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Cross sectional study on the Prevalence and Identification of Mange Mites on Cattle in and around Nekemte Town, Easter Wollega Zone, Oromia Regional State, Western Ethiopia

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Abstract

A cross-sectional study was conducted from November 2014 to April 2015, with the objective of determining the prevalence and identification of species of mange mites in cattle in selected areas of in and around Nekemte town. A total of 384 cattle were examined for the presence of mange mites. The study involved both clinical and laboratory examinations of skin scraping samples from skin of the animals. Of the total 384 cattle examined, 86 (22.40%) were found to be infected with mange mites. The most commonly encountered mange mites were Sarcoptes (15.10%), Demodex (5.47%), and Psoroptes (1.82%). Statistically insignificant variations were observed among two age categories (young and adult), even though the highest prevalence was observed in young, 49(22.69 %) while the lowest, 37 (22.02 %) in the adult cattle. However, there was a statistically insignificant variation detected between Gender (P>0.05) even if it was higher in female, 72 (23.00%) than male, 14 (19.72 %), but statistically significant variations observed among body condition score (x2= 44.4667; p<0.05), while the highest prevalence were observed in poor body condition score 31 (57.41%) than the moderate 15 (15.31%) and good 40 (17.24%) body condition score. Likewise, there was statistically significant variation detected among the different sites of infestation (p<0.05). The frequent sites of mange mite lesions were on the shoulder, neck, face, ears, tail and leg. To reduce the high prevalence and impact of mange mites on cattle appropriate and strategic control measures; extension service aiming at creation of awareness about the importance and control of mange mite for smallholder farmers is needed. Therefore, strategies have to design by professionals, regional governments and farmers to fight diseases of cattle.

Keywords: Cattle • Mange mites • Nekemte • Prevalence

Introduction

Agriculture is the mainstay of Ethiopian economy. It employs over 80% of the adult population and account for 45% of the Gross Domestic Production (GDP) and 85% of the export earnings. Ethiopia owns the largest number of livestock population in Africa which is approximately 44,318,877 cattle, 23619720 sheep, 23,325,113 goats, 6 million equines, 2.3 million camels and 43 million poultry. Ruminants represent an important segment of the Ethiopian livestock system. The national ruminant's population of Ethiopia is the largest in Africa and is estimated to be 47,570,675 for cattle, 26,117,272 for sheep and 21,709,428 for goats.

Livestock in the Greater Horn of Africa is vital resource in promoting development. It serves as an important source of income for the agrarian community and is one of the Ethiopia's major sources of foreign currency through exportation of skins and hides. Nevertheless, several factors exert an influence on the production and productivity of livestock mainly kept under extensive and unimproved management conditions [1]. Diseases, Seasonal feed scarcity and poorly developed infrastructures curtail the production potential. Animal diseases in general and particularly those caused by parasites are the major constraints to livestock production in the humid and sub-humid portions of the country and have been the stumbling block against the full utilization of this resource for foreign Currency through export of live animals, skin and hides.

Different causes of skin disease are accountable for considerable economic loss particularly to the skin and hide export due to various defects, 65% of which occur in the pre-slaughter slaves directly

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related mostly to skin disease causing often rejection because of poor quality (Bekele, 2002). Ectoparasites are ubiquitous, often highly damaging and in most cases cannot be permanently eradicated, as a result ectoparasitism represents a major obstacle to development and utilization of animal resource and causes huge livestock production losses.

From the ectoparasites mange is highly contagious skin disease caused by one or a combination of several species of mites. It is characterized by crusty, pruritic dermatitis and hair/feather loss and caused by a variety of parasitic mites burrowing in or living on the skin. Mites affect both domestic animals and humans, but also wildlife of zoonotic importance. It is small crawling animals related to ticks and spiders. Most mites are free-living and harmless. Those infest livestock animals can cause many diseases that are widespread, reduce production and profit for farmers [2]. Due to their behavior ectoparasitic mites may have a direct and indirect effect on their host. These could be a direct harm (blood loss, skin inflammation, pruritis, etc.) or indirect when they present at high density (cause disturbance, self wound, and social nuisance).

