

*Full Length Research Paper*

# **An example of tick-Crimean Congo hemorrhagic fever (CCHF) in Eflani district, Karabuk, Turkey**

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**Ticks are the ectoparasites that threatening animal and human health. Their effects on human health have started to attract attention, especially after the 1980s. Ticks can be seen in many parts of the world. Ticks are active during certain periods; many tick species are active between spring and autumn months. Tick bites may not be noticed immediately; when it is noticed, it should be immediately removed. While the tick is being removed, it is necessary to comply with certain rules. In this study, tick cases in the world and Turkey were mentioned then numbers of tick cases in Karabuk were investigated. The aim of the study is to examine the number of recorded cases in Eflani (Karabuk). The aim of the study is to examine the number of recorded cases in Eflani. The case records of Karabuk provincial health directorate about Crimean Congo hemorrhagic fever (CCHF) were used in the research. At the end of the study, it was concluded that Eflani is the district that has more tick cases in the Province of Karabuk with its suitable geographical conditions to host ticks.**

**Key words:** Tick, Crimean Congo hemorrhagic fever (CCHF), Eflani, Karabuk, Turkey.

## **INTRODUCTION**

Ticks are among the vectors carrying disease to human and animals. Ticks that absorb blood can be found in nearly every region of the world. Ticks are among the factors of many diseases such as Crimean Congo hemorrhagic fever (CCHF), lyme, tick paralysis, brucellosis, plague, salmonellosis, listeriosis and babesiosis. Vector ticks movements increase in hot seasons. Ticks which are the sources of infection live in the wild life intertwined with oak forests, close to the mountain slopes or in forests, agricultural land, while others live close to places inhabited by humans and animals. Climate does not affect only the life of ticks, it also affects the multiplicity of host ecology, tick-borne diseases in some regions indirectly and the causes of the emergence and disappearance in other areas as well (Ahmed et al., 2007: 161-162).

Activity periods of ticks are seasonal because they need a certain temperature and moisture. Some ticks are located close to wooded areas. It is almost impossible to eliminate ticks completely. However, some measures can be taken to minimize the damages of ticks. Ticks must be removed as soon as it is noticed by paying attention to certain rules.

Crimean Congo hemorrhagic fever is seen in Africa, Asia, Southeast Europe areas in the world up to 50° North parallel. The prevalence of parasitic diseases including Turkey in terms of generation is an important geographical position. CCHF is generally seen in the areas like inside the valleys with a partial structure and including oaks and wildlife such as Coruh, Kelkit, Tozanli, Cekerek and Yesilirmak. The risk areas are mainly Corum, Yozgat, Sivas, Tokat, Amasya, Bayburt, Gumushane, Cankiri, Kastamonu, Karabuk, Erzincan and Erzurum Provinces and Black Sea and the Aegean regions, especially in the inner parts of Thrace, some parts of the Taurus Mountains and north of the Central Anatolia region (Uyar, 2008).

The Province of Karabuk is located in the Western Black Sea Department in the Black Sea Region of Turkey. Eflani District has been chosen as the subject in the province, because it has common tick cases and is a risky field (Figure 1).

CCHF is one of most important zoonotic because of its widespread geographical distribution; with its high mortality rate, it can be used as an agent of bioterrorism and its ecological diversity also causes infection of

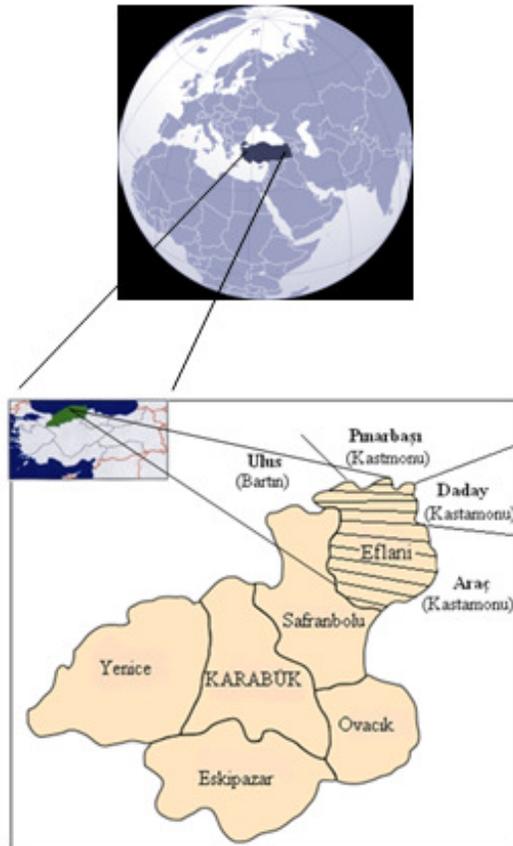


Figure 1. The location of the study area.

human to human.

