RESEARCH ARTICLE

Biodiversity and prevalence of Helminth parasites of Girna Dam Fishes

Kalse Ajit and Bhosale Yuvraj

Helminth Research Laboratory, Department of Zoology, Nanasaheb Y. N. Chavan ASC College, Chalisgaon, Jalgaon, 424101, (M.S.), India
Email-dr.ajit_kalse@yahoo.co.in

Manuscript details:

Available online on
http://www.ijlsci.in

ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

Editor: Dr. Arvind Chavhan

Cite this article as:
Kalse Ajit and Bhosale Yuvraj (2015) Biodiversity and prevalence of Helminth parasites of Girna Dam Fishes, *International J. of Life Sciences*, Special Issue, A3:42-48.

Acknowledgements: The authors are thankful to the U.G.C. authority for providing the financial assistance under Minor Research Project and to Principal Nanasaheb Y. N. Chavan ASC College, Chalisgaon, District Jalgaon for providing necessary laboratory facilities during tenure of this work.

ABSTRACT

The objective of the present study was to study the biodiversity and prevalence of helminth parasites of Girna dam fishes. A total of 500 fishes were examined, in which 249 fishes (49.8 %) were infected with 228 cestode parasites and 172 nematode parasites, which belongs to four and seven genera respectively. The result of the present study suggest that cestodes mainly *Circumoncobothrium spp., Senga spp., Lytocestus spp., Polyoncobothriumspp*., and nematodes mainly *Eustrongylides spp., Rhabdochona spp., Syphaciella spp*., *Contracaecum spp*., *Ascardiaspp*., *Camallanusspp*.,and *Trichurisspp*., are the main intestinal parasites of girna dam fishes(viz. *Mastacem bellusarmatus, Wallago attu, Ophiocephalus punctatu, and Clarius batrachus*). This report summarizes the data of incidence, intensity, density and index of infection in fresh water fishes in relation to environmental factors. Incidence of infection was higher in winter season. While intensity of infection was higher in Monsoon and density of infection was higher in winter season. The present study will be helpful to the status of diversity of cestode and nematode parasites from Girna dam.

Keywords: Cestodes, Nematodes, Girna dam, biodiversity, prevalence.

INTRODUCTION

The Girna river is originate at Kem Peak in the Western Ghats range of Nashik District. The name Girna derives from the name of the goddess Giraja (Parvati).Girna Dam is an earth fill dam on Girna river located in Nandgaonnear Malegaon, district Nasik of Maharashtra state. It was built in 1969. Irrigation and hydroelectricity are two major needs for which Girna Dam had been created. It has catchment area 4729.34 sq.km.

India is the third largest producer of fish in the world and second in inland fish production. Fisheries are important for the Indian economy as it provides employment opportunities; it is a source of nutritional food and foreign exchange earnings. The fishes are said to be "gold" from water. *Mastacem bellusarmatus* Lacepede (1800), *Wallago attu* Bleeker (1851), *Ophiocephaluspunctatu,* Hamilton (1822) *and Clarius batrachus*

Linnaeus (1758) are highly demanded market fish in India as a table fish for high quality of nutritional value. It contains protein, lipid, minerals and vitamins. But fish farming remains a high risk investment, mainly due to the disease problems caused by parasitic infection. A fish disease due to the helminth parasite is one of the most important problems in fish culture and fish farming. The common cestodes and nematodes of these fishes causing the economic loss includes the parasites like *Lytocestus, Polyonco bothrium, Senga, Gangesia, Circumonco bothrium* and nematodes mainly *Trichuris*. *Eustrongylides, Ascardia*, *Contracaecum*, *Camallanus, Rhabdochona* and *Syphaciella*, However, very little is known about the parasitic fauna of fishes of India in comparison with the information available from other regions of the continent. Several investigations have studied helminth parasites of fresh water fishes. The work of these investigations concerns the survey, population dynamics, host specificity and organ specificity. The environmental factors including climate, season and rainfall play an important role in the development of helminth parasites. Due to the environmental factors the natures of helminth infection of different group of livestock have been studied by workers from particular region of the country.

