

## Prevalence and Risk Factors of Ectoparasites in Small Ruminants in and around Haramaya University, Eastern Oromia Region, Ethiopia

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### Abstract

Infestation by external parasites causes mortality, decreased productivity and financial loss in the animal exports. A cross sectional study was conducted from November, 2016 to April, 2017 in and around Haramaya University, Eastern Oromia region, Ethiopia to determine the prevalence, host risk factors and identify ectoparasites on small ruminants. Accordingly, a total of 384 small ruminants (190 sheep, and 194 goats) were randomly selected and examined for the presence of ectoparasites. Then, samples of ectoparasites were collected manually and put in clean universal bottles containing 70% ethanol. The samples were transported to the Haramaya University Veterinary Parasitology laboratory and identified to genus/species level under stereomicroscope. The overall prevalence of ectoparasites was 98% (sheep 55.8% and goats 42.2%), and the major identified ectoparasites were ticks 80 (20.8%), lice 78 (20.3%) and fleas 70 (7.8%). The genus/species of the identified ectoparasites were lice (*Damalina ovis*, 12.8% and *Linognathus stenopsis*, 7.5%), fleas (*Ctenocephalus*, 7.8), ticks (*Amblyoma variegatum*, 6.8%, *Boophilus decoloratus*, 9.4%, *Rhipicephalus evertsi evertsi*, 2.9% and *Hyalomma truncatum*, 1.8%). Host risk factors such as sex, species, breed, body condition score and physiological status (pregnancy) were significantly associated ( $p < 0.05$ ) with the overall prevalence of ectoparasites in small ruminants. According to this study, there was high prevalence of ectoparasites in small ruminants of the study area. Therefore, to minimize this high prevalence of ectoparasites in small ruminants and their impacts, appropriate and strategic control measures are paramount important.

**Keywords:** Ectoparasites; Haramaya University; Prevalence; Risk factors; Small Ruminants

## Introduction

Agriculture is the mainstay of Ethiopian economy employing over 80% of the adult population and accounts for 45% of the gross domestic production and 85% of the export earnings (Sertse, 2004). Sheep and goats are sources of foreign currency owing to skin export to the international markets. Moreover, Wool and manure are also important by-products of small ruminant productions (MoARD, 2005).

Small ruminant husbandry is constrained by compound effect of disease, poor feeding, and poor management leading to low rural income and low export income (Chalachew, 2001). Ectoparasites commonly ticks, mites, lice and ked are important parasites because of their disease transmission, blood feeding habit and skin damage in most of the livestock population (CSA, 2004). Ectoparasites of small ruminants cause blood loss and very heavy infestations result with severe anaemia. Moreover, they are the most important vectors of protozoan, bacterial, viral and rickettsial diseases (Radostits *et al.*, 2007). All ectoparasites cause intense irritation to the skin, the extent depending on the parasite involved. Infested animals scratch, rub and bite the affected areas and this end up with skin damage (Radostits *et al.*, 2007).

The utilization of skins in Ethiopia is estimated to be 75% and 97%, from goats and sheep respectively (Mohammed, 2000). However in recent years, it has been relegated because of skin rejection and down grading inflicted on hides and skin defects mainly due to infestation by external parasites causing mortality and decreased productivity (Kassa, 2006) and accounts for 75% financial loss in the animal exports. Around 1 million birr annual loss was estimated through rejection and down-grading of hides and skins in Ethiopia (Zelege and Bekele, 2004). Keeping in view, little information on prevalence and importance of external parasites in small ruminant is available in and around Haramaya University, Oromia region. Therefore, the objectives of this study were: to estimate the prevalence of ectoparasites in small ruminants in the study area; to identify the ectoparasites to their genus/species level, and to assess the host risk factors for the prevalence of ectoparasites in small ruminants.

