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RESEARCH ARTICLE

Ticks (Acari: Ixodidae) infesting some wild animals and humans in Turkey: notes on a small collection

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ABSTRACT: In the present study, we collected a small number of tick specimens on some wild animals and humans in eleven different regions of Turkey, between November 2017 and October 2018. One hundred-eighty tick specimens were collected from 19 wild host animals (belonging to 10 different species) and humans. Ticks were identified as *Dermacentor marginatus* (4 nymphs), *Hyalomma* sp. (21 nymphs, 2 larvae), *Hyalomma aegyptium* (1 female), *Haemaphysalis inermis* (17 males, 25 females), *Ixodes redikorzevi* (1 female, 48 nymphs), *Ixodes ricinus* (7 males, 5 females, 1 nymph), *Ixodes laguri* (1 nymph), *Rhipicephalus bursa* (6 nymphs, 3 larvae), and *Rhipicephalus turanicus* (13 males, 25 females). To the best of our knowledge, *Ixodes redikorzevi* ticks were reported in the Marmara region, for the first time. Also, six new tick-host associations for Turkey were reported in the present study for the first time.

Keywords: Humans, wild animals, ticks, Turkey.

INTRODUCTION

Ticks (Acari: Ixodidae) are one of the best-known groups of blood-feeding ectoparasites of many kinds of terrestrial animals. Ticks have a major importance in medical and veterinary research not only because of their role of transmission of pathogenic agents to hosts but also cause blood loss and tick-induced paralysis. Turkish tick fauna is currently composed of 51 species, of which 43 were from the family Ixodidae and 8 from the family Argasidae (Bursali et al., 2012; Keskin et al., 2014; Kar et al., 2017; Keskin and Erciyas-Yavuz, 2018; Orkun and Karaer, 2018). The many of early studies that reported ticks on wild animals were based on individually or accidental reports in Turkey; however, in recent studies have been concentrate on tick-host relationships in Turkey (Keskin et al., 2013, 2016, 2018).

During our parasitological studies, we collected a small number of tick specimens from various wild animals and humans in different localities of Turkey. According to our knowledge, *Ixodes redikorzevi* Olenev ticks were reported in the Marmara region of Turkey, for the first time. Also, six new tick-host associations for Turkey were reported in the present study for the first time.

MATERIAL AND METHODS

The current study was conducted in 19 different localities of Turkey (Fig. 1). Between November 2017 and October 2018, ticks were collected from some wild animals which were captured by metal and plastic traps (Sherman and Economy Mammal Trip-Trap). In addition, some ticks were collected from road-killed wild animals. Ticks were manually removed from captured mammals and preserved in plastic tubes contained 70% ethanol. All live animals were immediately released to natural habitats. During the field work, some ticks were collected from humans (herdsmans and participants of the field work). Ticks were identified as morphological characters under the stereo microscope (SZ61, Olympus, Tokyo, Japan) using morphological keys or descriptions given by Özkan (1978) and Filippova (1977, 1997). All tick samples were deposited to tick collection at Tokat Gaziosmanpaşa University, Department of Biology for further studies. For the mammalian nomenclature, we followed Kryštufek and Vohralík (2001, 2009). Mammalian collection in the study has been conducted under the Ethical Principles in Animal Research which was approved by Ondokuz Mayıs University Animal Ethical Committee with the B.30.2.ODM.0.20.09.00-050.04-97 and B.30.2.ODM.0.20.09.00-050.04-09 ethical numbers.

RESULTS AND DISCUSSION

Identification of ticks infesting humans and wild animals is a fundamental step to the understanding the ecology of the ticks and their potential role as vectors of some zoonotic diseases (D'Amico et al., 2017). Tick species infesting humans have been investigated in detail in Turkey; however, the information about ticks infesting some wild animals is still very limited. In the current study, we performed an investigation on ticks infesting some wild animals in 19 different localities of Turkey; however ticks were found only in 11 different localities of Turkey (Fig. 1.) [Edirne (1), Demirköy/Kırklareli (2), Çilingöz National Park/İstanbul (3), Tekirdağ (4), Kapıdağ Peninsula/Balıkesir (5), Tavşan Mountain/Amasya (6), Sivas (7), Kars (8), Iğdır (9), Adana (10), Kahramanmaraş (11)]. In addition, we provided many new tick-host associations for Turkey.

