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Original Research

Prevalence of ixodid (hard ticks) infestation on cattle at Sabon gari, Zaria, Kaduna State, Nigeria

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ABSTRACT

Northern Nigeria has high number of cattle populations, the majority of which are in the hands of Fulani herdsmen. A cross-sectional study was conducted with the aim of determining the common species of ticks and their prevalence on cattle in three selected areas within Sabon Gari- Zaria, Kaduna State, Nigeria from June 2018 to October 2018. During the period, a total of 384 cattle were sampled and 439 ticks (*Ixodidae*) were collected from 335 infested cattle in the selected sampling sites. Three genera of ticks comprising five species were found infesting cattle in Sabon Gari. *Amblyomma variegatum* (47.8%; 210/439) constituted the highest percentage of ticks collected from the sample sites, followed by *Rhipicephalus (Boophilus) decoloratus* (31.0%; 136/439). *Hyalomma* species had the least percentage infestation, with *Hyalomma truncatum* having (18.5%; 81/439) infestation. *Hyalomma impeltatum* had (1.8%; 8/439) and *Hyalomma rufipes* had (0.9%; 4/439) infestation. The infestation of ticks in Bomo village was highest at 176 (40.1%) compared to Zangon Shanu at 167 (38.0%) and Angwan Fulani at 96 (21.9%). Tick infestation has serious medical and economic implications because of their tendency to inflict pathological effects on the cattle. Attention should therefore be given to prevention and control of ticks, since they affect the general health of the animal, thereby causing serious production and economic losses.

Keywords: Cattle, Ixodid ticks, Nigeria, Prevalence, Zaria

INTRODUCTION

Ticks are obligate blood-sucking ectoparasites of various species of animals and humans (Mekonnen, 2002; Jongejan & Uilenberg, 2004). They are classified as one of the most economically important groups of arthropod vectors parasitizing wild and domestic animals including humans (Uilenberg, 1995; Jongejan & Uilenberg, 2004). Ticks belong to the Phylum *Arthropoda* and Suborder *Ixodida* and share the Order Parasitiformes with the suborders *Holothyrida*, Mesostigmata (commonly known as mites) and *Opilioacarida* (Santiago *et al.*, 2009). Ixodida contains four (4) families; *Ixodidae* (hard ticks), *Argasidae* (soft ticks), *Laelaptidae* and *Nuttalliellidae* (Wall & Shearer, 2008). *Ixodidae* (hard) ticks and *Argasidae* (soft) ticks are the two well-established families (El-Kammah *et al.*, 2001). The hard ticks are the largest group with approximately 650 species while the soft ticks comprise about 150 species (Wall and Shearer, 2008). The latter two families (*Laelaptidae* & *Nuttalliellidae*) have one species each (monophyletic) and are of minor importance (Anderson & Magnarelli, 2008). The infestations of ticks on various domestic animals like cattle, sheep, goats and horses have been investigated by various authors in Nigeria (Dipeolu, 1975b; George *et al.*, 1990; Ahmed & George, 2002).

Ticks are important ecto-parasites of cattle and other domestic species of tropical and subtropical countries serving as a vector of several disease-causing organisms (Muhammed *et al.*, 2008). They transmit a wide variety of pathogenic microorganisms (Jongejan & Uilenberg, 2004), that cause severe infectious diseases in livestock and humans (Jongejan & Uilenberg, 2004). They are regarded as a major constraint to improving livestock production in sub-Saharan Africa (Muriithi, 1984). The medical and economic importance of ticks has been recognized worldwide (Rajput *et al.*, 2006).

Tick infestation causes huge economic losses in livestock production in terms of diseases, reduced productivity and fertility and often death (Rajput *et al.*, 2006), and continue to cripple the industry, especially in sub-Saharan Africa (Horak *et al.*, 1983). Reduced weight and poor carcass quality, low hide quality and a drop in milk production are the direct effects of tick infestation in domestic animals (Norval &

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Lightfoot, 1982). Feeding by a large number of ticks causes anaemia, loss of body weight, severe irritation with resultant dermatitis, loss of production, weakness and immune-suppression (Gwakisa *et al.,* 2001; Punyua *et al.,* 1991) as well as serious damage to hides and skin leading to significant financial losses to livestock farmers (Biswas, 2003), and many species of ticks can cause debilitating or even fatal paralysis in their hosts (Ejima & Ayegba, 2011).

