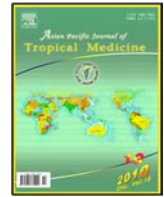


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Survey of tick species parasiting domestic ruminants in Ghaemshahr county, Mazandaran province, Iran

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ABSTRACT

Objective: To determine the tick species parasiting domestic ruminants in Ghaemshahr county in Mazandaran, a Caspian province in the north of Iran. **Methods:** About 361 sheep, 54 goats and 10 cattle of 18 herds in several villages in Ghaemshahr were inspected for tick infestation. Separated ticks were preserved in 70% alcohol and identified. **Results:** About 323 ticks (207 female, 116 male) were collected, the occurrence of ticks on sheep, goats and cattle were 28.3%, 22.2% and 20.0% respectively. The mean number of ticks on each animal was low (3–5 ticks per animal). *Rhipicephalus sanguineus*, *Rhipicephalus bursa*, *Ixodes ricinus*, *Boophilus annulatus*, *Haemaphysalis punctata* and *Haemaphysalis numidiana* were the tick species we found. *Rhipicephalus sanguineus* were the most abundant species in the study area. The largest number of ticks were generally present from April to July, mostly in animal ears and tails. *Ixodes*, *Boophilus* and *Haemaphysalis* occurred in mountainous areas of Ghaemshahr, whereas *Rhipicephalus* were present in both mountains and plains of the study area. **Conclusions:** The result of this study is a survey of tick species from domestic animals in Iran and implication of possible prevention measures for diseases transmitted by ticks.

1. Introduction

Ticks are nuisances and vectors of several diseases agents. Symptoms of these parasites vary from minor itching and irritation to extreme annoyance and fatigue, malnutrition, and even death. Parasites also can transmit diseases and cause secondary infections. Fortunately, many control options are available to help farmers manage livestock. Tick species distribution in Iran is briefly reviewed on the basis of published records. Tick studies were initiated by Delpy in Iran. Later, Abbasian–Lintzen and Mazlum compiled a list of adult ticks collected from domestic animals. Filippova *et al* presented data for 642 ixodid ticks taken from small-sized mammals, mainly rodents in different zoogeographical zones of Iran. Hoogstral and Wassef studied ixodid ticks parasiting wild sheep and goats in Iran focusing on maintaining natural foci of many hazardous diseases for human. Telmadarraiy *et al* published a list of

tick species and their prevalence in the northwest and the western part of the country^[1–3]. Rahbari *et al* published a primary report on distribution of various species of ticks on domestic animals in four geographical areas of Iran^[4]. There are several reports on epidemiology, distribution, medically importance and susceptibility of different ticks through the country^[5–11].

Since, thus far, only a few studies were accomplished about the tick fauna in different areas of Iran, there still seems to be a gap in our knowledge about distribution of tick species in the country. Further, there is a lack of finding about the frequency of ixodid tick species from domestic ruminants in Ghaemshahr. Therefore, this study is aimed to figure out the frequency of ticks on domestic ruminants in the Ghaemshahr county of Iran.

Approximately 10% of the currently known 867 tick species act as vectors of a broad range of pathogens of domestic animals and humans and are also responsible for damage directly due to their feeding behavior^[12]. Ruminants are also affected by direct tick damage including tick bite abscesses, tick paralysis, tick-induced dermatophilosis, etc. This present study is aimed at the survey of tick species in sheep, goats and cattle, in Ghaemshahr.

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2. Materials and methods

The tick survey was carried out in Ghaemshahr county of Mazandaran province. Mazandaran is located on the Southern coast of Caspian Sea. Tick samples were collected on both plains and mountainous regions of the study area.

About 361 sheep, 54 goats and 10 cattle of 18 herds were inspected for tick infestation. Tick sampling was performed on the whole body of each animal at different time intervals. The sites of attachment were noticed during collection, collected ticks were preserved in 70% alcohol. The collected ticks were counted, and speciation was done by using the criteria key.

3. Results

About 323 ticks were collected, the occurrence of ticks on sheep, goats and cattle were 28.3%, 22.2% and 20 % respectively. The mean number of ticks on each animal was low (3–5 ticks per animal) and the largest number of ticks were collected from animal ears and tails. Six species of ticks were identified based on the morphological features. The tick species comprised of *Rhipicephalus sanguineus* (*R. sanguineus*), *Rhipicephalus bursa* (*R. bursa*), *Ixodes ricinus* (*I. ricinus*), *Boophilus annulatus* (*B. annulatus*), *Haemaphysalis punctata* (*H. punctata*) and *Haemaphysalis numidiana* (*H. numidiana*). Out of 323 collected ticks from animals, a significant number of 266 *R. sanguineus* were identified. This species stands out as being the most prevalent tick species comprising 82.4% of the ticks collected from domestic ruminants in Ghaemshahr. The tick species prevalence is shown in Table 1.

