

## Prevalence of tick infestation in dromedary camels (*Camelus dromedarius*) brought for slaughter in Mashhad abattoir, Iran

Ali Moshaverinia · Elham Moghaddas

Received: 31 July 2013 / Accepted: 15 October 2013 / Published online: 26 October 2013  
© Indian Society for Parasitology 2013

**Abstract** This study was carried out to investigate the prevalence of tick infestation and identify tick species that parasitize dromedary camels. Since April 2012 through March 2013, a total of 400 camels that brought for slaughter in Mashhad abattoir were examined for tick infestation. Out of the total 400 camels examined, 237 were infested and annual prevalence of tick infestation 59.25 % (95 % CI 54–64) was calculated. The higher prevalence rates were found in the summer and spring, especially the summer that prevalence rate was the highest. A total of 1,122 ticks were collected from the infested camels and identified by stereomicroscopy. *Hyalomma dromedarii* was the predominant tick species and comprised 70.76 % of the collected ticks. The frequency of other species was as follows: *H. excavatum* (19.25 %), *H. anatolicum* (4.81 %), *H. asiaticum* (4.72 %), *Rhipicephalus turanicus* (0.17 %), *H. detritum* (0.09 %), *H. impeltatum* (0.09 %) and *H. schulzei* (0.09 %). Based on the results of present study, it is concluded that camels mostly harbor *Hyalomma* spp. The species of this genus are the most notorious ticks for transmission of human and animal diseases. Therefore, appropriate tick control measures need to be employed and pour-on method for acaricide application is suggested because this method is fast, easy and suitable for use by camel owners in deserts.

**Keywords** Prevalence · Tick infestation · Camel · Iran

### Introduction

Ticks are obligate blood-feeding parasites of terrestrial vertebrates. They have worldwide distribution and cause tick worry, anemia, skin injury and sometimes tick paralysis during feeding on their host (Wall and Shearer 2001). In addition, ticks can act as vectors for some pathogenic agents including bacteria, virus and protozoa. This role of ticks is very important in public health and veterinary medicine (Mullen and Durden 2009). Crimean-Congo Hemorrhagic Fever Virus (CCHFV) is transmitted by ticks to human and/or animals and can cause a fatal disease in humans. Based on reports from June 2000 to December 2009, there have been 635 CCHF confirmed cases in Iran and among them, 89 have died (Chinikar et al. 2010). Transmission of various pathogenic microorganisms to domestic animals by ticks imposes considerable economic losses to livestock industry (Jongejan and Uilenberg 2004).

According to the statistics of Iranian Veterinary Organization, there are 154,000 camels in Iran. Most of them are one-humped and live mainly in eastern parts of the country. Having high quality meat, shaggy wool, milk and ability to carry cargo and passenger in desert are special features of these animals. Due to the permanent presence of these animals in the deserts and lack of adequate care to them in Iran, they are vulnerable to ectoparasites. Among these ectoparasites, hard ticks are very important as mentioned before. Some studies have been done on camel tick infestations in Iran and other parts of the world (Elghali and Hassan 2009; Salimabadi et al. 2010; Nazifi et al. 2011; Fard et al. 2012; Taddese et al. 2013). These research projects mostly have targeted the frequency, seasonal population dynamics and predilection sites of ticks on camels. The aim of this survey was to determine the prevalence of ixodid tick infesting one-humped camels

A. Moshaverinia (✉) · E. Moghaddas  
Department of Pathobiology, Faculty of Veterinary Medicine,  
Ferdowsi University of Mashhad, Mashhad, Iran  
e-mail: moshaverinia@um.ac.ir

(*Camelus dromedarius*) brought for slaughter in Mashhad municipality abattoir.

**Materials and methods**

This study was conducted from April 2012 through March 2013 at Mashhad, north-east of Iran. Camels used for the study were selected from camels admitted for slaughtering at slaughterhouse. The studied animals were bought from eastern areas of Iran, including Sistan and Baluchestan, Razavi and South Khorasan provinces.

