

Full Length Research Paper

Identification of small ruminant external parasite species in Tanqua Abergelle and Kola Tembien districts of Tigray region, Northern Ethiopia

Guash Abay

Abergelle Agricultural Research Center, Abi Adi, Ethiopia.

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Ectoparasites are a major concern in sheep and goat flocks, wherever sheep and goat are kept. A cross-sectional study was carried out in the districts of Kola Tembien and Tanqua Abergelle from September 2014 to June 2017 with the objectives of identifying external parasites to their species level. Randomly selected sheep and goats were clinically examined for the presence of ectoparasites or lesions and identified in National Animal Health Diagnostic and Investigation Center (NAHDIC) by using taxonomical and entomological examination. A total of 237 sheep and goats were examined randomly for the presence of external parasites. Eight species of external parasites were identified and found on both species of animals. The species of external parasites with their prevalence included *Amblyomma variegatum* (35.4%), *Rhipicephalus parvus* (22.8%), *Rhipicephalus praetextatus* (8.4%), *Rhipicephalus pulchellus* (7.6%), *Ctenocephalides felis felis* (5.1%), *Linognathus africanus* (11.8%), *Rhipicephalus evertsi* (2.5%), *Hyalomma truncatum* (6.5%). Both in sheep and goats, there was no significant difference between infestation of external parasites and the associated risk factors except for *Amblyomma variegatum* which was higher in Tanqua Abergelle (25.7%) than Kola Tembien (9.7%). The odd of infestation by *Amblyomma variegatum* in goat was 3.5 higher than in sheep. To minimize the prevalence of external parasites urgent and well-coordinated external parasites control measures should be taken.

Key words: External parasites, identification, kola tembien, small ruminant, Tanqua Abergelle.

INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa (Solomon et al., 2003; Tilahun and Schmidt, 2012; UNDP, 2010). An estimate indicates that the country is a home for about 30.7 million sheep and 30.2 million goats. 99.8% of the sheep and nearly all

goat population of the country are local breeds (CSA, 2018).

The contribution of the subsector to the national Gross Domestic Product (GDP) is estimated to be 16.5% of and 35.6% of the agricultural GDP (Metaferia et al., 2011).

E-mail: guashaba81@gmail.com.

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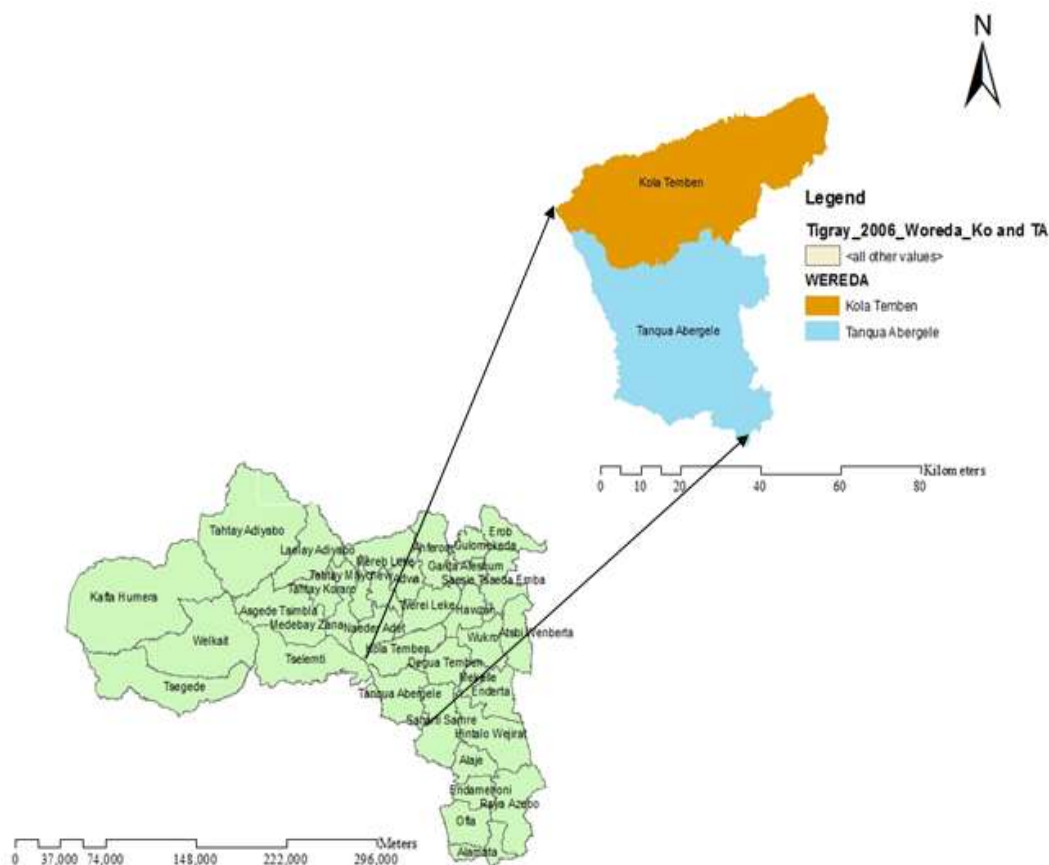


Figure 1. Topographic map of Tanqaua Abergelle and Kola Tembien districts in Ethiopia.

