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Research Article

## A systematic investigation on the ticks (Acari: Ixodida) of the domestic sheep in Niğde Province, Turkey

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### Abstract

The present study identified 881 specimens of the ticks found on about 2000 domestic sheep in Niğde Province. During this investigation, Argasidae (*Ornithodoros* (*Alveonasus*) *lahorensis*) and eight Ixodidae species of (*Dermacentor* (*Serdjukovia*) *marginatus*, *D. (S.) niveus*, *Haemaphysalis* (*Haemaphysalis*) *concinna*, *H. (Alloceraea)* *inermis*, *H. (Segalia)* *parva*, *H. (Aboimimalis)* *punctata*, *H. (Herpetobia)* *sulcata*, and *Rhipicephalus* (*Boophilus*) *annulatus*) were determined. The distribution at the genera level of the samples are as follows: *Haemaphysalis* 73.2 %, *Ornithodoros* 16.1 %, *Dermacentor* 10.2 %, and *Rhipicephalus* 0.45 %. *H. sulcata* was the most common species with 256 specimens (29.1 %), and *H. concinna* was the rarest species with only one specimen (0.1 %). *D. niveus* was recorded for the first time from Niğde Province. Besides, the seasonality and taxonomic status of the recorded species are discussed in the current article.

**Keywords:** Argasidae, Ectoparasites, Ixodidae, Ixodoidea

### Introduction

Ticks (Acari: Ixodida) are among the best-known groups of hematophagous ectoparasites of a wide variety of mammals, birds, reptiles, and amphibians. They have paramount importance in medical and veterinary research since either their transmission of pathogenic agents, including viruses, bacteria, and protozoa to hosts, causes blood loss and tick-induced paralysis (Keskin and Erciyas-Yavuz 2019, Keskin *et al.* 2019).

Horak *et al.* (2002) recognized 867 species in three families for the world's tick fauna. The family Argasidae consists of 183 species in four genera (*Argas*, *Carios*, *Ornithodoros*, and *Otobius*). Two hundred forty-one species represent the family Ixodidae in the genus *Ixodes* and 442 species in 11 genera. They regarded the genus *Boophilus* as a subgenus of the genus *Rhipicephalus*. The last family Nuttalliellidae is formed by the monospecific genus *Nuttalliella*.

In a more recent study, Guglielmone *et al.* (2010) listed valid 896 tick species in three families for the ticks of the world. The family of the soft ticks, Argasidae, comprises 193 species, but there is widespread disagreement concerning the genera in this family, and fully 133 argasids will have to be further studied before any consensus can be reached on the issue of genus-level classification. The family of the hard ticks, Ixodidae, consists of 702 species in 14 genera. The Nuttalliellidae is composed of a single species, *Nuttalliella*

*namaqua*. Of these, only the first two families are represented in Turkey by 51 species; 8 species from the family Argasidae and 43 species from the family Ixodidae (Bursalı *et al.* 2012, Keskin and Erciyas-Yavuz 2019, Keskin *et al.* 2019).

On the other hand, the taxonomic status of some taxa is discussed. In particular, the validity of some species of the genus *Dermocentor* remains uncertain. Estrada-Peña and Estrada-Peña (1991) examined part of the syntype series of *Dermocentor niveus* from Iran, and they reported that *D. niveus* is conspecific with *D. marginatus*. Moshaverinia *et al.* (2009) supported this view. Guglielmone *et al.* (2010) noted that a more comprehensive comparative study of *D. marginatus*, *D. niveus*, and *D. ushakovae* appears to be needed to demonstrate the validity of these taxa further, and they considered *D. niveus* provisionally valid while awaiting the results of this comparison.

The present study was aimed to determine species of ticks infesting domestic sheep in Niğde Province and their distribution. The fact that animal husbandry is one of the important livelihoods in Niğde increases the importance of this study. Also, considering that the

Crimean-Congo Hemorrhagic Fever (CCHF), with outbreaks between 2002 and 2010 in Turkey and can result in deaths in humans, is a zoonosis caused by pathogenic agents carrying by ticks, the increase of information about ticks in our country is significant to struggle disease.

