



New Record and Description of *Dermacentor marginatus* (Acari: Ixodidae) from *Ovis orientalis arkal* (Mammalia: Bovidae) in Northeastern Iran

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Authors

Jafari B.¹ MSc,
Shakeri Moghaddam H.¹ MSc,
Vaeznia P.² MSc,
Hosseinzadeh M.S.³ PhD,
Kayvanfar N.⁴ PhD

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ABSTRACT

Mouflon (*Ovis orientalis*, Linnaeus, 1758) is a mammal with four subspecies in Iran. *Ovis orientalis arkal* is one of the subspecies that is distributed in east and northeast of Iran. This subspecies, like other Iranian mammals' species, is vulnerable in International Union for Conservation of Nature (IUCN). If necessary, actions are not considered for the protection of this species, it faces extinction in Iran. The study and identification of mammals' ticks are vital since ticks are one of the most important factors that can transmit many dangerous diseases to animals. They transmit viral, unicellular and rickettsia factors which may cause encephalitis, tularaemia, paralysis, and poisoning in animals and human as well. In the present study, hard ticks of *Ovis orientalis arkal* in Tandooreh and Hezar Masjed Mountains were surveyed during the period 2014-2015.

In the present study, 175 ticks have been separated from eight heads of *Ovis orientalis arkals'* carcasses. After maintaining ticks in vials consisting glycerine 5% and alcohol 75%, they were transferred to the laboratory and identification was done. Based on the results, hard ticks were recorded. They include *Dermacentor*, *Rhipicephalus*, *Hyalomma*, *Haemaphysalis*, and *Dermacentor marginatus* (Sulzer, 1776) which have been reported for the first time in this study.

Keywords *Dermacentor marginatus*; Infection; Ixodidae; Mammals; *Ovis orientalis*

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¹Biology Department, Science Faculty, Ferdowsi University of Mashhad, Mashhad, Iran

²Ferdowsi Technologies Incubator Center, Mashhad, Iran

³Biology Department, Science Faculty, University of Birjand, Birjand, Iran

⁴Institute of Applied Zoology, Ferdowsi University of Mashhad, Mashhad, Iran

*Correspondence

Address: Ferdowsi University of Mashhad, Azadi Square, Mashhad, Iran. Postal code: 9177948974
Phone: +98 (51) 38806928
Fax: +98 (51) 38806929
kayvanfar@um.ac.ir

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Introduction

Ticks, the most important obligate blood-sucking ectoparasites especially in ruminants, are very important in the fields of medicine and hygiene. Not only do these ectoparasites hurt domestic livestock and wildlife with their feeding, but they also could cause severe damages. Ticks could cause severe diseases. Moreover, these parasites can transmit various pathogens including bacteria, helminths, protozoa, viruses, and fungi to humans and animals [1-3]. In fact, ticks are considered to be the most important vectors of zoonoses, so-called tick-borne diseases such as Lyme disease, Rocky Mountain spotted fever, tick-borne meningoencephalitis, babesiosis and Crimean-Congo hemorrhagic fever (CCHF) [4, 5]. Recently, 702 species of ticks are recognized from 14 genera of the family Ixodidae and are important in transmitting diseases [6, 7].

14 species of *Hyalomma*, 11 species of *Haemaphysalis*, 8 species of *Ixodius*, 5 species of *Rhipicephalus*, one species of *Boophilus*, and 3 species of *Dermacentor* from Ixodidae have been reported from domestic mammals in Iran [8]. *Dermacentor* consists of 34 species, which have a cosmopolitan distribution with native species on all continents except Australia. Hosts of *Dermacentor* ticks include large and small mammals such as horses, deer, cattle, lagomorphs, peccaries, porcupines, tapirs, desert bighorn sheep, and humans [4].

