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Classification and Disease Transmission by Ixodid Ticks in Household Animals

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ABSTRACT

From November 2018 to April 2019, researchers looked at local cow breeds to find out how common certain Ixodid tick species were. In order to test for tick infestation, a multistage sampling approach was used to contingently choose animal samples from farmer organizations. Tick infections were detected in 120 (28.57%) of the 425 cattle tested. Assembled and identified at the gene and species level from animal tissues were about 947 adult ticks. The three tick species identified belonged to the Amblyomma, Boophilus, and Rhipicephalus genera. Each strain had a single flesh prevalence: A. variegatum (61.08%), B. decoloratus (34.69%), and R. evertsi evertsi (4.11%). Although A. variegatum is more often found on the udder, scrotum, and axial regions, B. decoloratus is more commonly seen dewlapped and is more abundant. Areas below the tail, perianal and valva, as well as the neck, belly, and groin are preferred by R. evertsi evertsi. Transmission was shown to be not statistically significant ($P > 0.05$) when tested across various age and sex groups of animals, however it was found to be statistically significant ($P < 0.05$) when tested across body state values. Conventional tick species are now also under scrutiny for tick-borne infections and abnormalities, in addition to skin damage. Consequently, in order to alleviate preventive and control methods, further research on tick load and tick-borne illnesses is necessary.

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

INTRODUCTION:

With an estimated 56,706,379 cattle, 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 poultry, Africa is home to the biggest livestock and draft animal population on the continent (CSA, 2014). Ethiopia has a diversified animal population, but its productivity is low compared to other East and Sub-Saharan African nations. This is because of the prevalence of animal illnesses such as ectoparasitic infections, inadequate nutrition, and viruses. Bekele et al. (2010) outlined the challenges of effective activity management, reproductive insufficiency, and current limits.

The establishment of successful cattle industries is hindered by vectors and illnesses transmitted by them (Mekuria, 1987). Globally, ticks and tick-borne diseases (TBDs) are a major problem, particularly in humid and subtropical regions where cattle production is very important (Kettle, 1995). Eighty percent of the world's cattle are at risk of tick infection, according to the FAO (1984). Ticks and illnesses transmitted by ticks cost the global cattle industry an estimated $13.9–$16.7 billion per year in lost productivity (de Castro, 1997). In underdeveloped nations, where funds for prevention and control are few, the problem is both pervasive and severe.

Tick and tick-borne disease eradication efforts are limited. The tick-borne diseases (TBDs) babesiosis, cowdriosis, and anaplasmosis are economically significant in much of Africa, including Ethiopia. The most significant economic loss in Ethiopia

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occurs as a result of tick infestations in cattle and other animals (Solomon et al., 2001). Ticks are ectoparasites, or external parasites. It is known to include ticks of the genera Amblyomma, Boophilus, Rhipicephalus, Hyalo-mma, and Haemaphysalis. According to historical data, this parasitic illness ranks third in Ethiopia, causing significant economic and animal losses. It was thought that the vegetation and climatic conditions in Ethiopia were ideal for the vectors and the illnesses they spread (Pegram et al., 1981). In addition to spreading diseases, ticks do significant financial harm. At a conservative estimate, one million USD is wasted each year due to the rejection of downgraded skin and hides caused by tick damage; tick infestations are significant in many regions of Ethiopia. Approximately 65.5% of the principal faults in eastern Ethiopian hides were caused by ticks, and the downgrading of tick-affected skin and hides is anticipated to cost five million USD per year (Hayle et al., 2020; Bekele, 2002; Gashaw, 2005).
Strategic management of these parasites may be greatly advanced by investigations of the magnitude of infection and the species involved. In addition, the diagnosis of tick-borne diseases and the implementation of control programs may be facilitated by species-level identification. There is little evidence to support the identification of hard tick species or their distribution, despite the fact that tick infections cause significant losses in Ethiopia and that current research has shown the abundance and dispersion of tick species throughout the nation. Based on this, the primary goals of this study were to(1) determine the relative distribution of tick species and(2) identify and assess the prevalence of ixodid ticks in the study region.

