

**ARTICLE****Determination and Prevalence of Ticks in Cattle in Konya Province of Turkey**

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**ABSTRACT**

Ticks are common in the world. Diseases caused by ticks and fleas bring significant economic losses to the livestock industry. With the pathogens they carry, Blood-fed ticks infect humans and domestic animals. This study was conducted between January 01 and August 30, 2018, in the Konya province of Turkey, to determine the prevalence and species of ticks in cattle. 272 pieces of cattle were examined in terms of tick infestations. These cattle were selected from herds of 16 different cattle breeders in 5 different regions of Konya. Ticks were collected by the simple random sampling method. Tick infestation was detected in 70 (25.7%) pieces of cattle that were examined during the study.

Tick infestation was followed in 68 (29.3%) pieces female cattle and 2 (5%) pieces male cattle. During the study conducted, the following results had been determined; according to age, 12 (14.5%) of ticks were juvenile, 58 (30.7%) of them were adults, according to the body condition, 26 (23.4%) of them were good, 35 (26.1%) of them were average and 9 (33.3%) of them were week.

It is found that cattle in the study area were infested in the tick species *Rhipicephalus (Boophilus) annulatus* 65/272 (23.9%) and *R. bursa* 5/272 (%1.8). 332 female and 304 male total of 636 ticks were collected from the cattle. Genders were determined under a stereomicroscope. The high tick infestation shows that fight against tick is a hard process, and planning is a must to reduce the tick burden in cattle. Besides, this study will enable us to make suggestions to the relevant sectors in terms of parasitic struggle in eliminating the health and economic problems caused by ticks in the Konya province by determining the prevalence and species.

**1. Introduction**

Cattle breeding is very important for the Turkish economy. Animal products are raw materials of food, leather, and textile industries. Konya province is one of Turkey's most important livestock hubs. In Turkey, there are 18 million cattle. In terms of meat and milk production and

cattle population, Konya covers 5% of the country's requirements<sup>[1]</sup>.

Ticks cause serious health problems and economic losses in cattle. Ticks can cause restlessness, low productivity, growth retardation, inability to gain weight, irritation, toxic-allergic reactions, anemia, and even death. The number

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of parasites, age of the host, feeding status, and climatic conditions determine the degree of parasite damage to the host [2-5]. It has been reported that ticks are the most common vectors for human and animal diseases worldwide after mosquitoes [6,7]. Along with the direct effects of ticks on animal production and productivity, they transmit more than 200 bacteria, viruses, protozoans, and rickettsia-borne diseases to humans and domestic animals [8].

It is stated that out of 896 tick species diagnosed worldwide, 702 of them are Ixodidae (hard ticks), 193 of them are Argasidae (soft ticks) and 1 is from the Nuttalliellidae family [9,10]. In Turkey, the Ixodidae family is common except *Anocenter* and *Amblyomma*. Common lineages are some species of *Hyalomma*, *Rhipicephalus*, *Haemaphysalis*, *Ixodes*, and *Dermacentor* [10]. In every development period, ticks suck blood [5,6], and they cause damage to the skin of hosts [11]. Without sucking blood, larvae can survive for two months, nymphs for one year, and adult ticks for three years. Depending on the species, ticks live between 6 months and 3 years. During the day, they hide in nooks and crannies, and the plaster crevices and cracks on the wall. Females lay 25-100 eggs at a time, 200-15,000 in total [6,8,11,12,13,14,15].

Single-hosted ticks (for example, *Rhipicephalus spp.*) stays on the same host during all development stages. Double-hosted ticks (for example, *Hyalomma spp.* and *R. bursa*) stays on one host during the larval and nymph stages then stay on another host during the adult stage. Triple-hosted ticks (for example, *D. marginatus*, *Ixodes ricinus* and *Haemaphysalis punctata*) stays on different hosts during three development stages [8].

Ticks can easily detect the host by tracking chemical substances such as ammonia emitted by the host, host vibrations, body temperature, and the carbon dioxide they exhale [8].

