

Study On Prevalence And Associated Risk Factors Of Bovine Mange Mites In And Around Gondar Town, Northwest Ethiopia

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Abstract:-A cross-sectional study was conducted commencing October 2014 to April 2015 in and around Gondar town, Amhara National Regional State, Northwest Ethiopia, with the objective of assessing the prevalence and associated risk factors of mange mite in cattle. Both clinical and laboratory examinations of samples from skin were carried out and a simple random sampling technique was used to select the study animals. A total of 384 cattle of all age, sex and breed were examined and in a cattle having skin lesion sample of skin scrapings were taken. SPSS version 20 was used for data analysis and Chi square test was used to observe association of different risk factors with the occurrence of mange mite infestation. Out of 384 cattle's examined 34 (8.9%) animals were found positive for mange mites. Among the total of 34 positive cattle for mange mite, the two mite genera was detected. Of these, Demodex, 21(5.5%) followed by sarcoptes 13(3.4%) of total cattle examined for mange mites. Analysis of the potential risk factors has revealed that there was no statistically significant difference ($P>0.05$) between breeds, management and age of animals for the occurrence of mange mites. However, there was a significant association ($P< 0.05$) between sex and body condition of animal with mange mites. Generally the mite infestation causes considerable economic loss in livestock production. Further investigations should be conducted in order to know detail information about bovine mange mites in the study area, so as to put appropriate control and prevention measures.

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1. Introduction

Ethiopia has the largest livestock population in the continent. There are approximately 41.3 million cattle, 46.9 million small ruminants, more than 1 million camels and 4.5 million equines, and 40 million chickens. Despite the large number of livestock, there has been a decline in national and per capita production of livestock and livestock products, export earnings from livestock, and per capita consumption of food from livestock origin since in comparison to other African countries. Various estimates showed that the livestock sub-sector contributes 12 to 16% of the total and 30 to 35% of agricultural GDP, respectively (Nigatu and Teshome, 2012).

The existence of various skin diseases (dermatophilosis, Demodicosis, sarcoptic and psoroptic mange, ticks and lice infestations) affecting cattle is frequently reported from different parts of Ethiopia. The different skin diseases in Ethiopia are accountable for considerable economic losses particularly to the skin and hide export due to various defects, 65% of which occur in the pre slaughter states directly related mostly to skin disease and skin and hides are often rejected because of poor quality. Apart from quality degradation of skin and hides skin

diseases induce associated economic losses due to reduction of wool quality, meat and milk yield, losses as a result of culling and occasional mortalities and related with cost of treatment and prevention of the diseases (Yacob *et al.*, 2008).

Among ectoparasites, mange mites are most common which parasitize different domestic and wild animals. Most mites are microscopic or less than 1mm in length. They are covered by a relatively soft integument through which the smaller forms respire. The larger forms breath through opening called stigmata that contact to trachea. The body may have scales, spines or suckers used in attachment to the host and these structures are also used in identifying the organisms (Sloss, 1994). They spent their lives on the animal body by feeding on blood, lymph, skin debris and inject subcutaneous secretion while puncturing the skin, damaging the skin surface (Nejash, 2013). The infectious activity of these ectoparasitic mites which cause purities accompanied by hair loss or alopecia on the subcutaneous tissue and hair loss with associated skin thickening (Soulsby, 1998). The feeding habits depends on fluids which are secreted in the body of the host like edematous, fluid, blood and other body fluid. (Lefevre *et al.*, 2010).

Mites have different species which causes cattle mange and they are; *Demodex spp.*, *Sarcoptes spp.*, *Chorioptes spp.* and *Psoroptes spp.* Generally they causes intense itching and scratching accompanied by exudates which coagulate to form crust on surface of skin characterized by excessive keratinization and proliferation of connective tissue and leading to huge loss of skin and hide and decrease production capacity of animals and in some case leading to death (Nejash, 2013). according to tannery report, hides and skins account for 12-16% of the total value of exports. The current utilization of hides and skins is estimated to be 48% for cattle hide, 75% goat skin and 97% sheep skin with expected off take rate of 33%, 35% and 7% for sheep, goats and cattle respectively. The Ethiopian tannery industry has long complained about poor quality processed skin and hides because of the effect of insects, arthropods, and other parasites (Ayele *et al.*, 2003).

