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Review of Economically Important Cattle Tick and Its Control in Ethiopia

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Abstract

Ethiopia has the largest livestock population in Africa, but the contribution for the economic aspect of the country is still lowest and disease can be considered as major constrain. Ticks are the most important ectoparasites of livestock in tropical and sub-tropical areas. Ethiopia is not exceptional and ticks are responsible for severe economic losses both through the direct effects of blood sucking and indirectly as vectors of pathogens and toxins. Feeding by large numbers of ticks causes reduction in live weight gain and anaemia among domestic animals, while tick bites also reduce the quality of hides. However, the major losses caused by ticks are due to the ability to transmit protozoan, rickettsial and viral diseases of livestock, which are of great economic importance world-wide. This review concerns with general aspects of tick biology, the taxonomy, pathogenic effects and methods for the control of ticks. Ticks belong to the suborder Ixodida, which contains a single super family, the Ixodoidea, which is divided into two major families, Argasidae (soft ticks) and Ixodidae (hard ticks), and the rare family Nuttalliellidae, with a single African species. The main tick genera found in domestic animals of Ethiopia are *Amblyomma, Hyalomma, Rhipicephalus*, *Haemaphysalis* and *Rhipicephalus* (Boophilus). Various breeds of cattle differ in their response to tick infestations. Bos indicus pure breeds and crossbreeds were reported to be more innately resistant than Bos Taurus breeds. The conventional method of controlling tick infestations in Ethiopia is application of acaricide, either by hand spraying, by hand dressing. Therefore, to minimize tick adverse effect appropriate and timely strategic control measures are crucial.

Keywords

Acaricide; Argasidae; Ectoparasites, Ethiopia; Ixodidae; Ticks

Introduction

Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been contributing considerable portion to the economy of the country, and still promising to rally round the economic development of the country [1]. In Ethiopia, livestock production remains crucial and represents a major asset among resource-poor small holder farmers by providing milk, meat, skin, manure and traction force [2]. The contribution of livestock to the national economy particularly with regard to foreign currency earnings is through exploration of live animal, meat and skin and hides [3].

Poor health and productivity of animal due to disease has considerably become the major stumbling block to the potential of livestock industry [4]. Now a day's parasitism represents a major obstacle to development and utilization of animal resource. In Ethiopia ectoparasites in ruminant causes serious economic losses to small holder farmers, the tanning industry and country as a while through mortality of animals, decreased production, downgrading and rejection of skin and hide [5]. From the ectoparasites, ticks are ranked as the most economically important of livestock in tropics including sub-Saharan Africa [6]. Ticks are small, wingless ectoparasitic arachnid arthropods that are cosmopolitan and prevalent in warmer climates [7].

Eyo, et al. indicated that Ticks cause substantial losses in cattle production, in terms of diseases, reduced productivity and fertility and often death, and are economically the most important ecto-parasites of cattle. Huruma et al showed that different ticks have different predilection sites on the host's body. Ticks suck blood; damage hides and skins introduce toxins and predispose cattle to myiasis and dermatophilosis [8-11]. Furthermore, they reduce body weight gains and milk yield, in addition to creating sites for secondary invasion by pathogenic organisms [12,13]. More significantly, ticks transmit diseases from infected cattle to healthy ones. Ticks transmit a greater variety of pathogenic micro-organisms than any other arthropod vector group, and are among the most important vectors of diseases affecting animals [11].

According to Walker, et al. ticks which are considered to be most important to health of domestic animal in Africa comprise about seven genera. Among these genera the main tick genera found in Ethiopia includes *Ambylomma,* sub genus *Rhipicephalus (Boophilus), Haemaphysalis*, *Hyalomma* and *Rhipicephalus*. The genus *Ambylomma* and *Rhipicephalus* are predominating in many parts of country, *Hyalomma* and sub genus *Rhipicephalus* (Boophilus) also have significant role [13,14]. Due to economic and veterinary importance of ticks, their control and transmission of tick borne diseases remain challenge for the cattle industry of the world and it is a priority for many countries in tropical and subtropical regions [15,16]. In Ethiopia there are about 47 species of ticks found on livestock and most of them have importance as vector and disease causing agent and also have damaging effect on skin and hide production [17]. Therefore the objective of this paper is to review available literature on tick biology, the taxonomy, pathogenic effects and methods for the control of ticks and highlighting status of ticks and tick borne haemoparasitic diseases in Ethiopia.

