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Prevalence and species diversity of ticks infesting dogs in Zaria, Kaduna State, Nigeria

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Abstract

This study morphologically identified common ticks of dogs in Zaria, Kaduna state Nigeria. The study examined 431 ticks collected from dogs and investigated the prevalence and diversity of ticks infesting dogs in the study. Out of 157 dogs screened, 73, representing 46.5%, were infested with ticks. Three tick species were identified, with Rhipicephalus sanguineus being the most prevalent, with 88.63%, followed by Rhipicephalus simus 11.14%, and Haemaphysalis leachi at 0.23%, representing the least prevalent species. This research employed morphological examination, and for the first time in the study area *Rh. simus* was reported on dogs. The study also explored the impact of sex and age on tick infestation prevalence. Higher tick infestation rates were observed in male dogs compared to female dogs at 27.39% and 19.11%, respectively, while adult dogs showed a higher prevalence than younger dogs at 30.57% and 15.92%, respectively. The findings contribute valuable insights into the prevalence and diversity of ticks infesting dogs and highlight the need to intensify comprehensive research on ticks and tick-borne pathogens of dogs in the study area and their consequences on the well-being of dogs in Nigeria.

Keywords: Dogs, Nigeria, Prevalence, Rhipicephalus sanguineus, *Rhipicephalus simus*, Ticks, Zaria

Introduction

Ticks are vectors of several pathogenic protozoa, rickettsiae, spirochaetes and viruses; their vectorial capacity is more than any other arthropod vector group, with most important vectors of diseases affecting livestock, humans, and companion animals (Abdullah *et al.,* 2016; Karim *et al.,* 2017; Ola-Fadunsin *et al.,* 2021).

Ticks, taxonomically classified within the Phylum *Arthropoda*, Subphylum *Chelicerata*, Class *Arachnida*, Subclass *Acari*, Order *Parasitiformes*, and Suborder

Ixodida, share the Order *Parasitiformes* with suborders *Holothyrida, Mesostigmata* (commonly referred to as mites), and *Opilioacarida* (Santiago *et al.,* 2009). The hard ticks (*Ixodidae*) and soft ticks (*Argasidae*) are the two primary and well-established families (El-Kammah *et al.,* 2001). The hard ticks, encompassing approximately 650 species, constitute the larger group, while the soft ticks consist of around 150 species (Wall & Shearer, 2008). The remaining two families (*Laelaptidae* and *Nuttalliellidae*) each have only one species and are of lesser significance (Anderson & Magnarelli, 2008).

In Nigeria, *Rhipicephalus sanguineus*, *Rhipicephalus Boophilus decoloratus, Amblyomma variegatum*, and *Haemaphysalis leachi* ticks have been reported to infest dogs, and the brown dog tick *Rhipicephalus sanguineus* ticks have been established to be the most prevalent tick of dogs in Nigeria and globally (Natala *et al*., 2009; Konto *et al.,* 2014; Akande *et al*., 2018; Elelu *et al.,* 2021), and the environmental conditions also provide favourable and conducive conditions for the survival and propagation of these ticks.

However, there is still limited information on the pattern of tick infestation among dogs in Zaria, and this study aims to address this gap by providing an updated assessment of tick species infesting the dog population in Zaria.

Materials and Methods

A cross-sectional survey employed with convenience sampling method was used to sample ticks during the anti-rabies vaccination campaign within the Zaria metropolis, and dogs brought to Kaduna State Veterinary Clinic, Opposite Al-Huda Huda College, Zaria city, between September and December 2023, which falls within the dry season in Zaria (NIMET, 2017). Dogs of all age groups, sexes, and breeds were screened for the presence of ticks. The ticks were collected from the bodies of dogs considering the predilection sites. The breed, sex, and age of the sampled dogs were recorded, with the age being classified as either young or adult. The young dogs sampled ranged from less than one year to a year while adult dogs were from greater than one year upwards (Leticia *et al*., 2013). Each dog was properly restrained with a muzzle with the assistance of the owner or handler for a thorough examination of the entire body for ticks; ticks were carefully removed from different parts of the dog's body using blunt forceps making sure no ticks were crushed in the process. The harvested ticks from each dog were stored separately in vials containing 70% ethanol, properly labelled for easy identification, and transported to the Parasitological laboratory of the Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria. The ticks collected were washed twice with sterile water to remove excess debris contamination from animal skin and then rinsed once in 70% ethanol. The ticks were then counted and sorted into plain plastic tubes containing 70% ethanol for preservation. The ticks were morphologically identified to genus and species level, under the stereo microscope using Walker *et al.* (2003) as standard morphological tools.

Ethical approval

Ethical Approval was obtained from Ahmadu Bello University, Zaria Committee on Animal Use and Care, with approval number ABUCAUC/2023/146.

