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Prevalence of Ticks infestation in Traditionally Managed Cattle in Mambilla plateau, Sardauna LGA, Taraba State, Northeastern Nigeria

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Abstract

Ticks are known to be the most infamous hazard to cattle due to their ability to damage hides and spread diseases. As a result, continuous study of tick distribution on cattle is necessary. Four hundred cattle of determined breed, sex and age, were randomly sampled from five different livestock markets in Mambila Plateau, Sardauna Local Government Area (LGA), Taraba state, northeastern Nigeria in 2023. Collected ticks were identified to species level. Among the 400 cattle examined, 219 were male and 181 were female. 387 (96.75%) cattle had ticks while 13 (3.25%) had no ticks. From the total 181 female cattle, 172 (44%) had ticks, while 215 (56%) males had ticks out of the total 219 male cattle sampled. The mean age of the cattle sampled was 3.0±1.0 years. *Rhipicephalus spp* was the most prevalent tick (76%), followed by *Amblyomma spp* (19%) and *Hyalomma spp* (5%). Due to the financial and /or economic impact of ticks on morbidity and mortality cause by the tick's infestation, it is necessary to implement effective tick control plan and technology as well as promote tick surveillance in the study area.

Keyword: Prevalence; Ticks; Mambila plateau; infestation; traditional; management; Nigeria; cattle.

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https://djvs.uodiyala.edu.iq
Pages: 91-106

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Introduction

As obligate hematophagous arthropod ectoparasites, ticks are found all over the world (de la Fuente and Contreras, 2015). They are members of two commercially significant families: the hard-bodied Ixodidae and the soft-bodied Argasidae. Numerous tick species are important and serve as vital vectors of numerous illnesses that affect both humans and animals (Walker *et al.*, 2003; Norval & Horak, 2004). Argasidae (185 species), Ixodidae (713 species), and Nuttalliellidae (1 species) are among the 899 tick species that parasitize vertebrates (Barker and Murrell, 2004). In tropical and sub-tropical areas, ticks are the most significant ectoparasites of cattle and cause significant financial losses to these animals. However, ticks' primary cause of losses is their capacity to spread viruses, rickettsial and protozoan diseases of animals, which are of great economic importance world-wide (Mehlhorn, 2001). Tick-borne protozoan diseases (e.g. babesiosis and theileriosis), rickettsial diseases (e.g. anaplasmosis and cowdriosis) and viral diseases (e.g. crimean congo fever), may introduce severe health challenge and even death (Raether & Harder 2008; Mehlhorn 2001), and tick-associated dermatophilosis are major health and management challenges of livestock in many developing countries including Nigeria. The economically most important ixodid ticks of livestock in Mambila Plateau LGA, Taraba state, Nigeria are *Hyalomma, Rhipicephalus,* and *Amblyomma.* Frans, (2000) reported that *Hyalomma, Rhipicephalus, Rhipicephalus* and *Amblyomma* are economically important ticks of tropical region.

According to contemporary estimates, there are 13.9 million cattle, 34.5 million goats, and 22.1 million sheep in Nigeria. About 11.5 million of the 13.9 million cattle heads were housed in pastoral systems, with the remaining 2.4 million being housed in communities (RIM, 1992). The northern part of Nigeria, where this study was conducted, has a higher percentage of these creatures than the southern part. In particular, the northern area is home to over 90% of the cattle population. Also, in Mambila plateau and Nigerian agricultural system, livestock production is a source of employment and livelihood, and a significant percentage of the rural people satisfy their subsistence needs through the rearing and marketing of livestock. The importance of livestock production in Nigeria includes the production of proteinous-source food, draught power, and organic manure to crop sector and hides, skins, bones, blood, and fibers to the industrial sector. Livestock sector plays a significant role in socio-economic development of rural household in Mambila plateau and Nigeria as a whole (Birthar *et al.*, 2002).
Many important livestock diseases that inflict major economic losses occur every year and the result may be mortality, decreased productivity and reproduction, downgrading and rejection of skin. Of these, the most important problems that result in inferior quality skin and hide products are external parasites such as ticks, lice, ked, fleas and mange mite that causes noticeable lesion in the coat (Mullen & Durben, 2002). Ruminants like cows, sheep, and goats are crucial providers of food for humans and offer various economically valuable products such as leather and wool. As a result, they are frequently raised in large numbers and in single-species systems, which are very appealing to numerous tick species (Mehlhorn, 2001; Schnieder, 2008).

