



Prevalence and Diversity of Cestode Parasites of Freshwater Fishes of Genus *Channa* Scopoli, 1777

D. B. Bhure^a, S. S. Nanware^b, A. N. Jadhav^c

Post Graduate Department of Zoology, Yeshwant Mahavidyalya, Nanded - 431602, M.S., India

^{a-c}E-mail address: drajbhure82@gmail.com; snanware@rediffmail.com,
angadjadhav@rediffmail.com

ABSTRACT

Study was conducted to investigate prevalence and diversity of Piscean cestode parasites of freshwater fishes of four species of the genus *Channa* Scopoli, 1777 viz. *Channa straitus* (Bloch, 1793), *Channa punctatus* (Bloch, 1793), *Channa marulius* (F. Hamilton, 1822) and *Channa gachua* (F. Hamilton, 1822) in and around Nanded district, M.S. India during March, 2012 to August, 2014 by applying statistical approach. Five cestode genera *Senga* (Dollfus, 1934), *Polyoncobothrium* (Diesing, 1854), *Gangesia* (Woodland, 1924), *Proteocephalus* (Weinland, 1858) and *Silurotaenia* (Nybein, 1942) were recorded during this investigation. High prevalence were recorded during Summer followed by winter where as prevalence was low in monsoon. High prevalence was reported due to infection of *Senga* sp., as compared to other cestode infection. Prevalence of these Cestode parasites and severity of infection vary considerably depending on environmental conditions such as humidity, temperature, rainfall, vegetation and management practices.

Keywords: *Channa* sp.; Cestode parasites; Diversity; Nanded District; Prevalence

1. INTRODUCTION

Parasitism is a natural way of life, among large number of organism and parasitic diseases are major public health problem, which results into morbidity and mortality in

tropical countries, particularly in socioeconomically under developed societies in the world. The identification of parasite is the first step of controlling the parasitic infection of *Channa sp.*

Fish play an important role in economy. Mortality of fishes occurs due to heavy infestation of these parasites. Keeping in view the increasing importance of fish as rich source of protein diet, the present study focused on diversity of tapeworm of *Channa sp.* from different localities of Nanded District (M.S.), India.

2. MATERIALS AND METHODS

2. 1. Study area

The study was conducted from different collection sites of Nanded district. It is situated in the south eastern part of Maharashtra State.

The Nanded district lies between 18.15 to 19.55 North latitudes and 97.07 to 98.15 East longitude. It covers an area of 10,528 sq. km.

In present study, survey on cestodes was conducted on intestines of freshwater fishes viz. *Channa straitus*, *Channa punctatus*, *Channa marulius* and *Channa gachua* during the period of March, 2012 to August, 2014. Freshwater fishes of genus *Channa* were collected and examined for cestode infection.

Cestode parasites were collected, preserved in hot 4% formalin, washed in saline and water, dehydrated in various alcoholic grades, stained with Harris haematoxylin and Borax carmine, cleared in xylene, mounted in D.P.X. Drawings were made with the aid of camera Lucida and identification by standard methods (Gerald D. Schmidt, 1934; Yamaguti, S., 1959; Wardle, R.A., Mcleod, J.A. and Radinovsky 1974; Khalil, Jones and Bray, 1994; Hiware, Jadhav and Mohekar, 2003; and Bhure, 2008).

On taxonomic observations Cestode genus identified are *Senga*, *Polyoncobothrium*, *Gangesia*, *Proteocephalus* and *Silurotaenia*.

2. 2. Statistical analysis

Prevalence (Incidence) of infection were recorded and calculated according to Margolis et.al., (1982).

$$\text{Prevalence (Incidence) of Infection} : \frac{\text{Number of Host Infected}}{\text{Number of Total Host Examined}} \times 100$$

3. RESULTS AND DISCUSSION

Results of present study on diversity and prevalence of Piscean Cestodes are presented in Table 1, 2 & Figure 1.

