

# The species of ticks bites on human and their seasonal distribution in Ankara, Turkey

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**Summary:** Ticks (Acari: Ixodoidea) are among the most significant blood-sucking arthropods worldwide. In humans, they can cause severe toxic conditions such as paralyses, irritation and allergy. Besides these, they transmit a great variety of infectious diseases caused by viral, bacterial and protozoal agents, including Crimean-Congo hemorrhagic fever (CCHF) virus. This study was performed for evaluation of received 1562 samples from humans with the complaint of tick bite to National Parasitology Reference Laboratories between January 2011 and December 2013. Ticks were taken directly into 70% alcohol and have been identified under the stereo microscope. It was found that 1497 (95.84%) were ticks, 39 were (2.50%) artifacts such as scab and blood clots, 22 (1.41%) were different arthropods of non-medical importance, 3 were (0.19%) pubic lice (*Pthirus pubis*), 1 was (0.06%) bedbug (*Cimex lectularius*). The ticks were identified as follows: 322 *Rhipicephalus sanguineus* group, 241 *Haemaphysalis parva*, 188 *Hyalomma marginatum*, 175 *Hyalomma* spp. nymph, 138 *Rhipicephalus* spp. nymph, 109 *Rhipicephalus bursa*, 79 *Ixodes ricinus*, 68 *Dermacentor marginatus*, 59 *H. anatolicum*, 52 *H. detritum*, 17 *H. excavatum*, 9 *Haemaphysalis punctata*, 8 *Ixodes* spp. nymph, 1 *Haemaphysalis* spp. larva, 1 *Haemaphysalis* spp. nymph and 1 *Argas* spp. 29 ticks could not be identified, since they had morphological abnormalities or deficiencies. During January to December, tick bites were reported in all of the months. Most cases were occurred between April and September; 365 (24.38%) cases in June and 298 (19.91%) in July. In recent years, people have become more susceptible to infestations with ticks and other ectoparasites. So, it is concluded that informing the public about ticks, tick borne diseases and teaching them the ways to protect would be useful.

Key words: Ankara, human, tick, tick bite.

## Ankara'da insanlara tutunan kene türleri ve mevsimsel dağılımları

**Özet:** Keneler (Acari: Ixodoidea) dünyadaki en önemli kan emen artropodlar arasındadır. İnsanlarda felç, irritasyon ve allerji gibi ciddi toksik durumlara neden olabilirler. Bunların yanı sıra Kırım Kongo Kanamalı Ateşi (KKKA) virüsünün de dahil olduğu viral, bakteriyel ve protozoer etkenler tarafından oluşturulan birçok enfeksiyon hastalığını bulaştırırlar. Bu çalışma Ocak 2011 ve Aralık 2013 tarihleri arasında Ulusal Parazitoloji Referans Merkez Laboratuvarına kene tutunması şikayeti ile başvuran kişilerden elde edilen 1562 adet örneğin değerlendirilmesi için yapılmıştır. Keneler doğrudan %70'lik etil alkol içine alınmış ve stereomikroskop altında teşhis edilmiştir. Bunların 1497'si (%95,84) kene olup, 39'u (%2,50) artefakt (yara kabuğu, kan pıhtısı vb.), 22'si (%1,41) medikal önemi olmayan artropod, 3'ü (%0,19) kasık biti (*Pthirus pubis*) ve 1'i (%0,06) de tahtakurusu (*Cimex lectularius*) olarak bulunmuştur. Kenelerin 322'si *Rhipicephalus sanguineus*, 241'i *Haemaphysalis parva*, 188'i *Hyalomma marginatum*, 175'i *Hyalomma* spp. nimf, 138'i *Rhipicephalus* spp. nimf, 109'u *Rhipicephalus bursa*, 79'u *Ixodes ricinus*, 68'i *Dermacentor marginatus*, 59'u *H. anatolicum*, 52'si *H. detritum*, 17'si *H. excavatum*, 9'u *Haemaphysalis punctata*, 8'si *Ixodes* spp. nimf, 1'i *Haemaphysalis* spp. larva, 1'i *Haemaphysalis* spp. nimf ve 1'i *Argas* spp. olarak teşhis edilmiştir. Morfolojik bozukluğu veya eksikliği olan 29 kenenin ise tanımı yapılamamıştır. Ocak-Aralık arasında, tüm aylarda kene tutunması vakalarına rastlanmıştır. Olguların, 365'i (%24,38) Haziran ve 298'i Temmuz (%19,91) ayında olmak üzere çoğu Nisan-Eylül ayları arasında bildirilmiştir. Kırım Kongo Kanamalı Ateşi hastalığı nedeniyle insanlar son yıllarda kene ve diğer artropod enfestasyonlarına karşı daha duyarlı hale gelmişlerdir. Bu yüzden, keneler, bulaştırdıkları hastalıklar ve korunma yolları ile halkın bilgilendirmesinin doğru olacağı düşünülmektedir.

