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"Ectoparasites of Rodents from some Districts in Baghdad"

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"طفيليات القوارض الخارجية في بعض محلات بغداد"

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الخلاصة :
مسح للطفيليات الخارجية للقوارض اجري في بعض المحلات السكنية الموبؤة بالقوارض في بغداد عامي ٢٠٠٥-٢٠٠٦ . كان مجموع القوارض الكلي ٩١ ومن ثلاثة أنواع تضمنت ٥٨ جرذ نرويجي و٣١ جرذ اسود و فاران منزليان وبنسبة انتشار عامة (٧٢.٥) .حيث جمع (٣٠٦) عينة تضمنت الحلم والقمل والبراغيث والقراد ، تم التعرف على ثمانية ا أنواع منها تضمنت نوع واحد للبرغوث *Xenopsylla cheopis* و نوع واحد للقراد *Hyalomma asiaticum asiaticum* و ثلاثة أنواع من القمل *Hoplopleruraoenomydis, H. acanthopus, Polyplax spinulosa* وثلاثة أنواع من الحلم *Dermanyssus gallinae, Ornithonyssus bacoti , Laelaps echidnina* .
سجل الحلم أعلى نسبة انتشار ثم يليه القمل ثم يليهما و بأدنى نسب للقراد والبراغيث بشكل عام . كانت معدلات الطفيليات الخارجية للجرذ الأسود أعلى من مثيلاتها للجرذ النرويجي وبشكل غير معنوي إحصائيا ، في حين سجل الحلم في الفار المنزلي فقط . كانت الفروقات معنوية إحصائيا (P= ٠.٠٠٨) باختبار مربع كاي و (P<٠.٠٠١) باختبار كروكسال ووااليس لتحليل تغاير الرتب بين واحد أو اثنين من معدلات الحلم اوالقمل والبراغيث والقراد العائدة لأنواع القوارض الثلاثة تحت البحث. أن المعطيات الناتجة تساعد في السيطرة على أمراض القوارض المنقولة بواسطة المفصليات المهمة صحيا وبيطريا كالطاعون والتيفوس .

Summary :
A total of 91 rodents were identified including *Rattus norvegicus* (n=58) , *Rattus rattus* (n=31) & *Mus musculus*(n=2) which were collected from five districts of Baghdad area during 2005-2006 ; with total general ectoparasites prevalence infestation (72.5%). A total of 306 ectoparasites were collected comprising flea, lice, mites and tick . Eight species of ectoparasites were identified , comprising flea , *Xenopsylla cheopis* ; tick , *Hyalomma asiaticum asiaticum* ; lice , *Hoplopleruraoenomydis, H. acanthopus, Polyplax spinulosa*; mites , *Dermanyssus gallinae, Ornithonyssus bacoti , Laelaps echidnina*.

Mites recorded highest prevalence and index then lice with least flea and tick prevalence's and indices in general ; Only mites were collected from *Mus musculus*. *Rattus rattus* ectoparasites means were higher than that of *Rattus norvegicus* but not statistically significant (P=0.231) , while there were Statistically significant differences detected with chi square (P = 0.008), and Kruskal-Wallis one way analysis of variance on rank (P < 0.001) at 0.05 level between one or two means of lice , mites , fleas and ticks of *Rattus norvegicus* , *Rattus rattus* & *Mus musculus* . Given parameters of rodents vector arthropods understudy could assists in control of zoonotic diseases such as plague and murine typhus .

Introduction :

The number of rodent-borne diseases in urban areas is high and relates to the high rodent population densities found in both the developing and developed world. The higher density of a rodent population, the more frequent will be the contact between rodents and man and the higher likelihood of disease transmission; Many of these diseases are carried by arthropod pests and rodents (Gratz 1999) ; The frequency of disease transmission is facilitated by close - living of the three well known and wide spread commensal species *Rattus norvegicus* & *Rattus rattus Mus musculus* (Gratz &Ismail 1986) ; Transmission can occur by direct contact, or by bites of an arthropod vector (Rodhain 1996) ; among these diseases , plague was the most notorious (Zeigler 1969) transmitted by the rat flea *Xenopsylla cheopis* , which reported its most recent out breaks from middle-East area in Iran (Bahmanyar 1968) , Yemen 1969 (Bahmanyar 1973) , Libya 1984,2009 (Fewster 2009) , and in Algeria 2008 (Tarantola *et al.* 2009) .

