Prevalence and Occurrence of Various Canine Tick Species in Roma Valley, Lesotho

ABSTRACT

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| Ticks are ectoparasites that act as vectors for transmission of various pathogens to wild and domesticated animals and pose a serious threat to human health. The study aimed to determine the common tick species infesting canines in six villages within the Roma Valley. A cross-sectional study was conducted, during which dogs were randomly selected for tick collection. Approximately 15 dogs from each village were chosen as experimental units, resulting in a total of 90 dogs included in the experiment. The animals were classified by age into three categories: young (below one year of age), middle (puberty stage, between 7 and 10 months), and adults (one year and older). To comprehend the epidemiology of tick-borne diseases, it is essential to identify ticks on dogs of various age groups. This is due to the complex life cycle of ticks, which consists of four stages, each displaying distinct behaviors related to host attachment and feeding duration. Ticks were collected using the hand-picking technique and subsequently transferred to separate bottles containing 70% ethanol. These samples were then transported to the laboratory at the National University of Lesotho for species identification, which was performed using a light microscope. The species exhibited significant differences (p≤0.05) between different villages. The identified species include *Hyalomma rufipes, Boophilus decoloratus Koch, Boophilus microplus, Rhipicephalus microplus, Rhipicephalus evertsi, Hyalomma dromedarii, Hyalomma truncatum, Rhipicephalus e. evertsi, Rhipicephalus sanguineus, Ixodes ricinus, Ixodes rubicundus, Hyalomma marginatum,* and *Octobius megnini.* Among these, *Boophilus microplus* was the most prevalent species in Mafefooane at a rate of 57.8%, followed by *Boophilus decoloratus* at 48.0%. In contrast, *Ixodes ricinus* was scarce in Tloutle Ha Mpiti (1.3%), while *Octobius megnini* was the least common at just 0.3%. Furthermore, there were no significant differences in sex ratios, coat color, or predilection sites among the villages (p≥0.05). The presence of these tick species poses a detrimental effect by transmitting pathogens and hindering the growth of dogs. The study concludes that most of the canines found in Roma Valley are affected by the ectoparasites hence its recommend that famers should control the external parasites on canines.  |

*Keywords: Ticks, species, Infestation, canines*

1. INTRODUCTION

Ticks are among the most studied and economically most important ectoparasites (Jongejan and Uilenberg, 2004). Ticks are known to be abundant ectoparasites that can infest a wide range of animals including canines. Once infestation takes place, the deterioration actions to the host start via sucking blood, transmitting pathogens like bacteria, virus, and blood protozoans, and contributing to numerous infectious and zoonotic diseases (Eppleston *et al*., 2013). Ticks cause severe toxic conditions, including toxicosis, paralysis, allergies, and irritation in their hosts. They also transmit significant pathogenic microorganisms such as Rickettsiae and spirochaetes (Lv *et al.,* 2014). Ticks extract blood by burrowing a hole into the host’s epidermis, where they insert their hypostome and they excrete anticoagulants or platelet aggregation inhibitors (Mans *et al.,* 2002). The most common tick species that infest dogs include *Rhipicephalus sanguineus*, *Ixodes ricinus,* and *Dermacentor reticulatus* (Beugnet, 2009). Ticks belong to two major families: *Ixodidae* (hard ticks) and *Argasidae* (soft ticks). Additionally, there is a third family called *Nuttalliellidae* which comprises a single species, *Nuttalliella* (Guglielmone *et al*., 2010). Other ixodid ticks that infest dogs include Haemaphysalis, Ixodes, Boophilus, Dermacentor, and Amblyomma species, which vary in prevalence across different regions of the world (Wells *et al.,* 2012). Otobius megnini is the only soft tick species found in dogs (Soundararajan *et al*., 2000). Ticks serve as carriers of pathogens in Africa and parts of the United States. All these tick species act as vectors for pathogens that cause babesiosis, ehrlichiosis, hepatozoonosis, and anaplasmosis, as reported by Augustin *et al*. (2017). Some ticks are inornate and appear brown or reddish in color; however, certain species are ornate and display distinctive white patterns on their scutum (Sirois, 2015). The brown dog tick, *Rhipicephalus sanguineus*, is one of the most widely distributed tick species. Hard ticks possess a beak-like structure that contains their mouthparts, while soft ticks have their mouthparts located underneath their bodies (Giribet, 2018). Ticks find hosts by detecting odors, body heat, moisture, or vibrations in their environment. Infestations of ticks on dogs can vary from single occurrences to severe infestations, which may lead to serious life-threatening diseases (Dryden, 2004). Transmission of pathogens by ticks is influenced by several factors, including the duration of feeding, the pathogen load, the extent of tick tissue involved, and whether the tick was infected at the time of blood feeding. Additionally, certain tick species may infect aggressive dogs during fights, as noted by Clara *et al.* (2017). Hansford *et al.* (2016) reported that traveling and imported dogs often harbor a significant number of adult ticks and nymphs, primarily of the species *Rhipicephalus sanguineus* along with other tick species.

