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Study on Prevalence of Cattle Tick Infestation at Shone District of Hadiya Zone, South Ethiopia

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Abstract

A cross sectional study was conducted from March 2019 to August 2020 in Shone district with the objectives of determining the prevalence of ixodid ticks genera and assessing the difference in infestation among the different risk factors such as age, sex, body condition score. A total of 4112 adult ixodid ticks were collected from cattle. A total 384 cattle were selected by systematic randam sampling and examined. Results showed that the overall prevalence of tick infestation was found to be 79.2% (304/384). Four tick genera were identified with the constituents of Amblyomma 1942 (46.5%), Rhipicephalus (formerly Boophilus) accounts 1274 (31%), Hyalomma 635 (15.4%) and Rhipicephalus 291 (7.1%) From the total count, Amblyoma was the dominant tick species and Rhipicephalus was the least. The prevalence of tick infestation was found significantly different (x2=9.86, P<0.05) between age with higher prevalence in adult (37.5%) than young (21.6%). However, there was no statistically significant difference in tick infestation among cattle sex and body condition. The high prevalence of tick infestation in the study area might be associated to lack of community awareness about the impact of ticks, health care services and management practices of cattle. It is strongly suggested that the need to implement community awareness together with the setting up of tick prevention and control strategies.

Keywords: Cross-setional, Ethiopia, Genera, Infestation, Shone district, Ticks.

Introduction

Ethiopia has an extremely diverse topography, a wide range of climatic features and a multitude of agro-ecological zones that are suitable to host a very huge animal population. The country has believed to have the largest livestock population in Africa, with an estimated 43 million cattle, 23 million sheep and 18 million goats, 6.7 million of donkeys, 1.9 million horses and 42 million poultry (CSA, 2016). Livestock in Ethiopia represent the pillar of the economy and plays a vital role in the livelihood of the farming communities by providing milk, meat, skin, power, organic fertilizer, manure and traction, as well as generate direct cash income and foreign currency. Even though the livestock sub sector contributes much to the national economy, its development is hampered by different constraints. Poor health and productivity of animal due to disease has considerably become the major stumbling block to the potential of livestock industry. Now a day parasitism represents a major obstacle to development and utilization of animal resource. Ectoparasites are one of the most important constraints that directly or indirectly affect the socio-economic development of poor farmers. From the ectoparasites, ticks are ranked as the most economically important of livestock in tropics including sub-Saharan Africa.

Ticks were considered as parasites of domestic animals as early as 400 B.C. Aristotle in his famous historia animalium, stated that the ticks were disgusting parasites generated from grass. Despite this early realization, little work was done until the latter half of nineteenth century, when a number of parasitologists all over the world started working on taxonomy, prevalence, and bionomics, seasonal and regional occurrence of the ticks. Ticks are obligate blood feeding ectoparasites of vertebrates; particularly mammals, birds and reptiles throughout the world. They are cosmopolitan in distribution, but occur principally in tropical and subtropical regions with warm and humid climate which are suitable to undergo metamorphosis.

Ticks are obligated blood feeding ectoparasite of vertebrates, particularly mammals, birds, and they are arachnids in the subclass Acari, closely related to mites, surviving for up to several years. During this time they feed periodically taking large blood meals, often interspersed with long intervals each meal. There are at least 884 tick species in two major families, namely the Ixodidae comprises approximately 80% and Argasidae 20%.There are two well-defined families of ticks, the Ixodidae or hard ticks and the Argasidae or soft ticks, and the two groups differ from each other markedly in appearance, habits and

Development it has been estimated that 80% of the world's 1,281 million cattle are infested with ticks and while in Africa about 186 million head of cattle are at risk of ticks and Tick-borne diseases (TBDs). Besides the direct impact, ticks also have a greatest impact due to their large number and variety of microbial disease that they transmit among domestic animals. Mostly the tick-borne infections of humans, farm and companion animals are essentially associated with wildlife animal reservoirs.