Based on 50 % expected prevalence and 95 % confidence interval with a 5 % desired absolute precision, the calculated sample size was 384 camels.

One-humped camels brought for slaughter, were selected randomly and examined for tick infestation at the rate of 100 individuals per season. Overall, a total of 400 camels were investigated by visual examination during the study period. The ticks from infested animals were collected in labeled vials containing ethyl alcohol (70 %) and brought to the laboratory. The adult male ticks were identified under a stereomicroscope according to standard identification keys (Walker et al. 2003). Chi square test was used to compare the prevalence of tick infestation between different seasons. Statistical analysis was conducted using SPSS software Version 19.  $P < 0.05$  was considered as significant.

**Results**

Out of the total 400 camels examined, 237 were infested and annual prevalence of tick infestation 59.25 % (95 % CI 54–64) was calculated. Tick infestation was observed throughout the year during the study. The higher prevalence rates were found in the summer and spring, especially the summer that prevalence rate was the highest (Table 1).

Prevalence of infestation among seasons was statistically significant ( $P < 0.001$ ).

Overall, a total of 1,122 ticks were collected from the infested camels. Parasitological studies revealed that these ticks belonged to ten species of two genera. *H. dromedarii*

was the predominant tick species and comprised 70.76 % of the collected ticks. The frequency of other species was as follows: *H. excavatum* (19.25 %), *H. anatolicum* (4.81 %), *H. asiaticum* (4.72 %), *Rhipicephalus turanicus* (0.17 %), *H. detritum* (0.09 %), *H. impeltatum* (0.09 %) and *H. schulzei* (0.09 %). The seasonal occurrence of each species has been shown in Table 2.

**Discussion**

Dromedary camels in Iran are raised under semi-wild conditions and graze throughout the year on poor pastures. Fassi-Fehri (1987) reviewed 770 bibliographical references dealing with the diseases of dromedary and Bactrian camels in Africa and Asia. He concluded that 52 % of these articles dealt with parasitic diseases. In his survey tick infestation, Sarcoptic mange and myiasis were the most external parasitic diseases of camels. According to his survey, tick infestation is quite common and the tick found most often is *H. dromedarii*. In the present study, *H. dromedarii* was the predominant tick species found on infested camels. This finding is in agreement with results of other researchers in Iran and other parts of the world (Elghali and Hassan 2009; Salimabadi et al. 2010; Nazifi et al. 2011; Fard et al. 2012). Dromedary camels are the preferred hosts of this species; however, it can infest cattle, sheep, goats and horses (Walker et al. 2003). *H. dromedarii* is a thermophilic tick species and is usually found in arid and hyper-arid regions. This species has been reported from southeast and semi-desert areas of central parts of Iran (Rahbari et al. 2007; Salimabadi et al. 2010). These areas have similar climates to the hot and dry eastern parts of the country where studied camels were sourced. Because *H. dromedarii* is not a host-specific species and its roll in transmission of *Theileria annulata* and CCHFV has been revealed (Chisholm et al. 2012); therefore, it can be a potential threat for cattle and public health. The climatic changes induced by global warming can increase the distribution of this tick species and modify the epidemiology and control strategies of tropical theileriosis drastically (Salem et al. 2011).

**Table 1** Seasonal prevalence of hard tick infestation in one-humped camels slaughtered at Mashhad abattoir, Iran ( $n = 400$ )

Season	No. of tested animal	No. of infested (%)	95 % Confidence interval		OR	P value
			Lower level (%)	Upper level (%)		
Spring	100	77 (77 %)	69	85	1	
Summer	100	100 (100 %)	100	100	29.87	<0.001
Autumn	100	40 (40 %)	31	49	0.2	
Winter	100	20 (20 %)	12	28	0.07	

OR odds ratio

**Table 2** Inventory and seasonal frequency of hard ticks found on one-humped camels slaughtered at Mashhad abattoir, Iran