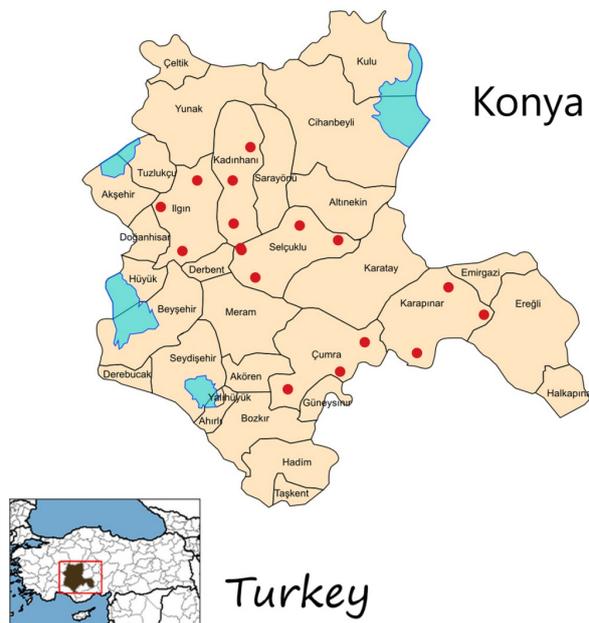
Ticks are common in our country and in different countries in the world. Ticks cause significant economic losses due to loss of yield, death, and treatment costs [16,17]. By determining the prevalence and types of ticks in the Konya province, this study will be beneficial to the relevant sectors and the public in terms of fighting against diseases and reducing economic losses.

## 2. Materials and Methods

### 2.1 Study Area

The study had been conducted in Turkey's largest city of Konya and its districts, within a total area of 40.838 sq km (Figure 1). Konya is located between 36°41' and 39°16' north latitudes, and between longitudes of 31°14' and 34°26' east. The elevation of Konya is 1016

meters above sea level. Konya is one of the important cities with a 926.217 cattle population [1].



**Figure 1.** Physical map of Konya (study area marked with red dots).

### 2.2 Study Period and Cattle

The study was conducted between January 1, 2018, and August 30, 2018. 272 cattle which were selected from the herds of 16 different cattle breeders and raised via traditional methods, were selected via the sampling method.

### 2.3 Determination of Sample Size

The required sample size was calculated according to the formula below [18].

$$n = \frac{(1.96)^2 P_{exp} (1 - P_{exp})}{(d)^2}$$

### 2.4 Sampling Methods

Simple random sampling method was used. The samples were inspected by randomly selected 272 cattle on farms that were told by the breeders that ticks were present without any ectoparasite control. Ticks found in cattle were collected. The age, sex and physical appearance of tick-infected cattle were noted during physical examination [19]. Cattle age was determined by checking the tooth structure [20].

### 2.5 Collection and Protection of Ticks

Cotton with 70% alcohol was pressed on ticks that were

detected by macroscopic examination of cattle to prevent mouth organelles to remain on the skin of the host. The ticks were collected by pincer on the skin and placed in vacuum tubes containing 70% alcohol. The species, gender, age, sample collection time, the general name of the parasite, the name of the cattle owner, and the sampling location were written on the collection tubes and labeled [4,6]. In our study, ticks were generally collected from the ear, mouth, neck, chest, back, inner and outer parts of the leg, lower chest, and tail.

### 2.6 Identification of Ticks

The tick samples were brought to Selçuk University Faculty of Veterinary Medicine, Department of Parasitology Laboratory. Ticks were made transparent in lactophenol and then fixed on a slide with Canada Balsam. With the help of identification tools in the relevant literature, ticks were examined under stereo microscopy and identified at the species level according to their morphological characteristics [2,3,6,12].

### 2.7 Data and Statistical Analysis

Data recorded in field studies evaluated by SPSS 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.) statistical package program. n and % are used to introduce the variables. Categorical data are relationships between the determinants of ectoparasite prevalence and prevalence percentage. Categorical data were analyzed by Fisher's Exact Test and Chi-Square test. For the significance level of the tests, p < 0.05 was accepted [21].

### 3. Results

272 cattle identified in the study areas were examined for tick presence. Tick prevalence was 25.74% (70/272) in cattle (Table 1). In terms of species two tick species, *R. (B.) annulatus* 23.90% (65/272) and *R. bursa* 1.84% (5/272) were identified (Table 1). 636 adult ticks (332 females and 304 males), were collected from the cattle

(Table 2).

**Table 1.** Tick distribution in the Konya province

External parasites	Cattle n=272	
	Number	%
<i>Rhipicephalus (Boophilus) annulatus</i>	65/172	23.9
<i>R. bursa</i>	5/272	1.8
Total	70/272	25.7
n: number of examined animals		

**Table 2.** Distribution of tick species collected in cattle in Konya province

External parasites	Gender			Total	
	Male n=304	Female n=332	Number of Ticks	%	
<i>R. annulatus</i>	286 94%	311 93.7%	597	93.9	
<i>R. bursa</i>	18 6%	21 6.3%	39	6.1	
Total	304	332	636	100	
n: number of collected ticks					

In terms of the gender of the host, *R. annulatus* was detected more in females (27.6%) than males (2.5%) (Table 3). In terms of age, *R. annulatus* was detected more than twice in adult cattle (29.1%) than juvenile (12%) (Table 3). In terms of the host body condition, it was determined as weak (33.3%), average (26.1%), and good (23.4%), respectively (Table 3).

