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THE PARASITIC FAUNA AND THE FOOD HABITS OF THE WILD JUNGLE CAT *FELIS CHAUS FURAX* DE WINTON, 1898 IN IRAQ

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ABSTRACT

A total of 72 specimens of the wild jungle cat *Felis chaus furax* De Winton, 1898 were examined for the purpose of this study. The results show that 55.6% of the sample harbored either single or mixed infections with ecto- and/ or endoparasites. The mode of infection shows that only four specimens(5.6% of the total sample) acquire single infections, the double infections comprise 15.3%, the triple infections comprised 33.3%, while the quadruplicate infections comprised 1.4%.

The systematic list of the parasites included six ectoparasites: *Ctenocephalides felis* (insect), *Sarcoptes scabiei* (mite), *Haemaphysalis adleri, Rhipicephalus leporis, Rhipicephalus turanicus* and *Hyalomma anatolicum excavatum* (ticks) and seven endoparasites: *Filaria felis* n. sp., *F. melis, Toxocara canis* (nematodes), *Mesocestoides* sp., *Taenia crassiceps* (cestodes), *Heterophyes dispar* (trematode), and *Oncicola* probably *travassosi* (acanthocephalan).

The meal of this cat in Iraq as revealed by the stomach analyses includes a wide variety of invertebrate and vertebrate preys belonging to 48 species of mammals, birds, reptiles, amphibians, fishes, insects, crustaceans, mollusks and scorpions as well as some fragments of vegetable food.

INTRODUCTION

The wild jungle cat *Felis chaus furax* De Winton 1898 is generally associated with the well-vegetated water environments including reed swamps, riverine forests, and dense jungles of tamarisk (Harrison, 1968). So, its expected distribution in Iraq is wide spread except that in the interior of the desert (Cheesman, 1920;Pitman, 1922;Sanborn, 1940; Hatt, 1959; Harrison, 1968). This species is not found in the Arabian Gulf countries (Harrison, 1981) probably due to predominance of pure sand desert environments. The ecological requirements of this cat are actually very broad. In Iraq, it was reported from the mountains up to 1600m at Rayat and Haj Omran, Erbil province in the north; from Himrin foothills at Kirkuk, Baquba, and Kut, and from Tarmiya riverine forests and orchards in the middle; and from the reed jungles of the marshes and open crop fields at Amara, Nasiriya and Diwaniya in the south. In an occasional report of the staff of Iraq Natural History Museum it is reported from Ain Tamur oasis in the desert which is, however, with dense date palm plantation.

Surprisingly, although of its common distribution and popularity as a game animal among hunters in Iraq, no work had been carried out in regard to its parasites except for some fragmentary records of ticks parasitized this cat (Hubbard, 1955;Hoogstraal and Kaiser, 1958; Mohammad, 1996).

The present work designated to give an idea on both ecto- and endoparasites along with some comments on the cat ecology, biology and diet utilized by this species in the middle of Iraq.

MATERIALS AND METHODS

A total of 72 specimens of the wild jungle cat were examined. Nine of them were shot at rural areas around Baghdad and Kut during the period from January 1998 to June 2000. These specimens were immediately kept in a large polyethylene sac to avoid escape of ectoparasites and then transferred to the laboratory as soon as possible for examination. The source of the rest of specimens was the Taxidermy section at Iraq Natural History Museum/ University of Baghdad which were received them from different individuals to be mounted during the past ten years. The taxidermists Mr. Saman R. Afrasiab and Mr. Salman Hamza at Iraq Natural History Museum kindly allowed the author to examine the specimens for their ectoparasites and also provided him with carcasses after slaughtering the skin in order to examine them for endoparasites. Mr. Afrasiab was so kind to identify the herpetofauna specimens of the stomach contents. Mrs. Azhar A. Saadallah of Ichthyology department, Iraq Natural History Museum, identified fishes. The author identified scorpions, ticks, mollusks, birds and mammals. The scientific names and classification of the vertebrate preys were according to Mahdi and George (1969). The recovered ectoparasites were kept in 70% alcohol, while the endoparasitic helminths were put in 1% warm normal saline for one hour to allow expanding, then transferred to 70% alcohol, stained with acetocarmine (cestodes and trematodes) or cleared with lactophenol (nematodes and acanthocephalans). Stomachs of the dissected specimens were separated, and their wet contents were isolated and weighed.

