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Review on Ectoparasites and Tick Borne Hemoparasites in Small Ruminants

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Abstract: Small ruminants are important contributors to food production in Ethiopia, providing meat, milk and an income generation for the country's farming system. Rearing of domestic animals are practiced by the majority of the farming communities in which they are considered as an investment and insurance against risk and to meet seasonal and emergency purchases such as crop, improved seed, fertilizers and medicine. Animals that have high fertility and short generation interval which means that milk production begins five or six month after initial mating and that the first carcass may be on sale in less than one year is their economic, managerial and biological advantages. Besides that domestic animals are also source of manure to fertile soil and skin, the most important items that generate foreign currency to the country. However, animal's production is constrained by compound effect of disease, poor feeding and poor management. Parasitic disease is among the major problems of small ruminants causing serious economic impact. Information obtained indicates that external parasites and tick borne hemoparasites of small ruminants are widely distributed with variable degree of prevalence in Ethiopia and are important in causing serious economic loss on the farming community, tanning and leather industry and the country as a whole, demanding effective control measures.

Key words: Ectoparasite · Ethiopia · Small Ruminants · Tick Borne Hemoparasites

INTRODUCTION

Arthropod ectoparasites constitute a diverse and highly adapted group of animals that inhabit the external body surfaces of vertebrates [1]. They may live permanently on their host, or they may occupy the host's nest and immediate environment and visit the body of the host periodically. In either case, there is a close dependency on the host for various life sustaining resources. The relationship between parasite and host is an ancient one and the mechanisms by which parasites seek, identify and maintain contact with their host is sophisticated and complex [2].

Insect and arachnid ectoparasites display a wide range of forms of association with their hosts: obligate to facultative, permanent to intermittent, superficial to subcutaneous. The activity of ectoparasites infesting livestock and companion animal hosts is of particular interest because it results in a wide range of pathogenic effects. Feeding may cause direct damage to skin and other subcutaneous tissues, inflammation and significant blood loss. This activity is usually associated with pruritis, erythema, excoriation, papules, scale and crusting and self-trauma. Wounds may be subject to secondary infestation or bacterial infection. The salivary and faecal antigens produced by ectoparasites as they feed can stimulate immune responses, in some individuals leading to hypersensitivity [3]. Importantly, some ectoparasites also act as vectors of protozoa, bacteria, viruses, cestodes and nematodes. The behaviour of ectoparasites also may cause harm indirectly, causing disturbance, increasing levels of behaviour such as rubbing and leading to reduced time spent grazing or ruminating and, in some cases, to self-wounding [4].

Many ectoparasites are known to be vectors of pathogens, which the parasites typically transmit to hosts while feeding or (occasionally) defecating. However, ectoparasites especially in large aggregations may also debilitate domestic animals in other ways, by causing the following disorders [5].

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As a result of their activity ectoparasites may have a variety of direct and indirect effects on their hosts. Ectoparasites, commonly tick, mite and lice affect the host species by the inflammation and the infection that inflict on the skin [6] and by their effect on the physiology of the animals as well as through transmission of different diseases. Infestations by ectoparasites significantly affect the quality of hide thereby affecting the economy of Ethiopian farmers as well as international market [7].Therefore, the objective of this paper is to review on the ectoparasites and tick borne hemoparasites in small ruminants.

Arthropod Parasites: Ectoparasites, most of which are arthropods, are those parasites that live on the body of the host. Some spend their entire life on the host; others spend only parts of their life on the host, while still others only occasionally visit the host. The ectoparasites most veterinarians deal with directly are those that live all or much of their life on the host [8]. Arthropods contain over 80% of all known animal species and occupy almost every known habitat, representing extremely diverse group that exhibit extensive morphological differences. The economically important arthropod belongs to two major groups; class insecta that comprise flies, lice and fleas and class arachnida that comprises tick and mites [9].

External parasites (also called ectoparasites) obtain nourishment from their hosts on the skin surface, either from sucking blood and body fluids or feeding on skin debris, hair, or body secretions. Some arthropods such as sarcoptic mange mites burrow under the skin just under the surface and are also considered external parasites [10].

Lice are wingless, dorsoventrally flattened insects ranging in length from about 1 to 8 mm. They are common ectoparasites of mammals and of birds and infestation may be referred to as "pediculosis." Lice are highly species specific and the entire life cycle is completed on the host. Immature lice resemble adults but are smaller. Eggs (nits) may be observed attached individually to hair shafts and sometimes as white to yellow masses at the bases of feathers on birds. With close attention, lice can usually be seen with the unaided eye [11]. Pediculosis is a serious health problem of small ruminants in Ethiopia [12].

Blood-sucking lice have been implicated in the transmission of disease such as those that transmit rickettsial and anaplasmosis; however, lice are predominantly of importance because of the direct damage they cause. This effect is usually a function of their density. A small number of lice may be very common and present no problem. However, louse populations can increase dramatically reaching high densities. Transfer of lice from animal to animal or from herd to herd is usually by direct physical contact. Because lice do not survive for long off their host, the potential for animals to pick up infestations from dirty housing is limited, although it cannot be ignored [6].