Work of Yamaguti (1959; 1961) related to the occurrence of helminth parasite in vertebrate host is of immense importance with regard to different zones of the world. Chubb (1982) illustrated the studies of seasonal occurrence of helminth in freshwaterfishes in different climatic zones of the world. Agrawal (1990) described some nematode parasites of freshwater fishes from Lucknow. Shomorendro and Jha (2003) also studied some of the nematode parasites. Karand Barbhuiya (2009) studied the effect of length of fish on the occurrence of nematode and acantocephalan parasites. Geetaraniet al. (2010) has studied the intensity of helminth infections in fishes of Manipur. While Dhole *et al*., (2010) has done survey of helminth parasites in freshwater fishes from Marathwada region. Recently, Jadhav*et. al.,* (2011) studied incidence of helminth parasites in freshwater fishes from SinaKolegoan Dam, Dist. Osmanabad.

The infection of helminth parasites are found in numbers of fresh water fishes. Due to immense infection it enhances the rate of mortality therefore in order to avoid loss of economical, nutritional and medicinal value also to preserve endangered species of fishes. The study is an important specially Helminth parasites which also liable to spread their effect upon human beings. This warrants serious attention of biologists for having knowledge of helminth parasites.

Keeping this view in mind, the author studied the biodiversity and prevalence of helminth parasites in *Mastacem bellusarmatus, Wallago attu, Ophiocephalus punctatus, and Clarius batrachus* from Girna dam for three seasons i.e. monsoon, winter and summer during February 2010 to January 2012.

MATERIAL AND METHODS

The freshwater fishes were collected from Girna dam for three seasons i.e. monsoon, winter and summer during February 2010 to January 2012. Fishes were opened up ventrally and the internal organs examined. The entire digestive system was removed and placed in a petri dish with physiological saline. Infection of each group of parasites was treated as follows: Collected cestodes were first relaxed and then fixed in 4% formalin and stained by using Harris haematoxyline. Stained parasites were washed in water, dehydrated in ascending grades of alcohol, cleared in xylene, mounted in D.P.X. Collected nematodes were first relaxed and then fixed in hot 10% glycerol or 70% alcohol, cleared in lactophenol and mounted in glycerinegelly. Drawings are made by using a camera lucida. The identification of helminth is made with the help of "SystemaHelminthum" Vol. II and III by Yamaguti(1959, 1961); Advances in the Zoology of Tapeworms, 1950-1970, by Wardle *et al.,* (1974) and Keys to the cestode parasites of vertebrates by Khali *et al.,* (1994). Collected the data month wise and calculate the percentage of incidence, intensity, density and index of infection seasonally i.e. monsoon, winter and summer.

Population dynamics of helminth parasites were determined by following formulae,

$$1.\ \text{Incidence of Infection} = \frac{\text{Infected host}}{\text{Total hosts examined}} \times 100$$

$$2.\ \text{Intensity of Infection} = \frac{\text{Number of parasite collected}}{\text{Number of infected hosts}}$$

$$3.\ \text{Density of Infection} = \frac{\text{No. of parasite collected}}{\text{Total hosts examined}}$$

$$4.\ \text{Index of Infection} = \frac{\text{No. of infected hosts} \times \text{No.of parasite collected}}{(\text{Total hosts examined})^2}$$

RESULTS AND DISCUSSION

Helminth parasite infection is the common problem of fresh water fishes all over the world. The study is related to taxonomy, statistical application and population of helminth parasites. The collection of the helminth parasites was carried out from the fresh water fish *Mastacem bellusarmatus, Wallagoattu, Ophiocephalus punctatus and Clarius batrachus* from Girna dam during study period i.e. February 2010 to January 2012.

