

Ticks (Acari: Ixodidae) Infesting Camels in El Butana Area Mid-Central Sudan

Maha¹ A. El Tigani. and Mohammed², A. S.

(1) Tambool Camel Research Center (TCRC), Animal Resources Research Corporation

(2) Department of Entomology and Ticks. Central Veterinary Research Laboratories Centre (CVRL). P.O.Box 8067
Al Amarat, Khartoum, Sudan

ملخص البحث

أجريت هذه الدراسة بمنطقة البطانة في الفترة من مارس 2006 إلى فبراير 2007 لمعرفة أنواع القراد وتوزيعه ومدى تأثير نوع وعمر وجنس الإبل في كثافته. سجل أحد عشرة نوعا من القراد تنتمي لأربعة أجناس وهي الهيلوما- الأمبليوما- البوفيلاس والرابيبسيفلاس. معظم الأنواع تواجدت على مدار العام ولكن بدرجات متفاوتة وأعلى متوسط إصابة كان في يوليو وفبراير بينما الأقل كان في أبريل. رغم أن الإصابة في الإناث كانت أعلى منها في الذكور إلا أن ذلك كان ظاهريا وغير ذا أثر معنوي ($P \geq 0.05$) كما لم تلاحظ فروقا معنوية ($P \geq 0.05$) بين القراد الذي جمع من نوعي الجمال رغم أن العنابي قد كان ظاهريا يحمل قرادا أكثر من البطاني. وأما شهور السنة المختلفة وأعمار الإبل فقد كان لها تأثيرات معنوية ($P \leq 0.01$) في الإصابة بالقراد.

Summary

This survey was carried out in the El Butana area mid-eastern Sudan during the period from March 2006 to February 2007 to identify tick species infesting camels, and the influence of sex, age and eco-type of camel on tick infestation. Eleven species of ixodid ticks belonging to four genera namely: *Hyalomma*, *Amblyomma*, *Boophilus* and *Rhipicephalus*. Most of the tick species were found throughout the year, with varied infestation rates. *Hyalomma dromedarii* constituted 69.64% followed by *H. rufipes*, *H. impeltatum*, *H. anatolicum*, *H. truncatum*, *Amblyomma lepidum*, and *Rhipicephalus sanguineus*, while *Boophilus decoloratus*, *H. detritum* and *R. e. evertsi*, were much less encountered. The highest means of 47 ± 4.6 and 48.2 ± 6.8 being during February and July, respectively. The lowest mean of 12.4 ± 2.6 was reported in April. No significant differences were observed between tick burden carried by males and females or different eco-types of camels ($P \geq 0.05$) although Anafi eco-type carried more ticks than El Butani. Significant differences ($P \leq 0.01$), however, were observed between ticks collected in different months and from the different age groups of camels.

Introduction

Ticks are destructive blood sucking ecto-parasites, found in most if not all the countries of the world, but are of greater economic importance in the tropical and sub-Tropical zones (Siegmund, 1979). According to El hussien *et al.* (2004) ticks and tick-borne diseases (TBPs) constitute an important problem that threatens livestock production and development in Sudan.

About 68 ixodid tick species have so far been recorded in the Sudan (Hoogstraal 1956; Osman; 1978; Jongejan *et al.*, 1987). They belonged to eleven genera infesting a variety of domestic, and the wild animals, reptiles and birds. The distribution of these species is governed by the climatic condition and plant cover from desert in the north to the mid-savannah in the southern parts of the country (Hoogstraal, 1956).

The world has 19.3 million camels. Somalia ranks first with a population of 6.2 million camels followed by the Sudan with 3.3 million camels.

Most of studies on the tick population dynamic were carried out on sheep and cattle. Studies on ticks infesting camel in Sudan are meager. Elghali and Hassan (2009) found *Hyalomma dromedarii* as the predominant species in northern Sudan comprising 89% of the tick fauna, while six other species were found in low numbers.

This survey was carried out to identify the tick species infesting on camels in El Butana plain, mid-eastern Sudan and to study the influence of sex, age and eco-type of camels on tick infestation.

