DATA ON SOME IXODID TICK SPECIES (ACARI, IXODIDAE) IN THE BALTIC COUNTRIES

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Abstract. Information on autochtonous ticks and their hosts is scarce in Baltic countries, especially in Lithuania. To contribute to tick knowledge in the region, during spring–summer of 2002–2009, in different localities of the Baltic region, different species and development stages of ticks were collected from vegetation and mammals. The ticks were identified as *Ixodes ricinus* (Linnaeus, 1758), *Ixodes persulcatus* Schulze, 1930, *Ixodes trianguliceps* Birula, 1895 and *Dermacentor reticulatus* (Fabricius, 1794). Small mammals were parasitized mainly by immature stages of *Ixodes* spp., while *D. reticulatus* mostly preferred carnivores as hosts. The distribution of two sympatric species, *I. ricinus* and *I. persulcatus*, is discussed.

Key words: ticks, *Ixodes,* host species, distribution

Introduction

Ticks from the order Parasitiformes are obligate hematophagous arthropods that parasitize vertebrates. Ticks are frequently an object of research, because they were considered to be second only to mosquitoes as vectors of infectious diseases in the world. There are two major Parasitiformes tick families: Ixodidae, or "hard ticks," which have a sclerotized dorsal plate, and Argasidae, or "soft ticks" which have a cuticle. The third family, Nuttalliellidae, is represented by only a single species in southern Africa. The family Ixodidae has 694 tick species; 511 species feed on mammals, 60 species feed on birds, and approximately the same number on reptiles. Hosts of other species of this family are unknown or their species validity is questionable (Parola and Raoult, 2001; Kolonin, 2007).

Information on Ixodid ticks from Lithuania is scarce. Ticks of the genus *Ixodes* Latreille, 1795 are widespread, with *Ixodes ricinus* occurring in all parts and *Dermacentor reticulatus* (Fabricius, 1794) in the central and northwest parts of the country (Žygutienė, 1995; 2009). *Ixodes persulcatus* Schulze, 1930 was found only once in the northern part of Lithuania in 1972 (Motiejūnas, Podėnaitė, 1972). Except this information, no data on the distribution of *I. persulcatus* in Lithuania has been published, and the knowledge of its western distribution border in the Baltic countries is very incomplete. *Ixodes trianguliceps* Birula, 1895*, Ixodes apronophorus* Schulze, 1924; *Ixodes arboricola* Schulze and Schlottke, 1929, and *Ixodes lividus* Koch, 1844,

according to the information on the distribution area of Ixodid ticks (Filippova, 1977; Kolonin, 2009), could also be found in Lithuania.

According to information available in the List of Latvian Invertebrates (Salmane, 2008), *I.ricinus, I. persulcatus, I. trianguliceps, I. apronophorus, I. lividus and Ixodes vulpicola* Schulze, 1937 were found in Latvia. *Ixodes ricinus* is spread in the western and central parts of Latvia, rarely also in small numbers in the eastern part, while *Ixodes persulcatus* seems to dominate only in the eastern part of the country (Bormane *et al*., 2004). *I. ricinus* and *I. persulcatus* are distributed with different prevalence in different parts of Estonia (Jõgiste *et al*., 2004), and *I. apronophorus* was found too (Kusilnõi, 1961). According to the information on the distribution of Ixodid ticks, *I. trianguliceps, I. arboricola*, and *I. lividus* also could be found in Estonia (Filippova, 1977, 2002; Kolonin, 2009).

The objective of the present study was to identify the Ixodid tick species present at the host– and tick–rich Baltic region, as well as the hosts they feed on, and to determine the western distribution border of *I. persulcatus*.

Material and Methods

During the spring–summer of 2002–2009, in different localities of the Baltic region different species and development stages of ticks were collected from vegetation and mammals.

Questing ticks were collected using a standard flagging method used for collecting active ticks on vegetation. A cloth or a blanket (1 m^2) was dragged over vegetation. Ticks attached to the cloth were periodically removed (Paulauskas *et al*., 2008).

For analysis of the distribution of Ixodidae ticks in Lithuania, during the spring–summer 2003–2008 ticks were sampled in 24 localities with different types of habitat: in grassland, pine forest, deciduous and mixed forest, coastal zone and urbanized zones (city parks). Ticks from different species of small rodents and carnivores were collected during 2005–2009.

