



Parasitic Infestation in Cockroaches (*Periplaneta americana*) Obtained in Selected Areas of Metro Manila

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Authors' contributions

This work was carried out in collaboration between all authors. Author GLSS did the study design and wrote the protocol and final manuscript. Authors NC, DP, SS and BT did the statistical analysis and analyses of study. Authors MLLSS and MM did the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Cockroaches are insects recognized to be mechanical vectors of disease-causing agents but in the Philippines there is little information on what particular parasites inhabit these organisms.

Objectives: This study assessed the parasitic infestation in cockroaches obtained in streets and canals of selected areas of Metro Manila. It likewise assessed the diversity of the parasites seen on the external surfaces of the cockroaches collected.

Methodology: Cockroaches were baited along the streets and canals of randomly selected areas of Metro Manila. Parasitic organisms were isolated and identified from the external surfaces of the cockroaches collected.

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Results: One hundred cockroaches (*Periplaneta americana*) were examined, and 36% of the cockroaches had multiple parasites seen on their external surface. The common parasite observed in the cockroach obtained was the rhabditiform larva (25%). Significant differences on the parasites seen on the cockroaches obtained from the selected areas were observed ($F = 4.03$; $P = 0.02$).
Conclusion: The cockroaches obtained in Manila had the highest diversity of parasites seen on the external surface, and those collected in Quezon City had the least parasite diversity although those in Quezon City had the highest parasite load seen in the cockroaches examined.

Keywords: Infestation; diversity; cockroach; parasite; external.

1. INTRODUCTION

A lot of people felt appalled to see cockroaches wandering in the environment, especially that these organisms are often times associated with places that are dirty and unsanitary. Cockroaches are insects that are distributed worldwide and have been in existence for millions of years. Cockroaches are recognized to be mechanical vectors of disease-causing agents. Studies have indicated that cockroaches are insects that carry parasites that are of medical significance [1,2], harbor pathogenic microorganisms that include bacteria and fungi [3,4], and are major sources of indoor allergens causing asthma-related ailments [5]. The risk of acquiring diseases brought about by coming in contact with these mechanical vectors heightens people's concerns. Despite that a number of studies have been done in other countries worldwide, to our knowledge there are neither parasitological studies on cockroaches conducted nor studies on the role of cockroaches as mechanical vectors of diseases in the Philippines. Hence, this study aims to assess the parasites present on the external surfaces of cockroaches in selected areas of Metro Manila. The result of this study is vital, as it provides the baseline information on the microorganisms, particularly parasites inhabiting the external surfaces of the cockroaches, especially those roaming our environment. The information generated may also raise awareness among the general public, particularly on safeguarding public health from the harmful parasites present in cockroaches.

2. METHODS

This study was conducted in three randomly selected areas of Metro Manila, namely Manila, Pasay, and Quezon City. The areas were randomly selected using the fish bowl method, where the areas were written in pieces of paper, rolled and drawn randomly. Cockroaches were collected overnight using empty jars coated with

a thin film of Vaseline baited with pieces of bread soaked in water. There were 35 collecting jars placed along the canals of the streets of the randomly selected areas in Metro Manila. Only the adult cockroach with an intact body was brought in the laboratory for immediate processing and morphologically identified using a taxonomic key [6]. The trapped cockroaches were aseptically transferred in sterile bottles containing 2 ml of sterile normal saline solution. The cockroach was washed by vigorously shaking the bottles, and the washings were collected for examination through the concentration method as described by Sia Su et al. [7]. The supernatant was discarded, and the filtrate was centrifuged for 10 min at 3200 rpm. The sediment was collected and examined in Lugol-stained slides through light microscopy at 400x to 1000x.

The parasite abundance per cockroach was determined by assessing the frequency of occurrence of parasites on the external surface of the cockroach. The parasite community diversity was determined using the Shannon–Wiener diversity index (H), and the parasite evenness was determined using the formula H/H_{max} .

Significant differences on the parasite abundance on the cockroaches across the study areas were determined using ANOVA. Significance was set at $P < 0.05$. All statistical analyses were determined using the GNU PSP software.

