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BURDEN, SEASONALITY, SEX RATIO AND PREFERRED SITES OF TICKS OF PUBLIC HEALTH IMPORTANCE ON CATTLE FOUND AT AMANSEA, ANAMBRA STATE NIGERIA

Ikpeze, O.O. ^{*1}, Eneanya, C.I. ², Onyido, A.E. ³

^{*1, 2, 3} Department of Parasitology and Entomology, Nnamdi Azikiwe University, PMB 5025 Awka, Anambra State, NIGERIA



ABSTRACT

*Cattle from arid north which graze at Amansea in southern Nigeria were thought to introduce ticks in the new area. Burden, seasonality, sex ratio and preferred sites of ticks on cattle were studied in late wet season of 2012 and early dry season of 2013 at Amansea. Cattle (n=200) were randomly selected and examined both visually and manually for tick infestation. Genera *Amblyomma*, *Boophilus*, *Hyalomma* and *Rhipicephalus* species constituted 69.6; 11.9; 13.8 and 7 percentages of all ticks encountered, at 2.87 ticks per infested cattle. Wet and dry seasons accounted for 68% and 32% of the ticks, generally in ratio of 1.9♂:1♀. Preferred sites were in descending order of magnitude; scrotum, udder, tail, back, fore leg, neck, ear, dewlap, groin, head (face), brisket, belly, shoulder, side, hind leg and escutcheon ($\chi^2=175.8472$, $df=42$, $P<0.01$). Potential tick-bites areas which abound in Amansea are risk factors for tick-borne diseases (TBD) known to be transmitted by ticks in West Africa. Results from this study will create public awareness on TBD and may be useful in evidence-based policy decisions on restriction of cattle movement, tick control and surveillance of TBD in the area.*

Keywords:

Cattle, ticks, tick-bites, tick-borne disease, tick control, TBD surveillance.

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1. INTRODUCTION

Ticks are cosmopolitan but are more prevalent in warmer climates [1] especially in tropical and sub-tropical areas where they are ectoparasites responsible for severe economic losses and impact on the productivity of indigenous cattle under ranch conditions [2] due to their ability to transmit protozoan, Rickettsial and viral diseases [3]. Tick-bites in humans could also result in tick-borne infectious diseases, e.g., human babesiosis [4] and severe toxic conditions such as

paralysis and toxicosis, irritation and allergy [5] caused by a neurotoxin synthesized, for example. in the salivary gland of female *Rhipicephalus evertsi evertsi* [6].

Dry environmental conditions are dangerous for ticks, particularly to the questing larvae which are very susceptible to drying out fatally but the survival of many species is improved if they have a seasonal cycle which reduces these risks. Most of the ticks occurred in relatively low number throughout the year, but were generally most common from the second half of the rainy season through the dry season in Nigeria [7] especially July and September [8]. In Nigeria, the nomadic system of grazing exposes cattle to ticks infestation [9] by at least four genera of ticks, *Amblyomma*, *Boophilus*, *Hyalomma*, and *Rhipicephalus* species [3] which transmit pathogens that cause important tick-borne diseases (TBD) of cattle [9] which may also be transmitted to humans through infective tick-bites. It has been observed that unrestricted movement of livestock in search of water and pasture increases and promotes tick-host contact and could result to high prevalence of tick infestation among cattle [10].

Moreover, potential outbreaks of tick-borne blood protozoan diseases may occur if infected cattle are moved from one tick-prevalent region to another. It was reported [11] that unrestricted livestock movement from area to area in search of water and grazing lands which is a common phenomenon increases and promotes tick-host contact; thus contributing to tick distribution and introduction of tick borne diseases. Cattle that continuously graze from northern Nigeria to the south usually introduce ticks in the southern environment, which is very suitable for the development and maintenance of ticks [12,13,14]. The present study focused on burden, seasonality, sex ratio and preferred sites of ticks found on cattle at Amansea, south-eastern Nigeria with the aim that data generated from will be used to create awareness on health hazards associated with unrestricted cattle movement and ticks in an environment. Policy makers may find the result useful in evidence-based decision to control ticks or initiate surveillance on TBD in the area.

