Original Research Article

On-Host Occurrence of Argas persicus in Retail Village Chickens (Gallus gallusdomesticus) from Maiduguri, Borno State, Nigeria.

ABSTRACT

Ticks transmit a greater variety of pathogenic micro-organisms than any other arthropod vector group, and are among the most important vectors of diseases affecting animals. A survey of the on-host occurrence of Argas persicus infesting retail domestic village chickens (Gallus gallusdomesticus) sourced from three local markets (Maiduguri Monday market, Baga Road market and Custom-Abbaganaram market) in Maiduguri was conducted between April and May, 2021. Five hundred (500) conveniently selected local birds consisting of 280 from Maiduguri Monday market, 100 from Baga road market and 120 from Custom-Abbaganaram markets were examined by feather separation with fingers and a pair of forceps to expose the skin of the birds for evidence of presence of ticks Out of the 500 domestic chickens examined, 23 were infested given an overall prevalence of 4.6%. Prevalence of infestation was higher in birds from Monday market 16 (5.7 %) compared to Custom-Abbaganaram market 4 (3.3%), while Baga road market had the least infestation 3 (3.0%). All the ticks' collected were identified as Argas persicus based on morphological keys. The distribution of the ticks based on infested body parts showed that the under-wings had the highest incidence 20 (4%), followed by the thigh 16 (3.2%) and breast 5 (1%). The incidence of tick's infestation between the sexes is not significant ($p>0.05$), with female infestation 14 (4.6%) being higher compared to males 9 (4.5%). Based on age groups of infested birds, incidence in adult birds 16 (4.7%) was higher than in young birds 7 (4.4%), though not statistically significant ($p>0.05$). This study has established the existence, although low, of

Argas persicus among retail village chickens in Maiduguri. In view of this, the likelihood of transmission of Argas persicus and the pathogens harboured to otherwise free flocks were possible in the study area.

Keywords: Poltry, Ticks, Argas persicus

1.0 Introduction

Ticks are highly specialized obligate hematophagous ectoparasites of mammals, birds and reptiles. They are worldwide in distribution and are of enormous veterinary relevance owing to the direct damage they cause to their hosts, and as vectors of a large variety of animpathogens (Peter *et al*., 2005).Anatomically, soft ticks (Argasids) do not possess a dorsal shield or scutum, their capitulum is less prominent and ventrally located, their coxae are unarmed (without spurs), and their spiracular plates are small (Hoskins, 1991).

The family Argasidae contains the important genera Argas, Ornithodoros, and Otobius (Jongejan, 2004). Argasid distribution can be considered cosmopolitan since they can be found throughout the world with the exception of places showing extreme cold conditions (Estrada-Peña *et al*., 2003). Generally, the prevalence of tickborne livestock diseases are attributed to environmental and climatic conditions, poor nutritional status, and poor management factors (Dugumae*t al*., 2012). Some soft tick species exhibit extremely rigid host specificity. However, it has been suggested that most soft ticks show indiscriminate host feeding and such apparent variation reflects preference and host availability within the microhabitat (Vial, 2009).

Ticks can impact the production and health of the animal, either directly by the effect of their bites or by transmitting infectious agents which include; viruses, bacteria, rickettsiae and protozoa (Tailor, 2016), sites bitten by soft ticks (eg.*O. megnini*) cause lesions that may predispose to localized dermatitis, secondary bacterial infections, or invasion by flies larvea (myiasis) that are attracted to bloody areas (Tailor, 2016). *Argas persicus* transmits *Borrelia anserina*, an important avian pathogen that causes spirochaetosis (Aslam 2015; Jongejan, 2004). Spirochaetosis has an important economic impact, since it causes a high mortality among birds that can reach up to

100%, in addition to its effect on the reduction of egg production in layers and the reduction of production in broilers.