3. RESULTS

All cockroaches collected in the streets of Metro Manila were taxonomically identified as *Periplaneta americana* as the distal segment of its cercus is elongated, length more than twice its width. The insect color is reddish brown and a pale brown to yellowish band around the edge of their pronotal shield. The wings of the male extend beyond tip of abdomen and have a

caudal tergite that is deeply notched, distal portion of plate thin projecting as hood over its corresponding terminal sternite. A total of 100 cockroaches were collected using the baiting method. About 56 cockroaches were obtained in Manila, 13 in Pasay, and 31 in Quezon City. Among the total cockroaches examined, about 36% had parasites on the external surface. Fourteen cockroaches in Manila, eight in Pasay and fourteen in Quezon City had parasites on the external surface. Those cockroaches examined in Manila, Pasay, and Quezon City had 61.5%, 45.2%, and 25.0% parasites infesting on the external surface of the cockroaches, respectively. Table 1 shows the parasites isolated from the external surface of the cockroaches examined. All cockroaches examined that have parasites, had more than one parasite present on its external surface. Table 2 shows the parasite abundance, diversity, and evenness on the cockroaches in the selected areas of Metro Manila. Significant differences on the parasite abundance on the cockroaches examined across the study areas were observed ($F = 4.03$; $P = 0.02$). Higher parasite community diversity was observed on cockroaches collected in Manila, whereas lower parasite community diversity was observed in Quezon City though the abundance of parasites was seen on the cockroaches examined in Quezon City.

4. DISCUSSION

This was a cross-sectional study, and its scope is limited in assessing the parasite infesting on the external surface of the adult cockroaches (*P. americana*) obtained in three randomly selected areas of Metro Manila. The most important result of this study is the baseline documentation of the parasites on the external surface of the cockroaches roaming in canals along the streets of Metro Manila. Results have shown that more than one parasite was observed on the cockroaches examined. Among the parasites observed, nematode eggs and larvae, mite, and tick were seen on the cockroaches. Our study corroborates with other studies [1,2,8] where parasites that are of public health significance were found on the external surface of cockroaches assessed. A lower overall parasite infestation of 36% on the external surface of the cockroaches we examined was observed compared to those observed in other countries. The variations on the parasite infestation on the cockroaches may be attributed to the differences in the environments where the cockroaches roamed, as different settings and conditions like the presence of human excreta and wastes in the areas where they wandered account for the variation in the parasite carriage rate of the cockroaches [8].

Table 1. Frequency of occurrence of parasites infesting the external surface of *Periplaneta americana* in selected areas of Metro Manila

Parasites	Study sites					
	Manila (14/56)		Pasay (8/13)		Quezon City (14/31)	
	n	%	n	%	n	%
<i>Ascaris</i> sp. eggs	7	16.3	2	5.0	15	4.8
Rhabditiform larva	14	32.6	36	90.0	293	92.7
Hookworm eggs	1	2.3	1	2.5	0	0.0
<i>Enterobius vermicularis</i> eggs	7	16.3	1	2.5	1	0.3
<i>Trichuris trichiura</i> eggs	12	27.9	0	0.0	5	1.6
Tick adult	1	2.3	0	0.0	0	0.0
Mite adult	1	2.3	0	0.0	2	0.6

(Cockroaches positive/Cockroaches examined)

Table 2. Parasite abundance, diversity, and evenness distribution on cockroaches in selected areas of Metro Manila

Study sites	Abundance (no. of individuals)	Shannon–Wiener diversity index (H)	Evenness (H/H_{max})
Manila	43	1.50	0.84
Pasay	40	0.48	0.34
Quezon City	316	0.33	0.21

$$H_{max} = \ln S$$

5. CONCLUSION

This study has assessed the parasites infesting on the external surface of cockroaches obtained in the streets of Metro Manila. The occurrence of parasites in the cockroaches examined indicates the need to raise people's awareness that they need to safeguard themselves and their food sources from being contaminated by cockroaches, as it may play an important role in the mechanical transmission of parasite-related morbidities. Proper personal hygiene and proper environmental sanitation must always be observed to reduce the possible risks that exposure to the microorganisms harbored by cockroaches may bring in our communities.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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