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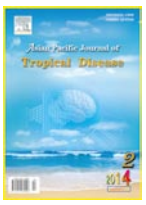

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Ticks (Acari: Ixodidae) of livestock and their seasonal activities, northwest of Iran

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ABSTRACT

Objective: To identify the ticks (Acari: Ixodidae) of livestock and their seasonal activities, in northwest of Iran, including the combination of two of the geographical regions of Iran (Caspian and mountain plateau) where the majority of the domestic ruminants in Iran exist.

Methods: Fifteen villages of Meshkin-Shahr County were selected randomly from different areas of the county. The animal dwellings were visited and the whole body of sheep, cows, goats and dogs were examined for their probable infestation. Samples were identified at the level of species according to the standard morphological key.

Results: In this study 1 208 specimen were collected and totally nine species (*Dermacentor marginatus, Dermacentor niveus, Haemaphysalis erinacei, Haemaphysalis punctata, Hyalomma anatolicum, Hyalomma asiaticum, Hyalomma marginatum, Rhipicephalus bursa* and *Rhipicephalus sanguineus*) were identified in this study. Also 569 host including 40 cows, 450 sheep, 70 goats and 9 dogs were examined for infestation and among them 255 were infested which showed a 44% of infestation among examined livestock. The infestation rate among sheep (46%) was higher than other hosts. The infestation rates among the rest of hosts were as: cows (40%), goat (37%) and dogs (33%).

Conclusions: The results of this study and other studies of the region showed the probability of the establishment and development of the burden of several tick-borne diseases.

1. Introduction

Ticks as the obligate hematophagous arthropods transmit wide range of pathogens by parasitizing different groups of vertebrates across the world[1]. Tick-borne pathogens in addition to animals encompass the human and lead to over 100 000 of clinical cases in the world annually[2].

In several notable tick-borne diseases which affect the human, the livestock play an important role. In addition to the study of the ticks and their distribution, based on the nature of these diseases, the pattern of their host should be determined[1]. In tick-borne diseases, the infectivity of the reservoir hosts which are susceptible to the infection, the tick infestation rate, and the host density are the most effective elements which determine the epidemiology of these diseases[3,4].

Several studies have been conducted in order to determine the tick fauna in different regions of Iran, their seasonal activity, host distribution, infestation rates and their infection with pathogens[5-20].

Because of the natural condition and the environment, keeping livestock, animal husbandry and related industries are the main jobs of the majority of the people of some areas like north and northwestern parts of Iran. On the other hand because of the importance of livestock in several tick-borne diseases, the identification of the ticks and their host in these regions is of considerable importance[18]. Some studies focused on the ticks of west and western-north of Iran. For instance, West-Azarbaijan Province and Ardabil Province[18].

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Ardabil Province has been located between two different climates, wet-forest climate (Caspian sea region, Guilan Province) and subtropical-mountainous areas (Azarbaijan region). Also its common borders with a foreign country (the republic of Azarbaijan), the wide exchange of the people between this region and neighbors, the movement of livestock within this Province and between different neighbors showed the necessity of a new comprehensive study to re-determine the situation of ticks, their hosts and their seasonal activity in one of the important counties of this specific region. Therefore, the aims of this study were to determine the composition of tick species, their seasonal activity and their domestic ruminants in Meshkin-Shahr county, Ardabil Province, Western-north of Iran.

2. Materials and methods

2.1. Study area

Ardabil Province is located in the northwest of Iran and its main city is Ardabil. Meshkin-Shahr county is located in its central part of the Province and is bordered to the north by Germi County, to the east by the republic of Azarbaijan, to the south by the Ardabil County, and to the west by East Azerbaijan Province (Figure 1). The main city of the Meshkin-shahr County is Meshkin-Shahr. The county is divided into four districts: Arshaq District, the Central District, Meshkin-e Sharqi District, and Moradlu District. The county has three cities: Meshkin-Shahr, Razi, and Lahrud[21].

Figure 1. The map of Iran and the location of Ardabil Province.

