

Original paper

Identification of ectoparasites of camels in Sabzevar City, Iran

Laya SHAMSI¹, Saeed SAMAEINASAB², Arash HAGHIGHATKHAH³

¹Department of Pathobiology, Faculty of Veterinary Medicine, Urmia University, Urmia, Iran

²Young Researchers and Elite Club, Sabzevar Branch Islamic Azad University, Sabzevar, Iran

³Faculty of Veterinary Medicine, Islamic Azad University, Urmia, Iran

Corresponding Author: Laya SHAMSI; e-mail: layashamsi@gmail.com

ABSTRACT. Ectoparasite infestation can transmit pathogens. They also cause economic losses and sometimes can cause mortality and reduce growth rates. Therefore, the objective of the present study was the determination of ectoparasite infestations on camels (*C. dromedarius*) in Sabzevar city, Iran. This survey was conducted from April 2017 to March 2018. A total of 75 camels were examined for ectoparasite infestation. All ectoparasites were collected in vials containing ethyl alcohol (70%) and were brought to the laboratory. The results showed that 25 camels (33.33%) were infested with hard ticks. There was not any infestation by other external parasites (mite, lice, flea, myias). The whole detected ticks were 130. The hard ticks on camels were identified as follows: *Hyalomma anatolicum anatolicum* (37/69%), *Hyalomma dromedarii* (34/61%), *Rhipicephalus bursa* (27/69%). In conclusion, appropriate tick control programs in Sabzevar city would seem a prerequisite for progressing camel milk and meat production.

Keywords: hard ticks, *Hyalomma*, camel, Iran

Introduction

Camel is the most important livestock that can live in poor farms and can be compared with animals of the same weight, like cattle, regarding productivity under manual feeding. Hence, it is necessary to improve management of camels in the regions where livestock production is becoming more difficult due to climate changes [1].

Two known species of camels are existed, including *Camelus bactrianus* (the two humped camels), and *Camelus dromedarius* (the one humped camel) which is also called the trade camel or Arabian camels [2]. In addition, camels are considered to be a good source of meat and milk to cities habitat and are used for other purposes such as to carry cargo and passenger and sport racing. It has been domesticated for meat, milk, clothing and transportation over 4000 years ago [3].

Ectoparasites have been identified as the major problems affecting the productivity, health, and performance of camels [4–6]. Among ectoparasites

of camel, various species of ticks have been reported [6–9].

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 [10]. Among tick species, *Hyalomma* is the most prevalent species [11,12], which could act as vectors for *Babesia* spp. and *Theileria* spp., [13–16] and *Anaplasma* spp. [13].

Crimean-Congo Hemorrhagic Fever Virus (CCHFV) is transmitted by ticks to human or animals and can cause death in humans. Based on some reports, there have been 635 CCHF confirmed cases in Iran and among them, 89 have died [17].

Tick infestation in one-humped camel causes mild to severe anemia and loss of appetite, growth rate reduction and decreased productivity [18–20]. There are some studies on the distribution of tick fauna in Iran [12,21–23].

Therefore, this study was carried out to identify the genus level or species diversity of external parasites of camels in Sabzevar city, Iran.

Table 1. Number and sex of ticks collected from camels in Sabzevar city, Iran

Tick species	Males	Females	Total	M:F Ratio
<i>H. anatolicum anatolicum</i>	40 (81.63%)	9 (18.36%)	49(37/69%)	4.44
<i>H. dromedarii</i>	39 (86.66%)	6 (13.33%)	45 (34/61%)	6.5
<i>R. bursa</i>	36 (100%)	0	36 (27/69%)	36
Total	115(88.46%)	15 (11.53%)	130 (100%)	7.66

Table 2. Seasonal prevalence of hard ticks found on camels in Sabzevar city, Iran

Tick species	Spring	Summer	Autumn	Winter	Total
<i>H. anatolicum anatolicum</i>	14 (28.57%)	29 (59.18%)	6 (12.24%)	0 (0)	49 (37/69%)
<i>H. dromedarii</i>	12 (26.66%)	21 (46.66%)	8 (17.77%)	4 (8.88%)	45 (34/61%)
<i>R. bursa</i>	10 (27.77%)	23 (63.88%)	3 (8.33%)	0 (0)	36 (27/69%)
Total	36 (27.69%)	73 (56.15%)	17 (13.07%)	4 (3.07%)	130

Materials and Methods

This survey was conducted from April 2017 to March 2018 in Sabzevar city which located in the west of Khorasan Razavi province at the northeast of Iran (between longitudes 36.21°N, 57.68°E). The eastern and northern regional of this mountainous city is temperate and warm in the lowlands.

