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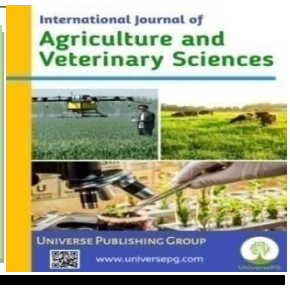


# Identification and Affliction of Ixodid Tick Species in Domestic Animals

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## ABSTRACT

Research on local breeds of cattle was conducted from November 2018 to April 2019 to identify major Ixodid ticks species and their prevalence. Sampled livestock from farmer associations was contingent selected by multistage sampling technique and then tested for tick infestation. Out of a total of 425 cattle examined, 120(28.57%) were infected with one or more tick strains. About 947 mature ticks were assembled and identified at the level of genes and species from animal organs. Three tick strains of three (3) genera (*Amblyomma, Boophilus, and Rhipicephalus*) were recognized. The one flesh prevalence of each strain was *A. variegatum* (61.08%), *B. decoloratus* (34.69%), and *R. evertsi evertsi* (4.11%). *A. variegatum* shows a higher preference for udder, scrotum and axial; *B. decoloratus* were dewlap and mainly available Neck, abdomen, and groin; R. *evertsi evertsi* prefers perianal and valva, and below the tail area of the body. Tested between different age and sex categories of animals, transmission was constructed to be statistically insignificant (P >0.05) whereas, transmission between body state values was constructed to be statistically significant (P <0.05). It has come to an end that conventional tick species may also be overseen for the infection Tick-borne abnormalities in addition to physical loss to the skin. Therefore, further studies should be carried out on tick burden and tick borne diseases thereby mitigating prevention and control strategies.

**Keywords**: Identification, Cattle, Mesela district, Affliction, Western hararghe, and Ixodid ticks.

## INTRODUCTION:

Africa has the largest livestock and draft animal population in the continent which has reached the count of approx 56,706,379 cattle's, 29,332,372 sheep, 29,112,953 goats, 2,033,105 horses, 400,319 mules, 7,418 donkeys, 1,164,116 camels, and 56,866,709 chickens in the country (CSA, 2014). In spite of the diverse population of animals, productivity in Ethiopia is low, and often below average for most East and Sub-Saharan African countries, due to prevailing animal diseases (bacterial, viral, protozoan agents of infection), poor nutritional status, ectoparasitic. Effective management of activity, reproductive insufficiency and existing limitations (Bekele *et al.*, 2010).

Vectors and vector-borne diseases constitute major obstacles to the development of viable livestock industries (Mekuria, 1987). Among them, ticks and tick-borne disease outbreaks (TBDs) are prevalent throughout the world, especially in humid and subtropical countries, which are of great productive importance in livestock production (Kettle, 1995). It is estimated that 80% of the world's livestock population is exposed to tick infestation (FAO, 1984). The annual productive losses caused due to ticks and tick-borne diseases in cattle alone, are estimated at 13.9 to 18.7 billion USD worldwide (de Castro, 1997). The problem is persistent and severe in developing countries where the available resources for the control and

eradication of ticks and TBD are restricted. In most parts of Africa, including Ethiopia, tick and TBD such as babesiosis, cowdriosis and anaplasmosis has economic significance. In Ethiopia, ticks are external parasites or ectoparasites that are considered responsible for maximum economic loss due to livestock infestations, particularly affecting cattle (Solomon *et al.*, 2001). Several species of ticks belonging to the genus *Amblyomma*, *Boophilus*, *Rhipicephalus*, *Hyalomma*, and *Haemaphysalis* have been reported. Existing records are suggestive of considerable losses to the livestock and the economy of Ethiopia, ranking it third among the major parasitic diseases prevalent in the country. The environmental condition and vegetation of Ethiopia was considered as highly conducive for the vectors, and the associated diseases they cause (Pegram *et al.*, 1981). Besides disease transmission, ticks inflict heavy economic losses. Tick infestations are severe in different parts of Ethiopia and at a conservative estimate; one mil-lion USD is lost annually to the rejection of down-graded hides and skin, on account of the damage caused by ticks. It is estimated that an annual loss of 5,000,000 USD is incurred due to the downgrading of hide and skin having been affected by ticks, and approximately 65.5% of the major defects associated with hides in eastern Ethiopia were due to ticks (Hayle *et al*., 2020; Bekele, 2002; Gashaw, 2005).

