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ORIGINAL RESEARCH ARTICLE

Infestation rate and distribution of hard ticks on cattle in the Eastern Anatolia Region of Turkey

Mustafa Serdar Deger, Kamile Bicek, Bekir Oguz✉

Yuzuncu Yıl University, Veterinary Faculty, Department of Parasitology, 65080 Van, Turkey.
Correspondence: Tel. +90432 225 1128/1574, Fax +90432 225 1127, E-mail bekiroguz_veterinary@hotmail.com

Abstract. Ticks are obligatory blood-sucking arthropods that have an important role in human and animal health. They are potential vectors of a wide range of pathogenic microorganisms, including protozoal, rickettsial, bacterial, and viral microorganisms. This study was conducted to determine tick infestation rate of cattle in the Eastern Anatolia Region of Turkey. Sampling was performed in 21 district through one year during spring 2008 until winter 2009. A total of 1330 cattle were selected and were checked for tick infestation. Ticks collected from villages were examined under a stereo microscope using the related keys, and their species were identified. Totally, 1832 hard ticks were collected. The ticks were classified into four genera and 14 species including *Hyalomma anatolicum* (22.1%), *Rhipicephalus bursa* (21.01%), *Dermacentor marginatus* (17.84%), *Haemaphysalis parva* (13.97%), *Rhipicephalus sanguineus* sensu lato (8.62%), *Rhipicephalus turanicus* (5.29%), *Hyalomma excavatum* (4.31%), *Rhipicephalus annulatus* (2.78%), *Hyalomma marginatum* (1.96%), *Dermacentor niveus* (0.65%), *Haemaphysalis sulcata* (0.65%), *Hyalomma detritum* (0.54%), *Hyalomma aegyptium* (0.16%) and *Haemaphysalis punctata* (0.16%). Tick infestation was detected in 494 (37.14%) out of 1330 cattle. *Hyalomma anatolicum* has the more frequent density in the study area.

Keywords: Ticks; Cattle; Eastern Anatolia Region; Turkey.

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Introduction

Ticks (Acari: Ixodida) are external parasites of both animals and humans that feed on blood and tissue of their hosts; and are important disease vectors that can cause considerable economic losses by affecting animal health and productivity, especially in tropical and subtropical regions. They transmits pathogens such as viruses, bacteria (including rickettsial), protozoa, spirochetes and nematodes and are also the main reservoirs of these pathogens. (Sonenshine, 1991; Estrada-Pena and Jongejan, 1999; Fuente et al., 2008).

Turkey has significant livestock resources. Management system is mostly extensive and traditional in ruminants. In despite of the generally decreasing numbers, total production figures have remained stable, indicating an improved productivity per animal. The numbers of cattle, buffalo, sheep, goat, and

poultry have been given from 2000 to 2004 to be 10,069,346, 103,900, 25,201,155, 6,609,937, and 296,876,000, respectively (Anonymous, 2004). The traditional farms are mostly localized in the eastern regions. Ticks transmit a number of protozoan, bacterial, helminth, rickettsial, and viral pathogens to humans and animals in Turkey (Karaer et al., 1997; Sevinc and Xuan, 2015). For the development of integrated tick control strategies, it is important to identify the vector ticks and their transmission pattern of the pathogens in the target geographical region (Aktas, 2014).

Ticks are grouped into three families: Argasidae (193 species), Ixodidae (702 species) and Nuttalliellidae (monotypic) (Guglielmone et al., 2010). The first review on the tick fauna of Turkey was published in 2007 (Aydin and Bakirci, 2007). Turkey's tick fauna is composed of 32 species from 2 families and 10 genera. Most of the published tick studies deal with its occurrence on domestic animals (Yukari and Umur, 2002; Dumanli et al., 2012; Bakirci et al., 2012) or humans (Gargili et al., 2010; Bursali et al., 2010; Karaer et al., 2011; Kar et al., 2013). However, comprehensive information about tick biology and ecology should be obtained by collecting unfed ticks, as tick species prefer different host species (Hornok and Farkas, 2009).

