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Ixodid tick species attaching to dogs in Hungary

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Abstract

A survey was carried out to investigate the occurrence of hard tick species (Acari: Ixodidae) infesting domestic dogs in Hungary. Forty veterinary clinics from a wide geographical area were asked to collect hard ticks from dogs and to complete a questionnaire. In total, 25 veterinary clinics submitted 900 ticks from 310 dogs. Intensity of infestation ranged from one to 78 per dog. The most preferred sites of tick attachment in decreasing order were head, neck and legs. The majority of ticks (91.7%) were adults, which were identified to species level, the others were nymphs. Six species were found: *Dermacentor reticulatus* (48.9%), *Ixodes ricinus* (43.2%), *Ixodes canisuga* (5.6%), *Haemaphysalis concinna* (2%) and there was one specimen of both *Dermacentor marginatus* and *Ixodes hexagonus*. Single species infestation with *I. ricinus* or *D. reticulatus* was found on 145 (46.8%) and 120 animals (38.7%), respectively. Mixed infestation caused by these two species was detected on 24 dogs (7.7%). *I. canisuga* and *H. concinna* were found on seven and five dogs, respectively. *D. reticulatus* and *I. ricinus* were collected almost throughout the year, except for a single month. The activity peaks were in spring and in autumn for both species. Based on clinical signs, canine babesiosis was diagnosed by the veterinarians in 66 (21.3%) tick infested dogs. These dogs were more frequently infested with *D. reticulatus* than the others. Our data contribute to the understanding of geographical and seasonal distribution of ixodid tick species infesting dogs in Hungary. The implication of these data, for the risk of canine tick borne diseases is discussed.

Keywords: Ticks; Dogs; *Dermacentor*; *Ixodes*; *Haemaphysalis*; Hungary

1. Introduction

Ixodid ticks are important vectors of different pathogens of veterinary and public health importance in many European countries. Emerging tick transmitted canine diseases like babesiosis, hepatozoonosis, ehrlichiosis, rickettsiosis and borreliosis have drawn both public and scientific attention to ticks (Beugnet, 2002). Increased mobility of pets and the ability of ticks to find niches in new climatic conditions have resulted in rapid extension of the zoogeographical ranges for many tick species (Shaw et al., 2001). The increasing number of ticks has also been associated with growing accessibility of natural environments and an increase in the

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population of wild host species (deer, small mammals and foxes) that now have a closer association with human activity. For example, *Ixodes ricinus* has extended its range in Sweden to more northern and western areas since the 1980's (Talleklint and Jaenson, 1998). Another important species, *Rhipicephalus sanguineus*, vector of several canine pathogens, also has a good adaptive ability and is likely to inhabit new areas throughout Europe (Fox and Sykes, 1985; Gothe, 1968, 1999; Gothe and Hamel, 1973). The importance of these arthropods is also highlighted by the rapid development of molecular biological methods enabling easy screening of blood samples and ticks for disease agents (Sparagano et al., 1999). There has been an increased awareness of tick borne pathogens of dogs because some of them can be dangerous also to humans causing zoonotic diseases (Shaw et al., 2001; Beugnet, 2002).

In Hungary, comprehensive studies on the occurrence of ixodid tick species were made only several decades ago (Kotlán, 1919, 1921; Janisch, 1959). According to previous studies (Janisch, 1959; Babos, 1965) there were about twenty species of ixodid ticks in Hungary. However, there is scant information about the temporal and spatial distribution of hard tick species infesting dogs. A recent study (Farkas and Földvári, 2001) showed that the most prevalent species on dogs is *I. ricinus* and *Dermacentor reticulatus* occurred in a greater geographic range than Horváth and Papp (1996) previously described. The latter species has been found to be vector of *Babesia canis*, a tick borne pathogen of dogs common in Hungary (Janisch, 1986). Because canine babesiosis is a severe and frequent disease in the country (Horváth and Papp, 1996; Csikós et al., 2001), it is crucial to study the geographical and seasonal distribution of *D. reticulatus*.

The risk of occurrence of non-indigenous tick species and/or new tick borne pathogens (Farkas et al., 2004) is increasing in Hungary because the number of travelling dogs has been increasing. The purpose of this study was to gather information on these ectoparasites occurring on dogs, and on the geographical and seasonal distribution of the most common species.

2. Materials and methods

After previous consultations, 40 veterinary clinics were asked to collect hard ticks from dogs which attended their surgeries in a period of 2 years. Participating clinics were recruited from a wide geographical area within the country. A simple questionnaire was designed to investigate the breed and age of host animal, date of collection and habitat to which the dog had been exposed. Questions on previous acaricidal and antibabesial treatment and on symptoms of babesiosis were also asked. Ticks were removed during the usual clinical examination of the animals. Questionnaires were completed and tick specimens were collected and posted by the participating veterinary surgeons.

Ticks collected from each dog were stored in separate tubes containing 70% ethanol. Counting and identification of species, life stages and sexes were carried out under a stereomicroscope. Standard keys of Babos (1965) and Hillyard (1996) were used for species identification of adults; immature specimens were identified to generic level.

