

**STUDIES ON THE FAMILY STRIGEIDAE RAILLIET,1919 WITH
REDESCRIPTION OF *APHARYNGOSTRIGEA GARCIAI* TUBANGUI,1933
A STRIGEID PARASITE OF *GRUS GRUS LILFORDI* (SHARPE,1894) FROM
KASHMIR, THE FIRST RECORD FROM INDIA**

V. K. KHAROO

Department of Zoology, University of Allahabad, Allahabad (U.P.)

ABSTRACT : *Apharyngostrigea garciai* Tubangui,1933 is redescribed and illustrated from the Grey Crane *Grus g. lilfordi* from Kashmir, which represents a new host record from India. Although the general morphology of the parasite collected by the author resembles with the original specimens described by Tubangui, yet there are marked variations in shape and dimensions of certain anatomical features, which are commented upon wherever necessary. A statement showing comparative dimensions recorded by different helminthologists along with the author's collection is also given. A brief history and classification of the family Strigeidae Railliet,1919 is also presented.

Key words : Trematode, Strigeidae, *Apharyngostrigea*, *Grus grus lilfordi*, Holdfast organ.

INTRODUCTION

The family Strigeidae Railliet,1919 has attracted the attention of several helminthologists and has been a topic of discussion from time to time. The prominent workers who have contributed to the knowledge of this family are Railliet (1919), La Rue (1926), Bayer (1938), Dubois (1938,1967,1968,1970,1971), Sudarikov (1959,1984), Yamaguti (1958,1971), Zazornova and Sysoev (1993) and Niewiadomska (2002). The family consists of a large number of digenetic trematodes with a distinct cup shaped forebody and a characteristic holdfast organ. These distomes have a body divided by a constriction into an anterior region which is cup or spoon shaped and a posterior oval or cylindrical part. The fore body contains a well developed adhesive apparatus and the posterior region is beset with most of the reproductive organs. The pioneering contribution of Nitzsch (1819) distinguished the genus *Holostomum* (Goeze,1782) after separating it from *Amphistoma* Rudolphy,1801, but subsequently synonymised with *Strigea*, Abildgaard,1790. Though Blanchard (1847) laid the foundation of this group by erecting the family Holostomidae, but Railliet,1919 is credited with working out the concepts of taxonomy. He created the family Strigeidae Railliet,1919 to accommodate all the bisegmented species within it but included the non-segmented one's in the family Cyathocotylidae. He further divided the family Strigeidae into two subfamilies : Strigeinae Railliet,1919 and Duboisellinae Railliet,1938.

Though Strigeidae is mostly represented from birds all over the world except the genus *Duboisella* Baer,1938, which has been reported by Baer,1938 from mammals infecting *Didelphys aurita* and *D. marsupials* in Brazil and U.S.A. respectively, which he placed in a separate subfamily Duboisellinae Railliet,1938. The uniqueness of the composition of holdfast organ with dorsal and ventral lobes, its confinement to within forebody cavity and the peculiar distribution of uterine coils in the fore body has given the genus *Duboisella* a special status with a separate subfamily Duboisellinae. These morphologically different characters have not been observed in any other diplostomid genera and therefore, a separate subfamily status. Of all the Strigeids known at present, this is the only genus with uterus extending into forebody.

Though the literature available within this group is vast but the classic work by Dubois (1938,1953,1963,1967,1968, 1970) is a significant contribution towards this family established in the record books of parasitology. He has published several systematic treatises on the members of the Strigeidae and Diplostomatidae. Dubois (1936) divided the subfamily Strigeinae into two sub-subfamilies (tribes) : Strigeini Dubois,1936 and Cotylurini Dubois,1936 and also accepted the validity of Duboisellinae Baer,1938. Dubois (1938) grouped together all the genera with a cup shaped forebody and a bilobed holdfast organ and placed them under the family Strigeidae. He also maintained the distinguished status of the two subfamilies Strigeinae and Duboisellinae according to their host groups. Although he acknowledged the existence of the polyphyletic origin of the species, yet he erroneously followed Fahrenholtz's rule and classified the species according to hosts they harbour. His views were opposed and considered inappropriate by (Chandler & Rausch,1946; Beverly-Burton,1960; Harris *et al.*,1967; Niewiadomska,1973 and Hendrickson,1986) - Shoop,1989.

