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**Research Article**
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# Ticks infestations and parasitism in resident and non-resident dogs of Plateau State, Nigeria

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## ABSTRACT

*The aimed of the study was to determine tick infestations and parasitism in resident and non-resident dogs of Kanke Local Government Area, Plateau State, Nigeria and was carried out from November 2023 to October 2024. A total of five hundred (500) dogs were examined for ticks, out of which 421(79.0%) were infested with ticks. Three species of ticks were discovered infesting dogs in the study area. These are Boophilus decoloratus, Rhipicephalus sanguineus and Amblyomma variegatum (Ixodid or hard ticks). The dogs had multiple infestations with no single presence of tick found. Rhipicephalus sanguineus had the highest prevalence rates of 901(31.0%) and 2009(69.0%) in resident and non-resident dogs respectively. Boophilus decoloratus recorded an infection rate of 455(22.1%) in resident dogs and 1603(77.9%) in non-resident dogs. 99(43.2%) and 130(56.8%) prevalence rates for Amblyomma variegatum were recorded in resident and non-resident dogs respectively. The ticks recorded were mostly found on the facial region, followed by the trunk, interdigital cleft, anal region and lastly the abdominal region. Adult dogs were heavily infested with all the species of ticks encountered when compared with puppies. (P<0.05). This study revealed that Babesia canis was the only tick-borne parasite present in the examined blood samples of the animals. This haemoparasite was more prevalent in non-resident dogs. Adult dogs were mostly infected with Babesia canis. The examined animals showed an association of tick infestations and babesiosis. The present study, therefore revealed multiple tick infestations with monoparasitism in the dogs. Both resident and non-resident dogs showed a decrease in PVC levels due to tick infestations. Packed cell volume indicated significant difference in the studied dogs (P<0.05), thus aneamic, emaciated and loss economic and meat value to the farmers and consumers respectively.*

***Keywords:*** *Resident, Non-resident, Ticks, Tick-borne parasites, Dogs, Ixodid, Boophilus decoloratus, Rhipicephalus sanguineus, Amblyomma variegatum, Haemoparasite, Babesia canis, Babesiosis, Association, Animals, samples, Infestations, Parasitism*

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## INTRODUCTION

Ticks are known to be responsible for the maintenance and transmission of widest variety of pathogens of any blood sucking arthropods such as bacteria, viruses, rickettsia and protozoa affecting domestic animals and humans. Ticks transmit bacteria which cause diseases including the relapsing fever which is a cosmopolitan condition in rodents and man and is transmitted by Ornithodoros vectors. The parasite is a bacterium of the genus *Borrelia*. Ricketsiae such as *Ehrlichia bovis,Ehrlichia canis* and *Ehrlichia ovina* of cattle, dogs and sheep in Africa are transmitted by *Hyalomma* species, *Rhipicephalus sanguineus* and *Rhipicephalus bursa* respectively which are the causes of Ehrlichiosis. There is a characteristic disease of goats, sheep and cattle known as heart water which is widespread in Africa, the causative agent being *Cowdria ruminatium.* Another disease called Anaplasmosis which is mainly of cattle but also sheep and goats is characterized by jaundice, anemia and debility has been reported from most African countries (Agbede, 2013). Ticks transmit protozoans. Protozoan disease includes Babesiosis. *Babesia canis* infects dogs (James-Rugu, 2004) to be vectored principally by the brown dog ticks, *Rhipicephalus sanguineus* (Ayoob, *et al* 2010).

### Statement of the problem

Ectoparasitic diseases are global problems including Nigeria and are considered as major obstacles in the health and product performance of animals. The disease may be due to ectoparasites (which attack body surface of animals and humans). The major losses caused by ticks are due to their ability to transmit viral, protozoan and rickettsial diseases of livestock which are of great economic importance worldwide. In addition, the wounds they produce may create sites for secondary bacterial infections. Ticks are notorious threats due to allergy and toxicosis. A single tick can cause paralysis by injecting its saliva into its host while feeding (Niyonzema and Kiltz, 1986).

### Justification

Ticks are ectoparasites of animals including dogs. They attach to the body of animals and cause irritation, allergic reactions and restlessness. Ticks are responsible for the transmission of endo parasites such as *Babesia canis, Anaplasma etc.* This work is important because it seeks to provide information on ticks that parasitize resident and non-resident dogs in Kanke Local Government Area, which has a very big dog market in Nigeria where dogs particularly from the Northern parts of the country are sold for consumption.