Investigations aimed at determining the extent of infection and the type of species involved will play a great role in designing strategic control of these parasites. Moreover, identification to a species level will help in the diagnosis of various tick-borne diseases and their respective control programs. Even though Ethiopia confronts considerable losses due to tick contagions, and present research has reported the distribution and plentifulness of tick species across various parts of the country, there are no evidences supporting the species identification and distribution of hard ticks. Therefore, the main objectives of this research were: to analyse the prevalence of ixodid ticks and identify them in the analysis area; to provide baseline data on the relative dissemination of tick species.

## MATERIALS AND METHODS:

### Study Area Description

The research study was convoyed in Mesela Shanan Dhugo (SD) district and partial collaborated work was conducted in Bangladesh and South Korea. Mesela is located in Western Hararghe zone of Oromia region, Ethiopia. It is situated 395 km East of Finfine and 74 km from Chirozonal town. The district has daily mean temperature ranging from $14^0$C-$34^0$C and mean annually rain fall ranging from 460mm-930 mm. The agro ecological zone of the district highland 20%, amid highland 60% and desert 20% and its altitude is between 1200-2700m, and the soil type is silt, sand and clay. The livestock population of the district are 82,137 cattle, 31,507 goats, 15,746 sheep's, 68,683 poultry, 8315 donkeys, and 198 horses & 188 mules. The total area coverage of the district is 65,440.95 hectares, of which 21,584 hectare is cultivated land, 5769.55 hectare is forest land, and 17153.522 hectare is bush land, 11,523.05 hectare is miscellaneous land and others. The district has 25 peasant associations and one town with total human population of 151,698 of which male 76,864 and female 74,834 (ARDO, 2014).

### Area and Study Population

The research animal is local breed of cattle belonging to six selected farmer associations of Mesela (SD) district. Farmer associations were selected on the basis of their accessibility to transport.

### Planning and Study Design

A cross-sectional survey was conducted on local breed cattle found in and around Mesela (SD) district, from November 2018 to April 2019 to identify the main Ixodid ticks, their predilection sites and tick burden, body condition score among different age groups, and gender of animals.

### Determination of Sample Size and Sampling

Animals sampled from six farmer associations in Mesela (SD) district were selected by multi-stage sampling technique. The names of the sampled attendants and their respective animals were recorded in the prepared format to avoid the risk of repeat sampling. The sample size required for the study was analysed by the formula given by Truesfield, (1995) 50% expected prevalence, 5% desired precision and 95% confidence interval. Although, the necessary sample size was calculated as 384, a total of 425 animals were tested to increase the accuracy of the investigation.

$$n = \frac{1.96^2 P_{exp}(1-P_{exp})}{d^2}$$

Where, n = needed sample size

$P_{exp}$= expected prevalence

d= desired precision

### Identification and Tick Sample Collection

The entire body surface of animals was thoroughly examined and adult ticks were collected from one side of the animal's body and placed in a universal bottle containing (10%) formalin. The bottles were labeled according to the location of predetermination and animal samples were taken and then sent to Hirna Regional Veterinary Laboratory. All assembled ticks were analysed under a stereomicroscope and identified to strains level using the taxonomic key described by Kaiser, (1987) and Walker *et al.* (2003).

The number of ticks from each animal's half-body zone was doubled to capture an equal number of ticks on both sides of an animal. Ticks are generally characterized by base of capituli, ornamentation of scutum, festoon, Coxae I, xenothosoma length, site preference and host location.

### Data Analysis and Entry

Assembled data were pushed and managed in Microsoft Excel and then descriptive statistics were performed using SPSS software version 19. Tick prevalence was analysed by dividing the number of positive samples by the total number of samples size, and is expressed as a percentage. Descriptive statistics were used to show the favoured predilection sites of tick species. $\chi 2$ test with a calculated P-value less than 0.05 was used to evaluate the statistical significance of tick infection rates with sex, age group as well as animal body state scores.