It also contributes 15% of export earnings and 30% of agricultural employment (Behnke, 2010). However, diseases have been the stumbling block against the full utilization of these resources for foreign currency through the export of live animals and skin (Solomon et al., 2003).

Currently, different causes of skin diseases in Ethiopia are accountable for considerable economic losses particularly to the skin export due to various defects, 65% of which occur in the pre-slaughter states directly related mostly to skin diseases causing often rejection because of poor quality (Behnke, 2010).

Ectoparasites which include mites, ticks, lice, fleas and flies parasitize a more extensive range of hosts (e.g. Ticks) while many of them are host specific (e.g. lice) (Singh et al., 2000; Aujla et al., 2000; Ranjan et al., 2014). Many ectoparasites are known to be vectors of pathogens which transmit different diseases to hosts while feeding, or occasionally it may also cause a significant defect to and skins of different animal populations (Jaswal et al., 2014; Salih et al., 2015; Mohammed et al., 2017). This damaging of the skin is one of the annoying effects on the animals induced by the ectoparasites. The existence of various ectoparasites and skin diseases affecting small ruminants are frequently

reported from different parts of Ethiopia. These are demodicosis, sarcoptic and psoroptic manges, ticks and lice infestations (Sertse and Wossene, 2007a; Mulugeta et al., 2010; Abay et al., 2017). The study area favors the development and propagation of ectoparasites which makes challenging to resist the annoying effect of these ectoparasites on the host and makes the control of ectoparasites difficult.

However, the major predisposing factors and enormous economic losses caused by ectoparasites need detailed studies on their identification of species. So far limited efforts have been made to investigate an overall situation of ectoparasites of small ruminants in the study districts.

The objectives of this study were to identify external parasites to their species level, to determine the associated risk factors of external parasites and to know the proportional defects of external parasites

MATERIALS AND METHODS

Description of the study area

As shown in Figure 1, the study was conducted in Kola Tembien (K. Tembien), and Tanqaua Abergelle (T. Abergelle) districts for disease

Table 1. Overall frequency of external parasite species in the study districts.

Species	Frequency	Percentage
<i>Amblyomma variegatum</i>	84	35.4
<i>Rhipicephalus parvus</i>	54	22.8
<i>Rhipicephalus praetexatus</i>	21	8.9
<i>Rhipicephalus pulchellus</i>	17	7.2
<i>Hyalloma truncatum</i>	15	6.5
<i>Rhipicephalus evertsi</i>	6	2.5
<i>Ctenocephalides felis felis</i>	12	5.1
<i>Linognathus africanus</i>	28	11.8

investigation and sample collection. The study districts are categorized as hot to warm sub-moist low lands sub-agro ecological zone of the region with an altitude of 1300-1500 m above sea level; the mean annual rainfall ranges from 400 to 600 mm, which is characterized by low, erratic and variable rainfall. The annual temperature ranges from 28 to 42°C (Figure 1).

Study population

The study was conducted from September 2014 to June 2017. Indigenous sheep and goats owned by individual farmers and managed under extensive management system were included. The districts have an overall small ruminant population of 693, 628 goats and 151,734 sheep (Kola Tembien Bureau of Agricultural Office, 2019).

Study design

A cross-sectional study was conducted on identification of external parasites of small ruminants to their species level. The study of ectoparasites on sheep and goats involved districts, sheep, and goats as a sampling unit. About 237 live sheep and goats were examined for the presence of external parasites in a weekly visit. Sample size was calculated according to the formula given by Thrusfield (2008) for random sampling method. A previous prevalence of 26.25% studied by Abay et al. (2017) was used to determine the maximum sample size.

Clinical examination and sample collection methods

Randomly selected sheep and goats were clinically examined for the presence of ectoparasites or lesions. In line with the sample collection explanatory variables such as sex, age, body condition and species were recorded. A body condition score of the animals considered as poor or good was recorded by modifying the system described (Gatenby et al., 1991) for sheep and (Steele et al., 1996) for goats. Poor body condition score was given to sheep and goats which were extremely thin and those with smooth and less prominent spinous process, transverse process in which finger can be pushed and moderate depth loin muscle. Good body condition score was given for sheep and goats in which the spinous process only sticks up very slightly; smooth, rounded and well covered transverse processes and those having full loin muscle and very fat.

