ISSN 1991- 8690 الترقيم الدولي ٨٦٩٠ - ١٩٩١
Website: http://jsci.utq.edu.iq Email: utjsci@utq.edu.iq

Parasites of Cockroach *Periplaneta americana* (*L.*) in Al-Diwaniya province,Iraq.

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Abstract

Out of 150 cockroaches examined in this study, 125 cockroaches (83. 33%) were infected with one or several species of external parasites (33.3) or gastro-intestinal helminthes (80%). The percentage infection and number of parasites of Cockroaches trapped in the toilets of houses more than infection of cockroaches trapped from the kitchens of houses (100% and 50%respectively) and 2-62 parasites/ml of Cockroaches trapped in the toilets while those trapped from the kitchens was1- 28 parasites/ml houses.

A seven species were isolated from the external surface and intestinal tract represented two protozoa and five nematodes. This species were:

Entamoeba blatti (33%), *Nyctotherus ovalis* (65.3 %), *Hammersmiditiella diesingi* (83.3 %), *Thelastoma bulhoe* (15.4 %), *Gordius robustus* (Horsehair worm) (1.3%), *Enterobius vermicularis* eggs , (2%) *Ascaris lumbricoids* eggs (1.3%). No Cestodes were records in the study.

Prevalence of intestinal worms was statistically higher significant than the protozoa in ($P<0.05$). The number of worms per cockroaches ranged from 1-3 while protozoa 42 parasites/ml. Prevalence of endoparasites were higher than ectoparasites and intestinal worms was statistically higher significant than the protozoa in (80%; 3. 3%) and (83. 3%; 65.3 %) respectively.

This study revealed Cockroach represent an important reservoir or carrier for medical importance parasites of human in houses as *Enterobius vermicularis* and *Ascaris lumbricoids* .

The work presents the first record of cockroach's parasites in Al-Diwaniya.

Introduction

Cockroaches are one of the oldest insect orders with a fossil history extending back more than 300 million years. There are 3500-4000 known species worldwide of which only a few are troublesome to people. About 175 species have been recorded from southern of cape town (Robertson, 2004).

The American cockroach, *Periplaneta americana* L.[Burmeister, 1838] is the largest of the common per domestic cockroaches measuring on average 4 cm in length. The American cockroach is second after the German cockroach in abundance. The cockroach is found in caves, mines, privies, latrines, cesspools, sewers, sewerage treatment plants, and dumps (Bell and Adiyodi, 1981). Their presence in these habitats is of epidemiological significance, At least 22 species of pathogenic human bacteria, virus, fungi, and protozoan, as well as five species of helminthes worms, have been isolated from collected American cockroaches (Rust *et al*., 1991). Cockroaches are also aesthetically displeasing because they can soil items with their excrement and regurgitation (Walter & Cancun, 2005).

The importances of cockroaches as a pest is traditionally linked to their medical importance ,They are known to be capable of carrying many common pathogenic organisims such as fungi, viruses, protozoa, and about 40 species of bacteria that are pathogenic to vertebrates (Glazer *et al*.2005).

Cockroaches are among the most notorious pests of premises, which not only contaminate food by leaving droppings and bacteria that can cause food poisoning but also they transmit bacteria, fungi and other pathogenic microorganisms in infested areas (Kopanic1994;Czajka *et al*., 2003). Cockroaches feed indiscriminately on garbage and sewage and so have copious opportunity to disseminate human pathogens (Cotton, 2000; Pai, 2005). Also their nocturnal and filthy habits make them ideal carriers of various pathogenic microorganisms (Salehzadeha *et al*., 2007).

Thyssen *et al*. (2004) studied the importance and role of insects as mechanical vectors of helminthes parasites and found the 58. 3% of the collected specimens of *Periplaneta americana* were carrying the following helminthes forms: Oxyuridae eggs (36.4%), Ascaridae eggs (28.04%), Nematodes larvae (4.8%), Cestoda eggs (3.5%), other Nematode (0.08%), and Toxocaridae eggs (0.08%).

