

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/279905126>

Parasites of the red fox (*Vulpes vulpes* Linnaeus, 1758) in Murcia, southeast Spain

Article in *Revue Méd Vét* · July 2007

CITATIONS

53

READS

1,247

8 authors, including:



Carlos Martínez-Carrasco Pleite

University of Murcia

151 PUBLICATIONS 1,222 CITATIONS

SEE PROFILE



Rocío Ruiz de Ybáñez

University of Murcia

113 PUBLICATIONS 1,396 CITATIONS

SEE PROFILE



Sandy Hernandez

Instituto Tecnológico Superior de Zongolica

26 PUBLICATIONS 760 CITATIONS

SEE PROFILE

Parasites of the red fox (*Vulpes vulpes* Linnaeus, 1758) in Murcia, southeast Spain

C. MARTÍNEZ-CARRASCO¹, M.R. RUIZ DE YBÁÑEZ^{1*}, J.L. SAGARMINAGA¹, M.M. GARIJO¹, F. MORENO¹, I. ACOSTA², S. HERNÁNDEZ² and F.D. ALONSO¹

¹ Departamento de Sanidad Animal, Facultad de Veterinaria, Universidad de Murcia, Campus de Espinardo, 30100 Espinardo, Murcia, SPAIN

² Departamento de Sanidad Animal, Facultad de Veterinaria, Universidad de Córdoba, Campus de Rabanales, 14014 Córdoba, SPAIN

* Corresponding author: E-mail: rocio@um.es

SUMMARY

Fifty five red foxes were captured in Murcia province (Southeast Spain) and necropsied to evaluate parasitic infections. Fifteen helminth species were found, including five cestodes (*Mesocestoides lineatus*, *Mesocestoides litteratus*, *Joyeuxiella pasqualei*, *Taenia pisiformis* and *Dipylidium caninum*), nine nematodes (*Pterygodermatites affinis*, *Toxocara canis*, *Trichuris vulpis*, *Toxascaris leonina*, *Oxyntema crassispiculum*, *Eucoleus (Capillaria) aerophilus*, *Toxocara cati*, *Uncinaria stenocephala* and *Angiostrongylus vasorum*), and one acanthocephalan (*Macracanthorhynchus catulinus*). Coprological method revealed the presence of, *Isospora* spp. oocysts. Also, fleas and ticks were recovered from the carcasses, corresponding to *Pulex irritans*, *Spilopsyllus cuniculi*, *Ctenocephalides felis felis*, *Rhipicephalus sanguineus*, *Ixodes ventraloi*, and *Ixodes ricinus*. Both *S. cuniculi* and *C. felis felis* are first records in foxes in the Iberian Peninsula.

Keywords : Red fox, *Vulpes vulpes*, Spain, protozoa, helminths, acanthocephalans, ectoparasites.

RÉSUMÉ

Parasites du renard roux (*Vulpes vulpes* Linnaeus, 1758) dans Murcie (Sud-est de l'Espagne).

Nous avons réalisé une étude parasitologique chez le renard roux (*Vulpes vulpes*) dans la province de Murcie (sud-est de l'Espagne). Au total, 55 renards ont été collectés et autopsiés. L'examen coprologique parasitaire a révélé la présence d'oocystes d'*Isospora* spp. Nous avons trouvé quinze espèces de helminthes, desquels cinq sont cestodes (*Mesocestoides lineatus*, *Mesocestoides litteratus*, *Joyeuxiella pasqualei*, *Taenia pisiformis* et *Dipylidium caninum*) et neuf nématodes (*Pterygodermatites affinis*, *Toxocara canis*, *Trichuris vulpis*, *Toxascaris leonina*, *Oxyntema crassispiculum*, *Eucoleus (Capillaria) aerophilus*, *Toxocara cati*, *Uncinaria stenocephala* et *Angiostrongylus vasorum*), et une espèce d'acanthocephalan (*Macracanthorhynchus catulinus*). Par ailleurs, nous avons identifié des puces et des tiques appartenant aux espèces *Pulex irritans*, *Spilopsyllus cuniculi*, *Ctenocephalides felis felis*, *Rhipicephalus sanguineus*, *Ixodes ventraloi* et *Ixodes ricinus*. C'est la première fois que *S. cuniculi* et *C. felis felis* ont été décrits chez le renard dans la Péninsule Ibérique.

