

Ectoparasitic Burden of Camels under Pastoral Management in Southern Ethiopia

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Abstract

Camels are suffering from wide range of diseases of which external parasites are the most common ones. Three seasonal surveys were carried out in Borana areas to investigate the external parasitic burden among 1227 camels. Results showed that mange mite (35.4%) and ticks (66.4%) were widely prevalent among the study camels. *Sarcoptes* mange identified from skin scrapings was found to be responsible for camel skin infestation. A total of 1164 ticks were collected and six tick species were identified. *Rhipicephalus pulchellus* was the most prevalent species (77.5%) followed by *Amblyoma gemma* (12.6%), *Hyalomma dromedarii* (4.3%), *R. evertsi* (3.6%), *A. variegatum* (1.5%) and *A. lepidum* (0.4%). Mange mite was more prevalent during the dry season, in young and male camels, camels owned by Gabra, and large herds compared to their counter parts. There was also a significant association between poor body condition and mange mite occurrence. Tick infestations were higher during minor wet season (82.3%) compared to dry season (58.4%). Higher prevalence of tick infestations were recorded for Borana herds, older and female camels compared to Gabra and young camels. Animals in poor body condition were more infested with ticks than those in good body conditions. High prevalence of mange mite and tick infestation among the study camels indicates inadequate ecto-parasite control in the area. Hence, mange mite and ticks are destructive parasites that hinder productivity of camels and require effective control measures.

Key words: Camels, Mange-mites, Ticks, Risk factors, Borana, Ethiopia

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INTRODUCTION

In Ethiopia, camels represent a subset of large livestock resources and are kept by pastoralists under diverse constraints in arid and semi-arid marginal areas of eastern and southeastern lowlands. Camels are generally versatile animals that play key role in ensuring food security and fulfilling the livelihood priorities of households inhabiting the arid environments (Schwartz and Dioli, 1992). They provide households with cash income, food supply, transportation services and other benefits including ceremonial uses, insurance and risk buffering options. Camels have both economic and ecological advantages in multiple herding as they represent a minimal competition with other ruminants, and enhance wise use of the rangeland resources with minimum pressure on the environment (Megersa et al., 2014).

The Borana people who have been based on cattle pastoralism are increasingly engaged in camel production in response to changing climate and rangeland ecosystem i.e. increased frequency of droughts and bush encroachment which reduced grazing land for cattle (Megersa et al., 2014). Thus, camels have been an indispensable component of pastoralism to cope up with the looming climatic changes and rangeland degradations, and are reliable source of milk under such environmental constraints. Thus, camels of the study area are managed by pastoralists of different herding experience. For instance, camel pastoralism among the Gabra people constitutes an age-old tradition and the

Gabra herders have also played an instrumental role in the introduction of camels to the Borana areas (Coppock, 1994). Gabras are endowed with rich indigenous knowledge in camel husbandry and health management. But the Boranas who are late adopters of camel pastoralism may have less experience and inadequate knowledge of camel production and health care (Megersa et al., 2014). Thus, such difference in the level of indigenous knowledge of camel husbandry and health management between the two clans may be anticipated to result in variations in disease occurrences (Megersa et al., 2008). Despite its ecological and economic importance of keeping camels with multiple livestock species, challenge of infectious diseases and parasitic burden on camels is not clear and require further investigations.

Infectious and parasitic diseases are among the major constraints that hinder the production and reproduction performances of pastoral camels in Ethiopia and elsewhere in East Africa. Research findings on camel diseases showed that camels are either carriers or suffering from a wide range of infectious and parasitic diseases (Richard, 1987; Agab and Abbas, 1999; Wernery and Kaaden, 2002; Abbas and Omer, 2005). Trypanosomiasis, camel pox, contagious skin necrosis, pneumonia, mange mite infestations and internal parasites are among the major camel health problems previously reported from Borana areas (Richard, 1979; Megersa, 2010). Various authors who provided extensive accounts of camel diseases have indicated that mange

mite infestation to be of greater economic importance (Wernery and Kaaden, 2002; Abbas and Omar, 2005). Camel mange is a highly contagious disease which can spread to animals associated with infected animals. *Sarcoptes scabiei* var *cameli* is the most commonly identified from skin scrapings, and was regarded as the most destructive parasitic disease hampering production and productivity of camels in Ethiopia (Dinka et al., 2010; Megersa et al., 2012; Feyera et al., 2015).

