Morphotaxonomic characteristics of *Hymenolepis mehрабpurenсis* N. sp., from (*Turdoides striata*, 1823) Leiothrichidae) of the tropical region, Sindh-Pakistan

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Citation
Wali Muhammad Mangrio, Hakim Ali Sahito, Tasneem Kousar, Zafar Hussain Shah and Faheem Ahmed Jatoi. Morphotaxonomic characteristics of *Hymenolepis mehрабpurenсis* N. sp., from (*Turdoides striata*, 1823) Leiothrichidae) of the tropical region, Sindh-Pakistan. Pure and Applied Biology. Vol. 9, Issue 1, pp. 979-988. [http://dx.doi.org/10.19045/baspab.2020.90103](http://dx.doi.org/10.19045/baspab.2020.90103)

Received: 12/10/2019 Revised: 31/12/2019 Accepted: 02/01/2020 Online First: 10/01/2020

Abstract
Sindh province having own unique identification due to historical Indus civilization and River Indus but research work was conducted at district: Naushahro Feroze, which is a most imperative sahati region of central Sindh and comprises mostly agriculture-based lands. For prevalence of helminth parasitic burden in Jungle babbler, a total no of (n=12) *T. striata* were collected from Taluka, Mehrabpur, during 2017-18 and (n= 86) specimen were recovered belonging to the genus; *Hymenolepis* Weinland, 1858 which were recovered from intestine and clocal opening. Whole specimens were pragmatic morphologically change, having larger opaque body and maximum width at gravid segments. Whitish delicate, long muscular scolexes, rostellum with rostellular sac contained four hooks in a single row, neck with 246, gravid 190 and mature proglottids 56 in number. All segments found wider than long, muscular suckers similar in length. Dome-shaped ovary, compact and irregular vitelline glands, cirrus sac is proturated outward, vagina situated behind the ovary, eggs oval-shaped and testes three to five in number. Actually, duration of present work was 12 months but high intensity of infection recorded in the month of January and minimum in June, by consequent difference compared (*P*<0.05) cold and hot summer seasons. The present findings suggest that more work should be carried out other former friendly Aves in this region. This is a new documentary and new record documented first time over the helminth parasites in above mentioned region.

**Keywords:** Cirrus sac; *Hymenolepis*; Proglottids; Rostellum; *T. striata*; Vitelline glands

Introduction
Birds, the most attractive creature including more than 10,000 species [1], majority of them found in continental regions remaining in islands. Pakistan comprises Oriental and Palearctic regions in both areas 670 species and 74 families of avifauna are found [2], about 356 bids
species have been documented in Sindh of which 17 species are at endangered conditions [3]. Surrounding the Indus Delta region 329 species are surviving [4]. These are traditionally divided into 30 to 40 orders [5]. The Passeriformes are commonly song producing beautiful and perching vertebrates. They are warm-blooded, oviparous and their eggs contain calcium carbonated porous shell. In Pakistan wide range of fauna are serving their life due to the fruitful location and diverse habitats. Geese, waders, ducks, flamingos, cranes, falcons, and swans are commonly migratory birds migrate towards Pakistan from European and Asian regions follow a zone known as Indus flyway or green route/root no. 4 [6]. Many scholars used their stamina to report helminth parasites of avifauna at Sindh region [7, 8, 9].

*T. striata* are Passeriformes insectivorous endemic [10], locally called Saath Bhai in regional languages, commonly seen where scrub forests and plenty of food intermixed is available [11]. They are considered farmer-friendly because they feed on variety of pest insects, their eggs and larvae. However; these species serve their life in social grouping manner and taking the advantages from their association, they are co-operative breeders, varies in their number from 7 to 20 [12]. Male Jungle babbler is dominant over the female breeders [13]. Being gregarious and social they form intermixed foraging flock and eat berries, nectars, and grains [14]. They are long-lived predators [15]. Young birds contain dark iris but older having pale creamy-colored iris with dark epithelium [16], at the age of three years they attain maturity and breed in both seasons. By forming social allopreeening they produce different voices to communicate among themselves such as; chases, chattering, chirping, squeaking, and mock flights [17]. Generally before dawn they wake up and move to screech for foraging but death occurs when they threatened by predators [18]. They are unable to fly at long distance [19]. They lay two to four eggs and after 14 to 16 days eggs become hatch but some other species are predators for their eggs i.e., greater coucal, crows and mongoose they also attack their young ones, including rat snake harm their chicks [20].