Mots-clés : Renard roux, *Vulpes vulpes*, Espagne, protozoaires, helminthes, acanthocéphales, ectoparasites.

Introduction

The presence of red foxes (*Vulpes vulpes* Linnaeus, 1758) in Murcia (Southeast Spain) is well known, being the most abundant wild carnivore. This wild canid is an opportunistic predator and scavenger perfectly adapted to periurban environments in Spain and other European countries [6]. In these locations, fox population densities can be much higher than in rural habitats due to the abundant availability of anthropogenic food sources. Red fox may harbour a wide range of parasites, some of which can be infectious to man and domestic animals [29, 32]. Therefore, the presence of red foxes has important implications for the control and prevention of these pathogens in rural and periurban areas. Many studies have investigated the prevalence of several parasites of zoonotic and veterinary importance from red fox in Europe [14, 11, 20, 17, 1, 22, 31, 19, 12, 8, 30, 27, 26, 5, 10, 24]. The absence of information concerning parasites from red fox in southeast Spain aimed the present study.

Material and Methods

A total of 55 foxes (19 females and 36 males) were hunted from 2001 to 2004 in Altiplano region (North of Murcia,

Spain, from 38° 30' to 38° 45' N and from 1° 00' to 1° 30' E). The climate of the study area is semiarid with an average annual precipitation of less than 300 mm. Animals were hunted during the breeding seasons (February to June) as a part of a population control program. Intact fresh carcasses were submitted to the Laboratory of Parasitic Diseases (Faculty of Veterinary, Murcia, Spain) and all of them were frozen at -20°C until necropsy.

At necropsy, foxes were visually aged by general size, and were classified as juveniles (less than 12 months age) or adults (more than 12 months). Also, animals were examined visually and by palpation for external injuries or wounds. Pelage was brushed and thoroughly inspected for the presence of ectoparasites, which were collected and stored in alcohol 70% until their identification.

Faeces, viscera, digestive tract, and thoracic and abdominal cavities from all foxes were examined and processed in order to collect and identify parasites. Faeces (5 g) were examined by Sheather's sugar flotation method to detect helminth eggs, protozoan cysts and coccidian oocysts. The gastrointestinal tract was removed and processed separately (stomach, small and large intestine). Each part of digestive tract was cut open longitudinally, mucosae was scraped and carefully examined for parasites. The content was washed and sieved through a

series of mesh screens, the final one of which had apertures 0.3 mm in size. Parasites were separated by taxa and stored in 70% ethanol (nematodes and acanthocephalans) or 5% formalin (cestodes). Cestodes were stained with Semichon's carmine and mounted in Canada balsam for their identification. Moreover, samples from diaphragm pillars were taken for larvae of *Trichinella* spp. evaluation; small pieces were compressed between glass plates and microscopically examined. For the same purpose, a 10 g sample of each diaphragm was minced and digested by using a solution of pepsine 2% and HCl 2% at 37°C during 3 h. The fluid was examined under 40x magnification. Finally, trachea, bronchi and lungs were

examined macroscopically, and subsequently 25 g of lung parenchyma were evaluated using the Baermann's method.

Results

The general condition of all foxes was rated as good. No external detectable injuries were observed.

All of the animals were infected with parasites: 23.6% had *Isoospora* spp. oocysts, 76.7% cestodes, 86.1% nematodes, 27.9% acanthocephalans, and 95.4% ectoparasites. Results of faecal flotations are summarized in table I, while parasites found at necropsy and their frequencies are shown in table II.