*R. bursa* tick species were rarely detected in both male (2.5%) and female (1.7%) cattle. Tick infestation rates by age and body condition are demonstrated in the table (Table 3). In our study, the significance level of the distribution of ticks in cattle according to age, sex, and body condition was p < 0.05.

Out of 597 detected *R. annulatus* ticks 286 of them are male and 311 of them are female. Out of 36 detected *R. bursa* ticks 18 of them are male and 21 of them are female. No significant difference was found between the female and male numbers of the collected ticks (Table 2)

**Table 3.** Percentage distribution of tick species in cattle by sex, age and body condition, number of cases

External parasites	Gender		$\chi^2$ and P-value	Age		$\chi^2$ and P-value	Body Status			$\chi^2$ and P-value
	Male n=40	Female n=232		Juvenile n=83	Senior n=189		Good n=111	Average n=134	Weak n=27	
<i>R. annulatus</i>	1 2.5%	64 27.6%	5.701 and 0.017	10 12.1%	55 29.1%	1.981 and 0.159	25 22.5%	31 23.1%	9 33.3%	2.088 and 0.358
<i>R. bursa</i>	1 2.5%	4 1.7%		2 2.4%	3 1.6%		1 1%	4 3%	0	
Total	2 5%	68 29.3%		12 14.5%	58 30.7%		26 23.4%	35 26.1%	9 33.3%	
n: number of examined animals										

It was found that ticks cause redness, bleeding spots, and abscessed lesions on the skins of some cattle.

#### 4. Discussion

40-50% of the daily protein requirement of humans should be met from animal-based foods to have a balanced diet and adequate nutrition<sup>[1,22]</sup>. In many countries, animal production is one of the major driving forces of economic development. Besides, animal husbandry contributes to social and economic development and the formation of a healthy society, such as supporting a balanced and adequate diet, an incentive to exports, supplying raw materials to factories, reducing unemployment in production and service sectors<sup>[22]</sup>. Therefore, detection of ticks and effective fight against them will reduce economic losses and health problems.

There are many studies to detect ticks in cattle around the world and Turkey. This study finds out that, tick infestation was common (25.7%) in cattle. Different studies around the world reported (16-89.4%) general tick infestation in cattle<sup>[23-29]</sup>.

In Turkey, different researchers reported (9.5-48.9%) general tick infestation in cattle<sup>[18,19,31-36]</sup>. Our study shows that *R. annulatus* (23.9%) was the most common species. The rate of *R. bursa* is (1.8%).

In the studies conducted in different parts of the world, different types of ticks have been identified than those identified in our study. For example; *Hyalomma detritum* (84.3%)<sup>[37]</sup> is the most common species in Tunisia, *R. bursa* and *H. m. marginatum* are the most common species in the Macedonian region of Greece. *Boophilus annulatus*, *H. detritum scupense*, *R. turanicus*, *R. sanguineus*, *I. gibbosus*, *H. anatolicum excavatum*, *I. ricinus*, *D. marginatus*, *Hae. inermis*, *Hae. punctata*, and *Hae. sulcata* are other identified species<sup>[38]</sup>. *A. variegatum*, *H. m. marginatum*, *H. rufipes*, *H. truncatum*, *H. nitidum*, *R. annulatus*, *R. muhsamae*, *R. senegalensis*, *R. sulcatus*, *R. turanicus*, *B. annulatus*, and *B. geigy* are found species in the Republic of Guinea<sup>[39]</sup>. In Japan, notified tick species are *Hae. longicornis*, *A. testudinarium*, *B. microplus*, *Hae. flava*, *Hae. kitaokai*, *I. ovatus*, *I. persulcatus*<sup>[40]</sup>. *Hyalomma anatolicum anatolicum* and *H. a. marginatum* tick species are found in the Dohuk province of Iraq<sup>[41]</sup>.