2.2. Tick collection

A total of 15 villages of Meshkin-Shahr County were selected randomly from different areas of the county. As the more than 60% of the Meshkin-Shahr county is mountainous and the rest categorized as plateau then 9/15 of villages selected from mountainous and 6/15 of them were selected from plateau region. The sample collections were conducted from May 2012 to May 2013.

The animal dwellings were visited and the whole body of sheep, cows, goats and dogs were examined for their probable infestation. The collected samples were counted and transferred to the laboratory in labeled glass vials. Samples were identified at the level of species according to the standard morphological key[22,23].

3. Results

In this study 1 208 specimen was collected among 4 genera (*Hyalomma*, *Rhipicephalus*, *Dermacentor* and *Haemaphysalis*). Analyzing the species composition showed that the most diversity has been observed among the genus *Hyalomma* by 3 species. Two species have been identified from the other three genera (*Rhipicephalus*, *Dermacentor* and *Haemaphysalis*).

Totally, nine species [*Dermacentor marginatus* (*D. marginatus*), *Dermacentor niveus* (*D. niveus*), *Haemaphysalis erinacei* (*H. erinacei*), *Haemaphysalis punctata* (*H. punctata*), *Hyalomma anatolicum* (*H. anatolicum*), *Hyalomma asiaticum* (*H. asiaticum*), *Hyalomma marginatum* (*H. marginatum*), *Rhipicephalus bursa* (*R. bursa*) and *Rhipicephalus sanguineous* (*R. sanguineous*)] were identified in this study.

Among them *D. marginatus* (by 77.4%), *R. bursa* (by 14.4%) were the most abundant species respectively whereas *H. erinacei* (0.16%) was the rarest species (Table 1).

Table 1
The prevalence of Ixodidae tick species according to different seasons, Meshkin-Shahr, Ardabil Province, 2012.

Species	Spring		Summer		Autumn		Winter		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
D. marginatus	188	15.56	434	35.90	314	25.90	0	0	936	77.40
D. niveus	0	0.00	4	0.32	0	0.00	0	0	4	0.32
H. erinacei	0	0.00	0	0.00	2	0.16	0	0	2	0.16
H. punctata	0	0.00	0	0.00	18	1.49	0	0	18	1.49
H. anatolicum	14	1.10	2	0.16	0	0.00	0	0	16	1.32
H. asiaticum	6	0.40	4	0.32	0	0.00	0	0	10	0.82
H. marginatum	27	2.23	12	0.99	0	0.00	0	0	39	3.23
R. bursa	161	13.30	2	0.16	11	0.91	0	0	174	14.40
R. sanguineous	1	0.08	8	0.65	0	0.00	0	0	9	0.74
Total	397	32.86	466	38.50	345	28.50	0	0	1 208	100.00

The results also showed that more than (38.5%) of specimen have been collected in summer, (32.86%) in spring, (28.5%) in autumn and (0%) in winter. The details of collected species, their number and percentage according to the different seasons have been presented in Table 1.

In this study totally 569 host including 40 cows, 450 sheep, 70 goats and 9 dogs were examined for infestation and among them 255 were infested which showed a 44% of infestation among examined livestock. The infestation rate among sheep

(46%) was higher than other hosts. The infestation rates among the rest of hosts were as: cows (40%), goat (37%) and dogs (33%). The details of infestation of different hosts by different ticks species have been presented in Table 2.

Table 2

The prevalence of ixodidae tick species among different hosts, Meshkin-Shahr, Ardabil Province, 2012.

Species	Host (No. of examined/No. of infested)				Total
	Cow (40/16)	Sheep (450/210)	Dog (9/3)	Goat (70/26)	
D. marginatus	75	699	14	148	936
D. niveus	0	1	2	1	4
H. erinacei	0	2	0	0	2
H. punctata	0	16	0	2	18
H. anatolicum	4	9	0	3	16
H. asiaticum	7	0	2	1	10
H. marginatum	16	23	0	0	39
R. bursa	12	130	0	32	174
R. sanguineous	0	1	6	2	9
Total	114	881	24	189	1 208

The analyzing of results according to the topographical preference of collection sites showed that more than half of the specimens have been collected from mountainous areas (722 specimens, 59.70%). In comparison 486 specimens have been collected from plateau region (Table 3).