A total of 75 camels were investigated by visual examination during the study period. The ticks from infested animals were collected in labeled vials containing ethyl alcohol (70%). The collected ticks were brought to the laboratory and were identified under a stereo-microscope according to general identification keys [24]. Statistical analysis was conducted using SPSS, version 19, software. Chi-square test was used to compare the prevalence of tick infestation between different seasons. $P < 0.05$ was considered as significant.

Results

The results showed that 25 camels (33.33%) were infested by hard ticks. There was no infestation by other external parasites (mite, lice, flea, myias). The whole detected ticks were 130 (115 males, 15 females). The hard ticks on camels were identified as follows: *Hyalomma anatolicum anatolicum* 49(37/69%), *Hyalomma dromedarii* 45(34/61%), *Rhipicephalus bursa* 36(27/69%). The ratio of male ticks was higher than female ticks. The relative frequency was 88.46% male ticks and 11.53% female ticks (Table 1). The seasonal occurrence of each species has been shown in Table 2. The higher prevalence rate was found in the summer (Table 2). Prevalence of infestation among seasons was statistically significant $P < 0.05$. Table 3 shows the collection location of ticks from different parts of the body of camels. It was shown that the

Table 3. The collection site of ticks from different parts of the body of camels in Sabzevar city, Iran

Tick species	External ear	Perineum and chest	Shoulder	Total
<i>H. anatolicum anatolicum</i>	4 (8.16%)	43 (87.75%)	2 (4.08%)	49 (37/69%)
<i>H. dromedarii</i>	5 (11.11%)	39 (86.66%)	1 (2.22%)	45 (34/61%)
<i>R. bursa</i>	3 (8.33%)	33 (91.66%)	0 (0)	36 (27/69%)
Total	12 (9.23%)	115 (88.46%)	3 (2.30%)	130

maximum number of ticks was collected from perineal and chest region of the camel and a minimum number of ticks was collected from the shoulder region.

Discussion

According to the present survey, tick infestation is common. 33.33% of camels were infested by hard ticks which was less than other reports [25,26]. Only two genera were observed including *Hyalomma* and *Rhipicephalus*. In contrast to other reports, three genera were found (*Hyalomma*, *Boophilus*, and *Rhipicephalus* spp.) [27]. Moreover, three species of ixodid ticks were observed from camels and the most prevalent tick was *H. anatolicum anatolicum*, while in another study, *H. dromedarii* was the predominant tick species in Iran [12,23,28–30] and other parts of the world [16,31,32]. It is also reported frequently in Jordan [33]. In another study, the highest mean prevalence was observed in *H. impeltatum* (60%) in central Tunisia [34]. *H. anatolicum anatolicum* was reported throughout Iran [35]. It is a vector of tropical theileriosis and transmits a different pathogenic organism such as *Theileria equi*, *T. lestoquardi*, *Babesia cabali*, *Trypanosoma theileri* and Crimean-Congo haemorrhagic fever virus [24]. *H. dromedarii* was the most frequent species after *H. anatolicum* in this study. *H. dromedarii* can be a potential threat for cattle and public health due to the role of *H. dromedarii* in the transmission of *T. annulata* and CCHFV [36]. The species of *H. dromedarii* existed worldwide and was observed in Africa, Turkey (eastern), Palestine, Syria, Iraq, Saudi Arabia, Yemen, Oman, Armenia, Azerbaijan, Iran, Afghanistan, Pakistan, Kirghizia (Fergana Valley), Uzbekistan, Turkmenistan, Tajikistan, India, and China (Xingjian) [37]. *H. excavatum* was found in some studies while it was not observed in the present study [12,30,38,39]. In the present study, the prevalence of *R. bursa* was 27/69%, the recent species was observed in some studies [29,30,40].

H. schulzei was found in some studies [26,39], but this finding is not in accordance with our study. The prevalence of tick infestation was 33.33%, while the prevalence of tick infestation in dromedary camels of Algeria and eastern Ethiopia was 57.14% and 94 % respectively [32,41]. The difference in the rate of prevalence in the two areas can be due to different climatic conditions and differences in the sampling periods.