The two species of sucking lice in sheep are essentially parasites of the haired regions of the body, invading the woolled areas only when the population is expanding rapidly. They are not very active and have a gregarious habit, feeding in swarms. The biting louse of sheep is active and usually found in woolled areas. Generally, for the transfer of louse infestation, close bodily contact is necessary and while this is unusual in the grazing animal in Europe, it does happen at gatherings and in sale yards and especially when sheep are housed for the winter since the heavy fleece provides a habitat which is readily colonized by lice. *Linognathuspedalis*, the 'foot louse', inhabits mainly the lower region of the limbs, from the feet to below the hocks and spreads from there to the crutch, scrotum and belly. In Merinos and other heavily woolled breeds, it is usually first detected at crutching. In its normal habitat on the legs it is exposed to great fluctuations in temperature and having adapted to survive in these conditions, it is one of the few lice which can live away from the host's body for more than a day or two and is viable on pasture for about a week [13].

Linognathusovillus, the 'face louse', occurs on the face and ears, spreading from there to the checks, neck and body and is usually detected in the heavily woolled breeds when excess wool is removed from the poll ('wigging'). In contrast to *L. pedalis*, this species, more used to even temperatures, can only survive off the sheep for 1-2 days. In very hot weather, when exposed to sun, the temperature of the sheep's back may reach 48 0c and in these conditions *L.ovillus* is killed in about an hour, its persistence depending on the parts of population inhabiting the cooler skin of the face and ears [13, 14].

The common sites of *Damalinia* (*Bovicola*) infestation on sheep were the sides, the back, the neck, the rump and the shoulder with decreasing proportion [15]. *Damalinia* (*Bovicola*) ovis, the biting louse of sheep, sometimes called the 'body louse', is much more active than *Linognathus,* roaming in the wool over the whole body. Like the others, *Damilinia* (*Bovicola*) is susceptible to high temperatures, but it is also intolerant of moisture. In a damp fleece, with a relative humidity of more than 90%, it will die in six hours and when covered by water it will drown in an hour [6].

In Ethiopia, most lice populations on animals vary seasonally, depending on the condition of the host. Lice populations on animals are greater during the rainy months [14]. Among sheep, agro climate and body condition were significantly associated with prevalence of *Bovicolaovis*and*Linognathus* species. The prevalence of *Damalinia* (*Bovicola*) ovis in midland sheep (48.4%) was significantly higher than the prevalence on both lowland (24.8%) and highland sheep (19.5%). On goats, agro-climate and body condition of the animal were significantly associated with the prevalence of *Linognathus* species infestation. The prevalence was 1.8 times higher in midland than lowland goats and 3.5 times higher in poor than in good body condition goats [15].

Mites: The ectoparasitic mites of sheep and goats feed on blood, lymph, skin debris or sebaceous secretions, which they ingest by puncturing the skin, scavenge from the skin surface or imbibe from epidermal lesions. Most ectoparasitic mites spend their entire lives associated their host, so that transmission from host to host is primarily by physical contact. Infestation by mites is called acariasis and can result in severe dermatitis, known as mange, which may cause significant welfare problems and economic losses [6]. The mites have a complex taxonomy, occupying at least eight different families and for veterinarians it is more useful to consider them according to their location on the host as burrowing and non-borrowing mites [13].

The distribution of mites on the animals varies according to season, the infection being in a quiescent state in reservoir sites such as the axilla, groin, infra-orbital fossa and inner surface of the pinna and auditory canal during spring, summer and early autumn and spreading rapidly over the rest of the body in the colder months as the fleece thickens. Populations of*Psoroptes*may also be found localized in the ears of sheep, causing chronic irritation, often associated with hematomas, head shaking and scratching. Probably because of its location deep in the dermis, it is very difficult to transmit*Demodex*between animals unless there is prolonged contact. In nature such contact only occurs during suckling and it is thought that most infections are acquired in the early weeks of life. Transmission appears to occur during the earlier days of suckling [6]. Though it is a non-burrowing mite, *Psoroptes* is very active in the keratin layer and causes direct damage to the skin [13].

Mange is a highly contagious, widespread condition that can be transmitted between animals by direct and indirect contact [16]. However, transmission may also occur via the environment. The length of time a mite can survive off its host is strongly affected by ambient temperature and humidity, but at low temperatures (<15°C) and high humidity (>75% relative humidity), survival may be in excess of 18 days, allowing transmission from housing, bedding or contaminated machinery, such as shearing equipment. Time of year may have an important impact on off-host survival. This has important implications for the potential for transmission from the environment to new hosts, transmission being considerably greater in the winter. The period when the mite infestation has declined, either as a response to environmental conditions or the host's immune response, is also very significant in the epidemiology of the disease. Sheep that appear to be uninfected but which carry small populations of mites may be introduced to healthy flocks during summer and autumn and subsequently initiate outbreaks [6].