The livestock sector represents a significant part of the global economy, especially in the developing world (Joseph *et al.,* 2014). Livestock production serves as a source of employment and livelihood in Nigeria. A large percentage of rural dwellers satisfy their subsistence need through livestock production. The business involves rearing and marketing of livestock which include mainly cattle, sheep, goats, pigs, camels and poultry but cattle are the most prominent of all domestic animals in Nigeria (Tewe, 1997). About 90% of the cattle populations in Nigeria are kept under the traditional pastoral husbandry system of Fulani herders; with the largest cattle population concentrated in the central to the northern part of the country (Iwuala & Okpala, 1978; Awogbade, 1979). Under the pastoral system of management, cattle are extensively grazed on pastures and forest, and as a result these animals are exposed to infestation by various species of ticks particularly ticks belonging to the genera *Amblyomma, Hyalomma* and *Rhipicephalus spp*., including sub-genus *Boophilus* (Bayer & Maina, 1984). Apart from the direct effect of tick infestation on animal production and productivity, ticks are inevitably efficient vectors of many pathogens, like protozoa, viruses, bacteria, and rickettsiae to man and domestic animals (Jongejan *et al.,* 2004).

Good health status coupled with proper management is one of the key factors that influence the productivity of ruminant animals (Lamorde, 1981). Achieving good herd health is only possible by adequate control of vectors of the diseases and the control of tick infestation and the disease they transmit is a multi-billion global investment (Lampo *et al*., 1997), making it one of the costliest operations in the livestock industry. Effective control of tick vectors could only be achieved if farmers have the idea of infestation (Hassan, 1997). Knowledge of the prevalence and distribution of ticks is an essential prerequisite for devising effective control against infestation by ticks and the infections they transmit (de Castro, 1997).

Sabon Gari and its' environ have a special climate condition that support the growth of pasture which favors animal husbandry (Mortimore, 1970). Fulani herders and other cattle farmers graze their animals on the pastures thereby exposing the animals to high tick infestation. Therefore, with the background knowledge of the harmful effects of tick on profitable cattle production and with the increasing rate of cattle rearing in Sabon Gari, it is important to survey the infestation of ticks in some selected herds of cattle to update the information status of tick infestation in these areas. This will support enlightenment campaigns against the spread of infestation among cattle farmers.

MATERIALS AND METHODS

STUDY AREA

Sabon Gari Local Government Area is located in Zaria, Kaduna State. It is bordered to the south by Tudun Wada Bridge, to the east by Zaria dam, to the west by Giwa Local Government area and to the north by Kaduna-Kano express way (Obadiah & Shekaro, 2012). It is located at latitude 11º3'N and longitude 7º 42'N. The city lies on the high plains of Northern Nigeria, in Sub-Saharan Africa. It is about 643.7 kilometers from the coast of Nigeria. The city has become a nodal point by virtue of its location in Northern Nigeria and in terms of its rail and road transport (Ubogu, 2008). Sabon Gari local government area comprises eleven wards namely; Angwan Gabas, Angwan Basawa, Angwan Auta-Jushi, Angwan Jamaa, Angwan Dogarawa, Angwan Hanwa, Angwan Chikaji, Angwan Samaru, Angwan Bomo, Angwan Zabi and Muchia wards (Encyclopedia, Zaria, 2009). The climatic characteristics are that of tropical savannah (Mortimore, 1970), with a monthly mean temperature of 25.25^0C (ranging from 13.8^0C to 36.7^0C) and annual rainfall of 1092.8mm (Agbogbu *et al.,* 2006).

ETHICAL APPROVAL

Verbal informed consent was sought from the cattle owners as the study does not involve sampling of animals in the National parks and other protected areas.