## Materials and Methods

### Study Area and Animals

The study was conducted in and around Haramaya University, Eastern Hararghe zone of Oromia Regional State of Ethiopia. According to the Zone Office of Agriculture and Rural Development, Haramaya is located approximately 527km East of Addis Ababa, and 14km West of Harare town. The elevation of the area is about 2000m above sea level, and geographically it is located at 41°59'58" latitude and 09°4'10" longitude. The livestock population of the area is Cattle: 63, 723 (40.8%) Sheep: 13, 612 (8.7%), Goats: 20, 350 (13%), Donkeys: 15, 975 (10.2%), Camels: 530 (0.3%), and Chickens: 42, 035 (27%). The study animals were sheep and goats population which were owned by Haramaya University and smallholder farmers under traditional management system (BoARD, 2017, unpublished data)

### Study Design and Sampling

A cross sectional study was employed to address the objectives of the study. The study animals were selected by systematic random sampling technique and the required sample size was determined based on the expected prevalence of 50% and the formula given by Thrusfield (1995). The study considered 95% confidence interval and 5% precision level. Accordingly 384 sheep and goats were selected and for this study. The selected host risk factors were species, sex, age, breed, body condition score and physiological status (pregnancy).

$$N = \frac{1.96^2 \times P_{\text{exp}} (1 - P_{\text{exp}})}{d^2}$$

Where

N=required sample size

$P_{\text{exp}}$  =expected prevalence

$d^2$ =desired absolute precision

### Sample collection and identification

A total of 384 small ruminants (190 sheep and 194 goats) were randomly selected and studied for the presence of ectoparasites. Before clinical examination the age and body condition score of each animal was recorded. The age and body condition score (BSC) of each animal were determined based on the description given by Gatenby (2002) and Steele (1996), respectively. Then, clini-

cal examination was conducted by visual inspection and palpation of the skin for the presence of ectoparasites on all parts of the animal. Next, ectoparasites such as ticks, lice and fleas were collected by hand from their attachment sites and put in clean universal bottles with 70% ethanol (Urquhart *et al.*, 1996). The collected samples were transported to the Veterinary Parasitology Laboratory of Haramaya University, and examined under stereomicroscope for identification following the identification key given by Urquhart *et al.* (1996) and Walker *et al.* (2003).

### Data management and analysis

Data obtained in the study was entered into a computer on Microsoft Excel spreadsheet. The frequencies of ectoparasites were compared with variables and expressed in percentage and subjected to p-value and chi-square ( $\chi^2$ ) test using SPSS version 20. A p-value <0.05 was considered statistically significant association.

## Results

### Overall prevalence of ectoparasites in small ruminants

The overall prevalence of ectoparasites in small ruminants was 48.9%. The identified parasites were lice 78 (20.3%), ticks 80 (20.8%) and fleas 70 (7.8%). Four genera of ticks were identified (*Amblyomma variegatum*, *Boophilus decoloratus*, *Hyalomma truncatum* and *Rhipicephalus evertsi evertsi*), two genera of lice (*Linognathus stenopsis* and *Damalina ovis*) and one genus of fleas (*Ctenocephalus*) (Table 1). The hypothesized host risk factors (species, sex, breed, body condition score and pregnancy except age) have shown a statistically significant association with the overall prevalence of ectoparasites in small ruminants (Table 2).

**Table 1. Overall and genus/species level prevalence of ectoparasites (N=384)**

Genus	Species	Number of infested animals	Percent (%)
Damalina	Damalina ovis	49	12.8
Linognathus	Linognathus stenopsis	29	7.5
Ctenocephalus		70	7.8
Ambyloma	Ambyloma variegatum	26	6.8
Boophilus	Boophilus decoloratus	36	9.4
Rhipicephalus	Rhipicephalus evertsi evertsi	11	2.9
Hyalomma	Hyalomma truncatum	7	1.8