Anahtar sözcükler: Ankara, insan, kene, kene tutunması

## Introduction

Ticks (Acari: Ixodoidea) are the most significant ectoparasites which are obliged to suck blood from vertebrates during all of their periods of development. They are commonly found all around the world, especially tropical and subtropical regions (20). Tick

species can cause severe toxic conditions such as paralyses and toxicoses, irritation and allergy. In addition to the direct effects, they are currently considered to be second only to mosquitoes as vectors of human infectious diseases in the World (8, 19). There are 896 tick species in 3 families and approximately 10% of them

plays a role to transmit more than 200 pathogens including many zoonotic agents like bacteria, rickettsia, protozoan and virus (16, 21), therefore they can cause morbidity and mortality in humans and animals. To date, a total of 46 tick species have been identified throughout Turkey, which belong to two tick families, Argasidae and Ixodidae (5).

Crimean-Congo hemorrhagic fever virus (CCHF) has been observed in 30 countries in Asia, the Middle East, southeastern Europe, and Africa. The average case fatality rate between 2002 and 2007 was 7% (the range for this ratio is %4.5-6.2) in Turkey (29, 30). While *Hyalomma marginatum* appear to be the major vectors of CCHFV, also *Rhipicephalus turanicus*, *R. bursa*, *H. excavatum*, *H. anatolicum*, *H. detritum*, *Dermacentor marginatus*, and *Ixodes ricinus* ticks may play a role in existence and transmission of the virus in Turkey (1). Although most of ticks have specific host preference from various other hosts, there are 222 tick species sucking humans but only 33 of them prefer humans as a host (2, 11).

The present study was carried out to determine tick species biting on humans and their seasonal distribution in Ankara region of Turkey.

### Materials and Methods

Ankara is located at Central Anatolian plateau (39-56°N, 32-52°E), which is the capital and second most densely populated city in Turkey with a population over 4.5 million. The average altitude of Ankara is 900-1000 m above sea level, with a land area of 24.521 km<sup>2</sup>. In general continental climate is dominant but in the south steppe-desert climate is influential. Annual mean temperature is 11.9 °C, it is 0.4°C in January and 23.5°C in July. Rainfall occurs mostly during the spring and autumn. Average rainfall varies between 300 and 540 mm and humidity ratio is between 40 and 79% in different counties.

Tick samples were collected from people, who applied to the primary and secondary health institutions and applied directly to National Parasitology Reference Laboratories with a complaint of tick bite between January 2011 and December 2013. Sex of hosts, tick biting seasons and years were recorded. Ticks were taken directly from 70% alcohol and have been identified under the stereo microscope (Leica) using x10 magnification power. In the identification process, adult ticks were identified at the species level, while larvae and nymphs at the genus level using related taxonomic keys (10, 27). Also development stages and gender of species were recorded.

The frequency test was used to analyze tick biting frequency on sex, developmental stages, years, seasons and tick genera. The differences were considered

statistically significant when probability (P) value  $\leq 0.05$  is taken into consideration.

