

Prevalance And Generic Identification Of Ectoparasites On Small Ruminants In Yirgachefe District, Central Southern Ethiopia

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Abstract: A cross sectional study was conducted from November, 2014 to March, 2015 in Yirgachefe district to determine the prevalence and generic identifications of ectoparasites on small ruminants. A total of 384 small ruminants, sheep (n=302) and goats (n=82) were sampled animals in the study. The overall ectoparasite prevalence showed that 240 (62.5%) small ruminants were infested by single or mixed ectoparasites. Accordingly, a total of 187 (61.9 %) of sheep and 53 (64.6%) of goats were found infested with ectoparasites. The most common ectoparasite encountered in order of their predominance in sheep were tick (30.8%), lice (23.2), flea (20.9%) and sheep ked (1.0%). where as in goats 31.7% tick, 21.9% flea and 14.6% lice were identified during the study. Among the risk factors, body condition score was found to be significantly associated with the prevalence of ectoparasites in the study area. The prevalence of ectoparasites infestation was significantly higher in small ruminants of poor body condition than with good body condition score. No statistical significant association ($P>0.05$) was found between the species of small ruminants and ectoparasites infestations. The infestation rates of ectoparasites were not statistically different between sex and age in the whole population of small ruminants. Nevertheless, the analysis showed as if there was statistically significant difference ($P<0.05\%$) in the prevalence of tick with age of small ruminants and it was relatively higher in adult (34.7%) than young (22.7%). Therefore, the higher prevalence of ectoparasites in small ruminants from result of the present study showed that, appropriate and strategic control measure of ectoparasites is needed to reduce high prevalence of ectoparasites and their impacts on the production and productivity of small ruminants in the study area..

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1. Introduction

Livestock production in Ethiopian agricultural economy is an important sector providing a significant contribution to gross domestic and export Products and raw material for industries. With an estimated 25.2 million sheep and 21.8 million goats in Ethiopia however, the economic gains from these animals remain insignificant when it is compared to their huge number (CSA, 2009). Sheep and goats are important source of income for agricultural community and are one of Ethiopia major source of foreign currency through livestock population of the country and are among important contributors to food production in Ethiopia, providing 35% of meat consumption and 14% of milk consumption (Asfaw, 1997). Export of livestock and livestock by-products have contributed to the economy of the country by providing foreign exchange earnings accounting about 15% and 40% of all export earnings and export from agriculture exports, respectively (FAO, 1996). But this is much lower than would be expected, given the size of the livestock population in the country (Berhanu *et al.*, 2007). Small ruminant production is an important

agricultural enterprise and constitutes about 30% the total livestock population of the country (Gryscels and Anderson, 1988). However, their contribution to food consumption, rural income and export economy is below the expected potential, because small ruminant husbandry is constrained by compound effect of disease, poor feeding, and poor management (Chalachew, 2001).

Recently different causes of skin disease of small ruminants in Ethiopia are accountable for considerable economic losses particularly to the skin and hide export due to various defects (ESGPIP, 2009). Skin disease caused by lice, sheep ked or melophagus ovinus, ticks and mange mites are among the major diseases of small ruminants and causes serious economic loss to farmers through mortality, decreased production, downgrading and rejection of skin which affects the tanning industries. According to tanneries report, skin diseases due to external parasites causes 35% sheep skin and 66% goat skin rejection (Bayou, 1998). Ectoparasites commonly ticks, mites, lice and sheep ked are important parasites because of their disease transmission ability, blood feeding habit and

skin damage in most of the livestock population (Tadesse *et al.*, 2011). 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. 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.*, 1994). Their end result may be mortality, decreased productivity and reproduction, downgrading and rejection of skins. External parasites are problem in both extensive and intensive livestock production systems (Phillips, 2005).

The problem created by ectoparasites is believed to be high. Hence, it would be essential to have up to date information on the importance of the prevalence of ectoparasites in various areas to provide an option to develop and implement a cost effective and ecologically important control strategies in the country.

Therefore, the main objectives of this study were:

- ❖ To determine the prevalence of ectoparasites on small ruminants in Yirgachefe district.
- ❖ To identify ectoparasites of small ruminants at generic level in the study area.