Rodents may transmit other disease – causing organisms , such as bacteria like tularemia ,leptospirisis ,salmonellosis & relapsing fever ; Virus , like Crimean hemorrhagic fever which reported in Iraq , where were the rodents at rate 14.2% seropositivty (Tantawi *et al*.1981) ; the main group of vectors involved in CCHF (Crimean-Congo Hemorrhagic Fever) virus transmission appears to be ticks of the genus *Hyalomma* (Nabeth *et al*.2004*)*. The rickettsial murine typhus hyperendemic in Kuwait ,where the outbreak coincided with a period of high rat and flea density, the most prevalent commensal rodent in Kuwait is *Rattus norvegicus* , and the study of the ectoparasites revealed *Xenopsylla astia fleas, Polyplax spinulosa* and *P. cenomudis lice,* and *Lelaps nutalli* and *Ornythonyssus bacoti (*AL-Awadi *et al*.1982); Traub *et al*. (1978) also state that these lice should be considered as potential sources of murine' typhus transmission to humans by the aerosol route (via inhalation of dust from infected louse feces . Scrub typhus, it is transmitted to humans by infected chiggers ; the larval stage of trombiculid mites (*Leptotrombidium* spp.) ; feeding on wild and domestic rodents (Jittapalapong *et al*.2009). The reservoir for Rickettsial pox is the house mouse and the infection has been found in other urban areas of the USA and in Europe and Asia ; The infectious agent is transmitted from mice to man by the mite *Allodermanyssus*

sanguineus (Gratz 1999). Parasitoids like cutaneous & visceral leishmaniasis ; where in Iraq *Leishmania tropica* has been found in one specimen of *R. rattus* (Desjeux 1991) ; *Babesia microti* (Anderson *etal*. 1991); rodent reservoir and flea vector appeared to be the most likely source of a *Trypanosoma lewisi*-like (*Herpetosoma*) infection recently reported in a sick infant from Thailand (Jittapalapong *et al*.2009 ; Nachai *et al*.2007) . *Ornithonyssus bacoti* , has the widest host range, parasitizing a variety of domestic and wild mammals and birds, and is the most commonly reported mesostigmatid mite both in laboratory rodent colonies and in human rat mite dermatitis cases (Watson 2008); *Hymenolepis diminuta* can be passed to people by the rat flea (*Xenopsylla cheopis*), (Viroj Wiwanitkit 2004) .

Finally, little is known on other rodent-borne parasites and pathogens that can be transmitted to humans (Arenaviruses, Hepatitis E virus, Rabies, bartonellosis, melioidosis, schistosomiasis, babesiosis, plague, etc.). Further investigations are needed with emphasis on the parasite load to also understand the susceptibility of each species (Telmadarraiy *et al*. 2007).

Regarding to what has been said hitherto, we studied in present survey the internal parasites of rodents in five districts in Baghdad known with high density of rodents and rat-man proximity as recorded by Hasson (2009) . The aim of this study was to identify ectoparasites of rodents in some districts of Baghdad , a parameter could be useful for implementation of any prevention and control measures for zoonotic diseases in the city.

Materials and methods :

During the study period 2005-2006 , 91 rodents collected from five residential district blocks with high density prevalent rodents such as Aljamhuiya ٣٨.٦٠%, Abunoas ٤٥% , Karada ٣٢.٨٠% , Kelani 52.2% & Saadon 50% ; traps were collected and transported to Baghdad health control department. Rodents were trapped alive; caught rodents were anesthetized in plastic bags with chloroform to control animal and for combing by fine toothed brush ,and also for scraping skin lesion found in order to collect ectoparsites in tray ; In some cases of ticks they were collected by forceps . The contents of the tray was examined carefully by hand lens for any ectoparasites which were picked up by moisten sharp end wood stick preserved by 70% alcohol for further studies ; Recovered adult arthropods & larvae were cleared in boiled 10%$NaOH_{(aq)}$; or lactophenol for different times periods at room temperature ; mounted in between slide and cover slip by Canada balsam , which placed in 40c◦ oven for few days to harden mounting medium ; then morphologically identified after using valid references of ,Communicable Disease Center (1966) , Durden (1990) and Watson (2008).

Preserved samples re-examination microscopically conducted at Al-Dora veterinary hospital during 2008 .