Parasites	Number of positive foxes (frequency %)		
	Juvenile (n = 26)	Adult (n = 29)	Total (n = 55)
<i>Isoospora</i> spp. oocysts	9 (34.6)	4 (13.8)	13 (23.6)
<i>Toxocara canis</i> eggs	4 (15.4)	3 (10.3)	7 (12.7)
<i>Trichuris vulpis</i> eggs	1 (3.9)	0	1 (1.8)

TABLE 1: Parasites recovered from faecal flotation of red foxes

Parasites	Number of positive foxes (frequency %)			Mean intensity in parasitized foxes (±SD)	Parasite burden range
	Juvenile (n = 26)	Adult (n = 29)	Total (n = 55)		
Cestodes					
<i>M. lineatus</i>	15 (57.7)	16 (55.2)	31 (56.4)	ND	ND
<i>M. litteratus</i>	1 (3.9)	2 (6.9)	3 (5.4)	ND	ND
<i>J. pasqualei</i>	3 (11.5)	16 (55.2)	19 (34.6)	ND	ND
<i>T. pisiformis</i>	2 (7.7)	2 (6.9)	4 (7.3)	ND	ND
<i>D. caninum</i>	0	1 (3.4)	1 (1.8)	ND	ND
Nematodes					
<i>P. affinis</i>	12 (46.2)	18 (62.1)	30 (54.5)	10.9±19.1	1-86
<i>T. canis</i>	15 (57.7)	10 (34.5)	25 (45.5)	4.9±8.5	1-35
<i>T. cati</i>	1 (3.9)	0	1 (1.8)	2.0	2
<i>T. leonina</i>	1 (3.9)	2 (6.9)	3 (5.4)	1.0	1
<i>O. crassispicuum</i>	0	3 (10.3)	3 (5.4)	2.0±1.4	1-4
<i>U. stenocephala</i>	1 (3.9)	0	1 (1.8)	1.0	1
<i>T. vulpis</i>	1 (3.9)	4 (13.8)	5 (9.1)	10.2±9.9	3-24
<i>A. vasorum</i>	0	1 (3.4)	1 (1.8)	1.0	1
<i>E. (C.) aerophilus</i>	0	3 (10.3)	3 (5.4)	1.3±0.6	1-2
Acanthocephalans					
<i>M. catulinus</i>	7 (26.9)	8 (27.6)	15 (27.3)	7.1±11.5	1-43
Arthropods					
<i>P. irritans</i>	24 (92.3)	26 (89.7)	50 (90.1)	6.3±8.3	0-34
<i>S. cuniculi</i>	2 (7.7)	0	2 (3.6)	0.1±0.2	0-1
<i>C. felis felis</i>	2 (7.7)	3 (10.3)	5 (9.1)	0.1±0.3	0-2
<i>R. sanguineus</i>	14 (53.9)	16 (55.2)	30 (54.5)	2.3±4.3	0-16
<i>I. ventalloi</i>	6 (23.0)	5 (17.2)	11 (20.0)	0.3±1.1	0-5
<i>I. ricinus</i>	1 (3.9)	0	1 (1.8)	0.1±0.1	0-1

ND: not determined - SD: standard deviation

TABLE 2: Parasites recovered from red foxes

Sixteen species of helminths (*Mesocestoides lineatus*, *Mesocestoides litteratus*, *Joyeuxiella pasqualei*, *Taenia pisiformis*, *Dipylidium caninum*, *Pterygodermatites affinis*, *Toxocara canis*, *Toxocara cati*, *Toxascaris leonina*, *Trichuris vulpis*, *Oxyntema crassispiculum*, *Uncinaria stenocephala*, *Eucoleus (Capillaria) aerophilus*, *Gongylonema spp.* *Angiostrongylus vasorum* and *Macracanthorhynchus catulinus*), and six arthropod species (*Pulex irritans*, *Spilopsyllus cuniculi*, *Ctenocephalides felis felis*, *Rhipicephalus sanguineus*, *Ixodes ventralloi*, and *Ixodes ricinus*) were identified. Larvae of *Gongylonema spp.* in the third stage of development were collected from the stomach of two foxes. Also, two larvae of *Angiostrongylus vasorum* were recovered by Baermann's technique using the lungs of the fox parasitized by this nematode species. Procedures for detecting *Trichinella spp.* were always negative, and trematodes were not found in this survey.