## Material and methods

Niğde is located in Central Anatolia of Turkey, with a 2699.23 km<sup>2</sup> area. The volcanic mountains, Hasan Mt and Melendiz Mts, in the northwest and north and tectonic mountain ranges, the Bolkarlar (Central Taurus) Mts in the south Aladağlar Mts in the southeast. The city is in the middle of these mountain groups. Although the altitude is about 1,230 m a.s.l. in the centrum, elevation reaches 3,524 m a.s.l. on Medetsiz Peak, the highest place of Bolkarlar, and to 3,767 m a.s.l. on Kızılkaya, the highest area in Aladağlar. Due to its height, Niğde Province has many plateaus, and it is an ideal place for livestock and parasites.

In this study, 881 tick samples collected from sheep in centrum and villages of Niğde province between 31 March 1996 and 21 May 1997 were evaluated. Localities where samples are collected, are shown in Fig. 1 and Table 1.



Figure 1. Localities of tick samples collected

**Table 1.** List of tick species according to the localities in Niğde province

District	The village, quarter, or vicinity	Tick Species
Central (Niğde)	centrum	6 <i>Ornithodoros (Alveonasus) lahorensis</i> , 1 <i>Haemaphysalis (Haemaphysalis) concinna</i>
“	abattoir	2 <i>Dermacentor (Serdjukovia) marginatus</i> , 8 <i>Haemaphysalis (Segalia) parva (=H. otophila)</i> , 5 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	around the cement factory	1 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Eski Saray	1 <i>Dermacentor (Serdjukovia) niveus</i>
“	Kayaardı	1 <i>Haemaphysalis (Aboimissalis) punctata</i>
“	Sariova	2 <i>Dermacentor (Serdjukovia) marginatus</i> , 3 <i>Dermacentor (Serdjukovia) niveus</i> , 16 <i>Haemaphysalis (Aboimissalis) punctata</i> , 56 <i>Haemaphysalis (Herpetobia) sulcata</i> , 4 <i>Rhipicephalus (Boophilus) annulatus annulatus</i>
“	Yörük Quarter	4 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Aşlama	6 <i>Ornithodoros (Alveonasus) lahorensis</i>
“	Bağlama	1 <i>Haemaphysalis (Aboimissalis) punctata</i>
“	Çavdarlı	61 <i>Ornithodoros (Alveonasus) lahorensis</i> , 45 <i>Haemaphysalis (Segalia) parva (=H. otophila)</i> , 4 <i>Haemaphysalis (Aboimissalis) punctata</i> , 18 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Dündarlı	1 <i>Dermacentor (Serdjukovia) marginatus</i> , 1 <i>Dermacentor (Serdjukovia) niveus</i> , 3 <i>Haemaphysalis (Segalia) parva (=H. otophila)</i> , 8 <i>Haemaphysalis (Aboimissalis) punctata</i> , 1 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Edikli	1 <i>Dermacentor (Serdjukovia) marginatus</i> , 7 <i>Dermacentor (Serdjukovia) niveus</i> , 2 <i>Haemaphysalis (Segalia) parva (=H. otophila)</i> , 23 <i>Haemaphysalis (Aboimissalis) punctata</i> , 60 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Elmalı	10 <i>Dermacentor (Serdjukovia) marginatus</i> , 12 <i>Dermacentor (Serdjukovia) niveus</i> , 2 <i>Haemaphysalis (Aboimissalis) punctata</i> , 3 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Gümüşler (incl. Eski Gümüş)	7 <i>Haemaphysalis (Segalia) parva (=H. otophila)</i>
“	Hacı Abdullah	1 <i>Haemaphysalis (Aboimissalis) punctata</i>
“	Hançerli	2 <i>Haemaphysalis (Segalia) parva (=H. otophila)</i> , 1 <i>Haemaphysalis (Aboimissalis) punctata</i> , 1 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Himmetli	54 <i>Ornithodoros (Alveonasus) lahorensis</i> , 3 <i>Dermacentor (Serdjukovia) marginatus</i> , 35 <i>Dermacentor (Serdjukovia) niveus</i> , 27 <i>Haemaphysalis (Segalia) parva (=H. otophila)</i> , 37 <i>Haemaphysalis (Aboimissalis) punctata</i> , 59 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Hüyük	1 <i>Dermacentor (Serdjukovia) marginatus</i>
“	Konaklı	2 <i>Dermacentor (Serdjukovia) marginatus</i> , 1 <i>Haemaphysalis (Segalia) parva (=H. otophila)</i>
“	Orhanlı	6 <i>Ornithodoros (Alveonasus) lahorensis</i>
“	Sazlıca	1 <i>Haemaphysalis (Herpetobia) sulcata</i>