In Ethiopia different researches has been conducted in order to assess the prevalence of mange mite infestation. Among those previous studies of Gashew (1986) (11.8%) in the administrative zone of Harrerghe, Asseged (1991) (10.4%) in southern Ethiopia range land, Habte (1994) with the prevalence 28% in Zebu cattle and 72.9% in cross breed in and around Mekelle were studies done previously. Generally mange mite is one of the most important diseases that seriously hinder skin and hide quality in Ethiopia and other part of the world. Knowledge of the disease in terms of symptoms observed and prevention methods are important in combating the disease and consequently improve the quality of skin and hide of animals.

There is lack of information on the occurrence and losses associated with bovine mange mite and very little attention has been given to the role of mange mite as the cause of disease and production losses in cattle in Ethiopia, the same is true, in and around Gondar town. Therefore, taking into account the significance of the mange mite as one of the most important causes of economic losses and the scarcity of information in the country, the present study was designed. Therefore the objectives of this paper are:

- To assess prevalence of mange mite in cattle in and around Gondar town.
- To Identify associated risk factors of mange mite in cattle.

2. Materials And Methods

2.1. Study Area

The study was conducted in and around Gondar town, starting from October 2014 to April 2015. Gondar town is one of the districts of North Gondar Administrative Zone in Amhara National regional state (ANRS). It is located 750 km northwest of the

capital city, Addis Ababa. It is situated between 12°36'N and 33°28'E at an altitude of about 2200 m above sea level with an average annual temperature of 19.7°C and an average annual rainfall of 1180 mm. Being a highland area, the city is spread on different mountains, slopes and in valleys and has three small rivers, many streams and a lake. According to Office of Agriculture and Rural Development, the population size of Gondar town in 2008 is about 112,249 out of which 60,883 are males and 51,366 are females. The livestock population in the area comprises of cattle, 200,135 (exotic, cross and local), goat (81,000), sheep (70,000), horse (9,000) and donkey, 12,000 (WARD, 2012).

2.2. Study Population

The study was conducted on 384 cattle of both local and cross breeds which were found in and around Gondar town from different farms and cattle of free grazing range lands. Cattle were categorized on the basis of ages as less than two years old, 2-5 years and greater than five years (Tewodros *et al.*, 2012) and body condition were categorized into three such as poor, medium and good according to body condition score (Annex 4). The management system was expected as risk factor and intensive, semi-intensive and extensive management systems were all considered as well. The origins of cattle were different kebeles of Gondar town and Azezo.

2.3. Study Design and Sampling Technique

A cross-sectional study has been conducted on cattle in order to assess prevalence and associated risk factors of mange mite in and around Gondar town. A simple random sampling technique is used to select the study animals.

2.4. Sample Size Determination

The sample size is determined by using the formula given by Thrusfield (2007) to calculate the sample size, 50% expected prevalence, 95% confidence level and 5% desired absolute precision was used. Since there was no similar study done previously on the study area, the expected prevalence was taken as 50%.

$$n = (1.96)^2 p^{exp} (1 - p^{exp}) / d^2$$

Where:-

n= required sample size

p_{exp}= expected prevalence

d= desired absolute precision

Therefore, using 50% expected prevalence and 5% absolute precision at 95% confidence interval, the number of animal examined in this study were calculated to be 384.

2.5. Study Methodology

2.5.1. Clinical observation, history and palpation

Animals with problems of skin lesions and history of itching were examined closely by inspection and palpation and skin scrapping was taken. The

management history was taken from the animal owners. Multiple sites were scrapped to increase the likelihood of mite detection. Skin scrap was taken from the periphery of the lesions after removing coat hair by gentle clipping and deep skin scraping (deep epidermal examination) until capillary ooze occurs. Nodular lesions with pus were also pressed and pyogenic exudates was directly taken to clean universal bottle and examined under microscope. The material scraped falls on paper held underneath and transferred to clean universal bottle with 10% formalin. After all of these, samples were directly transported to Gondar University veterinary laboratory for processing and mite identification.