Tick infestation in the Peshawar region of Pakistan is (20.4%) in cattle and detected species are *Boophilus* (43.4%), *Hyalomma* (36.7%), *Rhipicephalus* (16.9%), and *Amblyomma* (3.1%)<sup>[23]</sup>. This is similar to the general prevalence rate of ticks in our study (25.7%). Tick infestation in cattle in Iran is (57%), and detected ticks are *Rhipicephalus*, *Haemaphysalis* and *Dermacentor*, *Boophilus*, and *Ixodes* lineages<sup>[24]</sup>. *B. microplus* (40.7%)

was found in cattle in the Uttaranchal state of India<sup>[42]</sup>. *A. variegatum* (38.2%), *H. rufipes* (18.4%), *H. truncatum* (15.3%), *R. appendiculatus* (11.9%), *R. evertsi evertsi* (6.3%), *B. decoloratus* (5.6%), *R. praetextatus* (2.2%), *B. annulatus* (1.5%), *A. lepidum* (0.4%) and *R. sanguineus* (0.2%) were identified in cattle in South Sudan<sup>[43]</sup>. Study conducted in Gazipur Bhawal region of Bangladesh shows that (64.07%) of cattle hosts ticks. Reported ticks are *B. microplus* (45.63%), *R. sanguineus* (36.89%), *Haematopinus euysternus* (17.96%), *Hemaphysalis bispinosa* (16.50%) have been reported<sup>[25]</sup>. It was determined that tick infestation in studies conducted in Iran, India, Sudan, and Bangladesh was much higher than our study. *B. decoloratus* (45%), *A. coherence* (24.4%), *R. evertsi* (15.6%), and *A. variegatum* (15%) were collected from cattle in the Assosa region of Ethiopia<sup>[44]</sup>. Identified and reported ticks (89.4%) in the West Amhara region of Ethiopia in cattle are *A. variegatum* (49.2%), *B. decoloratus* (21.2%), *H. marginatum* (9.8%), *Hya. truncatum* (6.2%), *R. evertsi* (6.6%) and *R. pulchellus* (5.3%)<sup>[26]</sup>. Tick infestation in cattle in the Bench Maji region of southwestern Ethiopia is (16%), and identified types are *B. decoloratus* (8%), *Amblyomma variegatum* (4.7%), *A. coherens* (4.2%), *Haematopinus euysternus* (3.8%)<sup>[27]</sup>. In the Bishoftub region of Ethiopia, the infestation is (40.1%) in cattle, and reported tick species are *Amblyomma* (67.6%) and *Boophilus* (32%)<sup>[28]</sup>. It is reported that cattle in the Gondor region of Ethiopia are infested with *Boophilus* (6.81%), *Amblyomma* (2.92%), *Hyalomma* (5.84%), and *Rhipicephalus* (1.94%)<sup>[45]</sup>. Except for one, four separate studies conducted in Ethiopia, indicate that the general tick prevalence is higher than the rate in our study. Detected ticks in cattle in the Karakorum, Pakistan are (77.9%), and as species, *Hyalomma anatolicum* and *R. microplus* were identified<sup>[29]</sup>. According to a study in Punjab province of Pakistan detected ticks in cattle are (42.4%) and most of these are *H. anatolicum* (29%)<sup>[47]</sup>.

It is understood that the rate of tick infestation detected in two different studies conducted in Pakistan is two to three times higher than the rate indicated in our study. A study conducted in the Gazipur Bhawal region of Bangladesh, indicate that the prevalence was higher in the seniors, and females were more infested with ectoparasites than males, and the parasite infestation rate in cattle in the free rearing system was higher than in other cattle breeding system. All of these are similar to our study<sup>[25]</sup>.

Turkey also researched different regions to detect ticks in cattle and the commonly reported species are *Haemaphysalis*, *Hyalomma*, *Boophilus*, *Dermacentor*, *Rhipicephalus* and *Argas*<sup>[47]</sup>.