## RESULTS

Out of a total of 425 animals examined, 120(28.57%) were found to be invade with one or more ticks. Baha Biftu and Aba Kabsi were found to have the highest and lowest ubiquity of tick infestation at 41.42% and 22.85%, respectively, among the farmer associations (**Table 1**).

**Table 1:** Prevalence of the tick affliction among peasant association.

| Peasant association | Examined animals | Infested animals | Prevalence (%) |
|---|---|---|---|
| Aba Cabsi | 70 | 21 | 30 |
| Baha Biftu | 70 | 29 | 41.42 |
| Lubu Dhekeb | 70 | 16 | 22.85 |
| Meyra Lalisa | 70 | 18 | 25.71 |
| Rakobas | 70 | 17 | 24.28 |
| Salama | 75 | 19 | 27.14 |
| **Total** | **425** | **120** | **28.57** |

From the total of 947 ticks collected, 3 genera and 3 strains were explored, of which *A. variegatum* accounts 579 (61.08%), *B. decoloratus* 327 (34.69%) and *R. evertsi evertsi* 39 (4.11%). From the total count, *A. variegatum* was the dominant tick species (61.08%) and *R. evertsi evertsi* (4.11%) was the least. The higher proportion of ticks was collected on animals from Baha Biftu (19.62%) while the lower on animals from Aba Cabsi (11.81%) (**Table 2**).

**Table 2:** Distribution of the tick strains in the peasant association.

| Peasant association | Tick species | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *A. variegatum* | | *B. decoloratus* | | *R. evertsi evertsi* | | Total | |
| | No | % | No | % | No | % | No | % |
| Aba Cabsi | 72 | 64.58 | 34 | 30.35 | 6 | 5.35 | 112 | 11.81* |
| Baha Biftu | 122 | 65.59 | 58 | 31.18 | 6 | 3.22 | 186 | 19.62** |
| Lubu Dhekeb | 116 | 73.41 | 36 | 22.78 | 6 | 3.79 | 158 | 16.66 |
| Meyra Lalisa | 98 | 67.12 | 48 | 32.87 | 0 | 0 | 146 | 15.40 |
| Rakobas | 80 | 49.38 | 82 | 50.61 | 0 | 0 | 162 | 17.08 |
| Salama | 91 | 50 | 69 | 38.04 | 21 | 11.95 | 184 | 19.40 |
| **Total** | **579** | **61.08**** | **327** | **34.69** | **39** | **4.11*** | **947** | **100.00** |

**Highest, *Slowest prevalence

**Table 3:** Association among tick affliction, sex, duration, and age of animals by $x^2$.

| Parameters | Sex | | Age | | |
|---|---|---|---|---|---|
| | Male | Female | <1 year | 1-3 years | >3 years |
| Number of Animal tested | 206 | 219 | 29 | 141 | 250 |
| Infested animals | 50 | 68 | 6 | 37 | 75 |
| **Prevalence (%)** | **23.75** | **31.24** | **23.13** | **26.24** | **29.4** |

Sex: $x^2$= 2.882, P-value= 0.09 and age: $x^2$= 1.064, P-value = 0.587

Out of 425(206 male and 219 female) cattle tested for tick affliction, 51(23.75%) male and 69(31. 24%) female cattle were found positive for the presence of ticks on their skin. The highest number of tick afflictions (75 out of 120) was found in cattle over 3 years of age and the least (6 out of 120) in calves. In different age and sex groups of animals tested, transmission was found to be statistically insignificant (P >0.05) (**Table 3**).

**Table 4:** The association between tick affliction and body condition of the animals by $x^2$.

| Parameters | Body condition status | | |
|---|---|---|---|
| | Poor | Good | Total |
| Animal tested | 26 | 399 | 425 |
| Infested animals | 12 | 106 | 120 |
| **Prevalence (%)** | **60.90** | **25.81** | **28.57** |

Body condition: $x^2$=12.035, P= 0.001

Out of the total animals examined, 26 and 399 cattle respectively were in good physical condition. 11 out of 26 poor condition animals (60. 90%) and 106 out of 399 good condition animals (25.81%) were positive for ticks on their skin whereas infection was not statistically significant in body state scores (P <0.05) (**Table 4**).