Discussion

Although foxes are considered as hosts for parasites of potential zoonotic and veterinary significance, few data are available relating to parasites of this wild canid in southeast Spain and about their role in the natural nidality and propagation of these pathogens, knowledge that is necessary to develop prevention strategies.

In the present study, frequency of *Isospora spp.* oocysts was much higher than in previous records [31, 8]. This could be attributable to several factors, including differences in techniques used for diagnosis, bioclimatic or seasonal conditions of each area of study, or even to the high number of juvenile foxes in our work (47.3%).

Our results suggest that the helminth fauna of the fox in Murcia is similar to that in the Iberian Peninsula as a whole [16, 21, 1, 12, 8, 26]. However, it is remarkable the absence of trematodes. This group of parasites is usually associated to humid habitats since they use aquatic animals as intermediate hosts. This reason could explain the lack of trematodes in Murcia, since this is a semiarid region in which lakes, ponds or marshes are scarce.

Cestodes are highly frequent in foxes from Murcia (76.7%). Most of the foxes harboured *M. lineatus* (56.4%), followed by *J. pasqualei* (34.6%). Frequencies of other cestodes (*T. pisiformis*, *M. litteratus*, and *D. caninum*) were always low. In agreement with the results obtained by other authors [12, 26], the genus *Mesocestoides* is the most common finding in our study, usually associated to semiarid areas, and this suggests that diet of foxes probably includes reptiles, birds and rodents. The absence of *T. crassiceps*, which has been described as the most common taeniid species in foxes in other European countries [14, 11, 20, 27] endorsed that foxes in southeast Spain are less depend on rodents for their requirements than foxes from other areas. In this sense, the lack of *T. hydatigena* in our survey showed that fresh sheep, goat and cattle carcasses constitute a minor food item in the diet of foxes.

As occurred in most studies previously carried out in Spain [12, 26], we were unable to find any specimen of *Echinococcus granulosus* nor *E. multilocularis*, despite red fox has been

demonstrated to be a good host for both cestodes [9, 13]. The absence of these cestode species in our study suggests that foxes are unlikely to develop a significant role in cystic and alveolar echinococcosis in Murcia.

The most prevalent nematode in our study was *P. affinis* (54.5%). This parasite has been previously described in foxes in Spain [17, 12], although with lower prevalence records (6% and 23.4%, respectively). *Pterygodermatites affinis* shows higher prevalences in semiarid habitats, probably associated to the abundance of suitable paratenic hosts [12]. This should explain the frequent occurrence of this nematode in Murcia, and indicates a higher frequency of reptiles in the diet of these foxes.

Of particular interest, because of its association with human toxocarosis, is the presence of *T. canis* in red foxes from Murcia. In agreement with several reports in Spain [16] and other countries [31, 19], *T. canis* should be considered the most prevalent ascarid in red fox. With a minor presence, *T. cati* and *T. leonina* were also collected in our study. All three ascarid nematodes were previously cited in Spain [16, 21, 17, 1, 2, 12, 8]. Thus, the presence of foxes in urban and periurban areas could increase the risk of *Toxocara spp.* infection in humans [18, 23], although the evaluation of this epidemiologic role has not yet been ascertained in Spain.

The presence of *O. crassispiculum* in foxes is not a frequent finding, although this nematode has been previously described in this host in Spain [28].

Our report indicates the absence of *Trichinella spp.* in foxes from Murcia. Also negative results were obtained in Andalucía [16], Catalonia [17] and Galicia [1], in contrast with results obtained by other authors [12, 8], who found *Trichinella spp.* prevalences of 1.2% and 8.9%, respectively, in foxes from central and north-eastern Spain.

Only one fox harboured *U. stenocephala*; however, this nematode was highly prevalent [12] or even the most frequently occurring nematode in other studies [1, 22, 31, 8]. The reason explaining these results should be the humidity requirements of the nematode, whose preparasitic stages need moist soil conditions [22]. *Trichuris vulpis*, which is considered habitual in semiarid habitats [12], was also recovered in the present survey.

