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Article

Infestation of Zebu cattle (*Bos indicus* Linnaeus) by hard ticks (Acari: Ixodidae) in Maiduguri, Northeastern Nigeria

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ABSTRACT
This study was conducted to investigate the infestation of Zebu cattle by ixodid ticks in Maiduguri, Northeastern Nigeria. A total of 500 cattle were examined and adult ticks were collected from five different body parts for morphological identification. Our results indicate that 59.8% of cattle were infested with ixodid ticks and the differences in prevalence of tick infestation between study sites, breeds and management systems were significant ($p < 0.05$). The intensity of tick infestation between study sites and age of cattle were also significantly different ($p < 0.05$). *Amblyomma*, *Hyalomma* and *Rhipicephalus*, including the subgenus *R.* (*Boophilus*) were the main genera of ixodid ticks identified in the study. Furthermore, the total number of ticks collected shows that *A. variegatum* (798 ind.; 37.7%) prevailed, followed by *R. sanguineus sensu lato* (473 ind.; 22.3%), *R.* (*Boophilus*) *decoloratus* (453 ind.; 21.4%) and *H. truncatum* (395 ind.; 18.6%). The prevalence of mixed infestation (40.6%) was significantly ($p < 0.05$) higher than that of single infestations. Most of the ticks were collected from the perineum (46.2%) and base of tail (39.3%). *Amblyomma variegatum* was more common at the base of tail (48.0%) while *R. sanguineus s.l.* (53.9%), *R.* (*Boophilus*) *decoloratus* (48.3%) and *H. truncatum* (46.8%) were mostly collected from the perineum. Cattle from Gwange had significantly ($p < 0.05$) higher burden of *H. truncatum* (4.2 ± 2.8) than those from Gidan madara (1.7 ± 1.1), and had significantly ($p < 0.05$) higher burden of *R.* (*Boophilus*) *decoloratus* (5.2 ± 4.0) than those from the Abattoir (2.4 ± 1.1) and Gidan madara (1.8 ± 1.1). Our results were discussed in relation to the control of ticks, and epidemiology of the associated tick borne diseases (TBDs) in Maiduguri and environs.

KEY WORDS: *Amblyomma variegatum*; body parts; *Hyalomma truncatum*; Nigeria; prevalence; *Rhipicephalus sanguineus s.l.*

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INTRODUCTION

The Nigerian national cattle population was estimated at 13.9 million (Lawal-Adebowale 2012) and consists predominantly of zebu types; Bunaji, Rahaji, Sokoto gudali, Adamawa gudali, Azawak, Wadara and some muturu, keteku, n'dama and kuri breeds, among others (Blench 1999). Cattle production in Nigeria is an important economic activity that contributes 20% of the agricultural

component of gross domestic product (GDP), through the provision of high quality protein and essential raw materials for Agro-allied industries (Abebayehu *et al.* 2011). Currently, the Nigerian Livestock resources is valued in excess of ₦65 billion (Ojeme 2010). However, the cattle husbandry system in Nigeria is poorly managed and faced with challenges of parasitic diseases (Oyenaya and Olibajo 1977). Among them, ectoparasites, especially ticks and associated diseases are ranked the most important factors threatening cattle breeding (Soulsby 1982; Rajput *et al.* 2006). The global impact of ticks and associated tick borne diseases is very high, and no reliable estimates are available (Jongejan and Uilenberg 2004). However, the direct effects of tick infestation include anemia, reduced productivity, tick toxicosis and depreciation of hide value (Soulsby 1982; Jongejan and Uilenberg 2004; Beyecha *et al.* 2012; Lorusso *et al.* 2013). Furthermore, ticks also serve as vectors of important blood parasites and pathogens which are responsible for diseases of medical and veterinary importance (Soulsby 1982; Jongejan and Uilenberg 2004).