### Results

A total of 1562 samples were obtained from the human cases with a complaint of tick-bite. Of these, 1497 (95.84%) were ticks, 39 were (2.50%) artifacts such as scab and blood clots, 22 were (1.41%) different arthropods of non-medical importance, 3 (0.19%) pubic lice (*Phthirus pubis*) and 1 was (0.06%) bedbug (*Cimex lectularis*). Of 1497 tick species, 948 (63.33%) samples were collected from men and 549 (36.67%) from women ( $p=0.001$ )

Based on developmental stages and numbers, 1145 (78.00%) ticks were adult, 322 (21.93%) were nymph and 1 (0.07%) were larvae. There are distinctive differences between developmental stages and tick biting ( $p=0.001$ ).

Different numbers of ticks were recorded in each year, 490 in the first year, peak with 726 in the second year and the very low with 281 in the third year, which is the lowest number of cases of three years. The average number is 499 per year in 2011-2013. The statically analyses showed significant differences between the years ( $p=0.001$ ). Between January to December, in all months tick bites were reported. Most cases were occurred between April and September; 365 (24.38%) cases in June, 298 (19.91%) cases in July, 228 (15.23%) cases in May, 181 (12.09%) cases in August and 130 cases (8.68%) in April. There were significant differences between tick biting frequencies of seasons ( $p=0.001$ ). Infestations of *Hyalomma* genus was occurred mostly between June-August, with the peak in July. *Haemaphysalis* genus was predominantly recorded in April and May. *Ixodes* and *Rhipicephalus* genus were seen mostly between May and July with the peak in June, for both. *Dermacentor* genus was encountered in April-May and September-October. Distribution of tick genus based on months are given (Figure 1).

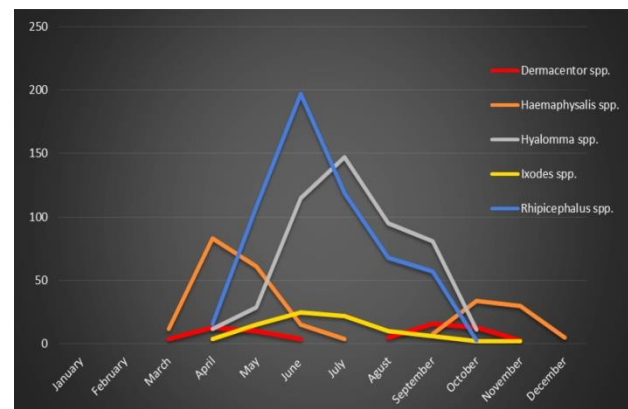


Figure 1. Seasonal distribution of tick genus.  
Şekil 1. Kene cinslerinin mevsimsel dağılımı.