In Ethiopia, ticks are widely distributed throughout all the agro-climatic zones of the country. The main ticks genera found in Ethiopia are Ambylomma, Rhipicephalus, Hyalomma and Heamaphysalis and a subgenus Rhipicephalus (Boophilus). Previous studies documented the presence of more than 50 species of ticks in the country including genus Amblyomma (8 spp.), subgenus Boophilus, (2 spp.), Haemaphysalis (4 spp.), Hyalomma (9 spp.), Rhipicephalus (15 spp.), Ixodes (1 sp.), Argas (1 sp.) and Ornithodorus (2spp.). Amblyomma variegatum (vector of Ehrlichia ruminantium and Theileria mutans) and Rhipicephalus decoloratus (vector of Anaplasma marginale and Babesia bigemina) are reported to have great veterinary and medical importancein Ethiopia. Amblyomma cohaerens, Amblyomma gemma, Hyalomma rufipes, Hyalomma truncatum and Rhipicephalus evertsi are also the commonly found tick species in Ethiopia. Several studies have been conducted in different parts of Ethiopia on ticks infesting cattle.

Ixodid ticks are one of the most common and harmful blood sucking ectoparasite of cattle worldwide. They are responsible for a wide range of livestock health problems in several countries of the

world. They reduce cattle productivity, milk yield, and skin and hide quality, cause udder damage and predispose to mastitis, suppress immunity, and increase susceptibility to other diseases. Approximately 80 % of cattle populations of the world are at risk of tick infestation and tick-borne diseases. In addition to sucking large volume of blood, ticks inject pathogens such as viruses, bacteria, protozoa, and toxins in to their hosts estimated that the annual global costs associated with ticks and TBDs in cattle amounted to between US $ 13.9 and 18.7 billion, globally. In Africa, tick-borne diseases are considered the most important animal disease problem.

Ticks infestation is severe in different parts of Ethiopia and at a conservative estimate, one million USD is lost annually only through rejection of downgraded hides and skins attributed to tick damage estimated that an annual loss of USD 5000,000 from hide and skin downgrading from ticks, and approximately 65.5% of major defects of hide in eastern Ethiopia were from ticks. Even though losses due to tick infestation is considerable in Ethiopia, and a number of researchers reported the distribution and abundance of tick species in different parts of the country, there is no work done in estimating the prevalence and distribution of ticks in Shone district, Hadiya Zone.

Hence, the objectives of this study were

- Estimating the prevalence and
- Identification of ixiodid ticks with respect to host related variables in study area.

Literature Review

Taxonomy and Identification of Ticks

Classification of Ticks

Ticks belong to the phylum (Arthropoda), class (Arachnida), sub class (Acari) and Order (Parasitiformes). Within the Parasitiformes, ticks belong to the suborder Ixodida, which contains a single super family, the Ixodoidea, which is divided into three families, Argasidae (soft ticks) and Ixodidae (hard ticks), and the third family Nuttalliellidae, with a single species. To date, a total of 901 tick species have been described, divided among the Ixodidae (700 spp., 14 genera), Argasidae (200 spp. the number of genera is controversial and currently under discussion), and Nuttalliellidae (one species). In the most commonly used classification of ticks, the family Ixodidae comprises 2 major groups, the Prostriata and the Metastriata (Figure1). Two subfamilies are currently recognized in the Argasidae: the Argasinae and the Ornithodorinae.

Morphology of Ticks

Ticks are dorso-venteral compressed and usually have no definite division between the head, thorax and abdomen. Sexes are separate. The Family of Ixodid varies in shape and species. Ticks belong to the super order of Acarina, which have certain characteristics that distinguish them from other arachnids such as spiders. Ticks have a rounded body, without a clear boundary between the anterior and posterior parts. The body is divided in to a capitulum (gnathosoma) and the rest of the body (idiosoma). Ticks have six pairs of appendages including the chelicerae, pedipalps, and four pairs of locomotors appendages. Tick morphology consists of two primary regions, the mouthparts (capitulum) and the body (idiosoma). The mouthparts of hard ticks protrude in front of the body and are visible from above (Figure 2), but the body of soft ticks extends forward above the mouthparts and hence is only visible from beneath. The body of ticks includes the eyes, legs, respiratory, digestive and reproductive structures.

Life cycle in Ticks

The completion of the lifecycle of Ixodid ticks requires four stages in their development; eggs, 6 legged larva, 8-legged nymph and adult. Members of the family Ixodidae are categorized into one-host; two-host or three-host life cycles (Table 1) according to the number of host required to complete their development. In the hard ticks mating takes place on the host, except with Ixodes where it may also occur when the ticks are still on the vegetation. Male ticks remain on the host and will attempt to mate with many females whilst they are feeding. They transfer a sack of sperm (spermatheca) into the female ticks. The females mate only once, before they are ready to engorge fully with blood. When they finally engorge they detach from the host and have enough sperm stored to fertilize all their eggs. Female hard ticks lay many eggs (2,000 to 20,000) in a single batch.