2. MATERIALS AND METHODS

**2.1 Study Area**

This study was conducted in the Roma Valley, which is located within the Manonyane Community Council in the Maseru District of Lesotho. The valley is situated approximately 34 kilometers southeast of Maseru, the capital city of Lesotho. Additionally, Roma Valley lies at an elevation of 1,680.24 meters above sea level. The average annual temperature in this district is 18.37 ºC, which is 2.31% higher than the national average for Lesotho. Roma receives approximately 83.47 millimeters of precipitation each year and experiences around 114.87 rainy days annually and the study was conducted in February.

**2.2 Study Design**

A cross-sectional study was conducted in which dogs were randomly selected, and ticks were collected from them using forceps and careful handpicking along with intact mouth parts. Six villages in the Roma Valley were chosen for sample collection. From each village, 15 dogs were selected as experimental units, resulting in a total of 90 dogs used in the experiment. The ages of the animals were classified into three categories: young (below one year of age), middle (puberty stage above six months), and adults (one year and older).

**2.3 Data Collection and Morphological identification of tick specimens**

With the assistance of the dog’s owner, muzzles were placed on the dogs to facilitate the collection of ticks from various predilection sites, including the neck, head, fore chest, ears, feet, and around the teats. Ticks were collected from selected dogs. The ticks discovered on each dog were transferred to separate bottles containing 70% ethanol and taken to the laboratory at the National University of Lesotho for identification. Subsequently, in the animal science laboratory, ticks were removed from their containers using forceps and placed under a stereo microscope (Olympus, Japan) for morphological examination of ticks. The tick species were identified by comparing important morphological parts such as scutum pattern, spiracle plate, coxa structure, adanal plates, and capitulum shape of different species (Gadahi *et al*., 2013).

**2.4 Statistical Analysis**

Data is being captured using Microsoft Excel and transferred to the Statistical Package for the Social Sciences version 20.00 for analysis. Descriptive statistics, specifically the crosstab tabulations were applied to tabulate percentages. Chi-square was employed to show significant association, and Values are regarded as statistically significant at a 95% confidence interval with a probability level of P ≤ 0.05.

3. results and discussion

**3.1** **Tick species found on canines in Roma valley**

Table 1 presents the tick species identified in the Roma Valley, which include: *Hyalomma rufipes, Boophilus decoloratus Koch, Boophilus microplus, Rhipicephalus microplus, Rhipicephalus evertsi, Hyalomma dromedarii, Hyalomma tancatum, Rhipicephalus e. evertsi, Rhipicephalus sanguineus, Ixodes ricinus, Ixodes rubicundus, Hyalomma marginatum,* and *Octobius megnini.* Among these species, *Boophilus microplus* was the most prevalent across all villages except for Hata Butle and Tloutle ha Shale. This species exhibited the highest prevalence in Mafefooane and Mafikeng, with percentages of 57.8% and 38.9%, respectively. Conversely, it was observed at the lowest percentages of 21.8% and 12.0% in Tloutle ha Mpiti and Haseqoma. *Rhipicephalus e. evertsi* was found in all villages except Haseqoma; however, Tloutle Ha Shale exhibited the highest infestation rate at 35.7%, followed closely by Tlootle Ha Mpiti at 30.8%. These villages are situated near one another, which likely facilitates the transmission of parasites among their dogs. *Hyalomma rufipes* was recorded in Hata Butle (17.1%), Mafikeng (11.1%), and Mafefoaone (5.9%), with the latter representing the lowest percentage of infestation. Notably, this species was absent from Tlootle Ha Shale and Tlootle Ha Mpiti. Haseqoma had the highest percentage of *Boophilus decoloratus* at 48.0%.

