

The public health importance of the association between *Camponotus Consobrinus* and potential bacterial pathogens in human dwellings

Abstract

Camponotus consobrinus, the banded sugar ant is so called because of its liking for sweet food. This study was carried out to determine the association between *Camponotus consobrinus* and potential bacterial pathogens in human dwellings and their public health importance. The ants were purposively collected from four locations; kitchens, bed rooms of various homes, shops and bakeries. Out of the 250 *Camponotus consobrinus* caught for the study, 90(36.0%) were caught in the kitchen, 75(30.0%) in the bed rooms 40(16.0%) in the bakery while 45(18.0%) were caught in the shops. A prevalence of 82.0% microbial isolates was recorded in the study. The kitchen had the highest number of isolates was 75(36.6%) followed by the bed room 55(26.8%) while the bakery recorded the lowest number of isolates 35(17.1%). *Escherichia coli* was the most common isolate 73(30.0%), followed by *Morganella morganii* 45(18.0%) while *Serratia marcescens* and *Citrobacter freundii* were the lowest common isolates 10(4.0%) each. Most of the *Camponotus consobrinus* examined in the four locations harboured potential pathogens. The presence of ants in homes and shops may lead to the spread of pathogenic microorganisms. Therefore, the control of ants in human dwellings must be taken seriously.

Keywords: *Camponotus consobrinus*, Microbial pathogens, Transmission, Public health

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Abbreviations: CLED, Cysteine Lactose Electrolyte Deficient; SAB, Sabouraud Dextrose Agar; KIA, Kligler Iron Agar

Introduction

Camponotus consobrinus, the banded sugar ant is a species in the ant family *Camponotus*. The ant is so called because of its liking for sweet food and the orange-brown band that goes round its gaster.¹ Ants are insects found in households, shops, hospitals and food service establishment. They are a nuisance when they occupy residence, restaurants and other places where food is prepared or eaten, yet they are considered as harmless small creatures.^{2,3}

Camponotus consobrinus is known as Nwanwaefudabang in Efik and Ibibio language the most spoken in Calabar. The banded sugar ant exist in different forms, measuring between 5 to 15 millimeters in length, making them a large species.⁴ Their colonies harbor two types of workers; major and minor workers with different size ranges. The male ants are completely black in colour while the females possess black heads, orange thorax and the orange-brown band round their gaster.⁵

Banded sugar ants are nocturnal. They also damage furniture and fittings with their mandibles.⁶ Ants in general are potential mechanical vectors of bacteria such as *Escherichia coli*, *Shigella*, *Salmonella*, *Enterobacter* and *Staphylococcus species*, etc.^{7,8} Ants can crawl on human secretions and waste such as urine, faces and sputum, transmitting microorganisms to utensils and surfaces in general.³

These ants are picked out of human foods on the dining table without fear of contamination by microbes. Nevertheless, little is known about their potential for carrying and transmitting pathogenic bacteria in households, and food related facilities. Many people live with and allow ants in their homes without any knowledge of the public health implication and possible pathogens that these insects carry. The level of microbial carriage of *Camponotus consobrinus* in association to the environment in which they are found is not known.

Urbanization processes results in challenges such as unusual population growth, poorly implemented sanitary control measures and water contamination. These scenario may promote the dissemination of arthropods and therefore of the diseases they transmit. For this reason, the presence of ants in human dwellings could be hazardous to health.^{9,10} Ants have impressive mobility features, reaching speeds of 3cm/s. This advantage grants these insects access to several environments, carrying pathogenic microorganisms that pose potential health threats.¹¹ The social organization of ants also induces workers to roam around several home environments. In this process these insects may acquire bacteria in potentially contaminated environments like bathrooms, toilets, stores, kitchens etc. The presence of pathogenic bacteria in the tegument of ants foraging in human dwellings qualify them as potentially important agents in the spread of infectious diseases.¹⁰

Oliveira et al.¹² in their study in Bahia, Brazil reported that, ants were carriers of pathogenic bacteria and may transmit the pathogens directly, when they crawl up a patient's skin, or indirectly, when they run on objects. They also reported high resistance to selected antimicrobials among the isolates from the ants which is a concern in this era of antimicrobial resistance war. With the growing concern about the presence of ant in human environments. It is necessary to know if banded sugar ants could transmit pathogenic organisms to man. This study was carried out to determine the potential pathogenic microbial profile on the external body parts of banded sugar ant collected from bakeries, shops and kitchen of different homes located in Calabar South Local Government Area of Cross River State.