## METHODS

Ticks whose names we heard about frequently threaten human health. In recent years, the number of people with diseases caused by ticks is increasing. This study covers the overall properties of ticks, Crimean Congo hemorrhagic fever (CCHF) disease in the world, and especially in Turkey; and over the years, the incidence of tick has developed in the Eflani district of Karabuk Province. The purpose of this study is to look at the increase of tick in Eflani district of Karabuk Province from a geographical point of view and investigate the effects of geographical factors on the inclination of tick cases. The recorded number of tick cases was taken from Karabuk Province Health Directorate.

The study has a descriptive survey nature, arranged as follows: Ticks and their living areas; climate change and tick; Crimean Congo hemorrhagic fever; ticks in the world and Turkey and ticks at Eflani District of Karabuk; result and discussion with recommendations.

### Ticks and their living areas

Ticks are the ectoparasites that can be found all over the world mainly in tropical and subtropical belt which either suck blood or act as vector of several diseases, threatening animals and people (Aydın, 2008). There are 899 types of ticks that affect vertebrates in

the world. 185 of them depend on Argasidae, 713 Ixodes and 1 of them Nuttalliellidae race (Nuhoglu et al., 2008). In ecological sense, ticks can be analyzed in two main groups as; nidicolous (residential ticks) and nonnidicolous (living in open areas, pasture ticks). The activity of pasture ticks are determined by the seasons, so their seasonal activities and the diseases are seasonal as well. These ticks search for suitable areas or stop their activities in relation with the soil surface temperature or day length. For the survival of ticks, absorption of blood is required. But temperature and humidity are important for the search of suitable places for living. Ticks indicate a slow development stage in case they cannot find suitable conditions and move in a minimum level. Ixodes species are relatively more sensitive to thirst, and therefore prefer forested areas with high humidity, whereas *Hyalomma* species which are the most resistant species without water and therefore show a prevalence of steppe and desert areas (Vatansever, 2008).

*Hyalomma* types of ticks that cause CCHF mostly complete their development and life cycle in two hosts. Ticks live in meadow areas, rich with forest vegetation and in areas with high wild life, a temperate climate and high humidity locations (Karaer et al., 1997). The larvae and nymphs of ticks are hosted at small vertebrates (rabbits, birds, mice, etc) and adults at the major vertebrate animals (sheep, goats, cattle, horses, wild ruminants, human, etc.).

Ticks which are the sources of infection, survive in wild life intertwined with the communities close to oak forest areas or near the open grassy areas, small pieces of agricultural lands through the forests, vineyards, gardens and wooden houses. The risk of this disease is almost negligible in cities, the coastal areas and in plains that do not contain wild animals. Investigating the biotic (host, especially wild animals) and abiotic (climatic, environmental, socio-economic) factors affecting the spread of the disease is necessary in terms of controlling of the disease (Gargılı, 2009).

The tick is noticed too late because tick bites are usually painless; ticks should be removed as soon as it is noticed in the body. When removing ticks, it is crucial to be careful; it should not be removed, pressed and crushed with bare hands; acetone, cologne and such substances should not be used over it and the tick should not be curled, folded or burnt. Tick gloves should be worn primarily in drawing, without spilling something, pulled up without turning it to the right, or left and removed; after removing the tick area, it should be washed with warm soapy water, and then stored in a glass tube or jar (Kelly, 2008).

