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Epidemiological Distribution of Tick Infestation in Bovine and its Associated Risk Factors in and Around Dilla Town, Gedeo Zone, Southern Ethiopia

Dessalew Shitu

National Institute for Control and Eradication of Tsetse Fly and Trypanosomosis,
Kaliti Tsetse flies Mass Rearing and Irradiation Center, P.O. Box: 19917, Addis Ababa, Ethiopia

Abstract: A cross-sectional study was conducted from November 2013 to February 2014 to assess and identify the prevalence of major ixodid tick species and associated risk factors with tick infestation on cattle in and around Dilla town of Southern Ethiopia. Adult ticks were collected from 384 local and cross breed cattle which were kept under different management systems. A total of 2010 adult ticks were collected and identified to their genera and species level. Two genera and four species were recorded, in which two species each belong to the genus *Amblyomma*, two species belong to the genus *Rhipicephalus*. Of all the total ticks collected, *Amblyomma* and *Rhipicephalus* constituted, 53.93 %, % and 46.07 % respectively. The adult tick species identified were *Amblyomma variegatum* (32.84 %), *Amblyomma cohaerens* (21.09 %), *Rhipicephalus* (formerly *Boophlus*) *decoloratus* (27.36 %) and *Rhipicephalus e. eversi* (18.71 %). The average burden of adult tick infestation was 16.21 ticks per animal. In this study, local breeds, old aged, poor conditioned animals and free grazing cattle had significantly higher prevalence of tick infestation than their contemporaries (P-value < 0.05 for each factor). Therefore, to reduce and avoid losses incurred by ticks and tick-borne diseases, cost effective tick control programs should be formulated and implemented in the study area incorporated with selection of tick resistant breeds of cattle, good management systems and participating and awareness creation of livestock owners regarding tick control and prevention methods.

Key words: Ticks · Prevalence · Cattle · Dilla · Ethiopia

INTRODUCTION

Ethiopia has the largest number of livestock in Africa including more than 38 million cattle, 30 million small ruminants, greater than 1 million camels, 4.5 million equines and 40 million chicken with livelihoods of an estimated 80% of the rural population and livestock production plays a major role in the overall development of Ethiopia`s agriculture [1]. Nevertheless, cattle productivity is low like other developing countries in the country [2]. Livestock is a “Living bank” or “Living account” for the rural and urban poor, farmer, or animal owners`. They serves as a financial reserve for periods of economic distress such as crop failure; as well as a primary cash income [3]. There is a growing demand for meat, milk and eggs to improve the nutritional status of the production. Hides and skins are important components of the agricultural center in generating foreign export earnings; draft animals provide power for cultivation of many peasants` agricultural holdings [4].

However, many factors affect the maximum benefit to be obtained from livestock. Among these, parasitic diseases are the global problems and considered as a major obstacle in the health and product performance of livestock. These may be due to end parasites that live inside the body or ecto-parasites such as ticks, mites, fleas, midges, etc., which attach to the body of animals. Among ectoparasites, ticks are very important and harmful blood sucking external parasites of mammals, birds and reptiles throughout the world [5]. Tick and tick borne diseases are regarded as one of the major constraints for livestock productivity in Africa [6].

Corresponding Author: Dessalew Shitu, National Institute for Control and Eradication of Tsetse Fly and Trypanosomosis, Kaliti Tsetse flies Mass Rearing and Irradiation Center, P.O. Box: 19917, Addis Ababa, Ethiopia.

Vector and vector borne diseases are also the associated constraints to the development of viable livestock industries, where ever they occur [5].

Ticks cause a great economic losses livestock in the world due to skin damage, treatment costs, losses associated with the transmission of tick-borne diseases and the direct negative effect on animal productivity [7, 8]. In Ethiopia, there is an estimated loss of US$50000 annually through rejection or down grading of hides and skins from these tick damages and burden [9].

Even though, some studies were conducted in some parts of the country regarding tick infestation in cattle, there was no previous study conducted in the current area. Therefore, the main objective of this study was to assess and to determine the existing tick species and their distribution on cattle and associated risk factors as well as to generate recommendations on the control and prevention methods for tick infestation.

MATERIALS AND METHODS

Study Area: The study was carried out in five selected kebeles of Dilla district in Gedeo zone, South Nations, Nationalities and Peoples Regional States (SNNPRS). Dilla is located at 359 km South of Addis Ababa and 90 km South of Hawassa. Geographically, Dilla town fall between 38°18´30´´E latitude and 6° 24´ 30´´ longitude. Dilla town is located with an elevation of 1570 meters above sea level. The town has a mean annual temperature of 30.2°C and annual rain fall of 1333.1 mm [10].

