Global Veterinaria 21 (6): 348-355, 2019
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2019.348.355

Epidemiology of Bovine Babesiosis in Ethiopia - A Review

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Abstract: Bovine babesiosis is tick-transmitted hemoparasites of the protozoan genus *Babesia* (Phylum Apicomplexa) are the second most common blood-borne parasites of mammals after the trypanosome. It is the worldwide most important arthropod-borne disease of cattle that causes significant morbidity and mortality. Two important *Babesia* species: *B. bigemina* and *B. bovis* infect cattle. They are widespread in tropical and subtropical areas including Ethiopia and are vectored by one host tick *Rhipicephalus* species and transmission is mainly transovarially. During the tick bite, sporozoites are injected into the host and directly infect red blood cells. *Babesia* produces acute disease by hemolysis and circulatory disturbance mechanism. Microscopic examination is adequate for detection of acute infections, but not for detection of carriers where parasitaemias are very low. Although some species of *Babesia* such as *B. microti* can affect healthy people, cattle parasites seem to cause disease only in people who are immunocompromised. It is also the most economically important of animal diseases, because of direct losses of production and because of restriction of movement of cattle for trade by quarantine laws. Currently bovine babesiosis is widespread in Ethiopia with most prevalent species being *B. bovis* and *B. bigemina*. Ethiopia should develop and implement surveillance systems and action plans to prevent bovine babesiosis from spreading. Awareness should be given to livestock owners in relation to vector control as one option of controlling bovine babesiosis.

Key words: *Babesia* · Ethiopia · Red-Water · Tick Fever

INTRODUCTION

Our country has 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. Even if having the largest livestock population in Africa, the contribution for the economic aspect of the country is still lowest and disease can be considered as major obstacle [1].

Bovine babesiosis is tick-transmitted hemoparasites of the protozoan genus *Babesia* (Phylum Apicomplexa) are the second most common blood-borne parasites of mammals after the trypanosome [2]. The two main *Babesia* species known to affect cattle are *Babesia bovis* and *Babesia bigemina* [3]. It is characterized by formation of thrombi and emboli in the brain capillaries, most important to nervous sign development and in some case sudden death before to onset of sign. The disease is of major economic important and will cost the agricultural sector some colossal amount of money in countries afflicted by this disease [4].

Two bovine Babesial species such as *B. bovis* and *B. bigemina* have worldwide distribution that corresponds to that of their tick vectors (*Boophilus* spp.). Greatest affected countries are located between 32°S and 40°N equator [5]. So that endemic condition of bovine babesiosis in specific geographic region is related with presence of vector capable to transmit the infection and introduction of infected animals to area [6].

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Table 1: Distribution of different *Babesia* species and their vectors and host [1].

Parasite species	Vertebrae hosts	Pathogenicity	Vectors	Distribution
B. bovis	cattle, deer	High	*Ixodes, Rhipicephalus (Boophilus)*	Europe, Africa, Australia
B. bigemina	cattle, deer	Moderate	*Haemaphysalis, Rhipicephalus (Boophilus)*	Europe, Africa, Australia, South & Central America
B. divergens	Cattle	Moderate	*Ixodes*	Western & Central Europe
B. major	Cattle	Low	*Rhipicephalus (Boophilus)*	Europe, Russia

It is transmitted by hard ticks in which *Babesia* passes transovarially, via the egg, from one tick generation to the next [1]. In the mammalian host, the major parasite division cycle take place erythrocytes and it is these stages, which induce the pathogenic effects [7]. Cattle develop a durable, long-lasting immunity after a single infection with *B. divergens*, *B. bovis* or *B. bigemina* [3]. Although some species of *Babesia* such as *B. microti* can affect healthy people, cattle parasites seem to cause disease only in people who are immunocompromised [8]. Active prevention and control of Babesiosis is achieved by three main methods: immunization, chemoprophylaxis and vector control [9].

In our country, now days no sufficient emphasis has been given to livestock disease, particularly, to Bovine Babesiosis, in spite of its devastating effect on cattle and other livestock's [10]. Bovine Babesiosis is one of the most important diseases in the country because it occurs sometimes in acute forms with serious recognized clinical manifestations yet decreasing the productive performance of the affected animals [8]. The disease widespread in the country but there is insufficiency of well documented information. Therefore, the objective of this paper is to review available literature in relation to epidemiology, diagnosis, public health importance, control and preventions of bovine babesiosis and to highlight the disease status in Ethiopia.