After closer observation the collected helminth were found belongs to the genus of cestodes *Circumonco bothrium* Shinde (1968), *Senga* Dollfus (1934), *Lytocestus* (Cohn, 1908) Hunter (1927), *Polyoncobothrium* Diesing (1854) and the genus of nematodes *Eustrongylides* Jagerskiold (1909), *Syphaciella* Monnig (1924), *Ascardia* Dujardin (1845), *Camallanus* Raillet et Henry (1915), *Rhabdochona* Railliet (1916), *Contracaecum* Railliet and Henry (1912) and *Trichuris* Roederer (1761).

Out of 500 samples examined 249 specimens (49.8%) were positive for various helminth parasites Table 1 and Table 2. The present investigation indicates that a total 228 cestodes and 172, nematodes were collected. The values for the incidence, intensity, density and index of infection are given in Table 3 whereas the Table 4 and Table 5 shows influence of season on parasitic infection of helminth parasites from freshwater fishes.

The incidence of infection of cestode parasite during 2010-11 was maximum (71.62%) in summer season, followed by (69.33%) in monsoon season and slightly lower (63.51%) in winter season. The intensity of infection was maximum (0.96) in winter season, followed by (0.89) in summer season and lower (0.75) in monsoon season. The density of infection was maximum (0.64) in summer season, followed by (0.61) in winter season and lower (0.52) in monsoon season. The index of infection was maximum (0.45) in summer season, followed by (0.39) in winter season and lower (0.36) in monsoon season.

Table 1: Incidence of Helminth parasites in fresh water fishes from Girna Dam during 2010-2012

Sr.No.	Parasitic species	No. of sample +ve	Locality
01	*Lytocestus sp.*	10	Intestine
02	*Polyoncobothrium sp.*	22	Intestine
03	*Senga sp.*	84	Intestine
04	*Circumoncobothrium sp.*	112	Intestine
05	*Trichuris sp.*	10	Large Intestine
06	*Eustrongylidessp.*	48	Subcutaneous tissues & Intestine
07	*Ascardiasp.*	54	Intestine
08	*Contracaecum sp.*	15	Stomach wall, mesentery & Intestine
09	*Camallanussp.*	09	Intestine
10	*Rhabdochonasp.*	18	Intestine
11	*Syphaciellasp.*	18	Body cavity, mesentery & Intestine
	Total	**400**	

Table 2: Incidence, Intensity, Density and Index of Helminth infection during 2010-2012

Sr. No.	Genus	No. of host dissected	No. of host infected	No. of parasite collected	Incidence of Infection	Intensity of Infection	Density of Infection	Index of Infection
01	*Lytocestus*	500	249	10	49.8	0.04	0.02	0.01
02	*Polyoncobothrium*	500	249	22	49.8	0.09	0.04	0.02
03	*Senga sp.*	500	249	84	49.8	0.34	0.17	0.08
04	*Circumoncobothrium*	500	249	112	49.8	0.45	0.22	0.11
05	*Trichuris*	500	249	10	49.8	0.04	0.02	0.01
06	*Eustrongylides*	500	249	48	49.8	0.19	0.10	0.05
07	*Ascardia*	500	249	54	49.8	0.22	0.11	0.05
08	*Contracaecum*	500	249	15	49.8	0.06	0.03	0.01
09	*Camallanus*	500	249	09	49.8	0.04	0.02	0.01
10	*Rhabdochona*	500	249	18	49.8	0.07	0.04	0.02
11	*Syphaciella*	500	249	18	49.8	0.07	0.04	0.02

Table 3: Showing helminth parasites of fishes collected from Girna Dam during 2010-2011

