

# Parasite Infestation of Cockroaches in Bali Town, Taraba State, Nigeria

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**Abstract:** Cockroaches constitute a major public health problem as they are mechanical vectors of human intestinal parasites and other disease causing micro-organisms such as bacteria, fungi and viruses. This study was carried out to evaluate the prevalence and distribution of parasites vectored by cockroaches (*Periplaneta americana*) in Bali Town between the months of May and October, 2023. A total of 540 adult cockroaches were collected from bedrooms, parlors, kitchen and toilets within households using sticky traps and hand catch method. The specimens were subjected to standard parasitological techniques for the isolation of endo and ecto-parasites. Out of 540 *Periplaneta americana* examined, 238 were infested with 6 parasites with an overall prevalence rate of 44.07%. Parasites identified in this study include *Ascaris lumbricoides* (30.64%), *Entamoeba coli* (25.81%), *Entamoeba histolytica* (16.93%), *Thelastoma* sp (13.31%), *Stroglyoides stercoralis* (8.87%) and *Enterobius vermicularis* (4.44%). More so, *Ascaris lumbricoides* had the highest prevalence (30.64%) followed by *Entamoeba coli* (25.81%). The cockroaches were contaminated more with helminth parasites (55.46%) than the protozoan (41.18%) while 3.36% were infested with both protozoan and helminth parasites. Cockroaches trapped from the toilets were found to be the most vectorial (58.57%) followed by those in kitchens (41.84%), bedrooms (22.62%) and parlours (17.95%). However, Parasites observed from the external body surface were higher (65.73%) than those from the internal body surface (34.27%). Statistically there was no significant difference, ( $P>0.05$ ) in parasite infestation of both body surfaces. The prevalence in female cockroaches was higher (49.63%) compared to the males (38.60%) within the study area. Although, this is statistically insignificant ( $p>0.05$ ). Hence, it is imperative to institute public enlightenment, proper hygiene and proper waste management in households for effective control of cockroaches.

**Keywords:** Bali Town, Cockroaches, Infestation, Parasites, Prevalence. Bali Town, Cockroaches, Infestation, Parasites, Prevalence.

## INTRODUCTION

With over 3500 species identified, cockroaches belong to the order Blattodea and are primarily found in tropical and subtropical regions (Otu-Bassey et al., 2019). Because they can spread pathogens, act as intermediate hosts for parasites, trigger allergic reactions like asthma, and possibly even cause entomophobia, cockroaches pose a threat for public health as well as medicine (Sosan et al., 2019).

Cockroaches are capable of living both indoors and outdoors and are found in areas with food, water, and shelter (Health Canada, 2010). According to Salehzadeh et al. (2007) and Melton (2012), they are usually found in cabinets, kitchens, toilets, septic tanks, trash cans, animal cages, etc. Although they are omnivores and will consume anything organic, they have a taste for things like cheese, sweets, carbohydrates, fats, and meat products (Alzain, 2013). They can contaminate food and leave an unpleasant smell in areas that have been infested for a long time (Zurek and Schal, 2004). Their nocturnal, filthy foraging habits and their body structure make them suitable and efficient mechanical transmitters of parasitic protozoa, eggs and larvae of intestinal worms such as oocysts of *Isospora belli*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*, cysts of *Entamoeba histolytica*, *Balantidium coli*, *Giardia lamblia*, *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworm, *Enterobius vermicularis*, *Hymenolepis nana*, *Toxocara canis*, and *Strongyloides stercoralis* (Graczyk et al., 2005; Nagham et al., 2011; Bala and Sule, 2012; Etim et al., 2013 and Adenusi et al., 2018) that causes diseases such as cholera,

diarrhea, dysentery and typhoid fever (Cotton et al., 2000). Asthma, dermatitis, itching, and swelling of the eyelids are among the allergic symptoms that have been linked to them (Chapman et al., 1996; Rozendaal, 1997).

