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Epizootiological survey and species composition of ixodid ticks infesting cattle in Plateau State, Nigeria: Dominance of *Amblyomma variegatum* and its implications for tick-borne disease risk

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Abstract

Ticks are important ectoparasites of cattle globally. In tropical and subtropical regions of the world, ticks contribute significantly to economic losses through blood feeding and pathogen transmission. In Nigeria, ixodid ticks remain a major constraint to cattle health and productivity. This study investigated the prevalence, species composition and associated risk factors of ixodid tick infestation in cattle reared at selected Local Government Areas (LGAs) of Plateau State, Nigeria. A cross-sectional survey was conducted between April and June 2023 across five LGAs: Jos South, Jos North, Mangu, Barkin Ladi, and Pankshin. A total of 250 cattle were randomly sampled, and 970 adult ticks were collected through handpicking and the use of blunt forceps. The ticks were preserved in 70% ethanol and identified morphologically using taxonomic keys. Data analysis was done using R software, with regression and GLM models to identify risk associations. Six ixodid tick species belonging to three genera were recorded in the study. *Amblyomma variegatum* (a key vector of multiple veterinary and zoonotic pathogens) was the most prevalent species, accounting for 52.3% of all ticks, followed by *Rhipicephalus (Boophilus) decoloratus* (18.6%), *Hyalomma impeltatum* (16.5%), *Hyalomma truncatum* (7.9%), *Rhipicephalus (Boophilus) annulatus* (4.5%), and *Hyalomma dromedarii* (0.2%). Significant differences were observed in tick abundance across LGAs ($p < 0.001$), with Jos South recording the highest burden (31.8%) and Barkin Ladi the lowest (8.4%). Risk factors influencing tick abundance included herd mobility, acaricide application methods and tick handpicking frequency. Sedentary herds, less frequent tick handpicking and hand-spraying of acaricides were associated with higher tick loads. The dominance of *A. variegatum*, a major vector of *Ehrlichia ruminantium* and other pathogens, underscores the heightened risk of tick-borne diseases in the region. These findings emphasize the need for targeted tick control strategies, farmer education and enhanced surveillance to mitigate the risk of pathogen transmission and improve cattle productivity in Plateau State, Nigeria.

Keywords: Ixodid ticks infestation; Cattle; Epizootiological survey; Plateau State, Nigeria.

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Introduction

Ticks are among the most economically important ectoparasites affecting cattle globally, particularly in tropical and subtropical regions where livestock production plays a critical role in livelihoods (Jongejan and Uilenberg, 2004; Walker *et al*., 2014). In Nigeria, tick infestations contribute significantly to cattle morbidity and reduced productivity, largely due to blood-feeding activities and transmission of a wide range of pathogens including protozoa, bacteria, and viruses (Ogo *et al*., 2012). The ixodid ticks (family Ixodidae) are of particular concern, because they serve as vectors for diseases such as babesiosis, anaplasmosis, theileriosis, and heartwater (Lorusso *et al*., 2016).

Despite the economic burden of tick infestation, traditional control measures among pastoralists in Nigeria such as manual handpicking, remain the predominant practice. While handpicking provides some degree of tick reduction, it is labor-intensive and often insufficient to prevent pathogen transmission (Lorusso *et al*., 2016). Modern approaches, including the use of chemical acaricides, offer improved control but are limited in adoption due to economic constraints, inadequate veterinary services and lack of farmer education (Ghosh *et al*., 2007; Minjauw and McLeod, 2003; Choudhury *et al.,* 2019)

The Fulani pastoralists, who manage most of Nigeria's cattle, practice nomadic or semi-nomadic livestock management systems, and thus frequently move across ecological zones in search of pasture and water. This mobility exposes cattle to diverse tick species and tick-borne pathogens, complicating control efforts. Additionally, environmental factors such as climate, vegetation and land use changes, influence tick survival and distribution patterns (Elelu *et al*., 2016).