Age categorization into young (lamb/kid) and adult was performed as described by Gatenby et al. (1991) for sheep and by Steele et al. (1996) for goats. Accordingly, sheep and goats less than one year were categorized as young and the rest as adult.

Sheep and goats found infested by parasites were considered

positive. Ectoparasites such as ticks, lice and fleas were collected by hand from their attachment site and put into container and preserved with 70 % alcohol (Urquhart et al., 1996). The collected parasites were taken to National Animal Health Diagnostic and Investigation Center (NAHDIC) and identified to species level by using taxonomical keys and entomological examination as per Keiser (1987).

Data management and analysis

Descriptive statistics were used to analyze the frequency of the identified species of external parasites. The effects of different epidemiological risk factors such as age, districts, and body condition on prevalence of ectoparasites in sheep and goats were analyzed by multivariate regression analysis at p value of 0.05.

RESULTS

Identification of species of external parasites

Eight different types of external parasites have been identified in NAHDIC by using taxonomical and entomological examination at species level. These are *Amblyomma variegatum*, *Hyalloma truncatum*, *Rhipicephalus parvus*, *Rhipicephalus praetexatus*, *Rhipicephalus pulchellus*, *Rhipicephalus evertsi*, *Ctenocephalides felis felis*, and *Linognathus africanus*, and their frequency is shown in Table 1. The highest prevalence was observed with *A. variegatum* infestation (35.4%) followed by *R. parvus* (22.8) in both species and districts.

The lowest prevalence was observed in *R. evertsi* infestation with an overall prevalence of 2.5% in both species and districts.

In our findings, a mixed infestation of more than two external parasite species has been observed in a single animal. Accordingly, 44 goats out of 141 and 28 sheep out of 96 were found infested with two or more external parasite species. As shown in Table 2, the higher infestation of external parasites in K. Tembien and T. Abergelle was by *R. parvus* (10.5%) and *A. variegatum* (25.7%), respectively. There was an observation of high external parasite infestation in T. Abergelle as compared with K. Tembien. This might be due to the high stress

Table 2. Prevalence of external parasite species across their associated risk factors in the study districts.

Variable	Prevalence of external parasites							
	<i>A. variegatum</i>	<i>R. parvus</i>	<i>R. praetexatus</i>	<i>R. pulchellus</i>	<i>C. felis felis</i>	<i>L. africanus</i>	<i>R. evertsi</i>	<i>H. truncatum</i>
Districts								
K. Tembien	23 (9.7%)	25 (10.5%)	12 (5.1%)	9 (3.8%)	8 (3.4%)	13 (5.5%)	3 (1.3%)	7 (3.0%)
T. Abergelle	61 (25.7%)	29 (12.2%)	9 (3.8%)	8 (3.4%)	4 (1.7%)	15 (6.3%)	3 (1.3%)	8 (3.4%)
Species								
Sheep	19 (8.0%)	29 (12.2%)	10 (4.2%)	8 (3.4%)	6 (2.5%)	16 (6.8%)	3 (1.3%)	5 (2.1%)
Goat	65 (27.4%)	25 (10.5%)	11 (4.6%)	9 (3.8%)	6 (2.5%)	12 (5.1%)	3 (1.3%)	10 (4.2%)
Sex								
Male	35 (14.8%)	24 (10.1%)	7 (3%)	8 (3.4%)	6 (2.5%)	12 (5.1%)	0.0	8 (3.4%)
Female	49 (20.7%)	30 (12.7%)	14 (5.9%)	9 (3.8%)	6 (2.5%)	16 (6.8%)	6 (2.5%)	7 (3.0%)

Table 3. Regression analysis of prevalence of *A. variegatum* with associated risk factors.

Variable	<i>A. variegatum</i>		COR	AOR	P value
	Positive	Negative			
District					
K. Tembien	23	77			0.001
T. Abergelle	61	76	0.37 (0.21, 0.66)	2.75 (1.51, 4.98)	
Species					
Sheep	19	77			0.000
Goat	65	76	0.23 (0.12, 0.53)	3.53 (1.91, 6.53)	

COR= Crude odd ration, AOR= Adjusted odd ratio.

conditions such as heat, drought, and shortage of feed in T. Abergelle as compared to K. Tembien district. With regard to species, there was an overall observation of higher infestation of external parasites in goat as compared to sheep. Therefore, higher infestation was by *A. variegatum* (27.4%) in goat and by *R. parvus* (12.2%) in sheep. According to sex, female animals have been infested more as compared to male animals. In our findings, all identified species of external parasites were found in both species.