Study Design and Study Population: A cross sectional study was conducted on local and cross breed cattle, found in and around Dilla Town, from November 2013 to February 2014 to identify the prevalence of major ixodid tick species, their predilection sites and tick burden in different age groups, breeds and sex of animals which kept under different type management systems.

Sampling and Sample Size Determination: The sample animals were selected by systematic random sampling technique from five selected kebeles in and around Dilla town. Since there was no previous study done in the area, the sample size was determined based on the expected prevalence of 50% and the absolute desired precision of 5% at a 95% confidence level. As a result, a total of 384 bovine species were sampled according to the formula [11] given below.

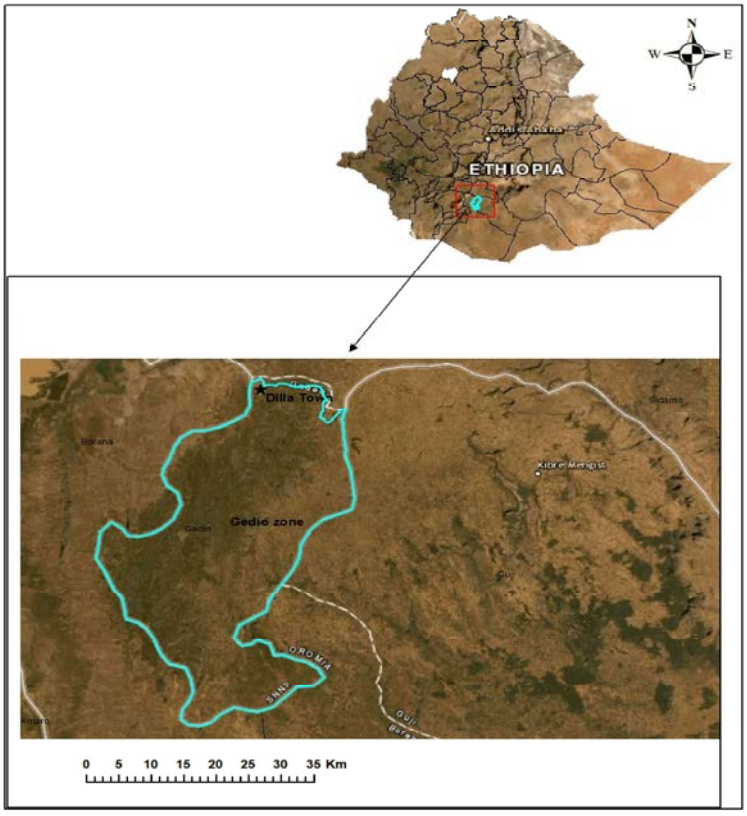

Fig. 1: Map of study area.

$$n = \frac{1.96^2 pq}{d^2}$$

where
n = sample size
d = Absolute percision
p = Expected prevalence
q = 1 - p and 1.96 the value of Z at 95% confidence interval

Sample Collection and Tick Species Identification: Firstly, the selected study animal was properly restrained and all tick samples were collected from half the body regions of six attachment sites (Head, Brisket/Dewlap, Abdomen/Back, Udder/Scrotum, Perineum and Legs. Ticks were removed carefully and gently in a horizontal pull to the body surface. The collected ticks were preserved in universal bottles containing 70% ethyl alcohol and labeled with respect to predilection site, age, sex and date of collection, then transported to Koffe Veterinary clinic in Dilla Town for counting and identification. The ticks were counted and subsequently identified to genus and species level by using stereomicroscope, according to standard identification keys given [12]. For analysis the half body tick counts were doubled to obtain whole body adult tick burden.

Data Analysis and Management: The data collected were entered and managed in Microsoft-excel. STATA 11 version software statistical program was employed for the data analysis. The overall prevalence of tick was determined by dividing the number of positive animals by total sample size and was expressed as percentage. Chi-square (χ^2) test was used to assess if there was a statistically significant association in tick infestation between ages, sex, breeds, body conditions and different management systems.

RESULTS

During the study period, a total of 2010 adult ticks from 384 cattle, comprising three genera and four species were identified. The genera identified were Amblyomma, Boophilus and Rhipicephalus with relative infestation rates of 53.93%, 27.36% and 18.71% respectively.

