The Tick (Acari: Ixodida) Fauna of Forested Area of Beytepe Campus

Beytepe Kampüsü Ormanlık Alanının Kene (Acari: Ixodida) Faunası

Research Article

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ABSTRACT

Ticks (Acari: Ixodida) are bloodsucking ectoparasites that affect human and animal health worldwide. This study was carried out in forested area of Beytepe Campus at two sampling periods between November 2014-April 2015 and November 2015-April 2016. One hundred fifty four specimens belonging to four species were collected from host animals and from vegetation via flagging method and CO_2 baited trap. Ticks were identified as *Hyalomma aegyptium, Haemaphysalis parva, Rhipicephalus bursa* and *Rhipicephalus sanguineus* complex. *Haemaphysalis parva* (62.98%) was the most abundant tick species in both sampling periods. *Hyalomma aegyptium* ticks parasited mainly on tortoises. The highest number of ticks were collected in April (42.85%).

Key Words
Tick, Beytepe campus, Fauna, Ankara, Turkey

ÖZ

Keneler insan ve hayvan sağlığını etkileyen kan emen ektoparazitlerdir. Bu çalışma Beytepe kampüsü ormanlık alanında Kasım 2014-Nisan 2015 ve Kasım 2015-Nisan 2016 olarak iki periyotta gerçekleştirilmiştir. Konak hayvanlar üzerinden ve bayraklama ve CO_2 tuzaklama yöntemi kullanılarak vejetasyondan dört türe ait 154 kene toplanmıştır. Keneler *Hyalomma aegyptium, Haemaphysalis parva, Rhipicephalus bursa* and *Rhipicephalus sanguineus* complex türleri olarak teşhis edilmiştir. *Haemaphysalis parva* (62.98%) her iki örnekleme periyodunda da en bol bulunan kene türüdür. *Hyalomma aegyptium* kaplumbağalar üzerinden örneklenmiştir. En fazla sayıda kene nisan ayında (42.85%) toplanmıştır.

Anahtar Kelimeler
Kene, Beytepe kampüsü, Ankara, Türkiye.

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INTRODUCTION

Ticks (Acari: Ixodida) are obligatory blood sucking arthropods that play an importat role in public health due to their ability to transmit pathogens, including bacterial, rickettsial, parasitic and viral microorganisms [1-3].

The latest reports on tick systematics indicated that there are 896 tick species belonging to 3 different families: Ixodidae (hard ticks) 702 species belonging to 14 different genus, Argasidae (soft ticks) 193 species belonging to 5 different genus. Nuttalliellidae family is being represented with only one species, *Nuttalliella namaqua* (Bedford, 1931) [3-5]. The first study on tick fauna in Turkey was published in 2007 and 32 tick species were reported in this study. More recently 46 species were reported [6,7].

Most of the published tick studies in Turkey mainly focused on Crimean Congo Hemorrhagic Fever cases, which is the most important tick disease in many countries of Asia and Africa, and Turkey as well. The vectors of the disease are *Hyalomma,* (Koch, 1844) species*,* especially *Hyalomma marginatum* (Koch, 1844), play role in CCHF endemics [8-10]. In order to make assumptions about the epidemiology of the disease, informations on the presence, abundance and general ecology of the ticks under the effect of local microclimatic conditions are crucial. Most of the systematic studies in Turkey was undertaken to evaluate tick occurence on domestic livestocks or humans [11-16]. However, it should be kept in mind that comprehensive information on tick systematic and biology can be obtained by collecting ticks from vegetation, where ticks actively search their hosts. Most notably, different tick species prefer different hosts. Therefore, it is important to use different sampling methods for tick fauna and systematic studies.

This study was performed in Beytepe Campus in Ankara. The tick attachment complaints arose from the academic staff and students in the Campus, especially in spring. In a study conducted in Ankara, 9 tick species belonging to four different genera were reported [17]. In another study in the same area, Crimean Congo Hemorrhagic Fever virus had been detected from the specimens, which were collected from the villages of Kızılcahamam [18].

