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A REPORT OF CESTODE (PHYLUM: PLATYHELMINTHES) PARASITES FROM INDIAN WATERBIRDS

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INTRODUCTION

Water birds have been defined as "species of bird that are ecologically dependent on wetlands". This is the definition used by the Ramsar Convention on Wetlands. Avian fauna occupies a significant position in an aquatic ecosystem. Birds are a diverse group, and their bright colours, distinct songs and calls, and showy displays add enjoyment to our lives. They not only have an aesthetic role but also occupy a very important position in food chain. India has about 243 species of water birds and species of wetlands dependent and associated birds (Kumar *et al*., 2005). It has been observed that almost half of these birds are migratory and come to the subcontinent from their breeding grounds in northern latitude of Russia, China, Central Asian countries, Mongolia and Persian gulf.

Cestoda is the name given to a class of parasitic flatworms of the Phylum Platyhelminthes. Its members live in the digestive tract of vertebrates as adults and often in the bodies of various animals as juveniles. Cestodes or tapeworms are the most specialized of the Platyhelminthes parasites. All cestodes have at least one and sometimes more than one secondary or intermediate host as well as their primary host. While the intermediate hosts are often invertebrates of some sort, the primary host is normally a vertebrate. In some cases however, both hosts are vertebrates. The adult tapeworm usually inhabit the alimentary canal of their hosts and attach themselves to the mucosa by means of a scolex. Though tapeworms lack a digestive system they absorb food from the hosts intestine, thereby providing the cestodes a habitat rich in nutritional level and feeding the tapeworms high growth rate. They penetrate the intestinal mucosa with the scolex causing inflammation and nodules (Heidenreich, 1997).

Cestode fauna in avian hosts is directly related to the type of food ingested. The prevalence of helminths is often greater in adult female waterfowl and in first-year birds because of a greater amount of invertebrates in their diet. The brine shrimp *Artemia parthenogenetica* (Crustacea, Branchiopoda) is intermediate host for several cestode species whose final hosts are water birds (Sanchez *et al*., 2007). There are very few reports on life cycle studies from water birds of India. Sanchez *et al* (2007) made important observations on life cycle studies from state fishery in Bohemia and Moravia. Life cycles of 16 cestode species of the families Hymenolepididae and Diploposthidae were studied in 52 ponds of the State Fishery in Bohemia and Moravia. The parasites were recovered from domestic ducks kept on the ponds and from wild birds, mostly of the genera *Anas* and *Aythya*. The studies revealed that a crustacean (copepod or ostracod) becomes the first intermediate host ingesting cestode eggs that contain the larvae. The first intermediate hosts infected with cestode larvae is eaten by the second intermediate host which are different species of water snails. Dead crustaceans like copepods and

ostracods are a component of their food and these water snails serving as reservoir hosts harbour the cysticercoids. When the water snails containing the infected cysticercoids are eaten by the definitive host which is the water bird in this case, the adult cestode develops in its digestive tract. It has been found experimentally that cysticercoids can survive in the digestive tract of snails for even two years. The pathogenic effects caused by cestodes in these birds has been discussed. The present paper is based on recorded literature and the hosts and distribution for each species of cestode has been given.

REVIEW OF LITERATURE

Avian cestode faunas in India have been poorly studied. Southwell (1930) reported a few cestode species of birds from the Indian region. There have been publications on cestodes from waterbirds by different Indian authors from time to time. The names of their papers have been given in the section References in the present work. But there has been no consolidated work or published checklist of cestodes reported only from water birds of the Indian subcontinent.

METHODS

The present paper is based on the reports of cestodes collected from water birds by various workers who collected these parasites from the different states of India. The names of these cestodes have been listed from various papers published from time to time in different journals of Helminthology, Parasitology and other journals as well. The details of each paper has been provided in References. The names of these tapeworm parasites have also been procured through literature searches in the website www.cabdirect.org. The included papers that have been consulted for listing the names of the parasites have reports of cestodes from both captive birds (e.g., zoos) and also from free-ranging birds. In the present study an attempt has been made to prepare a list of cestode species along with their distributional range in India from water birds.

RESULTS

In this paper, we report the presence of 119 species of cestode parasites from sixteen families of water birds from different states of India. The water birds harbouring the cestode parasites are represented by the families Podicipididae, Pelicanidae, Phalacrocoracidae, Anseridae, Anatidae, Ardeidae, Rallidae, Threskiornithidae, Phoenicopteridae, Charadriidae, Rostratulidae, Recurvirostridae, Burhinidae, Glareolidae, Laridae and Scolopacidae. Seven species of tapeworm parasites are reported from two species of birds from the family Podicipididae, two species of cestodes are reported from a single species of birds from Pelicanidae, three cestode species are recorded from three species of birds from Phalacrocoracidae, one tapeworm species is recorded from a single species of birds from Anseridae, forty two species of cestodes are reported from twenty species of birds from Anatidae, ten cestode species are recorded from six species of birds from Ardeidae, two tapeworm species are reported from two species of birds from Threskiornithidae, two cestode species are reported from two species of birds from Phoenicopteridae, four cestode species are reported from two species of birds from Rallidae, twenty one species of cestodes are recorded from two species of birds from Charadriidae, two cestode species are reported from one species of birds from Rostratulidae, four tapeworm species are recorded from one species of birds from Recurvirostridae, four cestode species are reported from one species of birds from Burhinidae, one species of cestode parasite is reported from a single species of birds from Glareolidae, four cestode species are recorded from three species of birds from Laridae and eighteen cestode parasites are recorded from eight species of birds from Scolopacidae.

