Eco. Env. & Cons. 28 (1) : 2022; pp. (319-325)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i01.046

Studies on Limnological Characteristics and Zooplankton Diversity in Durgadahalli and Mydala Lakes of Tumakuru, Karnataka State, India

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(Received 12 May, 2021; Accepted 1 July, 2021)

ABSTRACT

The specific status of limnological characteristics and diversity of zooplankton in Durgadahalli and Mydala Lakes have been studied in the period 2017-19. Diversity of zooplankton in the selected two lakes identified 35 species of zooplankton. In Durgadahalli lake 20 species were recorded, of which 14 are rotifers, 4 are cladoceraus and 2 are copepods. Among the rotifers, family Brachionidae reported as highest number of species (11 species), of which Genus *Brachionus* contain 08 species. Similarly, in Mydala lake recorded 26 species of zooplankton among which 17 are rotifers, 7 are cladoceraus and 2 are copepods. In rotifers, family Brachionidae contains high number of species (10 species), in which Genus *Brachionus* (08 species) represents the highest number. Most commonly occurring species are *Brachionus angularis, B. caudatus, Keratellatropica, Filinia longiseta, Ceriodaphnia cornuta, Ceriodaphniacornuta, Diaphanosomasarsi* and *Moina micrura*. The highest zooplankton population was recorded in rotifera and lesser in copepod in both the lakes. The water remained moderately alkaline (pH 7.07 and pH 7.27) while Biochemical Oxygen Demand (3.0 mg/l each), Dissolved Oxygen (7.5 mg/l and 5.32 mg/l), TDS (167 mg/l and 272 mg/l), chloride (15 mg/l and 27.5 mg/l), hardness (40 mg/l and 81.5 mg/l) showed low mean values respectively.

Key words : *Durgadahalli and Mydala lakes, Limnological characteristics, zooplankton diversity;*

Introduction

Water is nature's most wonderful, abundant and most useful chemical compound gifted with physicochemical properties, with unique characteristics. It is essential for the survival of all organisms on this earth planet. According to Kudesia and Kudesia (1998) about 97% of earth's water is found in ocean 2% is freeze as ice in poles and remaining 1% is available to us in the form of fresh water in rivers, streams, lakes and ground water and which is used for human beings for their daily needs, irrigation and factories. Biological production in any aquatic body gives direct correlation with its physico-chemical status which can be used as tropic status and fisheries resources potential (Jhingran, 1982). Life in aquatic environment is largely governed by physico-chemical characteristics and their stability. These characteristics have enabled biota to develop many adaptations that improve sustained productivity and regulate lakes metabolism. The food chain in lakes ecosystem is very simple comprising phytoplankton and aquatic vegetation as primary producers, zooplankton as primary consumers, small fishes as secondary consumers and large fishes as tertiary consumers. Plankton is the most sensitive floating community which is being the first target of water pollution, thus any undesirable change in

aquatic ecosystem affects diversity as well as biomass of this community. The measurement of plankton's productivity helps to understand conservation ratio at various tropic level and resources as an essential input for proper management of lakes. The lakes provide water to the city dweller, so study on limnological characteristics of lakes has high importance, the study of their tropic status may help in optimum utilization and conservation. Not much report is available on these lakes. Hence, present study was carried out to assess the zooplankton diversity status in relation to major hydrological parameters during the study period from 2017 to 2019.

Materials and Methods

Study Area

Durgadahalli lake (13° 13' 56" N latitude, 77° 25' 30" E longitude) is situated at about 15km away from the city and Mydala lake (13°18'46''N latitude, 77°11'37''E longitude) is situated at about 20km away from the city. These lakes are perennial water body having an area of about 15.60 hectares and 370 hectares, depth about 1.8 to 2.0 meters and 3.0 to 4.4 metersalong the bund, the total catchment area is 17.25 sq.km and 62.96 sq.km. Height is about 10.4 to 10.6 m with an average rain fall is 620 mm and 13 to 14.8 m with an average rain fall is 640.27 mm respectively and rain fed during monsoon period.

Methodology

Water Analysis: Water samples were collected from five sampling sites of those two lakes. The sampling was usually carried out during 8:00 am to 10:00 am. The water samples were collected directly from the surface layer in plastic can to avoid the unpredictable changes. The physicochemical analysis of samples was done in the lab according to the procedure prescribed by APHA (1998) and Adoni (1985).
Zooplankton Analysis: For Plankton study, samples were collected from surface water of these two lakes at different stations. 50L of water was collected in a known volume of a plastic bucket and filtered through zooplankton net made of bolting silk (No 25), 62 µm mesh size. The plankton sample so collected was fixed withlugol's solution. Identification of zooplankton species was done by using standard literature (Michael and Sharma, 1988; Sharma, 1992; Ranga Reddy, 1994; Segers, 1995; Dhanapathi, 2000; Sharma and Sharma, 2008) under a light microscope (Carl Zeiss 10×25x).