The aims of the present study are identifying the tick species in Beytepe Campus and discuss their vectorial importance, contributing to the literature of the tick fauna of Ankara and Central Anatolia Region, where the CCHF cases are highly prevalent, evaluating the differences between two consecutive sampling periods in terms of tick species and abundance, and informing the academic staff and students about those ticks that can be confronted in the campus area.

MATERIALS and METHODS

This study was performed at forested area of Beytepe Campus, Ankara, (39°87'E, 32°74'B), between November 2014-April 2015 and November 2015-April 2016 (Figure 1). The altitude of the study area is approximately 1000 m. The area has a semi-arid Mediterrannean climate and since the area is in the interior parts of Anatolian peninsula, continental climate effects are also seen. While July and August are the hottest months, January is the coldest month in the area. According to the long term climatic data of Ankara, mean annual temperature of the sampling area is 10°C and annual total precipitation is 415 mm (mean monthly precipitation is between 11-55 mm) [19].

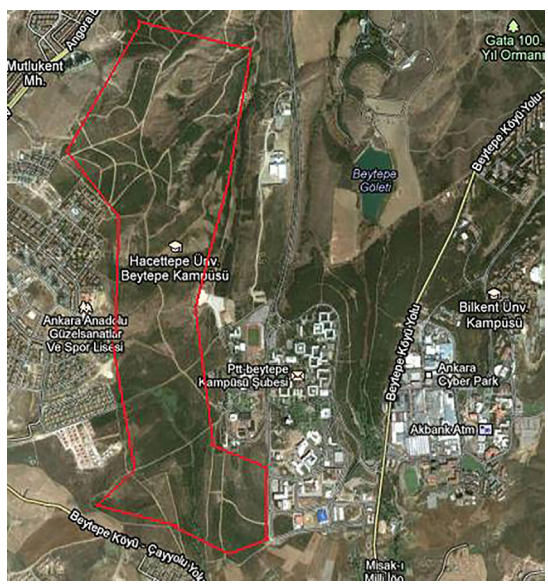

Figure 1. The field study area, Campus of Hacettepe University in Beytepe Village.

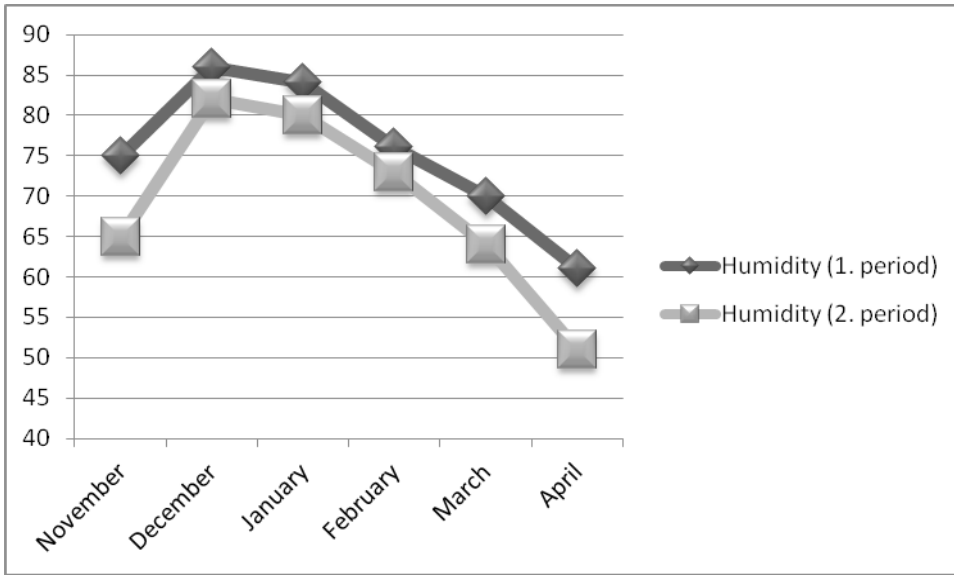

Figure 2. The comparison of the monthly average humidity of the two sampling periods.

