

## Frequency of hard-ticks and the influence of age and sex of camel on ticks infestation rates in one-humped camel (*Camelus dromedarius*) population in the northeast of Iran

Mohsen Champour<sup>1</sup>✉, Gholamreza Mohammadi<sup>1</sup>, Sadegh Chinikar<sup>3</sup>, Gholamreza Razmi<sup>2</sup>, Ehsan Mostafavi<sup>3</sup>, Tahmineh Jalali<sup>3</sup>

1 – Ferdowsi University of Mashhad, School of Veterinary Medicine, Department of Clinical Sciences, Iran, P.O. Box: 1793-91775.

2 – Ferdowsi University of Mashhad, School of Veterinary Medicine, Department of Pathobiology, Mashhad, Iran.

3 – Pasteur Institute Tehran, Arbo viruses and Viral Hemorrhagic Fever Laboratory, National Reference Lab, Iran.

Correspondence: Tel. 00985118803786, Fax 00985118763852, E-mail iman\_jampoor@yahoo.com

**Abstract.** Ticks are hematophagous arthropods belonging to the class Arachnida. They are the major vectors of pathogens in animals and humans. Injuries and diseases related to ectoparasites are more prevalent and severe than what is commonly perceived. Ticks cause widespread distress and morbidity and they act as vectors of diseases, and affect the economic conditions of camel-rearing. This survey was carried out in eleven towns and cities in the three provinces of Northeast Iran (Khorasan Razavi, Northern Khorasan, and Southern Khorasan) from May 2012 to January 2013 to identify the distribution of different tick species infesting camels and to evaluate the influence of sex and age of camels on the infestation rate of ticks. A total of 200 camels were examined and 480 ticks were collected (347 males and 133 females). Tick infestation was observed in 171 (85.5%) of camels. *Hyalomma dromedarii* was found to be the predominant tick species (90.7%). Other tick species were found in low numbers and were as follows: *Hyalomma anatolicum* (6%), and *H. marginatum* (2.9%), *H. asiaticum* (0.4%). Significant differences were observed in tick burden between females and males ( $p < 0.01$ ). Comparison of older and younger animals showed no significant difference in the number of ticks ( $p > 0.05$ ).

**Keywords:** Frequency; Tick; Camel; Iran; Khorasan.

Received 20/04/2013. Accepted 06/06/2013.

### Introduction

Ticks are hematophagous arthropods belonging to the class Arachnida. They are major vectors of pathogens in animals and humans. Injuries and

diseases related to ectoparasites are more prevalent and severe than what is commonly perceived. Ticks cause widespread distress and morbidity and act as vectors of disease and affect the economic conditions of camel-rearing.

The ability of a camel to survive in harsh environments, its endurance in prolonged droughts, and above all, its high potential to convert the scanty resources of desert into milk and meat makes it important to pastoralists (Wosene, 1991).

The main effect of tick infestation in one-humped camel is mild to severe anemia and loss of appetite, leading to a reduction in growth rate and decreased productivity. Tick infestation also results in increased calf mortality (Schwartz and Wilson, 1983; Hart, 1990; Nelson et al., 1997). There are some reports on the distribution of tick fauna in Iran (Nabian et al., 2007; Rahbari et al., 2007; Salimabadi et al., 2010; Nourollahi Fard et al., 2012). This survey was carried out to identify the frequency of infestation by different tick species in camels and to investigate the influence of sex and age of camels on the tick infestation rate and identification of sex ratio in Northeastern Iran.

### Materials and methods

The study was conducted in Khorasan Razavi, Northern Khorasan, Southern Khorasan provinces in Iran. These provinces are located at 55°17'-61°15'E and 30°24'-38°17'N in Northeastern Iran (figure 1). North Khorasan is a mountainous region with a temperate cold weather. Khorasan Razavi is a semi-desert region with mild weather. South Khorasan is a semi-desert region experiencing arid conditions. Average annual rainfall is approximately 300-400 mm in the northern areas and 150 mm in the southern areas. From May 2012 to January 2013, eleven cities and towns were selected randomly among the noted areas as a "cluster" and at least 14 camels were sampled from each cluster. All visible ticks were collected from the animals. Ticks from each animal were preserved in separate vials containing 70% ethanol. The vials were labeled with the date of collection, animal number, sex, age and area. Estimation of ages of camels was performed by the herdsman and recognized based on the dental eruption. The collected ticks brought to the laboratory and identified under a stereo-microscope according to general identification keys (Kaiser and Hoogstraal, 1963; Walker et al., 2003; Estrada-Pena et al., 2004). Data was analyzed using the Chi-square test and the prevalence of

tick species was assessed using descriptive statistics. Location of noted research is shown on the GIS map.



