

Original paper

Species diversity of ticks infesting dogs in the north-eastern part of Lublin Province (eastern Poland)

Anna PAŃCZUK¹, Małgorzata TOKARSKA-RODAK¹, Marta ZAREBSKA²,
Ewa PAWŁOWICZ-SOSNOWSKA³

¹Faculty of Health Sciences, Pope John Paul II State School of Higher Education in Biała Podlaska, ul. Sidorska 95/97, 21-500 Biała Podlaska, Poland

²Innovation Research Centre, Pope John Paul II State School of Higher Education in Biała Podlaska, ul. Sidorska 105, 21-500 Biała Podlaska, Poland

³Faculty of Social Sciences and Humanities, Pope John Paul II State School of Higher Education in Biała Podlaska, ul. Sidorska 95/97, 21-500 Biała Podlaska, Poland

Corresponding Author: Anna PAŃCZUK; e-mail: a.panczuk@dydaktyka.pswbp.pl

ABSTRACT. *Ixodes ricinus* followed by *Dermacentor reticulatus* are the most common tick species with medical and veterinary importance in Poland. *Ixodes ricinus* is widely distributed across Poland, whereas the range of *D. reticulatus* is limited to the eastern and central parts of the country, with several new foci in the mid-west and west. Concurrently, an increase in the occurrence range of *D. reticulatus* has been observed. Recent studies indicate its high density in eastern Poland. The aim of the study was to determine the species composition of ticks infesting dogs from the north-eastern part of Lublin Province. In a three-year study (2017–2019), 501 tick specimens were collected from 122 dogs in the north-eastern part of Lublin Province (eastern Poland). 174 ticks were removed from 24 pet dogs kept by individual owners and the other 327 were collected from 98 dogs from the animal shelter. Two tick species: *D. reticulatus* 55.5% (278/501) and *I. ricinus* 44.5% (223/501) were identified in the group of 501 ticks removed from the dogs. Dogs in the north-eastern part of Lublin Province are exposed to contact with two tick species: *I. ricinus* and *D. reticulatus*, with a higher frequency of the latter species. Identification of the species of ticks infesting dogs in an analyzed area and knowledge of pathogens transmitted by ticks facilitates correct differential diagnosis of tick-borne diseases.

Keywords: ticks, dogs, *Ixodes ricinus*, *Dermacentor reticulatus*, Poland

Introduction

Ixodes ricinus (Linnaeus, 1758) is the most common species of ticks with the greatest medical and veterinary importance in Central Europe, including Poland. Another most frequently reported species is *Dermacentor reticulatus* (Fabricius, 1794) [1,2], which may occur locally or on some hosts even more frequently than *I. ricinus* [3,4]. These two tick species differ in their distribution range, habitats, seasonal activity, and host specificity. *I. ricinus* is widely distributed across Poland, whereas the range of *D. reticulatus* is limited to the eastern and central parts of the country, with several new foci in the mid-west and

west. However, the occurrence range of the tick has been reported to expand [2,4–7]. Studies on the occurrence of *D. reticulatus* indicate a high density of the species in eastern Poland [7,8]. Recent research conducted in 2019 in Lublin Province (eastern Poland) has demonstrated that the region is characterized by a very high but irregular density of *D. reticulatus*. The highest density of these ticks has been reported from the northern and north-eastern parts of Lublin Province in areas predominantly covered by grasslands. An increase in their surface area exhibits a statistically significant positive correlation with the number of collected ticks. A substantial percentage of land in Lublin Province is also occupied by fallows, wasteland, and forest



Figure 1. Location of the Bialski District in Poland

islands. The mosaic character of the landscape creates favorable conditions for the development of *D. reticulatus* populations [7]. The expansion of the occurrence range and the increasing numbers of *D. reticulatus* ticks raise the risk of human and animal infections with tick-borne pathogens.

In Poland, *I. ricinus* and *D. reticulatus* are the most common tick species infesting companion animals, e.g. dogs and cats. Besides *I. ricinus* and *D. reticulatus*, other species of ticks have been collected from dogs in Poland, i.e. *I. hexagonus*, *I. rugicollis*, and *I. crenulatus* as well as *Rhipicephalus sanguineus*, which is an invasive species [1,4,6,9–15].

