

## POTENTIAL OF COCKROACHES IN TRANSMITTING PATHOGENIC ORGANISMS

<sup>1</sup>Ibrahim, A. W. and <sup>2</sup>Cece, M. A.

<sup>1</sup>Biology Unit, Science Laboratory Technology, Kwara State Polytechnic, Ilorin, <sup>2</sup>Department of Science Laboratory Technology, Federal Polytechnic, Bida.

### Abstract

*A study to determine the possible role of cockroaches as a transmitter of pathogenic organisms was undertaken. The study was carried out in residential houses of Ara'a village, Moro Local Government Area of Kwara State, Nigeria. One hundred and eighty cockroaches were collected from different residential houses in three sites, toilets, kitchens and rooms (living rooms / bed rooms). The pathogenic organisms were isolated and identified from external surface of cockroaches, using standard methods. The results showed that 170 (94.4%) of cockroaches harboured pathogenic organisms, of these 54.4% were parasites including Entamoeba histolytica, Entamoeba coli, Balantidium coli, Isopora belli and Cryptosporidium sp. 88.3% were bacteria including E. coli, Klebsiella pneumoniae, Proteus vulgaris and Proteus mirabilis and 94.4% were fungi including Candida sp., Mucor sp., Rhizopus sp., Aspergillus sp. And Penicillium Sp. Therefore as cockroaches continue to constitute important reservoir for infectious pathogen, control measure instituted in toilet, kitchen and rooms could substantially minimize the spread of some of these infectious disease in human neighbourhoods where cockroaches are associated.*

**Keyword:** - Cockroach, parasite, bacteria, fungi, mechanical transmission, pathogenic organism.

### 1. Introduction

Arthropods are probably the most successful of all animals because of one or other reasons. They are found in every type of habitat and in all regions of the world. They feed of a wide variety of plant and animal materials and have been known as major cause of diseases for centuries. Without the vector, a parasite life cycle would be broken and the pathogen cannot survive. Vectors can cause harm in different ways, they cause illness commonly transmitted through the consumption of food containing entero-pathogens. A great variety of insects are carrier of pathogens (Sramova

*et al.*, 1992). Cockroaches (Order Dictyoptera) are known to carry a diverse pathogenic bacterial flora, differing protozoans, pathogenic worms, fungus and viruses (Khrustalyova, 1994). Cockroaches have been on earth for about 300 million years and are world's most common insects. The most common species associated with human habitations are the American cockroaches (*Periplaneta american*) and the German Cockroaches (*Blattella germanica*) as reported by Robinson, 2005 and Uneks, 2007. Cockroaches are known vectors of human entero-pathogens, as there are reports of the isolation of various human pathogens from these insects (Fotedar, *et al.*, 1999). Several studies have shown that cockroaches can carry disease – caused by microorganisms such as *Escherichia coli*, *Enterobacter spp.*, *Klebsiella spp.*, *Pseudomonas aeruginosa*, various fungi and parasites and their cyst (Fotedar, *et al.*, 1991). Cockroaches may disseminate these microorganisms in many ways, predominantly by depositing them along with their excrement on human food (Robinson, 2005; Uncke, 2007). Out breaks and cases of food borne diarrhoeal diseases in urban and rural areas are closely related to the seasonal increase in abundance of cockroach and enforced control is closely related to reductions in the occurrence of such diseases. (Ronald *et al.*, 2005)

Cockroaches are among the most notorious pests of premises. They frequently feed on human faeces and therefore they can disseminate cysts of enteric protozoan in the environment if such faeces are contaminated (Mozon *et al.*, 1991). Cockroaches not only contaminate food by leaving droppings and bacteria that can cause food poisoning (Che Ghani *et al.*, 1993) but also they can transmit bacteria, fungi and other pathogenic microorganisms in infected area (Czajka, *et al.*, 2003). The nocturnal and filthy habits of cockroaches make them ideal carriers of various pathogenic microorganisms (Gehad *et al.*, 2011). This study was carried out in an unsanitary community near higher institution and student of different state were resided. This study aimed to isolate parasite, bacteria and fungi from external surface of cockroaches and subject them to treatments leading to outcomes of our investigation.

## **2. Materials and methods**

This study was carried out in Ara'a Village which is located in Moro Local Government Area of Kwara State. The Village is a rural settlement hosting a tertiary institution growing to be semi-cosmopolitan town. It is mostly populated by yoruba people of Kwara State and students from

various parts of Nigeria. Sanitary conditions in the village are almost under-developed. Faecal disposal and water supply are very elementary. The majority of the population relies on pit toilets for faecal disposal and handdug wells for water storage. These facilities could contribute immensely to the proliferation of insects such as house flies, mosquitoes and cockroaches which are reported to be serious vectors of parasitic bacterial, viral and fungal diseases. Samples were collected between the hours of 8:00pm and 11:00pm.