Three-host tick life cycle is the commonest type of life cycle. Larvae develop in the eggs until ready to hatch, usually in several weeks. The life cycle of three-host ticks is slow, from six months to several years. The life cycle of one-host ticks is usually rapid, for example in Rhipicephalus (Boophilus) it takes three weeks for the feedings on one host and two months for egg laying and larval development. The two-host life cycle is similar but only the larvae and nymphs feed on the same individual host, and the adults will feed on another host. Hyalomma detritum and Rhipicephalus evertsi have two-host life cycles.

Feeding Habit

Ticks feed only on the blood (blood cells and blood plasma) and lymph of their hosts. The ticks crawl onto their host and attach to the skin. Ticks use a combination of cutting mouthparts, which penetrate the skin, and often an adhesive (cement) is secreted in the saliva to aid attachment to the skin. At the end of the mouthparts are sharp chelicerae that scrape a hole into the dermis. This breaks the capillary blood vessels very close to the surface of the skin and the tick feeds on released blood and lymph which may accumulate at the wound. On the ventral surface of the mouthparts is the hypostome which is barbed with teeth to grip the host. A feeding tube into the tick is formed loosely between the hypostome and the sheath surrounding the chelicerae. The feeding of ticks makes is important to the health of domestic animals and humans.

Economic Impact of Ticks

In Ethiopia, ticks and tick-borne diseases cause considerable losses to the livestock economy, ranking third among the major parasitic diseases, after trypanosomosis and endoparasitism.

Direct Impact

Feeding by large numbers of tick causes' unrest, tick worry irritation, severe dermatitis, and anemia serious physical damages while tick bites also reduce the quality of hides due to the direct injury. These parasites generate direct effects in cattle in terms of milk production and reduce weight gain. Tick infestation is associated with huge economic losses and at a conservative estimate, one million USD is lost annually only through rejection of downgraded hides and skins attributed to tick damage in Ethiopia.

Indirect Impact

In addition to sucking large volume of blood, ticks also act as reservoirs and vectors for a wide range of human and animal pathogens worldwide and thus inject pathogens such as viruses, bacteria, protozoa and toxins in to their hosts. Some of the most important tick-borne diseases are East Coast Fever, Redwater, anaplasmosis and heartwater. Many other fatal and benign babesiosis and theileriosis are also transmitted by various tick species. An annual cost of 3 million Birr (US$ 1.5 million) to purchase acaricides was estimated in 1989. When other losses such as deaths, reduced growth rate and reduced milk production are added, economic losses due to ticks and tick-borne diseases are highly significant.

Ticks Control

Ticks control programmer, in many countries aims at reduction of the tick burdens on animals by periodic dipping or spraying using acaricides. Complete eradication of ticks is extremely difficult because of persistence of ticks, especially multi-host ticks, on wild fauna, and ability of adults to live for very long period apart from host. Tick control is necessary for improvement of animal and achievement of animal production. The prospect of the tick's control

Measures have been and are still receiving much attention of many scientists, researchers and policy makers concerned with livestock development all over the world.

Materials and Methods

Study Areas

The present study was conducted from March 2019 to August 2020 on randomly selected cattle in and around Shone District, Hadiya zone, South Ethiopia. Shone district is located in Hadiya zone of SNNP Regional government of Ethiopia. It is 25 Km from south of Hosanna and 345 Km south of Addis Ababa. Topographically, it is located at an altitude range of 1650-2050 meter above sea level. Geographically, it is located 07 o90 and 8015' North latitude and 350 and 40015' East latitude. The average temperature is 11-270c with lower temperature fluctuation climatically. The Shone district has ecological zone of which 100% midline. According to Shone town agricultural statistics information, the animal population in Shone has about 93,040 cattle's, 15,457 sheep's, 19,123 goats, 834 donkeys, 428 horses, 52 mule and 76,747 chickens. The production system of the district is mixed type (HADB, 2018).

Study Design and Animal

The cross-sectional study was conducted from March 2019 to August 2020 on 384 cattle to determine the types of tick genera, favorable preferred site and the relative tick burden. The animals investigated were categorized in to age, sex and body condition score groups according to the animals that were included in this study were those cattle which were not treated with any treatments for a month prior to sample collection time.