In general, our findings show that *A. variegatum* and *R. parvus* have a higher distribution in both species of animals in the study districts. On the other hand, *R. evertsi* has the lowest prevalence in both districts and both species. The overall prevalence of identified external parasite species was not significantly associated with their respected risk factors except for *A. variegatum* at a confidence level of 95%. As shown in Table 3, the prevalence of *A. variegatum* is significantly different across districts with P value 0.001. Accordingly, sheep and goats in T. Abergelle District were more likely infested with *A. variegatum* than K. Tembien District (AOR 2.75 (1.51, 4.98)). Additionally, the prevalence of *A. variegatum* was significantly ($p=0.000$) higher in goat (27.4%) than sheep (8%). As a result, the odd of infestation in goat was 3.5 higher than in sheep. However, the prevalence of *A.*

variegatum was not significantly different ($P>0.05$) across sex, age and body condition scores.

DISCUSSION

In our findings, eight species of external parasites were identified: *A. variegatum*, *R. parvus*, *R. praetexatus*, *R. pulchellus*, *C. felis felis*, *L. africanus*, *R. evertsi*, and *H. truncatum* with their prevalence of 35.4, 22.8, 8.9, 7.2, 5.1, 11.8, 2.5, and 6.5 percent, respectively. Tick infestations were the highest prevalence recorded in both species. Ahmed et al. (2017) found low prevalence of *A. variegatum* (24.5%), higher prevalence of *R. pulchellus* (34.1%), *R. evertsi evertsi* (22.1%), and *H. truncatum* (15.6%) in Dire Dawa districts compared to our findings. A small prevalence of *A. variegatum* (2.3%) was also reported by Seyoum et al. (2015) in Amhara Regional State, Sekela District. On the other hand there was a highest *A. variegatum* infestation in goat (27.4%) in our findings as compared to the study conducted by Mulugeta et al. (2010) which was 7.5%. An abundance of *A. variegatum* (66.15%) was reported by Jemere et al. (2011) in Wolmera District of Oromia, which is higher prevalence as compared to our findings. Such differences in prevalence may arise from differences in agro-climate,

control measures practiced, management, and health care of sheep and goats in the study areas. Sheep and goat owners also noted seasonality in occurrence of ticks, which is related to the beginning of annual rain. Higher environmental temperature, humidity and prolonged sunlight favor the survival and reproduction of ticks in lowland areas (Pangui, 1994).

In our study, the overall prevalence of flea infestation (*C. felis felis*) in small ruminants were 5.1% which is smaller than the findings of Sertse and Wossene (2007a) who reported a prevalence of 8.1% in eastern part of Amhara regional state. The previous *C. felis* infestation (11.1%) in Tigray region reported by Mulugeta et al. (2010) was higher than our findings. In our study area, the prevalence of *C. felis felis* in sheep and goat was 2.5% which was higher in sheep (0.2%) and lower in goat (8.1%) as compared to a report of Sertse and Wossene (2007b) in Eastern part of Amhara. According to Bates (2012) flea infestation is usually associated with close contact of animals with infested animals and also the same host.

Lice infestations with *Linognathus* species were the most prevalent external parasite recorded in sheep and goats in the study districts. According to Sertse (2004), higher prevalence of *Linognathus* species (28.3%) was found in Amhara regional state as compared to our findings. According to Mulugeta et al. (2010) the prevalence of *L. africanus* in sheep in three districts of Tigray region was 11.5%, which is higher than our findings (6.8%). Louse infestation may show some other underlying problems such as malnutrition and chronic diseases. The irritation caused by even a modest population of lice leads to scratching and rubbing, causing damage to the skin and severe infestation with *Linognathus* spp. may cause anemia (Sertse and Wossene, 2007b).

Conclusion

Our study revealed that eight species of external parasites have been found with a higher rate of infestation. Favorable environmental conditions, poor level of farmers' awareness and weak animal health extension services are believed to be the main factors for the wide distribution of external parasites in the study districts.

In this study a wide spread occurrence of tick infestation in small ruminant was observed and six species of ticks grouped under three genera were identified. *Rhipicephalus evertsi*, *Hyalomma truncatum*, *Rhipicephalus pulchellus*, *Amblyomma variegatum*, *Rhipicephalus praetexatus*, *Rhipicephalus parvus* was among the tick species identified in the study area. The most essential and abundant tick species identified in the study area were *Amblyomma variegatum* and *Rhipicephalus parvus* in order of predominance. By considering skin is a very important source of foreign

currency to Ethiopia, serious attention should be given to the high prevalence of external parasite infestation in the study districts.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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