Scientific Reports in Life Sciences 3 (4): 84-92

DOI: http://doi.org/10.5281/zenodo.7487506

Gastrointestinal helminth fauna of migratory waterfowl-ducks and geese in various wetlands of Kashmir, India

Muzaffar Rasool Mir*, G. Mustafa Shah, Ulfat Jan
Department of Zoology, The University of Kashmir, Srinagar-190006, India
**Email:muzaffarmir2@gmail.com*

Received: 15 October 2022 / Revised: 10 December 2022 / Accepted: 25 December 2022/ Published online: 27 December 2022.

How to cite: Rasool Mir, M., Mustafa Shah, G., Jan, U. (2022). Gastrointestinal helminth fauna of migratory waterfowl-ducks and geese in various wetlands of Kashmir, India, Scientific Reports in Life Sciences 3(4), 84-92. **DOI:** http://doi.org/10.5281/zenodo.7487506

Abstract

The present study was carried out to determine the biodiversity of gastrointestinal helminths in migratory waterfowl- ducks and geese in various wetlands of Kashmir. For this purpose, 93 dead migratory waterfowl (Mallards, Gadwall, Common Teal, Northern Pintail, Northern Shoveler, and Graylag Geese) were collected from various sites for necroscopic examination. The overall prevalence of helminthiasis recorded was 43.01% percent. The gastrointestinal helminths isolated were *Notocotylus attenuates* (15.05%), *Paryphostomum radiatum* (5.37%), Capillaria anatis (11.82%), and *Epomidostomum anattinum* (8.60%) and *Hymenolepis abortive* (2.15%). Prevalence with respect to host and sex was also recorded during the present study.

Keywords: Fauna, Gastrointestinal helminths, Waterfowl, Wetland

Introduction

The parasitism in birds (both resident and migratory) is a great concern causing heavy losses. Wild birds are very active and forage in a variety of locations and habitats increasing the opportunity for exposure to a diverse range of parasites. Their free access to the backyards brings them into contact with domestic species which facilitates the exchange of parasites between them. Parasites may affect hosts at the individual, population, and community levels. At the individual level parasites can cause various diseases and even the death of the host. The effects are usually density-dependent and heavy infections are often encountered in dying and dead

individuals. Waterfowl can act as the main source of various types of parasites; they can pick up infections from their habitat, transmit and spread them in the surrounding environment, including drinking water supplies and domestic animals (Gunnarsson *et al*. 2012). Research carried out in the past has suggested a very positive relationship between migration and parasite richness could stem from a weakening of the immune system during migration (Bibi *et al*. 2013), a greater aggregation of hosts (Krauss et al. 2010), or exposure to a wider range of habitats and parasite types.A survey was carried out on the prevalence of gastrointestinal helminthiasis in migratory waterfowl ducks and Geese from various wetlands wetland of Kashmir. Although studies regarding infection of migratory waterfowl ducks and geese have been carried out in different parts of the world by a number of researchers (Zedar, 1800; Lundahl, 1848; Railliet and Henry, 1909; Seurat, 1918; Skrjabin, 1915; Broderson et. al., 1977; Shah et. al., 1980; Mohammad et al., 2011; Sokol *et. al*., 2016; Aguilar *et. al*, 2020), studies regarding infection in this region are limited viz., Fotedar *et al*. (1965), Ahmad and Chishti (1995), Tanveer and Chishti (2001), Kharoo (2011). Parasitism is common in wild waterfowl (Atkinson *et al*., 2008). Waterfowl are considered one of the vertebrate groups with the greatest diversity of parasites (Barrera-Guzm´an and Guill´en-Hern´andez, 2008; Leung and Koprivnikar, 2016). This diversity may be explained due to the natural history of their bird hosts, the great diversity of feeding habits (Graves and Fedynich, 2013), migratory (Garvon *et al*., 2011) and seasonal patterns (Wallace and Pence, 1986), as well as the complexity of the digestive tract of waterfowl species (Poulin, 1995). The present investigation records the outbreak of different kinds of helminth parasites in migratory waterfowl ducks and Geese from various wetlands of Kashmir valley.

Material and methods

Study area

The present study was carried in six wetlands of Kashmir viz., Hokersar, Shallabugh, Chatlum, Fashkoori, Manibug and Kranchu. The wetlands are home to a number of resident species and also support considerable populations of migratory waterfowl in winter. The wetlands of Kashmir provide an overwintering resort to millions of water birds from their breeding grounds in the Palearctic region extending from North Europe to Central Asia (Ali, 1979) and breeding grounds to a segment of water bird species (Pandit, 1982).