Mimioglu and Sahin (1976) revealed the Cockroaches are widely spread in Turkey and they transmit bacteria, viruses, protozoa and helminthes mechanically and biologically. Because of their close contact with human beings, these insects encouraged us to make parasitological investigations. In the hindgut of cockroaches they found three nematode species; *Suifunema caudelli*, *Galebia aegyptiaca,* and *Hammerschmidtiella diesingi*.

Ramirez Perez (1989) point to that Cockroaches are arthropod transmitters of disease, acting both as mechanical vectors and as reservoirs of pathogenic agents. It has been shown that cockroaches harbor and transmit, both in nature and under experimental conditions, about 40 species of bacteria, including at least 25 from the Enterobacteriaceae group that cause gastroenteritis in man. In addition, it has been established that these insects are intermediate hosts of pathogenic

helminthes and carrier of viruses, fungi, protozoa and helminthes eggs. It is possible that cockroaches contribute to the transmission of Chaga's disease by feeding on triatomine vectors of that disease. There also are signs that substances produced by cockroaches are involved in certain allergic processes. The foregoing facts are sufficient to justify the immediate control and eradication of these insects whenever and wherever they constitute a threat to public health.

The present study was conducted to isolate and identify the parasites from external surfaces and digestive tract of the cockroaches, *Periplaneta americana* which were collected from different parts of different areas of Al-Diwaniya province.

Material & Methods

Collecting of the insects:

One hundred and fifty cockroaches (100 from toilettes and 50 from kitchens) were collected from different parts of Al-Diwaniya province at night time or in the morning. Each cockroach was collected put in a sterile test tube then transported to the laboratory of parasitology, in Education College, University of Al-Qadisiya.

Isolation parasites from external surfaces:

After identification 5 ml of sterile normal saline (0.9%) was added to the test tube and the cockroaches were thoroughly shaken for 5 minuets. Isolation of parasitic ova/cysts was carried out by using 2 ml of washing NS which was centrifuged at 2000 for 5 minuets. The deposit examined after staining with 1% Lugols iodine under light microscopy and identified (Salehzadeha *et al*., 2007).

Isolation parasites from internal surfaces:

After external washings, cockroaches were placed in flasks rinsed with 70% alcohol for 5 min to decontaminate external surfaces then the cockroach was fixed on dissecting Petri dish and dissected, Head is first severed out, and next are the legs, with the help of fine pointed forceps and scissors. Next the body must be pinned to another a small dissection dish with thin but rigid pins With the scissors cut the ligaments on the right hand side of the abdominal sternites, beginning at the rear end, and the ventral plate so released is hinged towards the left side, clearing its adhesions to the internal organs with needles, and is discarded or pinned down. A physiological saline solution designed to work with insects can be used to avoid damages to tissues by osmotic pressure differentials. With thin needles and fine pointed forceps, the fat bodies that surrounds the abdominal organs is removed. The alimentary canal is easily isolated and it can be set free from its ties, and examined over a black background with the help of an upper light, this will make it easy to see the nematodes which are wriggling most of the time, or the ciliates swimming in the saline. Collect the nematodes with a fine brush or needle into a small vial in a few of milliliters of ethyl alcohol 70%. Set apart the specimens in a well stopped vial to examine them later, all collected parasites were fixed by Canada balsam on glass slides then used light microscope under the low power(4 & 10 X) to see and Separate the internal protozoa .All separated parasites are

storage to examine later (Walter & Cancun,2005).

Results

The parasites were isolated from external surface and gastro-intestinal tract of 125 cockroaches where (83. 33%). The intensity of Cockroaches trapped in the toilets of houses more than which trapped from the kitchens of houses (100% and 50% respectively) the range of internal parasites were 2-62 parasites/ml of Cockroaches trapped in the toilets while those trapped from the kitchens was1- 28 parasites/ml (Table 1).

