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Ecology of Ticks (*Ixodidae*) on Cattle within Main Campus of the University of Abuja, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A survey was conducted using standard parasitological procedures to determine the ecology of ticks on the cattle within the main campus of the University of Abuja, Nigeria. The tick specie identified were *Amblyomma variegatum, Amblyomma hebraeum, 0rnithodorus moubata complex, Hyalomma truncatum, Hyalomma rufipies, Rhipicephalus decoloratus, Phipicephalus appendiculatus,* and *Boophilus microplus*. Of the 100 cattle examined. 47(47%) of the tick examined was found on the male cow and 53(53%) were found on the female cow. In addition, 23(23%) of the observed tick are found on the leg, 20(20%) are found in the anus, 20(20%) are found on the udder, 14(14%) are found on the back while 23(23%) of the ticks are found in the ear. 31(31%) of the observed ticks were found on the bunaj specie, 24(24%) of the ticks on the Gudali, 24(24%) of the observed ticks on the Rahaji specie and 21(21%) on the wadara specie. *Amblyomma hebraeum*, *Ornithodorus moubata* Complex and *Rhipicephalus dicoloratus* were found more dominantly on Bunaj breed (42.9%, 55.6% and 42.9% respectively), *Amblyomma variegatum* and *Phipicephalus appendiculatus* was observed to be more dominant on Rahaji breed (infesting 33.3% and 66.7% respectively), *Boophylus microplus* and *Hyalomma rufipe* were found dominant on wadara (30% and 50% respectively). There is need to help establish baseline information on

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ticks ecology and occurrence in the study area which would consequently lead to increased public awareness especially to the herdsmen and in avoiding tick borne diseases, also to help in vector control formulation and to prevent the herdsmen of suffering from low productivity due to the presence of ticks, thereby leading to various weaknesses, diseases and sometimes death of the cattle. Owing to this, this study did not only identify the tick species infesting cattle but also examined the host-parasite ecology of ticks on cattle within the main campus of the University of Abuja, Nigeria.

Keywords: Ecto parasites; cattle; ticks; acarina ixodidae.

1. INTRODUCTION

Beef cattle in the tropics are exposed to varying levels of challenge from endo and ecto - parasites to other environmental stressors. Among ectoparasites, ticks have been recognized as the most notorious world threat to cattle due to severe irritation and allergy [1]. Ticks are blood sucking ecto-parasites that live by feeding on the blood of different companion animals, wildlife and livestock species. (*Ixodidae*) is a three-host tick with three active life stages, larva, nymph and adult [2]. The immature stages are found on hosts of all sizes while adult stages tend to be the only stage found on larger hosts [3]. Ticks are ranked as the most economically important ectoparasites of livestock in the tropics, including Sub-Saharan Africa (SSA) [4]. Their veterinary importance is related to their blood-feeding, from which both their direct and indirect pathogenicity originates [5]. In dairy cattle, tick pervasion alone can cause pallor, stress, decrease in weight gain and milk yields, devaluation of conceal worth, excessive touchiness and poison levels, driving likewise to auxiliary diseases. In Nigeria, 90% of the dairy cattle populace is held under the customary peaceful farming of Fulani herders; for the most part amassed in the focal northern piece of the country [6]. Under the Fulanis' management, cattle are extensively grazed in pastures and forest, and exposed to infestation by the three tick genera present in Nigeria (i.e., *Amblyomma, Hyalomma,* and *Rhipicephalus* spp). Usually low in the dry season, tick loads on cattle tend to increase after the first scattered rains, reaching the highest abundance one month after the heavy rains (i.e., from July to September), when all tick species are required to be available [7].

Ticks on cattle are seen as a peril by the Fulani pastoralists, who traditionally control them by manual removal three times a week during the wet season (i.e., April to October) and twice a week during the dry season (i.e., November to March). Neither dip tanks nor acaricides have ever been used in this part of the country [8]. Information on tick dispersion is a fundamental essential for contriving any successful control of these arthropods and the contaminations they communicate [9]. The effect of ticks and tickborne illnesses on the individual and public economy warrants use of proper tick control methodologies [10]. Therefore, this study examines possible eradicating techniques of ticks on cattle and examined the host-parasite ecology of ticks on cattle within the main campus of the University of Abuja, Nigeria. within the main campus of the University of Abuja, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

This study was carried out at the University of Abuja permanent site FCT Abuja. The University of Abuja Main Campus is located along the Nnamdi Azikiwe Airport road, Abuja. Latitude 9℃/32N and Longitude 50°/10E with a land mass of about 11,800 hectares in Gwagwalada Area Council of Abuja. The main campus is characterized with a temperature range of 30℃ to 35℃.

