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Article

A survey of hard ticks (Acari: Ixodidae) infesting donkeys in West Azerbaijan Province, Iran

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Abstract

Donkeys (*Equus asinus* Linnaeus, 1758) are economical for use in small-scale farming and are handy in third world countries with a poor infrastructure. Ticks are one of the most important ectoparasites which affect the equine industry with high economic impact. The main objective of this study was to determine the tick species of donkeys that occur in the Northwest of Iran as possible risk for tick-borne diseases. The study was conducted during the four seasons in 2013 in 15 villages of West Azerbaijan province. During four seasons a total of 455 Ixodid ticks, 222 male and 233 female ticks were collected comprising 3 genera and four species. The species were *Hyalomma anatolicum, H. marginatum, Rhipicephalus bursa* and *Dermacentor marginatus*. Although the parasite did occur throughout the year, there was a seasonal variation in the prevalence of ticks. Some of the collected ticks may play an important role for transmission of vector borne disease to donkeys; therefore, there is a need to investigate the potential tick vectors involved in the transmission of heamoparasites in donkeys in this region.

Keywords: Ixodid tick, donkey, *Equus asinus*, West Azerbaijan province, Iran.

Introduction

Donkeys (*Equus asinus* Linnaeus, 1758) are used as preferable animals in small-scale farming and are handy in third world countries with a poor infrastructure (Mushi *et al.* 2003). Ticks are important ectoparasites because of their harmful bloodsucking activity and as vectors for various agents of diseases in both man and livestock (Cumming 1998; Hendrix 1998). Two main groups of ticks attack animals; hard ticks and soft ticks (Khosravi *et al.* 2012).

Studies of tick distribution and diversity are basic in building up knowledge about tick borne diseases. Based on effect of temperature and humidity on the occurrence and biodiversity of ticks, climatic conditions of a region should be considered in the study of ticks and tick-borne diseases (Papadopoulos *et al.* 1996; Bouattour *et al.* 1999; Aktas *et al.* 2004).

The existence of suitable hosts and climate conditions in different regions of Iran is beneficial for the maintenance of ticks and tick-borne diseases (Yakhchali *et al.* 2011).

Furthermore, donkeys can act as source of piroplasms for ticks, increasing the probability of transmission to other animals, including horses (Laus *et al*. 2015). Information on the prevalence of hard ticks in donkeys is very limited in Iran.

The importance of this study can be due to certain geographical specifications and the probable presence of different types of ectoparasites of donkeys in this region. The main objective of this study was to determine the tick species infesting donkeys in the Northwest of Iran and the possible risk of tick-borne diseases. We also determined the prevalence of infestation of donkeys with ticks and correlated the levels of infestations with seasons.

Materials and methods

Field study area

The study was conducted randomly in 15 villages which had a larger donkey population in West Azerbaijan province. West Azerbaijan province is located in Northwest part of Iran (37° 55' 28" N 45° 07' 59" E, Fig. 1). In the province there are four distinct seasons during the year: cold season (January to March), spring (March to June), summer (July to September), and fall (October to December) (Yakhchali and Hosseini 2006). This area borders with Turkey and Iraq and some residents of the area usually travel and carry goods by working horses and donkeys across the borders through the arduous mountain routes (Tavassoli *et al.* 2010).

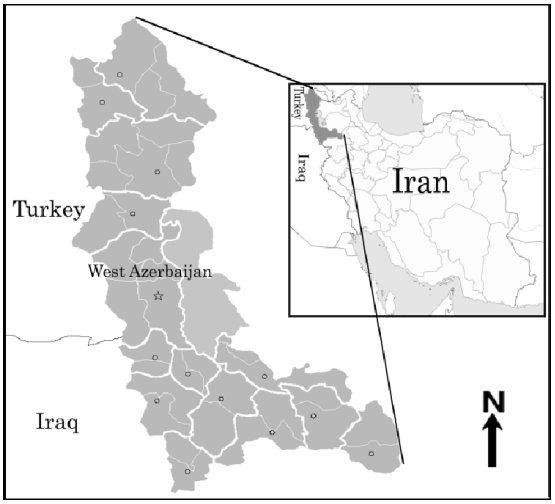

Figure 1. Map of West Azerbaijan province in Northwest of Iran.