2.5.2. Skin Scraping Examinations

Examination of skin scraping was made in supplementary with clinical observation essential in the diagnosis of mange mite. The blood stained scrap was aimed for the diagnosis of burrowing and follicular mites such as *Sarcoptes* spp and *Demodex* species. After adding of 10% KOH direct smear of skin scraping were examined under low power microscope. For further identification the skin scraping mixed with KOH was heated in order to digest skin scraping and centrifuged. Then after drop of sediment was taken on clean slide and covered with cover slip then examined under low power microscope. After that mite identification was done according to their morphology (Wall and Shearer, 2001).

2.6. Data Analysis

The data was first entered and managed in to Microsoft Excel worksheet analyzed using statistical package for social sciences (SPSS) software version

20. The prevalence of mange mite were expressed as percentage with 95% confidence interval by dividing the total number of cattle positive to mange mite to total number of cattle examined. The prevalence of mange mite was calculated for different risk factors as number of mange mite positive animal examined divided by total number of cattle investigated at the particular time. The significant difference between the prevalence of mange mite could be determined using descriptive statistics; chi-square test (χ^2) and $p < 0.05$ is considered as statistically significant.

3. Results

3.1. Over All Prevalence

Out of the total 384 cattle examined for mange mite infestation, 34 were positive with an overall prevalence of 8.9%. Of these, 5.5% (21/384) of cattle were infested by *demodex* and 3.4% (13/384) cattle by *sarcoptes*. In this study revealed that the genera of mite like *psoroptes* and *chorioptes* were non-prevalent in study area in cattle.

Table 1: Overall Prevalence of Mange mite species in and around Gondar town 2014/2015

Mange Mite Spps.	No. of Cattle	Prevalence (%)
Demodex	21	5.5
Sarcoptes	13	3.4
Psoroptes	0	0
Chorioptes	0	0
Total	34	8.9

3.2. Association of Risk Factors

Table 2: prevalence of mange mites among different Categories of cattle

Risk Factor		No. Examined	No. Positive (%)	X ² -Value	P-Value
Breed	Local	285	27 (9.5)	0.526	0.468
	Cross	99	7 (7.1)		
Sex	Male	210	13(6.2)	4.075	0.044
	Female	174	21(12.1)		
Age	<2 Years	72	5(6.9)	1.055	0.590
	2-5 Years	194	20 (10.3)		
	>5years	118	9(7.6)		
Management System	Intensive	172	20(11.6)	3.095	0.213
	Semi-Intensive	117	7(6.0)		
	Extensive	95	7(7.4)		
Body Condition	Poor	126	20(15.9)	11.822	0.003
	Medium	168	11(6.1)		
	Good	76	3(3.8)		
Total		384	34(8.9)		

Analysis of association of different risk factors with the prevalence of mange mite in cattle showed, there was no statistically significant difference ($P > 0.05$) between breed, age and management with mange

mite infestation. Accordingly, the highest percentage was recorded in local (9.5%), 2-5 yrs (10.3%) and intensive (11.6%). However, there was significant association ($P < 0.05$) between sex and body condition

with mange mite infestation (table 2). The higher prevalence was observed in females (12.1%) and in cattle with poor body condition (15.9%).

In the above (table 2): shows the detailed description of results obtained with regard to risk factor and mange mite infestation in cattle in and around Gondar town during my study period. Therefore, the prevalence of mange mite was found to be (9.5%) in local, (7.1%) in cross breeds and (12.1%) in females, (6.1%) in males and there was a statistically significant variation ($P < 0.05$) between sexes. In management system it was (11.6%) in intensive, (6.0%) in semi-intensive and (7.4%) in extensive. Whereas, (6.9%) in <2yrs, (10.3%) in 2-5yrs (6.1%) in >5yrs were recorded. Similarly comparing the prevalence of mange mite infestation with body condition showed, (15.9%) in poor, (6.1%) in medium and (3.8%) in good body conditioned cattle. There was statistically significant variation ($P < 0.05$) in mange mite infestation among different body condition score.

