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Lice of domestic animals in Ethiopia, Epidemiology and their vector role

***Yacob Hailu Tolossa, Geremew Haile Lemu and Berhane Wakjira**
Addis Ababa University, College of Veterinary Medicine and Agriculture,
P.O. Box 24, Bishoftu, Ethiopia,
***Corresponding author:** email: *yacob.hailu@aau.edu.et* or *yamilaya2008@gmail.com*

Abstract

Ethiopia has huge number of livestock population. However, diseases have brought detrimental effect on the production to utilize the resources. External parasites are one of the major factor that brought direct and indirect damage by causing irritation, inflammation, tissue damage, hypersensitivity, abscesses, and lameness on animals. Lice are one of the most common and economically important external parasites of livestock. Pediculosis (dermatitis due to lice) is more common in Ethiopia. They cause great pre-slaughter defects responsible for downgrading and rejection of goat. Furthermore, they cause weight loss, reduction in milk production, disease transmission, and predispose the animal to other pathogenic organism. Lice infestation reduces 25-30 kg of body weight and 15-25% in milk production per animal per year. The prevalence of lice in Ethiopia varies in different parts of the country. It ranges from 6 to 50.7 % in sheep and goat and from 10.4 to 63.5 in cattle. *Linognathus* and *Damalina* are the most prevalent species in large and small ruminants in Ethiopia. *Bovicolaequi*, and *Haematopinusasini*are reported from equine while *Menopon gallinae, Lipeurus caponi, Menacanthus stramineus* and *Cuclotogaster heterographa* are reported from poultry. *Heterodoxus spiniger and Trichodectus canis* are reported from dog with a prevalence of 4 and 2.6% respectively. The difference in prevalence observed in different studies might be due to the variation in management system, breed of animals, seasonal variation, agro ecological and implemented methods of the disease control and prevention. Lice are vectors for diseases caused by *Bartonella quintana, Borrelia recurrentis, Francisella tularensis, Rickettsia prowazekii, Rickettsia typhi, swinepox virus, dipylidiumcaninum* and filarial nematodes.

Keywords: Agro ecology, Dermatitis Epidemiology, Lice species, Vector.

Introduction

Ethiopia have owned about 65.35 million heads of cattle, 39.89 million sheep, and 50.50 million goats(CSA, 2020). In the country livestock play vital role in farming system. However, poor health and disease has considerably become the major stumbling block to the potential of livestock industry. Predominantly parasitism by internal and external parasites in livestock production is the major problems(Onu and Shiferaw, 2013).

External parasites including ticks, lice, fleas, and mange mites are cause detrimental effects such as irritation, inflammation, tissue damage, hypersensitivity, abscesses, and lameness; and when present in large numbers may cause anemia and reduced productivity of goats. In addition, ticks, lice, fleas, and mange mites are reported to cause great pre-slaughter defects responsible for downgrading and rejection of goat skins (Kumsa, 2012). Furthermore, they causes weight loss, reduction in milk production, irritation of the skin, disease transmission, and predispose the animal to other pathogenic organism(Shiferaw, 2018).

Lice are one of the most common and economically important external parasites of livestock worldwide. Pediculosis (dermatitis due to lice) is more common in cattle than any other species of domestic animals. Lice are permanent external parasites of cattle and cannot survive more than few days off their host animal and are highly host specific. Lice infestation reduces 25-30 kg of body weight and 15-25% in milk production per animal per year. Several studies reports louse infestation from different parts of Ethiopia from cattle, sheep, goat, horse and poultry. This review was carried out on epidemiology of lice and its vector role by using available electronic and non-electronic databases. The electronic search was used as the primary search method. The main electronic databases used were PubMed and Google Scholar. Accordingly 54 published articles are used to review this paper.

The aim of this review was to bring together available data from primary research conducted so far on prevalence of lice, the current epidemiological distribution in different parts of Ethiopia and their role as a vector.

