

## Distribution of Tick Species Collected from Cattle, Sheep, and Goats in Iğdır Province, in the Eastern Anatolia Region of Türkiye

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### Abstract

Ticks are important vectors that pose a risk to both animal and human health because they parasitize by sucking blood and transmitting many pathogenic disease agents. Türkiye harbors a large number of tick species due to its location, geographical structure, climate, habitat richness, and animal diversity. This study was designed to investigate the frequency and seasonal distribution of tick species found in sheep, cattle, and goats in the center and districts of Iğdır. Bovine and ovine animals were examined for tick infestation between January and December 2024 in the center and districts of Iğdır. A total of 1,050 tick samples obtained from 1,483 animals were collected and transferred to tubes containing 70% ethyl alcohol. Subsequently, these samples were sent to the Parasitology Research Laboratory of the Faculty of Medicine at Van Yüzüncü Yıl University, where the species were identified based on their morphological characteristics using a stereo microscope, in accordance with the relevant literature. Of the ticks examined, 57.52% were female and 42.48% were male. The following tick species were detected: *Rhipicephalus turanicus* (33%), *Rhipicephalus bursa* (21.6%), *Hyalomma anatolicum anatolicum* (17.2%), *Hyalomma anatolicum excavatum* (20.2%), *Hyalomma scupense* (3.6%), *Ixodes ricinus* (0.7%), *Haemaphysalis sulcata* (1.5%), *Haemaphysalis punctata* (0.4%) and *Dermacentor niveus* (1.8%). Among these, ticks belonging to the *Rhipicephalus* genus (54.6%) were the most common. When the tick species detected in the study were evaluated, *Rhipicephalus* species were found to be most prevalent between May and July. Additionally, the detection of *Hyalomma* and *Rhipicephalus* tick species, which are known vectors of the Crimean-Congo Hemorrhagic Fever virus that poses a risk to human health, is important. We believe that this data will serve as a valuable reference for future studies to be conducted in this province.

**Keywords:** Cattle, Goats, Iğdır, Sheep, Tick.

## 1. Introduction

Ticks are obligate ectoparasites that feed on the blood of all vertebrates, particularly mammals and birds, and transmit various pathogens, including protozoa, viruses, bacteria, rickettsiae, and helminths. The protein-rich salivary secretions introduced into the host during blood feeding can cause severe toxicity, irritation, and allergic reactions. Ticks have a one-piece body and use their specialized mouthparts at the front to feed on blood. A large number of ticks on animals can lead to blood loss and decreased productivity. Additionally, secondary infections may develop from the wounds caused by tick bites (1-3).

The spread of tick species to various regions around the world, influenced by climatic and environmental factors, increases the transmission rate of disease agents to both humans and animals. Urban forests, picnic areas, and wetlands with large populations of wild animals play a significant role in maintaining tick populations. Additionally, dogs pose a risk to public health, particularly in endemic regions, as they have close contact with humans (4-6).

Türkiye provides optimal conditions for the survival and reproduction of ticks due to its climatic characteristics, vegetation, and geographical diversity. Worldwide, 823 tick species from the *Ixodidae* and *Argasidae* families have been reported, with those from the *Ixodidae* family being particularly important as vectors. Türkiye's natural conditions are favorable for ticks and several species belonging to the *Ixodidae* family, including *Hyalomma*, *Boophilus*, *Rhipicephalus*, *Haemaphysalis*, *Ixodes* and *Dermacentor* are frequently observed. Recent studies have identified the presence of 55 tick species in 8 genera from 2 families in Türkiye (7-9). It is reported that 32 tick species are found in Türkiye. Crimean-Congo Hemorrhagic Fever (CCHF) is a significant disease transmitted to humans and animals by ticks of the *Hyalomma* genus, which has spread to large regions worldwide. In addition, *Babesia* spp., *Francisella tularensis*, Powassan encephalitis virus, Kyasanur forest disease virus, Colorado tick fever virus, *Borrelia burgdorferi* sensu lato, *Anaplasma phagocytophilum*, *Ehrlichia chaffeensis* and *Rickettsia rickettsii* are other disease agents transmitted by ticks (3,10-12).

