

## Short Communication

### FILARIOSIS IN FOXES IN ITALY

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#### INTRODUCTION

Control programmes for limiting predatory animals and preserving an ecological balance, organized by local authorities in 1989–1992, allowed us to examine foxes (*Vulpes vulpes*) and to study their parasitic fauna.

Attention was mainly directed to filarial helminths to assess the possible relationship between domestic and wild carnivores as regards filariasis.

#### MATERIALS AND METHODS

The carcasses of 523 foxes which had been shot in various areas of Tuscany were obtained, usually fresh, sometimes frozen, and mostly skinned. The search for microfilariae was carried out by pulmonary, splenic and renal smears; the morphological and morphometric features of the larvae were examined without fixing and staining. The acid phosphatase activity of the microfilariae was assessed by the histochemical method described by Chalifoux and Hunt (1971).

Adult filariae were sought in the heart and pulmonary artery of all the animals; the investigation was extended to the subcutaneous tissues of 28 animals obtained with their skin and to the serous cavities and intermuscular connective tissues of 28 animals positive for microfilariae of *Dipetalonema* species.

## RESULTS

Microfilariaemia, characterized by four types of larvae, was present in 160 foxes (30.59%): These four types were as follows.

Type 1: thin microfilariae ( $237\text{--}247\ \mu\text{m} \times 4.2\text{--}4.4\ \mu\text{m}$ , straight tail) in 99 animals (18.92%), identified as *Dipetalonema dracunculoides*.

Type 2: thick microfilariae ( $270\text{--}280\ \mu\text{m} \times 5.0\text{--}5.5\ \mu\text{m}$ , hooked tail) resembling the first-stage larvae of *Dipetalonema reconditum* in 57 animals (10.89%).

Type 3: microfilariae of *Dirofilaria repens* ( $345\text{--}385\ \mu\text{m} \times 6.5\text{--}7.0\ \mu\text{m}$ , umbrella handle-like tail) in 6 animals (1.14%).

Type 4: microfilariae of *Dirofilaria immitis* ( $290\text{--}330\ \mu\text{m} \times 6.0\text{--}6.5\ \mu\text{m}$ , straight tail) in 2 animals (0.38%).

Figure 1 shows the differing morphology of the tails in the four types of microfilariae. Two foxes presented microfilariae of types 1 and 2 simultaneously and two foxes microfilariae of types 3 and 4.

Acid phosphatase activity was restricted to the excretory and anal pore in microfilariae of *Dir. immitis* and to the anal pore in those of *Dir. repens*; this enzymatic activity was uniformly distributed throughout the body in the microfilariae of *Dip. dracunculoides* and *Dip. reconditum*(?).

Mature and immature adults of *Dir. immitis* were present in the right ventricle of the heart and in the pulmonary artery in 50 animals (9.56%). These included 26 males and 72 females; two-thirds of the females were characterized by the presence of developing embryos and were longer than 20 cm.

*Dir. repens* was found in the subcutaneous tissues in 3 of 28 foxes examined

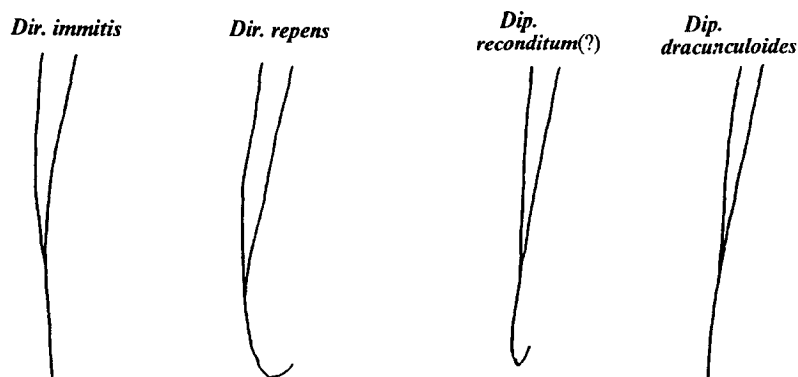


Figure 1. Tail characteristics of the four types of microfilariae

(10.71%). Adult parasites of *Dip. dracunculoides* were present in 5 of the 21 animals positive for microfilariae of the same species (23.80%), but it was not possible to find adult filariae in the 7 animals positive for microfilariae of type 2.

## DISCUSSION

The presence of adult heartworms in foxes with no or only sporadic microfilaraemia suggests that, like the cat, which also shows poor and transient presence of microfilariae in the blood, this wild animal is not a good host for *Dir. immitis*. The microfilariae of *Dir. repens* were found in nearly 1% of foxes examined in an area where this parasite is present in 25–30% of dogs. Therefore, the fox cannot be considered as an effective reservoir for the canine dirofilariosis.

More interesting are the data concerning dipetalonemosis, in that this infection is present in 30.2% of foxes. The presence of type 2 microfilariae prompts the question whether they are variant first-stage larvae of *Dip. dracunculoides* or microfilariae of another species, present in the fox. The microfilariae were always examined directly, without fixing or staining, which can influence the larval size (Webber and Hawking, 1955). Furthermore, the simultaneous presence of microfilariae of both type 1 and type 2 in two animals excludes the possibility that freezing or the interval between killing and examination of the animals are responsible for the larval variation. The size, the typical tail bend and the staining peculiarity of the type 2 microfilariae are exactly the same as those of the microfilariae of *Dip. reconditum*. This parasite has never been reported in the fox, but Bain and Beaucournu (1974) have found third-stage larvae, very similar to those of *Dip. reconditum*, in fleas, the specific intermediate hosts of this helminth, caught on foxes.

Our results on the somatic distribution of the acid phosphatase activity of *Dip. dracunculoides* microfilariae contrast with those described by Ortega-Mora and colleagues (1989). These authors found a very intense red colour in the centre of the body, a concentrated spot at the anal pore and a ring around the excretory pore; in contrast, our stained microfilariae presented uniform enzymatic activity throughout the body. This different staining behaviour may be correlated with the long interval between killing and the examination of the foxes. The *Dipetalonema* microfilariae were always motionless in the fresh carcasses, which causes us to suspect that they had died, with resultant changes in the enzymatic activity.

In the area in which foxes have been controlled, canine infection with *Dip. reconditum* has decreased remarkably in the last 15 years. In 1976, it was present in about 60% of canine filariosis (Marconcini *et al.*, 1976); now it is reduced to little more than 5% (Magi *et al.*, 1989). This decrease is probably due to the systematic treatment of dogs, especially with ivermectin, which acts against both the intermediate hosts (fleas and lice) and the microfilariae, and perhaps also against adults (Lindemann and McCall, 1983), of *Dip. reconditum*.

*Dip. dracunculoides* has been found in foxes by Marconcini and Macchioni (1980) and Cancrini (1986) in Italy. It occurs frequently in dogs in Africa; in Europe it was found in dogs in Portugal (Azevedo, 1943) and Spain (Rojo-Vazquez *et al.*, 1990). Since

hippoboscid flies are the intermediate hosts of this parasite, it is possible that the infection can diffuse from wild to domestic carnivora. Therefore, the fox can be considered to be a reservoir for filariosis in dogs caused by *Dip. dracunculoides*.

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