Current study's results showed that hard ticks were present throughout the year and summer. Seasonally, the prevalence of tick infestation was more prevalent during summer and reached the minimum in the winter. Our findings were in agreement with the results of Moshavernia et al. [38], Salimabadi et al. [23], Nourollahi Fard et al. [12] and Khelifi-Ouchene et al. [32]. Hence, it can be concluded that the prevalence of tick infestation depends on geographical conditions, temperature, and altitude in different seasons [42,43]. Our finding showed that the maximum number of ticks was collected from perineal and chest region of the camel and a minimum number of ticks was collected from shoulder region that was in agreement with the results of Nourollahi Fard et al. [12]. However, Pasalary et al. [44] showed that the highest mean number of collected ticks was 9.6 under tail of female camels in Qom city, Iran.

In the present study, although the ratio of male ticks was higher than female ticks, the number of males per female was normal since males stay on the host longer than females [27] and this is in agreement with the finding of Champour et al. [25]. In the present study, camels were infested by hard ticks. There was not any infestation by other external parasites (mite, lice, flea, myias). However, some studies showed that camels were infested with *Sarcoptes* in Ethiopia [7,45,46] and Algeria [32].

In conclusion, in this study, three tick species were determined on one-humped camels (*Camelus dromedaries*) of Sabzevar city, Iran. It is concluded that camels were mostly infested with *Hyalomma* spp. which transmitted human and animal diseases. The provision of tick control programs in this area is essential for improving camel meat and milk production. The pour-on method is the most useful method of applying a acaricide for the control of camel ectoparasites. Studies of other internal and external parasites in camels of this area would be useful in the development of a management strategy of camel.

References

- [1] Sazmand A. 2011. Prevalence of cryptosporidiosis in camel and camel handlers in Yazd province. PhD Thesis, Shahid Chamran University of Ahvaz, Iran (in Persian).
- [2] Dorman E.A. 1986. Aspects of the husbandry and management of the genus *Camelus*. In: *The Camel in health and disease*. (Ed. A.J. Higgins). Balliere