Iğdır is one of the provinces where agriculture and animal husbandry are widely practiced due to its vast meadow and pasture areas. Since the geography of Iğdır is predominantly flat, small cattle are more commonly preferred. According to 2023 TÜİK data, Iğdır ranks eighth in Türkiye and third in the Eastern Anatolia Region with 860,000 ovine animals. Parasitic infections lead to production losses in Iğdır, where livestock breeding, including sheep, cattle and goats, is intensive. Ticks, as ectoparasites, pose a significant risk to both human and animal health, especially in endemic areas. This study was designed to investigate the frequency and seasonal distribution of tick species found in sheep, cattle and goats in the center and districts of Iğdır (13,14).

## 2. Materials and Methods

This study was conducted on 1,050 tick samples collected from 857 sheep, 417 cattle and 209 goats between January and December 2024 in the center and districts of Iğdır. During the one-year study

period, Iğdır center and its districts were visited regularly each month and cattle, sheep and goats in the villages were examined for tick infestations. Information regarding the species of tick-infected animals was recorded. The samples were preserved in tubes containing 70% ethyl alcohol and transported to the Parasitology Research Laboratory of Van Yüzüncü Yıl University Faculty of Medicine. In ticks, the hypostome, which is embedded in the host's skin, is surrounded by pieces of the host's skin. Fine-tipped forceps and paintbrushes were used to remove both the secretion deposits and the remaining pieces of host skin. The ticks were then identified using keys for sex and species determination under a stereo microscope (15-17).

### 3. Statistical Analysis

The field data were evaluated using frequency, percentage distribution, and correlation analysis in the SPSS software program. The data obtained in this study were statistically analyzed using the MINITAB (Minitab Inc., PA, USA) program, and the Chi-Square Test ( $\chi^2$ ) (Two-Way Table in Worksheet) was applied for the analyses. In the statistical analysis, the chi-square test was used to determine whether different tick species varied in terms of the animal species from which they were collected, the rate of occurrence, the species and genera of the observed tick species, and the relationships between the seasons in which the ticks were found. Ethics committee approval was not required, as the study material consisted solely of ticks.

### 4. Results

In this study, conducted to investigate the species identification of ticks found in Iğdır province, the following species were detected: *Rhipicephalus turanicus* (33%), *Rhipicephalus bursa* (21.6%), *Hyalomma anatolicum anatolicum* (17.2%), *Hyalomma anatolicum excavatum* (20.2%), *Hyalomma scupense* (3.6%), *Ixodes ricinus* (0.7%), *Haemaphysalis sulcata* (1.5%), *Haemaphysalis punctata* (0.4%) and *Dermacentor niveus* (1.8%). *Rhipicephalus* spp. was detected at the highest rate (54.6%), while *Hyalomma* spp. accounted for 41%. Additionally, when these species were analyzed statistically by gender, a significant difference in the incidence rates was observed for *R. turanicus* ( $p = 0.001$ ), *R. bursa* ( $p = 0.018$ ) and *H. a. excavatum* ( $p = 0.001$ ) based on gender (Table 1; Figure 1).

Of the 1,483 animals examined in the study, 508 (34.2%) were found to be positive for tick infestation. The tick infestation rates were 279 (54.9%) in sheep, 171 (33.7%) in cattle, and 58 (11.4%) in goats. Of the 1,050 tick samples obtained from these animals, 604 (57.52%) were female and 446 (42.48%) were male. In this study, the highest tick infestation rate was observed in the center of Iğdır (41.5%), while the lowest rate was found in the Aralık district (25.1%). No significant difference was found when the density and distribution of tick species across districts were analyzed (Table 2; Table 3; Figure 2).

