Bangladesh J. Zool. ***52****(1): 39-55, 2024* *Article*
ISSN: 0304-9027
eISSN: 2408-8455

AVIAN NEMATODE PARASITES OF SOME WILD BIRDS OF BANGLADESH

Md. Rabiul Islam, Md. Aminul Islam Bhuiyan*, Aleya Begum and Zannatun Nahar Jhinu

Department of Zoology, Faculty of Biological Sciences, University of Dhaka, Dhaka 1000, Bangladesh

ABSTRACT: The current investigation into endoparasitic helminths in wild birds from various regions of Bangladesh sheds light on a previously unexplored aspect of avian parasitology in the country. The study used specimens provided by the Padma Bridge Museum Project, a sub-project of the Bangladesh government-owned Padma Multi-purpose Bridge Project (PMBP), where dead birds were utilized for museum specimens and taxidermy. A total of 22 specimens from 21 species of wild birds were examined in this study. The samples were primarily derived from the alimentary canal (gut) and liver of the hosts. It is important to note that the study faced limitations in calculating parameters such as prevalence and intensity since all hosts were single-sampled, except in the case of the Little Cormorant, where two samples were collected, both of which were found to be infected. The study identified six cases of helminth parasite infestation in the examined bird specimens. These findings provided valuable insights into the diversity of parasites affecting these avian hosts. The specific parasite species observed, along with the host species, are as follows- Peregrine Falcon (*Falco peregrinus* Tunstall 1771) was infected with *Serratospiculum tendo* (Nitzsch 1819) in the air sacs. Grey Heron (*Ardea cinerea* Linnaeus 1758) showed infestation with *Porrocaecumardeae* (Frölich 1802) in the intestine. Little Cormorant (*Microcarboniger* Vieillot 1817) had two parasites found: *Contracaecumrudolphii* (Rudolphi 1809) in the crop and *Ascaridia* sp. (Dujardin 1945) in the intestine. Little Egret (*Egrettagarzetta* Linnaeus 1766) had *Heterakis* sp. (Schrank 1790) identified in the intestine. Bank Myna (*Acridotheres ginginianus* Latham 1790) was found to host *Capillariaannulata* (Milon 1800) in the crop. One notable aspect of this study is that all the parasite-host associations observed were reported as the first records in their respective hosts within Bangladesh. This finding highlights the importance of this research in enhancing our understanding of avian parasitology in the region and the potential impact of these parasites on wild bird populations.

Key words: Endoparasitic helminths, wild birds, morphological and meristic features.

INTRODUCTION

Bangladesh, with its remarkable diversity of wild bird species, harbors a unique avian population. As documented by Khan in 2008, the country boasts a

*Author for correspondence: <aminul_zool@du.ac.bd>
 DOI: https://doi.org/10.3329/bjz.v52i1.74725

total of visitors, 12 are summer visitors, 14 are passage visitors, and 119 are vagrants. Regrettably, three wild bird species have been extirpated from Bangladesh. Despite this incredible avian diversity, parasitological investigations have remained limited in scope. Acharjee and Islam (2019) conducted a study focusing on gastrointestinal helminth endoparasites within a commonly found passerine bird species, the Black Drongo (*Dicrurus macrocercus*). These birds were sourced from paddy fields on the Chittagong University campus for a thorough examination, revealing the presence of four helminth adult parasite species. Among these, a trematode (*Eumegacetes triangularis*), a cestode (*Notopentorchis* sp.), and two nematodes (*Viguiera dicrurusi* and *Diplotriaena bargusinica*) were identified. Additionally, an unidentified pleurocercoid larva was also encountered.

In a separate study, Hoque *et al.* (2014) conducted a survey on gastrointestinal parasitic infections among domestic and wild birds in Bangladesh. Their observations were based on faecal examinations of birds collected from various locations, including households, wet marketplaces, and wetlands in the Chittagong and Greater Sylhet districts. The results indicated the presence of *Ascaridia* spp. in faecal samples from domestic and wild birds, with an average egg load ranging from 50 to 900. Other parasites identified in both domestic and wild birds included *Capillaria* spp. and *Heterakis* spp.

While some neighboring South-Asian countries, as exemplified by studies conducted by Banerjee and Subramanian (2015), Sanjota and Ghazi (2009), Bushra *et al.* (2014, 2016), Abro *et al.* (2016), and Ujan *et al.* (2014), have contributed limited insights into the endo-parasitic helminths of wild birds, the overall body of work in this field remains relatively sparse.

The ubiquitous challenge of parasitic infections poses a serious health concern for both wild and captive bird populations, with considerable economic repercussions. Parasitism exerts a substantial economic impact, leading to reductions in host bird populations. While the impact of parasites on wild birds is often deemed manageable, the present study represents a vital endeavor in addressing this knowledge gap. It aims to provide a comprehensive description of endo-parasitic helminths affecting wild birds in Bangladesh while establishing a fundamental dataset for future researchers in this field.

MATERIAL AND METHODS

The current law of Bangladesh, the Wildlife Conservation and Security Act of 2012 (Chapter-3, Article no. 6), strictly prohibits the catching, trapping, hunting, or killing of any wildlife animal. Consequently, no live birds were utilized in the present study. The gut samples or alimentary canals of the host

birds were obtained as by-products of the Padma Bridge Museum Project, a government-owned initiative under the Padma Multipurpose Bridge project in Bangladesh. These deceased birds were sourced from various regions across the country and were intended for use in taxidermy and museum specimens. Prior to the taxidermy process, the birds were gutted, and their gastrointestinal tracts were stored in a deep freezer for subsequent parasitological investigations.