Figure 1. Khorasan (North, Razavi, South), the study areas are shown on Iran's map

### Results

A total of 200 camels were examined. Tick infestation was observed in 171 camels, and 480 hard ticks (133 females and 347 males) were collected from different regions in the Khorasan provinces (table 1).

Table 1. Number and sex of ticks collected from different regions in northeast of Iran

Area	Males	Females	Total	M:F ratio
Nehbandan	27	9	36	3
Sarayan	28	23	51	1.21
Birjand	41	7	48	5.85
Kanimani	26	24	50	1.08
Boshroyeh	52	7	59	7.42
Robatsang	32	0	32	32
Quchan	28	13	41	2.15
Sabzevar	18	13	31	1.38
Mashhad	31	17	48	1.82
Chehl dokhtaran	28	6	34	4.66
Mangale	36	14	50	2.57
<b>Total</b>	<b>347</b>	<b>133</b>	<b>480</b>	<b>2.60</b>

Four species form a single genus (*Hyalomma*) were identified (table 2): *H. dromedarii* (90.7%) *H. anatolicum*(6%), *H. marginatum* (2.9%) and *H. asiaticum* (0.4%). Effect of camels' age on the tick infestation was not significant (table 3). Significant differences

were observed in tick burden between females and males ( $p < 0.01$ ) (table 4). Ratio of male ticks was higher than female ticks ( $OR = 2.61$ ). The relative frequency was 72.2% male ticks and 27.8% female ticks.

**Table 2.** Frequency of tick infestation in camels in different areas of Khorasan

Tick spp	Males	Females	Total
<i>H. dromedarii</i>	307 (70.6%)	128 (29.4%)	435 (90.7%)
<i>H. marginatum</i>	10 (71.4%)	4 (28.6%)	14 (2.9%)
<i>H. anatolicum</i>	29 (100%)	0 (0%)	29 (6%)
<i>H. asiaticum</i>	1 (50%)	1 (50%)	2 (0.4%)
<b>Total</b>	<b>347 (72.2%)</b>	<b>133 (27.8%)</b>	<b>480 (100%)</b>

**Table 3.** Camels age group in each area in northeast of Iran

Area/Age group (year)	< 5	6-10	10<	Total
Nehbandan	2	3	7	12
Sarayan	7	1	5	13
Birjand	21	1	3	25
Kanimani	8	4	2	14
Boshroyeh	8	0	8	16
Robatsang	7	8	1	16
Quchan	6	7	2	15
Sabzevar	8	7	0	15
Mashhad	4	7	5	16
Chehl dokhtaran	7	3	4	14
Mangale	2	12	1	15
without ticks	14	8	7	29
<b>Total</b>	<b>94</b>	<b>61</b>	<b>45</b>	<b>200</b>

**Table 4.** The frequency and percent of male and female camels and number of ticks on body according to group

Ticks Groups	No. ticks on body	Male	Female	No. Camels
1	0	11	18	29 (14.5%)
2	1-10	7	27	34 (17%)
3	11-20	9	49	58 (29%)
4	>21	18	61	79 (39.5%)
<b>Total</b>	-	<b>45</b>	<b>155</b>	<b>200 (100%)</b>

We believe that the differences in genera and species in distinct regions can depend on the climate. Significant differences were observed in tick burden between females and males ( $p < 0.01$ ) and the same results were reported by others (Elghali and Hassan, 2009; Hussein and Al-Fatlawi, 2009). However, this finding contradicts the results obtained by Maha and

