

# Morphotaxonomic Characteristic and Occurrence of Nematode *Heterakis pavonis* from Jungle Babbler in Tropical Region, Sindh-Pakistan

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## ABSTRACT

The *Turdoides striata* host birds were captured and dissected during, 2019-20 to find out intestinal nematode helminth worms from different localities of district Naushahro Feroze, Sindh. A total (n=54) hosts internal visceral organs were examined, (n=118) specimens were recovered from the mid-portion and terminal part of the large intestine belonging to the Genus: *Heterakis* Duj., The morphological characteristic in all features comprised wider buccal capsule than deep. Five well-defined lips in male but female with three lips, club-shaped esophagus with valvular apparatus, vulva found at the anterior region of the body and female specimens were larger and wider than male. The longitudinal chitinous rim and bulb were present without gubernaculum. Tail pointed posterior, spicules long and unequal in size. The postanal region with seven pairs of papillae, preanal region with two pairs of papillae, and the eggs was in elliptical position. The high intensity of nematode helminths was observed during June in summer when compared with months of winter, with the consequent difference ( $P<0.05$ ) among prevalence of helminths in Jungle babbler. This research study suggested that it is a firm call for a systematic study of the helminth parasites which are continuously affecting the local birds of this Sahati, region.

**Keywords:** *Turdoides striata*, Elliptical, Gubernaculum, Papillae, Spicules, Visceral organs.

## INTRODUCTION

*Turdoides striata*, (Dumont, 1823), former friendly, form foraging behavior, sociality, vocalization, and social birds, search food in the grouping of 6-10 up to 18-20, their grouping living habit defends from other enemies, all group members using communal feather posture displays, vocal choruses, and their popular name in Hindi and Bengali is Saath Bhai (Henry and Burnell, 1903). Sometimes found along with the company of other species in mixed form

(Rasmussen and Anderton, 2005). They are gloomily in brownish with yellow-billed, identically in sexes, dorsally slightly darker, some mottling visible on breast and throat region. They feed generally on insects and their larvae frequently search from adjoining plantations and various crops (Srivastava, 2013). They are noisy, from the flock, keen sense of direction, routing, coordination, detect the earth's magnetic field, time to time birds change their habitat and habits, continual chattering, chirping, squeaking is communication pattern, and show little annual, seasonal changes, open nesting in their behavior, terrestrial and co-operative, these activities may lead the evolution in the physiology and morphology (Gaston, 1977). The female bird can hatch their eggs and breed during the night after the passing of a few times immature young ones leave to their groups and exchange contact calls with other member species display copulation and one male can be nested consequently along with two females in the same season (Gaston, 1976a). These species are present all over Pakistan, India, Bangladesh, and their adjoining areas, even in lowland areas, wherever deciduous woodlands, and evergreen forests (Ripley, 1969). This species of birds belong to Passerine commonly called Passeriformes they are large order terrestrial preaching birds (Magwisha *et al.*, 2002). During feeding they search very carefully their fruitful breeding areas, to save their eggs and form their nests and the study on passerine from several past years remained as a model study for the economy and evolutionary consideration (Bateson and Kacelnik, 1996). There is a high population of the helminths in a variety of aves but nematode is the important group causing massive damage to their hosts and 13 families widely infect bird's namely; *Strongyloididae*, *Subuluridae*, *Syngamidae*, *Trichostrongylidae*, *Heterakidae*, *Ascarididae*, *Spiruridae*, *Gnathostomatidae*, *Spiruridae*, *Thelaziidae*, *Dipetalonematidae*, *Trichuridae*, and *Physalopteridae* (Silva *et al.*, 2009). About 1400 cestodes species cause harm to domestic and wild birds but *Hymenolepidae*, *Dilepididae*, and *Davainidae* are frequently found including various other genera such as *Fimbriaria*, *Amoebotaenia*, *Hymenolepis*, *Choanotaenia*, *Raillietina*, *Davainae*, *Metroliasthes*, *Drepanidotaenia*, *Diorchis*, and *Imparmargo* relying on negative effect to the body of their hosts (Fakae *et al.*, 2003). In the field of basic science, massive research work had been carried on helminth parasites, epidemiology, ecotoxicology, and agricultural pest control, and especially in poultry (Bhutt *et al.*, 2014). These pathogenic parasites in *T. striata* cause high mortality, morbidity, and great economic loss (Dube *et al.*, 2010).