Ticks are blood sucking parasites and are of high economic importance in the tropical environments. In addition to blood sucking, they cause tick paralysis and responsible for tick born diseases (Musa and Osman, 1990). The most important tick species reported to infest camels in Ethiopia include *Amblyomma gemma*, *A. variegatum*, *Boophilus decoloratus*, *Hyalomma dromedarii*, *Rhipicephalus pulchellus* (Zelege and Bekele, 2004; Dinka et al., 2010; Megersa et al., 2012; Taddese and Mustefa, 2013). The present study is therefore to investigate the ecto-parasites burden of camels, associated risk factors and major tick and mange species affecting camels of the study area.

MATERIALS AND METHODS

Study area

The study was conducted in Yabelo district of Borana zone in southern Ethiopia. The area has semi-arid climate with bimodal rainfall distribution during the major wet season, from mid-March to May, and the minor wet season from September to November. A cool dry period occurs from June to August while warm dry season extends from December to February (Coppock, 1994). The area is characterized by extensive pastoral production system. Cattle dominate the livestock species biomass followed by small ruminants and camels. Involvement in camel production among the previously cattle herders is on rise due to increased climate variability and rangeland ecosystem changes (Megersa et al., 2014).

Study design and sampling methods

Repeated cross-sectional surveys were carried out during three seasonal herd investigations. A total of 12 villages were randomly selected from six pastoral associations (Kebeles), namely Surupa, Jijido, Dadim, Dida Yabello, Dida Hara and Dartu with some restrictions depending on accessibility to villages by vehicle and presence of camel population. Subsequently, a total of 70 camel herds (i.e. sampling all herds found in the study villages) were selected and seasonally investigated during the dry period, and major and minor wet seasons. This study is part of a broader study on "Epidemiological investigations of major camel diseases in Borana" (Megersa, 2010). An assumption was made that at least

six camels exist per herd, so that 420 animals were anticipated to be examined over the three seasons (i.e. making an overall sample size of 1260 animals). However, the dynamic nature of pastoral herds, moving out and in of animals or herds in the study area, indeed made revisiting of the same animal or herd difficult. Since newly introduced animals or herds were used to replace those moved out of the selected villages, the study can be considered as repeated cross-section. Accordingly, a total of 442, 423 and 362 animals were clinically examined during dry, major wet and minor wet seasons, respectively.

Clinical examinations were performed on individually identified animals during each visits for presence of ectoparasite (ticks) and mange mite lesions. Participatory discussions on camel diseases and health care practices were also carried out on 12 groups (in each village), each having six to eight key informants. Since finding a tick free camels is unlikely, an animal having about ten or more ticks (rough count) was considered to be infested with ticks (tick burden). Ticks were collected carefully by hand and were preserved in universal bottles containing 70% ethyl alcohol for species identifications. A total of 1164 ticks were collected for laboratory analysis. The specimens were transported to Yabelo Regional Veterinary Laboratory for primary identifications using stereomicroscope following key identification procedures described by Walker et al. (2003). Further species identifications were performed at Veterinary Parasitology laboratory of Hawassa University. Skin scrapings were also taken from 125 suspected cases for mange mite identification during the first visit and preserved in 10% formalin. In the laboratory 10% KOH was added to the samples to allow the release of mites from scabs and crusts, and examined under stereomicroscope. Identification of mange mites at genera level was performed according to morphological features described by Urquhart et al. (1996) and Taylor et al. (2007).

Statistical analysis

In addition to descriptive summary of the data, further statistical analyses were performed using Stata version 11 (StataCorp 2009, College Station, TX 77845, USA). Prevalence of ecto-parasites was presented as proportion of positive cases to number of examined. Potential risk factors associated with parasitic prevalence were analyzed for herd and animal level variables using logistic regression analysis. Potential risk factors such as ethnic group, seasons, herd size, body condition score, sex and age of animals were analyzed using logistic regression analysis.