RESULTS

Examining of the studied specimens showed that 40 specimens of the wild jungle cat harbored either single or mixed infection with ecto- and / or endoparasites with a total infection rate of 55.6 %. The results on parasite groups and stomach contents are shown through tables 1-2.

The results on the mode of infection showed that only four specimens acquire single infections with either cestode or trematode parasite species and comprised 5.6% of the total sample (10% of the infected). The double infection with ticks, cestodes, nematodes, trematodes or acanthocephala appears in 11 specimens and comprised 15.3% (27.5% of the infected). The triple infection with insects, mites, ticks, cestodes, nematodes or trematodes appeared in 24 specimens and comprised 33.3% (60% of the infected). The quadruplicate infection with ticks, nematodes and acanthocephalans appears only in one occasion and comprised 1.4% (2.5% of the infected).

Table (1) summarized the results on species of parasites, their incidence, percentages of infection and the mean number of parasites/ host. It shows that the parasite species are 13 in number .The four tick species showed the highest infection rates as well as high mean number of parasites/ host, while *Sarcoptes scabiei* shows the lowest infection rate. Of this parasitic fauna, a filariid nematode is found to be a new for science and its description is given here:

Filaria felis n. sp. figs. 1- 4

Material: Five males and five females were recovered from subcutanous tissues of the shoulder region of three specimens collected near Kut city on May 1999.

Male holotype: Body length 72 mm, width 250 um, length of esophagus 6.5 mm, distance of nerve ring from the apical anterior end 125 um, right spicule 165 um, left spicule 800 um, length of caudal alae 5mm, tail 230 mm.

Female allotype: Body length 165 mm, width 425 um, length of esophagus 12.5 mm, distance of nerve ring from the apical anterior end 145 um, cervical dilatation is 2.5 mm from head apex, egg 55 x 47 um.

Tail of female is covered with a circle of spines. Tail of male with rounded blunt end. Postcaudal formation constituted from the fusion of caudal alae forming oval plate. The left

wing is longer than the right one. First and second pairs of postcloacal papillae are slightly oblique. Egg elongated with thick external shell. Type specimens were kept in the collection of the Invertebrates and Parasitology section/ Iraq Natural History Museum/ Baghdad, vial No. INHM/INC 193.

Table (2) represents a systematic list of the preys utilized by the studied specimens. The percentage weight of each prey species to the total stomach contents weight is then calculated as a mean. It is obvious that rodents comprised the major food components of this cat and constituted 41.3% of the meal, followed by apparently juveniles of larger mammals and certain birds such as *Lepus capensis*, *Francolinus francolinus arabistanicus* and *Streptopelia decaocto* while mollusks and scorpions constitute the lowest percentage of the meal.

Table 1: Species of parasites, percentages of infection, and intensity of infection.

Parasite species	No. hosts infected	% infection	Mean (range) of intensity
Ectoparasites			
Insecta			
Ctenocephalides felis	2	2.7	7.5 (4-11)
Arachnida			
Sarcoptes scabiei	1	1.4	many
Haemaphysalis adleri	12	16.7	24.5 (3-24)
Rhipicephalus leporis	8	11.1	2.25 (1-6)
Rhipicephalus turasnicus	16	22.2	31.0 (14-51)
Hyalomma anatolicum excavatum	3	2.7	3.3 (2-4)
Endoparasites			
Nematoda			
Filaria melis	3	4.2	2.3 (1-4)
Filaria felis n. sp.	3	4.2	3.3 (2-5)
Toxocara canis	2	2.8	6 (4-8)
Cestoda			
Taenia crassiceps	4	5.6	5.5 (3-7)
Mesocestoides sp.	4	5.6	1.3 (1-2)
Trematoda			
Heterophyes dispar	2	2.7	4.0 (1-7)
Acanthocephala			
Oncicola prob. *travassosi*	1	1.4	4.3 (2-8

Table 2: A systematic list of preys found in the stomachs of the specimens of wild jungle cat examined in the present study and its percentage of the cat meal.