### Climate change and ticks

Climate change is one of the factors that increase the incidence of tick-borne diseases and facilitates the increase of the number of ticks. For example, *Hyalomma marginatum*, are activated in the northern hemisphere in spring months with increasing temperature. Ixodid ticks are usually active in spring, summer and autumn (Fritzsche, 2002). In the winter, they remain still under the soil or under the cracks and crevices of an animal shelter (Aktas, 2008). Global climate changes may influence the emergence and reemergence of diseases (Hartelt et al., 2008). Summer temperatures increase the activity of the ticks, carries the diseases to the end of autumn and the beginning of spring (in some places due to the increase of temperature with global warming, ticks can reach higher levels. For example, the average temperature from 1960 to 2005 on Mount Krkono increased by 1.4°C). This means that it could carry disease from 800 to 1100 m elevation. Indeed, the incidence of tick-borne diseases all over Europe increased by 400% from 1974 to 2003 (Susse et al., 2008)

Air humidity and temperature are also important for the ticks. The places with humidity greater than 85%, the air temperature > 6 to 7°C and the presence of blood for the hosts are appropriate for ticks (Susse et al., 2008). The temperature goes over a certain level; increases the development of the ticks' cycle, prolongs the

duration, increases the egg production and cause shifts in the risk areas.

The population of ticks in an area can be kept to a minimum level and a certain number. Finishing ticks in a region is considered impossible in terms of transitory hosts and geographic features (Aydin, 2008). Already, climate change is not possible to explain the increase in tick-borne diseases alone. Environmental changes (the evacuation of agricultural land due to the war; discharged military personnel to regions or groups to a new placement; the large-scale collectivization, the natural tissue changes; floods and flood control areas; such as conversion of agricultural areas) and the effects of hosts are influential. But the climate can be said to be effective over the vectors since it is determinant on the spread of diseases of fields transmitted by vectors (Vatansever, 2008).

### Crimean congo hemorrhagic fever

There are many tick-borne diseases, Crimean Congo hemorrhagic fever (CCHF), rocky mountains spotted fever (RDBA), Lyme disease, erikliyoz, tularemia, babesios, Colorado tick fever, renegade like fire (Nuhoglu et al., 2008). In this study, CCHF disease, among the diseases was examined.

CCHF is an often fatal viral infection described in about 30 countries, and it has the most extensive geographic distribution of the medically important tick-borne viral diseases, closely approximating the known global distribution of *Hyalomma* sp ticks (Ergonul, 2006).

CCHF was first seen in Tajikistan in the 12<sup>th</sup> century, but the clinic definition was done after it was observed in 200 Russian soldiers going to Crimea in 1944. Then in 1956, it was noticed that the Crimean Congo hemorrhagic fever is the same as the disease referred to as Crimean-Congo hemorrhagic fever in Congo in 1969 and named like that thereafter (Hoogstraal, 1979; Whitehouse, 2004). In this disease, viruses attack vascular cells of the immune system, preventing the secretion of antibodies against them and cause damage to the vascular cells.

It was shown that it can be contained on migratory birds migrating between south East Europe and South Africa. It is thought that the birds may carry the virus between the two continents. The ticks that belong to *Hyalomma* descendants survive in a very wide geographic area including Turkey live (Ministry of Agriculture and Rural).

In CCHF transmission, *Hyalomma* ticks have a bigger place, but this disease has been reported to be transmitted through about 30 tick species. The disease virus carrying by tick bites.

### Modes of transmission

1. Bite of infected ticks,
2. Contact with the viremic animal's blood and tissues during cutting,
3. Contact with infected patients' blood and tissues,
4. Drinking the milk of infected animals,
5. Transcutaneous or respiratory tract by laboratory workers.

The disease is usually seen in shepherds, dairy-abattoir-meat and leather factory workers, veterinary doctors, farmers, health personnel, soldiers and in people with open space activity and in workers, peasants, forest workers, hunters, picnic goers in this kind of places (Gunduz et al., 2008; Uyar, 2008).

### Crimean Congo hemorrhagic fever in the world and Turkey

Tick is a vector that can be seen in most parts of the world. 899

Tick species are identified in the world so far (Ixodidae = 713, Argasidae = 185, Nuttalliellidae = 1). CCHF is usually seen in Africa, Asia, the Middle East and Southeast Europe. 50° north latitude is almost a boundary state for CCHF. This disease is not seen in the north of this latitude (Figure 2).