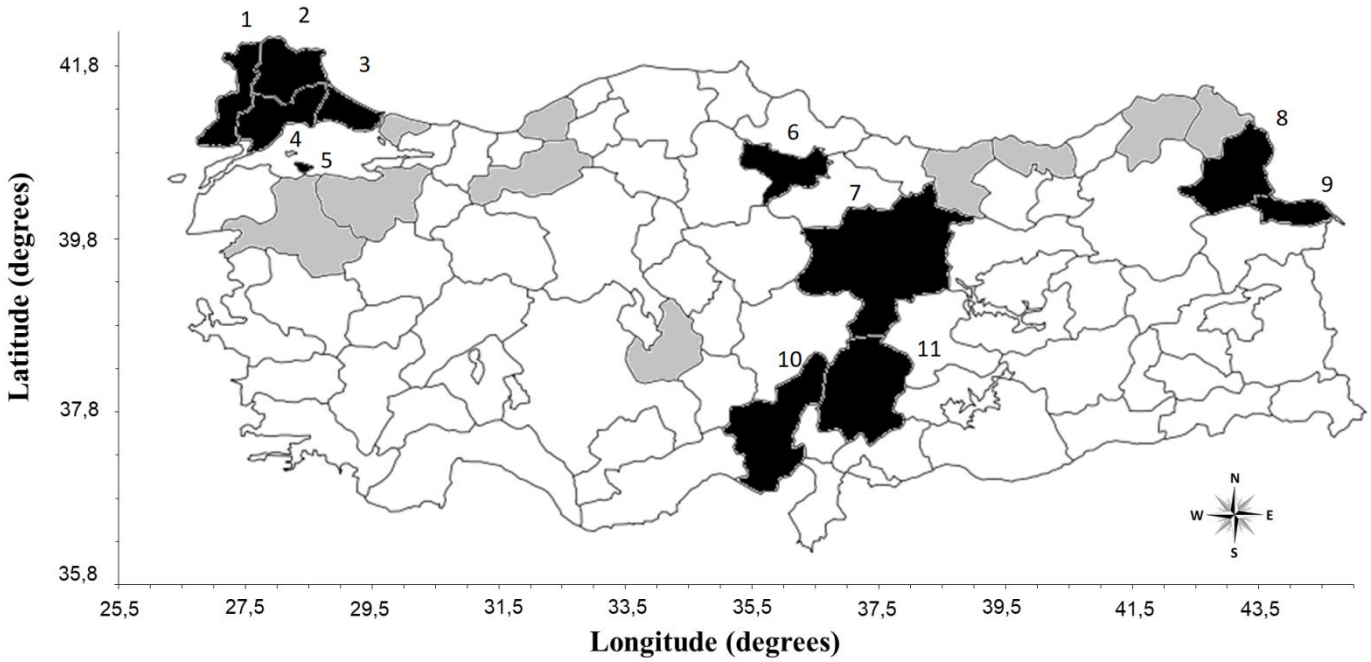

Figure 1. Map of the study area (gray + black). Geographical localities of ticks collected in the present study are marked black. **1.** Edirne, **2.** Demirköy (Kırklareli), **3.** Çilingöz National Park (İstanbul), **4.** Tekirdağ, **5.** Kapıdağ Peninsula (Balıkesir), **6.** Tavşan Mountain (Amasya), **7.** Sivas, **8.** Kars, **9.** Iğdır, **10.** Adana, **11.** Kahramanmaraş.