Etiology: Babesiosis also known by such names as bovine babesiosis, piroplasmosis, redwater and tick fever [1]. Bovine babesiosis (BB) is a tick-borne disease of cattle caused by the protozoan parasites of the genus *Babesia*, order Piroplasmida, phylum Apicomplexa. The *Babesia* species mainly cause bovine babesiosis are: *Babesia bovis*, *Babesia bigemina* and *Babesia divergens*. In addition to *B. major*, *B. ovata*, *B. occultans* and *B. jakimovi* infects cattle [11]. Two species, *B. bigemina* and *B. bovis*, have a considerable marked effect on cattle health and productivity in tropical and subtropical countries. *Babesia* belongs to protozoan parasites of the genus *Babesia*, order Piroplasmida, Subphylum Apicomplexa and subclass Piroplamsia and are commonly referred to as 'piroplasmas' due to the pear-like shaped merozoites which live as small parasites inside RBC of mammals [8].

Epidemiology

Geographical Distribution: Bovine babesiosis can be found wherever the tick vectors exist, but it is most common in tropical and subtropical areas. *B. bovis* and *B. bigemina* are present in most areas of the world, with the greatest incidence between the latitudes of 32 °N and 30 °S, where their *Boophilus* tick vector commonly occurs [8].

From the two cattle *Babesia*s occurring in northern temperate areas, *B. divergens* and *B. major*, *B. divergens* are both more pathogenic and more widespread. Epidemiological surveys have documented the presence of *B. divergens* throughout Europe, including Austria, Belgium, Britain, France, Germany, Ireland, Northern Ireland, the Netherlands, Scandinavia and Switzerland. A report of the parasite from Tunisia indicates that the real distribution of *B. divergens* may extend beyond Europe into North Africa [12].

Host Range: Babesiosis commonly infect cattle, sheep, goats, horses, pigs, dogs and cats and occasionally man. More than 100 known *Babesia* spp. has been identified which infect many types of mammalian host, out of these, 18 spp. cause disease in domestic animals [13]. *B. bovis* and *B. bigemina* are found in cattle, which are the main reservoir hosts. They also affect water buffalo (*Bubalus bubalis*) and African buffalo (*Syncerus caffer*). *B bovis* and *B. bigemina* were recently discovered in white-tailed deer (*Odocoileus virginianus*) in Mexico [8].

Risk Factor

Host Factor: Host factors associated with disease include age, breed and immune status. *Bos indicus* breeds of cattle are more resistance to babesiosis than *Bos taurus*. This is a result of evolutionary relationship between *Bos indicus* cattle, *Boophilus* species and *Babesia* [1]. Because of natural selection pressure, indigenous populations, having lived for a long time with local ticks and tick-borne diseases, have developed either an innate resistance or an innate ability to develop a good immune response to the tick or tick-borne hemoparasitic disease in question [9]. There is a variation in susceptibility to infection according to age in cattle. The greatest infection rate is in animals in the 6 to 12 month age group; infection is uncommon in animals over 5 years of age [14].

Pathogen Factor: Strains vary considerably in pathogenicity; however, *B. bovis* is usually more virulent than *B. bigemina* or *B. divergens* [1]. So, that *B. bovis* is the most pathogenic organism, resulting in high mortality rates among susceptible cattle conditions [9]. Many Intra-erythrocyte hemoparasites survive the host immune system through rapid antigenic variation which has been demonstrated for *B. bovis* and *B. bigemina* [14].

Environmental Factor: There is a seasonal variation in the prevalence of clinical Babesiosis, the greatest incidence occurring soon after the peak of the tick population [8]. From the climatic factors, air temperature is the most important because of its effect on tick activity; higher temperatures increase its occurrence. Heaviest losses occur in marginal areas where the tick population is highly variable depending on the environmental conditions. Babesiosis infection in cattle mostly reaches peak in summer [9] .