TAXONOMIC SUMMARY OF PARASITES:

Host 1: ***Tachybaptus ruficollis*** Pallas, 1764

Family PODICIPIDIDAE

English common name: **Little Grebe**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Armadoskrjabinia pandei* Khare and Srivastava, 1996	Intestine	India : Madhya Pradesh (Tikamgarh)

Host 2: ***Tachybaptus ruficollis*** [*capensis*] = (*Tachybaptus ruficollis capensis*) Salvadori, 1884

Family PODICIPIDIDAE

English common name: **Indian Little Grebe**

Total cestode species reported: 5

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis multistriata* Rudolphi, 1810	Intestine	India : Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	DIOECOCESTIDAE	2. *Neodioecocestus cablei* Siddiqui, 1960	Intestine	India : Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	AMABILIDAE	3. *Tatria acanthorhyncha* (Wedl, 1855) Kowalewski, 1904	Intestine	India : Uttar Pradesh (Lucknow), Chinhat Lake
CYCLOPHYLLIDEA	AMABILIDAE	4. *Pseudoschistotaenia pindchi* Fotedar and Chisti, 1977	Intestine	India: Kashmir
CYCLOPHYLLIDEA	AMABILIDAE	5. *Pseudoschistotaenia indica* Fotedar and Chisti, 1980	Intestine	India : Kashmir

Host 3: ***Pelecanus philippensis*** Gmelin, 1789

Family PELICANIDAE

English common name: **Spot-billed Pelican**

Total cestode species reported: 2

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis medici* (Stossich, 1890) Fuhrmann, 1906	Intestine	India : West Bengal (Kolkata)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Armadoskrjabinia medici* (Stossich, 1890) Spasskii and Spasskaja, 1954	Intestine	India: Locality is not known (from Schmidt, 1986)

Host 4: ***Microcarbo niger*** Vieillot, 1817

Family PHALACROCORACIDAE

English common name: **Little Cormorant**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis kempi* (Southwell, 1921) Mayhew, 1925	Intestine	India: Manipur, Assam

Host 5: ***Phalacrocorax carbo*** Linnaeus, 1758

Family PHALACROCORACIDAE

English common name: **Great Cormorant**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis phalacrocorax* Woodland, 1929	Intestine	India: Uttar Pradesh

Host 6: ***Anhinga melanogaster*** Pennant, 1769

Family ANHINGIDAE

English common name: **Oriental darter**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Echinorhynchotaenia lucknowensis* Singh, 1956	Intestine	India : Uttar Pradesh (Lucknow)

Host 7: ***Anser anser*** Linnaeus, 1758

Family ANATIDAE

English common name: **Greylag Goose**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis coronula* Dujardin, 1845	Intestine	India: Uttar Pradesh (Lucknow)

Host 8: ***Anas platyrhynchos*** Linnaeus, 1758

Family ANATIDAE

English common name: **Mallard or Wild Duck**

Total cestode species reported: 11

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Sobolevicanthus rashidi* Chishti, 1980	Intestine	India : Kashmir
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis gracilis* (Zeder, 1803) Cohn, 1901	Intestine	India : West Bengal, Kolkata
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	3. *Hymenolepis filumferens* Brock, 1942	Intestine	India: Tamil Nadu (Madras)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	4. *Dicranotaenia introversa* (Mayhew, 1925) Lopez - Neyra, 1942	Intestine	India : West Bengal (Calcutta Zoo)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	5. *Dicranotaenia makundi* Singh, 1952	Intestine	India : Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	DAVAINIDAE	6. *Raillietina* (*Skrjabinia*) *cesticillus* Molin, 1858	Intestine	India : Maharashtra
CYCLOPHYLLIDEA	DAVAINIDAE	7. *Cotugnia digonophora* (Pasquale, 1890) Diamare, 1893	Intestine	India : West Bengal (Behrampur, Zoological Garden, Kolkata)
CYCLOPHYLLIDEA	DAVAINIDAE	8. *Cotugnia fastigata* Meggitt, 1920	Intestine	India : West Bengal (Zoological Garden, Kolkata)
CYCLOPHYLLIDEA	DAVAINIDAE	9. *Cotugnia fila* Meggitt, 1931	Intestine	India : Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	DILEPIDIDAE	10. *Unciunia acapillicirrosa* Moghe, 1933	Intestine	India: Maharashtra (Nagpur)
PSEUDOPHYLLIDEA	DIPHYLLOBOTHRIIDAE	11. *Ligula intestinalis* Linnaeus, 1758	Intestine	India : Assam