2. Materials And Methods

2.1. Study area

The study was conducted in Yirgacheffe district which is located at the central southern Ethiopia, in the Gedeo_Zone of the Southern_Nations, Nationalities and Peoples' Region. Yirgachefe is bordered on the south by Kochere, on the west by the Oromia_Zone, on the north by Wenago, on the east by Bule, and on the southeast by Gedeb and located between 6.09 N to 6.33°N latitude and 38.08 up to 38.32 E longitude in the Southern Ethiopia, and far apart 395 km from Addis Ababa, 124 km from Hawassa and 34 km from Dilla. Topographically, this region mainly consists in rugged and undulating mountains, rolling hills, plateaus and flat platform and it is an important coffee growing area. It has an elevation between 1880 and 1919 meters (6,168 and 6,296 ff) above sea level. The annual rainfall in the Yirgachefe ranges from 1800-2000 mm with a temperature ranges from 12-25 °C (YBOA, 2007).

2.2. Study population:

From November 2014, the study was conducted on small ruminants (sheep and goats) that were found in Yirgachefe district. A total of 384 animals (302 sheep and 82 goats) of both sexes (139 males and 245 females) and of local breeds under extensive management system were included in the study and examined for the presence of ectoparasites. A greater number of sheep was sampled because of their

predominance in the area. The animal's were also from different age groups and classified as young and adult. The age determination was made based on owner's information according (Aiello and Mays, 1998).

2.3. Study Design

A cross sectional survey was conducted from November, 2014 to March, 2015 in Yirgachefe district in order to assess the prevalence and generic identification of external parasite of small ruminants.

2.4. Sampling Method and Sample Size Determination

Simple random sampling method was used for sampling small ruminants to determine the prevalence and generic identification of ectoparasites in Yirgachefe district and the sample size was determined by the formula given by Thrusfield (2005).

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

Where,

n = Required sample size

P_{exp} = Expected prevalence

d = Required precision

To calculate the total sample size, the following parameters will be used: 95% Level of Confidence (CL), 5% desired level of precision and with the assumption of 50% expected prevalence of ectoparasites in small ruminants, the sample sizes will be determined as, n = 384.

2.5. Study Methods

A total of 384 animals (302 sheep and 82 goats) were selected from Yirgachefe district and examined for presence of ectoparasites. Before clinical examination for ectoparasites, related risk factors such as body condition score, age, sex and species of each sampled animals were recorded. The age and body condition score of sheep and goats were determined based on the description given by Aiello and Mays, (1998) and Mulugeta *et al.*, (2010) respectively. The clinical examination was performed by multiple fleeces parting in the direction opposite to that in which hair or wool normally rests and visual inspection and palpation of the skin for parasites on all parts of the animal including ears and digits (Abebe *et al.*, 2012).

Ectoparasites including: ticks, lice, keds, and fleas were collected by forceps from their attachment site, put in universal bottle containing 70% alcohol (Soulsby, 1982). The collected Samples were then transported to Sebeta National Animal Health Diagnostic Investigatory Center (NAHDIC) Veterinary laboratory and examined under stereomicroscope for identification following the identification key given by Urquhart *et al.*, (1996) and Walker *et al.*, (2003).

2.6. Data Analysis

Data obtained in the study was entered into a computer on Microsoft Excel spread sheet. The frequencies of ectoparasites were compared with variables and expressed in percentage and subjected to P value and chi-square (χ^2) test using SPSS version 20.

3. Results

A total of 384 small ruminants (302 sheep and 82 goats) were examined, of which 240 (62.5%) were found infested by one or more types of ectoparasites.

Ectoparasites prevalence of sheep and goat were 178(61.9%) and 53(64.6%) respectively in the study area. The findings suggest that the ectoparasite prevalence is not statistically significant difference ($p>0.05$) between sheep and goat. Types of ectoparasites identified were ticks, 93 (30.8%) in sheep and 26 (31.7%) in goats; lice, 70 (23.2%) in sheep and 12 (14.6%) in goats; flea, 63 (20.9%) in sheep and 18 (21.9%) in goats; and sheep ked, 3 (1.0%) in sheep (Table 2).