Materials and Methods

El Butana plain lies between Latitude 13° 40' and 17° 50' North and Longitude 32° 40' and 36° 00' east. The type of soil in the area is essentially silts and clay deposits in a flat plain. Trees commonly found in the area are *Acacia mellifera*, *A. nubica* and *A. nilotica*. The predominant grasses are *Cymbopogon nervatus*, *Aristida funiculata*, *Ipomoea cardiocephala*, *T. cordofana* and *Blepharis persica*. The plant cover in El Butana is constantly changing as a result of variable annual rainfall, expansion of agricultural projects and flareup of accidental fires. Overgrazing has depleted most of the highly palatable grasses (Agab, 1993).

Four sites around Tamboul, the biggest camel market in the Sudan, were selected for this study: ALSial, 20 km south east Tumbol, SirAlcol, 25 km North, AlOmarab, 40 km east north and Alabaitour Mountain 50 km south east. A total of 40 camels, 10 from each of the sites, which were not known to be treated with chemical acaricides, were randomly selected for tick collection on a monthly basis from March 2006 to February 2007. Total half body collection (MacLeod *et al.*, 1977) was carried out. All visible ticks were collected. Ticks from each animal were preserved in separate vials containing 70% ethanol. The vials were labeled with regard to sites, date, animal number, sex, eco-type and age.

Ticks were identified to the species level according to Hoogstraal (1956) and Walker *et al.* (2003), taking into consideration the recent valid names of the genus and species (Barker and Murrell, 2004).

Data were analysed using ANOVA, and means separation were performed using Ryan–Einto– Gebriel– Welsh multiple range test (REGWQ) according to Day and Quinn (1989).

Results

A 15860 adult ticks collected from the four localities in El Butana area, four genera were identified as *Amblyomma*, *Boophilus*, *Hyalomma* and *Rhipicephalus*. Seven species were reported as the major tick species infesting camels in the area (Fig. 1). Among those, *H. dromedarii* was the predominant tick species (69.64%), followed by *H. rufipes* (7.29%), *H. impeltatum* (6.39%), *H. anatolicum* (4.35%), *H. truncatum* (0.71%), *A. lepidum* (1.16%) and *R. sanguineus* (2.22%). The least encountered ticks were *B. decoloratus*, *H. detritum*, *R. evertsi evertsi* (0.06%–0.17%), while only two males of *A. variegatum* (0.013) were identified. Total tick infestation showed two peaks in July (rainy season) and February (cold season) (Fig.2). Most of the species were available throughout the year, with varying infestation rates. The highest mean number of 47 ± 4.6 was encountered during July and 48.2 ± 6.8 during February, the lowest (12.40 ± 2.06) was encountered in April.

The effect of age was evident on *H. dromedarii* only when camels 5 to 10 year old carried more ticks followed by older ones (Table, 1). Slight differences were observed among ticks collected from different sites, sex and eco-types of camels, but the difference was insignificant ($P \geq 0.05$). The significant differences ($P \leq 0.01$) were observed in ticks collected during different months.

Table 1: Means (\pm SE) of Ticks collected from different age groups of camels in El Butana Area during March 2006 -February 2007

Species/ age groups	<5 year (74)	5-10 year (240)	>10 year (166)	F.value
<i>H.dromedarii</i>	17.68 \pm 1.54b	24.73 \pm 0.99a	23.07 \pm 1.21a	8.65***
<i>Ha.anatolicum</i>	1.43 \pm 0.22a	1.39 \pm 0.17a	1.51 \pm 0.26a	0.18 ns
<i>H.marginatum rufipes</i>	3.11 \pm 0.50a.	2.29 \pm 0.26a	2.25 \pm 0.28a	1.35 ns
<i>H.impeltatum</i>	2.59 \pm 0.72a	1.98 \pm 0.23a	2.08 \pm 0.27a	1.29 ns

Numbers in parenthesis: Sample size , * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$, ns: not significant
 Means (\pm SE) followed by the same latter in each row are not significantly different at 5% level based on Ryans Einot Welsh Gabriel Multiple Range test (REGW)

