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# Prevalence and Associated Risk Factors of Ixodide Tick of Cattle in Kersa District, Eastern Hararghe Zone of Oromia Regional State, Ethiopia

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**Abstract:** Ticks are important ectoparasites i.e they induce huge economic losses in livestock productivity in the area and the country as a whole. A cross-sectional study to determine the prevalence of ixodid ticks of cattle and assess its associated risk factors was conducted in kersa district, East Hararghe Zone, from November 2018 to April 2019. During the period a total of 384 local and crossbred cattle under an extensive management system were examined for the presence of tick infestation. Out of 384 cattle selected by systematic random sampling method, 226 (58.90%) were infested by a single and mixed tick species. A total of 1217 adult ticks were collected from their different attachment sites on cattle. The most abundant tick species in the areas were *Amblyomma varigetum* (40.01%), followed by *Rhipicephalus* (*Boophilus*) decolaratus (28.69%) but the least one was *Hyalomma marginatum* (1.39%). Concerning the animal-related risk factor sex of the animal did not show a significant difference ($P > 0.05$) with the infestation, but a statistically significant association ($P< 0.05$) was observed with the age of the animal. Ticks infestation was significantly higher in old cattle and the least prevalence was recorded in young cattle. The infestation of ticks was also highest in poor body condition and lowest in good body condition with a statistically significant association ($p<0.05$). The most favorable attachment site of ticks on the animal body with different tick species was udder/scrotum (14.54%) and lowest in legs (2.6%). Therefore, strategic and appropriate application of acaricides should be practiced to control ticks and tick-borne disease.

**Key words:** Cattle · Ixodid Tick · Kersa · Prevalence

## INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa. This can be due to the site and diversity of major agro-ecological zones of the country, which renders a suitable environment for the support of a large number and class of livestock. The country has approximately 44.3 million cattle, 46.9 million sheep and goats, more than 1.0 million camels 4.5 million equine and 40.0 million chicken [1]. Among livestock, cattle contribute a considerable portion to the socio-economic life of the people of Ethiopia. In addition to the product of meat, milk, hides, cattle provide draught power for the cultivation of the agricultural lands of many peasants [2].

Despite this contribution, its development and productivity are hampered by different constraints such as widespread endemic disease, poor veterinary service and lack of attention from the government [3]. From health constraints, parasitism represents the Major obstacle and cattle are highly affected by ectoparasites mainly ticks and tick-borne disease [4]. Ticks are small, wingless blood-feeding ectoparasites of vertebrates particularly mammals and birds. They belong to arachnids insub-class Acari. The families of ticks parasitizing livestock are categorized into two, the Ixodidae (Hard ticks) and Argasidae (Soft ticks).Both are sharing certain basic properties, but they differed in many structures, behavioral, physiological and reproduction patterns [5]. Ixodidae ticks occur in the temperate as well as in the tropical and sub-tropical regions of the world. They are adversely affecting animal health, especially in the tropics. Over 80 percent of the cattle population of the world are at risk of tick and tick-borne disease [6].

Relatively few of more than 889 species of tick in the world are important to domestic animals. More than 79 different species were found in eastern Africa but many of these appear to be of little or no economic importance [7]. In Ethiopia, there arearound 47 species of ticks found on

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livestock, most of them have importance as a vector and disease-causingagents, have a damaging effect on the skin and hide production [8]. Some ofthe major cattle tick-borne diseases in Ethiopia are Anaplasmosis, Babesiosis and Cowdrosis. Besides being important vectors of animal disease, ticks also cause nonspecific symptoms like anemia, Toxicosis and paralysis in animals. In Ethiopia, ticks and tick-borne diseases cause considerable losses to the livestock economy, ranking third among the major parasitic diseases, after Trypanosomosis and endo-parasitism. It resulted in an estimated annual loss of US$500000 from hide and skin downgrading and approximately 65.5% of major defects of hides in Eastern Ethiopia [9].