Table 3

The prevalence of ixodidae tick species according to different topographic situation, Meshkin-Shahr, Ardabil Province, 2012.

Species	Mountain		Plateau	
	n	%	*n*	%
D. marginatus	631	52.20	305	25.20
D. niveus	1	0.90	3	0.28
H. erinacei	2	0.16	0	0.00
H. punctata	7	0.57	11	0.91
H. anatolicum	12	0.90	4	0.33
H. asiaticum	1	0.08	9	0.74
H. marginatum	12	0.90	27	2.23
R. bursa	51	4.22	123	10.10
R. sanguineous	5	0.41	4	0.33
Total	722	59.70	486	40.23

H. erinacei was collected only from mountainous area and *H. anatolicum* was the only species which its abundance was significantly higher in mountainous areas and other species like *R. bursa*, *H. asiaticum*, *H. marginatum*, and *D. marginatus* were caught more in plateau areas (Table 3).

4. Discussion

Different researchers divided Iran into four geographical regions according to different topographic, climatic, vegetation pattern and geographical properties[24]. This study was carried out in the combination of two of the mentioned geographical regions (Caspian and mountain plateau) where the majority of the domestic ruminants in Iran exist.

Notable part of tick-borne diseases is zoonoses and ruminants play important role in the cycle of these disease. The presence of several species of disease vectors were shown in this study. This becomes more important when the presence of some serious tick-borne disease like CCHF, Ehrlichiosis, Borreliosis and others in the region have been reported previously[18,25].

On the other hand, the pattern of animal husbandry in the region is based on seasonal movements of people and livestock within the region and between neighbors and this fact makes it more important to understand the seasonal activity of people, livestock and ticks.

Some species like *H. anatolicum*, *H. marginatum*, *H. asiaticum* and *R. bursa*, which have been identified in this study, were reported previously.

On the other hand, species like *Haemaphysalis detritum*, *Haemaphysalis schulzei*, *Haemaphysalis dromedarii*, *Haemaphysalis aegyptium* and *Haemaphysalis inermis* were not found in this study. Another study which focused on the ticks of north of Iran found *R. bursa*, *D. marginatus*, *D. niveus*, *Haemaphysalis detritum* and *Haemaphysalis choldokovsky* from Ardabil Province[26]. Totally it seems that species like *R. sanguineous*, *H. punctata* and *H. erinacei* are new for the region. In this study, *Dermacentor* more frequently collected on domestic animas likewise earlier study conducted in northwest Iran that *Hyalomma* reported as most prevalent tick species[18,27].

As nomads of the region move their livestock to the mountainous areas during the late spring and whole summer and also most of the residents of mountainous areas are ranchers, then it could explain the higher rate of livestock infestation in mountainous areas also the higher abundance of infestation during spring and summer. As a result this should be carefully considered by the veterinary and health systems. They could emphasize on the mentioned areas for tick and tick-borne diseases control.

The seasonal activity of ticks in this region is properly compatible with the pattern of livestock husbandry and the movement of the livestock. Also sheep as the main livestock of the region showed higher infestation rate which shows that the relationships between ticks, their hosts, the socio-economic condition of the people and their animal husbandry pattern should be more studied and focused.

The studied region could be assumed as a representative for the western-north part of Iran according to the geographical, cultural and socio-economic properties. The results of this study and other studies of the region showed the probability of the establishment and development of the burden of several tick-borne diseases. Some of the tick-borne diseases have been studied but more studies are needed especially for determination more details of the relations between different cycles of the diseases.

Also even now the taxonomy of the ticks is problematic in some cases, using molecular approach in the field of ticks' taxonomy and Epidemiology will be useful which will lead to better understanding the chain of diseases and the value of each of them.

Conflict of interest statement

We declare that we have no conflict of interest.

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