In Pakistan, the helminths such as; *S. suctoria*, *A. hamulosa*, *R. cesticillus*, *R. tetragona*, *A. galli*, *R. magninumida*, *Capillaria* sp., *R. echinobothrida*, *C. infundibulum*, *Raillietina* spp., *C. digonopora*, *H. carioca*, *D. spiralis*, *H. cantaniana*, *Heterakis* spp., *H. isolonche*, and *H. gallinarium* are widely reported from the many avian hosts (Viera *et al.*, 2010), but *Ascaridae*, *Capillaria*, and *Heterakis* genera of nematodes were found frequently from the gastrointestinal tract of *T. striata* (Matur *et al.*, 2010).

The nematodes are parasitic worms, cylindrical, elongated, unsegmented, cuticular, circular, smooth, with longitudinal striations, complete their life cycle involving intermediate hosts such as; snails, slugs, and insects (McDougald, 2005). There are several reports of the prevalence of internal nematodes parasites of the avifauna, but few reports suggest that some parasites show little effect (McDougald, 2005), but an association of *H. gallinarium*, *H. meleagridis* frequently in the intestine cause blackhead disease, typhlitis along with harsh

diarrhoeal conditions, lymphocytic infiltration, granules like appearance in the inner lining of the intestine in different bird species (Chalyet *et al.*, 2004). The nematodes are continuously affecting the wild birds for many years and this condition is a hazard from a commercial point of view (Leighton, 2002). Sindh, the historical homeland for Sindhi people, is situated in the south-east of Pakistan, generally known as Mehran, the climatic condition of this region is mild winter, but hot summer, and this region is known as a sweet home and well-coming house for migratory birds, including fish-eating birds. Therefore, it is a dire need to take certain measures to control the burden of parasites to save bird species.

## MATERIALS AND METHODS

The host birds (n=54) were captured from different croplands at various intervals of district Naushahro Feroze during 2019-20 (Fig 1). Hosts were brought for dissection in Parasitology Laboratory, Shah Abdul Latif University Khairpur to find out the helminth prevalence. During intensive observation of internal organs of the host (n=118) specimens were recovered. The host birds were captured through different strategies such as wood-made gullels, air guns, standard nets, and traps. If any host severely injured or death may occur by use air gun these were kept in the refrigerator in the laboratory and on priority basis these were dissected, and others were kept in iron and wood-made cages by given food regularly and dissected as per need basis.

Under laboratory conditions, on a priority basis by the wearing of hand gloves and with the 100%, ethanol glass slides were cleaned, kept within Coplin jar for 15-20 minutes. The soft cloth was used for slide sterilization. The cotton bowl containing a few drops of chloroform was kept at the base of the beak of the host for anesthetized purpose and then host feathers were removed from the sternum up to the cloacal opening, a horizontal long cut was given with the help of fastening scissors and internal organs were tacked away from the body, by adding few amounts of normal saline solution in Petry dishes arranged in ascending order and whole internal organs were kept separately in each dish. Then each visceral organ was thoroughly examined with the help of the stereo dissecting microscope and all the specimens were recovered from the large intestinal region. Therefore, parasites were kept on the glass slide and added two drops of glycerol and lactophenol then parasites were covered with a coverslip for further microscopic examination, but the coverslip was given above the nematode for a short time because the nematode contained a tubular body. After the examination of helminth again nematodes were washed with ethanol and kept in the bottle for further examination and Camera Lucida was used for diagrams formulation of helminths also the Meiji Infinity 1DK3000 camera was used for photography of the nematode. The measurement of different visceral organs such as; buccal capsule, mouth, lips, esophagus, bulb, valvular apparatus, spicules, suckers, papillae, and tail parts in (mm) and eggs in ( $\mu$ m). The holotype specimens were kept in the laboratory reference motivation for research purposes. For statistical analysis data was placed in MS, excel spreadsheet later on for further analysis of inconsistency examination and fruitful results help was taken by the application of software SXW, version 8.1, (USA).



