

Local transmission of the eye worm *Thelazia callipaeda* in southern Germany

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Abstract This report describes the first assumed locally transmitted case of the eye worm *Thelazia callipaeda* in a dog living in southern Germany. A 4-year-old male golden retriever from the town of Bühl in north eastern Baden-Württemberg, about 10 km from the German–French border, showed one sided lacrimation for over 2 weeks. Despite the application of antibiotics, there was no improvement, and the dog additionally showed blepharospasm, epiphora and red conjunctivas. A deepened eye inspection revealed five whitish filiform parasites that were morphologically identified as *T. callipaeda*. The partial sequence of the mitochondrial cytochrome c oxidase subunit 1 gene (cox1, 605 bp) from one specimen revealed a novel haplotype, which differs by 1.3% from the only one (haplotype 1) identified in Europe so far. Since the infected dog had never been abroad with the exception of two daytrips to the close Alsace region in France, the transmission of *T. callipaeda* most probably was domestic. With the presence of end hosts and *Phortica* flies nourishing on lachrymal secretions acting as intermediate

hosts and an increasing number of dogs travelling to and coming from endemic regions in the South, the establishment of *T. callipaeda* in large parts of Europe cannot be excluded.

Introduction

Thelazia nematodes (Spirurida, Thelazioidea), phylogenetically closely related with *Spirocerca lupi* (Iorio et al. 2009), are commonly known as eyeworms and cause ocular infection in animals and humans. In particular, *Thelazia callipaeda* has been described as the causative agent of canine thelaziosis in Asia, and since the 1990s in endemic regions in southern Europe. Adult whitish nematodes of about 0.5–2 cm and the first larval stages (L1) can be found particularly under the third eye lid provoking lacrimation, conjunctivitis or even keratitis and corneal ulcer (Otranto and Traversa 2005). In Europe, *T. callipaeda* is transmitted by *Phortica variegata*, as shown in Italy under natural and experimental conditions (Otranto et al. 2005a). These drosophilid fruit flies of the family of the Steganinae not only feed on fruit juice but also on lachrymal secretions of carnivores, thereby, assimilating first larval stages of *T. callipaeda*, which develop into infectious third stage larvae within 3 weeks (Otranto et al. 2004).

In Europe, local transmissions of this nematode were reported in domestic dogs and cats, but also in wild foxes and wolves (Otranto et al. 2007). The first case of thelaziosis in a European dog was reported from northern Italy (Rossi and Bertaglia 1989). Surveys performed between 1995 and 2002 in herding and hunting dogs in southern and northern Italy revealed prevalences of 41.8% and 23.1%, respectively, but also four cats and 5.1% of foxes were *Thelazia*-positive in northern Italy (Otranto et al. 2003).

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Imported *Thelazia*-cases in dogs, which had been travelling to Italy, were initially reported from France (Bussi eras et al. 1996), southern Switzerland in 2000 (Malacrida et al. 2008) and Germany (Hermosilla et al. 2004). Subsequent investigations between 2005 and 2007 in southern Switzerland (canton Ticino) revealed prevalences in dogs and foxes of 6.2% and 11.1%, respectively, in the most southern part. In addition, five cats were also affected (Malacrida et al. 2008). All these cats and 58% of the infected dogs had never left the country. Local infections of four dogs and one cat were also described from the Dordogne region in the southwest of France (Dorchies et al. 2007). Finally, *T. callipaeda* infections were described in four human patients in Italy and France (Otranto and Dutto 2008). We, here, describe for the first time a case of *T. callipaeda* in a dog from north of the Alps without a travel history to known endemic regions.

Results and discussion

A 4-year-old male golden retriever from the town of B uhl in the north eastern Baden-W urttemberg (Fig. 1), about 10 km from the German–French border, showed one sided lacrimation for over 2 weeks. Despite the application of an ocular ointment containing the antibiotic gentamicin, there was no improvement and the lacrimation worsened. The



Fig. 1 Map showing the location of the described canine case of an assumed locally transmitted infection with the eye worm *Thelazia callipaeda* (star, town of B uhl) and the closest known endemic region (the cross mark indicates Ticino, southern Switzerland)

dog also showed middle graded blepharospasmus, epiphora and red conjunctivas on the right eye.

After local instillation of an anaesthetic, the third eye lid was lifted, and five whitish filiform parasites were detected. The nematodes were mechanically removed and morphologically identified as *T. callipaeda* according to Bhaibulaya et al. (1970). In order to confirm the morphological identification, a partial sequence of the mitochondrial cytochrome c oxidase subunit 1 gene (cox1, 605 bp) was determined from one specimen as previously described (Otranto et al. 2005b). Thus, a novel haplotype was identified, differing by 1.3% from haplotype 1, which is the only one found so far in the known endemic areas in Southern Europe and in animals with a travel history to these regions (Dorchies et al. 2007; Malacrida et al. 2008; Otranto et al. 2005b). Alternatively, scanning electron microscopy can be used to distinguish specimens belonging to the Thelaziidae (Naem 2007).

The affected dog is living in the centre of B uhl and gets walked three times a day, mainly in the city park. Additionally, the dog spends 1 day/week in a kennel in an animal pension, where he has contact to 10–12 other dogs. All these dogs were also subjected to a deepened eye inspection but none harboured eye worms. Since the infected dog had never been abroad with the exception of two daytrips to the close Alsace region, the transmission of *T. callipaeda* most probably was domestic. Most interestingly, the identification of a novel haplotype supports the assumption that the parasite has not been imported from known endemic European areas and therefore endorses an autochthonous transmission. The considered region in south West Germany is about 120 m above sea level in a region where also fruits are being cultivated. Interestingly, also strawberry fields are close by, as in Dordogne, where the first locally transmitted cases in France were described (Dorchies et al. 2007).

The presentation of this first assumed locally transmitted case of *T. callipaeda* in Germany demonstrates the potential of a further spread of this parasite in Europe. An ecological niche model based on the ecology and on the distributional data of *P. variegata* (Drosophilidae, Steganinae) in Europe had identified large parts of central Europe as suitable areas of this vector and intermediate host for *T. callipaeda* (Otranto et al. 2006). Other flies with zoophilic parasitic behaviour from the same family of the Steganinae, such as *Phortica semivirgo*, are discussed as vectors for the transmission of *T. callipaeda*. The morphological differentiation of *P. variegata* and *P. semivirgo* is arduous; therefore, a molecular identification by PCR-RFLP of the mitochondrial cytochrome oxidase c subunit I gene has been proposed (Cantacessi et al. 2008). Since dogs and also foxes as reservoir hosts are widely present in settlement areas as well as in recreational areas close to towns, a limiting factor for transmission and spread of *T. callipaeda*

may be a low population size and/or a short activity season of the incriminated zoophilic fruit flies north of the Alps. Indeed, a recent investigation has revealed the presence of *Phortica* spp. in Zürich (Switzerland) albeit at a lower density and during a shorter season as compared to an area in Ticino (Roggero et al. unpublished). Hence, with the presence of intermediate and end hosts and an increasing number of dogs travelling to and coming from endemic regions, the establishment of *T. callipaeda* in large parts of Europe cannot be excluded.

Previously diagnosed nematode infections in dog's eyes in Europe include *Onchocerca* spp., *Angiostrongylus vasorum* and *Dirofilaria repens* (King et al. 1994; Hermosilla et al. 2005a; Hermosilla et al. 2005b). Therefore, in case of conjunctivitis in dogs and cats, not only viral or bacterial but also parasitic etiologic agents have to be considered even without travel history to known endemic regions of these parasites.

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