Ixodid ticks belonging to the genus *Amblyomma*, *Dermacentor*, *Hyalomma*, *Rhipicephalus* including subgenus *R.* (*Boophilus*), and *Haemaphysalis* occur in Nigeria (Agbede 2013). The prevalence of various species of ixodid ticks in different ecological zones of Nigeria have been reported (Opara and Ezeh 2011; Obadiah and Shekaro 2012; Lorusso *et al.* 2013; Musa *et al.* 2014). Previous reports revealed a high prevalence of tick infestation in Maiduguri (Opara and Ezeh 2011; Musa *et al.* 2014). Furthermore, studies conducted in Askira-Uba and Maiduguri Metropolitan Local Councils of Borno state and parts of Yobe state also revealed a high prevalence of tick infestation (James-Rugu and Jidayi 2004). Obadiah and Shekaro (2012) also reported the occurrence of *A. variegatum* (Fabricius), *R.* (*Boophilus*) *decoloratus* Koch, 1844, *Hyalomma* species and *R. sanguineus* in Zaria, Nigeria. Similarly, a high prevalence rate of ticks was also encountered in the eastern region around Enugu state (Eyo *et al.* 2014). However, a significantly lower prevalence rate of tick infestation was reported on the Jos Plateau in the North-central region of Nigeria (Olabode *et al.* 2010).

Most of the cattle population in Nigeria are raised in transhumant conditions under pastoral nomadism by Fulani herders, usually grazing extensively on pasture and exposed to infestation by various tick species (Opara and Ezeh 2011; Lorusso *et al.* 2013). This study was therefore conducted to investigate the infestation of zebu cattle by ixodid ticks in Maiduguri, North eastern Nigeria.

MATERIALS AND METHODS

Study area

Maiduguri lies in the Lake Chad basin within the semi-arid zone of North-eastern Nigeria, between Latitudes 11° 50′ N & 13° 09′ E. It shares international boundaries with Republics of Niger, Chad and Cameroon. The climate is generally hot and dry for most of the year, with a short duration of raining season from June to October (Hess *et al.* 1995). Maiduguri is a destination to approximately 2.4 million trade cattle from other parts of the state and neighboring countries.

Study population and sample collection

The cattle under study are indigenous pure and crossed breeds of both sexes and variable age, within Maiduguri and environs. Age of cattle was determined by rostral dentition (Hassan and Hassan 2003). Thus, cattle < 2½ and > 2½ years were categorized as young and adult, respectively. Breed differences was established based on morphometric criteria including; fur colour, presence or absence of horns, dewlap and hump; shape, size and length of the horns; degree of muscling, body size and other linear body measurements (Blench 1999), while sex was determined by appearance of the external genitals. A total of 500 cattle were randomly selected from the five study sites comprising of Abattoir (162), Cattle market (156), Gidan madara (56), Gwange (73) and University of Maiduguri Research Farm (53). The head, neck, body, perineum and tail base of each cattle were carefully

examined and all adult ticks visible to the naked eyes were collected by forceps. Data on the age, sex, breed, system of management and study site of each cattle was recorded. Ticks were placed into clean and labelled universal bottles containing 70% ethanol and transported to the Veterinary Parasitology Research Laboratory, University of Maiduguri, for morphological identification.

