

Diversification of the Monogeneans (Platyhelminthes) in Indian Freshwater Fish Families

A. Chaudhary, H.S. Singh

Abstract—Present communication deals with general distribution and diversification of Monogenean families parasitizing different freshwater fish families of India. Levels of monogenean parasitism and their diversity are significantly greater in Indian fishes. The most monogeneans parasitized family of fish is Cyprinidae and most dactylogyrids parasitise cyprinids. The family dactylogyridae has more species than any other monogenean family and frequently associated with cyprinid, silurids and bagrids families. Of the various 52 families of freshwater fishes from India, only the Anguillidae, Balitoridae, Chacidae, Chanidae, Channidae, Cobitidae, Coiidae, Erethistidae, Megalopidae, Pristidae, Psilorhynchidae, Salmonidae, Schileidae, Sparidae, Synodontidae and Terapontidae were found to be free of infection with monogeneans. The present study takes a broad look at monogenean diversity in the freshwater fishes of India.

Keywords—Diversification, fish, India, Monogenea

I. INTRODUCTION

ESTIMATION of the present diversity of organisms, how they maintain it and diversified are the new cornerstones of conservation biology, ecology and evolutionary biology. For a considerable proportion of existing biodiversity, these questions are increasingly being asked in relation to parasitic organisms [1], [2]. Monogeneans are the most ubiquitous and abundant group of helminth parasites in the aquatic environment [3]. They are predominantly ectoparasitic on gills and skin of fishes [4].

Monogeneans are diverse not in their numbers but also in their morphology and ecology. They were parasitic on the skin of early vertebrates and then have expanded to colonize internal as well as external organs of a range of living aquatic and amphibious vertebrates and now display a variety of designs [5], [6]. Besides this, monogeneans are quite host specific, *i.e.*, each monogenean species infects only one or very few host species [7], [8]. Monogenea diversity in Indian subcontinent has not been documented completely. Therefore, with an aim to evaluate records of the monogenea in Indian region we took a broad look at their diversity in order to determine their diversification.

II. MATERIALS AND METHODS

Data were gathered from the published records and were entered into a computer database. A set of programs was written to merge and analyze the data set automatically.

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For this study we used two indices of diversity *viz.*, the Shannon-Weiner's index ($-\sum p_i \log_2 p_i$) and Simpson's index ($1 - \sum p_i^2$) to measure the width of the host spectrum of a monogenean family, where p_i is the ratio of the number of species of this monogenean family on the host family i to the total number of species of this monogenean family. The taxonomy of monogeneans followed from the work of [9].

III. RESULTS AND DISCUSSION

A. Monogeneans distribution on/in different families of host in India

In the fish hosts, 80 species of monogeneans belong to the Cyprinidae. The distribution of monogeneans on and in their hosts is shown in table 1. Host and parasite associated families of fishes and monogeneans showed by the figure 1. In figure 1 Dacty.-Freide., represents the monogenean families Dactylogyridae, Gastrocotylidae, Mazocraeidae, Diplectanidae, Diplozoidae, Gyrodactylidae, Allostocotylidae, Calceostomatidae, Axinidae, Gotocotylidae, Microcotylidae, Diclidophoridae, Heteromicrocotylidae, Fridericianellidae. Among the monogeneans families found in freshwater fishes of India, the Calceostomatidae and Diclidophoridae have the lowest diversity indices whereas Dactylogyridae has the highest diversity indices that reflect the fact that this family parasitizes a wider range of hosts. All the diplozoids species from freshwater fish of India and most of the dactylogyrids species parasitise Cyprinids. Dactylogyrids are found on 26 families of fishes, up to 67 dactylogyrid species (35.4%) infect cyprinids, 28 (14.8%) infects bagrids, 23 (12.1 %) infect silurids and 18 (9.5%) infects schilbeidae (Fig. 2). For monogeneans all host species are fishes that belong to 36 fish families harboring 14 families of monogeneans. For the diplozoids, (5 species) are found only on cyprinids. Among fish families 4 are parasitized by the Mazocraeidae, 8 by the Diplectanidae and 5 by the Gyrodactylidae. Cyprinids comprise the majority of freshwater monogenean fauna belonging to the Dactylogyridae, Mazocraeidae, Diplectanidae, Diplozoidae and Gyrodactylidae. Second to the cyprinids, the silurids are host of 10.1% (26) species of the total number of freshwater species of monogeneans and 23 belongs to the dactylogyrids. Moreover, bagrids also have host of many monogenean species including 12.5% (32) and the family Schilbeidae contains 7.0% (18) of total number of freshwater species of monogeneans. Besides this, the freshwater fish families which are not infected or not screened for monogenea in India are Anguillidae, Balitoridae, Chacidae, Chanidae, Channidae, Cobitidae, Coiidae, Erethistidae, Megalopidae, Pristidae, Psilorhynchidae, Salmonidae, Schileidae, Sparidae, Synodontidae and Terapontidae.