Tick infestation in the study conducted in Van City in

Turkey is (48.88%) and *H. excavatum*, *H. anatolicum*, and *Dermacentor* spp. are identified species<sup>[48]</sup>. According to our study, the prevalence is very high and the species are different. In the study conducted in Kayseri, tick infestation was (17%) and *R. turanicus*, *R. sanguineus*, *R. annulatus*, *R. bursa*, *H. anatolicum anatolicum*, *H. a. excavatum*, *H. detritum*, *Hae. sulcata*, *Hae. parva*, *D. marginatus*, and *O. lahorensis* are identified species<sup>[49]</sup>. The determined prevalence rate is close in our study, only two species *R. annulatus* and *R. bursa* are found similar. *Hae. parva* (33.8%), *B. annulatus* (21.1%), *H. marginatum* (19.7%), *Hae. concinna* (15.5%), *R. bursa* (7%) and *D. marginatus* (2.8%) were identified in the Sivas-Zara region in Turkey in cattle<sup>[50]</sup>. In our study, the two identified species are similar. Species of *Hyalomma*, *Rhipicephalus*, and *Haemaphysalis* in cattle (14-57%) have been reported in the study conducted in the Elazig province in Turkey<sup>[30]</sup>. Prevalence was similar in our study, and only *Rhipicephalus* was found as lineage. Tick infestation in cattle (29.9%) in the study in Malatya in Turkey and the surrounding area<sup>[31]</sup> is similar to our study. In the Burdur province, ticks in cattle are (21.8%), and reported species are *R. turanicus*, *R. annulatus*, *H. marginatum*, *Hae. parva*, *D. marginatus*<sup>[32]</sup>. The infestation was similar in our study, *R. annulatus* was similar to the species. A study conducted in Ankara City in Turkey indicates ticks are (19.16%) and identified species are *Hae. parva*, *Hae. punctata* and *Hae. sulcata*<sup>[33]</sup>. The infestation rate is close to our study, and different tick species are identified. In Aydın, Izmir and Manisa Cities of the western Aegean region of Turkey, reported species are *H. marginatum* (37.39%), *H. excavatum* (18.89%), *H. detritum* (13.68%), *H. anatolicum* (0.86%) and *H. rufipes* (% 0.07)<sup>[51]</sup>. These are completely different from the tick species identified in our study area. In the study conducted in Van and Ercis of Turkey, the infestation is (37.5%) in cattle and 12 tick species are identified<sup>[34]</sup>. The infestation rate and variety of species are very high compared to our study. In the Kütahya province of Turkey, ticks are found in (9.5%) of the cattle and the identified species is *R. annulatus*, *D. marginatus*, *Hae. parva*, *Hae. punctata*, *Hae. sulcata*, *H. marginatum*, *I. hexogonus*, *I. ricinus*, *R. bursa*, *R. sanguineus* and *R. turanicus*<sup>[35]</sup>. Prevalence is low but the number of species identified is very high compared to our study. In the Afyon City of Turkey, the infestation is (18.12%) in cattle, and reported species are *R. bursa*, *R. sanguineus*, *R. turanicus*, *H. marginatum*, *H. detritum*, *H. excavatum*, *D. marginatus*, *D. niveus* and *Hae. sulcata*<sup>[36]</sup>. The prevalence is similar in our study, as species with only similar identification is *R. bursa*. Another study reported that *R. bursa* is widespread in the Mediterranean and the Black Sea regions of Turkey<sup>[52]</sup>.

A study conducted in the year 1988 in the Konya province of Turkey reported *R. bursa*, *H. a. anatolicum*, *H. a. excavatum*, *H. detritum*, and *R. turanicus* species<sup>[53]</sup>. Compared to our study, *R. bursa* is the only similar species among five species belonging to the reported two lineages. In another study conducted in the year 2006 in the Konya province of Turkey, identified species are *R. bursa*, *R. turanicus*, *R. sanguineus*, *H. a. anatolicum*, *H. a. excavatum*, *H. m. marginatum*, *I. ricinus*, *D. marginatus*, *O. lahorensis* and *Hae. parva*<sup>[54]</sup>. One can say that identified species is very high compared to our study and the only concordance is seen for *R. bursa*.

Turkey is located in the subtropical climate zone. Since there is a variety between regions, diseases transmitted by ticks are seen in all regions.

*Rhipicephalus bursa*, *R. turanicus*, *R. sanguineus* and *R. (B) annulatus* is a significant number in Turkey. *R. bursa* completes the development process mostly in sheep, goats, cattle and horses. *R. (B) annulatus* is mostly seen in cattle, domestic ruminants such as sheep and goats.

As it is seen in other parts of Turkey, both *R. bursa* and *R. (B) annulatus* was determined in cattle in Konya. *Rhipicephalus bursa* species is a vector for *B. ovis*, *B. bigemina*, *B. bovis*, *B. caballi* and *T. ovis*, while *R. (B) annulatus* is a vector for *Babesia bigemina*, *B. bovis* and *Anaplasma marginale*. *R. sanguineus* is a vector of *B. canis*, *B. gibsoni*, *Ehrlichia canis*, *Rickettsia rickettsi* and *Hepatozoon canis*. *Rhipicephalus sanguineus* species is a vector of *B. canis*, *B. gibsoni*, *Ehrlichia canis*, *Rickettsia rickettsi* and *Hepatozoon canis*.

