhynchus catalinus	2	2–5

3. Results

A total of 37 (63.8%) of the 58 faecal samples, contained helminth eggs or coccidian oocysts (*Isospora* spp. and *Eimeria* sp). Isosporan oocysts were detected in 22 (37.9%) of the samples and two types of such oocysts were observed (measuring 17–22 μm and 46–50 μm). Eimerian oocysts were detected in only 3 (5.2%) of the samples. The nematode eggs found were *Trichuris* sp. {in 2 (3.5%) of the samples}, hookworm eggs {in 12 (20.7%) of the samples} and fully embryonated *Trichosomoides* sp. eggs in 9 (15.5%) of the samples. Eggs of *Taenia* sp. were found in a single sample, but no trematode eggs were observed (Table 1).

The faecal cultures revealed third stage larvae of *Ancylostoma caninum*, and adults in 3 male and 1 female of the necropsied foxes. *Pterygodermatitis affinis* and *Trichuris vulpes* were found in a single male and female fox. The cestodes included *Joyeuxiella echinorynchoides* (in 4 male and 2 female foxes), *Diplopylidium nölleri* (in 2 male and 2 female foxes) and *Taenia hydatigena* (in 3 male and 2 female foxes) and ranges of helminth infestation are shown in (Table 2). Acanthocephalan worms, *Macracanthorhynchus catalinus*, occurred in one male (3 worms) and a female fox (5 worms).

4. Discussion

The current study is the first comprehensive report to document the endo-parasites present in the Arabian red fox (*Vulpes vulpes arabica*) from Saudi Arabia, and the Arabian Peninsula as a whole. The Arabian red fox may well