Hosts: The host birds for this study encompassed 22 specimens from 21 different wild bird species. These specimens were procured from the Padma Bridge Museum Project (PBMP) laboratory. The specific bird species examined included *Ardea cinerea, Egretta garzetta, Gorsachius melanolophus, Mixornis gularis, Motacilla alba, Motacilla maderaspatensis, Psilopogon lineatus, Rhipidura albicollis, Anthus rufulus, Phaenicophaeus tristis, Microcarbo niger* (two specimens), *Falco peregrinus, Copsychus saularis, Motacilla flava, Zoothera citrina, Treron curvirostra, Nycticorax nycticorax, Acridotheres ginginianus, Tephrodornis pondicerianus, Ploceus philippinus,* and *Ardea cinerea*.

Sampling area and time: The host specimens were collected as part of the Padma Bridge Museum Project for taxidermy and museum specimen purposes. The gut or alimentary canal, along with other internal organs of these wild birds, was gathered for helminth parasitological research, with the assistance of PBMP authorities. As per PBMP records, these deceased birds were collected from various regions in Bangladesh, including Sunamganj, Munshiganj, Tangail, Dhaka, and Bagerhat. These collections occurred during two periods: from February to April 2020 and from November to December 2020.

Method of parasite collection: The method employed for parasite collection involved a thorough examination of all parts of the gut and other internal organs, including air sacs and the liver. Encysted larvae were meticulously inspected on the surface of visceral organs using a hand lens. Each section of the viscera, such as the esophagus, crop, proventriculus, stomach, intestine, caecum, and liver, was separated and placed in different petridishes containing water. The stomach, intestine, and caecum were incised to dislodge the parasites, as they might have remained attached to the epithelial lining. The liver was shredded with forceps to isolate the parasites, and the shredded matter was allowed to precipitate out. The sediment was examined with the naked eye, and larger parasites were collected using brushes and droppers. The collected parasites were transferred to fresh saline solution for cleaning from debris using brushes, dissecting pins, or forceps. They were then fixed using various fixatives. The preservation, fixation, and slide preparation of the parasites followed standard parasitological protocols. Parasite identification was done using taxonomic keys from Yamaguti 1961.

RESULTS AND DISCUSSION

The present study involved the investigation of endoparasitic helminths in 22 specimens, representing 21 distinct wild bird species. Among the total host specimens, six were found to be positive for helminth infestations. Notably, two samples from *Microcarbo niger* tested positive for parasitic infestation. The positive hosts exhibited infections with various species of parasites, totaling six nematode species identified across six different host samples, all belonging to the nematode group. However, certain parasites could not be fully prepared for in-depth study, resulting in their inability to be identified down to the species level. It is important to highlight that all the parasitic species found during this study represent first records in their respective hosts within the region of Bangladesh. The following sections provide detailed descriptions of the identified parasites, accompanied by remarks on their significance.

Table 1: Presents an overview of the hosts examined, the parasites found, and the respective sites of infection

Host species	Identified Endo-Parasites	Infection Site
Falco peregrinus	*Serratospiculum tendo*	Air sacs
Gorsachius melanolophus	No parasite found	
Ardea cinerea	*Porrocaecum ardeae*	Intestine
Mixornis gularis	No parasite found	
Motacilla alba	No parasite found	
Motacilla maderaspatensis	No parasite found	
Microcarbo niger	*Contracaecum rudolphii*	Crop
Psilopogon lineatus	No parasite found	
Rhipidura albicollis	No parasite found	
Anthus rufulus	No parasite found	
Phaenicophaeus tristis	No parasite found	
Microcarbo niger	*Asacaridia* sp.	Intestine
Zoothera citrina	No parasite found	
Copsychus saularis	No parasite found	
Motacilla flava	No parasite found	
Egretta garzetta	*Heterakis* sp.	Crop
Treron curvirostra	No parasite found	
Nycticorax nycticorax	No parasite found	
Acridotheres ginginianus	*Capillaria annulata*	Caecum
Tephrodornis pondicerianus	No parasite found	
Calidris minuta	No parasite found	
Ploceus philippinus	No parasite found	
Acrocephalus dumetorum	No parasite found	

***Serratospiculum tendo*:** (Nitzsch, 1819) Nematoda, Diplotriaenidae; Host: *Falco peregrinus,* Site: Air sacs, Location: Munshiganj

Description: The parasites unveiled a slightly smooth and whitish cuticle, with a long and elongated body. The mouth featured two trilobed structures, prominent lips, and was devoid of labial teeth. The oral aperture was surrounded by medially positioned epaulette-like structures and laterally by

trilobed structures, accompanied by two lateral amphids and four sub-median papillae immediately behind. The esophagus was distinctly divided into two parts: a short and thin anterior muscular section and a longer, wider posterior glandular portion.

Male: The posterior extremity exhibited a rounded shape, with short and broad caudal alae meeting beyond the tip of the tail. Four pairs of preanal papillae and four pairs of postanal papillae were observed. The spicules showed asymmetry, with the left spicule nearly twice the size of the right one, and no gubernaculum was present. The posterior end of the male featured spicules, resembling a pipe in the middle part and ending in a sharp tip. Two phasmids were positioned between the cloacal opening and the posterior end of the post-cloacal papillae. The transverse vulva was closed by two lips. Males were smaller in both length and width compared to females, with an average total body length ranging from 132 to 154 mm and a maximum width of 1.00 to 1.45 mm. The total length of the esophagus ranged from 9.7 to 11.4 mm, with the muscular part measuring 0.6 to 0.615 mm. The left spicule had a length of 1.00 to 1.2 mm and a maximum width of 1.00 to 1.2 mm. The tail measured 0.127 to 0.13 mm in length. The vulva measured 0.150–0.180 mm in length and was situated 0.878–1.160 mm from the anterior end.