### Aim of the study

To study ticks' infestations and parasitism in resident and non-resident dogs in Kanke Local Government Area of Plateau State.

### Objectives of the study

The objectives of the study include the following:

i. To determine the different species of ticks in the study dogs in relation to factors such as age,and predilection/attachment sites.
ii. To determine the most prevalent tick species in the examined dogs.
iii. To detect tick-borne parasites in the animals.
iv. To assess the infection rate of tick-borne parasites in the

## MATERIALS AND METHODS

### Study area

The study was conducted in Kanke Local Government Area of Plateau State. Plateau State is the twelfth largest state in Nigeria, Wikipedia (2023). It is located approximately in the center of the country with an area of 30,913Km and an estimated population of 3,206,531 people (National Population Commission (2006). The state borders Nasarawa State to the south west, Taraba State to the south east, Kaduna State to the North west and Bauchi State to the North east. The map of Plateau State is shown in (Figure 1).

Kanke Local Government Area is located at the southern eastern slope of the Jos Plateau highland. It is made up of four districts: Garram, Kabwir, Ampang and Amper covering an estimated land mass of ,1000 square kilometers. The people cultivate millet, beans, sorghum, cocoyam, upland rice etc and rear dogs, goats, fowls etc. Kanke Local Government Area is one of the council areas in Plateau State where mining activities are carried out. Evidence of mineral deposits and exploration abound there. Some of the mineral deposits include Tin, industrial clay, feldspar, columbite, limestone and cassiterite. There are potential tourist sites in this Local Government Area that are still untapped.

They include the rock craters, undulating plains, escapements, rock pedestals, Romtom water springs, Kawang Ampang District Palace and Seri-Amper. (http//www.plateau state.gov.ng). It is one of the major trades centre for dog business in Plateau State and the country in general and dog's meat is commonly consumed by the people in the area (Figure 1).

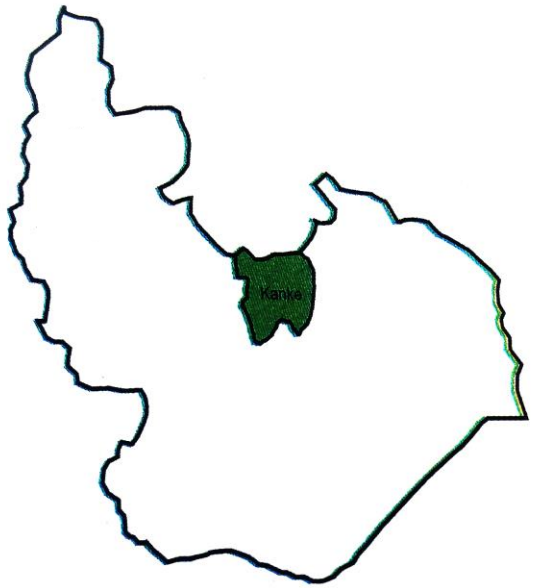


**Figure 1:** Map of Plateau State showing the study area (http://www.plateaustate.gov. ng).

## Method of study

### Advocacy visit

A pre-survey visit to the study area was conducted to identify houses with dogs and market and to interact with participants (both buyers and sellers) to seek their consent.

### Animals examined

Five hundred (500) resident and non-resident dogs were selected from Kanke Local Government Area using a stratified random sampling technique as adopted by James-Rugu & Iwuala (1992).

### Dogs sampling

The selected dogs were restrained and thoroughly examined by close inspection, palpation, and parting the hairs against their natural direction for the detection of ticks as adopted by James-Rugu and Iwuala (1992). The same dogs were also examined for haemoparasites at sub-clinical stage.

### Ticks sampling

The sampled dogs were carefully arrested and a secure muzzle placed to cover the mouth before ticks were collected from different parts of the body. The following host parameters were examined:

**Predilection Sites**: Interdigital cleft, trunk, facial, anal, abdominal(belly) regions were examined by brushing their hair with fine comb as described by Ekanem *et al.* (2010).

**Age group:** Dogs less than one year were referred to as puppies and those more than one year as adults.

### Ticks preservation

All the ticks collected were transferred into a clean bottle and preserved in 70% methanol then taken to the Post Graduate Research Laboratory of Zoology Department University of Jos for identification.