Out of the total samples of 384 bovine species, 124 were found to be infested by one or more tick species and the overall prevalence was 32.29%. A total of 2010 adult ticks belonging to four species were collected, comprising two species from the genus Amblyomma (*Amblyomma variegatum* and *Amblyomma cohaerens*), one species from the genus *Rhipicephalus* (*Rhipicphalus decoloratus*) and one species from the genus Rhipicephalus (*Rhipicephalus e. eversi*). From the total of adult ticks collected, *A. variegatum*, *A. cohaerens, R. decoloratus* and *R. e. eversi* encompasses 32.84%, 21.09%, 27.39% and 18.71% respectively (Table 1).

The distribution of tick species and their sex ratios were determined and the result showed that the numbers of male ticks were greater than the number of female ticks except for *R. decoloratus*. The total number of animals infested by each species of adult ticks and its proportion were summarized in Table 1.

Table 1 above, the highest proportions of animals were infested by *A. variegatum* (30.58 %) and the lowest by *R.e.eversi* (18.18 %).

During the study period, Amblyomma and Boophilus ticks were collected from Head, Brisket/Dewlap, Abdomen/Back, Udder/Scrotum, Perineum and Legs, while Rhipicephalus ticks were collected from Udder/Scrotum and Perineum (Table 3).

AS indicated on the Table 3 below, the prevalence of tick infestation was higher in local breeds than cross breeds. This might be related with an outdoor grazing practice of local breeds in the area compared to the cross breeds. The prevalence of tick infestation was significantly higher in male study animals with prevalence of 45%.

Animals with poor body condition score, free grazing system and aged animals had significantly higher tick infestation with prevalence of 60%, 55.45% and 49.23% respectively (Table 5). The increase of prevalence of tick infestation in free grazing animals is due high risk of exposure to ticks in outdoor during grazing.

Table 1: Sex distribution of adult tick species identified and proportion of animals infested by each tick species

Tick species	Male	Female	M:F	Total	Proportion (%)	No. of animals infested	Proportion (%)
A. variegatum	406	254	1.598	660	32.84	74	30.58
A. cohaerens	266	158	1.683	424	21.09	63	26.03
R. decoloratus	180	370	0.486	550	27.36	61	25.21
R. e. eversi	240	136	1.764	376	18.71	44	18.18
Total	1092	918	5.531	2010	100	242	100

Table 3: Tick species identified by their body site of infestation

	Count by attachment site						
Tick species	Head	Brisket/Dewlap	Abdomen/Back	Udder/Scrotum	Perineum	Legs	Total
A.variegatum	54	250	66	130	114	46	660
A. cohaerens	48	206	30	72	58	10	424
R.decoloratus	84	142	84	118	62	60	550
R. e. Eversi				184	192		376
Total	186	598	180	504	426	116	2010

Table 5: Distribution of tick infestation by breed, sex, body condition score, management and age of the animal

Variable		Nº of animal examined	Nº of positive animal	Prevalence (%)
Breed	Local	221	85	38.46
	Cross	163	39	23.93
Sex	Female	264	85	26.52
	Male	120	39	45.00
Body condition score	Good	51	7	13.73
	Medium	283	87	30.74
	Poor	50	30	60.00
Management	Free grazing	110	61	55.45
	Mixed	139	41	29.50
	Zero grazing	135	22	16.30
Age	Young	91	27	29.67
	Adult	228	65	28.51
	Old	65	32	49.23

Table 7: Association of different risk factors with tick infestation in bovine species in and around Dilla town.

Factor		Nº of animal examined	Nº of positive animals	Mean tick burden	95% CI	P value
Breed	Local	221	85	15.74	14.6-16.9	
	Cross	163	39	17.23	15.8-18.6	0.003
Sex	Female	264	70	16	14.7-17.3	
	Male	120	54	16.48	15.2-17.8	0.21
Age	Young	91	27	16.6	14.5-18.7	
	Adult	228	65	15.82	14.5-17.1	
	Old	65	32	16.69	15.2-18.2	0.006
BCS	Good	51	7	15.14	11.0-19.2	
	Medium	283	87	16.34	15.2-17.5	
	Poor	50	30	16.07	14.3-17.8	<0.0001
Mgt	Free grazing	110	61	15.57	14.4-16.7	
	Mixed	139	41	16.83	14.9-18.7	
	Zero grazing	135	22	16.81	14.9-18.7	<0.0001
Total		384	124	16.21	15.3-17.1	

From the analysis of different risk factors, breed of the animal (P: 0.003), age (P: 0.006), body condition score (P<0.0001) and management system (P<0.0001) were found to have statistically significant association with tick infestation in the study area. Cross breed animals carried more ticks than the local ones with a mean tick burden of 17.23 ticks per animal. Similarly, male animals, animals with medium body condition, older animals and animals in mixed type management system had relatively higher number of ticks per animal.