A total of 106 wild mammals (73 Rodentia, 29 Eulipotyphla 3 Carnivora and 1 Lagomorpha) were examined for the presence of tick infestation. A total 180 tick specimens were collected from 24 wild mammalian species which recorded as follows (total numbers of examined/numbers of infested in parentheses): from Rodentia: *Apodemus* sp. (3/1), *Apodemus agrarius* (Pallas) (1/0), *Apodemus flavicollis* (Melchior) (9/2), *Apodemus uralensis* (Pallas) (9/0), *Apodemus witherbyi* (Thomas) (18/1), *Chionomys nivalis* (Martins) (4/0), *Microtus guentheri* (Danford & Alston) (3/0), *Microtus levis* Miller (1/0), *Microtus arvalis* (Pallas) (3/0), *Microtus subterraneus* (de Selys-Longchamps) (4/1), *Mus domesticus* Schwarz & Schwarz (1/0), *Mus macedonicus* Petrov & Ruzic (6/0), *Myodes glareolus* (Schreber) (5/0), *Nannospalax leucodon* (Nordmann) (1/0), *Nannospalax xanthodon* (Nordmann) (3/0) and *Prometheomys schaposchnikowi* Satunin (2/0); from Eulipotyphla: *Crocidura suaveolens* (Pallas) (10/7), *Erinaceus concolor* Martin (1/1) *Erinaceus roumanicus* Barrett-Hamilton (3/2) *Neomys anomalus* Cabrera (1/0) and *Talpa levantis* Thomas (14/0); from Carnivora: *Vulpes vulpes* (L.) (2/2) and *Herpestes ichneumon* (L.) (1/1); from Lagomorpha *Lepus europaeus* Pallas (1/1). In addition, 56 tick specimens were collected from 11 humans.

Ticks were identified as *Dermacentor marginatus* (Sulzer), *Hyalomma* spp., *Hyalomma aegyptium* (L.), *Haemaphysalis inermis* Birula, *Ixodes redikorzevi* Olenev, *Ixodes ricinus* (L.), *Ixodes laguri* Olenev, *Rhipicephalus bursa* Canestrini & Fanzago, and *Rhipicephalus turanicus* Pomerantzev. With the current study, six new tick-host associations found for Turkey were listed in Table 1.

The most abundant tick species was determined as *I. redikorzevi* in this study. *I. redikorzevi* mainly infests on small mammals, birds, and some wild carnivores. It may transmit the Hazara virus (Begum et al., 1970) and *Francisella tularensis* (Kolonin, 2009) to humans. It also may cause toxicosis in humans (Kassis et al., 1997). *I. redikorzevi* has been reported on some small mammalian species in Turkey, namely *Apodemus flavicollis, Apodemus sylvaticus, Chionomys roberti, Cricetulus migratorius, Crocidura suaveolens, Erinaceus concolor, Microtus majori, Sorex raddei, Neomys fodiens, Talpa caucasica* and *Sorex volnuchini* (Nemenz, 1967; Keskin et al., 2017). With the current study, *I. redikorzevi* was reported on *Apodemus* sp. and *Microtus subterraneus* in Iğdır (locality 9) and Kapıdağ peninsula (locality 5).

H. inermis was the second abundant tick species found in this study. It is generally found in broad-leaf and mixed forests (Guglielmone et al., 2014). It is sparsely distributed and frequently well adapted to different biotopes. The presence of several zoonotic agents (such as tick-borne encephalitis virus, *Rickettsia aeschlimannii, R. helvetica* and *Babesia bigemina)* in *H. inermis* were reported in previously studies (Nosek et al., 1981; Garcia-Sanmartin et al., 2008; Portillo et al., 2008; Hornok et al., 2010). However, the vectorial capacity of *H. inermis* is still poorly known. In Turkey, this tick was reported on several domestic animals, foxes, and humans. In the current study, *H. inermis* was only collected on humans in localities 2, 3 and 5.

R. turanicus were found on five different hosts in the present study. It is one of the most common tick species on domestic animals and humans in Turkey. Also, there are some reports on hedgehogs and foxes in Turkey. Although the presence of some zoonotic agents, such as Crimean-Congo Hemorrhagic Virus (Tekin et al., 2012) and *Rickettsia aeschlimannii* (Orkun et al., 2014) in *R. turanicus* have been reported in Turkey, currently we have limited information about its accurate vectorial capacity. *R. turanicus* was reported on *E. roumanicus* (localities 1 and 4) and

Table 1. The hosts of tick species collected in this study.