Table 1. Diversity and Distribution pattern of Piscean Cestodes during March, 2012 to August, 2014.

S.N.	Cestode parasites	Host	Habitat	Locality
1.	<i>Senga pcyomera</i> Woodland, 1924.	<i>Channa straitus</i>	Intestine	Nanded, Mahur
2.	<i>S. lucknowensis</i> Johri, 1956	<i>Channa punctatus</i>	Intestine	Mudkhed, Bokar
3.	<i>S. khami</i> Deshmukh, 1980	<i>Channa marulius</i>	Intestine	Ardhapur, Nanded
4.	<i>S. godavari</i> Jadhav and Shinde, 1980	<i>Channa gachua</i>	Intestine	Degloor, Kandhar
5.	<i>S. raoi</i> Majid et. al., 1984	<i>Channa punctatus</i>	Intestine	Biloli, Bhokar, Nanded
6.	<i>S. jagannathae</i> Majid et. al., 1984	<i>Channa punctatus</i>	Intestine	Nanded, Loha, Mahur
7.	<i>S. madhavae</i> Bhure et. al., 2010	<i>Channa marulius</i>	Intestine	Degloor, Nanded
8.	<i>S. satatensis</i> Bhure et. al., 2011	<i>Channa punctatus</i>	Intestine	Bhokar, Umri, Naigaon
9.	<i>S. mangalbaiiae</i> Bhure et. al., 2011	<i>Channa gachua</i>	Intestine	Mukhed, Degloor
10.	<i>S. microrostellata</i> Bhure et. al., 2014	<i>Channa punctatus</i>	Intestine	Nanded, Mahur
11.	<i>Polygonocobothrium indicum</i> Nama, 1979	<i>Channa straitus</i>	Intestine	Kinwat, Mahur
12.	<i>P. srivastavai</i> Pande et. al., 2006	<i>Channa punctatus</i>	Intestine	Nanded
13.	<i>P. chauhani</i> Pande et. al., 2006	<i>Channa gachua</i>	Intestine	Nanded, Mahur, Kinwat
14.	<i>Gangesia godavarii</i> Kadam et. al., 1983	<i>Channa straitus</i>	Intestine	Nanded
15.	<i>G. paithenesis</i> , Kadam et. al., 1983	<i>Channa punctatus</i>	Intestine	Bhokar
16.	<i>G. maharashtrii</i> Hiware and Jadhav, 1995	<i>Channa marulius</i>	Intestine	Kandhar, Degloor

17.	<i>G. rohita</i> Pawar et.al, 2004	<i>Channa straitus</i>	Intestine	Kinwat, Mahur
18.	<i>G. pandeyae</i> Kasar et.al.,2010	<i>Channa gachua</i>	Intestine	Nanded
19.	<i>G. marathwadensis</i> Bhure et.al., 2011	<i>Channa punctatus</i>	Intestine	Degloor, Nanded
20.	<i>G.(G.) striatusii</i> Bhure and Nanware, 2012	<i>Channa gachua</i>	Intestine	Bhokar, Umri
21.	<i>Proteocephalus vitellaris</i> Verma,1928	<i>Channa marulius</i>	Intestine	Degloor, Nanded
22.	<i>P. raosahebae</i> Dandwate et.al., 2013	<i>Channa straitus</i>	Intestine	Mahur, Himayatnagar
23.	<i>Silurotaenia macroni</i> Shinde et al.,1984	<i>Channa marulius</i>	Intestine	Kandhar, Degloor
24.	<i>S. seenghala</i> Shinde et al., 1984	<i>Channa punctatus</i>	Intestine	Ardhapur, Nanded
25.	<i>S. ticto</i> , Shinde et al., 1984	<i>Channa gachua</i>	Intestine	Nanded, Kinwat, Mahur, Himayatnagar.
26.	<i>S. raoii</i> Bhure et.al., 2010	<i>Channa punctatus</i>	Intestine	Loha, Kandhar, Degloor

Table 2. Prevalence of Cestode parasites of *Channa Sp.* during March, 2012 to August, 2014.