One hundred and eighty adult cockroaches were collected for parasitological, bacteria and fungi studies. Twenty residential houses were sampled in which nine cockroaches were trapped from each house. In each house three areas were sited (Toilet, Kitchen and Room) and three cockroaches were trapped from each site in the house. Sixty cockroaches were designed for each study. And each cockroach was collected in a sterile container containing 5 ml of normal saline. The insects were transported to the laboratory for analysis.

The isolation and identification of parasites from external surface of cockroaches were done as follows. Each universal containing cockroach with normal saline was shaken vigorously for 2min. to detach the parasite from the insect body. The fluid was then transferred to a conical test-tube and spun at 2000 rpm for 5min. the deposit was transferred into a clean glass slide covered with a cover slip and then examined after staining with 1% lugols iodine under light microscopy and identified (Beaver, et al., 1984

The isolation and identification of bacteria and fungi on the external surface of cockroaches were also carried out as follows. Each sterile universal container, with cockroaches in normal saline, was shaken vigorously for 2 min. A loop full of each suspension was cultured in Mac-Conkey agar, blood agar, Desoxycholate Citrate agar (DCA) separately, the plates were incubated at 37 °C for 24 hours, and the organisms were identified by using standard bacteriological techniques (Baron *et al.*, 1990). The washing of isolated fungi was cultured in Sabouraud's dextrose agar with 0.5% chloramphenicol (Fotedar *et al.*, 1991), the tube were incubated at 25 °C and the resulting growth was identified by standard mycological methods (Evans *et al.*, 1999)

### **3. Summary of results**

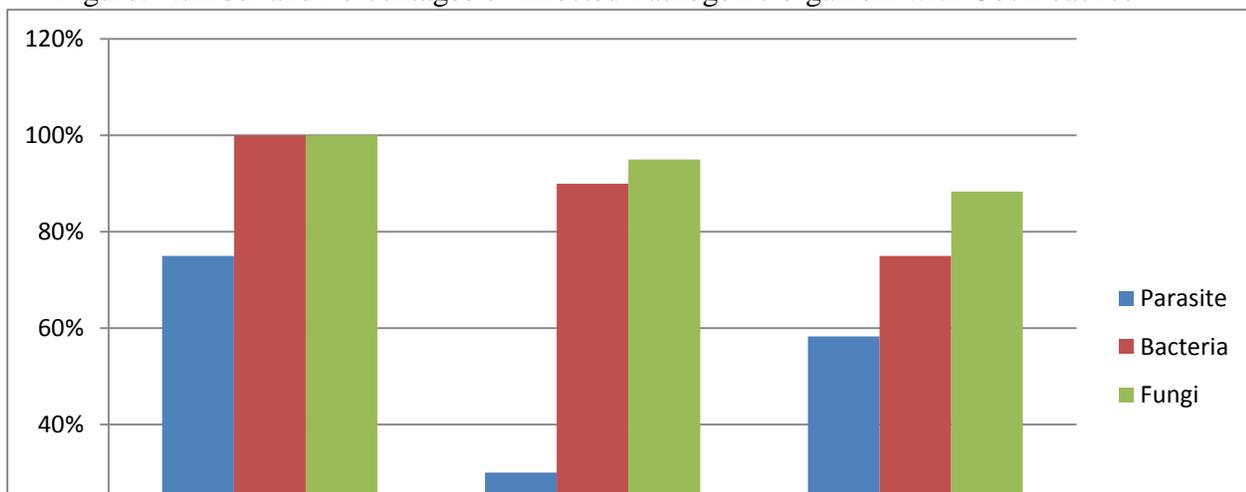
Our study revealed that cockroaches captured from different sites i.e. Toilets, kitchens and rooms (Bedroom/living room) in the houses shared almost the same pathogenic organisms. A total of one hundred and eighty cockroaches were captured, nine from each twenty sampled houses and three from each site i.e. toilet, kitchen and room. 94.4%. (170) cockroaches were found to carry one or more species of pathogens on external surface, indicating that they are carriers that are capable of mechanically transmitting these pathogens (Table 1).

**Table 1:** Percentages of infected cockroaches trapped in toilet, kitchens and rooms.

<i>Location</i>	<i>No of examined cockroaches</i>	<i>No of infected cockroaches</i>	<i>Percentage</i>
Toilet	60	60	100%
Kitchens	60	57	95%
Rooms	60	53	88.3%
<b>Total</b>	180	170	94.4%

Out of cockroaches caught at toilets 100% (60) were found to carried one or more species of medically important pathogens on external surface. 95% (57) and 88.3% (53) cockroaches caught at kitchens and rooms respectively were found to carried one or more species of medically important pathogens on external surface (Table 1). 75% (45) of cockroaches caught at toilets were found to harbor parasite, 100% (60) harbor bacteria and fungi. About 30% (18) cockroaches caught at kitchens were found to harbor parasites, 90% (54) harbor bacteria and 95% (57) harbor fungi while about 58.3% (35) cockroaches caught in rooms were found to harbor parasites, 75% (45) harbor bacteria and 88.3% (53) harbor fungi (Figure).