**Table 1 continued.** List of tick species according to the localities in Niğde province

District	The village, quarter, or vicinity	Tick Species
“	Tepeköy	1 <i>Haemaphysalis (Alloceraea) inermis</i> , 2 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila), 3 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Yarhisar	2 <i>Dermacentor (Serdjukovia) marginatus</i> , 4 <i>Dermacentor (Serdjukovia) niveus</i> , 79 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila), 4 <i>Haemaphysalis (Herpetobia) sulcata</i>
Altınhisar	centrum	2 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Keçikalesi	13 <i>Ornithodoros (Alveonasmus) lahorensis</i> , 4 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila), 1 <i>Haemaphysalis (Herpetobia) sulcata</i>
Bor	centrum	14 <i>Ornithodoros (Alveonasmus) lahorensis</i>
“	Balcı	1 <i>Haemaphysalis (Aboimimalis) punctata</i>
“	Gökbez	7 <i>Haemaphysalis (Alloceraea) inermis</i> , 4 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila)
“	Kemerhisar	2 <i>Dermacentor (Serdjukovia) marginatus</i> , 2 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Tepeköy	1 <i>Haemaphysalis (Aboimimalis) punctata</i>
Çamardı	centrum	13 <i>Ornithodoros (Alveonasmus) lahorensis</i>
“	Bademdere	61 <i>Haemaphysalis (Alloceraea) inermis</i> , 3 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila), 1 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Bulduruş Pass	7 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila), 5 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Celâller	1 <i>Haemaphysalis (Aboimimalis) punctata</i> , 1 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Sulucaova	2 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila), 2 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Üçkapılı (Özyurt)	1 <i>Dermacentor (Serdjukovia) niveus</i> , 2 <i>Haemaphysalis (Herpetobia) sulcata</i>
Çiftlik	Azatlı	2 <i>Ornithodoros (Alveonasmus) lahorensis</i> , 5 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila), 10 <i>Haemaphysalis (Aboimimalis) punctata</i> , 10 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Çınarlı	1 <i>Ornithodoros (Alveonasmus) lahorensis</i>
“	Murtaza	16 <i>Ornithodoros (Alveonasmus) lahorensis</i> , 3 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila), 5 <i>Haemaphysalis (Aboimimalis) punctata</i> , 12 <i>Haemaphysalis (Herpetobia) sulcata</i>
Ulukışla	centrum	1 <i>Haemaphysalis (Herpetobia) sulcata</i>
“	Başmakçı	3 <i>Haemaphysalis (Segalia) parva</i> (=H. otophila)
“	Ovacık	4 <i>Ornithodoros (Alveonasmus) lahorensis</i> , 1 <i>Haemaphysalis (Herpetobia) sulcata</i>

As a faunistic and systematic investigation, this study did not focus on sheep breeds and the ticks infestation rate o Starting from the animal's head, the whole body was examined as well as the naked eye and hand. Meanwhile, we checked the sheepfolds as well. The ticks collected are put into 70% ethyl alcohol, adding