**Table 2. Association of overall prevalence of ectoparasites with hypothesized host risk factors**

Risk factors	Category	Number of examined	Number of positive (%)	X <sup>2</sup>	95 % CI	p-value	
Species	Ovine	190	55.8	7.023	0.008, 0.012	0.011	
	caprine	194	42.3				
Sex	Male	202	55.4	7.178	0.007, 0.010	0.008	
	Female	182	41.8				
Breed	Goats	BC	92	18.751	0.000, 0.001	0.001	
		AC	16				68.8
	HHG	86	30.2				
	Sheep	BOH	144				54.2
		HHS	46				60.9
Age	Young	121	53.7	1.602	0.223, 0.240	0.206	
	Adult	263	46.8				
Body condition	Poor	69	78.3	58.602	0.000, 0.000	0.000	
	Moderate	244	50.8				
	Good	71	14.1				
Pregnancy status	Pregnant	132	37.1	11.278	0.000, 0.001	0.001	
	Non-pregnant	252	55.2				

ey: BHO: Black Head Ogaden, HHS: Hararghe Highland Sheep, BC= Boer Cross, AC: Anglo Cross, HHG: Hararghe Highland Goat

**Prevalence of ectoparasites by species and sex of small ruminants**

According to the results of the study, there was statistically significant difference ( $p < 0.05$ ) in the prevalence of lice between species of small ruminants, where it was more prevalent in ovine more than caprine. Moreover, statistically significant difference ( $p < 0.05$ ) was found in the prevalence of ticks and lice between sex of small ruminants, where it was higher in females than males (Table 3).

**Table 3. Prevalence of ectoparasites by species and sex of small ruminants**

Ectoparasites	Species		X <sup>2</sup> (P-value)	Sex		X <sup>2</sup> (P-value)
	Ovine (n=106)	Caprine (n=82)		Male (n=112)	Female (n=76)	
Ticks	23.7%	18.0%	1.85(0.173)	24%	55%	24.95(0.000)
Lice	25.8%	14.9%	8.13(0.017)	38.5%	44.4%	1.76(0.415)
Fleas	6.3%	9.3%	1.17(0.280)	21.8%	10.2%	3.03(0.082)

n: Number of animals examined

**Prevalence of ectoparasites by breeds of small ruminants**

The overall prevalence of ticks and lice infestations in the different breeds of small ruminants was highly significant. Ticks infestation was more prevalent in Hararghe highland sheep, Boer cross and Anglo cross breeds of goats. Lice were more prevalent in black head Ogaden sheep and Hararghe highland goats (Table 4).

**Table 4. Prevalence of ectoparasites by breeds of small ruminants**

Ectoparasites	Sheep breeds		X <sup>2</sup> (p-value)	Goat breeds			X <sup>2</sup> (p-value)
	BHO	HHS		BC	AC	HHG	
Ticks	14.6%	47.2%	22.430 (0.000)	50.0%	53.3%	11.2%	30.2(0.000)
Lice	34.3%	3.8%	20.656 (0.000)	0.0%	0.0%	7.0%	7.0(0.030)
Fleas	5.1%	9.4%	1.208 (0.000)	11.1%	20.0%	2.4%	2.4(0.302)

BHO: Black Head Ogaden, HHS: Hararghe Highland Sheep, BC= Boer Cross, AC: Anglo Cross, HHG: Hararghe Highland Goat

### Prevalence of ectoparasites by age groups of small ruminants

It was revealed that the difference in the prevalence of lice and fleas between young and adult goats was statistically significant ( $p < 0.05$ ). Furthermore, ticks prevalence was higher ( $p < 0.05$ ) in adult than young sheep. However, fleas prevalence was higher ( $p < 0.05$ ) in young than adult sheep (Table 5).