The frequency and severity of tick infestations in dogs depends on the presence and density of these parasites in habitats. Hence, comprehensive studies of both the tick fauna present in a given area and host are highly important, as they allow estimation of the risk posed by ticks to the health of domestic animals and humans [6]. The different competences of *I. ricinus* and *D. reticulatus* in terms of transmission of various pathogens determine the prevalence of tick-borne diseases in domestic animals. Canine borreliosis is diagnosed more often in animals living in the occurrence range of *I. ricinus*, i.e. a competent vector of *Borrelia* spirochetes, than in habitats colonized by *D. reticulatus* ticks, which do not play a significant role in the transmission of this disease. In

turn, in comparison with *I. ricinus*, a higher prevalence of *Babesia* spp. (canine babesiosis factor) is reported in *D. reticulatus* ticks collected from domestic animals [6].

The aim of the study was to determine the species composition of ticks feeding on dogs from the north-eastern part of Lublin Province (Bialski District).

Materials and Methods

In a three-year study (2017–2019), 501 tick specimens were collected from dogs in the north-eastern areas of Lublin Province (Bialski District) (Fig. 1). Ticks were collected from pet dogs kept by individual owners and from dogs from the „Azył” animal shelter in Biała Podlaska. Ticks were collected from dogs throughout the year. Both ticks attached to the dogs’ skin and those on their fur were collected. Ticks collected from pet dogs were removed by the pets’ owners, while ticks from dogs living in the animal shelter were collected by their keepers at the shelter. The ticks used for the research were therefore obtained as part of the nursing procedures of the dogs’ owners or keepers. The removed ticks were placed in test tubes with 70% ethyl alcohol, and then delivered to the laboratory. In the laboratory the species and developmental stage of the ticks were identified based on morphological traits with the use of an identification key [14,16].

Results

In a three-year study, 501 tick specimens were collected from 122 dogs. 174 ticks were removed from 24 pet dogs kept by individual owners and the other 327 were collected from 98 dogs from the „Azył” animal shelter in Biała Podlaska.

Only two tick species: *D. reticulatus* 278/501 (55.5%) and *I. ricinus* 223/501 (44.5%) were identified in the 501 ticks removed from the dogs during the three-year study. All collected ticks represented the adult stage. In both *D. reticulatus* and

Table 1. Species and developmental stages of ticks removed from dogs in 2017–2019

Number of ticks	<i>Dermacentor reticulatus</i>		<i>Ixodes ricinus</i>	
	females	males	females	males
	146 (52.5%)	132 (47.5%)	136 (61.0%)	87 (39.0%)
Total	278 (100.0%)		223 (100.0%)	

Table 2. Species of ticks relative to dogs' place of living

Number of ticks	Ticks collected from shelter dogs		Ticks collected from pet dogs	
	<i>Dermacentor reticulatus</i>	<i>Ixodes ricinus</i>	<i>Dermacentor reticulatus</i>	<i>Ixodes ricinus</i>
	184 (56.3%)	143 (43.7%)	94 (54.0%)	80 (46.0%)
Total	327 (100.0%)		174 (100.0%)	

I. ricinus, there were greater numbers of females than males, i.e. 52.5% (146/278) and 61.0% (136/223), respectively. *D. reticulatus* ticks dominated among specimens collected both from the shelter dogs 56.3% (184/327) and from the pet dogs 54.0% (94/174). Detailed data are presented in Tables 1 and 2.

Discussion

Both species of ticks (*I. ricinus* and *D. reticulatus*) have been reported to dominate and infest dogs in Poland most frequently. A study of ticks collected from dogs in 18 veterinary clinics in Wrocław agglomeration (western Poland) in 2013–2014 demonstrated a clear dominance of *I. ricinus*. The species accounted for as much as 88.7% (1005) of all the 1133 specimens removed from dogs. The second most abundant species was *I. hexagonus* accounting for 7.4% (84/1133), while *D. reticulatus* was the third species and represented 3.9% (44/1133) [12]. *I. ricinus* ticks were reported as a dominant species in a study of domestic dogs in Rymanów district (Subcarpathian Province, southern Poland) in 2005–2006. As many as 212 of the 236 ticks collected from the dogs were *I. ricinus* (89.8%) and 24 specimens were identified as *I. hexagonus* (10.2%). The investigations did not reveal the presence of *D. reticulatus* [10]. *I. ricinus* was also found to dominate in a nine-year study (2009–2017) of dogs from veterinary clinics located near Olsztyn (Warmińsko-Mazurskie Province, northern Poland). However, the difference in the abundance of *I. ricinus* was not high, as the species accounted for 59.75% of the total number of 4,537 collected ticks, whereas *D. reticulatus* represented 40.11% but exhibited a tendency towards a gradual increase in its number [17].