Transmission: Ticks are the natural vectors of babesiosis; the causative parasites persist and pass through part of their life cycle in the invertebrate host. Both *B. bovis* (Argentina) and *B. bigemina* pass part of their life cycle in the tick *Boophilus microplus* (Recently reclassified as *Rhipicephalus microplus*, but the name *Boophilus microplus* will be used) [14]. *Babesia* species is transmitted by hard ticks in which *Babesia* passes transovarially, via the egg, from one tick generation to the next. Ticks become infected when they ingest parasites in the blood of infected cattle [1]. Tick vectors of *Babesia bigemina*: *Rhipicephalus microplus* (Formerly *Boophilus microplus*) and *Rhipicephalus annulatus* (Formerly *Boophilus annulatus*); *Rhipicephalus decoloratus, Rhipicephalus geigyi and Rhipicephalus evertsi* are also competent vectors. It is transmitted by feeding of adult and nymphal stages of one-host *Rhipicephalus* spp.

Tick vectors of *Babesia bovis*: *Rhipicephalus microplus and Rhipicephalus annulatus; Rhipicephalus geigyi* is also a competent vector. It is transmitted by feeding of larval stages of one-host *Rhipicephalus* spp [11]. All three stages of *I. ricinus* can transmit *B. divergens* [1]. Infrequently, calves can become infected in utero [11]. In addition to it also transmitted by fomites and mechanical vectors contaminated by infected blood [11, 15].

Morbidity and Mortality: Morbidity and mortality of the bovine babesiosis vary greatly and are influenced by prevailing treatments employed in an area, previous exposure to a species/strain of parasite and vaccination status [11]. Recently, variable susceptibility to *B. bovis* was also reported in some *Bos taurus* cattle: approximately 28% of a population of adult animals was susceptible to infection but resistant to clinical signs. In fully susceptible breeds, up to half or more of untreated adults and up to 10% of treated adults may die. Once hemoglobinuria develops, the prognosis is guarded. Infections with *B. bovis* are generally more likely to be fatal than infections with *B. bigemina or B. divergens* and CNS signs suggest a poor prognosis [16].

Life Cycle and Development: The development of *B. bovis* and *B. bigemina* follow similar pattern in adult *Boophilus* spp. *Babesia* spp. do not parasitize any vertebrate host cell other than erythrocytes. Each sporozoite (Merozoite) penetrates the cell membrane of an erythrocyte with the aid of a specialized apical complex. Once inside, it transforms into a trophozoite from which two merozoites develop by a process of merogony [3].

In the passage of host blood to the mid gut of the tick vector, the development of two populations of ray bodies from the gamonts (Gametocytes) occurs. The ray bodies undergo further multiplication within the erythrocytes which continues after they have emerged [14]. Large aggregations of multinucleated ray bodies form, but once division is complete, single-nucleated ray bodies that are now haploid and assumed to be gametes emerge from the aggregates and then fuse together in pairs (Syngamy) to form a spherical cell (Zygote) [3].

The zygote selectively infects the digestive cell of the tick gut where they multiply and then the basophilic cells where further multiplication occurs with development to kinetes that escape into the tick hemolymph. In the gut cells, schizogony occurs with the formation of polyploid kinetes (Large merozoites). These motile club-shaped kinetes then escape into the hemolymph and infect a variety of cell types and tissues, including the oocytes where successive cycles of secondary schizogony occur. Thus, transovarian transmission occurs with further development occurring in the larval stage [14]. After egg hatching, the kinetes migrate to the salivary gland where they transform into multi-nucleated stages (Sporogony) which later form sporozoites.

Babesia species generally complete their life cycle in 3 stages namely: gamogony (In the tick gut gametes fusion and formation), Sporogony (In salivary glands asexual reproduction occur), merogony (In the vertebrate asexual reproduction occur) [8].