Literature Review

Classification of ticks

Ticks are within a member called the phylum (Arthropoda), class (Arachnida), sub class (Acari) and Order (Parasitiformes) [18]. Within the Parasitiformes, ticks belong to the suborder Ixodida, which contains a single super family, the Ixodoidea, which is divided into two major families, Argasidae (soft ticks) and Ixodidae (hard ticks), and the rare family Nuttalliellidae, with a single African species

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[19]. The family Ixodidae, or hard ticks, contains some 683 species [20]. As adults, Ixodids exhibit prominent sexual dimorphism: the scutum covers the entire dorsum in males, but in females (and immatures) the scutum is reduced to a small podonotal shield behind the capitulum, thereby permitting great distention of the idiosomal integument during feeding [20]. Ixodidae ticks are relatively large and comprise thirteen genera. Seven of these genera contain species of veterinary and medical importance *Amblyomma*, sub genus *Rhi. (Boophilus)*, *Rhipicephalus*, *Haemaphysalis, Hyalomma, Dermacentor* and *Ixodes* [21]. The family Argasidae, or soft ticks, consists of about 185 species worldwide and have one important genus that infests cattle, *Ornithodoros* [22]. Adult argasids lack a dorsal sclerotized plate or scutum, their integument is leathery and wrinkled, their mouthparts are not visible from above, and they show no obvious sexual dimorphism. Argasidae are wandering ticks, which only remain on their host while feeding [23].

Epidemiology of ticks

Host relationship: Some ticks live in open environments and crawl onto vegetation to wait for their hosts to pass by. This is a type of ambush and the behavior of waiting on vegetation of is called questing. Thus in genera such as *Rhipicephalus*, *Haemaphysalis* and *Ixodes* the larvae, nymphs and adults will quest on vegetation. The tick grabs onto the host using their front legs and crawl over the skin to find a suitable place to attach and feed. Adult tick of genera *Ambylomma* and *Hyalomma* are active hunters, they run across the ground after nearby hosts [13].

Attachment site: Tick attachment site specificity is one of the populations limiting system that operate through the restriction of tick species to certain parts of the host body. They seek out places on the hosts where they are protected and have favorable conditions for their development [9,24] indicated that different ticks have different predilection sites on the host's body.

The favorable predilection sites for *B.decoloratus* was the lateral and ventral side of the animal; A. variegatum, teat and scrotum; A. coherence udder and *H.truncatum*, scrotum and brisket and *H.marginatum rufipes* udder and scrotum, *R.evertsi evertsi* under tail and anus and *R.preaxtatus* anus and under tail [9]. Depending on the tick, site preference on the host depends on the accessibility for attachment, to get blood and protection to overcome the environment damage that inhibits its existence and grooming activity of the host. Tick location on the host is lined to the possibility of penetration by hypostome. Genera with short hypostome for example *Rhipicephalus*, *Dermacentor* and *Haemaphysalis* species usually attach to hairless area such as undertail and anovulval area [9].

Life cycle: In the hard ticks mating takes place on the host, except with Ixodes where it may also occur when the ticks are still on the vegetation. Male ticks remain on the host and will attempt to mate with many females whilst they are feeding. They transfer a sac of sperm (spermatheca) to the female. The females mate only once, before they are ready to engorge fully with blood. When they finally engorge they detach from the host and have enough sperm stored to fertilize all their eggs. Female hard ticks lay many eggs (2,000 to 20,000) in a single batch. Female argasid ticks lay repeated small batches of eggs. Eggs of all ticks are laid in the physical environment, never on the host [25].