DISCUSSION

In this study, about 2010 adult ixodid ticks of three genera (Amblyomma, Boophilus and Rhipicephalus) and four species (*Amblyomma vareigatum, Amblyomma cohaerens*, *Rhipicephalus decoloratus* and *Rhipicephalus e. eversi*) were collected from cattle. The spectrum of tick genera and species identified in the current study is consistent with other studies in Ethiopia [13] in Holeta town except that they also report *H. marginatum rufipes.* The distribution and abundance of adult ixodid tick species identified from cattle in this study were presented and discussed separately under each species as follow.

In this study, *Amblyomma variegatum* was the most widespread and dominant tick species from the total count and constituted 32.84% and this was consistent with tick survey conducted in western Shoa, Bako district [14] and Holeta [13] that indicated the distribution of this

tick species as the first most abundant species in that area with prevalence of 54.3% and 45.49% respectively. *Amblyomma vareigatum* is known by its common name, the tropical bont tick, is widely distributed in Ethiopia [15] and is the most important ticks of livestock mainly because of it is the principal vector of economically important livestock tick- borne diseases.

Rhipicephalus decoloratus is the second most abundant tick species in the study area that accounts for 27.36%, this result was in line with other study conducted in Humbo district [16] in Ethiopia with the prevalence of 30.63% and slightly higher than the study conducted in Holeta town [13] with the prevalence of 18.13%. It is mainly found in wetter high lands and sub-high lands receiving more than 800 mm rain fall annually. The distribution pattern is similar to that of *Amblyomma variegatum* [17, 18].

Amblyomma cohaerens is the third abundant tick during the study periods and makes 21.09% of the total collection of adult ticks. The result of this study was inconsistent with the study conducted in Jimma areas [19] which reported *Amblyomma cohaerens* to be the first most abundant tick of cattle in west Ethiopia. *Rhipicephalus e. eversi* was the fourth abundant tick species (18.71%) in the current study. This finding was slightly lower than the study conducted in Humbo district [16] with the prevalence of 25.91%. *Rhipicephalus e. eversi* is widely distributed and common on domestic livestock in Ethiopia [15] and it has no apparent preference for any particular altitude, rainfall and/or season [18].

During the study period there was a comparison of the sex of male with that of female ticks. With regard to number of male and female ticks, the number of female ticks is less than the number of male ticks except for *Rhipicephalus decoloratus* whose males are less than the female numbers and this result was consistent with the report on tick taxonomy and biology [20]. This was due to fully engorged female tick drop off to the ground to lay eggs while male tend to remain permanently attached to the host up to several months later to continue feeding and mating with other females on the host before dropping off and hence males normally remains on the host longer than female [16]. The increased female to male ratio of *Rhipicephalus decoloratus* might be due to small size of males which creates difficulty of finding it during collection [21].

In this study the prevalence of tick infestation was significantly associated with breeds of cattle (p-value:0.003), that means the prevalence was higher in local breeds (38.46%) than cross breeds (23.24%) and this was consistent with the work done in Holeta town [13]. This difference might be due to a difference in management system that most of the cross breeds in the study area were kept indoor with zero grazing system, so that they were less exposed to tick infestation compared with local breeds, which were free grazing with increased contact of cattle from different herds resulting in higher infestation.

Both the prevalence and mean tick burden are significantly associated with the age of the animals (p-value = 0.006) in that older animals had significantly higher prevalence and tick load than young animals. This finding was also in agreement with the findings in Eastern Harerghe which reported higher prevalence in older animals than in younger animals. The higher proportion might be due to outdoor management and of long distant movement of adult animals to search feed and water as compared to younger animals, so the chance of exposure is higher and it also associated with decreased in immunity as the animals get older.

The prevalence of tick infestation between different body condition score groups had a significant difference (p-value<0.0001) which was in line with the study conducted in Assosa, Western Ethiopia [22]. The higher prevalence in poorly conditioned animals was most likely due to poor management system and low immunity associated with inadequate nutrition.

A significant variation of tick infestation in animals kept under different management systems was observed (p-value<0.0001) in this study. This study was in agreement with the finding [13] in Holeta and this difference might be due to high contact of free grazing animals with different herds and this in turn increases the chance of high exposure to tick infestation.