Table 2: Prevalence of ectoparasites distribution by species of small ruminant

Ectoparasites				
Species	Tick	Lice	Flea	Sheep ked
Sheep	93(30.8%)	70(23.2%)	63(20.9%)	3(1.0%)
Goat	26(31.7%)	12(14.6%)	18(21.9%)	-
Total	119(31.0%)	82(21.3%)	81(21.1%)	3(0.8%)
χ^2 (P-value)	0.025(0.874)	2.804(0.094)	0.046(0.830)	0.821(0.365)

The major identified ectoparasites in order of predominance in sheep were ticks (30.8%), lice (23.2%), fleas (20.9%) and, sheep ked (1.0%) and, whereas 31.7% ticks, 21.9% fleas and 14.6% lice were identified in goat (Table 2).

Table 3: Age distribution prevalence of ectoparasites

Ectoparasites				
Age	Tick	Lice	Flea	Sheep ked
Young	27(22.7%)	24(20.2%)	30(25.2%)	-
Adult	92(34.7%)	58(21.9%)	51(19.2%)	3(1.1%)
Total	119(31.0%)	82(21.3%)	81(21.1%)	3(0.1%)
χ^2 (P-value)	5.555(0.018)	0.144(0.704)	1.755(0.185)	1.358(0.244)

The prevalence of tick (34.7%), lice (21.9%) and sheep ked (1.1%) infestation in adult were higher when compared to ectoparasites of young tick

(22.7%), lice (20.2%) and unlike in case of flea. Furthermore, tick infestation among the age categories were statistically significant ($P < 0.05$) (table 3).

Table 4: Prevalence of ectoparasites with regard to sex of small ruminants

Ectoparasites				
Sex	Tick	Lice	Flea	Sheep ked
Female	78(31.8%)	46(18.8%)	48(19.6%)	2(0.8%)
Male	41(29.5%)	36(25.9%)	33(23.7%)	1(0.7%)
Total	119(31.0%)	82(21.3%)	81(21.1%)	3(0.8%)
χ^2 (P-value)	0.227(0.634)	2.680(0.102)	0.917(0.338)	0.011(0.917)

The prevalence of tick (31.8%) and sheep ked (0.8%) infestation in females were higher when compared to male small ruminants tick (29.5%) and

unlike in case of lice and flea. But it has no statistically significant between sex of small ruminants ($p > 0.05$) (table 4).

Table 5: Prevalence of external parasites of small ruminants by body condition

Ectoparasites				
Body condition	Tick	Lice	Flea	Sheep ked
Poor	63(40.4%)	44(28.2%)	44(28.2%)	2(1.3%)
Good	56(24.6%)	38(16.7%)	37(16.2%)	1(0.4%)
Total	119(31.0%)	82(21.3%)	81(21.1%)	3(0.8%)
χ^2 (P-value)	10.844(0.001)	7.343(0.007)	7.983(0.005)	0.850(0.357)

The prevalence of all ectoparasites tick (40.4%), lice (28.2%), flea (28.2%), and sheep ked (1.3%) infestation in poor body condition were higher when compared to good body condition of tick (24.6%), lice

(16.7%), flea (16.2%) and sheep ked (0.4%). All of them have statistically significant between body condition of small ruminants ($p < 0.05$), except in sheep ked ($p > 0.05$) (table 5).

Table 6: Prevalence of ectoparasites at genus level on sheep and goat

Ectoparasites		Prevalence		
		Sheep (n=302)	Goats (n=82)	Total (n=384)
Tick	Rhipicephalus	69 (22.8%)	7 (8.5%)	76 (19.8%)
	Amblyomma	23 (7.6%)	19 (23.2%)	42 (10.9%)
	Boophilus	1 (0.3%)		1 (0.26%)
Lice	Damalina	70 (23.2%)	12 (14.6%)	82 (21.3%)
Flea	Ctenocephalides	63 (20.9%)	18 (21.9%)	81 (21.1%)
Sheep ked	Melophagus ovinus	3 (1.0%)		3 (0.8%)