- Tindall, London: 3-20.
- [3] Wilson R.T. 1984. The Camel. Longman Group Ltd., London, UK.
- [4] Anwar A.H., Khan M.N. 1998. Parasitic fauna of camel in Pakistan. In: *Proceedings of the Third Annual Meeting for Animal Production under Arid Conditions 2*: 69-76.
- [5] Bekele M. 2010. An epidemiological study on major camel diseases in the Borana Lowland, Southern Ethiopia. DCG Report No. 58, Drylands Coordination Group, Oslo: 67-98.
- [6] Parsani H.R., Singh V., Momin R.R. 2008. Common parasitic diseases of camel. *Veterinary World* 10: 317-318. doi:10.5455/vetworld.2008.317-318
- [7] Dinka A., Eyerusalem B., Yacob H.T. 2010. A study on major ectoparasites of camel in and around Dire Dawa, Eastern Ethiopia. *Revue de Médecine Vétérinaire* 161: 498-501.
- [8] Kiros S., Awol N., Tsegaye Y., Hadush B. 2014. Hard ticks of camel in Southern Zone of Tigray, Northern Ethiopia. *Journal of Parasitology and Vector Biology* 6: 151-155. doi:10.5897/JPVB2014.0162
- [9] Lawal M.D., Ameh I.G., Ahmed A. 2007. Some ectoparasites of *Camelus dromedarius* in Sokoto, Nigeria. *Journal of Entomology* 4: 143-148. doi:10.3923/je.2007.143.148
- [10] Mullen G.R., Durden L.A. 2009. Medical and veterinary entomology. Academic Press, Burlington, MA.
- [11] Elghali A., Hassan S.M. 2009. Ticks (Acari: Ixodidae) infesting camels (*Camelus dromedarius*) in northern Sudan. *Onderstepoort Journal of Veterinary Research* 76: 177-185. doi:10.4102/ojvr.v76i2.43
- [12] 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. *Tropical Animal Health and Production* 4: 197-200. doi:10.1007/s11250-011-9909-y
- [13] El Kady G.A. 1998. Protozoal parasites in tick species infesting camels in Sinai Peninsula. *Journal of the Egyptian Society of Parasitology* 28: 765-776.
- [14] Al-Deeb M.A., Muzaffar S.B., Abu-Zeid Y.A., Enan M.R., Karim S. 2015. First record of a spotted fever group *Rickettsia* sp. and *Theileria annulata* in *Hyalomma dromedarii* (Acari: Ixodidae) ticks in the United Arab Emirates. *Florida Entomologist* 98: 135-139. doi:10.1653/024.098.0123
- [15] Barghash S., Hafez A. 2016. Molecular detection of pathogens in ticks infesting camels in Matrouh Governorate, Egypt. *Journal of Bacteriology and Parasitology* 7: 2. doi:10.4172/2155-9597.1000269
- [16] Alanazi A.D., Abdullah S., Helps C., Wall R., Puschendorf R., Alharbi S.A., Abdelshafy S., Shaapan R.M. 2018. Tick-borne pathogens in ticks and blood samples collected from camels in Riyadh Province. Saudi Arabia. *International Journal of Zoological Research* 14: 30-36. doi:10.3923/ijzr.2018.30.36
- [17] Chinikar S., Ghiasi S.M., Moradi M., Goya M.M., Shirzadi M.R., Zeinali M., Meshkat M., Bouloy M. 2010. Geographical distribution and surveillance of Crimean-Congo hemorrhagic fever in Iran. *Vector Borne Zoonotic Diseases* 10: 705-770. doi:10.1089/vbz.2009.0247
- [18] Hart B.L. 1990. Behavioral adaptations to pathogens and parasites five strategies. *Neuroscience and Biobehavioral Reviews* 14: 273-294. doi:10.1016/s0149-7634(05)80038-7
- [19] Nelson W.A., Bell J.F., Clifford C.M., Keirans J.E. 1997. Interaction of ectoparasites and their hosts. *Journal of Medical Entomology* 13: 389-428. doi:10.1093/jmedent/13.4-5.389
- [20] Schwartz H.J., Wilson A.J. 1983. Camel production in Kenya and its constraints: Productivity. *Tropical Animal Health Production* 15: 169-178. doi:10.1007/BF02239929
- [21] Nabian S., Rahbari S., Shayan P., Haddadzadeh H.R. 2007. Occurrence of soft and hard ticks on ruminants in Zagros Mountainous areas of Iran. *Iranian Journal of Arthropod-Borne Diseases* 2: 12-17.
- [22] Rahbari S., Nabian S., Shayan P. 2007. Primary report on distribution of tick fauna in Iran. *Parasitology Research* 101: S175-177. doi:10.1007/s00436-007-0692-7
- [23] Salimabadi Y., Telmadarri 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 of Arthropod Borne Diseases* 4: 66-71.
- [24] Walker A.R., Bouattour A., Camicas J.L., Estrada-Pena A., Horak I.G., Latif A.A., Pegram R.G., Preston P.M. 2003. Ticks of domestic animals in Africa: a guide to identification of species. Bioscience reports, Edinburgh.
- [25] Champour M., Chinikar S., Mohammadi G., Razmi G., Shah-Hosseini N., Khakifirouz S., Mostafavi E., Jalali T. 2016. Molecular epidemiology of Crimean-Congo hemorrhagic fever virus detected from ticks of one humped camels (*Camelus dromedarius*) population in northeastern Iran. *Journal of Parasitic Diseases* 40: 110-115. doi:10.1007/s12639-014-0458-y
- [26] Ghashghaei O., Nourollahi Fard S.R., Khalili M., Sharifi H. 2016. Abundance and associated risk factors of ixodid ticks (Acari: Ixodidae) collected from one-humped camels (*Camelus dromedarius*) in Sistan and Baluchestan region, southeast of Iran. *Persian Journal of Acarology* 5: 219-227. doi:10.22073/pja.v5i3.21195
