

## Bacteriological Survey of Cockroaches in Calabar Metropolis, Cross River State, Nigeria

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### ABSTRACT

The Bacteriological survey of cockroaches was carried out in Calabar Metropolis. A total of 150 cockroaches was caught in kitchens; bedrooms, bathrooms, and toilets of enrolled houses in the study. Of the total number caught using the sweep net and the Insecticide spray methods, 85 (56.7%) were identified as the American cockroach (*Periplaneta americana*) and 65 (43.3%) were identified as the German cockroach (*Blattella germanica*). The external surfaces of cockroaches were washed in sterile water and cultured onto Nutrient, Macconkey blood agar respectively. Standard bacteriological and biochemical tests were performed to identify the bacterial isolates at the Genus level. A total of 30 pools was made from the 150 cockroaches caught and the following bacteria were isolated from the pools: *Staphylococcus aureus* was isolated in 18(62%) pools out of 30 followed by *Escherichia coli* in 8 (26.7%) pools, *Klebsiella Pneumonia* in 7 (24.6%) pools, *Proteus mirabilis* in 7 (24.6%), *Pseudomonas aeruginosa* in 6 (20.1%), *Streptococcus faecalis* in 4 (13.8%) and the least was *Citrobacter spp* in 3 (10.3%) pools. Of the total number of bacteria recorded in this study, the highest number of isolates were from the toilets 7 (70%) followed by bathroom and kitchen with 4 (66.7%) each and lastly the bedrooms with 13 (25%). Cockroaches caught from the toilets had the highest bacterial isolate per pools 18 (62%) followed by bathrooms 15(51.7%) cockroaches, kitchens with 11(37.9%) lastly by those from bedrooms 6 (20.7%). From the results obtained in this study, cockroaches present an important public health threat to the residents of the area and should be controlled.

**Keywords:** Bacteriological, survey, cockroaches , calabar

### INTRODUCTION

Cockroaches are distributed throughout the world and they are among the most notorious insects inhabiting apartments, food handling establishments, and health care facilities (Jeffery et al., 2012). Cockroaches have indiscriminate dietary habits. These features together with their nocturnal activity probably makes them widespread (Baumholtz et al., 1997; Kumie et al., 2002). Apart from human food, they also consume putrefied and decaying organic matter (Bennett, 2008; Parlik et al., 2009). During the day, these insects hide in isolated locations or gaps in the walls but become active at night when they move about unnoticed (Cochran, 1999). The German Cockroaches are among the most notorious pests of premises, they frequently feed on human faeces and therefore can disseminate cysts of enteric protozoan in the environment,

contaminate food by leaving droppings, bacteria, fungi and other pathogenic microorganisms in infested areas that can cause food poisoning (Che Ghani et al., 1993; Kopani, 1994; Czajka et al., 2003).

Cockroaches are abundant in most homes in Nigeria, where they are actually called "landlords" in homes (Bala et al., 2012). Their feeding habits make them ideal carriers of various pathogenic microorganisms (Allen, 1987). Microorganisms are carried on the insect cuticle or may be ingested and, sometimes later, regurgitated or excreted (Fotedar et al., 1991; Pai et al., 2005). Moreover, several species of bacteria of public health significance have been isolated from the digestive tract of cockroaches, e.g *Staphylococcus aureus*, *Streptococcus* species, *Enterobacteriaceae*, *Pseudomonas*

aeruginosa, etc. Apart from acting as mechanical carriers of microorganisms, cockroaches are the major sources of indoor allergen. (Rosenstreich et al., 1997; Hamiton et al., 1996).

This work aimed at isolating and identifying potential bacterial pathogen microorganisms from the external surfaces of cockroaches and assessing their role in the transmission and spread of infections.

### **The Study Area**

The study was carried out in Calabar South metropolis in the capital city of Cross River State of Nigeria. Calabar south is densely populated. It is located along the coastal plains of Nigeria (Solomon, 1985). It is a commercial centre well recognized for both local and international tourism. The majority of the population makes use of pit toilets. Poultry farms are located in close proximity to living quarters. Gutters with stagnant water and refuse dump sites are found in front of some compounds. These facilities contribute immensely to the proliferation of insects like cockroaches which are known as mechanical vectors of germs

### **MATERIALS AND METHODS**

One hundred and fifty Cockroaches were caught from kitchens, bedrooms, bathroom and toilets in 20 randomly selected houses in the study area using the sweep net and the Insecticide spray methods.

#### **The sweep net method**

The sweep net was swept back and forth through the houses quickly turning the opening from side to side and following a shallow figure eight pattern. Sweeping continues for some distance and then the net is flipped over, with the bag hanging over the rim trapping the insects until they can be removed with a pouter. The cockroaches were removed and put in a sterile universal bottle and transported to the laboratory for analysis.

#### **Insecticide spray Method**

The insecticide (Raid) was sprayed in kitchens, bedrooms ; bathrooms and toilets and two hours later knocked down cockroaches was picked into a sterile universal container and transported to the Parasitology laboratory of the University of Calabar Teaching Hospital for analysis and identification.

Identification of Cockroach Species Standard taxonomical keys were used to identify the cockroaches. Two species of cockroach the American cockroach (*Periplaneta americana*) and German cockroach (*Blattella germanica*) were identified.

#### **Processing of Samples**

After identification, a pool of five cockroaches of each species was put into a separate universal container for analysis.