Female: The posterior extremity showed a rounded shape, with the vulva situated between the junction of two portions of the esophagus. In the anterior part of the female, the esophageal tube was visible, while the caudal part revealed a segment of the uterus containing eggs with a thick shell in the distal uterine sphincter. For females, the average total body length ranged from 198 to 248 mm, with a maximum width of 1.20 to 1.40 mm. The total length of the esophagus varied from 17.8 to 21.4 mm, with the muscular part measuring 0.601 to 0.612 mm. The vulva was positioned 1.6 to 1.7 mm from the anterior part, and the excretory pore was located at 0.170–0.230 mm from the anterior extremity. The tail measured 0.097 to 0.110 mm in length.

Remarks: Bain and Mawson (1981) identified an air sac nematode parasite of *F. peregrinus* as *Serratospiculum tendo* based on habitats and morphological traits. Sonin (1968) also described it as *S. tendo*, identifying it by the size of spicules and body length. The average length of the air sac nematode in *F. peregrinus* was reported as 152 mm, with spicules measuring 550-1100 µm. Santoro *et al.* (2016) conducted examinations on 17 birds in Southern Italy, finding that 80.6% of *F. peregrinus* were infected with *S. tendo*. This suggests a strong host specificity for *F. peregrinus*. Ibarra *et al.* (2019) described the air sac nematode of *F. peregrinus* as *S. tendo*, noting the occurrence of epaulets on each anterior end and the absence of cuticular ornamentation in females.

***Porrocaecum ardeae*:** (Frölich, 1802) Nematoda, Toxocaridae; Host: *Ardea cinerea*, Site: Intestine, Location: Sunamganj

Description: Moderate to large-sized nematodes with a yellowish body color and fine transverse striation in the cuticle. Dentigerous ridges on the inner margin of the lips, hexagonal and fully developed, smaller towards the base. Distal margin of the lips with two lateral projections and a central indentation continuing as a groove on the lip's distal exterior surface. Inter-labial fold present, fully formed, shorter than the lips. Amphid's dorsal lip with two enormous double papillae; ventrolateral lips with one huge double papilla, a single outer labial papilla, and the amphid's outlet. Labial pulp consisting of a dissected distal median lobe with two anterior prolongations. Asymmetrical cervical alae with transverse striation; left ala larger and thicker than the right. Ventriculus at the distal end of the esophagus. Intestinal cecum present. Single internal unpaired lobe projecting distally from the base of the lips. Vulva located in the middle part of the body.

Male: The male nematode was characterized by two rows of proximal papillae. The median pre-cloacal papilla was shallow and positioned anterior to the cloacal margin. Spicules were found equal in size, and no gubernaculum was present. The tail narrowing to a point, exhibiting a conical shape with a slight taper at the tip. Phasmids were located at the mid-level between sublateral and lateral papillae. Despite being smaller than the female, the male measured a total length of 65.00 mm and a width of 1.10 mm. The left cervical ala was 2.10 mm long, while the right measures 2.00 mm. Lips were found 0.45 mm long, and the inter-labia measured 0.30 mm. The esophagus spanned 5.00 mm, and the ventriculus measured 0.90 mm. An intestinal caecum of 3.35 mm was present. The nerve-ring and excretory pore were located at 0.80 and 0.93 mm, respectively, from the anterior end. Right spicules measured 2.40 mm. There was one pair of double para cloacal papillae and four pairs of distal papillae (two subventral and two lateral). The tail length was 0.58 mm.

Female: The female nematode exhibited distinctive features, including the vulva positioned in the first third of the body length from the anterior end. The tail was found conical with a slightly curved and rounded tip, while the lateral phasmids contributed to its characteristic appearance. Notably, the female surpassed the male in both length and width, measuring a total length of 116 mm and a width of 1.25 mm. The left cervical ala spanned 2.25 mm, and the right measured 2.05 mm, contributing to asymmetry. Lips, measuring 0.68 mm in length, and interlabia, measuring 0.55 mm, add to the nuanced morphology. Internal structures included an esophagus of 8.25 mm, a ventriculus measuring 1.66 mm, and a discernible intestinal caecum of 5.60 mm. The nerve-ring and excretory pore were found positioned at 0.115 mm and 1.20 mm, respectively, from the anterior end, providing crucial anatomical landmarks. Finally, the tail extended to a length of 0.85 mm, completing the description of this distinct female nematode.

Remarks: Nematode parasites, specifically *Porrocaecum ardaea* within the genus *Porrocaecum*, stand as the exclusive representatives of the family Toxocaridae known to parasitize birds. In a parasitological investigation on grey herons, Dziekońska-Rynko *et al.* (2015) revealed that *Porrocaecum ardaea* infects these birds very early in life. Conducting a survey on wild birds in the Hyderabad district of Pakistan, Sanjota *et al.* (2013) collected nematodes from the gizzard and identified them as belonging to the genus *Porrocaecum*. The identification was based on morphological features, providing valuable insights in comparison to prior works.

The genus *Porrocaecum* has been documented in various wild bird species, encompassing Falconiformes, Ciconiiformes, Charadriiformes, Strigiformes, and Passeriformes, distributed globally. Approximately 40 species within this genus have been recorded in regions spanning Asia, Europe, America, and Australia (Atkinson *et al.* 2008; Barus *et al.* 1978; Mozgovoy 1953).