The Mambila Plateau gets more than 1850 millimeters of rainfall each year. Additionally, it is free from both mosquitoes and tsetse flies. The plentiful growth of vibrant green grasses on the plateau has drawn in a considerable number of cattle. The weather condition with the vegetation in Mambila plateau permit the multiplication and easy attachment of ticks to the grasses which facilitate easy infestation of the cattle with ticks while cattle are grazing (Soulsby, 1982). Mambila plateau, has the

P-ISSN: 2410-8863
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Pages: 91-106

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coolest weather in Nigeria, with daytime temperature of 21°C (normal) that hardly ever exceed 25 °C (77.0 °F).

Due to the weather and climatic condition in Sardauna LGA that allow easy spread and multiplication of ticks, with the large population of cattle in the area and the number of ticks notice in the traditionally manage cattle in Sardauna LGA, this study was conducted. Also, the prevalence of ticks' infestation in traditionally managed cattle in Mambila plateau, Sardauna LGA, Taraba State, Nigeria has not been reported recently, hence this study is necessary.

Materials and Methods

Ethical approval and Informed consent

Ethical approval was obtained from the University of Maiduguri Research Ethics Committee (UM-REC Aug/2023). The study was done in compliance with the procedures of the UM-REC. Consent was obtained from all participating cattle owners in the sampled area.

Study Area

Sardauna Local Government Area (LGA) in Taraba State, Nigeria, encompasses the entire Mambila plateau. The southern, eastern, and about half of the western portion of the plateau are trapped in Cameroon. According to Frantz (1981), the plateau is the highest point in West Africa. The former Sardauna province in northeastern Nigeria became Sardauna LGA, which is situated in southeast Taraba State, on February 3, 1976. The region was formerly referred to in Fulani language as Chabbal Haman Joda, which means the mountains of Haman Joda, according to Tukur (2005a). But later, the region was called the Mambila Plateau. Gembu serves as the administrative centre of Sardauna LGA. The local government area's metropolitan towns of Gembu and Nguroje (the second-most populous area) are home to a variety of ethnic groups, including the Fulani, Kaka, Panso, Kambu, Wawa, and Mambila, whose villages are located on the undulating mountain ranges that stretch from the Nigeria to Cameroun.

The Republic of Cameroon borders Sardauna local government area to the south, east, and about half of the west (Ahmadu *et al.*, 2009). Sardauna LGA borders the LGAs of Gashaka and Kurmi on the north and southwest axes. It encompasses 3,765.2 km² of land. According to Tukur (2005), Sardauna LGA is located at latitudes 5°31' and 7º18' North and longitudes 10°18' and 11º37' East. It is sufficient to mention that Sardauna LGA is situated approximately 1850 meters above sea level. The rainy season on the Mambila Plateau brings frequent and intense rainfall, attributed to orographic processes on the plateau that involve humid winds originating from the South Atlantic Ocean in southern Nigeria, along with the steep slopes and escarpments of the plateau (Ciroma, 2009).

P-ISSN: 2410-8863
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Pages: 91-106

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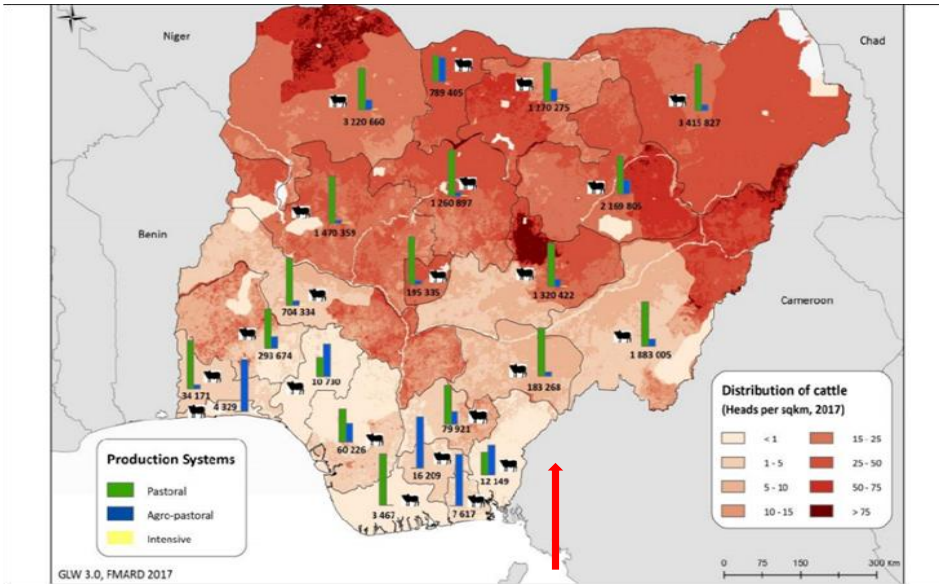