COLLECTION OF TICKS

Three hundred and eighty-four (384) Cattle were randomly selected from the sampling sites for the collection of ticks. The sampling lasted over five (5) months, from June 2018 to October 2018. Ticks were collected from cattle in three selected sites namely; Bomo village, Zangon Shanu and Angwan Fulani. The sampling was done after obtaining approval from the herd owners. The restraining of the cattle was done with the help of farm attendants, and the ticks were detached from the body of the cattle by hand picking and individually put in universal glass tubes and loosely plugged with cotton wool. The glass tubes were labelled indicating tick species and date of collection. The ticks were then transported to the Entomology Laboratory, Department of Veterinary Parasitology and Entomology, Ahmadu Bello University, Zaria for identification.

MORPHOLOGICAL IDENTIFICATION

The ticks collected were examined morphologically. Ticks were first washed twice with sterile water to remove excess particulate contamination from animal skin, and then rinsed

once in 70% ethanol. Each tick was placed in petri dish using a pair of forceps and examined using a stereo microscope at magnifications of x40, x80, and x100. Where possible, the ticks were identified up to the species level using both taxonomic descriptions (Walker *et al.,* 2003) and morphological keys (Hoogstraal, 1956; Hoogstraal and Kaiser, 1959; Madder 2012a, b).

STATISTICAL ANALYSIS

Prevalence was presented as simple percentages. Analysis of variance (ANOVA) was used to compare the prevalence of ticks of cattle in different sample sites (SPSS-Statistical Package for Social Sciences version 21.0). The level of significance was set at $p \leq 0.05$.

RESULTS

From a total of 384 cattle sampled, 439 ticks were recovered from 335 infested cattle. All the ticks collected were identified morphologically and classified into three genera namely: *Amblyomma, Rhipicephalus* and *Hyalomma*. Five species of ticks were identified from all the three sample sites. In the genus *Amblyomma,* only one species was identified (*Amblyomma variegatum*), in the genus *Rhipicephalus* only one species was identified in the subgenus *Boophilus Rhipicephalus* (*Booph.*) *decoloratus* while in the genus *Hyalomma* three species were identified (*Hyalomma rufipes, Hyalomma impeltatum* and *Hyalomma truncatum*).

MORPHOLOGICAL IDENTIFICATION OF TICKS

The prevalence of ticks of cattle collected from sample sites in Sabon Gari is presented in Table I. Out of 142 cattle sampled from Bomo Village, 131 were infested with different species of ticks namely *Amblyomma variegatum* 86(48.86%), *Rhipicephalus (Booph.) decoloratus* 52(29.55%) and *Hyalomma species* 38(21.60%). There was a significant difference in the number of ticks collected ($p \leq 0.05$). Out of 135 cattle examined from Zangon Shanu, 125 were found to be infested with *Amblyomma variegatum* 78(46.71%), *Rhipicephalus (Booph.) decoloratus* 58(34.73%), *Hyalomma* species 31(18.56%), ($p \leq 0.05$). From Angwan Fulani, 107 cattle were examined and only 79 were infested with *Amblyomma variegatum* 46(47.92%) (most prevalent ticks), *Rhipicephalus (Booph.) decoloratus* 26(27.17%), and *Hyalomma* species 24(25.00%). There was no significant difference ($p > 0.05$) between *Rhipicephalus (Booph.) decoloratus* and *Hyalomma* species.

The prevalence of ticks in different locations is presented in Table II. The infestation of ticks in Bomo Village was highest at 176(40.1%) compared to Zangon Shanu at 167(38.0%) and Angwan Fulani at 96(21.9%). There was no significant difference ($p > 0.05$) in the collection from Bomo village and Zangon Shanu even though, the collection from Angwan Fulani differed significantly ($p \leq 0.05$). Table III – V shows the prevalence of ticks collected based on sex. Of the 176 ticks collected from Bomo village 63 were in develo≤mental (immature) stages, hence, undifferentiated, second to the males which had the highest number with 68 ticks. The female ticks had the least number with 45 ticks; 167 ticks were sampled from Zangon Shanu, the developmental stages had the highest number with 74 ticks followed by the males with 49 ticks, and the females are the least with 44 ticks. From the collections in Angwan Fulani, the males had the highest number with 38 ticks followed by the developmental stages with 30 ticks and the females with 28 ticks.