Members of the family Ixodidae undergo either one-host, two-host or three-host life cycles. During the one-host life cycle, ticks remain on the same host for the larval, nymphal and adult stages, only leaving the host prior to laying eggs. During the two-host life cycle, the tick molts from larva to nymph on the first host, but will leave the host between the nymphal and adult stages. The second host may be the same individual as the first host, the same species, or even a second species. Most ticks of public health importance undergo the three-host life cycle. The three hosts are not always the same species, but may be the same species, or even the same individual, depending on host availability for the tick. Argasid ticks have two or more nymphal stages, each requiring a blood meal from a host. Unlike the Ixodidae ticks, which stay attached to their hosts for up to several days while feeding, argasid ticks are adapted to feeding rapidly (about an hour) and then promptly leaving the host [13].

All feedings of ticks at each stage of the life cycle are parasitic. For feeding, they use a combination of cutting mouthparts for penetrating the skin and often an adhesive (cement) secreted from the saliva for attachment. The ticks feed on the blood and lymph released into this lesion. All ticks orient to potential hosts in response to products of respiration [26]. Important Ixodidae ticks that feed on cattle according to the number of hosts required to complete life cycle are listed on Table 1.

Cattle resistance: Currently tick control depends largely on the use of different chemicals. But the development of resistance against commonly available acaricides has created problem in this regard and animal population is becoming susceptible to both the ticks and diseases they transmit, with disastrous outcomes [27]. Resistance of cattle to tick infestation was reported to consist of innate and acquired components. The defense mechanisms, including tick avoidance, grooming, skin characteristics and more specific immunological responses, are involved in reducing the number of ticks parasitizing cattle. Avoidance was attributed to the sighting of the ticks [21]. Spontaneous or acquired resistance may be following

Table 1: Important Ixodidae ticks according to the number of their hosts[36].

Tick genera	One host tick	Two host tick	Three host tick
Rhi.(Boophilus) spp.	*Rhi.(B).decoloratus* *Rhi.(B).annulatus* *Rhi.(B).microplus*		
Amblyomma spp.			All species of *Amblyomma*
Hyalomma spp.	*Hyalomma scupense*	*H. m. turanicum,* *H. d. dentritum*	*H.truncatum, H.a.anatolicum,* *H.dromedarii, H.m.marginatum,* *H.excavatum*
Rhipicephalus sps		*R .e .evertsi* *R. bursa*	*Rh.simus, Rh.pravus, Rh.pulchelus, Rh. Appendiculatus*
Haemaphysalis spp.			*Hae.punctata*
Ixodes sps.			*I.pilosus, I.ricinus*
Dermacentor spp.	*D.albipictus*		Most species

infestations, due to the development of cutaneous hypersensitivity. The mechanism responsible for acquired resistance to ticks has been suggested to be a mast cell-dependent eosinophil hypersensitivity [28]. Resistance can be passively transferred with viable lymph node cells but not with serum from resistant hosts. This passage method of tick resistance suggests a delayed hypersensitivity mechanism for the acquisition of resistance [29]. The blood histamine level have been found to be elevated as a result of cutaneous basophiles or mast cells increase in resistant hosts, which degranulate in the region of ticks attachment to produce histamine. The histamine has shown to stimulate detachment of tick larvae. But the infestation rate increases in normally resistant zebus either due to true inhibition by the allergic, or by reduced cutaneous pruritis that halts licking that enables to kill the larvae by resistant cattle [27].

It has been recognized that various breeds of cattle differ in their response to tick infestations. *Bos indicus* pure breeds and crossbreeds were reported to be more innately resistant than *Bos Taurus* breeds [28]. According to the observation of authors, African cattle (*Bos indicus*) naturally self-groom and groom each other frequently and thoroughly. Significantly fewer ticks were found on those animals that were able to groom. Some breeds have the ability to reduce the number of ticks they carry and are considered resistant while others cannot control the number of ticks they carry and thus are referred to as sensitive breeds [22].