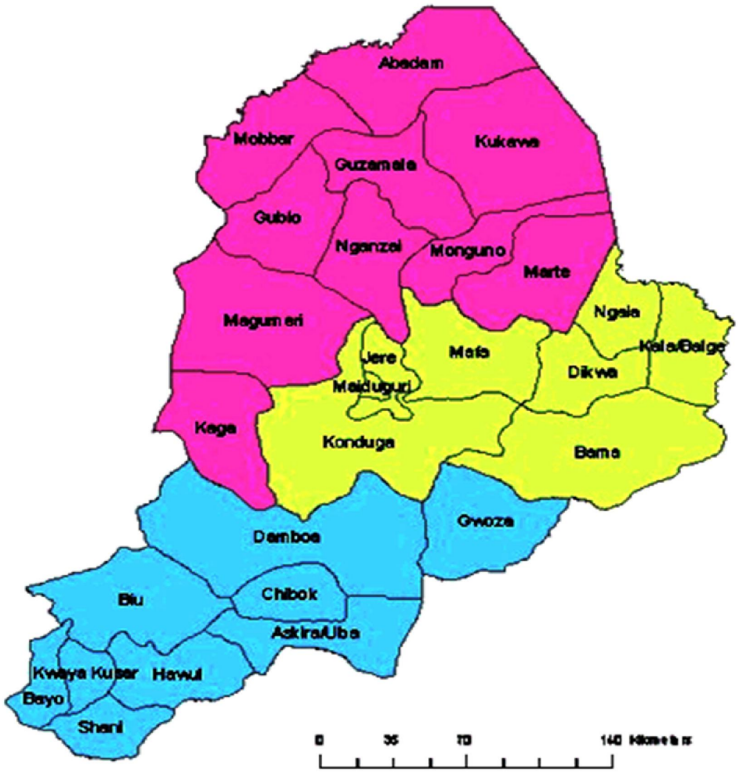

Figure 1. Map of Borno State of Nigeria, showing the study area.

Laboratory identification of ticks

Individual ticks were examined under a stereoscopic microscope, and grouped into genera and species using a combination of morphological features and geographical information on tick distribution in Africa described by Walker *et al*. (2003). *Amblyomma* species were recognized by their large sizes (6–7mm), long mouth parts, presence of pale rings on the legs and conspicuous ornamentation of the scutum and conscutum of both sexes. *Amblyomma variegatum* was distinguished by its small to medium punctuations and pink to orange coloured enamel. *Rhipicephalus* (*Boophilus*) species were recognized by their small sizes (2–3 mm), short mouth parts and the absence of festoons and ornamentation in both sexes. *Rhipicephalus* (*B.*) *decoloratus* was distinguished by the presence of 3 + 3 columns of teeth on the hypostome and has a protuberance bearing two pectinate setae on the internal margin of the first segments of the palps. *Hyalomma* species were recognized by their large sizes (5–6 mm), brown scutum and conscutum, striated integuments, and the presence of festoons in both sexes. *Hyalomma truncatum* was distinguished by the presence of smooth, shiny and dark conscutum bearing a large depressed area in the caudal part of males. Females of this species also have U shaped genital aperture with a concave preatrial fold. *Rhipicephalus sanguineus s.l.* was recognized by dark coloured cuticle and hexagonally shaped basis capitulum. In addition, the tailed spiracle plates are narrower than the width of adjacent festoons and the females had U-shaped genital opening (Soulsby 1982; Walker *et al.* 2003; Dantas-Torres 2017).

Statistical Analysis

Prevalence of tick infestation was estimated as p = d/n (%). Where; p = prevalence, d = number of individual cattle infested with ticks and n = number of individual cattle in the population at risk of infestation with ticks (Thrusfield 2005). The intensity of tick infestation was estimated as the average numbers (Mean ± SD) of ticks collected from infested individual cattle. Chi-Square test and ANOVA were computed using SPSS®-ver. 22, to estimate the prevalence rates (%) and intensity of tick infestation. The *p* value < 0.05 was considered as significant.

RESULTS

The prevalence of infestation with ixodid tick in Zebu cattle in Maiduguri is presented in Table 1. Out of a total 500 cattle examined, 299 (59.8%) were infested with ticks. Significantly ($p < 0.05$) higher prevalence of tick infestation was recorded in cattle in the Abattoir (23.2%) than those in the cattle market (19.8%), Gwange (8.4%), Gidan madara (4.8%) and Research farm (3.6%). Also, significantly ($p < 0.05$) higher prevalence of tick infested cattle were seen in extensive (43.0%) than semi-intensive system (16.8%). Among the breeds of cattle encountered, significantly ($p < 0.05$) higher prevalence was recorded in Rahaji (36.8%) than Wadara (8.4%), Sokoto gudali (6.2%), Zebu cross (3.6%), Kuri (3.2%), Adamawa gudali (0.8%) and Bunaji (0.8%). By contrast, non-significantly ($p > 0.05$) higher prevalence was recorded in adult (42.0%) than young cattle (17.8%), and in female (36.0%) than male (23.8%) cattle.