Sr. No	Month & Year	No. of dissected Hosts	No. of infected Hosts	Prevalence %	No. of Cestode Parasites collected
1	March, 2012	32	21	65.63	29
2	April, 2012	32	22	68.75	26
3	May, 2012	32	26	81.25	34
4	June, 2012	32	10	31.25	13
5	July, 2012	32	04	12.50	06
6	August , 2012	32	06	18.75	09

7	September, 2012	32	07	21.88	10
8	October, 2012	32	09	28.13	11
9	November, 2012	32	11	34.38	15
10	December, 2012	32	13	40.63	18
11	January, 2013	32	16	50.00	20
12	February, 2013	32	16	50.00	19
13	March, 2013	32	19	59.38	23
14	April, 2013	32	21	65.63	27
15	May, 2013	32	25	78.13	30
16	June, 2013	32	11	34.38	15
17	July, 2013	32	05	15.63	08
18	August, 2013	32	07	21.88	11
19	September, 2013	32	06	18.75	10
20	October, 2013	32	08	25.00	13
21	November, 2013	32	12	37.50	16
22	December, 2013	32	14	43.75	19
23	January, 2014	32	17	53.13	23
24	February, 2014	32	18	56.25	22
25	March, 2014	32	21	65.63	28
26	April, 2014	32	23	71.88	33
27	May, 2014	32	27	84.38	34
28	June, 2014	32	11	34.38	16