DISCUSSION

The studies carried out in the selected Fulani herds within Zaria, shows that the ticks infesting cattle in Zaria belongs to three genera namely; *Amblyomma, Rhipicephalus* (subgenus *Boophilus* included) and *Hyalomma*. Five different species of ticks from the three genera were identified from the survey carried out, these include; *Amblyomma variegatum, Rhipicephalus (Booph.)decoloratus*, *Hyalomma rufipes, Hyalomma impeltatum* and *Hyalomma truncatum.* Infestation percentage by these tick genera was variable in degrees but observed in all the different sample sites. *Amblyomma variegatum* constitute the highest percentage of sampled ticks in Zaria with 47.8% infestation, this was followed by *Rhipicephalus (Booph.) decoloratus* with 31.0% infestation. *Hyalomma* species had the least percentage

Table I: Prevalence of Ticks on Cattle Collected from Sample Sites in Sabon Gari

Location	No. of animals examined	No. of animals infested	Tick species identified	No. (%) collected
Bomo Village	142	131	*A. variegatum*	86 (46.86)[a]
			Rh. (B.) decoloratus	52 (29.55)[b]
			Hyalomma sp	38 (21.60)[c]
Zongon Shanu	135	125	*A. variegatum*	78 (46.71)[a]
			Rh. (B.) decoloratus	58 (34.73)[b]
			Hyalomma sp	31 (18.56)[c]
Angwan Fulani	107	79	*A. variegatum*	46 (47.92)[a]
			Rh. (B.) decoloratus	26 (27.17)[b]
			Hyalomma sp	24 (25.00)[c]
Total	384	355		439

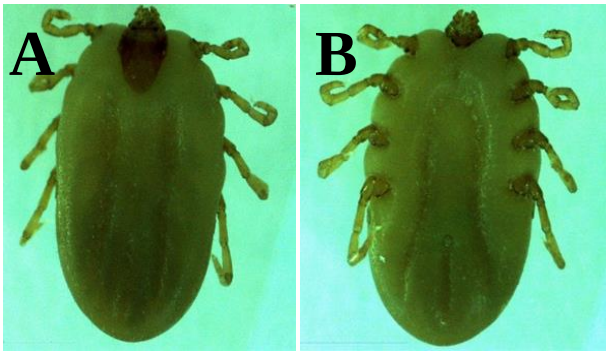

Figure I: Genus *Rhipicephalus* (subgenus *Boophilus*); A. dorsal view and B. ventral view (× 100 magnification).

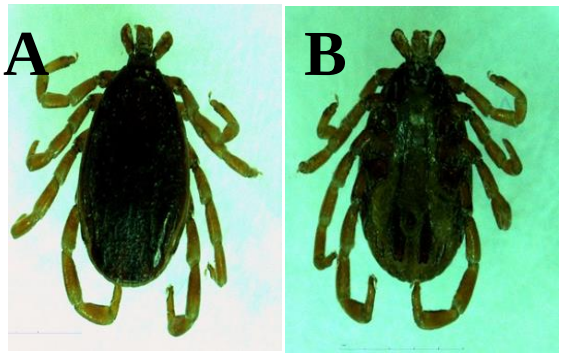

Figure II: Genus *Hyalomma* spp; A. dorsal view and B. ventral view (× 100 magnification).