- [27] 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-Sazandeg 63: 30-35.
- [28] Elghali, A., Hassan S.M. 2009. Ticks (Acari: Ixodidae) infesting camels (*Camelus dromedarius*) in Northern Sudan. *Onderstepoort Journal of Veterinary Research* 76: 177-185. doi:10.4102/ojvr.v76i2.43
- [29] Ganjali M., Dabirzadeh M., Sargolzaie, M. 2014. Species diversity and distribution of ticks (Acari: Ixodidae) in Zabol County, Eastern Iran. *Journal of Arthropod-Borne Diseases* 8: 219-223.
- [30] Nazifi S., Tamadon A., Behzadi M.A., Haddadi S., Raayat Jahromi A.R. 2011. One-humped camels (*Camelus dromedarius*) hard ticks infestation in Qeshm Island, Iran. *Veterinary Research Forum* 2: 135-138.
- [31] Jemli M., Zrelli M., Aridhi M., M'zah M. 1995. Contraintes pathologiques majeures du développement de l'élevage du dromadaire en Tunisie [Major pathological constraints for dromedary breeding development in Tunisia]. *Options Méditerranéennes - Etudes et Recherches* 13: 131-136 (in French with summary in English).
- [32] Khelifi-Ouchene N.A., Ouchene N., Dahmani A., Kaaboub E.A., Ouchetati I., Haif A. 2020. Investigation of internal and external parasites of the camels (*Camelus dromedarius*) in Algeria. *Annals of Parasitology* 66: 331-337. doi:10.17420/ap6603.271
- [33] Al Rawashdeh O.F., Al Ani F.K., Sharrif L.A., Al Qudah K.M., Al Hami Y., Frank N. 2000. A survey of camel (*Camelus dromedarius*) diseases in Jordan. *Journal of Zoo and Wildlife Medicine* 31: 335-338. doi:10.1638/1042-7260(2000)031[0335:ASOC CD] 2.0.CO;2
- [34] Gharbi M., Moussi N., Jedidi M., Mhadhbi M., Sassi L., Darghouth M.A. 2013. Population dynamics of ticks infesting the one-humped camel (*Camelus dromedarius*) in central Tunisia. *Ticks and Tick-Borne Disease* 4: 488-491. doi:10.1016/j.ttbdis.2013.06.004
- [35] Nabian S., Rahbari S. 2008. Occurrence of soft and hard ticks on ruminants in Zagros Mountainous Areas of Iran. *Iranian Journal of Arthropod-Borne Diseases* 2: 16-20.
- [36] Chisholm K., Dueger E., Fahmy N.T., Samaha H.A., Zayed A., AbdelDayem M., Villinski J.T. 2012. Crimean-Congo hemorrhagic fever virus in ticks from imported livestock, Egypt. *Emerging Infectious Diseases* 18: 181-182. doi:10.3201/eid1801.111071
- [37] Hoogstraal H. 1956. African Ixodoidea I, ticks of the Sudan. Research Report No. NM 005.29.07. US Dept of the Navy, Bureau of Medicine and Surgery.
- [38] Moshaverinia A., Moghaddas E. 2015. Prevalence of tick infestation in dromedary camels (*Camelus dromedarius*) brought for slaughter in Mashhad abattoir, Iran. *Journal of Parasitic Diseases* 39: 452-455. doi:10.1007/s12639-013-0367-5
- [39] Nabian S., Rahbari S., Changizi A., Shayan P. 2009. The distribution of *Hyalomma* spp. ticks from domestic ruminants in Iran. *Medicine Veterinary Entomology* 23: 281-283. doi:10.1111/j.1365-2915.2009.00804.x
- [40] Ranjbar Bahadori S. 2003. Study of species diversity of animal ticks in Garmsar. *Journal of Veterinary Research* 58: 11-14 (in Persian with summary in English).
- [41] Taddese A., Mustefa M., Fikru A. 2013. Prevalence and identification of camel ticks in eastern Ethiopia. *Online Journal of Veterinary Research* 17: 64-72.
- [42] Sajid M.S., Iqbal Z., Khan M.N., Muhammad GH., Khan M.K. 2009. Prevalence and associated risk factors for bovine tick infestation in two districts of lower Punjab, Pakistan. *Preventive Veterinary Medicine* 92: 386-391. doi:10.1016/j.prevetmed.2009.09.001
- [43] Yakhchali M., Bahramnejad K., Almasi O. 2012. Ticks (Acari: Ixodida: Ixodidae and Argasidae) abundance and associated risk factors for animals in the natural habitat of Sanandaj suburb, Iran. *International Journal of Acarology* 38: 353-361. doi:10.1080/01647954.2011.651155
- [44] Pasalary M., Arbabi M., Pashei Sh., Abdigoudarzi M. 2017. Fauna of ticks (Acari: Ixodidae) and their seasonal infestation rate on *Camelus dromedarius* (Mammalia: Camelidae) in Masileh region, Qom province, Iran. *Persian Journal of Acarology* 6: 31-37.
- [45] Awol N., Kiros S., Tsegaye Y., Ali M., Hadush B. 2014. Study on mange mite of camel in Raya-Azebo district, northern Ethiopia. *Veterinary Research Forum* 5: 61-64.
- [46] Regassa A., Awol N., Hadush B., Tsegaye Y., Sori T. 2015. Internal and external parasites of camels (*Camelus dromedarius*) slaughtered at Addis Ababa Abattoir, Ethiopia. *Journal of Veterinary Medicine and Animal Health* 6. doi:10.5897/JVMAH2014.0346

Received 21 September 2020

Accepted 27 November 2020