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MONITORING OF TICK SPECIES (ACARI: IXODIDAE) IN VOJVODINA HUNTING RESORTS

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Summary: The understanding of tick's role as pathogen vectors has to rely on the fact that potential tick activity obtained by sampling the free living forms from the vegetation or collected from the body of a host, represents the actual association between ticks and their numerous adequate hosts in nature. Ticks were collected from nature, from hosts and using CO_2 traps from four hunting resorts in Vojvodina: Srpski Krstur, Novi Kneževac, Senta and Kanjiža from March till September in 2011. Six species were identified: *Ixodes ricinus*, *Dermacentor marginatus, D. reticulatus, Haemaphysalis punctata, H. sulcata* and *H. concinna.* Precise estimation of tick abundance enhances the efficacy of control and enables calculation of ectoparasitic burden which could be used as a parameter in practice for adequate and suitable management of hunting resorts.
Key words: ticks, hunting resort, sampling method, Ixodidae, *Capreolus capreolus*

Introduction

Worldwide ticks are the objects of interest as vectors of numerous pathogens. Tick borne diseases (Lyme disease, babesiosis, anaplasmosis, ehrlichiosis...) constantly draw more and more attention of European scientists and researchers [1, 2]. A few studies concerning the relationship between ticks, pathogens and roe deer have been published recently [3]. The understanding of human-animal-tick relationship has to be based on epidemiological studies and analysis of tick borne zoonosis. Furthermore, the understanding of tick's role as pathogen vectors has to rely on the fact that potential tick activity obtained by sampling the free living forms from the vegetation or collected from the body of a host, represents the actual association between ticks and their numerous adequate hosts in nature. Moreover, it is necessary to comprehend the influence of abiotic and biotic factors on tick activity and their seasonal dynamics in order to predict the risk for humans and animals of being bitten by ticks or being infected by a tick borne pathogen [4]. Numerous studies of infected ticks and their vector role are mainly focused on rural habitats [5] where intensive pathogen transmission between ticks and their vertebrate hosts could be expected, but only a few studies analysed appearance, maintenance and seasonal activity of tick populations in hunting and nature resorts. Regarding more frequent appearance of different diseases in wild and domestic animal populations, in some parts of the world, the studies are aimed in finding the most efficient method of tick control using primary hosts (rodents, lizards, canids, felids, artiodactyls). Concerning the fact that ungulate has an important role in maintenance of ixodid tick populations in nature, it is necessary to define the diversity of tick species and their impact on animal health. In order to obtain the most precise data of tick species diversity it is obligatory to adjust the method for tick sampling in practice. Some ixodid ticks have unique questing behavior and they usually could not be found on vegetation waiting for a potential host. These tick species are attracted by a pheromone or the carbon dioxide (CO_2) that are excreted or exhaled by their potential hosts [6].

Considering all these facts it has to be emphasized that relative values of tick population densities are the results of applied sampling methodology and these results do not represent the actual presence of all tick species at particular locality. In addition, only the part of tick population could be found in active phase at certain period and those are the specimens that demonstrate active strategies in host questing, while the significant part of the tick population is in passive phase. The aim of this research was to identify tick species and their abundance in Vojvodina hunting resorts using three different methods.

Material and Method

Ticks were collected from nature, from the hosts (male roe deer *Capreolus capreolus* Linnaeus, 1758) and using CO_2 traps from four hunting resorts in Vojvodina: Srpski Krstur (N46 07.833 E20 05.583) and Novi Kneževac (N46.02.549 E20.05.258) (CA. 30.539 ha; 2.150 heads of roe deer), Senta (N45 56.703 E20 00.769; ca. 25.500 ha; 1.270 heads of roe deer), and Kanjiža (N46 04.302 E19 56.616; ca. 39.856 ha; 1.590 heads of roe deer) [7] from March till September in 2011. All studied areas were described as agro ecosystems with wide belts of mixed deciduous forests with sporadic shrub and bush vegetation. From nature, ticks were sampled according to "Flag-hour" method, i.e. by flagging low vegetation and soil surface for an hour, with white flannel cloths (1 x 1 m and 1 x 1.6 m) through the chosen transect in total length of 100 m [8, 9]. Both sides of the cloth were carefully examined every 20 m and all ticks were collected using tweezers. Ticks were sampled monthly, from 10 am to 6 pm, if the weather conditions were suitable. The sampling was not conducted if the temperature was under +5 C°. The collection of tick specimens from the hosts was performed