Both the German cockroach, *Blattella germanica*, and the American cockroach, *Periplaneta americana*, are widely distributed and may thrive and procreate more readily in tropical climates. According to Anikwe et al. (2014), they are the most prevalent and well-known global pest species in Nigeria. Unfortunately, a dearth of entomological and pathological knowledge has led to an underestimation of the health danger associated with their infestation. Therefore, the purpose of this study was to identify the parasites carried by cockroaches in Bali metropolis, Taraba State, Nigeria.

**MATERIALS AND METHODS**

**STUDY AREA**

Bali local government area of Taraba State lies between latitude 7°46' N and 7°54' N of the equator and longitude 10°30' E and 11°00' E of the prime meridian (Bureau for land and survey Jalingo, 2019). It is found in dry guinea savannah. It is the largest local Government in Taraba State, with an estimated land area of 11,540 km<sup>2</sup>. It has some mountains like Gazabu, Dakka, Maihula, Bagoni, among others. Bali local Government had a population of about 211,024 persons (NPC, 2006). It has a tropical climate marked by two seasons; dry and rainy seasons. The rainy season starts around April and ends November occasionally, with 1350 – 1500mm rainfall annually. The dry season is from December to March. Daily temperature varies from 37 to 40°C during the hottest months of March/April. It also varies from 32 to 37°C during the coldest months of December/January. The relative humidity is about 23.00 % during the hot dry weather and can reach 80.00 % during the peak of wet season in July/August (Dammo et al., 2015; Wikipedia, 2015). The major ethnic groups in the area include; Jibawa, Tiv, Chamba, Fulani, Hausa, Itchen etc. The major occupation of the inhabitants is farming, fishing and nomadism. In addition, Public servants, traders and artisans also inhabit the area. Their water sources for domestic and agricultural uses are River Taraba, Borehole, ponds and wells.

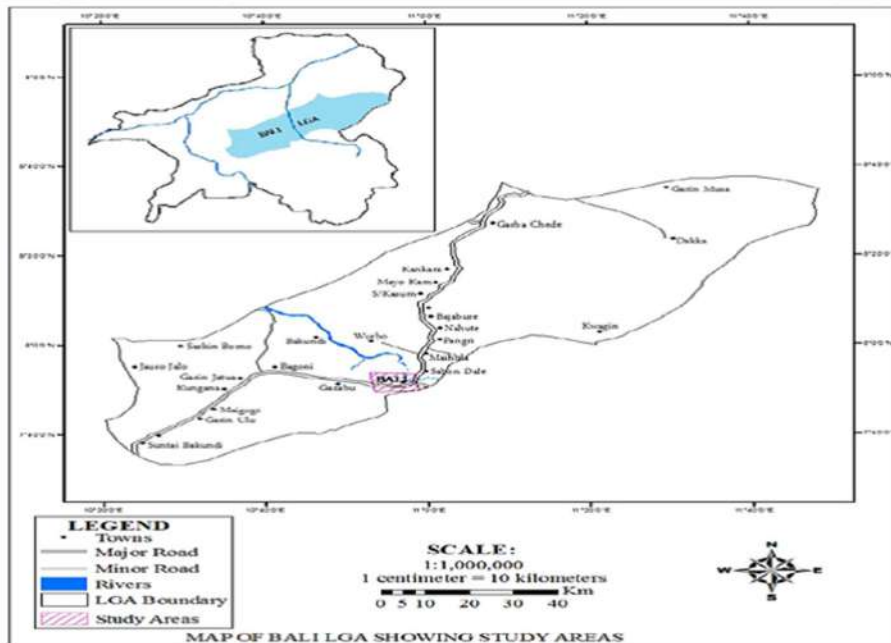


Figure 1: Map of the study Area

(Source: Bureau for land and survey Jalingo, Taraba State, 2019)

## **COCKROACH SAMPLING**

A total of five hundred and forty (540) adult cockroaches were caught randomly (both actively and passively) at strategic locations in households, such as bedrooms, parlours, kitchen and toilets with the help of sticky traps and hand catch method using sterile hand-gloves as described by Sosan et al. (2019). Collections were made once per month between May and October, 2023, between the hours of 6:00 pm and 7:00 am. They were placed in separate labeled sterile plastic containers containing cotton wool soaked in 10% chloroform and were immediately transported to the Biology/Microbiology laboratory, Department of Biological Sciences, Federal Polytechnic Bali, Taraba State, Nigeria for parasitological analysis.