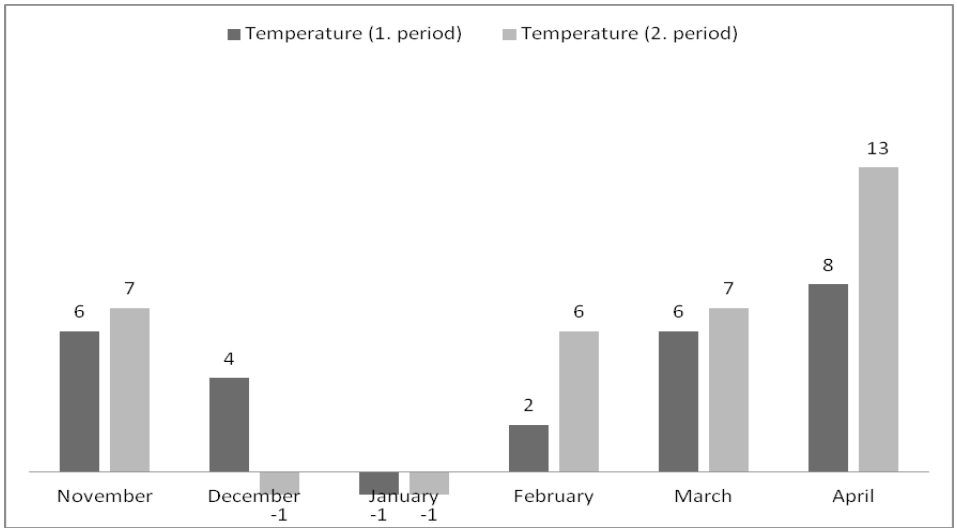

Figure 3. The comparison of the monthly average temperature of the two sampling periods.

The existance of *Apodemus flavicollis* (Melchior, 1834), *Mus macedonicus* (Petrov & Ruzic, 1983), *Rattus rattus* (Linnaeus, 1758) from Muridae; *Microtus guentheri* (Danford & Alston, 1880), *Microtus levis* (Miller, 1908) from Cricetidae, Rodentia and *Crocidura suaveolens* (Pallas, 1811) from Soricidae, Soricomorpha were demonstrated in the campus which are the important host species of immature stages of hard ticks [20]. In another faunistic study on Beytepe Village, 133 animal species; 3 amphibians, 7 reptiles, 92 birds and 11 mammals were reported [21]. These studies show that this region includes several possible host species that ticks can feed on. In the first sampling period, November 2014-April 2015, the temperature was between -1 and 8°C and the humidity was between 61-86% measured. In the second sampling period, November 2015 April 2016, the temperature varied between -1 and 13°C and the humidity was between 51-82% (Figure 2, 3).

In this study, three different tick sampling methods were used. Ticks were collected via flagging at approximately 1500 m transect [22,23] (Figure 4). In CO_2 baited trap, dry ice traps were placed and left

Figure 4. Flagging method and a *Rhipicephalus sangunieus* complex specimen, which was collected via this method.

a **b**

Figure 5. Dry ice trap (a) and a tick captured onto the trap (*Rhipicephalus sanguineus* complex) (b).

Figure 6. Sampling from the host (*Hyalomma aegyptium*).

to the field at 8 am and the collected at 8 pm when the tick activity is considered to be minimum [24] (Figure 5). The specimens of *Hyalomma* genus were collected directly from the host (tortoises) (Figure 6).

After the ticks were collected from each sampling area, they were placed into 50 ml falcon tubes. The tubes were labeled acccording to the date and smpling area. Temperature, humidity, altitude and coordinates of each sampling locality