MATERIALS AND METHODS:

Study Area Description

A portion of the research was carried out in South Korea and Bangladesh, but the most of it was carried out in Mesela Shanan Dhugo (SD) district. The name Mesela
Its precise location in Ethiopia's Oromia region is the Western Hararghe zone. It lies 395 kilometers east of Finfine and 74 kilometers from the town of Chirozonal. Average yearly rainfall in the district ranges from 460 millimeters to 930 millimeters, while daily temperatures range from 140 to 340 degrees Celsius.
Oh, my. The district's agro-ecological zone is characterized by silt, sand, and clay soils; its elevation ranges from 1200 to 2700 meters; and its terrain consists of highland 20%, mid-land 60%, and desert 20%. Within the district's animal population, there are 82,137 cows, 31,507 goats, 15,746 sheep,
There were 68,683 chickens, 8,315 donkeys, 198 horses, and 188 mules. The district covers a total of 65,440.95 hectares, with 21,584 hectares dedicated to culture, 5769.55 hectares to forests, 1,715.322 hectares to bushland, 11,523.05 hectares to other uses, and the remaining area to be determined. A total of 151,698 people, including 76,864 men and 74,834 females, live in the district's 25 peasant associations and 1 town (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 atten- dants 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.

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

Where, n = needed sample size
P_{exp}= expected prevalence
d= desired precision

Identification and Tick Sample Collection

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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 assem- bled 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 Micro- soft Excel and then descriptive statistics were perfor- med using SPSS software version 19. Tick preva- lence was analysed by dividing the number of posi- tive 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 signi- ficance 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* ac- counts 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 ani- mals 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

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	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 affli- ctions (75 out of 120) was found in cattle over 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

years of age and the least (6 out of 120) in calves. In different age and sex groups of animals tested, trans- mission was found to be statistically insignificant (P >0.05) (**Table 3**).

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, tes- ticles, vulva and perianal, tail and sole. Various species of ticks are found to prefer different pre- dilection sites where *A. variegatum* is mainly found in the soles, testicles and axils, whereas *B. deco- loratus* 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:

Cattle ticks are the most prevalent ticks in Ethiopia, however their distribution and abundance may vary greatly from one area to another. Ticks comprising 948 individuals from 425 different local breeds were used in this study, yielding an overall ubiquity rate of 28.57%. Both Belew and Mekonnen (2011) and Asrate and Yalew (2012) came to similar

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conclusions. The results of Alemu et al. (2014) and Nigatu & Teshome (2012), who found a total ubiquity of 80.25 and 88.4 percent, respectively, show that this is rather common. Possible explanations for this discrepancy include regional variations in the agroclimate. Tick behavior

factors such as precipitation, elevation, and atmospheric relative humidity were considered (Pegram et al., 1981). In the study region, researchers looked for ticks belonging to three genera: A. variegatum, R. evertsi evertsi, and B. decoloratus. The study found that A. variegatum ticks made up 61.08% of the total tick population. This finding is in line with previous research in other regions of Ethiopia, including the Wolaita zone (Nasser, 1985; Michael, 1993; Tessema & Gashaw, 2010; Assela et al., 2011; Holeta et al., 2012). Assefa (2004), Morel (1980), and Pegram et al. (1981) all found that A. variegatum is the most common and extensively distributed tick among Ethiopian cattle. Its productive value is high due to the fact that it is a vector for many illnesses, including Cowderiaruminatum, Theleriamutan, Theleriavelifera, and viruses; it also worsens the status of bovine dermatophilosis (Sileshi et al., 2007). The longest-mouthed tick, A. variegatum, is responsible for the most damage to skin and hides, rendering the product worthless. worldwide market if the tick population is large

