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Ticks infestation and diversity on indigenous cattle reared in Qua'an Pan LGA of Plateau State, Nigeria

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ABSTRACT

Ticks are distributed all over the world, they infest on livestock and man as a necessity to feed on blood at some stage of their life which results in transmission of tick-borne diseases. Therefore, the study on ticks infestation and diversity on indigenous cattle reared in Qua'an Pan Local Government Area of Plateau State, Nigeria was carried out between November 2014 and July 2015. Two hundred cattle (123 females and 77 males) were randomly selected across five locations; of these, 97 (48.5%) individuals were infested with 200 ticks. The infestation rate of the ticks was predominant in Namu 60.0% (15/25) and least in Kurgwi 38.0% (19/50). However, there was no significant difference ($P > 0.05$) in ticks' infestation across the five selected locations. A significantly higher proportion ($P < 0.05$) of female cattle (61.5%) was infested with ticks as compared to males (38.5%). Six tick species were identified from the 200 ticks collected, of which *Hyalomma ruficipes* was the most predominant 65 (32.5%) followed by *Amblyomma variegatum* 51 (25.5%), *Rhipicephalus sanguizeove* 47 (23.5%), *Boophilus neoroplus* 27 (13.5%), while *Otobuis* species and *Haemophysalis* species were the least 5 (2.5%). Thus, there was a significant difference ($\chi^2 = 94.42$, df = 5, $P < 0.001$) in tick abundance between species. The diversity of ticks in the area was relatively low ($H' = 1.5$). To this end, cattle owners should constantly monitor the body of their cattle weekly to keep them free of ticks.

Keywords: Ticks, cattle, infestation, diversity

INTRODUCTION

Ticks are legged spider-like creatures that occur in great variety (Katie, 1986). They are cosmopolitan but are reported to be more prevalent in warmer climates (Oluwoch *et al.,* 2009; Adejoh *et al.,* 2019). They are found to infest on livestock and man as a necessity to feed on blood at some stage of their life. Feeding occurs by burying their head in the skin of their host to suck blood, deriving nutritional requirements directly from its host (Adejoh *et al.,* 2019). Ticks are distributed all over the world, but occur principally in tropical and sub-tropical countries and are capable of taking-in many times their weights in blood, with a corresponding increase in width. Tick bites in humans could result to tick borne diseases (TBD) such as human babesiosis, Borrelia miyamotoi and anaplasmosis (Ikpeze *et al.,* 2007) and ticks also play a vital role in the transmission of other diseases such as babesiosis, anaplasmosis, piroplasmosis and canine erhlichiosis etc. among livestock animals (Akinboade and Dipeolu,1983).

Ticks can rapidly cause great problems to livestock owners such as severe economic losses and are also offensive in a home where no animal is kept (Inci, 2016; Meneghi *et al.,* 2016). Tick bites are reported to cause mechanical damage, inflammation, toxicosis, paralysis, allergy and anemia (Jongejan and Uilenberg, 2004). Among the ectoparasites infesting cattle, ticks are very significant and harmful because of their blood-sucking habits and direct debilitating effect which may produce pathological changes and may also lead to severe injury, reduced impact on cattle productivity or even death (Ikpeze, 2012). Tick infestation further results to low

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production yield in terms of both quantity and quality of any livestock. Cattle are hampered by the effect of ticks, which are often complicated by problems of poor management as well as inadequate nutrition. Tick infestation leads to the removal of appreciable quantity of blood from an animal (John *et al.,* 2017). They cause serious skin irritation which may become infested by bacteria resulting to sores.

Marufu *et al.* (2011) reported that in Nigeria, the nomadic system of grazing which is a common phenomenon has exposed cattle to ticks infestation by at least four genera of ticks. It has been observed that unrestricted movement of livestock in search of water and pasture increases and promotes tick–host contact which could lead to high prevalence of tick infestation among cattle (Ayana *et al.,* 2013). This study was conceived due to the fact that there is paucity of information on ticks infestation and diversity on indigenous cattle reared in Qua'an Pan Local Government Area of Plateau State, Nigeria.

MATERIALS AND METHODS

Study Area

Qua'an Pan is a Local Government Area located in the southern part of Plateau State, Nigeria, with the headquarters in Ba'ap. It has coordinates 8°48′N 9°09′E, an area of 2,478 km² and a population of 196,929 (Plateau State Information and Communication Development Agency, 2016). It shares boundaries with Shendam, Pankshin, Bokkos and Lafia Local Government Areas making it one of the Local Government Areas that share boundaries with most Local Government Areas. The major towns include Deomak, Bwall, Kwalla, Kurgwi, Kwande, and Namu. It is also made up of diverse ethnic groups among which are Deomak, Bwall, Muryang, Geomai, and Hausa/Fulani Kanata. Agriculture is the mainstay of the economy of the local government area with production of major cash crops such as yam, rice, maize, millet and cassava, while the livestock reared include cattle, sheep, goat, pig and poultry. Fruit crops such as guava, cashew, citrus and mangoes are also grown in large and commercial quantities.