RESULTS

Camel health care and parasite treatments were mainly practiced by herders and traditional healers. Participatory discussions showed that higher proportion of health care, especially parasitic treatments (90%) was provided by herders themselves, while veterinary services only contributed about 10%. The clinical examination showed that study camels were highly infested with mange mite (35.4%) and tick (66.5%). The study animals were also concurrently affected by other health problems of the integument system, such as contagious ecthyma (12.9%),

camel pox (4.8%) and contagious skin necrosis (8.8%), traumatic wounds (2.1%) and abscesses (9.5%).

Out of a total of 1227 animals examined for external parasites, 35.4% the animals were infected with mange mite (Table 1). Examination of skin scrapings showed that camels in the study area were affected by *Sarcoptes* mange. Mange mite prevalence was significantly higher during the dry season, in Gabra camels, large herds and young animals compared to their counterparts. There was also a significant association between poor body conditions and mange mite prevalence. Mange mite prevalence was found to be higher in male than female camels.

Table 1. Prevalence and associated risk factors of mange mites in camels

Factors	Number	Prevalence	Odds Ratio	P-value
Season				
Dry	442	42.1		
Major wet	423	31.2	0.58	0.000
Minor wet	362	32	0.46	0.000
Ethnic group				
Borana	581	28.2		
Gabra	646	41.8	1.82	0.000
Herd size				
< 10 animals	107	27.1		
10-20 animals	718	33.1	1.24	0.371
> 20 animals	402	41.5	1.7	0.031
Sex of camels				
Male	239	41		
Female	988	34	0.74	0.043
Age of camels				
< 4 years	396	42.4		
4-15 years	711	32.6	0.7	0.015
> 15 years	120	28.3	0.51	0.005
Body conditions				
Poor	158	40.8		
Good	767	33.5	0.43	0.000
Medium	302	37.3	0.43	0.003
Total	1227	35.4		

The study showed that ticks infestation was prevalent in 66.5% of the animals with a higher prevalence observed during minor wet season (82.3%) compared to dry season (58.4%) (Table 2). Contrary to the observed mange mite prevalence (Table 1), higher tick prevalence was observed in Borana camel herds, and female animals. Tick prevalence also increased with age of the animals and was more prevalent in camels with poor body conditions.

Table 2. Prevalence and associated risk factors of ticks in camels

Factors	Number	Prevalence	Odds Ratio	P-value
Season				
Dry	442	58.4		
Major wet	423	61.7	1.3	0.084
Minor wet	362	82.3	4.7	0.000
Ethnics				
Borana	581	69.7		
Gabra	646	63.8	0.77	0.028
Herd size				
< 10 animals	107	71		
10-20 animals	718	64.6	0.75	0.195
> 20 animals	402	68.9	0.9	0.672
Sex of camels				
Male	239	51.5		
Female	988	70.2	2.23	0.000
Age of camels				
< 4 years	396	43.4		
4-15 years	711	77.5	5.31	0.000
> 15 years	120	78.3	5.04	0.000
Body conditions				
Poor	158	79.6		
Good	767	67.3	0.53	0.003
Medium	302	58.1	0.35	0.000
Total	1227	66.5		

A total of 1164 ticks were collected and identified to belong to three genera, namely *Rhipicephalus* (81.2%), *Amblyoma* (14.6%) and *Hyaloma* (4.3%). *Rhipicephalus pulchellus* was the most dominant tick species (77.5%) followed by *A. gemma* (12.6%), *H. dromedarii* (4.3%),

R. evertsi (3.6%), *A. variegatum*, (1.5%) and the least abundant species was *A. lepidum* (0.4%) in which case only male ticks were encountered (Table 3).