Despite increasing reports of tick-borne diseases in Nigeria, region-specific surveillance data and localized risk factor analysis remain limited. Few studies have examined how management practices directly influence infestation rates at the community level. Understanding the epidemiology of tick infestations, including species diversity, prevalence and risk factors, is crucial for developing effective control strategies.

This study investigated the prevalence and species composition of ixodid ticks infesting cattle in Plateau State, Nigeria, and evaluated ecological and management risk factors influencing tick abundance. The findings will inform targeted interventions that will enhance cattle health and reduce the burden of tick-borne diseases in the region.

Materials and Methods

Study Area: The study was conducted in five Local Government Areas (LGAs) of Plateau State, Nigeria: Jos South, Jos North, Mangu, Pankshin, and Barkin Ladi, purposely selected to give an even geographical spread across the State (Figure 1). These areas span tropical highland climates characterized by distinct wet (April–October) and dry (November–March) seasons, with peak rainfall between June and September. Sampling coordinates were recorded using QGIS software version 3.12 for spatial mapping.

Study Design and Sample Size: A cross-sectional survey was adopted for the study. The survey was conducted between April and June 2023. A total of 250 cattle were randomly selected from 10 herds (two herds per LGA). Herds were chosen to represent both sedentary (5) and migratory (5) management systems. Informed consent was obtained from all cattle owners prior to sampling.

Ethical Approval: Ethical clearance for the study was obtained from the Research Ethics Committee of the University of Jos, Nigeria. Informed consent was obtained from all cattle owners prior to sample collection. The cattle

surveyed were handled humanely all through the study.

Tick Collection: Adult ticks were collected directly from restrained cattle using blunt forceps and by manual handpicking. Particular attention was paid to predilection sites such as the dewlap, ears, flank, groin, perineum and tail base. Each animal was thoroughly examined, and the number of ticks collected was recorded.

Preservation and Identification of the Ticks: Collected ticks were preserved in labeled vials containing 70% ethanol. Morphological identification to species level was performed at the ACEPRD Entomology Laboratory, University of Jos, using dissecting and stereomicroscopes (up to 100× magnification). Standard taxonomic keys (Walker *et al*., 2014) were used to distinguish tick genera and species. Molecular identification was not performed due to resource limitations, but it is recommended in future studies to confirm species identity.

Data Analysis: Data were entered into Microsoft Excel and analyzed using R software (version 4.3.2). Prevalence and relative abundance of each tick species were calculated. Differences in tick abundance across LGAs were assessed using ordinary least squares (OLS) regression models. Tukey's Honest significant difference (HSD) test was applied for pairwise comparisons. General linear models (GLMs) were used to evaluate associations between tick abundance and potential risk factors such as herd mobility, acaricide application methods and frequency of handpicking. Statistical significance was set at $p < 0.05$.