Sarcoptic mange has a wide geographic distribution in many sheep-raising areas of the world, such as the Middle East. In Africa it occurs in the local breeds of haired sheep and, because of hide damage, is of considerable economic importance, more than a million sheepskins being exported from the region annually. The mite, unlike the non-burrowing genus *Psoroptes*, prefers regions without wool, such as the face, ear, axillae and groin and has a slow spread. Affected areas are at first erythematous and scurfy. The intense pruritus characteristic of sarcoptic mange is present and sheep scratch and rub the head, body and legs against trees, posts and walls. Because of the itch, sheep are almost continuously restless and are unable to graze, so that there is progressive emaciation. In haired sheep the whole body may be affected [13].

*Sarcopticscabiei*var. *caprae*and *Sarcopticscabiei* var. *ovis* have a wide geographic distribution in many goat and sheep rearing in arid and semi-arid areas of Ethiopia and it is more commonly seen in goats than sheep [12]. In Ethiopia, they are widely distributed in lowland mainly [14, 17], low and midlands [18] as well as central midland part of the country [19].

Tick: Ticks are usually larger than mites, ranging in length from 3 to 12 mm, or more in the case of engorged females. Ticks are divided into two families: Ixodidae (hard ticks) and Argasidae (soft ticks). The Ixodid (hard) ticks are of greatest importance in veterinary medicine. Various hard tick species are vectors of a number of viral, bacterial and protozoal animal and human pathogens. In addition, hard tick species cause tick paralysis and tick

toxicosis. All ticks pass from the egg through larval and nymphal stages before becoming adults and utilize one or more host animals during the developmental cycle. Eggs are always laid in the environment. Hard tick larvae are acquired by the host from the environment. All hard ticks undergo a single molt from the larval to the nymphal stage and a second molt from the nymph to the adult. These molts follow attachment and blood feeding on the host that usually lasts for several days [11].

The distribution of ticks in a temperate climate with frequent and non-seasonal rainfall is closely linked with the availability of a micro-environment with a high relative humidity such as occurs in the mat which forms under the surface of rough grazing. In contrast, in tropical grazing areas the grass cover on pastures is discontinuous and often interspersed with bare or eroded patches. Where suitable grass cover does exist, it has been generally accepted, since temperatures suitable for development throughout a large part of the year, that the distribution of ticks is mainly governed by rainfall and with the exception of *Hyalomma* species a mean annual rainfall of more than 60cm is required for survive [13].

All feedings of ticks at each stage of the life cycle are parasitic. Ticks feed only on the blood (blood cells and blood plasma) and lymph of their hosts. The ticks crawl onto their host and attach to the skin. Ticks use a combination of cutting mouthparts, which penetrate the skin and often an adhesive (cement) is secreted in the saliva to aid attachment to the skin [20]. At the end of the mouthparts are sharp chelicerae that scrape a hole into the dermis. This breaks the capillary blood vessels very close to the surface of the skin and the tick feeds on released blood and lymph which may accumulate at the wound. On the ventral surface of the mouthparts is the hypostome which is barbed with teeth to grip the host. A feeding tube into the tick is formed loosely between the hypostome and the sheath surrounding the chelicerae. The feeding of ticks makes is important to the health of domestic animals and humans [21].

Feeding ticks concentrate the blood meal by removing excess water. This helps to accommodate the large blood intake (several milliliters) in the relatively small body of the engorging tick. The immature stages (larvae and nymphs) commonly feed for three to six days, while the adults may feed for as long as two weeks. Digestion of the blood may start during the first few hours after the beginning of feeding and usually lasts for several weeks or even months. While digestion takes place, possible pathogens acquired from the hosts cross the gut wall, become incorporated in the haemolymph circulation of the tick and invade the cells of the body tissues. After feeding, the tick will moult; after the moult is complete it takes several days for the cuticle to harden completely and the tick will then actively quest for a new host [22].

The feeding of ixodid ticks is slow because the body wall needs to grow before it can expand to take a very large blood meal. Larvae take typically 3 to 5 days to fully engorge with blood, nymphs 4 to 8 days and females 5 to 20 days. When the ticks have fully engorged with blood they detach from the host's skin and drop to the ground. Males of most types of ticks feed but do not expand like the females. They feed enough for their reproductive organs to mature [20].

Soft ticks have life cycles that vary in the number of stages and feeding bouts. They are nest parasites and are likely to feed repeatedly on the same animal or the same family group of animals within the nest. Most soft ticks do not attach to the host or enlarge greatly while feeding. Those that do attach only do so during the larval stage. Nymphs and adults feed quickly on the host while it is in the nest and then return to their resting or hiding place within the nest [23].

All ticks spend most of their life cycle away from their hosts, hiding either in soil and vegetation or in the nests of their hosts. So, they need to be able to find hosts on which to feed. Ticks find their hosts in several ways. Many ticks have the eggs and moulting stages in soil or vegetation in the environment in which their hosts graze or hunt. The ticks crawl onto vegetation and wait for their hosts to pass by. This is a type of ambush and the behavior of waiting on vegetation is called questing. Thus, in the group of ixodid ticks such as*Rhipicephalus* the larvae, nymphs and adults will quest on vegetation. The ticks grab onto the hosts using their front legs and then crawl over the skin to find a suitable place to attach and feed [21].