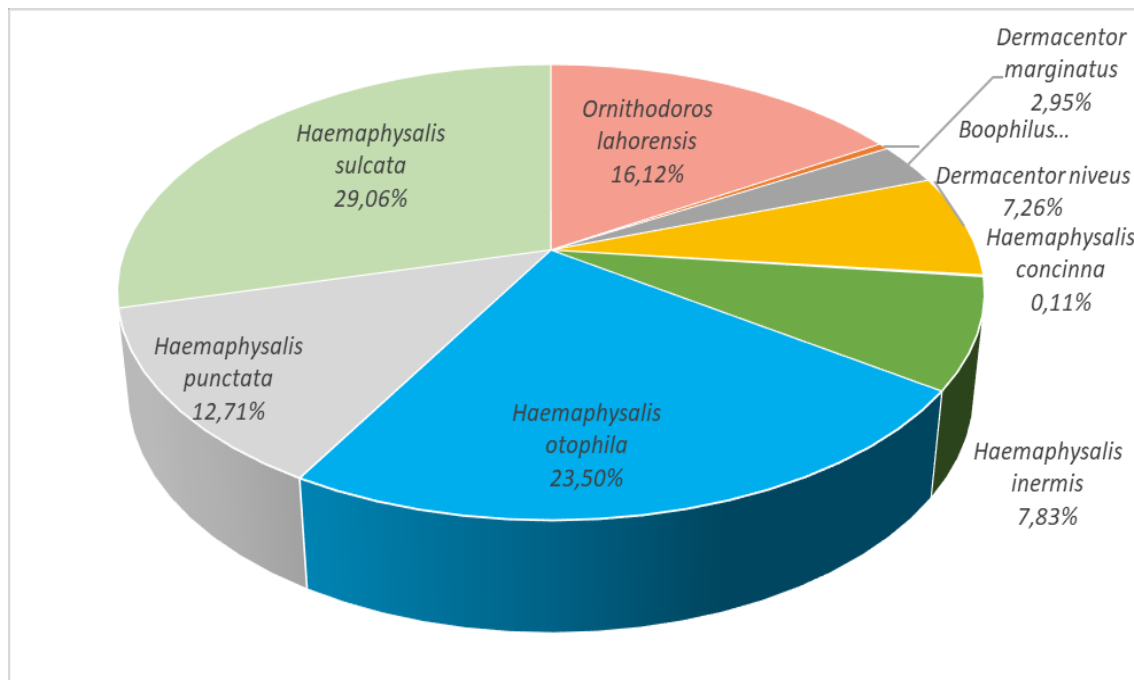
one drop of glycerin to the alcohol to prevent hardening. Ticks cleaned with a soft brush in the laboratory were placed on a glass paste, examined, and photographed under a stereo-microscope and light microscope (with upper light). Identification of ticks was made according to keys and other systematic

publications (Senevet 1937, Hoogstraal 1956, Arthur 1963, Merdivenci 1969, Özkan 1978, Hosseini-Chegeni *et al.* 2014). After species identification, the samples were placed in vials and labeled with their scientific name, age group, gender, locality, and date. All specimens have been deposited in our tick collection in the Department of Zoology, Niğde University (ZDNU).