**Table 5. Prevalence of ectoparasites by age of small ruminants**

Ectoparasites	Goats		X <sup>2</sup> (p-value)	Sheep		X <sup>2</sup> (p-value)
	Young	Adult		Young	Adult	
Ticks	13.2%	20.6%	1.64 (0.945)	11.8%	30.3%	8.32 (0.004)
Lice	14.7%	15.1%	0.01(0.000)	29.4%	23.8%	1.23 (0.54)
Fleas	22.1%	1.4%	20.32(0.000)	14.7%	1.6%	12.60(0.000)

### Prevalence of ectoparasites by body condition of small ruminants

This study has shown that the prevalence of lice and fleas was higher in small ruminants with poor than moderate and good body conditions ( $p < 0.05$ ). However, ticks prevalence was higher in small ruminants with moderate than poor and good body conditions (Table 6).

**Table 6. Prevalence of ectoparasites by body condition of small ruminants**

Ectoparasites	Sheep			X <sup>2</sup> (p-value)	Goats			X <sup>2</sup> (p-value)
	P	M	G		P	M	G	
Ticks	12.2%	28.6%	12.5%	5.86 (0.053)	12.2%	28.6%	12.5%	5.86(0.053)
Lice	43.9%	22.6%	6.2%	15.12(0.004)	43.9%	22.6%	6.2%	15.12(0.004)
Fleas	14.6%	4.5%	0.0%	6.61(0.037)	14.6%	4.5%	0.0%	6.61(0.037)

P: Poor, M: Moderate, G: Good

### Prevalence of ectoparasites by pregnancy status of small ruminants

It was also revealed that ticks prevalence was higher in pregnant than non-pregnant sheep ( $p < 0.05$ ). Likewise, lice prevalence was higher in pregnant than non-pregnant goats ( $p < 0.05$ ) (Table 7).

**Table 7. Prevalence of ectoparasites by pregnancy status of small ruminants**

Ectoparasites	Sheep		X <sup>2</sup> (p-value)	Goats		X <sup>2</sup> (p-value)
	Pregnant	Non-pregnant		Pregnant	Non-pregnant	
Ticks	40%	35.7%	24.15 (0.000)	17.9%	18.5%	0.01(0.994)
Lice	36%	19%	5.08 (0.280)	33.3%	13.0%	13.43(0.001)
Fleas	0.0%	4.8%	3.76 (0.152)	0.0%	11.1%	5.02(0.081)

## Discussion

The overall prevalence of ectoparasites in both host species was 48.9% (sheep 55.8%, goats 42.3%). The animals were infested by single or mixed ectoparasites. The higher prevalence of ectoparasites in the study area could be due to the fact that sheep and goats could have frequent exposure to the same communal grazing land that favored the frequent contact and management system of animals. This finding is lower than the report of Fentahun *et al.* (2012), who reported an overall ectoparasites prevalence of 78.38% in small ruminants in and around Gondar Town, Ethiopia.

The prevalence of ectoparasites in sheep and goats in this study is lower than previous report by Bekele *et al.* (2011), who reported ectoparasites prevalence of 99.38% and 96.92% in sheep and goats, respectively in Wolmera district of Oromia region, central Ethiopia. However, the prevalence of ectoparasites in sheep in the current study is in close agreement with the report of Abebe *et al.* (2011), who reported 51.7% in Tigray region, Ethiopia. Moreover, Sertse (2004), reported ectoparasites prevalence of 50.5% in sheep in Kombolcha and Dessie of Amhara region, Ethiopia, which is comparable to the findings of the current study. The author also reported ectoparasites prevalence of 56.4% in goats, and this is higher than the prevalence of ectoparasites in goats (42.3%) in the present study. Similarly, Mulugeta *et al.* (2010) reported ectoparasites prevalence of 55.5% and 58% in sheep and goats, respectively, in Tigray region. According to this study, the identified ectoparasites were ticks 80 (20.8%), lice 78 (20.3%), and fleas 70 (7.8%). The prevalence of ticks in this study is in agreement with the report of Fentahun *et al.* (2012), which was found to be 20%. However, the authors reported lice and fleas prevalence of 54.6% and 35.7%,



respectively, which is not in line with the present findings. However, the prevalence of ticks in the present study is lower than the report of Abebe *et al.* (2011), who reported 48%. On the other hand, the prevalence of lice and fleas which was reported by the authors was 1.3% and 3.1%, respectively, which is lower than the findings of the present study.