4. Discussions

The current study revealed an overall prevalence of 8.9% cattle Mange mites. This finding was higher than the previous studies of Bogale (1991), 4.19% in Debre-Zeit, Chalachew (2001), 1.63% in Wolayita Sodo, Regasa (2003), 0.42% in Nekemte, Yacob *et al.* (2008), 1.88% in Adama and Eydal and Richter (2010), 1.8 % in Iceland. However, it is lower than the finding of Gashew (1986), 11.8% in the administrative zone of Harrergha, Asseged (1991), 10.4% in southern Ethiopia range land, Habte (1994), 28% in Zebu cattle and 72.9% in cross breed in and around Mekelle, Ashenafi and Tibbo (2003), 11.78% in Tigray region, Tewodros *et al.* (2012), 15.63% in and around Gondar, Amhara Regional State, Abu-Samra and Shuaib (2014), 87.7% in Sudan.

In the current study two genera of mites were detected *Demodex* spp (5.5%) and *Sarcoptes* spp (3.4%). The present finding of demodicosis was higher than the previous study of Yakob *et al.*, (2008) in Adama (1.88%). It was relatively similar with previous study of Ashenafi and Tibbo (2003), 4.19% in central zone of Tigray. However, it was lower than the previous study of Mersha *et al.* (2013), 15.5% and Tewodros *et al.* (2012), 9.5% in Gondar Zuria district. Also, the present finding of mange mites due to *Sarcoptes* spp was higher than the previous reports of Baker and Fisher (1991), 1.4% in the southern rangelands, but it is similar with the findings of Matthes and Bukva (1993), 3.94% in Eastern Shoa district. However it was lower than reports of Ashenafi and Tibbo (2003), 7.69% in central zone of Tigray.

The difference in the prevalence of Mange mite infestation in different areas is due to variations in

agro-climatic conditions such as altitude, rainfall, temperatures, humidity and the management system of under which the animals are living (Numery, 2001). The existence of higher population of cattle in small area can facilitate the infestation because the main way of transmission is intimate contact between animals (Taylor *et al.*, 2007).

In the current study, there was no statistically significance difference ($p > 0.05$) between breeds of cattle on the occurrences of diseases. This finding was agreed with the previous finding of Tewodros *et al.* (2012) and it indicated that breed is not predisposing risk factor with regard to contracting mange mite infestation. It might be due to no immunity difference among breeds.

There was statistically significant variation between sex of cattle ($p < 0.05$). This result disagreed with study of Matthes and Bukva (1993), and Tewodros *et al.*, (2012). The significance difference might be due to factors like pregnancy and lactation that can decrease the immunity of females than males that can lead to the greater susceptibility of females for mange mite infestation. It might also be associated with physiological stress condition during pregnancy and lactation, the lesser emphasis given by owners on feeding of female animal with regard to better feeding habit of owners in feeding of male animals since they used for ploughing, fattening and higher financial gain at the market level.

In the current study, the prevalence of mange mite in different age categories was not found statistically significant even though it was more prevalent at the age between 2-5 years (10.3%) than other two age categories. This result agreed with study of Matthes and Bukva (1993), and Tewodros *et al.* (2012). The higher percentage in some age groups might be poor husbandry system and shortage of feed accessibility in which animal was living. The result indicated that the age was not risk factor for mange mite infestation and it was occurred in all age groups with various intensities (Radostits *et al.*, 2007).

The prevalence of mange mite was not significant ($p > 0.05$) different among the management system on the occurrence of mite infestation. However, slightly higher prevalence was recorded in intensive management system (11.6%) than others management systems. This result agreed with study of Tewodros *et al.*, (2012).

According to these study there was statistically significance difference ($p < 0.05$) between the body condition on the occurrences of mange mite. The finding of present study was agreed with Molu (2002). This might to be due to variation in immunity in animals with different body conditions. Animals which have poor body condition appear most susceptible for mite infestations (Taylor *et al.*, 2007).

Also mange mite infestation may result in reducing growth rate, loss of body condition because the parasites spend their entire life on their host. The hosts may spend most of time on scratching and itching instead of grazing leading to poor body condition (Foryet, 2001).

5. Conclusion And Recommendations

The present study was conducted on the prevalence and associated risk factors of bovine mange mites in and around Gondar town. The high prevalence of cattle mange mite as the result of the *Demodex* and *sarcoptes* was considered as one of the important infestation in the study area. There were statistically significant differences ($P < 0.05$) in the prevalence of mites to different body condition and sex of cattle. Beyond causing disease on individual animal mange mite infestation impairs the quality of skin and hide that leads to loss of huge amount of income to the country due to downgrading and rejection of skin and hides in terms of foreign exchange earnings. Furthermore, mite infestation causes considerable economic loss in livestock production. So to minimize the spread prevalence of this parasitic problem in the study area the following actions are forwarded:

➤ Further investigations should be conducted in order to render more detail information about bovine mange mites, so as to put appropriate control and prevention measures in place.