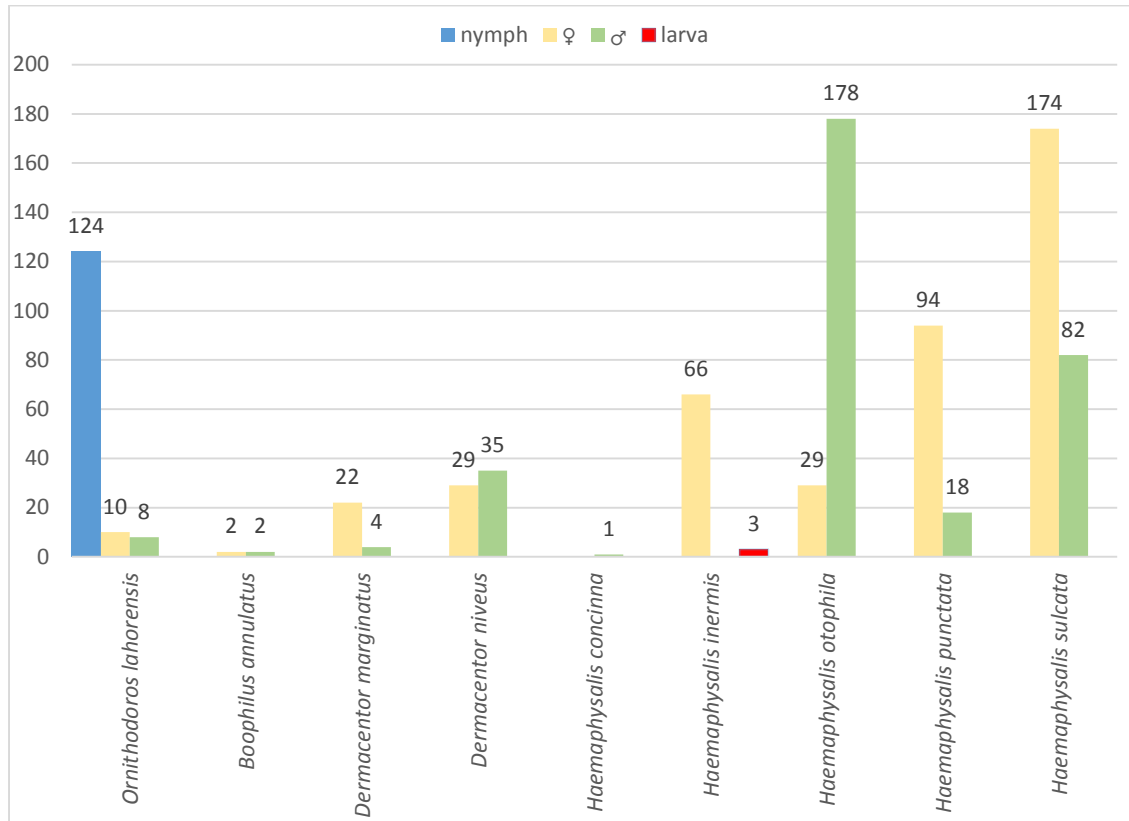
## Results

As a result of the examination of 881 ticks collected from Niğde Province, this study revealed a total of nine species parasitized in sheep that one species (*Ornithodoros (Alveonasus) lahorensis*) from the family Argasidae and eight species from the family Ixodidae (*Dermacentor (Serdjukovia) marginatus*, *D. (S.) niveus*, *Haemaphysalis (Haemaphysalis) concinna*, *H. (Alloceraea) inermis*, *H. (Segalia) parva*, *H. (Aboimisalis) punctata*, *H. (Herpetobia) sulcata*, and *Rhipicephalus (Boophilus) annulatus*). We

found that 73.2% of the samples belong to the genus *Haemaphysalis* Koch, 1844, 16.1% to the genus *Ornithodoros* Koch, 1844, 10.2% to the genus *Dermacentor* Koch, 1844, and 0.45% to the genus *Rhipicephalus* Koch, 1844 (or the subgenus *Boophilus* Curtice, 1891). Of these species, *H. sulcata* was the most common with 256 samples, and a ratio of 29.1%, and *H. concinna*, was the rarest species with a ratio of 0.1%. (with only a single individual). On the other hand, 426 of the samples were adult females, with a ratio of 48.4%; 328 samples were mature male, with a ratio of 37.2%; 124 samples were nymphs with a ratio of 14.1%, and we only found three specimens as larvae with a ratio of 0.3%. Larvae were observed only for *H. inermis* and nymphs for *O. lahorensis*. Additionally, any sample for both male *H. inermis* and female *H. concinna* could not be recorded (Fig. 2). The following pie chart shows the identified tick species, their localities, and the numbers of the specimens.



**Figure 2.** Percentage of species by number of samples



**Figure 3.** Number of samples of tick species by larvae, nymphs, adults (females and males)

#### Family ARGASIDAE Canestrini, 1890

##### *Ornithodoros (Alveonassus) lahorensis* (Neumann, 1901)

**Localities and number of specimens [total 142]:** Niğde (Central District), 17.I.1997, 4 nymphs, 1 ♀; 13.II.1997, 1 ♂; Aşlama, 1.I.1997, 3 nymphs, 2 ♀♀, 1 ♂; Çavdarlı, 12.III.1997, 6 nymphs, 1 ♂; Himmetli, 18.III.1997, 50 nymphs, 3 ♀♀, 1 ♂; Niğde (Gölcük): Orhanlı, 1.I.1997, 5 nymphs, 1 ♀; Altınhisar: Keçikalesi, 25.XII.1996, 2 ♂♂, 11 nymphs; Bor (centrum), 17.XII.1996, 14 nymphs; Çamardı: 1.I.1997, 12 nymphs, 1 ♂; Çiftlik: Azatlı, 5.III.1997, 1 nymph, 1 ♂; Çınarlı, 26.II.1997, 1 ♀; Murtaza, 25.XII.1996, 16 nymphs; Ulukışla: Ovacık, 1.I.1997, 2 nymphs, 2 ♀♀.