The wetlands of Chatlum, Fashkoori, Manibug, and Kranchu are located in the Pampore area about 16 km south of Srinagar city. The wetlands are permanent but relatively shallow water

bodies with the fluvial origin and have a vast catchment that extends from Pampore in the west to Wuyan in the east.

Shallabugh wetland is located around 20 km 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 km to the west of Srinagar on the Srinagar-Baramulla national highway. The wetland is more or less semicircular in outline, extending in an 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 a 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 waterfowl- ducks and geese. Hussain (1989) counted 64 species in and around the wetland during bird ringing studies.

Sample collection

During the study gastrointestinal tract of 93 dead migratory ducks and Geese were collected from various collection sites. The different parts of the study area were surveyed for the collection of dead waterfowl birds for parasitological investigation. The gastrointestinal tracts were separated anatomically, then each organ was opened separately and its contents and mucosa were washed in water to remove all parasites. The helminths collected were processed and preserved (70% alcohol) and were identified as per Yamaguti (1959) and Solusby (1982).

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; 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

In the present study, a total of 93 dead winter migratory waterfowl ducks and geese were examined and collected from various sites in Kashmir valley, out of which 40 were found positive for helminths. The overall prevalence of helminths was recorded as 43.01% percent. The gastrointestinal helminths isolated were *Notocotylus attenutus* (15.05%), *Paryphostomum radiatum* (5.37%), *Capillaria anatis* (11.82%) and *Epomidostomum anattinum* (8.60%) and Hymenolepis abortive (2.15%) as shown in Table 1. The Summary statistics of the percentage prevalence of endoparasitic infection are given in Table 3.

Table 1. Prevalence of Gastrointestinal Helminthes in waterfowl-ducks and Geese

S.No.	Taxonomic Group	Species	No. of Migratory Birds Examined	Total Positive	Infection percentage
1	Trematodes	*Notocotylus attenutus*	93	14	15.05
		Paryphostomum radiatum	93	5	5.37
		Total	**93**	**19**	**20.43%**
2	Nematodes	*Capillaria anatis*	93	11	11.82
		Epomidostomum anattinum	93	8	8.60
		Total	**93**	**19**	**20.43%**
3	Cestodes	(v) *Hymenolepis abortive*	**93**	**2**	**2.15**
		Total	**93**	**40**	**43.01%**

Out of the six migratory birds selected for the examination, the prevalence was maximum in Northern Pintail (60%), Northern Shoveler (60%), Common Teal (53.84%), Gadwall (44.44%), Mallard Duck (38.98%), Greylag Goose (0%) as shown in Table 2.

Out of 93 hosts examined, 60 were males and 33 were females. The prevalence of infection reported in females was higher (54.54%) as compared to males (36.66%). There was a significant difference in the prevalence of helminth parasites in the two sexes.

Table 2. Host-wise prevalence of Helminth parasites parasite

S. NO.	Waterfowl	NO. OF Birds examined	Males	Females	NO. Positive/Prevalence percentage	No. of males positive	No. of females positive
1	Mallard duck (*Anas platyrhynchos)*	59	38	21	23(38.98)	13 (34.21%)	10 (47.61%)
2	Gadwall(*Anas strepera)*	9	4	5	4(44.44)	1(25%)	3 (60%)
3	Common Teal(*Anas crecca)*	13	9	4	7(53.84)	5 (55.55%)	2 (50%)
4	Northern pintail(*Anas acuta)*	5	3	2	3 (60)	1 (33.33%)	2 (100%)
5	Northern shovelar (*Anas clypeata)*	5	4	1	3 (60)	2 (50%)	1 (100%)
6	Greylag goose (*Anser Anser)*	2	2	0	0 (0)	0 (0%)	0 (0%)
Total		93	60	33	40(43.01%)	22(36.66%)	18 (54.54%)

Table 3. Summary statistics of percentage prevalence of endoparasitic infection

	N	Mean	SD	SE	Median	Minimum	Maximum	Range
Species	5	8.6	5.1	2.28	8.6	2.15	5.05	12.9
Host	6	42.88	22.64	9.24	49.14	0	60	60
Taxonomic groups	3	14.32	10.58	6.11	20.43	2.1	20.43	18.33