➤ Implementation of improved cattle management practices is greatly suggested to prevent overcrowdings of the animals and mange mite disease problems in the study area.

➤ Furthermore, the level of awareness of the farmers should be increased regarding the effect of mange, its modern prevention and control methods and other management practices to which an overall participation would bear quality skin production and enhancement of exportation potential.

➤ Quarantine and treatment of infested animals saves the cost and labor of treating the entire flock

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Reference

1. Abusamra, M.T. and Shuaib, Y. A. (2014): Bovine Demodicosis: Prevalence, Clinicopathological and Diagnostic Study. Department of Veterinary Medicine and Surgery, College of Veterinary Medicine (CVM), Sudan University of Science and Technology (SUST), Khartoum North, Sudan, *J.vet.adv*, 4:382.
2. Anne, M., Zajac, R. and Gray, A.C. (2006): Veterinary clinical parasitology. 7thed, American Association of the protocolis, Pp.185-210.
3. Ashenafi, H. and Tibbo, M. (2003): Major skin diseases of cattle in the .
4. Central Zone of Tigray, Northern Ethiopia. *AE J.Agr. Envir. Sci.*, 7: 1-8.
5. Assegid, B.B., (1991): Epidemiological study of major skin diseases of cattle: .
6. Ayele,S., Assegide, W., Ahmed, M.M. and Belachew, M. (2003): Live stock marketing in Ethiopia. A reveiw of structural performance and development initiative, Socio economic and Policy research working paper 52 ILRI, Nairobi, Kenya. Pp. 35.
7. Baker, D.W. and Fisher, W.F (1991): The Incidence of *Demodectic* Mites in eyelids of various mammalian hosts. *Econ. Entomol.*, 62: 942.
8. Bogale, A. (1991): Epidemiological study of major skin diseases of cattle: Southern rang elands. DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre-Zeit, Ethiopia.
9. Bornstein, S., Mörner T. and Samuel, W. (2001): *Sarcoptes scabiei* and sarcoptic mange. *In: parasitic diseases of wild mammals*, 3rd ed., Iowa state university press, Ames, Jowa, USA, 107–119.