Contracaecum rudolphii (Rudolphi, 1809) Nematoda, Anasakidae; Host: *Microcarbo niger* Site: Crop, Location: Sunamganj

Description: The nematode, characterized by medium to moderate size, features a digestive system inclusive of a pair of oppositely-directed caecae. Prominent lips, exhibiting dentigerous ridges, are observed, along with well-developed interlabia. The stout body is adorned with a transversally striated cuticle. Dorsal and ventro-lateral lips display a marked medial depression on the upper margin, with the absence of dentigerous ridges; the dorsal lip possesses two double papillae. Labia are present, and labial denticulation is notably absent. The interlabia are well-developed, prominently displaying a bifurcated tip. The esophagus contains a reduced globular ventriculus, accompanied by a ventriculus with a posterior appendix that is reduced and solid. An intestinal caecum is discernible. The parasite exhibits an excretory pore located at the anterior end, representing a significant morphological characteristic. Furthermore, a conical tail is present in both males and females. In males, the tail is shorter than in females, with a distal extremity that tapers. Notably, post and pre-cloacal papillae are identified in males.

Male: The observed male nematode lacked distinct caudal alae. It exhibited seven pairs of postanal papillae, positioned partly subventral and partly lateral, while preanal papillae were numerous. The spicules were characterized as long and alate, with a slightly rounded distal end, and notably, a gubernaculum was absent. Measuring 11.2-14.8 mm in length and 0.52-0.75 mm in breadth, the worm presented specific dimensions across various anatomical features. In the anterior portion of the esophagus, measurements revealed a length of 1.20–1.56 mm and a width of 0.09–0.10 mm. The nerve ring was situated at a distance of 0.37–0.395 mm from the anterior end of the body, and the excretory pore lied

0.60–0.75 mm from the anterior extremity. The intestinal caecum spanned a length of 2.00–3.00 mm, and the vulva was positioned in the first third of the body. Further measurements included a ventricular appendix of 0.40–0.78 mm in length and an intestinal caecum ranging from 2.20–2.50 mm. The spicules were slightly subequal, with the right spicule measuring 3.80–4.20 mm and the left spicule measuring 4.00–4.70 mm. The tail, extending from 2.40–2.80 mm, was accompanied by specific arrangements of caudal papillae. These included 2–3 proximal papillae, 2 pairs of paracloacal papillae, and 4 pairs of distal papillae. Additionally, one pair of very small papilla-like phasmids was situated laterally to the 4th distal papillae.

Female: The detected female nematode exhibited distinct characteristics, notably with the vulva located in the anterior region of the body. Caudal alae, wide and extending from the posterior extremity throughout the body, define its anatomical features. Towards the end of the tail, a constriction known as the mucron was observed in the female. Notably, the female surpassed the male in both length and width, measuring 14-17.20 mm and 0.54-0.85 mm in breadth, respectively. The esophagus of the female measured 3.40–3.90 mm in length and 0.096–0.20 mm in width. The nerve ring was situated at a distance of 0.40–0.455 mm from the anterior end of the body, while the excretory pore was positioned 0.70–0.80 mm from the anterior extremity. A ventricular appendix of 0.45–0.90 mm in length and an intestinal caecum spanning 2.20–3.60 mm characterized the digestive system. Similar to the male, the vulva was positioned in the first third of the body. The distinct feature of caudal alae in the female began approximately 0.310–0.35 mm from the posterior extremity and continued throughout the entire length of the body. These detailed observations provide a comprehensive understanding of the morphological features of the female nematode.

Remarks: Contracaecum rudolphi, a nematode parasite, is known to infect piscivorous birds and has a global distribution, as documented by Amato *et al.* in 2006. Barson *et al.* (2004) reported the collection of *C. rudolphi* from the stomach and intestine of a piscivorous bird. Interestingly, they observed the coexistence of morphologically similar *C. multipapilium* with *C. rudolphi* in the esophagus and intestine. In a study by Dziekońska-Rynko *et al.* (2015), it was demonstrated that grey herons and their chicks were infected with *C. rudolphi*, exerting adverse effects on their health. The study suggested the transmission of parasites from adult birds to chicks during the feeding process.

Yamaguti (1961) provided notable morphological characteristics of *Contracaecum* spp., including lips lacking dentigerous ridges, well-developed interlabia, and a shortened ventriculus with a solid posterior appendix. Mozgovoy (1953) found *Contracaecum* spp. in *Microcarbo* sp. and *Ardea* sp. Deardorff and Overstreet

(1981) classified *Contracaecum rudolphii* based on the excretory pore's proximity to or below the nerve ring, Hartwich (1964) reported several species of the family Phalacrocoracidae (cormorants) as definitive hosts for *Contracaecum rudolphii* and other sibling species. In different environments, including brackish and freshwater, two anisakid species, *C. rudolphii* and *C. rudolphii B*, were identified infecting *Microcarbo niger* across Europe (Szostakovka and Fagerholm *et al.* 2007). This collective research highlights the diverse occurrences and impacts of *Contracaecum rudolphi* within avian populations.

***Heterakis* sp.** (Schrank, 1790) Nematoda, Ascaridiidae: Host: *Egretta garzetta,* Site: Intestine, Location: Sunamganj

Description: The parasites under consideration were of medium size, presenting a whitish coloration. Their elongated and triangular bodies featured a thin cuticle exhibiting very fine striations arranged in a transverse pattern. Notably, the mouth was encircled by one dorsal and two laterally positioned lips of similar size. Lateral alae emerged from the pharyngeal region, extending up to two-thirds of the body length. Each lateral lip held two papillae – one positioned at the inception of the lateral alae near the base of the lips, and others towards the anterior extremity of the lips. Behind the nerve ring, one pair of cervical papillae was situated. The mouth led to a short pharynx characterized by a muscular wall. The esophagus was distinctly divided into two parts: a long, slender anterior portion and a posterior part housing a bulb containing a triangular apparatus. The nerve ring was positioned in the middle part of the esophagus, and in close proximity, the excretory pore opened shortly behind the nerve ring. This detailed description provided a comprehensive overview of the morphological features of these medium-sized parasites.