Majority of the beautiful birds are resilient numerous helminths including trematodes, nematodes, acanthocephalans but cestodes are frequently found at high prevalence, all these helminths are responsible for clinical and subclinical symptoms. Mostly worms affect intestinal part and they release their eggs in host faecal material for the purpose to re-infection in same species when re-infection occurs by the same type of helminths then birds show signs such as, diarrohea, poor health, reduce their body weight, certain illness conditions which may lead to death. Also during infection parasites rely badly effects to their hosts, unthriftness, retarded growth, damage to the gut epithelium, lowering the gastro resistance against other infections, emaciation, lower production of eggs and may death occur to their hosts [21].

Speckled Pigeon, *Columbia guinea* was examined by [22], from which recovered *Monopolon gallinae* 56% and *Columbicola columbae* 60%, *Hymenolepis carica* 13%, *R. cesticillus* 26.7%, *Amoebotaenia cuneata* 13%, and *Raillietina tetragona* 3.3% respectively. A total of 136 common pigeons at Thessaloniki, Northern Greece, were examined found intestinal helminth infection in *Columbia livia domestica* with *R. cesticillus*, *R. echinobothrida*, *R. echinobothrida*, *R. cesticillus*, and *Raillietins* spp., respectively. These species of helminths are able transmit in poultry, wild and domestic animals including humans [23]. At Ethiopia, intestinal parasites were recovered from chickens, i.e., *C. infundibulum, H. carioca, D. progottina, R. echinobothrida, R. cesticillus* and *H. contaniana* at the percentage 13.7%, 17.7%, 8.1%, 63.7%, 40.3% and 17.7%, similary, nematodes i.
e., C. anatis, H. isolonche, A. suctoria, H. gallinarium, H. dispers, D. nasuta, G. ingluvicola and A. galli at 3.2%, 8.9%, 7.3%, 37.9%, 6.5%, 4.0%, 7.3% and 32.0%, respectively [24]. Parasites of chicken in India were observed [25], documented low infection during winter compared to summer season and report Raillietina spp. and Ascaridia spp. Helminth parasites, cestodes species namely; R. tetragonal, Raillentina ransomi, R. echinobothrida, Chonotaenia infundibulum and R. cesticillus from chicken hosts and helminth were observed at the 45.9%, 29.7%, 18.9% 5.4%, and 0.0%, but in his examination broiler forms were found free from the infection and highest prevalence of parasitic infection were recorded in backyards [26]. The Rooks, Ravens, Magpies, Crows, and Jays were examined and A. columbae cestodes recovered [27]. From the A. poecilorhyncha and A. brama host P. oxyurusis new parasite P. thapari was documented [28]. From the host Columba livia, helminth parasites, Eimeria sp., Raillietina, A. columbae and C. columbae at 31.0%, 9.0%, 33.3% and 17.4%, were also observed by [29]. In Shaanxi province China, host bird Nipponia nippon, critically endangered species were examined and observed, Ascaris spp., Coccidea, C. caudiflata, Fasciolidae, Blastocysts spp., and E. histolytica at 84.2%, 7.8%, 50.0%, 23.7%, 15.8% and 7.8%, respectively [30]. Gallus gallus spadiceus at Ulu Langat, Malaysia, were dissected and recovered cestodes such as; P. canariensis, P. gallinum, Eimeria sp., T. fissipina, C. contorta, R. tetragona, T. gallinarium, H. cantianana, C. nilesi, H. gallinarium, A. galli, R. cesticillus, D. spiralis, Gongylonema sp., and C. annulata but the population of Heterakis and Capillaria were observed high than other species [31]. Streptopelia senegalensis and Columba livia of Lagos state, Nigeria were examined and cestodes helminths were found such as; A. columbae, P. columbae, C. columbae, R. tetragona, A. galli, G. gigag, M. Gallinae, and R. Echinobothrida, respectively. Columbicola columbae and Raillietina tetragona found frequently inside the host species and observed higher infection in doves than pigeons [32]. For this purpose, the research study was conducted from this region to check out the prevalence of new helminth species from present agro-beneficial host species in this tropical region for future planning to save the other passerine host birds.