*I. ricinus* it is seen in the coastal regions of Turkey. It carries disease factors such as *Babesia bigemina*, *B. divergens*, *B. microti*, *Anaplasma phagocitophilum*, *Borrelia burgdorferi*, Tick borne encephalitis virus, louping-ill virus. *Ixodes ricinus* that are important vectors of terms in Turkey could not be identified in this study because it is not beachfront Konya region.

*Hyalomma spp.* has in every climate zone in Turkey significantly affect human and animal health. *H. anatolicum*, *H. detritum*, *H. excavatum*, *H. marginatum* and *H. aegyptium* is widely seen in Turkey, *Hyalomma spp.* has not been observed in cattle in this study. *H. marginatum* corresponds to Crimean-Congo Hemorrhagic Fever virus, *H. anatolicum* is the vector of *Theileria annulata* and *T. equi (B. equi)*.

*Haemaphysalis parva*, *Hae. punctata*, *Hae. sulcata* and *Hae. inermis* have been identified in Turkey, While *Haemaphysalis* species are more common in humid and temperate regions, Konya region has not been seen due to hot and dry summers and cold and rainy winters. *Haemaphysalis* species are vectors for *Anaplasma centrale*,

*Anaplasma marginale*, *B. bigemina* and *Theileria buffeli/orientalis*.

*Dermacentor marginatus*, *D. niveus* and *D. reticulatus* have seen in Turkey. These species are vectors for *Babesia caballi*, *T. equi* (*B. equi*) and *B. canis*. These species are not found in cattle in Konya region [7,8].

It is understood from studies that tick infestation is still at high levels in many parts of the world. It is considered that the prevalence of tick infestation is high in Turkey and the world because of drug resistance and inadequate parasite control. Climatic conditions in the research areas, precipitation, the feeding and sheltering conditions of the animals, and tick collection time interval could be effective in facing different tick species and variability of their prevalence. Besides, conducting the study before or after the parasite control may differ the results [15].

Although there is success about spicity diversity in external parasite control in the study areas *R. annulatus* is still widespread (23.9%). This important fact indicates that there are still things to do in tick control. The reason why some tick species are not observed in our research area could be the result of the transition to closed system (barn) animal husbandry and excessive ectoparasite control. However, this may bring into mind that tick species may also be seen in unexamined herds in the same region.

## 5. Conclusions

This research determines that tick infestation still threatens animals at high rates. The main reasons for these are; ticks hide in places where acaricides cannot reach, host selectivity of ticks, their ability to suck blood from every creature, their ability to survive for years even in adverse weather conditions, and the difficulties in their fight and control due to their resistance to acaricides. If even a small number survive after the pesticide application, many new tick infestations may occur thanks to their high reproductive ability. Besides, the fact that wild animals are effective in feeding and spreading ticks aggravates tick control and cause unsuccessful results. Thus, eradication of ticks is not fully possible [7,13].

Ticks attack the host only to feed and leave the host after feeding [4,5]. Therefore, these protection measurements should be taken; new animals entry into the herd should be controlled, the animals should be well fed and cared for, the animals should not be sheltered in closed areas for a long time, and the animals in the shelters should be ranged on sunny days [4,11].

To fight against the ticks and diseases caused by ticks, fighting methods based on species of ticks, their prevalence, hosts they prefer, their effects as vectors, the risk map about which hosts they use as reservoirs should be

determined [7]. It is important to prevent ticks from contact with animals in the prevention of zoonotic diseases transmitted by ticks. As a result, it is ensured that diseases transmitted by ticks do not pass to animals. Thus, it is ensured that zoonotic diseases are not transmitted from animals to humans. It is of great importance to provide personal protection in preventing the spread of these diseases.

As a result of the research, when the potentially harmful effects of ticks in terms of health and economy are evaluated, it will shed light on future studies as this is an up-to-date problem in the region.

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## Ethics Committee Approval

Selçuk University Faculty of Veterinary Medicine Experimental Animal Production and Research Center Ethics Committee was approved by decision number 2017/178 dated December 29, 2017.

## Authors Contribution

This research is designed and directed by U. Uslu. A. Küçükyağlıoğlu collected ectoparasites from the specified animals. Genre identification and statistical analysis are conducted by U. Uslu and A. Küçükyağlıoğlu. This article is prepared by A. Küçükyağlıoğlu.

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