Yamaguti,1958; while accepting the two subfamilies already existing, Strigeinae Railliet,1919 and Duboisellinae Baer, 1938 also included the subfamily Bolbocephalodinae Dubois,1936 under family Strigeidae in 1971, which the author (Dubois, 1936) had himself placed under the family Bolbocephalodidae. Yamaguti (1958) also maintained Strigeini and Cotylurini as two tribes under Strigeinae. Sudarikov (1959) rejected the contentions of both Dubois (1936) and Yamaguti (1958) and opined

that these tribes have subfamilial status. He also included *Pseudapatemon* Dubois, 1936 in a separate subfamily Pseudapatemoninae because of the stopper like structure of the holdfast organ. However, Niewiadomska (2002) was of the view that because of its invisibility, the unique structure of the holdfast organ of *Pseudapatemon* cannot be substantiated without sufficient proof and accordingly he did not consider the inclusion of this character at subfamilial level.

Bisseru (1956), while accepting the standards of host specificity created a separate family the Neostrigeidae (Bisseru, 1956) for three species obtained from the intestines of *Crocodilus niloticus* in Rhodesia (Present Zimbabwe) : *Neostrigea africana* Bisseru, 1956; *N.leiperi* Bisseru, 1956 and *Prostrigea arcuata* Bisseru, 1956. However, Dubois (1968) did not accept the validity of a separate family and emphasized upon the fact that that crocodile could be an accidental host. He also rejected the contention of raising new species and based upon their morphology he established that *N.africana* is a synonym of *Strigea falconis* Szidat, 1928. Accordingly, he synonymized *N.leiperi* with the genus *Strigea* Abildgaard, 1790 and *Prostrigea arcuata* with *Parastrigea* Szidat, 1928. Although Sudarikov (1959) maintained the distinct identity of the Neostrigeidae but as an addendum to the family Strigeidae, which he considered as superfamily in his system of classification. Niewiadomska (2002) accepted both the views expressed by Sudarikov (1959) and Dubois (1968) with regard to retention of the species under discussion within the family Strigeidae and synonymization of the Neostrigeidae with the family. Although a considerable part of the literature available deals with description of species yet, only a few helminthologists have tackled taxonomy. While working on the taxonomy of the Strigeidae, La Rue, 1926 expressed that : "The aims of the classification are twofold - to express the genetic relationship and to offer a convenient method of cataloging and arranging facts". The selection of taxonomic characters, according to La Rue's contention is that the taxonomist may choose some with little significance but further clarified that with scarce knowledge of cercariae, miracidia and life history, it is virtually impossible to distinguish between the characters of value and those of no significance.

Dubois (1953), while continuing his studies on the family Strigeidae (syn. Holostomidae Brandes, 1890) included four genera under the sub-sub family (tribe) Strigeini Dubois, 1936 : *Apharyngostrigea* Ciurea, 1927; *Ophiosoma* Szidat, 1928; *Parastrigea* Szidat, 1928 and *Strigea* Abildgaard, 1890. The classic treatise on the British and other European forms on the trematodes by Ben Dawes, 1968 stands out as a significant and valuable contribution. He diagnosed the family Strigeidae Railliet, 1919 thus : feebly developed suckers, situated in anterior region. Adhesive organ posterior to ventral sucker. Genital pore at or near posterior end, sometimes opening into a bursa or depression. Cirrus and cirrus pouch absent. Vitellaria well developed, distributed in both parts of body or only the posterior. Uterus short, containing a few large sized eggs. Excretory system with a network of vessels. Excretory pore almost terminal. Parasites of birds mainly. He recognized the validity of seven genera : *Strigea*, *Apharyngostrigea*, *Parastrigea*, *Ophiosoma*, *Cardiocephalus*, *Apatemon* and *Cotylurus*. Trematodes of the family Strigeidae are mainly parasites of birds. Niewiadomska (2002) revised the family, accommodated 13 genera of this family into two subfamilies according to host specificity; 12 genera included in Strigeinae Railliet, 1919-parasites of birds and one genus included in Duboisellinae Baer, 1938 - parasite of mammals.