**Material and methods**

T. striata were collected during 2017-18, for the purpose to examine internal organs to find out the prevalence of helminth parasites. A total (n=12) host birds were captured from different locations including farmlands, villages, crop fields, surrounding the industries, towns, by the source of air gun and some purchased from local rural people and few from poultry forms and brought them Parasitology Laboratory, Zoology department, Shah Abdul Latif University, Khairpur for dissection. From intestinal region of all hosts (n=86) specimen were recovered. If captured bird were supposed to be dead than on priority basis were kept in the refrigerator and first dissected those hosts which were injured by air gun and other birds were kept few days in wooden cage or iron made cage by supplying them nourishment and dissected under laboratory conditions as per need basis. Firstly, cotton swab was taken by putting five to eight drops of chloroform hold for few minutes on both minute pores at the beak region with the help of one hand and intensively hold host with the help of another hand. When birds become completely anesthetized then feathers were removed from cloacal opening up to the neck region and a longitudinal cut was given by the source of scissors. Arranged petri plates by adding few amounts of distilled water and each segment of the visceral organs were kept in it individually. Adding few amounts of 100% ethanol in coplin jar and slides were
poured for 16 to 18 minutes, then slide were taken for dehydration and with spongy pieces of cloth or handkerchief slides were sterilized. A stereo dissecting microscope very intensively used for examination of internal organs. Then the cestode specimen were laid on the slide covered with cover slip after that thorough threads were wrapped and again slides containing specimen placed inside coplin jar and left it for one night once again threads were reopened and in separate petri plate few amount of borax carmine were added parasite containing slide were placed inside the borax for mounting purpose until specimens were completely mount then parasites were washed with ethanol more than one time and two to three drops of Canada balsam were released by the help of dropper, now on the surface of fresh slide parasites were laid by putting them cover slip, then slide containing stained specimens were kept in oven box at least 12-15 hours at fixed appropriate temperature. By the help of Camera Lucida diagram of the specimens were taken, finally, camera Meiji infinity, 1DK-3000 were used for photography and in millimetres (mm) measurement of all internal organs of the helminths were tacked and in micrometers (μm) eggs were measured. Holotype permanent slides of specimens were kept in Parasitology Laboratory, Department of Zoology, SALU, Khairpur for reference motivation.

Statistical analysis
For statistical examination total data was placed in Ms, excel, analysis of variation also for the purpose of authentic result help were also taken by using of SXW software, 8.1, version (USA).

Results
The systematic position of *Hymenolepis mehrabpurensis* N. sp. (Fig. 1 & 2)

Family: Hymenolepididae Rilliet and Henery, 1910
Sub-family: Hymenolepidinae Perrier, 1897
Genus: *Hymenolepis* Weinland, 1858
Host: *Turdoides striata*
Location: Large intestine
Locality: Naushahro Feroze, Sindh-Pakistan.
No of hosts: 12

During research work 12 host birds were anesthetized and etically dissected all were found positive with cestode parasitic infection and their description is given as under:

Description
All specimens were recovered from the large intestine and near the cloacal opening of the host birds, cestode consists 1.11-1.18 X 29.30-32.33 by 1.19 mm in length and width but at gravid segments maximum width was observed. When cestodes were alive all specimens were found opaque, whitish and relatively delicate. Neck followed by 246 series of segments, comprises 0.25 to 0.78. Wider then long muscular scolex consist 0.11-0.12 X 0.13-0.14 in size. A single row consist four hooks in vertical position comprises 0.38-0.44 X 0.07-0.09 in size. Rostellular sac 0.83 by 0.104 in size and rostellum 0.02-0.03 X 0.06-0.08 in size were found. One hundred and ninety gravid segments were counted contain measurement 0.12-0.118 X 0.31-0.33 of which one hundred and fifty-six mature proglottids consist 1.12-1.15 X 0.22-0.28 but all segments were wider than long. Muscular suckers consists 0.03-0.04 X 0.06-0.07 in size. Oval shaped compact and irregular vitelline gland measured 0.128-0.080 X 0.112-0.120 in size. Portrayed outward cirrus sac measured 0.51-0.53 X 0.12-0.15 in size and dome-shaped ovary contain 0.12-0.15 X 0.13-0.17 in size. Behind the ovary vagina is situated measured 0.241-0.242 by 0.112-0.055 in size. Size of eggs 0.01-0.02 X 0.02-0.03, testes oval in shape three to five in number comprises 0.03-0.06 X 0.03-0.08 same in size, respectively (Fig. 1).
Specimens no: 86

Figure 1. *Hymenolepis mehrabpurensis* N. sp., Scolex, Gravid segments, Hooks, Mature segments

Figure 2. Photograph of Mature segment, Scolex, and Gravid segment

*Hymenolepis mehrabpurensis* n. sp., found different form *Hymenolepis clausa*, which was recovered from *Columba livia* at Lahore, *H. medici*, from *Anas crecca*, Peshawar, *H. moghensis*, from *Anas crecca* at Noweshera, *H. megalorichis*, from *Anas crecca* at Charsaddah, *H. Lanceolata*, from *Anas crecca* at Peshawar, Pakistan and *H. uralensis*, from *Anas crecca* at Charsaddah, *H. bilharzi* and *H. fringillarum*, from *Lanius senator niloticus* at Gaza and *H. paucianulata*, from *Anas querquedula* at Egypt.