TABLE I
THE NUMBER OF SPECIES OF MONOGENEAN FAMILIES PARASITIZE ON HOST FAMILIES IN THE INDIAN FRESHWATER

Host Family	Dacty.	Gastro.	Mazo.	Diple.	Diplo.	Gyro.	Allo.	Calce.	Axini.	Goto.	Micro.	Dicli.	Hetero.	Fride.
Ambassidae	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Anabantidae	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Ariidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bagridae	28	0	0	1	0	1	0	1	0	0	0	0	0	1
Belonidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Belontiidae	4	0	0	0	0	2	0	0	0	0	0	0	0	0
Carangidae	0	0	0	0	0	0	2	0	0	0	2	0	1	0
Cichlidae	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Clariidae	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Clupeidae	1	0	11	0	0	0	0	0	0	0	0	0	0	0
Cyprinidae	67	0	3	1	5	4	0	0	0	0	0	0	0	0
Engraulidae	0	1	1	0	0	0	0	0	0	0	0	1	0	0
Gasterosteidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Gobiidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Heteropneustidae	1	0	0	0	0	2	0	0	0	0	0	0	0	0
Latidae	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Leiognathidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Loricariidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Lutjanidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mastacembelidae	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Mugilidae	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Nandidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Notopteridae	7	0	0	1	0	0	0	0	0	0	0	0	0	0
Ophiocephalidae	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Pangasiidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Platycephalidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polynemidae	0	0	0	2	0	0	0	0	0	0	1	0	0	0
Schilbeidae	18	0	0	0	0	0	0	0	0	0	0	0	0	0
Sciaenidae	2	0	1	5	0	0	2	0	0	0	1	0	0	0
Scombridae	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Sillaginidae	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Siluridae	23	0	0	1	0	0	0	2	0	0	0	0	0	0
Sisoridae	8	0	0	0	0	0	0	0	0	0	0	0	0	0
Stromateidae	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Tetraodontidae	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Triacanthidae	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	189	1	16	14	5	11	4	3	1	1	5	3	1	1
Shannon-Weiner's index	3.27	0.00	1.32	2.69	0.00	2.19	1.00	0.92	0.00	0.00	1.92	0.92	0.00	0.00
Simpson's index	0.82	0.00	0.48	0.81	0.00	0.76	0.50	0.44	0.00	0.00	0.72	0.44	0.00	0.00