## **IDENTIFICATION OF PARASITES FROM COCKROACH EXTERNAL SURFACE**

Each cockroach was placed in a centrifuge tube containing 10 ml of sterile physiological saline solution and was shaken vigorously by hand for 2 minutes to dislodge the parasites attached to the insect body surface. Afterwards, the cockroaches were removed from the solutions in the tube using sterile forceps. The suspension was centrifuged at 2000 rpm for 5 minutes after which the supernatant was decanted and the resulting sediment was transferred onto a clean grease free slide, stained with Lugol's iodine and covered with a cover slip. The preparation was examined microscopically using a light microscope with  $\times 10$  and  $\times 40$  objective lenses for body parasites (WHO, 2019; Patil, 2023).

## **IDENTIFICATION OF PARASITES FROM COCKROACH INTERNAL SURFACE**

After external washing, the cockroaches were fixed in 70 % alcohol and subsequently air-dried at room temperature. Each cockroache was placed in a clean sterile Petri dish and dissected under a dissecting microscope using entomological needles. The whole gut content was removed and poured into a clean universal container and was homogenized with 5 ml physiological saline. The homogenate was filtered through a tea sieve and centrifuged at 2000 rpm for 5 minutes, after which the supernatant was decanted. The sediment was placed on a clean grease free slide, stained with Lugol's iodine, covered with coverslip and examined microscopically (WHO, 2019).

## **STATISTICAL ANALYSIS**

Descriptive statistics were used to analyse the prevalence of parasites on cockroaches while chi-square ( $\chi^2$ ) test was used to analyse the differences in the distribution of parasites between the captured sites.  $P < 0.05$  was considered statistically significant.

## **RESULTS AND DISCUSSION**

### **RESULT**

238 of the 540 *Periplaneta americana* cockroaches that were studied had parasite infections, representing a 44.07% overall prevalence rate. The highest parasite prevalence was found in cockroaches trapped from the toilets (58.57%), followed by those from the kitchen (41.84%), bedroom (22.62%), and parlour (17.95%). According to Table 1, the differences in parasite prevalence amongst the captured sites is not statistically significant ( $p > 0.05$ ). Furthermore, females had a higher prevalence of parasites (49.63%) than males (38.60%). But according to Table 2, this is statistically insignificant ( $p > 0.05$ ).

Table 1: Prevalence of parasites according to capture sites.

Capture sites	No. of cockroach examined	No. of cockroaches infested (%)
Parlor	78	14(17.95)
bedroom	84	19(22.62)
Kitchen	98	41(41.84)
Toilet	280	164(58.57)
Total	540	238 (44.07)
	*	*

$\chi^2$  calculated = 5.74 ;  $\chi^2$  tabulated = 7.82,  $df= 3$ ,  $p>0.05$ , \* = Statistically insignificant

NB: Figures in parenthesis are % prevalence of parasites in cockroaches within the study area

Table 2: Distribution and prevalence of parasites in relation to gender of cockroaches

Gender	No. of cockroach examined	No. of cockroaches infested (%)
Male	272	105(38.60)
Female	268	133(49.63)
	*	*

$\chi^2$  calculated = 0.5 ;  $\chi^2$  tabulated = 3.84,  $df= 1$ ,  $p>0.05$ , \* = Statistically insignificant

NB: Figures in parenthesis are percentage of contaminated cockroaches in the study area

Table 3: Distribution of parasites species on external and internal surface of cockroaches