Figure 1: Nigeria distribution of cattle by region and production system, red arrow facing up showing Sardauna LGA (Source: GLW 3.0 and FMARD, 2017)

Figure 2: Map of Taraba State showing Sardauna LGA. (Source: Oruonye and Ngamdu 2022).

P-ISSN: 2410-8863
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https://djvs.uodiyala.edu.iq
Pages: 91-106

Diyala Journal for Veterinary Sciences
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Study Population and Sampling Method

A total of 400 cattle comprising white Fulani, cross breed, red Bororo and Gudali breeds were randomly selected from different livestock markets covering Nguroje, Mai Samari, Gembu, Dorofi and Mayo Ndaga Livestock Markets in Mambila Plateau Sardauna local government area, Taraba state, Nigeria were examined, and ticks collected within the period of June to November 2023.

Sample Collection and Analysis

Tick collection

Apparently healthy cattle of various breeds and sexes were sampled with consent from the cattle owners. During sample collection, every effort was made to reduce the animals' level of suffering. With the assistance of the herdsmen, the sampled cattle were securely bound using horn restraint and rope as an anti-kick, which made it simpler to reach all the cattle's body parts. To prevent mutilation, ticks were plucked with gloved hands and then carefully twisted 180 degrees. Samples were labelled according to specific categories, including breed, age, and sex of the cattle, as well as the date and location of the cattle collection site and cattle market. The ticks that were gathered were placed in clean, accurately labelled glass vials that were properly sealed, which contained 70% alcohol and 5% glycerol for preservation purposes. The vials were then taken to the parasitology laboratory at the Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine at the University of Maiduguri for additional analysis and identification.

Tick Identification

Ticks were cleaned, sorted, and counted in the laboratory before being placed in a Petri dish with a drop of 10% formalin. The ticks were then examined under a stereo-zoom microscope, photographed with a digital camera, and analysed with a hand lens. Typically, ticks were identified based on their size and length of the capitulum, body colour, preferred site, and location on the host. Identification was performed using the key morphological characters and pictographs and guides as described by Estrada-Pena *et al.*, (2004). Additionally, the morphology of the ticks was examined in the lab using both dissecting and compound microscopes. The identification of various tick species was achieved by utilizing the anatomical and morphological traits outlined by Soulsby (1982).

Data Analysis

The prevalence of tick infestation was calculated using the formula $p = d/n$ (%), where p represents prevalence, d denotes the number of cattle individuals infested with ticks, and n signifies the total number of cattle in the population at risk of tick infestation (Thrusfield 2005). Data was organized and documented using Microsoft Excel 2013. Prevalence was determined following the methodology outlined by Thrusfield (1995). A chi-square test was employed to assess the statistical significance and relationship between the disease and other independent variables. Additionally, a 95% Confidence Interval for the estimated prevalence was calculated, with $P < 0.05$ regarded as statistically significant. All statistical evaluations in this study were executed using Graphad Instat version 17.0 statistical software.

P-ISSN: 2410-8863
E-ISSN:2958-6178
https://djvs.uodiyala.edu.iq
Pages: 91-106

Diyala Journal for Veterinary Sciences
Vol. 4 No.1 March (2026)
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Results

Among the four hundred cattle sampled, 119 (29.8%) were White Fulani, 83 (20.8%) Sokoto Gudali, 145 (36.2%) Red Bororo and 53 (13.2) cross breed (Table 1). Also, 49 (12.7%) of the crossbreed were infested with ticks and, 140 (36.3%) of the red Bororo were infested with ticks. Of all the Sokoto Gudali sampled, 81 (20.9%) were infested with ticks, 117 (30.2%) of the white Fulani sampled were also infested with ticks.

Table1: prevalence of ticks among the breeds of cattle sampled in Mambila Plateau, Sardauna LGA, Taraba State.