Table 1. Prevalence of infestation with ixodid ticks in Zebu cattle in Maiduguri, Nigeria.

Risk Factors	Examined cattle	Infested cattle (%)	*P*-values (Fishers-Exact test)
Study site			
Abattoir	162	116 (23.2)	
Cattle Market	156	99 (19.8)	
Gidan madara	56	24 (4.8)	
Gwange	73	42 (8.4)	
Research farm	53	18 (3.6)	0.000*
Management system			
Extensive	318	215 (43.0)	
Semi-intensive	182	84 (16.8)	0.000*
Breed			
Adamawa gudali	11	4 (0.8)	
Bunaji	13	4 (0.8)	
Kuri	26	16 (3.2)	
Rahaji	275	184 (36.8)	
Sokoto gudali	48	31 (6.2)	
Wadara	78	42 (8.4)	
Zebu cross	49	18 (3.6)	0.000*
Age			
Young	141	89 (17.8)	
Adult	359	210 (42.0)	0.343
Sex			
Male	210	119 (23.8)	
Female	290	180 (36.0)	0.255
Total	500	299 (59.8)	

* $p < 0.05$ considered significant.

Intensity (Mean ± SD) of infestation with ixodid ticks in Zebu Cattle in Maiduguri is shown in Table 2. The intensity of tick infestation between study sites and age groups of cattle was significantly different ($p < 0.05$). However, intensity of tick infestation was not significantly different ($p > 0.05$)

among sexes, breeds and management systems.

Table 2. Intensity (Mean ± SD) of infestation with ixodid ticks in Zebu Cattle in Maiduguri, Nigeria.

Risk Factors	Intensity of infestation (Mean ± SD)	P-values (Fishers-Exact test)
Study site		
Abattoir	6.1 ± 5.8	
Cattle market	7.6 ± 8.0	
Gidan madara	5.7 ± 3.5	
Gwange	9.6 ± 7.6	
Research farm	9.3 ± 8.0	0.023*
Management system		
Extensive	6.8 ± 6.9	
Semi-intensive	8.4 ± 6.9	0.060
Breed		
Adamawa gudali	6.3 ± 3.9	
Bunaji	10.5 ± 8.9	
Kuri	8.7 ± 9.6	
Rahaji	7.6 ± 6.4	
Sokoto gudali	8.2 ± 11.2	
Wadara	5.5 ± 4.6	
Zebu cross	9.3 ± 8.0	0.420
Age		
Young	8.5 ± 7.7	
Adult	6.7 ± 6.6	0.043*
Sex		
Male	6.6 ± 5.7	
Female	7.6 ± 7.7	0.232
Total	7.2 ± 7.0	

*$p < 0.05$ is considered significant.

The prevalence and intensity of single and mixed infestation with various species of ixodid ticks collected from cattle in Maiduguri is presented in Table 3. The prevalence (40.6%) and intensity (9.1 ± 7.4) of mixed infestation with a combination of two or more tick species was significantly higher ($p < 0.05$) than single infestation with either *A. variegatum* alone (5.6%), *H. truncatum* alone (6.0%), *R. sanguineus s.l.* alone (4.2%) or *R.* (*B.*) *decoloratus* alone (3.4%).

Table 3. Prevalence and intensity of single and mixed infestation with various species of ixodid ticks in Maiduguri.

Tick Species	Prevalence (%)	Intensity (Mean ± SD)
A. variegatum	5.6	5.6 ± 5.1[a]
H. truncatum	6.0	2.0 ± 1.2[a]
R.* (*Boophilus*) *decoloratus	3.4	2.1 ± 1.7[a]
R. sanguineus s.l.	4.2	2.6 ± 1.8[a]
Mixed infestations	40.6	9.1 ±7.4[b]

Means with different superscripts (a, b) in column differ significantly ($p < 0.05$)

The mean numbers of individual ticks belonging to various species collected from cattle in different locations in Maiduguri is shown in Table 4. The count (mean ± SD) of *H. truncatum* was significantly ($p < 0.05$) higher in Gwange (42 ± 2.8) than in Gidan madara (1.7 ± 1.1). Similarly, the count (mean ± SD) of *R. (B.) decoloratus* was significantly ($p < 0.05$) higher in Gwange (5.2 ± 4.0) than in Abattoir (2.4 ± 1.6) and Gidan Madara (1.8 ± 1.1). On the other hand, the mean counts of *A. variegatum* and *R. sanguineus s.l.* in the different study sites were not significantly different ($p > 0.05$).