Livestock production occupy about 30 percent of the planet's ice-free terrestrial surface area and are a significant global asset with a value of at least $1.4 trillion (Steinfeld *et al*., 2006). The livestock sector is increasingly organized in long market chains that employ at least 1.3 billion people globally and directly support the livelihoods of 600 million poor smallholder farmers in the developing world (Thornton *et al*., 2006). The Nigerian poultry industry comprises about 180 million birds, being the second largest chicken production in Africa after South Africa (SAHEL, 2015). It produced 650,000 tons of eggs and 300 000 tons of poultry meat in 2013 (FAOSTAT, 2017). Livestock and poultry production are an essential part of the Nigerian society and economy. About 13 million households keep farm animals and the sector contributes 6 to 8 percent of the national GDP (ASL, 2015, 2018).

Methodology

Study Area

Maiduguri, the study area is the capital and largest city of Borno State, northeastern Nigeria. It is located on the north bank of the seasonal Ngadda (Alau) River. It is located between latitude 115^{o} N and longitude 135^{o} E (Elumere, 1987), and bordered by Konduga Local Government area to the northwest and Jere Local Government area to the south (Ahmed, 2014). It has the months of March – April as the hottest period of the year and temperature ranging between 30^{o}C- 40^{o}C.

Study Design

The study was a prospective cross sectional study involving retail village chickens from three selected markets (Maiduguri Monday market, Baga road market and Custom-Abbaganaram) in Maiduguri, Borno State.

Sample Size Determination

An assumed prevalence of 50% was used for the calculation of sample size due to lack of previous data on prevalence of Argas persicus in Maiduguri. The formular of Thrusfield (2005) was used

$$N = \frac{Z^2Pq}{d^2}$$

Where:

q = complementary probability (1-P).

n = minimum sample size.

P = Assumed prevalence of fasciolosis (50.0%)

d = desired absolute precision 0.05.

Z = appropriate value for the standard normal deviate set at 95% confidence interval (1.96). The calculated sample size was 384, but further by 23% to 500 increase precision

Sample Collection and Transportation

Sampling was carried out conveniently in the months of April-May, 2021 across the three selected markets of Maiduguri Monday market, Baga road market and Custom-Abbaganaram market. These marketswere selected because of their peculiarity of retail in high number of village chickens from across the state. Biweekly visit was made to Baga road and Custom-Abbaganaram markets, while Maiduguri Monday market was visited weekly for the collection of

the samples in tandem with the population of retail birds. A total of five hundred (500) chickens were examined in all from the three markets consisting of 280 from Maiduguri Monday market, 100 from Baga road and 120 from Custom-Abbaganaram markets.

On each visit, sampled chickens were picked individually at random from their cages with the consent of their owners and were restrained properly for physical examination. Birds were examined by the gentle movement of the hand against the direction of the feather in a caudo-cranial fashion aided by a hand lens. All body parts were systematically examined as previously described (Nwangu, 2002). Ticks observed were picked using forceps into well labelled sample bottles containing 70% ethanol and 5% glycerine for preservation prior to identification at the Veterinary Parasitology Research Laboratory, Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine, University of Maiduguri.

Processing and Identification of Ticks

Collected ticks were processed by clearing in 1% potassium hydroxide (KOH) for 24 hours, followed by dehydration of the cleared ticks in ascending grades of alcohol (50%, 70% and 100%) for one hour each before being mounted on a glass slide using polyvinyl alcohol (PVA). Mounted ticks were then observed under the stereomicroscope at X10 magnification.Identification of the ticks was accomplished with the help of standard anatomical and morphological characteristics as described by Barker and Walker (2014)

Data Analysis

Data generated from the study were analysed using Epi info 7.0 statistical software. Significant variation among and between variables was tested using chi-square, while $p<0.05$ was considered significant throughout the study.