An overall prevalence of ectoparasites was observed in the two small ruminant species at genus level of ectoparasites. Under tick genera in sheep, Rhipicephalus (22.8%) was the higher followed by Amblyomma (7.6%) and Boophilus (0.3%). While in goats the prevalence of Amblyomma and Rhipicephalus was 23.2% and 8.5% respectively. The identified genera of lice infestation in sheep and goats were Damalina which had the prevalence of 23.2% and 14.6% in sheep and goats respectively. The overall prevalence of Ctenocephalides was 20.9% and 21.9% in sheep and goats respectively. The prevalence of Melophagus ovinus 1.0% was observed in sheep (Table 6).

4. Discussion

The prevalence of small ruminant ectoparasites in the present study area was 61.9% in sheep and 64.6% in goat with an overall prevalence of 62.5% infested by at least single or mixed external parasites. The current study showed that the prevalence of ectoparasites of goats were slightly higher than sheep however, there was no significant association between species of small ruminants and prevalence of the ectoparasites ($p > 0.05$). Similar higher prevalence of ectoparasites reports were made by Mulugeta *et al.* (2010) 55.2% in sheep and 58.0% in goats in Tigray and the eastern Amhara regions. In agreement with the present study, Tefera (2004) also reported high prevalence of ectoparasite 50.5% in sheep and 56.4% in goats in Amhara region.

In the present study, a relatively lower prevalence of tick infestation (30.8% in sheep and 31.7% in goat) was observed as compared to Rahmeto *et al.* (2011) and Abunna *et al.* (2009) who reported a higher prevalence of tick infestation in sheep (48.0%) and in goats (58.8%) in selected Districts of Tigray Region whereas (87.5%) sheep and (89.9%) goats, in Mieso district respectively. Zelalem (1994) also reported a higher tick prevalence of 65.5% in sheep

and 33% in goat in Dire Dawa region, Eastern Ethiopia. However, the present study showed relatively high prevalence as compared to the report by Tewodros *et al.* (2012) in and around Gondar town and Sisay *et al.* (2013) in Northwestern Amhara Regional State that showed 21.2% in sheep and 17.1% in goat and 3.9% in sheep and 17.7% in goat respectively. Environmental variations and differences in the time of year when the study was conducted could also contribute to differences in the prevalence of tick infestation in various areas of the country as temperature and relative humidity are the major ecological determinants for the reproduction and growth of tick populations (Latif and Walker, 2004).

Ticks were found to be the most frequently recorded ectoparasites in both sheep and goats of the current study. This finding is in a general agreement with those of Rahmeto *et al.* (2011) in selected districts of Tigray Region and Dawit *et al.* (2012) at Bahir Dar Veterinary clinic with the prevalence of 48.0% and 31.4% in sheep and 58.8 and 12.2 in goats respectively. Yacob *et al.* (2008) in Wolaita also reported high prevalence of tick both in sheep and goats when compared to other ectoparasites. The higher proportion of tick among the ectoparasites could be due to various factors including the fact that ticks are easier to find compared to, for example, fleas which jump frequently. Three tick genera, *Rhipicephalus*, *Amblyomma* and *Boophilus*, were observed in the study area.

The overall prevalence of lice obtained in this study area (23.2% in sheep and 14.6% in goats) was higher than observations made by Dawit *et al.* (2012) at Bahir Dar Veterinary clinic (3.8% in sheep and 9.7% in goats); Rahmeto *et al.* (2011) in selected districts of Tigray region (1.3% in sheep and 6.1 in goats) and Mohammed (2001) in southern range land 0% in sheep and 1.55% in goats was recorded. But the present finding was lower than the prevalence reported by Tewodros *et al.* (2012) in and around Gondar town

(57% in sheep and 48.1 in goats), Sisay *et al.* (2013) in Northwestern Amhara Regional state of Ethiopia (34% in sheep and 27% in goats) and Tefera (2004) in Amahara region (40.9% in sheep and 28.3% in goats). This prevalence variation may be due to environmental variation and time of year of sample collection. The genera of lice identified on sheep and goats in the study areas was, *Damilina* which was the only observed ectoparasites with the prevalence of 23.2% and 14.6% on sheep and goats, respectively.