Ticks are one of the most serious ectoparasites in Ethiopia. They cause the greatest economic losses in livestock production. Their effects are various including reduced growth, milk and meat production, damaged hides and skins, transmission of tick-borne diseases of various types and predispose animals to secondary attacks from other parasites such as screw worm flies and infection by pathogens such as *Dermatophiluscongolensis*, the causative agent ofstreptothricosis [24].

Adult ticks of the genera *Amblyomma*and *Hyalomma*are active hunters; they run across the ground after nearby hosts. The general behavior of seeking hosts in an open environment is described as exophilic. Argasids ticks andmanyIxodesspecies spend their entire life cycle in their host?s nest and attach to their hosts

there. This is called endophilic or nidicolous behavior. A few species of ticks, such as the dog tick *Rhipicephalussanguineus,* have adapted to living in housing built by humans and will feed on domestic animals there. This is called domestic behavior [20].

Ticks generally prefer the head area including the ear, the eye and oral region. But ticks were also found in wide range of sites on the small ruminant's body including the neck, chest, leg, vulva, inter-digital space and anal area. The lesions inflicted by the ticks were also various involving bleeding point, roughness, redness or severe abscesses lesion during heavy infestation [25].

Fleas, Sheep Ked and Myiasis (Fly Strike): Adult fleas are wingless, laterally flattened insects that have long legs for jumping and a large abdomen. Fleas feed on the blood of such animals as dogs, cats, pigs, humans, rodents and birds. Metamorphosis is complex, with three caterpillar-like larval stages and an enduring pupal stage enclosed in a silken cocoon. Certain hosts develop hypersensitive reactions to flea bites characterized by intense pruritus. A hypersensitive dog or human suffers intolerably from the bites of a small number of fleas that a normal individual would scarcely notice. Various species of fleas transmit plague (*Yersinia pestis*), murine typhus (*Rickettsia typhi*), rabbit myxomatosis virus and feline parvovirus and serve as intermediate hosts of the tapeworm *D. caninum* and the filariid nematode *Acanthocheilonemareconditum*. The ubiquitous *Ctenocephalides felis* the relatively rare *Ctenocephalidescanis* are parasites of a very wide range of domestic andwild mammals, including cats, dogs, cattle and humans. *C. felis* can be pathogenic in its own right simply as a result of the amount of blood that the fleas extract from their hosts. Gravid female*C. felis* consume an average of 13.6 ìl of blood per day and 75 females would remove 1ml of blood from an animal each day. *C. felis* has been reported as the cause of slow death by exsanguinations of lambs, sheep, goats, calves and a jenny [26].

Sheep keds are hairy, brown, wingless, 'degenerate' fly, approximately 5.0-8.0 mm long with a short head and broad, dorsoventrally flattened, brownish thorax and abdomen. It sucks blood, heavy infections may lead to loss of condition and anaemia. Inflammation leads to pruritus, biting, rubbing, wool loss and a vertical ridging of the skin known as 'cockle'. *Melophagusovinus* is the vector of the non-pathogenic *Trypanosomamelophagium*. Sheep Keds are permanent ectoparasites. The spread of sheep keds is largely through contact and the movement of keds from ewes to lambs is an important route of infestation. Within a flock, transfer occurs when sheep keds move to the tips of the fleece in response to increasing air temperature. Air temperature must usually be 21°C or above before many keds are observed on the surface of the fleece. Consequently, transfer between animals is more likely and occurs more rapidly, in summer than in winter. Sheep with dense, long or clotted fleeces are more likely to spread the infection because the ked come to the surface of such fleeces [6].

Heavy infestations of ked are most commonly seen in autumn and winter [6]. In Ethiopia, few works are available on ecological distribution of sheep ked. Recent reports on sheep ked of small ruminants indicated that the parasite is most common in sheep mainly in cooler high altitudes [12].

The larvae of certain dipterans are capable of developing in the tissues of many domestic animals. These results in a condition called myiasis. There are two types of myiases: (1) facultative myiasis—larvae are free-living, but can become parasitic under certain conditions; and (2) obligatory myiasis—larvae are always parasitic, i.e., without a proper host, the flies cannot complete their life cycle [8].

Ectoparasites Host Relationship: The presence of ectoparasite on the host is termed as infestation. When a parasite is dependent on a host for some resource for continued life or to complete a portion of their lifecycle, this is referred to as obligatory parasitism. Facultative parasites, on the other hand, may feed or live only occasionally on a host and are not dependent on the host for survival. With obligatory parasitism, there can be considerable variation in the amount of time spent in or on the host. Some parasites live in continuous association with their host throughout their entire lifecycle. They are highly dependent on the host for survival. Lice, some species of mites and sheep ked are examples of continuous parasites. They are usually disseminated between individual hosts by direct contact. Most parasitic arthropods have only intermittent contact with their host and are free living for a major portion of their lifecycle. Only certain life stages of these parasites depend on the host for resources. An example of this intermittent type of parasitism is hard ticks (family Ixodidae) [10].

