Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379



# Prevalence and Infestation of the Chewing Louse *Heleonomus Adnani* (Phthiraptera: Menoponidae) on Cranes (*GRUS GRUS*) in Wildlife Park Dera Ismail Khan, Pakistan

**Muhammad Fawad Fareed**
Department of Zoology, Government Degree College No 1 Dera Ismail Khan KPK Pakistan & Department of Zoology, Faculty of Basic Sciences, University of Agriculture Dera Ismail Khan KPK Pakistan.
**Saddam Hussain***
Department of Zoology, Faculty of Basic Sciences, University of Agriculture Dera Ismail Khan KPK Pakistan. Corresponding Author Email: saddamhussain883@gcuf.edu.pk
**Sehar Gul**
Department of Zoology, Faculty of Basic Sciences, University of Agriculture Dera Ismail Khan KPK Pakistan
**Muhammad Hamza**
Department of Forestry and Range Management Bahaudin Zakriya University Multan.
**Muhammad Khalid**
Department of Zoology, Faculty of Basic Sciences, University of Agriculture Dera Ismail Khan KPK Pakistan
**Umaima Anam**
Department of Zoology, Faculty of Basic Sciences, University of Agriculture Dera Ismail Khan KPK Pakistan
**Yashfa Sana**
Department of Zoology, Faculty of Basic Sciences, University of Agriculture Dera Ismail Khan KPK Pakistan

**Author Details**

**Received on** 25 Dec, 2025
**Accepted on** 18 Jan, 2026
**Published on** 21 Jan, 2026

Corresponding E-mail & Authors*:
Saddam Hussain
saddamhussain883@gcuf.edu.pk

## Abstract

Ectoparasites are important indicators of avian ecology and health, more in particular in the context of captive and semi-captive birds. As birds are kept in close contact with one another, parasite transmission is facilitated through ectoparasites. The aim of the study was to understand the prevalence and distribution of chewing louse *Heleonomus adnani* (Phthiraptera: Menoponidae ) on Common Crane (*Grus grus*) in Wildlife Park Dera Ismail Khan, Pakistan. A total of 24 cranes were examined using standard techniques for collection of ectoparasites. 11 individuals

were infested with lice, making for an overall prevalence of 45.83%. A total of 73 lice were recovered from infested birds, resulting in a mean intensity of 6.64 lice per infested host and an infestation range of 2–8 lice within the given time period of study. Across the body of the host, there was uneven distribution. Measurements of the distribution of the specimens were taken in descending order which are tail, wings, breast, abdomen, cloacal region, and head and neck Findings also reflect body site preferences of *G. grus* within the study area and conclude that H. adnani, in the given context, is an effective and prevalent ectoparasite. The study quantifies the level of chewing louse infestation on cranes at Wildlife Park Dera Ismail Khan for the first time and adds to the very little information on crane ectoparasites in Pakistan with the possible use in avian health monitoring and management in wildlife parks.

**Keywords:** Chewing lice; *Heleonomus adnani*; *Grus grus*; ectoparasite prevalence; infestation intensity; wildlife park; Pakistan

## Introduction

Avian ecosystems have a variety of components that can affect the health, reproduction, and survival of a host – ectoparasites being one of them. One example of ectoparasites is the chewing lice (order Phthiraptera). They undergo their entire life cycle on the host that they are parasitizing. Most are transmitted through direct contact. They also belong to the family Menoponidae that infests large-bodied birds such as cranes. Members of the Menoponidae family also infest birds, and are widely distributed and described to infest feathers and skin, as they describe to feed on the skin and keratin (Clayton et al., 2016; Bush et al., 2019).

Host social behavior and environmental conditions influence the prevalence of chewing lice. In wildlife parks, birds that are kept captive have a limited range of movement and experience contact with a higher number of hosts. This also leads to a greater host density and increased likelihood of adjusting parasite dynamics. In the field of avian parasitology, localized prevalence estimates are important for the understanding of localized social structure of managed bird populations (Dik et al., 2017; Gustafsson & Bush, 2017).

People sometimes keep cranes for educational purposes and they also winter in Pakistan, but they are mostly migratory. Despite being ecologically important, the Pakistan's ectroparasite of cranes is understudied. *Heleonomus adnani* is a chewing louse that is associated and confirmed with the species *G. grus*. This species is still confirmed and represents a taxonomically valid ectoparasite of cranes (Naz et al. 2009, Price et al. 2020). Crane chewing lice were documented in Asia and Europe, however, reports on the prevalence, intensity of infestation, and site distribution of H. adnani in

Dera Ismail Khan and the rest of Khyber Pakhtunkhwa wildlife parks are missing. (2016, Bush et al.) Parasite management, avian health, and conservation planning in-situ are some of the reasons for the significance of ectoparasite data collection in wildlife parks.