Discussion

A total 93 samples (60 males and 33 females) were examined for the study of helminth fauna during the study in various wetlands, out of them 40 were found infected with different gastrointestinal parasites. The total five species of gastro-intestinal parasites were recorded as *Notocotylus attenutus, Paryphostomum radiatum, Capillaria anatis, Epomidostomum anattinum, and Hymenolepis abortive.* The helminths isolated in the present study are in agreement with the previous findings of Fotedar et al. (1965), Ahmad and Chishti (1995), Tanveer and Chishti (2001), Kharoo (2011). The present findings are also in concurrence of the helminthic infection reported in other parts of the world (Avery ,1969; Crichton and Welch. 1972; Broderson et. al.,

1977; Shah and Kocan 1980); Canaris *et al*., 1981; Dronen *et al*., 1994 ; Gicik and Arslan 2003; Garvon *et al*., 2011; Mahammad and Al-Moussawi 2011; Malgorzata Nowak et al., 2012 ; Graves and Fedynich, 2013; Youssefi *et. al*., 2014; R. Sokol *et. al*., 2016; Oo Ean *et al*., 2018 ; Thebo *et al*., 2019 ; Farook *et al*., 2020 ; Aguilar *et. al*, 2020).

The present study revealed host-wise prevalence among various migratory bird species. The reports from other studies that there are significant differences in susceptibilities between various waterfowl species, this study also found prominent differences in parasitic load between these birds with high infection in Northern Pintail (60%), Northern Shovelar (60%) followed by Common Teal (53.84%), Gadwall (44.44%), Mallard Duck (38.98%), Greylag Goose (0%). The most possible reason for this could be environmental factors and local climatic conditions which might be responsible for reporting in some cases that differ in the intensity of parasitism in these migratory waterfowl species.

The study further revealed that the sex of the waterfowl showed an association with the prevalence of the parasite. It was found that females (54.54%) were more infected than males (36.66%). The influence of sex on the susceptibility of birds to infection could be attributed to genetic predisposition and the differential susceptibility owing to hormonal control (Blood and Radostitis, 2000). The difference in susceptibility to infection between sexes has been observed by various workers (Matur *et al* (2010); Youssefi *et al* (2014); Atsanda *et al* (2015). Youssefi *et al* (2014) reported a maximum percentage of helminth prevalence in females 71.79 in green-winged Teal (*Anas crecca*) in North Iran.

Acknowledgment

We thank the Wildlife Department for granting permission for the collection of samples. The authors are also thankful to the Department of Zoology, the University of Kashmir for providing the facilities to carry out the Laboratory work.

References

Avery, R. A. (1969). The ecology of tapeworm parasites in wildfowl. Biology, Environment Science, corpus ID: 59496322.

Atkinson, C. T., Thomas, J.N., Bruce, D.H., 2008. Parasitic diseases of wild birds. Wiley, New Jersey.

Ahmad F. and Chishti, M. Z. (1995). Avian Trematode parasites of Kashmir. Part-II. Genus Notocotylus Diesing 1839. Orient. Sci., 1(1-2): 59-65.

Atsanda N. N., Jajere S. M., Adamu N. B., Lawal J. R., Zango M. K., Chindo M. B., 2015. Prevalence of helminth parasites of helmieted guinea fowl (Numida meleagris galeatus) in Maiduguri, Northeastern Nigeria. New York Sci J., 8 (3): 93-7

Aguilar, P. P., Evangelina Romero-Callejas, Jose Ramirez-Lezama, David Osorio-Sarabia, Luis Garcia-Prieto, carlos Manterola, luis Jorge Garcia-Marquez, heliot Zarza (2020). Gastrointestinal helminthes of waterfowl (Anatidae: Anatinae) in the Lerma marshes of central Mexico: some pathological aspects. International journal of Parasitology: Parasites and Wildlife, 13: 72-79.

Barrera-Guzm´an, A., Guill´en-Hern´andez, S., 2008. Helmintos intestinales en aves Ciconiformes de la ci´enega de Chuburn´a, Yucat´an, M´exico. Rev. Mex. Biodivers. 79, 525–527.

Bibi F., Ali Z., Qaisrani S. N., Shelly S. Y. and Andleeb S. 2013. Biodiversity and its use at Tounsa Barrage Wildlife Sanctuary. Pakistan J. Anim. Pl. Sci. 23(1):174-181.