Regarding cardiorespiratory nematodes, *E. (C.) aerophilus* was recovered from three foxes (5.4%); this frequency is much lower than that one previously described in Catalonia [15]. Again, the dryness of the study area could explain these results since infection is more probable in moist soils.

In the present study, it should not be surprising the scarce presence of *A. vasorum* and the absence of *Dirofilaria immitis*, given that their obligatory intermediate hosts require moist habitats. In what concerns *D. immitis*, our results contrast with those obtained in north-eastern Spain [12], with a prevalence of 12.7%, but are similar to findings reported in Catalonia (0.4%) [15].

In our study, two larvae in the third stage of development of *Gongylonema spp.* were recovered from the stomach of two foxes. In our knowledge, this is the first time that this nematode is recovered from the digestive tract of a red fox. This

result should be attributed to the ingestion of intermediate hosts of this parasite (coprophagic beetles), but certainly these larvae would not be able to reach the adult stage in this host.

Macracanthorhynchus catulinus is an uncommon acanthocephalan, which has been scarcely recovered from foxes in Spain [12]. Infection should be associated to the inclusion in foxes' diet of intermediate hosts such as beetles harbouring larvae, or adult acanthocephalans present in definitive hosts such as birds [22].

Ticks and fleas were frequently found in foxes (60.5% and 90.7%, respectively). In most cases (58.5%), these two kinds of arthropods infected simultaneously the animals. It is notable the absence of lice in our study despite the care with which foxes were examined; this result is in agreement with the findings consulted in the literature, where no lice are described in red foxes [16, 4, 25, 30]. Frequency of *P. irritans* in our study is much higher than the one previously cited in foxes in Spain [16] and in other European countries: 51.25% in France [3], 43% in Hungary [30], and 2% in England [4]. The predominance of the human flea should be attributed to the contact of foxes with animals living in a synanthropic environment in rural and suburban areas [30]. The finding of *S. cuniculi* and *C. felis felis* constitute the first report of these flea species in foxes in the Iberian Peninsula.

Regarding ticks, *I. ventralloi*, *I. ricinus*, and *R. sanguineus* have been previously found in foxes in Spain [7] and, except for *I. ricinus*, in other European countries [30]. It could be emphasized the absence of *I. canisuga* and *Chaetopsylla globiceps*, considered the fox tick and flea respectively. Presence of *S. cuniculi* and *I. ventralloi* in the studied foxes is probably due to the close contact with rabbits and their burrows; these arthropod species are specific parasites of rabbit, and should not be regarded as parasites of fox, that acts as a simply phoretic host.

In the present study, both necropsy and faecal flotation test have been made to all red fox. This information allows us to confirm that the flotation technique underestimates the level of infection with cestodes and nematodes [31]. The same hypothesis was mentioned by other authors [8], who found much lower prevalence records for these parasites than in other works, concluding that the lacking of necropsies should explain those values. This indicates a need for direct intestinal examination for surveillance of parasites in fox populations.

Our results show that the fox in southeast Spain is a host to a wide range of parasites. Most of them are known to be present in dog, and for this reason, the possibility of foxes serving as a reservoir for all the referred parasites might represent a significant risk for dogs. In addition, the environmental contamination with ascarid eggs constitutes a threat for humans. So, sanitary authorities should take into account this possibility for any attempt to control parasite infection in dogs and zoonosis, and surveys in the fox population should be undertaken periodically.