## Problem Statement

Previous studies (Naz et al., 2009; Dik et al., 2017) highlight the lack of prevalence-based ectoparasite studies on cranes, and no such data are available for Wildlife Park Dera Ismail Khan.

## Objectives

1. To determine the prevalence of *Heleonomus adnani* on *Grus grus* in Wildlife Park Dera Ismail Khan.
2. To estimate the mean intensity and range of infestation of *H. adnani* on examined cranes.
3. To assess the distribution of lice on different body regions of the host.
4. To provide baseline data for future comparative and longitudinal ectoparasite studies on cranes in Pakistan.

## Hypotheses

*Heleonomus adnani* occurs at a variable infestation intensity among *Grus grus*

## Materials and Methods

### Study Area and Study Period

This study took place at Wildlife Park Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan. Since the park keeps captive populations of cranes (*Grus grus*) under semi-natural conditions, it is ideal for studying the ectoparasite prevalence and infestation parameters. Since ectoparasite loads in birds tend to increase in the winter (Clayton et al., 2016; Bush et al., 2019), sampling was undertaken during the wintering period 2024.

### Study Animals

During the study period, all available *Grus grus* individuals present during the study period were examined and checked for occurrences of ectoparasite infestation. Birds were chosen opportunistically during regular health assessments to reduce the number of times they were handled and the stress caused. Basic data was taken and the sex, if able to be identified, and condition, were checked for each bird individually. In accordance with avian parasitology guidelines (Friend & Franson, 1999; Clayton et al., 2016) All birds were handled in accordance with standard ethical guidelines for avian parasitological research

### Collection of Ectoparasites

Ectoparasites sampling followed avian ectoparasites sampling protocols to the letter. Each crane was carefully examined, ensuring no feathers were left unparted, as the skin

was the target area to be checked. This was particularly the case for the head, neck, wings, breast, abdomen, tail, and cloacal region, as chewing lice usually exhibit site preference to be their residence. Using fine forceps, the lice were extracted and were put in 70% ethanol for later identification, as suggested in the references Clayton and Drown (2001) and Dik et al. (2017).

### Identification of *Heleonomus adnani*

Lice specimens were cleared in lactophenol and mounted on glass slides using Canada balsam for microscopic examination. Using the available taxonomic keys and original species descriptors for Menoponidae, an identification was performed using a microscope, giving special attention to *Heleonomus adnani*. A few of the confirmation techniques were head shape, chaetotaxy, and segmentation of the abdomen (Naz et al. 2009, Price et al. 2020).

### Prevalence, Mean Intensity, and Range of Infestations

Prevalence was calculated as the proportion of examined cranes infested with one or more lice. Mean intensity is the mean score of the lice among the hosts, and the range of infestation refers to the minimum and the maximum scores of the lice on the birds. They have also been defined to ensure consistent interpretation in the previous literature (Bush et al. 1997, 2019).

### Lice Distribution by Host Body Regions

We examined the lice by the region and the body part where the lice were removed. Recordings of the body parts have been classified as head and neck, wings, breast, abdomen, tail, and the cloacal region. The cloacal region is also called cloaca. To recognize lice distribution and lice preference to the body parts, Each body region was evaluated separately to assess lice distribution and site preference. Parasites often have a particular preference to microhabitat location. (Clayton et al. 2016, Gustafsson and Bush 2017).

### Data Analysis

The data was input into Microsoft Excel and basic descriptive statistics were applied. Prevalence was calculated and reported as percentages, mean intensity and range as distributions. Results were tabulated for comparison against other studies dealing with avian ectoparasites. With this study being intended to offer baseline data for forthcoming longitudinal and comparison studies, no inferential statistics were applied (Bush et al, 1997; Dik et al., 2017).

## Results

### Prevalence of *Heleonomus adnani* on *Grus grus*

We examined 24 Common Cranes (*Grus grus*) for infestation by the chewing louse *Heleonomus adnani* at Wildlife Park Dera Ismail Khan. Of these, 11 cranes were infested, which gives an overall prevalence of 45.83%. This suggests that during the study period, almost half of the population of examined cranes carried H. adnani.