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immediately after the hunt. Roe deer carcasses were disemboweled by the hunters and each carcass was systematically inspected and palpated by three observes using latex gloves. Ticks specimens were collected using acarological tweezers. The third method of tick species monitoring was conducted using dry ice traps (CO_2). The traps were designed as plastic bottles with perforated holes (5 mm of diameter). These traps were filled with 2 kg of small pieces of broken dry ice as a CO_2 source. Once a month the traps were placed on a white cloth (0.5 x 0.5 m) and checked every hour from 10 am do 6 pm for three days. All sampled ticks were put into plastic tubes (5 ml) with a small cotton ball soaked in water to maintain the humidity, and closed with perforated plastic stopper for sufficient ventilation. The collected specimens were transported to the laboratory and maintained alive at +5°C till examination. Tick species were identified according to detailed identification keys [10, 11, 12].

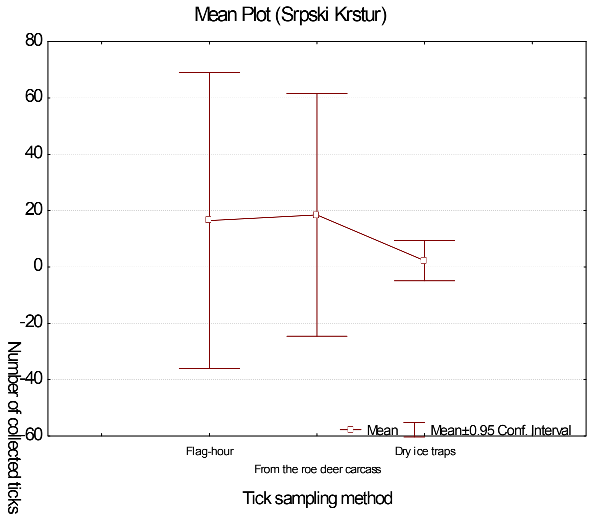
Results and Discussion

Studies of the qualitative and quantitative composition of tick species collected by flagging from nature, collected from the carcasses of male roe deer (*Capreolus capreolus* Linnaeus 1758) and sampled from dry ice traps have shown the differences in relative abundance of identified tick genera and species. Six species from three genera were identified: from genus *Ixodes* only one species was registered - *Ixodes ricinus* Linnaeus 1758, from genus *Dermacentor* two species: *D. marginatus* Sulzer 1776 and *D. reticulatus* Fabricius 1794, and from genus *Haemaphysalis* three species: *H. punctata* Canestrini & Fanzago 1878, *H. sulcata* Canestrini & Fanzago 1878 and *H. concinna* Koch 1844.

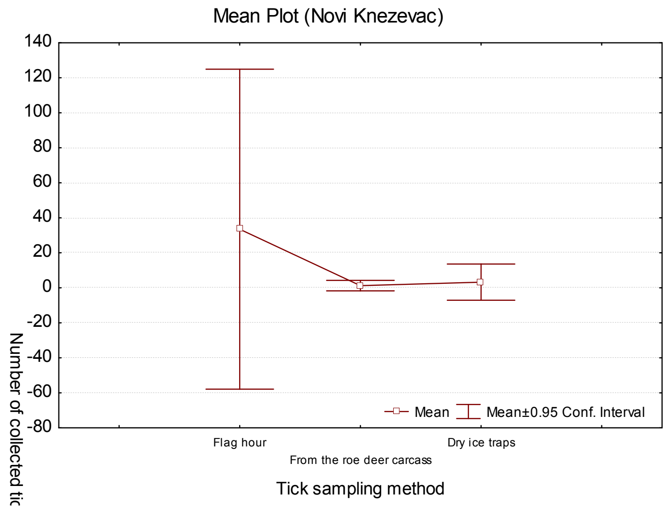
The most abundant species was *I. ricinus* collected by using all three methods (86.36%), then *D. marginatus* (6.68%) and *H. punctata* (3.68%). The lowest abundance was obtained for *H. concinna* (2.32%), *D. reticulatus* (0.68%) and *H. sulcata* (0.27%) (Tab. 1.).