Male: The worms displayed two characteristic and dissimilar spicules. The preanal sucker was well-developed, featuring strongly chitinized walls, and a small semicircular incision was recognized in the posterior margin of the sucker wall. These worms bore two large lateral bursal wings, and their straight tails terminated in slender and tapering points. The abdominal surface of the male displayed up to 10 pairs of caudal papillae, with the two most posterior pairs being stout and laid one over another. The male, though smaller, was slightly wider than the female, measuring 10-12 mm in length and 0.30-0.35 mm in width. Lateral alae extended 3.50-4.00 mm from the base of the lips, contributing to the overall structure. The esophagus measured 1.00-1.20 mm in length and 0.12-0.15 mm in width, with the nerve ring located at 0.35-0.40 mm from the anterior extremity. The excretory pore was situated 0.44-0.50 mm from the anterior end of the body, and caudal alae were located at 0.40-0.45 mm away from the posterior end. The spicules were unequal; the right spicule measured 2.00-2.15 mm, and the left spicule measured 1.00-1.15 mm in length. The tail measured 0.60-0.70 mm in length.

Female: The female parasite exhibited a long, narrow, and pointed tail, with a relatively inconspicuous vulva positioned slightly posterior to the middle of the body. The lateral alae, narrow in structure, extended almost to the end of both sides of the body, culminating in a well-developed bulb at the termination of the esophagus that houses a valvular apparatus. The female worm measured 12-14 mm in length and 0.25-0.30 mm in width. The lateral alae extended 4.00-4.50 mm from the base of the lips, contributing to the overall morphology. The esophagus was characterized by a length of 1.00-1.25 mm and a width of 0.15-0.20 mm, with the nerve ring positioned at 0.40-0.45 mm from the anterior extremity. The excretory pore was situated 0.50-0.60 mm from the anterior end of the body. Notably, the vulva was located 6.00-6.50 mm from the anterior end of the body, and the tail measured 1.00-1.20 mm in length. This comprehensive description provides insights into the detailed anatomical features of the female parasite.

Remarks: Adult *Heterakis* worms primarily inhabit the lumen of the ceca in both wild and domestic birds. Among the various species known to be common in birds such as chickens, turkeys, guinea fowls, quails, ducks, pheasants, and geese, *H. gallinarum, H. isolonche,* and *H. dispar* are identified as prevalent, as highlighted by Park and Shin in 2010.

In his extensive work, Yamaguti (1961) described around 44 species within the genus *Heterakis* found in domestic and wild birds, with only 8 of them parasitizing domestic birds. Notably, the identification of the parasite as *Heterakis* sp. was determined by Gupta and Acharya (1970) based on the presence of two sessile papillae near the base of the final intermediate solitary papillae. This detailed information sheds light on the distribution and species diversity of *Heterakis* worms in avian hosts.

***Asacaridia* sp.** (Dujardin, 1945) Nematoda, Ascaridiidae: Host: *Microcarbo niger*, Site: Intestine, Location: Munshiganj

Description: The nematode observed was medium to large-sized, featuring a slender and stout body. The cuticle was thick, semitransparent, and displayed transverse striations. The mouth was prominent and surrounded by well-defined lips, with the dorsal lips slightly broader than the lateral ones. Notably, interlabia were absent. The vulva was present, albeit not prominent, and positioned at the middle part of the body. The esophagus took on a club-shaped form without a posterior bulb. Lateral alae were distinct, cuticular, and prominently visible. The nematode exhibited 10 pairs of papillae, with one pair situated laterally to the precloacal sucker, three pairs extending from the precloacal sucker to the cloaca, and three pairs extending para-cloacally. The remaining pairs of papillae extended from the cloaca to the tip of the tail. Interestingly, the buccal cavity was absent. The intestine was simple, long, and

lacked any diverticulum. The nerve ring was positioned near the end of the esophagus, and the excretory pore was located behind the tail's end. Both males and females had a pointed tail. These detailed observations provide intuitions into the morphological features of the nematode in its experimental state.

Male: The male revealed well-developed, alate spicules, and a circular, well-developed precloacal sucker with a depression on its posterior margin. The tail featured ventrolateral and well-developed caudal alae. The male worms measured 12.00-15.00 mm in length and 0.25-0.40 mm in breadth. Oesophagus was 2.00-2.5 mm long, with the nerve ring located at a distance of 1.80-2.00 mm from the anterior extremity of the body. The precloacal sucker measured 0.10-0.12 mm in size, and the spicules were well-developed, measuring 0.90-1.50 mm in length. Additionally, the caudal alae measured 0.40-0.90 mm in length and 0.05-0.08 mm in width. These characteristics defined the morphological features of the male nematode in its observed state.

Female: The ova and eggs within the uterus were not readily apparent, exhibiting a conical shape with a small mucron at their tips. The vagina was muscular, and the uterine structure was branched and opposed. The female, longer and wider than the male counterpart, measured 18-20 mm in length and 0.30-0.40 mm in width. The esophagus extended 2.00-3.00 mm in length, with the nerve ring encircling at a distance of 2.00-2.50 mm from the anterior extremity. The vulva was situated approximately in the middle of the body, positioned at a distance of 8.50-9.50 mm from the anterior extremity. The tail of the female measured 0.50-0.80 mm in length and 0.240-0.480 mm in width. The mentioned morphological features characterized the female nematode.

Remarks: Kajerova *et al.* (2004) conducted a comprehensive survey to revise the study on *Ascarida* spp. parasitizing wild birds. They employed a determination key to identify and differentiate various species within the genus Ascaridia, providing a list of seven species: *Ascaridia galli, Ascaridia columbae, Ascaridia hermaphrodita, Ascaridia sergiomeirai, Ascaridia ornate, Ascaridia nicobwerensis,* and *Ascaridia platyceri*. The differentiation of these species relied on meticulous observations of morphological characteristics, including the location and number of caudal papillae, the presence or absence of alae of spicules and interlabia, the position of the vulva, and the length of the tail (Kajerova *et al.* 2004a, 2004b; Kung 1949).