The host provides a number of important resources for ectoparasites. Most vitally, the host supplies a source of food, which may be blood, lymph, tears or sweat or the debris of skin, hair or feathers. The host's body also provides the environment in which many ectoparasites live, generating warmth, moisture and within the skin or hair, a degree of protection from the external environment.

The host may also provide transportation from place to place for the parasite, a site at which to mate and in many cases the means of transmission from host to host [1]. The life cycles of most of the parasites are direct. Their eggs require high humidity and warm temperatures to develop into infective larvae. Animals become infected when they are feeding or resting, particularly in herds. The fairly common occurrence of these parasites indicates the potential means of clinical infection when conditions such as warmth and adequate moisture combine and in particular, when animals are overcrowded in unhygienic conditions [9].

Importance and Damage of Ectoparasites: According to Wall and Shearer [1], the direct and indirect losses due to ectoparasite includes:

Blood Loss: Although each individual ectoparasite only removes small volume of blood from a host, in large numbers the blood removed by feeding may be directly debilitating and anemia is common in heavily infested hosts.

Myiasis: The infestation of the living tissue with larvae causes direct damage to carcass or skin.

Skin Inflammation and Pruritus: Various ectoparasite infestations cause pruritus, often accompanied by hair and wool loss (alopecia) and occasionally by skin thickening (lichenfication). The presence of ectoparasite on or in burrowing in to the skin can also stimulate keratinocytes to release cytokines, which leads to epidermal hyperplasia and cutaneous inflammation.

Toxic and Allergic Responses: Caused by antigen and anticoagulant in the saliva of blood feeding arthropod.

Disturbance: The irritation caused, particularly by flies as they attempt to feed or oviposit, commonly result in a variety of behavior such as head shaking, stamping skin twitching and tail switching or scratching. These activities may result in reduced growth and loss of production because the time spent in avoidance behaviors in lost from grazing or resting.

Self-Wounding: The activities of particular ectoparasites, such as warble flies, may causes dramatic avoidance responses in the intended host, known as gadding. The animals may cause serious self-injuries following collisions with fence and other objects.

Immuno Suppression: Due to infestation, the immune response of the animals may be weakened which further leads to increased susceptibility to other diseases.

Social nuisance: large number of flies may breed in animal dung, particularly in and around intense husbandry units. The activity of flies may cause considerable social problem. Adult flies and their feces may also decrease the esthetic appearance and values of farm facilities.

Diagnosis of Parasitic Skin Diseases: In making a diagnosis of ectoparasitic infestation or an ectoparasite associated dermatosis it is important to have an idea of the parasite involved and its life cycle. Some parasites live in intimate relationship with the hosts' skin, however, visiting parasites may be on the skin only for a short period of time and a diagnosis is often made by implication. Hence a working knowledge of the clinical sign of skin disease is usually also required [1]. The ideal approach to diagnosis of skin disease is a logical progression from history to an overall clinical examination to a detailed examination of the skin and finally to confirmatory testing or diagnosis by response to treat [27].

History: According toJackson [28], the main points to be noted during history taking includes: date when symptoms first appeared, symptom observed by owner, contact with other flock, spread with in the flock, previous health history of affected animals other disease problems within the flock past and present, response to treatment (including home remedies) so far and detailed management.

Clinical Examinations: Simple observation allows identification of most external parasite infestation and clinical sign of skin disease; thus, many conditions can be diagnosed with reasonable certainty [27]. The entire skin surface of the patient should be examined for parasite and lesions and the elasticity of the skin, its temperature, thickness, color and consistency should be noted and response of animal to palpation of affected area should be observed [28]. The appearance and location of lesions are the basis for diagnosis. The primary lesion includes papules, vesicles, pustules and nodules, secondary lesions such as scales, crusts and alopecia are the result of self-trauma or superimposed bacterial infections [27].

During clinical examination unidentified external parasites or their eggs are collected, fixed and stored in 70% alcohol or 10% formalin and identification can be

made with the help of an identification key [9]. Ticks may be collected directly of the host using appropriately sized forceps. Small specimens may be picked up with the end of moistened paint brush. Unattached mites and ticks can be removed by combing or brushing of the host animal, over a white enamel tray or sheet or paper. Brushing over moistened white blotting paper or paper towel may help to identify flea infestation [1]. To ensure that the mouth parts are not left behind, embedded living ticks may be removed most effectively by dabbing the ticks and the surrounding skin with alcohol. This relaxes the tick, allowing it to be pulled out in fact. Alternatively, the tick can be covered with a layer of petroleum jelly, which prevent respiration and after about 30 minutes, the tick will drop off [1].