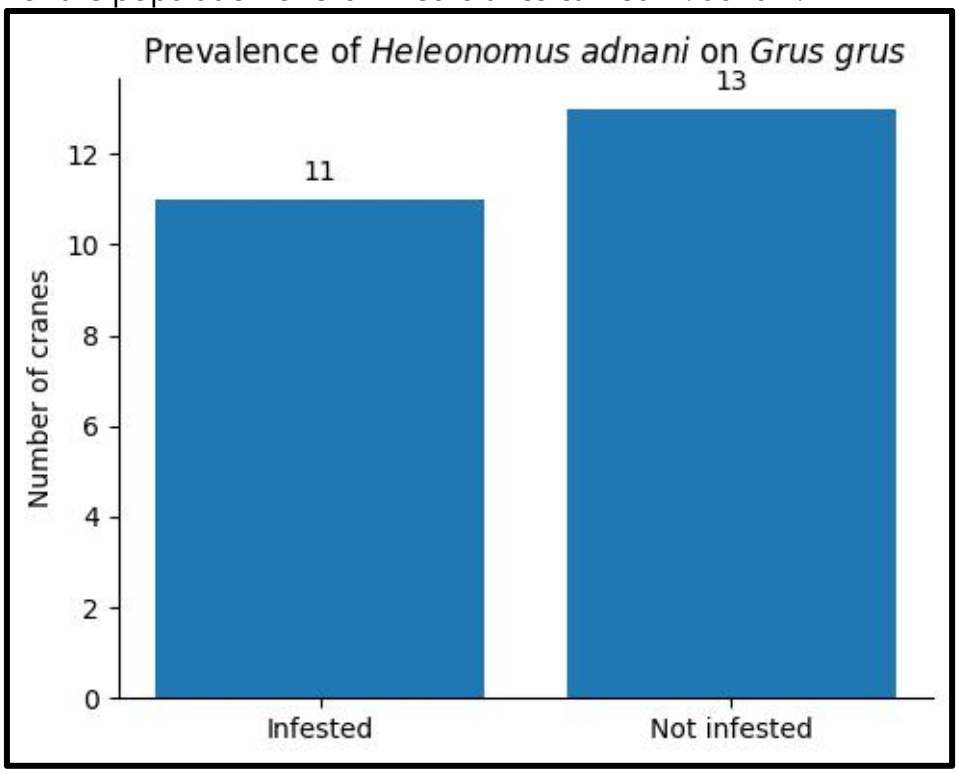


*Figure 1. Prevalence (%) of Heleonomus adnani infestation among examined Grus grus in Wildlife Park Dera Ismail Khan.*

### Mean Intensity and Range of Infestation

In total, 73 lice were found on the 11 infested cranes. On average, there were 6.64 lice per infested crane. Each crane had between 2 and 8 lice, meaning the number infested varied moderately from crane to crane.