Table 1. The number of collected ticks

Locality	Tick species	Methods of tick sampling															Total	Total
		Flag-hour					From the body of male roe deer					CO_2 traps						
		Larvae	Nimphs	Males	Feamles	Total	Larvae	Nimphs	Males	Feamles	Total	Larvae	Nimphs	Males	Feamles	Total		
Srpski Krstur	*I. ricinus*	23	18	9	16	**66**	0	3	14	41	**58**	2	4	1	2	**9**	**133**	**149**
	H. conncina	0	0	0	0	**0**	0	1	2	11	**14**	0	0	0	0	**0**	**14**	
	H. sulcata	0	0	0	0	**0**	0	0	0	2	**2**	0	0	0	0	**0**	**2**	
Novi Kneževac	*I. ricinus*	58	24	11	26	**119**	0	1	1	2	**4**	3	5	2	3	**13**	**136**	**152**
	H. conncina	0	0	0	0	**0**	0	0	0	1	**1**	0	0	0	0	**0**	**1**	
	D. marginatus	0	0	5	10	**15**	0	0	0	0	**0**	0	0	0	0	**0**	**15**	
Senta	*I. ricinus*	71	25	18	42	**156**	0	0	1	17	**18**	5	3	1	2	**11**	**185**	**213**
	H. conncina	0	0	0	0	**0**	0	2	0	0	**2**	0	0	0	0	**0**	**2**	
	H. punctata	0	8	1	2	**11**	0	0	0	0	**0**	0	0	0	0	**0**	**11**	
	D. marginatus	0	0	6	9	**15**	0	0	0	0	**0**	0	0	0	0	**0**	**15**	
Kanjiža	*I. ricinus*	26	36	22	40	**124**	0	0	5	30	**35**	9	10	0	1	**20**	**179**	**219**
	H. punctata	0	8	2	6	**16**	0	0	0	0	**0**	0	0	0	0	**0**	**16**	
	D. marginatus	0	0	8	11	**19**	0	0	0	0	**0**	0	0	0	0	**0**	**19**	
	D. reticulatus	0	0	1	4	**5**	0	0	0	0	**0**	0	0	0	0	**0**	**5**	
	Total	178	119	83	166	**546**	0	7	23	104	**134**	19	22	4	8	**53**	**733**	**733**

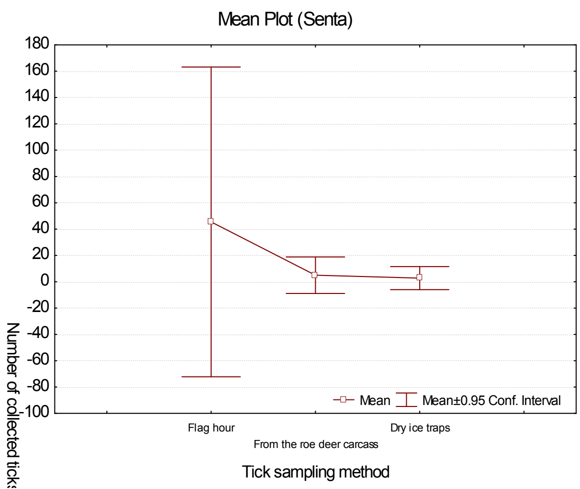


Graph 1. The number of collected ticks using different methods of sampling at locality Srpski

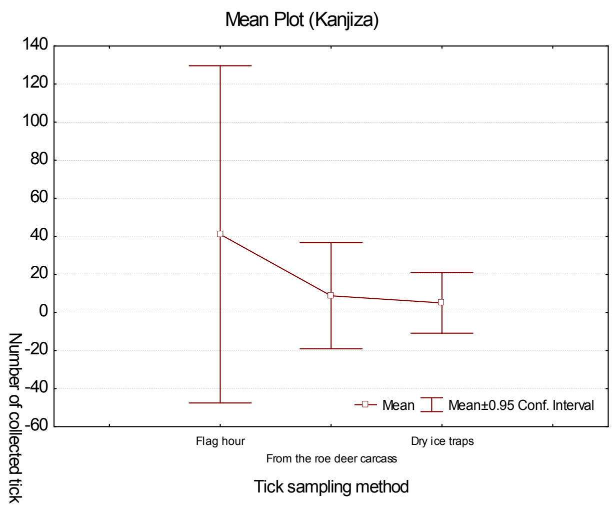


Graph 2. The number of collected ticks using different methods of sampling at locality Novi Kneževac