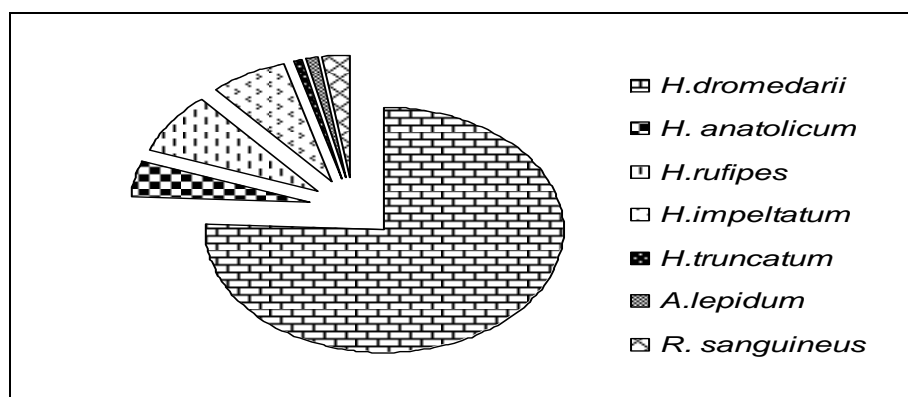


Fig. 1: Relative intensity of major tick species infesting camels in Butana area, mid-eastern Sudan during March, 2006-February, 2007.

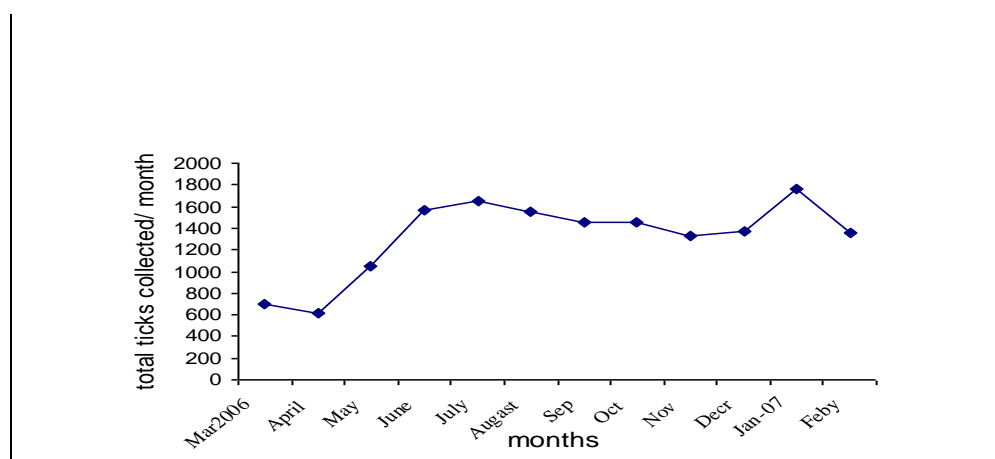


Fig.2. Monthly total ticks collected from 40 camels in El Butana area, mid-eastern Sudan during March, 2006-February, 2007.

Discussion

To interpret the results of this study, some important factors should be taken into consideration. Firstly, this tick survey was conducted in a semi-arid zone where rainfall is less than 600 ml (July to October). The mean maximum ambient temperature in summer could reach as high as 45°C, while the mean minimum in the cold season may fall to 10°C. On the other hand, the *Acacia* trees, bushes and cultivated areas conserve the microhabitats for ticks. Another important factor is the camel herd migration to and fro the center of El Butana. The interaction of these factors might have a role in the seasonal population dynamics of ticks.

The highest population density of the tick species within the four sites was recorded in Al Abitour, while the lowest was in Sir Al Col. Although the differences were insignificant, but they might be attributed to population density in Alabitour due to gathering of camels from different parts of the area.