Breeds	Total	(%)	Infested with ticks	(%)
Red Bororo	145	36	140	36
White Fulani	119	30	117	30
Cross Breed	53	13	49	13
Gudali	83	21	81	21
Total	400	100	387	100

Among the 400 cattle sampled, 219 (55%) were males and 181 (45%) were females, the cattle were categorized based on age as young (≤3years) 181 (47%) and adult (>3years) 206 (53%). 387 (96.8%) of the four hundred had ticks on their body and 13 (3.2%) had no ticks on their body. Of the 387 tick infested cattle, 215 (56%) were males and 172 (44%) were female. Among the 13 cattle that were no ticks infested, 9 (69%) were females and 4 (31%) were males. Based on age 206 (53%) and 181 (47%) adult and young respectively were infested with tick (Table2).

Using chi-square, it was discovered that the breed of cattle had no significant difference for tick infestation (p= 0.2358) but there was a statistical significance with age among infested cattle (p =0.0072) and there was no statistical significance difference with sex among infested cattle (p=0.3286).

P-ISSN: 2410-8863
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https://djvs.uodiyala.edu.iq
Pages: 91-106

Diyala Journal for Veterinary Sciences
Vol. 4 No.1 March (2026)
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Table 2: Prevalence of tick infestation based on the sex and age of the cattle sampled in Mambila Plateau, Sardauna LGA Taraba State.

Risk factor		Total	(%)	Infested with ticks	(%)
Sex	Female	181	45	172	44
	Male	219	55	215	56
Total		400	100	387	100
Age	Adult	208	52	206	53
	Young	192	48	181	47
Total		400	100	387	100

One Thousand, Four Hundred and Seventy-Four (1474) ticks were collected from the 387 cattle, and these were identified to species and sex level. *Rhipicephalus microplus* was the most prevalent ticks having a total of 1121 (76%) which include 999 female and 122 male ticks, followed by *Amblyomma variegatum* with 278 (19%) having 151 female and 127 male and lastly *Hyalomma truncatum* with only 75(5%) male ticks without any female ticks seen or collected in this study (Table 3). These ticks were obtained from various body sites as follows: 233 on the necks/dewlaps, 230 on the fore limbs, 350 on the mammary gland area, 95 around the eyes, 280 under a tails/perineum, 159 on the ears and finally 127 Scrotal areas. The highest number of ticks were collected from the mammary gland area followed by the perineal/under the tail region with the least from the face of these cattle (Table 4). Note that all cattle sampled were totally removed of any visible ticks seen.

Table 3: Distribution of varied species of ticks collected and their sexes at five different livestock markets sampled in Mambila plateau Sardauna LGA Taraba State.

Tick Species	Female	(%)	Male	(%)	Total	(%)
Boophilus microplus	122	49	999	82	1121	76
Amblyomma variegatum	127	51	151	12	278	19
Hyalomma truncatum	0	0	75	6	75	5
Total	249	100	1225	100	1474	100

P-ISSN: 2410-8863
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https://djvs.uodiyala.edu.iq
Pages: 91-106

Diyala Journal for Veterinary Sciences
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Table 4: prevalence of tick infestation in different body parts and ticks' specie of the sampled cattle in Mambila Plateau, Sardauna LGA, Taraba State.

Predilection site	Number of ticks	(%)	Tick species identified
Neck/dewlap	233	16	*Rhipicephalus microplus* *Amblyomma variegatum*
Ears	159	11	*Hyalomma truncatum* *Rhipicephalus microplus*
Around the eyes	95	6	*Hyalomma truncatum* *Amblyomma variegatum*
Mammary gland area	350	24	*Amblyomma variegatum* *Hyalomma truncatum* *Rhipicephalus microplus*
Fore limb	230	16	*Rhipicephalus microplus* *Hyalomma truncatum*
Under the tail/perineum	280	18	*Rhipicephalus microplus* *Amblyomma variegatum*
Scrotal area	127	8	*Rhipicephalus microplus* *Amblyomma variegatum* *Hyalomma truncatum*
Total	1474	100	