The government region is found only north of the juncture of the Niger River and Benue River. It is lined by provinces of Niger toward the West and North, Kaduna toward the Upper east, Nasarawa toward the East and South, and Kogi toward the southwest (Government Capital Domain 2015). Lying between scope 8.25 and 9.20 north of the equator and 7.39 east of Greenwich Meridian, Abuja is geologically situated at the centre of the country.

2.2 Population of the Study

A total of 100 cows comprising Bunaji, Gudali, Rahaji and Wadara breeds were randomly selected from the different Fulani settlement of the University of Abuja permanent site. This was

carried out within the period of September-October 2019.

2.3 Samples Collection

This research employed random sampling to select a representatives unit of 5% of the total population area estimated to be one hundred (100). Ticks were gathered from various parts of the body including the leg, anus, udder, back, and ear by utilizing forceps and hand gloves. At the point when required, little hairbrush dunked in ethanol was utilized for the assortment of the ticks. The place of connection was spread with ethanol. Satisfactory safeguards were taken to protect the mouthparts and a few limbs of the ticks during assortment to help in the identification. The ticks gathered were placed into clean, appropriately marked and well-plug glass vials containing 70% liquor and 5% formalin for safeguarding. The vials were promptly transported to the biological science laboratory, University of Abuja for further identification.

2.4 Method of Identification

Ticks were collected, identified and sorted out according to the parts of the body they were found. Ticks gathered were inspected under low power and afterward high power magnification of the microscope. The morphology of the ticks was analyzed in the laboratory using the compound microscope. Identification of the various types of the ticks was aided by the anatomical and morphological characteristics.

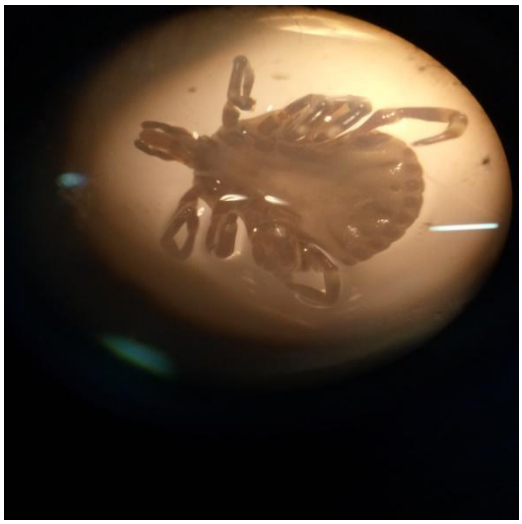

Plate 1. *Amblyomma variegatum*

Plate 2. *Amblyomma hebraeum*

Plate 3. *Rhicephalus appendiculatus*

Plate 4. *Hyalomma rufipe*

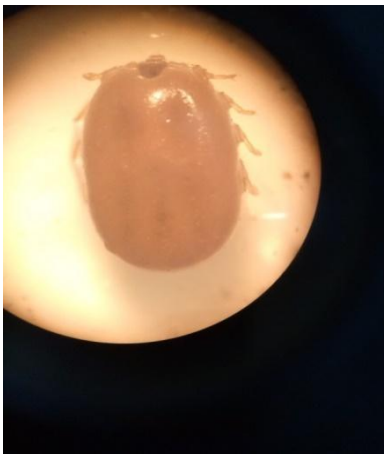

Plate 5. *Boophilus microplus*

Plate 6. Data Collection

2.5 Data Analysis

The data collected was presented through percentages (%), this helps to assign and give percentage height to each alternative in order to make a good comparative analysis and to determine the statistical significance and association between the disease and other independent variables. All statistical analyses for the present study were assessed using Statistical Package for Social Sciences (SPSS) evaluation.

3. RESULTS

From the above result in Table 1, 47(47%) of the tick examined was found on the male cow and 53(53%) are found on the female cow. 23(23%) of the observed tick are found on the leg, 20(20%) are found in the anus, 20(20%) are found on the udder, 14(14%) are found on the back and 23(23%) of the ticks are found in the ear. 31(31%) of the observed ticks were found on the bunaj specie, 24(24%) of the ticks on the Gudali, 24(24%) of the observed ticks on the Rahaji breed and 21(21%) on the wadara specie. Whereas 7(7%) of the ticks found are *Amblyomma hebraeum*, 15(15%) are *Amblyomma variegatum*, and 40(40%) are found to be *Boophylus microplus*, 4(4%) are *Hyalomma rufipe*, also, 12(12%) are *Hyallomma truncatum*, 6(6%) are *Phipicephalus appendiculatus*, 9(9%) are *Rhipicephalus dicoloratus* and 7(7%) were found to be *Ornithodorus moubata* Complex.