2. MATERIAL AND METHODS

Study area: The study was conducted at Amansea (Latitude 6° 14' 19.97"N; Longitude 7° 06' 56.92"E) in rainforest and derived guinea savannah zone of Anambra State, Nigeria. The area is drained by Amansea River and its tributaries, has average daily minimum and maximum temperatures of 27°C and 34°C with mean annual rainfall and relative humidity of 1,600mm and 80% respectively. Indigenes are mainly crop farmers and fishermen but herdsmen have migrated from Northern Nigeria to Amansea both for cattle trade and grazing. Amansea is a conducive environment for tick development and survival.

Sample population and sampling procedure: A total of 200 from 523 cattle in pasture at Amansea were randomly selected, then visually and manually sampled for ticks, with the consent and assistance of the herdsmen, between August 2012 and January 2013. All ticks detached from fifteen attachment sites described as shown in Plate 1 [12] were preserved in separately labeled jam jars containing 70% ethanol for subsequent identification.

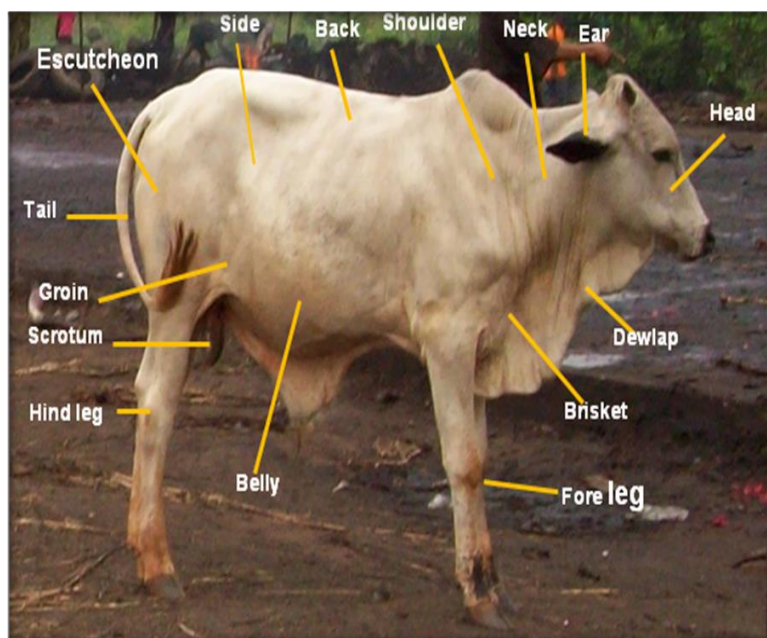


Plate 1: Attachment sites of ticks on cattle [12].

Identification of ticks: Voucher specimens of the preserved ticks were cleared of debris, dried on filter paper, before examination and identification to genera and species levels using the Keys for Identification of African ticks [15].

Data analysis: Data obtained were subjected to descriptive statistics for totals, percentages, mean and standard deviation; variable data were also subjected to Chi square (χ^2) statistics to determine any differences at 5 and 1% level of significance [16].

3. RESULTS AND DISCUSSIONS

Four cattle types shown in Table 1 were encountered at Amansea, with an average tick infestation rate of 2.87 ticks per infested cattle.

Table 1: Infestation rate of ticks on cattle at Amansea

Cattle types	No. of cattle examined	No. of cattle infested	No. of ticks detached	No. of tick per infested cattle*
White Fulani	65	49	78	1.59 ^a
Red Fulani	15	13	106	8.15 ^b
N'Dama	85	36	92	2.55 ^a
Sokoto Gudali	35	28	86	3.0 ^c

* Infestation rate with different superscripts are significantly different at 5% level ($p > 0.05$)

The observation that N'Dama and White Fulani cattle were more preponderant but recorded less infestation rates than Red Fulani and Sokoto Gudali which were fewer in numbers suggested that ticks at Amansea prefer certain breeds of cattle to others. Previous workers who reported more ticks on White Fulani than on darkly coloured breeds claimed that white colour attracts ticks more readily than dark colours [17]. The fact that ticks were easily noticed on white bodied animals and detached more frequently by herdsman may also result in fewer numbers observed on N'Dama and White Fulani cattle in this study but factors such as heat and carbon dioxide

emitted by cattle as well as attraction-aggregation-attachment pheromones secreted by attached male ticks are known to enhance attachment of ticks on cattle [12]. Acaricidal treatments of cattle by herdsmen in the study area have been reported [18] but the level of acaricidal use on the examined cattle was not revealed by herdsmen interviewed during the study. However, *Bos indicus* (White Fulani) i.e., Bunaji cattle are thought to be naturally more resistant to infestation with cattle ticks than *Bos taurus* (Red Fulani, N'dama) though considerable variation in resistance occurs within and between breeds [19]. Plates 2-5 show the salient morphological features observed on representative samples of *Amblyomma*, *Boophilus* and *Rhipicephalus* species encountered on cattle in the study area.