References

1. - ÁLVAREZ M.F., IGLESIAS R., GARCÍA J., PANIAGUA E. SANMARTÍN M.L.: Intestinal helminths of the red fox (*Vulpes vulpes* L.) in Galicia (Northwest Spain). *Wiad. Parazytol.*, 1995, **41**, 429-442.
2. - ÁLVAREZ M.F., HAZ P., FREIRE M., LEIRO J.M., SANMARTÍN M.: Biodiversity and aggregation of the helminth fauna of the red fox (*Vulpes vulpes* L.) in Galicia (NW Iberian Peninsula). Euro-American Mammal Congress, July 19-24, Santiago de Compostela, Abstracts, 1998, 392.
3. - BEAUCOURNU J.C.: Notes sur les Siphonaptères Parasites de Carnivores en France. *Ann. Parasitol. Hum. Comp.*, 1973, **48**, 497-516.
4. - BUCKLE A., HARRIS S.: The flea epifauna of suburban fox (*Vulpes vulpes*) population. *J. Zool.*, 1980, **190**, 431-439.
5. - CASULLI A., MANFREDI M.T., LA ROSA G., DI CERBO A.R., DINKEL A., ROMIG T., DEPLAZES P., GENCHI C., POZIO E.: *Echinococcus multilocularis* in red foxes (*Vulpes vulpes*) of the Italian Alpine region: is there a focus of autochthonous transmission? *Int. J. Parasitol.*, 2005, **35**, 1079-1083.
6. - CHAUTAN M., PONTIER D., ARTOIS M.: Role of rabies in recent demographic changes in Red fox (*Vulpes vulpes*) populations in Europe. *Mammalia*, 2000, **64**, 391-410.
7. - CORDERO M., CASTAÑÓN L., REGUERA A.: Índice-catálogo de zooparásitos ibéricos, 650 pages, 2nd Edition, Universidad de León, León, 1994.
8. - CRIADO-FORNELIO A., GUTIÉRREZ-GARCÍA L., RODRÍGUEZ-CAABEIRO F., REUS-GARCÍA E., ROLDÁN SORIANO M.A., DÍAZ-SÁNCHEZ M.A.: A parasitological survey of wild red foxes (*Vulpes vulpes*) from the province of Guadalajara, Spain. *Vet. Parasitol.*, 2000, **92**, 245-251.
9. - DALIMI A., SATTARI A., MOTAMEDI GH.: A study on intestinal helminthes o dogs, foxes and jackals in the western art of Iran. *Vet. Parasitol.*, 2006, **142**, 129-133.
10. - DAVIDSON R.K., GJERDE B., VIKØREN T., LILLEHAUG A., HANDELAND K.: Prevalence of *Trichinella* larvae and extra-intestinal nematodes in Norwegian red foxes (*Vulpes vulpes*). *Vet. Parasitol.*, 2006, **136**, 307-316.
11. - DEBLOCK S., PETAVY A.F., GILOT B.: Helminthes intestinaux du renard commun (*Vulpes vulpes*) dans le Massif central (France). *Can. J. Zool.*, 1988, **66**, 1562-1569.
12. - GORTÁZAR C., VILLAFUENTE R., LUCIENTES J., FERNÁNDEZ-DE-LUCO D.: Habitat related differences in helminth parasites of red foxes in the Ebro valley, *Vet. Parasitol.*, 1998, **80**, 75-81.
13. - KAPEL C.M.O., TORGERSON P.R., THOMPSON R.C.A., DEPLAZES P.: Reproductive potential of *Echinococcus multilocularis* in experimentally infected foxes, dogs, raccoon dogs and cats. *International J. Parasitol.*, 2006, **36**, 79-86.
14. - LOOS-FRANK B., ZEYHLE E.: The intestinal helminths of the red fox and some other carnivores in Southwest Germany. *Z. Parasitenkd.*, 1982, **67**, 66-113.
15. - MAÑAS S., FERRER D., CASTELLÁ J., LÓPEZ-MARTÍN J.M.: Cardiopulmonary helminth parasites of red foxes (*Vulpes vulpes*) in Catalonia, northeastern Spain. *Vet. J.*, 2005, **169**, 118-120.
16. - MARTÍNEZ F., HERNÁNDEZ S., CALERO R., MORENO T.: Contribución al conocimiento de los parásitos del zorro (*Vulpes vulpes*). *Rev. Ibér. Parasitol.*, 1978, **38**, 207-211.
17. - MIQUEL J., TORRES J., CASANOVA J.C., FELIU C.: Helminths paràsits de carnívors silvestres a Catalunya. Particularitats de les faunes del Montseny, 166 pages, 1st Edition. Museu de Granollers, Granollers, 1994.
18. - MIZGAJSKA H.: Eggs of *Toxocara* spp. in the environment and their public health implications. *J. Helminthol.*, 2001, **75**, 147-151.
19. - PAPADOPOULOS H., HIMONAS C., PAPAZHARIADOU M., ANTONIADOU-SOTIRIADOU K.: Helminths of foxes and other wild carnivores from rural areas in Greece. *J. Helminthol.*, 1997, **71**, 227-231.
20. - PETAVY A.F., DEBLOCK S., PROST C.: Epidemiologie de l'échinococcose alvéolaire en France. I. Helminths intestinaux du renard commun (*Vulpes vulpes*, L.) en Haute-Savoie. *Ann. Parasitol. Hum. Comp.*, 1990, **65**, 22-27.