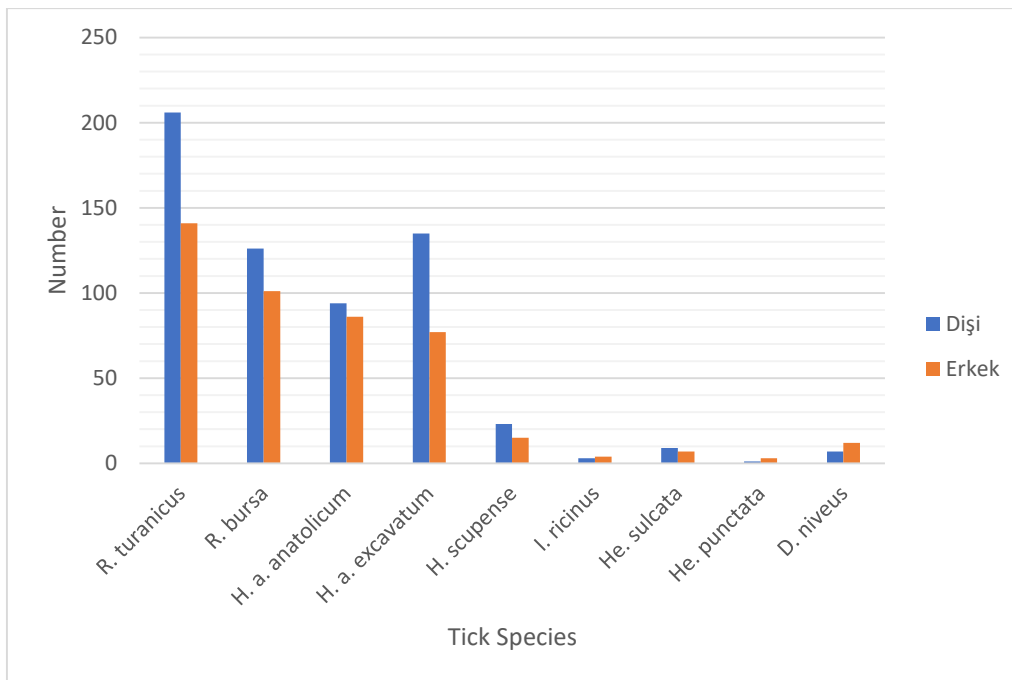
In this study, it was determined that the tick species detected in Iğdır province showed a significant increase during the summer months, when the average air temperature was high. The most

common tick species detected in this study were *Rhipicephalus* spp. from May to July and *Hyalomma* spp. from June to August. The majority of cases occurred between May and September, with 217 (42.71%) cases occurring in June, 144 (28.34%) in July, 69 (13.58%) in May and 23 (4.52%) in August. When the distribution of tick species by month was analyzed, a statistically significant difference was found in the frequencies of species observed in different months ( $p = 0.001$ ).

**Table 1.** Frequencies of tick species detected in Iğdır province and their distribution according to gender

Detected Tick Species	Number		Total		* <i>p.</i>
	Female	Male	Number	%	
<i>Rhipicephalus turanicus</i>	206	141	347	33	<b>0,001</b>
<i>Rhipicephalus bursa</i>	126	101	227	21.6	<b>0,018</b>
<i>Hyalomma anatolicum anatolicum</i>	94	86	180	17.2	0,399
<i>Hyalomma anatolicum excavatum</i>	135	77	212	20.2	<b>0,001</b>
<i>Hyalomma scupense</i>	23	15	38	3.6	0,060
<i>Ixodes ricinus</i>	3	4	7	0.7	0,995
<i>Haemaphysalis sulcata</i>	9	7	16	1.5	0,476
<i>Haemaphysalis punctata</i>	1	3	4	0.4	0,102
<i>Dermacentor niveus</i>	7	12	19	1.8	0,093
<b>Total</b>	<b>604</b>	<b>446</b>	<b>1050</b>	<b>100</b>	<b>0,001</b>

