



Cockroaches [*Periplaneta americana* (L.), Dictyoptera; Blattidae] as Carriers of Bacterial Pathogens, Khorramshahr County, Iran

Hamid Kassiri^{1*}, Shahnaz Kazemi²

¹Department of Medical Entomology and Vector Control, School of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran

²Khorramshahr Health and Medical Service Center, Khorramshahr, IR Iran

ARTICLE INFO

Article type:

Original Article

Article history:

Received: 01 Jan 2011

Revised: 20 Mar 2011

Accepted: 01 May 2011

Keywords:

Bacterial Pathogen

Cockroach

ABSTRACT

Background: American cockroaches are found in association with human dwellings and hospitals. They have a worldwide distribution. These domestic pests affect human health in several ways. Their habits make them ideal mechanical carriers of different pathogenic microorganisms. Numerous bacteria of medical importance have been isolated from cockroaches.

Objectives: The objective of this research was to determine the role of American cockroaches as carriers of pathogenic bacteria. This was accomplished through the isolation and identification of these microorganisms from the external surfaces of cockroaches captured in Health and Medical Services Centers and their surroundings.

Materials and Methods: Seventy-three cockroaches were caught in Health and Medical Services Centers in Khorramshahr County, southwestern Iran, in 2006. The fluid used to wash the external surfaces of cockroaches was cultured to isolate and identify bacterial pathogens.

Results: Pathogenic bacteria were isolated from the external surfaces of 100% of the American cockroaches examined. The following bacterial pathogens were recovered from their body surface: *Klebsiella* (47.9%), *Pseudomonas* (37%), *Escherichia coli* (30.1%), *Staphylococcus* (24.6%), *Enterobacter* (19.2%), *Streptococcus* (15.1%), *Serratia* (8.2%), *Bacillus* (4.1%), and *Proteus* (2.7%).

Conclusions: The bacterial pathogenic flora isolated from this cockroach species indicate that domestic pests could pose a health problem to humans. Thus, we must control cockroaches, particularly in indoors, sewage and solid wastes.

©2012, AJUMS. Published by Kowsar M.P.Co. All rights reserved.

► Implication for health policy/practice/research/medical education:

The results displayed medically significant bacteria segregated from *Periplaneta americana* in health and medically centres. This is important data that reveal cockroaches may transmit nosocomial bacterial infections in such environments.

► Please cite this paper as:

Kassiri H, Kazemi S. Cockroaches [*Periplaneta americana* (L.), Dictyoptera; Blattidae] as Carriers of Bacterial Pathogens, Khorramshahr County, Iran. *Jundishapur J Microbiol.* 2012;5(1):320-2.

1. Background

Hospital-acquired infections have emerged as a cause of death and illness in people over recent years (1). Insects, hospital care staff, or medical equipments could

transport etiologic agents to patients in medical environments. Cockroaches are highly prevalent in residential homes, restaurants, and medical and financial institutions. During the daytime, these insects remain concealed in secluded locations or gaps in walls, but become active at night (2).

In hospitals, cockroaches have been detected inside sick rooms, the intensive therapy zone, surgical section, kitchen, and medicine part (3). The hospital provides them with suitable temperature, food, water, and protective cover(4). Cockroaches can derive nourishment from

* Corresponding author: Hamid Kassiri, Department of Medical Entomology and Vector Control, School of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, IR Iran. Tel: +98-6113738296, Fax: +98-6113738282, E-mail: Hamidka_2000@yahoo.com

vomit, spit, phlegm, excrement, human entrails, and on other diverse food sources. They are able to transfer viruses, bacteria, fungi, and other medically significant pathogenic agents in infectious regions (5). They have been proposed as likely transmitters of drug-resistant pathogens. Up to 98% of cockroaches found in a clinical setting can bear pathogenic agents on their teguments or in their intestines (6). The American cockroach [*Periplaneta americana* (L.)] is one possible vector of bacteria. Over 100 species of bacteria have been isolated from domestic cockroaches (7). They have been found to carry *Escherichia coli*, *Enterobacter* spp., *Klebsiella* spp., *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Serratia marcescens*, *Shigella* spp., *Staphylococcus aureus*, *Enterococcus* spp., and *Bacillus* spp. (8, 9).

2. Objectives

The aim of this study was to assess the presence of medically important bacteria on the external surfaces of American cockroaches collected from health and medical centers.