Table 4. Mean numbers (±SD) of individual ticks belonging to various species collected from cattle at different locations in Maiduguri.

Tick species	Numbers of individual ticks collected (Mean ± SD)				
	Abattoir	Cattle Market	Gidan madara	Gwange	Research farm
A. variegatum	4.5 ± 4.2	4.2 ± 4.2	3.7 ± 2.1	6.1 ± 5.7	7.7 ± 5.9
H. truncatum	2.6 ± 1.8	3.2 ± 2.5	1.7 ± 1.1[a]	4.2 ± 2.8[b]	3.9 ± 4.1
R. (Boophilus) decoloratus	2.4 ± 1.6[a]	3.1 ± 3.0	1.8 ± 1.1[1]	5.2 ± 4.0[2b]	3.9 ± 3.3
R. sanguineus s.l.	3.2 ± 2.0	4.0 ± 3.6	2.6 ± 1.8	3.2 ± 1.8	3.8 ± 1.7

Unmatched superscripts (alphabets and letters) in row denote significant differences ($p < 0.05$).

The numbers of individual ticks of different species collected from various body parts of cattle in different locations within Maiduguri is shown on Figure 2. Generally, most ticks (980 ind.; 46.2%) were collected from the perineum area and tail base (833 ind.; 39.3%) which were the most tick infested regions while neck (66 ind.; 3.1%) was the least infested region on the host. *Amblyomma variegatum* (798 ind.; 37.7%) was the most numerous species collected, and most of them were collected from the tail base (383 ind.; 48.0%) and perineum (321 ind.; 40.2%). On the other hand, *R.* (*Boophilus*) *decoloratus*, *H. truncatum* and *R. sanguineus s.l.* were mostly collected from the perineum area.

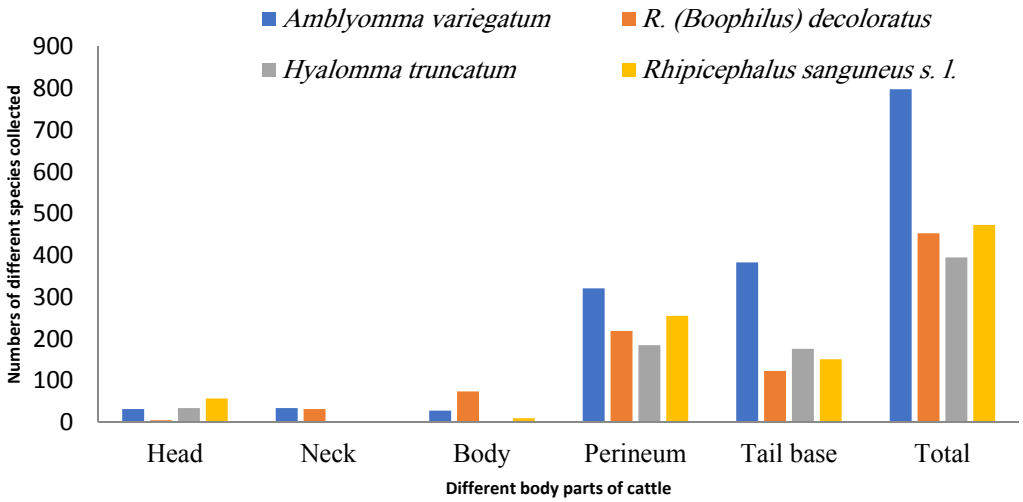

Figure 2. Numbers of individual ticks of different species collected from different body parts of cattle.