The disease is usually seen in Africa, the west of Asia, Eastern Europe and the Middle East. Crimean-Congo hemorrhagic fever virus had reported outbreaks in Bulgaria, Macedonia, Pakistan, Iraq, Afghanistan, Iran, Kosovo, Kazakhstan, sub-Saharan African countries, the southern regions of the former Soviet Union, former Yugoslavia, Greece, the Arabian Peninsula, Dubai, Kuwait, China and in Mauritania. The cases in Eastern Europe and Asia are thought to develop by the people, usually due to environmental conditions. For example the first pandemic in the Crimea is thought to occur as a result of a tick infected region's agricultural activities during the World War 2. It has been reported that the outbreaks in former Soviet Union and Bulgaria were related to changes in farming and livestock (Ministry of Health, 2005).

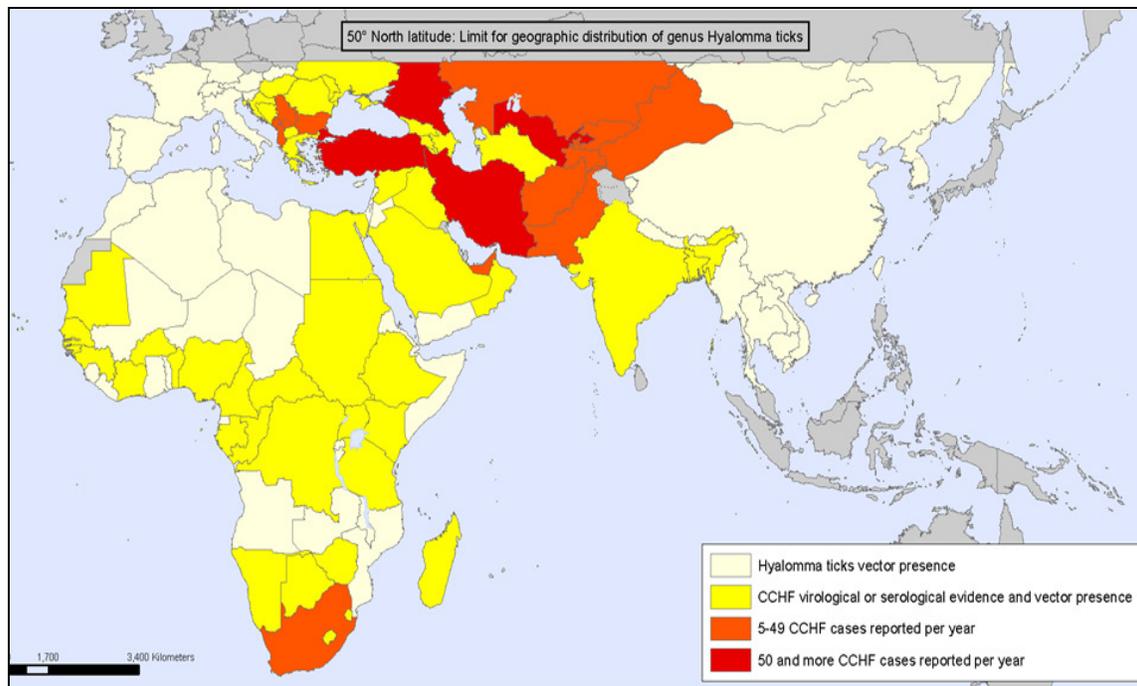
In Turkey, the climate and vegetation cover in terms of surface shape, has the appropriate conditions to maintain biological activity of ticks (Nuhoglu et al., 2008). Crimean-Congo hemorrhagic fever virus, the main carrier of Turkey indicate the spread with climate zones at the intersection of the other regions, especially the base cover with a dry scrub forest (oak groves, scrub) areas, which is associated with *H. marginatum* very closely with the wildlife and desert climate (Vatansever, 2008). About 32 tick species have been identified to be related to two families of 10 lineages in Turkey. CCHF which was seen in some neighboring countries of Turkey since the 1970s has been reported in the province of Tokat in 2002 (the first time). The risky areas are Yozgat, Sivas, Tokat, Amasya, Bayburt, Gumushane, Cankiri, Kastamonu, Karabuk, Erzincan and Erzurum provinces in the Black Sea and the Aegean region, especially in the inner parts of the Taurus and the mountainous parts of Thrace, north of Central Anatolia region (Uyar, 2008). Turkey is one of the world's largest countries with CCHF epidemic (Figures 3 and 4).