In the present study, *H. dromedarii* was the predominant species infesting camels. This finding is in agreement with Karrar *et al.* (1963) and ELGali (2005). The same result was reported by Van Straten and Jongejan (1983) in Egypt, Al Waer (2004) in Libya and El Khalifa *et al.* (1995) in Saudi Arabia. Besides *H. dromedarii*, Karrar *et al.* (1963) reported *R. s. sanguineus*, *R. praetextatus (simus)*, *H. excavatum (anatolicum)* and *A. lepidum* from eastern Sudan. *R. praetextatus (simus)*, however, was not encountered in this study. In addition to the above mentioned ticks, Diab *et al.* (2001) found *H. impeltatum*. The same tick species was reported by El Khalifa *et al.* (1995) and it is in accordance with this study. It is highly worthy to note that only females of *H. dromedarii* were found to be engorged on camels. The females of the other tick species were found either flat or partially engorged. This may indicate the host specificity of camels to *H. dromedarii*. El Ghali (2005) in the River Nile State reported *H. dromedarii* as the predominant tick species in camels, whereas, Ahmed, (1999) studying tick infestation on sheep in the same area found *H. dromedarii* representing only 0.5% of the tick fauna. These findings on host preference might support our speculations. It could also be speculated that *H. dromedarii* competes other tick species and lessen their chance to engorge.

Amblyomma lepidum was recovered from the four sites but with low infestation rates. Walker *et al.* (2003) reported *A. lepidum* in a wide variety of climatic zones, from temperate highland, savannah and the desert, but it was common in the arid habitat with rainfall of 250-750 mm.

The occurrence of *A. variegatum* and *H. detritum* in El Butana area was not expected. However, collection of only two males of *A. variegatum* is of no significance as they may be introduced by migrating camels, but collection of females and males *H. detritum* in June, November and December may imply that this species is establishing itself. This species might have been introduced to the area through camels crossing during the first showers and could survive during the rainy season to appear in winter. More investigations, however, are needed to verify this situation although Walker *et al.* (2003) reported this species in the desert and steppe climatic areas of north central Sudan and they claimed that the tick had invaded the area from the Red Sea coast or along the valley of the River Nile.

The seasonality of ticks infestation of camels was observed by Diab *et al.* (2001) who reported high tick infestation in Egypt occurs during March to November. In the present study, *H. dromedarii* showed a clear pattern of seasonality and two peaks, the first during the rainy season and the second, which was even higher, was reported in the cold season. This could be attributed to the fact that the non-parasitic flat stages could survive well during the rainy season. This is in accordance with the findings of Ahmed (1999) who found high tick infestation in the cold season and supports Pegrum and Banda (1990) in that *H. dromedarii* does not go into behavioural diapause during high temperatures of summer that exceed 45 °C. Although, she-

camels were observed to carry more ticks than males, the difference was not significant. This was true for all adult tick species. Hassan (1997) reported similar findings for cows with higher loads of *R. appendiculatus* and *A. variegatum* than bulls. Animal movement, hormonal effect, pregnancy and lactation may have resulted in lower resistance of females to tick infestation.

The effect of age on tick load was shown by the fact that, camels 5 to 10 year old carried significantly more tick load than the others. This finding is in agreement with AlWaer (2004) and Abdalla (2007). Initially, the majority of moving camels fall within this age, and thus are more exposed. This age involves the breeding females which are groups already explained that they carry more ticks than males. On the contrary, in cattle Latif *et al.* (1991) found no difference between numbers of ticks carried by young calves (12-18 months old) and old cattle.

With regard to the camel eco-types, there was no significant difference ($P>0.05$) between number of ticks collected from El Anafi and El Butani eco-types. However, as these two eco-types co-exist in the same habitat, browsed the same area and no clear differences in their characters, their susceptibility to tick infestation is not expected to differ.

Acknowledgements

The authors are grateful to the staff members of Ticks and Tick-borne Diseases department, Central Veterinary Research laboratories Centre (CVRLC) for the technical help. The efforts of the staff members of Tumbool Camel Research Centre, are highly appreciated. The authors, also, wish to express their thanks to Prof Osman, A, Y and Dr. Elamin. A. D. for critical review of the manuscript.