Parasite species	No. of parasites specie identified (%)	No. of parasites identified	
		Internal surface	External surface
<i>Ascaris lumricoides</i> ova	76(30.64)	29(38.16)	47(61.84)
<i>Entamoeba histolytica</i> cysts	42(16.93)	16(38.10)	26(61.90)
<i>Entamoeba coli</i> ova	64(25.81)	27(42.19)	37(57.81)
<i>Thelastoma</i> sp. larva	33(13.31)	7(21.21)	26(78.79)
<i>Strogylodes stercoralis</i> larva	22(8.87)	4(18.18)	18(81.82)
<i>Enterobius vermicularis</i> larva	11(4.44)	2(18.18)	9(81.82)
Total	248(100)	85(34.27)	163(65.73)
		*	*

$\chi^2$  calculated = 4.71 ;  $\chi^2$  tabulated = 11.07,  $df= 5$ ,  $p>0.05$ , \* = Statistically insignificant

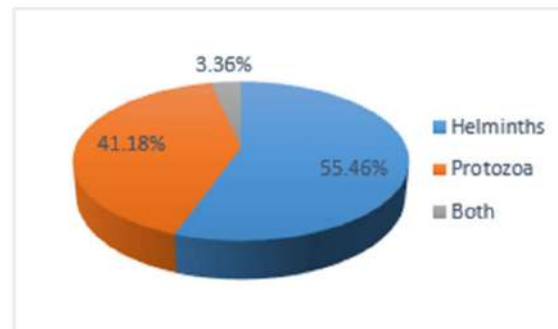


Figure 2: Types and percentage prevalence of parasite identified from cockroaches

A total of six (6) parasite species were found during the investigation. These include the eggs of *Ascaris lumricoides*, the cysts of *Entamoeba histolytica*, the ova of *Entamoeba coli*, the larvae of *Thelastoma* sp., the larvae of *Stroglyoides stercoralis*, and the larvae of *Enterobius vermicularis*. In comparison to *Entamoeba coli* (25.81%), *Entamoeba histolytica* (16.93%), *Thelastoma* sp. (13.31%), *Stroglyoides stercoralis* (8.87%), and *Enterobius vermicularis* (4.44%), *Ascaris lumricoides* had the highest prevalence (30.64%). Similarly, helminth parasite contamination was higher (55.46%) than that of protozoa (41.18%), and 3.36% of the cockroaches had both protozoan and helminth parasite infestations (Figure 2). This study further demonstrated that most of the parasites were located on the external body surface (65.73%), compared to the internal body surface (34.27%). Although, there was no significant difference in infestation across the body surfaces ( $p > 0.05$ ) (Table 3).

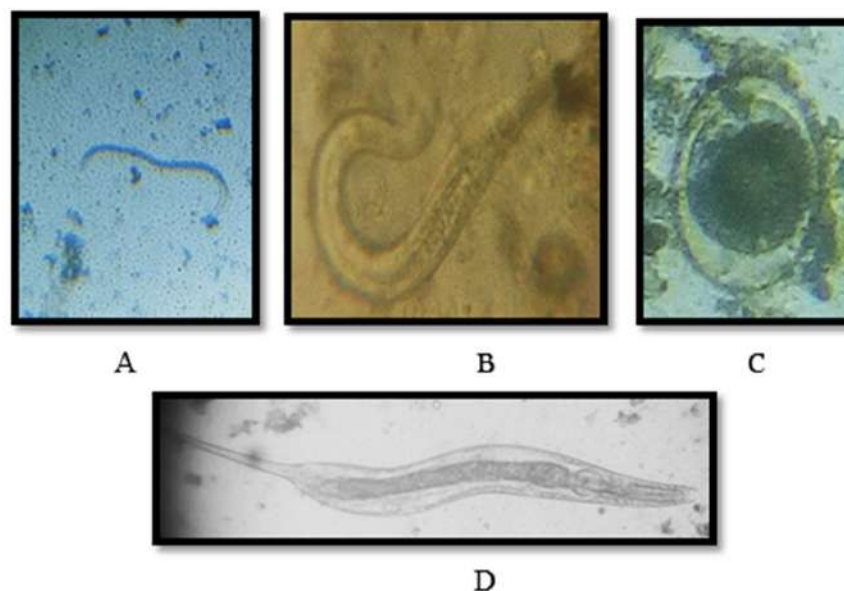


Figure 3. Photos of some parasites recovered from external surfaces and gut contents of cockroaches in the study area. A. *Strongyloides stercoralis* larva B. *Enterobius vermicularis* larva C. *Ascaris lumricoides* ova (decorticated) D. *Thelastoma* sp