DISCUSSION

Our results indicate a high overall prevalence of ixodid tick infestation in cattle within Maiduguri metropolis in accordance with previous reports, which suggested that ixodid ticks are highly prevalent within the metropolis (James-Rugu and Jidayi 2004; Opara and Ezeh 2011; Musa *et al.* 2014). The

abundance of ixodid ticks in Maiduguri could be correlated with high temperature that naturally favours the bionomics of Ixodidae (Shah-Fischer and Say 1989). The management system, breed of cattle, and their location within the metropolis exerted a greater effect on their susceptibility to infestation with ixodid ticks ($p < 0.05$) than their age and sex ($p > 0.05$). The significantly ($p < 0.05$) higher prevalence of tick infestation encountered in abattoir and cattle market than in other study sites suggest that ixodid ticks are unevenly distributed within the same geographical location, depending on the source of animals and/or their management system. Moreover, the abattoir and cattle market are transit points for large numbers of various animals from different sources, and may facilitate rapid spread of ticks through contact or by acting as potential feeding hosts for different tick stages. This finding agrees with previous report by Musa *et al*. (2014) who reported a high prevalence of tick infested cattle in Maiduguri abattoir and cattle market. The significantly ($p < 0.05$) higher numbers of infested cattle encountered in extensive system indicate that extensive management increase the risk of tick infestation. Moreover, cattle under this system graze over a wide area encountering other animals and possibly contaminated vegetation, which may serve as sources of tick infestation. Furthermore, cattle raised under the extensive pastoral nomadic system in Nigeria usually receive little or no veterinary care and rely more on local methods of parasite control which may have several limitations.

The significantly ($p < 0.05$) higher total prevalence of tick infestation in Rahaji (36.0%), and numerically higher but insignificant ($p > 0.05$) intensity of tick infestation in Bunaji (10.5 ± 8.9) than other breeds of cattle in Maiduguri indicate that breed strongly determines the prevalence but not the intensity of tick infestation in cattle, and may have a genetic origin since breed difference is a genetically determined trait. This finding agrees with Jongejan and Uilenberg (2004) who reported that resistance to ticks is genetically determined. Moreover, genetic variation in resistance of different cattle breeds to various parasites has been documented (Gray 1995). Coat colour, a genetically determined trait is also known to influence the prevalence and intensity of tick infestation in cattle (Opara and Ezeh 2011), being higher in dark coloured animals (Jawale *et al.* 2012). Thus, the deep burgundy-coloured coat of Rahaji breed (Blench 1999) may be accountable for the higher prevalence due to camouflage effect (Machado *et al.* 2010), which may mask and protect ticks from predatory birds like egrets, thereby increasing their chances of survival and establishment on the host.

The prevalence of tick infestation was not significant ($p > 0.05$) but numerically higher in adult than young cattle even though the intensity of infestation was significantly ($p < 0.05$) higher in young than adult cattle. This finding suggests that resistance to ticks may develop in older cattle, while younger ones, with poorly developed immunity, tend to accumulate heavier tick burdens, thus, revealing an inverse relationship between age of cattle and intensity of tick infestations. This finding agrees with Eyo *et al*. (2014) who reported a similar trend in grazing cattle from the Eastern region of Nigeria. The age, nutritional plane and hormonal dynamics in the host animals are known to play vital roles in the development of acquired and innate immune response of cattle to ticks (Maharana *et al.* 2011). The sex of cattle had no significant ($p > 0.05$) effect on prevalence of tick infestation but, numerically higher tick infestation rate was encountered among females. This finding agrees with Jawale *et al*. (2012), and could be associated with the common practice of keeping cows for longer periods in the herd for milk production and breeding purposes, thereby serving as potential feeding hosts for tick stages. Even though, some farmers in this area practice routine ectoparasites control using a combination of conventional chemicals and local methods, the system is not harmonized, and tick resistance to most of the pharmaceutical principles has been described (Rajput *et al*. 2006; Coles and Dryden 2014), thus, undermining chemical control. Females are kept longer in the herd and may become less resistant to repeated challenge with age, due to poor immune response (Sahibi *et al*. 1997). Furthermore, the influence of female hormones, stress of pregnancy and lactation generally render female animals more vulnerable to diseases than their male counterparts (Lloyd 1983; Kabir

et al. 2011). Our results, however, disagree with Musa *et al*. (2014) and Opara and Ezeh (2011) who reported higher prevalence rates of tick infestation among male cattle. Additionally, sex related difference in prevalence rate of tick infestation in livestock was also reported elsewhere (Rony *et al.* 2010; Sarkar *et al.* 2010; Asmaa *et al.* 2014).