Population densities and abundance of different tick species varied according to particular locality. The highest number of collected tick specimens was recorded at localities Kanjiža and Senta, and the lowest at hunting resorts Novi Kneževac and Srpski Krstur (Tab. 1.). From the total number of 149 collected ticks at locality Srpski Krstur, approximately equal values of *I. ricinus* specimens were obtained by flagging and by collecting from the male roe deer carcasses (Graph. 1.). The second recorded species from this locality, *H. concinna*, was recorded only on the roe deer carcasses. This species is a confirmed vector of pathogens: *Francisella tularensis* (tularemia), *Rickettsia sibirica* (tick typhus), Russian spring summer encephalitis (RSSE) virus and tick borne encephalitis (TBE) virus. This is the first record of this species for our country. The status of this species is relatively unknown for our country and could be explained as a new introduced species or that this species has been historically present only sporadically on the territory of our country. The third opinion could be based on the fact that the collecting of *H. concinna* was strictly connected with the methods of sampling. Furthermore, there was a possibility that



Graph 3. The number of collected ticks using different methods of sampling at locality Senta



Graph 4. The number of collected ticks using different methods of sampling at locality Kanjiža

regarding the roe deer migration that could be up to 100 km in diameter, their diurnal rhythms of feeding and resting phases, the ticks could be attached and transmitted to our country, considering that the exact place of finding (Srpski Krstur) is only 3 km of Hungarian and about 20 km of Romanian boundary [13]. This species was sporadically recorded at localities Novi Kneževac and Senta, too. *H. sulcata* was documented only at locality Srpski Krstur using the method of palpatory examination of the roe deer carcasses. The third species from the genus *Haemaphysalis*, *H. punctata*, was noticed only at localities Senta and Kanjiža applying the method of “Flag-hour”. The species from the *Dermacentor* genus were collected by the method of “Flag-hour” only: *D. marginatus* at localities Novi Kneževac, Senta and Kanjiža, and *D. reticulatus* in Kanjiža. *D. marginatus* beside *I. ricinus* was described as the most abundant species in Europe, especially in deciduous forests, pastures and different species of shrub vegetation found

along the river banks. As ectoparasite it could be found as larvae or nymphs on different rodent species, and as adult stage on large and medium sized mammals [13]. In our study the presence of this species has not been recorded on roe deer carcasses. Otherwise, *D. marginatus* has been very abundant in our country [14] and feeds on humans and large mammals as accidental hosts [15]. Data from the last five years indicate the zoogeographical expansion of this tick species. Its presence has been reported in several new regions of Hungary, including its southern, northern and eastern parts where the specimens of *D. marginatus* were found on a large number of wild boars, deer, rabbits, foxes, cats and dogs in the last decade [16]. The geographical expansion of this species was recorded also in Germany [17]. Futhermore, some studies indicate that this species has been very abundant on dogs in Berlin [18]. *D. reticulatus* has been recorded in Spain and France [11]. This species was recorded in our country too, but under the synonym of *D. pictus* [14], although the valid nomenclature accepts it only as *D. reticulatus* [13].
Tick obtained specimens varied in relation to the applied method of collection. The „Flag-hour" method obtained the highest number of *I. ricinus* specimens in all developmental stages at all inspected localities. The specimens of *H. punctata* and both species of genus *Dermacentor* were collected using this method too. *H. sulcata* and *H. concinna* were obtained only from the carcasses of roe deer, while using the dry ice traps only specimens of *I. ricinus* in all developmental stages were collected (Graph 1., 2., 3. and 4.).

Conclusion

Six species from three genera were identified: from genus *Ixodes* only one species – *I. ricinus*, from genus *Dermacentor* two: *D. marginatus* and *D. reticulatus*, and from the genus *Haemaphysalis* three species: *H. punctata*, *H. sulcata* and *H. concinna* using three methods of collection: by flagging from nature, collected from the carcasses of male roe deer (*C. capreolus*) and by sampling from dry ice traps. All identified species have been confirmed vectors of numerous pathogens epidemiologically significant for human and animal health.
Considering the fact that all game species have been described as reservoir species for pathogens that could be transmitted by ticks on humans, domestic and other wild animals, it is necessary to include, besides roe deer, also other game species (canids, felids, artiodactyls) in monitoring programme. The results of this study which include the different methods of tick collecting could be useful as models for description of the tick species diversity in hunting resorts, their population and seasonal dynamics and potential way of pathogen transmission.
Precise estimation of tick abundance enhances the efficacy of control and enables calculation of ectoparasitic burden which could be used as parameter in practice for adequate and suitable management of hunting resorts.

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