Results of the present study revealed the presence of 7 species of protozoa and nematodes (adult and eggs) which were isolated from the external surface and gastro- intestinal tract represented two species of protozoa and five species of nematodes. The identified species were: *Entamoeba blatti* (33.%), *Nyctotherus ovalis* (65.3%), *Hammersmiditiella dieingi* (83.3%), *Thelastoma bulhoesi* (15.4%), *Gordius robustus* (1.3 %),*Enterobius vermicularis* eggs, (2 %) *Ascaris lumbricoids* eggs (1. 3 %) Table (2)and figures 1-10 . This first record of cockroach parasites in Iraq and Al-Diwaniya city. Generally, the study demonstrated the *Nyctotherus ovalis* (protozon) and *Hammersmiditiella diesingi* (nematode) are common in cockroaches (83. 3% and 65. 3% respectively). Although majority of cockroaches harboring two species of parasites , Single species and mixed infections of up to three worms were recorded, and the number of worms per cockroaches ranged from 1-3 while protozoa 2-42 parasites/ml.

Prevalence of endoparasites(80%) were higher than ectoparasites(3.3%) and intestinal worms was statistically significantly than the protozoa in ($P<0.05$) and intestinal worms 100% of infected cockroaches , the protozoa 65.3% of infected cockroaches Table (3 & 4).

Table (1) Comparison between infected Cockroaches trapped in Toilettes and kitchens.

LOCATION	NO. EXAMINED COCKROACHES	NO. INFECTED COCKROACHES	PERCENTAGE	RANGE OF PARASITES
Toilettes	100	100	100	2-62
kitchens	50	25	50	1-28
Total	**150**	**125**	**83.3**	**42**

Table (2) Type and percentage of infection with parasites in cockroach *p. americana* in Al_Diwaniya city.

TYPE OF INFECTION	NO. INFECTED	PERCENTAGE
Worms	125	83.3
Protozoa	98	65.3

Table (3) Percentage of infection with Worms and Protozoa in cockroach *P. americana*.

TYPE OF PARASITE	NO. EXAMINED	NO. INFECTED	PERCENTAGE
Endoparasites	150	120	80
Ectoparasites(eggs)	150	5	3.3
Total	**150**	**125**	**83.3**

Table (4) Percentage of infection with Endoparasites and Ectoparasites(eggs on surface) in cockroach *P. americana*.

PARASITES	NO. INFECTED COCKROACHES	PERCENTAGE	RANGE OF PARASITES
Nyctotherus ovalis	98	65.3	42
Entamoeba blatti	5	3. 3	2
Hammersmiditiella dieingi	125	3.83	3
Thelastoma bulhoesi	27	4.15	1
Gordius robustus	2	13.	2
Enterobius vermicularis eggs	3	2	1
Ascaris lumbricoids Eggs	2	3.1	1
Total	**125**	**83 .3**	

Figure (1)-morphology of *Hammersmiditiella dieingi* (male on left &female on rite) (10X).

Figure (2)-*Hammersmiditiella dieingi* female Anterior and posterior end. (40X).

Figure (3)- *Thelastoma bulhoesi* female (10X).

Figure (4) - *Thelastoma bulhoesi* female Anterior and posterior end. (10X).

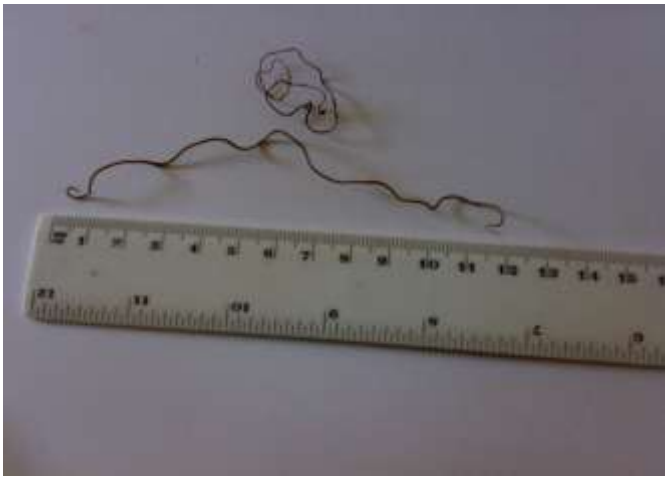

Figure (4)-*Gordius robustus*(horse hair worm).