In this study, four genera of ticks (*Amblyoma*, *Boophilus*, *Rhipicephalus* and *Hyalomma*) were identified which made a total prevalence of 23.7% and 18% in sheep and goats, respectively. This result is supported by previous reports of Teshome (2002), who reported ticks prevalence of 23.8% and 16% in sheep and goats, respectively in Sidama zone, southern Ethiopia. Additionally, Abebe *et al.* (2011), reported ticks prevalence of 40% and 58.8% in sheep and goats, respectively in selected districts of Tigray region, Ethiopia.

According to this study, it was revealed that the host risk factors such a species, sex, breed, body condition score, and physiological status (pregnancy) were found to have a statistically significant association with the overall prevalence of ectoparasites in small ruminants. However, Fentahun *et al.* (2012), reported species, sex and body condition score did not have statistically significant association with the overall prevalence of ectoparasites in small ruminants. But, they reported tick infestation was higher in adult than young small ruminants which contradict with the finding of the present study.

This difference might be due to factors such as difference in agro ecological zones and management systems of small ruminants. Moreover, Abebe *et al.* (2011), reported body condition score was statistically significantly associated with the overall prevalence of ectoparasites in small ruminants, where animals with poor body condition score were highly infested with single or mixed ectoparasites. This is also in line with the findings of the present study, where animals with poor body condition score were highly infested with ectoparasites than these with moderate and good body condition scores. This might be due to lowered immune response as a predisposing factor. The poor body condition could also be due to chronic ectoparasites infestation as the ectoparasites are blood suckers and cause skin irritation which in turn results animals to spend most of their time on itching (James *et al.*, 2002)

In the current study, host species was not found to have statistically significant association with the prevalence of ticks and fleas in small ruminants.

However, it was significantly associated with lice prevalence. However, age has shown highly significant association with the prevalence of ectoparasites in small ruminants. Likewise, Hailu *et al.* (2008) have reported higher fleas' infestation in young than adult small ruminants in and around Welaita Sodo, Southern Ethiopia. The higher prevalence of ectoparasites in the young small ruminants could be attributed due to the shorter hair and thin skin in which the fleas can find easy access to the skin and penetrate it without difficulty (Kusiluka and Kambarage, 1996).

## Conclusion

This study was conducted to assess the prevalence of ectoparasites in small ruminants in and around Haramaya University, Oromia region, Ethiopia. The overall prevalence of ectoparasites in small ruminants was 48.9%. Host risk factors such as species, sex, breed, body condition score and physiological status (pregnancy) have shown statistically significant association with the overall prevalence of ectoparasites in small ruminants. The major identified ectoparasites were ticks, lice and fleas. Four genera of ticks (*Amblyoma*, *Boophilus*, *Rhipicephalus* and *Hyalomma*), two genera of lice (*Damalina* and *Linognathus*) and one genus of fleas (*Ctenocephalus*) were identified in this study. The high prevalence of ectoparasites in the study area affects the health, production and productivity of small ruminants. Hence, the high prevalence of ectoparasites prevailing in small ruminants in the study area needs serious attention.

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## Conflict of interest

The authors declare that there is no conflict of interest.