Data analysis

Data obtained were organized, edited, and analyzed using Statistical Package for Social Sciences (SPSS) Version 25. The association between sex, breeds, and age were evaluated using the Chi-square test for independence. Values of $p \leq 0.05$ were considered statistically significant.

Results

Tick species distribution

Figure 1 shows the percentage distribution of ticks collected for this study. A total of 431 ticks were collected, representing three species, the three

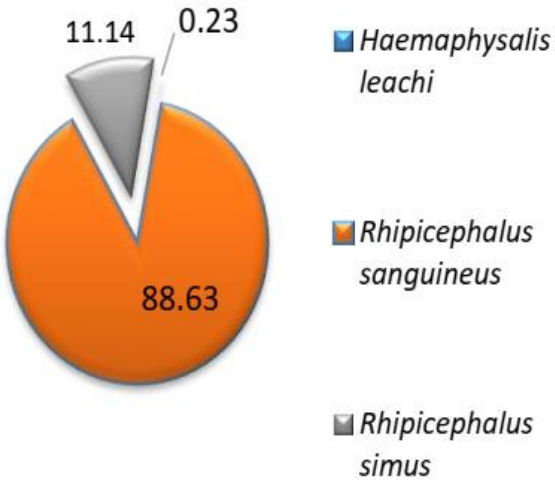

Figure 1: Percentage distribution of total ticks collected for this study

different species of ticks identified were *Rhipicephalus sanguineus* (88.63%) followed by *Rhipicephalus simus* (11.14 %), and *Haemaphysalis leachi* (0.23%), with the least prevalence.

Prevalence of ticks in relation to sex of the dogs in Zaria, Kaduna state, Nigeria

Table 1 shows that out of 157 dogs screened, 73, representing 46.5 %, were infested with ticks. Tick prevalence was found to be higher among males (27.39%) than in females (19.11%), but the difference was not statistically significant ($p \geq 0.05$).

Prevalence of ticks in relation to the age of the dogs in Zaria, Kaduna state, Nigeria

Table 2 indicates that among the dogs studied, tick prevalence was found to be higher in adult dogs. The prevalence of tick infestation in adult dogs (30.57%) was slightly higher than that of young dogs (15.92%), and this variation was statistically significant ($p \leq 0.05$)

Prevalence of ticks in relation to the breed of the dogs in Zaria, Kaduna state, Nigeria

Table 3 indicates the prevalence of tick infestation was found to be higher in the Local dogs (36.94%), followed by crossbreeds (7.64%) and then the exotic breeds which were (1.91%), and this variation was statistically significant ($p \leq 0.05$).

Discussion

This study revealed *Rh. sanguineus* as the predominant tick species infesting dogs, consistent with earlier reports from Nigeria (Natala *et al.,* 2009; Akande *et al.,* 2018; Shitta *et al*., 2018; Elelu *et al*., 2021) and other regions, including Algeria, Egypt, and Europe (Smith *et al.,* 2011; Abdullah *et al*., 2016; Maurelli *et al.,* 2018; Kebbi *et al.,* 2019; Laatamna *et al*., 2020).

The widespread occurrence of *Rh. sanguineus* reflects its remarkable ecological adaptability and close association with domestic dogs, which serve as its primary host. This finding contrasts with the observations of Konto *et al.* (2014), who identified *Boophilus decoloratus* as the most prevalent tick species on dogs in Maiduguri, possibly reflecting geographical and climatic differences that influence tick distribution.

The predominance of *Rh. sanguineus*, in this study, aligns with its global recognition for its ability to thrive in both tropical and temperate environments and adapts well to human habitation. Its abundance has been attributed to poor tick control measures, close dog-human interactions, and favourable climatic conditions that promote year-round infestation (Abdullah *et al.,* 2016; Maurelli *et al.,* 2018).

Rh. sanguineus are main vector of several Canine tick-

Table 1: Prevalence of ticks for sex of the dogs in Zaria, Kaduna state, Nigeria

Sex	No. Examined	No. Positive (+)	Prevalence (%)	χ^2	p-value
Male	91	43	27.39		
Female	66	30	19.11		
Total	157	73	46.50	1.391	0.238

Table 2: Prevalence of ticks for the age of the dogs in Zaria, Kaduna state, Nigeria

Sex	No. Examined	No. Positive (+)	Prevalence (%)	χ^2	p-value
Adult	103	48	30.57		
Young	54	25	15.92		
Total	157	73	46.50	4.787	0.029

Table 3: Prevalence of ticks for the breed of the dogs in Zaria, Kaduna state, Nigeria

Breed	No. Examined	No. Positive (+)	Prevalence (%)
Local	118	58	36.94
Exotic[1]	14	3	1.91
Crossbreeds[2]	25	12	7.64
Total	157	73	46.50