## Discussion

In the current study, only four species were observed, all from a single genus, *Hyalomma*. This is not in agreement with results reported by Yakhchali who found *Hyalomma*, *Boophilus*, and *Rhipicephalus* spp. (Yakhchali and Hasanzadehzarza, 2004). Population frequency of *H. dromedarii* (90.7%) was higher than the others and *H. asiaticum* had the lowest frequency (0.4%). *Hyalomma marginatum* comprised about 2.9% and *H. anatolicum* accounted for 6% of total collected species. In this study, *H. dromedarii* was found to be the most dominant species and this is in agreement with the results obtained by Salimabadi et al. (2010) in Yazd province, Vanstraten and Jongejan (1983) in Egypt, Alwaer (2004) in Libya, Lawal et al. (2007) in Nigeria, Gupta and Kumar (1994) in India, Maha and Mohammed (2010) and Elghali (2005) in Sudan. In addition to *H. dromedarii*, Karrar et al. (1963) reported the presence of *Rhipicephalus sanguineus* and *Rhipicephalus praetextatus* but these species were not encountered in our study. Other reports of ticks from camels found *H. impeltatum* (Diab et al., 2001) but this finding is not in accordance with our study. *Hyalomma dromedarii* and *H. schulzei* are commonly found in camels and rarely in cattle in semi-desert areas of Iran (Nabian et al., 2009). *Hyalomma schulzei* was not found in our study but our findings are in concordance with Nourollahi Fard et al. (2012).

Mohammed (2010). We believe that these significant differences are related to hormonal changes, pregnancy, and lactation in females, which results in lower resistance to tick infestation. We did not observe higher number of ticks in older animals in comparison with younger ones in our study ( $p > 0.05$ ) and this is not in agreement with the finding that the most

infested animals were 5-10 years old (Hussein and Al-Fatlawi, 2009) or that the total tick burden was significantly higher in camels of 1-3 years with poor health condition (Megersa et al., 2012).

The relative frequency was 72.2% male ticks and 27.8% female ticks. Although the overall M:F sex ratio was 2.61, the number of males per female was normal since males stay on the host longer than females (Yakhchali and Hasanzadehzarza, 2004). It is important to note that only females of *H. dromedarii* were found engorged and that the females of the other tick species were not engorged or only partially engorged. This may indicate host specificity of camels for *H. dromedarii*. Host specificity could also account for the lesser number of other species detected in our study. Elghali et al. (2009) reported that *H. dromedarii* is the predominant tick species in camels. Alwaer (2004), studying tick infestation in sheep, found *H. dromedarii* representing only 0.5% of the tick fauna in the same area. These findings on host preference might support our suggestion.

In our study we found a special location for each age group of ticks. For example, nymphs almost always (97%) were collected from the flank region. Elghali et al. (2009) found a high percentage of nymphs on the back, particularly the hump region. Highly engorged females were always found with one or two male ticks in the long hair of camels' shoulder and the lower part of their neck. Flat female and male ticks were found on all parts of the animal's body (perineum, tail, udder, scrotum, neck, shoulder and axilla). No ticks were observed in the palpebra and external ear. Based on our findings, *H. dromedarii* is the most dominant tick species in the Khorasan region and a camel is a suitable host. The life cycle of this tick includes one, two, or three hosts. Immature ticks feed on small or large mammals, depending on their life cycle. Females had a significantly higher tick burden. Comparison of older and younger animals showed no significant difference in the number of ticks. Poor husbandry practices may be a determinant, making the animals more prone to tick infestation and strategic application of acaricide might minimize the tick burden.

## Acknowledgements

The project was funded by Ferdowsi University of Mashhad, bearing registration code 3/230667. Thanks to staff members of veterinary department of the North Khorasan province, particularly **Dr Razavi, Dr Ramezani, Dr Ahmadi, Dr Hassan Safaee and Dr Shahin Ahmadi** for their complete support and collaboration in sampling. The authors really appreciate **Dr Jalali** for sincerely technical support.