Relatively high prevalence of flea was encountered in the present study, 20.9% in sheep and 22.0% in goat compared to the study by Sisay *et al.* (2013) in Northwestern Amhara Regional state of Ethiopia with a total prevalence of flea (1.1% in sheep and 2.6% in goats), Dawit *et al.* (2012) at Bahir Dar Veterinary clinic (13.2% in sheep and 11.3% in goats), Rahmeto *et al.* (2011) in selected districts of Tigray region (0 in sheep and 3.1 in goats) and Tadesse *et al.* (2011) in Kombolcha of 8.57% in sheep and 1.51% in goat. In agreement with the present study a report by Yacob *et al.* (2008) in Wolaita, indicates there was no significant difference ($p > 0.05$) between prevalence of flea in sheep and goat.

In the present study, prevalence of sheep ked (*Melophagus ovinus*) was 1.0% in sheep where as no keds were observed in goats. In contrary to the present study, higher prevalence of *M. ovinus* were reported by Sisay *et al.* (2013) in Northwestern Amhara Regional state of Ethiopia (10.8%), Tewodros *et al.* (2012) in and around Gondar town (10.6%), Rahmeto *et al.* (2011) in selected districts of Tigray region (6.7%) and Dawit *et al.* (2012) at Bahir Dar Veterinary clinic (1.8%). Tefera (2004) in selected sites of Amhara regional state also reported that higher prevalence of sheep keds (12.5%) in wooly sheep than in hairy or sheared sheep. The variation in the infestation rates might be due to the agro ecological variations among the study areas and the type of sheep breeds that are kept (Dawit *et al.*, 2012).

The prevalence of ectoparasites in small ruminants by ages in the study area was 62.2% in young and 62.6% in adults. The prevalence infestation rate of young and adult in the area was almost similar. In agreement with the present study a report by Tewodros *et al.* (2012) in and around Gondar town, indicates there was no significance association between age of small ruminants and prevalence of ectoparasites ($p > 0.05$). The prevalence of ectoparasites recorded in the current study in age groups of small ruminants associated with tick infestation in young and adult were 22.7% and 34.7%, respectively and there was statistically significant association with the prevalence of tick infestation on small ruminants ($p < 0.05$), but no significance

difference between age of lice, flea and sheep ked infestation on small ruminants.

The prevalence of major ectoparasites in small ruminants with poor body condition (80.8%) were significantly higher ($P < 0.05$) than animals with good body conditions (50.0%). This higher prevalence of ectoparasites in poor body condition of small ruminants show in agreement with Rahmeto *et al.* (2011) in selected districts of Tigray region (49.1% in good and 74.1% in poor body condition), and Tefera (2004) in selected sites of Amhara regional state with 49.1% and 57.5% in sheep and 52.0% and 73.7% in goats of good and poor body conditions respectively. This could be due to lowered immune response as a predisposing factor and/or the poor body condition could be the result of chronic ectoparasite infestation (James *et al.*, 2002a). This may also be as result of debilitating or emaciated animals don't groom and leak themselves and reside in their host's body (Urquhart *et al.*, 1996).

The current study showed that the prevalence of ectoparasites regarding to sex relatively high prevalence was observed in male (66.2%) than females (60.0%). However sex of small ruminants did not show significant association with the prevalence of the ectoparasites ($p > 0.05$). This was agree with those reported by Tewodros *et al.* (2012) in and around Gondar town (60.28 % female and 68.0% male in sheep and 21.78% female and 65.6% male in goats). Rahmeto *et al.* (2011) also reported in selected districts of Tigray region (52.9% female and 57.6% male). This may be due to the area of people use one male for many flocks of sheep and goats in the areas, due to this the males has opportunity to frequent contact with infested sheep and goat.