A number of physiological and environmental factors can affect the level of host resistance to ticks or the expression of host resistance. Among which nutrition, sex, pregnancy, lactation, age, exposure to ticks, breed and tick density play key roles [30]. Cattle lose resistance with time, and it seems that the older the animal, the lower the resistance. Pregnant cows were significantly more sensitive than non-pregnant female and carried a higher number of ticks mainly during the late stages of the pregnancy. The stress of lactation causes a marked decline in the resistance of exotic breeds; it also affect Zebu, but to a much smaller extent. Stable resistance is acquired after several months of exposure to the species of tick to which resistance is required [28].

Pathogenic role of ticks

Direct effects of ticks on cattle are tick worry, blood loss, damage to hides and skins of animals and introduction of toxins [10]. The ecology and physiology of ticks have made them second most important vectors after mosquitoes. Ticks transmit a large variety of intercellular bacteria in the Rickettsia group like Rickettsia, Ehrlichia and Anaplasma. Similarly several piroplasm protozoa like *T. annulata*, *T.parva* and *Babesia bigemina* are also transmitted specifically by ticks [31,32]. Hard ticks (Acari: Ixodidae) are obligate hematophaguos ectoparasites and important vectors of viruses, bacteria and protozoa. They are considered second only to mosquitoes as the most medically important group of arthropods [33]. Tick worry is a generalized state of unease and irritability of cattle severely infested with ticks, often leading to serious loss of energy and weight. This negative effect on the growth of animals and their production is thought to be due to the effects of a toxin in the saliva of ticks [10].

Anaemia is another inevitable consequence of heavy infestation by any blood-feeding parasite, and cattle deaths attributable to anaemia as a result of tick infestation are common. Engorging Ixodidae females will increase their weight by 100–200 times but the actual amount of blood ingested is much greater than this, as blood meal is concentrated and fluid excreted in saliva. Estimates of the amount of blood removed vary according to the species under consideration [10]. Tick saliva contains toxins which have a specific pathogenic effect. The toxins affect not only the attachment site but also the entire organs of the host. Some ticks produce neurotropic toxins which induce tick paralysis that is characterized by an acute ascending flaccid motor paralysis. Females of the species *Hyalomma truncatum* produce a dermotropic (epitheliotropic) toxin which causes sweating sickness in calves and some adult cattle [34].

Ticks control methods

The aim of tick control campaign is not to control all ticks simultaneously, but a definite species because of its particular role [30]. The successful implementation of rational and sustainable tick control programmes in grazing animals is dependent upon a sound knowledge of the ecology or epidemiology of the tick as it interacts with the host in specific climatic, management and production environments. In most situations, however, efficient and reliable methods for the control of cattle ticks and TBD are based on the use of a chemical treatment (acaricide application), often without a local understanding of appropriate ecology or epidemiology [35].

The availability of each of these options, their advantages and disadvantages, and the cost benefit of each alternative strategy should be assessed before deciding on a control programme [36]. Ideally, strategies should target the parasitic and free-living phases of the life cycle and the role of the ticks in the transmission of Tick-borne diseases should not be neglected [14]. It is now generally understood that tick control should not only be based on acaricide use, despite the fact that this remains the most efficient and reliable single method. Complementary approaches have been developed and are being researched to enable integrated control strategies against the tick and its haemoparasites [35,36]. The following are the most commonly used tick control methods.

Ecological tick control: Ecological control method is used for habitat and host linked treatment. Tick control in the habitat and vegetation requires modification of the plant cover by removal of vegetation that shelters ticks [36]. Pasture management, including spelling and seasonal changes in cattle grazing areas in Australia and in Zambia respectively has been used as a tick control strategy and are believed to be responsible for a decrease its burden [13].