Adult *H. marginatum* that spend winter hungry is activated in the spring when the average daily temperature exceeds 10.5°C maintains the optimum level of development where the temperature 22 to 27°C and 75 to 100% humidity. Hungry adults search for hosts on the surface of the earth actively when the heat does not exceed 27°C.

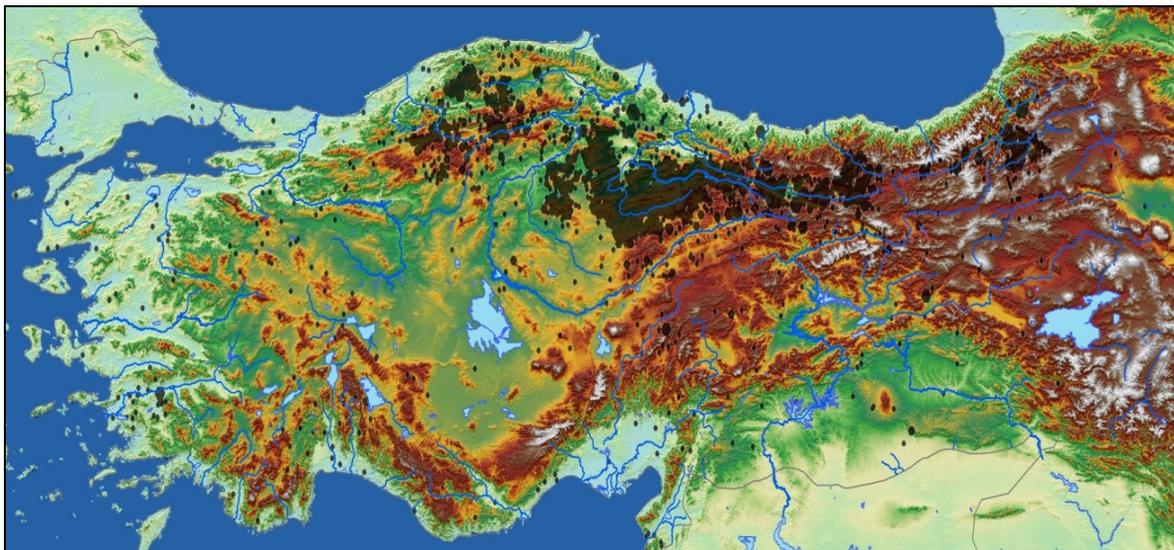
Ticks are stored in the shade, or even embedded into the soil at the times when the soil temperature exceeds 45°C and air temperature of 30°C. After females suck, the blood fell down and does not produce eggs if the average daily temperatures fall below 16°C. Shirts shifting nymphs can complete their developments even in the extreme conditions as 7 to 42°C temperature and 0 to 100% relative humidity (Ministry of Health, 2005). It was determined that the number of days in April is more than 5°C and the increase in the average temperature in April indicated the epidemic increase more than previous years (Vatansever, 2008).

According to the analysis of abiotic factors in Turkey, the suitable living conditions of *H. marginatum* is mapped and potential risk areas in terms of habitat and disease were determined in our country (Figure 4). Spread of diseases transmitted by ticks is limited to certain land structures and climate. The natural foci of diseases are constant in time and space and ticks act as reservoirs of disease agents and as vectors around there. The increase in tick population and increase the status of human-tick exposure are the reasons (Ergonul, 2006). The disease is seen between March and September, the maximum occurs in July.

Tick population in Turkey affect the infestation rate of the animals, seasonal fluctuations in tick population, terrain, vegetation and climate changes and the distribution of ticks between the regions (Aydin, 2008). The number of cases of CCHF seen eight-nine times and the number of deaths increased ten times in Turkey, since the first cases seen in 2002 (Table 1).