Systematic list	Percentage
Phylum Arthropoda	
Class Insecta	
Order Coleoptera	
Family Carabidae	
Scarites sp.	0.8
Family Cantharidae	

Anthia sp.	0.7
Order Orthoptera	
Family Gryllotalpidae	
Gryllotalpa gryllotalpa	*1.5*
Class Crustacea	
Order Decapopda	
Family Potamidae	
Potamon sp.	0.4
Class Arachnida	
Order Scorpionida	
Family Buthidae	
Androctonus crassicauda	0.03
Mesobuthus eupeus	0.01
Orthochirus scorbiculosus	0.02
Family Scorpionidae	
Scorpio maurus	*0.04*
Order Acari	
Family Ixodidae	
Hyalomma anatolicum excavatum	—
Rhipicephalus turanicus	—
Phylum Mollusca	
Class Gastropoda	
Order Pectinibranchiata	
Family Viviparidae	
Viviparus beneghalensis	0.1
Phylum Chordata	
Class Pisces	
Order Cypriniformes	
Family Cyprinidae	
Barbus sp.	0.6
Cyprinus carpio	0.4
Family Siluridae	
Silurus triostegus	0.6
Family Bagridae	
Mystus sp.	0.5
Famiy Heteropneustidae	
Sacchobranchus fossilis	0.9
Order Cyprinidontiformes	
Family Muglidae	
Liza abu	0.7
Order Mastacembeliformes	
Family Mastacembelidae	
Mastacembelus mastacembelus	0.1
Class Amphibia	
Order Anura	
Family Bufonidae	
Bufo viridis	0.1
Family Ranidae	
Rana ridibunda	0.1
Class Reptilia	

Order Squamata	
Family Scincidae	
Mabuya aurata	0.5
Eumeces schneiderii	0.5
Family Lacertidae	
anthodactylus sp.	0.5
Family Boidae	
Eryx jaculus	0.7
Famiy Colubridae	
Coluber ventromaculatus	0.5
Natrix tessellata	0.8
Class Aves	
Order Ciconiiformes	
Family Ardeidae	
Ardeola ralloides	0.7
Bubulcus ibis	0.9
Order Anseriformes	
Family Anatidae	
Anas angustirostris	0.9
Order Galliformes	
Family Phasianidae	
Ammoperdix griseogularis	1.0
Francolinus francolinus	4.5
Gallus domesticus	0.5
Order Gruiformes	
Family Rallidae	
Gallinula chloropus	2.2
Fulica atra	2.6
Order Charadriiformes	
Family Charadriidae	
Vanellus leucurus	1.0
Hoplopterus spinosus	0.9
Family Recurvirostridae	
Himantopus himantopus	0.6
Family Glareolidae	
Glareola pratincola	0.4
Order Columbiformes	
Family Pteroclididae	
Pterocles alchata	1.5
Family Columbidae	
Columba livia	1.9
Columba palumbus	2.2
Streptopelia decaocto	4.8
Order Coraciiformes	
Family Meropidae	
Merops superciliosus	0.8
Order Passeriformes	
Family Ploceidae	
Passer domesticus	1.6
Class Mammalia	
Order Lagomorpha	

The Parasitic Fauna	
Family Leporiade	
Lepus capensis	5.2
Order Rodentia	
Family Muridae	
Apodemus mystacinus	12.1
Rattus rattus	8.7
Rattus norvegicus	6.3
Mus musculus	12.2
Total	86.2%
Unidentifiable animal material	11.3%
Plant origin material	2.5%

DISCUSSION

Except for the interior of deserts, the wild jungle cat has a wide distribution in Asia and Africa and utilizes many different biotopes. However, only few attempts to investigate the parasitic fauna were carried out. These include Gupta & Kazim (1980) who recorded *Toxascaris leonina* and Shaikh *et al.* (1982) who examined the incidence of helminths.
The high infestation rate of the total sample may be related primarily to the infestation with ticks (table 1) which seems high. Mohammad (1996) reported similar result.

Results on the mode of infection showed different ranks of single, double, triple and even quadruplicate infections. This is simply explained by the wide range of biotopes utilized by the host and also by the wide variety of its food items. This is in accordance with Mundhenke & Daugschies (1999) who found that polyinfections in domestic cats occurred more frequently in the rural areas than in the city. Also, Delahay *et al.* (1998) found that differences in habitat preference and diet were among factors that affect the prevalence and abundance of helminth parasites in wild-living cats in Scotland.

