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Full Length Research Paper

Ticks and mange mites infesting camels of Boran pastoral areas and the associated risk factors, southern Ethiopia

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A cross-sectional study was conducted on selected camel herds of Borana lowland, southern Ethiopia. From a total of 560 camels examined, 97.7 and 25.9% were found infested with ticks of various species and *Sarcoptes* species. A total of 4636 adult tick species were collected from half-body regions of selected camels. The tick species identified and their relative abundance were as follows: *Rhipicephalus pulchellus* (69.6%), *Amblyomma gemma* (12.4), *Hyalomma dromedarii* (10.8%), *Boophilus decoloratus* (4.2%), *Amblyomma variegatum* (2.6%) and *Amblyomma lepidum* (0.4%). *Sarcoptes* species was the only mange mites observed during this study in Borana lowland. The overall half-body region observed mean tick burden was 48.4 ticks/camel. The total half-body regions mean tick burden was significantly higher in young males (1 to 3 years of age) with poor body conditions, large herd size (greater than 40 camels) and IN wet season. Also mixing camels with sheep and goats, and cattle significantly affect the mean half-body tick burden of camels. However, the impact of ticks and mange mites on host camel and the environment was not measured during this study; it was concluded that the number and species of infesting ticks and mange mites encountered were significant enough to pose a potential health hazard. Further research work on the seasonal pattern, biology and vector role for the ticks should be carried out in Borana lowland.

Key words: Ticks, risk factors, Boran, Ethiopia.

INTRODUCTION

Camels are sources of milk, meat, drought power and serve as means of transportation, and hence, they support the survival of millions of people in semi-arid and arid areas of the world (Schwartz and Dioli, 1992). The ability of the camel to survive in harsh areas of the world, its endurance in prolonged drought, and above all its high potential to convert the scanty resources of the desert into milk and meat makes them more important to the pastoralists (Wosene, 1991). Ticks are the most important among the factors affecting camels' health in transmitting various diseases causing agents and causing blood loss, damage to hide and udder. It is the feeding of ticks that makes them important in the health of livestock (Walker et al., 2003). Camel mange is caused by *Sarcoptes scabie var cameli*, which is the most important parasitic disease affecting camel production and productivity (Kumar et al., 1992). In Ethiopia, ticks are common in all agroecological zones of the country (Pegram et al., 1981). The most important tick species reported to infest camel in eastern Ethiopia include *Rhipicephalus pulchellus, Amblyomma gemma, Hyalomma dromedarii,* (Dinka et al., 2010; Zeleke and Bekele, 2004), *Amblyomma variegatum, Boophilus decoloratus* and some others with very low proportion (Zeleke and Bekele, 2004). Dinka et al. (2010) also reported *Sarcoptic* species from camels of the eastern Ethiopia. In spite of their impact on camel production and productivity information regarding ticks and mange mites

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infesting camels in Borana, the southern Ethiopia, is scanty.

Therefore, the aim of the present study was to identify tick and mange mites' species affecting camels, to assess the relative abundance of ticks, to evaluate the mean tick load and the associate risk factors.

MATERIALS AND METHODS

Description of study area

The study was conducted in selected camel herds of Yabello district in Borana lowland, southern Ethiopia. The settlement of households in pastoral villages of Borana and elsewhere is characterized by clustering of households with close proximity in a village. Villages are traditionally managed by chiefs' Abba Olla who are important contact person for any cooperation of village members. For this study, villages were selected as sampling unit and villages' herds were selected and investigated.

The climate of the area was generally semi-arid with average annual rainfall ranging from 300 to 700 mm. The Boran area was characterized by bimodal pattern of rain, with the main rainy season locally known as Ganna extending from mid of March to May and small rainy season termed Haggaya from mid September to mid November. The other two seasons are the cool dry season Adoleessa extending from June to August and the major dry season Bonna extending from December to February (Coppock, 1994) (Figure 1).

Study population

Camel production is generally characterized by extensive pastoral production system in which animals are allowed to forage freely during day time and kept in open enclosure during the night. Borana and Gabra ethnics are the main camel herders in Yabello district (Megersa et al., 2008). Camel herd mobility is characterized by moving the whole herd to water point and to relatively better forage areas or herd splitting into mobile and homestead herds. Camel herds found within the radius of 40 km were considered as study population. Animals above 1 year old were included in this study.