4.0 Results

Representative samples of the identified *Argas persicus* from the study are presented in Figures 1 and 2. These samples were identified on the basis of morplogical keys.Among a total of 500 local retail chickens (*Gallus gallusdomesticus*) examined, 23(4.6%) birds were infested with *Argas persicus*. Maiduguri Monday market had the highest infestation with 16(5.7%) birds infested of the 280 examined, Baga road and Custom-Abbaganaram markets respectively had 3(3.0%) and 4(3.3%) infested birds of the numbers examined (Table 1). In all, there was no statistical significant variations (P>0.05) in infestation rate from the markets surveyed.

Table 2 details the incidence of *Argas persicus* based on sex and age. Only nine 9(4.5%) out of the 200 male birds were infested, compared to 14(4.6%) infested female birds. Among 159 young birds examined, only 7(4.4%) were infested, farless than the 16 (4.7%) infested birds among 341 adults. In all, there was no statistical significant variation (P>0.05) in incidence based on either sex or age. The distribution of recovered parasites based on the predilection sites infested showed that under wings is the most infested region 20(4.0%), followed by the thighs, while the breast muscle had the least infestation.

Table 1: Incidence of *Argas persicus* on Retail Village Chicken in Maiduguri based on location

Location	**Number Examined**	**Number infested (%)**	**P-value**
Monday Market	280	16 (5.7)[a]	0.4037
Baga Road Market	100	3 (3)[a]	
Custom-Abbaganaram Market	120	4 (3.3)[a]	
Total	**500**	**23(4.6)**	

Table 2: Incidence of*Argas persicus* on Village Chicken in Maiduguri based on Sex and Age

Parameter	Number Examined	Number infested (%)	P value
Sex			
Male	200	9 (4.5)	0.9306
Female	300	14 (4.6)	
Age			
Young	159	7 (4.4)	0.8856
Adult	341	16 (4.7)	
Total	**500**	**23(4.6)**	

Table 3: Distribution of *Argaspersicus*on Body Parts of Infested Chickens from Maiduguri, Borno State, Nigeria

Predilection Site	Number Infested (%)
Under wings (wing web)	20 (4.0)
Thighs	16 (3.2)
Breast muscle	5 (1.0)