Biological tick control: A first attempt at tick biocontrol was made with the introduction of tick parasitic wasps from France to the USA and Russia. During the past decades, interest in developing anti-tick bio control agents such as birds, parasitoides, entomopathogenic nematodes, entomopathogenic fungi and bacteria have gained momentum [37]. In biological tick control the activities of the hyperparasites chalcid flies Hunterellus are probably important in nature, but they are difficult to evaluate and it is still more difficult to manipulate or reproduce them for practical use. The biological agents, which potentially include predators like rodents, birds, ants, spiders, lizards and beetles as well as Prasitoids (destroy the host: the wasp lay the eggs in the engorged ticks and larvae eats the tick and emerges as adult to attack another tick) and parasites (Nematodes and fungus) attack soil living stages of the ticks are effective and depending on the conditions, these predators can consume a large number of ticks. Yet, having such effective importance the development of a biological tick control methods has been neglected as compared to the control of plant pests or dipterous insects harmful to men and animals [36].

Chemical tick control: Acaricide treatments are commonly used in a suppressive approach, applying multiple treatments at regular intervals during the height of infestation. Suppressive treatments

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are the most effective in the short term; keeping animals almost tick free, thereby reducing the direct effect of the ticks and the risk of disease transmission. This procedure will, however, select heavily for acaricide resistance in the ticks [37].

An ideal acaricide would be cheap, easily applied, with a strong knock down effect and sufficient residual effect on female ticks to prevent egg lying and to protect cattle from reinfestation by larvae. It should not select for resistance through a prolonged, gradual decay on the animal (i.e. it should have a sharp cut off in efficacy with time). In addition, it should be non-toxic to livestock and humans and have no detectable residues in meat and milk. Unfortunately, such an ideal acaricide has not yet been produced. Generally, although the use of acaricides for the control of ticks has limitations and tick resistance to acaricides is an increasing problem and real economic threat to the livestock worldwide, most livestock holders depend completely on acaricides to control ticks, but do not have access to guidelines on how to make a profit from their tick control program or how to detect and resolve problems with resistance to acaricides [37].

Genetic tick control: The application of acaricides is the most common method used to control cattle ticks. However, the improper use of these chemicals compounds has been causing the development of tick resistance to various pesticides available in the market, reducing these products' useful lifetimes. Besides this, problems generated by the presence of chemical residues in meat, milk and the environment have prompted reflection on the need for better monitoring of their application [38]. Therefore, the study of the genetic resistance to ticks among different breeds of cattle can contribute to the development of alternative control methods [39]. It is widely known that Bos indicus cattle are more resistant to ectoparasites than are *Bos taurus* animals. There are great differences between these two breeds of cattle in regard to their susceptibility to parasitism by cattle ticks [40]. Studies are intensifying the crossing of these two groups, aiming to obtain animals that are more resistant to the conditions found in tropical countries and are also good meat producers [41].

The distribution of ticks in Ethiopia

The distribution and abundance of tick species infesting domestic ruminants in Ethiopia vary greatly from one area to another area [42]. In Ethiopia, studies on tick fauna have begun early in the 19th century. Since then, different researchers from abroad and country determine the pattern of ticks and the tick-borne diseases; and ticks are common in all agro-ecological zones of the country [43,44]. The main tick genera found in domestic animals of Ethiopia are *Amblyomma*, *Hyalomma*, *Rhipicephalus*, *Haemaphysalis* and *Rhipicephalus* [42].

