

A survey of chewing lice of some raptors in southern Iraq, with remarks on prevalence and occurrence

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Abstract

This study was conducted to isolate and identify the chewing lice from some raptors in Basrah, Thi-Qar, and Missan provinces located in south of Iraq. Samples of birds were collected from January to December 2018. The survey was accomplished with a total of 87 raptors belonging to five species, sparrow hawk *Accipiter nisus*, marsh harrier *Circus aeruginosus*, lesser kestrel *Falco naumani*, kestrel *Falco tinnuculus*, and black kite *Milvus migrans*. Totally 58 of 87 birds were infested with chewing lice, the overall prevalence was 66.67%. Five chewing lice species were identified: *Craspedorrhynchus platystomus*, *Degeeriella fulva*, *Degeeriella fusca*, *Degeeriella rufa*, and *Laemobothrion maximum*. All these species were identified in Iraq for the first time. *D. rufa* was recorded the highest prevalence in all raptors with 28.74%, whereas *C. platystomus* was the lowest 10.34%. As for the prevalence of bird's species, the highest percentage was recorded in kestrels and black kite with 71.43%, while sparrow hawk was the lowest 53.85%. Some notes about ecology and occurrence of the chewing lice were reported.

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Introduction

The lice (order: Phthiraptera) are adapted successful insect ectoparasites of birds and mammals. This order is divided into four suborders: Anoplura, Amblycera, Ichnocera and Rhynchophthirina (1). The Anoplura is described as sucking lice, Amblycera and Ichnocera are described as chewing lice, and they are usually described into one suborder called Mallophaga (2). Chewing lice are permanent obligate ectoparasites (3). These parasites constitute about 3500 species of chewing lice worldwide (4). Many species of lice exhibit a high degree of host specificity. The life cycle of lice is complicated on the body of the host (5). Chewing lice have mouthparts designed for biting; they feed on feathers and dermal debris (6). These parasites can be harmful to domestic and wild birds; they can cause some pathological effects (2). These conditions cause some changes in body mass, flight performances; thermoregulatory capacity, and survival (1,7). Sometimes could lead to serious problems, even to death in birds, and

decreased egg production (5). Migratory birds were played an essential role in the parasite transmission to domesticated birds and fishes (7). The birds in Iraq were very diverse and may number 410 species (8). Birds were infected with a wide variety of ectoparasites such as lice, mites, ticks, hippoboscids, flies, fleas and fly larvae (1). The previous studies of raptors in Iraq focused on identification and distribution of these birds. The information about parasitic infections of raptors in Iraq is very limited. Therefore, the aims of current study to identify the species diversity of the chewing lice fauna of raptors collected from three provinces located South of Iraq, Basrah, Thi-Qar, and Maissan provinces.

Materials and methods

Study area

This study was conducted in three provinces located at South of Iraq: Basrah, Thi-Qar and Maissan. This area is confined approximately within 45°-49° longitude and 30°-33° latitude. In this region are the Tigris, Euphrates, Shatt al-

Arab rivers, and some of permanent and seasonal marshes. Although it's surrounded by Arabian Desert, the western mountains of Iran coalesces, and Arabian Gulf. The lands of this region are agricultural plains, semi-desert lands and deserts.

Raptors collection

This study carried out between January to December 2018. Raptors were borrowed from amateur people in the collection and breeding of birds, from 13 locations in South of Iraq. A total of 87 specimens belonging for five species obtained during the survey. Two of the birds' species are endemic: marsh harrier *Circus aeruginosus*, and kestrel *Falco tinnuculus*. Other three species are migratory: sparrow hawk *Accipiter nisus*, lesser kestrel *Falco naumani* and black kite *Milvus migrans*.

Collection and Identification of chewing lice samples

The birds were accurately examined for the chewing lice infestations. The beak and legs of the bird were restrained by adhesive tape for 30-60 minutes, so that the body could be easily held. The examination involved a search on body regions of bird: head, neck, abdomen, breast, wings, and tail. The lice preserved in 70% ethanol, then cleared in 10% KOH and washed with distilled water, passed in ethanol series 70%, 80%, 90% and 100% (9,10). Some of lice specimens mounted on slides in Canada balsam and examined by compound microscope to use them in the diagnosis. The identification of chewing lice species was carried out according to some studies (9-13). The most diagnostic characters were used in the identification of lice as follows, body size, head shape, sutures, antenna, setae, terga, sternal plates and ganglia.