Host 9: ***Spatula clypeata* (= *Anas clypeata*)** Linnaeus, 1758

Family: ANATIDAE

English common name: **Northern Shoveler**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Echinocotyle rosseteri* Blanchard, 1891	Intestine	India: Locality is not known (from Schmidt, 1986)

Host 10: ***Querquedula querquedula (= Anas querquedula)*** Linnaeus, 1758

Family ANATIDAE

English common name: **Garganey**

Total cestode species reported: 4

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Echinocotyle minutissima* Singh, 1952	Intestine	India : Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Echinocotyle singhi* Srivastava and Pandey, 1980	Intestine	India: Uttar Pradesh (Allahabad)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	3. *Hardayali anasi* Khare and Srivastava, 1996	Intestine	India : Madhya Pradesh (Tikamgarh)
CYCLOPHYLLIDEA	DILEPIDIDAE	4. *Choanotaenia bhattacharai* Chatterji, 1954	Intestine	India : Andhra Pradesh (Visakhapatnam), Uttar Pradesh (Gorakhpur)

Host 11: ***Aythya nyroca*** Guldenstadt, 1770

Family: ANATIDAE

English common name: **Ferruginous Pochard**

Total cestode species reported : 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Diploposthe laevis* (Bloch, 1782) Jacobi, 1896	Intestine	India : Punjab, Uttar Pradesh (Barabanki)

Host 12: ***Aythya ferina*** Linnaeus, 1758

Family ANATIDAE

English common name: **Common pochard**

Total cestode species reported: 4

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis fimula* Meggitt, 1933	Intestine	India: West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis setigera* Froehlich, 1789	Intestine	India: West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	3. *Retinometra fimula* (Meggitt, 1933) Lopez-Neyra, 1942	Intestine	India: Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	4. *Sobolevicanthus gracilis* Zeder, 1803	Intestine	India: Locality is not known (from Schmidt, 1986)

Host 13: ***Nettapus coromandelianus*** Gmelin, 1789

Family ANATIDAE

English common name: **Cotton Pygmy Goose**

Total cestode species reported: 3

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis smythi* Singh, 1959	Intestine	India : Uttar Pradesh (Barabanki and Unnao)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis fista* Meggitt, 1933	Intestine	India : West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	3. *Retinometra fista* (Meggitt, 1933) Lopez-Neyra, 1942	Intestine	India : Locality is not known (from Schmidt, 1986)

Host 14: ***Anas crecca*** Linnaeus, 1758

Family ANATIDAE

English common name: **Common Teal**

Total cestode species reported: 3

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Retinometra longicirrosa* (Fuhrmann, 1906) Spasskii, 1963	Intestine	India : West Bengal

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis longicirrosa* Fuhrmann, 1906	Intestine	India : West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	3. *Diploposthe laevis* (Bloch, 1782) Jacobi, 1896	Intestine	India : Punjab, Uttar Pradesh (Barabanki)

Host 15: ***Aythya fuligula*** Linnaeus, 1758

Family ANATIDAE

English common name: **Tufted Duck**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Mayhewia* sp., Capoor and Srivastava, 1978	Intestine	India : Uttar Pradesh

Host 16: ***Anas poecilorhyncha*** Forster, 1781

Family ANATIDAE

English common name: **Indian Spot – billed duck**

Total cestode species reported: 4

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis collaris* Batsch, 1786	Intestine	India : West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis introversa* Mayhew, 1925	Intestine	India : West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	3. *Hymenolepis foveata* Meggitt, 1933	Intestine	India : West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	4. *Hymenolepis cameroni* Singh, 1959	Intestine	India : Uttar Pradesh (Barabanki)

Host 17: ***Cygnus atratus*** Latham, 1790

Family: ANATIDAE

English common name: **Black swan**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis lanceolata* (Bloch, 1782) Weinland, 1858	Intestine	India : West Bengal

Host 18: ***Tadorna ferruginea*** Pallas, 1764

Family: ANATIDAE

English common name: **Ruddy shelduck**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis echinocotyle* Fuhrmann, 1907	Intestine	India : West Bengal

Host 19: ***Tadorna tadorna*** Linnaeus, 1758

Family ANATIDAE

English common name: **Common Shelduck**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis simplex* (Fuhrmann, 1906) Mayhew, 1925	Intestine	India : West Bengal (Kolkata)

Host 20: ***Cygnus olor*** Gmelin, 1789

Family ANATIDAE

English common name: **Mute swan**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis fona* Meggitt, 1933	Intestine	India : West Bengal

