

BACTERIAL PATHOGENS FROM THE INTESTINAL TRACTS OF VARIOUS SPECIES OF COCKROACHES

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SUMMARY

*Bacterial isolates were made from the intestinal tracts of various species of cockroaches (**Periplaneta americana**, **Periplaneta brunnea**, **Periplaneta australasiae**, **Neostylopyga rhombifolia**, **Nauphoeta cinerea**) trapped from kitchens and stores (houses and hospital), **Shigella flexneri**, **Salmonella typhi**, **Escherichia coli** and **Salmonella sp.** were some of the bacteria isolated and identified.*

INTRODUCTION

Until recently cockroaches were merely considered as nuisance and repulsive insects mainly due to their physical presence and intense nocturnal activities in human dwellings. However, in recent years enough evidence has been assembled from Europe and elsewhere to incriminate them as possible transmitters of pathogenic organisms.^{1,2,3,4} Their habit of feeding on both human faeces and food coupled with the fact that they move freely from building to building make them potential vectors.⁴

The role of cockroaches as potential vectors of pathogens has not been investigated in Malaysia. To determine this, a study was undertaken to isolate bacteria present in the intestinal tracts of cockroaches trapped from representational human dwellings.

MATERIALS AND METHODS

Collection

Cockroaches were mainly trapped from kitchens

TABLE I
BACTERIA ISOLATION FROM VARIOUS SPECIES OF COCKROACHES

BACTERIA	PERIPLANETA AMERICANA	PERIPLANETA BRUNNEA	PERIPLANETA AUSTRALASIAE	NEOSTY- LOPYGA RHOMBIFOLIA	NAUPHOETA CINEREA
<i>Acinetobacter</i> sp.	3	1	-	-	1
<i>Bacillus</i> sp.	35	8	1	1	1
<i>Citrobacter</i> sp.	-	1	-	-	-
<i>Enterobacter</i> sp.	6	5	1	-	-
<i>Escherichia coli</i>	25	2	-	3	3
<i>Klebsiella</i> sp.	26	3	-	2	-
<i>Proteus</i> sp.	4	-	-	-	-
<i>Pseudomonas Aeruginosa</i>	1	-	-	-	-
<i>Pseudomonas</i> sp.	1	-	-	-	-
<i>Salmonella typhi</i>	1	-	-	-	-
<i>Salmonella</i> sp.	1	-	-	-	-
<i>Shigella flexneri</i>	1	-	-	-	-
<i>Staphylococcus Epidermidis</i>	1	-	-	-	-
<i>Streptococcus</i> spp.	70	8	-	7	2
Total No. of Isolates	175	28	2	13	7

of houses and a hospital (wards, kitchens and stores). These were identified to species and processed for bacteria isolation.

The number of cockroach species processed were as follows: *Periplaneta americana* (80), *Periplaneta brunnea* (14), *Periplaneta australasiae* (1), *Neostylopyga rhombifolia* (9) and *Nauphoeta cinerea* (19).

Dissection of gut

Cockroaches were killed with chloroform, and their wings and legs removed. External surfaces of all cockroaches were disinfected with cotton wool soaked in 70 percent ethyl alcohol to prevent contamination of gut contents by microflora from body surfaces. Dissection was made from the ventral surface with sterile instruments. The gut was removed and placed in sterile petri-dishes containing sterile normal saline. An emulsion of the gut was prepared and a few drops transferred into peptone water (OXOID).

Isolation and identification of bacteria

For the isolation of bacteria a loopful of the suspension was plated out on Blood Agar (OXOID) (incubated aerobically and anaerobically) and on MacConkey Agar (OXOID). Plates were incubated for 24 - 48 hours. The identification of bacterial isolates were carried out using the methods and tables of Cowan and Steel.⁵ Grouping for streptococci were performed using Streptex (Wellcome Laboratories). Slide agglutination were

also done on isolates suspected to be either *Salmonella* sp. or *Shigella* sp. using antisera from Wellcome Laboratories employing the Kaufmann-White Schema.