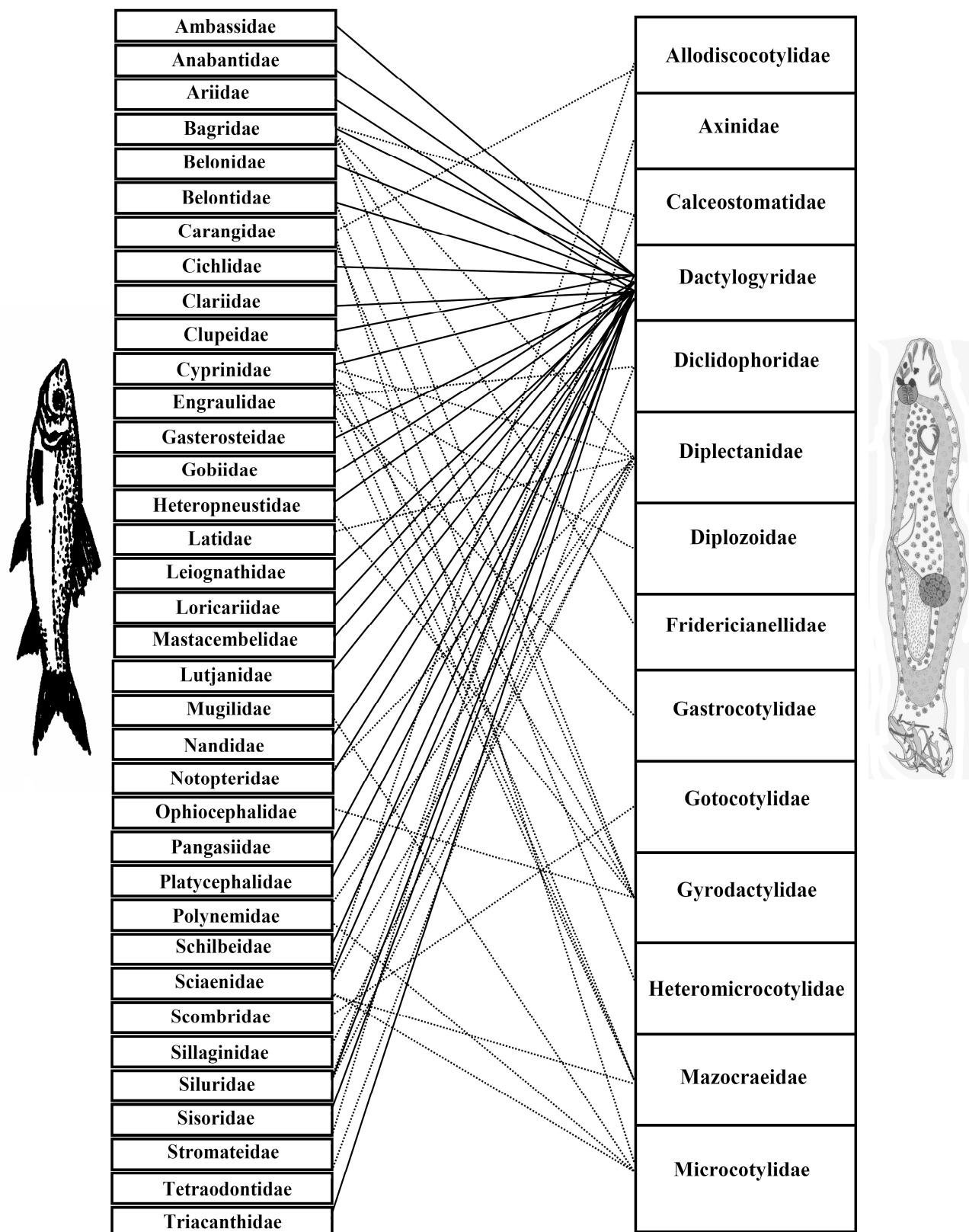


Fig. 1 Host-parasite associated families (dotted lines). Continuous lines showed highly diverse Dactylogyridae family