In each sampling season, a different number of mammal species of were examined for tick infestation. Small rodents were live–trapped with locally constructed wooden traps (Paulauskas et al., 2008). Captured rodents were carefully examined for ticks. Attached engorged ticks were removed from skin of rodents. Ticks were mainly found on the head, especially on ears and around the mouth, and rarely on paws and tails.

Ticks were collected also from carnivores. The investigated animals were victims of traffic accidents or killed by hunters. Attached and moving ticks were collected on different animal body parts (especially in the head area).

For the identification of *I. persulcatus* and *I. ricinus* distribution area in the Baltic countries, unfed *Ixodes* ticks were collected on 19 sampling sites in Lithuania, Latvia and Estonia in May 2008. The sites were located at a distance of 50 km from each other, and the main gradient of localities was from south to north (Fig. 1).

Microscopic and morphometric analyses were used for the identification of ticks to the species level. Keys (Fillipova, 1985; Hillyard, 1996) were used for the identification of larvae, nymphs, females and males. The taxonomic identification of *I. ricinus* and *I. persulcatus* was confirmed by molecular identification (Turčinavičienė *et al*., 2006) using PCR techniques with species-specific primers.

Results

A total of 763 rodents belonging to 5 species – *Apodemus agrarius* (Pallas, 1771), *Apodemus flavicollis* (Melchior, 1834), *Microtus agrestis* (Linnaeus, 1761), *Microtus arvalis* (Pallas, 1778) and *Myodes glareolus* (Schreber, 1780) – were collected in 12 locations of Lithuania and examined for ticks, as were also ten animals of three different species of carnivores – *Nyctereutes procyonoides* (Gray, 1834), *Meles meles* Linnaeus, 1758 and *Vulpes vulpes* Linnaeus, 1758. Table 1 shows the number and species of wild animals analyzed and the tick species collected from vegetation and animals. In different localities of Lithuania, from vegetation and mammals, 13896 specimens of *I. ricinus* ticks (10816 larvae, 994 nymphs and 1786 adults), 401 specimens of *Ixodes trianguliceps* ticks (285 larvae, 105 nymphs and 11 adults) and 138 specimens of *D. reticulatus* ticks (15 nymphs, 123 adults) were collected.

Table 1. Number of wild animals and Ixodid ticks examined in Lithuania, in 2001 – 2009 (abbreviations: ad. – adults; la. – larvae; ny. – nymphs; vg – vegetation; *A.a.* – *Apodemus agrarius*; *A.fl.* – *Apodemus flavicollis*; *M. ag.* – *Microtus agrestis*; *M. ar.* – *Microtus arvalis*; *M. g.* – *Myodes glareolus*; *M. m.* – *Meles meles*; *N. pr.* *Nyctereutes procyonoides; V. v.* – *Vulpes vulpes*)

Locations	Sampling period	Ticks from	No. of animals	Species							
				Ixodes ricinus			***Ixodes trianguliceps***			***Dermacentor reticulatus***	
				la.	ny.	ad.	la.	ny.	ad.	ny.	ad.
Biržai district N56°15', E25°55'	2001–2004	vg			6	163					
Biržų giria forest N56°27';E24°99'	2005.09	*M. g.*	10	1							
		A. fl.	5	2							
		A. a.	1	2							
		M. ag.	9	1							
Ignalina district N55°53', E25°97'	2001–2004	vg			1	137					
Joniškis district N55°53', E25°97'	2001–2004	vg			3	42					
		M. g.	42	1864	35						
N56°14';E23°40'	2009 06 20 – 2009 06 26	*A. fl.*	14	1783	52						
		A. a.	1								
Jurbarkas district N55°04';E22°30'	2009 08 11 – 08 14	*M. g.*	44	222	2		243	83			
		A. fl.	23	267	8		7	4			
		A. a.	4								
Kaišiadorys district Lapainios botanical reserve N54°44', E24°11'	2008.04	vg								1	10
Vaiguva N54°46', E24°11'	2008.04	vg									47
Vilnius-Kaunas highway	2007, 2008	*N. pr.*	2		1				5		1

Table 1 (continuation)