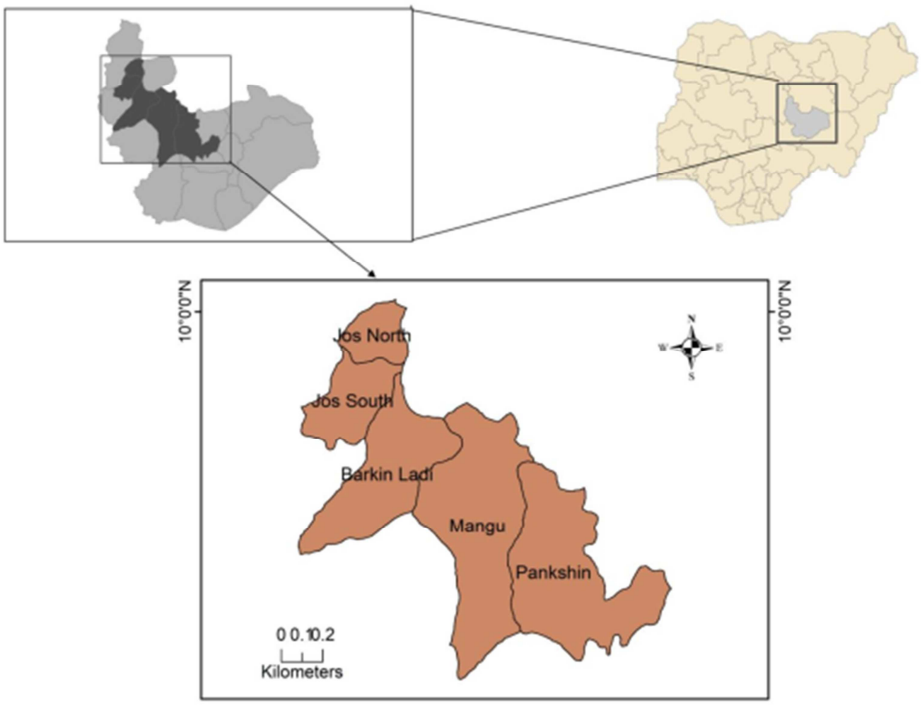

Figure 1. Map of Plateau State, Nigeria, showing the study areas: Jos North, Jos South, Barkin Lardi, Mangu and Pankshin Local Government Areas. [Generated using QGIS version 3.12]

Results

Tick Species Composition and Prevalence: A total of 970 adult ixodid ticks were collected from 250 cattle sampled across five LGAs in Plateau State, Nigeria (Table 1). Six tick species from three genera were identified. *Amblyomma variegatum* was the most abundant, comprising 52.3% of all collected ticks (Figure 2). Other species recorded included *Rhipicephalus (Boophilus) decoloratus* (18.6%), *Hyalomma impeltatum* (16.5%), *Hyalomma truncatum* (7.9%), *Rhipicephalus (Boophilus) annulatus* (4.5%), and *Hyalomma dromedarii* (0.2%) [Figure 2].

Geographical Distribution: The highest tick burden (308/970 = 31.8%) was recorded in Jos South LGA, followed by Jos North (222/970 = 22.9%), Pankshin (206/970 = 21.2%), Mangu (153/970 = 15.8%), and Barkin Ladi (81/970 = 8.4%) [Table 1]. Species distribution of tick prevalence varied by location, with *H. impeltatum* dominant in Jos North and *A. variegatum* most prevalent elsewhere (Table 1).

Table 1*:* Total tick counts and prevalence of tick infestation in the various Local Government Areas (LGAs) of Plateau State, Nigeria surveyed.

Local Government Area	Total ticks collected	Percentage of total ticks (%)	Most prevalent species
Jos South	308	31.8%	*A. variegatum*, *H. truncatum*
Jos North	222	22.9%	*H. impeltatum*, *R. decoloratus*
Pankshin	206	21.2%	*A. variegatum*
Mangu	153	15.8%	*A. variegatum*, *R. decoloratus*
Barkin Ladi	81	8.4%	Mixed species (low abundance)
Total	**970**	**100%**	—

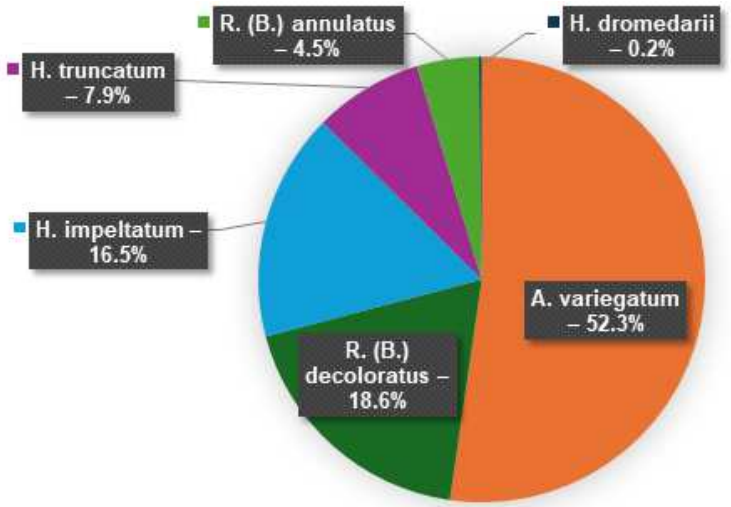

Figure 2. Distribution of the tick species among the 970 ticks collected from 250 cattle surveyed in the various Local Government Areas (LGAs) of Plateau State, Nigeria.