D. reticulatus was reported as a dominant species in a study of dogs from six veterinary clinics in Warsaw (central Poland) carried out in 2003–2005. *D. reticulatus* ticks represented 64.6% of all 590 ticks collected from the dogs and *I. ricinus* accounted for 35.4% [18]. Even greater

dominance of *D. reticulatus* was found in a group of 224 ticks collected in 2012–2013 from dogs in Mazovia and Masuria regions. *D. reticulatus* accounted for 86.1% of ticks, while two other species, i.e. *I. ricinus* and *I. hexagonus*, represented 12.7% and 1.2% of all ticks, respectively [4]. In the present three-year study of ticks collected from dogs in the north-eastern part of Lublin Province (eastern Poland), *D. reticulatus* (55.5%) dominated over *I. ricinus* (44.5%), but the difference was not as high as in the investigations conducted in Warsaw [18] and Mazovia and Masuria [4]. In the present study, *D. reticulatus* was the dominant species in the infestations of the shelter dogs (56.3%) and the pet dogs (54.0%).

Identification of the species of ticks feeding on animals and the knowledge of transmitted pathogens facilitates rapid and correct differential diagnosis of tick-borne diseases. The analysis of the prevalence of infection of *I. ricinus* ticks by various pathogens in Lublin Province revealed the presence of *Borrelia burgdorferi* s.l. (at present *Borrelia* [19,20]) at a level of 5.4% [21] and 5.6% [22], *Babesia microti* (5.4%) [23], *Anaplasma phagocytophilum* (10.3%) [22], and TBEV (1.6%) [24].

In turn, the following pathogens were detected in *D. reticulatus* ticks collected in Lublin Province: *Babesia. canis* 21.3%, *B. burgdorferi* s.l. (at present *Borrelia*) 0.6% [22], TBEV 10.8% [24], *B. microti* (4.5%) [25], and *Rickettsia* spp. 53.0% (all except one rickettsial isolates showed 100% homology with *Rickettsia raoultii*) [26]. Zając et al. [27] analyzed the presence of 6 pathogens and found that *D. reticulatus* ticks were infected with the following species: *Rickettsia raoultii* (43.8%), TBEV (8.5%), *Babesia* spp. (2.5%), *Toxoplasma gondii* (2.1%), *B. burgdorferi* s.l. (at present *Borrelia*) (1.6%), and *A. phagocytophilum* (1.1%).

Since a high percentage of the *D. reticulatus* ticks collected from the dogs in the present study were males (47.5%), the investigations conducted by Bartosik et al. [28], who analyzed the questing behavior of *D. reticulatus* males in terms of

pathogen transmission, should be mentioned. Their results show that the behavior of *D. reticulatus* males on the host is responsible for their ability to transmit pathogens and non-pathogenic microorganisms that are present in tick saliva in the different periods of the parasitic phase. Clinical diagnostics of tick-borne diseases should take into account the vector potential of tick males feeding on the host for several days.

In conclusions, dogs in the north-eastern part of Lublin Province are mainly exposed to contact with two species of ticks: *I. ricinus* and *D. reticulatus*, with a higher frequency of the latter species. Identification of the species of ticks infesting dogs in an analyzed area and knowledge of pathogens transmitted by ticks facilitates correct and rapid differential diagnosis of tick-borne diseases. Given the increase in the *D. reticulatus* occurrence range observed in Poland and the high density of this species in eastern Poland, raising the awareness among veterinary services and dog owners of the role of these ticks in the transmission of pathogenic microorganisms is advisable.

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