10. Bowman, D.D. (2003): Parasitology for veterinarian. 8thed, sounders, Pp.63.
11. Chalachew, N. (2001): Study on skin diseases in cattle, sheep and goat in and around Wolayta Soddo, Southern Ethiopia. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeit, Ethiopia.
12. Charles, J.B and Hinrix, C.M. (1998): Diagnostic parasitology for veterinary technicians. 3rded, Elsevier, Pp. 69-76
13. Chauhem, N.S. and Chandra, D.H. (2003): Diseases of small ruminants, in India, Statishseria publishing House, Pp.299-302.
14. Eydal, M. and Richter, H.S. (2010): Lice and mite infestations of cattle in Iceland. Institute for Experimental Pathology, University of Iceland, Keldur, IS-112 Iceland, Icelandic Agricultural Sciences, 23: 87-95.
15. Fain, A. (1968): Etude de la variabilite de *Sarcoptes scabiei* avec une revision des Sarcoptidae. *Acta Zool. Pathol.Antverp.*, 47, 1-196.
16. Falconi, F., Ochs H. and Deplazes D. (2002): Serological cross-sectional survey of Psoroptic sheep scab in Switzerland. *Vet. Parasitol.*, 109, 119-127.
17. FAO (2005): Ethiopia FAO'S information system on water and Agricultural, fao.org. Rome, Italy.
18. Ferguson, J.D. (2011): Review of body condition scoring dairy herd. Available at: <http://www.txanc.org/wp-content/uploads/2011/.../Body-Condition-Scoring.pdf> [accessed on 23 November 2013].
19. Foryet, W.F. (2001): veterinary parasitology, Reference manual 2nd ed, Mosby. Pp.199-211.
20. Gashew, T. (1986): Prevalence of Mange Mites on Goat, Sheep and cattle, in Administrative Zone of Harreghe. DVM thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeit, Ethiopia, Pp. 16.
21. Gondar Zuria Woreda Agricultural and Rural Development Office (WARDO), (2012): Gondar Zuria, Agricultural censuses Report 2012.
22. Gray, M. and Lance, D. (2002): Medical and Veterinary Entomology. Department of Entomology and plant pathology, University of Auburn, Pp.452-456.
23. Habte, G. (1994): Prevalence of Mange Mite Infestation on Camel, cattle and sheep, in and around Mekelle. DVM thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeit, Ethiopia.
24. Howard, J.L. (1986): Current Veterinary therapy. 1st ed. USA: Sounders Company. Pp.881-885.
25. Jones, T.C., Hunt, R.D. and King, N.W. (1996): *Veterinary pathology*. 6th ed. Lippincott Williams and Wilkins: London, Pp.675-677.
26. Jubb, K.V., Kenedy, O. and Palmer, N. (1992): Pathology of Domestic animals. 4thed. London: Peter Academic press INC. Pp.681-694.
27. Junquera, P. (2013): *Cattle Mites: biology, prevention and control. Cattle mange; Psoroptes, Sarcoptes, Chorioptes, and Demodex*. Available at: [http://parasitipedia.net/index.php?option=com_content & view=article & id=2539 & Itemid=2814](http://parasitipedia.net/index.php?option=com_content&view=article&id=2539&Itemid=2814) [Accessed on 28 Feb. 2013].
28. Lefevre, P., Blancous, J., Chermette, R. (2010): Infectious and parasitic diseases of live stock. 2nd ed. London: Academic press. Pp.1427-1439.
29. Mandal, N.G. (2012): Diversity of ectoparasits on sheep flock in Saopaulo, Brazil, *Tropical Animal health and production*, 32:225-232.
30. Marquardt, W., Demaree, R. and Grieve, R. (2000): Parasitology and vector Biology. 2nd ed. Boston: Harcourtac, Academic press. Pp. 681-685.
31. Marrison, D., Bewket, S., Kassa, T., Tefera, T., Gezahgne, M., Dagne, M. and shihun, S. (2000): Mange: A disease of growing threat for the production of small ruminants in Amhara National Regional State. The opportunities and challenges of enhancing goat production in Ethiopia, November, Pp. 10-12.
32. Matthes, H.F. and V. Bukva. (1993): Features of Bovine Demodecosis in Mongolia. Germany. Preliminary Observations. *Folia Parasitologica*, 40: 154-155.
33. Mersha, C., Solomon, T. and Basazenew, B. (2013): Prevalence of Bovine Demodicosis in Gondar Zuria District, Amhara region, North West Ethiopia. *Global Veterinaria*, 11(1) 30-35.
34. Molu, N. (2002): Epidemiological study on skin diseases of the small ruminants in the southern rangelands of Oromia, Ethiopia. DVM Thesis, Addis Ababa University, faculty of Veterinary Medicine, DebreZeit, Ethiopia.
35. Mullen, G and Durden, L. (2002): Medical and Veterinary Entomology 1sted, Academic press, imprint of Elsevier. Pp. 445-450.
36. NADIC. (2014): National animal health research center, animal health skill, South east Scotland.
37. Nejash, A.M. (2013): Ectoparasitism: Threat to Ethiopian small ruminant population and Tanning Industry, Department of pathology and parasitology, Addis Ababa University. College of Veterinary Medicine and Agriculture, Ethiopia. Pp. 28-31.
38. Nigatu, K. and Teshome, F. (2012): Population dynamics of cattle ectoparasites in Western Amhara National Regional State, Aklilu Lemma