**Fig. 1. Map of District Naushahro Feroze showing the host bird Jungle babbler**

## RESULTS

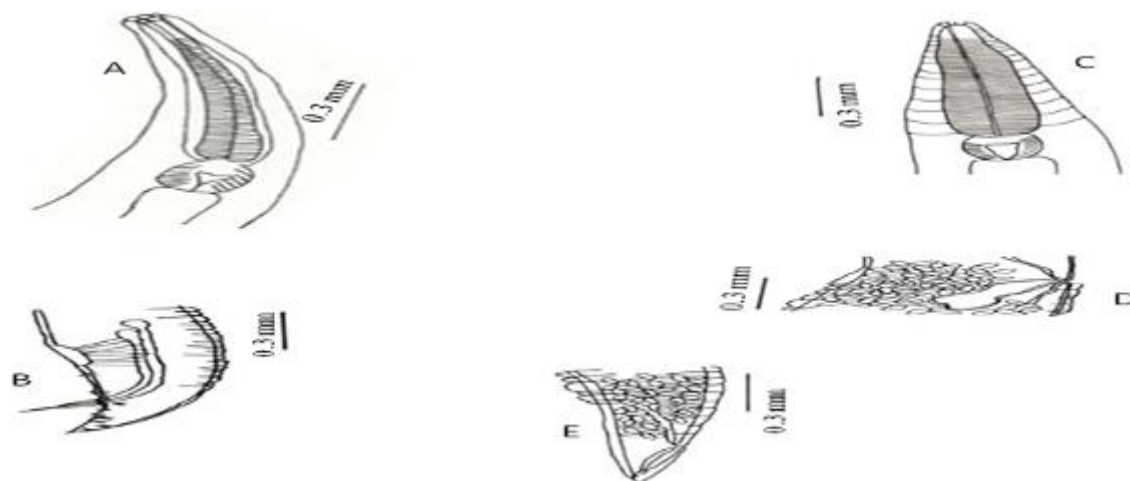
### Systematic status

Family: Heterakidae Railliet and Henty, 1914; Subfamily: *Heterakinae* Railliet and Henry, 1912; Genus: *Heterakis* Duj., 1845; Species: *H. pavonis* Maplestone, 1931; Location: Large intestine; Host: *T. striata*; Locality: Naushahro Feroze; Number of specimens: 118; Number of host birds: 54

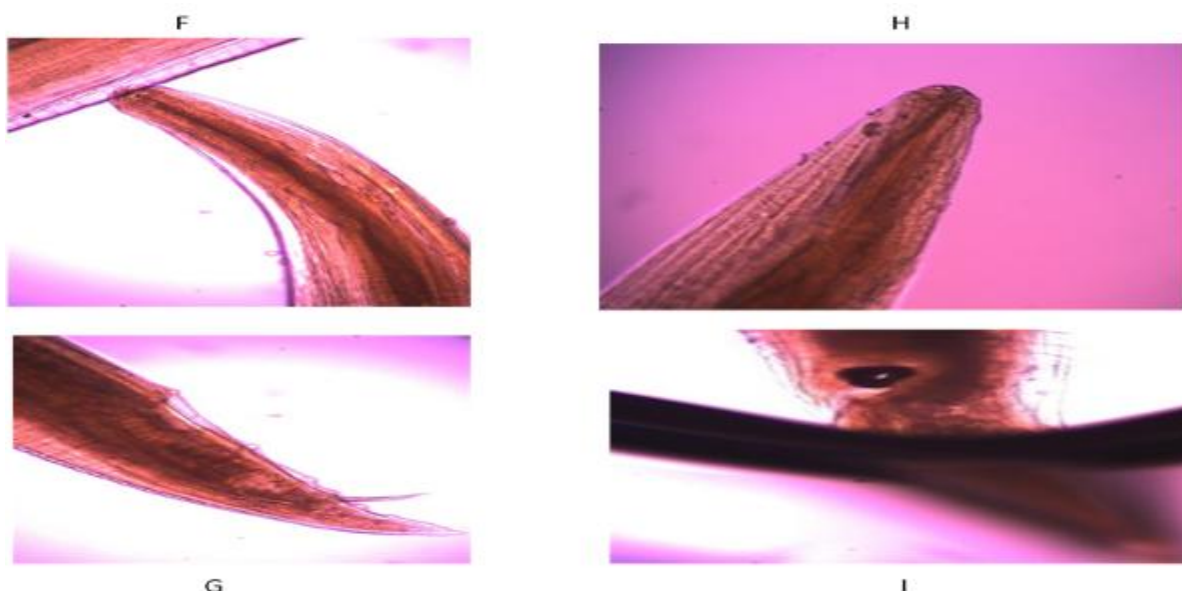
### Description of male and female (♂:♀)

The male total body length measured, 12.06 x 0.45 mm, wider at buccal capsule consist, 0.04 x 0.06 mm and five well-defined lips at the mouth area. Club-shaped narrow anterior esophagus and long posterior region of the esophagus containing a valvular apparatus followed by a bulb-like appearance measured, 0.10 x 0.78 with 0.73 mm. Unequal-sized spicules having, 0.62 x 0.76 mm. The large-sized suckers contain chitinous rim measured, 0.54 x 0.17 mm without gubernaculum. Bulb of the worm was found 0.13 x 0.17 mm in length and width. The postanal region contains two pairs of papillae and seven pairs of papillae at the preanal region. The tail pointed posteriorly and male specimens without gubernaculum.