### Ticks processing

The ticks were processed using the method of Iwuala & Okpala (1978) where large ticks were sorted out while the smaller ones were processed. The method of processing involved warming in Potassium hydroxide to remove dirt then rinsing in water and dehydrating through graded series of methanol as follows: 15%, 25%, 35%, 45%, 55%, 65%, 75%, 85% and 95%. Details on the dilution of methanol is as presented in (Table 1). After dehydrating the ticks, they were cleared in xylene and mounted on slides in Canada balsam (Iwuala & Okpala, 1978 a,b).

### Ticks identification

Ticks were identified using different identification keys and diagrams of ticks. Low power dissecting stereomicroscope ZEISS model stem DV4 (Germany).

### Recording of ticks

All the identified ticks were recorded in various data charts as reflected in various appendices.

### Ticks assessment in relation to different host parameters

The ticks collected were assessed with respect to the host parameters including age, PVC, predilection sites, haemoparasites.

### Blood examination

### Collection of blood samples

Blood samples were collected aseptically from inter-digital cleft and cephalic vein using 23 G needle and

Table 1: Grades of methanol used for dehydrating ticks.

| Grades | Dilutions |
|---|---|
| 15% | 15mls of methanol to 85mls of distilled water |
| 25% | 25mls of methanol to 75mls of distilled water |
| 35% | 35mls of methanol to 65mls of distilled water |
| 45% | 45mls of methanol to 55mls of distilled water |
| 55% | 55mls of methanol to 45mls of distilled water |
| 65% | 65mls of methanol to 35mls of distilled water |
| 75% | 75mls of methanol to 25mls of distilled water |
| 85% | 85mls of methanol to 15mls of distilled water |
| 95% | 95mls of methanol to 5mls of distilled water |

5.0ml syringe. The blood samples were stored in well-label Ethylene diamine tetra acetic Acid (EDTA) tubes and taken to the Parasitology Division of the National Veterinary Research Institute (NVRI) Vom for analysis.

### Determination of packed cell volume (PCV)

Packed Cell Volume was measured using the microhaematocrit method described by Embert (1986). Blood was collected into heparinized capillary tubes and allowed to enter the tube by capillary action up to three quarter (75mm), leaving at least 15mm unfilled. The capillary tube was then cleaned to prevent contamination of the haematocrit centrifuge. The end of the tube which is filled with blood was sealed at one end using sealant. The sealed tubes were placed in a microhaematocrit centrifuge (Hawksley, England) and span at 3,000 revolution per minute(rpm) for five minutes after which the Packed Cell Volume was read using the standard microhaematocrit PCV reader (Hawksley, England). The individual results obtained were expressed in percentages.

### Preparation of thin smears

Thin smears were prepared by dropping a small drop of blood near the end of a glass slide. Another slide which was used as a spreader was placed on the glass slide at an angle of 45. The drop was allowed to spread along the line of the spreader and the film was spread by smooth rapid forward movement of the spreader. Two/three thin blood films were prepared for each animal and left in air to dry. Then fixing in absolute methanol for three minutes. The slides were stained with freshly filtered Giemsa stain for 40-45 minutes and washed with distilled water for few seconds to remove excess stain and left in air to dry.

### Identification of tick-borne parasites

The slides were examined under oil immersion using the light microscope at 100x for the detection of haemo (blood) parasites as described by Coles (1986).

### Statistical analysis

The statistical analysis was performed using SAS statistical software 8.2, SAS Institute Inc. Cary, NC, USA. All data were expressed as mean values with their standard errors, and comparison of mean values was performed by Chi-square. The differences between groups was considered significant if $p<0.05$.

## RESULTS

### Species of ticks infesting dogs

The present study showed that a total number of 5197 ticks were recovered (Table 2). Three species of ticks were identified (Table 2). The tick species include *Boophilus decoloratus, Rhipicephalus sanguineus and Amblyomma variegatum* (Table 2). *Rhipicephalus sanguineus* was the most prevalent species of ticks in the examined animals (Table 2). The prevalence rates of 901(31.0%) and 2009 (69.0%) of *Rhipicephalus sanguineus* were obtained from resident and non-resident dogs respectively. *Boophilus decoloratus* were 455(22.1%) and 1603(77.9%) in the studied animals respectively. *Amblyomma variegatum* had the least infestations rates of 99(43.2%) and 130(56.8%) in the animals respectively (Table 2). The results showed that there was significant difference in ticks' infestations on the dogs ($P<0.05$).