- Institute of Pathobiology, Addis Ababa University, Ethiopia. Adamitulu PPSC, Research and Development Department, Addis Ababa, Ethiopia, *Journal of Veterinary Medicine and Animal Health*, 4: 22-26.
39. Numery, A. (2001): Prevalence and effect of ectoparasites in goats and fresh goat pelts and assessment of wet-blue skin defects at Kombolcha tannery. South Wollo, Northeastern Ethiopia. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeit, Ethiopia.
 40. Nutting, W. (1985): Prostigmata – Mammalia: Validation of coevolutionary phylogenies. *In: Coevolution of Parasitic Arthropods and Mammals*, 2nded. New York, USA 569–640.
 41. OIE Terrestrial Manual (2013): Version adopted by the World Assembly of Delegates of the OIE. Chapter 2.9.8: Pp; 2-10.
 42. Olubunmi, P. (1995): The Prevalence of Mange Due to *Sarcoptes Scabiei var capraein* Ile-Ife Area of Nigeria, Its Control and Management. *Bull. Anim. Hlth. Prod. Afr.*, 43, 115-119.
 43. Pangui, L. (1994): Mange in Domestic Animals and Methods of Control. *Rev. Sci. Tech. off. Int. Epiz.*, 13(4), 1227-1243.
 44. Radostits, O. M., Gay, C.C., Hindeliffe, K.W. and Costable, P.D. (2007): *Medicine, a Text book of Diseases of cattle, sheep, pig and horse*. 10th ed. London: sounders, Elsevier. Pp.103-112.
 45. Radostits, O., Blood, D., Gay, C. (1994): *Veterinary Medicine, Textbook of Cattle, Sheep, Pigs, Goats and Horses*, 8th edition, Bailliere Tindall, UK, Pp. 1280-1308.
 46. Regasa, C., (2003): Preliminary study on major skin diseases of cattle coming to Nekemte Veterinary Clinic, Western Ethiopia. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeit, Ethiopia.
 47. Riviere, J.M. and Papich, M.G. (2009): *Veterinary pharmacology and therapeutic*. 9th ed, Wiley-Black well. Pp.1186-1286.
 48. Sloss, M.W. (1994): *Veterinary clinical parasitology*. 6th ed, Low state press, Black wall Publishing Company, Pp.121-127.
 49. Soulsby, E. (1982): *Helminthes, Arthropods and Protozoa of Domestic Animals*, 7th edition, Lea and Faebiger, Philadelphia, Pp. 375-502.
 50. Soulsby, E. (1998): *Helminthes, Arthropods and Protozoa of Domesticated Animal*. Bailliere, Tindalland Easel Ltd, London, Pp: 465-46.
 51. Taylor, M.A. Coop, R.L. and wall, R.L. (2007): *Veterinary parasitology*. 3rd ed. London: Black wall Publishing Company, Pp. 144-223.
 52. Tefera, S.D. (2004): Investigation of ectoparasites of small ruminants in selected sites of Amhara regional state and their impact in the tannery industry, DVM thesis, Addis Ababa University, Debrezite, Ethiopia, Pp.1-3.
 53. Tewodros, F., Mekash, A., Mersha., C. (2012): *Demodex and Sarcoptes* of cattle; extravagance for leather industry, University Gondar, America-Eursian. *J. sc. res.* 7(3):131-135.
 54. Thrusfield, M. (2007): *Veterinary Epidemiology*. 3rd ed. Blackwell Science, Great Britain, Pp. 259-263.
 55. Torell, R., Bruce, B., Kvasnicka, B. and Conley, K., (2003): *Methods of Determining Age of Cattle*. The University of Nevada, *Cattle Producer's Library - CL 712*.
 56. Urquhart, G. M., Armour, J., Duncan, J. L., Dunn, A. M. and Jennings, F. W. (1996): *Veterinary Parasitology*, 2nd ed., Blackwell Science Ltd, UK Pp.190-192.
 57. Wall, R. and Shearer, D. (1997): *Veterinary Entomology*, 1st ed., Chapman and Hall, UK, Pp.76-439.
 58. Wall, R. and shearer, D. (2001): *Veterinary ectoparasits, Biology, pathology and controle*, 2nd ed. UK, Black science, Pp.23-54.
 59. Yacob, H.T., Netsanet, B. and Dinka, A. (2008): Prevalence of major skin diseases in cattle, sheep and goats at Adama veterinary clinic, Oromia regional state. Ethiopia. *Rev. Med. Veter.*, J.V. Med and A. H, 159(8-9): 455-461.
 60. Yeruham, I., Rosen, S. and Handni, A. (1999): Chorioptic mange (acarina;) Psoroptidae in Domestic and Wild ruminants, Isreal. *Experimental and applied acarology*, 23:861-865.