Host 21: ***Anas crecca*** **(= *Nettion crecca*)** Linnaeus, 1758

Family ANATIDAE

English common name: **Common Teal**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis crecca* Singh, 1952	Intestine	India : Uttar Pradesh (Lucknow)

Host 22: ***Aythya fuligula*** Linnaeus, 1758

Family ANATIDAE

English common name: **Tufted duck**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Mayhewia* sp. Capoor and Srivastava, 1978	Intestine	India : Uttar Pradesh

Host 23: ***Anas acuta*** Linnaeus, 1758

Family ANATIDAE

English common name: **Northern Pintail**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Skrjabinoparaksis thapaliyali* Pandey and Rajvanshi, 1984	Intestine	India : Uttar Pradesh

Host 24: ***Sarkidiornis melanotos*** Pennant, 1769

Family ANATIDAE

English common name: **Knob billed duck**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Fimbriaria fasciolaris* (Pallas, 1781) Froelich, 1802	Intestine	India : Uttar Pradesh (Lucknow)

Host 25: ***Ardea cineria*** Linnaeus, 1758

Family ARDEIDAE

English common name: **Grey Heron**

Total cestode species reported: 2

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DAVAIENIDAE	1. *Satyanarayana satyanarayani* Khan, 1984	Intestine	India : Andhra Pradesh
CYCLOPHYLLIDEA	DILEPIDIDAE	2. *Dilepis campylancristrota* (Wedl, 1855) Fuhrmann, 1908	Intestine	India: (Locality is not known)

Host 26: ***Ardeola ralloides*** Scopoli, 1769

Family: ARDEIDAE

English common name: **Squacco Heron**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Dilepis macrosphincter* Fuhrmann, 1909	Intestine	India : Locality is not known (from Schmidt, 1986)

Host 27: ***Ardeola grayii*** Sykes, 1832

Family ARDEIDAE

English common name: **Indian Pond Heron**

Total cestode species reported: 4

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Dilepis ardeolae* Singh, 1952	Intestine	India : Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	DILEPIDIDAE	2. *Parvitaenia capellae* Saxena, 1969	Intestine	India : Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	DILEPIDIDAE	3. *Parvitaenia campylancristrota* Saxena, 1969	Intestine	India: Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	DILEPIDIDAE	4. *Parvitaenia ardeolae* Burt, 1940	Intestine	India: Locality is not known (from Schmidt, 1986)

Host 28: ***Bubulcus ibis*** Linnaeus, 1758

Family ARDEIDAE

English common name: **Western Cattle Egret**

Total cestode species reported : 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Valipora amethiensis* Srivastava and Capoor, 1975	Intestine	India : Uttar Pradesh

Host 29: ***Nycticorax nycticorax*** Linnaeus, 1758

Family ARDEIDAE

English common name: **Black crowned night heron**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Valipora sultanpurensis* Capoor *et al*., 1975	Intestine	India : Uttar Pradesh (Sultanpur)

Host 30: ***Bubulcus coromandus*** Boddaert, 1783

Family ARDEIDAE

English common name: **Eastern Cattle Egret**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Mayhewia filta* Meggitt, 1933	Intestine	India : West Bengal

Host 31: ***Plegadis falcinellus*** Linnaeus, 1766

Family THRESKIORNITHIDAE

English common name: **Glossy Ibis**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Paradilepis urceus* (Wedl, 1855) Hsu, 1935	Intestine	India : Locality is not known (from Schmidt, 1986)

Host 32: ***Platalea leucorodia*** Linnaeus, 1758

Family THRESKIORNITHIDAE

English common name: **Eurasian Spoonbill**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Mayhewia filirostris* (Wedl, 1855) Lopez–Neyra, 1942	Intestine	India : Locality is not known (from Schmidt, 1986)

Host 33: ***Phoenicopterus roseus* (=*Phoenicopterus antiquorum*)** Pallas, 1811

Family PHOENICOPTERIDAE

English common name: **Greater flamingo**

Total cestode species reported: 2

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Flamingolepis liguloides* (Gervais, 1847) Spasskii and Spasskaja, 1954	Intestine	India : Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Flamingolepis megalorchis* (Luhe, 1898) Spasskii and Spasskaja, 1954	Intestine	India: Locality is not known (from Schmidt, 1986)

Host 34: ***Fulica atra*** **Linnaeus,** 1758

Family RALLIDAE

English common name: **Common coot**

Total cestode species reported: 3

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Diorchis gigantocirrosa* Singh, 1959	Intestine	India : (Locality is not known)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Diorchis balacea* Johri, 1960	Intestine	India : (Locality is not known)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	3. *Diorchis americana* Ransom, 1909	Intestine	India : Uttar Pradesh (Lucknow)