Louse Infestation

Lice are very small insects, but are visible to the naked eye about 0.5-8 mm in length, dorsoventrally flattened, wingless and possess stout legs and claws for clinging tightly to fur, hair and feathers. They are classified under two orders Anoplura (sucking lice) and Mallophaga (chewing/biting lice). Biting lice graze on epidermal tissue, hair and other organic waste. They cause intense itching by their action. Sucking lice have a narrow head with mouthparts adapted for penetrating the skin of the host and sucking blood. Both immature and adult stages suck the blood or feed on the skin.

The life cycle of lice is one of incomplete metamorphosis. Eggs (nits) are attached to hairs and develop through three nymphal stages to adult males and females. The life cycle is completed in approximately 3 weeks(Urquhart, 1986).Lice usually are unable to survive for more than 1-2 days off their host and tend to remain with a single host animal throughout their lives. Most species of louse are highly host specific and many species specialize in infesting only one part of their host bod and transfer to new hosts is by body contact, particularly under condition of close confinement. To allow them survive as permanent external parasites, lice show a number of adaptations which enable them to maintain a life of intimate contact with their hosts(Bedada, 2014).

The saliva and feces of lice contain substances capable of causing allergies giving rise to severe irritations to the skin. This is usually shown by the animal rubbing itself against objects. Animal's exhibit reduced weight gain and loss in production. Lameness can result from the foot lice of sheep. Lice are also associated with development of cockle. Cockle is an inflammatory response of the skin to the presence of lice and their saliva. This is seen after the wool or hair has been removed from the skin. Animals in poor body condition are likely to be seriously affected (Shiferaw, 2018)

Epidemiology of lice

Transmission

Lice spend their whole life on the same hosts. The transmitted from one host to another by contact. The introduction of infested host to the herd theherd get the lice through the introduction of an infested host, but flies or fomites may also

occasionally transport lice. The carrier animals usually in poor body condition are the source of re-infestation during the fall. Winter housing provides the ideal conditions for the transfer of lice between cattle(Egri, 2018).

Risk factors

For all age classes of cattle, stressors such as high stocking density, poor feed quality, gestational status, and underlying health issues are often contributing factors to susceptibility and degree of infestation. Factors determining the severity of infestation with blood-sucking lice include the animals' age and sex and also the season. Occurrences of bovine pediculosis do not show seasonal variation in countries with a warm climate. However, in the temperate zone and in colder regions, the most severe infestations occur in late winter and early spring, when the weather is cold and damp and the animals have the thickest coat of hair(Kumsa *et al.*, 2012; Abebe, 2011).

The prevalence of louse infestation has been reported by researchers from different parts of Ethiopia have varying in prevalence in different species in association with differences in the ecological, geographic and weather conditions. In addition, the sex, body condition, age and management systems of animals have effect on the prevalence of parasite (see table 1, 2 and 4).

Prevalence of lice in Ethiopia

The overall prevalence of lice in sheep and goats

Louse infestation in sheep and goat reported from different parts of Ethiopia including Oromia, Amhara, Tigray and southern parts of the country. The overall prevalence of parasites ranges from 6 to 50.7 % (table 1). The major lice species identified in those studies are Damalinia and Linognathus species. According to kumsa,2012, the largest prevalence of lice is recorded in midland(Kumsa, 2012).Lice infestation prevalence differences observed between the different studies may be partly attributed to differences in agro-climate and season of study, since there is strong seasonal cycle in louse numbers. The management and health care of sheep and goats in the study areas could also be another factor(Tamirat, Tessema and Kiros, 2019).