5. Conclusion And Recommendations

This study was conducted to identify the major ectoparasites and their prevalence on the small ruminants. The most important ectoparasites identified were tick, lice, fleas and sheep ked. Ticks were the most abundant ectoparasites in the study area followed by lice, flea, and sheep ked. The infestations of ectoparasites are important affecting the health and productivity of small ruminants in Yirgachefe woreda. In view of the significance of skin and hide production as main source of foreign currency to the country and the ever increasing demands of livestock market, the high prevalence of ectoparasites prevailing in sheep and goat in the area require serious attention to minimize the effect of the problem.

Based on the above conclusion the following recommendations are forwarded:

- ✚ Strategic treatment of small ruminants with insecticides should be practiced in the study area to

minimize the impact of ectoparasites on the health of animals.

✚ Awareness creation for the local farmers about the effect of ectoparasites and their control is essential.

✚ Better small ruminant management practices should be implemented to minimize transmission of the disease and increase the productivity of small ruminants.

✚ Further detail study should be done to assess the seasonal dynamicity and major ectoparasite borne disease in the study area.

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References

1. Abebe, R., Tatek, M., Megersa, B. and Sheferewu, D. (2011): Prevalence of Small Ruminant Ectoparasites and Associated Risk Factors in Selected Districts of Tigray Region, Ethiopia School of Veterinary Medicine, Hawassa University and Afar Regional State Bureau of Agriculture, Semera, Ethiopia, 7: 433-437.
2. Abunna, A., kassa, D., Megressa, B., Regassa, A. and Amenu, k. (2009): Survey of tick infestation in small ruminant of Mieso district, West Harergie, Oromia Region, Ethiopia, *Trop. Anim. Health. Prod.*, 41: 969-972.
3. Aiello, S. and Mays, A. (1998): The Merck Veterinary Manual, 8th ed, Merck and Co (eds). Inc., White House Station, N. J. USA, Pp: 131-140.
4. Asfaw, W. (1997): Country Report: Ethiopia. In, Proceedings of a Seminar on Livestock Development Policies in Eastern and Southern Africa, 28 July-1August, 1997, Mbabany, Organized By CTA, OAU/IBAR and The Ministry of Agriculture and Cooperative, Swaziland.
5. Bay, D. and Harris, R. (1988): Introduction to Veterinary Entomology (A Guide to Livestock Insects), Stonefly Publishing, Texas, Pp: 111.
6. Bayou, K. (1998): Overview of sheep and goat skin disease treatment Trial for improved quality of hides and skins, Addis Ababa, Ethiopia (phase2), Pp: 13-20.
7. Berhanu, G., Hoekstra, D. and Samson, J. (2007): Heading towards commercialization? The case of live animal marketing in Ethiopia. ILRI (International Livestock Research Institute), Nairobi, Kenya, Pp: 1-73.
8. Boden, E. (2005): Blacks veterinary Dictionary 21st ed, london, A and Bpubulisher limited, Pp: 260-646.
9. Bowman, D. and Lynn, R. (1999): Georgis' Parasitology for Veterinarians, 7th ed, W.B. Sounder Company, Pp: 1-78.
10. Chalachew, N. (2001): Study on the skin disease in cattle sheep and goats in and around Wolaita Sodo, Southern Ethiopia.DVM Thesis, Addis Ababa University, Faculty of Vet. Med. Debre ziet, Ethiopia, *World Appl. Sci. Jour.*, 9: 21-23.
11. Charles, M. (1998): Diagnostic of Veterinary Parasitology, 2nd ed. Mosby. Elesvier, USA, Pp: 18.
12. Colvill, G. (1991): Diagnostic Parasitology for veterinary Technian, 1st ed. United States of America, America Veterinary publication, Pp: 159-182.
13. CSA, (2009): Central statistical Authority, Agricultural sample survey, Statistical bulletin 302, Addis Ababa, Ethiopia.
14. Dalgliesh, R., Jargensen, W. and Devos, A. (1990): Austrian frozen vaccines for control of babesiosis and anaplasmosis in cattle, *Trop. Anim. Health. Prod.*, 22: 44-52.
15. Dawit, T., Mulugeta, A., Tilaye, D. and Mengistie, T. (2012): Ectoparasites of small ruminants presented at Bahir Dar Veterinary Clinic, Northwest Ethiopia, *Afri. Jour. Agri. Res.*, 7: 4669-4674.
16. ESGPIP, (2009): Ethiopian sheep and goats productivity improvement program: common Defects of sheep and goats skin in Ethiopia and their causes. Technical Bulletin No. 19.