Despite these detailed observations, it was acknowledged that the morphometric features of different species within the genus exhibited similarities, making it challenging to detect the position of caudal papillae using light microscopy and differentiate among the species. Ascaridia nematode parasites were noted to infect a diverse range of wild and domestic birds, as documented by Yamaguti in 1961.

Capillaria annulata (Milon, 1800) Nematoda, Capillaridae: Host: *Acridotheres ginginianus,* Site: Crop, Location: Dhaka

Description: The specimen was medium in size, featuring a triangular, elongated, and thin body. The anterior end exhibited a slight latero-dorsal bend. The cuticle was thin with extremely fine striations arranged in a transverse pattern. Narrow lateral alae extended along two-thirds of the body, particularly well-developed in the cephalic region. The mouth was simple and lacked surrounding lips. Cervical papillae were positioned near the base of the lips and slightly behind the nerve ring. Mouth led to a lengthy esophagus that gradually increased in size backwardly, consisting of a narrow tube running up to almost half of the total length of the body through a chain of transverse structures. Intestine was simple, separated from the esophagus by a prominent constriction, and lacking a diverticulum. However, another constriction was noted at the posterior region of the intestine. The body narrowed down fairly and sharply near the tail end, which was bluntly rounded. These morphological features characterized the specimen.

Male: The spicular sheath of the male was smooth, extruded along with the spicule, and marked by irregular transverse striations but devoid of spines. The spicule was simple, thin, and transparent, making it difficult to trace out; it had a rounded tip and was attached anteriorly with a band of muscles. Caudal alae were absent, and the tail ended bluntly. The cloaca was terminal. The male worm measured 10 mm in length, with the maximum width occurring at the middle of the body and measuring 0.20 mm. The esophagus was 4.00 mm in length, slightly less than half of the total body length. The nerve ring was situated at 0.65 mm away from the anterior end of the body, and the spicule measured 1.06 mm in length and 0.05 mm in width.

Female: The vulva was positioned near the junction of the esophagus and intestine, not prominently projecting and lacking a membranous protrusion. The anus was sub-terminal, and the tail wasn't completely blunt. The female, larger than the male, measured 12 mm in length with a maximum width of 0.25 mm at the body's midpoint. The esophagus measured 5.60 mm in length and 0.07 mm in breadth. Additionally, the nerve ring was situated 0.07 mm from the anterior extremity, while the vulva was found 3.00 mm away from the posterior end of the body.

Remarks: Capillaria sp. that parasitized birds are divided into two groups: those that burrowed into the upper epithelium of the gastrointestinal tract (the esophagus and the crop) and those that burrowed into the lower epithelium of the digestive tract (the small intestine and, rarely, the ceca) (Park and Shin 2010).

Numerous species of the genus *Capillaria* were described and identified in the esophagus and crop, such as *C. annulata* (Molin 1858), *C. caudinflata* (Molin 1858), and several other *Capillaria* spp. collected from different parts of the digestive tract, including *C. bursata* (Freitas and Almeida 1934), *C. contorta* (Creplin 1839), and *C. obsignata* (Madsen 1945), which parasitizes the small intestine. Additionally, *C. anatis* (Schrank 1790) was found inhabiting the caecal region. All these species were identified in both farmed and wild birds, and their distribution was global (Park and Shin 2010).

General Discussion: In the present study, the gastrointestinal (GI) tracts of 22 specimens, representing 21 different bird hosts, were meticulously examined to identify helminth parasites. Among these, six hosts were found to be infected by helminth (nematode) parasites. The investigation involved a thorough examination of various parts of the GI tract, including the esophagus, crop, proventriculus, gizzard, duodenum, small intestine, caecum and other internal organs including air sacs and lungs. The majority of these sites were found to be parasitized by helminths. Detailed descriptions of these parasites, along with additional remarks, are provided in the results section, while the following sections offer an overarching discussion.

It is important to note that among different groups of helminths, which include trematodes, cestodes nematodes and acanthocephalans and only nematode parasites were recorded in this study. Trematodes cestodes and other helminths were not found. This limited diversity of parasites can be attributed to the relatively small number of samples examined. Most of the host species were represented by a single specimen, with the exception of *Microcarbo niger*, which had two specimens available for examination. It's worth noting that wild birds frequently become infected with nematodes, particularly those that use diverse aquatic habitats, which harbor a more varied nematode fauna compared to primarily terrestrial species. This is likely due to the increased opportunities for contact with infective stages of parasites and the consumption of infected hosts (Leung *et al.* 2016). Another factor contributing to the limited diversity of recorded parasites is that the gut samples were preserved in formalin for an extended period, resulting in the darkening of the livers and other organs, making it impossible to separate cestodes and trematodes from these tissues.

The legal restrictions on the examination of more specimens presented a challenge as only dead birds, provided by the Padma Bridge Museum Project (PBMP), were available for use. The host samples were by-products of the Padma Bridge Museum Project, where various deceased wild animals, including wild birds, were collected for taxidermy and museum specimens. The gut samples were acquired from the PBMP authority, making it impossible to increase the sample size as needed for a more comprehensive examination of different parasite fauna. This constraint further contributes to the limited variety and

number of parasites recorded in this study. Among the 22 host birds examined, only six were found to be parasitized by helminths. This could be attributed to the fact that wild birds possess a range of anti-parasitic mechanisms, including anti-parasite behaviors, immunological responses, and morphological adaptations. These mechanisms serve as defenses against parasites and pathogens. Additionally, host birds' anti-parasite behaviors can be categorized into five major groups: (i) body maintenance, (ii) nest maintenance, (iii) avoidance of parasitized prey, (iv) migration, and (v) tolerance (as reviewed by Bush and Clayton in 2018).