\*:  $p < 0.05$  indicates significant differences



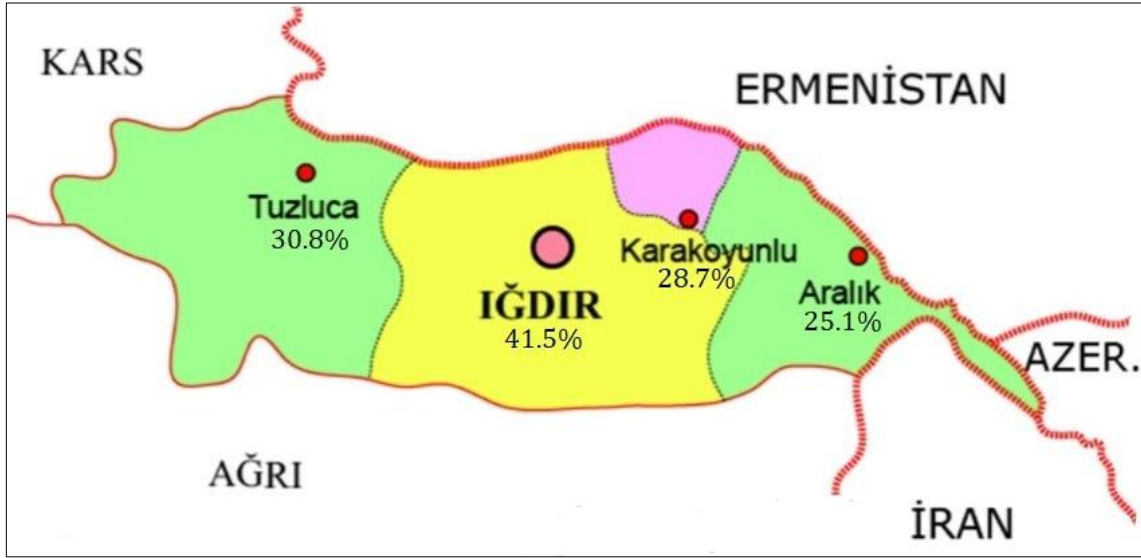
**Figure 1.** Distribution of ticks at the level of species and gender factors

**Table 2.** Distribution of tick infestation rates in sheep, cattle and goats

Type	Number of Animals with Ticks Detected	Tick Infestation Rate (%)
Sheep	279	54.9
Cattle	171	33.7
Goat	58	11.4
<b>Total</b>	<b>508</b>	<b>34.2</b>

**Table 3.** Distribution of tick infestation rates in Iğdır province and its districts

Provinces and districts	Number of Animals Inspected	Number of Animals with Ticks Detected	Tick Infestation Rate (%)	Number of Ticks Detected
Iğdır center	643	267	41.5	578
Aralık	175	44	25.1	96
Karakoyunlu	376	108	28.7	227
Tuzluca	289	89	30.8	149
<b>Total</b>	<b>1483</b>	<b>508</b>	<b>34.3</b>	<b>1050</b>

**Figure 2.** Distribution map of tick infestation rates by districts

#### 4. Discussion

Ticks are vectors that are known to have significant negative effects on both human and animal health. Iğdır province is one of the most important agricultural production areas in the Eastern Anatolia Region, with its economy largely based on agriculture. Approximately 41% of the province consists of meadows and pasturelands. In animal husbandry, sheep farming ranks first, followed by cattle breeding, with goats, cattle-buffaloes, and poultry also contributing. In Iğdır, where cattle and sheep farming is widespread, the occurrence of certain tick-borne diseases in animals results in productivity losses (6,14).