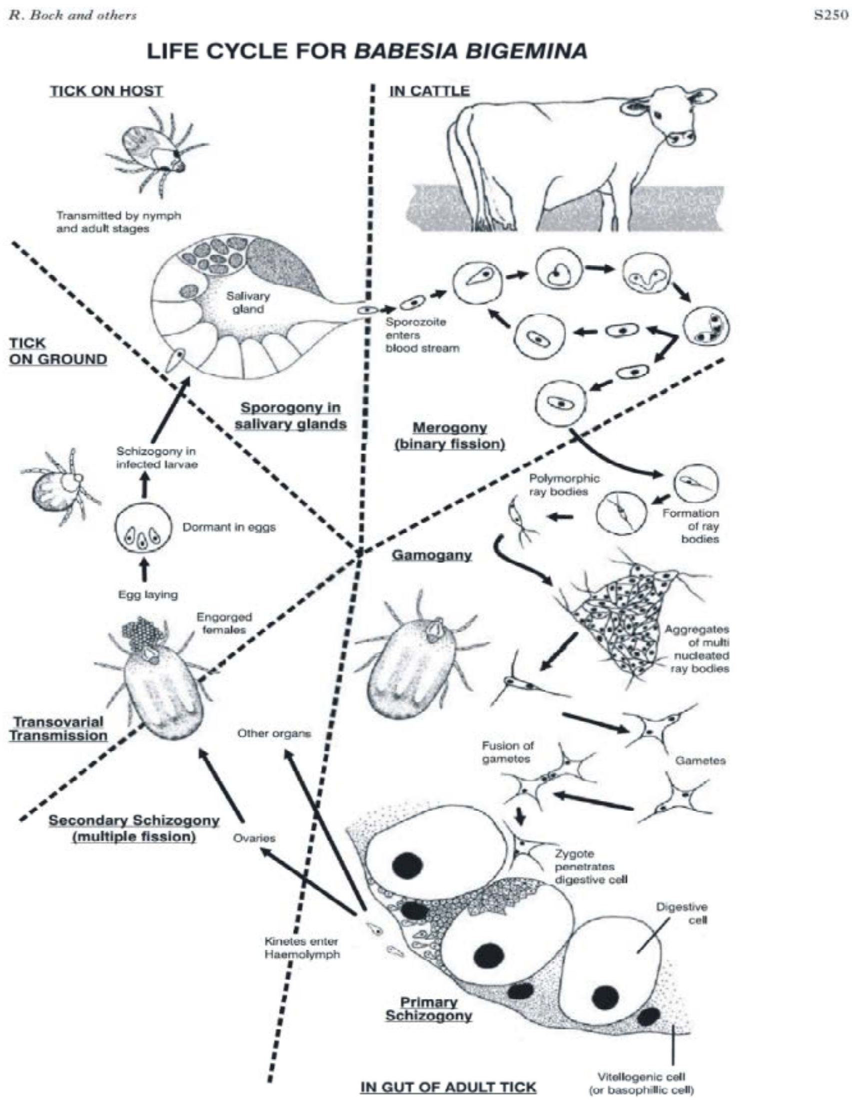

Fig. 2: Life cycle for Babesia begimina [3].

Pathogenesis and Clinical Sign: *Babesia* spp. is a diverse group of tick-borne, obligate, intra- erythrocytic Apicomplexan parasites infecting a wide variety of organisms [14]. *Babesia* produces acute disease by two principle mechanism; hemolysis and circulatory disturbance. During the tick bite, sporozoites are injected into the host and directly infect red blood cells [9].

In the host, *Babesia* sporozoites develop into piroplasms inside the infected erythrocyte resulting in two or sometimes four daughter cells that leave the host cell to infect other erythrocytes. It invades erythrocyte and cause intravascular and extra vascular hemolysis. The rapidly dividing parasites in the red cells produce rapid destruction of the erythrocytes with accompanying haemoglobinaemia, hemoglobinuria and fever [1].

Subclinical infections are quite common and are usually missed by the farmer and clinician. Affected animals have low parasitemia, may suffer mild fever and anorexia and make an uneventful recovery. More severe cases of redwater present with an acute onset of fever (Up to 41°C), anemia, anorexia, depression, weakness, cessation of rumination and an increase in respiratory and heart rate. The mucous membranes are pale and may be jaundice [12].

In cerebral babesiosis, hyper excitability, convulsions, opisthotonos, coma and death, may be observed in cattle infected with either *B. bigemina* or *B. bovis*, but especially with the *B. bovis*. Central nervous system signs are caused by brain anoxia resulting from severe anemia [17].

Other symptoms noticed were anorexia (19%) and enlargement of superficial lymph glands (10%). Reduction in milk yield, dullness, debility, salivation, diarrhoea, nasal discharge, cough, lachrymation and panting were observed in the affected cattle in one or more combinations [18]. The fever during infections in some cases cause abortion to pregnant cattle. Coffee colored urine is the characteristics clinical feature of Babesiosis [9].