RESULTS

A total of 225 bacterial isolates were made and identified from various cockroaches (Table I).

Bacillus sp. was isolated from all species of cockroaches. *Streptococcus* spp. was most frequently isolated, and it was isolated from all cockroaches except *N.rhombifolia*. Other common isolates were *Klebsiella* sp. and *Escherichia coli*. *Shigella flexneri* and *Salmonella typhi* were isolated from specimens of *P.americana* collected from a store in Carey Island and a kitchen cabinet from Kampong Delek respectively. *Salmonella* sp. was isolated from the same species of cockroach trapped in the store of a hospital. Other isolates identified were *Streptococcus faecalis* (10) and *Streptococcus viridans* (16).

Table II shows single and mixed isolates identified from individual cockroaches. Isolates made from cockroaches collected from kitchens and stores of a hospital are shown in Table III.

DISCUSSION

Cockroaches in human dwellings are predominantly found in kitchens and stores where cooked food kept uncovered is a ready means of transferring potentially infected faeces.⁶ This

TABLE II
ISOLATES OF BACTERIA FROM VARIOUS SPECIES OF COCKROACHES

Species of cockroach	No. of isolates			
	1	2	3	4
<i>P. Americana</i>	21.5%	50.6%	20.3%	7.6%
<i>P. Brunnea</i>	14.3%	35.7%	42.9%	7.1%
<i>P. Australasiae</i>	100%	-	-	-
<i>N. Rhombifolia</i>	66.7%	22.2%	11.1%	-
<i>N. Cinerea</i>	25.0%	50.0%	25.0%	-

process of transferring organisms may be further aided by the insects' habit of regurgitating digestive fluid from their crop onto food to facilitate digestion.⁶ Thus, it is evident that they may easily serve as mechanical vectors of pathogens. Many pathogens, including bacteria, fungi, protozoans and helminth eggs have been found naturally present in cockroaches.^{1,7} Moreover, experimental transmission of bacteria such as Asiatic cholera, pneumonia, diphtheria, anthrax and tuberculosis have been demonstrated in these insects.⁴

Although cockroaches have not been incriminated directly to be responsible for epidemics, their involvement is strongly suspected. Cockroaches trapped in a children's ward where an epidemic of gastroenteritis caused by *Salmonella typhimurium* had the pathogen in them.⁸ *S. typhi* was isolated from cockroaches infesting the houses of typhoid sufferers.⁹ Tarshis¹⁰ showed the connection between cockroaches in the sewer system and the incidence of hepatitis in a housing area.

In the present study several pathogenic bacteria were isolated from various species of cockroaches. *P. americana* by far the most common and abundant species found in Malaysian homes, harbour bacteria such as *S. flexneri*, *S. typhi*, *Klebsiella* sp. and *E. coli*. *Klebsiella* sp. have been frequently obtained from cockroaches collected in hospitals⁶ and similar observations were made from a hospital store in our study.

It is obvious that cockroaches can serve as mechanical vectors of pathogens. However, their role in active transmission of pathogenic organisms is difficult to prove.¹¹ Experimental studies, however, have shown that many pathogens can survive for several days within the intestinal tracts of cockroaches.^{12,13,14} Thus, it is a strong possibility that cockroaches that are able to move freely

TABLE III
ISOLATES OF BACTERIA FROM KITCHENS AND STORES OF HOSPITAL

BACTERIA	KITCHEN	STORES
<i>Bacillus</i> sp.	5	3
<i>E. Coli</i>	1	3
<i>Klebsiella</i> sp.	-	5
<i>Salmonella</i> sp.	-	1
<i>Streptococcus</i> spp.	5	19

between buildings, sewers, latrines and human dwellings¹⁵ can acquire, maintain and transmit pathogens onto human food. Our study shows that cockroaches, especially *P. americana*, an ubiquitous species, is indeed a potential vector of pathogens. Further investigation in this field is needed.

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