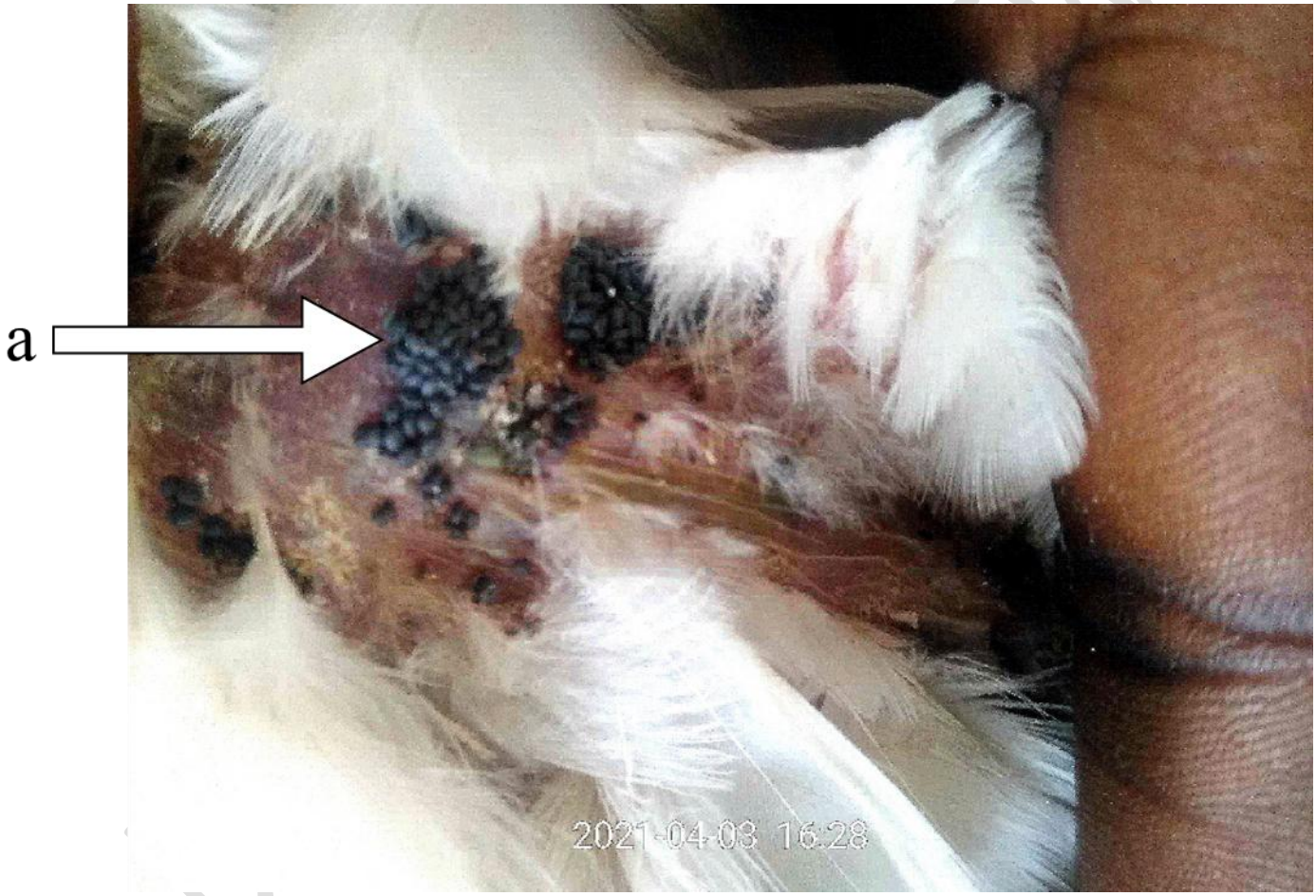

Figure1: Massive infestation by engorged *Argas persicus* on the breast muscle of a chicken.