References

- Abdalla, M. M. (2007).** Studies on ticks and tick -borne diseases of cattle in South Darfour. M. V. Sc. Thesis, University of Khartoum, Khartoum, Sudan.
- Agab, H. (1993).** Epidemiology of camel diseases in Eastern Sudan, with emphasis on brucellosis. M. V. Sc. Thesis, Faculty of Veterinary Science, University of Khartoum, Khartoum, Sudan.
- Ahmed, B. M. (1999).** Studies on epizootiology of *Theileria lestoquardi* (*nomennovum hirci*) (Apicomplexa: Theileriidae) in the River Nile State. M. Sc. Thesis, Upper Nile University, Sudan.
- Al Waer O. R. (2004).** Epidemiological study on camel ticks infestation in Libya and vaccine trials using *Boophilus* derived vaccine against *Hyalomma dromadarii* ticks. M.Sc. Thèses. Institute Agronomique et veterinaire Hassan 11, Morocco.
- Barker, S. C. and Murrell, A. (2004)** *Parasitol.*, **129**: 15-36
- Day, R. W. and Quin, G. P. (1989).** *Ecol. Monog.*, **59**(4)433-463.
- Diab, F. M.; ELKady G. A and Shouky, A. (2001).** *J. Egypt. Soc. Parasitol.* **31** (2): 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). PhD. Thesis Faculty of Veterinary Medicine University of Khartoum, Sudan.
- ElGhali, A. and Hassan S. M. (2009).** *Onderstep. J. Vet. Res.*, **76**: 177-185.
- ElHussein, A. M.: Abdel Majid, A. M. and Hassan S. M. (2004).** Present status of tick- borne diseases in Sudan. *Arabs. Inst. Pasteur. Tunis*, **81**:1- 4.
- El Khalifa, M. S.; AL Asgah, N. A. and Diab, F. M. (1995).** *J. Med. Entomol.*, **21**(1): 114-115
- Hassan, S.M. (1997).** Ecological studies on *Rhipicephalus appendiculatus* and *Amblyomma variegatum* (Acari: Ixodidae). Drop off rhythm, development, survival and seasonal population dynamics. Ph. D. thesis. University of Kenyatta, Nairobi, Kenya.

- Hoogstraal, H. (1956).** African Ixodoidea. 1. Ticks of the Sudan with special reference to Equatoria province and with preliminary review of the genera *Boophilus*, *Margaopus* and *Hyalomma*. Navy, Bureau of Medicine and Surgery Washington D. C. U. S. 1101p
- Jongejan, F.; Zivkovic, D.; Pegram, R. G.; Tatchell, R. J.; Fison, T.; Latif, A. A. and Paine, G. (1987).** *Exp. Appl. Acarol.*, 3: 331-346.
- Karrar, G.; Kaiser, M. N. and Hoogstraal, H. (1963).** *Bull. Enomol. Res.*, 54 (3): 509-522.
- Latif, A. A.; Punyua, D. K.; Nokoe, S. and Capstick, P. B. (1991).** *J. Med. Entomol.*, 28 (1): 114-121.
- MaCleod, J.; Goblo, M. H.; Madbouly, M. H. and Mwanaamo, B. (1977).** *Bull. Enomol. Res.*, 87: 161-175.
- Osman, A. M. (1978).** Water relation of Sudanese ticks of the genus *Amblyomma*. In tick- borne diseases and their vectors. Proceedings of an International Conference held in Edinburgh. 27 September–10 October. Ed J. K. H. Wilde, CTVM, U.K.
- Pegram, R. G. and Banda, D. S. (1990).** *Exp. Appl. Acarol.*, 8: 291-301.
- Siegmund, O. H. (1979).** *The Merck Veterinary Manual*, 5th edn. U. S. A., 1600 p.
- Van Straten, M. and Jongejan, F. (1983).** *Exp. Appl. Acarol.*, 17 (8): 605- 612.
- Walker, A. R.; Bouattour, A.; Camicas, A.; Estrada, Pena, Horak, I. G.; Latif A. A.; Pegram, R. G. and Preston, P. M. (2003).** *Ticks of Domestic Animals in Africa. A Guide to Identification of species*, Published by Bioscience Reports, Edinburgh, Scotland, U. K 221p.