



Chewing lice species found on Dunlin birds *Calidris alpina* in Al-Diwaniyah province/Iraq

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Abstract

Introduction: Birds (Class Aves) are one of the most varied categories of vertebrates with over 9,000 species found on the planet and able to inhabit vastly different environments. They are important ecologically, as they are involved in seed dispersal, pollination and scavenging, and as biological control of harmful insects, small vertebrates as well as having economic value as providers of animal protein to humans in many areas. Birds due to their mobility and various habitats act as hosts to a wide range of parasites and especially the ectoparasites which can have a major impact on the health, survival and reproductive success.

Methods: In this study, chewing lice infestation was studied in Dunlin birds (*Calidris alpina*) found in various locations in the Al-Diwaniyah Province of Iraq where 54 birds were collected between September 2023 and April 2024.

Results: Five species of chewing lice were isolated and identified after careful examination, they include: *Actornithophilus umbrinus* (35.18%), *Austromenopon alpinum* (29.62%), *Carduceps* sp. (24.07%), *Lunaceps actophilus* (24.07%), and *Lunaceps drosti* (16.66%). One hundred and forty infested birds were identified totaling 62.96 infestation rate.

There was a statistically significant difference between male and female birds ($P \leq 0.05$), with the male having a higher infestation rate (72.41%) than females (52%). Infestation pattern analysis showed that there was a significant difference ($P 0.05$) in patterns of infestation with single infestation being the most common (76.47%), then followed by double (50) and triple infestations (20.58).

Conclusion: The results of the current paper are the initial record of chewing lice species infesting *Calidris alpina* in Iraq. These findings add a useful contribution to the literature on the avian ectoparasite in migratory birds and underscore the role of gender of the host and ecological conditions on dynamics of infestation. Surveillance of migratory birds is also advisable to get a clearer insight into host-parasite interactions and patterns of chewing-lice species distribution in the area.

Keywords: Ectoparasites, *Calidris alpina*, Infestation rate, Chewing lice, Iraq

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Introduction

Birds (Class Aves) are one of the most varied categories of vertebrates with over 9,000 species found on the planet and able to inhabit vastly different environments. They are important ecologically, as they are involved in seed dispersal, pollination and scavenging, and as biological control of harmful insects, small vertebrates as well as having economic value as providers of animal protein to humans in many areas (1,2). Birds due to their mobility and various habitats act as hosts to a wide range of parasites and especially the ectoparasites which can have a major impact on the health, survival and reproductive success (3).

Chewing lice (Insecta: Phthiraptera) are obligatory ectoparasites, which survive their entire life cycle on the host and are also spread primarily by direct animal-to-animal contact. These parasites are very specific to their hosts and are often known to be parasites of birds, in which case they either nest in feathers or skin depending on their taxonomic classification (4). The avian chewing lice can be divided into two major suborders namely, the amblycera

and Ischnocera. Amblycera species are usually blood-, skin-, and dermal secretion-feeding, and Ischnocera species are feather-feeding species (5,6). Chewing lice may cause feather damages, dermatitis, irritation, reduced body condition, decline in flight performance, and increased vulnerability to other diseases; and some species have been proved to be the carriers of pathogenic microorganisms (7).

Recent research has given the ecological and evolutionary importance of chewing lice with the focus on their host-parasite relationships, interspecies competition, and coevolution (8,9). Host behavior, sex, age, habitat, and migratory patterns affect distribution and prevalence of chewing lice, migrating birds being especially significant in ectoparasites dispersal on the large geographical scale (10,11). Migratory shorebirds are therefore regarded as the important hosts in the determination of diversity and biogeography of avian ectoparasites.

Iraq borders various major migratory flyaway paths and the country is typified with extensive wetlands, rivers, marshes and agricultural topographies, which offer apt



habitats to both resident and migratory birds species (12). These migratory birds include the Dunlin (*Calidris alpina*) which is a small shorebird visiting Iraq during the wintering and migration seasons and usually occurs in coastal mudflats, estuaries and inland wetlands (13). Although this species is widely distributed with ecological significance, very little data exists on ectoparasites of this species in Iraq.

The chewing lice infestation of several bird species such as *Pycnonotus leucotis*, *Meleagris gallopavo*, *Gallinula chloropus*, and several migratory aquatic birds has been reported in previous research in Iraq indicating that a significant diversity of avian ectoparasites exists in different regions of the country (14-17). Nevertheless, no research has ever been conducted on the infestation of lice in *Calidris alpina* in Iraq, and this is an obvious gap in the parasitological information.