Figure.2: *Argapersicuss:* Dorsal view at X10 Stereomicroscop**e**

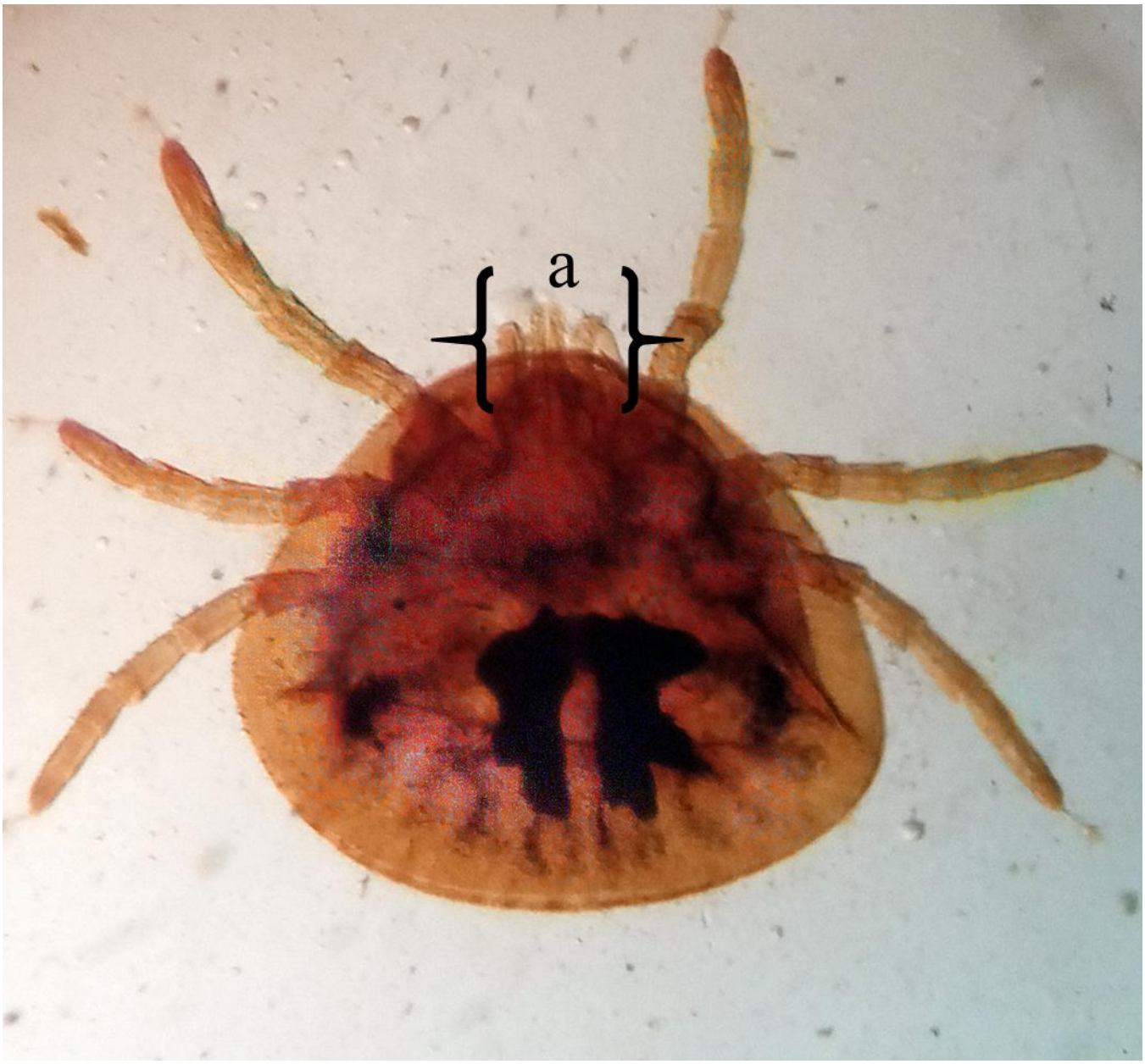

Figure 3: *Argas persicus*(a; mouthpart)Ventral view at X10 stereomicroscope

Discussion

Argas persicus is an important poultry (fowl tick) as it acts as vector of pathogens (Aslam *et al*., 2013) that causes several devastating diseases to poultry/chickens (Mir *et al*., 1993). Prevalence of ticks in any part has been found associated with some of factors that favour tick's survival and growth including; areas topography, rain fall pattern, relative humidity, atmospheric temperature, seasons, husbandry and or management practices. Besides these other factors including; birds' density (crowding), farm management (Solomon and Elsabet, 2009), use of acaricides, hygienic conditions of farms also influence prevalence of tick infestations. These enlisted factors influence occurrence of ticks in any area,(Mulugeta *et al*., 2013).

The identified tick, *Argas persicus* in this study was identified on the basis of key morphological features (Barker and Walker, 2014). The identification of *Argas persicus* using morphological features has wide application across different regions (Swai et al., 2007; Zahid *et al*, 2021; Rahmani et al., 2022). The 23.6% on-host presence of the ticks in this study is comparable to the earlier report of Rahmani et al. (2022) where an on-host prevalence of 25.3% was recorded in Setif region of Algeria. Contrarily, the obtained incidence in this study is higher 1than the 12.9% reportd from Pakistan (Zahid et al., 2021)

acrossglobally distributed including tropical and sub-tropical areas of the world (Hoogstraal& Kim, 1985), that is known as a fowl parasite with veterinary importance. It serves as the vector of avian spirochaetosis (*Borrelia anserina*) and aegyptianellosis (*Aegyptianella pullorum*),

(Khater *et al*., 2013; Tavassoli *et al*., 2015)). Additionally, it is involved in spreading West Nile virus (WNV; Flaviviridae), *Salmonella pullorum*, and *Salmonella gallinarum*, as well as Rickettsia spp. of the spotted fever group (Tavassoli *et al*., 2015; Yu *et al*., 2015).