**Table2:** Species of ticks encountered on resident and non-resident dogs in Kanke Local Government Area of Plateau State.

| Species | No. of Parasites Recovered (%) | | Total | $X^2$ | df | P Value |
|---|---|---|---|---|---|---|
| | Resident dogs | Non-resident dogs | | | | |
| *Boophilus decoloratus* | 455(22.1) | 1603(77.9) | 2058 | 74.63 | 2 | 0.00 |
| *Rhipicephalus sanguineus* | 901(31.0) | 2009(69.0) | 2910 | | | |
| *Amblyomma variegatum* | 99(43.2) | 130(56.8) | 229 | | | |
| Total | 1455 | 3742 | 5197 | | | |

There was significant difference in the resident and Non-resident dogs infested with ticks **(**$P<0.05$).

### Tick infestation in relation to age of dogs

Tick infestation in resident dogs in relation to age showed that 46(63.0%) puppies of resident dogs examined were infested while 71.4% of the adult resident dogs examined were also infested. There was no significant association ($p>0.05$) between the age of resident dogs and tick infestation as shown in (Table 3). Tick infestation in non-resident dogs in relation to age showed that 99(78.8%) examined puppies were infested while 222(98.6%) of the adult dogs examined were also infested. There was significant association ($p<0.05$) between the age of Non-

**Table 3:** Tick infestation in relation to age of dogs.

| Tick infestation | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Number (%) | | Total Number | | | |
| **Dogs** | **Age** | **Positive** | **Negative** | **Examined** | **$X^2$** | **Df** | **P value** |
| Resident | Puppy | 29(63.0) | 17(37.0) | 46(100) | 1.129 | 1 | 0.288 |
| | Adult | 95(71.4) | 38(28.6) | 133(100) | | | |
| Non-Resident | Puppy | 78(78.8) | 21(21.2) | 99(100) | 39.04 | 1 | 0 |
| | Adult | 219(98.6) | 3(1.4) | 222(100) | | | |

Thera was a significant difference in the various ages infested with ticks (P<0.05).

Table 4: The prevalence of *Babesia canis* in Relation to age of dogs.

| Infection with ***B. canis*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Number (%) | | Total Number | | | |
| Dogs | Age | Positive | Negative | Examined | $X^2$ | Df | P value |
| Resident | Puppy | 6(13.0) | 40(87.0) | 46(100) | 19.7 | 1 | 0 |
| | Adult | 67(50.4) | 66(49.6) | 133(100) | | | |
| Non-Resident | Puppy | 14(14.1) | 85((85.9) | 99(100) | 78.2 | 1 | 0 |
| | Adult | 150(67.6) | 72(32.4) | 222(100) | | | |

There was significant difference in the presence of *Babesia canis* to the varied ages of the dogs (P<0.05)

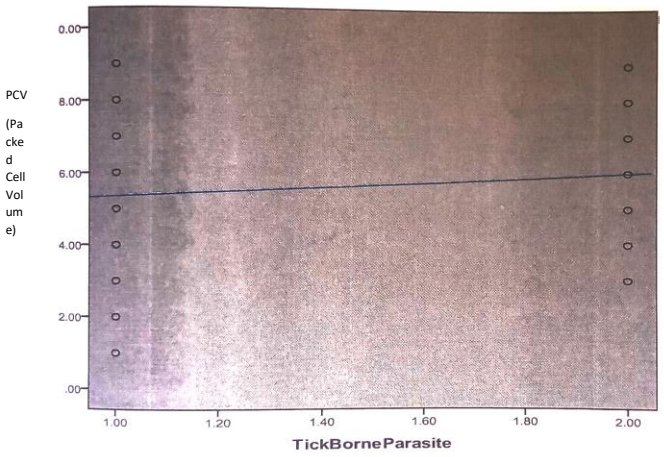


**Figure 2:** Tick Borne Parasite Infection in Relation to PCV in Resident and Non-resident dogs

resident dogs and Tick Infestation as shown in (Table 3).

### Tick-borne parasites of resident and non-resident dogs

*Babesia canis* was the monoparasite recovered from the blood samples collected from the animals.