Table 3. Genera and species of ticks collected from camels

Tick Genera	Species	Male	Female	Total
		No (%)	No (%)	No (%)
Ambyloma	<i>A. gemma</i>	80 (12.9)	67 (12-3)	147 (12.6)
	<i>A. variegatum</i>	12 (1.9)	6 (1.1)	18 (1.5)
	<i>A. lepidum</i>	5 (0.8)	0	5 (0.4)
Hyloma	<i>H. dromedarii</i>	30 (4.8)	20 (3.7)	50 (4.3)
Rhipicephalus	<i>R. pulchellus</i>	468 (75.)	434 (79.8)	902 (77.5)
	<i>R. evertsi</i>	25 (4.0)	17 (3.1)	42 (3.6)
Total		620	544	1164

Discussion

In addition to external parasites such as ticks and mange mites, study camels were found to suffer from other diseases affecting cutaneous system. The observed high prevalence of Sarcoptic mange (35%) and ticks (66.5%) is comparable to previous reports from Borana area (Megersa et al., 2012; Regassa et al., 2015). In particular, mange mite is more damaging and can be regarded as the major health problem in the study areas similar to reports elsewhere (Richard 1987; Abbas and Omar, 2005; Megersa et al., 2012; Zahid et al., 2015; Awol et al., 2014; Feyera et al., 2015). Sarcoptic mange is a burrowing mite that penetrates deep into skin and lead to pruritus, irritation, development of papules, hairless areas and scab formation (Driot et al., 2011; Megersa et al., 2012). As a result of intense pruritus and irritations, affected camels stop feeding and rub against objects, bite or scratch the affected areas. This indeed affects the feed intake of infested animals in addition to facilitating spreading of infestation to other body parts and to healthy ones (Schwartz and Dioli, 1992).

The prevalence and severity of mange was higher during the dry period perhaps due to aggregation of camels at water points and prevailing feed shortage which might have reduced the resistance of the animals. Mange mite infestation is a highly contagious disease which spreads from affected to susceptible animals especially during aggregation at water point and night resting. The mite may spread directly by contact or indirectly through objects such as harnessing materials, bedding and tree trunk (Schwartz and Dioli, 1992). Thus, close contacts of camels particularly at water points coupled with high feed shortage could account for the observed higher mange mite prevalence during the dry period. Contrary to the present finding, other studies suggested that the mite actually tends to spread more quickly during cold weather when animal coats usually grow long and the animals huddle together more often (Richard, 1987; Zahid et al. 2015; Kotb and Abdel-Rady, 2015). In general, several factors have an effect on occurrences of mange mite infestation including poor hygienic condition, climate (temperature and humidity), overcrowding, feed shortage (including mineral deficiency) and poor animal health services (Wernery and Kaaden, 2002; Driot et al., 2011; Kotb and Abdel-Rady 2015). Since, animal health service is too limited to access such a highly mobile pastoral herds; animals continuously suffer from such a high disease burden. Once a herd is infested with Sarcoptic mite, the disease circulates within herd and severely affects susceptible animals such as young animals. Thus, observed higher prevalence with severe clinical manifestation in young animals also suggests their vulnerability to mange infestations similar to other reports (Hussain et al., 2012;

Megersa et al., 2012; Awol et al., 2014; Zahid et al., 2015). Severely affected animals were also in poor body conditions and often had concurrent infections and other skin problems.

Mange mite infestation was more prevalent in Gabra camels which were large sized herds and affected by feed shortage due to limited mobility. Large herd size and overcrowding of animals coupled with nutrition deficiency favors mite transmission and infections. Feyera et al. (2015) also observed increased prevalence of mange mite with large herds which augment close contact between animals during herding, housing and watering. Mange mite prevalence was found to be higher in male than female animals, and this is in agreement with a report from Morocco (Driot et al., 2011) in which male camels (35.1%) had higher prevalence than females (19%). Our result could be explained by increased proportion of young animals in male groups compared to females (most of which were breeding animals). Conversely, Zahid et al. (2015) reported a higher prevalence of mange mites in females than the males, and ascribed their findings to physiological stresses and hormonal effects. In general, improving herd management and treatment of affected animals particularly during feed scarcity, young and those in poor body conditions may reduce the disease burden and further halt the spread of the disease within herds (Richard, 1987).

Similar to the present finding, high level of tick occurrences among camels have been reported from different parts of Ethiopian (Dinka et al., 2010; Megersa et al., 2012; Taddese and Mustefa, 2013; Kiros et al., 2014; Regassa et al., 2015). Tick prevalence progressively increased during the subsequent wet seasons and peaked in the minor wet season, which is in line with the findings of other studies (Zelege and Bekele, 2004; ElGhali and Hassan, 2009; El Tigani et al., 2010; Megersa et al., 2012). In wet season, climatic factors (high humidity and lower temperature) and ecological factors such as increased vegetation cover of bush and shrubs may create a conducive conditions that favor the growth and survival of tick at all developmental stages.