Examination of the external surface of cockroaches. About 2ml of sterile water was added to the universal container with the cockroaches and shaken vigorously for 2 minutes to detach any bacteria on the surface of their surfaces. A sterile forceps was then used to remove the washed cockroaches into a separate container for identification. For primary enrichment, 1ml of the homogenate was added to 9ml of buffered peptone water (BPW) and incubated at 37 °C for 4 hours. The homogenate was then subcultured onto Blood agar, Nutrient

agar, and Cysteine Lactose Electrolyte Deficient agar plates and the plates incubated overnight at 37 °C for 24 to 48 hours.

### **Identification of Isolates/Biochemical Tests**

Bacteria were identified based on their characteristics using standard microbiological techniques such as colonial morphology, motility, Gram staining reaction and biochemical test.

### **RESULTS**

The distribution of cockroaches per location and types is shown in Table 1. Of the 150 cockroaches caught, 47 were trapped from toilets, 43 from the kitchen, 33 from the bathrooms and 27 from bedrooms. Of these numbers, a total of 85 (56.7%) were American cockroaches (*Periplaneta americana*) while 65 (43.3%) were German cockroaches (*Blattella germanica*).

The distribution of bacterial isolates per households is presented in Table 2. Of the 30 pools obtained from 150 cockroaches caught, Seven bacterial Genera were isolated to include: *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Citrobacter freundii*, *Klebsiella pneumoniae*, *Proteus mirabilis* and *Streptococcus faecalis*. Five different bacteria Genera were isolated from the American cockroaches (*Periplaneta americana*) while four were isolated from German cockroaches (*Blattella germanica*). The most common bacteria isolated were *Staphylococcus aureus* 18 (62%) followed by *Escherichia coli* 8 (26.7%), *Klebsiella pneumoniae* 7 (24.6%), *Proteus mirabilis* 7 (24.6%), *Pseudomonas aeruginosa* 6 (20.1%), *Streptococcus faecalis* 4 (13.8%) and the least was *Citrobacter spp* 3 (10.3%). Of the total number of bacteria recorded in this study, the highest number of isolates were from the toilets 7 (70%) followed by bathroom and kitchen with 4 (66.7%) and lastly the bedrooms with 13 (25%).

### **DISCUSSION**

All cockroaches trapped in this research were identified as American Cockroach (*Periplaneta americana*) and the German cockroach (*Blattella germanica*). The highest number of cockroaches trapped were found to be the American cockroaches reason being that they are often found in close association with humans and are numerous in cities and villages where unsanitary situations predominate. The presence of cockroaches in human dwellings has never been favorable, and should be an issue of concern. It also has serious health implications, as the insects move freely from one area to another, within and around the houses, in places with poor standards of hygiene which may harbor pathogenic organisms. Due to their association with habitats, cockroaches which are carriers of micro-organisms can then transmit diseases mechanically to human populations and compromise their health status in such environments.

In this study, seven Genera of bacteria were isolated from the toilets and kitchens respectively, while six were from the bathroom and three from the bedrooms. This is, however, lower than the number of bacterial isolates detected by Hamid Kassiri et al., 2014 in Iran who isolated four gram-positive and four-gram negative bacteria respectively. *Staphylococcus* species was the highest isolate in the study followed by *Escherichia coli* from the sampling sites. This is, however, different with the study carried out by Hamid Kassiri on the Detection and prevalence rate of American Cockroaches (*Periplaneta americana*). Bacterial Infections in Human

Dwellings in Iran in 2014, a state where the most commonly detected bacteria were found to be *Escherichia coli*. The highest number of bacterial isolates 21 (40.4%) from the toilets in this study concord with the reports of Sisai et al.; 2006 in Botswana on microbiological studies of cockroaches from three localities in Gaborone and Botswana where the highest number of bacterial isolates were gotten from the toilets.

In conclusion, to reduce the risk of transmission of various pathogens, the application of appropriate control methods should be considered to manage populations of cockroaches in human dwellings. People should be aware of the potential pathogenic transmission by cockroaches and should keep kitchens, bathrooms, and toilets clean and prevent infestation of cockroaches in their houses.

**Table 1:** Distribution of cockroaches in Houses according to Cockroach species

Location	American cockroach	German cockroach	Total
	No (%)	N(%)	
Bathrooms	20(60.6)	13(39.4)	33(22.0)
Toilets	27(57.4)	20 (42.6)	47(31.3)
Kitchen	19(44.2)	24 (55.8)	43(28.7)
Bedrooms	19(70.7)	8 (29.6)	27(18.0)
Total	85(56.7)	65(43.3)	150(100)

**Table 2:** Distribution of bacterial isolates based on site of collection

Organisms	LOCATIONS							
	No of pools	No(%) of isolates	No of pools	No(%) of isolates	No of pools	No(%) of isolates	No of pools	No(%) of isolates
	Toilets		bathrooms		bedrooms		Kitchens	
<i>Staphylococcus aureus</i>	4 (40)	7 (80)	3(42.8)	4(80)	5	18(62)	8	7(87.5)
<i>Pseudomonas aeruginosa</i>	1 (10)	7 (20)	2 (28.6)	1(20)	5	6(20.7)	8	2(25)
<i>Citrobacter freundii</i>	2(20)	7	-	-	5	3(10.3)	8	1(12.5)
<i>Escherichia coli</i>	4 (40)	7 (20)	2 (28.6)	1(20)	5	8(27.6)	8	1(12.5)
<i>Klebsiella pneumoniae</i>	2( 20)	7	4(51.1)	-	5	7(24.1)	8	1(12.5)
<i>Proteus mirabilis</i>	3(30)	7	3 (42.8)	-	5	7(24.1)	8	1(12.5)
<i>Streptococcus faecalis</i>	2 (20)	7	1(14.3)	-	5	4(13.8)	8	1(12.5)
Total	18(62)	7	1(51.7)	6(20.7)			11(37.9)	

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