While as; the female body was found slightly larger compared to males measured, 17.67 x 0.77 mm, the length of the buccal capsule, 0.01 x 0.047 mm. Three lips situated surrounding the mouth, esophagus comprises, 0.24 x 0.98 mm and the muscular portion of esophagus measured, 0.85 mm. The measurement of the body bulb was 0.18 x 0.20 mm. At the distance of 10.176 mm anterior regions of the body, the vulva was located, and tail length measured 0.32 mm. The eggs were found oval in elliptical shape measured, 26-38 x 34-46 mm. *H. pavonis* body parts are further described i-e- male anterior and posterior parts of the worm, female posterior and anterior portions, and vulva. The photography of the helminths i-e- posterior and anterior male helminth portions and female posterior and anterior region of the female worm, respectively shown in (Fig 2 and Fig 3).



**Fig. 2. A: Anterior portion of the male worm; B: Posterior end of a male showing spicules; C: Female anterior portion; D: Vulva; E: Posterior portion of the female.**



**Fig. 3. The photograph such as F: Anterior portion of male; G: Posterior portion of male; H: Anterior portion of the female; I: Posterior portion of the female.**

### **The body comparison of *Heterakis pavonis* with other *Heterakis* nematode species.**

The *H. Gireterakis* (Lane, 1914) nematodes recovered from many species of passerine i-e., *H. pavonis* (Maplestone, 1931) nematode reported from *Nyctrococorax nyctricorax* host birds, *H. kurilensis* (Oshmarin, 1950) nematode from *Aethia cristatella* hosts, from *Pheasant* birds respectively. The detailed observation of recovered specimen having closely morphological similarities in certain characteristics with *H. pavonis* Maplestone 1930 nematode species recovered from the large intestinal parts of *T. striata*. Hence, based on all essential features

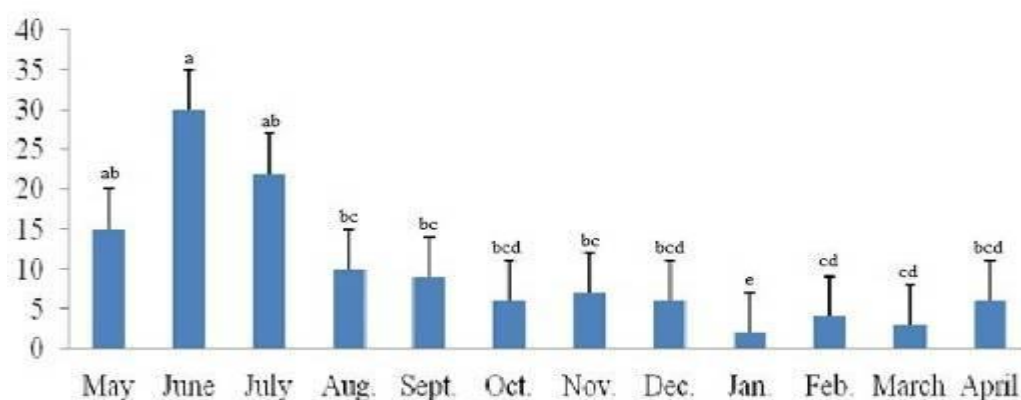
acknowledged as such and for the genus *Heterakis* Duj., 1845 present host bird is a new host record from Sindh (Table 1).

**Table1. Comparative morphological features and measurements of *Heterakis* species under laboratory conditions during, 2019-20**

Species	Present species	<i>H. gallinarum</i> Schrank, 1788	<i>H. kurilensis</i> Oshmarin, 1950	<i>H. pavonis</i> Maplestone, 1931
Male	12.06 x 0.45	11.14 x 0.39	7.4 x 0.45	10.9 x 0.35
Female	17.67 x 0.77	11.43 x 0.45	7.28 x 0.16	13.7 x 0.38
Esophagus	0.78 x 0.98	0.81 x 1.17	0.66 x 0.35	1.0 x 1.03
Bulb	0.13 x 0.20.	0.26 x 0.33	Not mentioned	0.16 x 0.24
Spicules	Subequal	Hook-like	Subequal	Hook-like
Vulva	0.10 x 0.20 anterior end of the body	4.38 x 6.44 anterior end of the body	3.25 anterior end of the body	middle of the body
Eggs	26-38 x 34.46	0.07 x 0.03	0.06 x 0.03	0.07 x 0.04
Host	<i>Turdoides striata</i>	<i>Podiceps</i>	<i>Aethia crisatella</i>	<i>Nycticorax nycticorax</i>
Locality	N. Feroze, Sindh	Uzbekistan	U.S.S.R	Japan