This cat is partially diurnal (Ognev, 1935) and feed mainly on rodents (Ishunin, 1965; Schaller, 1967; Khan and Beg, 1986). However, the meal of this species in Iraq as revealed by the stomach analyses of the 72 specimens of this study includes a wide variety of invertebrate and vertebrate preys belonging to three phyla, nine classes, 21 orders and 33 families (table 2) of mammals, birds, reptiles, amphibians, fishes, insects, mollusks and scorpions as well as some fragments of vegetable food such as cucumber and water melon. This would contribute to the diversity of endoparasitic fauna and to a lesser extent to the ectoparasites as well, although the infestation with different ectoparasites is related directly to the different biotopes utilized by the cat. Two species of ticks found in the stomach contents were of negligible weights. They might be accidentally swallowed with their original host/s, which are most likely mammalian prey species.

The high ratio of birds in the meal of this cat may be directly correlated to the observation of Harrison (1968) who stated that the cat is more often seen hunting in daylight than most wild cats. This is partially supported by field observations of the author. In many instances, the cat hides during daytime in a straw heap waiting for the walking black partridge *Francolinus francolinus arabistanicus*. This observation is also true for many species of birds. In this regard, it is of importance to refer to Harrison's (1968) statement that " this cat is found exactly in the same terrain as that favored by the black partridge".

As shown through present results on stomach contents, the rodents seem to be the primary food since they comprise 41.3% of the meal. This is in accordance with Ishunin (1965), Schaller (1967) and Khan and Beg (1986). In his study on a related species, the European wild cat *Felis silvestris* Schreber, 1777 in Portugal, Sarmento (1996) found that rodents were the dominant components of the diet and represent 55% of the relative consumed biomass

followed by lagomorphs which constitute 28.7%, while reptiles, birds and insectivores together constitute 16.3% of the consumed biomass. In this study in regard to the weight, the mammals although they are only five species, they comprise 44.5% of the meal, followed by birds 29%, fishes 3.8%, reptiles 3.5%, insects 5%, crustacea 0.4%, amphibia 0.2%, mollusks 0.1% and scorpions 0.1%. Harrison (1968) considered this cat as a predator of domestic poultry. In this study, no domestic poultry was found in the stomach. The animal material in the stomach contents constituted 97.5%. Of them, 11.3% were impossible to identify including bird eggs of unknown species. This relatively high percentage of the unidentifiable animal diet perhaps would make the meal list rather longer.

In this study, plant origin material and insects constitute 5.5% of the diet of *Felis chaus furax* in Iraq, while they were unimportant items of the diet of *Felis silvestris* in Portugal (Sarmento, 1996). This reflects the environmental conditions and food availability differences of the two areas as well as their specific allopatry.

No reports were available on endoparasites of wild jungle cat in Iraq, but only few studies concerning helminths in the gastrointestinal canal of domestic cat, *Felis catus* L. had been carried out (Shaheen *et al.*, 1962; Babero *et al.*, 1963; Al-Berwari and Nassir, 1983; Al-Saeed, 1983; Daoud *et al.*, 1988). Recording of *Filaria melis* Chabaud & Mohammad, 1989, *Taenia crassiceps* (Zeder, 1800); *Mesocestoides* sp. ; *Heterophyes dispar* Looss,1902 and *Oncicola* prob. *travassosi* Witenberg, 1938 from the wild jungle cat *Felis chaus furax* represent new host records.

The genus *Filaria* Gmelin, 1790 is known from various mammals (Chabaud and Mohammad, 1989). Its species taxonomy are rather misleading and confusing. Some authors recognized only two species while others acknowledge plurality of species. The filariid nematode *Filaria felis* n. sp. is considered here as a new species. It is related to *Filaria latala* Chabaud and Mohammad, 1989 (figs. 5-8) recovered from lions *Panthera leo* (L.) in South Africa, but it differs from it in the following: 1. In male specimens, it has a distinctive circular blunt end of the tail, 2. It is with shorter asymmetrical pedunculate male caudal papillae, 3. Presence of small concavity at the apical end of the female anterior extremity, 4. Muscular and glandular parts of esophagus are not macerated 5. The posterior end of the tail of female is with laterally situated circle of spines instead of terminal situation.