Diagnosis

Clinical Examination: On clinical examination of animals, mucous membrane was pale and animal was voiding red colored urine which was collected in bottle. Animal was very depressed and dull. On physical examination of cow ticks were found on body of animal based on these and history the patients, it was tentatively diagnosed as babesiois [19]. Babesiosis should be suspected in cattle with fever, anemia, jaundice and hemoglobinuria [1].

Laboratory Examination

Identification of the Agent: Microscopic examination of blood-traditional method of identifying agent in infected animals by microscopic examination of Giemsa-stained thick and thin blood films [20]. It is adequate for detection of acute infections, but not for detection of carriers where parasitaemia are very low. Parasite identification and differentiation improved by using a fluorescent dye, such as acridine orange instead of Giemsa [11].

Transmission test*:* Sub inoculation of blood to susceptible splenectomized calves is highly sensitive technique for direct detection of *Babesia* infection. In transmission tests, 50-0 mL of blood is injected into the recipient either SC or IV. In the latter case, the incubation period will be shorter. The recipients are examined daily and the blood examined for protozoa at the peak of the febrile reaction [14].

***In-vitro* culture:** Thus, in-vitro culture could become a highly sensitivity tool to successfully identify carrier animals. The sensitivity of the culture technique has not yet been assessed in comparison with polymers chain reaction. The culture technique requires expensive tissue culture facilities and skilled personal. Sample throughput is low and it may take up to 4 weeks until a result is obtained [21].

Serological Tests: Because of the difficulty in finding protozoa in smears in animals during the subclinical stages of the disease, especially in surveillance studies for the detection of the infection in herds or areas, much attention has been directed to serological tests [14]. The Indirect Fluorescent Antibody Test (IFAT) is the most popular serological technique used both to distinguish between *Babesia* spp. and to demonstrate the presence of *Babesia* antibodies in a population. It's clearly differentiates between antibodies to *B. divergens* and other bovine *Babesia* but not between *B. divergens* and *B. capreoli* from red deer (*Cervus elaphus*). Observed no variation attributable to strain differences [12]. Complement fixation has been used to detect antibodies against *B. bovis* and *B. bigemina* used to qualify animals for importation into some countries [11]. Enzyme-linked immunosorbent assays (ELISA) have largely replaced the IFA as the diagnostic test of choice for *Babesia* spp. because of the objectivity in interpretation of results and capacity to process high numbers of samples daily [20].

PCR Techniques: Polymerase chain reaction (PCR) assays can detect and differentiate *Babesia* species and are particularly useful in carriers. Immunofluorescent and immunoperoxidase labeling have also been described. These parasites are found within RBCs and all divisional stages ring (Annular) stages, pear shaped (Pyriform) trophozoites either singly or in pairs; and filamentous or amorphous shapes can be found simultaneously. Filamentous or amorphous forms are usually seen in animals with very high levels of parasitemia [8]. As cited and discussed by Antonio *et al.* [27] a series of molecular epidemiological surveys have been conducted in various countries to detect and genetically characterize *Babesia* parasites present in apparently healthy cattle. Molecular methods based on the detection of *Babesia* DNA in blood by PCR techniques provides results with high sensitivity and specificity. Recently, nested PCR (nPCR) assays targeting *B. bovis* rhoptry-associated protein-1 (BbovRAP-1), *B. bovis* spherical body protein 2 (BboSBP2), *B. bovis* spherical body protein 4 (BboSBP4), *B. bigemina* Apical Membrane Antigen-1 (BbiAMA-1) and *B. bigemina* rhoptry-associated protein-1a (BbiRAP-1a) have proven to be a powerful tool for epidemiological investigations in apparently healthy, persistently infected cattle in Pakistan, Ghana, Mongolia, Brazil, Egypt, South Africa, Myanmar, Thailand, Syria, India and the Philippines.

Postmortem Lesion: Cattle dying from babesiosis show postmortem lesions which are somewhat characteristic and vary with the acuteness and severity of the clinical signs. In cattle that have died after a few days of high fever, the lungs may be edematous and congested [22].