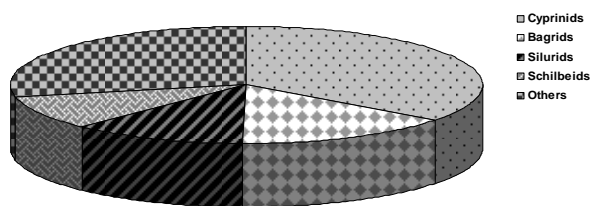


Fig. 2 Showed most diverse dactylogyrids infected fish families

B. Monogeneans distribution in different sub families of Cyprinidae in India

There are 6 subfamilies of Cyprinidae that are infected by monogenean species (Table 2). In the table 2 Dan.-Leu., represents the cyprinidae subfamilies Danioniae, Garrinae, Cyprininae, Cultrinae, Schizothoracinae and Leuciscinae. Sixty nine species of monogeneans belonging to 15 genera parasitize the Cyprininae, representing 78.4% of the total monogeneans on cyprinids. Members of the Cultrinae have been reported to harbour 8 (9%) species of monogeneans of the total cyprinids. Besides this, the numbers of monogenean species found on the Danioniae, Schizothoracinae, Garrinae and Leuciscinae are 7, 2, 1 and 1 belong to 5, 1, 1 and 1 genera respectively. On cyprinid host most of the monogeneans genera are *Dactylogyrus* (45 species, 51.13%), *Dactylogyroides* (5 species, 5.68%), *Gyrodactylus* (4 species, 4.54%), *Diplozoon* (3 species, 3.40%), *Paradactylogyrus* (2 species, 2.27%) whereas genera *Dogielius*, *Haploclleidus*, *Mazocraes*, *Metadactylogyrus*, *Neodiplozoon*, *Parancyrocephaloides*, *Paramazocraes*, *Pellucidhaptor*, *Singhiogyrus* and *Thaparogyrus* all contains (1 species, 1.13%) (Fig. 3).

Genus *Dactylogyrus* is the most dominant in Cyprininae. The best host for the dactylogyrids species seems to be fishes of the Cyprininae then Danioniae and Cultrinae.

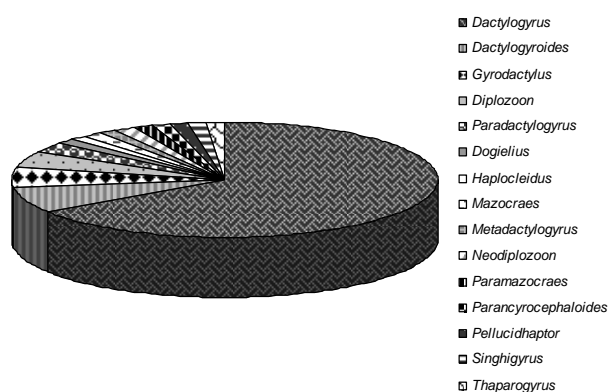


Fig. 3 Shows the distribution of monogeneans on subfamily Cyprininae

IV. CONCLUSION

The Cyprinidae family found to be most infected by the monogenean parasites that in particular are important in a variety of ways including to provide food, sport, or biological

control for some pest species. The genus *Dactylogyrus* has more species than any other monogenean genus associated with cyprinid subfamily. This information might prove to be a meaningful and path breaking observation that can be used in designing the control measures of these serious pathogens of fishes.

TABLE II
THE NUMBER OF MONOGENEAN SPECIES ON DIFFERENT SUBFAMILIES OF THE CYPRINIDAE IN INDIAN FRESHWATER

Monogenea genus	Dan.	Gar.	Cyp.	Cul.	Sch.	Leu.
<i>Ancyrocephalus</i>	0	0	0	3	0	0
<i>Dactylogyroides</i>	0	0	5	0	0	0
<i>Dactylogyrus</i>	3	0	45	3	0	0
<i>Diplozoon</i>	1	0	3	1	2	0
<i>Dogielius</i>	1	0	1	1	0	0
<i>Gyrodactylus</i>	0	0	4	0	0	0
<i>Haploclleidus</i>	0	0	1	0	0	0
<i>Heteromazocraes</i>	1	0	0	0	0	0
<i>Labotrema</i>	1	1	0	0	0	0
<i>Mazocraes</i>	0	0	1	0	0	0
<i>Metadactylogyrus</i>	0	0	1	0	0	0
<i>Neodiplozoon</i>	0	0	1	0	0	0
<i>Paradactylogyrus</i>	0	0	2	0	0	0
<i>Paramazocraes</i>	0	0	1	0	0	0
<i>Parancyrocephaloides</i>	0	0	1	0	0	0
<i>Pellucidhaptor</i>	0	0	1	0	0	0
<i>Singhiogyrus</i>	0	0	1	0	0	1
<i>Thaparogyrus</i>	0	0	1	0	0	0

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