The main diagnostic characters which he identified for the family are : Family Strigeidae Railliet, 1919 (syn. Neostrigeidae Bisseru, 1956): Fore body cup shaped to tubular or bulbous; hind body cylindrical. Pseudosuckers present or absent in forebody. Hold fastorgan with dorsal and ventral lobes contained within forebody. Proteolytic gland at the junction of the two body regions. Oral sucker and pharynx usually present. Oesophagus short. Caeca terminating close to body extremity. Reproductive organs confined to hind body. Tandem testes are bi, tri or multilobed. Cirrus sac absent. Ovary pre-testicular; Laurer's canal present. Vitellaria distributed in both parts of body or may be present either in fore or hind body. Parasites of birds mainly.

I. Subfamily : Strigeini Railliet, 1919 : Parasites of birds. Vitellaria occupying both parts of body or restricted to hind body.

Genera : *Parastrigea* Szidat, 1928 (syn. *Prostrigea* Bisseru, 1956; *Chaseostrigea* Ukoli, 1967; *Brasiliana* Ukoli, 1967); *Apharyngostrigea* Ciurea, 1927 (syn. *Ridgeworthia* Verma, 1936); *Nematostrigea* Sandground, 1934; *Ophiosoma* Szidat, 1928; *Cardiocephaloides* Sudarikov, 1959 (syn. *Cardiocephalus* Szidat, 1928); *Schwartzitrema* Perez Viguera, 1941 (syn. *Schwartziella* Perez Viguera, 1940); *Pseudapatemon* Dubois, 1936 (syn. *Eroliostrigea* Yamaguti, 1971); *Cotylurus* Szidat, 1928; *Ichthyocotylurus* Odening, 1969; *Apatemon* Szidat, 1928 (syn. *Pseudostrigea*, Yamaguti, 1933); *Australapatemon* Sudarikov, 1959; *Strigea* Abildgaard, 1790.

II. Subfamily : Duboisellinae Baer, 1938 : Parasites of mammals. Vitellaria confined mainly to forebody.

Genus : *Duboisella* Baer, 1938.

The validity of *Tetracotyle* as a genus and published in Fauna Europa was also cited by Gibson, 2001. Niewiadomska, 2002 did not accept its validity but categorized it as one of the four main types of metacercariae namely : *Diplostomulum*, *Neascus*, *Prohemistomulum* and *Tetracotyle* and finally accepted it as *Tetracotyle* type. Another genus *Chabastrigea* was erected by Sudarikov (1959) for *Strigea geoduboisii* Chabaud *et al.* (1956) on the basis of the structure of holdfast organ and

presence of seminal receptacle. However, Yamaguti (1971) did not accept these characters of generic importance and the uncertainty of seminal receptacle. Niewiadomska (2002), following Yamaguti (1971) synonymized it with *Strigea*. He also considered *Agamostrigea* Lutz, 1933 a *lapsus calami* (slip of the pen) of *Apharyngostrigea* Ciurea, 1927. The genus *Cardiocephaloides* Sudarikov, 1959 was considered a synonym of *Cardiocephalus* Szidat, 1928 by Dubois (1968), although Yamaguti (1971) considers both the genera as valid. Baer (1969) accepted the validity of *Cardiocephaloides* Sudarikov, 1959 because as per his opinion *Cardiocephalus* Szidat, 1928 is preoccupied by *Cardiocephalus* Broili, 1904, a fossil amphibian. The aim of the present investigation is to describe a brief history of the family *Strigeidae* Railliet, 1919 and to present new morphological and anatomical details of *Apharyngostrigea garciai* Tubangui, 1953.

MATERIAL AND METHODS

A fairly large number of migratory birds fly to the Indian sub continent during winters either in search of feeding grounds or to escape severe winters in their natural habitat. In Kashmir, the bird migration is similarly a regular seasonal journey undertaken by large number of birds of different species in response to food availability, habitat or weather, though the primary motivation seems to be food. With the commencement of winter season several species of migratory birds fly to Kashmir from Siberia, Central Asia, Afghanistan, China etc. Hundreds and thousands of exotic birds such as Mallard, Brahmny and Tuffed Ducks, Coots, Cranes, Greyleg Geese, Gadwalls, Teals, Shovellers, Pintails etc. make their winter sojourn to Kashmir since times immemorial. Their prominent destinations at or around Srinagar are Hoksar, Hygam and Shallabug and other water bodies at Mirgund and Narabal, which they flock in large numbers and this higher concentration of the migratory birds at stopover sites makes them susceptible to parasites and pathogens. *Grus grus lilfordi* (Sharpe, 1894) is a member of the Gruidae family commonly known as Common Crane and Kulangi in India. It is a pale grey, large, shy and stately bird of open country and cultivation, found in grasslands in wide open rivers, marshes and shallow lakes. It is omnivorous in diet feeding upon a variety of food including green crops, insects, small birds and mammals.