Month	Helminth group	No. of host dissected	No. of host infected	Total No. of parasite collected	Incidence %	Intensity %	Density %	Index of infection
Feb. 2010	Cestode	18	8	10	44.64	1.25	0.55	0.25
	Nematode		4	6	22.22	1.50	0.33	0.07
March 2010	Cestode	19	9	11	47.37	1.22	0.58	0.27
	Nematode		7	8	36.84	1.14	0.42	0.16
April 2010	Cestode	18	9	17	50.00	1.88	0.94	0.47
	Nematode		5	10	27.77	2.00	0.55	0.15
May 2010	Cestode	19	6	9	31.58	1.50	0.47	0.15
	Nematode		5	6	26.32	1.20	0.32	0.08
June 2010	Cestode	17	9	12	52.94	1.33	0.71	0.37
	Nematode		5	8	29.41	1.60	0.47	0.14
July 2010	Cestode	19	4	9	21.05	2.25	0.47	0.09
	Nematode		5	9	26.32	1.80	0.47	0.12
Aug. 2010	Cestode	18	8	14	44.44	1.75	0.77	0.35
	Nematode		4	5	22.22	1.25	0.27	0.06
Sept. 2010	Cestode	20	5	10	25.00	2.00	0.50	0.12
	Nematode		7	6	35.00	0.86	0.30	0.10
Oct. 2010	Cestode	19	7	8	36.84	1.14	0.42	0.15
	Nematode		5	4	26.32	0.80	0.21	0.05
Nov. 2010	Cestode	18	7	8	38.88	1.14	0.44	0.17
	Nematode		4	6	22.22	1.50	0.33	0.07
Dec. 2010	Cestode	20	9	11	45.00	1.22	0.55	0.24
	Nematode		7	7	35.00	1.00	0.35	0.12
Jan. 2011	Cestode	18	7	12	38.88	1.71	0.66	0.26
	Nematode		6	8	33.33	1.33	0.44	0.15
Total		**223**	**152**	**214**	**68.16**	**1.40**	**0.96**	**0.65**
During 2011-2012								
Feb. 2011	Cestode	25	4	8	16.00	2.00	0.32	0.05
	Nematode		4	7	16.00	1.75	0.28	0.04
March 2011	Cestode	20	4	9	20.00	2.25	0.45	0.09
	Nematode		5	8	25.00	1.60	0.40	0.10
April 2011	Cestode	22	5	8	22.73	1.60	0.36	0.08
	Nematode		3	7	13.64	2.33	0.32	0.04
May 2011	Cestode	21	3	8	14.29	2.66	0.38	0.05
	Nematode		5	7	23.81	1.40	0.33	0.08
June 2011	Cestode	26	4	9	15.38	2.25	0.35	0.05
	Nematode		5	8	19.23	1.60	0.31	0.06
July 2011	Cestode	20	3	6	15.00	2.00	0.30	0.04
	Nematode		3	7	15.00	2.33	0.35	0.05
Aug. 2011	Cestode	24	4	7	16.66	1.75	0.29	0.05
	Nematode		3	7	12.50	2.33	0.29	0.04
Sept. 2011	Cestode	22	5	8	22.73	1.60	0.36	0.08
	Nematode		3	7	13.64	2.33	0.32	0.44
Oct. 2011	Cestode	26	5	**9**	19.23	1.80	0.35	0.07
	Nematode		4	**8**	15.38	2.00	0.31	0.05
Nov. 2011	Cestode	25	4	**8**	16.00	2.00	0.32	0.05
	Nematode		4	**7**	16.00	1.75	0.28	0.04
Dec. 2011	Cestode	24	5	**9**	20.83	1.80	0.38	0.08
	Nematode		4	**8**	16.66	2.00	0.33	0.05
Jan. 2012	Cestode	22	4	8	18.18	2.00	0.36	0.07
	Nematode		4	8	18.18	2.00	0.36	0.67
Total		**277**	**97**	**186**	**35.01**	**1.92**	**0.67**	**0.24**

Table 4: Showing influence of seasons on helminth infection during 2010-2011

Helminth group	Seasons	No. of host dissected	No. of host infected	Total No. of Parasite collected	Incidence %	Intensity %	Density %	Index of infection
Cestode	**Monsoon**	75	52	39	69.33	0.75	0.52	0.36
	Winter	74	47	45	63.51	0.96	0.61	0.39
	Summer	74	53	47	71.62	0.89	0.64	0.45
Total		**223**	**152**	**131**	**68.16**	**0.86**	**0.59**	**0.40**
Nematode	**Monsoon**	75	52	25	69.33	0.48	0.33	0.23
	Winter	74	47	28	63.51	0.60	0.38	0.24
	Summer	74	53	30	71.62	0.57	0.41	0.29
Total		**223**	**152**	**83**	**68.16**	**0.55**	**0.37**	**0.25**