Tick species	Season				
	Spring	Summer	Autumn	Winter	Total
<i>H. dromedarii</i>	75 (9.44)	543 (68.38)	138 (17.38)	38 (4.78)	794 (70.76)
<i>H. excavatum</i>	63 (29.16)	145 (67.12)	8 (3.70)	0 (0)	216 (19.25)
<i>H. anatolicum</i>	0 (0)	54 (100)	0 (0)	0 (0)	54 (4.81)
<i>H. asiaticum</i>	10 (18.86)	38 (71.69)	5 (9.43)	0 (0)	53 (4.72)
<i>Rh. turanicus</i>	2 (100)	0 (0)	0 (0)	0 (0)	2 (0.17)
<i>H. detritum</i>	0 (0)	1 (100)	0 (0)	0 (0)	1 (0.09)
<i>H. impeltatum</i>	0 (0)	1 (100)	0 (0)	0 (0)	1 (0.09)
<i>H. schulzei</i>	0 (0)	0 (0)	1 (100)	0 (0)	1 (0.09)
Total	150 (13.36)	782 (69.69)	152 (13.54)	38 (3.38)	1,122 (100)

*Hyalomma excavatum* was the most frequent species after *H. dromedarii* in this survey. This species has been found on camels by Nazifi et al. (2011) and NourollahiFard et al. (2012). Nabian et al. (2009) found this species all over the country except Caspian Sea zone in the north and they believed it was often less commonly found on animals than *H. anatolicum*. Our results showed *H. excavatum* was more commonly found on camels than *H. anatolicum* that is in accordance with results found by Fard et al. (2012).

*Hyalomma asiaticum* was another tick species which found on infested camels. Although Hoogstraal and Valdez (1980) believed *H. asiaticum* parasitizes camels, domestic and wild herbivores in semi-arid and arid regions, Nabian et al. (2009) found it throughout the country. Salimabadi et al. (2010) have reported this species on cows, camels and sheep from Yazd province in center of Iran.

We also found *H. detritum*, *H. impeltatum* and *H. schulzei* on camels in this survey. There is no previous record of *H. detritum* on camel in Iran. Walker et al. (2003) assumed that adult *H. detritum* infests cattle, horses, sheep, goats and camels. Nabian et al. (2009) and Salimabadi et al. (2010) have reported this species from all zoogeographical zones and Yazd province in center of Iran, respectively. *H. impeltatum* occurs in areas of Mediterranean, steppe and desert climates. The range of this species includes the North African countries and it extends into Iran and other Middle Eastern countries (Walker et al. 2003). Nazifi et al. (2011) have identified this species on dromedary camels in Qeshm Island in south of Iran. *H. impeltatum* has been found on dromedary camels in Northern Sudan (Elghali and Hassan 2009). Kaiser and Hoogstraal (1963) reported *H. schulzei* from the Saravan area in southeast Iran, near the Pakistan border. This species has also been reported from central and eastern parts of Iran (Rahbari et al. 2007). Nabian et al. suggested that *H. schulzei* is commonly found on camels and rarely on cattle in semi-desert areas of Iran.

In this study, the annual prevalence of tick infestation was 59.25 % and was recorded for the first time in Iran. The study on the prevalence of tick infestation in dromedary camels of eastern Ethiopia showed that 94 % of camels were infested (Taddese et al. 2013). The difference in the rate of prevalence in two areas can be attributed to different climatic conditions and particularly differences in the sampling periods.

Our results showed that hard ticks were present throughout the year and more prevalent during the summer. Seasonally, the prevalence of tick infestation reached the highest level in summer and decreased in autumn and winter. These findings are in agreement with the results of Salimabadi et al. (2010) and Fard et al. (2012).