#### Family IXODIDAE Murray, 1877

##### *Dermacentor (Serdjukovia) marginatus* (Sulzer, 1776)

**Localities and number of specimens [26]:** Niğde (centrum): Sarıova vicinity, 26.XI.1996, 2 ♀♀; abattoir (unknown origin), 17.XI.1996, 1

♀, 1 ♂; Dünderlı, 21.III.1997, 1 ♀; Edikli, 16.XII.1996, 1 ♀; Elmalı, 10.I.1997, 2 ♀♀; 28.III.1997, 8 ♀♀; Himmetli, 18.III.1997, 1 ♀, 2 ♂♂; Hüyük, 17.XI.1996, 1 ♀; Konaklı, 17.XI.1996, 2 ♀♀; Yarhisar, 17.III.1997, 2 ♀♀; Bor (Kemerhisar): 31.III.1996, 1 ♀, 1 ♂.

##### *Dermacentor (Serdjukovia) niveus* Neumann, 1897

**Localities and number of specimens [64]:** Niğde (centrum): Eski Saray Quarter, 5.IV.1996, 1 ♂; Sarıova vicinity, 30.X.1996, 1 ♀; 20.III.1997, 1 ♂; 7.IV.1997, 1 ♂; Dünderlı, 21.III.1997, 1 ♀; Edikli, 31.III.1997, 7 ♀♀; Elmalı, 28.III.1997, 3 ♀♀, 9 ♂♂; Himmetli, 18.III.1997, 15 ♀♀, 20 ♂♂; Yarhisar, 17.III.1997, 2 ♀♀, 2 ♂♂; Çamardı: Üçkapılı (Özyurt), 17.XI.1996, 1 ♂.

##### *Haemaphysalis (Haemaphysalis) concinna* Koch, 1844

**Localities and number of specimen [1]:** Niğde (centrum), 21.V.1997; 1 ♂.

##### *Haemaphysalis (Alloceraea) inermis* Birula

1895

**Localities and number of specimens [69]:**

Niğde (Central District): Tepeköy, 16.XII.1996, 1 ♀; Bor (Kemerhisar): Gökbezi, 17.XII.1996, 7 ♀♀; Çamardı: Bademdere, 17.XII.1996, 3 larvae, 58 ♀♀.

***Haemaphysalis (Segalia) parva* (Neumann, 1897) (= *H. otophila* Schulze, 1918)****Localities and number of specimens [207]:**

Niğde (centrum): abattoir (unknown origin), 12.XI.1996, 1 ♂; 20.III.1997, 7 ♂♂; Çavdarlı, 17.III.1997, 11 ♀♀, 34 ♂♂; Dünderli, 21.III.1997, 2 ♀♀, 1 ♂; Edikli, 16.XII.1996, 1 ♀, 1 ♂; Gümüşler, 1.I.1997, 4 ♂♂; Gümüşler, Eskiğümüş, 25.XII.1996, 3 ♂♂; Hançerli, 8.I.1997, 2 ♂♂; Himmetli, 17.III.1997, 1 ♂; 18.III.1997, 2 ♀♀, 21 ♂♂; 13.IV.1997, 3 ♂♂; Tepeköy, 16.XII.1996, 1 ♀, 1 ♂; Yarhisar, 16.XI.1996, 2 ♀♀, 13 ♂♂; 17.III.1997, 4 ♀♀, 60 ♂♂; Niğde (Gölcük): Konaklı, 17.XI.1996, 1 ♂; Altınhisar: Keçikalesi, 25.XII.1996, 4 ♂♂; Bor (Kemerhisar): Gökbezi, 17.XII.1996, 1 ♀, 3 ♂♂; Çamardı: Bulduruş Pass, 16.XI.1996, 1 ♀, 6 ♂♂; Bademdere, 17.XII.1996, 3 ♂♂; Sulucaova, 4.XI.1996, 1 ♂; 8.I.1997, 1 ♂; Çiftlik: Azatlı, 16.II.1997, 4 ♀♀; 5.III.1997, 1 ♂; Murtaza, 25.XII.1996, 3 ♂♂; Ulukışla: Başmakçı, 1.I.1997, 3 ♂♂.