Study design and sample size

A cross-sectional study was employed to study the selected camel herds. A total of 560 camels were selected for ticks and mange mites, study from October, 2009 to May, 2010. Camel herds were visited and sampled early in the morning before released to field, and thereafter samples were taken to Veterinary Laboratory of Yabello Research Center. The villages were selected randomly, and then 6 herds of camels per village were randomly selected. Sample size was determined based on 50% expected prevalence, 5% precision and 95% level of significance.

Examination for tick burden and mange mites

The camels thoroughly were examined for ectoparasites presence, and all ticks on half-body region were counted (modified from Kaiser et al., 1982; Dreyer et al., 1997; Okello-Onen et al., 1999) after restraining the animal. The count was done on half-body parts of the anatomical sites as follows: head- neck, brisket, lateral side, udder/scrotum, anal area, tail, foreleg and hind leg. Skin scrapings were collected from suspected cases for mange mites and preserved in 10% formalin. The samples were taken to the laboratory and before examination, 10% KOH was added to allow the release of mites from scabs and crusts (Soulsby, 1982).

Tick collection and identification

Ticks in different anatomical sites of half-body region were collected carefully and gently on a horizontal pull to the body surface of the camel by hand. The collected adult ticks were preserved in universal bottles containing 70% ethyl alcohol. Then it was labeled appropriately and then transported to the Veterinary Laboratory of Yabello Research Center, and identified using stereomicroscope following the standard identification procedures described by Walker et al. (2003), Okello-Onen et al. (1999) and Hoogstraal (1956).

Data analysis

Data were organized, edited and analyzed using the STATA software, version 11. The prevalence of ectoparasites was assessed using descriptive statistics. The effect of considered risk factors on the mean ticks' burden was tested using Poisson regression and logistic regression analysis.

RESULTS

Tick species and mange mite

From a total of 560 examined camels, about 547 (97.7%) were infested with various species of ticks. During the study period, a total of 6436 adult ixodid ticks were collected from selected camels of both sexes and half-body region. The study showed the presence of 4 tick genera namely: *Rhipicephalus*, *Amblyomma*, *Hyalomma* and *Boophilus*, with prevalence of 4480 (69.6%), 993 (15.4%), 695 (10.8%) and 268 (4.2%), respectively. The species of ticks identified are shown in Table 1. *R. pulchellus* with prevalence of 69.6% (4480), was identified as the most common tick species on camels of Boran areas. *A. gemma* and *H. dromedarii*, with prevalence of 12.4% (797) and 10.8% (695), were identified as the second and third common tick species affecting camels of the study area. About 145 (25.9%) camels were infested with mange mites. *Sarcoptes* species was the only mange mites identified in the study area. Detail of the finding and associated risk factors are shown in Table 3.

Tick burden

The overall half-body region observed mean tick burden was 48.4 ticks/camel. The total half-body regions mean tick burdens were significantly higher for male, young and poor body condition camels. Large herd size (greater than 40 camels), absence of recent treatment, presence of other ruminants and end of wet season (Table 2) had

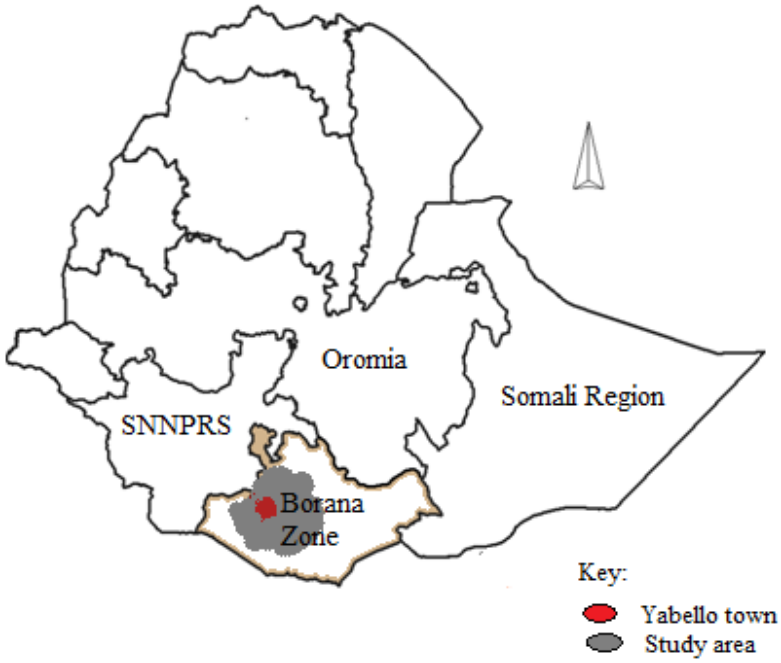

Figure 1. Administrative map of Ethiopia and Borana zone showing study areas.