Ticks are common in all agro-ecological zones of Ethiopia. This is due to the environmental condition and vegetation of the country, which was considered as highly conducive for the vectors and the associated diseases they cause. Therefore, relevant data on the distribution of ticks is essential for the development of effective tick and Tick born disease control strategies in the study area [10]. Several tick genera are widely distributed in Ethiopia. The major tick genera recorded are *Amblyomma*, *Hyalomma* and *Rhipicephalus*. The distribution of tick species is influenced by climatic changes, which affect the rate of the tick population. *Amblyomma varigetum* was prevalent and abundant in humid highland areas of Ethiopia. *Boophilus decolaratus* and *Rhipicephalus evertsi evertsi* are widely distributed in southern and most altitudinal ranges [11]. Although some preliminary research work on tick infestation is carried in Eastern parts of Ethiopia, a study directed towards distribution, a species-level and associate risk factor of tick infestation at Kersa district were not well obtained. Therefore, the objectives of this study were to determine the distribution and prevalence of tick infestation of cattle, to identify the common tick species that exist, and to assess the major associated risk factors with the occurrence of tick species in the study area.

## MATERIALS AND METHODS

**Study Area:** Kersa is one of the woredas in the east Hararghe zone of the Oromia region of Ethiopia. It is named after a river that flows through it. It is located at 475 km to the East of Addis Ababa and was bordered on the south by the Bedano, on the west by the Meta, on the north by Diredawa, on the northeast by Haramaya andon the southeast by Kurfachela. The Livestock Population of a district is 103, 817 cattle, 36, 29 sheep, 47, 883 of Goat, 16, 822 donkeys, 420 horse, 461 camels and 82, 677 poultry [12].

According to the information gained from the Agricultural Office of the woreda, the agro-climate condition of the area falls within a tropical humid climate as the area has 8 to 9 humid months. The altitude of the Kersa district ranges from 1400 to 3200masland their longitude and latitude are 41°40’ E and latitude of 09°15’.’ N respectively. Kersa district has an average rainfall of 886.5mm, average temperature of 21.2°C. The area is generally concluded as “Woina Degas” even though some of it is kola and some other isdega.

The annual rainfall of Kersa districts ranges from a maximum of 1658 mm to a minimum of 830 mm and it has a temperature that ranges from 30°C to 10°C. The main rainfall season for the districts where from June to September and the dry season is from December to March and their humidity was 57.83%. From a land coverage of the district, 28.5%of the land is arable or cultivable, 2.3% pasture, 62% forest and the remaining 56.3% were consideredbuilt-up degraded or otherwise unusable. Khat, coffee fruit and vegetable are important cash crops in the district. There are 35 peasant or farmer associations each with about 27, 837 members and most of them have road access, but few of them is not access to a road.

**Study Population:** The study population consists of cattle that were brought to the kersa veterinary clinic for different reasons and cattle kept under individual households were the target population. A total sample population of 384 cattle was examined out of the source of local and crossbreed cattle found in the area which was managed under extensive management.

**Study Design:** A cross-sectional type of study design was conducted to determine the prevalence and identification of ixodid tick infesting cattle with an assumption that helped to understand the status of tick about its prevalence and associated risk factors within the area. Animal investigated in the area were categorized based on associated risk factors into different age groups, breed, sex, body condition and different peasant association. The age of animals was grouped into young (1 to2 year), adult (3 to7 years) and old (>8years) [13]. Sex is categorized into male and female categories and body condition into poor, medium and good body condition according to Nicolson and Butterworth [14].

**Sampling Technique:** Systematic random sampling technique was followed in which sampling cattle was selected at a four individual animal interval. The peasant association was purposively selected based on the accessibility, lack of animal health care and information on a tick infestation. The selected locality was namely Kersa, Sodu, matakoma and Golawachu of the kersa district. The name of the attendant and their respective animal were recorded to avoid the risk of repeated sampling. Ticks were collected fromanimal's body sites namely: head, neck, ear, dewlap, back, axillae, udder or scrotum, under the tail, Perianal and leg during the study period.

**Sample Size Determination:** The sample size was determined by assuming an expected prevalence of 50%of tick infestationsince there is no previous study in the area. The desired sample size for the study was calculated according to the formula given by Thrusfield [15] by setting a 95% confidence interval at 5% absolute precision. Therefore the required sample size (n) is determined by the formula.

$$N = \frac{1.96^2 Pex(1 - Pex)}{d^2}$$

N= $1.96^2$*0.5*(1-0.5) / (0.0025)
n= 384

where, n= required sample size, Z= confidence interval (95%), Pexp= expected prevalence and d = desired absolute precision. According to above formula samples of 384 cattle was selected in the study.