Dermacentor ticks are the vectors of many pathogens including *Rickettsia rickettsii*, which causes Rocky Mountain spotted fever and *Coxiella burnetii* causing Q fever. Moreover, other pathogens such as *Anaplasma marginale*, *Francisella tularensis*, *Babesia caballi*, and *Flavivirus* which cause anaplasmosis in cattle, tularemia, equine piroplasmosis, and Powassan encephalitis, respectively, are transmitted through *Dermacentor* ticks. These ticks produce a neurotoxin that causes tick paralysis [4]. Furthermore, *Dermacentor marginatus*, European ornate sheep tick, is a common vector of *Rickettsia slovaca*, the causative agent of tick-borne lymphadenopathy (TIBOLA) in southern Europe [9]. *D. marginatus* may also play a role as a vector of tick-borne encephalitis virus (TBEV), *Coxiella burnetii* and the protozoan parasite *Babesia canis* [10-12].

Dermacentor marginatus, is found in Portugal, southern Europe, Iran, Kazakhstan, and the mountain areas of central Asia [13]. The species

has usually been reported from domestic mammals especially sheep in Germany, Turkey, and Italy (Figure 1) [14-16]. They are also found in other domestic hosts such as dogs, cattle, goats, and horses. Ticks have also been reported from wild animals including deer, hare, hedgehog, wolf, and wild boar [9, 17]. However, the juvenile tick often feeds on small mammals like rodents and insectivores of the genera *Myodes*, *Apodemus*, *Microtus*, and rabbits [17-19].

Wild sheep, *Ovis orientalis*, is a member of the order Artiodactyla, family Bovidae and subfamily Caprinae and is listed as vulnerable (VU) by IUCN. *Ovis orientalis* has eight subspecies and according to the latest records of IUCN, they are distributed in Afghanistan, northwestern India (Kashmir), northeastern, southern, and southeastern Iran, southwestern Kazakhstan, Oman (where it is possibly introduced), Pakistan, Tajikistan, Turkmenistan, Armenia, southern Azerbaijan, northern Iraq, western Iran, Uzbekistan, and south-central, eastern Turkey. The subspecies are distributed as follows (Figure 2):

1- *Ovis orientalis isphahanica*: It occurs only in southwestern Esfahan in east-central Iran.

2- *Ovis orientalis laristanica*: It inhabits southern and southeastern Iran.

3- *Ovis orientalis arkal*: It is the resident of Kazakhstan, Turkmenistan, Uzbekistan, and northeast Iran including Golestan, Gorkhod, Serany, and Tandooreh national parks.

4- *Ovis orientalis bocharensis*: It is found in Tajikistan, Turkmenistan, and Uzbekistan and the southwestern part of the Pamir [20, 21].

5- *Ovis orientalis cycloceros*: It was observed in Turkmenistan, Pakistan, and Afghanistan, throughout the Hindu Kush and the mountains of central Afghanistan, extending from the Zebak mountains in the north to the Seyah Koh range in the southwest.

6- *Ovis orientalis gmelinii*: It is the resident of the mountain foothills and rolling steppe of northwestern and southwestern Iran, northern and northeastern Iraq, Trans Caucasus, southwestern Azerbaijan [22].

7- *Ovis orientalis vignei*: This subspecies occurs only in India, northern Pakistan, and Afghanistan [23-25].

8- *Ovis orientalis punjabiensis*: This subspecies is distributed in Pakistan and probably India [26].

Aesthetically, urial sheep is one of the species that attracts nature supporters' attention around the world. According to the species

status in IUCN red list and the role of ticks in transmission of pathogenic agents, conservation of these sheep is important. Therefore, in this

study, it is focused on ticks of urial sheep (*Ovis orientalis arkal*) in Tandooreh National Park and Hezar Masjed Mountains in northeast of Iran.