Table 1: The proportion of tick species identified in Roma Valley

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| **Tick Species** | **Villages (%)** |
| **Hata Butle** | **Mafefooane** | **Tloutle ha Mpiti** | **Tloutle ha Shale** | **Haseqoma** | **Mafikeng** |
| ***hyalomma\_******rufipes*** | 17.1 a | 5.90 b | 0.00 c | 0.00 c | 4.00 b | 11.1 d |
| ***boophilus\_******decoloratus\_koch*** | 32.9 a | 9.80 b | 24.4 c | 0.00 d | 48.0 e | 0.00 d |
| ***Boophilus microplus*** | 0.00 a | 57.8 b | 21.8 c | 0.00 a | 12.0 d | 38.9 e |
| ***Rhipicephalus microplus*** | 0.00 a | 5.90 b | 0.00 a | 7.10 b | 6.00 b | 0.00 a |
| ***Rhipicephalus Evertsi*** | 0.00 a | 15.7 bc | 19.2 b | 0.00 a | 18.0 b | 0.00 a |
| ***Hyalomma dromedari*** | 25.7 a | 1.00 b | 0.00 b | 42.9 c | 12.0 d | 3.70 eb |
| ***Hyalomma Tancatum*** | 22.9 a | 0.00 b | 0.00 b | 7.10 c | 0.00 b | 0.00a |
| ***Rhipicephalus e. evertsi*** | 1.40 a | 2.90 a | 30.8 b | 35.7 b | 0.00 a | 22.2 c |
| ***Rhipicephalus sanguineus*** | 9.00 a | 0.00 b | 1.30 b | 7.10 c | 0.00 b | 0.00 b |
| ***Ixodes*** ***ricinus*** | 0.00 a | 0.00 a | 1.30 a | 0.00 a | 0.00 a | 0.00 a |
| ***Ixodes*** ***rubicundus*** | 0.00 a | 0.00 a | 0.00 a | 0.00 a | 0.00 a | 1.90 a |
| ***Hyalomma Maginitum*** | 0.00a | 0.00 a | 0.00 a | 0.00 a | 0.00 a | 22.2b |
| ***Octobius*** ***Megnini*** | 0.00 a | 0.00 a | 0.30 a | 0.00 a | 0.00 a | 0.00 a |

This high rate can be attributed to the fact that dogs in this area were never treated for ticks and often stayed in kraals while hunting wild animals. On the other hand, Hata Butle is the closest village to Haseqoma, had a percentage of 32.9%. Tloutle ha Shale followed with 24.4%, while Mafefooane recorded the lowest percentage. The species *Hylomma dromedari* was found in the highest proportion in Tloutle ha Shale at 42.9%, along with Hata Butle at 22.9%. Conversely, the lowest percentages were observed in Haseqoma, Mafikeng, and Mafefooane, which had percentages of 12%, 3.7%, and 1.0% respectively. Notably, Hata Butle, Mafefooane, Tloutle ha Shale, Tloutle Ha Mpiti, and Haseqoma were not affected by *Ixodes rubicundus or Hyalomma marginatum*. In contrast, Mafikeng exhibited both species: *Ixodes rubicundus* at 1.9% and *Hyalomma marginatum* at 22.0%. This study found that most tick species infesting dogs originated from cattle. Consequently, *Boophilus microplus* was statistically (P≤0.05) identified as having the highest infestation rate among all species, which aligns with the findings of Shepelo *et al.* (2021), who reported that Boophilus microplus is abundant in dairy cattle. *Rhipicephalus sanguineus* was noted as the only tick species affecting dogs in Indonesia, as stated by Hadi *et al*. (2016). Canines in the Roma Valley appeared to be less infested with ticks from this species; however, various tick species were found in dogs across different villages. Most of the tick species identified in this study belonged to the Ixodidae family, including *Rhipicephalus evertsi evertsi, R. microplus, Hyalomma rufipes,* and *H. truncatum.* Additionally, one Argasidae tick, *Otobius megnini*, was noted; this species is recognized as the only tick found in dogs, as reported by Soundararajan *et al.* (2000). The presence of other tick species in dogs reported elsewhere (Foldvari and Farkas, 2005; Smith *et al*., 2011), which were not detected during this investigation, may be attributed to climatic variations that influence the proliferation of different tick species.