Host 35: ***Zapornia parva*** Scopoli, 1769

Family RALLIDAE

English common name: **Little crake**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	ACOLEIDAE	1. *Acoleus longispiculus* (Stossich, 1895) Fuhrmann, 1899	Intestine	India : Locality is not known (from Schmidt, 1986

Host 36: ***Vanellus malabaricus*** Boddaert, 1783

Family: Charadriidae

English common name: **Yellow wattled lapwing**

Total cestode species reported: 7

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Anomotaenia volvulus* (Linstow, 1906) Fuhrmann, 1908	Intestine	India : (Locality is not known)
CYCLOPHYLLIDEA	DILEPIDIDAE	2. *Dictymetra reticulosa* Singh, 1952	Intestine	India : Uttar Pradesh
CYCLOPHYLLIDEA	DILEPIDIDAE	3. *Lapwingia malabarica* Shinde, 1972	Intestine	India : Maharashtra (Aurangabad)
CYCLOPHYLLIDEA	DILEPIDIDAE	4. *Lapwingia jalnaenis* Ghare and Shinde, 1980	Intestine	India : Maharashtra (Jalna)
CYCLOPHYLLIDEA	DILEPIDIDAE	5. *Choanotaenia dispar* Burt, 1940	Intestine	India : Uttar Pradesh

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	6. *Panuwa indica* Khan, 1983	Intestine	India : Andhra Pradesh
CYCLOPHYLLIDEA	PROGYNOTAENIIDAE	7. *Progynotaenia longicirrata* Singh, 1952	Intestine	India : Uttar Pradesh (Lucknow)

Host 37: ***Vanellus indicus*** Boddaert, 1783

Family: CHARADRIIDAE

English common name: **Red wattled lapwing**

Total cestode species reported: 9

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Anomotaenia oligorhyncha* Singh, 1960	Intestine	India : Andhra Pradesh
CYCLOPHYLLIDEA	DILEPIDIDAE	2. *Anomotaenia chandleri* (Moghe, 1925) Mathevossian, 1963	Intestine	India : Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	DILEPIDIDAE	3. *Lapwingia singhi* Shinde, 1972	Intestine	India: Maharashtra (Aurangabad)
CYCLOPHYLLIDEA	DILEPIDIDAE	4. *Lapwingia yogeshwarii* Shinde, 1972	Intestine	India: Maharashtra (Aurangabad)
CYCLOPHYLLIDEA	DILEPIDIDAE	5. *Lapwingia alii* Gupta and Parmar, 1992	Intestine	India: Uttar Pradesh (Khurja, Bulandsahar)
CYCLOPHYLLIDEA	DILEPIDIDAE	6. *Lapwingia indicusae* Pawar and Shinde, 2001	Intestine	India: Aurangabad, India
CYCLOPHYLLIDEA	DILEPIDIDAE	7. *Lapwingia shindei* Pawar and Shinde, 2001	Intestine	India: Maharashtra (Aurangabad)
CYCLOPHYLLIDEA	DILEPIDIDAE	8. *Choanotaenia intestinalis* Nanware *et al*., 2011	Intestine	India : Maharashtra (Nanded)
CYCLOPHYLLIDEA	DILEPIDIDAE	9. *Panuwa chandleri* Moghe, 1925	Intestine	India : Locality is not known (from Schmidt, 1986)

Host 38: ***Vanellus leucurus*** Lichtenstein, 1823

Family CHARADRIIDAE

English common name: **White tailed lapwing**

Total cestode species reported: 4

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Panuwa caballeroi* Singh and Singh, 1960	Intestine	India : Uttar Pradesh (Barabanki and Unnao)

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	DILEPIDIDAE	2. *Panuwa vogeae* Singh and Singh, 1960	Intestine	India : Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	DILEPIDIDAE	3. *Chettusiana indiana* Singh, 1959	Intestine	India : Uttar Pradesh (Barabanki and Unnao)
CYCLOPHYLLIDEA	PROGYNOTAENIIDAE	4. *Progynotaenia leucura* Singh, 1959	Intestine	India : Uttar Pradesh (Unnao)

Host 39: ***Charadrius dubius*** Scopoli, 1786

Family: CHARADRIIDAE

English common name: **Little ringed plover**

Total cestode species reported: 1

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Diorchis jodhpurensis* Mukherjee, 1970	Intestine	India: Rajasthan (Umedsagar, Jodhpur dist.)