In Turkey, tick-borne protozoan parasites *(Theileria* and *Babesia* spp.) constitute major health and management problems of cattle and small ruminants (Karaer et al., 1997; Ica et al., 2007; Aktas, 2014). Some tick species transmit a number of zoonotic diseases such as Crimean-Congo hemorrhagic fever (CCHF). However, to the best of our knowledge, no extensive investigation has been conducted to this end covering particularly the East Anatolia Region of Turkey. Therefore, we aimed in the present study to determine the identity and distribution of tick species of cattle in the the East Anatolia Region of Turkey.

Materials and methods

Sample area

In the Eastern region of Anatolia (East Anatolia), the elevation of mountains exceeds 2,500-3,000 m. Since most of the region is far from the sea, and has high altitude, it has a harsh continental climate with long winters and short summers. The region has the lowest average temperature of all Turkish regions, with -25°C. The summer average is about 20°C. This region is an important cattle breeding area in Turkey.

21 district within thirteen provinces were included in the present study. Geographical outlines and coordinates of the region covered are given in figures and table 1, respectively.

Table 1. Geographical coordinates of the study area

District	City	Latitude	Longitude
Dogubayazit	Agri	39,547722	44,070536
Patnos	Agri	39,233745	42,862473
Gole	Ardahan	40,793502	42,608953
Karliova	Bingol	39,298070	41,013746
Solhan	Bingol	38,967666	41,053791
Tatvan	Bitlis	38,502539	42,281207
Ahlat	Bitlis	38,755940	42,486735
Sivrice	Elazig	38,447055	39,308766
Maden	Elazig	38,391493	39,667218
Otlukbeli	Erzincan	39,973712	40,022440
Pasinler	Erzurum	39,977210	41,666981
Yüksekova	Hakkari	37,569302	44,299884
Tuzluca	Igdir	40,040108	43,662843
Kagızman	Kars	40,141141	43,119215
Digor	Kars	40,374974	43,413908
Puturge	Malatya	38,195829	38,869214
Bulanik	Mus	39,096794	42,267420
Malazgirt	Mus	39,146185	42,538263
Gevas	Van	38,297786	43,105160
Ozalp	Van	38,658341	43,989714
Pertek	Tunceli	38,867598	39,325007

Tick collection

Sampling was performed in 21 district through one year during spring 2008 until winter 2009. A total of 1330 cattle were selected and were checked for tick infestation. Collected adult ticks were placed in a pre-labelled universal sampling bottle filled with 70% ethanol and kept at room temperature until identified in the laboratory. Identification of ticks based on morphological and structural differences of the species was carried out using the methods described by Hoogstral (1956), Walker et al. (2003) and Estrada Pena et al. (2004).

Figure 1. Region of Turkey and locations of sampling areas (small black stars) within Eastern Anatolia region (red zone)

Results

During this study, 1832 hard ticks were collected from 1330 cattle. The ticks were classified into four genera and 14 species including *Hy. anatolicum* (22.1%), *R. bursa* (21.01%), *D. marginatus* (17.84%), *Hae. parva* (13.97%), *R. sanguineus* sensu lato (s.l.) (8.62%), *R. turanicus* (5.29%), *Hy. excavatum* (4.31%), *R. annulatus* (2.78%), *Hy. marginatum* (1.96%), *D. niveus* (0.65%), *Hae. sulcata* (0.65%), *Hy. detritum* (0.54%), *Hy. aegyptium* (0.16%) and *Hae. punctata* (0.16%). Tick infestation was detected in 494 (37.14%) out of 1330 cattle (table 3). The *Hy. anatolicum* group was the most common tick species in the sampling areas. Adults of this species were found at all of the locations. *Rhipicephalus* spp., a genus represented by three species: *R. bursa*, *R. sanguineus* s.l. and *R. turanicus*, constituted 34.94% of the ticks collected. *Rhipicephalus annulatus*, were collected only in very few numbers. The distribution of this tick species is given in table 2. *Rhipicephalus annulatus* were detected mainly in Erzurum and Igdir. Three speciemens of *Hae. punctata*, were collected on cattle only in Erzurum. Whereas *H. anatolicum* (22.1%) was determined to be the most abundant *Hyalomma* spp., *H. aegytium* were present mainly in Van. Moreover, *Hy. aegytium* constituted only a very small proportion (0.16%) among the *Hyalomma* species detected in the present study (table 2).