**Study Methodology**

**Tick Sample Collection and Identification:** The entire body surfaceof the host was inspected for tickafter fully restraining the animal. All visible adult ticks were collected from half of the animal body part using by hand or using special forceps holding at the basis of the capitulum and gently removed by exerting a horizontal pull to the body surface and by slightly rotating the tick so as not to lose the mouthpart of the tick. Tick was collected from different predilection sites namely: udder/scrotum, dewlap, axillae, head, back and belly, neck, under the tail, Perianal, leg and ear of the animal during the study period. Ticksfrom each animal and each site were collected and preserved in a pre-labeled separate universal bottle by using a 70% alcohol and transported for identification [5]. Identification was done at the veterinary parasitology laboratory (College of veterinary medicine Haramaya University) by using the standard identification procedure.

The collected ticks were identified by using stereomicroscope based on their morphological features such as the size of mouthparts, scutum, the color of legs, festoons, interstitial punctuation's, presence or absence of adrenal shields, posterior groove and marginal spots and then classified into the different genera and species levels. Furthermore, different tick morphology such as the shape of Scutum, the color of festoons, interstitial punctuations, posterior groove and ventral plates was considered for species-level identification according to Walker *et al.* [16].

**Data Management and Analysis:** The data collected during sampling and laboratory findings were recorded properly in a format prepared for this purpose, then entered and managed in Microsoft excel. The STATA (Stata version 11) was used to perform the statistical analysis. The overall prevalence of tick infestation was determined by dividing the number of the positive sample by the total sample size and wasexpressed as a percentage. Chi-square test was used to assess statistically significant association in the infestation of tick between age, breed, sex, body condition, attachment sites of a tick and locality within the area whether there was a significant association ($p<0$) or not significant ($p>0$).

## RESULTS

Out of 384 cattle examined for the presence of ticks infestation 226 (58.9%) cattle were infested with single or mixed species. The examined cattle were involved 337 (64.39%) local breed and 47 (19.35%) crossbreed. A total of 1217 ticks were collected from infested cattle and classified into four tick genera and six species. From identified genera, *Amblyomma* (48.64%)was the most abundant followed by *Rhipicephalus* (*Boophilus*) (28.69%), *Rhipicephalus* (22.02%) and *Hyalomma* (1.39%). Regarding species of tick, *Amblyomma varigetum* (40.01%) was the abundant tick species in the area followed by the *Boophilus decolaratus* (28.69%), whereas *Hyalomma marginatum* (1.39%) was the least abundant tick speciesin thearea. In this study, a different risk factor was investigated about the prevalence of tick infestationin the area.

Table 1: Prevalence of ixodid tick genera in a Kersa district

| Genera | Prevalence (%) |
|---|---|
| *Ambloyomma* | 48.64 |
| *Rhipicephalus* | 22.02 |
| *Rh (Boophilus)* | 28.69 |
| *Hyalomma* | 1.39 |

Table 2: Identified tick species on cattle in the kersa area

| Tick spp. | Total tick count | Prevalence (%) |
|---|---|---|
| *Amblyommavarigetum* | 487 | 40.01 |
| *Amlyomma gemma* | 105 | 8.63 |
| *Rhipicephalus evertesi evertesi* | 169 | 13.89 |
| *Rh (Boophilus) decolaratus* | 349 | 28.69 |
| *Rhipicephalus pulchellus* | 97 | 8.13 |
| *Hyalomma marginatum* | 17 | 1.39 |

Table 3: Prevalence of tick infestation to the breeds of cattle

| Breeds | No of animals | Negative | Infested animal | Prevalence (%) |
|---|---|---|---|---|
| Local | 337 | 120 | 217 | 64.39 |
| Cross | 47 | 38 | 9 | 19.15 |
| Total | 384 | 158 | 226 | 58.9 |