When the mites pierce the skin to feed on cells and lymph, there is a marked irritation, and scratching. Rubbing and scratching by host frequently results in deeper wounds that ooze serum and blood. These coagulate and form crusting over the surface. The crusting is accompanied or followed the formation of a thick, tough, wrinkled skin, frequently; these are secondary skin infections.

Mites have a lifecycle in which larvae hatch from the eggs, then feed and molt into nymphs. Several stages of nymphs may follow and finally molt produces adult. In most parasitic mites, the entire lifecycle takes place on the host, with all stages present simultaneously. Mites is comprises two major evolutionary lineages, parasitiformes and acariformes, but only certain acariform mites cause mange in domestic animals.

The mites have a complex taxonomy, occupying at least eight different families and for veterinary, it is more useful to consider them according to their location of the host as burrowing and non-burrowing mites. Burrowing mites consists of the following genera of veterinary importance, Sarcoptes and Demodex. Sarcoptes is round in outline and up to 0.4 mm in diameter with short legs which scarcely project beyond the body margin. It has transverse ridges and triangular scales on the dorsum. The other genera Demodex has elongated tapering worm like body, is up to 0.2 mm long with four stumpy legs anteriorly and transverse strations on the abdomen, while non-burrowing mites of major veterinary importance are Psoroptes. It is a typical non-burrowing mite, up to 0.75 mm, oval in shape and with all the legs projecting beyond the body margin. It's most important reorganization features are the pointed mouth parts, the rounded abdominal tubercles and the three jointed pedicles bearing funnel-shaped suckers on most of the legs. The most common mange mites in bovine are due to infestation, Sarcoptes bovis, and Psoroptes ovis. The genetic differentiation of these mange mites likely to be encountered in routine veterinary practice requires little more than examination of their pretarsi. If the pretarsus has a long unsegmented pedicel (stack), the specimen is most likely Sarcoptes and the three segmented pedicel in a long pretarsus is bound to be Psoroptes.

The demodectic mange is identified by its elongated cigar shaped body and has 4 pairs of short stubby legs. Sarcoptic mange in cattle caused by burrowing mites Sarcoptes scabie var bovis which results severe pruritic dermatitis. Animals in poor condition appear to be most susceptible, but conditions, especially overcrowding in which sarcoptic mange occurs often go hand in hand with poor feeding and general poor husbandry. This parasite is a ubiquitous ectoparasite that infects more than 100 species of mammals worldwide. In humans it is known to cause considerable morbidity in a number of different counties and epidemics can be caused by contagion from a single case of scabies in crowded living conditions. Sarcoptic mange may lead to considerable economic losses in domestic animals with repercussions for the animal trade.

Psoroptic mange is caused by non-burrowing Psoroptes ovis commonly seen in range and feedlot cattle. The parasite does not burrow in the epidermis but remains at the base of the hairs and pieces the skin with its stylet like chelicerae. This feeding manner results in exudation of serum, which hardens to form scab. They dwell and feed on the surface of the host's skin. Survival time for some of these mites off the host may be two weeks or more.

Demodectic mange in cattle results from infestation of an obligate burrowing parasitic form of Demodex bovis which lives in the hair follicles and sebaceous and sweat glands. Lesions consist of follicular papules and nodules appear over the body. In heavy infestation nodules are thick, waxy or caseous material, sometimes stained with blood. Demodectic mange may be come generalized and fatal, this outcome contributed to other debilitating conditions such as malnutrition, tick worry, and tropical heat. This leads to pustular folliculitis and indurate (thickened) plaques within the skin. On cattle, these localized foci of infestation can become as large as to be clearly visible externally. The value of the hides from cattle infested this way is reduced.