Discussion

While feeding on the host, ticks cause direct or indirect problems for animal health and management. Direct problems like skin irritation and anemia occur while feeding on the host. Moreover, they cause serious health problems for domestic animals as vectors of many pathogens (Soulsby, 1986) including *Babesia*, *Theileria* and *Anaplasma* spp., which are the most common parasites seen in domestic animals in Turkey (Karaer et al., 1997). It is now well established that ticks also transmit Crimean–Congo hemorrhagic fever virus that has also been reported as an epidemic zoonotic disease in Turkey (Vatansever et al., 2007), to the best of our knowledge, in the East Anatoli Region of Turkey, data on the prevalence and the presence of İxodid ticks in cattle are limited. Hence, we aimed in the present study to determine the identity and distribution of tick species of cattle in the East Anatolia Region of Turkey. For this purpose, 21 district within thirteen provinces were surveyed between spring 2008 and winter 2009.

In total, 1832 hard ticks were collected from 1330 cattle. The ticks were classified into four genera and 14 species. Tick infestation was detected in 494 (37.14%) out of 1330 cattle (table 1 and 2). Data gathered in the present study indicate *Hy. anatolicum* (22.1%), *R. bursa* (21.01%) and *D. marginatus* (17.84%) as the dominant tick species on cattle in the East Anatolia Region.

Table 2. Distribution of tick species detected on cattle in the Eastern Anatolia of Turkey

Ticks species	City														Total	%
	Agri	Ardahan	Bingol	Bitlis	Elazig	Erzincan	Erzurum	Hakkâri	Igdir	Kars	Malatya	Mus	Tunceli	Van		
Rhi.. (B.) annulatus							44		7						51	2.78
Rhipicephalus bursa	23	5	48	55	52	14				8	38	44		98	385	21.01
Rhipicephalus sanguineus	11	6			16	7					60		29	29	158	8.62
Rhipicephalus turanicus	6		13	16					14	5				43	97	5.29
Dermacentor marginatus	32	37			2	5	12	3	25	57	5	12	3	134	327	17.84
Dermacentor niveus	4	1		4	1	2									12	0.65
Hyalomma aegyptium														3	3	0.16
Hyalomma a. anatolicum	7	9	63	38	40	40	26	31	9	6	20	62	25	29	405	22.1
Hyalomma a. excavatum					34	14		14	9		1	6		1	79	4.31
Hyalomma detritum					8	1						1			10	0.54
Hyalomma marginatum					20	5			1			7		3	36	1.96
Haemaphysalis parva	20	28	1	17						69		2	5	112	254	13.97
Haemaphysalis punctata							3								3	0.16
Haemaphysalis sulcata			2		2	2		3	3						12	0.65
Total	**103**	**86**	**127**	**130**	**175**	**90**	**85**	**51**	**68**	**145**	**124**	**134**	**62**	**452**	**1832**	**100**

Table 3. Infectivity of cattle to ticks in the Eastern Anatolia of Turkey

City	Surveyed cattle	Infected cattle	Percentage (%)	Number of the ticks
Agri	95	31	32.63	103
Ardahan	87	25	28.73	86
Bingol	103	40	38.83	127
Bitlis	115	42	36.52	130
Elazig	135	57	42.22	175
Erzincan	86	28	32.55	90
Erzurum	106	37	34.9	85
Hakkari	48	11	22.91	51
Igdir	56	17	30.35	68
Kars	118	44	37.28	145
Malatya	96	32	33.33	124
Mus	92	34	36.95	134
Tunceli	48	13	27.08	62
Van	145	83	57.24	452
Toplam	**1330**	**494**	**37.14**	**1832**

Yukari and Umur (2002) collected 3280 ticks in total from the cattle, sheep and goats in 14 different settlement areas in Burdur region between September 1999 and August 2000, and reported that *R. turanicus* is one of the most important cattle ticks in Burdur. In contrast to this, this species (5.29%) was the least common in the present study. In another study, in which the infested cattle, sheep and goats were examined in Zara District located in the North-East of Sivas, *Haemaphysalis parva* (33.8%), *Rhipicephalus annulatus* (21.1%) and *Hyalomma marginatum* (19.7%) were found to be at a dominant rate in the cattle (Mamak et al., 2006). Accordingly, *Hae. parva* was the third most abundant (23.5%) tick species that was identified in the study area.