29	July, 2014	32	06	18.75	09
30	August, 2014	32	08	25.00	14
	Total	960	420	43.75	561

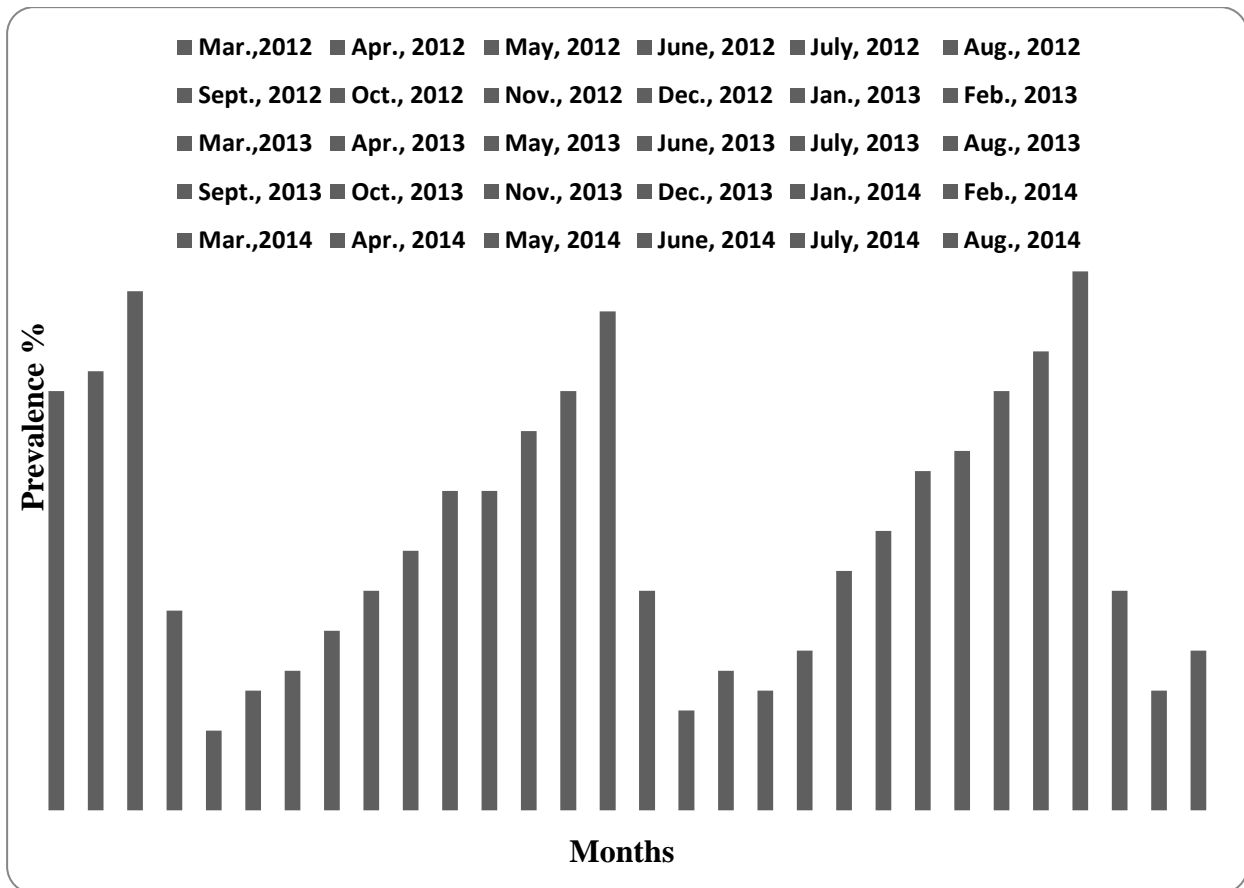


Figure 1. Prevalence of Cestode Parasites of *Channa Sp.* during March, 2012 to August, 2014.

Diversity of piscean Cestodes includes 26 species of five genera (Fig. 2). Ten species of *Senga*, Seven of *Gangesia*, Four of *Silurotaenia*, Three of *Polyoncobothrium* and Two of *Proteocephalus* were reported from *Channa sp.* (Fig. 2).

All these species differs from each other in general topography of organs. Nanware et. al., 2013 reported 85 different species of Piscean tapeworms belonging to 08 genera viz. *Lytocestus* Cohn, 1908 (20 sp.); *Lytocestoides* Baylis, 1928 (08 sp.); *Bothrioccephalus* Rudolphi, 1898 (02 sp.); *Proteocephalus* Weinland, 1958 (01 sp.); *Polyoncobothrium* Diesing, 1834 (04 sp.); *Senga* Dollfus, 1934 (22 species); *Gangesia* Woodland, 1924 (18 sp.); and *Silurotaenia* Nybelin, 1942 (10 sp.) from different localities of Marathwada Region of Maharashtra.



Channa gachua (F. Hamilton, 1822)



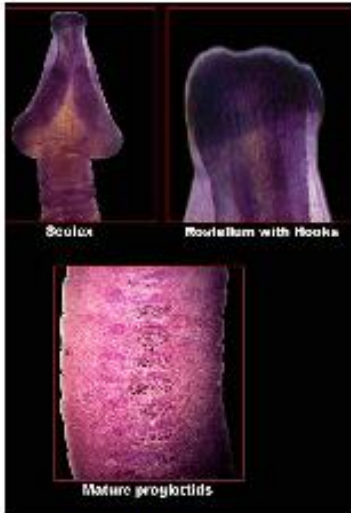
Channa punctatus (Bloch, 1793)



Channa marulius (F. Hamilton, 1822)



Channa straitus (Bloch, 1793)



Senga (Dollfus, 1934)



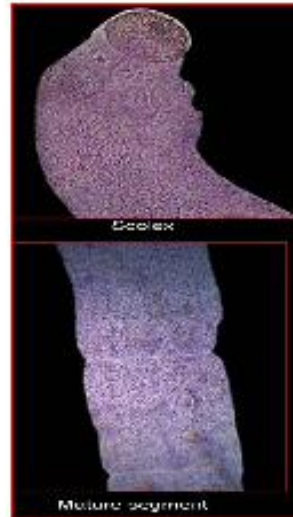
Polygoncobothrium (Diesing, 1854)



Gangesia (Woodland, 1924)



Proteocephalus (Weinland 1858)



Silurotaenia (Nybein, 1942)

Figure 2. Photoplates of Host and Cestode Parasites.