Host 40: ***Rostratula benghalensis*** Linnaeus, 1758

Family ROSTRATULIDAE

English common name: **Common Greater painted snipe**

Total cestode species reported: 2

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Mayhewia fola* (Meggitt, 1933) Spasskii and Spasskaja, 1954	Intestine	India : West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis fola* Meggitt, 1933	Intestine	India : West Bengal

Host 41: ***Himantopus himantopus*** Linnaeus, 1758

Family RECURVIROSTRIDAE

English common name: **Black winged stilt**

Total cestode species reported: 4

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Hymenolepis himantopodis* (Krabbe, 1869) Fuhrmann, 1906	Intestine	India : Uttar Pradesh (Barabanki)
CYCLOPHYLLIDEA	DIOECOCESTIDAE	2. *Infula burhini* Burt, 1939	Intestine	India : Locality is not known (from Schmidt, 1986)

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	ACOLEIDAE	3. *Acoleus vaginatus* (Rudolphi, 1819) Fuhrmann, 1899	Intestine	India : Rajasthan (Sikar), Maharashtra (Nagpur), Uttar Pradesh (Lucknow) *Elsewhere*: Asia, Africa, Europe, U.S.A.
CYCLOPHYLLIDEA	DAVAINEIDAE	4. *Davainea himantopodis* Johnston, 1911	Intestine	India : Uttar Pradesh (Lucknow)

Host 42: ***Burhinus oedicnemus*** Linnaeus, 1758

Family: BURHINIDAE

English common name: **EurasianThick-knee**

Total cestode species reported: 4

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Paricterotaenia coronata* (Creplin, 1829) Burt, 1940	Intestine	India : Rajasthan (Jaisalmer); Uttar Pradesh *Elsewhere*: Sri Lanka, Africa, Europe.
CYCLOPHYLLIDEA	DILEPIDIDAE	2. *Choanotaenia bhattacharai* Chatterji, 1954	Intestine	India : Andhra Pradesh (Visakhapatnam), Uttar Pradesh (Gorakhpur)
CYCLOPHYLLIDEA	DILEPIDIDAE	3. *Malika woodlandi* Pandey and Tayal, 1981	Intestine	India : Uttar Pradesh (Faizabad)
CYCLOPHYLLIDEA	DILEPIDIDAE	4. *Malika chauhani* Pandey and Tayal, 1981	Intestine	India : Uttar Pradesh

Host 43: ***Cursorius cursor*** Latham, 1787

Family GLAREOLIDAE

English common name: **Cream coloured Courser**

Total cestode species reported: 1

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Choanotaenia kapurdiensis* Mukherjee, 1970	Intestine	India : Rajasthan (Jaisalmer and Barmer)

Host 44: ***Sterna aurantia*** Gray, 1831

Family LARIDAE

English common name: **River tern**

Total cestode species reported: 2

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Choanotaenia aurantia* Singh, 1956	Intestine	India : Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis lali* Singh, 1959	Intestine	India : Uttar Pradesh (Barabanki)

Host 45: ***Hydroprogne caspia*** Pallas, 1770

Family LARIDAE

English common name: **Caspian Tern**

Total cestode species reported: 1

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Dicranotaenia neosouthwelli* Hughes, 1940	Intestine	India : Locality is not known (from Schmidt, 1986)

Host 46: ***Chroicocephalus brunnicephalus*** Jerdon, 1840

Family LARIDAE

English common name: **Brown headed gull**

Total cestode species reported: 2

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Dicranotaenia neosouthwelli* Hughes, 1940	Intestine	India : Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis fusa* (Krabbe, 1869) Fuhrmann, 1906	Intestine	India : West Bengal, Kolkata

Host 47: ***Limosa limosa*** Linnaeus, 1758

Family SCOLOPACIDAE

English common name: **Black - tailed Godwit**

Total cestode species reported: 1

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Dicranotaenia annandalei* (Southwell, 1922) Lopez - Neyra, 1932	Intestine	India : Locality is not known (from Schmidt, 1986)

Host 48: ***Tringa nebularia*** Gunnerus, 1767

Family SCOLOPACIDAE

English common name: **Common Green shank**

Total cestode species reported: 1

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Echinocotyle nitida* (Krabbe, 1869) Clerc, 1902	Intestine	India : Uttar Pradesh

Host 49: ***Calidris pugnax*** Linnaeus, 1758

Family SCOLOPACIDAE

English common name: **Ruff**

Total cestode species reported: 2

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Echinocotyle oweni* (Moghe, 1933) Yamaguti, 1959	Intestine	India : Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Hymenolepis oweni* Moghe, 1933	Intestine	India : Maharashtra (Nagpur)

Host 50: ***Gallinago gallinago*** Linnaeus, 1758

Family: SCOLOPACIDAE

English common name: **Common Snipe**

Total cestode species reported: 4

Order	**Family**	**Species**	**Site of Infection**	**Distribution**
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	1. *Echinocotyle uralensis* Clerc, 1902	Intestine	India : Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	DILEPIDIDAE	2. *Eugonodaeum testifrontosa* Johri, 1934	Intestine	India: Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	DILEPIDIDAE	3. *Choanotaenia cirrospinosa* (Patwardhan, 1935) Mathevossian, 1963	Intestine	India : Locality is not known (from Schmidt, 1986)
CYCLOPHYLLIDEA	DILEPIDIDAE	4. *Choanotaenia manipurensis* Patwardhan, 1935	Intestine	India : Locality is not known (from Schmidt, 1986)