Mange mite diagnosis is a prerequisite to subsequent strategy of studies regarding prevalence, infestation, burden, seasonal pattern and control of mange mites on bovine. Multiple skin scrapings should be performed on pruritic cattle. The acquired debris should then be dispersed on a slide cover slip applied and examined microscopically using low power magnification. An appropriate disease control program against mange mites should take into account the entire ecosystem and thus integrate measures targeting both wildlife and livestock. Disease control in domestic animals may be able to interrupt mange transmission to wild animals and vice versa.

However, in severely infected animals as is often seen in burrowing mite problems, the skin reaction can mean that contact between the product and the mite is limited. In such cases, scabs may have to be removed before treatment. If very severe then injectable products are probably a better bet. Ivermectin is a very effective drug which may be used subcutaneous injections for all type of mite infestations. Therefore, the aim of this study was to determine the prevalence and identification of mange mites on cattle in and around Nekemte town.

Materials and Methods

Study animals and sampling

The study was conducted on 384 cattle of local breeds which were found in and around Nekemte town from small-scale owners. Animals were divided into two groups, namely young and adult animals and on the bases of production systems; the cattle which are found in this area are kept mainly under extensive traditional management system. The age of the animals was estimated using the dentation formula described.

The body condition score was taken based on estimation designed. The animals were inspected visually and by palpation for any skin lesion and samples were collected by skin scraping from animals showing sign of scales, nodules, itching and alopecia for further laboratorial examinations by applying the following procedures. A drop of mineral oil was put on clean glass slide, clean scalpel blade was dipped in to the mineral oil and then the edge of affected area was scraped until capillary blood oozes and then the sample was labeled and transferred to another clean microscopic slide, treated with 10% potassium hydroxide solution and examined under light microscope. In cases where nodular skin lesion suspected for Demodectic mange, the content (white cream pus) were collected and direct smear was made for microscopic examination. Identification of mange mite species was done based on the morphological characteristics described.

Study design and method

Cross-sectional study was conducted from November 2014-April 2015 to determine the prevalence and identification of mange mites on cattle in and around Nekemte town. The examination of each animal was conducted by visual inspection and palpation of skin lesions and by the eventual identification of mange mites. When skin lesions were evidenced the detailed history was taken from the owner and subsequently, skin samples were taken from at least two sites covering the adequate depth and peripheral edges. Some of the approaches used for diagnosing mange mites are presented as follows: Skin scrapping from suspected cases of manages were collected and preserved in 10% formalin. After addition of 10% KOH to the specimen, mites may be released from scabs and crusts before examination.

Sample Size determination

The total numbers of animals required for the study was calculated based on the formula given. $N = 1.962 \times P \exp (1\text{-}Pexp)/ d^2$.

Where, N = required sample size, Pexp. = expected prevalence, d=desired absolute precision (usually 0.05). Therefore, by substituting the value in the above stated formula, the required sample size was determined as n=384.

Since there was no previous similar study in the prevalence of mange mites in the area, 50% prevalence was taken to calculate the sample size and it was calculated at 95% confidence interval and a desired accuracy level of 5%. Therefore, the calculated sample size was 384 and these animals were selected randomly.

Study Methodology

For each of the cattle skin scraping samples were collected with scalpel blade of skin lesion. The skin lesion of sample would be put into petridish, identified appropriately and transported to wollega University veterinary parasitology laboratory to be processed. The observation of parasitic forms in the skin scrappy would be evaluated by using 10% KOH, and then examined under light microscope.

Data analysis

The data obtained were entered to Microsoft excel spread sheet and coded appropriately. For data analysis statistical analysis (STATA) software version 11.0 were used. The prevalence of mange mite was calculated for different risk factors as the number of mange mite positive cattle examined dividing by the total number of cattle investigated at the study area. The significant difference between the prevalence of mange mite was determined using Descriptive statistics; Chi-Square test (X2- value) and $P<0.05$ was considered as statistically significant.