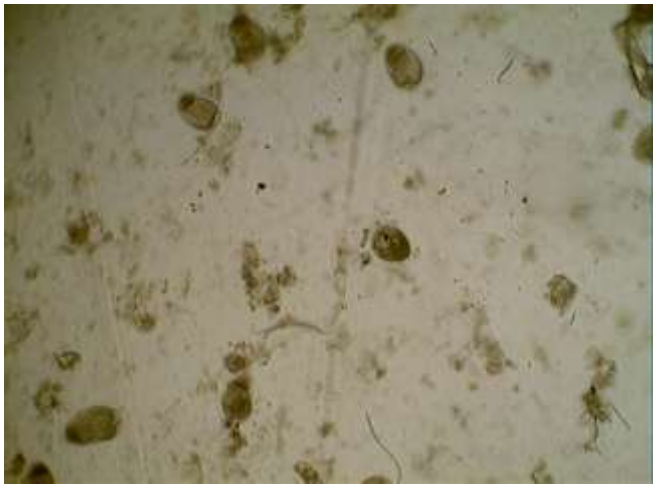

Figure (4)-*Nyctotherus ovalis* (10X)

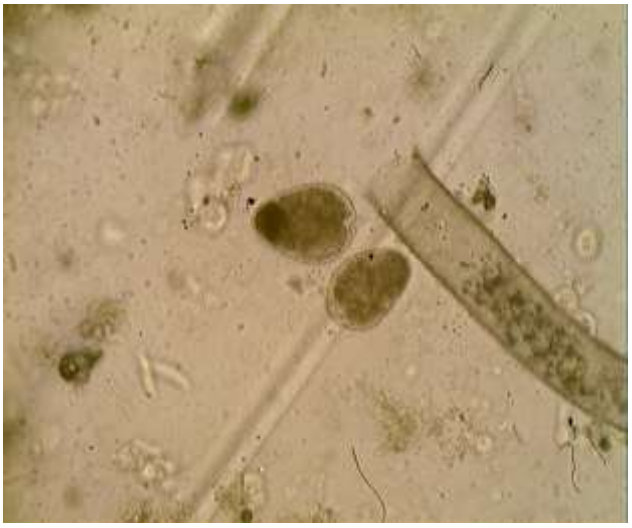

Figure (5)-*Nyctotherus ovalis* (40X)