Among the genera *Rhipicephalus, Rhipicephalus lunulatus* species were observed in Central Ethiopia [45] and *Rhipicephalus muhasmae* in Borena [46], in wetter western areas of the country [43,47]. Seyoum [48] has recorded *Rh. humoralis*, *Rh. cliffordi*, *Rh. compositus* and *Rh. distinctus* in Wollo and Northeast areas. *Rhipicephalus evertsi evertsi*, "Red-legged tick" [13] is the most widespread species of *Rhipicephalus* [49,50]. *Rhipicephalus pulchellus*, "Zebra tick" [13], is distributed widely in the north eastern [48], eastern [51] and southern range [50] part of the country. *Rhipicephalus simus*, "Glossy tick" [13], are found in northern [49], eastern [51], central [45]. Of the genus Amblyomma four species that commonly infest cattle includes *Amblyomma variegatum*, *A. gemma*, *A. lepidum* and *A. cohaerens* and are known to exist in Ethiopia [52,53].

Regassa in Borena zone showed that *A. variegatum*, *A.gemma* and *A. lepidum* distributed in wider area of southern Ethiopia. From the studies of Abebaw [54] in Jimma *A.variegatum* and *A. coherense* are widely distributed in south western Ethiopia. *Amblyomma variegatum* and *A. cohaerens* are the two most prevalent *Amblyomma* species in Awassa areas in decreasing order [55]. In eastern Ethiopia, *A.variegatum* and *A. gemma* are the two most widely spread species [56]. *Amblyomma gemma*, "*Gem-like bont tick*" [57], is recorded in eastern and southern Ethiopia [43,47]. *Ambylomma variegatum* and *Ambylomma* coherence in was also recorded in Haramaya [58]. It is clearly associated with dry types of vegetation or semi-arid rangelands [43]. *Amblyomma lepidum*, "East African bont tick"[57], is most commonly inhabits arid habitats and in open bushed shrub or wooded grassland and its distributions overlap with *Ambylomma gemma* and that of *Ambylomma variegatum* [13].

Two species of *Rhipicephalus* (Boophilus) sub genus are known to exist in Ethiopia, which include *Rhipicephalus (Boophilus) decoloratus* and *Rhipicephalus (Boophilus) annulatus*. The study done by Regassa in Borena zone; Mekonnen et al [45] in central Ethiopia; Assefa [54] in Asella; Berhane [58] in Awassa; Dessie [59] in Asella; Seyoum [48] in Wollo and Asosa area [60] indicated the distribution of *Rhipicephalus* (Boophilus) decoloratus. *Rhipicephalus (Boophilus) annulatus* is known to present in Gambella region and recorded by Pegram et al [43] and de Castro [47]. In Ethiopia, about eight species of *Hyalomma* that affect cattle are identified, which includes *Hyalomma marginatum rufipes, Hy. dromedarii*, *Hy. tuncatum*, *Hy.m. marginatum*, *Hy. impelatum*, *Hy. anatolicum excavatum*, *Hy.anatolicum anatolicum* and *Hy. albiparmatum* [57].

Tick borne diseases and status of tick borne haemoparasitic diseases in Ethiopia

Tick borne disease: The term vector-borne disease refers to any of a broad array of infectious diseases caused by pathogens that are transmitted by arthropods or other biologic intermediaries. Although transmission usually occurs on blood feeding by an infected insect or acarine parasite, infection can also result when a vertebrate host ingests a vector or on contamination of a wound by infectious organisms in the feces of the arthropod intermediary. Regardless of the means of transmission, the vector, a critical component in disease transmission, engages in a lifestyle that is at least partially parasitic and that somehow contributes to its ability to both acquire and serve as a source of infection to animals [61]. Theileriosis, heartwater, babesiosis and anaplasmosis are considered the most important tick-borne diseases of livestock in sub-Saharan Africa [62].