Study of parasitism measures of chewing lice

The total prevalence of chewing lice infestations of all raptors was recorded, and of each species of chewing lice. Some important measures of parasitism were recorded according to the following equations (5,6,14). Prevalence = number of individuals of a raptor species infested with a particular chewing lice species ÷ number of raptors examined. Mean of intensity = total number of individuals of a particular lice species in a sample of a raptor species ÷ number of infested individuals of the raptor species in the sample. Relative density = total number of individuals of a particular lice species in a sample of raptor ÷ total number of individuals of the raptor species (infested + uninfested) in the sample. The location or attachment site of biting lice species in the bird's body and concurrent infestation was observed.

Study of the seasonal occurrence

Temperature means and relative humidity rates for the months in the study period were adopted by Iraqi meteorological organization and seismology in Basrah

Airport. The occurrence of infestations during the months of the year was recorded, and observed the relationship between the occurrence of infestations and the variations in temperature and relative humidity.

Statistical analysis

The results were analyzed with t test and chi-square analysis by using SPSS program (computerized Statistical Program for Social Sciences). P value <0.05 was considered to be least limit of significance. The Yates correction factor was incorporated into the chi-square calculation, whenever the test possessed less than two degrees of freedom.

Results

Prevalence and diversity of chewing lice in raptors

The results of the study showed that chewing lice were infested 58 of 87 specimens of raptors with total prevalence 66.67%. Five species of chewing lice were isolated. The species recorded in this survey were as follows: *Craspedorrhynchus platystomus* Burmeister, 1838, *Degeeriella fulva* Giebel, 1874, *Degeeriella fusca* Denny, 1842, *Degeeriella rufa* Burmeister, 1838 (family: Philopteridae), and *Laemobothrion maximum* Scoli, 1763 (family: Laemobothrionidae) Figures 1-5. All the species were recorded in Iraq for the first time.



Figure 1: *Craspedorrhynchus platystomus* male (10X).



Figure 2: *Degeeriella fulva* female (10X).



Figure 3: *Degeeriella rufa* female (10X).



Figure 4: *Degeeriella fusca* male (10X).



Figure 5: *Laemobothrion maximum* female (4X).

Measures of parasitism of lice species

Table 1 showed the total numbers of chewing lice specimens collected in the study. The species *D. rufa* was recorded the highest prevalence of lice in studied raptors with 28.74%, while *C. platystomus* was the lowest

abundance with 10.34%. Statistical analyzes showed a significant difference between the prevalence of *D. rufa* and the other species, which did not differ significantly between them. The mean of intensity of chewing lice infestation was 5.24 in *D. rufa*, whereas the lowest was 3.36 in *D. fulva*. Based on statistical analysis of lice collection data, some significant differences were found between the mean of intensity of isolated lice species. The highest relative density of chewing lice was in *D. rufa* with 1.51, whereas the lowest in *D. fulva* with 0.43. The statistical analyzes showed a significant difference between the relative density of *D. rufa* and the other species, which did not differ significantly between them.

The infestations depending on the raptors species

Table 2 explained the numbers of infestation with chewing lice according the raptors species. The prevalence of infestations in each bird, it has been shown, the highest prevalence was recorded in *F. naumani* and *M. migrans* with 71.43%. Significant differences were recorded between the previous species with *C. aeruginosus*, and *A. nisus* which recorded the lowest prevalence 53.85%. Figure 6 show the diversity of chewing lice species infesting some raptors in southern Iraq. *Falco tinnuculus* and *Falco naumani*, *C. aeruginosus* and *M. migrans* have been infested with three species of chewing lice, whereas the two other raptors infested with two species. This figure also showed the numbers of infestation cases of lice species in the studied raptors. Figure 7 indicated that the patterns (concurrent) of infestations of raptors with chewing lice species were ranged between single to triple. The double infestations were the highest with 58.62% followed by single then triple. Based on statistical analysis of lice collection data, a significant differences were found between the types of concurrent infestations of raptors with isolated lice species.

Ecology of chewing lice

Table 3 showed some variations in the chewing lice infestations on the bodies of raptors. The infestations were recorded in many sites of the birds' body. *D. fulva* and *D. rufa* was collected from four sites on the raptors bodies, while *L. maximum* was founded in the wings only. The head is the most site of the bird's body in which chewing lice are present, where they found four species. While the lowest is the lower abdomen, where there is only one species.