Table 2 above shows the distribution of the species across the breed with *Amblyomma hebraeum*, *Ornithodorus moubata* Complex and *Rhipicephalus dicoloratus* found more dominantly on Bunaj breed (42.9% 55.6% and 42.9% respectively), *Amblyomma variegatum* and *Phipicephalus appendiculatus* was observed to be more dominant on Rahaji Breed (infesting 33.3% and 66.7% respectively), *Boophylus microplus* and *Hyalomma rufipe* were found dominant on wadara (30% and 50% respectively).

From the above result, *Hyalomma rufipe* and *Phipicephalus appendiculatus* are found more dominant on the leg (infesting 100% and 100% respectively), *Rhipicephalus dicoloratus* is found to be dominant in the anus region having 100% of the observed ticks, *Amblyomma hebraeum* is found to be dominant in the udder region also having prevalence of 100% of the observed ticks, *Amblyomma variegatum* is also found to be dominant on the back region having also 53.3% prevalence rate of the observed ticks, *Ornithodorus moubata* Complex is found to be dominant in the udder region also having 100% of the observed ticks and *Boophylus microplus* is equally distributed around the leg and ears of the observed cows.

4. DISCUSSION

This examination was carried out in the late wet season, when the overall moistness just as vegetation cover is at its pinnacle. This research aimed to evaluate the ecology of ticks on cattle within the main campus of the University of Abuja. An average of 100 cattle were randomly selected and examined, the greater number of adults as opposed to younger cows sampled, reflects the age composition of Fulani herds, with at least 65% of cattle being adult.

Table 1. Frequency distribution of variables

		Frequency	Percent	P-Value
Sex	Male	27	47.0	
	Female	33	53.0	**.000**
	Total	**60**	**100.0**	
	Leg	23	23.0	
Location	Anus	20	20.0	
	Udder	20	20.0	
	Back	14	14.0	
	Ear	23	23.0	**.000**
	Total	**100**	**100.0**	
Breed	Bunaj	31	31.0	
	Gudali	24	24.0	
	Rahaji	24	24.0	
	Wadara	21	21.0	**.000**
	Total	**100**	**100.0**	
Species	*Amblyomma hebraeum*	7	7.0	
	Amblyomma variegatum	15	15.0	
	Boophylus microplus	40	40.0	
	Hyalomma rufipe	4	4.0	
	Hyallomma truncatum	12	12.0	
	Phipicephalus appendiculatus	6	6.0	
	Rhipicephalus dicoloratus	9	9.0	
	Ornithodorus moubata Complex	7	7.0	**.000**
	Total	**100**	**100**	

Table 2. Species * Breed crosstabulation

			Breeds				Total
			Bunaj	**Gudali**	**Rahaji**	**Wadara**	
Species	*Amblyomma hebraeum*	Count	3	2	1	1	7
		% within Species	42.9%	28.6%	14.3%	14.3%	100.0%
		% within Breeds	9.7%	8.3%	4.2%	4.8%	7.0%
	Amblyomma variegatum	Count	4	4	5	2	15
		% within Species	26.7%	26.7%	33.3%	13.3%	100.0%
		% within Breeds	12.9%	16.7%	20.8%	9.5%	15.0%
	Boophylus microplus	Count	11	9	8	12	40
		% within Species	27.5%	22.5%	20.0%	30.0%	100.0%
		% within Breeds	35.5%	37.5%	33.3%	57.1%	40.0%
	Hyalomma rufipe	Count	1	0	1	2	4
		% within Species	25.0%	0.0%	25.0%	50.0%	100.0%
		% within Breeds	3.2%	0.0%	4.2%	9.5%	4.0%
	Hyallomma truncatum	Count	4	4	2	2	12
		% within Species	33.3%	33.3%	16.7%	16.7%	100.0%
		% within Breeds	12.9%	16.7%	8.3%	9.5%	12.0%
	Phipicephalus	Count	0	2	4	0	6