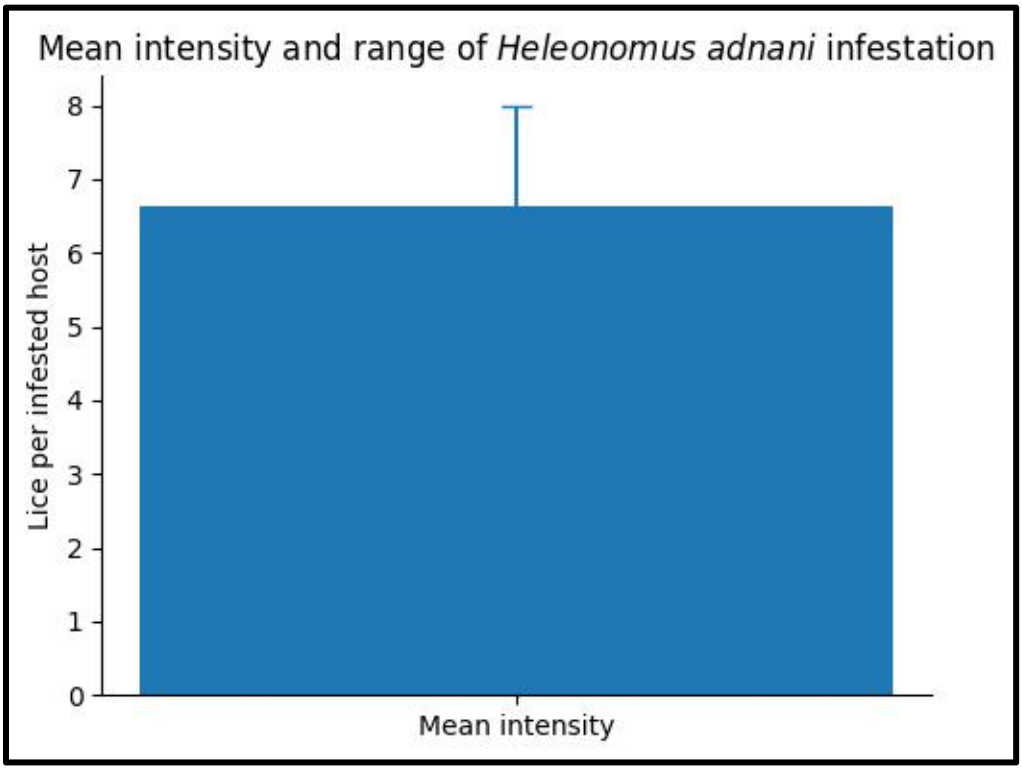


*Figure 2. Mean intensity of Heleonomus adnani infestation (number of lice per infested host) on Grus grus.*

**Distribution of *Heleonomus adnani* on host body regions**

The distribution of lice on the host was uneven. The highest lice count was found in the tail region (23 lice; 31.5%), followed by the wings (18 lice; 24.7%). The breast region accounted for 11 lice (15.1%); the abdomen had 8 lice (11.0%). The head and neck region harbored 6 lice (8.2%), and the cloacal region had the lowest count with 7 lice (9.6%).

Table 1: *Distribution of Heleonomus adnani on different body regions of Grus grus*

| Body region | Number of lice | Percentage (%) |
|---|---|---|
| Tail | 23 | 31.5 |
| Wings | 18 | 24.7 |
| Breast | 11 | 15.1 |
| Abdomen | 8 | 11.0 |
| Head & neck | 6 | 8.2 |
| Cloacal region | 7 | 9.6 |
| **Total** | **73** | **100** |