Figure III: Genus *Amblyomma variegatum*; A. dorsal view and B. ventral view (× 100 magnification).

infestation, with *Hyalomma truncatum* having 18.5% infestation. *Hyalomma impeltatum* had 1.8% and *Hyalomma rufipes* had 0.9% infestation. The findings in this study are in line with the reports of Obadiah & Shekaro (2012), who reported similar species in addition to *Rhipicephalus sanguineus*, and also agrees with the report of Obadiah *et al.* (2017), who identified these ticks in addition to *Rhipicephalus (Booph.) microplus.* These tick species, in addition to *Dermacentor variabilis*, were identified in Borno and Yobe States, Northeastern Nigeria, South-western Nigeria and North central Nigeria by a number of authors (Mohammed, 1976; Okon & Obiekazie, 1981; Amoo*et al.*, 1984; Hitcheock, 1993; James-Ruguand Jidayi, 2004). These authors reported these ticks as vectors of haemoparasitic diseases of livestock. Similar findings were reported from other parts of the world (Atif *et al.*, 2012; Asmaa *et al.*, 2014).

A high prevalence of *Amblyomma variegatum* was reported from all the sampling sites, followed by Rhipicephalus

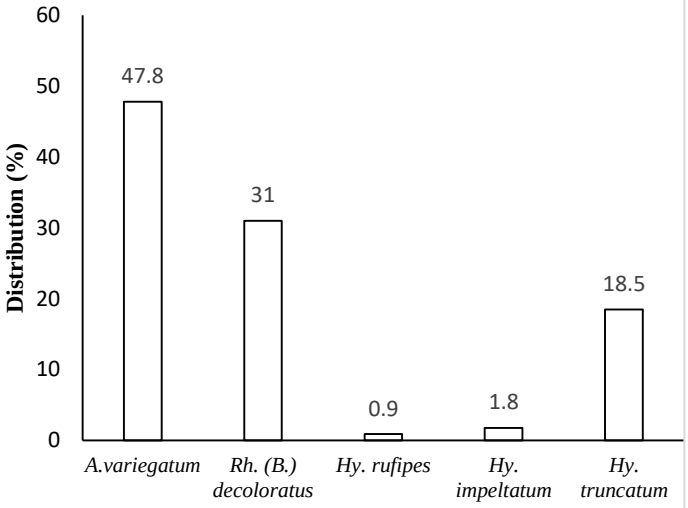

Figure IV: Distribution of tick species on cattle in the sample sites in Zaria

Table II: Prevalence of Tick Infestation with Location

Location	*A. variegatum*	*Rh. (B) decoloratus*	*Hy. rufipes*	*Hy. Impeltatum*	*Hy. truncatum*	*Total (%)*
Bomo	86 (48.86)[a]	52 (29.55)[a]	1 (0.57)[a]	3 (1.70)[a]	34 (19.32)[a]	176 (40.1)[a]
Zangon Shanu	78 (46.70)[b]	58 (34.73)[a]	3 (1.80)[a]	1 (0.60)[a]	27 (16.17)[b]	167 (38.0)[a]
Angwan Fulani	46 (47.92)[c]	26 (27.08)[b]	0 (0.00)[a]	4 (4.17)[b]	20 (20.83)[c]	96 (21.9)[b]
Total	210 (47.8)	136 (31.0)	4 (0.9)	8 (1.8)	81 (18.5)	439 (100)

Values in the same column with different superscripts differ significantly at P<0.05

Table III: Prevalence of Ticks collected from Bomo Village Based on Species and Sex. Dev; developmental, Infest: infestation

Tick species	Dev. stages	Adults			Infest. (%)
		Males	Females	Total	
A. variegatum	22	46	18	86	48.86
Rh. (B) decoloratus	29	4	19	52	29.55
Hy. rufipes	-	-	1	1	0.57
Hy. Impeltatum	-	2	1	3	1.70
Hy. truncatum	12	16	6	34	19.32
Total	**63**	**68**	**45**	**176**	**100**

Table IV: Prevalence of Ticks Collected from Zangon Shanu Village Based on Species and Sex. . Dev; developmental, infest: infestation

Tick species	Dev. stages	Adults			Infest. (%)
		Males	Females	Total	
A. variegatum	26	37	15	78	46.70
Rh. (B) decoloratus	33	3	22	58	34.73
Hy. rufipes	-	2	1	3	1.80
Hy. Impeltatum	-	-	1	1	0.60
Hy. truncatum	15	7	*5*	27	16.17
Total	**74**	**68**	**45**	**167**	**100**