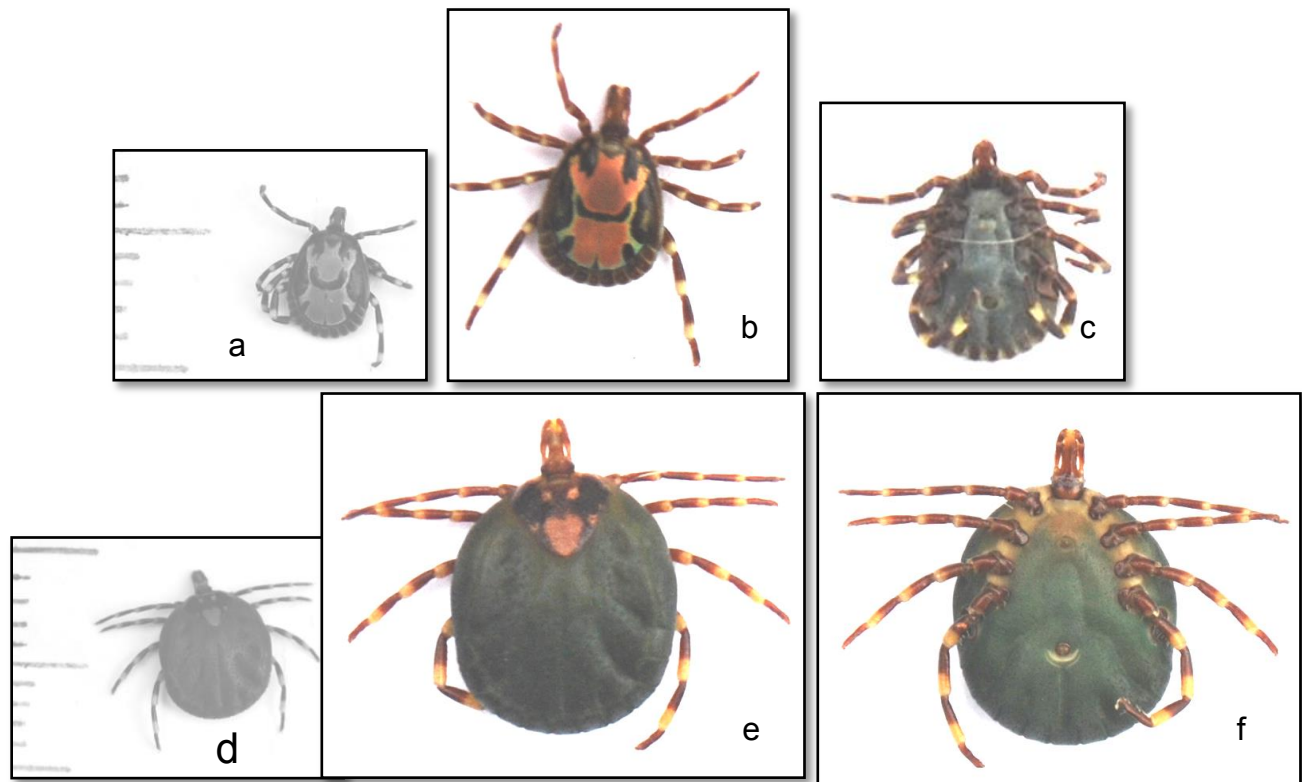


Plate 2: [a] Adult male of *Amblyomma variegatum* (5x3mm); [b, c] dorsal and ventral views of engorged male; [d] Adult female *A. coherens* (7x5.5mm), [e, f] dorsal and ventral views of engorged female.

