

# Isolation of mechanically transmitted parasitic pathogens from cockroaches surveyed at the hostels of Nnamdi Azikiwe University Awka, Anambra state, Nigeria

## Abstract

This study's goal was to uncover the intestinal parasites of medical significance that are associated with cockroaches in Ifite, Awka, Anambra state. Due to their ability to spread diseases through mechanical means, cockroaches are widely recognized as insects of great medical significance. Cockroach samples were collected actively by hand picking and passively by trapping methods from different lodges randomly selected in the study area. A total 276 cockroaches were collected and examined using normal saline rinse method and formalin-detergent technique. Data was analyzed using SPSS version 25. In all, Divine standard villa had the highest abundance of cockroaches. The percentage distribution of cockroaches among the 10 lodges showed that for male species of cockroach, king lodge recorded a higher male cockroach abundance of (22.30%) while Divine standard lodge revealed a slightly lower abundance (20.86%). On the other hand, Steve lodge had the highest abundance of female cockroach species (21.17%) followed by Divine standard villa (15.33%). The result of this study also showed a high number of parasites ranging from trematodes, nematodes and protozoa as well as a high abundance of cockroaches. A total of Four(4) parasites were recorded. The parasites found in this study were *Schistosoma mansoni* (8.00%), *Ascaris lumbricoides* (48.00%), cysts of *Entamoeba coli* (24.00%), *Enterobius vermicularis* (20.00%). These pathogenic parasites were found on the studied cockroaches, illustrating their potential role as mechanical vectors of parasitic diseases in Ifite, Awka. Hence, proper hygiene and sanitation as well as fumigation of home and our surroundings should be opted for effective control of cockroaches.

**Keywords:** cockroaches, vectors, parasites, lodges, ifite, Awka, Anambra

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## Introduction

Approximately 250 million years ago, cockroaches existed on Earth, as far back as the Paleozoic era.<sup>1</sup> More than 4000 cockroach species have been recorded, with 25-30 species being synanthropic,<sup>2,3</sup> and four species being pests. The remaining 1% of the 4000 species are domestic and pose a significant health risk to humans.<sup>4</sup> Approximately 99% of the identified species are wild and pose no threat to public health. Cockroaches can mechanically transmit pathogenic bacteria, viruses, and protozoa to humans due to their chewing mouthparts and ability to feed on a wide range of substances (omnivorous). Cockroaches can survive anything from Polar regions cold to tropical heat and can be found all over the world, particularly in tropical and subarctic regions.<sup>5</sup> In warm, humid climates where food and water are easily accessible, their population increases.<sup>6</sup> They usually emerge from hiding at night to feed and do other things.<sup>7</sup> Depending on the availability of food, adult cockroaches can live up to a year or longer and lay numerous egg capsules during this time.<sup>8</sup> They are commonly found in places with organic wastes, including sewer systems, chicken coops, animal cages, and trash cans.<sup>9,10</sup> In addition to their unpleasant appearance and behavior, they can contaminate and consume food, leaving behind a strong and unpleasant odor in infested buildings.<sup>11</sup> Cockroaches have also been known to feed on feces, and are often found in cupboards, sewage systems, kitchens,<sup>12</sup> and toilets.<sup>13</sup> They are opportunistic eaters (omnivores) and will consume anything organic, but have a preference for foods such as cheese, sweets, starches, fats, and meat products.<sup>14</sup> Cockroaches' indiscriminate choice of diets, their

nocturnal, feeding and filthy habits in terms of their activities and their body structure make them suitable and effective vectors of pathogenic parasites like protozoa, fungi, bacteria and viruses.<sup>14,15</sup> Their attraction to rotten food, human and animal faeces, pus, sputum and secretions from corpses has made highly despised in many parts of the world.<sup>10</sup> Aside contamination of food, they also cause food poisoning which may result to asthmatic-related health complications for individuals allergic to cockroach faeces and antigens.<sup>16-18</sup> They mostly live around human dwellings, thus posing a serious threat to human health and the environment.<sup>14</sup> However, the health risk resulting from their infestation has been underestimated due to lack of entomological and epidemiological information. Hence, this study was carried out to survey cockroaches as carrier and mechanical transmitter of parasites in Ifite, Awka, Anambra State.

