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BIODIVERSITY OF TICKS OF SHEEP AND GOATS IN SEMI-INTENSIVE FARMING SYSTEM IN VOJVODINA

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Abstract: The present study was conducted in 90 sheep and goats flocks from the territory of Vojvodina in the two years period of March 2016 to October 2017, during the grazing season. Tick infestation was deteected in 53.14% of examined animals. The most dominant was *Ixodes ricinus* (43.91%), followed by *Dermacentor marginatus* (31.91%), *Rhipicephalus bursa* (15.22%), *R.sanguineus* (8.72%), *Hyalomma savignyi* (3.72%),, *Haemaphysalis punctata* (3.21%) and *D.pictus* (2.72%) . The sex ratio of detected tick species showed a higher number of females in four species (*I.ricinus, H.punctata, R.sanguineus* and *D.marginatus),* while higher number of males were detected in two species *(R.bursa* and *Hy.savignyi*), and an equal number of ticks of the *D.pictus.* The population dynamics of recorded tick species showed two annual maxima, in spring (April-May) and in autumn (September-October). The considerable interchange between spring and autumn tick populations can be attributed mainly to environmental conditions

Key words: semiintensive sheep production, ticks biodiversity, seasonal distribution

Introduction

Semi-intensive sheep and goats production is a tradition in the northern region of Serbia (Vojvodina). Some parts of Vojvodina are abundant in grasslands, especially in the Banat region, where animals grazing is mainly semi-intensive. The rational use of pastures in the period of April-October makes the sheep and goats production sustainable and low input in this period of the year. The specific climate and the unique habitat includes high biodiversity of flora and fauna of the grasslands (*Janković et al., 1984*).

Ticks represents one of the indispensable elements of that specific biotope. A diverse tick fauna present in this region mainly influences the health status of grazing ruminants. Ticks are known as vectors for a number of diseases (*Papadopoulos et al., 1996; Jongejan and Uilenberg, 2004; Sevinc et al., 2013*). However, in the semi-intensive breeding system, which is the most often practice in this region, is very difficult to avoid infections with different types of ticks that are contaminants of the grasslands and pastures (*Pavlović et al. 2018; 2019*). Tick infestations are common, especially during late spring and autumn months of the year (*Harlan and Foster, 1990; Fourie and Horak, 1991; Milutinović, 1992*)

Our research was carried out in those parts of Serbia which have never been examined for their tick fauna, but which border directly on areas known as enzootic foci of domestic ruminant piroplasmosis, tailreosis and other tick borne diseases (*Dimitrić, 1999; Nieder et al., 2013; Pavlović et al., 2002; 2012; 2016b*). These research covered the effects of climatic factors such as temperature, relative humidity and precipitation which usually vary throughout the year (*Milutinović et al., 1996a; 1996*). Thus, environmental conditions change seasonally and are characterised by differences in temperature or precipitation, and may have an influence on the distribution of ticks to appear periodically (*Daniel, 1978; Fourie et al., 1988; L'Hostis et al., 1995; Dautel et al.,2008; Hornok, 2009*).

The aim of the study was to considerate the following parameters: biodiversity, relative abundance, sex ratio, and the effects of environmental factors (temperature, relative air humidity and precipitation) on tick populations. Data on the monthly average temperature, relative air humidity and precipitation for the examined period were obtained from the Weather Bureau of the Republic of Serbia.

Materials and Methods

The present study was conducted in 90 sheep and goats flocks from the territory of Vojvodina in the two years period of March 2016 to October 2017, during the grazing season. A systematic investigation of the ticks was carried out at 12 places (in Srem, Banat and Bačka) where was the largest number of flocks. Usually, sheep and goats are keep together at same pastures and had a same tick fauna.

Ticks were collected by removing them from sheep and goats with tweezers and were placed in vials with 70% ethanol. The tick species and sex/gender were identified by morphometric characteristics. The main attribute of identification of tick family is a plain dorsal sclerotised scutum or shield, which is often ornate with patterns in white or gold against a brown or grey background and which distinguishes these ticks from other families. This sclerotised plate covers the entire dorsal surface of the male, but only one third of the female's dorsal

surface. Second one was the capitulum of hard ticks which just as the mouthparts and is visible from a dorsal view. The peritreme or groove is big and clearly visibly around the stigmal plate. Grooves are deep, linear depressions in the body cuticle, usually on the ventral surface. Hard ticks can be easily differentiated by the shape of the basis capitulum and by the form of anal grooves (*Pomerancev, 1950; Kolonin, 2009*).

