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Chewing lice (Phthiraptera: Amblycera, Ischnocera) of some migratory waterfowl-ducks and geese in Kashmir province, JKUT, India

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Abstract

The chewing lice (Phthiraptera: Insecta) were examined for their rate of infestation on migratory waterfowl-ducks and geese (Anatidae: Anseriformes: Aves) in Kashmir region during the years 2015-2019. During the present study, two species of chewing lice have been found on winter migratory waterfowl-ducks and geese in various wetlands of Kashmir. The study of 93 dead winter migratory waterfowl-ducks and geese over a period of 5 years revealed that 47 birds were infested with one or other type of parasite with an overall prevalence rate of 50.53%. The ectoparasites reported during the present study includes *Anaticola crassicornis* and *Trinoton anserinum* with prevalence percentage respectively 22.58% and 27.95%. Among the two ectoparasites recovered from the different migratory waterfowl, *Trinoton crassicornis* was found to be most prevalent. During the study host wise, year wise, mean intensity and abundance of ectoparasites was also reported.

Keywords: Chewing lice, waterfowl, Kashmir

Introduction

Parasitism is common in wild waterfowl (Atkinson *et al.*, 2008) [4]. Waterfowl are considered one of the vertebrate groups with the greatest diversity of parasites (Barrera-Guzmán and Guillén-Hernández, 2008; Leung and Koprivnikar, 2016) [5, 19]. This diversity may be explained due to the natural history of their bird hosts, the great diversity of feeding habits (Graves and Fedynich, 2013) [13], migratory (Garvon *et al.*, 2011) [12] and seasonal patterns (Wallace and Pence, 1986) [32], as well as the complexity of the digestive tract of waterfowl species (Poulin, 1995) [23].

Lice are one of the most widespread ectoparasites, due to their high reproductive efficiency, their ability to tolerate adverse conditions, and their elusiveness, making them pests that are capable of seriously debilitating, or even killing, their hosts (Perman *et al.*, 1998) [25]. Lice are traditionally divided into sucking lice and chewing lice, with more than 3000 species of chewing lice being recorded worldwide (Fryderyk *et al.*, 2009) [10]. Chewing lice may also have many of the structural and behavioral transformations that help them spend their life cycle with their Diversity hosts (Horak *et al.*, 2005) [14]. Avian lice belong to the order Mallophaga (The chewing or biting lice) and are known for their rigid host specificity as stated by Alderton (1980) [2]. Mallophaga (biting and chewing lice) is a group of obligatory ectoparasites mainly of birds and to a lesser extend (only 12%) of mammals.

This work deals with the contribution to the prevalence and ecological parameters in the population of chewing lice in particular to migratory waterfowl- ducks and geese in various wetlands of Kashmir.

Material and Methods

Study area

The present study was carried in six wetlands of Kashmir viz., Hokersar, Shallabugh, Chatlum, Fashkooi, Manibug and Kranchu. The wetlands are home to a number of resident species and also support considerable populations of migratory waterfowl in winter. Wetlands of Kashmir provide over wintering resort to millions of water birds from their breeding grounds in Pale arctic region extending from North Europe to Central Asia (Ali, 1979) [1] and breeding ground

to a segment of water bird species (Pandit, 1982) [24].

The wetlands of Chatlum, Fashkoori, Manibug and Kranchu are located in Pampore area about 16 km south of Srinagar city. The wetlands are permanent but relatively shallow water bodies with fluvial origin and have a vast catchment which extends from Pampore in the west to Wuyan in the east.

Shallabugh wetland which is located around 20 km from Northwest of Srinagar city. On the north of this wetland is the Shallabugh village. The wetland is fed by Anchar Lake and various tributaries of River Sind and Jehlum. The periphery of the wetland is surrounded by Willows and Poplars. Most of the wetland consists of marshy areas but for the winter visiting waterfowl, several compartments in the wetland have been made that retain a considerable amount of water in winter. It has been observed that the Shallabugh wetland is mostly visited by the winter migratory fauna

Hokersar is a well-protected reserve for ducks and geese managed by J&K wildlife Protection Department. The wetland is located about 10 kms to the west of Srinagar on Srinagar-Baramulla national highway. The wetland is more or less semicircular in outline, extending in East = west direction with an area of about 5 sq. km. Doodhganga and Sukhnag streams are the major water sources for the wetland. The wetland is surrounded by group of villages on its north, south, southwest and eastern sides. The wetland provides an excellent habitat to a variety of resident and nonresident birds and is very famous for the winter visiting water fowl- ducks and geese. Hussain (1989) [15] counted 64 species in and around the wetland during bird ringing studies.