Blood, D. C. and Radostitis, O. M. (2000). Veterinary medicine, 7th Edn. The English Language Book society, Bailliere Tindall, London.

Broderson D., Albert G. Canaris and John R. Bristol., 1977. Parasites of waterfowl from Southern Texas:II. The Shovelar, Anas clypeata. Journal of wildlife diseases, 13: 435-439.

Canaris A.G., Mena A.C. and Bristol J.R. (1981). Parasites of waterfowl from Southwest texas:III. The green Winged Teal, Anas crecca. Journal of wildlife diseases, 17(1): 57-64.

Crichton, V. F. J. and H. E. Welch. 1972. Helminths from the digestive tracts of mallards and pintails in the Delta Marsh, Manitoba. Can. J. Zool. 50:633637.

Dronen N. O., Lindsey J. R., Ross L. M., and Krise G. M., 1994. Helminths from Mallard Ducks, Anas platyrhynchos, wintering in the Post-Oak Savannah of SouthCentral Texas. The Southwestern Naturalist, 39(2): 203-205.

Dorothy Broderson, Albert G. Canaris and John R. Bristol., 1977. Parasites of waterfowl from Southern Texas:II. The Shovelar, Anas clypeata. Journal of wildlife diseases, 13: 435-439.

Fotedar D.N. and Kaw L.K. , 1965. Studies on some trematode parasites of common Mallard duck in Kashmir. Part III (abstracts) of Proceedings of the 53rd session of Indian Science Congress. Chandigargh.

Farook Z., Nadeem M., Hussain T., Abrar M., Tanveer-ul- Hassan, Khan M. S., Wajid M., Fatima M. and Baber M. E. (2020). Gastrointestinal parasites of common teal (Anas crecca) in the Wetlands of Punjab, Pakistan. International Journal of Progressive Science and Technologies, 21(1):188-195.

Garvon, J. M., Fedynich, A. M., Peterson, M.J., Pence, D.B., 2011. Helminth community dynamics in populations of blue winged teal (Anas discors) using two distinct migratory corridors. J. Parasitol, Res. 2011, e306257.

Gicik, Y. and Arsalan, M. O., 2003. The prevalence of Helminthes in the alimentary tract of Geese (Anser anser domesticus) in Kars District, Turkey. Veterinary Research Communication, 27: 391-395.

Gunnarsson, G., Latorre-Margalef, N., Hobson, K. A., Van Wilgenburg, S. L., Elmberg, J., Olsen, B. and Waldenstron, J. (2012). Disease dynamics and bird migration- linking mallards Anas platyrhynchos and subtype diversity of the influenza A virus in time and space. PloS one, 7(4):e35679.

Graves, D.W., Fedynich, A.M., 2013. Assessing helminth community structure and patterns in gizzard helminths of blue-winged teal (Anas discors). J. Parasitol. 99, 748–751.

Jaime D. Farias and Albert G. Canaris., 1986. Gastrointestinal helminthes of the Mexican Duck, Anas platyrhynchos Diazi Ridgway, from North Central Mexico and Southwestern United States. Journal of Wildlife Diseases, 22(1):51-54.

Krauss, S., Stallknecht D. E., Negovetich N. J., Nile L. J., Webby R. J. and Webster R. G. (2010). Coincident ruddy turnstone migration and horseshoe crab spawning creates an ecological hot spot for influenza viruses. Proceedings of the Royal Society B: Biological Sciences 277: 3373-3379.

Kharoo V K, 2011. Studies on monostomes from the winter migratory birds in Kashmir. Indian Journal Of Fundamental and Applied Life Science.1 (3), 209-216.

Leung, T.L.F., Koprivnikar, J., 2016. Nematode parasite diversity in birds: the role of host ecology, life history and migration. J. Anim. Ecol. 85, 1471–1480. Liebler, E.M., Pohlenz, J.F., Woode, G.N., 1988. Gut-associated lymphoid.

Lundahl, C. 1848. Bemerkungen Uber Zwei Neve Strongylus Arten Notis Sallsk. Fauna et Flora Fenn Forh., 1 Hafted: 283-287

Matur, B. M., Dawam N. N., Malann Y. D. (2010). Gastrointestinal helminth parasites of local and exotic chickens slaughtered in Gwagwalada Abuja (FCT), Nigeria. New York Sci J., 3(5):96-9.