Table 1. Overall prevalence of lice infestation on sheep and goat in Ethiopia

Species	Place of study	Prevalence	References
Sheep and goat	Mekelle university hospital	3.9	(Tamirat, Tessema and Kiros, 2019)
	Banja	8.8	(Wondimu *et al.*, 2018)
	Wolaita	27.7, 0	(Yacob, Yalew and Dinka, 2008)
	Dembidolo	41.8, 22.9	(Disasa *et al.*, 2020)
	Bahirdarvet.clinic	3.8	(Tesfaye *et al.*, 2012)
	Nono district	48.5, 50.7	(Urgessa *et al.*, 2020)
	Haramaya university	20.3	(Abera and Gebrewahd, 2019)
	Hawassa	7.3, 6.25	(Daniel, Alemu and Yacob, 2019)
	Tigray	6	(Kassaye and Kebede, no date)
	Soddozuria	7.1	(Israel *et al.*, 2015)
	Guto-gidda	6.51	(Shibeshi, Bogale and Chanie, 2018)
	Bench maji	14.8	(Tesfaheywet and Simeon, 2016)
	Alemata, mekelle	1.3	(Abebe, 2011)
	Arsi	49.5	(Deferes and Geresu, 2016)

Prevalence of lice in cattle

The prevalence of lice infestation in cattle reported from different studies ranges from 10.4 to 63.5 % (table 2). The highest prevalence was recorded from western parts of Amhara region. *Linognathus vituli* and *Damalina bovis* were among the major lice species identified in different studies.The prevalence of lice infestation in cattle was significantly varied among sex, thus female and cross breed cattle were more at risk than male and indigenous local cattle. Moreover, production system was also found significantly associated with the prevalence of pediculosis in cattle managed under extensive management system were being more at risk to be infested with lice than cattle under intensive management system(Gebreselama, Zeru and Romha, 2014).

Table 2.Overall prevalence of lice infestation on cattle in Ethiopia

Species	Place of study	Prevalence	Reference
Cattle	BenchiMaji zone	10.4	(Onu and Shiferaw, 2013
	Amhara /Western part/	63.5	(Kebede and Fetene, 2012)
	Haderovet.clinic/Southern nation/	18.2	(Eskadmas Assefa Ayele, 2019)
	Bishoftu town	11	(Gebreselama, Zeru and Romha, 2014)

Prevalence of lice in horse

There is only one studies of lice infestation on equine in Ethiopia. This indicated that limited information about prevalence of lice throughout the country. According to Tafese 2014, one species of a chewing louse, *Bovicola equi*, and one species of a sucking louse, *Haematopinus asini* are reported. The higher overall prevalence of lice on horses is reported from highland than midland agro-ecology. This variation is most probably attributed to differences in environmental factors like humidity and low temperature that are suitable for the survival and repro- duction of lice population in the highland agroecology due to cool skin temperature, denser coat and relative cooler weather condition suitable for female lice fecundity leading to increase in lice population on horses(Tafese, Jibat and Aklilu, 2014).

This variation in prevalence of lice on horses in different countries of the world is most probably attributed to differences in seasons of studies, agro-ecologies of the study areas and breed and management of horses in different localities as has been suggested.

Table 3.Prevalence of lice infesting horse in three agro-ecological zone in central Oromia

		Species of lice	Bovicolaequi
			Nopositive(percentage)
Host affected	**Studydistrict**	Agroecology(Noexamined)	
Horse	Adama	Lowland(60)Midland(60)Highland(60)Midland(60)Midl	13(21.7)
	Akaki	and(60)Lowland(60)	9(15)
	DebreBrehan	Highland(60)	27(45)
	Bishoftu	420	5(8.3)
	Hawassa		16(26.7)
	Modjo		8(13.3)
	Shashemene		18(30)
	Overall		96(22.8)

Source:(Tafese, Jibat and Aklilu, 2014)

Prevalence of lice in poultry

There is limited information regarding the distribution of lice infestation on poultry. The reports of prevalence lice in infestation ranges from 28 to 82.3 % (table 4). *Menopon gallinae*, *Lipeurus caponi*, *Menacanthus stramineus* and *Cuclotogaster heterographa* among the most prevalent lice specie reported from the studies. According to the study reported from jimma town local breed, females and under extensive managements systems poultry were more infested than exotic, male and intensive management system respectively(Mata, Galgalo and Jilo, 2018).