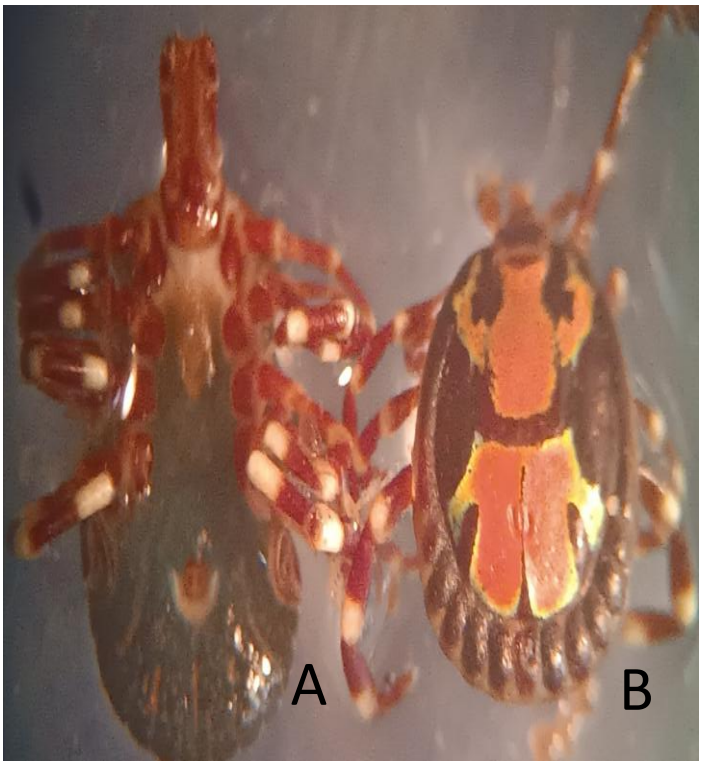

Figure 3: (A) ventral and (B) Dorsal view of male *Amblyomma variegatum* examined at the Parasitology Laboratory, Department of Veterinary Parasitology and Entomology University of Maiduguri. X100M.

P-ISSN: 2410-8863
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https://djvs.uodiyala.edu.iq
Pages: 91-106

Diyala Journal for Veterinary Sciences
Vol. 4 No.1 March (2026)
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Figure 4: (A) ventral and (B) Dorsal views of a male *Rhipicephalus s microplus* examine at the Parasitology Laboratory, Department of Veterinary Parasitology and Entomology University of Maiduguri. X100M.

Figure 5: Dorsal view of *Hyalomma truncatum* examine at the Parasitology Laboratory, Department of Veterinary Parasitology and Entomology University of Maiduguri. X100M.

P-ISSN: 2410-8863
E-ISSN:2958-6178
https://djvs.uodiyala.edu.iq
Pages: 91-106

Diyala Journal for Veterinary Sciences
Vol. 4 No.1 March (2026)
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Figure 6: A picture showing high ticks infestation under the tail/perineum on an adult Red Bororo Bull in Mambila Plateau, Sardauna LGA Taraba State.

Figure 7: Adult White Fulani Bulls in Mambila Plateau, Sardauna LGA, Taraba State, with high level of ticks infestation on the perineum and scrotal area.

P-ISSN: 2410-8863
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https://djvs.uodiyala.edu.iq
Pages: 91-106

Diyala Journal for Veterinary Sciences
Vol. 4 No.1 March (2026)
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Discussion