M. K. Mohammad and A.A. Al-Moussawi., 2011. Prevalence and infection rate of three Gizzard nematodes in the mallard Anas platyrhynchos L., 1758 collected in Al-Diwaniya and Diyala Provinces, Central Iraq. IBN Al- HAITHAM J. For PURE and APPL. Sci. 24(3).

Malgorzata Nowak, Katarzyna Kavetska, Katarzyna Krolaczyk, Agata stapf, Slawomir Kornas, Marek Wajdzik and Marta Basiaga (2012). Comparative study of cestode and nematode fauna of the gastrointestinal tract of mallards (Anas platyrhynchos L., 1758) from three different Polish ecosystems. Acta Sci. Pol., Zootechnica, 11 (4):99-106.

M. K. Mohammad. 2015. The parasitic fauna of the Wigeon Anas Penelope L. 1758 collected in central Iraq. Advances in Bioresearch. 6(2): 60-63.

OO Esan, EC Uwalaka and MT Apampa (2018). Prevalence of gastrointestinal helminthes of waterfowls and its possible public health implications in Ibadan, Nigeria. Sokoto Journal of Veterinary Sciences, 16(3): 76-79.

Poulin, R., 1995. Phylogeny, ecology, and the richness of parasite communities in vertebrates. Ecol. Monogr. 65, 283–302.

Pandit AK, DN Fotedar. 1982. Restoring damaged wetlands for wildlife. J. Env. Man. 14: 359-368pp.

Qadri SS. 1989. Ecological factors affecting waterfowl in the wetlands of Kashmir. Ph.D thesis, University of Kashmir, Srinagar.

Rajmund Sokol, Malgorzata Ras-Norynska, Michal Gesek, Daria Murawska, Vladimir Hanzal and Pawel janiszewski. 2016. The parasites of the mallard duck (Anas Platyrhynchos) as an indicator health status and quality of the environment. Annals of Parasitology. 62(4): 351-353.

Railliet, A. et Henry, A. 1909. Surla Classification des Stronglidae II Ancyclostominae. C. R. Soc. Bio. T., 66:168.

Revelle, W. (2020) psych: Procedures for Personality and Psychological Research, Northwestern University, Evanston, Illinois,USA, https://CRAN.R-project.org/package=psych.

R Core Team, (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://cran.r-project.org/.

Stunkard HW (1965). Studies on trematodes of the family Notocotylidae. BIO Bullentin. 129-425.

Seurat, L. G. 1918. Sur Unnouveau Strongl (Tricho-Stronglidae), de I echasse. Bull Musee Hist Natur: 11-15.

Skrjabin, K. I. 1915. Nematody Turkestanki- khptitis (Nematoden of Birds in Turkestan) Ezhened Zoo. Muzya Acad Nank, N. Petro-grade: 457-557.

Shah, M. G. and A. Alan Kocan. 1980. Helminth fauna of waterfowl in central Oklahoma. Journal of wildlife diseases. 16(1): 59-64.

Soulsby, E. J. L. 1982. Helminths, Arthopords and protozoa of Domesticated animals, 7th Ed.

Tanveer, S. and Chishti, M. Z.(2001): Studies on Notocotylid Trematode genus Paryphostomum (Luhe ,1909) in domestic fowl and common coot in Kashmir with the description of a new species J.Parasitic Diseases, vol 25(2), pp:95-99.

Thebo A. K., Naz S., Dharejo A. M.., Siyal S. and Birmani N. A.,(2019). A new species of a digenetic Trematode from common Pochard Aythya ferina (Anseriformes: Anatidae) in Sindh, Pakistan. Journal of Entomology and Zoological Studies, 7(1): 151-154.

Wallace, B.M., Pence, D., 1986. Population dynamics of the helminthes community form migrating flue-winged tail: loss of helminthes without replacement of the wintering grounds. Can. J. Zool. 64, 1765–1773.

Yamaguti S (1959). Systema helminthum volume 1 inter Science Publishers.

Youssefi M.R, Hosseini S. H., Tabarestani, A. H. A., Ardeshir H. A, Jafarzade F. and Rahimi M. T. (2014). Gastrointestinal helminthes of Green-Winged Teal (Anas crecca) from North Iran. Asian Pacific Journal of Tropical Biomedicine, 4(suppl. 1): S143-S147.

Zeder, J. G. H. 1800. Erster Nachtrag Zur Naturgeschichte der Eingeweidewurmer mit zusassen und. Amerkungen horau- seg-geben. XX+320 pp. Leipzig.