Table 4: Prevalence of ixodid tick Infestation within a Peasant association

| | Examined animals | | |
|---|---|---|---|
| Peasant association (PAS) | N | Positive | Prevalence (%) |
| Kersa | 96 | 39 | 40.35 |
| Matakoma | 95 | 50 | 52.63 |
| Sodu | 97 | 76 | 78.35 |
| Golawachu | 96 | 61 | 63.54 |
| Total | 384 | 226 | 58.9 |

Table 5: Prevalence of ixodid tick in association to age, sex and BCS

| Risk factors | | No of the animals examined | No of the animals infected | Prevalence (%) | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| Age | Young | 102 | 23 | 22.35 | 83.11 | <0.001 |
| | Adult | 229 | 156 | 68.12 | | |
| | Old | 53 | 47 | 88.68 | | |
| Sox | Female | 223 | 129 | 57.85 | 0.22 | 0.637 |
| | Male | 131 | 97 | 60.25 | | |
| BCS | Poor | 74 | 68 | 91.89 | 10.798 | <0.001 |
| | Medium | 238 | 151 | 63.45 | | |
| | Good | 72 | 7 | 9.72 | | |
| Total | | 384 | 226 | 58.9 | | |

Table 6: Distribution of Tick species on its different predilection sites

| | Attachment sites | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ear | | Head, neck, back/belly | | Dewlap | | Axile | | Udder/scrutum | | Under tail and perineum | | Legs | |
| Tick spp. | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| *A. varigetum* | - | - | 2 | 9.52 | 13 | 28.8 | 5 | 29.4 | 46 | 79.31 | 2 | 5.26 | 3 | 30 |
| *A. gemma* | - | - | - | - | 1 | 2.23 | 12 | 76.4 | 3 | 5.26 | - | - | - | - |
| *R. evertsi evertsi* | 1 | 6.7 | - | - | - | - | - | - | - | - | 2 | 76.31 | - | - |
| *R. pulchellus* | 13 | 92.86 | - | - | - | - | - | - | - | - | 1 | 2.63 | - | - |
| *R. (B) decolaratus* | - | - | 18 | 85.7 | 21 | 46.7 | - | - | 3 | 5.1 | 1 | 2.63 | 7 | 70 |
| *H. marginatum* | - | - | - | - | - | - | - | - | - | - | - | - | 6 | 15.7 |
| Mixed infestation | - | - | 1 | 4.76 | 8 | 17.8 | - | - | 5 | 8.62 | - | - | - | - |
| Total | 14 | 3.65 | 21 | 5.47 | 45 | 11.72 | 17 | 4.43 | 57 | 14.54 | 38 | 9.89 | 10 | 2.6 |

The study revealed that the prevalence of tick infestation in Local breeds was that 64.39% recorded and the prevalence of tick infestation in Crossbreed was found to be (19.15 %) (Table 3).

The result of this study showed that there was a high prevalence of ticks in the Sodu (78.35%) followed by Golawachu (63.54%), Matakoma (52.63%) and least in Kersa (40.35%) Peasant association.

Among sex, age group and body condition of animals examined, the tick prevalence was 60.25% and 57.85% in males and females respectively. The highest tick's infestation prevalence was recorded in old age (88.68%) followed by adult age (68.12%) and lower on young age (22.35%). A high prevalence of tick's infestation was recorded in poor body condition (91.89%) followed by medium body condition (63.45%) and the least was recorded in good body condition (9.72%).

The preference of tick infestation on the host body differed from site to site and the highest infestation was on udder/scrotum (14.54%), followed by dewlap (11.72%), Under tail and perineum(9.89%), head, neck, back/belly (5.47%) Axillae (4.43%), Ear (3.6%) and lowest on legs (2.6%).

## DISCUSSION

The current study was carried out to determine the prevalence of tick infestation in cattle and to assess the major risk factors in the study areas. From a total of 384 local and cross-breed cattle, the overall prevalence recorded was 58.9%. This finding is in line with reports of Tadesse and Sultan [11] with an overall prevalence of 59.5% at Ficheselale and with Meseret *et al*. [6] who reported an overall prevalence of 59.6% in the Harari region. The finding was greater than a report of Zelalem *et al*. [17] with a prevalence of 38% in chiro district, Kassa and Yalew [18] with a prevalence of 33.21% in Haramaya district and Tesfahiwet and Simeon [19] with a prevalence of 16.0% in BenchiMaji Zone of the Southern Nations and nationalities of Ethiopia. However, the results of this study were lower than reports of Alemu *et al.* [20] northwest of Ethiopia, Gedlu *et al.* [21] in Bahirdar, Nateneal *et al*. [22] in Bedelle district and Abdeta *et al.* [23] in Gondar who reported the overall prevalence of 81.5%, 74%, 82% and 74.7% respectively. This difference could be due to the difference in the agro-climatic condition of the study areas since tick activity was influenced by rainfall, altitude and atmospheric relative humidity [17].