Four males and three females of *Filaria melis* were also recovered subcutaneously from the shoulder region of three hosts collected on January 1998 at Baghdad City. This nematode was originally described from honey badger *Meles meles* (L., 1758) in Baghdad area by Chabaud and Mohammad (1989). They found the parasite subcutaneously in the shoulder region also. The infection with *F. melis* is not surprising since Harrison (1968) mentioned that this cat utilizes the empty burrows of other mammals such as badgers and porcupines and thus it is exposed to the bites of the probable insect intermediate hosts which are available nearby. This finding indicates that this parasite may have a good distribution among the wild carnivora of Iraq, since the two mentioned hosts are wide apart phylogenetically from each other.

Chabaud and Mohammad (1989) pointed out that *Filaria* spp. which were reported from carnivores of Americas and Africa either without description or giving only insufficient description. They stated also that in contrast to the Ethiopian region in which the genus *Filaria* is found in different kinds of mammals, it is absent in Oriental region and Australia and presents only in fissipeda of Palearctic, Nearctic and Neotropical regions.

Toxocara canis was reported from wild cat *Felis silvestris*, *F. onca*, Iberian lynx *Lynx pardinus*, red fox *Vulpes vulpes*, wolf *Canis lupus* and jackal *Canis aureus* (York and Maplestone, 1962; Papadopoulos *et al.*, 1997; Pfeiffer *et al.*, 1997; Lassing *et al.*, 1998; Rodriguez & Carbonell, 1998). However, the infection rates of mentioned studies which ranged from 26.5 – 46.8% vary widely with the one reported here (2.8%). The difference may reflect the difference in potentiality of both of the environments of Europe and Iraq.

The Parasitic Fauna

The cestode *Taenia crassiceps* was frequently reported from the red fox *Vulpes vulpes* L. (Yamaguti, 1959; Papadopoulos *et al.*,1997; Lassing *et al.*, 1998). Infection rates varied considerably between the wild jungle cat in this study (5.6%) and the red fox in Lassing's *et al.* (1998) study (14.6%). This may be related to different feeding habits of these two carnivores. Yamaguti (1958) found larval stages of this cestode as small bladders beneath skin of six species of rodents including *Mus musculus* and one species of fishes. In this study, both of rodents and fishes, the suspected intermediate hosts constituted 41.3% and 3.8% in weight of prey, respectively. The another cestode, *Mesocestoides* sp. was recorded from a wide range of wild carnivores as well as dogs and cats (Yamaguti, 1958; Papadopoulos *et al.*, 1997; Lassing *et al.*, 1998).

The trematode *Heterophyes dispar* is with relatively low rate of infection. Yamaguti (1958) reported it from dogs and cats in Egypt. He found the metacercariae in five genera of fishes, among them *Mugil & Barbus* which are listed in the wild cat food items in the present study. This low rate of infection coincides with the percentage share of these fishes which represent 0.7% and 0.6% respectively.

Although the infection rate of *Oncicola* prob. *travassosi* represents the least rate among other parasites, this acanthocephalan seems with a good distribution in the Middle East region since it was reported from Palestine from *Felis bubstis* (Yamaguti, 1963).

The high infestation rate of ectoparasites which comprises 56.78% of the total number of hosts (table 1) is not surprising since the empty burrows of other mammals such as badgers and porcupines may be sometimes employed as den instead of the usual thick dry vegetation (Harrison, 1968). This may support infection with ticks and other ectoparasites that associate with these hosts. Another factor may contribute to this high infestation rate is the wide variety of the meal list utilized by this cat which included many potential hosts of ectoparasites.

The mite *Sarcoptes scabiei* causes sarcoptic mange in a wide variety of mammals (Arlian, 1989; Lane & Crosskey, 1993). Although this mite was recorded frequently from carnivores (Arlian, 1989; Little *et al.*, 1998 a & b; Baker *et al.*, 2000) it is the first time to the best of the author's knowledge that is reported from *Felis chaus.* The low rate of infestation in the present study with this mite may be related to that the author overlooked them in the skins of the taxidermy section provided specimens, which constitute 84.4% of the total sample. Therefore, it is reasonable to assume that the normal rate of infestation with sarcoptic mange in free living *Felis chaus* in Iraq is higher than the figure presented here.