Table 1

Survey of species spectrum of ticks in domestic ruminants in Ghaemshahr, Iran [n(%)].

Genus species	Male	Female	Total
<i>R. sanguineus</i>	106 (91.4)	160 (77.3)	266 (82.4)
<i>R. bursa</i>	–	1 (0.3)	1 (0.5)
<i>I. ricinus</i>	9 (7.8)	40 (19.3)	49 (15.2)
<i>B. annulatus</i>	–	4 (2.0)	4 (1.2)
<i>H. punctata</i>	1 (0.9)	–	1 (0.3)
<i>H. numidiana</i>	2 (1.0)	2 (0.6)	–
Total	116 (36.0)	207 (64.0)	323 (100.0)

Identified tick species on domestic ruminants according to their prevalence were: *Rhipicephalus* 266 (82.4%), *Ixodes* 49 (15.2%), *Boophilus* 4 (1.2%), *Haemaphysalis* 3 (0.9%), respectively. *R. sanguineus* was the most prevalent tick species collected from domestic animals in Ghaemshahr. *Rhipicephalus* were the most abundant ticks in both mountainous areas and the plains of Ghaemshahr, whereas *Ixodes*, *Boophilus* and *Haemaphysalis* occurred in mountainous areas, only. Therefore, the species diversity of ticks in mountainous areas was more than the plains. The largest number of ticks was generally present in April to July period, in which ticks were in more number in animal ears and tails.

4. Discussion

In the present study 102 (24%) out of 425 inspected animals were infested with ticks, the mean number of ticks on each animal was low (3–5 ticks per animal), the occurrence of ticks on sheep, goats and cattle were 28.3%, 22.2% and 20.0%

respectively. A tick survey was carried out by Rahbari *et al* in four different geographical zones of Iran, where the majority of the domestic ruminants in Iran exist. The occurrence of ticks on cattle, sheep and goats were 62%, 55% and 57%, respectively. The mean number of ticks on each animal was low (10–20 ticks per animal)[4].

In another study in the north west of Iran, 10.16% of cattle and 1.70 % of buffaloes have been contaminated to ticks[13]. In a survey from April 2001 to June 2003 in Tamil Nadu of India from 600 randomly selected sheep and goats, 64.66% of sheep and 97.66% of goats were infested with ticks[14]. The contamination rate in our study is lower than the results of Rahbari *et al*[4] and is higher than the findings of Davoudi *et al*[13] revealing significant difference between environmentally different areas. It was reported by Vathsala *et al*[14] that ticks were present in two periods from January to March and October to November. In the study of Davoudi *et al*[13] in the northwest of Iran, the highest infestation rate of cattle and buffaloes belonged to spring, which is in agreement with our study. In the studies of Telmadarraiy *et al*[1] and Salari Lak *et al*[15], in the north west of Iran, most of the ticks were collected during summer and spring, respectively. During our study the largest number of ticks was shown to be present during the period of April to July. In the studies conducted in Iran, the least number of ticks were collected during winter, whereas in Tamil of India, in winter, a huge number of ticks were present. It may be as a result of the similar Tamil climate during winter to the spring and summer climate of areas in northern Iran.

In the present study, the ticks were in more number in animal ears and tails. The factors deciding the site of attachment of the ticks are temperature and thickness of the skin of the animals where they get attached to. The temperature of the skin covering the body was 35 °C and that of the ears was 25 °C. Ticks in winter were mostly on their host trunk attached to the skin among the wool which was warmer than ears and tail, so their preferred site is corresponding to their season of occurrence. Ixodid ticks are known as vector for several pathogens and bacteria to animals and human. In our study, four genera of ixodid ticks including *Rhipicephalus*, *Ixodes*, *Boophilus* and *Haemaphysalis* were collected. *Rhipicephalus* were dominant comprising 82.6% of ticks in the study area. In a survey on ticks from sheep, in Bahar township of Hamadan Province in the western part of Iran, the ixodid ticks were *Hyalomma*, *Rhipicephalus* and *Haemaphysalis*, and *Hyalomma* were the dominant ticks collected[2]. In a study in Ardabil Province, in the north west of Iran, the frequency of *Hyalomma* comprising 43.6% of all more than that of *Rhipicephalus* (41.7%), *Dermacentor* (13.5%) and *Haemaphysalis* (0.9%)[3]. In the studies of Davoudi *et al*[13] and Salari Lak *et al*[15] in West Azerbaijan Province, *Hyalomma* as the most prevalent ticks in this province, 63.2% and 61.2%, respectively. In another study in West Azerbaijan accomplished by Telmadarraiy *et al*[1] *Rhipicephalus* (42%), *Hyalomma* (41%), *Boophilus* (7%), *Dermacentor* (7%), and *Haemaphysalis* (3%) were found. *Rhipicephalus* and *Hyalomma* were the most prevalent.