Table 1. Proportion of different tick species collected from camels in Borana.

Tick genera	Species	Female	Male	Total	Prevalence (%)
Rhipicephalus	*R. pulchellus*	1037	3443	4480	69.6
	A. gemma	201	596	797	12.4
Amblyomma	*A. variegatum*	44	127	171	2.6
	A. lepidum	3	22	25	0.4
Hyalomma	*H. dromedarii*	109	586	695	10.8
Boophilus	*B. decoloratus*	176	92	268	4.2
Total ticks		1570	4866	6436	100.0

higher tick burden. Anal region was the most infested area of camels' body by ticks while the lateral-side was the least infested. The half-body region mean tick burden was progressively decreased from November to February (Figure 2).

DISCUSSION

Tick species and mange mites

The tick species identified in the present study were reported from eastern parts of the country and from various domestic animal species (Dinka et al., 2010; Zeleke and Bekele, 2004; Bekele, 1996). In the present study, *R. pulchellus* and *H. dromedarii* represented the main tick species infesting camels (69.6%) followed by *A. gemma* (12.4%) and *H. dromedarii* (10.8%). This finding is comparable with the report in eastern Ethiopia (Dinka et al., 2010). The 3 tick species commonly found in infesting camels were also reported by Dinka et al. (2010), Zeleke and Bekele (2004) and Bekele (1996) from eastern Ethiopia. Study conducted by Lawal et al. (2007) and Gupta and Kumar (1994) indicated that *H. dromedarii* was the most abundant tick species affecting dromedaries in Sokoto Nigeria and India, respectively. This difference in tick species abundance could be due to the variation in the ecology of the study areas.

The result of the current study revealed that male ticks of all species except *B. decoloratus* outnumbered

Table 2. Poisson regression analysis of risk factors for mean tick count in camels (n = 560).

Variable	Levels	Mean + SE	95% CI	P - value
Sex	Male	67.6 ± 2.0	63.8 - 71.5	
	Female	34.2 ± 0.9	32.6 - 35.9	0.000
Age	1 -3	77.8 ± 4.0	70.1 - 85.6	-
	4 -10	44.1 ± 1.1	42.0 - 46.3	0.000
	> 10	33.6 ± 2.5	28.6 - 38.5	0.000
Body condition	Poor	68.8 ± 1.9	65.1 - 72.1	-
	Medium	38.7 ± 0.5	37.7 - 39.7	0.000
	Good	24.9 ± 1.6	21.7 - 28.1	0.000
Herd size	< 20	43.5 ± 2.4	38.8 - 48.2	-
	20 - 40	38.2 ± 1.5	35.2 - 41.2	0.094
	> 40	56.3 ± 1.9	52.6 - 59.9	0.000
Recent treatment	No	53.5 ± 1.2	51.1 - 55.9	-
	Yes	18.2 ± 1.5	15.2 - 21.1	0.000
Presence of sheep-goat	No	33.0 ± 1.5	30.0 - 35.9	-
	Yes	52.7 ± 1.4	49.9 - 55.4	0.000
Presence of cattle	No	29.2 ± 1.0	27.5 - 31.0	-
	Yes	62.5 ± 1.5	59.5 - 65.5	0.000
Ethnics	Gabra	48.8 ± 1.8	45.3 - 52.2	-
	Borana	48.0 ± 1.6	44.8 - 51.0	0.168
Wet months	Nov-Dec	65.4 ± 2.3	60.9 - 70.0	-
Dry months	Jan-Feb	40.5 ± 1.3	38.0 - 43.1	0.000

Table 3. Logistic regression analysis of risk factors versus prevalence of mange mites.

