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First record of *Clinostomum complanatum* (Trematodes: Clinostomatidae) in Pakistan from *Phalacrocorax niger* (Aves: Phalacrocoracidae)

Muhammad Moosa Abro, Ali Murtaza Dharejo, Muhammad Munif Khan and Nadir Ali Birmani
Government College Hyderabad Postgraduate Center, Hyderabad Sindh Pakistan.
Department of Zoology, University of Sindh, Jamshoro, Pakistan.

(Corresponding author: Nadir Ali Birmani)
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ABSTRACT: During study of helminthic fauna of Little cormorant (*Phalacrocorax niger*), from Sindh, Pakistan, a total of 90 trematodes belonging to genus *Clinostomum* were collected from esophagus and gizzard of four hosts. On the basis of body shape and size, distribution of vitellaria, shape and position of testes, ovary and cirrus sac, these trematodes were identified as *Clinostomum complanatum* (Rud., 1814) Braun, 1899.However, this species of trematode is being reported for the first time in *Phalacrocorax niger* from Pakistan.

Keywords: Trematode, *Clinostomum complanatum*, *Phalacrocorax niger*, Sindh, Pakistan.

INTRODUCTION

Clinostomum complanatum is cosmopolitan digenetic trematode of *Ardea, Ardeola, Cancroma, Mycteria, Egretta, Nycticorax, Pelecanus, Nyctanassa, Larus, Butorides, Phalacrocorax, Bubulcus, Botaurus* and *Plegadis* species of birds. It is found in oral cavity and esophagus of piscivorous bird (Yamaguti, 1971). This trematode completes its life cycle in snails, mostly in fishes and fish eating birds. Snails are first intermediate hosts; fishes, frogs, salamander and garter snakes are second intermediate hosts and piscivorous birds are definitive hosts (Yamaguti, 1971; Mcallister *et. al*., 2007, 2010 and Lemke *et. al*., 2008). The metacercariae of *C. complanatum* commonly called "yellow grubs," embedded in stomach of fishes, migrates up to esophagus and settle in throat or oral cavity. Metacercariae cause pathological changes in skin, muscles, fins, head and viscera resulting change in behavior of host and incur economic losses in fish farms. Moreover, *C. complanatum* makes fishes unsuitable for edible purpose. Sometime it causes human infection where it attached on the mucus membrane of the throat and produce disease called Halzoun. These cases have been reported from Japan and Korea (Aohagi *et al*., 1992; Chung *et al*., 1995; Eiras, 1994; Szalai *et al*., 1988; Park *et al*., 2009 and Sutili *et al*., 2014).

Phalacrocorax niger is migratory cum resident and voracious piscivorous bird in habit, search food in ponds, lakes, streams and coastal areas (Roberts, 1991; Sarkar, 2002 and Chozyhiyatt *el al.,* 2009). Sanghar district has freshwater lakes, rivers, water reservoirs which are favorable habitats for Little cormorant *P. niger*. These habitats are also best for the development as well as breeding of fishes, gastropods (snails) and crustaceans which play significant role in the *C. complanatum* life cycle. Thus, the bird under study (*P. niger*) has reasonable probability of success to become infected with *C. complanatum* from surrounding habitats. A few researchers have investigated helminthic fauna of Little cormorant (*P. niger)* in Pakistan including Akram (1996), Dharejo *et al*. (2010) and Abro *et al.* (2016). Reports on trematodes of genus *Clinostomum* Leidy, 1856 includes: *C. mujibi* Bilqees, 1972; *C. marulus* Bilqees, 1972 and *C. sindensis* Khan and Bilqees, 1986 from fish hosts and *Clinostomum singhi* described from *Ardeolagrayii* (Bhutta and Khan, 1975) in Pakistan.