Data gathered in the present study also demonstrated that *Hy. anatolicum* represent the highest frequency of genus of ticks parasitizing cattle in the East Anatolia Region. This tick species is adapted to the Mediterranean as well as to steppe climates of North Africa and desert climates. It is also found in other parts of Mediterranean basin and extends eastwards into the Middle East, Southern Russia, Iran, India and China (Estrada-Peña et al., 2004). *Hy. anatolicum* is widely distributed in much of the East Anatolian region of Turkey (Aktas and Dumanli, 2001; Aktas et al., 2004, 2006). This is in accordance with the data gathered in the present study.

Rhipicephalus bursa was the second most abundant tick species (21.01%) in the study area. The result agrees with that of Yilmaz and Değer (2011) (20.2%) in Van and Ercis, Aktas et al. (2006) (15%) in eastern Turkey and Tasci (1989) (26.59%) in Van. However, slightly higher prevalence (31.39%) was reported by Akdemir (2001) in Van. The reason for wide distribution of this species of ticks in different parts of the country could be related with the non apparent preference for particular altitude, rainfall zones or seasons (Pegram et al., 1981).

Ixodes ricinus, a common tick species in wetter areas of all European countries, preferentially occurs in rough grasslands and unimproved grazing areas of cattle and sheep in areas of high altitude and high rainfall (Estrada-Peña et al., 2004). According to Aydin and Bakirci (2007), *I. ricinus* has been observed only in rainy and forested parts of northern and northwestern Anatolia, located by the coasts of the Black Sea and the Marmara Sea, suggesting that this species is not common in the East Anatolia Region of Turkey.

Dermacentor marginatus, another tick species detected in the present study, is widespread in the Mediterranean region (Estrada-Peña et al., 2004). This tick species is restricted to areas with dense bush and tree cover in the European part of the Mediterranean region (Estrada Pena et al., 2004). *Dermacentor marginatus* was the third abundant tick species with the prevalence of 17.84%. According to the reports of Arslan et al. (1999) on the prevalence of *Dermacentor marginatus* (18.8%) in and province Kars slightly agree with the result. This might be due to similarities of the livestock production system and agro-ecology of the study areas.

Rhipicephalus annulatus were collected between Erzurum and İgdir, but only in very few numbers. Similarly, from fourteen species identified in this report *R. annulatus* was found to be the eighth prevalent species (2.78%).

Conversely, Aktas et al. (2006) in cattle in eastern Turkey reported a much more prevalence (19%) than this result, which could be due to the differences in the seasons when the ticks were collected.

Among *Haemaphysalis* species, *Hae. punctata* and *Hae. sulcata* were detected in this study, but not abundant. Particularly, *Haemaphysalis punctata* (0.16%) was the least tick infestations in present study. *Hae. parva* was previously recorded in low numbers by Bakirci et al. (2012) in the West Aegean Region. However, Arslan et al. (1999) reported higher prevalence (14%) in Kars province, East Anatolia of Turkey. Moreover, *Hae. parva* and *Hae. punctata* have been frequently observed infesting domestic animals such as goats, sheep, and cattle in Ankara Province (Cicek, 2004). Although East Anatolia of Turkey is a suitable region in terms of climatic and ecological factors for spread of tick species and most of the known ticks species including *H. excavatum*, *H. detritum*, *H. marginatum*, *R. sanguineus* s.l., *R. bursa*, *R. annulatus*, *R. turanicus*, *Hae. parva* and *D. marginatus* were previously introduced in the region, studies on the presence and prevalence of these species in different district of Eastern Turkey are limited.

In this study, several tick species, which are important in diseases transmission in animal and human, are identified. This information is important for epidemiological studies of tick-borne pathogens in this region. The geographical activity of ticks will help authorities to provide appropriate strategy for tick control program.

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