**Table 5:** Distribution of the ticks in different parts of body of animals.

| Predilection sites | Tick species | | | | | | |
|---|---|---|---|---|---|---|---|
| | *A. variegatum* | | *B. decoloratus* | | *R. evertsi evertsi* | | Total |
| | No | % | No | % | No | % | % |
| Dewlap and neck | 5 | 0.86 | 234 | 71.34 | - | - | 25.21 |
| Belly and groin | 15 | 2.58 | 70 | 21.34 | - | - | 8.96 |
| Axial | 120 | 20.68 | 4 | 1.21 | 2 | 5 | 13.29 |
| Scrotum | 209 | 36.03 | 12 | 3.65 | - | - | 23.31 |
| Vulva and perianal | - | - | - | - | 35 | 87.5 | 2.69 |
| Tail | 1 | 0.17 | 2 | 0.60 | 2 | 5 | 0.52 |
| Udder | 230 | 39.65 | 6 | 1.82 | 1 | 2.5 | 25 |
| **Total** | **580** | **61.08** | **328** | **34.69** | **40** | **4.11** | |

Ticks were assembled from seven body areas such as dewlap and neck, abdomen and groin, axilla, testicles, vulva and perianal, tail and sole. Various species of ticks are found to prefer different predilection sites where *A. variegatum* is mainly found in the soles, testicles and axils, whereas *B. decoloratus* is found in abundance on the dewlap and neck and abdomen and groin and *R. evertsi evertsi* predominates in the perianal area. The vulva and the underside of the tail of the animals tested (**Table 5**).

## DISCUSSION:

The dissemination and multitude of cattle, the most common tick stains in Ethiopia, varies widely from one region to another. In this research, a total of 948 ticks were assembled from a total of 425 local breeds with an overall ubiquity of 28.57%. This finding agrees with the results of Belew & Mekonnen, (2011) and Asrate & Yalew, (2012). However, this is numerous from the findings of Nigatu & Teshome, (2012) and Alemu *et al*. (2014) who reported an overall ubiquity of 88.4% and 80.25%, respectively. This difference may be due to differences in agro-climatic conditions of the study area. Tick activity was influenced by rainfall, altitude and at-mospheric relative humidity (Pegram *et al*., 1981). The three genera of the hard ticks were explored; *A. variegatum*, *R. evertsi evertsi,* and *B. decolouratus* were the species of ticks explored in the study area. *A. variegatum* was the most abundant of all tick species comprising 61.08% of the ticks collected at the study site and this result is in agreement with various reports made by other authors in different parts of Ethiopia viz Naser (1985) and Michael, (1993) in Wolaita zone, Tessema & Gashaw, (2010) in Assela *et al*. (2011) in Holeta *et al*. (2012) in Haramaya. This may be due to the fact that *A. variegatum* is the most polpular and widely allocated cattle tick in Ethiopia (Morel, 1980; Pegram *et al*., 1981; Assefa, 2004). It has a great productive importance, because it is an efficient vector of *Cowderiaruminatum*, *Theleriamutan, Theleriavelifera*, and viral diseases, Nairobi sheep disease and also aggravates the situation of bovine dermatophilosis (Sileshi *et al*., 2007). Among the tick stains *A. variegatum* causes the greatest loss to hides and skin because of its long mouth part which extends the commodity valueless on world market if the ticks are in high number