3. Materials and Methods

This study was carried out in Khorramshahr, southwestern Iran. The locality is situated at an elevation of approximately 3m above sea level. Its geographical coordinates are 30°26'21" North, 48°10'45" East. It has long, hot summers and mild, short winters. The mean temperature in summer is 55°C and the annual rainfall is 200 mm. The annual relative humidity of the area ranges from 50% to 80%. Khorramshahr has an estimated total population of 164,797. Health and Medical Services Centers, and their surroundings, were considered in this study. Cockroaches were collected randomly from five health and medical centers (Emam Reza, Taleghani, Emam Hossein, Behbahanian, and Kofeish) in 2006. Identification of cockroaches was performed in accordance with a standard taxonomic key (10).

Seventy-three *P. americana* cockroaches were caught using sterile test tubes and sterile hand gloves. Each cockroach was collected in a sterile test tube, transported to the laboratory, and anesthetized by freezing at 0°C for 5min. Two milliliters of sterile normal saline (0.9%) was then added to each test tube and the cockroaches were thoroughly shaken for 2 min. A fixed volume (0.01mL) of the saline washing was inoculated onto blood agar (Hi Media, India), MacConkey agar (Merck, Germany), and desoxycholate citrate agar (Merck) plates. The plates were incubated overnight at 37°C and the colonies identified by standard bacteriological procedures (11, 12). Briefly, a representative colony was identified by its macroscopic morphology, Gram stain, various biochemicals, and other specific characteristics.

In addition, 0.5-mL aliquots of the saline washings were inoculated into thioglycollate (Merck) and selenitebroths (Merck), incubated for 24 h at 37°C, and subcultured

on the same media. After overnight incubation at 37°C, the media were examined and colonies identified.

4. Results

A total of 73 cockroaches (captured mostly at night) and their microbial flora were studied. All cockroaches were identified as *P. americana*. Medically important microorganisms were isolated from the external surfaces of 100% of the cockroaches examined. Examination of the external body washes of cockroaches revealed that cockroaches are carriers of *Klebsiella*, *Pseudomonas*, *E. coli*, *Staphylococcus*, *Enterobacter*, *Streptococcus*, *Serratia*, *Bacillus*, and *Proteus*. *Klebsiella* spp. (47.9%), *Pseudomonas* spp. (37%), and *E. coli* (30.1%) were the most frequently identified organisms. The frequencies of the bacterial species carried on the external surfaces of cockroaches are given in Table.

Table. Bacteria Isolated From the External Surfaces of Cockroaches (*P. americana*) in Health and Medical Environments, Khorramshahr, Iran

	No.	%
<i>Klebsiella</i>	35	47.9
<i>Pseudomonas</i>	27	37
<i>Escherichia coli</i>	22	30.1
<i>Staphylococcus</i>	18	24.6
<i>Enterobacter</i>	14	19.2
<i>Streptococcus</i>	11	15.1
<i>Serratia</i>	6	8.2
<i>Bacillus</i>	3	4.1
<i>Proteus</i>	2	2.7

5. Discussion

Nosocomial infections are considered important causes of morbidity in immuno compromised patients, particularly in those who have prolonged hospital stays (13). In this study, a high percentage of cockroaches (100%) were found to carry various bacteria of medical importance. This finding suggests the probability that almost all cockroaches in Health and Medical Services Centers carry pathogenic bacteria. We therefore consider that these insects could represent a risk to patients, although the involvement of cockroaches in diseases transmission is difficult to demonstrate.

Isolation of pathogenic bacteria from 83% of cockroaches trapped in different areas of a hospital has been reported (14). Bacterial species, such as *Klebsiella* spp., *E. coli*, *Staphylococcus* spp., *Enterobacter* spp., *Streptococcus* spp., *Pseudomonas* spp., *Proteus* spp., *Bacillus* spp., *Neisseria* spp., *Shigella* spp., and *Salmonella* spp., have also been isolated from *P. americana*, *Blattella germanica*, and *Polyphaga aegyptica* cockroaches by other researchers (15-20). The findings of the present study confirm that cockroaches in health and medical centers can play an important role as mechanical vectors of pathogenic bacteria. Therefore, it is suggested that suitable control measures are taken

specifically to make medical centers free from cockroaches.

Acknowledgments

We are grateful to F. Izadpor from the microbiology laboratory, Khorramshahr Vali-e-Asr Hospital, for helping us in carrying out this research.