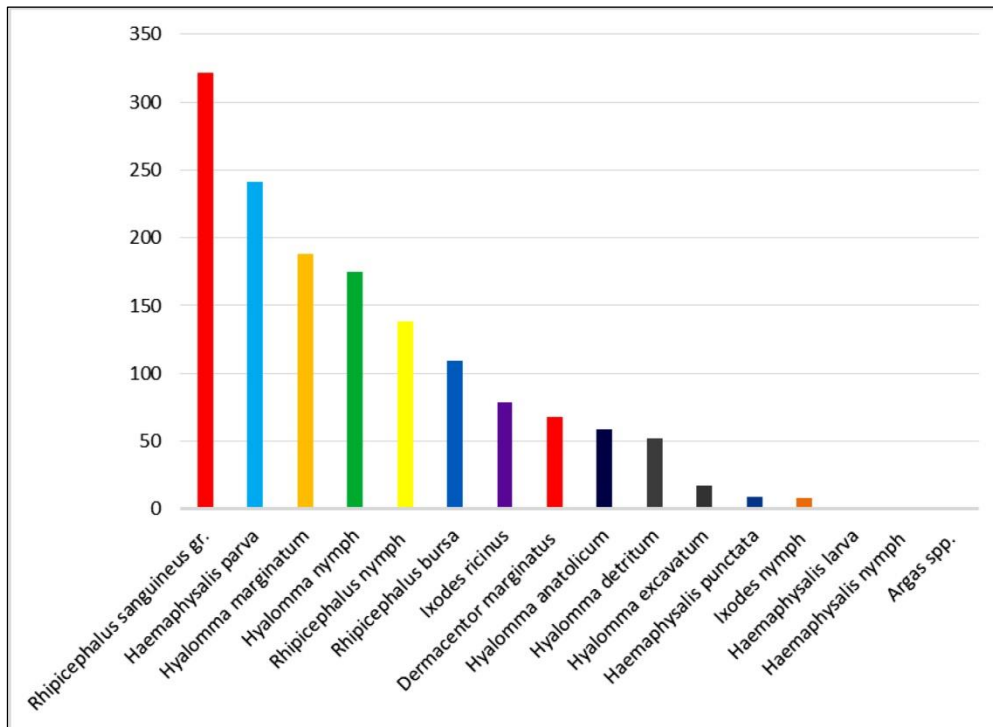


Figure 2. The distribution of ticks in species level.  
Şekil 2. Tür düzeyinde kenelerin dağılımı.

The ticks species were identified as follows: 322 *R. sanguineus* (21.51%), 241 *Haemaphysalis parva* (16.10%), 188 *Hyalomma marginatum* (12.56%), 175 *Hyalomma* spp. nymph (11.69%), 138 *Rhipicephalus* spp. nymph (9.22%), 109 *Rhipicephalus bursa* (7.28%), 79 *Ixodes ricinus* (5.28%), 68 *Dermacentor marginatus* (4.54%), 59 *H. anatolicum* (3.94%), 52 *H. detritum* (3.47%), 17 *H. excavatum* (1.13%), 9 *Haemaphysalis punctata* (0.60%), 8 *Ixodes* spp. nymph (0.53%), 1 *Haemaphysalis* spp. larva (0.07%), 1 *Haemaphysalis* spp. nymph (0.07%) and 1 *Argas* spp. (0.07%) and 29 (1.94%) ticks could not be identified, since they had morphological abnormalities or deficiencies (As shown in figure 2). Thus, the number of ticks with regard to genera was found as follows: 569 (38.76%) *Rhipicephalus*, 491 (33.45%) *Hyalomma*, 252 (17.16%) *Haemaphysalis*, 87 (5.93%) *Ixodes*, 68 (4.63%) *Dermacentor* and 1 (0.07%) *Argas* ( $p=0.001$ ).

### Discussion and Conclusion

Turkey's tick fauna contains about 46 species, which are integrated in two families and classified in ten genera (3). They transmit a greater variety of pathogenic microorganisms, protozoa, rickettsiae, spirochaetes and viruses in addition to CCHFV (25). Also they can maintain as the agent of diseases within their own populations by transstadial and transovarial transmission. Emerging tick-borne zoonotic diseases in the temperate

parts of the world poses an ever increasing public health risk (14, 24).

Because of CCHF incidence increased in recent years, people have become conscious about tick biting in Turkey. So, people are admitted to hospitals when an ectoparasite is seen on their body. Sometimes different materials has been detecting in tick-bite cases. In the present study, totally 1562 samples were accepted to our laboratories and of these, 39 (2.50%) cases were artifacts such as scab and blood clots, 22 (1.41%) cases were different arthropods of non-medical importance, 3 (0.19%) cases were pubic lice (*Phthirus pubis*) and 1 (0.06%) case was bedbug (*Cimex lectularius*). This is also evidence that people were not able to recognize and distinguish the ticks from other arthropods.

According to the developmental stages, most of the ticks had host preference but this situation is very low in immature stages (25). Many of studies in Turkey concluded that *Hyalomma* nymphs were primarily encountered and they had a specific human affinity. But in this study we found 21.87% of *Hyalomma* ticks at nymph stage.

In this study, different numbers of ticks were recorded in each year. Hereof, possibly weather conditions and environmental factors may affect the presence and abundance of tick species or patients' susceptibility changes about tick bites between the years (6). Different tick species prefer specific seasons or

months. They are especially abundant between late spring and early autumn throughout of Turkey. Most cases occurred between April and September, with the peak in June with 356 (24.25%) cases. It appears in the present study that tick bites occurred more frequently during the summer seasons when people spend more time in grasslands and picnic sites. This is in agreement with the previous observations (4, 12, 13, 18).