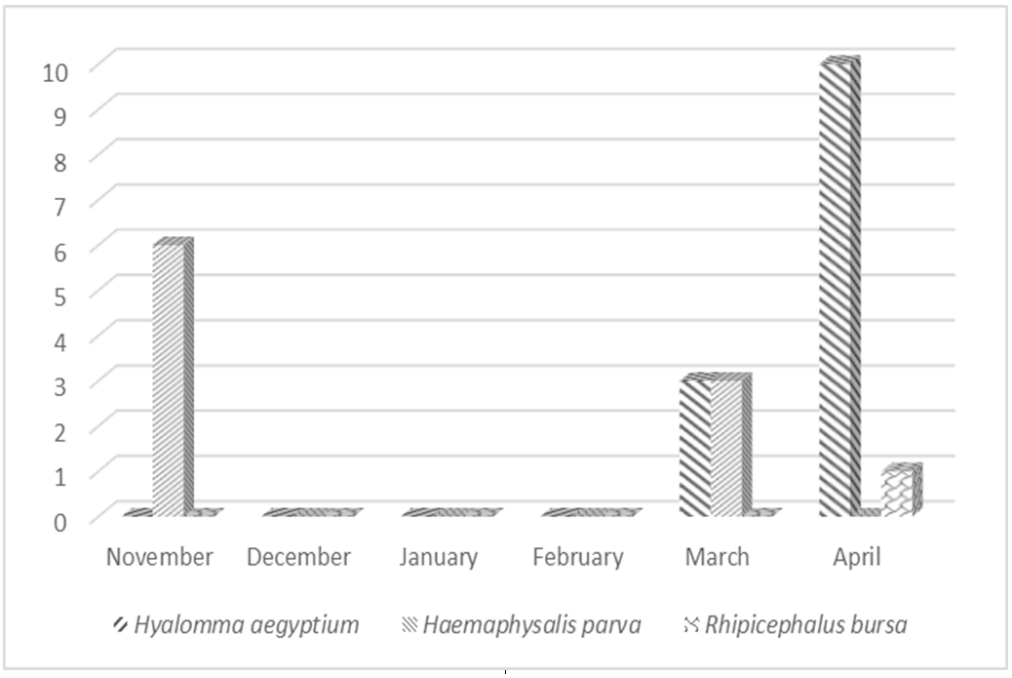

Figure 7. The distribution of the number of ticks by month between November 2014-April 2015.

were noted. The morphological identification was performed using a Leica MZ-7,5 steoroskopic 200M dissection microscope with a DC-300 digital camera system and identification keys [25-27]. The ticks were then classified in eppendorf tubes by species and sex and stored at -80°C.

RESULTS

This study was carried out in November 2014-April 2015 and November 2015-April 2016 in Beytepe Village of Ankara Province. Ticks were sampled using three different methods; flagging, CO2 baited trap and collecting from host animals (tortoises) (Table 1). Totally, 154 adult tick specimens were collected; 97 of those were identified as *Hae. parva*, 31 were *R. sanguineus* complex, 21 were *Hyalomma aegyptium* (Linnaeus, 1758) and 5 were *Rhipicephalus bursa* (Canestrini & Fanzago 1877). Most of the ticks were collected via flagging method (85.72%) (Table 1).

According to the periodically distribution, in the first sampling period, 23 ticks belonging to 3 different species were collected and the highest number of ticks, 11, were collected in April (47.82%) (Figure 7). In the second sampling period, 131 ticks belonging to 4 different species were collected and the highest number of ticks, 55, were collected in April (47.82%) (Figure 8).

DISCUSSION

The substantial increase in the number of the tick borne diseases in Turkey put a spotlight on ticks. The knowledge on the abundance and activity patterns of ticks, host preferences and seasonal activity is essential in order to develop effective control strategies against them.

With this regard, systematic studies in local areas are very important in order to collect information about the existence and abundance of the tick species and their ecological behaviour. In these studies, different sampling methods should be used instead of using only one sampling method since ticks have different strategies to find their hosts. In this study, *H. parva*, *R. sanguineus* complex and *R. bursa* were collected mostly using flagging method. These species have an ambush strategie (passive strategy) in which they crawl up the stems of grass and wait for their hosts pass by. *H. aegyptium* specimens were sampled directly from their spesific host (tortoises) since they use active host-finding strategie, these are called hunter ticks, in which ticks crawl or run towards their hosts. Such ticks may run many meters to attack and feed on animals staying nearby [28].

Table 1. The distribution of the percentages for the species according to the different sampling methods at the both study periods.