**Figure 2.** Geographic distribution of Crimean-Congo haemorrhagic fever (WHO).



**Figure 3.** Crimean-Congo hemorrhagic fever cases in Turkey (Vatansver, 2010).

#### **CCHF in Eflani district (Karabuk)**

Eflani district on a plateau, 47 km away from the province of Karabuk, among high mountains and valleys. The district has an area of 587 km<sup>2</sup> and an altitude of 930 meters from the sea. Continental climate prevails in the field. The annual average temperature is over 20 °C. The average annual rainfall in the province is a little more than the other settlements; 722.2 mm (Ozdemir, 1998). So Eflani district has suitable environment for ticks in terms of humidity, temperature and vegetation cover.

Ticks start activity in spring because of climatic suitability in spite

of the seasonal changes every year. The appearance of cases begins in April to May and reaches the highest level with a warm period in July and August. With the decrease of temperature and precipitation periods increase the incidence of cases is decrease in Eflani district.

The most cases and deaths were recorded in the Eflani district in the province, especially in 2009 (Table 2 and Figure 5). This is an important indicator of ecosystem balance has changed negatively especially Eflani and its surrounding land. In the working field, the lack of especially coniferous crow, pheasant, and animals like the red ant has led to growth of the little tick-like harmful organisms

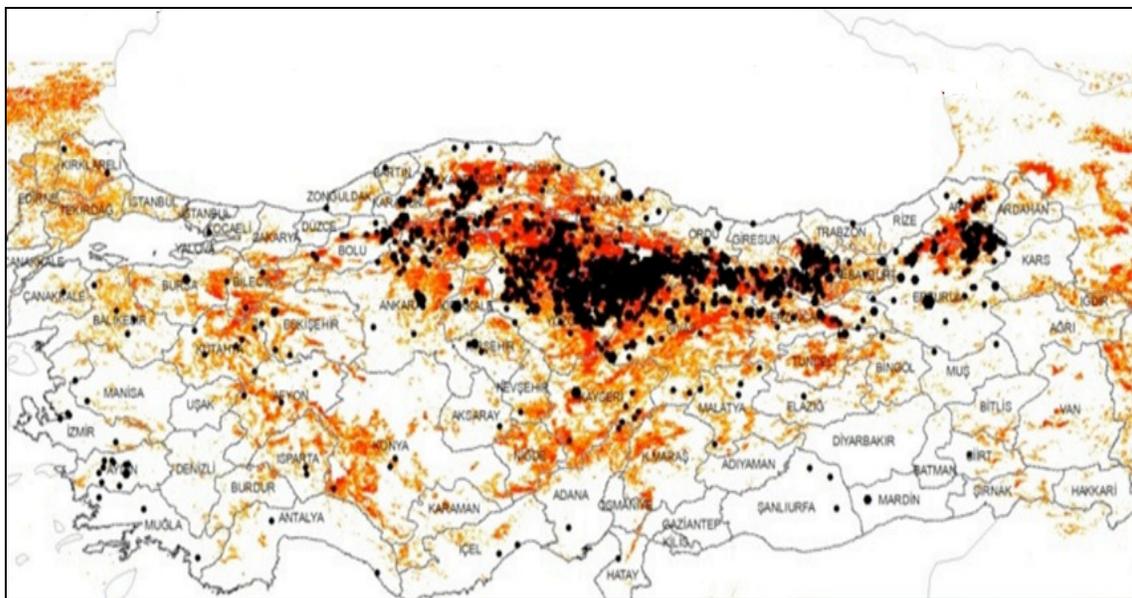


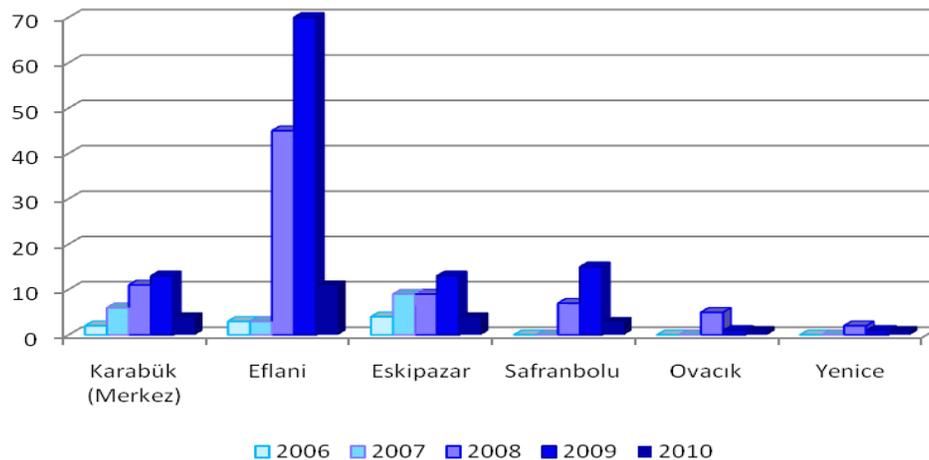
Figure 4. Safe living areas for ticks and matches with the disease featured regions (Vatansever, 2010).