Sampling Procedure and Identification

A total of 200 indigenous white Fulani breed (*Bos indicus*) cattle which comprised 123 females and 77 males were randomly selected from the entire sample population using simple random sampling technique. Fifty cattle were selected from Kwalla, Doemak, Kurgwi while 25 cattle were selected from Namu and Bwall. In each site, visible adult ticks were collected using blunt steel forceps by thorough examination of the entire body surface of the selected cattle. The ages of the study subjects were estimated on the basis of the dentition score method developed for zebu cattle under a low plane of nutrition (Katie, 1986) and on information provided by their owners [recorded either as 'calf' (0-6 month), juvenile (6-24months) or adult (older than 24 months)]. The animal body was divided according to the method of Ikpeze *et al.* (2015) into five quadrants, namely the head (mouth, eye and ear); the neck (neck and dewlap); the trunk (thorax, abdomen and tail); the groin (scrotum, anus and udder); and the limbs (shoulder, forelimb and hind limb). All sample collection was carried out between the hours of 6 to 10 in the morning. Ticks from each animal were stored separately in vials containing 70% ethanol and labeled accordingly. In the laboratory, ticks were counted and identified by the genus and species level with the aid of a microscope and relevant morphological keys according to Fallis (1980), Soulsby (1986) and Okello-Onen *et al.* (1999).

Statistical Analysis

Data obtained were analyzed using R Console Software (version 3.2.2). Descriptive statistics was used to calculate percentages. The proportions of ticks' abundance in relation to location, gender and as well as between tick species were compared using Pearson's Chi-square (χ^2) test to determine any differences at 5% level of significance (Roa, 2007). Shannon-Wiener diversity index according to Begon *et al.* (2003) and Lamead (2011) was used to determine the diversity of ticks in the area.

$$H' = -\sum_{i=1}^{S} (Pi)(In\ Pi)$$

Where:
H' is the diversity index
Pi is the proportion of individual species
S is the total number of species in the habitat and,
i is the proportion of S species
Diversity index ranges from 0-5. Diversity index of 0-2.4 indicates low diversity, while 2.5-5 indicates high diversity.

RESULTS AND DISCUSSION

Ninety-seven (48.5%) of the 200 cattle sampled were infested with ticks (Table 1) of which two hundred individual ticks were collected. This is in accordance with the finding by Adejoh *et al.* (2019) who recorded a

prevalence of 56.0% in cattle sold at Shinge livestock market in Lafia, Nasarawa State, North Central Nigeria. Also, Ikpeze (2012) reported that factors such as heat and carbon dioxide emitted by cattle as well as attraction pheromones secreted by attached male ticks are also known to increase the rate of infestation of ticks on any species of cattle. Tick infestation in relation to locations was predominant in Namu 60.0% (15/25) followed by Kwalla 58.0% (29/50), then Bwall 48.0% (12/25), and Doemak 44.0% (22/50), while Kurgwi was the least infested 38.0% (19/50) as shown in Table 1. However, there was no significant difference ($\chi^2 = 7.00$, df = 4, P = 0.136) in the prevalence of tick infestation across the five selected sites.

The observation that the indigenous white Fulani were more preponderant among cattle found in all locations of the study site when compared to other local and exotic species may be responsible for the observed prevalence and infestation in the study site. This is in agreement with the findings of Opara and Ezeh (2011) who reported that the white colour of white coloured breed of cattle more readily serve as attractant to ticks than the dark coloured breeds.