Results And Discusion

Tick infestation was deteected in 53.14% of examined animals. The most abudant species was *Ixodes ricinus* (43.91%), followed by *Dermacentor marginatus* (31.91%), *Rhipicephalus bursa* (15.22%), *R.sanguineus* (8.72%), *Hyalomma savignyi* (*Hy.marginatum*) (3.72%),, *Haemaphysalis punctata* (3.21%) and *D.pictus* (2.72%).

Out of the total number of ticks collected, 52.35% were females and 47.65% were males. The sex ratio of detected tick species showed a higher number of females in four species (*Ixodes ricinus, Haemaphysalis punctata, Rhipicephalus sanguineus* and *Dermacentor marginatus),* while higher number of males were detected in two species *(Rhipicephalus bursa* and *Hyalomma savignyi*), and an equal number of ticks of the *D.pictus.* This is in agreement with the research of the tick sex ratio that have been made around the world (*Černy et al., 1974; Milutinović, 1992; Milutinović et al.,1997a; Anderson and Magnarelli, 2008; Kolonin, 2009*).

Comparison of the obtained results with findings in other regions of Serbia indicated that there is a great similarity in the established tick species. Examination performed in small ruminants in eastern, northeastern, and southern parts of Serbia and the Prizren district (Kosovo) (*Milutinović et al., 1987; 1990; 1997b; 1998; Miščević et al., 1990; Pavlović et al., 1995; 1999; Petrović et al., 1996; Becskei et al., 2015*) pointed to the presence of the same tick species, including *Hy. savignyi*, *Ha. inermis, Boophilus calcaratus* and *Ornythonisus lachorenis.* Simillyary results established in the Belgrade area and northwest (Mačva district) where the *I. ricinus. R. sanguineus, D. pictus* and *D. marginatus* as the most abundant species at small ruminants (*Milutinović et al., 1992; 1996 a, b; 1997b; 1998; Dimitrić, 1999; Pavlović et al., 1999; 2013; 2016a*). The found species of ticks are most common in sheep and goats in the regions of the Western Balkans including Macedonia, Mediterranean and Central Europe (*Omeragić, 2011; Dumitrache et al., 2012; Mihalca et al., 2012; Pavlović et al., 1995; 2014; 2016a, c*).

Climate conditions have a great influence on the population dynamics of ticks. Population dynamics of ticks is related to the impact of climate factors like air temperature, relative humidity and rainfall (*Milutinović, 1992; Belozerow, 1982; Clark, 1995; Carrol and Kramer, 2003; Anderson and Magnarelli, 2008*). The climate in the Vojvodina is moderate continental. The average annual

temperature is 10.9^{0}C. The average winter temperature is -1^{0}C and in July is 21.6^{0}C. Annual rainfall is 686 mm, with 122 rainy days. The lowest point of the Danube is 70.83 m and the highest is 79.70 m above sea level. The highest recorded water level is +778 cm and the lowest is -134 cm.

The influence at climate condition to population dynamics of ticks was monitored from March to October. They showed two annual maxima, in spring (April-May) and in autumn (September-October) (*Milutinović, 1992; Anderson and Magnarelli, 2008*). The March was a period when the grazing season started and the first occurrence of *Ixodes ricinus, Ha. punctata* and *Dermacentor marginatus* (*Clark, 1995; Carol and Kramer, 2003*) was recorded. During April the following tick species were found: *I.ricinus, R.sanguineus, D.marginatus* and *Ha. punctata* (*Černy et al., 1974;1982; Pavlović et al., 2019*). Climate condition during April (average 10.02 °C temperature, 72% relative humidity, i.e. in early spring at the beginning of the rainy season (monthly mean precipitation: 35.21 mm) reached maximum numbers of *D.marginatus* and *Ha.punctata.* In May, we observed the occurrence of the following species: *D.pictus, R.bursa, Hyalomma savignyi* and *Ha.inermis* (*Milutinović et al., 1996b; Dimitrić, 1999; Hornok, 2009)*. Climate conditions in May, temperature of 15.55 °C, relative humidity of 71.5%, and 71.19 mm precipitation - induced population peak for a species which requires higher relative humidity - *I.ricinus, Hy.savignyi, R.bursa* and *D.pictus* (*Dyk and Boučkova, 1968; Tovornik, 1976; Zahler and Gothe,1995; Estrada-Peña et al., 2011*).