This study has revealed the presence of three genera of Ixodidae; *Amblyomma*, *Hyalomma* and *Rhipicephalus*, including the sub genus *Boophilus*, in Maiduguri and environs, among which *A. variegatum* was the most prevalent species. These findings are in agreement with Opara and Ezeh (2011), Obadiah and Shekaro (2012) who reported all three tick genera and *A. variegatum* as the most prevalent species of Ixodidae in Nigeria. Similarly, Musa *et al*. (2014) reported the occurrence of *Boophilus*, *Amblyomma*, *Rhipicephalus* and *Ornithodoros* species in Maiduguri. Furthermore, Eyo *et al*. (2014) reported a high prevalence of *A. variegatum*, *A. maculatum*, *R.* (*B.*) *annulatus* and *R.* (*B.*) *microplus* in Enugu state, Nigeria. The three genera of Ixodidae identified in this study have been widely recognized as vectors of tick borne diseases of veterinary and public health significance (Soulsby 1982; Jongejan and Uilenberg 2004). The occurrence of *Anaplasma*, *Babesia* and *Theileria* species in Maiduguri has been linked to a high prevalence of ixodid ticks (Biu and Kabono 2005; Paul *et al.* 2016). The significantly ($p < 0.05$) higher prevalence of mixed infestation with two or more species of Ixodidae depicts the multiplicity of typical field infestation. Under field conditions, mixed parasitic infestations are more likely to be encountered due to the practice of mixed farming in typical backyard and pastoral nomadism in Nigeria. The frequent encounter of *R. sanguineus s.l.* on cattle in Maiduguri (James-Rugu and Jidayi 2004; Opara and Ezeh 2011; Musa *et al.* 2014), may be linked to the large population of stray, farm and hunting dogs, which commonly live in the same environment with livestock and could carry these tick stages. This finding has serious implications in the epidemiology and control of tick and associated tick borne diseases of cattle in Maiduguri and environs.

The total number of different species of ixodid ticks collected from various body parts of cattle examined in this study revealed that perineum area and tail base were the most preferred sites of attachment by adult stages of Ixodidae. This may be due to suitable micro environments created by the relatively sparse fur, softer coat and high vascular supply in the perineum and tail base, which allows ticks to easily colonize and engorge in good time, to ensure succession (Opara *et al.* 2005). Moreover, the perineum area and tail base are less exposed parts of the host's anatomy, which may provide additional protection for the attached ticks, from extreme environmental factors. The ticks might prefer attachment in these sites to enable them overcome the effects of high ambient temperatures experienced in Maiduguri. *Hyalomma truncatum*, *R. sanguineus s.l.*, and *R.* (*B.*) *decoloratus* were mostly attached to the perineum area while *A. variegatum* were mostly attached to the base of the tail. This difference in preferred sites of attachment on the same host by the different genera of ixodid ticks observed in this study indicated that different groups of ticks have evolved adaptations to feeding on different body parts of their host. This difference may also reflect morphological peculiarities in appearance of feeding apparatus in the mouth parts of the various genera (Walker *et al*. 2003).

CONCLUSION

This study revealed the presence of four species of ixodid ticks, including *R. sanguineus s.l.*, *R.* (*B.*) *decoloratus*, *H. truncatum* and *A. variegatum*, of which *A. variegatum* was the most prevalent species. Mixed infestation with various species was higher than single infestation, and ticks were mostly found attached to remote parts of the host's anatomy. The management system, breed type, age and location of cattle were the important risk factors of tick infestation identified in this study. These findings provide insight into the epidemiology of ixodid ticks, especially their role as vectors of tick borne

diseases. Our findings further provide information for design and implementation of effective control measures against ixodid ticks in Maiduguri and environs.