## References

- Alwaer O.R. 2004. Epidemiology study on camel ticks infestation in Libya and vaccine trials using *Boophilus* derived vaccine against *Hyalomma dromedarii* ticks. Unpublished MSC Thesis, Institut Agronomique et Vétérinaire. HASSAN II, Morocco.
- Diab F.M., Elkhali G.A., Shouky A. 2001. Bionomical of ticks collected from Sinai. 2. Abundance attachment sites and density of ticks infesting Arabian camels. J. Egypt. Soc. Parasitol. 31:479-489.
- Elghali A. 2005. Studies on camel ticks in River Nile State, Sudan with particular reference to ecology and behavior of *Hyalomma dromedarii*, Acari: Ixodidae. Unpublished PhD thesis, Faculty of Veterinary Medicine, University of Khartoum, Sudan.
- Elghali A., Hassan S.M. 2009. Ticks (Acari: Ixodidae) infesting camels in Northern Sudan. Onderstepoort J. Vet. R. 76:177-185.
- Estrada-Pena A., Bouattour A., Camicas J.L., Walker A.R. 2004. Ticks of domestic animals in the Mediterranean region – a guide to identification of species. Unpublished, University of Zaragoza, Zaragoza, Spain.
- Gupta S.K., Kumar R. 1994. Ixodid ticks of camel in India and their control measures. Int. J. Anim. Sci. 9:55-56.
- Hart B.L. 1990. Behavioral adaptations to pathogens and parasites five strategies. Neurosci. Biobehav. Rev. 14:273-294.
- Hussein M.H., Al-fatlawi M.A.A. 2009. Study the epidemiology of tick's infected *Camelus dromedarii* in Al-Qadysia city Al-Anbar. J. Vet. Sci. 2:1.
- Kaiser M.N., Hoogstraal H. 1963. The *Hyalomma* ticks (Ixodidae) of Afghanistan. J. Parasitol. 49:130-139.
- Karrar G., Kaiser M.N., Hoogstraal H. 1963. Ecology and host-relationships of ticks infesting

- domestic animals in Kassala Province, Sudan, with special reference to *Amblyomma lepidum*. Bull. Entomol. Res. 54:509-522.
- Lawal M.D., Amen I.G., Ahmed A. 2007. Some ectoparasites of *Camelus dromedarius* in Sokoto. Niger. J. Entomol. 4(2):143-148.
- Maha A. El Tigani, Mohammed A.S. 2010. Ticks infesting camels in El Butana area Mid-Central Sudan. Sudan. J. Vet. Res. 25:51-54.
- Megersa B., Bekele J., Adane B., Sheferaw D. 2012. Ticks and mite infesting camels of Boran pastoral areas and the associated risk factors, Southern Ethiopia. Journal of Veterinary Medicine and Animal Health 4(5):71-77.
- Nabian S., Rahbari S., Shayan P., Haddadzadeh H.R. 2007. Occurrence of soft and hard ticks on ruminants in Zagros Mountainous areas of Iran. Iran. J. Arthropod-Borne Dis. 2:12-17.
- Nabian S., Rahbari S., Changizi A., Shayan P. 2009. The distribution of *Hyalomma* spp ticks from domestic ruminants in Iran. J. Med. Vet. Entomol. 23:281-283.
- Nelson W.A., Bell J.F., Clifford C.M., Keirans J.E. 1997. Interaction of ectoparasites and their hosts. J. Med. Entomol. 13:389-428.
- Nourollahi Fard S.R., Fathi S., Norouzi Asl E., Asgary Nezhad H., Kazeroni S.S. 2012. Hard ticks on one-humped camel and their seasonal population dynamics in southeast Iran. Trop. Anim. Health Prod. 44:197-200.
- Rahbari S., Nabian S., Shayan P. 2007. Primary report on distribution of tick fauna in Iran. Parasitol. Res. 101 suppl.2:S175-177.
- Salimabadi Y., Telmadarriy Z., Vatandoost H., Chinikar S., Oshaghi M.A., Moradi M., Mirabzadeh V., Ardakan E., Hekmat S., Nasiri A. 2010. Hard ticks on domestic ruminants and their seasonal population dynamics in Yazd Province, Iran. Iranian Journal Arthropod-Borne Disease 4:66-71.
- Schwartz H.J., Wilson A.J. 1983. Camel production in Kenya and its constraints: Productivity. Trop. Anim. Health Prod. 15:169-178.
- Van Straten M., Jongejan F. 1983. Ticks (Acari: Ixodidae) infesting the Arabian camel (*Camelus dromedarius*) in the Sinai, Egypt with a note on the acaricidal efficacy of ivermectin. Exp. Appl. Acarol. 17(8):605-612.
- Walker A.R., Bouattour A., Camicas J. 2003. Ticks of domestic animals in Africa – a guide to identification of species. Unpublished Bioscience Report 42, Coniston Drive Edinburgh, Scotland, UK:1-221.
- Wosene A. 1991. Traditional husbandry practice and major health problems of camels in the Ogaden, Ethiopia. Commission on Nomadic People.
- Yakhchali M., Hasanzadehzarza H.S. 2004. Study on some ecological aspects and prevalence of different species of hard ticks (Acarina: Ixodidae) on cattle, buffalo and sheep in Oshnavieh suburb. Pajouhesh-va-Sazandegi in Anim. Fish Sci. 63:30-35.