On the basis of morphological characteristics such as; length, width, shape, and size of the hooks, ovary, testes, shape of the mature and immature proglottids, size and arrangement of the
eggs and all other essential characteristics *Hymenolepis mehrabpurensis* n. sp., is proposed. New species were given new names from their locality where from host birds were captured. This species is first time reported from Sindh, Pakistan and Jungle babbler host birds is a new record for the genus *Hymenolepis Weinland*, 1858. The present research work was conducted during the month of October 2017 to September 2018, a total of (n=12) host birds *T. striata* were captured and only one host bird was dissected in every month for the prevalence of helminth intensity. The penalty examination demonstrates the greatest population was found in the month of January but the very less burden of helminth is observed in the month of June (Fig. 3). The investigation of discrepancy shows the momentous differentiation among 12 months of the year (P<0.05).

Table 1. *Hymenolepis* species body measurements and comparative morphological features under laboratory conditions

| Species                  | *H. mehrabpurensis* N.sp. | *H. Claustra* | *H. medici* | *H. megalorchis* | *H. lanceolata* |
|-------------------------|--------------------------|---------------|-------------|------------------|-----------------|
| Body                    | 1.11-1.18 X 29.30-32.33 by 1.19 | 111-114 X 0.88-0.92 | 0.26 X 0.03 | 0.26 X 0.35 | 19.4 X 1.78 |
| Hooks                   | 0.38-0.44 X 0.07-0.09 | 10 in number 0.07-0.09 X 0.02-0.03 | 23 | 8 | 8 |
| Neck                    | 0.25 to 0.78. | 0.8 X 1.6 | Not-observed | 0.34 | Not-observed |
| Scolex                  | 0.11-0.12 X 0.13-0.14 | 0.23-0.32 X 0.22-0.25 | 1.24 X 1.38 | Not-observed | 0.28 X 0.32 |
| Rostellum               | 0.02-0.03 X 0.06-0.08 | 0.07 X 0.11 | 0.27 X 0.49 | 0.05 X 0.08 | 0.06 X 0.08 |
| Suckers                 | 0.03-0.04 X 0.06-0.07 | 0.11 X 0.14 | 0.45 X 0.57 | 0.12 X 0.48 | 0.13 X 0.14 |
| Cirrus sac              | 0.51-0.53 X 0.12-0.15 | 0.17-0.28 X 0.05-0.07 | Not-observed | Not-observed | Not-observed |
| Ovary                   | 0.12-0.15 X 0.13-0.17 | 0.04 X 0.06 | 0.09 X 0.22 | 0.07 X 0.08 | 0.09 X 0.11 |
| Testes                  | 0.03-0.06 X 0.03-0.08 | 0.05 X 0.06 | 0.13 X 0.12 | 0.07 X 0.11 | 0.07 X 0.08 |
| Mature segments         | 1.12-1.15 X 0.22-0.28 | 0.08-0.11 X 0.29-0.46 | 0.85 X 0.96 | 0.12 X 0.44 | 1.82 in length |
| Gravid segments         | 0.12-0.118 X 0.31-0.33 | 0.12-0.18 X 0.8-0.11 | 0.18 X 1.29 | 0.02 X 0.04 | 0.33 X 3.08 |
| Eggs                    | 0.01-0.02 X 0.02-0.03 | Abundant | 0.4 X 0.5 | Abundant | Abundant |
| Host                    | Jungle babbler | Rock dove | Eurasian teal | Green-winged tail | Common teal |
| Locality                | N. Feroze, Sindh | Lahore | Peshawar | Charsaddah | Peshawar |
Figure 3. Prevalence of *Hymenolepis mehrabpurensis* N. sp., from *Turdoides striata*, 1823 (Leiothrichidae) a tropical region, province of Sindh