Skin Scraping Examinations: Deep skin scrapings are used for diagnosis. However, mites may be difficult to recover and several scrapings should be collected from suspected cases. Many cases are treated presumptively when no mites are recovered. Fecal examination may reveal mites and mite eggs swallowed during grooming. In swine, *Sarcoptes* can often be found in scabs in the ears of chronically infected animals. To diagnose these infections on the farm, scab material can be removed and broken up over dark paper. Tiny, moving specks will be mites. Scabs can also be digested with 10% sodium hydroxide and the remaining material examined with the microscope [11]. Superficial skin scraping (epidermal surface examination) after removing coat hair by gentle clipping can be used to identify surface mites and deep skin scraping (deep epidermal examination) until capillary ooze occurs is useful in the diagnosis of burrowing and follicular mites such as *Sarcoptesscabiei* and *Demodex* species [1].

A few drops of 10% potassium hydroxide solution or liquid paraffin due added to the sample a cover slip applied and cleaning of debris allowed to process for 15-30 minutes before microscopic examination. Large samples may be processed by boiling 10 minutes in 10% KOH solution, centrifuging and performing sugar floatation on the sediment [27].

Collection of Free Living Ectoparasites: Mobile free-living mites can be extracted from bedding and nets by careful search or by sharking the material through a tier or sieve of decreasing mesh size. They may be swept from vegetation using a hand net; most commonly used for collecting ticks, however is a blanket drip [1].

Biopsy and Histopathology: Although these indirect techniques are not as useful as direct identification for the diagnosis of ectoparasite dermatitis, they may be valuable in some circumstances. Such as insect and arthropod bite lesions [1], small whole thickness strips of skin 25mm by 5mm are taken from normal and abnormal area and the skin strip should be fixed in formal saline [28].

Tick Borne Parasitic Diseases: *Babesia* species are intra erythrocyticprotozoal organisms spread by arthropods like ticks and biting flies trans-placentally and by blood transfusion. Babesiosis is a tick born disease of domestic, wild and laboratory animals as well as humans caused by the genus *Babesia*. More than 100 known *Babesia* spp. have been identified which infect many types of mammalian host, out of these, 18 cause disease in domestic animals notably in cattle, sheep, goats, horses, pigs, dogs and cats. Almost any mammals, that serves as a host for a*Babesia*infected tick is a potential reservoir [29].

Two species of *Babesia,* the smaller *B. ovis* and the larger *B. mofasi,* are known to occur in sheep and goats in tropical and subtropical areas, including southern Europe. Transmitted by various tick genera, such as *Rhipicephalus, Haernapbysalis, Dernracentor* and *Ixodes,* these infections are usually mild in indigenous sheep although severe clinical signs may occur in animals introduced from a non-endemic area.Diminazeneaceturate is effective against *B. ovis* and *B. morasi* [13].

Control measures are essentially similar and require control of tick vectors. Topical application of acaricides may provide some level of protection but may be difficult in sheep, expensive and may have a negative cost–benefit. Under certain conditions, it may be more beneficial to attain endemic stability, allowing early infection and development of immunity [6, 30].

The genus *Theileria* differs from *Babesia* in that schizonts occur in lymphocytes and induce the infected lymphocytes to undergo division and proliferation. Also, typically no transovarial transmission occurs in the case of ticks infected with *Theileria*species. *Theileriaparva*, the causative agent of East Coast fever of African cattle, occurs in the erythrocytes, lymphocytes and endothelial cells and is transmitted interstadially by *Rhipicephalus* and *Hyalomma* species. East Coast fever is characterized by dyspnea, emaciation, weakness, tarry feces and exceptionally heavy mortality. There are vaccines available for preventing disease due to *T. parva* and to *Theileriaannulata* in Africa [26].

Anaplasmosis is a vector born infectious blood disease in cattle caused by the rickettsial parasites, *Anaplasmamarginale* and *A. centrael*. It occurs primarily in worm tropical and subtropical areas. The disease is not contagious but transmitted most commonly by ticks. It can also be transmitted via contaminated surgical instruments, biting flies and mosquitoes. The intracellular parasites destroy the red blood cells. It causes anemia, fever, weight loss, breathlessness, uncoordinated movements, abortion and death (Centers for Disease Control and Prevention [31].

Development and transmission of hemoparasites by tick vectors are phenomena closely synchronized with the tick feeding cycle. In all known life cycles, initial infection of tick tissues occurs in midgut epithelial cells and transmission is affected as ticks feed after parasites have developed and multiplied in salivary glands. Many factors reviewed affect development and transmission of hemoparasites by ticks including age of ticks, artificial, temperature, climate and/or season, tick stage or sex, hemoparasite variation, concurrent infection of ticks with other pathogens, host cell susceptibility, transovarial transmission, effect of hemoparasites on tick biology and the effect of infecting parasitemia level in cattle on infection rates in ticks. *Babesia*is transmitted trans-ovarially, whereas the other hemoparasites are transmitted transvacially.Potential control methods for hemoparasites include tick control, vaccines (against ticks and parasites) and drugs (against ticks and parasites). Successful application of control strategies will be dependent upon thorough understanding of parasite developmental cycles, biology of the tick vectors and the immune response of cattle to ticks and to hemoparasites. The most effective control measures are targeted against both ticks and the hemoparasites [32].