Variable	Levels	No. examined	Prevalence % (95% CI)	OR	P-value
Sex	Female	323	25.4 (20.6 - 30.2)	1	0.750
	Male	237	26.6 (20.9 - 32.2)	1.1	
Age	1 - 3	83	28.0 (18.2 - 37.9)	1.1	
	4 - 10	436	25.7 (21.6 - 29.8)	1.2	0.860
	> 10	41	23.8 (10.7 - 36.9)	1	
Body condition	Good	237	21.4 (14.2 - 28.6)	1	
	Medium	197	24.9 (18.8 - 30.9)	1.2	0.257
	Poor	27	29.1 (23.3 - 34.9)	1.5	
Herd size	< 20	106	22.6 (14.6 - 30.7)	1	
	20 - 40	170	24.6 (18.1 - 31.0)	1.1	0.508
	> 40	284	27.9 (22.7 - 33.2)	1.3	
Ethnics	Gabra	275	25.1 (19.9 - 30.2)	1	0.670
	Borana	285	26.7 (21.5 - 31.8)	1.1	

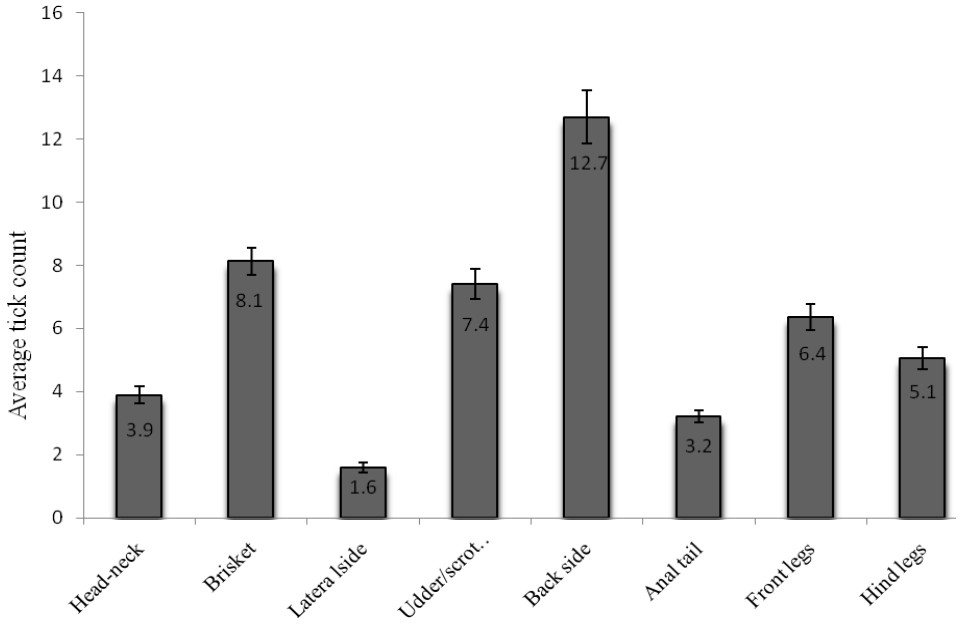

Figure 2. Mean half-body region tick burden of camel body parts.

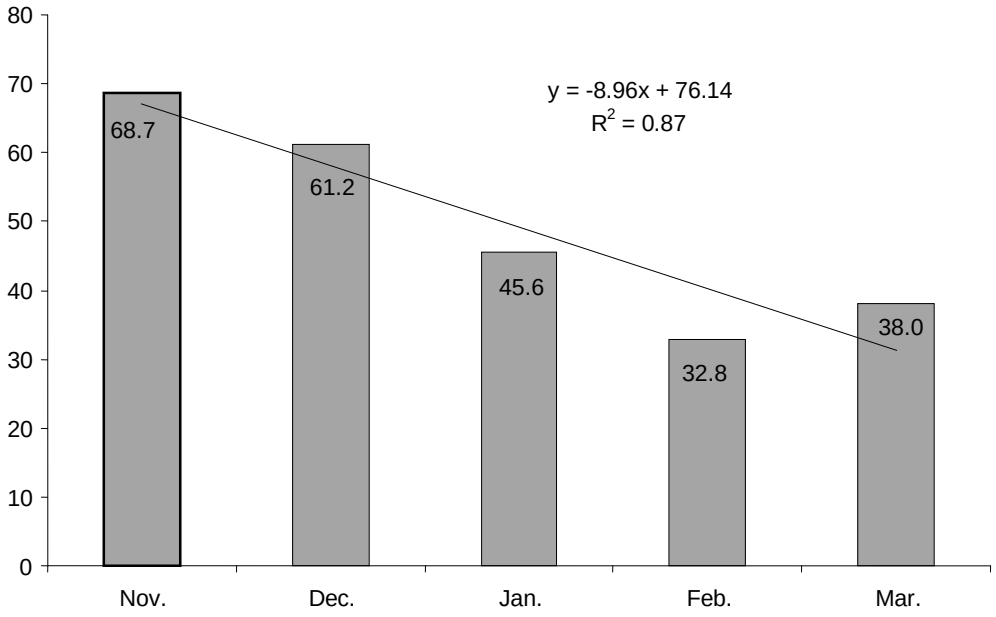

Figure 3. Trends of the mean monthly half-body ticks' burden in camels.