Table 1: Total presence of chewing lice species isolated from examined raptors in southern Iraq

lice species	No. examined raptors	No. infested raptors	Prevalence %	No. collected lice	Mean of intensity	Relative density
<i>C. platystomus</i>	87	9	10.34	45	5.00	0.52
<i>D. fulva</i>	87	11	12.64	37	3.36	0.43
<i>D. fusca</i>	87	10	11.49	45	4.50	0.52
<i>D. rufa</i>	87	25	28.74	131	5.24	1.51
<i>L. maximum</i>	87	13	14.94	55	4.23	0.63

Table 2: Prevalence of raptors infestation with chewing lice in southern Iraq

Raptor species	No. examined	No. infested	Prevalence %
<i>A. nisus</i>	13	7	53.85
<i>C. aeruginosus</i>	16	10	62.50
<i>F. naumani</i>	21	15	71.43
<i>F. tinnuculus</i>	23	16	69.57
<i>M. migrans</i>	14	10	71.43
Total	87	58	66.67

Table 3: Distribution of chewing lice species in the bodies of the raptors studied depending on the site of attachment (+) Indicate the presence of lice infestation at this site of the bird's body, (-) no infestation

Lice species	Head	Neck	Wing	Breast	Abdomen	Tail	Anus
<i>C. platystomus</i>	+	+	-	-	-	-	-
<i>Degeeriella fulva</i>	+	-	+	-	-	+	+
<i>Degeeriella rufa</i>	+	+	+	+	-	-	-
<i>Degeeriella fusca</i>	+	+	-	-	+	-	-
<i>L. maximum</i>	-	-	+	-	-	-	-

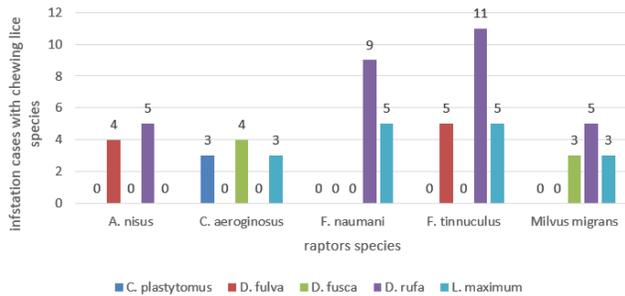


Figure 6: The diversity of chewing lice species infesting some raptors, and the number of infestation cases.

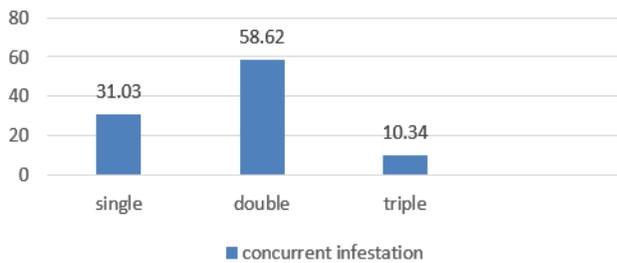


Figure 7: Concurrent infestation of chewing lice species in the examined raptors.

The seasonal occurrence of chewing lice

Figure 8 revealed that isolation of chewing lice from collected raptors from southern Iraq has been concentrated in the autumn, winter and spring months (when temperature varied between 12°-30°). In January and February, the highest occurrence of chewing lice collection was recorded with 20.69%, followed by December 18.97%. The results of the statistical analysis showed that the rates of lice collection

in these three months significantly exceeded that collected in the rest of the year. No samples of chewing lice were collected in August.

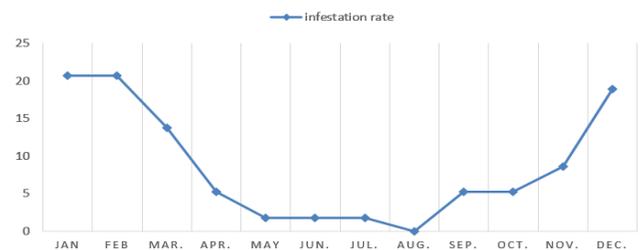


Figure 8: Seasonal occurrence of chewing lice on some raptors studied in southern Iraq for the period from January to December 2018.