***Haemaphysalis (Aboimisisalis) punctata* Canestrini et Fanzago, 1877****Localities and number of specimens [112]:**

Niğde (centrum): Kayaardı vicinity, 17.IV.1996, 1 ♀; Sarıova vicinity, 30.X.1996, 8 ♀♀; 20.III.1997, 7 ♀♀, 1 ♂; Çavdarlı, 17.III.1997, 2 ♀♀, 2 ♂♂; Dünderli, 21.III.1997, 7 ♀♀, 1 ♂; Edikli, 16.XII.1996, 1 ♂; 31.III.1997, 22 ♀♀; Elmalı, 28.III.1997, 2 ♀♀; Hacı Abdullah, 12.III.1997, 1 ♀; Hançerli, 8.I.1997, 1 ♀; Himmetli, 17.III.1997, 8 ♀♀, 4 ♂♂; 18.III.1997, 25 ♀♀; Niğde (Gölcük): Bağlama, 25.XII.1996, 1 ♀; Bor: Balcı, 28.IX.1996, 1 ♀; Tepeköy, 16.XII.1996, 1 ♀; Çamardı, Celâller, 1.I.1997, 1 ♂; Çiftlik: Azatlı, 5.III.1997, 6 ♀♀, 4 ♂♂; Murtaza, 25.XII.1996, 1 ♀, 4 ♂♂.

***Haemaphysalis (Herpetobia) sulcata* (Canestrini et Fanzago, 1877)****Localities and number of specimens [256]:**

Niğde (Central District): around the cement factory, 26.X.1996, 1 ♀; Sarıova, 24.XI.1996, 10 ♂♂; 20.III.1997, 46 ♀♀; abattoir (unknown origin) 13.XI.1996, 1 ♂; *ibid.* (transferred from Sulucaova), 4.XI.1996, 1 ♂; *ibid.* (transferred from Yeşilhisar-Kayseri), 24.XI.1996, 3 ♂♂; Yörük Quarter (transferred from Üçkapılı-Çamardı), 29.XII.1996, 1 ♀, 3 ♂♂; Çavdarlı, 17.III.1997, 2 ♀♀, 16 ♂♂; Dünderli, 21.III.1997, 1 ♀; Edikli, 21.III.1997, 51 ♀♀; 31.III.1997, 9 ♀♀; Elmalı, 10.I.1997, 3 ♂♂; Hançerli, 8.I.1997, 1 ♂; Himmetli, 17.III.1997, 14 ♂♂; 18.III.1997, 45 ♀♀; Sazlıca, 10.III.1997, 1 ♂; Tepeköy, 16.XII.1996, 2 ♀♀, 1 ♂; Yarhisar, 16.XI.1996, 1 ♀; 17.III.1997, 3 ♀♀; Altınhisar (centrum), 1.I.1997, 2 ♀♀; Keçikalesi, 25.XII.1996, 1 ♂; Bor (Kemerhisar), 17.IX.1996, 1 ♀; 25.XII.1996, 1 ♀; Çamardı: Bademdere, 17.XII.1996, 1 ♀; Bulduruş Pass, 16.XI.1996, 4 ♀♀, 1 ♂; Celâller, 1.I.1997, 1 ♂; Sulucaova, 8.I.1997, 2 ♂♂; Üçkapılı, 17.XII.1996, 1 ♂; 1.I.1997, 1 ♀; Çiftlik: Azatlı, 5.III.1997, 1 ♀, 9 ♂♂; Murtaza, 25.XII.1996, 12 ♂♂; Ulukışla (centrum), 25.XII.1996, 1 ♂; Ovacık, 1.I.1997, 1 ♀.

***Rhipicephalus (Boophilus) annulatus annulatus* (Say, 1921)****Localities and number of specimens [4]:**

Niğde (centrum): Sarıova vicinity, 30.X.1996, 2 ♀♀, 2 ♂♂.

**Discussion**

Oytun (1947), Kurtpınar (1954) and Merdivenci (1969) recorded *Ornithodoros (Alveonassus) lahorensis* from many provinces of Turkey, including Niğde. According to Bursalı *et al.* (2012), it is common throughout Turkey. Merdivenci (1969) noted that this tick was found from November-December to January-February (sometimes March). In this study, we observed that its presence in sheep from mid-December to mid-March.

Merdivenci (1969) reported that *Dermacentor*

(*Serdjukovia*) *marginatus* was seen in all climate zones of Turkey including Niğde. Taşçı (1989) stated that this species is found in the spring and summer in Van Province. During our studies, unlike Taşçı (1989) this species was observed between November and March.