Discussion

The genus; *Hymenolepis* Weinland, 1858 was observed to documented cestode helminths of birds. Many other species of present genus; *H. neoartica*, collected from *Sterna hirundo* birds; from Anseriformes *H. anatine*, *H. compressa* and *H. paracompressa* collected from *Aythya farina* (L), *Anser platyrhynchos* (L), *Querquedula querquedula* (L), *Aythya fuligula* (L), *Aythya marila* (L), and *Aythya rufa* (L); *H. fusus*, *H. cirros* and *H. megarostrellis* from *strunus vulgaris* (L), *Turdus viscivorus* (L), *Garrulus glandarius* (L), *Oriolus oviolus*, *Pica pica* (L), *Turdus merula* (L), and *Corvus splendens*, cestode helminths *H. farciminosa*, were recovered from Anseriformes *H. microsoma*, *H. megarostris*, *H. parina* and *H. passeris*, from *Corvus monedula* (L), *Corvus corone* (L), *Corvus frugilegus* (L), *Pica pica* (L), *Garrulus glandarius*, *Turdus torquatus* (L), *Turdus pilarius* (L), *Sturnus vulgaris* (L), *Turdus viscivorus* and *Turdus philomelos*, *H. serpentulus*, were documented. From different species of passeriformes such as; Blue tit, House sparrow, Coal tit, Hedge sparrow and Chaffinch cestode *H. fringillarum*, were observed and from Ringed plover helminth *H. rectacantha* recovered. From *Aythya farina* and *Anas acuta*, *H. fausti* and *H. solowiow* were reported. From *Anas platyrhynchos* (L) *H. furcigera*, from *Gallinago gallinago* (L) cestodes *Hymenolepis sp.*, from *Tringa ochropus* host, *H. hirsute* and from Jackdaw, Rook, Magpie, Carrion crow and Jay *H. stylosa* were documented.

During dissection and internal examination, no any host is observed free from infection and high appearance is found in colder months as compares with hot summer and the result is formulated with the agreement of [33], who already worked on same host and established the prevalence of cestode worm *Hymenolepis sp.*, (Weinland, 1858) from *Turdoides striata* of other talukas of the same district. The present research indicates that cestodes widely affect the birds but Jungle babbler cannot be examined properly in Pakistan. Although, a variety of birds had been investigated by many scholars for the prevalence of helminth parasites little work is conducted in perspective of wild birds [34].

Notably, from broiler poultry chickens at Maharashtra, India helminth *Raillietina*
sp., and Ascarida sp., were found [35]. Columbidae was examined in Iran and recovered Phthiraptera, C. columbae [36]. At Nigeria chickens were dissected and recovered Raillentina spp., Strongyles spp., Heterakis spp., Ascaris and gallinarian cestodes [37]. Chickens were dissected at Murehwa, Zimbabwe and recovered, C. infundibulism, A. cuneata, A. cuneata, Hymenolepis sp., and ectoparasites i-e, E. gallinacean, C. mutants, D. gallinae and A. persicus [38]. In cestode of Aves i-e., Capillaria sp., and A. galli and A. Acuaria sp., H. gallinae, A. galli may infect rib cage of the hosts [39]. Albendazole and fenbendazole are treatment effective sources for the prevention of cestode infection [40]. Furthermore, this kind of research was documented by [41-44], and from T. striata host recovered Lyperosomum longicauda (Rudolphi, 1809) at same region. This type of research was conducted first time to examine the helminth intensity of Jungle babblers.

Conclusion

T. striata birds are omnivores in their feeding behavior widely distributed in Asian countries, generally known as seven sisters, these species mostly feed pest insects, vertebrate pests and predators due to such type of nature commonly denoted as farmer-friendly. This kind of bird also harbors helminth parasites in their internal tract create morbidity; reduce population and causative reason for their high mortality. In this regard, present scientific documentary suggests more research and systematic study should be carried out on the internal helminth parasites of Leiothrichidae because there is no particular record or scientific documentary regarding cestode helminth in T. striata, at the above-mentioned area.

Authors’ contributions

Experiments designated and conceived: WM Mangrio & HA Sahito. Experiments performed: WM Mangrio & FA Jatoi. Data analyzed: WM Mangrio, HA Sahito & T Kousar, Contributed analysis tools/

materials/ reagents: WM Mangrio & ZH Shah. Wrote the paper: WM Mangrio & HA Sahito.

Acknowledgments

The scholars are cheerfully thankful to the local peoples of taluka Mehrabpur, villagers, town dwellers of this region by participating in this research work for a collection of hosts to their surroundings because they provided gathered support to authors in hot and summer season of the years. The authors are again thankful to the farmers who given cages for the purpose to keep the bird alive inside them and providing tricks and techniques in capturing the T, striata birds from their croplands. Authors are really thankful for their guide, who gives such a pathway way and guide in this work each and every moment.

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