Results

Over all prevalence of mange items in cattle: Out of the 384 cattle examined during the study period, 86(22.40%) were found to be infested with species of manges, of which 15.10%, 5.47% and 1.82% for Sarcoptes, Demodex and Psoroptes respectively (Table 1 and 2).

Species of mange	Number of infected	Prevalence %
Sarcoptes	58	15.1
Psoroptes	7	1.82
Demodex	21	5.47
Total	86	22.4

Table 1. Prevalence of mange mite based on cattle examined.

Site of infestation	Number of cattle found positive (%)	X2	p-value
Ear	14 (3.65)	12.97	0.024
Face	18 (4.69)		
Neck	18 (4.69)		
Shoulder	24 (6.25)		
Leg	4 (1.02)		
Tail	8 (2.08)		
Total	86 (22.40)		

Table 2. Prevalence of bovine mange mites based on site of infestation.

Prevalence of mange mite infestation was assessed in relation to age category. The prevalence of mange mites in the adult and young age groups was 22.02% and 22.69%, respectively. However, the present study revealed no statistical difference ($p>0.05$) in the

prevalence of the various species of mange mites between the two age categories.

The prevalence of bovine mange mites was also assessed in relation to Gender. Prevalence of mite infestation in females and males were found to be 23% and 19.72%, respectively. There was not statistically significant difference (p>0.05) among the different gender. With comparing of female and male, the female animal was more infected with the mange mites than the male animals. Prevalence of mange mite infestation according to body condition score. Higher prevalence was recorded in poor body condition animals (57.4%), followed by good (17.24%) and (15.3%) moderate body condition score animals. In all the three examined hosts, there was statistically significant difference (p<0.05) among different body condition categories (Table-3).

Risk factors	No examined	No Positive for sarcoptes	No Positive for psoroptes	No Positive for demodex	Total prevalence (%)	95%CI	X2	P-Value	
Age	young	216	30(13.88%)	6(2.77%)	13(6.02%)	49(22.69)	0.226(0.173-0.288)	0.0238	0.877
	Adult	168	28(16.66%)	1(0.59%)	8(4.76%)	37(22.02)	0.22(0.16-0.29)		
Gender	Male	71	5(7.04%)	5(7.04%)	4(5.63%)	14(19.72)	0.19(0.11-0.3)		
	Female	313	53(16.93%)	2(0.64%)	17(5.43%)	72(23.00)	0.23(0.18-0.28)	0.3593	0.549
Body condition	Poor	54	28(51.85%)	1(1.85%)	2(3.70%)	31(57.4)	0.57(0.43-0.70)	44.4667	0
	Moderate	98	9(9.18%)	0(0%)	6(6.12%)	15(15.3)	0.15(0.088-0.239)		
	Good	232	21(9.05%)	6(2.58%)	13(5.60%)	40(17.24)	0.17(0.126-0.227)		
Total		384	58(15.10%)	7(1.82%)	21(5.47%)	86(22.40)			

Table 3. Association and variety analysis of different risk factors with mange mite infestation in cattle examined in and around Nekemte town.

Discussion

The present study revealed that skin diseases caused by mange mite were common in cattle in and around Nekemte town. In this study, the overall prevalence of mange mite on cattle in the study area was 22.40%. It's slightly higher than the previous studies of Tewodros et al. (2012) who reported 13.792% in the Gondor town reported 11.78% in central zone of Tigrai and 3.54% in Womberta reported 3.13% the prevalence rate of mange mite obtained in and around Hawassa, Southern Ethiopia [3]. This variation might be attributed to the difference in weather conditions, inadequate veterinary services and type of managements practiced in the study area. In cattle observed for mange mite infestetion, the three mange generas, Sarcoptes, Demodex and Psoroptes were detected. From these, Sarcoptes was more prevalent in the study area and accounts 58 (15.10%). This is higher than the previous reports reported the prevalence of 19 (4.367 %) for sarcoptes in the Gondor town and 0.57% reported and around kombolcha. This higher prevalence of sarcopti mange might be attributed to characteristic of management practices, high air temperature and prolonged sunlight.