## Materials and methods

### Location of study

The investigation took place in the sewers, rooms, kitchens, and toilets of selected student lodges in Ifite, Awka, Anambra state. Ifite is located between the latitudes of 6°15'N and 7°50'E. It is bordered by Okpuno, Amawbia, Awka, Ezinato, Isiagu, Mbaukwu, Nibo, Nise, and Umuawulu, which are all part of the Awka South Local Government Area. Ifite is situated in the Nigerian state of Anambra. The ecosystem is Guinea Savanna, with average rainfall ranging from 1,000 to 1,500 mm. It also has two seasons: dry and wet, with a harmattan period

from December to January. Awka’s topography is defined by a North-South and East-West embankment.<sup>19</sup> As a commercial city, Awka has poorly maintained drainage systems, which serve as a breeding ground for Cockroaches.

### Selection of lodges

In order to obtain the occupants’ cooperation and participation throughout the study, awareness visits were paid to each of the selected lodges. Within the ten lodges chosen for the study, 30 randomly selected rooms were sampled.

### Method of trapping

Cockroaches were collected by active and passive trapping from different parts of the rooms. The active trap was made from empty glass jars (86mm outer height and 76mm inner height) encased with a light coating of Petroleum jelly and taunted with a variety of food items such as soaked bread, grilled fish, and crayfish, while the passive trap was made from sticky board (rat gums) and placed in the sewer, kitchen cabinet, toilets, and rooms of each selected lodge. Plenty sticky boards were placed around the sewer, kitchen, toilets and rooms with crayfish as bait.

### Identification of cockroaches

To determine the species and sexes of the cockroaches, morphological identification was performed using a dichotomous key.

### Isolation and identification of parasites from cockroach body surface

The insects were slowly killed with chloroform-soaked cotton wool. Two methods were used to remove parasites from the cockroaches’ body surfaces. Individually, they were washed in 10ml sterile physiology saline and vortexed at low speed for 2 minutes in the first method. The washed solutions were centrifuged for 5 minutes at 2000rpm. The sediment was mixed with 0.5ml of saline, positioned on a slide, discolored with Lugol’s iodine, and microscopically examined for body parasites. They were washed manually for 1 minute using the formalin- detergent technique in the second method. Each insect was washed with 5ml of formalin-detergent solution (1ml detergent + 1ml formaldehyde + 48ml distilled water), which was properly mixed and dispensed into a desiccator and rolled for 5 minutes at 3000 rpm. The residue was mixed, poured on a clean dry slide, encased with a coverslip, & analyzed with 10x and 40x objective lenses under a microscope. With the aid of sterile forceps and room-temperature air drying, cockroaches were extracted from wash solutions.

Two methods were used to identify parasites on the cockroach. The first method was used to identify parasites in female Adult cockroach

while the second method was used to identify parasites in male Adult cockroach.<sup>20-23</sup>

### Statistical analysis

These observations were tabulated and data was analyze during SPSS version 25. The parasites associated with cockroaches in each lodge was calculated using percentage distribution.

## Result and discussion

### Distribution of cockroaches in different lodges in ifite-awka

The result showed that two hundred and seventy-six (276) adult *Periplaneta Americana* (cockroaches) obtained from the 10 lodges (El-joe, Maryland, Benjamin, Harmony, El- glory, His grace, Steve, Divine standard villa, King and Dependable) were examined for this study. The study revealed a higher male cockroach species than the female cockroaches among the 10 lodges sampled. The percentage gender distribution of cockroaches among the 10 lodges showed that King (22.30%) and Divine lodges (20.86%) recorded the highest abundance of male cockroaches. On the other hand, Steve lodge had the highest abundance of female cockroach species (21.17%) followed by Divine standard villa (15.33%) while the least distribution of cockroaches was found in Benjamin lodge (2.92%) (Table 1).

**Table 1** Distribution of cockroaches by gender in different lodges in Ifite-Awka

Lodges	Male	Percentage (%)	Female	Percentage (%)
El-joe	8	5.76	12	8.76
Maryland	10	7.19	15	10.95
Benjamin	16	11.51	4	2.92
Harmony	17	12.23	10	7.3
El-glory	8	5.76	12	8.76
His grace	9	6.47	14	10.22
Steve	9	6.47	29	21.17
Divine standard villa	29	20.86	21	15.33
King	31	22.3	13	9.49
Dependable	2	1.44	7	5.11
<b>Total</b>	<b>139</b>		<b>137</b>	

### Species of parasites isolated from different lodges in Ifite, Awka, Anambra state

The overall prevalence of the identified parasites species found in the infected cockroaches were, *Ascaris lumbricoides* (48.00%), *Entamoeba coli* (24.00%), *Enterobius vermicularis* (20.00%), *Schistosoma mansoni* (8.00%) (Table 2).