Bhure et. al., 2013 described twelve species of genus *Cotugnia*, five sp. of *Davainea*, five sp. of *Raillietina*, four sp. of *Valipora* and four sp. of *Mogheia* Parasitic in *Gallus gallus domesticus* of locality Nanded.

Jadhav et.al., 2015 studied population dynamics of *Cotugnia sp.* parasitizing domestic fowl and showed High incidence, density and index of infection were reported in Summer followed by Winter whereas infection was low in monsoon. Bhure and Nanware 2015 studied Faunestic diversity of Piscean, Avian and mammalian cestodes of genus *Lytocestus*, *Senga*, *Gangesia*, *Cotugnia*, *Davainea*, *Raillietina*, *Moniezia*, *Stilesia* and *Avitellina* from Nanded region (M.S.) India.

It was found that, high incidence of infection of these species were recorded in Summer followed by winter whereas infection was low in monsoon. Kennedy (1976) explained temperature; humidity and rainfall, feeding habits of host, availability of infective host and parasite maturation are responsible for influencing the parasitic infections. Jadhav and Bhure, (2006) reported high temperature, low rainfall and sufficient moisture were necessary for development of parasite. Feeding activity of the host is reason for seasonal fluctuation of infections (Pennuyuick1973). Nair and Nadakal, (1981) noticed retarded growth, decreased egg production, reduced weight gain, significant haemoglobin depression due to infections of cestode parasites in chickens.

Results of present study are in agreement with Bhure et. al., 2010 reported high incidence (51.78%), intensity (1.18%) and density (0.613%) of *Rhabdocona sp.* in summer followed by winter and rainy season. Bhure et al., 2013 reported high prevalence in summer where as low in monsoon season, he explained domestic fowl infected with cestode parasites showed clinical signs in the form of dullness, emaciation, weakness, reduced growth, uneven body weights, reduction in voluntary food intake, loss of productivity, diarrhoea and decreased egg production. Bhure et.al., 2013 studied seasonal variation of Caryophyllidean tapeworms, Which showed maximum infection in winter (71.66%) followed by summer (43.33%) whereas lower infection in monsoon season(15.00%). Bhure and Nanware, 2014 reported high incidence of infection of *Cotugnia dignopora*, *Cotugnia diamarae* and *Raillietina (R.) domestica* in summer (75%, 67.85 % & 71.42%) followed by winter (60%, 52 % & 48%) whereas low infections in monsoon season (38.09%, 33.33% & 38.09%).

Bhure and Nanware, 2014 recorded high incidence of infection of *Senga sp.*, *Gangesia sp.*, *Proteocephalus sp.* infected to *Channa sp.* was in summer (76.66 %, 73.33 % & 70.00 %) followed by winter (65.21 %, 52.17% & 56.52%) whereas infection was low in monsoon (36.84%, 26.31% & 31.57%). Nanware et.al., 2015 reported High incidence, Density and Index of infection of Piscean nematode of genus *Camallanus sp.* and *Spinitectus sp.* in Summer followed by Winter whereas infection was low in monsoon. Salam 2015 studied highest load of prevalence of *Ascaridia galli* was found highest in Summer with total of 312 parasites recovered from 56 infected chicken.

Availability of food and feeding activity of host also may be reasons for occurrence of parasitic diversity. Maximum infections occurred in host *Channa punctatus* and *Channa gachua*. Infections are host specific because morphological, physiological and ecological factors affect host specificity. Morphological factors are those which like a parasite with its host at the site of attachment. Ecological factors are such as, distribution, and environment of host, diet and mode of feeding. These adaptations often provide important role for limiting a parasite to a particular host sp. in particular season.