Fig. 1 *Serratospiculum tendo* (10x)

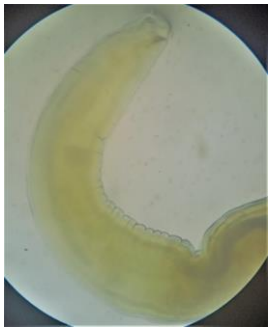

Fig. 2. *Porrocaecum ardeae* (10x

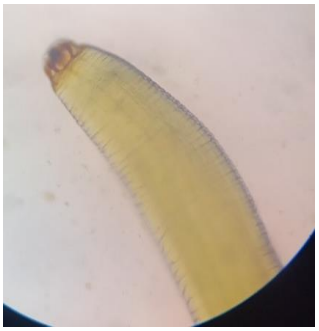

Fig. 3. *Contracaecum rudolphii* (10x)

Fig.4: *Heterakis* sp. (10x)

Fig.5: *Capillaria* sp. (10x)

Fig.6: *Asacaridia* sp. (10x

Plate-1. Photograph of different nematode parasites.

Furthermore, out of the 22 host birds, 11 were insectivores, 5 were frugivorous, 4 were piscivores, 2 fed on invertebrates, 1 was omnivorous (consuming grain and insects), and 1 was a carnivore. Among the 22-host species, the six positive hosts included 4 piscivores, 1 omnivore, and 1 insectivore. It is noteworthy that 4 out of 5 piscivore hosts and 1 out of 11 insectivores were positive for helminth parasites. This observation suggests a correlation between a host's food habits and helminth infections. Specifically, it indicates that piscivorous birds are more frequently parasitized by helminths, while insectivores are less frequently affected.

LITERATURE CITED

ABRO, M. M., DHWEREJO, A. M., KHAN, M. M. and N. A. BIRMANI. 2016. New host and locality record of *Paryphostomum radiatum* (Dujardin, 1845) (Trematodes: Echinostomatidae) from Pakistan. *Journal of Bio Nat.* **6**(2), 104-108, https://www.researchgate.net/publication/308203995

ACHARJEE, R., and ISLAM, T. 2019. Helminth endoparasites of black drongo, *Dicrurus macrocercus* (Passeriformes: Dicruridae) from Chattogram, Bangladesh. *Bangladesh Journal of Zoology*. **47**(1), 159-171, http://doi:10.3329/BJZ.V47I1.42054

AMATO, J.F., MONTEIRO, C.M. and AMATO, S.B. 2006. *Contracaecum rudolphii* hartwich (nematoda, anisakidae) from the neotropical cormorant, *Phalacrocorax brasilianus* (Gmelin) (aves, Phalacrocoracidae) in southern Brazil. Revista Brasileira de Zoologia. **23**,1284-1289, https://doi.org/10.1590/S0101-81752006000400046

ATKNSON, C.T., THOMAS, N.J. and HUNTER, D.B. (Eds). 2008. Diplotriaena, *Serratospiculum* and Serratospiculoides. Chapter 25. Iowa, USA: John Wiley & Sons, pp. 434- 438, https://doi.org/10.1002/9780813804620.ch25

BAIN O. and MAWSON, M.1981. Oviparous filarial nematodes mainly from Australian birds. *Records of The South Australian Museum* (Adelaide) **18**, 265-284, https://www.biodiversitylibrary.org/page/40862198

BANERJEE, S. and SUBRAMANIAN, K. A. 2015. A Report of Cestode (Phylum: Platyhelminthes) Parasites from Indian Waterbirds. *Records of the Zoological Survey of India*. **115**(2), 141-166, https://doi.org/10.26515/rzsi/v115/i2/2015/120720

BARSON, M., and MARSHALL, B. E. 2004. First record of *Contracaecum* spp. (Nematoda: Ansakidae) in Fish-eating birds from Zimbabwe. Journal of the South African Veterinary Association, 75(2), 74-78, https://doi.org/10.4102/jsava.v75i2.456

BARUŠ, V., SERGEEVA, T.P., SONIN, M.D., RYZHIKOV and K.M., RYŠAVÝ, B. 1978. Systematic Part. In: Ryšavý, B., Ryzhikov, K.M. (eds) Helminths of Fish-Eating Birds of the Palaearctic Region. Helminths of Fish Eating Birds, vol 1. Springer, Dordrecht. 1978, ISBN : 978-94-009-9974-9

BUSH, S. E., and CLAYTON, D.H. 2018. Anti-parasite behaviour of birds. Philosophical Transactions of the Royal Society B: Biological Sciences, 373(1751), 20170196, https://doi.org/10.1098/rstb.2017.0196

BUSHRA, S., SANJOTA, N.D., ABBASI, M.A.A and KHAN, A. 2014. *Echinostoma rafiae* new species (Trematoda: Echinostomotidae) from the little egret *Egretta garzetta* in Sindh, Pakistan. *Int. J. Biol. Biotech.* **11**, 491-495, http://www.journalcra.com

BUSHRA, S., SANJOTA, N. D.GHAZI, R. R. and KHAN, A 2016. *Episthmium jamshorensis* sp. n. (Trematoda: Echinostomatidae) from the bird *Egretta garzetta* (Little egret) in Sindh, Pakistan. *Int. J. Biol. & Biotech.* **13**, 261-265.