			Breeds				Total
			Bunaj	Gudali	Rahaji	Wadara	
	appendiculatus	% within Species	0.0%	33.3%	66.7%	0.0%	100.0%
		% within Breeds	0.0%	8.3%	16.7%	0.0%	6.0%
	Rhipicephalus dicoloratus	Count	5	3	0	1	9
		% within Species	55.6%	33.3%	0.0%	11.1%	100.0%
		% within Breeds	16.1%	12.5%	0.0%	4.8%	9.0%
	Ornithodorus moubata Complex	Count	3	0	3	1	7
		% within Species	42.9%	0.0%	42.9%	14.3%	100.0%
		% within Breeds	9.7%	0.0%	12.5%	4.8%	7.0%
Total		Count	31	24	24	21	100
		% within Species	31.0%	24.0%	24.0%	21.0%	100.0%
		% within Breeds	100.0%	100.0%	100.0%	100.0%	100.0%

Table 3. Distribution of the species around some selected body parts location

Species		Leg	Anus	Udder	Back	Ear	Total
Amblyomma hebraeum	Count	0	0	7	0	0	7
	% within	0.0%	0.0%	35.0%	0.0%	0.0%	7.0%
	location	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
	% within species						
Amblyomma variegatum	Count	3	0	4	8	0	15
	% within	13.0%	0.0%	20.0%	57.1%	0.0%	15.0%
	location	20.0%	0.0%	26.0%	53.3%	0.0%	100.0%
	% within species						
Boophylus microphylus	Count	10	5	9	6	10	40
	% within	43.5%	25.0%	45.0%	42.9%	43.5%	40.0%
	location	25.0%	12.5%	22.5%	15.0%	25.5%	100.0%
	% within species						
Hyallomma rufipe	Count	4	0	0	0	0	4
	% within	17.4%	0.0%	0.0%	0.0%	0.0%	4.0%
	location	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	% within species						
Hyallomma truncatum	Count	0	6	0	0	6	12
	% within	0.0%	30.0%	0.0%	0.0%	26.1%	12.0%
	location	0.0%	50.0%	0.0%	0.0%	50.0%	100.0%
	% within species						
Rhipicephalus appendiculatus	Count	6	0	0	0	0	6
	% within	26.1%	0.0%	0.0%	0.0%	0.0%	6.0%
	location	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	% within species						
Rhipicephalus dicoloratus	Count	0	9	0	0	0	9
	% within	0.0%	45.0%	0.0%	0.0%	0.0%	9.0%

Species		Leg	Anus	Udder	Back	Ear	Total
	location % within species	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
Ornithodorus moubata	Count	0	0	0	0	7	7
complex	% within	0.0%	0.0%	0.0%	0.0%	30.4%	7.0%
	location % within species	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
Total	Count	23	20	20	14	23	100
	% within	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	location % within species	23.0%	20.0%	20.0%	14.0%	23.0%	100.0%

Table 4. Distribution of the species across gender sex species cross tabulation

		Sex		
Species		**Male**	**Female**	**Total**
Amblyomma hebraeum	Count	2	5	7
	%within sex	4.3%	9.4%	7.0%
	% within species	28.6%	71.4%	100.0%
Ambyomma variegatum	Count	7	8	15
	% within sex	14.9%	15.1%	15.0%
	% within species	46.7%	53.3%	100.0%
Boophylus microphylus	Count	21	19	40
	% within sex	44.7%	35.8%	40.0%
	% within species	52.5%	47.5%	100.0%
Hyallomma rufipe	Count	1	3	4
	% within sex	2.1%	5.7%	4.0%
	% within species	25.0%	75.0%	100.0%
Hyallomma truncatum	Count	5	7	12
	% within sex	10.6%	13.3%	12.0%
	% within species	41.7%	58.3%	100.0%
Rhipicephalus appendiculatus	Count	3	3	6
	% within sex	6.4%	5.7%	6.0%
	% within species	50.0%	50.0%	100.0%
Rhipicephalus dicoloratus	Count	4	5	9
	% within sex	8.5%	9.4%	9.0%
	% within species	44.4%	55.6%	100.0%
Ornithodorus moubata complex	Count	4	3	7
	% within sex	8.5%	5.7%	7.0%
	% within species	57.1%	42.9%	100.0%
Total	Count	47	53	100
	% within sex	100.0%	100.0%	100.0%
	% within species	47.0%	53.0%	100.0%

The results of this study reveal presence of *Amblyomma variegatum*, *Hyalomma srifipes*, *Rhicepiphalus appendiculatus*, *Ornithodorus moubata* and *Boophilus microplus* pervading cows is in accordance with reports by [11] who identified these ticks in addition to *Demacentor varisbilis*. Comparative perceptions were accounted for from different pieces of the world [12].