### Tick-borne parasites in relation to packed cell volume (PCV)

The relationship which exists between tick-borne infection and Packed Cell Volume (PCV) in resident and non-resident dogs showed non-significant difference. As tick-borne parasite infection increases, Packed Cell Volume (PCV) level decreases and as tick-borne parasite infection decreases, Packed Cell Volume (PCV) level increases. The result was significant at 5% (P<0.05). (Figure 2).

### Prevalence of *babesia canis* infection in relation to age of dogs

The rate of infection of dogs with *Babesia canis* showed that 6(13.0%) of total puppies of resident dogs examined were infected, while 67(50.4 %) of total examined adult dogs were infected. There was significant association (p<0.05) between the age of resident dogs and *Babesia canis* infection as shown in (Table 4). In non-resident dogs, the infection rate showed that 14(14.1%) of the puppies examined were infected and 150(67.6%) of the adult dogs examined had *Babesia canis*. There was significant association (p<0.05) between the age of non-resident dogs and *Babesia canis* infection as shown in (Table 4).

Plate 1: Adult Male *Amblyomma variegatum*

Plate 2: Engorged Female *Rhipicephalus sanguineus*

Plate 3: Ventral View of Adult *Boophilus decoloratus*

Plate 4: Tick burden on Dog

**Tick infestation in relation to predilection sites**

Ttick infestation in relation to predilection sites on resident dogs showed that ticks mostly preferred the facial region, followed by the trunk, interdigital cleft, anal region. The ticks least prefer the abdominal region. The result is significant at 5% level of significance (P<0.05). In a similar way, all the tick species encountered on non-resident dogs mostly prefer the facial region, followed by the trunk, interdigital cleft, anal region. The abdominal region was the least preferred region (Plates 1-4). The result showed significant difference (P<0.05).

**DISCUSSION**

The ticks species identified and collected were *Boophilus decoloratus, Rhipicephalus sanguineus* and *Amblyomma variegatum*. These three species of ticks are common in Nigeria as similarly reported by Konto, *et al* (2014). Hadi, *et al* (2016) and Arong, *et al* (2013) observed that ticks are found mostly on the head, neck and ears of dogs. Their findings are similar with the present work. In resident and non-resident dogs, tick infestation was higher in adults than in puppies. This may be due to the fact that adult dogs move around in search for food and mates. This agrees with the records of James-Rugu & Iwuala (1998) who observed that adult to adolescent dogs were more infested with ticks than puppies. Concerning tick-borne parasite of dogs, the mono haemoparasite identified was a protozoan-*Babesia canis*. This agrees with the reports of Kamani, *et al* (2011) who identified *Babesia canis* as the tick-borne parasites of dogs. This blood parasite was obtained from both resident and non-resident dogs. The infection rate of non-resident dogs with *Babesia canis* was greater than that of resident dogs. This finding implies that the work agrees with the records of other researchers who worked on ticks and tick-borne parasite of dogs. Both resident and non-resident dogs showed a decrease in PVC levels due to tick infestations.

**Conclusion**

*Boophilus decoloratus, Rhipicephalus sanguineus* and

*Amblyomma variegatum* were encountered during the study. *Rhipicephalus sanguineus* had the highest prevalence. The adult dogs were mostly infested with all the tick species collected in the study area and they were also the most infected with the protozoan haemoparasite *Babesia canis*. It was observed that *Babesia canis* was the monohaemoparasite encountered in the blood samples of dogs investigated. All over the world ticks caused great economic losses in livestock populations either by transmitting a wide variety of tick-borne diseases (TBDS) or by affecting the health of animals and the quality of their skins and hides.

## Recommendation

The study revealed that there was more tick infestations and tick-borne parasite infections in both resident and non-resident dogs. Man has since many years ago benefited from his close association with dogs in terms of meat, hunting and security. This association has promoted zoonosis. To prevent tick infestation on dogs and tick-borne parasite infections, we recommend that the following:

1. There should proper enlightenment to dog owners on the negative effects of ticks and tick-borne parasites.
2. Government should build dips in Veterinary Clinics at all Local Government Areas.
3. Dog owners should be enlightened on the need to visit Veterinary Clinics regularly.
4. There is need for all infested and non-infested dogs and other animals to be dipped in acaricides such as diazinon, amiton, endosulfan, bromociclen, mevinphos and camphechlor in order to eliminate the ticks.
5. All dogs should be quarantine so that they will not move around randomly and get infested with ticks.

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