Sampling and Sample Size Determination

The study cattle were selected by systematic random sampling to determine Genera of ticks in study cattle. The sample size was determined by assuming the expected prevalence of 50% tick infestation. The desired sample for the study was calculated by setting 95% confidence interval at 5% absolute precision. Therefore, sample size of 384 cattle was examined in the study. Areas in the district were selected purposively according to accessibility and the cattle within the selected areas were selected and examined systematically from the household.

Study Methods

Tick collection

Tick collection was done during its parasitic phase from the cattle for tick genera identification. The selected cattle were casted down and restrained appropriately then, the skin of each selected cattle were inspected for the presence or absence of ticks. Adult ticks were manually collected by using forceps from half regions of the animals' body and care was taken to avoid recapitulations. The collected ticks from predilection sites were counted into separate bottle, labeled and preserved in sampling bottles containing 70% ethanol from each study cattle. The ticks were then transported to the Laboratory of Hadiya Zone Livestock and fisheries resource Department, for identification.

Tick identification

Ticks were identified to the genera level according to their morphological key structures such as shape of scutum, leg colour, scutum ornamentation, body grooves, punctuations, basis capitulum, coxaes and ventral plates. During tick identification in the laboratory the sample were put on petridish and adult ticks were identified to genus level under a stereomicroscope.

Data Analysis

The data were entered in to Microsoft Excel spread sheets and coded appropriately and analyzed using STATA Version 13.0 statistical software. The data was summarized by descriptive statistics. Chi square test were used to quantify the association among the factors with the presence of tick infestation. For all statistical analysis a statistical significance level of $p<0.05$ was considered.

Results

Out of the total 384 animals examined, 304 (79.2%) were found infested with one or more ticks. From the total of 4112 ticks collected, 3 genera and 1 subgenus were identified, of which Amblyomma 1912 (46.5%), Rhipicephalus (formerly Boophilus) accounts 1274 (31%), Rhipicephalus 291 (7.1%) and Hyalomma 635 (15.4%). From the total count, Amblyomma was the dominant tick species and Rhipicephalus was the least (Table 2). Amblyomma (46.5%) was recorded as the most abundant and the most prevalent tick genera respectively. There was significant (x2=17.3237, Pr = 0.000) difference between different age groups (Table 1).

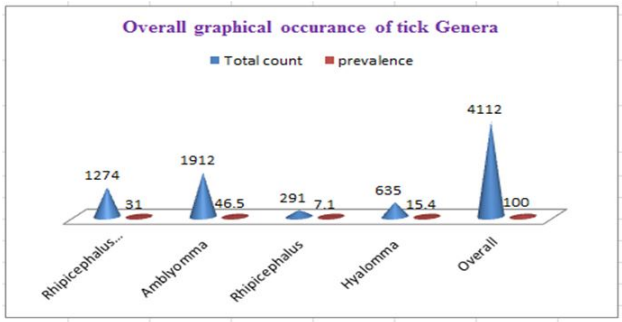
Table 1: Prevalence of tick's infestation in age, sex and body condition score.

Variable		Total examined	Positive animals	Prevalence (%)	X2	p-value
Age	Young	107	83	21.6	9.86	Pr = 0.000
	Adult	177	144	37.5		
	Old	100	77	20.1		

Sex	Female	217	168	43.7	1.3658	Pr = 0.243
	Male	167	136	35.5		
Body condition score	Young	30	25	6.5	5.3210	Pr = 0.070
	Medium	223	179	46.6		
	Old	131	100	26.1		
Overall		384	304	79.2		

The study revealed that highest rate of overall infestation by ticks occurs during this study period. Amblyomma and Rhipicephalus (Boophilus) genera of ticks were more abundant than the others tick genera during the study. Hyalomma and Rhipicephalus ticks were the least collected (Figure 1).

Figure 1: Overall Graphical occurrence of tick Genera during the study period.



The present study revealed that the preferred attachment sites of ixodid ticks infesting cattle vary among different genera of ticks. This study suggested that Ambylomma species has got greater preference for ventral parts such as udder/scrotum, dewlap/brisket, perineum, legs and shoulder to tail base of cattle in descending order. Tick species that belong to the genus Hyalomma showed greater presence for tail and anal region, ventral parts such as legs, perineum and brisket of their host cattle. The subgenus Rh. (Bo.) decoloratus looks too had got greater preferences for the attachment sites such as dewlap, head and neck, and shoulder to tail base of their host cattle (Table 2).

Table 2: Count, percentage and attachment sites of tick genera.