## DISCUSSION

The current study found that two taxonomic groups of parasites-helminth and protozoan were recovered from cockroaches in the studied area. This is consistent with earlier research conducted in Thailand by Sutaravitun and Dokmaikaw (2019) and in Oyo State, Nigeria by Morenikeji et al. (2016); however, it is at odds with Yusof's (2018) findings, which stated that there was no protozoan parasite infestation in the

cockroach samples examined in Malaysia. Six types of intestinal parasites that affect humans were also discovered. These include larva of *Stroglyoides stercoralis*, *Enterobius vermicularis*, *Ascaris lumricoides*, *Thelastoma sp.*, cyst of *Entamoeba coli*, and *Entamoeba histolytica*. This is comparable to reports from Wahedi et al. (2020) in Adamawa State, Northeastern Nigeria, and Otu-Bassey et al. (2019) in Calabar, Nigeria who observed similar parasites with the exception of *Thelastoma* species. *Ascaris lumricoides* and *Enterobius vermicularis*, have all been linked to chronic diarrhoea, making all of the parasites retrieved medically important (Auta et al., 2019).

In this investigation, the overall prevalence of contamination was 44.07%, which is marginally less than the 67% reported by Ajero et al. (2011) in Owerri, Nigeria. The low prevalence in this study compared to that of Owerri may be due to variations in the hygienic conditions of the research areas. Additionally, the high rate of contaminated cockroaches recorded in Owerri may have been caused by a lack of proper environmental sanitation and household hygiene services in Owerri environs. However, the most common parasites observed were *Ascaris lumricoides* (30.64%) and *Entamoeba coli* (25.81%), which support the findings of Ikeh et al. (2023) but conflict with those of Auta et al. (2019), who found *Strongyloides stercoralis* and fluke to be the most common in Katsina State, Nigeria.

Cockroaches likely had more physical contact with parasites than direct ingestion, as evidenced by the higher rate of parasites on their external body surface (65.73%) compared to those in the gut content (34.27%) examined (Wahedi et al., 2020). They may also have carried the parasites mechanically through their body structure as they moved between dirty environments. The same was found in earlier research by Ito (2019), where it was statistically significant ( $p < 0.05$ ) that *P. americana* exoskeletons had more parasite species than the alimentary tract. The results of another study by Etim et al. (2013), which recorded 63.3% for exterior surface and 34.6% for internal organs, were consistent with the findings of this study. Our results, however, are in opposition to those of Ahmed and Maji (2023) in Jigawa State, Nigeria, who discovered that the number of parasites isolated from the inner body was more than that from the external body surface.

Cockroaches trapped from the toilet had the highest parasite prevalence (58.57%) compared to those from the kitchen (41.84%), bedroom (22.62%), and parlour (17.95%). This could be explained by the fact that these areas are frequently exposed to human faeces, which is likely to cause contamination, as well as the constant moisture found there (Tantang et al., 2017). This is consistent with the study of Bala and Sule (2012), who likewise indicated that cockroaches found in toilets contained more parasites (85.21%) than those found in kitchens (79.41%), garbage dumps (55.55%), bedrooms (44.44%), and parlours (37.50%). Because females forage more than male cockroaches do to find food and a location to lay eggs, female cockroaches were more vectorial (49.63%) than male cockroaches (38.60%). As such, they are more prone to parasite infestation upon contact with contaminated surfaces.

## CONCLUSION

This study demonstrated that cockroaches in Bali metropolis may act as carriers of medically important parasites and could pose a health risk to the local population. Therefore, immediate action must be taken to effectively control and manage these insects through better environmental hygiene, particularly in our homes, and public education on proper waste disposal.

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