Locations	Sampling period	Ticks from	No. of animals	Species							
				Ixodes ricinus			***Ixodes trianguliceps***			***Dermacentor reticulatus***	
				la.	ny.	ad.	la.	ny.	ad.	ny.	ad.
Kaunas district											
Kaunas Botanical Garden (KBG) park N54°87'; E23°90'	2001–2004	vg			42	77					
	2006.05	vg			12	58					
	2008.04–05	vg		1	44	46					
		M. g	17	57	1						
	2005.06–07;	*A. fl.*	34	8	12						
	2006.08	*A. a.*	4	10							
		M. ar.	12		3						
Panemunė forest park N54°86'; E23°96'	2008.04–05	vg			40	34					
Kleboniškis forest park N54°95'; E23°94'	2008.04–05	vg		1	119	8					
Kėdainiai district N55°19';E23°59'	2009 07 20–07 23	*M. g*	20	430	38						
		A. fl.	30	1234	196						
Kelmė district N55°64', E22°98'	2001–2004	vg			5	64					
Klaipėda district N55°69', E21°18'	2001–2004	vg			11	40					
Kretinga district N55°43', E21°08'	2001–2004	vg			4	37					
Lazdijai district N54°14';E23°33'	2009 07 07–20069 07 11	*M. g*	47	408	28		1				
		A. fl.	19	1252	13		11	1			
Marijampolė district N54°60', E23°30'	2001–2004	vg			19	41					
Mažeikiai district N56°44', E22°41'	2001–2004	vg				31					
Panevėžys district N55°73', E24°42'	2001–2004	vg				50					
Prienai district N54°60', E23°89'	2001–2004	vg			14	48					
Radviliškis district N55°85', E23°37'	2001–2004					89					
Raseiniai district Raseiniai–Kaunas highway	2008	*M. m.*	2			1					19

Table 1 (continuation)

Locations	Sampling period	Ticks from	No. of animals	Species							
				Ixodes ricinus			***Ixodes trianguliceps***			***Dermacentor reticulatus***	
				la.	ny.	ad.	la.	ny.	ad.	ny.	ad.
Šilutė district											
Kintai	2006.08	vg				59					
N55°42';E 21°26'	2008.05	vg								15	40
		M. g	7	66	48						
	2006.08	*A. fl.*	13	109	9						
		A. a.	4	35	1						
Muižė	2006.06	vg				3					2
N55°39';E21°24'		*M. g*	15	3	1						
	2005.09;	*A. fl.*	25	9							
	2006.06,08	*A. a.*	10	4							
		M. ag.	8		1						
Ventė	2006.06	vg			7	1					
N55°34';E21°20'		*M. g*	1	4							
	2005.09	*A. fl.*	5	3							
Šilutė N55°33', E21°46'	2001–2004	vg				21					
Rusnė N55°29';N21°37'	2006, 2007	*N. pr.*	3		4	13					3
Šiauliai district N56°00', E23°24'	2001–2004	vg			14	107					
Ukmergė district N55°26', E24°77'	2001–2004	vg			9	89					
Taujėnai N55°39';E24°76'	2008.09	*V. v.*	3			11					6
Utena district N55°52', E25°58'	2001–2004	vg				81					
N55°29';E25°39'	2009 05 26–	*A. fl.*	42	1209	54						
	2009 07 02	*M. g*	16	813	50						
Varėna district N54°18', E24°55'	2001–2004				3	34					
Vilnius district N54°50', E25°30'	2001–2004	vg			20	377					
Skauduliškės	2006.04–	*M. g*	205	379	19		13	15	1		
N54°51';E25°10'	2007.06	*A. fl.*	87	604	28		3	2	1		
		M. ar.	3	11							
Zarasai district											
Dusetos	2006.06	vg				24					2
N55°75';E25°87'		*M. g*	7	4							
		M. ar.	37	20	17		7				

For the identification of the western distribution border of *I. persulcatus*, a total of 419 unfed *Ixodes* ticks were collected in 19 sampling sites in Lithuania, Latvia and Estonia in May 2008 (Table 2). The distribution of *I. persulcatus* across the Baltic countries did not confirm previous data (Motiejūnas, Podėnaitė, 1972) on *I. persulcatus* presence in Lithuania (Fig. 1).