The distribution and abundance of tick species in Ethiopia are varied greatly from one area to another area. In this study, six species of ticks in four genera were identified. *Amblyomma varigetum* was the most abundant of all tick species encountered in the study area with a prevalence of 40.01%. This could be in line with the report of Tamirat *et al.* [24] with a prevalence of 40.63% at a Guder district andMohammed *et al.* [25] with a prevalence of 39.3% at Hotesa district and Gulilat and Yehualashet [26] with a prevalence of 40.08%. This result was lower than the report of Tadesse and Sultan [27] with a prevalence of 74%. However, it was higher than that of Bossena and Abdu [28] who reported 23.4% in and around Asosa and that of Tadesse *et al*. [29] in Mezan Teferi with a report of (18.1%).The main reason could be attributed to the fact that this Tick is the most widely distributed tick species in Ethiopia due to suitable wooded or grassy environments [30].

*Rh (Boophilus) decolaratus* was the second prevalent tick species in the study area (28.69%). This result was in agreement with a report of Mesert *et al.* [6] at the Harari region who reported a prevalence of 29.02%. This result is lower than the report of Bossena and Abdu [28] who reported a prevalence of 45% inthe Assosa region. However, the result was higher than the report of Tamiru *et al.* [31] who indicated 15.4% prevalence and of Alekaw [32] at Metekel who report the prevalence of 5.7%. This difference might be due to this tick was being abundant in highlands and sub-highlands receiving more than 800 mm rainfall annually and widely distributed in the central rift valley in Bale, highland areas of Harar and Dire Dawa and many other administrative regions of the country except in afar region [33].

*Rhipicephalus evertsi evertsi* was the third abundant tick species with a prevalence of (13.89%) and this result is in agreement with the previous work reported by Tamerat *et al*. [34] with a prevalence of 13.5%, Kassa and Yalew [18] with the prevalence of 14.6% in Haramaya district and results of Alemu *et al*. [20] with the prevalence of 11.5%, but it was lower than the results of Abdisa [35] and Gurmessa *et al.* [36] who reported 50.9% and 53.4%, prevalence respectively. However, the lesser prevalence was indicated in the western Amhara region (6.6%) [37]. This might be due to the study period and due to all stages of *R. evertsi evertsi* were less active during a dry season. *Ambylomm agemma* was the fourth abundant tick species identified in the area (8.63%). This result makes almost in line with a report of Fanos *et al*. [38] in Mizan with the prevalence of 8.3% and it was higher than

the report of Takele *et al*. [39] in the Gursum district who reported 0.69% prevalence. However, it is lower than the results in Borena Pastoral area by Ayana *et al*. [40] with a prevalence of 23.64%. This might be due to lesser dry types of vegetation, woodland and bushland that favor the occurrence of *A. gemma* in the area. *A. gemma* was associated with dry types of vegetation or semi-arid rangelands and in lowland areas [41].

*Rhipicephalus pulchellus* was the fifth abundant tick in this study with a prevalence of 8.13%. The result is relatively in agreement with the results of Amsalu [42] who reported infestation of 6.64% in Haramaya district. This might be due to *Rh pulchellus* was less common in highland and sub highland area which is similar to this study area and was distributed in an area with arid and semi-arid climate range. *Hyalomma marginatum* was the least abundant tick species collected and represented only 1.39% of the total counts. This result is inline with a result of Tiki and Addis [43] with a prevalence of 1.86% in and around Holeta and with the prevalence of 2.5% by Tamiru *et al*. [31] in Asella. The low prevalence of this tick species in the study area might be due to the high altitude and rainfall distribution of the study area which may not favor its occurrence. It is due to *H. marginatum* was mostly found in arid parts of tropical Africa that receive about 250 to 650 mm annual rainfall and rare in the western and central highland of the country [36].