Hubbard (1955) and Hoogstraal and Kaiser (1958) reported the following ixodid ticks from the wild cat *Felis chaus* in Iraq: *Haemaphysalhs adleri* Feldman-Muhsam,1951, *Ixodes* sp., and *Rhipicephalus sanguineus* (Latreille,1806). Then Mohammad (1996) added *Rhipicephalus turanicus* Pom., 1940 to the list. The present study adds other two ticks: *Hyalomma anatolicum exxcavatum* and *Rhipicephalus leporis.*

The cat flea *Ctenocephaloides felis* is the most important medical and veterinary synanthropic ectoparasite of domestic cats and dogs worldwide and responsible for many nuisances including bites or transmission of pathogenic agents (helminths, protozoa, bacteria) to man or domestic carnivores (Rust & Dryden, 1997; Farkas, 1999; Menier & Beaucournu, 1999). Many attempts were carried out to interrupt the flea life through preventing the introduction and establishment of new infestations in a household environment using insecticides (Guerrini & Kriticos, 1998; McTier *et al.*, 2000; Shanks *et al.*, 2000). It is appropriate to mention here that the cat flea was collected by the present author from the domestic cat, *Felis catus*, Indian mongoose , *Herpestes auropunctatus* and Norway rat, *Rattus norvegicus.*It was reported also from the domestic cats in Amman, Jordan (Morsy *et al.*, 1980).

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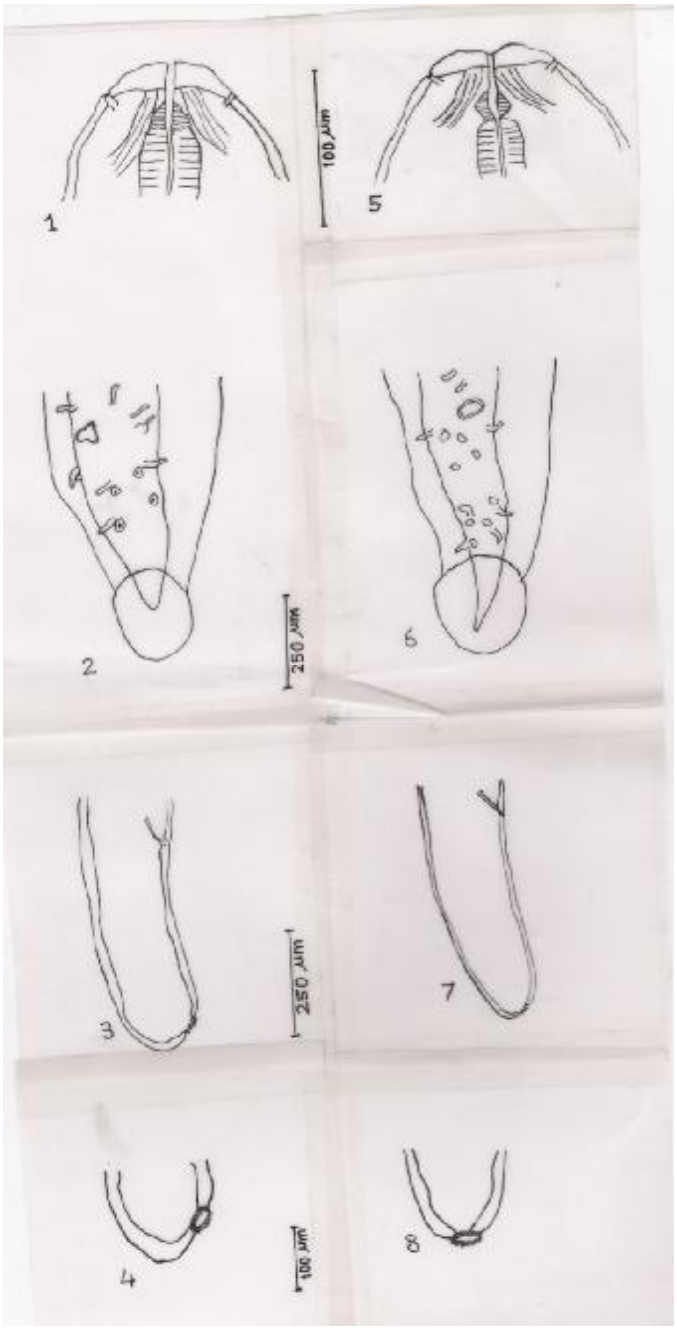
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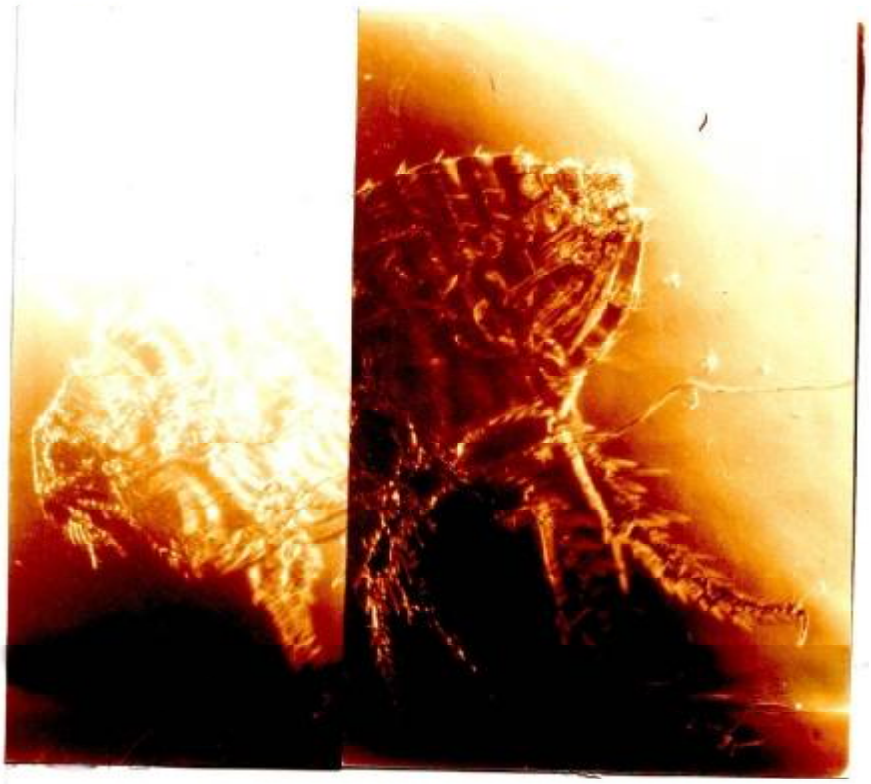