Recorded data of present study shows high incidence of infections of cestodes was in summer followed by winter where as low in monsoon due to environmental factors and feeding habitat influence the seasonality of parasitic infection either directly or indirectly.

ACKNOWLEDGEMENT

DBB is indebted to SERB, New Delhi for sanctioning the Fast Track Research Project No. SR/FT/LS-19/2010 Dt. 2nd May, 2012.

References

- [1] Anderson, R.M. 1976. Seasonal variation in the population dynamics of *Caryophyllacus lacticeps*. *Parasitology* 72: 281-395.
- [2] Anderson, R.M. And May, R.M. 1978. Regulation and stability of the host parasite population interaction. I- Regulation process. *Jr. Animal. Ecol.* 47(1): 219-247.
- [3] Anderson, R.M. And May, R.M. 1978. The regulation of the host population growth by parasite species. *Parasitology* 76: 199-157.
- [4] Anderson, R.M. And Gordon, D.M. 1982. Processes influencing the distribution of parasite numbers within host population with special emphasis on parasite-induced host mortalities. *Parasitology* 85: 373-398
- [5] Bhure, D.B., Jadhav, B.V., Pathan, D.M. and Padwal, Nitin 2007. Population index of some trematode parasites in freshwater fishes from Aurangabad. *Proc. 16th All India ZSI conference, Fisheries and Fish Toxicology*. Chapter - 20, pp. 217-229.
- [6] Bhure, D.B., Jadhav, S.S., Supugade, V.B., Sawant, A.D. and Jadhav, B.V. 2007. Population Dynamics of Trematode parasites in freshwater fishes from Nath Sagar reservoir at Paithan Aurangabad District. *Proc. Nat. Work. on Recent. Trends in Biotechnology*. Pp. 120-124.
- [7] Bhure Dhanraj Balbhim 2008. Faunal diversity of helminth parasites of freshwater fishes from Maharashtra State, India. *Ph.D. Thesis, Dr. B. A.M.U. Aurangabad, M.S. India*. pp.1-178.
- [8] Bhure, D.B., Nanware, S.S., Kardile, S.P. and Dhondge, R. M., 2010. A survey of the population ecology of *Rhabdochona* Ralliet, 1916 (Nematoda-Rhabdochonidae) from *Labeo rohita* (Ham. and Buch.). *The Ecosphere (An International Biannual Journal of Environment and Biological Sciences)*. 1(1): 12-24.
- [9] Bhure, Dhanraj Balbhim, Nanware, Sanjay Shamrao and Dhondge, Ramesh Mohanrao. 2010. Studies on population dynamics of piscian nematode *Spinectectus corti* Moorthy, 1938 *The Ecosphere (An International Biannual Journal of Environment and Biological Sciences)*. 1(1): 130-132.
- [10] Bhure D.B. and Nanware S.S., 2011. Population Dynamics of *Silurotaenia raoii* Bhure et.al., 2010 from *Mystus seenghala*. *The Ecosphere (An International Biannual Journal of Environment and Biological Sciences)*. 2(1&2): 9-12.