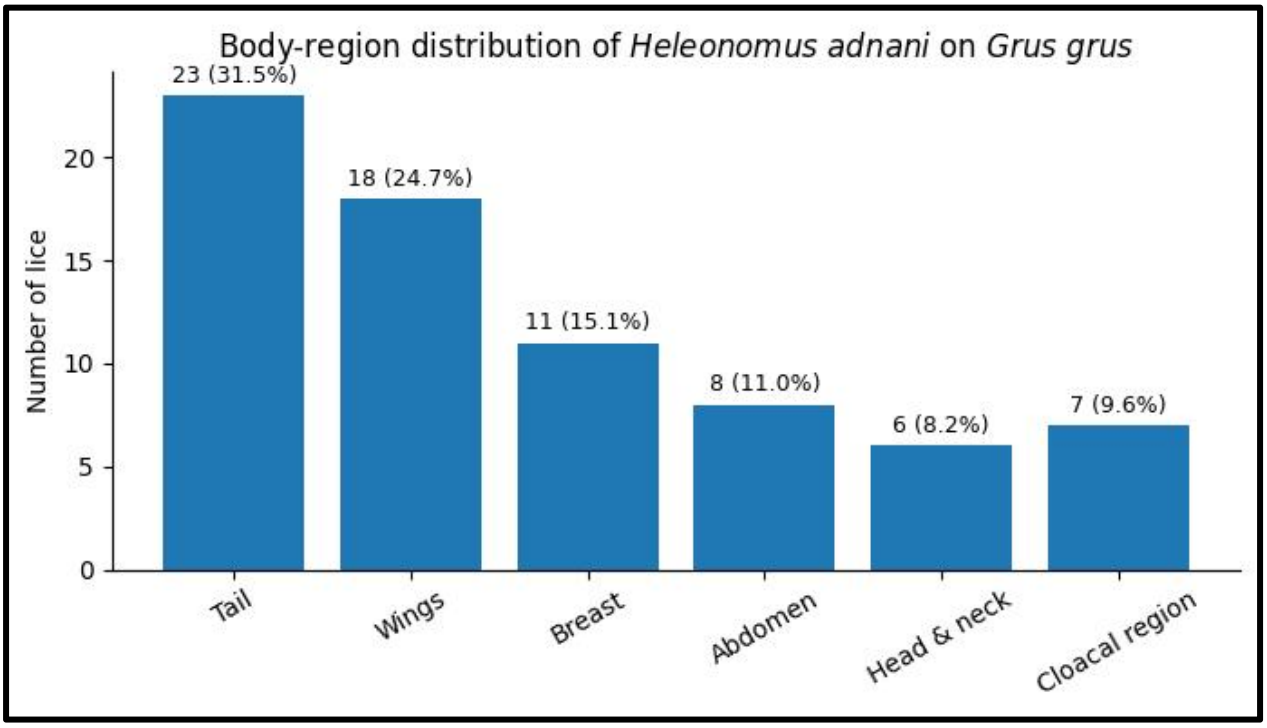


*Figure 3. Percentage distribution of Heleonomus adnani across different body regions of Grus grus.*

## Summary of Infestation Parameters

Table 2: *Summary statistics of Heleonomus adnani infestation on Grus grus in Wildlife Park Dera Ismail Khan*

| Parameter | Value |
|---|---|
| Number of cranes examined | 24 |
| Number of cranes infested | 11 |
| Prevalence (%) | 45.83 |
| Total lice collected | 73 |
| Mean intensity (lice/infested host) | 6.64 |
| Range of infestation | 2–8 |

## Discussion

The current research sheds some light on the prevalence and infestation characteristics of chewing louse *Heleonomus adnani* on the Common Crane (*Grus grus*) at Wildlife Park Dera Ismail Khan. An overall prevalence of 45.83% suggests H. adnani can be classified among the common ectoparasites in the examined crane population. Moderate levels of chewing lice prevalence have been reported in other large-bodied, sociable, and visually flocking bird species where close proximity to one another facilitates the interaspecific

transmission of the parasites, especially in captive and semi-captive situations as in wildlife parks (Clayton et al., 2016; Bush et al., 2019).

The overall mean lice infestation intensity (6.64 lice per infested host) and the lice infestation range (2–8 lice) suggests a moderate level of louse burdens. Literature shows the reported levels of infestation reflect limited, yet copious, louse-facilitated ectoparasite infestations, and shows the levels of infestation may have been effective host preening or an adequate environmental host-immune response. The levels of infestation have been attributed to the intensive grooming behaviors of the host's individual, which positively correlate to the host's age, health, and employed microhabitat (Bush et al., 1997; Gustafsson & Bush, 2017).

H. adnani was not spread uniformly across host body regions, and the highest concentration of lice was on the tail and wing feathers. These areas have dense feather coverage, and are relatively protected from host preening, so they are ideal microhabitats for chewing lice. Areas with less feather coverage, like the head and neck, likely have less chewing lice because they are subject to more frequent preening. This same body-site distribution has been noted for chewing lice on other species of birds and likely stems from lower preening and removal by host grooming (Clayton & Drown, 2001; Clayton et al., 2016).

Finding H. adnani on cranes in Wildlife Park Dera Ismail Khan has shown that managed populations of birds need to have ectoparasites monitored on a more regular basis. It was noted that the level of infestation was not high, but to leave ectoparasites unmanaged can lead to chronic ectoparasitism that negatively impacts feather quality, thermoregulation, and health overall. This study has added to the very few references on ectoparasites of cranes in Pakistan, and to some extent, gives baseline data to be used for future comparative and long term studies (Naz et al., 2009; Dik et al., 2017).

## Conclusion

The current research validates the finding of chewing louse, *Heleonomus adnani*, on *Grus grus* in Wildlife Park Dera Ismail Khan with a prevalence of 45.83% and a moderate mean intensity of infestation. There is an unequal distribution of lice on the host's body parts, with a higher concentration on the tail and wing feathers. This is the first study to provide a quantitative evaluation of the infestation parameters of H. adnani on cranes in this wildlife park and provides groundwork for similar studies to be conducted in the future.

## Recommendations

1. To prevent and lessen the potential health threats to the birds, there should be ectoparasite screening of the cranes in wildlife parks to detect and manage an infestation in its early stages (Clayton et al., 2016; Bush et al., 2019).
2. To prevent the circulation of parasites among the crane population in captivity, there should be improved enclosure sanitation, and the addition of parasite control to be administered by the veterinarian (Friend & Franson, 1999; Dik et al., 2017).
3. Future research should be inclusive of a larger sample size, inter-seasonal and intra-seasonal studies and studies that compare the crane ectoparasite communities in captivity and in the wild (Bush et al., 1997; Gustafsson & Bush, 2017).

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