The Grey Crane breeds in Eastern Siberia and in Turkestan and in winter migrates particularly to the whole of North and Northwest India though it has also been sighted at Assam too. During the course of a helminthological study of the migratory birds in Kashmir, four dozen specimens of the trematode referable to a known species of *Apharyngostrigea garciai* Tubangui, 1953 were obtained from the small intestine of two *Grus g. lilfordi* (local name "Anz"). The birds were caught from the Narabal area on the outskirts of Srinagar through bird catchers and necropsied in accordance with ethical procedures. The dissected organs including viscera were kept in petri dishes with 0.85 NaCl solution and examined under high power of microscope. The digeneans were removed and examined in living condition to study movements and changes in shape and position of various organs. The trematodes were mounted in toto, compressed-fixed in Bouin's fluid, stained in Ehrlich's haematoxylin, dehydrated in graded series of alcohol, cleared in xylol and kept as whole mounts in Canada balsom. Drawings were made with the help of camera lucida. Identification of the parasite was done at Zoology Department, University of Allahabad. Holotype and paratypes were deposited in the helminthological collection of the said department.

RESULTS AND DISCUSSION

Family	: <i>Strigeidae</i> Railliet, 1919
Sub family	: <i>Strigeinae</i> Railliet, 1919
Sub-subfamily	: <i>Strigeini</i> Dubois, 1936
Genus	: <i>Apharyngostrigea</i> Ciurea, 1927
Species	: <i>Apharyngostrigea garciai</i> Tubangui, 1933. (Fig. 1; Table. 1)

Redescription based on ten mature specimens; all measurements are in mm.; mean followed by range appear within brackets.

A redescription is given of *Apharyngostrigea garciai* Tubangui, 1933 based on the newly collected specimens from the small intestines of two Kulangs, *Grus g. lilfordi* at Srinagar. Apparently its infection in the area of Narabal, Srinagar seems to be common, although no bionomics of the parasite has been studied therefrom. The specimens in my possession were identical to the description given by Tubangui, 1933 though there are a few disagreements in morphological structures between the description given by Tubangui, 1933 and the author's collection and these variations have been particularly mentioned wherever necessary.

Body greatly elongated in outline covered by a relatively thick cuticle devoid of spines, characteristically strigeid in shape and distinctly divided into two regions (7.23) 5.37-8.96 in total length. The fore body or the anterior segment is cup shaped, slightly bulbous in the center, (2.30) 1.24-2.94 long by (1.58) 0.97-2.06 wide. Hind body or posterior segment

cylindrical, more than double the length of fore body, (4.92) 4.12-6.08 long and (1.14) 0.51-1.71 broad. Forebody holds a well developed adhesive apparatus besides two feebly developed suckers and the reproductive organs are confined to posterior segment. Oral sucker subterminal, almost rounded, (0.20) 0.11-0.28 by (0.19) 0.12-0.28 in size. Oral sucker leads into a moderately long oesophagus, which divides into two thin walled, slender intestinal caeca, whose course behind the acetabulum could not be traced. Pharynx not seen. Acetabulum sub median, lying at the anterior one third of the fore body, (0.37) 0.3-0.44 long and (0.33) 0.25-0.4 in breadth. Holdfast organ well developed, occupying most of the cavity of fore body and fairly obliterated by large number of vitelline follicles; its component lamellae not distinctly visible. Adhesive gland prominent, at the junction of two body regions measuring (0.38) 0.32-0.48 by (0.43) 0.32-0.56 in size.

Table. 1 Comparative data on *A.garciai* recorded by different authors. All dimensions are in mms, unless stated otherwise.