## References

- Abebe, R., Tatek, M., Megersa, B. and Sheferaw, D., 2011. Prevalence of Small Ruminant Ectoparasites and Associated Risk Factors in Selected Districts of Tigray Region. *Global Veterinaria* 7 (5), 433-437.
- Bekele, J., Tariku, M. and Abebe, R., 2011. External parasite infestations in small ruminants in Wolmera district of Oromia region, central Ethiopia. *Global Vet.*, 10, 518-523.
- Chalachew, N., 2001. Study on skin diseases of cattle, sheep, and goat in and around wolayta sodd, Southern Ethiopia. DVM thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
- CSA (Central Statistics Authority), 2004. Prevalence of Ectoparasites fauna of ruminants in Ethiopia, Addis Ababa.
- Gatenby, M.R., 2002. Sheep, revised edition. The Tropical Agriculturalist, CTA and Macmillan, Wageningen, The Netherlands, pp: 128-135.
- Hailu, Y., Tefera, Y., and Ayana, D., 2008. Ectoparasite prevalence's in sheep and goats in and around Wolita Sodd, Southern Ethiopia. *Reve. Med. Vet.*, 159, 450-454.
- James, P., Carmichael, I., Pfeffer, A., Martin, R. and O'Callaghan, M., 2002. Variations among Merino sheep in susceptibility to lice (*Bovicola ovis*) and association with susceptibility to trichostrongylid gastro-intestinal parasites. *Vet. Parasitol.*, 103, 355-365.
- Kassa, B., 2006. 'Cockle, mange and pox: Major threats to the leather industry in Ethiopia. Ethiopian leather industry: Perseverance towards value addition', Proceedings of the National Workshop, Addis Ababa, Ethiopia, December 14-15, 2006, pp. 71-92.
- Kusiluka, L. and Kambarage, D., 1996. Disease of small ruminant, 1<sup>st</sup> ed., Scotland VET AID pp. 102-105.
- MoARD, 2005. Mange, Lice and Sheep Ked control project in Amhara, Tigray and Afar regions, MoARD Animal Health Department, Addis Ababa.
- Mohammed, M., 2000. Raw hides and skin improvement in Ethiopia Status and Challenges. In: Proceedings of the opportunities and Challenges of Goat Production in East Africa, A Conference held 10-12 Nov, 2000 at Debub University, Awassa, Ethiopia.
- Mulugeta, Y., Yacob, T. and Ashenafi, H., 2010. Ectoparasites of Small Ruminants in three Selected Agro- Ecological sites of Tigray Region. *Trop. Anim. Health Prod.*, 42(6), 1219-1224.

- Radostits, O.M., Gay, C., Hinchcliff, K.W. and PConstable, P.D., 2007. A textbook of the diseases of cattle, sheep, goats, pigs and horses, 10 edition, Saunders, Edinburgh, London, pp: 1585-1612.
- Sertse, T., 2004. Investigation in ectoparasites of small ruminants in selected sites of Amhara Regional State and their Impact on the Tanning Industry. MSc Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre zeit, Ethiopia.
- Steele, M.R., 1996. Goats. The Tropical Agriculturalist, CTA and Macmillan, Wagenin-gen, pp: 79-86.
- Teshome, W., 2002. Study on small ruminant skin disease in Sidama Zone, Southern Ethiopia. DVM thesis. Faculty of Veterinary Medicine, Addis Ababa University, Deber Zeit, Ethiopia.
- Fentahun, T., Fasil, W., Mersha, C. and Malede, B., 2012. Prevalence of Ectoparasites on Small Ruminants in and Around Gondar Town. *American-Eurasian J. Sci. Res.*, 7 (3), 106-111.
- Thrusfield, M., 1995. Veterinary epidemiology, 2<sup>nd</sup> ed. UK. Blackwell science pp, 182-189.
- Urquhart, G.M., Armour, J Duncan, J.L., Dunn, A.M. and Jennings, F.W., 1996. Veterinary Parasitology, 2<sup>nd</sup> edition. Blackwell Science Ltd., London, UK, pp: 89-205.
- Walker, A.R., Bouattour, A., Camicas, J.L., Estrada Pena, A., Horak, L.G., Latif, A.A. *et al.*, 2003. Ticks of Domestic Animals in Africa. A Guide to Identification of Species. International Consortium on Ticks and Tick-borne Diseases (ICTTD-2), Bioscience Reports, University of Edinburgh, UK, pp: 221.
- Zelege, M. and Bekele, T., 2004. Species of ticks on camels and their seasonal dynamics in Eastern Ethiopia. *Trop. Anim Health Pro.*, 36, 225-231.