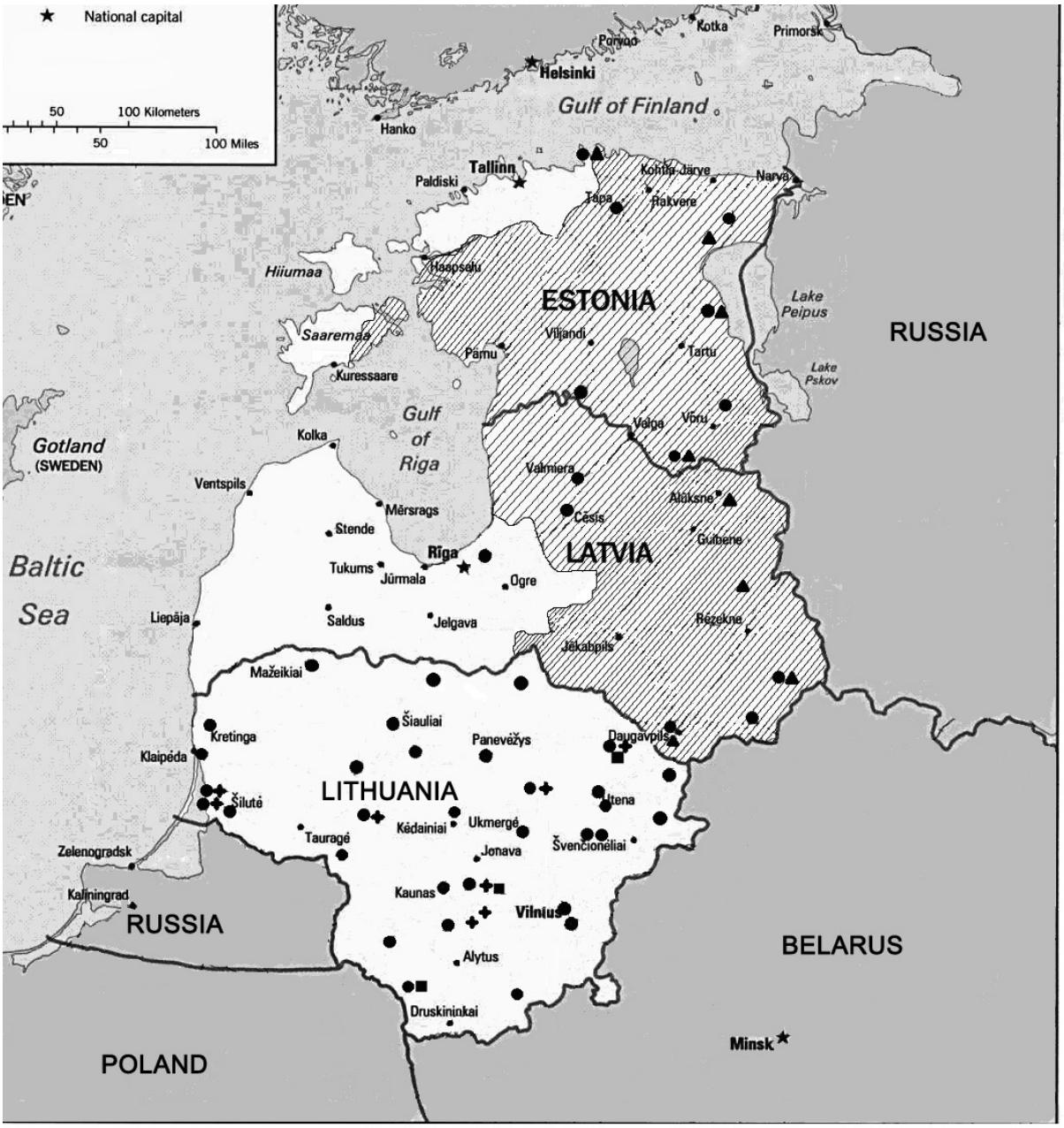

Fig 1. Distribution of Ixodidae ticks in Lithuania
Ixodes ricinus ●
Ixodes persulcatus ▲
Ixodes trianguliceps ■
Dermacentor reticulatus ✚

Distribution area of *I. persulcatus* according to Bormane et al. (2004) and Jõgiste ett al. (2004).