Financial Disclosure

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Funding/Support

None declared.

References

- Walsh TJ, Pizzo PA. Nosocomial fungal infections: a classification for hospital-acquired fungal infections and mycoses arising from endogenous flora or reactivation. *Ann Rev Microbiol.* 1988;**42**:517-45.
- Cochran DG. Cockroaches: their biology, distribution and control. Geneva, World Health Organization; 1999. Document No.: WHO/CDS/CPC/WHOPE/99.3.accessed: 2006 July 20.
- Dubus J, Guerra M, Bodiou A. Cockroach allergy and asthma. *Allergy.* 2001;**56**(4):351-2.
- Baker LF. Pests in hospitals. *J Hosp Infect.* 1981;**2**(1):5-9.
- Cloarec A, Rivault C, Fontaine F, Le Guyader A. Cockroaches as carriers of bacteria in multi-family dwellings. *Epidemiol Infect.* 1992;**109**(3):483-90.
- Paul S, Khan AM, Baqui MA, Muhibullah M. Evaluation of the common cockroach *Periplaneta americana* (L.) as carrier of medically important bacteria. *J Commun Dis.* 1992;**24**(4):206-10.
- Cruden DL, Markovetz AJ. Microbial ecology of the cockroach gut. *Ann Rev Microbiol.* 1987;**41**:617-43.
- Cotton M, Wasserman E, Pieper C, Theron D, Tubbergh D, Campbell G, et al. Invasive disease due to extended spectrum beta-lactamase-producing *Klebsiella pneumoniae* in a neonatal unit: the possible role of cockroaches. *J Hosp Infect.* 2000;**44**(1):13-7.
- Uckay I, Sax H, Longet-Di Pietro S, Baur H, Boulc'h MF, Akakpo C, et al. Cockroaches (*Ectobius vittiventris*) in an intensive care unit, Switzerland. *Emerg Infect Dis.* 2009;**15**(3):496-7.
- Lane RP, Crosskey RW. *Medical insects and arachnids.* London; New York: Chapman & Hall; 1993.
- Baron EJ, Peterson LR, Finegold SM. Bailey and Scott's diagnostic microbiology. *St Louis, Baltimore.* 1994:386-405.
- Cruickshank R. *Medical microbiology.* 13th ed. London: Churchill Livingstone; 1978.
- Colombo AL, Guimarães T. [Epidemiology of hematogenous infections due to *Candida* spp]. *Rev Soc Bras Med Trop.* 2003;**36**:599-607.
- Ritter RS, Williams OB. Enteric organisms from the American cockroach. *J Infect Dis.* 1949;**85**(1):87-90.
- Elgderi R, Ghenghesh K, Berbash N. Carriage by the German cockroach (*Blattella germanica*) of multiple-antibiotic-resistant bacteria that are potentially pathogenic to humans, in hospitals and households in Tripoli, Libya. *Ann Trop Med Parasitol Categories.* 2006;**100**(1):55-62.
- Fotedar R, Shrinivas UB, Verma A. Cockroaches (*Blattella germanica*) as carriers of microorganisms of medical importance in hospitals. *Epidemiol Infect.* 1991;**107**(1):181-7.
- Lamiaa B, Lebbadi M, Ahmed A. Bacteriological analysis of *Periplaneta americana* L.(Diptera; Blattellidae) and *Musca domestica* L.(Diptera; Muscidae) in ten districts of Tangier, Morocco. *Afr J Biotechnol.* 2010;**6**(17).
- Salehzadeh A, Tavacol P, Mahjub H. Bacterial, fungal and parasitic contamination of cockroaches in public hospitals of Hamadan, Iran. *J Vector Borne Dis.* 2007;**44**(2):105-10.
- Tachbele E, Erku W, Gebre-Michael T, Ashenafi M. Cockroach-associated food-borne bacterial pathogens from some hospitals and restaurants in Addis Ababa, Ethiopia: Distribution and antibiograms. *J Rural Trop Public Health.* 2006;**5**:34-41.
- Vazirianzadeh B, Mehdinejad M, Dehghani R. Identification of bacteria which possible transmitted by *Polyphaga aegyptica* (Blattodea: Blattellidae) in the region of Ahvaz, SW Iran. *Jundishapur J Microbiol.* 2011;**2**(1):36-40.