**3.2 Effect of sex on canine tick infestation**

The results presented in Table 2 indicate that the majority of male canines were infested with ticks in Hata Butle, with an infestation rate of 64.0% and the lowest infestation rate was recorded in Haseqoma (20.0%). In contrast, among females, Haseqoma exhibited the highest tick infestation rate of 80.0% and Hata Butle reported the lowest rate. The findings of the current study differed statistically significant (p ≤ 0.05) between villages and these findings align with those reported by Konto et al. (2014), which indicated that female dogs tend to have higher infection rates than males. This may be attributed to the tendency of male dogs to roam in search of female dogs for mating, which increases their exposure to ticks. On contrary Chander *et al.* (2020) from Bikaner, Rajasthan reported higher prevalence in female dogs (68%) than in male dogs (32%) and Lema *et al*. (2020) from Nigeria also revealed prevalence rate was in males (31.67%) and the females (43.33%). The significantly higher proportion of ectoparasitic infestation in male may be due to hormonal factors which predispose male dog more susceptible to ectoparasite infection (Sahu *et al.,* 2013). However, this observation contrasts with the findings of Ekanem *et al.* (2010), who reported a higher tick infestation rate in males (52.2%) compared to females (47.8%). This discrepancy is further highlighted by Akande et al. (2018), who found that in hunting dogs, the prevalence of ticks was greater in males (66.6%) than in females (51.9%), although these results were not statistically significant. Similarly, Modu *et al*. (2021) reported a significantly higher rate of tick infestations among male dogs (58.6%) compared to female dogs (57.1%). In addition, Hadi *et al.* (2016) reported that the percentage of male dogs infested with ticks was higher (45.68%) than that of female dogs (22.22%). However, this lack of correlation may be attributed to the fact that training activities or guard duties did not differentiate between male and female dogs, resulting in both sexes spending equal time outdoors and having similar opportunities for tick infestation. Furthermore, the study indicated that male dogs exhibited a higher overall tick infestation rate (61.08%) compared to female dogs (38.81%). Abdullah et al. (2016) reported that age and sex had no effect on tick infestation. They also found that the presence of ticks is strongly correlated with tick exposure rather than specific characteristics of the dogs. Conversely, Arong *et al.* (2011) reported a higher prevalence of tick infestation among female dogs compared to males, which aligns with the findings of the present study conducted in Roma Valley., there appears to be no definitive evidence regarding the influence of sex on the prevalence of tick infestation.

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| Table 2: The effect of sex on tick infestation in different villages in Roma Valley. |
| **Sex of canines** | **Villages (%)** |
|  | **HataButle** | **Mafefooane** | **Tlootle ha Mpiti** | **Tloutle ha Shale** | **Haseqoma** | **Mafikeng** |
| **Males** | 64.3a | 40.0 b | 53.3 c | 41.7 b | 20.0 d | 50.0 c |
| **Females** | 35.7 a | 60.0 b | 46.7 c | 58.3 b | 80.0 d | 50.0 c |
| **Total**  | 100 | 100 | 100 | 100 | 100 | 100 |