Genus	Species	Flagging (%)	CO_2 baited trap (%)	Host (Tortoises%)
Hyalomma	*H. aegyptium* Linneus, 1758	0	0	13.64
Rhipicephalus	*Rhipicephalus bursa* Canestrini & Fanzago, 1878	3.25	0	0
	Rhipicephalus sanguineus complex	19.48	0.64	0
Haemaphysalis	*Haemaphysalis parva* Neumann, 1897	62.99	0	0
Total		85.72	0.64	13.64

The field studies were conducted between November and April. The main reason behind prefering this was academicians and students benefit the campus area for scientific purposes or leisure time activities at most during these particular periods and the complaints on tick attachment cases mostly were recorded during those periods. Therefore, it became more important to detect the tick species in the campus and talk about their vectorial importance. The field studies were carried out three days a month. The abundance of ticks in the first and second sampling periods were 23 and 131 specimens, respectively. The variation in tick abundance at different time periods can be derived from a variety of factors such as microclimatic conditions, diversity and abundance of host species and habitat characterisation [29]. According to our results, in the first sampling period, the tick activity started later than the second period since the winter was cold and snowy so it might postpone the activity cycle of the ticks. In the second period, the winter was milder than the first period so the tick activity started earlier than the first period to find suitable hosts. Hence, adult ticks were collected in February both from the vegetation and from the tortoises. In April 2016, four species were collected and the total number of the samples were 55. The weather conditions of this month (average 13°C; humidity 51%), which are very suitable for both ticks and hosts.

In a systematic study carried out in Ankara between April 2010 and July 2012, 1800 tick specimens were collected from 31 different localities. Of these, the most abundant species were *R. sanguineus* complex (43.44%) and *R. bursa* (36.67%); the other species were reported

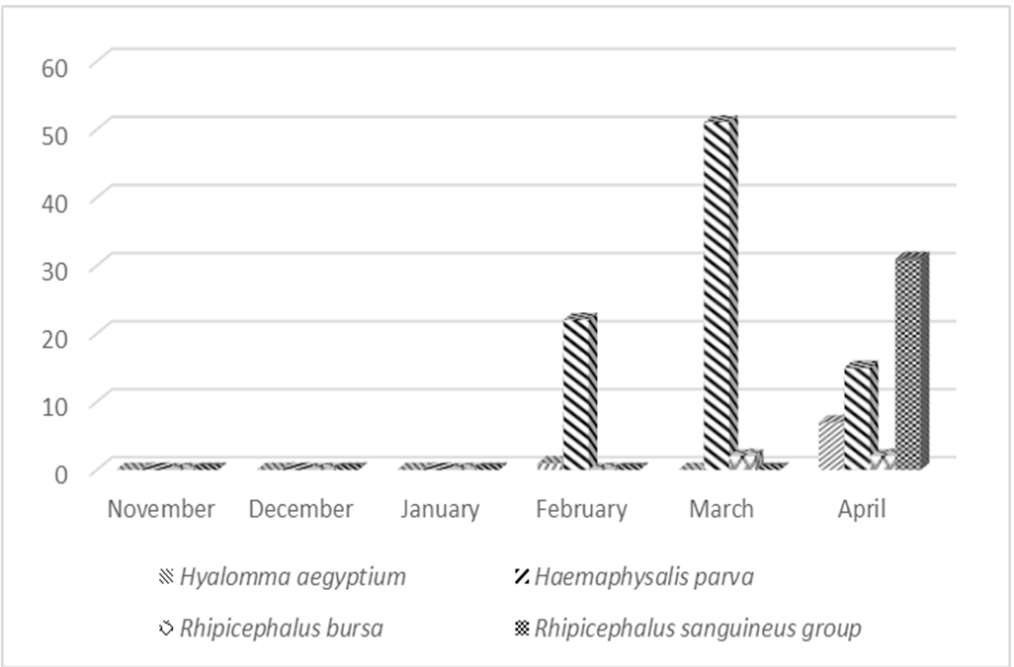

Figure 8. Seasonal abundance of ticks collected from November 2014 to April 2015 in Beytepe.

as *Hae. parva*, *Haemaphysalis punctata* (Canestrini and Fanzago, 1877), *Hyalomma marginatum*, *H. excavatum* (Koch, 1844), *H. aegyptium*, *H. detritum* (Schulze, 1919) and *Dermacentor marginatus* (Sulzer, 1776) [17]. *Hae. parva* was the most collected tick species in our study (62.98%). The main reason for the tick diversity between these two studies lies behind the different sampling periods. Our study period was more restricted than this study. Therefore we could not catch some tick activity periods.