Kurtpınar (1954) gave the first record of *D. (S) niveus* from Turkey with Burdur specimens among ticks collected by provincial veterinary offices. Although Oytun (1947) reported that the species is unique to horse and very rare; Özkan (1978) obtained many examples from Erzurum and seven of other provinces. This tick was recorded here for the first time from Niğde. It was not very rare as Oytun (1947) reported, since it constituted 7.3% of the total number of samples.

Species of the genus *Haemaphysalis* were the most common ticks in our study area. It constituted 73.2% of the total number of samples, and five species in five subgenera were found on sheep in Niğde. Although Taşçı (1989) reported that *Haemaphysalis* species are found only in winter in the Van region, this study recorded it during the sampling period. Merdivenci (1969) stated that *H. concinna* could be found in all areas of Turkey, including Niğde; however, Bursalı *et al.* (2012) reported that its distributional ranges limited only to the Black Sea, Mediterranean, and Eastern Anatolia regions.

*H. parva* is distributed in India, Sri Lanka, and Iran, and it was redescribed by Hoogstraal and Trapido (1963) under the name of *H. intermedia*. The species was found in domestic animals in Çankırı, Samsun, Malatya and some eastern provinces (Güler *et al.* 1993). Another tick species, *H. otophila*, was reported in all climatic regions of Turkey (Merdivenci 1969). However, all of these records belonged to *H. parva*, because of *H. otophila* is considered to be the synonym of *H. parva* (cf. Hosseini-Chegeni *et al.* 2014). In addition, it was concluded that Mimioğlu (1954)'s records of *H. sulcata* from Niğde belonged to *H. parva* due to our comparisons.

*H. punctata* was recorded under *H. cinnaberina*

*punctata* in previous studies (Senevet 1937, Oytun 1947, Kurtpınar 1954, Mimioğlu 1954). According to Merdivenci (1969), this species is seen in all climatic regions of Turkey during the winter period. In the present study, it was found from the end of September to the mid-April. On the other hand, *H. sulcata* cited as *H. cholodkowski* in older studies (Oytun 1947, Kurtpınar 1954, Mimioğlu 1954), it is seen in all climatic regions of Turkey (Merdivenci 1969). This tick was the most common species in this study. Bursalı *et al.* (2012) has similar results and they stated that the most prevalent *Haemaphysalis* species in Anatolia were *H. parva*, *H. punctata* and *H. sulcata*.

*Rhipicephalus (Boophilus) annulatus* was recorded from Konya and Adana by Oytun (1947) as *Margaropus calcaratus*. Kurtpınar (1954) gave it under the name of *Boophilus calcaratus* and he reported that this tick was found mainly on cattle in many province of Turkey, including Niğde. Parrish (1961) separated samples of the genus *Boophilus* from Turkey into two species as *B. annulatus* and *B. calcaratus*. Özkan (1978) identified two form for the samples of *B. annulatus* collected on cattles from some provinces in Eastern Anatolian as the subspecies *B. a. annulatus* and *B. a. calcaratus*. In a comparison with the findings of Özkan (1978), it was concluded that our samples from Niğde can be included in the subspecies *B. a. annulatus* with respect to the setae, adanal plates and color of the scutum in males and the color of scutum, shapes of the poros areas and stigma in females. However, it was given here as *Rh. annulatus annulatus*, since Horak *et al.* (2002) included the genus *Boophilus* into the genus *Rhipicephalus*. Similarly, Guglielmone *et al.* (2010) classified the former genus *Boophilus* with five species as a subgenus under the genus *Rhipicephalus* with 82 spesces and also they noted that the genus *Boophilus* was still considered valid by some authors.

## Conclusion

Most studies on Turkey's tick fauna were



published before 1980. A significant number of publications related to ticks are made mostly in terms of veterinary medicine and diseases. However, during the 2002-2010 period, when the CCHF outbreak was intense, the orientation towards faunistic and systematic studies started again. According to the most recent data, 53 tick species are known in our country list. The number of species is likely to increase with the studies to be carried out. As in the present study, new studies are important for revealing existing species' distribution, at least when animal movements are more in this century.

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