**Table 2** Percentage of parasite species isolated in the study area

Lodges	<i>Schistosomamansoni</i>	<i>A. lumbricoides</i>	<i>E. coli</i>	<i>Enterobius vermicularis</i>
El-joe	2	0	0	0
Maryland	0	0	0	0
Benjamin	0	2	0	0
Harmony	0	1	1	0
El-glory	0	0	0	0
His grace	0	0	0	0
Steve	0	2	1	0
Divine Standard Villa	0	4	2	2
King	0	3	2	3
Dependable	0	0	0	0
<b>Total</b>	<b>2 (8.00%)</b>	<b>12(48.00%)</b>	<b>6 (24.00%)</b>	<b>5 (20.00%)</b>

## Discussion

The species of cockroaches obtained from the different lodges were all identified as *Periplanata Americana* which agrees with the studies done by<sup>15</sup> and They discovered similar results in Nigerian and Cameroonian markets and housing areas. This finding, however, contradicts the findings of,<sup>17</sup> who reported that the most common species collected from Ethiopian residential units, hospitals, and indoor households was *Blattella germanica* (German cockroach). The difference in cockroach species could be attributed to geographical differences. The cockroaches were also infested with protozoan and helminthes parasites, according to the study findings. This is in line with the study done by and slightly in contrast with the report findings of,<sup>13</sup> who reported no protozoan cysts in all the cockroach samples studied. *Entamoeba coli* (cysts), *Ascaris lumbricoides*, *Enterobius vermicularis*, and *Schistosoma mansoni* were among the four kinds of human intestinal parasites recovered from cockroaches. These parasites are life- threatening and are to blame for a variety of human pathological conditions.<sup>21</sup> identified all three parasites found in this study except *Schistosoma mansoni* in their study of parasitological survey of domestic cockroaches. They discovered *Isospora belli* in place of the parasites (*Schistosoma mansoni*).

The highest prevalence of the identified parasites peciesisolated from the body of the Cockroaches was 48.0 % for *A. lumbricoides*. This result is similar to the 49.8% *A. lumbricoides* prevalence reported by<sup>11</sup> but contradicts the findings of who reported a lower prevalence 3.1% for *A. lumbricoides* and that reported Hookworm 63.1% as the most prevalent parasite in cockroaches sampled in southwest Nigeria. 24.0% prevalence was recorded for *E. coli* which is in contrast with.<sup>21</sup> The 20.0% prevalence recorded for *Enterobius vermicularis* is also lower than the 43.1% prevalence documented by.<sup>21</sup> The least prevalence recorded was 8.0% for *Schistosoma mansoni*. Many of the parasites isolated from cockroach cysts, eggs, and larvae in this study can be transmitted to humans via contaminated water and guitar. As cockroaches move between dirty and human food sources, they may spread parasite stages on their body surfaces through physical contact, vomit, or feces on any surface in the surrounding including man's food, kitchen utensils, and meal preparation spaces. The high prevalence recorded may be due to variations in household conditions, environmental sanitation, and hygiene practices.<sup>18</sup> In addition to poor sanitation and lack of proper maintenance, Nigerian Universities are known to be largely crowded. Also, the students cook and eat in their room which substantially provides a wide range of food items, increase the amount of waste generated and escalates the breeding of cockroaches in nearby sites.

The highest distribution of cockroaches among all the lodges in Ifite was found in Divine standard villa which had a total distribution of (38.19%), King's lodge had the highest abundance of male cockroaches (22.30%) while Steve lodge had the highest abundance of female cockroaches (21.17%). This could be attributed to indiscriminate dumping of refuse and presence of dumpsite around these lodges. Most of these lodges are old and has cracks with damp walls which creates a favourable condition for the existence of cockroaches in these lodges.

## Conclusion

This study revealed the presence of helminthes and protozoan parasites associated with the cockroach species in Ifite, Awka, Anambra state. The proliferation of cockroaches in the study area may have been due to the mishandling of refuse such as uncovered punctured bins, late collection of refuse and indiscriminate littering of

waste around residential lodges. Out of the four (4) parasites isolated, *A. lumbricoides* was the most prevalent parasite. The presence of these pathogenic parasites on the studied cockroaches highlights their role as potential mechanical vectors of parasitic disease agents in Ifite, Awka. Appropriate measures should be taken to reduce the impact of cockroaches on disease spread, particularly in student areas where cockroach contamination is intense, as they pose a public health risk.

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## Conflict of interest

Authors declare no conflict of interests.

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