Statistical analysis tests were performed using Acastat 6 , Minitab 15 & sigmaplot11 program soft ware packages

Results :

From the total of 91 rodents captured , three well known and wide spread commensal species *Rattus norvegicus* (n=58) , *Rattus rattus* (n=31) & *Mus musculus*(n=2) were identified from the five districts of Baghdad area understudy. The number of positive rodents ectoparasites was (n=66) , from them *Rattus norvegicus* (n=33) with highest prevalence infestation (36.3%) , *Rattus rattus* (n=31) with prevalence infestation (34.1%), & *Mus musculus* (n=2) with lowest prevalence infestation (2.2%) , with total general prevalence infestation (72.5%) ; The total number of ectoparasites collected was 306 included , mites (n= 157), lice (n=137) , fleas (n= 6) & ticks (n= 6) , shown in table (1) ; Results in table (2) and fig. (2) , revealed that, mites were had highest mean 2.5±6.4 in *M. musculus* and lowest 1.4±0.8 in *R. norvegicus*, while mean of lice recorded highest in *R. rattus* 1.9±0.9 and lowest in *M. musculus* 0 , beside mean of fleas recorded highest in *R. rattus* 0.07±0.07 and lowest in *R. norvegicus* 0.07±0.09 , finally *R. rattus* had the highest mean of tick 0.3±0.1 ; The results also shown higher lice ,mites ,fleas and tick means of *R. rattus* rather than of *R. norvegicus* but not statistically significant (P=0.231) at 0.05 level with t-test.

Table (1) . Numbers of different rodents ectoparasites orders.

rodents	lice	mites	fleas	tick	total
Rattus norvegicus	**78**	**78**	**4**	**2**	**162**
Rattus rattus	**59**	**74**	**2**	**4**	**139**
Mus musculus	**0**	**5**	**0**	**0**	**5**
total	**137**	**157**	**6**	**6**	**306**

Table (2) . Means of different rodents ectoparasites orders.

rodents	lice	mites	fleas	tick
Rattus norvegicus	**1.4±0.7**	**1.4±0.8**	**0.07±0.07**	**0.04±0.05**
Rattus rattus	**1.9±0.9**	**2.4±1**	**0.07±0.09**	**0.3±0.1**
Mus musculus	**0**	**2.5±6.4**	**0**	**0**

Ectoparasites were identified as following , lice species , *Hoplopleura oenomydis* (n=44), *H. acanthopus* (n=20) , *polyplax spinulosa* (n=73) with highest indices 0.55 in *R. rattus* and 0.25 in *R. norvegicus* ; mites species , *Dermanyssus gallinae* (n=42) , *Ornithonyssus bacoti* (n=79) with highest indices 0.42 in *R. rattus* and 0.38 in *R. norvegicus* , *Laelaps echidnina* (n=36) ; fleas as , *Xenopsylla cheopis* (n=6) with with highest index 0.04 in *R. norvegicus* ; *Hyalloma asiaticum asiaticum* (n=6)with highest index 0.3±0.1 in *R. rattus* , shown in table(3), fig.(1) .

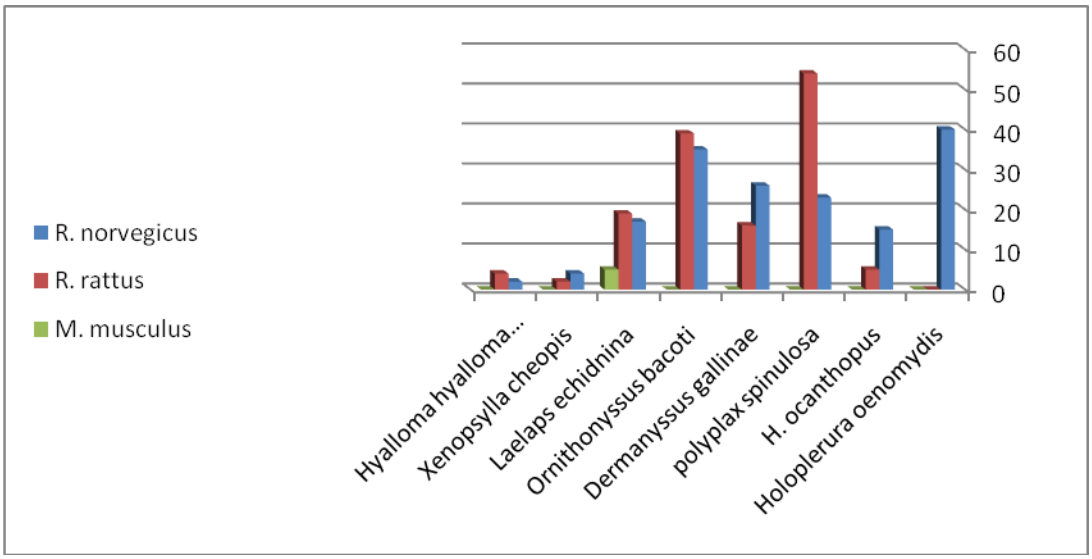

Fig. 1. Numbers of different rodents ectoparasites species.