In June, the population peak is observed for the *R.sanguineus,*which are the most common types both in July and August. The autumn population peak in September (with temperature of 15.95°C, 73.5% relative humidity and 51 mm precipitation) we saw an increase in the population of two species of ticks: *I.ricinus* and *D.marginatus*, while in October (17.9°C temperature, 73% relative humidity and 32.42 mm precipitation) we observed the emergence of the following species: *Ha.punctata, Ha. inermis, R.sanguineus* and *R. bursa* while the two species of the genus *Dermacentor - D. marginatus* and *D. pictus* were rarely encoun (*Černy et al.,1982*). The influence of climate condition and some part of it (temparatur, humidity and precipitation) to population dynamics of ticks we presented at figure 1, figure 2, figure 3 and figure 5.

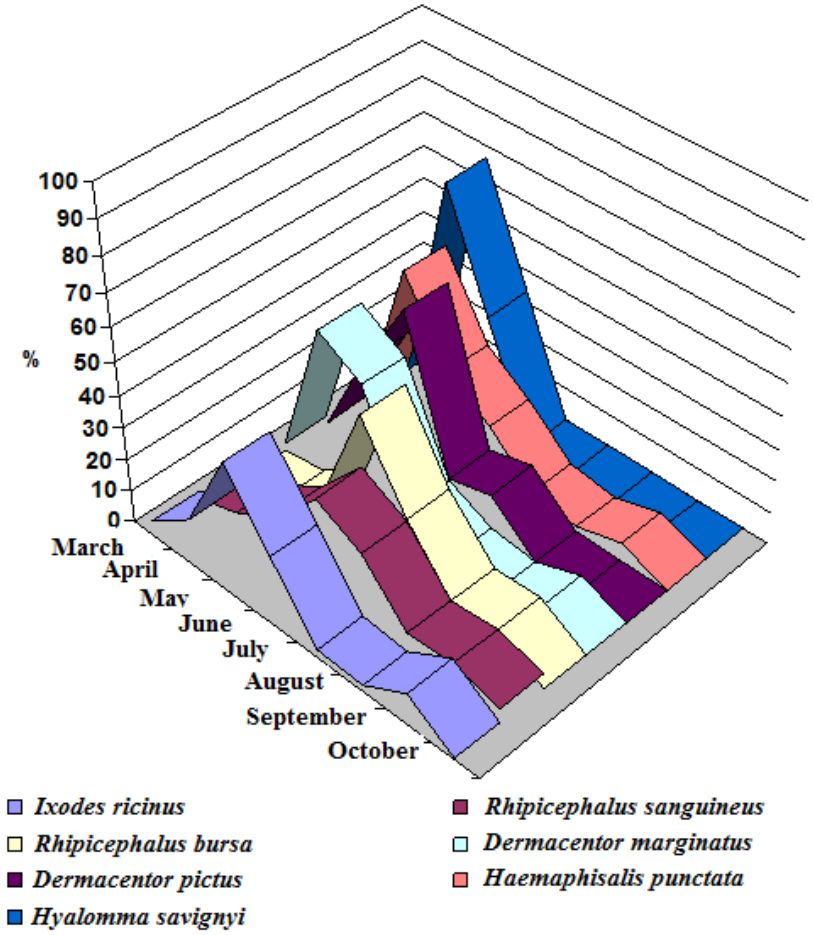

Figure 1. The influence at climate condition to population dynamics of ticks

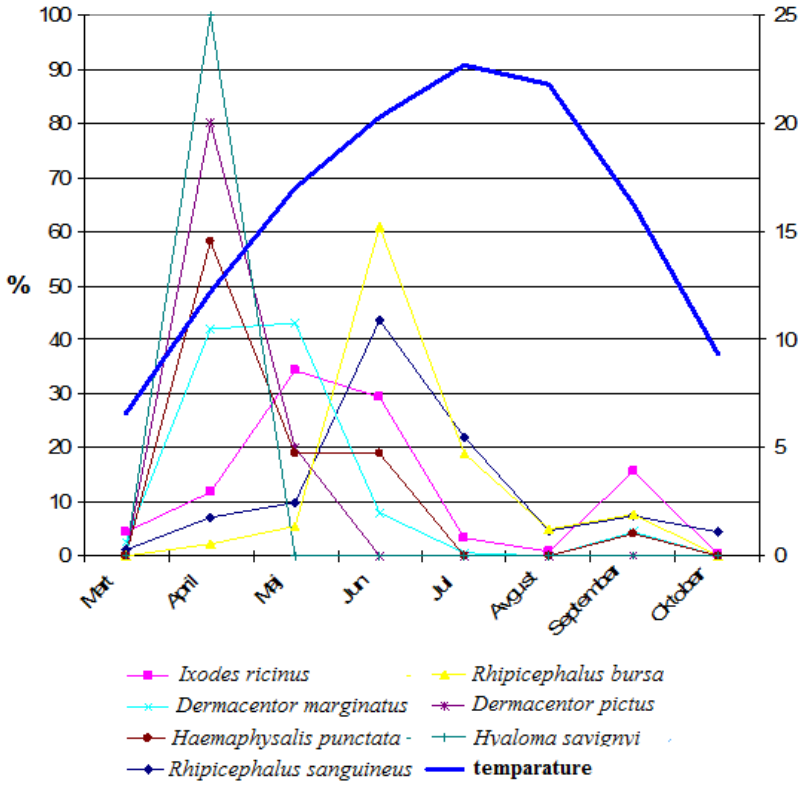

Figure 2. The influence of temperature to population dynamics of ticks

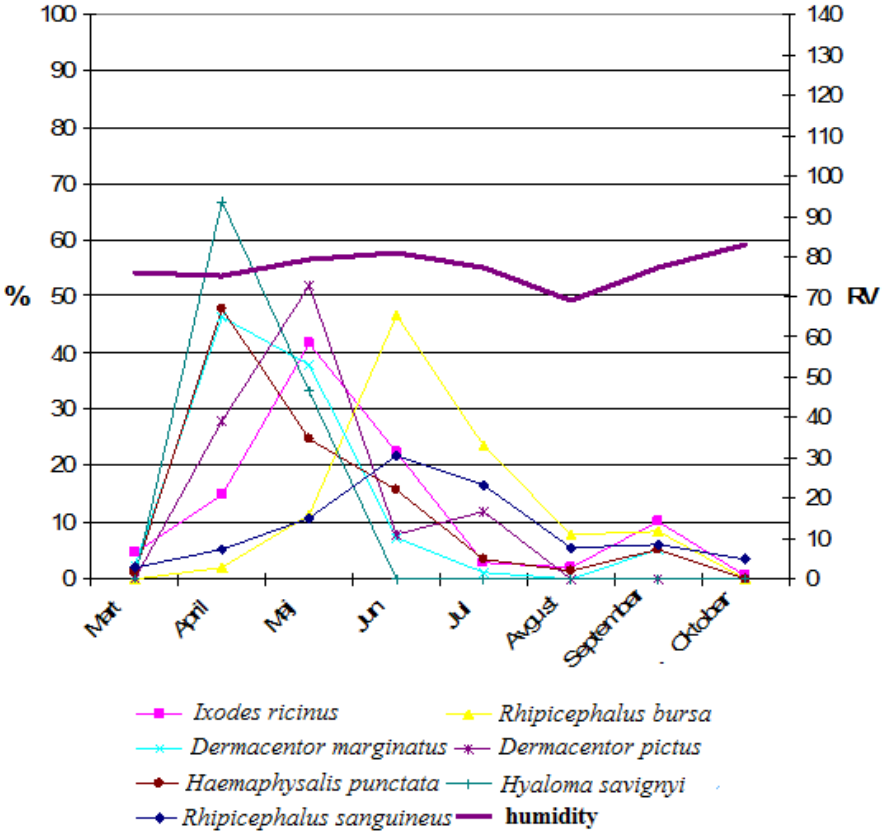

Figure 3. The influence of humidity to population dynamics of ticks

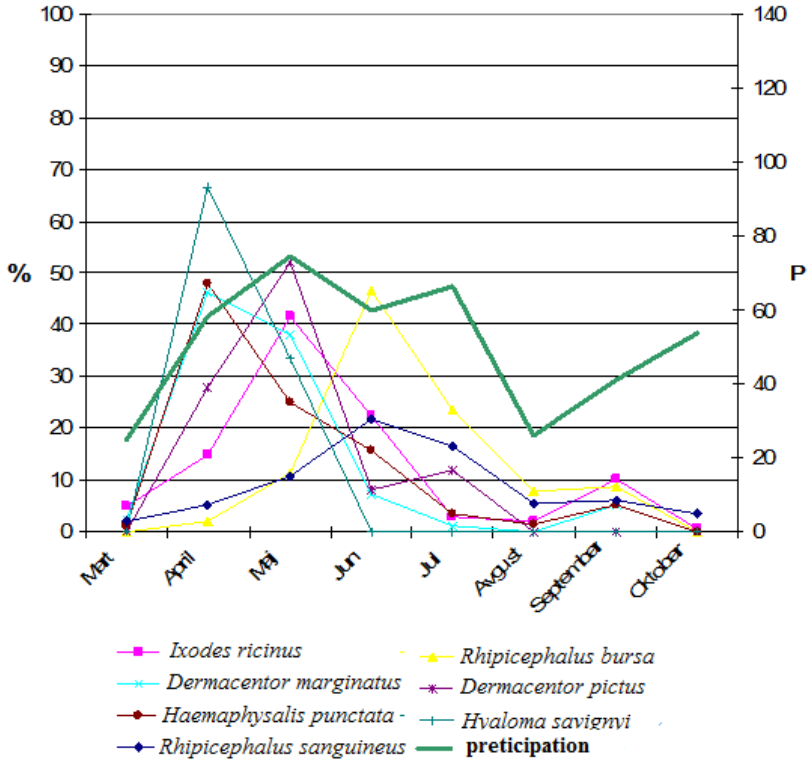

Figure 4. The influence of precipitation to population dynamics of ticks