MATERIAL AND METHOD

The Little cormorants were collected from District Sanghar during September 2014 to December 2015. Hosts were captured alive with trapping nets randomly from different water bodies of Sanghar District. Collected hosts were brought in the Parasitological laboratory of department of Zoology, University of Sindh, Jamshoro. The identification of *Phalacrocorax niger* was made with descriptions given by Roberts, 1991 and Ali and Ripely, 1978. Dissection and examination of hosts, collection and processing of trematodes was done according to methods given by Gracia and Ash (1979) and Schmidt (1988). Diagrams were made with help of Camera Lucida.

The measurements of specimens and their organs were taken in millimeter. Identification of trematodes was carried out with help of keys given by Gibson *et al*., 2001, Yamaguti, 1971 and relevant literature.

RESULT

Eleven Little cormorants were examined during present study and four were infected with90 specimens of *Clinostomum complanatum*. Thee specimens were recovered from esophagus and gizzard of the host birds. The description of specimens is given below.

Flukes have elongated, large body with rounded posterior and anterior extremity, measuring 5.5-7.7 in length and 1.76-2.06 in width; attended at about mid-body. Oral sucker round, sub-terminal, measuring 0.277-0.366 in length and 0.29-0.39 in width. Ventral sucker well developed, prominent, round, situated in first quarters of body, measuring 0.36-0.533 in length and 0.27-0.466 in width, larger than oral sucker. Pharynx absent. Esophagus short, measuring 0.2-0.266 in length connecting mouth with bifurcated ceca situated laterally, terminates blindly at posterior extremity of body. Testes irregular, multilobed, situated behind one another, separated by uterus.

Anterior testis asymmetrical, lobed, situated in third quarter of body, lateral to ovary, measuring 0.36-0.466 in length and 0.399-0.499 in width. Distance between anterior testis and ventral sucker is 2.43-3.33. However, the distance between anterior testis and posterior testis is small, measuring 0.56-0.669 in length. Posterior testis also irregular; multi-lobed occupying almost entire inter-cecal area, found in last quarter of body, measuring 0.39-0.49 in length and 0.73-0.83 in width.

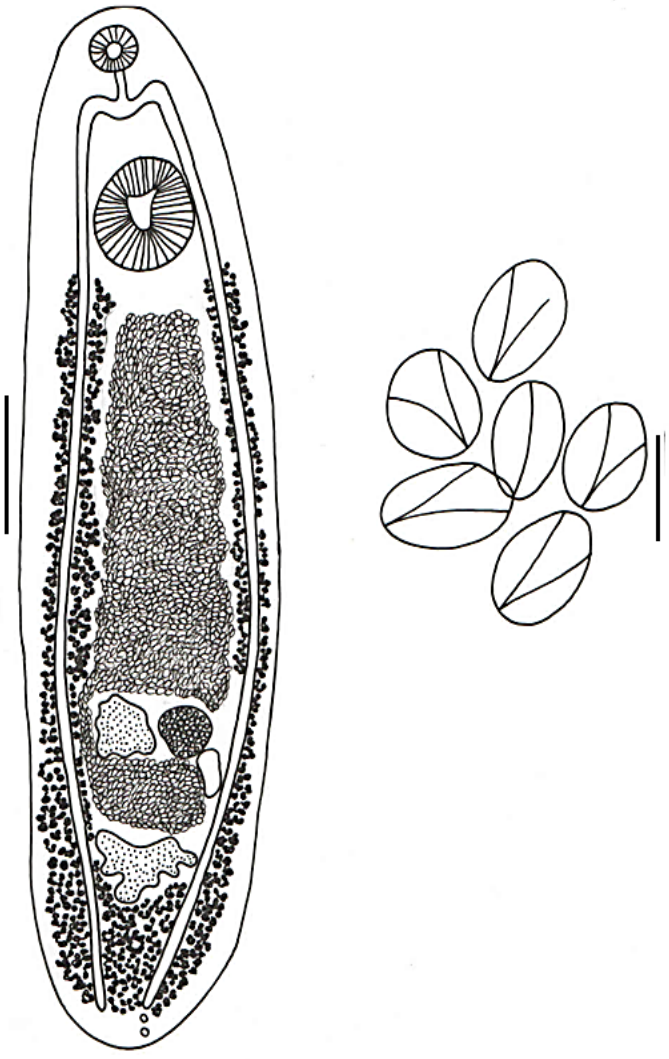

Fig. 1. *Clinostomum complanatum* **(**Rud., 1814) Braun, 1899.
A. Entire worm and B. Eggs. ***Scale bar*:** A. 1 mm and B. 0.1 mm.