Tick genera	Total count	Percentage	Predilection site
Rhipicephalus (Boophilus)	1274	31	Dewlap, neck, head, back
Amblyomma	1912	46.5	Udder/ scrotum, brisket, dewlap,
Rhipicephalus	291	7.1	Under tail, anovulva, ear and neck
Hyalomma	635	15.4	Under tail, tail brush, anovulva
Overall	4112	100	

Discussion

The current study revealed that a total 4112 ticks were collected from a total of 304 animals yielding an overall prevalence of 79.2%. And this finding is in agreement with the findings of who reported an overall prevalence of 89.4%. However, it is different from the findings. This difference could be due to the difference in the agro climatic condition of the study areas. Tick activity was influenced by rainfall, altitude and atmospheric relative humidity. Four genera of hard ticks were identified, namely Amblyoma, Rhipicephalus (Boophilus), Hyalomma and Rhipicephalus in the study area. The distribution and abundance of tick species infesting cattle in Ethiopia vary greatly from one area to another area.

Amblyomma was the most prevalent and abundant genera of tick comprising 46.5% of the collected ticks in the study sites. This finding is in line with the findings of due to the fact that A. variegatum is the most common and widely distributed cattle tick in Ethiopia. Likewise, indicated Amblyomma was the leading tick genera with 43.46% prevalence. This finding is also inagreement with that of previous reports on a high number of Amblyomma in three agroecological zones in central Oromia by Ayalew et al. (2014) and at Haramaya University. It has a great economic importance, because it is an efficient vector of Cowderia ruminatum (Eimeria bovis) and greatest damage to hide, due to its long mouth parts, so it will reduce the value on world market.

In this study Rhipicephalus (Boophilus) were found to be the second prevalent and abundant tick species in Humbo district (67.5%). This is in disagree with Sileshi et al. (2007) who described that Rhipicephalus (Boophilus) decolaratus is the commonest and most wide spread tick in Ethiopia, collected in all administrative regions except in the Afar region. This is also in line with Tamru, and Teshome reported the highest prevalence of B. decolaratus (80%) in the study areas. According to Shiferaw (2005) B. decolaratus had highest frequency in the observed area during dry seasons (January, February and early March) in Wolaita zone. This result disagreed with the findings of Alekaw at Metekel Ranch, Ethiopia showing prevalence of 5.7%. This may be due to the geographical location and altitude factors which is 1,500 to 1,600 m above sea level of Metekel Ranch. The one-host ticks of the genus Rhipicephalus (Boophilus) that parasitize ruminants represent a hindrance to livestock farming in tropical and sub-tropical countries. They transmit the causative agents of anaplasmosis ("gall sickness") and babesiosis ("red water") in cattle.

With regard to predilection site for attachment, different tick genera show different site preferences. Amblyomma are found in scrotum, udder dewlap and vulva whereas the subgenus Rh. (Boophilus) were found on the head and neck, shoulder to tail base and dewlap. Rhipicephalus showed high preference to the anogenital region of the body and then followed by the inside of the ear. Hyalomma showed similar preferences for the tail and anal region of their hosts which is consistent with previous report by Walker et al.

This study revealed that different animal related risk factors were studied to determine whether there is a significant variation in tick infestation between and among different groups of animals with suspected risk factors. The proportion of tick infestation was higher in adult animals as compared to young animals. So, there was

statistically significant association ($p > 0.05$), and the higher proportion may be due to outdoor management and long distant movement of adult animals to search for food and water compared to younger animals, so the chance of exposure is higher. This finding is also in agreement with the finding of Feseha, Tessema and Gashaw and Belew and Mekonnen who stated a higher proportion in adult cattle.

Conclusion and Recommendations

The present study revealed that high prevalence of ixodid tick infestation in the study area. These pose huge economical and health constraint to the farmers and the animals. The prevalent and abundant tick species investigated in the study area were Amblyomma, Rhipicephalus (Boophilus), Hyalomma and Rhipicephalus. The study indicated that there was high burden of ticks in the area. However, the attention given to controlling the infestation had not been sufficient. In conclusion, the distribution of ticks are not fixed but are determined by a complex interaction of factors such as climate, host density, host susceptibility, grazing habits, and pasture-herd management. Therefore, effective tick control program should be formulated and implemented based on the distribution pattern of ticks and factors responsible for their distribution.

In line with above conclusion the following recommendations are forwarded:

- Systematic intervention and control of tick infestation should be put in place to tackle the diseases.
- Detection of acaricide resistance tick species which are economically important since limited types of acaricides were used in the area.
- Appropriate pasture management in communal grazing area is important.

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