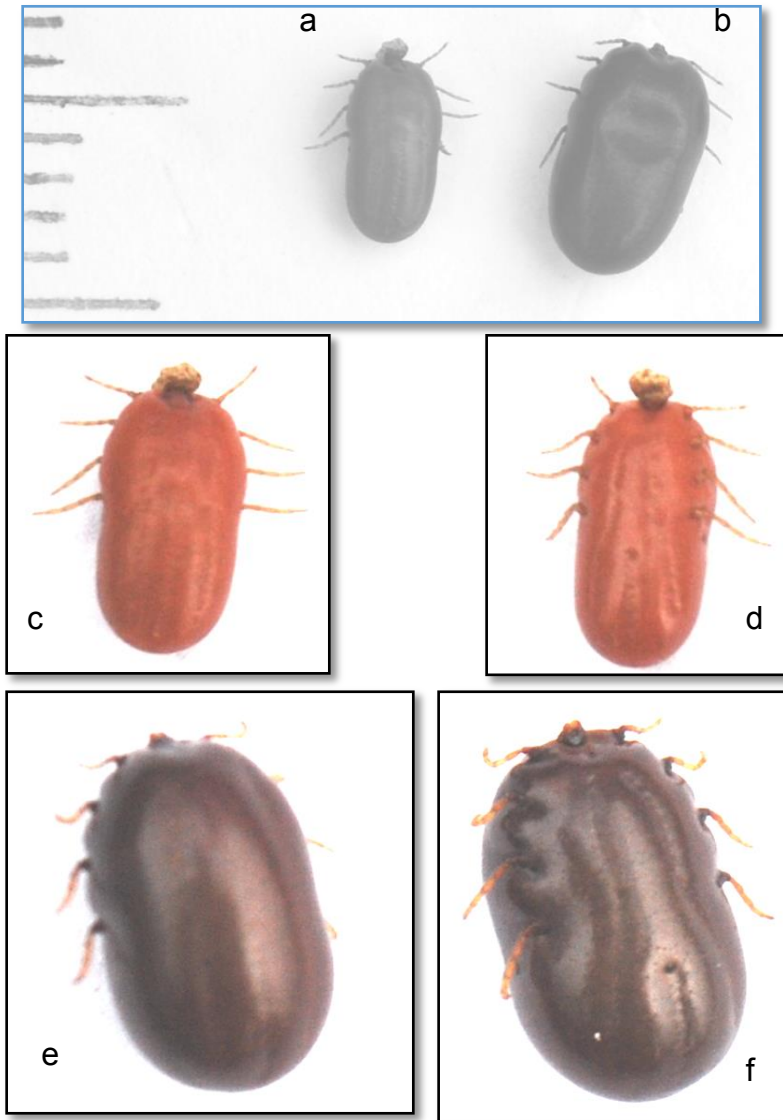


Plate 3: [a] Nymph of *Boophilus* species (4.5x2mm); [b] adult of *Boophilus* species (6.5x3.5mm); [c, d] dorsal & ventral views of engorged nymph; [e, f] dorsal and ventral views of engorged female.

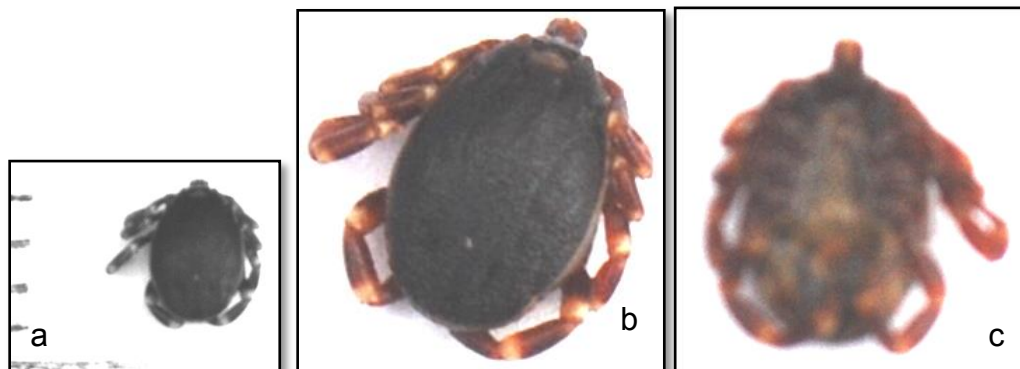


Plate 4: [a] Adult male of *Rhipicephalus* species (3.0x2.5mm), [b, c] dorsal & ventral views of engorged male.