Ovary spherical, sub-median, lateral to anterior testis above uterus, measuring 0.29-0.39 in length and 0.33-0.433 in width. Cirrus sac lies on right side of uterus in between ovary and posterior testis, measuring 0.26-0.366 in length and 0.1-0.199 in width. Seminal vesicle and ejaculatory duct present. Genital atrium and Laurer's canal also present. Excretory vesicle small and excretory plexus extended in peripheral parenchymal pore. Uterus well developed, inter-testicular, situated in fourth quarter of body, filled with large eggs. Extension of uterus occupies entire inter-cecal space in between ventral sucker and anterior testis. Eggs numerous, having almost same size, measuring 0.08-0.056 × 0.128-0.084. Vitellarium follicular distributed densely over ceca laterally, extended from ventral sucker to posterior extremity.

Photograph of the *Clinostomumcomplanatum* (Rud., 1814) Braun, 1899

Taxonomic summary
Family: Clinostomidae
Subfamily: Clinostominae
Genus: *Clinostomum* Leidy, 1856
Species: *Clinostomum complanatum* (Rud., 1814) Braun, 1899
No. of specimens recovered: 90
No. of hosts found positive: 04
Site of infection: Esophagus and Gizzard
Rate of infection: 36.36%
Locality: Sanghar, Sindh, Pakistan
Record: New host and locality record.

DISCUSSION

Clinostomum complanatum has been reported from every nock and corner of the world. A large number of research reports and papers are available to study and verify the description of *C. complanatum.* Therefore, on the basis of following similarities including; tongue-shaped body, equal body size, position and shape of oral and ventral suckers, position, arrangement and size of testes, ovary, cirrus sac and uterus and distribution of vitellaria, the present flukes are described as *C. complanatum*.

However, this species is being reported for the first time from Pakistan and *Phalacrocorax niger* is a new host record for this trematode species. A few other forms of genus *Clinostumum* including *C. mujibi* Bilqees, 1972, *C. marulus* Bilqees, 1972 and *C. sindensis* Khan and Bilqees, 1986 hosts and *Clinostomum singhi* Jaiswal, 1957 have been reported from fishes and birds of Pakistan.

There is no question on validity of *C. complanatum*. It is widely recognized by many great parasitologists. However, diversity and divergence of diagnostic features in *Clinostomum complanatum* have confused many taxonomists. Moreover, the diversity of characteristics have placed question mark over validity of many other species in genus *Clinostomum*. In this context, Ukoli (1966) questioned validity of many species of genus *Clinostomum*. He kept previously reported species as synonymous of *Clinostomum complanatum*. Meanwhile, he consolidated supremacy of *Clinostomum complanatun* over other species of *Clinostomum*. Yamaguti partially accepted synonymizing of Ukoli but described *C. complanatum* in detail. Feizuleav and Mirzaeva (1983, 1986) were of opinion that diagnostic feature of *C. complanatum* are not reliable. Mattews and Cribb (1998) disagreed with previous writers in putting many species in single species *C. complanatum.* Lo *et al*. (1982) also confirmed validity of *C. complanatum* and *C. marginatum*. Dzikowski *et al*. (2004) verified *C. complanatum* and *C. marginatum* through differences in Ribosomal DNA.

Concluding *Clinostomum complanatum* is valid species of genus *Clinostomum*. Description of present record completely agrees the morphological features of previously described *C. complanatum*. It is first record of *C. complanatum* in Pakistan as well as from the host *Phalacrocorax niger*.

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