In this study, the different animal-related risk factor was investigated to determine whether there was a significant variation in a tick infestation between and among the different group of an animal which could involve between the different sex, age, body condition score, breed, locality within the area and attachment sites of ticks on the animals. The study revealed that there was no statistically ($p>0.05$) significance on the infestation of tick between both sexes and there was with the only minor extending occur in male which may be associated with the high sampled female animal than the male animal or it may be due to the female animal was kept properly at home for the dairy purpose. This result was agreed with the previous work reported in Bakoby Hussen [44].

There was a statistically significant difference in infestation rate among different age groups of cattle. The old and adults were more susceptible than calves because the calves were not often drivento the grazing and watering points. This practice naturally reduces the chance of exposure of calves to ticks. This result agrees with Yismashewa [45], in Dechaworeda, Southern Ethiopia and Esihak, (2011) in Adami Tulu. Similarly, Seyoum [46] also found that the number of ticks attached to animals increases with their age. Since host-seeking activity involves awaiting hosts in an environment, there was a greater chance of attaching to larger animals than calves because of body surface area.Calves are less attractive to ticks than cows because they are protected by some form of innate, age-related resistance. This is probably associated with decreases in immunity as the animals get older. It might also possible that these differences may be attributed to continuous selective grooming of calves' heads, ears and necks by their respective dams [47].

In different body conditions, statistical significance was found. The highest prevalence of tick infestation was observed in animals with poor body condition and the result agree with Wogayehu *et al*. [48]. The situation might be associated with the management and nutritional condition that can cause reduce disease resistance by altering immune responses and a depressed immune system, in turn, causes increase susceptibility to disease, reduce immunological response to vaccines and nonresponsive to medical therapy and increase survival of tick for a long on the host [49].

In between breeds Tick infestation was significantly higher in local breed cattle as compared with crossbreed cattle and this finding was in agreement with Amsalu *et al*. [42]. The higher prevalence of tick infestation in local breed animals may be attributed to the currently existing modified animal husbandry practices where crossbreed animals are kept most of the time indoor with intensive care whereas local breed cattle are kept under field grazing system. Hence the chance of occurrence in local breed cattle is greater than crossbreeds [31].

The effort was made to observe the prevalence of tick infestation in cattle of the four different peasant associations of the Kersa district and high tick infestation was recorded in a sodu peasant association. This might be due to having a large common grazing area where they stay the whole day time or it may be due to lack of animal health service and lack of accessibility of information on about a tick infestation. This was lower than the report of Abriham *et al*. [50] at a Barko Daleti Peasant association with a prevalence of 80.4%, but it was higher than the report of 42% from West Haraghe Zone by Zelalem *et al.* [17]. As favorable attachments sites of a tick on the host body was concerned animal was also observed and in this study the most infested region of animal body with a different tick species the infestation was encountered on udder/scrotum (14.54%) followed by dewlap (11.72%) and Under tail perineum (9.89%). The least was on the legs. This might be due to the interaction of different species of the tick to the sites and accessibility for grooming [51].

## CONCLUSION AND RECOMMENDATIONS

The present study showed a high prevalence of ixodid tick infestation in the Kersa district with an overallprevalence of 58.9%. The important tick species encountered in this study area were A. varigetum, *R. evertsi evertsi*, *R. pulchellus*, *R.* (formerly *Boophilus*) decolaratus, A. gemma and *H. marginatum*. The most abundant species was *A. varigatum* and the least one is *H. marginatum*. Furthermore, predilection sites of tick were identified which helps in designing for identification and control methods. In general, the distribution of ticks is not fixed but is determined by a complex interaction of factors. Even though the prevalence of ticks is high in the area, proper policies and strategies are not yet in place to control ticks. Therefore, In light of the above conclusion the following recommendations are forwarded:

- Animal health extension should be provided to livestock owners to know how to prevent their animals from tick infestation.
- Appropriate pasture management should be applied in communal grazing areas to reduce high infestation due to common grazing fields.
- Strategic and appropriate application of acaricides should be practiced to control ticks and tick-borne disease.

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