Based on the results of this study, it is concluded that camels mostly harbor *Hyalomma* spp. The species of this genus are the most notorious ticks for transmission of human and animal diseases. Therefore, appropriate tick control measures need to be employed and pour-on method for acaricide application is suggested because this method is fast, easy and suitable for use by camel owners in deserts.

**Acknowledgments** We thank Dr. Mohammad Azizzadeh for his collaboration in statistical analysis of this research. The authors also wish to thank Ferdowsi University of Mashhad for providing the financial support for this study.

## References

- Chinikar S, Ghiasi SM, Moradi M, Goya MM, Shirzadi MR, Zeinali M, Meshkat M, Bouloy M (2010) Geographical distribution and surveillance of Crimean-Congo hemorrhagic fever in Iran. *Vector Borne Zoonotic Dis* 10:705–708
- Chisholm K, Dueger E, Fahmy NT, Samaha HA, Zayed A, Abdel-Dayem M, Villinski JT (2012) Crimean-Congo hemorrhagic fever virus in ticks from imported livestock, Egypt. *Emerg Infect Dis* 18:181–182

- Elghali A, Hassan SM (2009) Ticks (Acari: Ixodidae) infesting camels (*Camelus dromedarius*) in Northern Sudan. *Onderstepoort J Vet Res* 76:177–185
- Fard SR, Fathi S, Asl EN, Nazhad HA, Kazeroni SS (2012) Hard ticks on one-humped camel (*Camelus dromedarius*) and their seasonal population dynamics in southeast, Iran. *Trop Anim Health Prod* 44:197–200
- Fassi-fehri MM (1987) Diseases of camels. *Rev Sci Tech OIE* 6:337–354
- Hoogstraal H, Valdez R (1980) Ticks (Ixodoidea) from wild sheep and goats in Iran and medical and veterinary implications. *Fieldiana Zool* 6:1–16
- Jongejan F, Uilenberg G (2004) The global importance of ticks. *Parasitology* 129:3–14
- Kaiser MN, Hoogstraal H (1963) The *Hyalomma* ticks (Ixodoidea) of Afghanistan. *J Parasitol* 49:130–139
- Mullen GR, Durden LA (2009) *Medical and veterinary entomology*. Academic Press, Burlington, MA
- Nabian S, Rahbari S, Changizi A, Shayan P (2009) The distribution of *Hyalomma* spp. ticks from domestic ruminants in Iran. *Med Vet Entomol* 23:281–283
- Nazifi S, Tamadon A, Behzadi MA, Haddadi S, Raayat-Jahromi AR (2011) One-humped camels (*Camelus dromedaries*) hard ticks infestation in Qeshm Island, Iran. *Vet Res Forum* 2:135–138
- Rahbari S, Nabian S, Shayan P (2007) Primary report on distribution of tick fauna in Iran. *Parasitol Res* 101:175–177
- Salem H, Rekik M, Lassoued N, Darghouth MA (2011) Global warming and livestock in dry areas: expected impacts, adaptation and mitigation. In: Blanco J, Kheradmand H (eds) *Climate change—socioeconomic effects*. InTech, Rijeka, pp 341–366
- Salimabadi Y, Telmadarraiy Z, Vatandoost H, Chinikar S, Oshaghi MA, Moradi M, Mirabzadeh Ardakan E, Hekmat S, Nasiri A (2010) Hard ticks on domestic ruminants and their seasonal population dynamics in Yazd Province, Iran. *J Arthropod Borne Dis* 4:66–71
- Taddese A, Mustefa M, Fikru A (2013) Prevalence and identification of camel ticks in eastern Ethiopia. *Online J Vet Res* 17:64–72
- Walker AR, Bouattour A, Camicas JL, Estrada-Pena A, Horak IG, Latif AA, Pegram RG, Preston PM (2003) *Ticks of domestic animals in Africa: a guide to identification of species*. Bioscience reports, Edinburgh
- Wall R, Shearer D (2001) *Veterinary ectoparasites: biology, pathology and control*. Blackwell Science, London