*Hyalomma* tick species are vectors for many pathogens, such as *Theileria* spp., *Babesia* spp., *Coxiella burnetii*, and *Anaplasma* spp. Twenty-seven species of the *Hyalomma* genus are known to be associated with the transmission of the Crimean-Congo Hemorrhagic Fever (CCHF) virus. Numerous studies conducted in Türkiye have determined the presence of several *Hyalomma* species. In line with these studies, *Hyalomma aegyptium*, *Hyalomma anatolicum*, *Hyalomma marginatum*, *Hyalomma excavatum*, *Hyalomma dromedarii*, *Hyalomma scupense*, *Hyalomma impeltatum*, *Hyalomma rufipes* and *Hyalomma turanicum* species have been reported in Türkiye (7,18-20). In this study, we identified the presence of *H. a. anatolicum*, *H. a. excavatum* and *H. scupense* species belonging to the *Hyalomma* genus in Iğdır province.

*Rhipicephalus* is one of the largest genera in the *Ixodidae* family, originally from Africa. Studies conducted in Türkiye have reported the presence of *R. bursa*, *R. sanguineus*, *R. turanicus* and *R. annulatus* species belonging to the genus *Rhipicephalus* (21-25). In this study, we identified the presence of *R. turanicus* and *R. bursa* species of the *Rhipicephalus* genus in Iğdır province.

Although it is known that very few livestock are affected by *Haemaphysalis* species worldwide, studies conducted in Türkiye have detected the presence of *Hae. concinna*, *Hae. punctata*, *Hae. sulcata*, *Hae. erinacei taurica* and *Hae. parva* species (21-23). In this study, we observed the presence of *Hae. sulcata* and *Hae. punctata* species in Iğdır province.

*Dermacentor* species ticks, known as three-host ticks, are typically found attached to the head and neck area and are most commonly observed in April and May. Studies conducted in Türkiye have reported the presence of *D. reticulatus*, *D. marginatus* and *D. niveus* species (7,8,26,27). In this study conducted in Iğdır province, we observed only *D. niveus*.

*Ixodes* ticks are vectors of pathogens such as *Borrelia*, *Anaplasma phagocytophilum* and *Babesia microti*. Lyme disease, caused by *Borrelia* and associated with encephalitis virus infections, is widely spread in Europe and is the primary disease transmitted by *Ixodes* ticks. This genus, which is found worldwide, consists of 261 species, with the number increasing as current studies continue. Species such as *Ixodes crenulatus*, *Ixodes eldaricus*, *Ixodes festai*, *Ixodes frontalis*, *Ixodes gibbosus*, *Ixodes hexagonus*, *Ixodes laguri*, *Ixodes redikorzevi*, *Ixodes ricinus* and *Ixodes vespertilionis* have been identified (7,8,13,19,20,27-29). In this study conducted in Iğdır province, we observed the presence of *I. ricinus* ticks.

In a study conducted on ticks in Ankara, 190 (41.5%) of the 458 ticks examined were identified as *Hyalomma*, 135 (29.5%) as *Haemaphysalis*, 105 (22.9%) as *Rhipicephalus*, 18 (3.9%) as *Dermacentor* and 10 (2.2%) as *Ixodes*. Among the tick species in this study conducted in Ankara, *Hyalomma* species were detected at the highest rate. However, in our study, species belonging to the genus *Rhipicephalus* were found to be more frequent (30).

In a study conducted in the center and Gevaş district of Van, 2,376 (61.71%) out of 3,850 cattle were infested with *R. bursa*, *R. sanguineus*, *R. turanicus*, *H. detritum*, *H. anatolicum*, *H. excavatum*, *Hae. parva* and *D. marginatus*, while 2,464 (63.53%) out of 3,878 sheep were infested with *R. bursa*, *R. sanguineus*, *R. turanicus*, *H. detritum*, *H. anatolicum*, *H. excavatum*, *Hae. parva* and *D. marginatus*. Additionally, *R. sanguineus*, *Hae. parva*, *D. marginatus*, *Ornithodoros lahorensis* and *D. marginatus* species found in Van were encountered for the first time in this study (31). The high detection rate of *Rhipicephalus* and *Hyalomma* tick species in this study conducted in Van is consistent with the findings of previous study (11,31).