Tick species vary in each geographical region of Turkey depending on climate, vegetation, altitude, variety of some certain animals (3, 13, 15, 24). Previous studies showed that 38 tick species in the Ixodidae family are known to exist in Turkey. In the present study 10 ixodid tick species (*R. sanguineus*, *H. parva*, *H. marginatum*, *R. bursa*, *I. ricinus*, *D. marginatus*, *H. anatolicum*, *H. detritum*, *H. excavatum* and *Hae. punctata*) were identified on humans. But previous studies performed on humans in other regions of Turkey demonstrated that the presence of also different tick species like *H. aegyptium*, *H. dromedarii*, *H. scupense*, *H. rufipes*, *D. niveus*, *B. kohlsi*, *B. annulatus*, *H. inermis* and *Hae. sulcata* were recorded (4, 13, 17, 18, 22). Karaer et al. (18) conducted their research in the same area on humans and they also found *H. sulcata* and *H. aegyptium* but not *I. ricinus* species. Ixodes ticks are mostly seen in Northern Turkey and also in Marmara, Aegean, Mediterranean and East Anatolia regions. In this study we encountered 79 *Ixodes ricinus* and 8 *Ixodes* spp. nymphs. The reason for this can be explained as: maybe patients who applied to our laboratories came after travelling these areas. Previous studies in Turkey demonstrated that, mainly *Hyalomma* (19, 21, 22, 25, 26,28), *Rhipicephalus* (24) and *Ixodes* (19,27) genres are biting on humans. *Hyalomma* nymphs are most prevalent with 54.91% in Kocaeli (13), 64.71% in Aydın (4), 39.6% in Izmir (22) and 29.78% in Ankara (18). Some researchers identified the *Hyalomma* nymph species as *H. aegyptium* and the biting ratio was 68.54% in Thrace Province (Tekirdag, Kirikkale and Edirne) (12) and 52.19% in Istanbul (26). Also Karaer et al. (18) were incubated engorged 20 *Hyalomma* nymphs and all of them were identified as *H. aegyptium*. In other studies, different tick species were found, the most common species have found as follows: *Ixodes* nymph and larva (33.62%) in Istanbul (17), *H. anatolicum* (37.1%) in Sivas (9), *Rhipicephalus* nymph (42.3%) in Bursa (7) and *I. ricinus* (50.30%) in Sakarya (13). In this investigation, examination of ticks at species level indicated that *R. sanguineus* (n=322, 21.51%) was frequently found, is followed by *H. parva*, *H. marginatum* and *Hyalomma* nymphs. Variety of the species was not similar to the results of other studies performed on humans in Turkey. Activities of ticks are related with the temperature, humidity, altitude, rainfall and vegetation, so is normal to encounter different tick species in different parts of

country (13). But results of the study are also in disagreement with Karaer et al.'s, which was conducted in Ankara. They frequently encountered *H. aegyptium* nymphs, while we predominantly found *R. sanguineus* (21.51%). So these differences were not geographical. Karaer et al. (18) reported that *Rhipicephalus* species mostly bite humans in rural areas, whereas *Hyalomma* nymphs the most prevalent tick group biting humans in urban areas that is related to the habitat preferences of the tick species. The differences attributed may stem from the fact that patients are mostly received to health institutions and our laboratory from rural areas during research time.

The brown dog tick *R. sanguineus*, which is relatively host specific for dogs. It is the most widely distributed tick throughout the world temperate and tropical countries (28). In warmer areas it lives within the general environment; however, in the colder areas it is restricted to kennels or houses where the dogs live (23). This tick species occasionally found on humans, especially after intense contact with dogs.

The current study demonstrated that ticks biting on humans were mostly of the *Rhipicephalus* genus and *R. sanguineus* species. It is a potential transmitter of *Rickettsia conorii*, the pathogen causing Mediterranean spotted fever in humans (23).

Rapidly growing human population and global climate changes lead to increased level of risks of various diseases. Today tick borne diseases have a very high level of risk and their significance is increasing continually. Therefore ticks species and their distributions must be determined in each region. Taking into consideration the increased number of cases applied to our laboratory, it is concluded that informing the public about ticks, tick borne diseases and teaching them the ways of protection would be useful.

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