CONCLUSION AND RECOMMENDATION

The overall prevalence of tick infestation was high in the study area and local breeds, older animals, males, poor body conditioned and free grazing animals had relatively higher tick infestation. Type of breed, age, body condition score and type of management system were found to be statistically significant factors for higher infestation of tick in the study area. To reduce and avoid losses incurred by ticks and tick-borne diseases, cost effective tick control programs should be formulated and implemented in the study area incorporated with selection of tick resistant breeds of cattle, good management

systems and participating and awareness creation of livestock owners regarding tick control and prevention methods.

REFERENCES

1. Yacob, H., T. Yalew and A. Dinka, 2008. Part I: Ectoparasite prevalences in sheep and in goats in and around Wolaita Soddo, Southern Ethiopia. Revue de Médecine Vétérinaire, 159: 8-9.
2. Alekaw, S., 2000. Distribution of ticks and tick born diseases at Metekel ranch, Ethiopia. J Eth Vet Asso. 4: 40-60.
3. ILRI, 1999. Making the livestock revolution work for poor; Annual Report. Nairobi, Kenya.
4. Mekonnen, S., 1996. editor. Epidemiology of ticks and tick-borne diseases in Ethiopia: Future research needs and priorities. FAO/ILRI Workshop on the Epidemiology of Ticks and Tick-Borne Diseases in Eastern, Central and Southern Africa Harare (Zimbabwe) 12-13 Mar 1996.
5. Rajput, Z.I., S.H. Hu, W.J. Chen, A.G. Arijo and C.W. Xiao, 2006. Importance of ticks and their chemical and immunological control in livestock. Journal of Zhejiang University Science B, 7(11): 912-21.
6. Mekonnen, S., I. Hussein and B. Bedane, 2001. The distribution of ixodid ticks (Acari: Ixodidae) in central Ethiopia.
7. Jonsson, N., 2006. The productivity effects of cattle tick (Boophilus microplus) infestation on cattle, with particular reference to Bos indicus cattle and their crosses. Veterinary parasitology, 137(1-2): 1-10.
8. Polanco-Echeverry, D.N. and L.A. Ríos-Osorio, 2016. Biological and ecological aspects of hard ticks. Ciencia y Tecnología Agropecuaria, 17(1): 81-95.
9. Radley, D., 1980. Development of veterinary field and laboratory services in Ethiopia. Consultant Report.
10. Dilla town administration office. Dilla town profile, 2014.
11. Thrusfield, M., 2007. Veterinary epidemiology: Blackwell Science Ltd., Oxford; [cited 2013 Dec, 17].
12. Walker, A.R., 2003. Ticks of domestic animals in Africa: a guide to identification of species: Bioscience Reports Edinburgh.
13. Tiki, B. and M. Addis, 2011. Distribution of ixodid ticks on cattle in and around Holeta town, Ethiopia. Global Veterinaria, 7(6): 527-31.
14. Hussen, Y., 2009. Preliminary survey of cattle tick species and burden in and around Bako Town. DVM Thesis, School of Veterinary Medicine Jimma University, Jimma, Ethiopia.
15. Sileshi, M., R. Pegram, G. Solomon, M. Abebe, J. Yilma and Z. Sileshi, 2007. A synthesis review of ixodid (Acari: Ixodidae) and argasid (Acari: Argasidae) ticks in Ethiopia and their possible roles in disease transmission. Ethiopian Veterinary Journal, 11: 1-24.
16. Wasihun, P. and D. Doda, 2013. Study on prevalence and identification of ticks in Humbo district, Southern Nations, Nationalities and Peoples Region (SNNPR), Ethiopia. Journal of veterinary medicine and Animal Health, 5(3): 73-80.
17. Feseha, B., 1997. Species composition and distribution of Ixodid tick in Eastern Harerghe. Ethiopia Agric Sci., 16: 37-51.
18. Pegram, R.G., H. Hoogstraal and H.Y. Wassef, 1981. Ticks (Acari: Ixodoidea) of Ethiopia. I. Distribution, ecology and host relationships of species infesting livestock. Bulletin of Entomological Research, 71(3): 339-59.
19. Yetbarek, G., 2004. Tick species infecting livestock in Jimma areas South West Ethiopia. DVM Thesis, Faculty of Veterinary Medicine, Addis Abeba University, Debre Zeit Ethiopia.
20. Kaiser, M.N., 1987. Report on Tick Taxonomy and Biology. AG: DP/ETH/83/023. Consultant Report. FAO. Rome, Italy.
21. Adane, T., 2008. Study on major tick species identification in bovine in and around Bahir Dar. Haramaya University.
22. Bossena, F. and M. Abdu, 2012. Survey on the distribution of tick species in and around Assosa Town, Ethiopia. Research Journal of Veterinary Sciences, 5(2): 32-41.