Recommendations

Effective prevention and control of ixodid ticks in Maiduguri requires an integrated prevention and control approach based on the available epidemiological data. A successful strategy depends on combined use of strategic acaricidal treatments and environmental management, considering the role of potential vertebrate reservoir hosts, especially small mammals, rodents and domestic or farm dogs.

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آلودگی گاو کوهان‌دار (*Bos indicus* Linnaeus) به کنه‌های سخت (Acari: Ixodidae) در مایدوگوری، شمال شرق نیجریه

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چکیده

این مطالعه در راستای بررسی آلودگی گاوهای کوهان‌دار به کنه‌های سخت در مایدوگوری، شمال شرق نیجریه انجام شد. پانصد دام مورد بررسی قرار گرفتند و کنه‌های کامل از پنج قسمت مختلف بدن برای شناسایی ریخت‌شناختی جمع‌آوری شدند. نتایج نشان داد که ۵۹/۸٪ دام‌ها به کنه‌های سخت آلوده بودند و اختلاف در غالبیت آلودگی به کنه بین منطقه‌های مورد مطالعه، گوساله‌ها و سامانه مدیریت‌ها معنی‌دار بود ($p < ۰/۰۵$). شدت آلودگی بین منطقه‌های مطالعه شده و سن دام نیز اختلاف معنی‌دار داشت ($p < ۰/۰۵$). جنس‌های *Amblyomma*، *Hyalomma* و *Rhipicephalus* شامل زیرجنس *R.* (*Boophilus*) جنس‌های اصلی شناسایی شده در این پژوهش بودند. افزون بر این، تعداد کل کنه‌های جمع‌آوری شده نشان داد که *A. variegatum* (۷۹۸ فرد؛ ۳۷/۷٪) غالب بود و پس از آن *R. sanguineus sensu lato* (۴۷۳ فرد؛ ۲۲/۳٪)، *R.* (*Boophilus*) *decoloratus* (۴۵۳ فرد؛ ۲۱/۴٪) و *H. truncatum* (۳۹۵ فرد؛ ۱۸/۶٪ قرار گرفتند. غالبیت آلودگی مخلوط (۴۰/۶٪) از آلودگی به یک گونه به طور معنی‌داری ($p < ۰/۰۵$) بیشتر بود. بیشتر کنه‌ها در حد فاصل بین مقعد و دستگاه تناسلی (۴۶/۲٪) و پایهٔ دم (۳۹/۳٪) جمع‌آوری شدند. گونهٔ *Amblyomma variegatum* بیشترین تعداد را در پایهٔ دم و گونه‌های *R. sanguineus s.l.* (۵۳/۹٪)، *R.* (*Boophilus*) *decoloratus* (۴۸/۳٪) و *H. truncatum* (۴۶/۸٪) بیشتر از ناحیهٔ حد فاصل بین مقعد و دستگاه تناسلی جمع‌آوری شدند. گاوهای منطقهٔ گوانج به طور معنی‌داری تعداد کنهٔ بیشتری از گونهٔ *H. truncatum* (۲/۸ ± ۴/۲) نسبت به گاوهای آلوده به این کنه در منطقهٔ گیدان مادارا (۱/۱ ± ۱/۷) و به طور معنی‌داری تعداد کنهٔ بیشتری از گونهٔ *R.* (*Boophilus*) *decoloratus* (۴/۰ ± ۵/۲) نسبت به گاوهای آلوده به این کنه در مناطق آباتوئیر (۱/۱ ± ۲/۴) و گیدان مادارا (۱/۱ ± ۱/۸) داشتند. نتایج این مطالعه در ارتباط با کنترل کنه‌های سخت، و همه‌گیرشناسی بیماری‌های کنه‌زاد مرتبط (TBDs) در مایدوگوری و حومه بحث می‌کند.

واژگان کلیدی: *Amblyomma variegatum*؛ قسمت‌های بدن؛ *Hyalomma truncatum*؛ نیجریه؛ غالبیت؛ *Rhipicephalus sanguineus s.l.*

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