Table 1. Crimean-Congo hemorrhagic fever case number and death-cases number in Turkey.

Year	Case number	Death cases
2002-2003	150	6
2004	249	13
2005	266	13
2006	438	27
2007	717	33
2008	1315	63
2009	1318	63

Table 2. The cases of CCHF in Karabuk and its districts (Karabuk Province Health Directorate).

Year		Karabuk	Eflani	Eskipazar	Safranbolu	Ovacik	Yenice	Total
2006	Death	0	2	0	0	0	0	2
	Discharged	2	1	4	0	0	0	7
2007	Death	0	0	1	0	0	0	1
	Discharged	6	3	8	0	0	0	17
2008	Death	0	7	1	0	0	0	8
	Discharged	11	38	8	7	5	2	71
2009	Death	0	3	1	1	1	0	6
	Discharged	13	68	12	14	0	1	108
2010	Death	0	1	0	0	0	0	1
	Discharged	4	10	4	3	1	1	23
TOTAL	Death	0	13	2	1	1	0	17
	Discharged	36	120	36	24	6	4	226



**Figure 5.** Number of CCHF cases in Karabuk (Karabuk Province Health Directorate).

around the environment.

Eflani has the most number of CCHF case in the province, especially after 2008. This situation can be noticeable from Figure 5. The highest number has recorded in 2009. Eflani has 120 discharged and 13 death cases from 2006 to 2010. This number is bigger than other cases in the province nearly four times. Also this number is nearly half of the all cases in the province. Nearly 75% of all deaths from CCHF in Karabuk province are occur in Eflani (Table 2).

## RESULT

Ticks are blood suckers can live anywhere in the world especially in tropical and subtropical belt. Ticks are vectors of many diseases and ectoparasites that threaten people day by day. Global warming and climate change contribute the ticks become active in their environment and the incidence of cases. Therefore, climate change, has been found to facilitate the increase in the number of ticks, tick and tick borne diseases and it is also said that factors that increase the incidence of seasonal surge in the different species are active at different times (Ica et al., 2007).

CCHF began to seen in Turkey in 2002, reached to the highest level in 2008-2009. In 2010, there has been a decrease in cases as a result of the studies of the Ministry of Health and the Ministry of Agriculture. The study in Eflani district of Karabuk Province is an example from Turkey as CCHF cases and the number of deaths is significant. The cases start in Eflani in April-May and the most number of cases are seen from July to August.

## DISCUSSION

CCHF that was caused by ticks is seen in Africa, the west of Asia, Eastern Europe and in the Middle East. *H. marginatum* is responsible for transmitting the disease in Turkey. CCHF disease spread mostly in the north of Turkey. CCHF cases of tick diseases are common in the

areas of depression; Corum, Yozgat, Sivas, Tokat, Amasya, Bayburt, Gumushane, Cankiri, Kastamonu, Karabuk, Erzincan and Erzurum provinces that are in the shadow of the mountain belt of the North Anatolian. Also the cases are encountered in certain regions as Inner west Aegean, Thrace, Aydin Mountains and some particular upper parts of The Taurus Mountains. Source of infection ticks intensively seen in wild life intertwined with the forest areas near the grassy fields, forests, agricultural land, gardens, stables and wooden houses. The above results also supported by similar studies by Karaer et al. (1999), Nuhoglu et al. (2008), Vatansever (2008), Gunduz et al. (2008), Uyar (2008) and Vatansever (2010).