References	Tubangui,1933	Dubois,1938	Dubois et Burton,1971	Author's collection
Body length	2.8-5	3.9-5.2	3.97	5.37-8.96
Ant. segment	1.0-1.5 x 1.15-1.4	1.5-1.65 x 1.44-1.5	0.82-1.19 x 0.9-1.43	1.24-2.94 x 0.97-2.06
Post. segment	1.8-3.5 x 1.2-1.4	2.4-3.7 x 1.37-1.62	1.66-2.78 x 0.5-0.77	4.12-6.08 x 0.5-1.7
Oral sucker	0.2-0.6	0.18-0.19 x 0.14-0.16	145-18 x 12-16*	0.11-0.28 x 0.12-0.28
Acetabulum	0.22-0.3	0.22-0.28 x 0.18-0.24	18-245 x 22- 275*	0.3-0.44 x 0.25-0.4
Prot. gland	0.16-0.22 x 0.3-0.36	0.25-0.27 x 0.17-0.18	18-25 x 27-34*	0.32-0.48 x 0.32-0.56
Ovary	0.22-0.4 x 0.48-0.68	0.48-0.7 x 0.27-0.4	17-22 x 24-34*	0.14-0.44 x 0.17-0.56
Testes	0.6-0.7 x 0.9-1.1	0.6-0.9 x 0.96-1.2	0.38-0.65 x 0.34-0.6	0.35-1.6 x 0.36-1.6
Ova	0.087-0.096 x 0.06-0.063	0.082-0.099 x 0.052-0.067	90-99 x 52-60*	0.08-0.112 x 0.048-0.088

*Mew

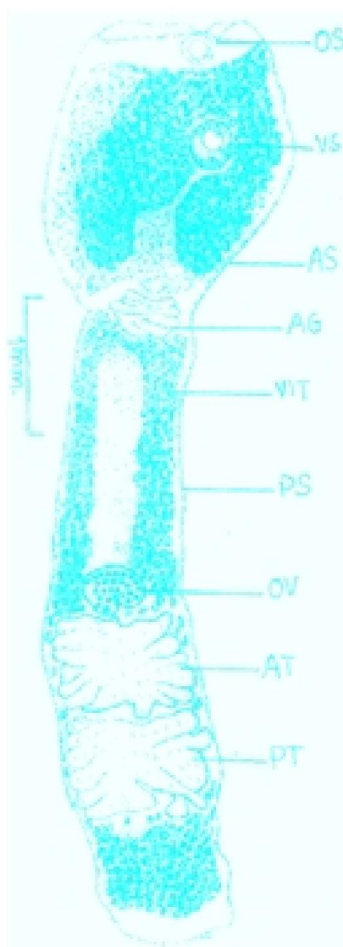


Fig. 1 *Apharyngostrigea garciai* Holotype entire worm.

OS - Oral sucker, VS - Ventral sucker, AS - Anterior segment, OV - Ovary, VIT - Vitellaria, AG - Adhesive gland
PS - Posterior segment, AT - Anterior testis, PT - Posterior testis.

Testes tandem, multilobed, immediately post-ovarial, overlapping each other, making it difficult in some specimens to distinguish them separately. Anterior testis (0.8) 0.35-1.28 long and (0.88) 0.4-1.18 broad; posterior testis (0.88) 0.41-1.6 long and (0.96) 0.36-1.6 wide. Vesicula seminalis well developed, slightly coiled, immediately behind posterior testis. It continues into a long ductus ejaculatorius, which unites with the terminal end of metraterm at the base of genital cone and opens to the exterior at the genital pore situated at the tip of genital cone. Ovary median, very close in front of anterior testis, transversely compressed, surface smooth with a notch on the posterior margin, (0.31) 0.14-0.448 long and (0.43) 0.17-0.56 broad. Shell gland mass lies in between the two testes. Vitellaria well developed, occupying almost the entire space within the anterior segment, extending upto the base of oral sucker and covering the entire available space of hind body left vacant by the genitalia. Uterus takes a forward course almost upto the base of adhesive gland where it makes a sharp backward turn to continue its downward course upto the posterior end where it meets the terminal part of ejaculatory duct. Genital cone is distinctly delimited from the body parenchyma as observed from the sections. Genital atrium is well developed and opens to the exterior at the posterior end. Eggs oval, numerous, thin shelled, (0.096) 0.08-0.112 x (0.068) 0.048-0.088 in size.