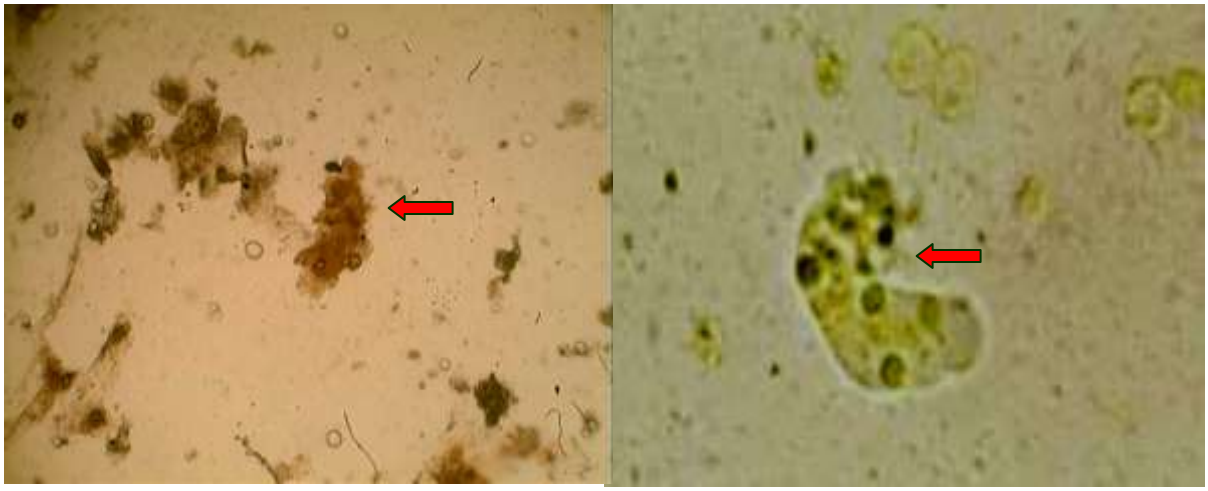

Figure (6)- *Entamoeba blatti* (10,20X).

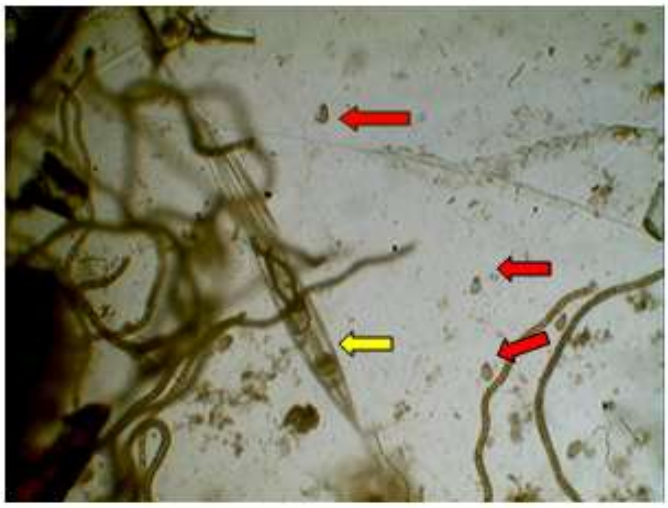

Figure (8)-Mixed infection with *Nyctotherus ovali*( ) and *Hammersmiditiella dieingi* ( ) (10X)

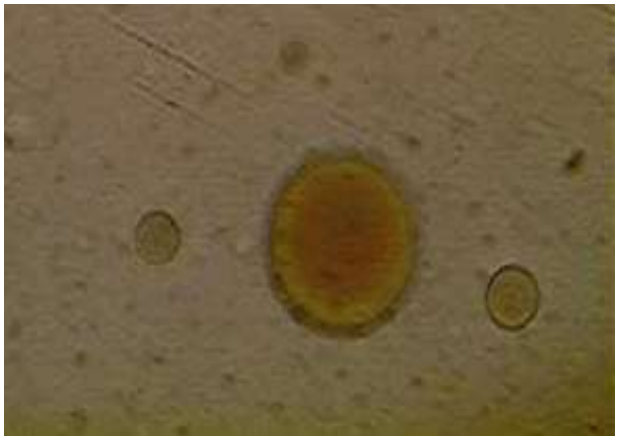

Figure (9)-*Ascaris lumbricoids Eggs* (40X).

Figure (10)-*Enterobius vermicularis eggs* (10X).