The source is Taylor et al. (2007). The research site tick sample included 34.69 percent B. decoloratus, the second tick species discovered. Consistent with the findings of Asrate and Yalew (2012) in Haramaya, this species is known to be prevalent throughout Ethiopia's central Rift Valley area (Pegram et al., 1981; Solomon et al., 2001). In contrast to this finding, other research has shown that B. decolaratus is the most common and widespread tick in Ethiopia, collected in all administrative regions except Afar. This contradicts the findings 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, and Sileshi et al. (2007) in their study area. Possible causes include variables related to geographical location and altitude. cattle husbandry in humid and subtropical areas is hindered by one-host ticks of the species Buphilus, which parasitize cattle. Anaplasmosis and babesiosis are cattle diseases that they transmit (Wal-ker et al., 2003). This finding is in agreement with that of Solomon et al. (2007), which found that R. evertsi evertsi made up 4.11 percent of the adult ticks that were collected. Its extensive spread in the Ethiopian faunal area was detailed by Hogstral (1956). One study conducted by Pegram et al. in 1981 R. evertsi evertsi feeds on soft surfaces with its tiny mouthparts; reports indicate that this species does not exhibit a predilection for a particular height, rainfall zone, or season. Because of this, it may transmit diseases including Rickettsia, Babesia, and Theleria (Kettle, 1995). In the Ethiopian city of Harar, it has also been shown to paralyze ticks (Morrell, 1980). Animals in poor health had a greater percentage of tick infections (60.90%) compared to those in excellent health (25.61%). It was previously known that animals' weaker physical state and lack of significant physical ability to acquire resistance to tick infections diminish with age. Several authors have found that tick infestations lead to poor body state because ticks drain a lot of blood and fluid. For example, Bianchi et al. (2003) found that British cattle breeds with the worst body state scores in tropical climates also had the highest tick infestations. Other sources, such as Kettle (1995), Bianchi et al. (2003), and Gazali (2010), found that breed and nutritional stress affect tick load ani-mal. An individual's vitals, including their blood pressure, heart rate, respiration rate, hunger, and overall health, are all impacted by this aspect. causes a low bodily state score in the end. The results of this new study corroborate those of the aforementioned investigations. The stains left behind by various ticks reveal their attachment preferences. The udder, scrotum, and axial regions are inhabited by A. variegatum, whereas the dewlap, neck, belly, and groin regions are inhabited by B. decoloratus. The lower tail area is the second most popular spot for R. evertsi evertsi, after the perianal and vulva regions. The present research found that 24.21% of participants had tick bites on their dewlap and neck, 25% on their sole, 22.31% on their scrotum, 12.29% on their axilla, and 7.96% on their groin and abdomen. According to Solomon and Kassa (2001), tick attachment locations are determined by factors such host population, interactions between tick species, time of year, and accessibility to grooming. This study's preference locations were consistent with those reported by Siyoum (2001) in the North Wollo zone and Behailu (2004) in Asella. Ticks in the Mesela (SD) area are mostly controlled using acaricides. At the moment, the chemicals that are most often utilized include organophosphate acaricides and ivermectin. Another strategy for tick management is to target

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certain phases of the tick life cycle, namely the larval stage (FAO, 1984). Implementing traditional techniques, zero-grazing, managing livestock appropriately, and breeding tick-resistant cattle are all crucial, in addition to the use of acaricides.

CONCLUSION AND RECOMMENDATIONS:

A. variegatum, R. evertsi evertsi, and B. decoloratus were three of the most prevalent and important tick species to research in this region. The area mostly uses acaricide applications for tick management. But there wasn't enough focus on infection management. An economically acceptable amount of tick management is required. Tick identification, prevalence, and epidemiology knowledge, in addition to technical expertise, are necessary. Included in this are the following: selecting tick-resistant cattle; treating with acaricides; managing livestock appropriately; and evaluating and incorporating traditional treatments or cures that show promise.
Based on the above findings, we suggest the following -
1) More attention should be paid to integrated tick management approaches, which include monitoring tick populations using one or more ways, such as increasing the number of feed the area's productive breeds well so they may perform at their best.

2) Activities to manage ticks, such as applying acaricides, should be scheduled and carried out regularly, taking into account seasonal changes.

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