Materials and methods

Study area/sites

The study was carried out in Calabar South Local Government area of Cross River State. Calabar was the first capital city of Nigeria. She is located at latitude 04°N and longitude 80° 10°E along the

coastal plains of Nigeria.¹³ Calabar is also known as the paradise city and has a great tourism potential. She has recreational centers like the Museum, Cultural center, Tinapa, and a Seaport.¹³ *Camponotus consobrinus* were purposively collected from three sampling sites in Calabar south local government area. The locations were; kitchens, Bed rooms and sitting rooms of various homes, grocery/food Shops and Bakeries. The homes, shops and bakeries where the ants were collected were made of brick walls some of which had cracks that could serve as nests to ants. They also had wooden furniture example, kitchen cabinets, chairs, wardrobes etc where the ants could nest in. The kitchens, food shops and bakeries were selected because ants are attracted to sweet foods including proteins and carbohydrates.

Sample collection

A total of 250 banded sugar ants were collected from homes, shops and bakeries within Calabar South Local Government Area. The ants were obtained between the months of May to October, 2016. This covered both rainy and dry seasons which are the two seasons in Nigeria. The rainy season spans between April to September, while the dry season is between October to March. The ants are seen in human dwellings in the two seasons in Calabar. The sample collection took place within the hour of 6:30pm to 11:00pm. The ants were trapped in transparent plastic containers with baits including:sugar, pineapple peals and sugar cane syrup. The ants were removed and put in 10mls of peptone water in sterile universal bottles and pooled as 5 per universal bottle. The containers were vigorously shaken to wash the external surface of the ant. It was left overnight and transported to Microbiology laboratory, University of Calabar Teaching Hospital for analysis.

Sample processing

Culture:A loopful of overnight pooled broth containing 5 ants per sample bottle was cultured on Chocolate agar, Cysteine Lactose Electrolyte Deficient agar (CLED) and Sabouraud dextrose agar (SAB). Plates were incubated aerobically at 37°C for 24 hours. After incubation period, the plates were checked for microbial growth.¹⁴ Pure cultures of isolates were obtained by sub-culture individual isolates onto cysteine lactose electrolyte deficient (CLED) agar and nutrient agar. Plates were incubated for 24 to 48 hours until colonies were visible.¹⁵

Identification of isolates:Isolates were identified morphologically and through biochemical tests. Gram staining, urease test, coagulase test, catalase, sugar fermentation on Kligler iron agar (KIA) were Indole test were carried out.^{15,16}

Data analysis

Data were analyzed using Epi Info 2012 (CDC, Atlanta, Georgia, USA) statistical software. Descriptive statistics were carried out. Frequencies were calculated for categorical variables. Interactions between specific categorical clinical variables were tested for significance using the χ^2 test. A p-value of ≤ 0.05 was considered statistically significant.

Results

Figure 1 shows the distribution of *Camponotus consobrinus* by location of catch. Out of the 250 *Camponotus consobrinus* caught for the study, 90(36.0%) were caught in the kitchen, 75(30.0%) in the bed rooms while 45(18.0%) were caught in the shops. Table 1 shows the profile of micro-organisms associated with *Camponotus consobrinus* in households sampled. A total of 205 bacterial and fungal species

were isolated from the Banded sugar ants, *Escherichia coli* was the most common isolate 75(30.0%), followed by *Morganella morganii* 45(18.0%) while *Serratia marcescens* and *Citrobacter freundii* were the lowest common isolates 10(4.0%) each. Table 2 shows the distribution of microbial isolates associated with the external surface of *Camponotus consobrinus* by location of catch. Out of the 250 *Camponotus consobrinus* sampled in the four locations 82.0% prevalence of different microbial isolates was recorded in the study. The kitchen had the highest number of isolates 75(36.6%) followed by the bed room 55(26.8%) while the bakery recorded the lowest number of isolates 35(17.1%). The most common bacterial isolate in the study was *Escherichia coli* with 33.3%, 45.4% and 62.5% prevalence in the kitchens, bed rooms and shops respectively (Table 2).

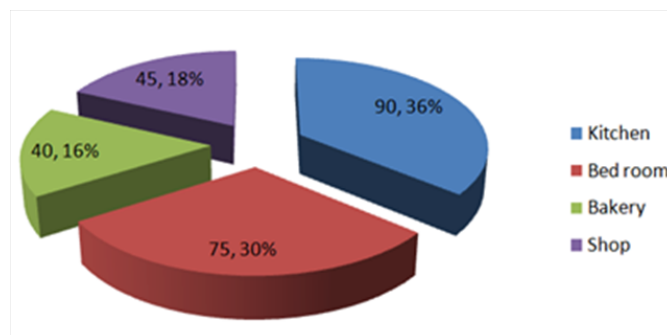


Figure 1 The photograph of adult *Camponotus consobrinus* showing the different parts.

The distribution of *Camponotus consobrinus* by location of catch.



Figure 2 *Camponotus consobrinus* on a food particle.