The predominance of these ticks chiefly belonging to the family *Ixodidae* (hard ticks) in University of Abuja permanent site could be as a result of the high temperature usually experienced. This high temperature makes it unfavorable for the survival of soft ticks [11].

Females were found to have a somewhat higher tick prevalence over male cattle. This outcome is

in accordance with reports by [13,14] who reported that female cattle have more ticks than male cattle, because most of the female cattle are fundamentally bound for reproducing purposes and in this way is primarily infested by ticks from the male dairy cattle during mating. Infestation rate was higher in adult animals aged 3-7years and mostly minimal in older animals aged >7years. This is in concordance with the works of [13] which found that resistance in the animal was building up as the animals grew up and the animals became more resistant and adoptable than in younger stages irrespective of the farm species. It was also found that adult cattle were more susceptible to tick infestation than the calves and older animals. It is also reported that calves were 20 times more resistant to tick infestation than adult cattle. The result of this current research suggests that none of these breed (Bunaj, Gudali, Rahaji and Wadara) was totally impervious to tick pervasion as all the breed were pervaded at different levels. [15] reported that prevalence of ticks was significantly higher in local cattle (43.8%) than the crossbreed (24.1%) cattle. The distribution (%) of tick infestation in different body parts of cattle examined reveals that udder, anus, ears, back and leg were the most tick infested sites. This further affirms that tick like to connect and feed from certain regions of the cattle.

This result is in concurrence with the work by (Opara *et al*. 2012) who found that ticks plaguing dairy cattle in this area like to append and benefit from the udder, butt, ears, back and leg. These finding could be ascribed to the way that the udder, butt, ears, back and leg are highly supplied with blood and ticks for the most part lean toward more slender and short air skin for invasion.

5. CONCLUSION

This investigation gives data on tick populaces affecting cattle within the main campus of the University of Abuja. The presence of *Amblyomma variegatum*, *Hyalomma rufipes*, *Rhicepiphalus appendiculatus*, *Ornithodorus moubata* and *Boophilus microplus* on the cattle within the main campus of the University of Abuja is of great veterinary importance as these species are involved in the transmission of anaplasmosis, Babesiosis, Cowdriosis and dermatophilosis (*A. variegatum*) and sweating sickness (*H. rufipes*). From the result, it can be predicted that Hard ticks (*Ixodidae*) are dominant and the female cattle are susceptible to the infestation of this ticks in the Fulani settlement of the university of Abuja, due to movement of grazing cattle and crossbreeding with other breeds within the campus and neighboring villages and also the climatic conditions of the study area.

6. RECOMMENDATION

This examination indicates that there was a high burden of ticks in the area. However, the consideration given to control the pervasion had not been adequate. Acaricide application is the main method of tick control in the region. Ticks ought to be managed at an economically acceptable level by a blend of strategies and the required information on the tick species pervasiveness and comprehension of their epidemiology. It is advisable that surveillance should be done by the parasitologist periodically to ascertain the level of infestation of ticks on the cattle within the main campus of the University of Abuja. The herdsmen should be taught the various methods of controlling tick infestation and eradicating tick borne disease, by setting up awareness and providing the herdsmen with the necessary chemicals and equipment to help avert tick infestations on their cattle.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

Location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Leg	23	23.0	23.0	23.0
	Anus	20	20.0	20.0	43.0
	Udder	20	20.0	20.0	63.0
	Back	14	14.0	14.0	77.0
	Ear	23	23.0	23.0	100.0
	Total	100	100.0	100.0	

Breeds

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bunaj	31	31.0	31.0	31.0
	Gudali	24	24.0	24.0	55.0
	Rahaji	24	24.0	24.0	79.0
	Wadara	21	21.0	21.0	100.0
	Total	100	100.0	100.0	

Species

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	*Amblyomma hebraeum*	7	7.0	7.0	7.0
	Amblyomma variegatum	15	15.0	15.0	22.0
	Boophylus microplus	40	40.0	40.0	62.0
	Hyalomma rufipe	4	4.0	4.0	66.0
	Hyallomma truncatum	12	12.0	12.0	78.0
	Phipicephalus appendiculatus	6	6.0	6.0	84.0
	Rhipicephalus dicoloratus	9	9.0	9.0	93.0
	Ornithodorus moubata Complex	7	7.0	7.0	100.0
	Total	100	100.0	100.0	

Peer-review history:
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