3. Results

3.1. Tick collection

In total, 25 veterinary clinics submitted 900 tick specimens collected from 310 dogs. Intensity of infestation ranged from one to 78 ticks per dog. The majority (825; 91.7%) of specimens were adults belonging to six species, the others (75; 8.3%) were nymphs. *D. reticulatus* (403; 48.9%) and *I. ricinus* (356; 43.2%) were the most frequently identified species. Forty-six (5.6%) and 18 (2%) adults were *Ixodes canisuga* and *Haemaphysalis concinna*, respectively. There was only one specimen of *Dermacentor marginatus* and *Ixodes hexagonus*. Most of the adults collected (625, 75.8%) were semi-engorged or fully engorged females. The number of males was 200 (24.2%). Specimens of *D. marginatus*, *I. hexagonus* and *I. canisuga* were only females.

Single species infestation by either *I. ricinus* or *D. reticulatus* occurred on 145 (46.8%) and 120 (38.7%) dogs, respectively. Mixed infestation caused by these two species was detected on 24 dogs (7.7%). *I. canisuga* and *H. concinna* were found on seven and five dogs, respectively. Seven dogs had only nymphs and two dogs harboured one specimen of *D. marginatus* and *I. hexagonus*, respectively.

Fig. 1. Localities in Hungary where ticks were collected.

3.2. Questionnaire

One hundred and eighty questionnaires were returned. The infested animals originated from 37 different locations in the country (Fig. 1). Dogs infested with adults of *D. reticulatus* were found at 31 localities (Fig. 2). Date of tick collection was given for 817 specimens. Based on these records *D. reticulatus* and *I. ricinus* occurred virtually throughout the year, except for July and December, respectively (Table 1).

Fig. 2. Geographical distribution of *D. reticulatus* collected from dogs in Hungary.

Table 1
Number of specimens from the indicated species according to month of collection (blank = zero)

	January	February	March	April	May	June	July	August	September	October	November	December
D. reticulatus	3	13	176	51	17	10		5	53	28	37	3
I. ricinus	1	1	143	50	41	32	11	1	57	17	1	
I. canisuga	24			22								
H. concinna				13	1	2	2					
D. marginatus						1						
I. hexagonus							1					

The activity peaks of these species were in March–April and in September–October. *I. canisuga* was collected in January and April, while *H. concinna* occurred from April to July. The specimens of *D. marginatus* and *I. hexagonus* were found in June and July, respectively.

Localization of tick specimens on dogs was recorded in all the questionnaires. The most preferred sites of tick attachment in decreasing order were head, neck and legs.

Living conditions of 103 dogs were given in the questionnaires. Two thirds (68; 66%) of the animals lived in gardens, 23 (22.3%) in flats and there were 12 (11.7%) stray dogs. Walking habits for 88 dogs were indicated, which showed that they were walked in watersides (25; 28.4%), forests (15; 17.1%), mixed habitats (15; 17.1%), meadows (12; 13.6%), parks (5; 5.7%), streets (4; 4.5%), or were not walked at all (12; 13.6%). No correlation was found between living conditions/strolling and the species of ticks that were collected.

Based on clinical signs (e.g., fever, weakness, lethargy, loss of appetite, haemoglobinuria), canine babesiosis was diagnosed by the veterinarians in 66 (21.3%) tick infested dogs. However, only nine of these cases were confirmed by the detection of intraerythrocytic *Babesia* forms in blood smears taken from the animals. Seven from the nine dogs harboured only *D. reticulatus*, one was infested with *D. reticulatus* and *I. ricinus* and one carried only *I. ricinus*. The other 57 dogs diagnosed only on clinical symptoms, were infested with *D. reticulatus* only (35; 61.4%), *I. ricinus* only (15; 26.3%), *I. ricinus* and *D. reticulatus* (5; 8.7%), with a single adult of *D. reticulatus* and *Ixodes* nymphs (1; 1.8%) and with a *Haemaphysalis* nymph (1; 1.8%). Specimens of *D. reticulatus* were collected from 49 (74.2%) dogs having clinical signs of canine babesiosis.

4. Discussion

In the present study, specimens of six hard tick species were found on 310 dogs in 25 veterinary clinics of Hungary. More than 90% of the 900 specimens were adults, which can be partly explained by the macroscopic examination of the animals that may have overlooked nymphs and larvae.