**3.3 Effect of predilection site on canine tick infestation**

The results in Fig. 1 reported that the preferred sites for tick attachment on infested dogs in Roma Valley varied. However, the majority of ticks were found on the neck, abdomen, and forechest. In Tloutle ha Shale, the most commonly infected areas were the neck (91.7%) and abdomen (8.3%) among all observed sites. Ticks were predominantly recorded on the necks of dogs in Haseqoma (70.0%), Mafefooane (66.7%), Hata Butle (57.1%), Mafikeng (50.0%), and Tloutle ha Shale (33.3%). This pattern suggests that dogs found it more challenging to remove ticks from their necks. In other villages, some dogs exhibited tick infestations on various sites, particularly around the ears and between the teats; however, these areas showed a lower percentage of tick infestation compared to the neck and abdomen. In contrast, at other predilection sites, dogs could easily use their paws or mouths to remove ticks. The most preferred sites for tick attachment were the neck, abdomen, forechest, ears, and between the teats. Also, in study by Yan *et al*. (2024) found out that the head, ear, and the neck were most preffered attachment sites for ticks on stray dogs. These findings align with those of Foldvari and Farkas (2005), who noted that the head, ears, and neck were the most favored areas for ticks on dogs, followed by the legs and interdigital spaces. However, in their study, they observed only a few ticks on the ears and interdigital spaces. Similarly, Kebbi *et al*. (2019) reported that the neck was the most preferred attachment site for ticks, with a prevalence of 55.8%. However, this finding contrasts with previous studies by Dutto *et al*. (2009), Lorusso *et al.* (2010), and Wright *et al.* (2018), who reported that dogs’ heads, particularly around the eyes, ears, and muzzle, as well as their legs and necks, were the most frequently attacked body areas. This discrepancy highlights the need for further research to understand the factors influencing tick attachment and feeding preferences.

**Fig. 1:** Shows the predilection sites and percentages of dogs affected in each village

**3.4 Effect of canine coat colour on tick infestation**

The results in Fig.2 indicated that most dogs with brown coat color were the most affected by ticks across various villages, with Haseqoma reporting the highest infestation rate at 50.0%. Hata Butle followed closely with 42.9%, Tloutle ha Shale had 41.7%, Mafefooane recorded 40.0%, and Tloutle ha Mpiti had the lowest rate at 20.0%. In Tloutle ha Shale, black-colored dogs experienced a similar level of infestation as brown ones, both at 41.7%. However, in other villages, the infestation rates for black dogs varied: Haseqoma reported 40.0%, Tloutle ha Mpiti had 26.7%, Hatabutle recorded 21.4%, Mafefooane showed 13.3%, and Mafikeng had the lowest at 6.2%. White-colored dogs were most infested in Hatabutle, where the rate was 35.7%. The percentages for white dogs in other villages were as follows: Tloutle ha Mpiti (26.7%), Mafefooane (20.0%), Haseqoma (10.0%), and Mafikeng with the lowest percentage at 6.2%. Mixed-colored dogs were most observed in Mafikeng, which had the highest tick infestation rate of 31.2%. This was followed by Mafefooane at 13.3%, Tloutle ha Shale at 8.3%, and Tloutle ha Mpiti at 6.7%. Notably, there were no mixed-colored dogs with ticks found in Haseqoma and Hatabutle. Yellow-colored dogs exhibited no tick infestation across all villages except Mafikeng, where the infestation rate was recorded at 12.5%. Brownish-dark dogs were only found to have a tick infestation in Mafefooane, with a rate of 6.7%. Brown-red dogs showed infections in three villages: Tloutle ha Mpiti had an infestation rate of 3.7%, while Mafefooane and Tloutle ha Shale both recorded an infestation rate of 1.2%. Dark-coated dogs, such as black or brown, are harder to inspect for ticks, resulting in delayed detection and prolonged feeding periods. However, these results were not statistically significant (p≥0.05). This study aligns with the findings of Opeyemi *et al*. (2019), who also reported that the comparison of parasite prevalence based on coat color and hair length indicated that brown-coated dogs had the highest infestation rate at 91.1%, followed by black-coated dogs at 81.8%, mixed-colored dogs at 78.4%, and white-coated dogs at 54.4%.

**Fig. 2:** shows different coat colours of dogs that were affected in each village.

4. Conclusion

The study concluded that the most common tick species in Roma villages varied from one village to another; however, *Boophilus microplus* and *Boophilus decoloratus* were the most prevalent. This variation may be attributed to the fact that dogs are primarily companion animals, and there are fewer kennels available in these villages. These species of ticks thrive throughout the year, exhibiting varying levels of abundance. The preferred sites for tick attachment were predominantly the neck and fore chest areas. Among all dogs studied in the villages, brown dogs exhibited a higher level of infestation compared to other canine coat.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that no generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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