Host 51: ***Tringa ochropus (= Totanus ochropus)*** Linnaeus, 1758

Family: SCOLOPACIDAE

English common name: **Green Sandpiper**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Similuncinus totaniochrpodis* Inamdar, 1934	Intestine	India: Locality is not known (from Schmidt, 1986)

Host 52: ***Tringa glareola*** Linnaeus, 1758

Family SCOLOPACIDAE

English common name: **Wood Sandpiper**

Total cestode species reported: 3

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	AMABILIDAE	1. *Laterochites glareolae* Ashfaq and Shinde, 1989	Intestine	India : Maharashtra (Aurangabad)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	2. *Echinocotyle glareolae* Singh, 1952	Intestine	Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	DILEPIDIDAE	3. *Krimi tringae* Shinde and Sonune, 1992	Intestine	India : Maharashtra (Aurangabad)

Host 53: ***Calidris alpina*** Linnaeus, 1758

Family SCOLOPACIDAE

English common name: **Dunlin**

Total cestode species reported: 1

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Paricterotaenia decacantha* Fuhrmann, 1913	Intestine	India: Locality is not known (from Schmidt, 1986)

Host 54: ***Actitis hypoleucos*** Linnaeus, 1758

Family SCOLOPACIDAE

English common name: **Common Sandpiper**

Total cestode species reported: 4

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	1. *Choanotaenia hypoleucia* Singh, 1952	Intestine	India : Locality is not known (from Schmidt, 1986)

Order	Family	Species	Site of Infection	Distribution
CYCLOPHYLLIDEA	DILEPIDIDAE	2. *Bancroftiella forna* Meggitt, 1933	Intestine	India : West Bengal
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	3. *Echinocotyle hypoleuci* Singh, 1952	Intestine	India : Uttar Pradesh (Lucknow)
CYCLOPHYLLIDEA	HYMENOLEPIDIDAE	4. *Aploparaksis tandani* Singh, 1952	Intestine	India : Uttar Pradesh (Lucknow)

CONCLUSION

In the present study, 16 families under 6 orders of water birds from India are found to harbour cestode parasites. A total of 8 cestode families represented by 45 genera and 119 species are found to infect these water birds.The present work reveals that only two cestode orders Cyclophyllidea and Pseudophyllidea parasitize these water birds. The order Pseudophyllidea is represented by only one cestode family Diphyllobothriidae and *Ligula intestinalis* under this family was found to infect the water bird family Anatidae. The order Cyclophyllidea is represented by 7 cestode families. The family Hymenolepididae affects maximum number of water birds and under this family 63 species under 16 genera of cestodes infect at least 14 families of water birds which are Podicipididae, Pelicanidae, Phalacrocoracidae, Anseridae, Anatidae, Ardeidae, Threskiornithidae, Phoenicopteridae, Rallidae, Charadriiae, Rostratulidae, Recurvirostridae, Laridae and Scolopacidae.The family Dilepididae is found to be the second largest family after Hymenolepididae with 37 cestode species under 15 genera parasitizing 8 water bird families which are Anatidae, Ardeidae, Threskiornithidae, Charadriidae, Burhinidae, Glareolidae, Laridae and Scolopacidae. The family Davaeinidae with 6 species under 4 genera is the third cestode family affecting 3 families of water birds which are Anatidae, Ardeidae and Recurvirostridae. The families Dioecocestidae, Amabilidae, Acoleidae and Progynotaenidae are all represented by 2 species each. The cestode family Dioecocestidae is represented by 2 genera *Neodioecocestus* and *Infula* affecting 2 families of water birds which are Podicipididae and Recurvirostridae. A single genus *Acoleus* under the cestode family Acoleidae affects 2 water bird families Rallidae and Recurvirostridae. The cestode family Progynotaeniidae represented by only one genus *Progynotaenia* affects only a single water bird family Charadriidae. The 2 genera *Tatria* and *Pseudoschistotaenia* under the tapeworm family Amabilidae affects the water bird family Podicipididae. The tapeworms under the genus *Hymenolepis* of the family Hymenolepididae affects a maximum of 9 water bird families which are Podicipididae, Pelicanidae, Phalacrocoracidae, Anseridae, Anatidae, Rostratulidae, Recurvirostridae, Laridae and Scolopacidae. The genus *Dicranotaenia* under Hymenolepididae affects the 3 water bird families of Anatidae, Laridae and Scolopacidae. The cestode genus *Mayhewia* under the same family affects the 3 water bird families of Anatidae, Threskiornithidae and Rostratulidae. The genus *Echinocotyle* under Hymenolepididae affects 2 water bird families Anatidae and Scolopacidae. The genus *Diorchis* under Hymenolepididae affects 2 water bird families which are Rallidae and Charadriidae. The genera *Armadoskrjabinia*, *Variolepis*, *Echinorhynchotaenia*, *Sobolevicanthus*, *Hardayali*, *Diploposthe,* *Retinometra*, *Skrjabinoparaksis*, *Fimbriaria*, *Flamingolepis* and *Aploparaksis* under the Hymenolepididae family affect only single families of water birds. The water bird family Scolopacidae is parasitized by 6 genera of cestodes under the family Dilepididae which are *Choanotaenia, Eugonodaeum, Similuncinus, Krimi, Laterochites, Bancroftiella and Paricterotaenia*. The three genera *Malika*, *Paricterotaenia* and *Choanotaenia*