(Taylor *et al*., 2007). *B. decolouratus* was identified as the second tick species at the study site constituting 34.69% of the total tick collection. This species is known to be widely distributed in the central Rift Valley region of Ethiopia (Pegram *et al*., 1981; Solomon *et al*., 2001) and this result is agreed with the reports of Asrate & Yalew, (2012) in Haramaya. But this finding is disagreed with the reports of Teshome *et al*. (1995); Shiferaw, (2005) in Wolaita zone, Tamiru, (2008) in Assela *et al*. (2013) in Southern Nations, Nationalities, and People's Region**,** who reported highest prevalence in their study area, and Sileshi *et al*. (2007) who described that *B. decolaratus*is the commonest and The most widespread tick in Ethiopia, collected in all administrative regions except Afar region. This may be due to geographical location and altitude factors. One-host ticks of the genus *Buphilus* that parasitize livestocks are a hindrance to livestock farming in humid and subtropical countries. They convey the causative agents of anaplasmosis and babesiosis in cattle (Walker *et al*., 2003). *R. evertsi evertsi* was the third most abundant tick species constituting 4.11% of the adult ticks collected is comparable to the results of Solomon *et al*. (2007). Hogstral, (1956) described its wide distribution throughout the Ethiopian faunal region. Pegram *et al*. (1981) It has been reported that this species does not show a specific preference for a particular altitude, rainfall zone or seasons; *R. evertsi evertsi* has small mouthparts with which it feeds on soft surfaces. Consequently, it is a potential vector of Babesia, Theleria and Rickettsia (Kettle, 1995) and it is also known to cause tick paralysis in Harar, Ethiopia (Morrell, 1980). The proportion of tick infestation was higher in animals with poor body condition (60.90%) than in animals with good body condition (25.81%). It was known that animals are less resistant to tick infection due to poor physical condition and lack sufficient physical potential to develop resistance with increasing age. Several authors have reported high infestations of ticks results in poor body state due to losses of high amounts of blood and fluid by ticks (Bianchi *et al.*, 2003) reported that the British cattle breeds having the lowest body state score under tropical conditions had the highest affliction of ticks (Kettle, 1995; Bianchi *et al.*, 2003; Gazali, 2010) reported that tick load animal is affected by breed and nutritional stress. Ultimately, this factor affects general body state, which affects blood component, respiration rate, appetite, and ultimately leads to a poor body state score. This current research is in agreement with the previous studies mentioned above. In terms of predilection sites for attachment, different tick's stains show different site preferences. *A. variegatum is* found in udder, scrotum and axial whereas the *B. decoloratus* species were found on the dewlap and neck and belly and groin. *R. evertsi evertsi* shows high preference for perianal and vulva followed by lower tail region. In the current study tick affliction rate was 24.21% on dewlap and neck, sole (25%), scrotum (22.31%), axilla (12.29%) and groin and abdomen (7.96%). Factors such as host density, interactions between tick species, time and season, and accessibility to grooming determine tick attachment sites (Solomon & Kassa, 2001). The predilection sites found in this study were in line with those reported by Siyoum, (2001) and Behailu, (2004) in their study conducted in North Wollo zone and Asella, respectively. The main choice for tick control in the Mesela (SD) district is the use of acaricides. Currently Ivermectin and organophosphate acaricides are the most commonly used chemicals. Tick control can also be achieved by attacking one or more larval stages along the life cycle chain (FAO, 1984). In addition to acaricide application, appropriate livestock management, zero-grazing, breeding of tick-resistant cattle and implementation of traditional practices are quite important.

## CONCLUSION AND RECOMMENDATIONS:

Important and abundant tick species to investigate in this study area were *A. variegatum, R. evertsi evertsi and B. decoloratus.* Acaricide application is the main method of tick control in the district. However, the attention given to infection control was not enough. One should manage the tick at an economically acceptable level It requires a combination of techniques and tick knowledge species identification, prevalence and an understanding of their epidemiology. This includes selection Tick resistant cattle, acaricide treatment, appropriate livestock management, evaluation and incorporation of traditional practices or remedies that appear to be of value.

In light of the above conclusion the following recommendations are forwarded -

1) More surveillance should be given to integrated tick control options through the use of one or more methods like appropriate pasture management in communal grazing area and increase of

good nutrition plane to get good performance of productive breeds in the area.

2) Tick control activities (application of acaricides) should be planned and applied on regular basis depending on the seasonal variations.

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**CONFLICTS OF INTEREST:**

The author's declare that the manuscript has no competing interests to the publication.

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