Sample collection

During the study 93 dead migratory ducks and Geese were collected from various collection sites. The different parts of study area were surveyed for collection of dead waterfowl bird for parasitological investigation. The dead bird collected

from study area was wrapped in cotton, placed in refrigerator, and was examined as soon as possible. Examination of the specimen was done near a closed window in a strong light and under a binocular microscope. The feathers were carefully turned back with forceps for inspection. The eyes, ears, head, back, legs, tail and wings (in particular the under surface of the remiges and under wing coverts) were examined systematically. Special attention was given to the ventral body feathers and skin, especially around the vent. The parasites were removed with fine forceps and preserved in 70% alcohol. The ectoparasites collected were identified as per Solusby (1982) [29].

Statistical analysis

We calculated the essential summary statistic information (including the mean, variability-standard deviation and standard error, median, minimum, maximum and range) for the percentage prevalence of endoparasitic infection separately using the “psych 2.1.3” package (Revelle, 2020 [27]; <https://CRAN.R-project.org/package=psych>) in the R 4.0.2 statistical software (R Core Team, 2020; <https://cran.r-project.org/>).

Results

During the present study, two species of chewing lice have been found on winter migratory waterfowl-ducks and geese in various wetlands of Kashmir. The study of 93 dead winter migratory waterfowl-ducks and geese over a period of 5 years revealed that 47 birds were infested with one or other type of parasite with an overall prevalence rate of 50.53%. The ectoparasite reported during the present study includes *Anaticola crassicornis* and *Trinoton anserinum* with prevalence percentage respectively 22.58% and 27.95% as shown in Table 1.

Table 1: Species wise prevalence of Ectoparasites in various wetlands of Kashmir waterfowl-Ducks and Geese.

S. No.	Species	Total Examined Birds	Total Positive Birds	Total Prevalence
1	<i>Anaticola crassicornis</i>	93	21	(22.58%)
2	<i>Trinoton anserinum</i>	93	26	(27.95%)
		93	47	(50.53%)

The year-wise pattern of ectoparasite load is represented in Table 2. The maximum prevalence of ectoparasites was found

in 2017 (64.28%) and least prevalence was reported in 2015 (44.44%).

Table 2: Year-wise prevalence of Ectoparasites in winter migratory waterfowl- Ducks and Geese

Year	No. of Hosts Examined	Males	Females	Total Number infected	Total Males positive	Total Females positive
2015	27	21	6	12(44.44)	9(42.85%)	3(50%)
2016	23	15	8	11 (47.82%)	7(46.66%)	4(46%)
2017	14	9	5	9(64.28%)	6(66.66%)	3(60%)
2018	16	8	8	8 (50%)	4(50%)	4(50%)
2019	13	7	6	7 (53.84%)	4(57.14%)	3(50%)
Total	93	60	33	47(50.53%)	30(50%)	17(51.51%)

The reports from other studies that there are significant differences in susceptibilities between various hosts, this study also found prominent differences in parasitic load

between these migratory waterfowl with high infection in Northern Pintail (60%) and minimum in Northern Shoveler (40%) (Table 3).

Table 3: Host wise prevalence, mean intensity and abundance of Ectoparasites in migratory waterfowl.

S. No.	Wetland	No. of waterfowl examined	No. Positive	Prevalence	Total Parasites	Mean intensity	Abundance
1	Mallard Duck	59	29	49.15%	340	11.72	5.76
2	Gadwall	9	5	55.55%	97	19.4	10.77
3	Common Teal	13	7	53.84%	38	5.42	2.92
4	Northern Pintail	5	3	60%	35	11.66	7

5	Northern Shoveler	5	2	40%	31	15.5	6.2
6	Greylag goose	2	1	50%	17	17	8.5
	Total	93	47	50.53%	558	11.87	6

Descriptive statistics of Ectoparasites.