Results and Discussion

Durgadahalli lake

In this study, we have recorded 20 species of zooplankton from the Durgadahalli lake. Of which 14 are rotifers, 4 are cladoceraus and 2 are copepods (Table 1 and Fig. 1). Among the rotifers, family Brachionidae (11 species) contains high number of species, of which Genus *Brachionus* (08 species) represents the highest number. The Hexarthridae, Filiniidae and As planchnidaere present one species in each family (Table 1 and Fig. 1). In cladocera, family Daphniidae (02 species), family Moinidae (01 species) and family Chydoridae (01 species) recorded in this lake. In copepoda, family Diaptomidae has two species (Table 1 and Fig. 1). Most commonly occurring species are *Brachionus angularis, B. caudatus, Keratellatropica, Filinialongiseta, Ceriodaphniacornuta* and *Moinamicrura*. The highest zooplankton population was recorded in rotifera andlesser zooplankton population was observed in copepod.

The physicochemical analysis of water was recorded as follows, temperature (25.5 °C), pH (7.07), biological oxygen demand (BOD) (3.00 mg/l), dissolved oxygen (DO) (7.5 mg/l), chemical oxygen demand (COD) (29.5 mg/l), electrical conductivity (EC) (242.25 µs/cm), turbidity (8.00 NTU), total hardness (40.00 mg/l), total suspended solids (TSS) (14.5 mg/l), total dissolved solids (TDS) (167.00 mg/l) and total solids (181.5 mg/l) (Table 2). It was observed that, dissolved metals like Nickel, total Chromium, Arsenic, Lead, Cadmium, Zinc, Iron, Manganese and Copper showed below detection level (BDL) with a little bit muddy and slight fishy odour.

Mydala lake

In Mydala lake recorded 26 species of zooplankton among which 17 are rotifers, 7 are cladoceraus and 2 are copepods (Table 1 & Fig. 1). Among the rotifers, family Brachionidae contains high number of species (10 species), in which Genus *Brachionus* (08 species) represents the highest number. The family Lecanidae (05 species), Trichocercidae and Filiniidae represent one species in each family (Table 1 & Fig. 1). In cladocera, family Daphniidae have two number of species, family Sididae, Bosminidae, Moinidae, Macrothricidae, Chydoridae have same

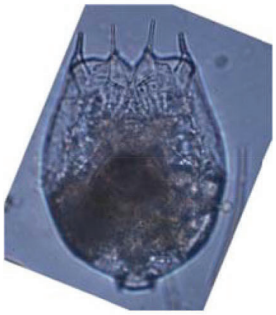
number of species (01 species each) recorded in this lake. In copepoda, family Diaptomidae has two species (Table 1 & Fig. 1). Most commonly occurring species in Mydala lake as, *Brachionus angularis, Keratellatropica, Ceriodaphniacornuta, Diaphanosomasarsi* and *Moinamicrura.* The highest number of zooplankton was recorded in rotifera and lesser number of zooplankton recorded in the copepod as like that of Durgadahalli lake.

The physicochemical analysis of water in Mydala lake was recorded as follows, water temperature (25.00 °C), pH (7.27), Biochemical oxygen demand (BOD) (3.00 mg/l), dissolved oxygen (DO) (5.32 mg/l), the chemical oxygen demand (COD) (35.00 mg/l), the electrical conductivity (EC) (427 µs/cm), turbidity (2.65 NTU), total hardness (40.00 mg/l), total suspended solids (TSS) (10.50 mg/l), total dissolved solids (TDS) (272 mg/l) and total solids (307.5 mg/l) (Table 2). Dissolved metals like Nickel, total Chromium, Arsenic, Lead, Cadmium, Zinc, Iron, Manganese, Copper which were observed below the detection level (BDL). In Mydala lake dissolved Phosphate (0.032 mg/l) was observed whereas it is absent in Durgadahalli lake, which was

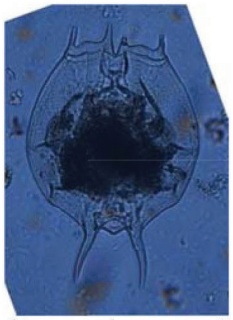
Table 1. Zooplankton diversity of Mydala and Durgadahalli Lakes of Tumakuru,