Table 2. Number of specimens (females, males and nymphs) of two tick species collected across the Baltic countries in May 2008

Locations	Species	Stage and sex			Species	Stage and sex		
	I. ricinus	♀	♂	juv.	***I. persulcatus***	♀	♂	juv.
LITHUANIA								
Molėtai–Ignalina–Vilnius–Utena crossroad N55°14'1,03"; E25°27'4,4"	13	7	4	2				
Labanoras RP N55°14'7,65"; E25°39'9,33"	62	21	20	21				
Dūkštas N55°33'9,33"; E26°21'1,03"	42	20	20	2				
LATVIA								
Daugavpils N55°54'9,39"; E26°23'7,87"	27	12	15		1	1		
Kraslava N55°57'0,46"; E27°18'8,45"	10	1	9					
Ezernieki N56°10'2,67"; E27°39'6,46"					24	13	10	1
Dricani N56°40'8,43"; E27°09'3,41"					23	16	7	
Užarokas (Salaspils) N56°58'0,79"; E24°21'2,70"	29	17	12					
Cesis N57°13'2,70"; E25°13'0,00"	23	12	11					
Guldupis N57°15'0,12"; E27°03'7,82"					10	8	2	
Vaidava N57°25'8,45"; E25°22'9,73"	10	5	5					
ESTONIA								
Varstu N57°37'4,87"; E26°38'1,63"	11	4	7		20	13	7	
Pölva N57°59'9,70"; E27°03'4,70"	3	1	1	1				
Lilli N58°01'506"; E25°32'562"	25	9	16					
Koosa N58°28'7,72"; E27°04'1,09"	3	1	2		7	5	1	1
Lohusuu N58°57'7,36"; E27°05'5,53"					3	2	1	
Iisaku N59°08'3,59"; E27°21'6,88"	11	4	7					
Tapa N59°10'6,64"; E25°47'1,97"	2	1	1					
Võhma N59°36'1,17"; E25°34'5,97"	59	29	30		1	1		

Discussion

Small mammals appeared to harbor principally two *Ixodes* species – *I. ricinus* and *I. trianguliceps*, whereas *D. reticulatus* mostly preferred carnivores as hosts. *I. trianguliceps* were collected only from small rodents, as this species never harbors on vegetation. *I. ricinus* ticks were collected in all the Lithuanian localities investigated. Adults were abundant on vegetation, while immature ticks were collected mainly from hosts. *D. reticulatus* ticks were collected in Zarasai, Kaišiadorys, Raseiniai, Šilutė, Šauliai, Ukmergė districts.

The distribution of *Ixodes persulcatus* in Eastern and Southern Estonia was

confirmed by our data, as well as mixed distribution in the sympatric zone of both species, *I. ricinus* and *I. persulcatus*. *I. persulcatus* dominated in the eastern areas of Latvia as well, while the southern distribution of this species is considered to be the north of Lithuania (Fig. 1). *I. ricinus* can be found over all Baltic countries. This fact confirms the data (Filippova, 2002) that the nearly transpalearctic distribution range of *I. persulcatus* in the west is overlapped by a typically European distribution range of *I. ricinus*. Climate changes were noted to influence the boundaries of areals of *Ixodes* (Yasyukevich et al., 2009), and the southwest distribution of *I. persulcatus* has decreased, its boundary being moved to the east.

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Duomenys apie kai kurias iksodinių erkių (Acari, Ixodidae) rūšis Baltijos šalyse

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Santrauka

Pateikiami duomenys apie kai kurias iksodines erkes ir jų šeimininkus Baltijos šalyse. 2002–2009 metais surinkta medžiaga nuo paklotės ir įvairių žinduolių skirtingose Baltijos regiono vietose papildo žinias apie kai kurių erkių rūšių paplitimą ir šeimininkus. Identifikuotos šių rūšių erkės: *Ixodes ricinus* (Linnaeus, 1758), *Ixodes persulcatus* Schulze, 1930, *Ixodes trianguliceps* Birula, 1895, *Dermacentor reticulatus* (Fabricius, 1794). Smulkieji žinduoliai daugiausiai buvo užsikrėtę *Ixodes* genties nesubrendusiomis erkėmis, t. y. lervomis ir nimfomis, tuo tarpu *D. reticulatus* daugiausia buvo rastos ant plėšriųjų žinduolių ir paklotės. Aptariamas dviejų simpatrinių rūšių - *I. ricinus* ir *I. persulcatus* paplitimas.

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