Table 1: Prevalence of ticks infestation in relation to locations in Qua'an Pan Local Government Area of Plateau State

Location	No. Examined	No. Infested (%)
Kwalla	50	29 (58.0)
Doemak	50	22 (44.0)
Kurgwi	50	19 (38.0)
Namu	25	15 (60.0)
Bwall	25	12 (48.0)
Total	**200**	**97 (48.5)**

Tick infestation rate was higher in females 60.1% (74/123) than males 29.9% (23/77), and the difference was significant ($\chi^2 = 10.19$, df = 1, P = 0.001) in tick infestation rate between sex. Out of 200 ticks collected, predominant of the ticks were collected from female cattle 123 (61.5%) than males 77 (38.5%) (Table 2). Therefore, ticks abundance in relation to sex of cattle showed a high significant difference ($\chi^2 = 10.58$, df = 1, P = 0.001). The observed preference of ticks for female cattle may possibly be related to more regular frequent intervals of stops by females to breast feed their young. This agrees with the finding by Adejoh *et al.* (2019) who recorded more ticks on cows (55.5%) than bulls (45.5%) in a study on the prevalence of ticks infesting cattle in Lafia, Nasarawa State, North Central Nigeria. This finding is in agreement with the report of Fasanmi and Onyima (1992) on a review on current concepts in the control of ticks and tick-borne diseases in Nigeria. Also, it is believed to be due to the heat and carbon dioxide emitted by cattle. In addition, attraction pheromones secreted by attached male ticks (Ikpeze, 2012) on male cattle at the front of the herd may attract other ticks which attach to the female and young cattle in the middle and back of the herd. This is however in contrast to the findings of Ikpeze *et al.* (2015) which showed that more ticks were collected from male cattle than females in Nnamdi Azikiwe University Awka premises. Solomon *et al.* (2001) attributes this to the behavioral differences in the life cycle of the female ticks that when fully engorged, they drop off to the ground to lay eggs while the male ticks tend to remain on the host for several weeks or months to mate as many females as possible before falling off the host to die.

Table 2: Distribution of ticks infestation in relation to sex of cattle

Sex	No. Examined	No. of Cattle Infested (%)	No. of Ticks Collected (%)
Male	77	23 (29.9)	77 (38.5)
Female	123	74 (60.2)	123 (61.5)
Total	**200**	**97 (48.5)**	**200**

Table 3 showed that *Hyalomma rufiscipes* was the most abundant 65 (32.5%) followed by *Amblyomma variegatum* 51 (25.5%), then *Rhipicephalus sanguizeove* 47 (23.5%), and *Boophilus neoroplus* 27 (13.5%), while *Otobuis spp* and *Haemophysalis* spp. had the least prevalence of 5 (2.5%) respectively. Therefore, there was a significant difference ($\chi^2 = 94.42$, df = 5, P < 0.001) in the abundance of the six tick species. The finding of *Amblyomma variegatum* not having the highest prevalence rate in this study is contrary to the works of Obadiah and Shekaro (2011) in Zaria, Ejima and Ayegba (2011) in Idah Local government of Kogi state and Ikpeze *et al.* (2011) in Enugu and Anambra States. Also, it worthy to note that apart from the abundance of hard ticks in Qua'an Pan Local Government Area, there is an existing evidence of the presence of soft ticks. The presence of soft ticks *Otobius* spp. may probably indicate gradual encroachment of soft ticks on the Plateau. This is in agreement with the findings in studies conducted by Ahmed and George (2002), and Dogo (2002). However, ticks diversity in the area is relatively low with a diversity index of H′ = 1.5088 (Table 3). This is in accordance with the finding by Ikpeze *et al.* (2011) who obtained low tick species diversity on trade cattle at Enugu and Anambra States, South-eastern Nigeria.

Table 3: Checklist of tick species collected from cattle in Qua'an Pan LGA, Plateau State, Nigeria

Species	Total (%)	Pi	ln(Pi)	Pi[ln(Pi)]
Hyalomma rufiscipes	65 (32.5)	0.325	-1.12393	-0.36528
Amblyomma variegatum	51 (25.5)	0.255	-1.36649	-0.34846
Rhipicephalus sanguizeove	47 (23.5)	0.235	-1.44817	-0.34032
Boophilus neoroplus	27 (13.5)	0.135	-2.00248	-0.27033
Otobuis species	5 (2.5)	0.025	-3.68888	-0.09222
Haemophysalis species	5 (2.5)	0.025	-3.68888	-0.09222
Total	**200 (100)**			**-1.5088**
H' = -∑(Pi)ln(Pi);	H' = - (-1.5088);	H' = +1.5088;	H' ≈ +1.5	

CONCLUSION

About half of the cattle population sampled was infested on by diverse ticks which suggest the likelihood for transmission of tick-borne diseases (TBDs) in the area. It is therefore necessary for cattle owners to adhere to control measures such as maintaining regular proper sanitation, land cultivation, and regular examination of cattle for ticks, and prompt treatment of those infected cattle to reduce the risk of transmission of TBDs and their adverse effects in both animal and human populations. In addition, the State Government should institute surveillance on TBDs and also organize periodic awareness campaign on their prevention and control, on radio and television.

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Conflict of interest

None declared.

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