Parasitological procedures

The study was conducted during four seasons in 2013. Tick collection was usually done from the body of the donkeys. Ticks were collected from each animal using a systematic approach by examining the animals at the head and neck region and continued to the pectoral, axillary and inguinal regions, concluding at the tail of each animal (Teglas *et al.* 2005). Care was taken to ensure that the mouthparts of the ticks were not left behind during their removal with thumb forceps (Yakhchali and Hosseini 2006). Ixodid ticks were counted and ticks were placed into 70% ethanol in glass vials. The vials were individually labeled with the date and place of collection. The age, sex and body color were recorded for each animal. The recorded data included the tick

infestation site (ear, testis, vulva, udder, anus, inner thigh and tail). Samples were sent from the field to the Parasitology laboratory of Urmia University for identification.

Ticks were individually identified based on morphological features, recording the genus and species characteristics, developmental stage, and sex (Wall and Shearer 2001; Estrada-Peña *et al.* 2004). Intensity and extensity of infestation, prevalence of tick species during four seasons and percentage of ticks attached to different sites on donkey's body were calculated.

Statistical analysis

Data were analyzed by SPSS statistical program (ver. 17) using Chi-square test, t-test and one-way ANOVA test. A value of $P < 0.05$ was considered as statistically significant.

Results

A total number of 455 ticks, 222 male and 233 female ticks were collected from 280 donkeys. Out of 280 donkeys studied, 105 (37.5%) were infested with ticks. Among these infested animals, 61(58.09%) were female and 44(41.9%) were males and the mean intensity of infestation for all infested animals was 4.3.

Four Ixodidae species were identified: *Hyalomma anatolicum* (49.9%), *Rhipicephalus bursa* (28.79%), *Hyalomma marginatum* (14.28%) and *Dermacentor marginatus* (7.03%). Only adult ticks were infesting donkeys. The tick *H. anatolicum* (49.9%) was the most abundant species.

Table 1. Percentage of infested donkeys based on sex, age.

Infested animals	Sex (%)		Age (%)	
	Male	Female	≤ 5	> 5
105 (37.5%)	58.09	41.9	19.04	80.95

According to the age, the heaviest infestation rate was observed on donkeys older than five years (80.95%). The tick prevalence was significantly different among donkeys with different age groups ($P < 0.05$). Nevertheless, no significant differences were found between the infestation rate of male and female donkeys ($P > 0.05$) (Table 1). The frequencies of male and female ticks are presented for each species (Table 2).

Table 2. The prevalence of tick species in donkeys of West Azerbaijan province.

Tick species	No. of		Total	(%)
	Male	Female		
Hyalomma anatolicum	104	123	227	49. 9
Rhipicephalus bursa	53	78	131	28.79
Hyalomma marginatum	46	19	65	14.28
Dermacentor marginatus	19	13	32	7.03
Total	222	233	455	100

The results of this study over four seasons in the study area are presented in Table 3. There was a seasonal variation in the prevalence of ticks, with its predominance in

spring, although the parasite did occur throughout the year, but its occurrence in the winter was very low.

Table 3. Percentage of hard ticks collected in West Azerbaijan province during different seasons.

Season	Identified tick species (%)				
	H. anatolicum	*R. bursa*	*H. marginatum*	*D. marginatus*	Total
Spring	51.74	49.88	53.63	43.33	49.87
Summer	41.04	35.08	35.12	39.04	37.09
Fall	6.74	14.95	10.37	17.23	13.02
Winter	0.48	0.09	0.88	0.4	0.02

The result showed that hard tick infestation on tail and udder was the most prevalent, whereas ear, vulva and testis with other body regions had minor importance (Fig. 2).