[1] Exotic breeds include: Samoyed and German Shepherd

[2] Crossbreeds include: German Shepherd and Rottweiler crosses

borne pathogens (CTBPs), including *Ehrlichia* spp., *Anaplasma* spp., hemotropic mycoplasma, *Babesia* spp. and *Hepatozoon* spp., which widely affect canine health (Cardoso *et al.,* 2016; Kaewmongkol *et al.,* 2017), and also of zoonotic concern as causative agents of human infections such as Mediterranean spotted or boutonneuse fever (*R. conorii conorii*), spotted fever (*R. massiliae*), Rocky fever Mountain spotted fever (*R. rickettsii*), monocytic ehrlichiosis (*E. canis*) and infectious canine cyclic thrombocytopenia (A. platys) (Otranto *et al*., 2009; Dantas-Torres & Otranto, 2015).

Amblyomma variegatum and *Haemaphysalis leachi* have been reported to infest dogs in Nigeria (Akande *et al*., 2018; Konto *et al*., 2014; Shitta *et al*., 2018; Elelu *et al*., 2021), but this study did not report Amblyomma variegatum; instead, we observed *Rh. simus* to be the most abundant after Rh. sanguineus, and this happens to be the first study to document *Rh*. *simus* on dogs in the study area and Nigeria at large to the best of our knowledge, but it has been previously reported in South Africa by Horak *et al.* (2009).

Rabiu (2019), reported *Rh. simus* group of ticks to be the most prevalent tick species infesting cattle in Zaria, and considering the facts that most dogs sampled in this study were dogs actively used for herding and hunting, and they share the same environment with other domestic animals infested by these ticks, this might have exposed them to infestation by these cattle ticks.

Rh. simus is a known tick of zoonotic importance and vector of *Rickettsia conorii* (Beati *et al.,* 1995) and other pathogens like Ehrlichia minasensis, *Theiliera* spp., *Babesia caballi, Hepatozoon* spp., *Anaplasama* spp., Rickettsia massiliae, and Candidatus Rickettsia barbariae (Parola, 2006; Ledger *et al.,* 2021). The recent findings of Munjita *et al.* (2024) mark the first identification of phlebovirus in *Rh. simus* ticks anywhere in the world; this is of great concern, considering the aggressive feeding behaviour of *Rh. simus* ticks and their potential to transmit pathogens to humans.

The detection of *Haemaphysalis leachi* in low numbers is consistent with its typically limited distribution and host range (Guglielmone *et al.,* 2014), these ticks occur in a wide range of climatic regions from rain forest to desert but it is sparse in desert areas, the difference in climate, time of sample collection are contributing factors because these tick species thrives better in warm and humid conditions, but apparently can occur wherever the rodent hosts for the immature stages are present in association with dogs as hosts for the adults (Walker *et al.,* 2003). The relatively drier conditions in the study area could explain its low prevalence compared to findings from southern Nigeria (Akande *et al.,* 2018; Elelu *et al.,* 2021). Notably, sampling was conducted during the dry season, and as such, seasonal variations in tick abundance and species distribution were not fully captured.

A higher prevalence of tick infestation in male dogs has also been recorded by Silveira *et al.* (2009) and Akande *et al.* (2018). Likewise studies like (Konto *et al.,* 2014; Shitta *et al*., 2018, Lema *et al*., 2020) reported a higher prevalence of tick infestation among females than males, and the possible reasons for high prevalence among male dogs in this study might be due to increased outdoor activities of male dogs, ranging from mating, hunting and herding which might have predispose them to high tick infestation compare to female dogs.

The prevalence of tick infestation in young dogs was slightly less than that of adult dogs in contrast to findings from earlier studies of Konto *et al.* (2014), where a higher incidence was seen in younger dogs. The higher prevalence in adult dogs recorded in this study is similar to that reported by Abah & Audu (2013), Akande *et al*. (2018), Shitta *et al*. (2018), and Lema *et al*. (2020), which might be due to the neglect of adult dogs in terms of tick control.

In conclusion, the findings contribute valuable insights into the prevalence and diversity of ticks infesting dogs and highlight the need for continuous surveillance of tick populations on dogs in Nigeria, its underscore the importance of integrated tick control strategies, improved dog management practices, and public health awareness of the zoonotic risks associated with canine tick infestations, thereby contributing valuable information for improved tick management practice and disease prevention, emphasizing the importance of further research to enhance parasite detection method, however future studies should consider an all year round sampling for a comprehensive epidemiological data on tick prevalence of dogs and better inform tick control strategies.

This study recommends that tick control measures for dogs should be concentrated on the dominant tick species, bathing of dogs in acaricides at 2-4 week intervals during peak infestation periods, grooming, and restriction of movement, to help reduce tick burdens and subsequently tick-borne infections.

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Conflict of Interest
The authors declare no conflict of interest.

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