Table (3). Numbers of different rodents ectoparasites species

	Rodent species			
Ectoparasite species	***R. norvegicus***	***R. rattus***	***M. musculus***	**total**
lice				
Hoploplerura oenomydis	**40**	**4**	**0**	**44**
H. acanthopus	**15**	**5**	**0**	**20**
Polyplax spinulosa	**23**	**50**	**0**	**73**
mites				
Dermanyssus gallinae	**26**	**16**	**0**	**42**
Ornithonyssus bacoti	**35**	**39**	**5**	**79**
Laelaps echidnina	**17**	**19**	**0**	**36**
fleas				
Xenopsylla cheopis	**4**	**2**	**0**	**6**
tick				
Hyalloma asiaticum asiaticum	**2**	**4**	**0**	**6**
total	**162**	**139**	**5**	**306**

The rates and indices used were calculated as follows: Prevalence (Bush *et aI*., 1997) of a given species of ectoparasites = (number of rats infested with this particular species/total number of collected rats) X 100 ; General index of a given species of ectoparasites = collected number of this particular species/total number of collected rats ; Prevalence & General index of lice , mites , fleas and ticks of the rodents species are shown in the table (4) : Statistically significant differences ($P = 0.008$) with chi square , and Kruskal-Wallis one way analysis of variance on rank ($P < 0.001$) at 0.05 level between one or two means of lice , mites , fleas and ticks of *Rattus norvegicus* , *Rattus rattus* & *Mus musculus* .

Table (4). Prevalence and index of different rodents ectoparasites species

	Rodent species					
	R. norvegicus (n=58)		*R. rattus* (n=31)		*M.musculus* (n=2)	
Ectoparasite species	**prevelance**	**index**	**prevelance**	**index**	**prevelance**	**index**
Lice						
Hoplopleruraoenomydis	**8.8**	**0.04**	**5.5**	**0.04**	**0**	**0**
H. acanthopus	**6.6**	**0.16**	**1.1**	**0.05**	**0**	
polyplax spinulosa	**9.9**	**0.25**	**23.1**	**0.55**	**0**	**0**
Mites						
Dermanyssus gallinae	**6.6**	**0.29**	**6.6**	**0.18**	**0**	**0**
Ornithonyssus bacoti	**13.2**	**0.38**	**14.3**	**0.42**	**٢.2**	**0.05**
Laelaps echidnina	**5.5**	**0.19**	**3.3**	**0.21**	**0**	**0**
Fleas						
Xenopsylla cheopis	**4.4**	**0.04**	**2.2**	**0.02**	**0**	**0**
Tick						
Hyalloma asiaticum asiaticum	**2.2**	**0.02**	**4.4**	**0.04**	**0**	**0**

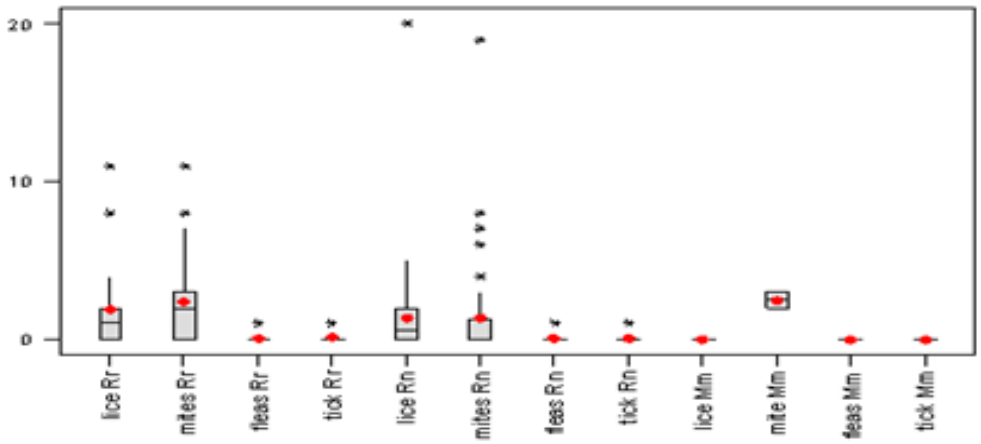

Fig.(2) .Boxplots of ectoparasites means.

Discussion:

Ectoparasite species recorded in this study as known vectors of zoonotic pathogens include the lice, mites , flea and ticks, with total general prevalence infestation (72.5%) ; from them *Rattus norvegicus* (n=33) with highest prevalence infestation (36.3%) , *Rattus rattus* (n=31) with prevalence infestation (34.1%), & *Mus musculus* (n=2) with lowest prevalence infestation (2.2%) .