The second common mange mites observed in the study area was Demodex with the prevalence of 21 (5.47%). This is higher than the previous reports and region registered at the rates of 1.88% and 1.63% in cattle respectively. However, it was lower than reports of 15.5% and 9.425% prevalence of bovine demodecosis from Gondar areas respectively. This difference might be due to a variation in climatic condition, management and feed accessibility and usage of acaricides.

The third common mange mites observed in the study area was Psoroptes with the prevalence of 7 (1.82%). This is higher than the result of 0.9% reported in the Bench Maji zone of southwest 0.6% in and around Bishoftu town, central Ethiopia and 0.4% reported in and around kombolcha, Northestern Ethiopia. This higher prevalence of mange might be attributed to high air temperature and prolonged sunlight, extensive poor traditional cattle management system and lack of awareness of the owners about veterinary service which can exacerbate the disease condition.

The prevalence of mange mites in different age categories were found statistically not significant (p>0.05), even though young cattle were more infected than the adult. This difference might come due to poorly developed immune system of young cattle than the rest age categories. This finding was in close agreement with the work manage mites on young and adult with prevalence of 7 (20%) and 14 (13.3%) respectively. When the level of infestation of mange mites were calculated for the two genders of cattle, prevalence of 23.00% and 19.72% were observed in female and male cattle respectively [4]. However, there was no significance difference (p>0.05) in gender groups. This finding was in agreement with previous observation made elsewhere in the country. Gender has no significant effect on the prevalence of mange mites. This indicated that the mange mite infestation was not age and gender selective.

Mange mite affects all age groups and both gender. But it was more prevalent in females than males; this might be due to factors like pregnancy and lactation that can decrease the immunity of females which might enhance the susceptibility of female animal for mange mite infestation. In the present study, prevalence was compared in animals which have poor body condition, moderate and in animals of good body condition. The highest level of prevalence (57.4%) was observed in animals which had poor body condition while the lowest prevalence (15.3%) was observed in animals with moderate body condition. This result is consistent with the 26.3% and 3.8% prevalence for poor and moderate body condition respectively in and around Bishoftu town [5]. This might be due to nutritional status; as well fed animals can better withstand parasitic infestation than animals on an inadequate diet which can influence the level of immunity.

Increase in mite populations occur commonly in animals with poor body condition score. The distribution of mange mites was studied on six anatomical sites indicated that mange mites were detected at the highest frequency from the shoulder 24 (6.25%) followed by the neck and face region 18 (4.69%) and the region of the ear 14 (3.65%). The level of detection of mites was less in the regions of the tail 8 (2.08%) and leg 4 (1.02) described. This distribution of mange agrees with more preferable sites of infestation were shoulder, neck and back area of the body.

The variations on various site of infestation might be due to the living condition of the parasite as commensals that leads for suddenly pathogenic states or due to the frequent exposure of neck and shoulder for various stress conditions like yoke sore, traumatic injury and kick by ploughing instruments which facilitate the mite to feed easily by puncturing the host skin and sucking out the tissues of the injured area.

Conclusion

The present study revealed widespread occurrence of mange mite in cattle in the study area, and the major genera of mange mites identified were Sarcoptes, Demodex and Psoroptes. From the order of highest prevalence to the lowest prevalence are Sarcoptes, Demodex and followed Psoroptes. Thus, improved management practice and well-coordinated control interventions are required. From risk factors, body conditions are important factors affecting occurrence of mange mites in cattle. High levels of prevalence were observed in female, young and in which had poor body condition. Mites were frequently identified in decreasing order from shoulder, neck, face, ear, tail, and leg region. Even though the study revealed high level of mange mites prevalence compared to previous reported. However, even the current level of mange mites is enough to cause significant economic effect in the study area.

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