21. - REINA D., NAVARRETE I., HERNANDEZ S., HABELA M. : Contribución al conocimiento de la parasitofauna de Cáceres, Primera relación, *Helmintos. Rev. Ibér. Parasitol.*, Extra Issue, 1987, 85-90.
22. - RICHARDS D.T., HARRIS S., LEWIS J.W.: Epidemiological studies on intestinal helminth parasites of rural and urban foxes (*Vulpes vulpes*) in the United Kingdom. *Vet. Parasitol.*, 1995, **59**, 39-51.
23. - RICHARDS D.T., LEWIS J.W.: Fecundity and egg output by *Toxocara canis* in the red fox, *Vulpes vulpes*. *J. Helminthol.*, 2001, **75**, 157-164.
24. - SAEED I., MADDOX-HYTTEL C., MONRAD J., KAPEL C.M.O.: Helminths of red fox (*Vulpes vulpes*) in Denmark. *Vet. Parasitol.*, 2006, **139**, 168-179.
25. - SCHÖFFEL I., SCHEIN E., WITTSTADT U., HENTSCHE J.: Zur Parasitenfauna des Rotfuchses in Berlin (West). *Berl. Münch. Tierärztl. Wochenschr.*, 1991, **104**, 153-157.
26. - SEGOVIA J.M., TORRES J., MIQUEL J.: Helminth parasites of the red fox (*Vulpes vulpes* L., 1758) in the Iberian Peninsula: an ecological study. *Acta Parasitol.*, 2004, **49**, 67-79.
27. - SHIMALOV V.V., SHIMALOV V.T.: Helminth fauna of the red fox (*Vulpes vulpes* Linnaeus, 1758) in southern Belarus. *Parasitol. Res.*, 2003, **89**, 77-78.
28. - SIMÓN VICENTE F.: Los Rictularia (*Nematoda: Spiruridae*) y *Oxyurina* (*Nematoda: Oxyuridae*) de *Vulpes* sp. en dos provincias de España. *Rev. Ibér. Parasitol.*, 1968, **28**, 1-18.
29. - SMITH G.C., GANGAGHARAN B., TAYLOR Z., LAURENSEN M.K., BRADSHAW H., HIDE G., HUGHES J.M., DINKEL A., ROMIG T., CRAIG P.S.: Prevalence of zoonotic important parasites in the red fox (*Vulpes vulpes*) in Great Britain. *Vet. Parasitol.*, 2003, **118**, 133-142.
30. - SRÉTER T., SZÉLL Z., VARGA I.: Ectoparasite infestations of red foxes (*Vulpes vulpes*) in Hungary. *Vet. Parasitol.*, 2003, **115**, 349-354.
31. - WILLINGHAM A.L., OCKENS N.W., KAPEL C.M. O., MONRAD J.: A helminthological survey of wild red foxes (*Vulpes vulpes*) from the metropolitan area of Copenhagen. *J. Helminthol.*, 1996, **70**, 259-263.
32. - WOLFE A., HOGAN S., MAGUIRE D., FITZPATRICK C., VAUGHAN L., WALL D., HAYDEN T.J., MULCAHY G.: Red foxes (*Vulpes vulpes*) in Ireland as hosts for parasites of potential zoonotic and veterinary significance. *Vet. Rec.*, 2001, **149**, 759-763.