

**Isolation and Identification of Some Parasites Transmitted by
Cockroach *Blattella germanica* in Al-Diwaniya City/ Iraq**

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Abstract

Fifty samples of adults German cockroach *Blattella germanica* were collected from different parts of Al-Diwaniya city during the period between October 2013 until March 2014 in order to isolate and identify the parasitic pathogens from external and digestive tract of German cockroach.

78% of the examined cockroaches were infected with one or more species of protozoa or worms, the infected percentage of protozoa was 62% while the percentage of infection by worms was 70%. Prevalence of Endoparasites was statistically higher significantly than the parasites carried on the external surface by using Chi square test at ($P < 0.05$).

Eight species of parasites were isolated from the external surface and digestive tract of German cockroaches included two species of protozoa were *Nyctotherus ovalis* and *Entamoeba coli* cyst by infection present of (62 and 4)%, respectively; and four species of worms *Hammerschmidtella diesingi*, *Thelastoma bulhosi*, *Blattellicola blattae* and *Gordius robustus* (42, 28, 16 and 14)%, respectively, in addition to the eggs of worms *Enterobius vermicularis* and *Ascaris lumbricoids* by infection present of (6 and 4)%, respectively.

The results showed presence of three species of parasites shared between humans and animals which carried by German cockroach were *Entamoeba coli* cyst, *Enterobius vermicularis* eggs and *Ascaris lumbricoids* eggs which were isolated from the external body of German cockroach.

Introduction

Cockroaches have been on earth for about 300 million years, and the most common insects in the worlds, today there are about 4,500 species of cockroaches that can be found in every part of the world ⁽¹⁾. Thirty species are associated with human habitations, but only a few of these species inhabit human dwellings. The most common of these are the American cockroach (*Periplaneta americana*) and the German cockroach (*B. germanica*) ⁽²⁾.

Cockroaches are among the most notorious pests of premises, they frequently feed on garbage, sewage and human feces therefore they can disseminate microorganisms in the environment if such feces are contaminated ⁽³⁾, which can not only contaminate food by leaving droppings and bacteria that can cause food poisoning but also can transmit bacteria, fungi, and other pathogenic microorganisms in infested areas ⁽⁴⁾, in addition the filthy breeding habits,

feeding mechanisms and indiscriminate travel between filth and food make some cockroaches efficient vectors of human enteric protozoan parasites ⁽⁵⁾.

Cockroaches are proven carriers of the organisms causing diarrhea, dysentery, cholera, leprosy, plague, typhoid fever ⁽⁶⁾ and viral diseases such as poliomyelitis ⁽⁷⁾. Findings have also shown that exposure to cockroach antigens may play an important role in asthma related health problems ⁽⁸⁾ and it carries the eggs of parasitic worms and may cause allergic reactions including dermatitis itching, swelling of the eyelids and serious respiratory conditions, in addition to major source of indoor allergens and responsible for increased incidence of asthma ⁽⁹⁾.

Many researchers reported the role of *B. germanica* in the transmit of pathogens ⁽¹⁰⁾, in America who recorded five species of worms in the German cockroach which were *Taenia* sp., *Ascaris* sp., *Ancylostoma* sp., *Schistosoma* sp. and *Hymenolepis nana*. ⁽¹¹⁾, they referred to the role of German cockroach as a mechanical vector for *Entamoeba histolytica*, *Entamoeba dispar* and *Giardia* sp. Cyst. ⁽¹²⁾, proved in their study of the allergic bronchitis that 40% of people in China are allergic to German cockroaches, because of the high prevalence of *B. germanica*, its proximity to the human environment and the lack of studies to evaluate the role German cockroach played in the transfer of parasitic pathogens in houses, this study was conducted to isolate and identify parasites from external surfaces and digestive tract of German cockroaches (*B. germanica*) which were collected from different parts of Al-Diwaniya city.

Materials and methods

A- Samples Collection:

Fifty samples of adult *B. germanica* were collected from different parts of Al-Diwaniya city at night time and in the morning during study period between October 2013 and March 2014. All collected cockroaches were put in the sterile test tube then transported to the laboratory of parasitology in College of Education/ Al-Qadisiya University.