Our results confirmed the results of the similarly studies carried out in northeast, eastern and south-eastern part Serbia (*Milutinović et al., 1987; 1996; 1998; Miščević et al.,1990*). This data is in correlation with the results of other examinations of the seasonal dynamics of ticks in Europe (*Belozerow, 1982; Černy et al., 1974; Daniel,1978; L'Hostis et al., 1995; Maroli et al., 1996; Papazahariadou et al.,2003; Estrada-Peña et al., 2011*). This agrees with the data published about ticks in various part of Russia, Central Europe and the West Balkans (*Belozerow, 1982; Dautel et al., 2008; Kolonin, 2009; Omeragić, 2011; Sevinc et al., 2013; Pavlović et al., 2014;2016c*). The authors point out that the low temperature, high humidity and rainfall significantly affect the life cycle of ticks, particularly the *I. ricinus* species.

Conclusion

Based on the obtained results, it can be seen that ticks represent a significant problem of small ruminant production in Vojvodina. The method of

holding allows permanent infections with these parasites and the climatic conditions favor their development and maintenance on grazing surfaces. Climate conditions have a great influence on the population dynamics of ticks which had two picks - at late Spring and early Autumn. Fauna, seasonal dynamics and sex ratio of ticks found do not differ much from the results obtained in other regions of Serbia. Likewise, the presence of ticks points to the ever-present possibility of infections of the often zoonotic character that the ticks carry.