Discussion

The present study recorded a high rate of infection with intestinal parasites in cockroaches (83, 33%). These are comparable with the previous studies the prevalence rate of intestinal parasites of cockroaches was less than reported by Fotedar *et al*. (1991) when they found 99.4% of cockroaches collected from hospital and 94.2% cockroaches collected from residential areas were carrying medically important microorganisms and higher than Thyssen *et al.* (2004) which found 58. 3% of *Periplaneta americana* carrying the helminthes forms. The high prevalence of parasitic infections in the present study might be due to the social and environmental conditions.This results are similar to Several previous studies on the ectoparasites and endoparasites of cockroaches have been conducted in different parts of the world as Mimioglu and Sahin (1976) revealed to that

cockroaches transmit bacteria, viruses, protozoa and helminths mechanically and biologically, in the hindgut of cockroaches they found three nematode species : *Suifunema caudelli, Galebia aegyptiaca,* and *Hammerschmidtiella diesingi.* While Fotedar *et al.* (1991) found a various fungi and parasitic cysts of medical importance were also isolated from cockroaches, but the carriage rates were low and suggest that cockroaches in hospitals can act as a vectors of medically important bacteria, parasites and fungi.

Chan *et al*., (2004) revealed to cockroaches are known carriers of bacteria and fungi that produce disease in humans. However, the link between pathogenic helminthes and cockroaches has not been fully explored. This preliminary study demonstrates *Trichinella* and *Enterobius* (also known as human "pinworm") infestation in cockroaches obtained from a grade school and hospitals in Hawaii. This is the first report of *Trichinella* and *Enterobius* infestation in naturally occurring cockroaches. These results suggest that cockroach are an unappreciated host for these human pathogens and are potential reservoirs for these nematodes, supporting their persistence and transmissibility in the environment.

Thyssen *et al*. (2004) found A total of 700 insects (54 Blattodea, 275 Diptera, and 371 Hymenoptera) were collected and examined externally and individually. In the Blattodea order, only specimens of *Periplaneta americana* were collected, and 58.3% were carrying the following helminth forms: Oxyuridae eggs (36.4%), Ascaridae eggs (28.04%), Nematoda larvae (4.8%), Cestoda eggs (3.5%), other Nematoda (0.08%),and Toxocaridae eggs (0.08%). Tatfeng *et al*., (2005) found cyst of *E. hystolitica*, oocysts of *C. parvum*, *C. cayetenensis* and *Isospora belli*, cysts of *Balantidium coli*, ova of *Ascaris lumbricoides*, *Anchylostoma deodunalae, Enterobius vermicularis,* ova *Trichuris trichura,* larva of *Strongyloides stercoralis*.

Salehzadeh *et al*. (2007) showed 4 adult *Enterobius vermicularis* and 8 *Ascaris* eggs in two cockroaches from hospital but observation of control group did not show any parasitic contamination.

Helminthes can be transmitted to human beings in several ways, but little attention has been given to vector or mechanical transmission of infective forms by insects (Chan *et al*., 2004). This study recorded the importance parasites and role of insects as mechanical vectors of helminthes parasites, the most important role is the arthropods play is in carrying germs and parasites.

Cockroaches are arthropod transmitters of disease, acting both as mechanical vectors and as reservoirs of pathogenic agents. It has been shown that cockroaches harbor and transmit, both in nature and under experimental conditions, about 40 species of bacteria, including at least 25 from the Enterobacteriaceae group that cause gastroenteritis in man. In addition, it has been established that these insects are intermediate hosts of pathogenic helminthes, viruses, fungi, and protozoa. It is possible that cockroaches contribute to the transmission of Chaga's disease by feeding on triatomine vectors of that disease. There also are signs that substances produced by cockroaches are involved in certain allergic processes. The foregoing facts are sufficient to justify the immediate control and eradication of these insects whenever

and wherever they constitute a threat to public health Ramírez (1989).

Prevalence of intestinal worms was statistically higher significant than the protozoa, This results similar to Tatfeng *et al*. (2005) which found cockroaches trapped in the toilets of houses are more infection with bacteria and parasites than cockroaches from kitchens of houses and water system, cockroaches trapped in the toilets of houses had a mean parasites count of 98 parasites/ml, while those trapped in the houses with water system had a mean parasitic count of 31 parasites/ml and a parasitic count of 19 parasites/ml were recorded from kitchens of houses with water system, this result also agreement with Chinchilla *et al*., (1994) and Chan *et al*., (2004) which found the importance of cockroaches as carriers of parasitic worm, cyst or eggs, they are found presence of parasitic forms on or in cockroaches, the finding of the present study also showed the parasitic contamination, this indicates that these cockroaches had opportunity to get touch with infected patients or contaminated cloths Because of their close contact with human (Mimioglu and Sahin,1976). We concluded cockroaches represent an important reservoir for infectious pathogens.