B- Isolation parasites from external surface of cockroaches:

All cockroaches were collected in a sterile test tube anaesthetized by freezing at 0°C for 5 minutes. 5 ml of normal saline (0.9%) was added to the test tube and the cockroaches were thoroughly shaken for 2 minutes to detach the parasites from surface body of cockroach. 2 ml of washing fluid which was centrifuged at 2000 rpm for 5 minutes, the deposit transferred to clean glass slides and staining with 1% Lugols Iodine then covered with a cover slide and examined under light microscope (4 and 10 X) ⁽¹³⁾.

C- Isolation parasites from digestive tract of cockroaches:

After external washing, cockroaches were placed in flask rinsed with 70% alcohol for 5 minutes to decontaminate external body, then transferred to sterilized flask and allowed to dry at room temperature under sterile conditions⁽¹⁴⁾. Cockroaches were then washed with normal saline for 2-3 minutes to remove traces of alcohol fixed in petri dish and cut the head and legs by scissors, as well as, the ligaments in the left and right sides of the body from the bottom to the top and removed fat bodies surrounded by the needles and used normal saline to prevent tissue damage.

The digestive tract of cockroaches were dissected out and isolated in the bottom of the petri dish then added drops of normal saline with put black cardboard underneath and shed light upon that helps to see the nematodes move and ciliated swim in solution, isolated nematodes by needles and placed in test tube contain ethyl alcohol 70%, all parasites isolated were fixed by Canada balsam on glass then covered with cover slide and examined by used light microscope under the low power (4 and 10 X)⁽¹⁵⁾.

Results

The current study showed that 39 sample of *B. germanica* out of the 50 samples collected from different parts in Al-Diwaniya city with infection percentage (78%). The numbers of cockroaches infected by protozoa were 31 samples (62%) while the numbers of cockroaches infected by worms were 35 samples (70%) as shown in table (1).

The results of study appeared in table (2) 7 samples of cockroaches were carrying the parasites on the external body (14%) while 39 samples of them were infected by internal parasites (78%).

Eight species of parasites were isolated from the external body and digestive tract of cockroaches included two species of protozoa were *Nyctotherus ovalis* and *Entamoeba coli* cyst with infected percentage (62 and 4)%, respectively. Four species of worms were *Hammerschmidtiella diesingi*, *Thelastoma bulhoesi*, *Blattellicola blattae* and *Gordius robustus* with infected percentage (42, 28, 16 and 14)%, respectively. The eggs of the worms *Enterobius vermicularis* and *Ascaris lumbricoids* with infected percentage (6 and 4) %, respectively.

The study demonstrated that *Nyctotherus ovalis* (protozon) and *Hammersmiditiella diesingi* (nematode) are common in cockroaches (62 and 42) %, respectively; as in table (3).

Prevalence of endoparasites was statistically higher significant ($P<0.05$) than the parasites carried on the external surface by using Chi square test.

The result of the current study showed the presence of three species of human parasites that were carried by German cockroach which were *Entamoeba coli* cyst, *Enterobius vermicularis* eggs and *Ascaris lumbricoids* eggs which were isolated from the external surface of German cockroach. From these results we notice the ability of German cockroach to transfer of the parasites between

human and animals which exist in environment by external body parts or digestive tract through feeding on contaminated materials or feces of infected people in the environment.

Table (1): The percentage of parasitic infections and type of parasites in *B. germanica* in the houses of Al-Diwaniya city.

Type of parasites	No. examined	No. infected	Percentage (%)
Protozoa	50	31	62
Worms	50	35	70

Table (2): The percentage of parasites carried on the external surface and internal parasites recorded in *B. germanica*.

Type of infected	No. examined	No. infected	Percentage (%)
Parasites carried on external body	50	7	14
Endoparasites	50	39	78

Table (3): Species of the parasites recorded in *B. germanica* in houses of Al-Diwaniya city.