females. This observation is in a general agreement with report of Feleke et al. (2008), Sheferaw and Abebe (2006), Solomon et al. (2000) and Kaiser et al. (1991) from various domestic animals. This outnumbering of male ticks is due to the fact that female ticks once fully engorged drop-off the host to oviposit while males remain for several months, and continue feeding and mating with other females (Hoogstraal, 1956). According to ElGhali and Hassan (2009), Mohammed (2002) and Hassan (1997) engorged that *H. dromedarii*, *A. lepidum* and *A. variegatum* dropped within short hours.

The present study was also able to demonstrate the occurrence of higher percent of mange infestation (25.9%). This finding is higher from Dinka et al. (2010) and Lawal et al. (2007) who reported 10.7 and 3.5% from eastern Ethiopia and Sokoto, Nigeria, respectively. Ecological as well as owners management variation could be the cause of these differences. There was no

significant variation (*P > 0.05*) in the prevalence of *Sarcoptes* species infestation between the sexes, age groups, body conditions, herd size and ethnic groups.

This finding is in a general agreement with report of Dinka et al. (2010) from eastern Ethiopia.

Risk factors and mean tick burdens

This study revealed that male camels carried significantly more ticks than the females (*P < 0.01*). This could be due to the fact that, female camels are being daily restrained for milking, and during this time the milkers might remove ticks by hand, and this could lead to gradual reduction in the average tick load. A significantly higher tick load was recorded in younger camels aged 1 to 3 years (*P < 0.01*). This finding is in agreement with the report of Dia (2006). The possible suggestion of the present result shows that the adult camels do not lay on the ground more but search the higher plant strata for their feeding, whereas the young ones lay on the ground for a longer period and easily acquire the tick. A higher tick burden was recorded on camels with poor body condition than the others. This is consistent with the report of Radley (1980), relating to the resultant worry due to tick attachment which interfere with feeding and lead to loss of condition.

Camels kept and grazing mixed with small ruminant (95% CI = 30.0 - 35.9 and 49.9 - 55.4, *P < 0.01*) and cattle (95% CI = 27.5 - 31.0 and 59.5 - 65.5, *P < 0.01*) found on average to harbor more tick burden. Also, when the camel herd size increases to more than 40, the average tick load significantly increased (*P < 0.01*). In both conditions, there is temporary crowding at grazing areas and watering point, which could facilitate the spread of ticks and increase the infestation level. Frequent contact between camels, cattle and small ruminants might also contribute to the abundance of *R. pulchellus* and *A. variegatum* as they share common pastoral areas with abundant cattle and shoats.

This study started in the last month of the small rainy period, November. The half-body region tick burden was higher in this month, and then progressively decline from wet to dry months. At the beginning of main rainy season, March, the burden starts to increase. Ticks were found on camels throughout the year although higher burden of tick were observed during wet months, November, than the dry time, December to February. This finding is in line with the report of ElGhali and Hassan (2009), Sheferaw and Abebe (2006), Zeleke and Bekele (2004), Mushi et al. (1997) and Gupta and Kumer (1994). Wet season, high humidity and lower temperature range, facilitate the growth and survival of tick at all the different developmental stages (Hoogstraal, 1956). Inclement weather has a negative influence on the hatching and moulting time, and hence, immediately after the rainy season, there is a marked seasonal decrease in tick burdens on camels (Schwartz and Dioli, 1992). The main tick attachment sites were anal area, brisket, scrotum in males and under in females. Similar report was provided by Yacob et al. (2008).

These sites provide highest moisture, favorable for growth and the skin were easilypenetrated for sucking blood.

In conclusion the predominant tick species encountered were *R. pulchellus*, *A. gemma* and *H. dromedarii*. Factors like age, sex, body condition, herd size, herd composition and season were found to affect the mean tick burden of camels. *Sarcoptes* species was also found to be important external parasites of camels in Borana. However, the impact of ticks and mange mites on host camel and the environment was not measured during this study, it was concluded that the number and species of infesting ticks and mange mites encountered were significant enough to pose a potential health hazard. As per the current finding, it would be imperative to design external parasite control strategy to Borana area with great emphasis on tick control geared to the three predominant tick species previously stated. Further research work on the seasonal pattern, biology and vector role of the ticks should be carried out in Borana lowland.

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