Table 1 Profile of Micro-organisms associated with *Camponotus consobrinus* in households

Microbial isolates	No. (%) isolates
<i>Escherichia coli</i>	75(30.0)
<i>Morganella morganii</i>	45(18.0)
<i>Staphylococcus aureus</i>	20(8.0)
<i>Candida spp</i>	25(10.0)
<i>Klebsiella spp</i>	20(8.0)
<i>Serratia marcescens</i>	10(4.0)
<i>Citrobacter freundii</i>	10(4.0)
Total	205

Table 2 Distribution of microbial isolates on *Camponotus consobrinus* by location of catch

Microbial isolates	Location of catch/No. (%) isolates				
	Kitchens (n = 90)	Bed rooms (n = 75)	Bakery (n = 40)	Shops (n = 45)	Total
<i>Escherichia coli</i>	25(33.3)	25(45.4)	0(0.0)	25(62.5)	75(36.6)
<i>Morganella morganii</i>	15(20.0)	0(0.0)	30(91.4)	0(0.0)	45(21.9)
<i>Staphylococcus aureus</i>	5(6.7)	10(18.1)	5(14.3)	0(0.0)	20(9.7)
<i>Candida spp</i>	15(20.0)	0(0.0)	0(0.0)	5(12.5)	20(9.7)
<i>Klebsiella spp</i>	10(13.3)	5(9.1)	0(0.0)	5(12.5)	20(9.7)
<i>Serratia marcescens</i>	5(6.7)	5(9.1)	0(0.0)	0(0.0)	10(4.8)
<i>Citrobacter freundii</i>	0(0.0)	10(18.1)	0(0.0)	0(0.0)	10(4.8)
Total	75(36.6)	55(26.8)	35(17.1)	40(19.5)	205(82.0)

n, number of *Camponotus consobrinus* examined.

Out of the 75(36.6%) microbial isolates encountered in the kitchen among ants *Escherichia coli* was the most prevalent 33.3%, followed by *Morganella morganii* 15(20.0%) and *Candida* species respectively. However, the least encountered isolates among kitchen ants were *Staphylococcus aureus* 5(6.7%) and *Serratia marcescens* 5(6.7%) respectively (Table 2). The most encountered isolates in the bed rooms was also *Escherichia coli* 45.4% followed by *Staphylococcus aureus* 18.1% and *Citrobacter freundii* 18.1% respectively. *Morganella morganii* was also the most common isolate 91.4% in the bakery (Table 2).

Discussion

The occurrence of ants in households and the risks associated with these insects has been a research focus,⁶ but little or no work is done in households or other premises on the bacterial carriage of these insects and the risk they could pose to occupants of such households. In this study most of the banded sugar ants were caught in the kitchen 90(36.0%) and bed rooms 75(30.0%). This reveals the possibility of transmission of potential food pathogens example *Escherichia coli* into foods not properly protected or covered in the kitchen. Fontana et al.¹⁷ reported that.

Camponotus consobrinus is a potential agent for disease transmission.

Among the factors that may favour the presence of ants in the kitchen and bedrooms are; attraction to food scraps, organic materials, clothing, objects that may contain ant nests and unhygienic environments. Although we did not investigate these factors Zarzuela et al.¹⁸ & Braganca et al.¹⁹ also reported that clothing materials as possible nests to house hold ants.

In this study a total of 205 bacterial and fungal species were isolated from the Banded sugar ant's integuments. *Escherichia coli* were the most common isolates 75(30.0%), followed by *Morganella morganii* 45(18.0%). This is different from the work of Maximo et al.⁶ in Brazil, where *Bacillus spp.* 45.7% and *Listeria spp.* (10%) were the most prevalent. The difference in the types of isolates may be due to geographical differences. Other bacteria encountered in our study were *Staphylococcus aureus* 20(8.0%), *Klebsiella* species 20(8.0%), with *Serratia marcescens* and *Citrobacter freundii* being the lowest common isolates 10(4.0%) each. Other bacteria associated with Maximo & colleagues⁶ study were *Pseudomonas aeruginosa*, *Streptococcus* species, *Klebsiella* species, *Staphylococcus aureus*, *Arcanobacterium* species, *Proteus* species, *Micrococcus luteus* and *Staphylococcus epidermidis*. There is a slight difference in the bacterial profile of the two studies, although both contain potential human pathogens. The bacterial profile in our study reveals that most of the isolates were potential pathogens to humans. In this study

Candida albicans species was also isolated. It has been reported as the most prevalent opportunistic fungal agent in our locality Ogba et al.²⁰ Its presence in our environment may explain the reason for cross infection among subjects.

Conclusion

Most of the *Camponotus consobrinus* examined in the four locations harboured potential pathogens. Our result is of public health importance because the presence of ants in homes and shops may lead to the spread of pathogenic microorganisms. Therefore, the control of ants in human dwellings must be taken seriously.

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Ethical approval

Not applicable.

Competing interests

Authors have declared that no competing interests exist.

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