Discussion

The results of the present study show a variety of chewing lice species infesting raptors in southern Iraq. The diversity of chewing lice species on raptors may be due to some reasons, including host defense, body size and shape and amount of feathers (13). Some reports have demonstrated significant correlations between lice species diversity and host body size, local population density, and geographic range size (6). There are a correlation between the abundance and species richness, and that between the mean abundance and host body mass (14). In this regard, Dik (9) showed that many chewing lice usually parasitize on specific host, but some can found on different hosts. Some studies about the chewing lice in Iraq, and focused on chicken and pigeons. In southern Iraq there are few studies on chewing lice. In Basrah Province there were four studies about the chewing lice were conducted, all these researchers

studied on chickens and pigeons only. In Thi-Qar province, Mohammad (15) were studied the abundance of chewing lice on some aquatic birds. Of global studies on external parasites of raptors, Morishita *et al.* (16) isolated ten species of lice in California State. Gonzales *et al.* (17) studied chewing lice in diurnal raptors in Chile. Dik *et al.* (9) identified ten species of lice from some raptor birds in Turkey. De Olivera *et al.* (18) isolated three species of lice from hawks in Mexico. Liebana *et al.* (19) recorded two species in Argentina from kestrels. Grisign *et al.* (20) recorded nine species of lice from wild birds in North of Turkey. Tomas (21) founded seven species in raptors in Portugal.

The results also explained that lice species varied in attachment sites of the birds' body. The high prevalence of chewing lice on birds is complex with the fact that they are not given any form of body treatment (1). The ability of lice to stay attached to the host may also control analyses of Harrison's Rule in swift lice reveal a big correlation (13). Some species attached to bird feathers by means of a tarsal claws, and a close match between lice and host size may be preserve by selection for coherence, staying attached during bird flight (12). The correlation between louse and bird size in the genus *Columbicola*, is likely selected by bird preening, since wing of lice escape preening by inserting between the barbs of feathers (6). The population of lice affected with some factors though to influence population dynamics and age structure (8). Some differences between chewing lice in attachment sites of raptors bodies (6). Lice populations are normally controlled by host grooming and other factors, increasing in louse populations can degrade host condition, reproductive success and survival (22).

The difference in the seasonal occurrence of chewing lice during the study period is due to the monthly presence of raptors. The migration of birds due to climatic conditions may affect the seasonal occurrence, distribution and diversity of chewing lice (23). The ecological conditions, temperature and humidity are very important to determine seasonal variation of chewing lice infestations (6). High temperature with low humidity are effected in the lice abundance (24). The geographical location and seasonality may be responsible for distribution of infestation rates of chewing lice (25,26). There may be several other factors affecting the presence of chewing lice on raptors, including the size of the body of the bird and its shape, behavior and habitat (23,27).

Conclusion

This study concludes that high prevalence of chewing lice on raptors in South of Iraq. These birds may also be acting as reservoir hosts for ectoparasites transmission to domestic birds because they are migratory, and some are epidemic. This information will therefore be interesting to evaluate the effects that these parasites on birds' health, and also to establish the type of diseases they transmit between

different birds. The results of the present study may contribute to the increased understanding of epidemiology of ectoparasites of the birds in Iraq.

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Conflict of Interest

The authors assert that there are no conflicts of interest with other researchers or institutions.

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مسح للقمل القارض في بعض الطيور الجارحة في جنوب العراق مع ملاحظات حول الانتشار والتواجد

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الخلاصة

أجريت هذه الدراسة لعزل وتشخيص القمل القارض من بعض الطيور الجارحة في محافظات البصرة وذي قار وميسان، جمعت عينات الطيور في الفترة من كانون الثاني إلى كانون الأول ٢٠١٨، وقد اجري المسح باستخدام ما مجموعه ٨٧ من الطيور الجارحة التي تنتمي إلى خمسة أنواع وهي الباشق وصقر المستنقعات والعوسق والعوسق الصغير والحدأة السوداء، سجل إصابة ٥٨ من ٨٧ طيراً بالقمل القارض وبنسبة إصابة بلغت ٦٦,٦٧٪، شخّصت خمسة أنواع من القمل المتطفل على هذه الطيور وهي: *Craspedorrhynchus platystomus* و *Degeeriella fulva* و *Degeeriella fusca* و *Degeeriella* للمرة الأولى في العراق، سجل النوع *D. rufa* أعلى نسب لإصابة الطيور الجارحة بـ ٢٨,٧٤٪ بينما كان *C. platystomus* الأدنى بـ ١٠,٣٤٪، وكان أعلى معدل انتشار للقمل بين الطيور الجارحة قد سجل في العوسق والحدأة السوداء وبلغت نسبة الإصابة ٧١,٤٣٪، بينما كان للباشق أدنى نسبة إصابة وبلغت ٥٣,٨٥٪، وكذلك ذكرت بعض الملاحظات والمشاهدات عن بيئة هذه الأنواع وتواجدها السنوي.