Economic Impact of Ectoparasites and Tick-Borne Parasitic Diseases in Small Ruminants in Ethiopia: Theeffect of lice is usually a function of their density. Lice numbers build up relatively slowly on newly infested sheep and the pattern of population increase depends on the time of year the introduction occurs. A small number of lice may present no problem and may become a normal part of fauna. However, they have a potential of massive increases [1]. Solar radiation, temperature and rainfall all have a profound effect on lice numbers. The chief effect of lice on their host is due to irritation they cause. All species cause irritation of the skin and stimulate scratching, rubbing and licking leading to restlessness, damage to the fleece and skin. Moreover, the saliva and feces of the lice contains substances which are capable of causing allergies, giving rise to severe irritations followed by the skin thickening. Sever infestation with sucking lice may cause “Pediculosis” which is infestation with lice and cause anemia. The foot louse of sheep is found most frequently around the dewclaws, sever infestation of which produces lameness [9].

Ticks are blood sucking ectoparasites that feed on mammals, birds and reptiles. The medical and economic importance of ticks had long been recognized due to their ability to transmit disease to humans and animals in several ways and parasitize a wide range of vertebrate hosts and transmit a wide variety of pathogenic agents than any other group of arthropods [33]. They play a major role of vector in spreading different diseases of livestock and humans such as Babesiosis, Thileriosis, Anaplasmosis and many Rickettsial and viral diseases. In addition, direct losses due to their being ectoparasites includes blood loss, irritations that result in “tick worry” and interrupt the grazing habits of the host. Damage and loss of udders are also caused by the attachment and feeding activities of ticks, which provide portals of entry for secondary bacterial infections and induce Myiasis and tick paralysis due to the toxins they secrete in to the blood. The secreted toxins may evenly disseminate to the respiratory organs and cause death of the animal [9]. Their attachment and feeding also down grade hides and skins and reduce milk and wool production. Reduce productivity and increase susceptibility to other disease [34].

Mites have chewing rather than blood-sucking mouth parts and appear to feed on skin debris and secretions. Any host reactions are there for likely to be due to mere presence of the mites, their “products” on the skin surface and the secondary bacterial invasion [9].

The estimated global costs of control and productivity losses to be around USD 7000 million annually and [34] estimated that the annual global cost associated with tick and tick-borne disease in cattle ranges between USD 13.9 to USD 18.7 billion. Frans [35] indicated that the economically most important Ixodidea ticks of livestock in tropical regions belong to the genera of *Hyalomma, Boophilus* and *Ambylomma*. Species belong to these genera most economically important in Ethiopia are: *A. cohaerans* on cattle, sheep, goat, camel and equine; *A. varigatum* on cattle, sheep, goat and camel; *A. gemma* on cattle, sheep, goat and camel, *A. lepideum* on cattle, sheep, goat and camel;

B. decoloratus on cattle, sheep, goat, camel and equine; *R. pulchellus* on cattle, camel and equine; *Hyalommatruncatum* on sheep and goat, *H. rufipes* on cattle, sheep, goat and camel and *H. dromedary*on camel [36].

The feeding of keds cause a wide spread priorities exacerbated by the rubbing, scratching and biting of the host in response to the irritation in young lambs, loss of blood to keds may be sufficient to cause a patent anemia, with consequent reduction of growth rate and production. Keds serve as the mechanical vector of *Anaplasmaovis* and *Orbivirus*, responsible for the Blue Tongue Disease, a serious condition that cause 70% mortality in sheep and weight and wool loss, abortion and congenital abnormalities in survivors. They are also biological vectors of *Trypanosomamelophagium* which is a harmless blood parasite of the sheep [26].

In Ethiopia the tanneries reported that 35% of sheep skin and 56% of goats' skin are rejected due to external parasites and out of the reject groups of the processed skin, about 80 to 90% defects were believed to be due to external parasites. The estimated economic loss due to drop in quality of sheep and goat skin is around USD 25.8 million per year [12]. The presence of ectoparasites in small ruminants has a great economic impact through decreased production and productivity, deaths and down grading the quality of skins of sheep and goats, hence reduces the foreign currency earnings of the country [37].

The economic impact of tick infestations is enormous in Ethiopia with a conservative estimate of 1 million Ethiopian Birr (over 55 thousand USD) loss annually was made through rejection and downgrading of hides and skins due to effect of ticks. Lice are easily overlooked because of their small size. They can multiply very fast before being discovered. By this time, the animal might be too anemic and emaciated and difficult to recover. An allergic skin hypersensitivity reaction due to lice is another cause for "Cockle" in processed sheep skins [16].

Arthropod transmitted hemoparasitic diseases are economically important vector-borne diseases of tropical and subtropical parts of the world including Ethiopia. These diseases cause negative effects on the health of the livestock including production and productivity [38]. Losses from tick borne hemoparasitic diseases of ruminants like reduction of milk and meat production, restricting the introduction of susceptible breed with superior genetics, costs from death and abortion as well as costs for treatment and control purposes are taking away the benefits of livestock owner and nation [30].