Some of the most important tick-borne diseases are East Coast Fever, Redwater, anaplasmosis and heartwater. Many other fatal and benign babesiosis, theileriosis and anaplasmosis are also transmitted by various tick species [20]. These diseases generally affect the blood and/or lymphatic system and cause fever, anaemia, jaundice, anorexia, weight loss, milk drop, malaise, swelling of lymph node, dyspnoea, diarrhoea, nervous disorders and even death. Major cattle tick-borne diseases in Ethiopia are anaplasmosis, babesiosis, theileriosis [46] and Dermatophilosis [63]. Besides to disease transmission ticks inflict a huge economic loss. Production losses due to ticks and tick-borne diseases around the globe have been estimated at US$ 13.9 to US$ 18.7 billion annually leaving world's 80% cattle at risk [64]. Bekele [65] estimated an annual loss of US$ 500,000 from hide and skin downgrading from ticks, and approximately 65.5% of major defects of hides in eastern Ethiopia are from ticks. Furthermore, the costs associated with maintaining chemical control of ticks in tropical and subtropical regions of the world have been estimated at US$ 25.00 per head of cattle per year [66].

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Table 2: Existing Tick-borne haemoparasitic diseases in four regions of Ethiopia.

Region	TBDs	Samples	Diagnostic Tests	Sources
Amhara	*Babesia species* *B. bigemina* *Theileria mutans*	Blood smear Lymph node impression	Microscopic	[48]
SNNPRS	Babesia species Theileria species	Blood smear Lymph node impression	Microscopic	[70]
Central Ethiopia	abesia species	Blood smear	Microscopic	[71]
Oromia	*Babesia species* *B. bigemina* *Theileria mutans*	Serum Blood smear	Microscopic Serology (ELISA)	[69]

Status of tick borne haemoparasitic diseases in Ethiopia: Similar to other countries, there are a considerable number of economically important livestock diseases occurring in Ethiopia. Among others, tick borne haemoparasitic diseases are of the major constraints to the livestock industry of the country. Sileshi [67] indicated the existence of Anaplasmosis, Babesiosis, Cowdriosis and Theileriosis (*T. mutans*), but their significance in terms of mortality and productive losses and the degree of enzootic stability are not yet very well known. Only Feseha [68] reported a conservative estimate of birr 1 million loss annually through rejection or downgrading of hide and skin. Moreover, light to severe inflammatory reaction sometimes leading to surgical removal of teats are damages caused by ticks.

There are no clinical or serological reports of the presence of either *T.annulata* or *T. parva* in Ethiopia. But, there is relatively uncontrolled movement of livestock from Sudan and Kenya, where these diseases and their vectors are found [67]. In previous studies, conducted by Mekonnen et al. [46] *B. bovis*, *T. orientalis* and *T. velifera* were reported from Gambella region, western Ethiopia (Table 2) [48,69-71]

Conclusions and Recommendations

Ticks are obligate blood feeding ectoparasites of vertebrates and induce huge production loss in livestock industry and creating serious public health problems in the world. The main tick genera found in Ethiopia are *Amblyomma*, *Boophilus*, *Haemaphysalis*, *Hyalomma* and *Rhipicephalus*. Tick-borne diseases of cattle such as *Anaplasmosis*, *babesiosis, cowdriosis* and *theileriosis* (*T. mutans*) are present in Ethiopia. Heavy infestations by different tick species suppress the immunity of cattle and also damage teats and reduce productivity of animals and there are direct effects associated with tick infestation that leads to tick worry, anorexia and anemia. These all are the impacts of tick infestation so, to minimize tick impact appropriate and timely strategic control measures are crucial. The conventional method of controlling tick infestations in Ethiopia is application of acaricide, either by hand spraying, by hand dressing. The ability to induce an effective, sustained immunological response is crucial but needs improvement. Problems of acaricide resistance, chemical residues in food and the environment and the unsuitability of tick resistant cattle for all production systems make the current situation unsatisfactory and require the development of absolute control through effective vaccine. Therefore, in line with the above conclusions; the following recommendations were forwarded:

The government should monitor the use of potentially dangerous chemicals and conserve foreign exchange.

Intensive acaricide application to control ticks has a number of limitations, Therefore, immunization together with strategic tick control are recommended for exotic and crossbred cattle

Research should be conducted on tick species and their epidemiology for the continuous understanding of improved control strategies

Awareness should be given to animal breeder on problem of tick and TBD and different control method.

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