Table 5: Showing influence of seasons on helminth infection during 2011-2012

Helminth group	Seasons	No. of host dissected	No. of host infected	Total No. of Parasite collected	Incidence %	Intensity %	Density %	Index of infection
Cestode	**Monsoon**	92	30	30	32.60	1.00	0.33	0.11
	Winter	97	34	34	35.05	1.00	0.35	0.12
	Summer	88	33	33	37.50	1.00	0.37	0.14
Total		**277**	**97**	**97**	**35.00**	**1.00**	**0.35**	**0.12**
Nematode	**Monsoon**	92	30	29	32.60	0.96	0.31	0.10
	Winter	97	34	31	35.05	0.91	0.32	0.11
	Summer	88	33	29	37.5	0.88	0.33	0.12
Total		**277**	**97**	**89**	**35.00**	**0.92**	**0.32**	**0.11**

The incidence of infection of nematode parasite during 2010-11 was maximum (71.62%) in summer season, followed by (69.33%) in monsoon season and lower (63.51%) in winter season. The intensity of infection was maximum (0.60) in winter season, followed by (0.57) in summer season and lower (0.48) in monsoon season. The density of infection was maximum (0.41) in summer season, followed by (0.38) in winter season and lower (0.33) in monsoon season.

The index of infection was maximum (0.29) in summer season, followed by (0.24) in winter season and slightly lower (0.23) inmonsoon season.

The incidence of infection of cestode parasite during 2011-12 was maximum (37.50%) in summer season, followed by (35.05%) in winter season and lower (32.60%) in monsoon season. The intensity of infection was same (1.00) in all seasons. The density of infection was maximum (0.37) in summer season, followed by (0.35) in winter season and lower (0.33) in monsoon season. The index of infection was maximum (0.14) in summer season, followed by (0.12) in winter season and lower (0.11) in monsoon season.

The incidence of infection of nematode parasite during 2011-12 was maximum (37.50%) in summer season, followed by (35.05%) in winter season and lower (32.60%) in monsoon season. The intensity of infection was maximum (0.96) in monsoon season, followed by (0.91) in winter season and lower (0.88) in summer season. The density of infection was maximum (0.33) in summer season, followed by (0.32) in winter season and lower (0.31) in monsoon season. The index of infection was maximum (0.12) in summer season, followed by (0.11) in winter season and lower (0.10) in monsoon season.

It was observed that the cestode and nematode species were present throughout the period of investigations but the intensity varied. Specially, large numbers of cestode and nematodes were recovered mainly from the intestine throughout the period. The development of parasites needs temperature and sufficient moisture. Environmental variations are reflected in seasonal difference in the incidence of diseases. The infections caused by the nematode parasites may be a major problem in the mortality of fishes. Such infections not only deteriorate the muscle quality, stunt growth but even sometimes prove fatal due to internal injury. In addition to this we may also suffer from many diseases if we ingest improperly cooked fishes.

The present investigation provides a good deal of information on the occurrence of cestode and nematodes from fresh water fishes of Girna Dam. The fish host is infected by ingesting invertebrates or fish intermediate host carrying the last larval or infective stage of the parasite. The level and periodicity of infection of these intermediate hosts, their availability to the definitive fish hosts, the feeding behavior and migrations of these fishes and the success of the parasites larva in establishing itself in the appropriate niche in the fish host all play a part in determining the ultimate biology of the parasites.

Feeding activity of the host also be one of the reasons for the seasonal fluctuation of infection according to the fishes were infected with large number of parasites in late winter to end of summer months, because the environmental conditions are favorable in such months. Thus the temperature and seasons play an important role in the recruitment of parasitic fauna.