Most of the studies mentioned *Hyalomma* were the most abundant ticks, but in ours the largest number of ticks were *Rhipicephalus* and the most abundant species in the study area was *Rhipicephalus sanguineus*. This species is the vector of the diseases like anaplasmosis and babesiosis in animals, fortunately, rarely cause disease in humans. In parts of Europe, Asia and Africa, *R. sanguineus* is a vector of *Rickettsia conorii*, known locally as Mediterranean spotted

fever, boutenneuse fever, or tick typhus. In this study we also isolated *Anaplasma ovis*, *Theileria ovis*, *Rickettsia massiliae* and *Brevibacterium* sp. from *R. sanguineus* using molecular methods (unpublished data).

Along with our findings, Nabian *et al* found *R. sanguineus* as the major species in Mazandaran province, and did not find *R. bursa*, but our study displays one *R. bursa* female^[16]. In the study conducted by Rahbari *et al* *R. sanguineus* was the main species in the north part of Iran^[4]. According to these studies, it can be concluded that *R. sanguineus* is the tick species of great significance for domestic ruminants in the north part of Iran.

Razmi *et al* found *Boophilus* comprising the majority of ticks (51.3%) in a study conducted in Mazandaran province. *Hyalomma* (18.5%), *Rhipicephalus* (16.8%), *Haemaphysalis* (6.3%), *Ixodes* (6.3%) and *Dermacentor* (0.1%) were also present in the study area^[17]. In our study we collected *Boophilus* but *Rhipicephalus* were the ticks mostly in Ghaemshahr. In Iran, *I. ricinus* ticks were only in Caspian Sea regions^[4,16,17]. The most common ixodid ticks–vectors of Human Granulocytic Ehrlichiosis (HGE) in Europe is *I. ricinus*^[18]. In a study by Bashiribod *et al* in Ghaemshahr, 5.1% of *I. ricinus* ticks examined by molecular methods were shown to be infected with *Anaplasma phagocytophilum*^[19]. In the present study, 49 out of 323 collected ticks were identified as *I. ricinus*, which can be considered as an important vector of tick–borne diseases in the study area.

Several *Haemaphysalis* species were in Iran. In the present study, *H. numidiana* were collected from animals, but this species was not reported in a study conducted by Rahbari *et al* in three geographical zone of Iran. They reported 6 species, including: *H. punctata* (3.4%), *Haemaphysalis parva* (0.5%), *Haemaphysalis sulcata* (0.6%), *Haemaphysalis choldokovskyi* (1.7%), *Haemaphysalis concinna* (0.06%) and *Haemaphysalis* sp. (0.6%)^[20]. In the present study, *R. sanguineus* and *R. bursa*, were collected from sheep, goats and cattle. In the studies accomplished by Telmadarriy *et al*^[1,2] and Davoudi *et al*^[13], *R. sanguineus* and *R. bursa* were collected from different animals including: sheep, goats, cattle, buffaloes and camels, showing *Rhipicephalus* are interested in the bloods of different hosts. During our study two genera of *Boophilus* and *Haemaphysalis* were collected from sheep, in the studies of Davoudi *et al*^[13] and Telmadarriy *et al*^[1,2], they were collected from sheep, goats, cattle and buffaloes.

The tick infestation has thus been shown to occur in different areas of Iran, and this may indicate that special attention should be directed to certain areas concerning certain ticks. A long time has passed since the previous studies on tick fauna in Iran, and the intensity of livestock has been changing in different places. Together with climatic changes of recent years, these factors can influence the diversity of ticks in Iran, and it is planned to apply new suggested criteria key and biological methods to investigate tick species in Iran.

Conflict of interest statement

We declare that we have no conflict of interest.

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