- [11] Bhure, Dhanraj Balbhim, Nanware, Sanjay Shamrao and Sunnap, Namrata V. 2013. Status of Diversity of Cestode Parasites of Domestic Fowl (*Gallus Gallus Domesticus*) from Nanded District, Maharashtra State. *Indian Journal of Applied Research*. 3(10): 28-31.
- [12] Bhure, Dhanraj Balbhim, Nanware, Sanjay Shamrao, Barshe, M.U., Deshmukh, V.S. and Kardile, S.P. 2013. Population Dynamics of Caryophyllidean Tapeworms from Freshwater Fish *Clarias batrachus*. *Flora and Fauna An International Research Journal of Biological Sciences*. 19(1): 161-166.
- [13] Bhure, Dhanraj Balbhim, Nanware, Sanjay Shamrao and Kasar C.R. 2014. Studies on Prevalence of Cestodes Parasitizing *Gallus gallus domesticus*. *Environment Conservation Journal*. 15(1&2); 171-175.
- [14] Bhure, Dhanraj Balbhim, Nanware, Sanjay Shamrao 2014. Studies on Prevalence of Cestode Parasites of Freshwater Fish, *Channa punctatus*. *Journal of Entomology and Zoology Studies*. 2(4); 283-285.
- [15] Bhure Dhanraj Balbhim and Nanware Sanjay Shamrao 2015. Faunestic Diversity and Distribution of Cestode Parasites of Piscean, Avian and Mammalian Host. *American Journal of Biology and Life Sciences*. 3(6): 241-245.
- [16] Dobson, A.P. and Roberts, M.G. 1994. The population dynamic of parasitic helminth Communities. *Parasitology* 102 (Suppl.): 507-510.
- [17] Dogiel, V.A. 1935. The present tasks of ecological Parasitology. *Tud. Patergof. Biol Inst* 15: 2
- [18] Dogiel, V.A. et al. 1958. *Parasitology of Fishes*. Leningrad University press, Oliver and Boyd, Edinburgh and London.
- [19] Dollfus, R. Ph. 1934. Sur un cestode pseudophyllidae parasite de poisson ornement. *Bull. Sac. Zool. France* 69: 476-490
- [20] Euzeby, J. 1972. Climate and development of helminthes: Climatology and helminth dev. *J Rev Med Vet (Toulouse)*, 123(5): 637-655.
- [21] Fernando, C.H. and Hanek, C. 1976. Gills. In: C.R. Kennedy (ed.). *Ecological aspects of Parasitology*. North Holland publishing company Amsterdam pp. 209-226.
- [22] Hiware, C.J., Jadhav, B. V. and Mohekar, A. D. 2003. *Applied Parasitology A practical manual*. Mangal Deep Publ. Jaipur. Pp. 243.
- [23] Jadhav, A. N. , Bhure, D.B. and Nanware, S.S. 2015. Application of Data Analysis and Presentation for Population Dynamics of *Cotugnia* sp. Parasitizing Domestic Fowl. *World Scientific News*. 32 (2016) 37-48.
- [24] Jadhav, B.V. and Bhure, D.B. 2006. Population dynamics of Helminth parasites in freshwater fishes from Marathwada region (M. S.) India. *Flora and Fauna An International Research Journal*, 12(2): 143-148.
- [25] Jadhav, B.V., Bhure, D.B., Padwal, Nitin and Nanware, S.S. 2007. Studies on seasonal infection of *M.armatus* (Cur & Val) By Ptychobothriidae, Luhe1902. *Proc. 17th All India ZSI conference, Bioinformatics*, Chapt. 14, pp. 125-131.