In this study we found Horsehair worms(Gordian worm), it is an internal parasite of crickets and other insects like grasshoppers and beetles this worm re thread like roundworms that get their name because they resemble the hair of a horse's tail or mane hair, These worms resemble to that found by Barb Ogg (2007) he found this worms in cricket, and revealed these worms are active and often observed during late summer or fall months. horsehair worms "swimming" in the toilet bowl after emerging from a cricket that had been tossed into the toilet (Barb Ogg 2007). They are commonly confused with mermithid nematodes. Poinar (1991) provides a key to genera found in North America. Baker and Capinera (1997) provide a summary with emphasis on nematomorphs affecting grasshoppers.

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طفيليات حشرة الصرصر الامريكي (L) *Periplaneta americana* في مدينة الديوانية

هادي مدلول حمزة الميالي محمد صالح مهدي اليعقوبي

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الخلاصة

من مجموع 150 صرصراً امريكياً تم فحصها خلال الدراسة الحالية تم عزل عدد من الطفيليات من السطح الخارجي والداخلي ل125 صرصراً منها وبنسبة أصابة بلغت 33.83 % حيث كانت مصابة بواحد او اكثر من انواع الطفيليات الابتدائية او الديدان .

أظهرت الدراسة ان النسبة المئوية للاصابة وشدتها في الصراصر التي تم صيدها من المرافق الصحية للمنازل كانت اكبر منها في الصراصر التي تم صيدها من المطابخ (100% و50% على التوالي).وعدد الطفيليات من2- 62 طفيلي لكل مل الواحد من محتويات الامعاء في الصراصر التي تم صيدها من المرافق الصحية للمنازل بينما كانت اعدادها 1-28 طفيلي لكل مل في الصراصر التي تم صيدها من المطابخ.

تم عزل سبعة انواع من الطفيليات من السطح الخارجي والقناة الهضمية تمثل نوعين من الابتدائيات هي

Entamoeba blatti (33%), *Nyctotherus ovalis* (65.3 %)

وخمسة انواع من الديدان الخيطية وهي :

Hammersmiditiella diesingi (83.3 %), *Thelastoma bulhoe* (15.4 %),*Gordius robustus* (Horsehair worm) (1.3%), *Enterobius vermicularis* eggs , (2%) *Ascaris lumbricoids* eggs (1. 3%).

بينما لم يسجل اي نوع من الديدان الشريطية

ظهرايضاً ان انتشار الديدان المعوية كان اكبر معنوياً من انتشار الابتدائيات عند مستوى احتمالية ($P<0.05$) وكذلك عددالديدان بشكل عام في الصرصر الواحد قد تراوح بين 1-3 دودة بينما عدد الابتدائيات هو 42 لكل مل . انتشار الطفيليات الداخلية في هذة الدراسة كان اعلى من الطفيليات الخارجية والديدان المعوية اعلى معنوياً من الابتدائيات (80%؛3.3%)و (83.3%؛65.3%).

أوضحت هذة الدراسة ان الصرصر الامريكي يمثل خازن مهم لعدد من الطفيليات ذات الاهمية الطبية للانسان في المنازل مثل الاسكارس والتي *Ascaris lumbricoids* والدودة الدبوسية *Enterobius vermicularis* قديعمل على نشرها الى بيئتنا .

ويمثل هذا التسجيل الاول لطفيليات الصرصر في الديوانيه وكذلك اشارت هذة الدراسة الى الوبائية والاهمية الطبية لهذة الطفيليات .