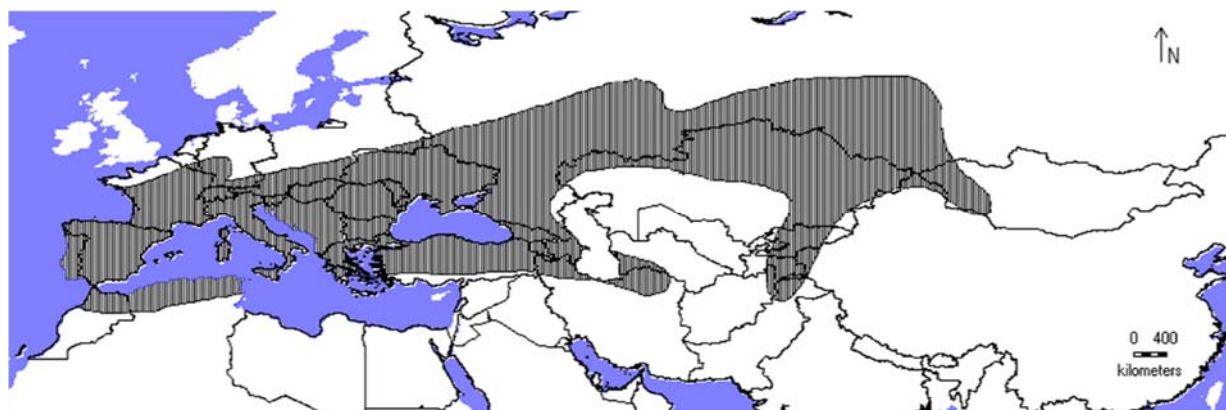


Figure 1) Distribution map of *Dermacentor marginatus*

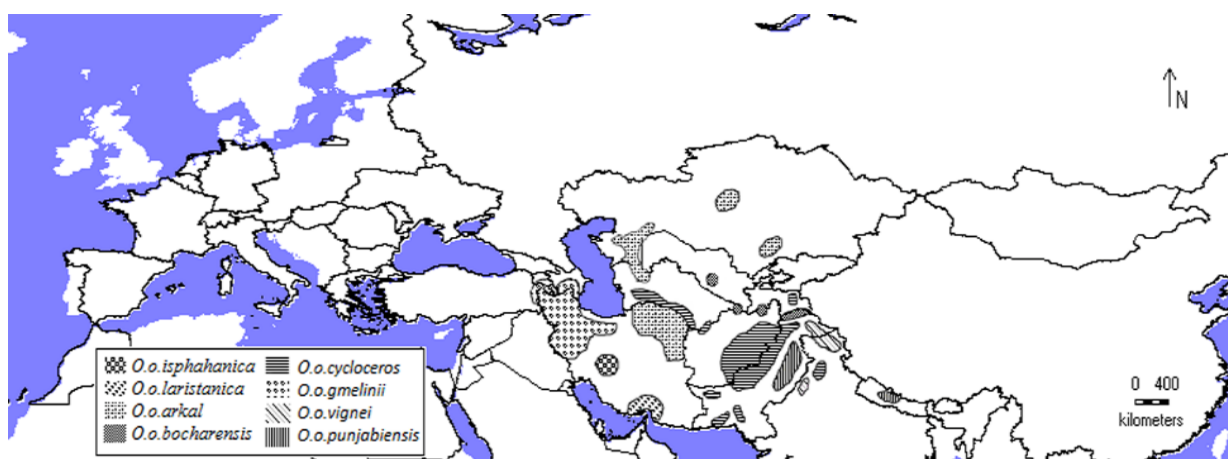


Figure 2) Distribution map of subspecies of *Ovis orientalis*

Materials and Methods

Sample collection

Ticks of wild sheep *Ovis orientalis arkal* were collected during spring 2013 to summer 2015. Sampling was done in Tandooreh National Park and Hezar Masjed Mountains. The national park is located in northeastern Iran, close to the border of Turkmenistan. The park is mountainous with frequent rocks, hill, and deep valleys. The vegetation is diverse and nutritionally rich and the region is a very suitable habitat for urial sheep (Figure 3).

In the current study, the samples were collected from Environmental Department of Razavi Khorasan, northeastern Iran. Ticks were removed from head, neck, pinna, groin, anus, and scrotum or testis, which have high blood flow. In order to remove ticks from infected positions, first ticks were anesthetized using

ethanol 70% and then they were removed using forceps with 45 angles along their mouth appendages. Removal of the whole body of ticks was performed without leaving their chelicerae on hosts' body.