The difference in prevalence observed in studies might be due to the variation exist in the management system, breed, seasonal variation, agro ecological and implemented methods of the disease control and prevention(Nafyad et al, 2015).

Table 4. The overall prevalence of poultry lice infestation in Ethiopia

Species	District	Prevalence	References
Poultry	Ambo	44.36	(Tamiru *et al.*, 2014)
	East Shoa	84.3	(Belihu *et al.*, 2008)
	Jimma	28	(Mata, Galgalo and Jilo, 2018)
	Bishoftu	62.6	(Nafyad Alemu, Yimer Muktar, Dawit Kassaye, 2015)

Prevalence of lice in dog

Thespecies of lice infested dog reported from Ethiopia are *Heterodoxus spiniger and Trichodectus canis* with a prevalence of 4% and 2.6% respectively(Kumsa and Mekonnen, 2011; Tadesse *et al.*, 2019).

The vector role of lice

Lice (Phthiraptera) are obligate, blood-feeding, external parasites of mammals and birds on all continents and most oceanic island(Londoño *et al.*, 2017). Lice have been shown to transmit viruses, bacteria, fungi, and protozoa. Wild and domestic mammals which harbor lice, which can serve as vector for both animals and humans.Lice are vectors or intermediate hosts of Anaplasma species *Bartonella quintana, Borrelia recurrentis*, Brucella species, *Francisella tularensis, Rickettsia prowazekii, Rickettsia typhi, swinepox virus*, dogtapeworm, and filarial nematodes (Reeves *et al.*, 2021).

Pediculosis

Different species of lice parasitize domestic animals and humans and cause mechanical damage on the skins and hides. Pediculosis is manifested by pruritus and dermal irritation, with resultant scratching, rubbing, and biting of infested areas. A generally unthrifty appearance, rough coat, and lowered production in farm animals is common. In severe infestations, there may be loss of hair and local scarification. Extreme infestation with bloodsucking lice can cause anemia. In sheep and goats, rubbing and scratching often results in broken fibers, which gives the fleece a “pulled” appearance. In dogs, the coat becomes rough and dry and, if lice are numerous, the hair may be matted. Sucking lice cause small wounds that may become infected. The constant crawling and piercing or biting of the skin may cause restless behavior in hosts (Ransfusions *et al.*, 2000).

From three species of lice affecting humans, the head louse (*Pediculushumanus capitis*) is the most important. Transmission occurs directly from person to person between infested individuals and indirectly through hats, clothes, or pillow- cases. In humans this louse also play a role as a vector for epidemic typhus, relapsing fever, and trench fever. *Pthirus pubis* infests pubic hair and occasionally other hairy areas, such as eye lashes. Pubic lice are usually transmitted during sexual intercourse.

Treatment must therefore include the patient's partner. Rash and pruritus are the most frequent symptoms(Heukelbach and Feldmeier, 2004).

Dog tape worm

The parasite causes dipylidiasis in humans and teaniasis caused by *Dipylidium caninum*. It is also called the double pore tapeworm (cu- cumber tapeworm, dog tapeworm, or flea tapeworm). Morphologically *Dipylidium caninum* adults are relative small, averaging about 15 cm in length and scolex with both rostellum and rows.Segments are longer in length than wider with two set of genital pores per segments. They have indirect life cycle in which larvae of dog flea(*Ctenocephalides canis*) and lice(*Trichodectes canis)* ingested the eggs and developed to cystcercioid in abdominal cavity. The final host (dog and cat) are infected by ingestion of the flea or louse containing the cysticercoids. Humans can acquire the infection by accidental ingestion of the infected fleas of dog and cat. The infections with *Diplydium caninum* are rare in humans , but it is more likely to occur in young children who kiss or are licked by their infected pets(Jiang *et al.*, 2017).