Table IV: Prevalence of Ticks Collected from Zangon Shanu Village Based on Species and Sex. Dev; developmental, Infest.; infestation

Tick species	Dev. stages	Adults			Infest. (%)
		Males	Females	Total	
B. variegatum	12	24	10	46	46.7
Rh. (B) decoloratus	7	6	13	26	34.73
Hy. rufipes	-	-	-	0	1.80
Hy. Impeltatum	-	2	2	4	0.60
Hy. truncatum	11	6	*3*	20	16.17
Total		**68**	**45**	**167**	**100**

(Booph.) decoloratus and *Hyalomma spp.* The highest percentage abundance of *Amblyomma* species recorded from all the sampling sites was expected, as it has been established in the literature as the most important species in the African continent, being adapted to domestic livestock and widespread throughout tropical and sub-Saharan Africa (Obadiah *et al.*, 2017). This finding is in agreement with the report of Obadiah *et al.* (2017), who studied tick Infestation of Cattle in three markets in Makurdi, North-Central, Nigeria and identified the following species, *Amblyomma variegatum, Rhipicephalus (Booph.) decoloratus, Hyalomma spp* and *Rhipicephalus (Booph.) microplus* with *A. variegatum* having the highest prevalence (55.6%), and also the report by George *et al.* (1990), who reported *Amblyomma variegatum* as the most prevalent species, followed by *Rhipicephalus (Booph.) decoloratus* and *Hyalomma impeltatum* as the least prevalent. Similarly, Ejima and Ayegba (2011) attributed the prevalence of Ixodid ticks to favorable climatic conditions such as moisture provided by light and moderate rainfall as occurs in Sabon Gari.

The number of ticks recovered from Bomo village was higher than Zangon Shanu and Angwan Fulani, probably because the vegetation where the ticks thrive are readily available in Bomo village. Most cattle owners do not regularly deworm and apply acaricides on their cattle which contribute to the high prevalence of ticks in their herds (Obadiah & Shekaro, 2012).

A high percentage of male ticks was identified from all the sample sites which was higher than the number of female ticks identified. However, this finding does not agree with the work of Rahmeto *et al.* (2010), who reported higher number of female ticks compared to the male ticks. With most of the tick species identified, particularly *Ambyomma variegatum* and *Hyalomma spp* the males dominate the fauna except that of *Rhipicephalus (Booph.) decoloratus* whereby the females dominate. A similar report was made by Abunna *et al.* (2009). Control of tick infestation has been difficult because of the paucity of information on the prevalence and distribution of the tick species.

CONCLUSION

From the survey carried out, high tick infestation rate was recorded in Sabon Gari. This may be as a result of the favorable climatic condition and vegetation where the ticks thrive. Three genera namely; *Amblyomma, Rhipicephalus* (subgenus *Boophilus* included) and *Hyalomma* were identified from the survey. Five different species of ticks identified from the three genera include; *Amblyomma variegatum, Rhipicephalus (Booph.) decoloratus, Hyalomma rufipes, Hyalomma impeltatum* and *Hyalomma truncatum* with *Amblyomma variegatum* having the highest prevalence 210 (47.84%). Bomo village had the highest prevalence 176 (40.1%). This might be because of the poor management practice and favorable climatic conditions for the spread of the ticks in the area.

The high prevalence of tick infestation recorded in this research has serious health and economic implication as it has the potential of inflicting pathological effects on both cattle and humans. The limited scope of awareness regarding the impact of ticks among the herdsmen, lack of adequate veterinary infrastructures for access by pastoral society and

absence of tick control strategy in the study area are the most important factors attributable for the widespread existence of tick species. Therefore, there is a need to create awareness among livestock owners on the effect of tick infestation and the need to control tick infestation on cattle. Good management should be ensured at all times by cattle owners to limit the spread of ticks and their associated-diseases.

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CONFLICTS OF INTEREST

The authors have no conflict of interest to declare.

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