Host/ticks	*Dermacentor marginatus*	*Hyalomma* spp.	*Hyalomma aegyptium*	*Haemaphysalis inermis*	*Ixodes redikorzevi*	*Ixodes ricinus*	*Ixodes laguri*	*Rhipicephalus bursa*	*Rhipicephalus turanicus*	*Total*
Apodemus flavicollis					1F					1
Apodemus sp.					1N					1
Apodemus witherbyi	4N*									4
Crocidura suaveolens					46N					46
Erinaceus roumanicus									6M, 16F*	22
Erinaceus concolor			1F						2F	3
Herpestes ichneumon									3M, 2F*	5
Homo sapiens				17M, 25F		7M, 5F, 1N			1M	56
Lepus europaeus		21N, 2L						6N, 3L*		32
Microtus subterraneus					1N*		1N*			2
Vulpes vulpes									3M, 5F	8
Total	**4**	**23**	**1**	**42**	**49**	**13**	**1**	**9**	**38**	**180**

* New tick–host association for Turkey.
L larva, *N* nymph, *F* female, *M* male.

H. ichneumon (locality 10) for the first time in Turkey with the present study. In addition, limited number of specimens of *R. turanicus* were found on *V. vulpes* and humans in Sivas (locality 7) and Kırklareli (locality 2) provinces.

I. ricinus was other abundant tick species found in this study. It plays an important role in the transmission of numerous pathogenic agents, such as *Borrelia burgdorferi* s.l., *Anaplasma phagocytophilum, Francisella tularensis, Rickettsia* spp., *Babesia* spp., and *Neoehrlichia mikurensis* (Medlock et al., 2013). It can infest on numerous hosts such as birds, reptiles and mammals including humans. In early studies, *Crocidura suaveolens, Felis catus* (L.), *Felis sylvestris* Schreber, *Rattus rattus* (L.), *E. concolor, Oryctolagus cuniculus* (L.), *L. europaeus, Allactaga williamsi* Thomas, *S. volnuchini, N. leucodon* and *M. domesticus* (as *Mus musculus* L.) were reported as small mammals hosts of *I. ricinus* in Turkey (Bursali et al., 2012; Keskin et al., 2017). In the current study, both adults and nymphs of *I. ricinus* ticks were found on humans in localities 2, 3 and 5.

I. laguri is one of the rarest tick species collected on small mammals in the current study. The main hosts of *I. laguri* are rodents (Guglielmone et al., 2014). In the current study, a nymph of *I. laguri* was found only a *Microtus subterraneus* (locality 5); that is a new host record for Turkey. The distribution and host association of *I. laguri* are poorly known in Turkey (Bursali et al., 2015; Keskin et al., 2015). To date, *I. laguri* has been reported in only seven localities from Turkey. However, we believe that information on distribution and host association of *I. laguri* will be increased with the further studies.

In the current study, the limited number of ticks belonging to *D. marginatus, H. aegyptium* and *R. bursa* were collected from some wild animals. *A. witherbyii* for *D. marginatus* (locality 8) and *L. europaeus* for *R. bursa* are new host records for Turkey. In addition, (n= 23) immature individuals of *Hyalomma* sp. were collected from *L. europaeus* (locality 6); however, they were only identified as the genus level. Single female *H. aegyptium* was collected from *E. concolor* in Kahramanmaraş province (locality 11).

Finally, a small collection of ticks infesting some wild animals and humans in Turkey were represented in this study. To our knowledge, some hosts reported in this study were documented first time in Turkey. Also, *I. redikorzevi* ticks were reported in the Marmara region, for the first time. We believe that the results of this study provide useful information for the further studies on ticks and tick-host association.