Fig. 9: The cat flea, *Ctenocephalides felis*

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قار ع ل ا ي يشحو لا لمرطلأا قلة يلغ لا ا د ا عو يلا يفط ل ةومجملا

د محم مظ ا كد محم

مي ع يطاالخير ر تالفحـ ت– داللغ بقعماجـ ظ ع لاب ا ب– د الملغ بـقلرعط ا

ةصلاخ لا

ص ف تم ٧٢ هلم ي حـ و ا شرا حـ لطـ ق ن لذونمنا بج ئا نلا تـ رهظ أ لقوقه ا دلا ا ٥٥% و ا ةيجولختـ ا يلـ يف لاب ط لمخ ا ةر فنه روصـ ب ا أ بطـ م نك ةحوفخ لـ ةنيعلاا ن م ةيلخ لدلا. ناـ بدجو ةـ فـة بصلإ ازاطـ ل بسـ ن ابو ٥٥.٦% و ة در فـ م ةبا لتبسـ ا ١٥.٣% و تجو زم ة با إ ٣٣.٣% و ةيـ ثـ ث ةبا إ ٤,١% ة يعا ب ةبطـ إ.

ت لمشـ ا ةعبسـ يلخدلاا ت ي لـ يفطلا ةمئ قتحضـ لمنيبـ ع ا و أة تمـ ةيجرلخاا ت يلـ يفطلا مئاق علو ً ٤٨ أ ظـ رتحـلتإ لاطعـ دوجو لمـ لمو معـ ا فرأ ئا ا لل يرقف ولاا فريةـ ت ود ا ىلـ .أزوعا م ن اللد لبـ ن واطـيو لو ز واحفو ا لربم ئا ا تـ وأ لأا كولحشلرت و ا ليقشلا واد ناو م ولعةق ر ب ظلإ ا يتبا بـ ل ا ءا ا ذ لاا ن معط لضرع ىلا ةف ا.