In a study conducted on ticks in the provinces of Malatya, Adıyaman, Şanlıurfa, Mardin and Diyarbakır, tick infestation rates were 29.9%, 29.1% and 21.5% in cattle, sheep and goats, respectively. The species identified in cattle, sheep and goats in the study were *H. excavatum*, *H. detritum*, *H. anatolicum*, *Hae. parva*, *R. bursa*, *R. sanguineus* and *I. ricinus*. *R. annulatus* and *Hae. sulcata* were

observed in sheep and goats, *Hae. punctata* in sheep and *Rhipicephalus kohlsi* in goats. The findings from the studies conducted in these provinces indicate that the tick infestation rate in cattle and sheep is quite similar. In our study conducted in Iğdır province, we found that there was no significant proportional difference. Additionally, in the study by Güler et al. (1993), it was determined that the tick infestation rate in goats was higher than in our study (32).

In a study conducted in Kayseri province, 21.7% of cattle were infested with ticks. The species identified were *R. turanicus*, *R. bursa*, *R. sanguineus*, *H. marginatum*, *H. excavatum*, *H. anatolicum*, *D. niveus*, *R. annulatus* and *O. lahorensis*. In our study conducted in Iğdır province, the tick infestation rate in cattle was found to be higher than that in the study conducted in Kayseri. Furthermore, *R. sanguineus*, *H. marginatum*, *R. annulatus* and *O. lahorensis* tick species were not observed in our study (33).

The diseases carried by Ixodidae species, which exhibit seasonal activity, are observed between March and October in Türkiye. However, *Hyalomma* species, especially *H. detritum* and *H. a. anatolicum*, as well as *Boophilus annulatus*, are known to be present year-round due to their habitation in dwellings (34). In this study, *Rhipicephalus* spp. species were detected at the highest rate between May and July. When the seasonal activity of the tick species detected in the study was analyzed, tick attachment cases were found to be most prevalent between March and October. It was determined that 42.71% of tick attachment cases occurred in June, 28.34% in July, 13.58% in May and 4.52% in August. Additionally, the seasonal distribution of tick species in studies on cattle, sheep, and goats is rarely addressed. Since understanding the seasonal activity of ticks is crucial for developing strategies for their effective control, detailed studies covering all regions should be conducted and documented.

## 5. Conclusion

This study was conducted to determine the distribution of tick species collected from cattle, sheep, and goats in Iğdır province. The findings indicate that tick infestations in the region pose a significant threat to animal health and may lead to economic losses, particularly for producers involved in agriculture and animal husbandry. The detected tick species revealed that *Rhipicephalus* and *Hyalomma* genera are especially common in the region and it is important to note that these species could play a critical role in the transmission of zoonotic diseases such as Crimean-Congo Hemorrhagic Fever (CCHF). According to our findings, *H. anatolicum* was the most common tick species in July.

The results of our study revealed that tick populations increase significantly during the summer months. This suggests that warm weather conditions are favorable for ticks to multiply and attach to animals. Tick infestation rates, particularly in May and July, were found to peak. These findings serve as an important warning to animal owners and veterinary health professionals to enhance tick control measures and precautions during hot weather.

As a result, this study can be considered an important step in determining the distribution of tick species in the region and controlling tick-borne diseases. Early diagnosis of tick infestations in animals and the implementation of effective control methods are crucial for both animal health and public health.

In this regard, it is important to conduct regular screening and tick control programs, enhance productivity in animal breeding, and reduce disease risks.

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### **Conflict of interest statement**

The authors declare that there is no conflict of interests.

### **Ethical approval**

This study is not subject to approval by HADYEK, in accordance with Article 8(k) of the Regulation on the Working Procedures and Principles of Animal Experiment Ethics Committees. The data, information, and documents presented in this article were obtained in compliance with academic and ethical standards.