Ciurea, 1927 established the genus *Apharyngostrigea* to include *A. Cornu* (Zeder, 1800). Since then many helminthologists have contributed to this genus from various parts of the world. Yamaguti, 1958 accepted the validity of seventeen species thus : *A. cornu* (Zeder, 1800) Ciurea, 1927; *A. ardeolina* Vidyarthi, 1937; *A. bilobata* Olsen, 1940 syn. of *A. cornu* (Zeder, 1800) Dubois et Rausch (1950); *A. brasiliiana* (Szidat, 1928) Szidat, 1929; *A. duboisi* Perez Viguera, 1944; *A. egretti* Verma, 1936; *A. flexilis* Dubois, 1934; *A. garciai* Tubangui, 1933; *A. gundlachi* Perez Viguera, 1944; *A. ibis* Azim, 1935; *A. indiana* Vidyarthi, 1937; *A. intermedia* Bykhovska Pavlovskaya, 1952; *A. multiovata* (Viguera, 1944) Dubois et Viguera; *A. pipentis* (Faust, 1918); *A. ramai* (Verma, 1936) Dubois, 1953; *A. repens* (Chase, 1921) Dubois, 1937; *A. simplex* (Johnston, 1904) Szidat, 1929. From India one more species *A. joanae* (Gupta, 1964) was added to the list. The species described from India and their harbouring hosts reported are : *A. indiana* Vidyarthi, 1937 in *Egretta alba*; *A. joanae* Gupta, 1964 in *Ardeola grayii*, *A. ramai* (Verma, 1936) Dubois, 1953 in *Nycticorax*, *Ardeola*, *Ardea*, *Casmerodius* and *Bulbulcus*; *A. ardeolina* Vidyarthi, 1937 from India and Azerbaijan in *Ardea cinerea cinerea*, *Ardea cinerea* and *Egretta alba*. Verma (1936) created the genus *Ridgeworthia* to include his species *R. ramai* from the Night Heron *Nycticorax nycticorax*. Dubois, 1953 did not accept the generic status of *Ridgeworthia* and synonymised it with *Apharyngostrigea*, thus *R. ramai* became *A. ramai* (Verma, 1936) Dubois, 1953. Yamaguti, 1958, Skrjabin, 1959 and Odening, 1963 agree with Dubois and accepted the synonymy of *Ridgeworthia* and *Apharyngostrigea*. Though Dubois accepted the validity of *A. ardeolina* Vidyarthi, 1937 but dropped the other species *A. indiana* Vidyarthi, 1937; which he synonymised with *A. ramai* (Verma, 1936). Odening, 1963; while working on the Strigeidae synonymized *Apharyngostrigea indiana* Vidyarthi, 1937 and *Apharyngostrigea ardeolina* Vidyarthi, 1937 with *A. ramai* (Verma, 1936).

Apharyngostrigea garciai was for the first time described by Tubangui, 1933 in *Herodias timoriensis* from Philippines followed by redescription of the same by Dubois (1938) and Dubois et Burton (1971). Apart from Philippines, this species has also been reported from Azerbaijan, Manchuria, Russia etc. in *Ardea purpurea*, *Citellus mongolicus* and *Herodias* etc. The present location and host reported by the author is the first record of the species from India. The specimens though collected from an entirely different host belong undoubtedly to *Apharyngostrigea garciai* Tubangui, 1933. It coincides very much in morphological and anatomical features with the original description given by Tubangui. However, there are conspicuous variations in certain characters between the specimens collected by the author and the original collection which have been commented upon wherever necessary.

1. As is evident from the comparative table of measurements (Table.1), the dimensions of the body show a definite variation, the present specimens being fairly larger, almost double the size.
2. The typical cylindrical shape of the hind body segment and its large size is morphologically a significant feature of the author's collection.
3. The size of proteolytic gland in comparison to ovary is smaller in Tubangui's collection but in the present collection, proteolytic gland is considerably large when compared to ovary.
4. Vitellaria are profusely distributed covering the entire available space of hind body in the author's collection, whereas in the original description vitellaria are abundant in fore body.
5. The size of oral sucker, testes, ovary and eggs show a definite variation between Tubangui's specimens and the author's collection which are comparatively smaller.

The author is confident that these structural differences found between author's collection and those presented by Tubangui, 1933 are of sufficient magnitude to justify a redescription of the species with new combinations, if not significant for creation of a new species. These characters appear too minor to sustain a specific distinction. These variations could be attributed to different hosts, contraction of the specimens, pressure applied to the cover glass and environmental changes. Although the parasites upon, which this study has been made differ in several important respects from *A. garciai* Tubangui, 1933, but, I believe the two forms are identical for reasons, which have been elaborated upon.