The OLS regression revealed statistically significant differences in tick abundance between LGAs ($p < 0.001$). Tukey's HSD test showed that Jos South had significantly higher tick counts compared to Barkin Ladi and other areas. GLM analysis indicated that sedentary herds had higher tick loads than migratory herds ($P < 0.05$), and that cattle treated with pour-on acaricides had significantly fewer ticks than cattle treated with hand-sprayed acaricides ($p < 0.01$). Also, frequent handpicking (≥ 5 times/week) significantly reduced tick abundance compared to less frequent removal ($p < 0.05$).

Discussion

The six species of ticks recorded in the present study, with *Amblyomma variegatum* emerging as the most dominant (52.3%), is consistent with previous reports from Nigeria and other parts of West Africa (George *et al.,* 1992; Dipeolu, 1975; Kamani *et al.,* 2017). Lorusso *et al.* (2013) similarly identified *A. variegatum* as a predominant species in Plateau State, emphasizing its wide ecological adaptability and aggressive feeding behavior.

The finding in the present study of significant differences in tick abundance among the five LGAs, and that Jos South recorded the highest tick burden, is believed to be due to its semi-urban cattle management system, which supports higher and more stable tick-host interactions. Conversely, Barkin Ladi, characterized by cooler climate and more extensive grazing systems, recorded the lowest infestation. This aligns with findings by Rwang *et al.* (2019), who reported environmental factors, such as elevation and land use, as influential on tick distribution patterns.

Risk factors significantly associated with tick infestation in the present study included herd mobility, acaricide application methods, and handpicking frequency. Sedentary herds harbored significantly higher tick burdens compared to migratory herds, likely due to prolonged exposure to established tick populations in limited grazing zones. Pour-on acaricides were more effective than hand-spraying techniques, probably due to better distribution and residual efficacy. Frequent handpicking (≥ 5 times weekly) was associated with reduced tick loads, although manual removal alone remains insufficient to eliminate infestation risks.

The high prevalence of *A. variegatum* is of particular concern, given its role in the transmission of *Ehrlichia ruminantium*, the causative agent of heartwater disease, and other pathogens such as *Rickettsia africae* and *Theileria mutans*. Other species recorded in the study, including *Hyalomma impeltatum* and *Rhipicephalus (Boophilus) decoloratus*, are also known vectors of significant protozoan and bacterial pathogens that pose risks to cattle health and productivity.

Although the study was conducted during the early rainy season (April – June), the tick burden observed aligns with the seasonal dynamics of tick populations, with higher infestation rates typically recorded during periods of increased humidity and vegetation growth. This highlights the need for year-round tick surveillance and control, particularly at the onset of the rainy season when infestation risks usually escalate.

Overall, the findings reinforce the urgent need for integrated tick control strategies, including the promotion of modern acaricide usage, improved farmer education, and enhanced veterinary extension services. Without such interventions, the risk of tick-borne disease outbreaks and associated economic losses will remain high among cattle-rearing communities in Plateau State, Nigeria.

Conclusion and Recommendations: This study highlighted the high prevalence and species diversity of ixodid ticks infesting cattle in Plateau State, Nigeria, with *Amblyomma variegatum* identified as the dominant

species. Significant spatial variations in tick abundance were observed across the five LGAs, with Jos South recording the highest infestation rates. Management practices, such as herd mobility, frequency of handpicking, and acaricide application methods, were significantly associated with tick burden.

Given the role of *A. variegatum* and other tick species as vectors of economically important pathogens, there is urgent need for integrated tick control strategies. Farmer education, enhanced veterinary services and targeted acaricide interventions are recommended to mitigate tick infestations and reduce the risk of tick-borne disease transmission, in order to improve cattle health and productivity in the region.

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Conflict of Interest

The authors declare that they have no competing interests.

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