Means of lice(1.9±0.9) , mites(2.4±1), fleas(0.07±0.09) and tick (0.3±0.1) were higher in *R. rattus* rather than in *R. norvegicus* , although they were not significant by t-test (P=0.231) , similar results were recorded by other authors El-Bahrawy and Al-Dakhil (1993) In urban areas of Riyadh ,Saudi Arabia were the highest infestation rate by mites was 49.9% on *R. rattus* followed by 18.5% on *R. norvegicus* and lowst 0.1 in *M musculus* ; our results disagree with Soliman *et*

aI.(2001) in Eygpt who found significant differences in same means in favour of *R. norvegicus* ; this diversity of catch rate and infestation rate to different ectoparasite could be due to depend on season, size of rodents, host preference, sex of host, host age, location of capture and co-evolution between rodent and ectoparasites (Soliman *et aI*.2001).

The Mean of mites was very low in addition to lice ,tick and fleas means were reported zero , this results agreed with results of El Kady *et al*. (2007) in Egypt who found only mites n=1 (0.16 mite/Mus) on *M. musculus* and also with Kia *et al* .(2009) in Iran who explained that with their satisfaction with another study in Egypt which revealed that *Rattus rattus frugivorus*, *R. norvegicus* and *Meriones shawi* were the most vulnerable hosts for ectoparasites while *M. musculus* harbored the lowest numbers of ectoparasites.

Regarding the individual species variations understudy ,The mite *Ornithonyssus bacoti* which is a significant etiology of human rat mite dermatitis cases (Watson 2008) had (n=79) with highest indices 0.42 in *R. rattus* and 0.38 in *R. norvegicus* ; and for the louse *polyplax spinulosa* (n=73) with highest indices 0.55 in *R. rattus* and 0.25 in *R. norvegicus* ; and in general , all mites and lice species means were recorded higher than results of kia *et al*.(2009) who found catch rate for lice 1.4% and for mites 8.7%; but our results agree with results recorded by other authors El-Bahrawy and Al-Dakhil (1993) were the highest rat-mite index was 2.3 on *R. rattus* followed by 1.3 on *R. norvegicus* and 0.1 on *Mus musculus* ; these differences with our study may be referred to the distribution of ectoparasites varied according to rodent host and location (El Deeb *et al*. 1999).

The lice do not bite humans but may be intra murid vectors of murine typhus and other zoonoses ; On the other hand in present results , even there was no significant difference in the total general index of the louse *P. spinulosa* between the 2 rat species but they were recorded the highest prevalence and indices among all collected ectoparasites and also reflects its impact on public health; This may be attributed to the fact that lice spend their entire lives on the individual host (Kim *et al*., 1986).

Understudy, the flea *Xenopsylla cheopis* ,vector of plague & rickettsial murine typhus had least indices 0.04 and 0.02 in *R. norvegicus* and *R. rattus* respectively agrees with results of Alahmed and Al-Dawood (2001) who found only 3 *X. cheops* on *R.rattus*; but it is disagree with El Kady *et al*. (2007) who mentioned in his study that the most abundant ectoparasite was *Xenopsylla* fleas n= 53 (0.76 flea/rat) , and also with kia *et al*. (2009) who noted 88.7% catch rate in *R. norvegicus* ; The present least index could be attributed to sever hot dry weather in Baghdad area.

The least tick indices results 0.04,0.02 in *R. norvegicus* and *R.rattus* respectively found were similar to results of other authors Alahmed and Al-Dawood (2001) in saudia but differ with many studies of authors El-Bahrawy and Al-Dakhil (1993) and Shoukry *et al*. (1993) who recorded two species of ticks (Immature stages) Rhipicephalus spp. and Hyalomma spp ; and El Kady *et al*. (2007) who reported

nymph of ticks n= 16 (0.12 tick/rat) ; The present least index of ticks could be attributed to sever hot dry weather in Baghdad area.

Conclusion: Among all arthropods collected, mites and lice had the highest then lowest frequency respectively regarding their role in public and veterinary health , while flea and tick had the least frequency ;Nearly 2 rodent species were infested with *Xenopsylla cheops* gives this flea a signal importance due to its role in plague and murine typhus transmission; Ticks are also important due to their role in CCHF (Crimean-Congo Hemorrhagic Fever), theileriosis, babesiosis, anaplasmosis and ehrlichiosis transmission .Monitoring of ectoparaiste infestation periodically is important for preparedness and early warning preparation for possible control of arthropod-borne diseases.

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