Thus, the current research will isolate and determine the chewing lice species parasitizing *Calidris alpina* in Al-Diwaniyah Province in Iraq to estimate the overall infestation rate, the level of infestation in both male and female birds, and the nature of infestation among this migratory bird. The results of the current research will offer baseline information about the avian ectoparasites in Iraq and will assist in understanding the relationships between the host and the parasites, and the distribution patterns of the parasites in migratory birds.

Sample Collection and Area of Study

The current research was conducted in the Al-Diwaniyah Province, central Iraq. Dunlin birds (*calidris alpina*) were trapped in various areas within the province between the months of September 2023 and April 2024 and totaled 54 birds that were made up of 29 males and 25 females. The migratory and wintering birds were found and their parasitological was done at the Parasitology Laboratory, Department of Biology, College of Education, University of Al-Qadisiyah.

Collection and preparation of lice samples

All birds were carefully inspected to see whether they had ectoparasites with particular emphasis being put to the head, neck, wings, breast, and abdominal areas. Lice were also picked off very closely by hand with the fine forceps and put in Petri dishes with 70-percent ethanol so as to take off feather debris. Standard parasitological procedures were used to prepare specimens to clear the collected specimens in 10% potassium hydroxide (KOH) solution and after that, the specimen was washed in distilled water before being mounted on permanent microscope slides using Canada balsam (10).

Identification of chewing lice

All the prepared slides were observed under the light microscope at varying magnification. The species of chewing lice were identified with the help of morphological

features such as body form, the structure of the head, the chaetotaxy of the head, and the division of the abdomen with the usage of the typical taxonomic keys and the descriptions (3).

Statistical Analysis

The statistical processes were carried out to examine the differences in the infestation of male and female birds and the differences in infestation between the types based on the results obtained using Chi-square (χ^2) test. The statistical significance was defined at the probability of $P < 0.05$.

Results

Analysis of 54 Dunlin birds (*Calidris alpina*) sampled at Al-Diwaniyah Province revealed that 34 of the birds were infested with chewing lice and the general infestation rate was 62.96%. In the current study, five species of chewing lice were identified, which were classified to two suborders, viz. Amblycera and Ischnocera as indicated in (Table 1).

These species were recorded as *Actornithophilus umbrinus*, *Austromenopon alpinum*, *Carduiceps* sp., *Lunaceps actophilus* and *Lunaceps drosti*. *Actornithophilus umbrinus* (35.18%), then *Austromenopon alpinum* (29.62%) had the highest percentage of infestation. Infestation was also found to be the same with the species *Carduiceps* sp. and *Lunaceps actophilus* (24.07% and 16.66% respectively) but was the lowest with *Lunaceps drosti* (16.66%) (Table 1).

Figures 1-5 is the morphological description of the chewing lice species that were recorded: Figure 1 shows *Actornithophilus umbrinus*, Figure 2 shows *Austromenopon alpinum*, Figure 3 shows *Carduiceps* sp., Figure 4 shows *Lunaceps actophilus*, and Figure 5 shows *Lunaceps drosti*.

There was a high difference in the infestation rate between male and female birds ($P < 0.05$). Among the 29 males inspected, 21 had an infestation, that is, the infestation rate amounted to 72.41, and the 13 females inspected were infested, that is the rate of infestation was 52 as indicated in (Table 2).

On the infestation type, a large difference ($P < 0.05$) was observed between infestation patterns. The most frequent was single infestation (26 birds or 76.47 percent). The infestation of double was found in 17 birds (50%), and in 7 birds (20.58) triple infestation (Table 3).

Discussion

The findings of the current research are more or less comparable to the past researches on chewing lice infestation on wild and migratory birds in Iraq. Chewing lice have been found to be prevalent ectoparasites of birds in the Iraqi habitat as studies conducted by Al-Mayali (15) and Al-Aredhi (16) have revealed the presence of

Table 1. Chewing lice species recovered from Dunlin birds in Al-Diwaniyah province

Suborder	Family	Lice species	Infested No.	Percentage
Amblycera	Menoponidae	<i>Actornithophilus umbrinus</i>	19	35.18%
Amblycera	Menoponidae	<i>Austromenopon alpinum</i>	16	29.62%
Ischnocera	Philopteridae	<i>Carduiceps sp.</i>	13	24.07%
Ischnocera	Philopteridae	<i>Lunaceps actophilus</i>	13	24.07%
Ischnocera	Philopteridae	<i>Lunaceps drosti</i>	9	16.66%

**Figure 1.** *Actornithophilus umbrinus* (40x)**Figure 4.** *Lunaceps actophilus* (40x)**Figure 2.** *Austromenopon alpinum* (40x)**Figure 5.** *Lunaceps drosti* (40x)**Figure 3.** *Carduiceps* spp. (40x)

various species of chewing lice on various bird species in Al-Diwaniyah Province and other regional areas. The closeness of the current results to the previous Iraqi records gives the idea that environmental factors and availability of hosts in the area give the right conditions that accommodate the circumstance of survival and spread of the chewing lice among the migratory and resident bird species.