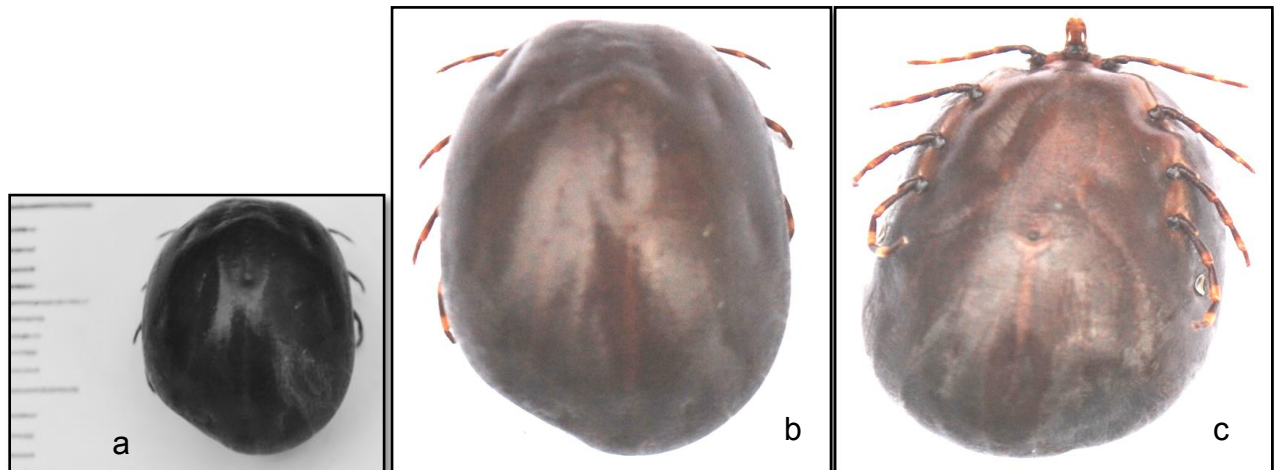


Plate 5: Adult female of *Rhipicephalus* species (13.0x11.5mm); [a, b] dorsal & ventral views of engorged female.

Although differences occurred in the distribution of these genera of ticks, infestations with the very abundant *Amblyomma* species (Figure 1) were not independent of cattle types at both 5% and 1% levels of significance ($\chi^2_{cal}=7.5640$, $\chi^2_{crit0.05}=16.919$, $\chi^2_{crit0.01}=21.666$, $df=9$, $p>0.01$). The findings that *Amblyomma* species represented about 60% of the total ticks collected in this study were in line with similar results on tick species encountered on cattle at two cattle markets in Anambra and Enugu States [13], Zaria abattoir [11] and Iddah Local Government Area of Kogi State Nigeria [20].

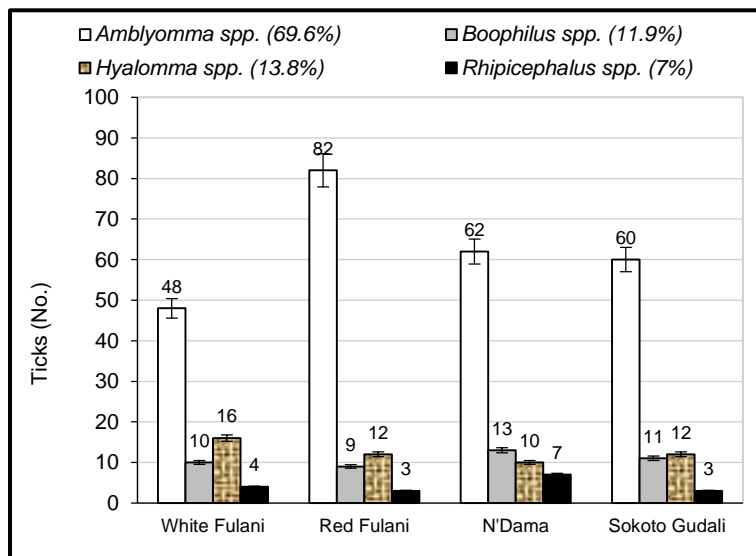


Figure 1: Genera of ticks found on cattle types at Amansea

With the exception of *Amblyomma* species, there were no marked differences in seasonal distribution of other ticks found on cattle at Amansea. Generally, the ticks recovered during late wet season were numerically more than those of early dry season (Figure 2). This is in line with the findings that higher infestation rates were between months of August and September [21,11].