The summary statistics of percentage prevalence of ectoparasitic infection is presented in Table 4.

Table 4: Summary statistics of percentage prevalence of ectoparasitic infection.

	N	Mean	SD	SE	Median	Min.	Max.	Range
Year	5	52.08	7.63	3.41	50	44.44	64.28	19.84
Host	6	51.42	6.84	2.79	51.92	40	60	20
Species	2	25.26	3.8	2.68	25.26	22.58	27.95	5.37

The Chi-square test showed that the gender wise percentage prevalence of infection from the ectoparasites showed no significant difference between the studied years ($\chi^2 = 1.2787$, $df = 4$, $p = 0.865$). The results of the Chi-square test once again showed that the gender wise percentage prevalence of infection from the ectoparasites differed significantly with host identity ($\chi^2 = 120.85$, $df = 5$, $p < 2.2e-16$).

Discussion

It was observed by surveying that all lice species were found sluggish on various parts of migratory water birds and were easily collected by visual examination using magnifying glass during the sampling. In the current study, most of the waterfowl were found to harbor ectoparasites. Indeed, many of the genera of mallophagans, and some of the same species, recorded here have also been recorded from ducks of the genus *Anas* in both North America (Broderson *et al.*, 1977; Lapage, 1961) [7, 17] and Asia (McClure *et al.*, 1973) [21]. Results during the present study showed that the infestation rate of ectoparasites in migratory waterfowl-ducks and geese is lower than percentage 87% recorded by Garbarino *et al.* (2013) [11] in their study on 13 species of aquatic birds in Georgia, and higher than percentage 22.36% reported by Awad and Mohammad (2015) [3] in Iraq. The prevalence of *Anaticola crassicornis* (Scopoli) vary in the ranges 31-86% reported from various parts of the world (Blagoveshtchensky, 1951 and Mey, 2003) [6, 22]. Broderson *et al.* (1977) [7] reported prevalence of 84% and 39% respectively for *Trinoton querquedulae* and *Anaticola crassicornis* on Shoveler (*Anas clypeata*) from Southwest Texas. Our findings present the first record of these ectoparasites from shallabugh and pampore wetlands of Kashmir. The *Trinoton anserinum* has been reported for the first time from various regions of Kashmir (Tanveer, S.1994) [31].

The year wise prevalence of different parasites indicates that almost all study migratory waterfowl were to prone to infection in all the years. What was the difference; it was only the percentage of prevalence. This could be due to the existence of various climatic factors such as temperature, humidity and vegetation (Clayton *et al.* 2016) [8]. The temperature may be a very important abiotic factor controlling the incidence of ectoparasites as well as distribution of the parasites on the host (Seibert, 1949) [30].

The prominent differences in parasitic load between these migratory waterfowl- ducks and geese is due to the difference of number of birds and type of birds examined, different study areas and climatic conditions that may play an important role

in the increase or decrease of the infestation rate of ectoparasites. The prevalence of parasitism is also very much relying on activity of the host. It is important to mention that the temperature is very important abiotic factor and plays an important role in enhancing the population of lice on the body of the migratory birds. The level of ectoparasite infestation depends on the density of birds, with ectoparasites spreading easily when birds are in high density. Thus, the number and variety of ectoparasites are more on colonial birds than territorial birds (Rozsa *et al.*, 1996) [26]. The lack of host specificity of lice in case of waterfowl is well known from all areas of the world. Horizontal lice transmission is thought to be very repeated in the countless aggregations that waterfowl exhibit on bodies of water during winter months (Clayton *et al.*, 2016) [8]; live lice has been observed on moulted feathers (Eichler, 1963) [9]; and walking on water has been reported for specimens of *Trinoton*.

Conclusion

The present study will be of great importance while facilitating identification of these parasite in future taxonomic studies.

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