### **References**

1. Bürger HJ, Eckert J, Kutzer E, Körting W, Rommel M. Veterinärmedizinische Parasitologie. Stuttgart: Georg Thieme Verlag; 2006.
2. Mullen GR, Durden LA. Medical and veterinary entomology. New York: Academic Press; 2009.
3. Sonenshine DE, Roe RM. Biology of ticks. Volume 2. Oxford University Press; 2013.
4. Shimada Y, Beppu T, Inokuma H, Okuda M, Onishi T. *Ixodid* tick species recovered from domestic dogs in Japan. Med Vet Entomol. 2003;17(1):38-45.
5. Brites-Neto J, Duarte KMR, Martins TF. Tick-borne infections in human and animal populations worldwide. Vet World. 2015;8(3):301.
6. Zhao GP, Wang YX, Fan ZW, Ji Y, Liu MJ, Zhang WH, Fang LQ. Mapping ticks and tick-borne pathogens in China. Nat Commun. 2021;12(1):1075.
7. Bursali A, Keskin A, Tekin S. A review of the ticks (Acari: *Ixodida*) of Turkey: species diversity, hosts and geographical distribution. Exp Appl Acarol. 2012;(57):91-104.
8. Keskin A, Koprulu TK, Bursali A, Ozsemir AC, Erciyas-Yavuz K, Tekin S. First record of *Ixodes arboricola* (*Ixodida*: *Ixodidae*) from Turkey with presence of *Candidatus Rickettsia vini* (Rickettsiales: Rickettsiaceae). J Med Entomol. 2014;(51):864-867.
9. Orkun Ö, Karaer K. First record of the tick *Ixodes (Pholeoixodes) kaiseri* in Turkey. Exp Appl Acarol. 2018;(74):201-205.
10. Merdivenci A. Türkiye keneleri üzerine araştırmalar. Istanbul Cerrahpasa Tıp Fak Yayınları. 1969;pp. 1448-1443.

11. Akdemir C. Research on the detection and epidemiology of tick species (fam: *Ixodidae*) found in sheep in Van region. Doctoral Thesis, Van: Yüzüncü Yıl University. Institute of Health Sciences; 2001.
12. Aydın MF, Coşkun A. Tick-borne disease agents in humans and the current situation in Turkey. *J Adv Vet Bio Sci Tech*. 2019;4(1):26-32.
13. TurkStat. Turkish Statistical Institute. Animal numbers, December 2023-June 2024. Available at: <https://data.tuik.gov.tr/Bulten/Index?p=Hayvancilik-Istatistikleri-Haziran-2024-53811>.
14. InvestinIğdır. Iğdır Investment Support Office. Available at: <https://igdir.serka.gov.tr/sectorler/tarim-ve-hayvancilik>. Accessed September 27, 2024.
15. Estrada-Peña A, Bouattour A, Camicas JL, Walker AR. Ticks of domestic animals in the Mediterranean region. A guide to identification of species. Zaragoza: University of Zaragoza Press; 2004.
16. Apanaskevich DA, Filippova NA, Horak IG. The genus *Hyalomma* Koch, 1844. X. Redescription of all parasitic stages of H. (*Euhyalomma*) scupense Schulze, 1919 (H. detritum Schulze) (Acari: *Ixodidae*) and notes on its biology. *Folia Parasitol*. 2010;57(1):69-78.
17. Estrada-Peña A, Mihalca AD, Sprong H, Pfaffle MP, Petney TN. How to collect ticks and interpret these collections. In: *Ticks of Europe and North Africa*. Springer; 2017. p. 5-10. doi: 10.1007/978-3-319-63760-0\_2
18. Apanaskevich DA, Horak IG. The genus *Hyalomma* Koch, 1844: V. Re-evaluation of the taxonomic rank of taxa comprising the H. (*Euhyalomma*) marginatum Koch complex of species (Acari: *Ixodidae*) with re-description of all parasitic stages and notes on biology. *Int J Acarol*. 2008;(34):13-42.
19. Guglielmone AA, Robbins RG, Apanaskevich DA, Petney TN, Estrada-Peña A, Horak IG, et al. The *argasidae*, *ixodidae* and *nuttalliellidae* (Acari: *Ixodida*) of the world: a list of valid species names. *Zootaxa*. 2010;(2528):1-28.
20. Bakheit MA, Latif AA, Vatansever Z, Seitzer U, Ahmed J. The huge risks due to *Hyalomma* ticks arthropods as vectors of emerging diseases. Springer; 2012. p. 167-94.
21. Vatansever Z, Gargili A, Aysul NS, Sengoz G, Estrada-Peña A. Ticks biting humans in the urban area of Istanbul. *Parasitol Res*. 2008;(102):551-553.
22. Gargili A, Kar S, Yilmazer N, Ergonul O, Vatansever Z. Different abundances of human-biting ticks in two neighboring provinces in Turkey. *Kafkas Univ Vet Fak Derg*. 2011;(17):93-97.
23. Bursali A, Keskin A, Tekin S. Ticks (Acari: *Ixodida*) infesting humans in the provinces of Kelkit Valley, a Crimean-Congo hemorrhagic fever endemic region in Turkey. *Exp Appl Acarol*. 2013;(59):507-515.
24. Şababoğlu E, Ayan A, Oruç Kılınç Ö, Yılmaz AB, Tekindal MA, Akkaya H, Aslan Çelik B. Molecular detection of *Mycoplasma haemocanis* and *Candidatus Mycoplasma Haematoparvum* in