Another feature that makes the disease dangerous is that the factor feature of the virus can be used as biological weapons. As known, biological terrorism and biological weapons are the issues often spoken of in the recent years, and viruses are forcing our limits today more than yesterday. Unfortunately, viruses cannot be removed completely. Various institutions listed the microorganisms that are used as biological weapons or the possibility of using. CCHF has been included in these lists (Akyazi and Ecevit, 2006, Pinar, 2010). CCHF virus suggests that it can be used as biological weapons in terms of the production of the vaccine, easy culture obtainment, easy portability and being effective in the health staff.

The researchers also reported that because of the vector features, CCHF is a seasonal disease, because disease-causing ticks increased their movements in warm seasons (Gazyagci and Aydenizoz, 2010). The months between April to September are the seasons that the cases are encountered in the district. Although there are different tick species in Eflani, not all of them cause CCHF. Bursali et al. (2010) have found that Ticks are associated with bioclimatic properties as a result of the multiplicity and diversity of the districts (Bursali et al., 2010). There is homogeneity in the recorded cases of CCHF distribution in Eflani district. In most of the villages

CCHF cases occurred.

Eflani is eligible for a settlement for ticks with humid climate, the increasing heat and vegetation. The incidence of tick increased with the increase of the wild animal population and the reduction in the use of agricultural land because of the decrease of the county population. Therefore, most cases in the province have been in Eflani. A lot of cases in the district influenced the Eflani County's population. This caused the county population registered citizens residing outside the province come less to the district and has caused a decrease in the population of the district especially in the summer. This situation has caused economic and social problems besides.

There are both individual and political precautions against ticks. Individual precautions are: staying away from the lands of ticks, wearing long-sleeved clothes and long pants, pant legs into socks, stay away from long herbs and leafy areas, wearing large peaked cap, gloves and so on, wearing light-colored clothing to easily recognize the ticks, use insect repellent lotions, clothing and hats medicate sprays containing DEET or Permethrin, when returned from the places of ticks check out all the clothes and the body, to keep the animal barns plastered, closing the cracks suitable for the settlement of ticks. The precautions can be taken politically are; hunting the tick bearing rabbits, pigs and the birds' feeding from the ground, turning from pasture breeding to closed stockbreeding, develop vaccines.

Even it was thought to feed or release of the birds that are enemies of the ticks to the environment, it is not enough alone, they may increase the number of ticks. Long grass should be cut in the Picnic areas and bushy areas should be cleaned. Animal shelters should be plastered; cracks that can harbor ticks should be closed. Some spiders, ants and bird species may help to eradicate ticks and their eggs (Gündüz et al., 2008; Kara, 2008; Aydın, 2008).

As Vatanserver states, Turkey is one of the world's largest countries with CCHF epidemic, 2002-2009 in 2200 villages of 300 towns recorded 4448 cases, 218 of them (4.9%) resulted death (Vatanserver, 2010: 43). When the cases of tick distribution areas in Turkey are examined, some questions are brought to mind. What could be the reason of the distribution of cases of ticks in Turkey that is seen densely in Coruh, Kelkit, Tozanli, Pulling, The Yesilirmak, The Kizilirmak, The Filyos river through the valley areas, perhaps the least affected areas compared to other regions such as global warming of the belt and ornithological bird migration routes strictly cases started to be seen after 2002 and rapid increase in subsequent years?

When it is considered that *Hyalomma* species grows more in steppe or deserted areas, and love hot weather, why was *Hyalomma marginatum* ticks distributed in the north Black Sea regions instead of hot spots in Turkey's or close to it? Whether the natural richness of the places mentioned, cause to happen a quiet biological war? What is

intended for the taking the people away of the region by not visiting the people's hometowns? Or this case is a simple struggle between the useful creations and harmful things and the change of balance with the increase of harmful things in the environment? Questions should be sought.

CCHF is not a disease that can be completely destroyed. However, some precautions for the disease taken may reduce the number of cases. Indeed with the studies in this direction decreased the number of cases in 2010. Public consciousness should be developed against the ticks and tick-transmitted diseases. Pets and cattle should be disinfected from time to time. Risk maps should be created and necessary precautions should be taken. Government must investigate on the issue multidimensional by establishing a scientific council. The effects of global warming on the timing of disinfection and other actions against ticks will be taken into consideration.

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