Distribution and Prevalence of Ectoparasites and Tick-Borne Parasitic Disease of Small Ruminants in Ethiopia: In Ethiopia, a number of studies have reported on the distribution and prevalence of arthropod parasites of sheep and goats in different areas. In the northern and eastern part of the country, sheep and goats were reported to be seriously affected with ectoparasites. From the tick's genera at species level *Ambylommavarigatum, Ambylommacohaerans, Rhipicephalus (Boophilus) decoloratous, Rhipicephaluspulchellus* and *Rhipicephalusevertsievertsi* were reported to be the most aboundant and widely distributed tick species [39, 40]. In North east Ethiopia Ectoparasites identified in sheep were *Damaliniaovis*, *Mellophagusovinus*, ticks, *Linognathus* species and flea. Among goats, *Linognathus* species, ticks, flea and demodectic mange were identified [15]. The prevalence of sheep ked infestation has been reported. It was more prevalent in the high lands of Ethiopia than in low lands. *Sarcoptes* species, *Psoroptes* species and *Demodex* species are common among goats [41]. Poor health management, malnutrition and lack of good knowledge about mange mites of animal owners have been suggested as favorable factors for this widespread occurrence of infestation [42].

In central Ethiopia, the major ectoparasites identified in sheep were tick infestations (*Rhipicephalus, Boophilus, Hyalomma* and *Ambylomma*), followed by lice (*Linognathusafricanus*) and lastly mite (*Demodex*) [37] and ticks, mites, lice, fleas and keds also reported as their descending proportion [43]. In Southern parts, the tick species observed, in order of importance, were *Ripicephalusevertsieversti, Amblyomavariegatum, Boophilusdecoloratus*, *Amblyoma coherences* and *Ripicephaluspulchellus (*exclusive to sheep). The flea species observed were *Ctenocephalidesfeli s*and *Ctenocephalidescanis*. Regarding mange mites, *Sarcoptusscabie* was more frequent and affected both sheep and goats whereas *Demodexcaprea* was found only in goats [44]. Also, the ectoparasites identified in sheep were *Damalinaovis*, ticks, *Melophagusovinus*, *Linognathus* species. In goats, ticks, Sarcoptic mange, *Ctenocephlides* spp, *Linognathus* spp, Demodectic mange and *Damalinacaprae* were identified [17].

In Eastern Ethiopia, Among the tick species *Rhipicephalus pravus* followed by *Rhipicephalus pulchellus*, in goats and *Rhipicephalus praetextatus* followed by *Ambloyomma variegatum*, in sheep were the most prevalent, *Bovicolaovis* was the only lice found in sheep, whereas *Linognathusafricanus* was encountered

in goats. *Demodex*mites were found in both sheep and goats, while *Psoroptescuniculi* was found only in goats, *Ctenocephalides* fleas were also found in both sheep and goats [25]. In western Ethiopia the ectoparasites identified in both species of animals were tick, mange mites, fleas, lice and sheep ked. Ticks were the most abundant ectoparasites recorded both in sheep and goats with a prevalence of 25.44% and 23.72%, respectively. The genera of ticks observed in both sheep and goats were *Amblyomma* spp. *Rhipicephalus* spp. and *Boophilus* spp. in decreasing order of prevalence [45].

The presence of diseases caused by hemoparasites is broadly related to the presence and distribution of their vectors [13]. In small ruminants *Theleriaovis*and *Theleriaseparata* found in northern Ethiopia [46]. *Theleria* species (18.5%) and *Anaplasma* species (6%) were identified from Sebeta town [47]. *Anaplasmaovis* and *Babesiaovis* were identifiedfrom Debre-Zeit, central Ethiopia [48].

CONCLUSION AND RECOMMENDATION

In Ethiopia the contribution of livestock subsector to the country economy remains marginal compared with the largest livestock potential of the country. This is due to the disease caused by diversified etiology. Epidemiological studies conducted on a diseases caused by ectoparasites and the tick borne hemoparasites of the domestic animals have clearly demonstrated the impact of the problem both on the health of animals and their performance. Ectoparasites of the animals are currently a disease of considerable importance in small ruminant production sector as a major cause of down grading and rejection of skin and hide and hemoparastes cause degradation of production and productivity of small ruminants in Ethiopia. The economic losses by the disease are also the result of reduction in productivity, reproductive performance and death of the affected animals. Based on the above conclusion remarks, the following recommendations are forwarded:

- Further studies should be conducted on the epidemiology of ectoparasites and tick borne parasitic disease in different agro- ecological parts of the country.
- All possible economic losses due to the disease should be assesses at different stages of skin and hide processing including at its early trading stages and in different tanneries.
- Public education should be created on the effect of these parasites on production and productivity.
- The government, private sectors and veterinarians should work together in order to minimize ectoparasites and the tick borne hemoprasites and their impact.

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