Filiriasis and fowl cholera

The filarial heartworm *Sarconemaeurycerca Wehr* parasitized waterfowls. Chewing lice *Trinotonanserinum Fabriciu* play a role as intermediate host for heart- worm. Other studies indicated that the development of *Pelecitusfulicaeatrae Diesing* in the third stage in the *amblyceran* chewing louse *Pseudomenoponpilosum Scopoli*, as well as the biting-lice mediated transmission of this avian filarioid worm in coots. The microfilariae and developing first-stage larvae have been detected in nymphs and adults of *Pseudomenoponpilosum*, while third-stage larvae have been found only in adult insects. In addition, live and virulent of *Pasteurella multocida*, the agent of avian or fowl cholera, was found in the gut of *Menacanthus stramineus Nitzch* and *Menachanthus gallinae* fed on the blood of hens affected with fowl cholera(Benelli *et al.*, 2018).

Louse-Borne Relapsing Fever

Louse-borne relapsing fever is a human epidemic and transmitted by human body louse *Pediculushum anuscorporis*, and, perhaps, the head louse *Pediculushumanus capitis*. The epidemic associated with war, famine, refugees, poverty, crowding and poor personal hygiene. Now the diseases confined to confine to the Horn of Africa, while retaining its potential to cause future epidemics when conditions become conducive. The causative spirochaete, *Borrelia recurrentis*, has a genome so similar to *Borrelia duttonii and Borrelia crocidurae* (causes of East and West African tick-borne relapsing fever), that they are now regarded as merely ecotypes of a single genome species. Infection is by inoculation of louse coelomic fluid or faeces by scratching. Nosocomial infections are possible from contamination by infected blood. Between blood meals, body lice live in clothing until the host's body temperature rises or falls, when they seek a new abode(Warrell, 2021).

Epidemic Typhus (louse-borne typhus)

Epidemic typhus is a louse-borne rickettsial disease caused by *Rickettsia prowazekii* in humans. The occurrence of disease associate with wars and disasters where people living in overcrowded unhygienic conditions, such as refugee camps or prisons.The diseases transmitted by human body lice infected with the bacteria that cause epidemic typhus fever. It is most commonly occurred during cold season (winter), when conditions favor person-to-person spread of body lice. Human body lice become infected when they feed on the blood of a person with epidemic typhus fever. Infected lice then pass infectious feces when they feed. People become infected when infected lice feces or crushed infected body lice are rubbed into small cuts on the skin, such as those caused by scratching the bite site. It is the feces, not the bite of the louse that spreads illness to humans. The disease may also be spread when a person breathes in infected dried lice feces in

dust. The way that the disease is spread from flying squirrels to humans is not well understood. Prevention involves good hygiene, clean living conditions, and avoiding contact with lice-infested clothing(Warrell, 2021).

Conclusion and Recommendations

In Ethiopia livestock industry play a great role to country economy. This is due to the disease caused by diversified etiology. However, external parasites causes direct and indirect loss in lives stock production. External parasites of the animals are currently a disease of considerable importance in domestic animals production sector as a major cause of down grading and rejection of skin and hide in Ethiopia. The economic losses by the disease are also the result of reduction in productivity, reproductive performance and death of the affected animals. Moreover, the impact of the disease caused external parasites is severely limiting the performance of the tanning industries, which in turn affect the country's foreign currency warranted an urgent control intervention.

Integrated Parasite Management is very important to control external parasites. The management system includes the integration of chemical, biological and cultural control methods to reduce parasite burden below an economic threshold. Applying several methods and strategies plays great role to reduce, rather than eliminate, external parasite with expected ecological, economic, and sociological costs and benefits. In addition, Integrated Parasite Management strategies seek to maximize the effectiveness of parasite control actions whilst conserving beneficial insects and minimizing pesticide residue. The application of Integrated Parasite Management depends on the livestock production system in use, the biology of the parasites associated with the system.

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