**Figure:** Number and Percentages of Infected Pathogenic organism with Cockroaches



Parasite isolated from external surface of cockroaches included; - *Entamoeba histolytica*, *Entamoeba coli*, *Balantidium coli*, *Isospora belli*, and *Cryptosporidium sp.* Bacterial isolated were *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, and *Proteus mirabilis* while fungi isolated included were - *Candida sp*, *Mucor sp*, *Rhizopus sp*, *Aspergillus sp*, and *Penicillium sp.* (Table 2).

Table 2: Number and the rate of pathogenic organisms transmitted by cockroaches

<b>Pathogenic organisms</b>	<b>Toilets</b>			<b>Kitchens</b>			<b>Rooms</b>		
	No	%	Avg. %	No	%	Avg. %	No	%	Avg. %
<b>Parasites</b>									
<i>Entamoeba istolytica</i>	27	45%		15	25%		12	20%	
<i>Entamoeba coli</i>	45	75%		18	30%		35	58.3%	
<i>Balantidium coli</i>	18	30%		14	23.3%		11	18.3%	
<i>Isospora belli</i>	3	5%		0	00%		2	3.3%	
<i>Cryptosporidium sp</i>	6	10%		0	00%		0	00%	
			33%			16%			20%

<b>Bacteria</b>									
<i>E. coli</i>	60	100%		54	90%		45	75%	
<i>Klebsiella</i>	54	90%		45	75%		33	55%	
<i>Pneumoniae</i>	45	75%		38	63.3%		38	63.3%	
<i>Proteus vulgaris</i>	45	75%		30	50%		35	58.3%	
<i>Proteus mirabilis</i>			85%			70%			63%
<b>Fungi</b>									
<i>Candida sp</i>	38	63.3%		30	50%		23	38.3%	
<i>Mucor sp</i>	60	100%		57	95%		53	88.3%	
<i>Rhizopus sp</i>	57	95%		48	80%		42	70%	
<i>Aspergillus sp</i>	47	78.3%		23	38.3%		26	43.3%	
<i>Peniillium sp</i>	30	50%	77.3%	24	40%	60.72%	30	50%	58%

These results showed that the cockroaches caught from these three (3) sites shared the same pathogenic organisms except in the kitchens where there is no isolation of *Isospora belli* and *Cryptosporidium* (parasites) and rooms also have no isolated *Cryptosporidium* (parasite) as found in table 2. Table 2 shows the numbers and the rates of cockroaches that contaminated with pathogenic organisms. There were significant differences between numbers of cockroaches contaminated with pathogens according to the site of trap. In this study the vast majority of isolated parasite attributed to 33% in toilets 16% in kitchens and 20% in rooms. The lowest parasites isolated from cockroaches were found in kitchens. Bacterial attributed to 85% in toilets, 70% in kitchens and 63% in rooms where the lowest bacterial isolated from cockroaches were found in rooms. Fungi attributed to 77.3% in toilets, 60.7% in kitchens while 58% in rooms, the lowest pathogenic fungi isolated from cockroaches were also found in rooms.

#### 4. Discussion of results

Our study has revealed that cockroaches represent a store of infectious pathogens with different organisms identified or isolated from their body surfaces, as mentioned earlier. This finding correlates with the outcomes of many studies that a large number of microorganisms have been isolated from cockroaches captured either from houses or building (Mpuchane *et al.*, 2008) from

food-handling establishments (Uckay *et al.*,2009). The outcomes demonstrated that the cockroaches were found to carry the 13 genera of medical importance. Fungi microorganisms were also isolated from cockroaches trapped from toilets, and kitchens (Mpuchane *et al.*, 2006).

In our study, the pathogenic microorganisms which were isolated from external surface of cockroaches trapped in toilet were higher compare to those isolated from kitchen and rooms. This demonstrated that parasite, bacteria and fungi may be disseminated by contact more cockroaches of toilet than the other food habits. Among common pathogens are *Entamoeba coil*, *Entamoeba histolytica*, *Balantidium coli*, *E. coli*, *Klebsiella pneumonias*, *Proteus sp*, *Candida sp*, *Mucor sp*, *Rhizopus sp*, and *Aspergillus sp* isolated in highest number of cockroaches trapped from toilets, kitchens and rooms. The same study experimentally shows that cockroaches may play a role in transmitting pathogens from contaminated food to uncontaminated cockroach. The result, of the present study confirmed that cockroaches are much more than a nuisance and showed that they pose potentially serious health risks, as mechanical vectors of these pathogens were isolated from only external surface of cockroaches.

## 5. Conclusion

Cockroaches act as a potential transmitter of medically important pathogenic and may cause infection in houses. Therefore control of cockroaches will substantially minimize the spread of infectious diseases in our environment.

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