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Prevalence, risk factors and vectors identification of bovine anaplasmosis and babesiosis in and around Jimma town, Southwestern Ethiopia

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ABSTRACT

Among tick-borne diseases, bovine anaplasmosis and babesiosis are considered to be one of the most important in ruminants worldwide, causing significant economic losses in tropical and subtropical areas. This cross-sectional study was therefore undertaken from November 2016 to April 2017 with the objectives to assess the prevalence and potential risk factors associated with bovine anaplasmosis and babesiosis and also to identify the vectors involved in transmission of these diseases in and around Jimma town, south western Ethiopia. A simple random sampling technique was employed for selecting a sampling unit and logistic regression was used to determine the association of hypothesized risk factors with positivity for bovine anaplasmosis and/or babesiosis. A total of 408 bovine blood samples were examined for the presence of either anaplasmosis or babesiosis by Giemsa staining technique and overall prevalence of 11.7% babesiosis and 6.1% anaplasmosis were determined. Two *Babesia* species (2.2% *Babesia bovis* and 9.8% *B. bigemina*) and two anaplasma species (5.1% *Anaplasma marginale* and 1.2% *A. centrale*) were identified. Even though risk factors like age, body condition, management system, sex and presence of ticks were considered, only age ($p = 0.006$) and body condition ($p = 0.039$) were found to be significantly associated with anaplasmosis. Moreover, multivariable logistic regression analysis showed statistically significant association of babesiosis with age ($p = 0.003$), body condition ($p = 0.012$) and presence of ticks ($p = 0.005$). For both infections the mean PCV of infected animals was significantly ($p < 0.05$) lower than non-infected animals. Similarly, the mean body temperature of infected animals was significantly ($p < 0.05$) higher than non-infected animals. The overall 70.8% infestation of cattle with four tick species, namely *Amblyomma cohaerens* (58.5%) and *A. variegatum* (44.1%), *Rhipicephalus (Boophilus) decoloratus* (50.5%) and *R. evertsi evertsi* (12.9%) were recorded. A significant positive correlation was observed between the presence of *R. evertsi evertsi* ($p = 0.000$) and *R. (B). decoloratus* ($p = 0.000$) on the animals and positivity for bovine anaplasmosis. Besides, *R. (B). decoloratus* was found to be the only tick species which its presence on the animal was significantly correlated ($p = 0.000$) with babesiosis positivity. Conclusively, the study revealed a moderate prevalence of bovine anaplasmosis and babesiosis in the study area which need further investigations using modern serological and molecular techniques for the identification of the carriers the infections and identification of the potential vectors.

1. Introduction

Ethiopia is a resourceful country bestowed with estimated largest livestock population in Africa with cattle being the dominant livestock species accounting for approximately 58 million heads (CSA, 2016). The Livestock sector has a significant role in socioeconomic activity of the country and contributes much to the national economy which can be estimated at 19% of the total gross domestic product (GDP), 45% of the agricultural GDP and about 20% of the country's export earnings (Behnke and Metaferia, 2011). Furthermore, livestock industry is considered as a priority sector for poverty alleviation and there is

increasing demand for livestock products from national and regional markets (LMP, 2014). However, development of this sector is hampered by different constraints. The most important bottlenecks are widespread endemic diseases including viral, bacterial, and parasitic infestation (Leta and Mesele, 2013; Abdela, 2017). Besides, lack of appropriate disease control policy, lack of appropriate veterinary services and lack of attention from government is also another constrains (Leta and Mesele, 2013). Of health problem ticks and tick-borne diseases are widely distributed and contribute to important economic losses (Kumsa et al., 2014).

Ticks and tick-borne diseases affect the productivity of bovine in

tropical and subtropical parts of the world including Ethiopia and leads to a significant negative impact (Sitotaw et al., 2014; Abdela, 2016; Abdela and Bekele, 2016; Abdela and Jilo, 2016). Globally, four main tick-borne diseases (TBDs), namely anaplasmosis, babesiosis, theileriosis, and cowdriosis (heartwater) affect bovines (Jabbar et al., 2015). Among these anaplasmosis and babesiosis are important diseases with greater economic importance in tropical and subtropical regions (Filia et al., 2015; Constable et al., 2017). Babesiosis is a haemoprotozoan and anaplasmosis is a haemobacterial infection of cattle (Dumler et al., 2001). Both diseases have a serious economic impact due to obvious reason of morbidity, mortality and lowered working efficiency (Rahman et al., 2015) and have been reported in Ethiopia (Feleke et al., 2008; Sitotaw et al., 2014; Zerihun et al., 2014; Hamsho et al., 2015; Wodajnew et al., 2015).

The primary causative agent of bovine anaplasmosis is *Anaplasma marginale* and to a lesser extent, by *A. centrale,* a Gram-negative obligate intracellular bacteria parasitizing erythrocytes (Jabbar et al., 2015; OIE, 2015). Almost 20 tick species have been shown to transmit anaplasmosis experimentally (Kocan et al., 2004), and the most important tick genera are *Hyalomma* and *Rhipicephalus* species (Camus et al., 2010), which are widespread in Ethiopia (Sileshi et al., 2007; et al., 2010; Tesema and Gashaw, 2010). The most common causative agent of bovine babesiosis is hemoprotozoa *Babesia bovis* and *B. bigemina.* The principal vectors for this disease is Rhipicephalus (Boophilus) species (OIE, 2013) which are also common in Ethiopia including Jimma (Abebaw, 2004). Animals suffering from acute babesiosis or anaplasmosis can have a variety of symptoms such as fever, oculo-nasal discharge, increased heart rate, increased respiratory rate, abnormal mucous membrane colour, and low PCV values. Although these symptoms are very typical, they are not pathognomonic, and animals with chronic infections can be asymptomatic carriers (Kocan et al., 2010; El-Ashker et al., 2015).