Icterus may also be present in the momentum, abdominal fat and subcutaneous tissues. The spleen is markedly enlarged with a dark, pulpy, friable consistency. The liver may be enlarged and darkened or icteric, with a distended gallbladder containing thick, granular bile. The kidneys are usually dark red or black and the urinary bladder often contains reddish-brown urine; however, in some cases, the urine may be normal [15].

Differential Diagnosis: A syndrome of acute hemolytic anemia should suggest the following alternative diagnoses: Theileriasis (*Theileria annulata*), Leptospirosis [14, 15], Post parturient hemoglobinuria, Bacterial hemoglobinuria and S-methyl-L-cysteine-sulfoxide (SMCO) [14]. In addition to these anaplasmosis, rabies and other encephalitides may also be considerations in cattle with CNS signs [16].

Public Health and Economic Significance

Public Health Significance: Some species of *Babesia* such as *B. microti* can affect healthy people; cattle parasites seem to cause disease only in people who are immunocompromised [1]. *Babesia divergens* causes serious disease in humans who have had splenectomies. This infection is rare; in Europe, approximately 30 cases had been reported as of 2003. It is characterized by the acute onset of severe hemolysis, hemoglobinuria, jaundice, persistent high fever, chills and sweats, headache, myalgia, lumbar and abdominal pain and sometimes vomiting and diarrhea [16]. Shock and renal failure may also be seen.

Babesia divergens infections in humans are medical emergencies. They usually progress within a week. With modern, antiparasitic drugs and supportive therapy, the case fatality rate is approximately 40%. Mild cases may resolve with drug treatment alone [8]. It is transmitted by tick. To prevent infection with *B. divergens*, immunocompromised individuals should be careful when visiting regions where babesiosis is endemic, especially during the tick season. Exposure to ticks should be prevented by wearing appropriate clothing [16].

Economic Significance: Bovine Babesiosis causes most serious economic loss to the livestock industry, endangering half a billion cattle across the world [1]. It is the most economically important of the diseases, because of direct losses of production and because of restriction of movement of cattle for trade by quarantine laws [9]. Many animals die or undergo a long period of convalescence entailing loss of meat and milk production [14]. The disease is also a barrier to improving productivity of local cattle by cross-breeding due to the high mortality of genetically superior but highly susceptible cattle, especially dairy cattle, imported from *B*abesia free areas [8].

Treatment: Treatment of babesiosis is most likely to be successful if the disease is diagnosed early; it may fail if the animal has been weakened by anemia. A number of drugs are reported to be effective against *Babesia*, but many of them have been withdrawn due to safety or residue concerns [8]. Animal was given Berenil 5 % (Diminazene Aceturate) injection at the dose rate of 1 ml/20 kg, intramuscularly. Berenil is an antiparasitic drug for treatment and control of protozoa infection in cattle, sheep, horses and dogs [19].

Imidocarb are the drug of choice for bovine babesiosis, which can prevent clinical infection up to 2 months [1]. It is used subcutaneously at a dose of 1.2 mg/kg for treatment while 3 mg/kg provides protection from *B. bovis* for 4 weeks and *B. bigemina* for at least 2 months. At the high dose, Imidocarb also eliminates *B. bovis* and *B. bigemina* from carrier animals and at either dose can interfere with the development of immunity following live vaccination [3].

Supportive treatment is advisable, particularly in valuable animals and may include the use of anti-inflammatory drugs. Blood transfusion may be life-saving in very anemic animals [23].

Prevention and Control: Active prevention and control of babesiosis is achieved by three main methods: immunization, chemoprophylaxis and vector control [1, 9]. Chemoprophylaxis: Imidocarb, the only chemo prophylactic on the market, provides protection from clinical disease for 3 weeks to 6 weeks but allows a sufficient level of infection for immunity to develop. Imidocarb is most toxic when given intravenously and intramuscular or subcutaneous administration is generally recommended. Side effects include coughing, muscular tremors, salivation, colic and local irritation at the site of injection following administration of high doses [12]. Tick control: The most commonly used acarcids are pyrethroid, foramidine and organophorus compound [24]. Environmental modification can also destroy tick habitats, but in some cases this may be difficult and/ or ecologically undesirable [16].

Vaccine for *Babesia*: Vaccination using live, attenuated strains of parasite has been used successfully in a number of countries, includes Argentina, Australia,

Table 2: Prevalence of bovine babesiosis from different area of Ethiopia.