In this study, a total number of 175 ticks were removed from the bodies of 8 *ovis orientalis*. They were stored in tubes filled with ethanol 70% and glycerin 5%. Different characters of specimen including sampling time, locality of sampling, host tissue, host type, age, gender, and name of collector were written on the tubes. After that, the specimens were transported to zoology laboratory of Ferdowsi University of Mashhad for identification. The ticks were studied using a stereoscopic microscope (Olympus SZ40; Olympus; Japan) and recognized with pictorial keys [19, 27-29].

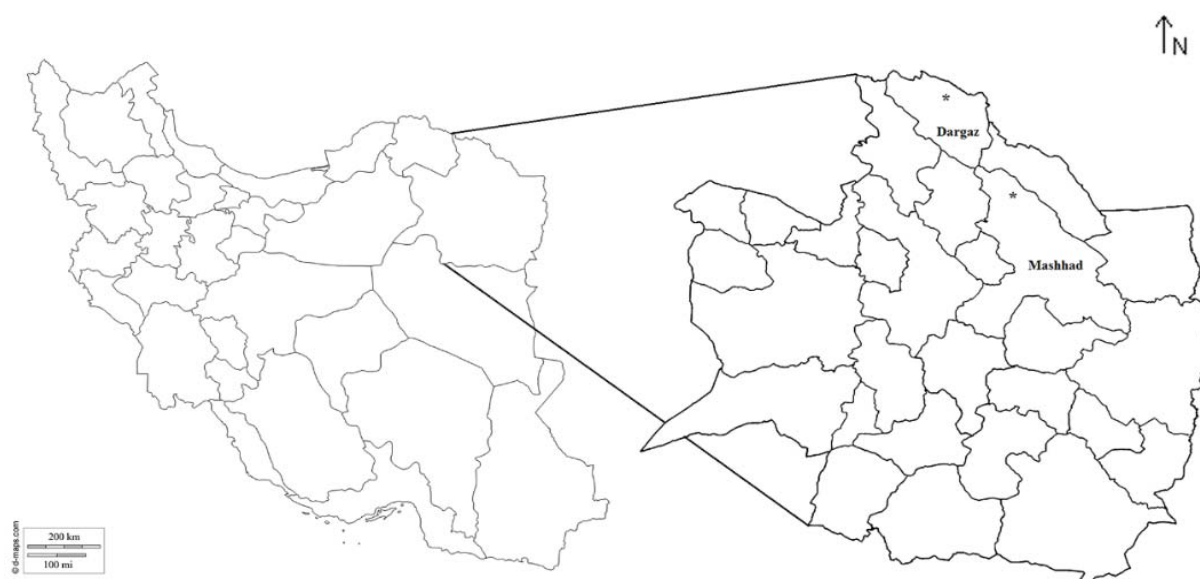


Figure 3) Map of sampling locality to investigate ticks on mouflon, Razavi Khorasan, Iran

Findings

A total number of 175 ticks were collected from wild sheep. The ticks included 78 males and 97 females. The ticks were identified as follows: *Dermacentor niveus*, *Rhipicephalus turanicus*, *Dermacentor raskemensis*, *Hyalomma marginatum*, *Homaphysalis solkata*, *Hyalomma Egypt*, and *Dermacentor marginatus*. This is the first record of *Dermacentor marginatus* of wild sheep in Iran.

Description of *Dermacentor marginatus*

The size of unfed tick is medium (4-5mm). Lateral suture is absent. Integument texture has striations. Mouthparts are anterior. Palp articles 2 are broad in *Dermacentor*. Basis capituli has straight lateral margins and it is rectangular dorsally. Legs have no pale rings. Legs are slender. Pulvilli are always present. Scutum is present in the female (a conscutum is present in the male). Enamel (ornamentation) is present on scutum and conscutum of most of *Dermacentor*, forming a white pattern. Eyes are present and usually flat to slightly convex. Fестоons are present in males. Spiracular plates are large and posterior to legs 4. Spiracle goblets are scattered over the spiracular plates. Ventral plates are absent in males. Anal groove is posterior to the anus. Coxae 4 is very large. Coxae 1 has large and equal paired spurs (all features apply to both sexes except where stated; Figure 4) [19].