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REFERENCES

Begum, F., Wisseman, C.L. and Casals, J. 1970. Tick-borne viruses of West Pakistan: II. Hazara virus, a new agent isolated from *Ixodes redikorzevi* ticks from the Kaghan Valley. W. Pakistan. American Journal of Epidemiology, 92: 192-194.
doi: 10.1093/oxfordjournals.aje.a121197

Bursali, A., Keskin, A. and Tekin, S. 2012. A review of the ticks (Acari: Ixodida) of Turkey: Species diversity, hosts and geographical distribution. Experimental and Applied Acarology, 57: 91-104.
doi: 10.1007/s10493-012-9530-4

Bursali, A., Keskin, A., Şimşek, E., Keskin, A. and Tekin, S. 2015. A survey of ticks (Acari: Ixodida) infesting some wild animals from Sivas, Turkey. Experimental and Applied Acarology, 66: 293-299.
doi: 10.1007/s10493-015-9898-z

D'Amico, G., Dumitrache, M.O., Matei, I.A., Ionică, A.M., Gherman, C.M., Sándor, A.D., Modrý, D. and Mihalca, A.D. 2017. Ixodid ticks parasitizing wild carnivores in Romania. Experimental and Applied Acarology, 71: 139-149.
doi: 10.1007/s10493-017-0108-z

Filippova, N.A. 1977. Ixodid ticks (Ixodinae). Fauna USSR New Ser. 4 (4). Nauka, Moscow, Leningrad, 316 p.

Filippova, N.A. 1997. Ixodid ticks of subfamily Amblyomminae. Fauna of Russia and neighbouring countries, 4 (5), Nauka Publishing House, St. Petersburg, 436 p.

Garcia-Sanmartin, J., Barandika, J.F., Juste, R.A., Garcia-Perez, A.L. and Hurtado, A. 2008. Distribution and molecular detection of *Theileria* and *Babesia* in questing ticks from northern Spain. Medical and Veterinary Entomology, 2: 318-325.
doi: 10.1111/j.1365-2915.2008.00748.x

Guglielmone, A.A., Apanaskevich, D.A., Estrada-Peña, A., Robbins, R.G., Petney, T.N. and Horak, I.G. 2014. The hard ticks of the world: (Acari: Ixodida: Ixodidae). The Hard Ticks of the World: (Acari: Ixodida: Ixodidae). Springer, Dordrecht, 738 p.

Hornok, S., Meli, M.L., Perreten, A., Farkas, R., Willi, B., Beugnet, F., Lutz, H. and Hofmann-Lehmann, R. 2010. Molecular investigation of hard ticks (Acari: Ixodidae) and fleas (Siphonaptera: Pulicidae) as potential vectors of rickettsial and mycoplasmal agents. Veterinary Microbiology, 140: 98-104.
doi: 10.1016/j.vetmic.2009.07.013

Kassis, I., Offe-Uspensky, I., Uspensky, I. and Mumcuoglu, K.Y. 1997. Human toxicosis caused by the tick *Ixodes redikorzevi* in Israel. Israel Journal of Medical Sciences, 33: 760-761.

Kar, S., Yilmazer, N., Akyildiz, G. and Gargili, A. 2017. The human infesting ticks in the city of Istanbul and its vicinity with reference to a new species for Turkey. Systematic and Applied Acarology, 22 (12): 2245-2255.
doi: 10.11158/saa.22.12.14

Keskin, A., Bursali, A., Kumlutas, Y., Ilgaz, C. and Tekin, S. 2013. Parasitism of immature stages of *Haemaphysalis sulcata* (Acari: Ixodidae) on some reptiles in Turkey. Journal of Parasitology, 99: 752-755.
doi: 10.1645/13-187.1

Keskin, A., Kul-Koprulu, T., Bursali, A., Ozsemir, A.C., Erciyas-Yavuz, K. and Tekin, S. 2014. First record of *Ixodes arboricola* (Ixodida: Ixodidae) from Turkey with presence of '*Candidatus* Rickettsia vini' (Rickettsiales: Rickettsiaceae). Journal of Medical Entomology, 51: 864-867.
doi: 10.1603/ME13169