- [26] Kasar, C. R., Patki, A. K., Bhure, D.B. and Nanware, S.S. 2012. Seasonal Variation of *Valipora* Linton,1927 (Dilepididae-Wardle, McLeod and Radinovsky,1974) from *Columba livia*. *Bionano Frontier* 5(2-1): 212-213.
- [27] Kennedy, C.R. 1968. Population biology of the Cestode *caryophyllaeus* (Pallas, 1781) in dace, *Leuciscus leuciscus* L. of the river Avon. *J. Parasitol* 54: 538-543.
- [28] Kennedy, C.R. And Hine, D.M.1970. Population biology of the cestode *Proteocephalus torulisus* (Bat Sch) in dace *Leuciscus leuciscus* (L) of the river Avon. *J. Fish Biol.* 1(3): 209-219.
- [29] Kennedy, C.R. 1974. A checklist of British and Irish freshwater fish parasites with notes on their distribution. *J. Fish Biol.* 6 (5): 613-644.
- [30] Kennedy, C.R. 1976. *Ecological aspects of parasitology*. North Holland publishing company Amsterdam 10x ford.
- [31] Kennedy, C.R. 1977(a). The regulation of fish parasite populations. In regulation of parasite population 61-109.
- [32] Khalil, L.F, Jones, A. and Bray, R.A. 1994. *Keys to the cestodes parasites of vertebrates*. CAB International Pub. U.K. pp. 1-751.
- [33] Kulakovskaya, O.P. 1962. The seasonal changes in representatives of the family Caryophyllaeidae (Cestoda) under conditions existing in Western Ukrainian region, *URSR. Scientific Memories of Science Biological Museum of the Utranisn Academy of Science* (10): 88-93.
- [34] Kulakovskaya, O.P.1964. Effect of environmental conditions on relationship between some intestinal parasites of fish. *Paroblemiy Parazitologii.* (3): 9-15.
- [35] Lawrence, J.L.1970. Effect of season, host age on endo helminthes of *Catostomus Commersoni*. *J. Parasitology* 56(3): 567-571.
- [36] Moller, H.1978. The effect of salinity and temperature in the development and survival of fish parasites. *J. of Fish Bio.* 12: 311-324.
- [37] Nair, K.V. and Nadakal, A. M. 1981. Hematological changes in domestic fowl infected with cestode Raillietina tetragona (Molin, 1958). *Vet. Parasitol.* 8: 49-58.
- [38] Nanware, S. S. Bhure, D. B., Deshmukh V.S. and Barashe M.U. 2013. Survey of Cestode Parasites Of Freshwater Fishes From Marathwada Region. *The Biosphere (An International Journal of Life Sciences)* 5(2), 149-151.
- [39] Nanware Sanjay Shamrao, Bhure Dhanraj Balbhim and Deshmukh V.S. 2015. Population Dynamics of Nematodes of Freshwater Fish, *Mastacembelus armatus* Lacepede, 1800. *Proceeding of National Conference on "Current Trends in Aquaculture"*. Published as a Special Issue of *International Journal of Advanced Research in Basic and Applied Sciences*. (Special Issue), August, 2015 pp. 72-77
- [40]. Nybein, O. 1942. Zuer Helminth Fauna der Sussawasser Fische Schwedens II. Die cestode, des welses. *Goteboogs Kgl. Vetenskaps-Akad Handl.* Sect. B. L. 1-24.
- [41] Pennyuick, K.L. 1973. Seasonal variation in the parasite population of three spined Stickle backs, *Gasterosteus aculeatus* L. *Parasitology* 63: 373-388.

- [42] Rajeshwar Rao and V. Ramkrishna.1982. The seasonal variations of Helminth Parasites of *Rana tigrina* in Hyderabad district *Geobios* 10: 34-36.
- [43] Ramreddy, G.B.V. 1980. Studies on the population dynamics of helminth parasite of certain lizard of Hyderabad. *Ph. D. Thesis, Osmania University Hyderabad A. P. India.*
- [44] Rudolphi.1810. Entozoorum sive vermium intestinalium nistoria naturalis 11 pars. 2 xii 386 pp Amstelaedami. *Zool. Anz.* 29(8): 224-252.
- [45] Schmidt, Gerald D. 1934. *Handbook of Tapeworm Identification.* CRC Press, Inc. Boca Raton, Florida. Pp. 1-675.
- [46] Wardle, R.A., Mcleod, J.A. and Radinovsky 1974. *Advances in the Zoology of tapeworm 1950-1970*, University of Minnesotar Press, Minneapolis, 1-780.
- [47] Woodland, WNF. 1924. On a new Proteocephalidae from Indian freshwater fishes. *Parasit.* 16: 441-451.
- [48] Yamaguti, S. 1959. *Systema Helminthum. II. The Cestodes of Vertebrates.* Intescience Publ., N.Y., pp. 860.

(Received 06 December 2015; accepted 15 December 2015)