under the family Dilepididae affects the water bird family Burhinidae.The water bird family Charadriidae is infected by the 4 cestode genera *Anomotaenia, Lapwingia, Panuwa and Chettusiana* under Dilepididae. The 3 genera *Dilepis*, *Parvitaenia* and *Valipora* under Dilepididae parasitize the water bird family Ardeidae. Thus, Scolopacidae, Burhinidae, Charadriidae and Ardeidae are the water bird families affected by more than one genera of the cestode family Dilepididae. *Dilepis*, *Parvitaenia*, *Valipora*, *Paradilepis*, *Anomotaenia*, *Lapwingia*, *Panuwa*, *Chettusiana*, *Paricterotaenia*, *Malika*, *Eugonodaeum*, *Similuncinus*, *Krimi*, *Laterochites*, *Bancroftiella* and *Paricterotaenia* under the family Dilepididae infect only single families of water birds.The genus *Choanotaenia* under Dilepididae affects 5 families of water birds which are Anatidae, Burhinidae, Glareolidae, Laridae and Scolopacidae. *Choanotaenia* is thus the second largest genus after *Hymenolepis* infecting Indian water birds.The family Anatidae is affected by the 2 cestode genera *Raillietina* and *Cotugnia* under Davainidae. The genera *Satyanarayana* and *Davainea* infect single families of water birds. The water bird family Anatidae is the maximum infected family and is parasitized by 14 genera of cestode parasites. Scolopacidae is the next infected family parasitized by 10 genera of cestodes. Charadriidae is the third largest family parasitized by 9 genera of cestodes. The family Podicipididae is affected by 7 genera of cestodes. Ardeidae is parasitized by 5 genera of cestodes. Recurvirostridae is parasitized by 4 genera of cestodes. Burhinidae and Laridae are parasitized by 3 genera of cestodes. Pelicanidae, Phalacrocoracidae, Rallidae and Rostratulidae are parasitized by 2 genera of cestodes. Anseridae, Glareolidae Threskiornithidae and Phoenicopteridae are parasitized by single genera of cestodes.

Water birds, play key functional roles in many aquatic ecosystems, including as predators, herbivores and vectors of seeds, invertebrates and nutrients, although these roles have often been overlooked. Water birds can maintain the diversity of other organisms, control pests, be effective bioindicators of ecological conditions, and act as sentinels of potential disease outbreaks. They also provide important provisioning (meat, feathers, eggs, etc.) and cultural services to both indigenous and westernized societies.

Tapeworms are common in wild birds, but they seldom cause death. Heavy burdens of these parasites may reduce the vigor of the bird and serve as a predisposing factor for other disease agents, or the parasites may occlude the intestine. One genus, *Gastrotaenia* sp., lives in the gizzard and penetrates the keratohyalin lining or the horny covering of the gizzard pads, causing inflammation and necrosis. *Cloacotaenia* sp. inhabit the ureter or the tubular area that transports wastes from the kidneys to the cloaca in some waterfowls. *Cloacotaenia megalops* may occasionally be the cause of death in waterfowl (Price, 1985)

From the above discussion it is clear that water birds form important components of the food chain, help in disease management, and act as ecological gauge.Though very little work has been done in India to save water birds from the fatal attacks of cestode infections the present study will provide an insight into the diverse cestode species affecting these birds and will help conservationists to save water birds with a better understanding on host parasite relationships and protection of water birds from cestode and other parasitic infections.

SUMMARY

Tapeworm or cestode infection is a major problem in water birds. Heavily infested birds usually show impaired general conditions and are listless, apathetic with dull, ruffled plumage, loss of weight, anaemia and leg weakness. Cestode infections are responsible for significant chronic mortalities and poor growth that is reflected in low survival in affected birds. The present paper is a list of cestode parasites found in different families of water birds from India. The present paper is based on recorded literature and no field studies have been made. In this paper, 119 species of cestode parasites from 16 families of water birds from different states of India is listed.

The water birds harbouring the cestode parasites are represented by the families Podicipididae, Pelicanidae, Phalacrocoracidae, Anseridae, Anatidae, Ardeidae, Threskiornithidae, Phoenicopteridae, Rallidae, Charadriidae, Rostratulidae, Recurvirostridae, Burhinidae, Glareolidae, Laridae and Scolopacidae.

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