The effects of animal factors such as age and sex on tick prevalence were observed in this study. Older animals and female camels harbored more ticks than their counterparts similar to the results of El Tigani et al. (2010) and Taddese and Mustefa (2013). The effect of sex may also be coupled with age of animals in which adults and old females carry more ticks than males (which were relatively younger). Other studies found no significant difference in tick infestations between the two

sexes and age groups (Dinka et al., 2010; Megersa et al., 2012).

Similar to the findings of this study, earlier studies also reported that *A. gemma*, *H. dromedarii*, and *R. pulchellus*, are the major tick species infesting camels in Ethiopia (Zelege and Bekele, 2004; Dinka et al., 2010; Megersa et al., 2012; Taddese and Mustefa, 2012; Kiros et al., 2014). Unlike the present results, other studies have reported low proportion of *Boophilus decoloratus* such as 1.2% by Tadesse & Mustefa (2012), 4.2% by Megersa et al. (2012) and 1.8% by Kiros et al. (2014). *B. decoloratus* is generally widely prevalent in the highland areas, but lowest in arid environments. Among the tick species identified, *Amblyoma* and *Hyalomma* species are long mouthed ticks that are more important in inflicting udder and skin damages and being a risk factor for opportunistic infections. Likewise, *Hyalomma* and *Rhipicephalus* species are responsible for causing tick paralysis among camels. For instance, Musa and Osman (1990) reported an outbreak of tick paralysis in Sudanese camel herd, and incriminated *Hyalomma* and *Rhipicephalus* ticks to be responsible. Additionally, tick infestation causes tick worry and reduces feed intake, leading to decreased production performances (Schwartz and Dioli, 1992).

In conclusion, this study revealed high prevalence of mange mite and tick infestations of camels and existence of associated risks in the southern pastoralist areas as shown in Garba and Borana herds. Owing to their destructive effects, mange mite and ticks deserves implementation of effective ecto-parasite control and strategic treatment interventions.

Acknowledgements

The study was supported by the Drylands Coordination Group (DCG) of Norway. The authors duly acknowledge the contribution of camel owners in Gabra and Borana for sharing their knowledge on camel husbandry and the district veterinary assistants for effective support during the field works.