DEARDORFF, T.L. and OVERSTREET, R.M. 1981. *Raphidascaris camura* sp. n., *Hysterothylacium eurycheilum* (Olsen) comb. n., and comments on *Heterotyphlum spaul* (Nematoda: Ascaridoidea) in marine Fishes. *The Journal of Parasitology*. 426-432, https://doi.org/10.2307/3280567

DZIEKOŃSKA-RYNKO, J., MIERZEJEWSKA, K. and HLIWA, P. 2015. Parasitic helminths in grey heron (Ardea cinerea) chicks. *Biologia*, **70**(2), 279-282, https://doi.org/10.1515/biolog-2015-0022

GUPTA, N.K. and ACHARYA, A.K. 1970. Morphology of *Heterakis gallinae* (Gmelin) Freeborn, 1923 (Nematoda : Oxyuroidea). Research Bulletin of the Punjab University, Science **21**(3-4), 285-289, https://eurekamag.com/research/013/727/013727694.php

HARTWICH, G. 1964. Revision der vogelparasitwaschen Nematoden Mitteleuropas II.- Die Gattung *Contracaecum* Railliet and Henry, 1912 (Ascaridoidea). *Mitteilungen aus dem Zoologischen Museum in Berlin*. **40**, 15– 53, https://doi:10.1002/mmnz.19590350107

HOQUE, M., A., HASSAN, M., M., HAQUE, E., SHAIKAT, A., H., KHAN, S., A., and ALIM, A. 2014. A survey of gastro- intestinal parasitic infection in domestic and wild birds in Chittagong and Greater Sylhet, Bangladesh, *Preventive Veterinary Medicine*. **117**, (1) 305-312, https://doi:10.1016/j.prevetmed.2014.07.012

IBARRA, J., SIERRA, R. L. M. Y., NEIRA, G., IBACETA, D. E. and SAGGESE, M. D. 2019. Air sac nematode (*Serratospiculum tendo*) infection in an Austral peregrine falcon (*Falco peregrinus cassini*) in Argentina. *Journal of wildlife diseases*. **55**(1), 179-182, https://doi: 10.7589/2017-12-314

KAJEROVA, V., BARUS, V. and LITERAK, I 2004a. Nematodes from the genus Ascaridia parasitizing psittaciform birds: a review and determination key. *Vet Med.* **49**, 217–223, http//doi: 10.17221/5698-VETMED

KAJEROVA, V., BARUS, V. and LITERAK, I. 2004b. New records of *Ascaridia platyceri* (Nematoda) in parrots (Psittaciformes). *Vet Med.* **49**, 237– 241, http//doi: 10.17221/5700-VETMED

KHAN, M. A. R. 2008. Birds of Bangladesh (in Bangla). *Bangla Academy, Dhaka*.

KUNG, C.C. 1949. Notes on some avian species of Ascaridia. *J. Helminthol.* **23**, 95–106, http//doi: 10.1017/s0022149x00032442

LEUNG, T. L., and KOPRIVNIKAR, J. 2016. Nematode parasite diversity in birds: the role of host ecology, life history and migration. *Journal of Animal Ecology*. **85**(6), 1471-1480, https://doi.org/10.1111/1365-2656.12581

MOZGOVOY, A.A., 1953. Ascaridata of animals and man and the diseases caused by them. Fundamental of Nematodology. *Nauk SSSR*, pp. 8–42

PARK, S.I., Shin, S.S. 2010. Concurrent *Capillaria* and *Heterakis* infections in zoo rock partridges, *Alectoris graeca*. *The Korean journal of parasitology*. **48**(3), 253, http// doi: 10.3347/kjp.2010.48.3.253

SANJOTA, N. D. and GHAZI, R.R. 2009. Some observations on light and scanning electron microscopic study of an ascarid nematode *Contracaecum* sp. (Nematoda: Filucapsulariinae) from the little cormorant. *Pakistan Journal of Nematology*. **27**(2), 245-253, http://142.54.178.187:9060/xmlui/handle/123456789/17747

SANJOTA, U.M.S., DAS, N., CHANNA, M.A. and KHAN, M.M. 2013. New host record of the genus *Porrocaecum* Railliet & Henry, 1912 (Nematoda: Anisakidae) from the bird, *Egretta garzetta* in Hydrabad, Sindi, Pakistan. *Pakistan Journal Nematology*. **31**(2): 183-186, https://cabidigitallibrary.org by 45.120.115.229

SANTORO, M., D'ALESSIO, N., DI PRISCO, F., KINSELLA, J. M., BARCA, L. DEGLI, B. and V. VENEZIANO 2016. The occurrence and pathogenicity of *Serratospiculum tendo* (Nematoda: Diplotriaenoidea) in birds of prey from southern Italy. *Journal of Helminthology*, **90**(3), 294-297, http//doi:10.1017/S0022149X15000139

SONIN, M.D. 1968. Filjariaty zivotnych i celoveka I vyzyvaemye imi zabolevanija. 2: Diplotrenoidea. Nauka, Moskva. [In Russian]

SZOSTAKOWSKA, B. and FAGERHOLM, H.P. 2007. Molecular identification of two strains of third-stage larvae of *Contracaecum rudolphii* Sensu Lato (Nematoda:Anisakidae) from Fish in Poland. *Journal of Parasitology*. **93**, 961–964, http//doi: 10.1645/GE-1100R.1

UJAN, H.M., BIRMANI, N.A. and SHAIKH, A.M. 2014. *Echinochasmus mazharuddini* n.sp. (Digenea: Echinostomatidae) from the Bank Myna *Acridotheres ginginianus* L. (Passeriformes: Sturnidae) in Sindh province, Pakistan. *Journal of Entomology and Zoology Studies*. **2 (6),** 226-232, https://api.semanticscholar.org/CorpusID:89815791

YAMAGUTI, S. 1961. Systema Helminthum Volume III. The Nematodes of Vertebrates, Parts I & II. Interscience Publishers, New York. 1261 pp.

(Manuscript received on 11 February 2024 revised on 1 April 2024)