The above results were compared with many earlier workers as Anderson (1976) who worked on seasonal variation in the population dynamics of *Caryophyllaeus luticeps.* Availability of food and feeding activity, distribution and environment of host, are influence the parasitic development Kennedy (1978) and Lawrence (1970). The parasites causes depletion of the nutritional contents in host's body and results in the low productivity, loss in fish industry Hiware (1999). Moller and Anders (1986) concluded that fish from more polluted water tend to harbor more helminth parasites than those from less polluted waters. Fresh water fishes was the most heavily infected, it was observed they feed mainly on a particular type of zooplankton and other small fishes. Some of these parasitize cause diseases to fish, affecting their health and reproduction, making them fall easy prey to predators and some infect man. In fish farming, parasites may lead to epidemics and mortalities, resulting in economic losses Khalil and Polling (1997).

Thus the present study gives the idea of damage caused by these helminth parasites to the fish economy. This study also adds some data regarding the taxonomy and diversity of parasites so that it will provide them preliminary literature to the researchers in the field of fish parasites.

CONCLUSION

The two year survey has shown that fresh water fishes from Girna Dam harbor a wide range of cestode and nematode parasites. After the analysis of data, it can be concluded that the high infection of Cestode and Nematodes (incidence, intensity, density and index of infection) occurred in summer and monsoon seasons followed by winter during 2010-11 and high infection of Cestode and Nematodes occurred in summer and winter seasons followed by monsoon during 2011-12 This type of results indicates that environmental factors influencing the seasonality of parasitic infection either directly or indirectly. However, the above study can only be complete if it covers a whole season to investigate the variation in parasite fauna with the diet of the host and variation in infection with the habitat type.

REFERENCES

Agarwal V (1990) Studies on some nematode parasites of freshwater fishes from Lucknow. *Ann. Parasitol. Hum. Camp*. 41:217-237.

Anderson RM (1976) Seasonal variation in the population dynamics of *Caryophyllaeusluticeps*. *Parasitology*, 72:28-395.

Bhure DB, Nanware SS, Barshe MU, Deshmukh VS and Karaile SP (2013) Population dynamics of caryophyllidean tapeworm from freshwater fish *Clariasbatrachus*. *Flora and Fauna* 19(1): 161-166.

Chubb JC (1982) Seasonal occurrence of helminth parasite in fishes Part-IV. Adult Cestoda, Nematoda and Acanthocephala. Advances in Parasitology. Academic Press. London and New York. 20: 1-292.

Dhole J, Jawale S, Waghmare S and Chavan R (2010) Survey of helminth parasites in Freshwater fishes from Marathwada region, MS, India. *Journal of Fisheries and Aquaculture*, 1(1):1-7.

Diesing KM (1854) UebereinenaturgemasseVerteilung der Cephalocotyleen.Sitz.-ber.Akad. Wiss. Wien, Math. Naturw.Klasse, Abt. I. 13, 555-616.

DollfusRPh (1934) Sur *"Taeniagallinulae"* P.J. van Beneden, 1858. Ann. Par. 12, 267-272.

Dujardin F (1845) Histoire naturelle des Helminthes ouversintestinaux. Paris. Xvi +654+15 pp.

Geetarani B, Shomorendra M and Kar D (2010) Studies on the intensity of helminth infections with special reference to nematodes in the fishes of utra lake, Manipur. *Natl. J. Life Sci*. 7(2):103-104.

Gupta SP and Shrivastava AB (1983) Nematode parasites of fishes. *Indian Journal of Helminthology*, 35:18-28

Hiware CJ (1999) Population dynamics of the *Caryophyllaied*cestode parasitizing fresh water Air breathing predatory fish *Clariasbatracus*, Linnaeus Revista Di. *Parasitologia* XIX (LXIII):1.

Hunter GW III (1927) Notes on the Caryophyllacidae of North America. J.Par. 14, 16-26

Jadhav S, Anarse S and Borde SN (2011) Incidence of Helminth parasites in fresh water fishes from Sina Kolegoan Dam, Dist. Osmanabad (MS) India. Recent Research in Science and Technology 3(3): 49-50.