Area	Staining techniques	Diagnostic Method	Prevalence	Reference
In and around Jimma Town, southwestern Ethiopia	Giemsa	Microscopic examination	23%	[10]
In and around Borena zone, southern Ethiopia	Giemsa	Microscopic examination	16.9%	[13]
In and around Assosa Woreda, Benishangul Gumuz Regional state, western Ethiopia	Giemsa	Microscopic examination	1.5%	[25]
In and around Debre-Zeit, central Ethiopia	Giemsa	Microscopic examination	0.6%	[26]

Brazil, Israel, South Africa and Uruguay. The vaccine is provided in either a chilled or frozen form. One vaccination produces adequate immunity for the commercial life of the animal; however vaccine breakdown have been reported [23].

Live Vaccine: Most live vaccines contain specially selected strains of *Babesia* (Mainly *B. bovis* and *B. bigemina*) and are produced in calves or in vitro in government-supported production facilities as a service to the livestock industries. Killed vaccine: prepared from blood of *B. divergens*-infected calves; little information available on level and duration of the conferred immunity [11]. Other vaccines: Despite the worldwide efforts, the prospects for recombinant vaccines against *Babesia* spp. remain challenging to date, no effective subunit vaccine is available commercially [16].

Status of Babesoisis in Ethiopia: Ticks and tick borne diseases cause considerable losses to the livestock economy of Ethiopia, ranking third among the major parasitic disasters, after trypanosomes and endoparasitism. Babesiosis is one of the most important diseases in Ethiopia because it occurs sometimes in acute forms with serious recognized clinical manifestations yet lowering the productive performance of the affected animals [8].

The study from Western Ethiopia Benishangul Gumuz Regional State, by reported the overall prevalence of 1.5% from which *B. bovis* was found to be 1.24% and *B. bigemina* was 0.248%. Furthermore, the reviewed study revealed that the highest prevalence was compiled during the autumn season (2.99%) followed by extremely low prevalence in the winter season (0.88%) [25].

Another study in and around Jimma town, southwest Ethiopia by reported overall prevalence rate of Bovine Babesiosis as 23% by Giemsa stained blood smears from these 33.33% is *B. bovis* and 62.96% is *B. bigemina*. Similarly the study at the same place revealed an overall prevalence rate of bovine babesiosis to be 12.8% [10]. Furthermore, another study in and around Debre-Zeit, central Ethiopia found prevalence of 0.6% of which equal prevalence of *Babesia bigemina* and *Babesia bovis* (0.3%) was found [26]. The result of microscopic examination of more recent study from Southern Ethiopia in Teltele District, Borena Zone, indicated the overall prevalence of 16.9% out of which two species of *Babesia* comprising of *B. bovis* (9.9%) and *B. bigemina* (7%) [13].

High prevalence of bovine babesiosis was reported in and around Jimma town, southwest Ethiopia compared to other study which is 23% [10]. In contrast, the study from Central Ethiopia, indicated low prevalence of bovine babesiosis (0.6%) [26].

CONCLUSION AND RECOMMENDATIONS

Bovine babesiosis is the most important a tick-borne disease of cattle worldwide that causes significant morbidity and mortality. *B. bovis* and *B. bigemina* are present in most areas of the world, with the greatest incidence between the latitudes of 32 °N and 30 °S, where their *Boophilus* tick vector commonly occurs. All *Babesia* are transmitted by ticks with a limited host range. The principal vectors of *B. bovis* and *B. bigemina* are *Rhipicephalus* spp. ticks and these are widespread in tropical and subtropical countries. Bovine Babesiosis causes most serious economic loss to the livestock industry, endangering half a billion cattle across the world. It is also the most economically important of animal diseases, because of direct losses of production and because of restriction of movement of cattle for trade by quarantine laws. Currently bovine babesiosis is widespread in Ethiopia with most prevalent species being *B. bovis* and *B. bigemina*. Therefore based on the above conclusions the following points are forwarded. Ethiopia should develop and implement surveillance systems and action plans to prevent bovine babesiosis from spreading. Awareness should be given to livestock owners in relation to vector control as one option of controlling bovine babesiosis. Various control strategies should be adopted in order to prevent the day to day increasing losses to livestock industry and vaccines should be practiced in control and prevention of babesiosis.

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