**Prevalence of *H. pavonis* Maplestone, 1931 helminth parasite from *Turdoides striata* (Dumont, 1823).**

The prevalence of *H. pavonis* helminth parasites in *T. striata* was found in huge numbers during the hot season. Jungle babbler birds are found in several crops, feed over a variety of insect species, and do not depend to feed only pest insects but also use weed and seeds. During crops post-harvesting season the population of *T. striata* decreases but gradually increases in winter. Further, the data was shown in (Fig. 4), found a significant difference ( $P < 0.05$ ) in each month throughout the summer and winter seasons. Whereas; (Fig. 5), shows the dissection and helminth parasitic process and (Fig. 6) prevalence of helminths parasites from internal body organs of Jungle babbler under laboratory conditions, respectively.



**Fig. 4. Monthly overall mean prevalence of *Heterakis pavonis* (Maplestone, 1923) helminth parasite in *Turdoides striata* (Dumont, 1823)**





**Fig. 5. Dissection and helminth parasitic examination from the internal body visceral organs of Jungle babbler under laboratory conditions**



**Fig. 6. Internal body visceral organs recovered to find out the helminth parasites under laboratory conditions.**

## DISCUSSION

Genus *Heterakis* Duj., 1854 was projected to document the nematodes from the avian species. Present genus is further divided *Meteterakinae* Inglis, 1957 and *Heterakinae* Railliet and Henry, 1912 sub families but Lane alienated this genus into Genus: *Gireterkis*, 1917, *Ganguleterakis* Lane, 1914 and *Heterakis* Duj., 1845. The *H. gallinarium* (Schrunk, 1788) is the type species of this genus found in domestic and wild gallinaceous birds. Many species belonging to this genus are recovered from several host birds, such as; *Podiceps* sp., and *Ciconia ciconia* in Uzbekistan and Turkmenistan. *A. vesicularis* Frolich, 1791, and *A. papillose* Bloch, 1782 are the Syn., species. *H. dispar* (Schrunk, 1790) reported from Anser host species, from *Musdecumanus* birds. *H. spumosa* (Schneider, 1866) documented from *Tinamus* sp., of birds, *H. alata* (Schneider, 1866) species of helminth documented *H. valvata* (Schneider, 1866) found from *Crypturus cupreus* host, *H. arquata* (Schneider, 1866) recovered from *Cypturus* sp., birds, *H. arquata* (Schneider, 1866) recovered from *Megacephalon* sp., of the host *H. longecaouda* (Linstow, 1879) documented from

*Megaloperdix nigelii* host *H. macroura* Linstow, 1883) recovered from *Ostis tarda* host *H. monticellina* (Stossich, 1892) reported, from the host *Lampronessa sponsa* helminth, from *Tragopan* sp., *Thaumelea* sp., *Lophophorus* sp., hosts *H. caudate* (Linstow, 1906) were recovered, *H. isolonche* (Linstow, 1906) helminth documented, *H. paradoxa* (Linstow, 1906) helminth documented from the *Didelphys dorsigera* host birds, *Cygnus atratus* hosts *H. circumuallata* (Linstow, 1906) species of worm documented, *Ostis tarda* birds *H. stylosa* (Linstow, 1907) parasites found, *Ammoperdix griseogularis* hosts *H. numidae* (Leiper, 1908) helminth recovered, *Numida Meleagris* aves *H. brevispiculum* (Gendre, 1911) helminth reported, *Tinamus* sp., and *Cathetus* sp., species of birds *H. bancrofti* (Johnston, 1912) found, *Chenonetta jubata* birds *H. chenonettae* (Johnston, 1912) documented, *Ceriornis satyra* species of birds *H. bosia* (Lane, 1914) documented, domesticated fowl birds *H. beramporia* (Lane, 1914) helminth reported, *Cricetomys gambianus* hosts *H. dahomensis* (Gendre, 1911) worms found, domesticated fowl hosts *H. putaustralis* (Lane, 1914) nematode reported and *Odontophorus capueria* birds *H. fariai* (Travassos, 1913) documented.