17. FAO, (1996): Food and Agricultural Organization, Yearly book. Agricultural Production. Vol. 48. FAO, Rome, Italy.
18. Fasil, W. (2012): Study on prevalence of ectoparasites of small ruminant in and around Gondar town, Northern Ethiopia, DVM Thesis, FVM, Gondar university, Gondar, Pp: 7-8.
19. Gashaw, N. (1986): Preliminary survey of mange mites on black head Ogadan sheep, goats And pigs in the administrative region of Harage, DVM Thesis, faculty of Veterinary medicine, Addis Ababa University, Debrezeit, Ethiopia.
20. Gryscels, G. and Anderson, F. (1988): Study on traditional agricultural system initial result. In: Research on farm and livestock productivity in central Ethiopian highland, International Livestock Research center for Africa, Pp: 7-22.
21. Hendrix, C. and Robinson, E. (2006): Diagnostic Veterinary Parasitology, 2nd ed. Mosby, USA, Pp: 221-222.
22. Hopla, C., Durden, L. and Kerian, J. (1994): Ectoparasites of animal and control methods OIE, 12: 985-1381.
23. Jackson, G. (1991): Skin diseases in goats. In sheep and goats practice Baillie, Tindal.
24. James, P., Carmichael, I., Pfeffer, A., Martin, R. and O'Callaghan, M. (2002a): Variation among Merino sheep in susceptibility to lice (*Bovicola ovis*) and association with susceptibility to trichostrongylid gastro-intestinal parasites, *Vet. Parasitol.*, 103: 355-365.
25. Kusiluka, L. and Kambarage, D. (1996): Diseases of small ruminant, 1st ed. Scotland vet AID, Pp: 102-105.
26. Latif, A. and Walker, A. (2004): An introduction to the biology and control of ticks in Africa. ICTTD-2 project, Pp: 1-29.
27. Lehman, T. (1993): Ectoparasites: Direct Impact on Host Fitness, *Parasitol. Tod.*, 9: 8-13.
28. Mandal, S. (2006): Veterinary Parasitology at glance, 1st ed. chrboogs India, international book distributor, Pp: 314-380.
29. Manning, T. and Scott, D. (1985): Canine dermatology practice, allergic, hormonal and neoplastic disorders. Com. cont. Edu. Veterinary University of Pennsylvania School of veterinary medicine, 718: 5435-5445.
30. Morel, P. (1980): Study on Ethiopian ticks (Argasidae and Ixodidae) Republic of France, Ministry of foreign affairs, French Veterinary mission, Addis Ababa, Pp: 332.
31. Mohammed, H. (2001): Study on Skin Disease of Small Ruminants in Central Ethiopia, DVM thesis, FVM, Addis Ababa University, Debre Zeit.
32. Mulugeta, Y., Yacob, H. and Ashenafi, H. (2010): Ectoparasites of small ruminants in three selected agro-ecological sites of Tigray Region, Ethiopia, *Trop. Anim. Health. Prod.*, 42: 1219-1224.
33. Olubunmi, P. (1995): The Prevalence of Mange Due to *Sarcoptes Scabiei var capri* in Ile-Ife Area of Nigeria, Its Control and Management, *Bull. Anim. Hlth. Prod. Afr.*, 43: 115-119.
34. Pangui, L. (1994): Mange in Domestic Animals and Methods of Control, *Rev. Sci. Tech. off. Int. Epi.*, 13: 1227-1243.
35. Peter, G. (1995): Parasites and Skin Diseases. J. A. Allen & Company Limited, London.
36. Phillips, C. (2005): The Effects of External Parasites and their Control on the Welfare of Livestock Center for Animal Welfare and Ethics. School of Veterinary Science, University of Queensland, Pp: 63.
37. Radostits, O., Blood, D. and Gay, C. (1994): Veterinary Medicine, Textbook of Cattle, Sheep, Pigs, Goats and Horses, 8th Edition, Bailliere Tindall, UK, Pp: 1280-1308.
38. Rahmeto, A., Makelesh, T., Bekele, M. and Desie, S. (2011): Prevalence of Small Ruminant Ectoparasites and Associated Risk Factors in Selected Districts of Tigray Region, Ethiopia, *Glob. Vet.*, 7: 433-437.
39. Regassa, A. and De Castro, J. (1993): Tick resistance to acaricides in western Ethiopia, *Trop. Anim. Health. Prod.*, 25: 69-74.
40. Schmid, T. (1994): Essential of Parasitology, 4th ed. New Delli, universal book Stall, Pp: 198-224.
41. Seifert, S. (1996): Tropical Animal Health, 2nd ed. London, klulver academic publishers, Pp: 56-64.
42. Sewell, M. and Brockesby, D. (1990): Hand Book on Animal Disease in the Tropics, 4th Ed, Bailliere Tindall, Pp: 2 -28.
43. Sisay, A., Yilkal, A. and Yacob, H. (2013): Ectoparasites of Sheep and Goats in North-West Amhara Regional State, Ethiopia, *Ethio.Vet.Jour.*, 17: 55-67.
44. Smith, M. and Sherman, D. (1994): Goat medicine, Pp: 17-47.
45. Soulsby, E. (1982): Helmenths, arthropods and protozoa of domesticated animals, 7th ed. Baillire Tinal, UK, Pp: 356-497.
46. Tadesse, A., Fentaw, E., Mekibib, B., Mekuria, S. and Zewdu, E. (2011): Study on the prevalence of ectoparasites infestation of ruminant in and around kombolcha and damage to Fresh goat pelts and wet blue (pickled) skin at kombolcha Tannery, Northeastern. Ethiopia, *Ethio. Vet. Jour.*, 15: 87-101.