During the present study *Argas persicus* was identified base on morphological features. Ronaghi *et al*., (2015) reported that taxonomic distinguishing of Argasidae ticks (soft ticks) is difficult using macroscopic and microscopic examination thus, molecular-genetic characterization of the Argas ticks is highly recommended, where 16S rRNA and COX1 genes are recognized as appropriate markers to investigate their phylogenetic or evolutionary characteristics (Cruickshank, 2002). Various investigators from different parts of the world reported that *Argas persicus* is the most common soft tick's species found infesting chickens as well as commercial poultry around the globe (Adelusi*et al*., 2014; Lak *et al*., 2008: Qamar *et al*., 2009). However, some researcher reported that other soft tick species has also been found infesting poultry (Shah *et al*., 2006; Lak *et al*., 2008). Both lower, higher and comparable prevalence % of *Argas persicus* have been reported (Usman *et al*., 2012; Shah *et al*., 2006; Swai *et al*., 2009). Chickens are considered as main host of *Argas persicus* (Mir *et al*., 1993). Although, prevalence of *Argas persicus* recorded during this study was not very high, which means it has little or no impact on local chicken production.

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From the present study, body parts of the hosts most commonly affected were wings, thighs and breast regions. This may be due to low distribution of feathers, thus easily invaded by the ectoparasites. This also agreed with the findings of Biu *et al*., (2007). On the other hand, the absence of ticks on neck/head and vent (cloacae) region of some of the birds may be tied to the presence of high feather cover on the neck and that the areas are not soft and fleshy like the other parts, thus, tissue fluid and blood may not be as available as in the three parts affected. This showed that ticks (ectoparasite) in birds or any animals is mostly found on areas with little or no hairs, fleshy muscles and feather to get their nutrition requirement. *Argas persicus* have the potential to cause harm in a number of ways, from the physical effects, (such that the infested birds had to spend much time removing parasites from the skin, grooming, head-scratching, head shaking and end up with slow movement and depression) to the disease they are able to transmit (*Borrelia anserina*) (Aslam *et al*., 2015).

Regarding sex of examined birds, statistically, there was no significant variation was encountered between the sexes of birds ($p>0.05$). However, Female birds had relatively higher prevalence (4.6%) than male (4.5%).

Higher prevalence of ectoparasite in female bird than male disagrees with the finding of Mungube*et al*., (2008) Ethiopia and of Belihu*et al.*, (2010) Ethiopia who reported that male had a higher rate of occurrence of ectoparasite compared to female birds. One of the reasons could be that female are most constantly kept in the pen than male who at most time move freely about especially in bird kept under intensive system of rearing.

Although the effects of the ectoparasitic arthropod on the infested chicken was not evaluated in the present study, it could be significant and results to adverse effects. *A. persicus* for instance, is known to harbour different types of bacteria and causes paralysis in chicken (Colebroke and Wall, 1991) *Echidnophagagallinacea* could cause blindness in birds as they cluster around their eyes as was found in the present study. According to (Colebroke and Wall, 1991) arthropod ectoparasites have major impact on husbandry, productivity and welfare of domestic animals. (Richards and David, 2011) listed blood loss, myiasis, skin inflammation, pruritis and toxic and allergic responses as some of the direct damages, while disturbance, social nuisance and self-wounding are indirect damages which arthropod ectoparasites cause. Nwadike *et al* (2019] stated that severely affected birds may die. Thus, there is little doubt that the arthropod ectoparasites (*Argas persicus*) recorded in the present study could be causing varying degrees of damage/hrm to the infested birds.

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