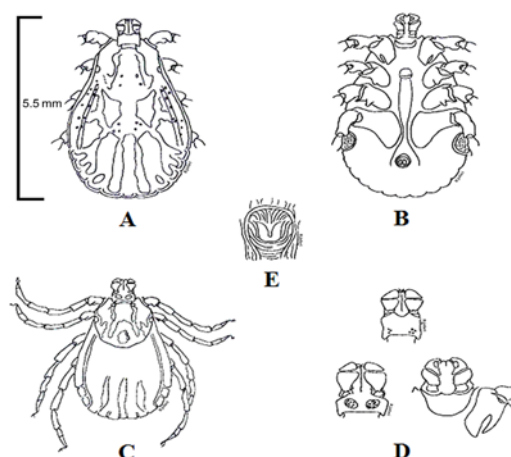


Figure 4) Adult tick of *Dermacentor marginatus*; A: Male, dorsal view; B: Male, ventral view; C: Female, dorsal view; D: Mouthparts, the upper one belongs to the male and the lower ones belong to the female; E: Genital aperture

Discussion and Conclusion

Ticks as ectoparasites suck blood from their hosts and carry pathogenic agents. Hard ticks including *Hyalomma*, *Rhipicephalus*, and *Haemaphysalis* in northwestern Iran infect livestock [4]. So far, some species of *Hyalomma*, *Rhipicephalus*, *Ixodes*, *Haemaphysalis*, *Boophilus*, and *Dermacentor* have been reported from the Iranian domestic mammals [8]. Hard ticks *Dermacentor* are vectors of many pathogens including *Rickettsia rickettsi*, *Babesia ovis*, *Babesia motasi*, *Theiliera lesoquardi*,

Theileria recondite, and *Theileria ovis* and they can infect livestock [4, 30, 31]. Wild sheep, *Ovis orientalis*, is one of the hosts that can be infected by ticks and they are susceptible to Babesia and Theileria [32]. *Ovis orientalis* has been stated by IUCN as vulnerable and its conservation is very important. Furthermore, the total number of *Ovis orientalis arkal* estimated in ex-Soviet republics at the beginning of the 1960s until 1980s was declined sharply [20,33]. This reduction could be seen in Turkmenistan in 1980s as well [34]. In Afghanistan, *O. orientalis* was on the country's first protected species list in 2009, prohibiting all hunting and trading of this species within the country. The population was estimated to be at least 20,000 animals in the mid-1970s [35], of which around 15,000 were estimated to inhabit Golestan National Park alone [36], although there are no recent data in Iran. In this study, hard tick *Dermacentor marginatus* was identified in urial sheep, located in northeastern Iran, for the first time.

Previous investigations on ticks in Iran mostly focused on livestock such as cow, goat, camel, and sheep [37-40]. A few of ticks were reported from wildlife [41].

According to the importance of large mammals like urial sheep, its dangerous state in IUCN red list

(<https://www.cites.org/eng/app/index.php>)

and its vulnerability to some pathogenic species, identification of pathogenic agents in these species is vital. The main activity periods of unfed adults are in spring and autumn, but may extend throughout the winter in more southern regions [19, 42]. This is probably the reason that *Dermacentor marginatus* was not recorded in the previous investigation by Razmi and Ramon [41]. Therefore, the current study suggests more extensive and comprehensive sampling especially during spring and autumn. Moreover, identification of ecto- and endo-parasites especially ticks of urial sheep subspecies is necessary. More studies would help shed light on the distribution of *D. marginatus* as one of the most important vectors of tick-borne pathogens.

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