47. Taylor, M., COOP, R. and wall, R. (2007): *Veterinary Parasitology*, 3rd ed. Black well publishing, USA, Pp: 685-687.
48. Tefera, S. (2004): Investigation on ectoparasites of small ruminants in selected sites of Amhara regional state and their impact on the tanning Industry, MSc thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre zeit, Ethiopia.
49. Tewodros, F., Fasil, W., Mersha, C. and Malede, B. (2012): Prevalence of Ectoparasites on Small Ruminants in and Around Gondar Town, *Amer-Eur Jour Sci Res.*, 7: 106-111.
50. Thrusfield, M. (2005): *Survey in Veterinary Epidemiology*, 2nd ed. Blackwell Science, Limited, Cambridge, USA, Pp: 178-198.
51. Urquhart, G., Armour, J., Duncan, A., Dunn, A. and Jennings, F. (1996): *Veterinary Parasitology*, 2nd ed. Blackwell Science Ltd., UK, Pp: 141-205.
52. Wall, R. and shearer, D. (1997): *Veterinary Entomology*. 1st ed. Champan and Hall, UK. Pp: 1- 439.
53. Walker, A., Bouattour, A., Camicas, L., Estradaand Pena, A., Horak, G., Latif, A., Pegram, G. and Peston, M. (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: 1-22.
54. White, S. (1998): *The Merck Veterinary Manual*, 8th ed. Merck and Co. inc. N. Y. USA, Pp: 593-673.
55. Williams, C., Richard, S. and Robert, B. (2000): *Parasitology and vector Biology* 2nd ed. Harcourt Academic press, Pp: 639-640.
56. Yacob, H., Yalow, T. and Dink, A. (2008): Ectoparasite prevalences in sheep and in goats in and around Wolaita soddo, Southern Ethiopia, *Revue. Méd. Vét.*, 159: 450-454.
57. YBOA, (2007): Yirgacheffe Bureau of Agriculture, Agriculture in Yirgacheffe Woreda, Yirgacheffe, Ethiopia.
58. Zelalem, T. (1994): Survey of mange mites of small ruminant in Dire Dawa, DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Ziet, Ethiopia.

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