Biodiverzitet krpelja ovaca i koza držanih u poluintenzivnom sistemu odgoja u Vojvodini

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Rezime

Studija je rađena tokom dvogodišnjeg perioda od marta 1996. do oktobra 2017. godine, tokom pašne sezone, na 90 stada ovaca i koza u Vojvodini. Infestacija krpeljima je ustanovljena kod 53,14% životinja. Dominantna vrsta krpelja je bila *Ixodes ricinus* (43,91%), slede *Dermacentor marginatus* (31,91%), *Rhipicephalus bursa* (15,22%), *R.sanguineus* (8,72%), *Hyalomma savignyi* (3,72%),, *Haemaphysalis punctata* (3,21%) i *D.pictus* (2,72%). Odnos polova je bio u korist ženki kod četiri vrste (*I.ricinus*, *H.punctata*, *R.sanguineus* i *D.marginatus*), dok su mužjaci bili brojniji kod dve vrste (*R.bursa i Hy.savignyi*). Jednak broj mužjaka i ženki je ustanovljen kod samo jedne vrste krpelja - *D.recticulatus.* Populaciona dinamika je pokazala da nađene vrste krpelja imaju dva sezonska maksimuma u proleće (april-maj) i u jesen (septembar-oktobar). Brojnost populacije tokom ovih sezonskih maksimuma je u direktnoj korelaciji sa životnim uslovima (temparatura,vlaga).

Ključne reči: poluintenzivno ovčarstvo, biodiverzitet krpelja, sezonska distribucija

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