Parasites	No. infected	Percentage (%)
<i>Nyctotherus ovalis</i>	31	62
<i>Entamoeba coli</i> cyst	2	4
<i>Hammerschmidtella diesingi</i>	21	42
<i>Thelastoma bulhoesi</i>	14	28
<i>Blattellicola blattae</i>	8	16
<i>Gordius robustus</i>	7	14
<i>Enterobius vermicularis</i> eggs	3	6
<i>Ascaris lumbricoids</i> eggs	2	4

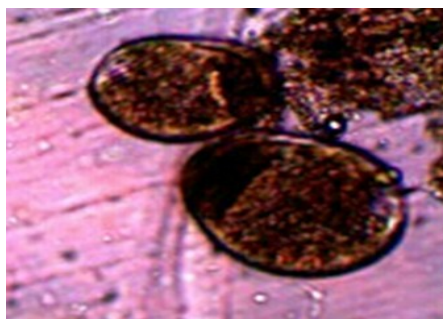


Figure (1): *Nyctotherus ovalis* (100 X).

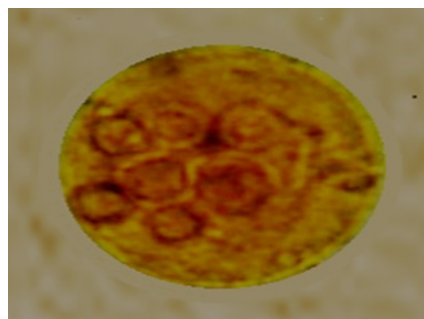


Figure (2): *Entamoeba coli* (100 X).



Figure (3): *Hammerschmidtella diesingi* (40 X)



Figure (4): *Thelastoma bulhoesi* (40 X)



Figure (5): *Blattellicola blattae* (100 X)



Figure (6): *Gordius robustus* (40 X)

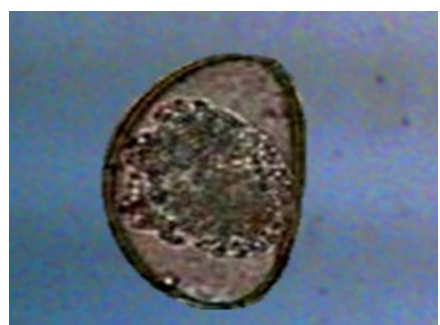


Figure (7): *Enterobius vermicularis* egg (40 X)

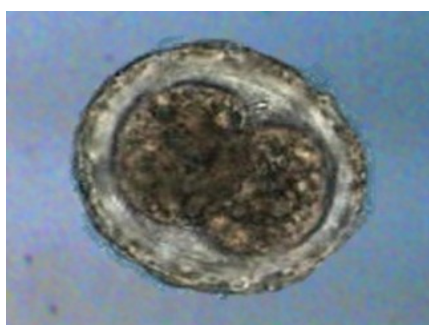


Figure (8): *Ascaris lumbricoides* egg (40 X)

Discussion

The results of the current study showed infection of 39 out of 50 samples German cockroach (*B. germanica*) collected from different parts in Al-Diwaniya city with infected percentage 78%. The infected percentage by protozoa was 62%, while infected percentage by worms was 70%. It is less than the percentage recorded by ⁽¹⁶⁾ in India when they found 99.4% of cockroaches collected from hospitals and 94.2% of cockroaches collected from residential areas were carrying medically important microorganisms, as well as less than the percentage recorded by ⁽¹⁷⁾ in the samples of *B. germanica* that were collected from the hospital in the Hamadan city in Iran which amounted to 98%. The reasons for the difference in the recorded percentages returned to a difference of the number of samples tested and the places that were collected

from, use of pesticides, health and cultural awareness for the people living in those areas.

Prevalence of Endoparasites (78%) were higher than parasites carried on the external body (14%). The reasons for the lack infected with Exoparasites may be due to that eggs of worms and cysts of parasites that exist on the external body of the cockroach is due to chance, where stick on external body of the cockroach while they feed on contaminated sites that may contain infected feces contaminated with these eggs or cysts which works as a mechanical vector by legs or wings or other body parts. This agrees with study of ⁽¹³⁾ in China where they noted the ability of the cockroaches that transfer cysts of *Entamoeba histolytica* by legs or wings or tentacles which work as mechanicals vectors of parasites.