REFERENCES

- Abbas B. and Omer O.H. 2005. Review of infectious diseases of the camel. *Vet. Bull.* 75: 1N–16N.
- Agab H. and Abbas B. 1999. Epidemiological studies on camel diseases in eastern Sudan. *World Anim. Rev.* 92: 42–51.
- Awol N. Kiros S. Tsegaye Y. Ali M. and Hadush B. 2014. Study on mange mite of camel in Raya-Azebo district, northern Ethiopia. *Vet. Res. Forum* 5: 61–64.
- Coppock D.L. 1994. The Borena Plateau of Southern Ethiopia: Synthesis of the Pastoral Research, Development and Change, 1980–1991. ILRI, Addis Ababa, Ethiopia.
- Dinka A. Eyerusalem B. and Yacob H.T. 2010. A study on major ectoparasites of camel in and around Dire-Dawa, Eastern Ethiopia. *Rev. Med. Vet. (Toulouse)* 161: 498–501.
- Driot C. Kamili A. Bengoumi M. Faye B. Delverdier M. and Tligui N. 2011. Study on the epidemiology and histopathology of Sarcptic mange and ring worm in one-humped camel in south of Morocco. *J. Camel Pract. Res.* 18: 107–114.
- El Tigani M.A. and Mohammed A.S. 2010. Ticks Infesting Camels in El Butana Area Mid-Central Sudan. *Sudan J. Vet. Res.* 25: 51–54.
- ElGhali A. and Hassan S.M. 2009. Ticks infesting camels (*Camelus dromedarius*) in Northern Sudan. *Onderstepoort J. Vet. Res.* 76: 177–185.
- Feyera T. Admasu P. Abdilahi Z. and Mammed B. 2015. Epidemiological and therapeutic studies of camel mange in Fafan zone, Eastern Ethiopia. *Parasit. Vectors* 8: 612.
- Hussain M.H. Habasha F.G. and Faraj M.K. 2012. *Demodectic* mange in Iraqi camels. *Al-Qadisiya. J. Vet. Med. Sci.* 11: 1–5.
- Kiros S. Awol N. Tsegaye Y. and Hadush B. 2014. Hard Ticks of Camel in Southern Zone of Tigray, Northern Ethiopia. *J. Parasitol. Vector Biol.* 6(10): 151–155.
- Kotb S. and Abdel-Rady A. 2015 Sarcptic mange of camel in upper Egypt: Prevalence, risk assessment, and control measures. *J. Adv. Vet. Anim. Res.* 2(4): 410–417.
- Megersa B. 2010. An epidemiological study of major camel diseases in the Borana lowland, Southern Ethiopia. DCG Report No 58. Oslo, Norway.
- Megersa B. Damena A. Bekele J. Adane B. and Sheferaw D. 2012. Ticks and mange mites infesting camels of Boran pastoral areas and the associated risk factors, southern Ethiopia. *J. Vet. Med. Anim. Health* 4: 71–77.
- Megersa B. Markemann A., Angassa A., Ogutu J.O. Piepho H.P. and Valle Zárate A. 2014. Livestock diversification: an adaptive strategy to climate and rangeland ecosystem changes in southern Ethiopia. *Hum. Ecol.* 42 (4): 509–520.
- Megersa B. Regassa A. Kumsa B. and Abunna F. 2008. Performance of camels (*Camelus dromedarius*) kept by pastoralists with different degree of experience in camel keeping in Borana Southern Ethiopia. *Anim. Sci. J.* 79 (4): 534–541.
- Musa M.T. and Osman O.M. 1990. An outbreak of suspected tick paralysis in one-humped camels (*Camelus dromedarius*) in the Sudan. *Rev. Elev. Med Vet. Pays. Trop.* 43(4): 505–510.
- Regassa A. Awol N. Hadush B. Tsegaye Y. and Sori T. 2015. Internal and external parasites of camels (*Camelus dromedarius*) slaughtered at Addis Ababa

- Abattoir Ethiopia. *J. Vet. Med. Anim. Health*: 6: 71-77.
- Richard D. 1979. Study of the Pathology of the Dromedary in Borana Awraja (Ethiopia). PhD Thesis; IEMVT. Maisons-d'Alfort France.
- Richard D. 1987. Camel mange. *Rev. Sci. Tech. Off. Int. Epiz.* 6 (2): 475-477.
- Schwartz H.Z. and Dioli M. 1992. The one-humped camel in Eastern Africa. A pictorial guide to diseases health care and management. Verlag Josef Margaf Schonwald Druck Berlin. 282pp.
- Taddese A. and Mustefa M. 2013. A Study on Camels Ticks in and Around Dire Dawa Eastern Ethiopia. *Acta Parasitologica Globalis* 4 (2): 64-70.
- Taylor M.A. Coop R.L. and Wall R.L. 2007. Veterinary Parasitology 3rd edition Blackwell Publishing Ltd. 9600 Garsington Road Oxford. 600pp.
- Urquhart G.M. Armour A. Duncan J.L. and Jennings F.W. 1996. Veterinary Parasitology. 2nd edition Blackwell Science, London. pp. 141-205.
- Walker A.R. Bouattour A. Camicas J.L. Estrada-Pena A. 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. Bioscience Reports, Edinburgh Scotland, UK. pp. 7-221.
- Wernery U. and Kaaden O.R. 2002. Infectious Diseases of Camelids. 2nd edition. Blackwell Science Berlin. pp. 19 – 388.
- Zahid M.I. Maqbool A. Anjum S. Ashraf K. Khan M.S. and Ahmad N. 2015. Prevalence of Sarcoptic Mange in Camels in Punjab Pakistan. *J. Anim. Plant Sci.* 25: 1259-1263.
- Zelege M. and Bekele T. 2004. Species of ticks on camels and their seasonal population dynamics in eastern Ethiopia. *Trop. Anim. Health Prod.* 36(3): 225-231.