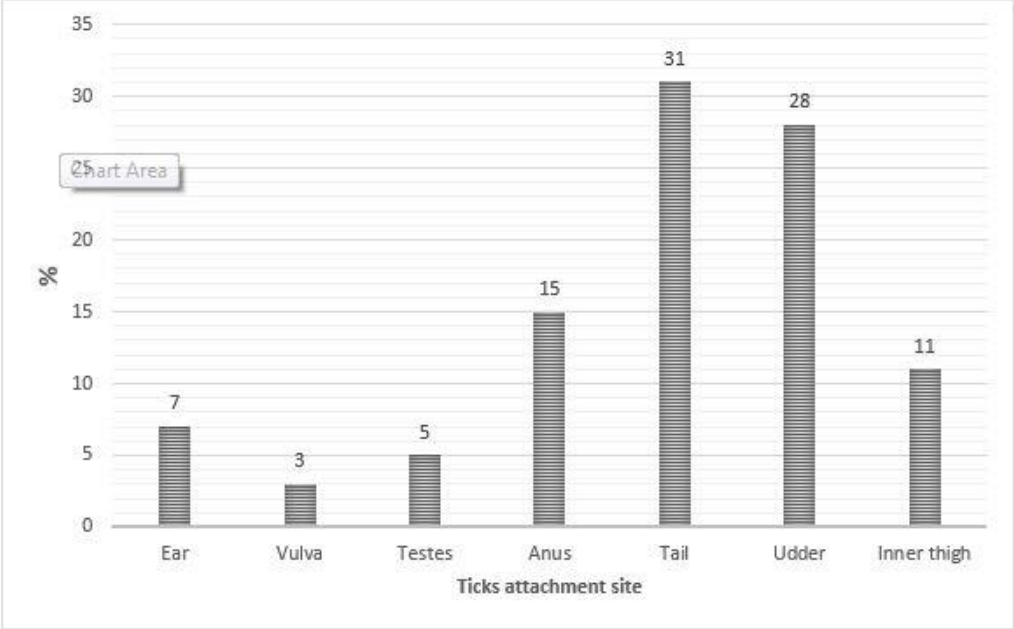

Figure 2. Percentage of ticks attached to different sites on donkey's body

Discussion

Ticks are the most important vectors of numerous protozoan (e.g. *Babesia*), viral, bacterial and fungal pathogens of medical and veterinary importance (Nicholson *et al.* 2009). Tick-borne diseases are of global importance, affecting humans and domesticated animals with high economic impact (Keirans *et al.* 2005). Tick dispersal ranges are determined by complex interactions of several determinants including climatic conditions, vegetation types, host densities, animal husbandry activities, lifespan of species, movement of livestock and the resistance of the hosts to ticks and tick-borne diseases (Tatchell 1969).

With regard to the present study on the ticks, ixodid ticks were present on donkeys throughout the year, being most abundant in spring and least abundant in winter. These findings are in agreement with previous studies which showed peak activity of hard

ticks from June to July in the western and northwestern regions of Iran (Mazlum 1971; Yakhchali and Hosseini 2006). In the present study the number of ticks was increased after the rainy seasons with higher temperatures. Therefore, rainfall was considered as the most important climatic factor that influenced the seasonal variation in tick numbers. This finding is in accordance with the results of other studies in Iran (Yakhchali and Hajihasanzadezarza 2004; Yakhchali and Hosseini 2006; Yakhchali and Azizi 2007; Yakhchali *et al.* 2011).

Most of the ticks in this study infested sites with shorter hair and thinner skin (ear, testis, vulva, udder, anus area, inner thigh and tail). The higher tick infestations on these sites could be related to the fact that ticks prefer warm, moist and hidden sites with a good vascular supply and thin skin (Muchenje *et al.* 2008). Verissimo *et al.* (2002) reported a positive association of skin thickness and hair length with the number of ticks. Preferred sites for larvae of *Rhipicephalus* (*Boophilus) microplus* including escutcheon, flank, axillae and dewlap was reported by Reik (1962).