Another study conducted on hospitalized people in Ankara, who had experienced tick attachment. In that study, ticks were identified as *Hyalomma aegyptium*, *H.excavatum*, *H. marginatum*, *H. anatolicum* (Koch, 1844), *H. detritum*, *D. marginatus*, *R. bursa*, *R. sanguineus, R. turanicus, Hae. punctata*, *Haemaphysalis sulcata* (Canestrini and Fanzago, 1878), *Hae. parva* [15]. In our study, residents of Beytepe Campus stated tick attachment but no specimen was provided for identification.

The other species that have been focused on tick fauna in Central Anatolia region were performed certain hosts. In a study, which was conducted in Kayseri between June 2000-November 2001, 1585 ticks were sampled from goats and *H. excavatum* (24.73%) has been reported as the most abundant species; *Rhipicephalus turanicus* (Pomerantzev, 1940), *R. bursa*, *R. sanguineus*, *Hyalomma marginatum, H. anatolicum*, *Dermacentor niveus*, *Boophilus annulatus* (Say, 1821) and *Ornithodoros lahorensis* (Neumann, 1908) were the other species that have been reported in this study [30]. Forty six tick specimens were collected from rodents in Çorum, of which were identified on genus level and *Ixodes* (Latreille, 1795) was reported to be the most abundant genus [31]. The difference of these studies from ours are different collecting periods in the year and collection from different hosts. Tortoises are the only hosts in our study. Thus, *H. aegyptium* specimens, which specifically prefer tortoises as hosts, were collected.

The most abundant tick species in our study was *Hae. parva*, with a rate of 62.99%. This species was collected mostly in April. *Hae. parva* transmits babesiosis. CCHF was scanned in samples that were collected in Ankara between April 2010- July 2010. *H. marginatum*, *R. bursa* and *Hae. parva pools* were positive [18]. Nevertheless, there is no study shown that *Hae. parva* is the vector of CCHF disease.

The genus *Hyalomma* Koch, 1844, distributed in Africa, southern Europe and Asia [8,32]. *H. aegyptium* occurs in the Mediterranean region and in the Middle East [26]. On tortoises, it is most frequently reported from *Testudo graeca* Linnaeus, 1758 [32-34]. *H. aegyptium* is the vector of theileriosis and tularemia [26]. *H. marginatum*, one of the most important tick species in Europa, Asia and Africa and the main vector of CCHF disease. This species has been recorded in many studies in Turkey [14-18,35] was not collected in our study. One potential reason for this discrepancy is this tick species can be collected from wild and domestic animals, but we didn't catch such kind of hosts in Beytepe village. Furthermore, *H. marginatum* is active mostly between March and November [26] but our study comprised between November and April in both sampling periods. Similarly, we didn't find *Ixodes ricinus* (Linnaeus 1758), the main vector of Lyme and tick borne encephalitis diseases in Europe. This is not a surprise, since this tick species prefers rainy and humid habitats and observed only forested parts of northern and nortwestern Anatolia, located by the coasts of the Black Sea and Marmara region [27,36].

Rhipicephalus is one of the most prevalent genus in Central Anatolia [15,17,18]. Using all sampling methods, we collected second mostly *Rhipicephalus* genus specimens. The *R. sanguineus* complex (Ixodidae) includes some of the most widely distributed tick species in the world. They are the vectors of *Rickettsia* species in humans and *Ehrlichia canis*, *Hepatozoon canis, Babesia vogeli* and *Anaplasma platys* in dogs [37-41]. *R. bursa* transmits babesiosis, theileriosis and ehrlichiosis [42,43].

When the diversity of vertebrates in Beytepe campus is considered, sampling from rodents and other mammalian species should be carried out with future studies. The main objective of our study was to inform the Beytepe campus

residents about the tick fauna, therefore the sampling periods were limited with the course periods of the university and the results of these periods are being represented with this study. The abundance and diversity of ticks can be truly evaluated after sampling the ticks throughout the year using all methods and collecting them from different hosts.

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