Both anaplasmosis and babesiosis are not well studied in Ethiopia. However, from central Ethiopia recently Sitotaw et al. (2014) reported 1.6% *A. marginale* and 0.3% *A. centrale* using microscopic examination. Recently microscopic examination by Zerihun et al. (2014) reported 5.9% of *Anaplasma* spp. in Illubabor zone, Western Ethiopia. Babesiosis is also another most important TBDs disease in Ethiopia that occurs sometimes in acute forms with serious recognized clinical

manifestations (Wodajnew et al., 2015). Recently microscopic examination by Hamsho et al. (2015) and Wodajnew et al. (2015) reported an overall prevalence of 16.9% and 1.5%, respectively.

Despite the widely distribution of several tick species in all agro-ecological zones of Ethiopia (Abera et al., 2010; Tomassone et al., 2012; Ayalew et al., 2014), including Jimma (Abebaw, 2004; Yitbarek, 2004), little is known about the occurrence of tick-borne pathogenic bacteria and parasite like anaplasmosis and babesiosis. A few studies undertaken on these diseases were also failed to assess the correlation of different tick species with disease occurrence despite its significant role in disease transmission. Thus, there is scarcity of information on bovine anaplasmosis and babesiosis at national level and in Jimma in particular. In view of addressing the problem, the objectives of the present research is to bridge the information gap on bovine anaplasmosis and babesiosis and their vectors helping to generate base line data that may assist for designing effective disease control and prevention strategies.

Therefore, the objectives of this study were:

- To determine the prevalence and risk factors associated with bovine anaplasmosis and babesiosis in and around Jimma town.
- To identify different tick species associated with occurrence of bovine anaplasmosis and babesiosis in and around Jimma town.

2. Materials and methods

2.1. Study area

The study was conducted from November 2016 to April 2017 in and around Jimma town which is the town is located in the south western part of the Ethiopia in Oromia regional state (Fig. 1). Jimma town is found at distance of about 352 km from Addis Ababa, the capital city of Ethiopia. Geographically, it is located at 7°13′ and 8°56′N latitude and 35°52′ and 37°E longitude. The area has an altitude ranging between 880 and 3358 m above sea level. The annual rainfall is ranging between 1200 mm–2000 mm; and the annual temperature of the area ranges 7 °C–30 °C. Farmers in the area practices mixed crop-livestock agriculture. The zone is one of the major coffee growing areas in southwest part of Ethiopia. Furthermore, the zone is well known by livestock production which can be estimated at about 2,212,962 cattle, 866,561
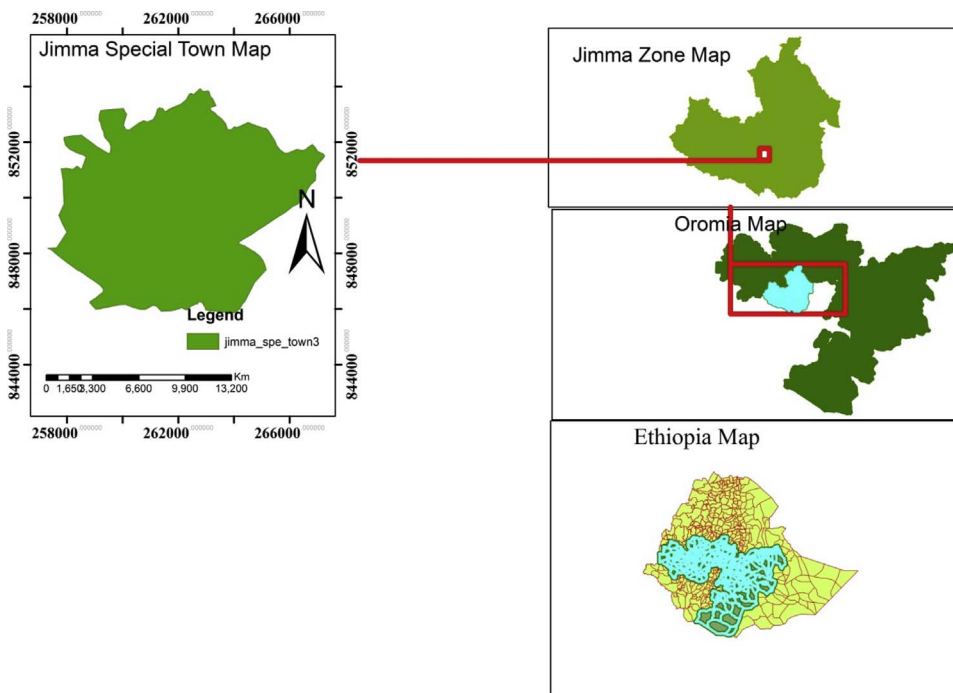

Fig. 1. Map of the study area.