In Iran, major taxonomic studies on *Hyalomma* were conducted by Abbasian-Lintzen (1960, 1961). *Hyalomma anatolicum* is the most widespread species in Iran and was collected from all zoogeographic situations including xeric, temperate (less common) and mountainous conditions. *H. marginatum* is widely distributed in entire Iran and is possibly in the second place following *H.anatolicum* (Hosseini Chegeni *et al.* 2013). According to Mazlum (1971), *H. anatolicum* is the most prevalent tick among ixodid ticks in horses of West Azerbaijan Province. In this study, the highest number of identified and widely distributed tick species belonged to *Hyalomma*. This can be attributed to the fact that this genus is considerably resistant to adverse climatic conditions. This finding is in close agreement with the results of the study by Davoudi *et al.* (2010). They reported *H. anatolicum* as a predominant tick of donkeys in Meyaneh city in northwest of Iran. *H. anatolicum* which has a wide dispersal is a vector of tropical theileriosis in Iran (Hooshmand Rad 1967; Izadi *et al.* 2004) and can transmit a wide range of pathogens including *Theileria lestoquardi, Theileria equi, Babesia caballi, Trypanosoma theileri*, and Crimean-Congo hemorrhagic fever virus (Walker *et al.* 2003). Due to widespread distribution of *H. anatolicum* in this region, we suggest that *H. anatolicum* may have an important role in transmission of equine babesiosis in this area. However, more researches are needed to confirm these findings.

Dermacentor marginatus is one of the most frequent vectors for babesiosis (Heyman *et al.* 2010). Rahbari *et al.* (2007) and Nabian *et al.* (2008) could find *D. marginatus* mostly in the mountainous areas of Iran. In this study infestation of donkeys with *Dermacentor marginatus* was seen in all seasons.

Rhipicephalus bursa is one of the hard tick species which has an important role in transferring different diseases to animals. This tick transfers the protozoon *babesia caballi* to horses experimentally (Walker 1994).

In this study, of 280 donkeys studied, 105 (37.5%) were infested with ticks. Because of certain geographical specifications of the studied area, the sampled donkeys had closed communication with horses and donkeys of neighboring countries and they had probably been exposed to ticks several times. This situation emphasizes the importance of border control and quarantine (Akkan *et al.* 2003).Very little information is available on the ticks of donkeys in Turkey and Iraq. *Hyalomma marginatum*, *Hyalomma detritum*, *Rhipicephalus bursa* and *Rhipicephalus turanicus* were reported in the horses with babesiosis in Turkey (Inci 2002; Akkan *et al.* 2003; Acici *et al.* 2008).

Based on the high prevalence of ticks infesting donkeys of this region, it is concluded that continuous parasitological researches and using suitable control measures are necessary for decreasing the spread of tick infestation. Heavy tick infestations among donkeys pose a high risk of transmission of tick borne diseases to this livestock of the region. Therefore there is a need to investigate the potential tick vectors involved in the transmission of heamoparasites in donkeys in this region.

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بررسی کنه‌های سخت آلوده‌کننده الاغ‌ها در استان آذربایجان غربی، ایران

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چکیده

استفاده از الاغ درکشاورزی در مقیاس کوچک از نظر اقتصادی مقرون به صرفه بوده و در کشورهای جهان سوم با امکانات ضعیفی نگهداری می‌شوند. کنه‌ها جزء مهم‌ترین انگل‌های بیرونی هستند که اثرات اقتصادی زیادی در پرورش تک‌سمیان دارند. هدف اصلی این مطالعه، تعیین میزان فراوانی کنه‌های سخت در الاغ‌های استان آذربایجان غربی است که می‌تواند موجب انتقال بیماری‌های ناشی از کنه در منطقه شود. این مطالعه در طی ۴ فصل در سال ۲۰۱۳ و در ۱۵ روستا در استان آذربایجان غربی صورت گرفت. در طی ۴ فصل، در مجموع ۴۵۵ کنهٔ سخت شامل ۲۲۲ کنهٔ نر و۲۳۳ کنهٔ ماده شامل سه جنس و چهار گونه جمع‌آوری شد. گونه‌ها شامل *Hyalomma anatolicum* ، *H. marginatum* ، *Rhipicephalus bursa* و *Dermacentor marginatus* بود. اگرچه آلودگی به انگل در سراسر سال دیده شد، اما تغییرات فصلی در شیوع کنه‌ها نقش داشت. برخی از کنه‌های جمع‌آوری شده ممکن است در انتقال بیماری‌های ناشی از کنه‌ها در الاغ نقش داشته باشند. بنابراین مطالعاتی در مورد کنه‌هایی که در انتقال بیماری‌های انگلی خونی در الاغ‌ها نقش دارند مورد نیاز است.

واژگان کلیدی: کنهٔ سخت، الاغ، *Equus asinus* ، استان آذربایجان غربی، ایران.

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