ACKNOWLEDGMENTS

The present work is part of an unpublished Doctoral dissertation submitted and approved by the University of Allahabad, Allahabad (U.P.) in 1974 for award of D.Phil degree. The same has been reviewed, emended and updated by incorporating the contributions of subsequent researchers through their published records and original data on the group/family/genus wherever necessary as on date. Certain details concerning bird nomenclature, habit/habitat is also added to the previous description. The author expresses his deep sense of gratitude to the late Dr. R. K. Mehra, Reader, Department of Zoology, for his valuable suggestions and inspiring guidance. Thanks are also due to Head, Zoology Department for providing library and laboratory facilities.

REFERENCES

- AVIS-IBIS (2010). *Indian Biodiversity Information System*, V.I. 2010.
- Bates, R. S. P. and Lowther, E. H. N. (1952). Book. Check list of breeding birds of Kashmir. *Oxford University Press*.
- Ben, Dawes (1968). Book. *The Trematoda* : With special reference to British and other European forms. Cambridge University Press. New York. pp. 105 & 370-372.
- Bhalerao, G. D. (1945). *Rec. Ind. Mus.*, **44** : 207-216.
- Bisseru, B. (1956). *Jour. of Helminthology*, **30(4)** : 217-232.
- Dubois, G. (1938). *Memoirs de la Societe neuchateloise des Naturelles*, **6** : 1-535. Dubois, G. (1953). *Mem. Soc. neuchatel. des Sci. Natur.*, **8(2)** : 1-141.
- Dubois, G. (1967). *Revue Suisse de Zoologie*, **74(32)** : 693-700.
- Dubois, G. (1968). *Mem. de la Soc. neuch. des Sci. Natur.*, **10** : 1-258.
- Dubois, G. (1970). *Memorias du Instituto Oswaldo Cruz*, **68(1)** : 169-196.
- Dubois, G. and Burton (1971). *Mem. de la Soc. neuch des Sci. Natur.*, **10(2)** : 259-727.
- Grewal, Bikram (1995). *Birds of India and Nepal*, p. 52.
- Gupta, N. K. and Mehrotra, Veena (1968). *Res. Bulletin of the Punjab University*, **22(I-II)** : 141-157.
- Kharoo, V. K. (1974). Systematics and morphology of some digenetic trematodes of certain Vertebrates. *Ph.D. Thesis*. University of Allahabad, Allahabad.
- Kharoo, V. K. and Dhar, R. L. (1991). *Russian Academy of Sciences*, **XXXVIII** : 28-32. La
- Rue (1926). *Trans. Amer. Mic. Soc.*, **45(1)** : 11-19.
- Lunaschi, L. I. and Drago, F. B. (2006). *Zootaxa*, pp. 25-33.
- Niewiadomska, K. (2002). Family Strigeidae Railliet, 1919. In : *Keys to Trematoda* (eds. Gibson, D. I.; Jones, A. and Bray, R. A.). Wallington : CABI Publishing and The Natural History Museum, **1** : 231-241.
- Odening, K. (1963). *Agnew Parasitology*, Jg. 4, H. 3.
- Shoop, W. L. (1989). *The Journal of Parasitology*, **75(1)** : 21-32.
- Singh, K. S. (1956). *Jour. Zool. Soc. India*, **8(1)** : 47-56.
- Sudarikov, B. E. (1959). Order Strigeida (La Ru, 1926) Sudarikov, 1959. Part 1. In : *Trematodes of animals and man* (ed. Skrjabin, K. I.). Pub. House of Acad. Sci. of USSR, Moscow, pp. 217-631.
- Tubangui, M. A. (1933). *Phil. Jour. Sci.*, **52(2)** : 167-197.
- Yamaguti, S. (1958). *Systema Helminthum* Vol. I (Book). The digenetic trematodes of vertebrates. Interscience Pub. Inc. New York.
- Yamaguti, S. (1971). *Synopsis of Digenetic Trematodes of Vertebrates*. Vol. I and II. Keigaku Pub. Co., Tokyo.
- Zhatkanbaeva, D. (1990). Structure of the family Strigeidae Railliet, 1919 and revision of the genus *Cotylurus* Szidat, 1928. CABI Publishing, pp. 7-11.
-