The isolated protozoa and cysts, worms with their eggs in this study from the *B.germanica* in Al-Diwaniya city which agree with ⁽¹⁸⁾ they studied parasitic pathogen that transmit by German cockroach in New York city of the United States and isolated following parasites *Gregarina blattarum*, *Entamoeba thomsoni*, *Nyctotherus ovalis*, *Endolimax blattae*, *Hammerschmidtella diesingi*, *Lophomonas blattarum*, *Lophomonas strieta* and *Nephridiophage blattellae*, it also agrees with the study of ⁽¹⁹⁾ in Turkey as showed the role of the cockroach as mechanical and vital vector for bacteria, viruses, protozoa and worms. ⁽²⁰⁾, in Venezuela which referred to the role of cockroach as a mechanical vector and as reservoirs of pathogenic agents. ⁽²¹⁾, in China isolated *Entamoeba histolytica* cyst and *Entamoeba dispar* cyst from cuticle and gut of German cockroach, because of the exist cockroaches in contaminated environments with feces of infected people or in gathering waste places and left over food which is a favorable environment for cockroach so it that transmits parasitic pathogens present in these environments through parts of her body ⁽²²⁾.

This study showed the presence of three species of parasites shared between humans and animals carried by German cockroach were *Entamoeba coli* cyst, *Enterobius vermicularis* and *Ascaris lumbricoids* which were isolated from the external surface of the German cockroach. This result agrees with ⁽¹¹⁾ were isolated cysts of *Giardia* sp. and *Entamoeba* cyst from *Blatella germanica* and ⁽¹⁷⁾ were isolated eggs of *Enterobius vermicularis* and *Ascaris lumbricoids* from *Blatella germanica* collected from hospital in Hamdan city in Iran, because the cockroaches feed on the contaminated fecal material which might be carrying those cysts or eggs and sticking with cockroaches bodies which works as a mechanical vectors through various body parts ⁽²³⁾.

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عزل وتشخيص بعض الطفيليات المنقولة بواسطة الصرصر الألماني *Blattella germanica* في مدينة الديوانية / العراق

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الخلاصة

جُمعت 50 عينة من بالغات الصرصر الألماني من مناطق متفرقة في مدينة الديوانية خلال مدة الدراسة المحصورة ما بين تشرين الأول 2013 ولغاية آذار 2014 بهدف عزل وتشخيص المسببات المرضية الطفيلية التي ينقلها الصرصر الألماني.

78% من عينات الصرصر الألماني التي فُحصت كانت حاملة لواحد أو أكثر من أنواع الطفيليات الابتدائية أو الديدان، إذ كانت نسبة الإصابة بالطفيليات الابتدائية 62% في حين كانت نسبة الإصابة بالديدان 70%، وأظهرت النتائج أيضاً أن نسبة الإصابة بالطفيليات الداخلية كانت (78%) وهي أعلى معنوياً من نسبة الطفيليات المحمولة على السطح الخارجي (14%) باستخدام اختبار مربع كاي عند مستوى احتمالية ($P < 0.05$).

سجلت خلال الدراسة الحالية ثمانية أنواع من الطفيليات والتي عزلت من السطح الخارجي والقناة الهضمية للصرصر الألماني تضمنت نوعين من الطفيليات الابتدائية هي *Nyctotherus ovalis* وأكياس *Entamoeba coli* بنسبة إصابة بلغت (62 و 4) % على التوالي، وأربعة أنواع من الديدان هي *Hammerschmidtella diesingi*، *Thelastoma bulhosi*، *Blattellicola blattae* و *Gordius robustus* بنسبة إصابة بلغت (42، 28، 16 و 14) % على التوالي، بالإضافة إلى بيوض الديدان الآتية *Enterobius vermicularis* و *Ascaris lumbricoids* بنسبة إصابة (6 و 4) % على التوالي.

كذلك أظهرت النتائج وجود ثلاثة أنواع من الطفيليات المشتركة بين الإنسان والحيوان والمنقولة بوساطة الصرصر الألماني وهي أكياس *Entamoeba coli*، وبيوض *Enterobius vermicularis* و *Ascaris lumbricoids* التي عُزلت من السطح الخارجي للصرصر الألماني.