Three tick's species, *Amblyomma variegatum, Rhipicephalus microplus* and *Hylomma truncatum*, infest cattle in Mambila Plateau, Sardauna LGA, Taraba State figure 3, 4, 5, 6 and 7; *Rhipicephalus* is the most common amongst other species sampled in this study. This is due to the herdsmen believe in the area that the *Rhipicephalus spp* has no significant health challenge to their cattle, there for it is usually left untreated as seen in figure 7 and 8 above. Paul *et al*. (2017) reported in their study conduct in Maiduguri, Borno State, Northeastern Nigeria that *Amblyomma variegatum* (37.7%) was more prevalent, followed by *R. sanguineus sensu lato* (22.3%), *R.* (*Rhipicephalus*) *decoloratus* (21.4%) and *Hylomma truncatum* (18.6%) was the least prevalent. Also, in a study conducted in Sokoto municipal, Sokoto State, Nigeria, Opara *et al*. (2005) reported that *Amblyomma species* were the most prevalent (53.9%) followed by *Rhipicephalus spp*. (35.3%) and *Hyalomma species* (10.8%) this opposed the current study of which *Rhipicephalus spp* predominate the collected ticks. Tukur and Abdulkarim (1998) reported 52% prevalence rate of *Rhipicephalus spp*. 34% *Rhipicephalus* species and 14% of *Amblyomma* species in Sokoto livestock market Sokoto, Nigeria. Other countries have also reported the prevalence of ticks in cattle, sheep and goat. Mushi *et al*., (1996 a and b) in Gaborone, Botswana recorded five tick's species from indigenous goats, and *Rhipicephalus evertsi evertsi*, *Rhipicephalus decoloratus* and *Amblyomma hebraeum* were the most abundant tick species collected. Studies in the eastern Free State have revealed that the principal ticks affecting cattle are *Rhipicephalus decoloratus* (53.1%), *Rhipicephalus evertsi evertsi* (44.7%), *Rhipicephalus follis* (1.0%), *Rhipicephalus gertrudae* (0.7%) and *Rhipicephalus* warburtoni (0.4%) (Hlatshwayo *et al.*, 2002). Rony *et al.* (2010) reported the prevalence of *Rhipicephalus microplus* (45.63%) to be the highest followed by *Rhipicephalus sanguineus* (36.89%) and *Haemophusalis bispinosa* (16.50%) at Bhawal Forest. Islam *et al.*, (2006) reported that the prevalence rate of *Rhipicephalus decoloratus* was the highest with (56.3%) followed by *Hyalomma anatolicum anatolicum* (15.0%), *Rhipicephalus sanguineus* (14.7%), *Hyalomma bispinosa* (11.3%) and *Amblyomma testudinarium* (2.8%) in cattle in Bangladesh.

Likewise, Kabir *et al*. (2011) reported high prevalence of *Rhipicephalus microplus* (36.19%), followed by *Rhipicephalus sanguineus* (16.07%) and *Hyalomma bispinosa* (14.09%) in grazing cattle in Bangladesh. Furthermore, Kabir *et al*. (2011) also reported that in Chittagong district of Bangladesh, (36.31%) cattle were found to be infested with tick of which the highest prevalence rate of tick was *Rhipicephalus micorplus* with (25%), *Rhipicephalus sanguineus* (13.68%) *Haemaphysalis bispinosa* (12.63%) respectively. These results are not too different from what was seen in our study. In our study, *Rhipicephalus s spp*. recorded the highest prevalence, and this could be possible, because *Rhipicephalus* species may have more preference to cattle or may be more frequent or abundant ticks in the study area. In Asella town Southeast Ethiopia, Tamiru and Abebaw (2010) reported that *Amblyomma variegatum* had the highest prevalence rate (48.2%) among cattle followed by *Rhipicephalus evertsi evertsi* (22%), *Rhipicephalus decoloratus* (15.4%) and *Hyalomma marginatum* (2.5%). These results are contrary to what was obtained in this study, which may be differences in geographical area, time and season of sampling, area covered for sampling and total number of animals sampled.

In terms of age, our research found that adult cattle had a higher rate of tick infestation compared to younger cattle. Previous studies by James-Rugu & Iwuala (2002) reported an infestation rate of 63.2% in adult cattle, which they attributed to their larger body size and the tendency to feed on vegetation

P-ISSN: 2410-8863
E-ISSN:2958-6178
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Pages: 91-106

Diyala Journal for Veterinary Sciences
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where ticks were present. They also suggested that adult and adolescent cattle, sheep, and goats are more favoured by ticks for infestation than younger animals, regardless of breed or species.

Ticks' infestation was higher in the cattle's mammary gland, scrotum, under the tail/ perineum and lowest in the face as seen in table 4 above, this is possible because mammary gland, scrotum, under the tail/ perineum are body parts that the cattle both hind and fore limbs cannot easily access to necessitate scratching to distract or remove the ticks. So, the ticks prefer such areas that they are not distracted. Opara *et al*. (2005) and Musa *et al*. (2014) reported in their study that, ticks' distribution was more in the inguinal region in most males followed by the scrotum and the pre-anal region also in female cattle; the udder and external genitalia, Inner thighs and under the tail/perineum harboured the highest number of ticks as also seen in this study. There was also an agreement between the predilection sites in this study and those reported by Wolde and Muhammad (2014), the researchers reported that, hard ticks' invasion of the mammary and groin glands regions in cattle are most common and least predominance in the neck and facial areas. Production of meat, milk, fur, and skin may decrease because of tick infection because tick's infestation makes the animal uncomfortable, sucks blood and transmit some diseases.