The present research work was performed during the consequent years 2019-20 in response to observe the helminth infection from the internal organs of *T. striata*. After surgical examination from fifty-four birds, a total of one hundred and eighteen specimens were recovered from the large intestine of the host birds. The burden of parasites was calculated with the work agreement of (Mangrio *et al.*, 2017) who also performed research work to report the helminths of *T. striata* and found nematode, *Contracaecum travassosi* (Gutierrez, 1943) in the above-mentioned location. Furthermore, the same kind of systematic work on the helminth of the same species was conducted (Mangrio *et al.*, 2017) documented Cestode, *Confluaria capillaris* (Rudolphi, 1810) from the same host at the same locality. The change in the rainforest habitat effectively alter the bird community, which may lose their sufficient numbers and changes the species composition and diversity and few species may have a chance to disappear slowly (Andren, 1994) and the *T. striata* birds are widely occurring species and are sensitive to their seasonal variation but different types of vegetations and other biodiversity, animals, and microorganisms particularly influence the breeding, nesting behaviors (Hoque *et al.*, 2014). Since a couple of times research work had been applied by many scholars to find out the reasons and give the particular and applicable answer in perspective of the habits and habitat, threats, ecology, environmental effects, feeding behavior, and cause of distribution, now we must examine only species from all indications and examine different parameters regarding the host species. Many birds are the part of agro-ecosystem now it is firmly called to arrange suitable measures for beneficial and sustainability (Duelli, 1997). Speedily growth rate, regular activities of human beings are alarming results disturbed certain bird species because some species of the birds have a direct relationship with farmers and they are playing role in pest control, but due to the high application of chemical pesticides reduced the number of population (Henry and Burnell, 1903). Mismanagement, use of chemicals, cultivation shifting, crop type, rainfall, and harsh conditions badly influence food, breeding, growth, and deteriorate bird population (Jobin *et al.*, 1996). Birds are serving as a natural source of pest control being insectivorous they are beneficial for plants but also the carrier agent of a certain disease (Maurer *et al.*, 2009).



Despite that, birds are ingredients very important because they are regulating the food chain and are beneficial from a biological point of view (Sivaperuman and Jayson 2006). *H. gallinae* helminth species were reported from the fecal material of the host at UK (Fakae *et al.*, 2003), and *A. gali* infecting wild and domestic aves (Hoque *et al.*, 2014). The prevalence of the helminth was found high during the hot season of the year it is with the agreement (Yadav and Tandon 1991), who found several species of nematodes and cestodes from Chickens, Pheasants, and Quail's hosts. *G. gallus domesticus* species dissected and reported helminths at Parbhani and Germany (Hange *et al.*, 2007). Based on morphological features the nematode species were found to change from the congress of other species but nearly resemble, *H. pavonis* based on the esophagus, bulb, valvular region, spicules tail, and eggs position hence; identified as such. (Sahito *et al.*, 2016) also observed the *Subulura suctoria* (Molin, 1860) and *C. travassosi* helminths from *T. striata* in this area. The results were found with a significant difference in summer and winter conditions. However, many parasitologists used their stamina to find out the helminth infection of several birds but little work is performed on the feeding behavior and living habitat but still majority of birds are not properly examined in helminth perspective in Pakistan. That was the reason scholars chose the Jungle babbler, conducted research, and documented morpho-taxonomy of the helminth of this bird. Therefore, the present study emphasizes that further research work on the systematic plan of the internal helminths should be carried out on the other Passeriformes. It is suggested and needed that further research work in this manner should be supportive for the identification of helminths and their root cause of infection in *T. striata*.

## CONCLUSION

Finally, it has been concluded that present host birds are not cosmopolitans but are frequently found in the Indian sub-continent and their surrounding regions. They are also well popular by a unique name Sath Bhai in India and Bangladesh. They are considered as former friendly, because in feeding habit mostly feed insect pest complex in a variety of crops but this species of birds rear a high prevalence of helminths which are reducing the population rate. Therefore, the morbidity and mortality were high lightened through the identification and occurrence of helminths.

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**Availability of Data and Materials.** The data findings of this research study are available at the request of the corresponding author. Due to privacy and ethical restrictions the data are not available publicly.

**Conflict of interest.** The authors declare that they have no conflict of interest.

**Consent for publication.** The authors accept responsibility for releasing this material.

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