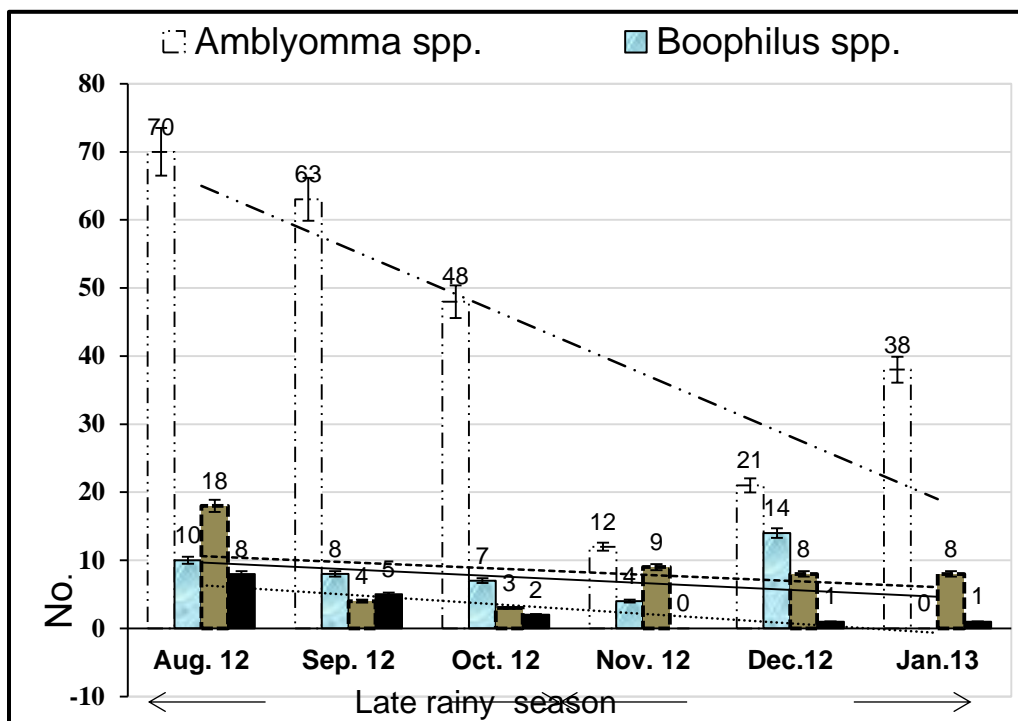


Figure 2: Seasonal occurrence of ticks on cattle at Amansea

The average Sex ratio (♂: ♀) of ticks encountered on cattle at Amansea was 1.9:1 (Table 2). Generally, there were more males than females, perhaps due to the fact that fully engorged female ticks drop off to the ground to lay eggs but the males tend to remain on the host for several weeks or months to mate with as many female as possible on the host before dropping off to die; so that males normally remain on the host longer than females [22](Solomon *et al.*, 2001).

Table 2: Sex ratio of adults of genera of ticks found on cattle

Cattle type	Amblyomma spp.	Boophilus spp.	Hyalomma spp.	Rhipicephalus spp.
	♂: ♀	♂: ♀	♂: ♀	♂: ♀
White Fulani	2.3: 1	1: 1	1.5: 1	2: 1
Red Fulani	1.9: 1	1.5: 1	1.7: 1	1.5:1
N’ Dama	1.9: 1	2.5: 1	1: 1	1.5: 1
Sokoto Gudali	1.9: 1	1.5: 1	1: 1	1.5:1

Male to female ratio of ticks on cattle found in Nnamdi Azikiwe University (UNIZIK) premises Awka also showed that males were usually more in number than the females [12]. The same trend was reported for ticks on cattle in southeast Ethiopia [23], and in southwestern Ethiopia [24]. The sex ratios of all tick species identified around Assosa Town in Ethiopia were also skewed towards male except for Boophilus decoloratus [25].