D. reticulatus was collected with the greatest number. Until the late 1990's, this species was known to be present only in the middle and western parts of Hungary (Horváth and Papp, 1996). Results of the present study have, therefore, improved our knowledge about the geographical distribution of this tick species, because it was also collected in northern and southern parts of the country. Compared to data of similar surveys, *D. reticulatus* seems to infest dogs more often in Hungary than in Spain (Grandes, 1986), Greece (Papadopoulos et al., 1996; Papazahariadou et al., 2003) and in the UK (Ogden et al., 2000). The sampling method could also contribute to the high proportion of this species, because it is probable that more *Babesia* infected animals (possibly carrying the vector tick) were taken to the veterinary clinics than healthy ones. This hypothesis is supported with the high number (66; 21.3%) of dogs having clinical signs of babesiosis. In accordance with this, dogs with clinical signs of babesiosis had higher *D. reticulatus* infestation (74.2%) than all dogs examined (46.5%). The only vector of *Babesia canis* in Hungary (Janisch, 1986; Horváth and Papp, 1996; Csikós et al., 2001) and in other European countries (Regendanz and Reichenov, 1932; Martinod et al., 1985; Zahler and Gothe, 1997; Zahler et al., 2000) appears to be *D. reticulatus*. Further studies need to investigate its potential role in the life cycle of small babesiae detected recently in two Hungarian dogs (Farkas et al., 2004). *D. reticulatus* is also known to transmit tick borne encephalitis virus, *Francisella tularensis* and Rickettsia spp. (Zahler, 1994).

Based on the number of infested dogs, *I. ricinus* was found to be the most prevalent species. This finding is in accordance with German and British studies (Beichel et al., 1996; Ogden et al., 2000). *I. ricinus* is widespread in Europe and has a wide host range. It has great medical and veterinary importance as a vector of *Borrelia burgdorferi* (Beichel et al., 1996), *Ehrlichia* spp. (Cinco et al., 1997), tick-borne encephalitis virus (Jaenson et al., 1993; Farkas, 2002) and other disease agents. Bózsik et al. (1987) first reported on the occurrence of human Lyme borreliosis in Hungary. There is an increasing number of *Borrelia* seropositive dogs (personal communication), but a survey of canine borreliosis or ehrlichiosis has not been conducted in this region.

The single specimen of *D. marginatus* collected indicates that it is likely to be found on dogs only accidentally. *D. marginatus* is known to infest large domesticated or wild mammals (Hillyard, 1996) and it was found to be the second most frequent species after *I. ricinus* in Hungary (Babos, 1965). *Rickettsia slovaca* has been detected in this species in France, by Beati et al. (1993), but there is no data on the risk of canine infestation.

Only one specimen of *I. hexagonus* was collected. It is a common species in Hungary (Babos, 1965). However based on this study, *I. hexagonus* was found to be less prevalent on dogs compared to in Germany (Beichel et al., 1996) and Great Britain (Ogden et al., 2000). *I. hexagonus* usually infest medium-sized and large mammals that have a permanent dwelling, such as carnivores (Jaenson et al., 1993). This species may be involved in the epizootiology of, e.g., *Borrelia burgdorferi* (Gern et al., 1991) and *Theileria annae*, a recently identified canine piroplasm in northwest Spain (Camachoa et al., 2003).

Forty-six specimens collected from dogs were identified as *I. canisuga*. Babos (1965) reported that this species can also infest dogs in Hungary. It usually parasitizes medium-sized and large mammals, e.g., foxes that regularly return to their nest or lair (Jaenson et al., 1993). *I. canisuga* has been shown to be important vector of *B. burgdorferi* sensu lato in areas where *I. ricinus* is absent (Estrada-Pena et al., 1995).

In this study, 18 specimens of *H. concinna* were found on dogs that lived in central and western parts of Hungary. Babos (1965) reported that this species is likely to occur only in the western half of the country. This species is known to be restricted to areas where the environment is relatively unaltered (Hillyard, 1996). Spitalska and Kocianova (2003) recently showed the ability of this tick species to carry *Coxiella burnettii* in Slovakia and Hungary. Boni et al. (1998) reported that dogs can be infected with these intracellular zoonotic bacteria.

No specimens of *R. sanguineus* were found during our study. It has a great veterinary importance among dogs in several European countries. This species is able to transmit *Babesia canis vogeli*, *B. gibsoni*, *Ehrlichia canis* and *Rickettsia conorii* (Shaw et al., 2001). Because of the ability of this species to establish in a single kennel, it is possible that it could be introduced from abroad, as it was into the UK (Fox and Sykes, 1985), Czech Republic (Cerny, 1989) and Germany (Dongus et al., 1996). The appearance of *R. sanguineus* needs to be monitored in Hungary, because the tourism from and into the Mediterranean countries is increasing.

In the course of our study, questionnaires were available only for 180 of the 310 tick-infested dogs. In a number of cases, no questionnaire was obtained or not all questions were answered unambiguously. According to the date of tick collection, the two most abundant species (*D. reticulatus* and *I. ricinus*) can infest dogs nearly throughout the year. As a consequence, there is a risk of infection with pathogens transmitted by these species in every season.

Dogs in Hungary were found to be infested with species of ticks that included competent disease vectors. With support of molecular biological methods (Sparagano et al., 1999), infections of various tick borne parasites should be studied in both the vector and the host to clarify the epidemiological role of both the tick and the dog in the transmission of these pathogens. Deepening our understanding of the ecological needs of the tick species found on dogs in Hungary would further enhance the prevention of tick borne diseases in Europe.

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