Jagerskiold, LA KE (1990) ZurKenntnis der Nematoden-Gattungen *Eustrongylides u. Hystrichis.* Soc. *Acta*., ser.4(2)Art. 3, 48 pp. Upsala.

Jayaram KC (1981) *The freshwater fishes of India.* Calcutta, A Hand book ZSI.

Kalse AT, Naidu TSV and Murhar BM (2007) Seasonal variation of *Eustrongylides*larvae in *Clarias batrachus* at Ambadi Dam, Kannad, Dist. Aurangabad (M.S.). *Nat. J. of Life Sciences*, 4(3): 99-102.

Kar D and Barbhuiya AH (2009) Mahseer fishes of barak drainage, Mizoram and Tripura. Souvenir: National Symposium on cold water fisheries management: New strategies and approaches, 2-4 oct. 2009. Directorate of cold water fisheries research (ICAR), Bhaimtal, Uttarakhand. Pp. 77-80

Kennedy CR (1978) Ecological aspects of Parasitology. North Holland Publishing Company. Amsterdam, Oxford.

Khalil LF and Polling K (1997) Checklist of the Helminth Parasites of African Freshwater Fishes.Uni. of the North Department of Zoology. Republic of South Africa 184.

Lawrence JL (1970) Effect of season, host age on endo helminths of Castostomus commersoni, *J. Parasitology*.56 (3):567-571.

Moller H and Anders K (1986) Kiel: Moller 365.

Monnig HO (1924) South African parasitic nematodes. Ninth and Tenth Reports of the Director of Veterinary Education and Research Union of South Africa, Dpet. Agriculture, Pretoria, 435-478.

Puinyabati H, Shomoredra M, Vishweshwari A, Binky KH, Kar D and Jha AN (2013) Helminth parasites of fishes of awangsoi fishery, Manipur. *Uttar Pradesh J. Zool.* 33(1): 109-113.

Railliet A (1916) Nematodes parasites des rongeurs [Review of Hall's paper, 1916]. *Rec. Med. Vet*., 92(15-16), 517-521.

Railliet A and Henry A (1912) Nematodes vasculicoles des bovinsannamites. Ibid., 5(2), 115-118.

Railliet A and Henry A (1915) Sur les nematodes du genre *Camallanus* Raill. And Henry, 1915 (*Cucullanus*auct., non Mueller, 1777) Ibid. 8(7), 446-452.

Reddy BL and Benarjee G (2011) Seasonal analysis of cestode parasite, *Lytocestusindicus*in fresh water fish, *Channastriatus*. *The Asian Journal of Animal Science* 6(1): 39-42.

Roederer JG (1761) Nochnichtbeschriebene Art Wurmeriminens chlichen Korper. Gotting. *Ahz. Gelehrt. Sachen*, 1.243-246.

Shinde GB (1968) On *Circumoncobothriumophiocephali*n. gen., n. sp. from a fresh water fish *Ophiocephalus leucopunctatus*in India. *Riv. Parasitology,* 19, 111-114.

Shomorendro M and Jha AN (2003) On a new nematode parasite *Paraquimperia manipurensis* n. sp. from the intestine of *Anabas testudineus* (Bloch). *Utter Pradesh J. Zool*., 23(2): 155-157.

Sinha P, Kumar S and Jha V (2008) Studies on the helminth infestation of *Channa punctatus* in and around patna. *Proc. Zool. Soc. India*. 7(2): 79-84.

Wardle RA, McLeod JA and Radinovsky S (1974) Advances in The Zoology of Tapeworms, 1950-1970. University of Minnesota Press, Minneapolis. 1- 274.

Yamaguti S (1959) SystemaHelminthum Vol. II. The Cestodes of Vertebrates pp.1-860

Yamaguti S (1961) SystemaHelminthum Vol. III. The Nematodes of Vertebrates Part I & II, pp.1-1261. Interscience Publishers Ltd. London.