Keskin, A., Keskin, A., Bursali, A. and Tekin, S. 2015. Ticks (Acari: Ixodida) parasitizing humans in Corum and Yozgat provinces, Turkey. Experimental and Applied Acarology, 67: 607-616.
doi: 10.1007/s10493-015-9966-4

Keskin, A. and Erciyas-Yavuz, K. 2016. A preliminary investigation on ticks (Acari: Ixodidae) infesting birds in Kizilirmak Delta, Turkey. Journal of Medical Entomology, 53: 217-220.
doi: 10.1093/jme/tjv149

Keskin, A., Selçuk, A.Y. and Kefelioğlu, H. 2017. Ticks (Acari: Ixodidae) infesting some small mammals from Northern Turkey with new tick-host associations and locality records. Experimental and Applied Acarology, 73: 521-526.
doi: 10.1007/s10493-017-0182-2

Keskin, A. and Erciyas-Yavuz, K. 2018. Ticks (Acari: Ixodidae) parasitizing passerine birds in Turkey with new records and new tick-host associations. Journal of Medical Entomology. (in press)
doi: 10.1093/jme/tjy151

Kolonin, G.V. 2009. Fauna of Ixodid tick of the world (Acari, Ixodidae). Available http://www.kolonin.org (Last accessed: 24 January 2015).

Kryštufek, B. and Vohralík, V. 2001. Mammals of Turkey and Cyprus. Introduction, checklist, Insectivora. Knjiznica Annales Majora, Koper, 140 p.

Kryštufek, B. and Vohralik, V. 2009. Mammals of Turkey and Cyprus. Rodentia II: Cricetinae, Muridae, Spalacidae, Calomyscidae, Capromyidae, Hystricidae, Castoridae. Knjiznica Annales Majora, Koper, 372 p.

Medlock, J.M., Hansford, K.M., Bormane, A., Derdakova, M., Estrada-Peña, A., George, J.C., Golovljova, I., Jaenson, T.G.T., Jensen, J.K., Jensen, P.M. et al., 2013. Driving forces for changes in geographical distribution of *Ixodes ricinus* ticks in Europe. Parasites and Vectors, 6: 1.

doi: 10.1186/1756-3305-6-1

Nemenz, H. 1967. Zecken aus der Türkei (Acari, Ixodidae). Zoologischer Anzeiger, 178: 191-193.

Nosek, J., Kozuch, O. and Lysy, J. 1981. The survival of the tick-borne encephalitis (TBE) virus in nymphs of *Haemaphysalis inermis* tick and its transmission to pygmy mouse (*Micromys minutus*). Cahiers ORSTOM. Serie Entomologie Medicate et Parasitologie, 19: 67-69.

Orkun, O. and Karaer, K. 2018. First record of the tick *Ixodes* (*Pholeoixodes*) *kaiseri* in Turkey. Experimental and Applied Acarology, 74: 201-205.
doi: 10.1007/s10493-018-0219-1

Orkun, O., Karaer, Z., Çakmak, A. and Nalbantoğlu, S. 2014. Spotted fever group rickettsiae in ticks in Turkey. Ticks and Tick-borne Diseases, 5: 213-218.
doi: 10.1016/j.ttbdis.2012.11.018

Özkan, M. 1978. Erzurum ve çevre illeri kenelerinin sistematik yönden incelenmesi. Atatürk Üniversitesi yayınları, Erzurum, 116 p. [In Turkish]

Portillo, A., Santibáñez, P., Santibáñez, S., Pérez-Martínez, L. and Oteo, J.A. 2008. Detection of *Rickettsia* spp. in *Haemaphysalis* ticks collected in La Rioja, Spain. Vector-Borne and Zoonotic Diseases, 8: 653-658.
doi: 10.1089/vbz.2007.0272

Tekin, S., Bursali, A., Mutluay, N., Keskin, A. and Dundar, E. 2012. Crimean-Congo hemorrhagic fever virus in various ixodid tick species from a highly endemic area. Veterinary Parasitology, 186: 546-552.
doi: 10.1016/j.vetpar.2011.11.010

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