Attachment of genera of ticks on cattle was highly dependent on preferred sites on cattle at Amansea (Table 3) but we did not ascertain the extent to which use of acaricides by herdsmen affected the occurrence and distribution of ticks. Generally, Amblyomma species occurred on

almost all parts of the body but that genera of ticks are dependent on preferred attachment sites on cattle ($\chi^2_{cal}=175.8472$; $\chi^2_{crit0.05}=58.124$; $\chi^2_{crit0.01}=66.206$), $df=42$; $p<0.01$).

Table 3: Attachment of genera of ticks at preferred sites on cattle at Amansea

Preferred site	<i>Amblyomma</i> spp.	<i>Boophilus</i> spp.	<i>Hyalomma</i> spp.	<i>Rhipicephalus</i> spp.	Total	%
1. Scrotum/udder	38	15	11	1	65	17.9
2. Tail	21	0	13	3	37	10.2
3. Back	31	3	0	1	35	9.7
4. Foreleg	29	0	1	0	30	8.3
5. Neck	19	4	5	0	28	7.7
6. Ear	16	7	0	4	27	7.5
7. Dewlap	18	5	4	0	27	7.5
8. Groin	23	0	0	1	24	6.6
9. Head	18	2	0	3	23	6.3
10. Brisket	15	5	0	0	20	5.5
11. Belly	17	0	0	2	19	5.3
12. Shoulder	0	0	12	1	13	3.6
13. Side	7	2	0	0	9	2.5
14. Hind leg	0	0	4	0	4	1.1
15. Escutcheon	0	0	0	1	1	0.3
Total	252	43	50	17	362	100

A similar survey of ectoparasites of cattle in Bukuru near Jos Nigeria revealed that *Amblyomma* species could occur all over the body, *Boophilus* species on the neck and scrotal areas, and *Hyalomma* on the abdomen and limbs [26]. Most ticks recovered from cattle at Enugu Nigeria were from the neck region, hind limb, back, scrotum/udder, and forelegs [13]. The presence of ticks in these sites could be probably due to their exposure to the questing ticks as the cattle move about to graze. Also these sites can also act as protective coverings from desiccation by sunlight and hiding places for the ticks. The sites also make ticks less accessible to natural preys and prevent dislodgement of ticks by cattle movements and grooming [13].

Public health importance as well as economic loss in livestock production due to the genera *Amblyomma* spp., *Boophilus* spp., *Hyalomma* spp., and *Rhipicephalus* spp. in Nigeria have been reported [27]. *Amblyomma variegatum* causes dermatitis, transmits *Cowdria ruminantium* (agent of heart water disease in ruminants), virus of Q fever (*Coxiella burnetii*), and *Dermatophilus congolensis* responsible for Cutaneous Streptothricosis that damages hides and skin of Nigeria's cattle [28,29]. *A. variegatum* also transmits *Rickettsia africae*, the causative agent of African Tick-bite fever [30]. The role of *Boophilus* species in human babesiosis has been elucidated [31,32,4] while the incidence and economic significance of equine babesiosis in Lagos and Ibadan in Nigeria were reviewed by [33]. *Hyalomma* species are primary vectors for Crimean Congo Hemorrhagic Fever (CCHF) virus that is endemic throughout Africa [34], and *Hyalomma truncatum* have been implicated as vectors of Q fever, responsible for tick-paralysis in Africa [15]. In Equatorial Africa, all stages of *Rhipicephalus appendiculatus* feed throughout the year, resulting in inter-stadial transmission of pathogens, especially *Theileria parva parva* that causes Theileriosis which is a very deadly disease of cattle [35].

4. CONCLUSIONS AND RECOMMENDATIONS

This study provides new information on cattle types and their tick infestation rates in Amansea, Anambra State. It also documented the sex ratio of all tick genera found on the cattle types, including the seasonality and preferred attachment sites of the ticks on cattle. Potential tick-bites areas which abound in Amansea are risk factors for tick-borne diseases (TBD) known to be transmitted by ticks in West Africa. Results from this study will create public awareness on TBD and will be useful in evidence-based policy decisions on restriction of cattle movement, tick control and surveillance of TBD in the area. Further studies should therefore be carried out to ascertain the status of tick-borne infectious diseases in cattle and humans in the study area and to initiate the process of their control in the study area.

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