In relation to age range, Musa *et al*. (2014) reported in their study conducted in Maiduguri Northeastern Nigeria that ticks infestation was highest in cattle <3 years and lowest in the cattle of age 3 – 7 years which is contrary to our study. Our study agreed with Rony *et al*. (2010), they reported that, prevalence of tick infestation was lowest in younger animals <3 years old and significantly higher in older animals.

In relation to breeds our study revealed that red Bororo which are the local breed in the study area shows higher rate of tick's infestation (36%) followed by the white Fulani (30%) which are also local breed in the study area. Other studies also revealed that local cattle showed greater prevalence of ticks. According to Kabir *et al.* (2011), local cattle had greater tick prevalence (43.8%) than crossbred cattle (24.1%). Nonetheless, additional research revealed that crossbred cattle between the ages of 5 and 10 years had a greater frequency of tick infestation (Sajid *et al.*, 2009). Cross breed *Bos indicus* hybrids were observed to exhibit varying degrees of relative tolerance to ticks' infestations as compared to a cross of *Bos taurus* (Wambura *et al.*, 1998). Given that every breed had some degree of ticks' infestation, none of the cattle of different breeds were immune to ticks' infestations.

In term of sex the ticks' infestations were higher in male cattle as compared to the female cattle. Our finding was consistent with studies by Opara and Ezeh (2011) and Hitcheock (1993) these researchers found out in their studies that male cattle had higher tick infestations than female cattle. The reason of higher rate of infestation in male as compared to the female could be that most males in the tropics are primarily for farming activities and often moved around in search of food, which causes them to become infested with ticks. In contrast, female cattle are primarily kept in confinement for breeding and milking purposes, which reduces their exposure to tick infestations. Ticks' larvae have revealed to scale grass and shrub blades to attach themselves on moving hosts, primarily males, while grazing (Soulsby, 1982).

One of the biggest issues Nigeria's farm animal productions is currently experiencing is tick's control. For cost-effective control, it is imperative to accurately diagnose the type of ticks infesting the farm animals and to determine the time of proliferation. Arthropod ectoparasites of farm animals are highly prevalent in the environment, impacting the daily activities and health of the animals, while also posing threat to food security (Olabode *et al*. 2010). Therefore, extension services that attempt to raise

P-ISSN: 2410-8863
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Pages: 91-106

Diyala Journal for Veterinary Sciences
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awareness about the significance and control of these ticks for animal producers are necessary to prevent the high prevalence and negative effects of ticks on farm animals.

In this study, most ticks collected were adults and there were more males than females. This could be that the female ticks are mostly for a brief period in the cattle body and after engorgement drop down to lay eggs and some even die after egg laying. Also, the adult ticks having higher rate of prevalence in cattle is possible as most of the younger ticks newly hatch may still be on the ground and have not yet opportunity to attach themselves to the animals.

Conclusion

Decrease in livestock production output in the Mambila Plateau traditionally managed cattle may be due to tick infestations, poor management, poor veterinary services, and inadequate knowledge of the herdsmen regarding the effect of ectoparasites in general and ticks in particular. Ticks are believed to have contributed to widespread occurrence of diseases. Given the significance of meat, skin, and hide as income sources, the high rate of tick infestation noted in the study area indicates a need for urgent action to reduce the spread of ticks and enhance the health of the cattle. This survey verifies the endemic nature of ticks and their related diseases, which negatively affect cattle. Thus, controlling these tick species is crucial for advancing livestock production among traditionally managed cattle in Sardauna LGA, Taraba State, Northeastern Nigeria.

Recommendation

Three species of ticks were found to be infesting cattle, in the study area. Based on our findings in this study, the following recommendations are suggested:

It is advisable that herdsmen in the study area should receive training on strategic ticks control techniques, such as proper grazing management, and that tick's bath and or spray be done as needed as possible due to the higher prevalence of tick infestation in the region. Ticks control and treatment should be done at the beginning, middle and or at the end of rainy season. Mass treatment of a herd with antiparasitic drugs such as Ivermectin, Doramectin etc. is recommended, to promote sustainable and lucrative livestock production. Further research is however required on the protozoan, helminths and other parasitic organisms that are found in the study area. This will lessen productivity losses brought by diseases transmitted by ticks and other parasites in the study area.

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