The current study had relatively high infestation of

chewing lice on *Calidris alpina* of which five species were found. This observation proves that shorebirds are valuable hosts of various species of chewing lice on migration and wintering. Similar lice diversity and prevalence patterns have been already documented in the case of migratory shorebirds that belong to various geographic areas, where numerous lice species were often detected on individual hosts (18).

In this study, the rates of infestation of *Actornithophilus umbrinus* and *Austromenopon alpinum* were greater than other species that were registered. The same patterns of domination have been noted in recent surveys of chewing lice on shorebirds and as such, some lice genera have a higher adaptation to a particular host group and feather microhabitat allowing this group to survive over an extensive geographic range (19).

The infestation rate that was recorded to be much higher in male birds than in female could be linked to the particular behavioral and ecological patterns of male and female birds. Male birds tend to be more active and

Table 2. infestation rate with chewing lice species according to the gender of birds

Gender of birds	No. examined	No. infested	Percentage
Male	29	21	*72.41%
Female	25	13	52%
Total	54	34	62.96%

*Indicate a significant difference at ($P < 0.05$).

move more between feeding and rest areas and this might expose them more to the transmission of ectoparasites. The same sex-biased patterns of infestation have been reported in recent work on avian ectoparasites (20).

On infestation patterns, there were single infestations that were more common than mixed infestations. This trend can be competitive interactions by the species of chewing lice over available sites of attachment to the host body. The newest ecological research has indicated that competitive exclusion and niche partitioning among lice species have the ability to decrease the risk of a number of species living on the same host individual (21).

The conditions of the habitat at the stopover sites, seasonal differences in temperature and humidity and host preening behavior can also have an influence on the prevalence and distribution of chewing lice in migratory birds. The recent studies have shown that the environmental conditions in the course of migration and wintering can have a great influence on the dynamic of survival and transmission of the ectoparasites (22).

Recent developments in the ecological and evolutionary avian parasitology have underlined the need to integrate ecological and evolutionary approaches to the study of ectoparasite assemblages on migratory birds. Long-term coevolution of hosts and parasites and host phylogeny have been found to influence large-scale comparative studies to indicate that lice diversity and intensity of infestation are not only influenced by migration of hosts. The findings of this kind indicate that the species of lice that have been identified on *Calidris alpina* might indicate evolutionary correlations that are maintained between generations and areas in contrast to ecological interactions in the short term (23).

Furthermore, molecular and integrative taxonomic methods have come to be used more often in the study of chewing lice, which has shown cryptic specialisation among morphologically similar taxa. Recent researches proved that morphological identification allowed to enhance the delimitation of species and clarification of phylogenetical relations among the lice species, parasitizing the migratory birds. Despite the fact that the current study was based on morphological recognition, the use of molecular tools in the future research can reveal more information about the diversification and evolutionary dynamics of chewing lice related to *C. alpina* and other migratory shorebirds (24- 27).

On the whole, the results of the current study present

Table 3. shows the kind of chewing lice infestation in the studied birds.

Infestation type	No. infested	Percentage
Single	26	*76.47%
Double	17	50%
Triple	7	20.58%

*Indicate a significant difference at ($P < 0.05$).

the baseline data on the chewing lice infestation in *Calidris alpina* in Iraq and help improve the knowledge of the host-parasite interactions in the migratory shorebirds. It is advisable that further research using bigger samples sizes, other geographical areas, and molecular methodologies should be done to bring light in ecological and evolutionary effects that determine distribution of chewing lice.

Conclusion

The current research reported the occurrence of five species of chewing lice parasites of Dunlin birds (*Calidris alpina*) in the Al-Diwaniyah Province of Iraq. The general percentage of the infestation showed that the chewing lice are typical ectoparasites of this migratory bird species in wintering and migratory stages. The infestation rate of males and female birds was found to differ considerably with the male birds having a higher infestation rate. Moreover, there were more single infestations than double and triple infestations, which could be related to potential competition of lice species in the attachment sites in the host body. The results of this work present the background data on the diversity and abundance of chewing lice on *Calidris alpina* in Iraq and may help to understand the host-parasite interaction of migratory birds better. It is advisable that future research on this avian ectoparasites in Iraq should be conducted using larger sample sizes, other geographical areas, and other methods of molecular identification.

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