- Rhipicephalus sanguineus* tick species collected from dogs in Adana province of Turkey. Fresenius Environ Bull. 2021;(30896):6485-6489.
25. Aslan Çelik B, Çelik ÖY, Ayan A, Yılmaz AB, Oruç Kılınç Ö, Şababoğlu E, et al. Molecular investigation of some bacteria (*Coxiella burnetii*, *Mycoplasma haemocanis*, *Candidatus Mycoplasma haematoparvum*, *Wolbachia*) in *Rhipicephalus sanguineus* ticks in Siirt province, Turkey. Assiut Vet Med J. 2022;68(175):28-38.
  26. Durden LA, Beati L. Modern tick systematics. In: Sonenshine DE, Roe RM, editors. Biology of Ticks. Vol. 1, 2nd ed. Oxford University Press; 2014. p. 17-58.
  27. Kar S, Yılmaz N, Akyıldız G, Gargılı A. The human infesting ticks in the city of Istanbul and its vicinity with reference to a new species for Turkey. Syst Appl Acarol. 2017;(22):2245-2255.
  28. Orkun O, Karaer Z. Molecular characterization of *Babesia* species in wild animals and their ticks in Turkey. Infect Genet Evol. 2017;(55):8-13.
  29. Yılmaz AB. Academic developments in health sciences. Part IV, I:61. 2022.
  30. Yücesan B, Babür C, Sezen F, Nalbantoğlu S. Tick species infecting humans in Ankara: species diversity, host characteristics and geographical distribution. Turk Hij Den Biyol Derg. 2019;(76):3-14.
  31. Taşçı S. Relationships between tick species seen in cattle and sheep in Van region and blood parasites (Protozoon) carried by them. Ankara Univ Vet Fak Derg. 1989;36(1):53-63.
  32. Güler S, Özer E, Erdoğan SZ, Köroğlu E, Bektaş İ. Tick (*Ixodidea*) species found in cattle, sheep and goats in Malatya and some Southeastern Anatolian provinces. Doga Tr J Vet Anim Sci. 1993;(17):229-231.
  33. İca A, İnci A, Vatansever Z, Karaer Z. Status of tick infestation of cattle in the Kayseri region of Turkey. Parasitol Res. 2007;101(2):167-169.
  34. Gazıyağcı AN, Aydenizöz M. Keneler ve kenelerin taşıdığı bazı önemli hastalıklar. Türkiye Parazitoloji Dergisi. 2010;34(2):131-136.