Sl.No	Name of the species	Durgadahalli Lake	Mydala Lake
Rotifera :Brachionidae			
1	*Brachionus angularis* Gosse, 1851	+	+
2	*Brachionuscalyciflorus*	+	+
3	*Brachionuscaudatus* Barrois & Daday, 1894	+	+
4	*Brachionusdichotomusreductus* Koste & Shiel, 1980	+	-
5	*Brachionusdiversicornis* (Daday, 1883)	+	-
6	*Brachionusfalcatus* Zacharias, 1898	+	+
7	*Brachionusforficula* Wierzejski, 1891	+	+
8	*Brachionusquadridentatusquadridentatus* Hermann, 1783	+	+
9	*Brachionuspatulus* Muller, 1786	-	+
10	*Brachionusrubens* Ehrenberg, 1838	-	+
11	*Keratellacochlearis* (Gosse, 1851)	+	-
12	*Keratellatropica* (Apstein, 1907)	+	+
13	*Platyias quadricornis* (Ehrenberg, 1832)	+	+
14	**Lecanidae** *Lecanearcula* Harring, 1914	-	+
15	*Lecane bulla* (Gosse, 1851)	-	+
16	*Lecaneleontina* (Turner, 1892)	-	+
17	*Lecaneluna* (Muller, 1776)	-	+
18	*Lecanecurvicornis* (Murray, 1913)	-	+
19	**Trichocercidae** *Trichocercasimilis* (Wierzejski, 1893)	-	+
20	**Hexarthridae** *Hexarthraintermedia* Wiszniewski, 1929	+	-
21	**Filiniidae** *Filinialongiseta* (Ehrenberg, 1834)	+	-
22	*Filiniaopoliensis* (Zacharias, 1898)	-	+
23	**Asplanchnidae** *Asplanchnabrightwellii* Gosse, 1850	+	-
Cladocera			
24	**Sididae** *Diaphanosomasarsi* Richard, 1894	-	+
25	**Daphniidae** *Ceriodaphniacornuta* Sars, 1885	+	+
26	*Daphnia* (Ctenodaphnia) *lumholtzi* Sars, 1885	+	-
27	*Simocephalusexspinosus* (De Geer, 1778)	-	+
28	**Bosminidae** *Bosmina* (Bosmina) *longirostris* (O.F. Muller, 1785)	-	+
29	**Moinidae** *Moinamicrura* Kurz, 1875	+	+
30	**Macrothricidae** *Macrothrix spinosa* King, 1853	-	+
31	**Chydoridae** *Chydorussphaericus* (O. F. Muller, 1776)	-	+
32	*Indialonaganapati* Petkovski, 1966	+	-
Copepoda			
33	**Diaptomidae** *Heliodiaptomusviduus* (Gurney, 1916)	-	+
34	*Tropodiaptomusorientalis* (Brady,1886)	+	-
35	*Neodiaptomus intermedius* Flossner, 1984	+	+

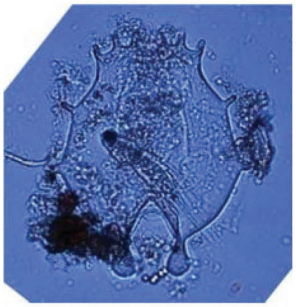
Brachionus angularis



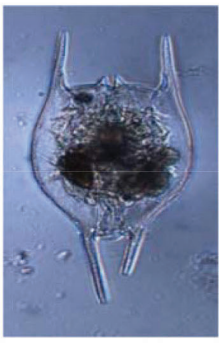
Brachionus calyciflorus



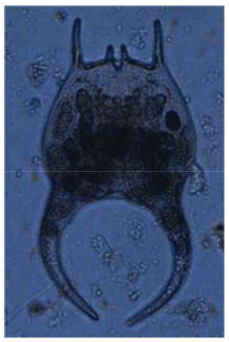
Brachionus caudatus



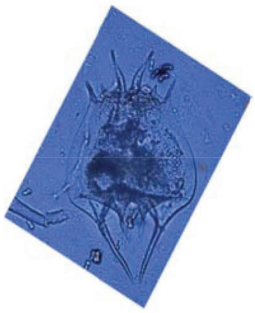
Brachionus dichotomus reductus



Brachionus diversicornis



Brachionus forficula



Brachionus quadridentatus quadridentatus

Keratella cochlearis

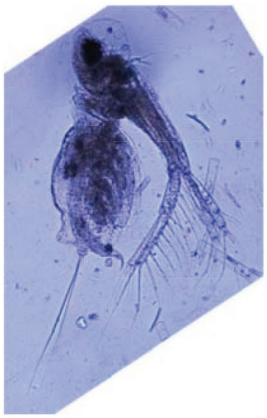
Keratella tropica

Lecane arcula

Lecane bulla

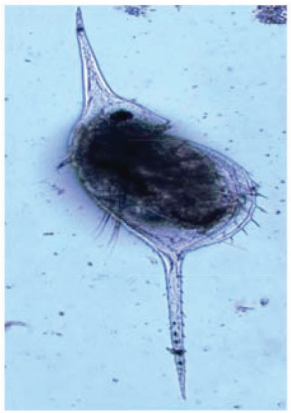
Lecane leontina

Filinia longiseta

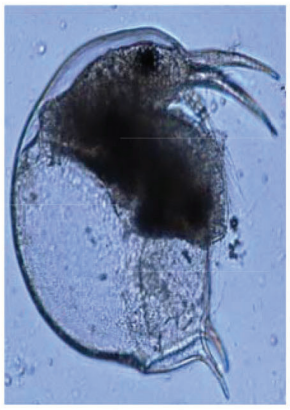


Diaphanosoma sarsi

Ceriodaphnia cornuta



Daphnia (Ctenodaphnia) lumholtzi



Bosmina longirostris

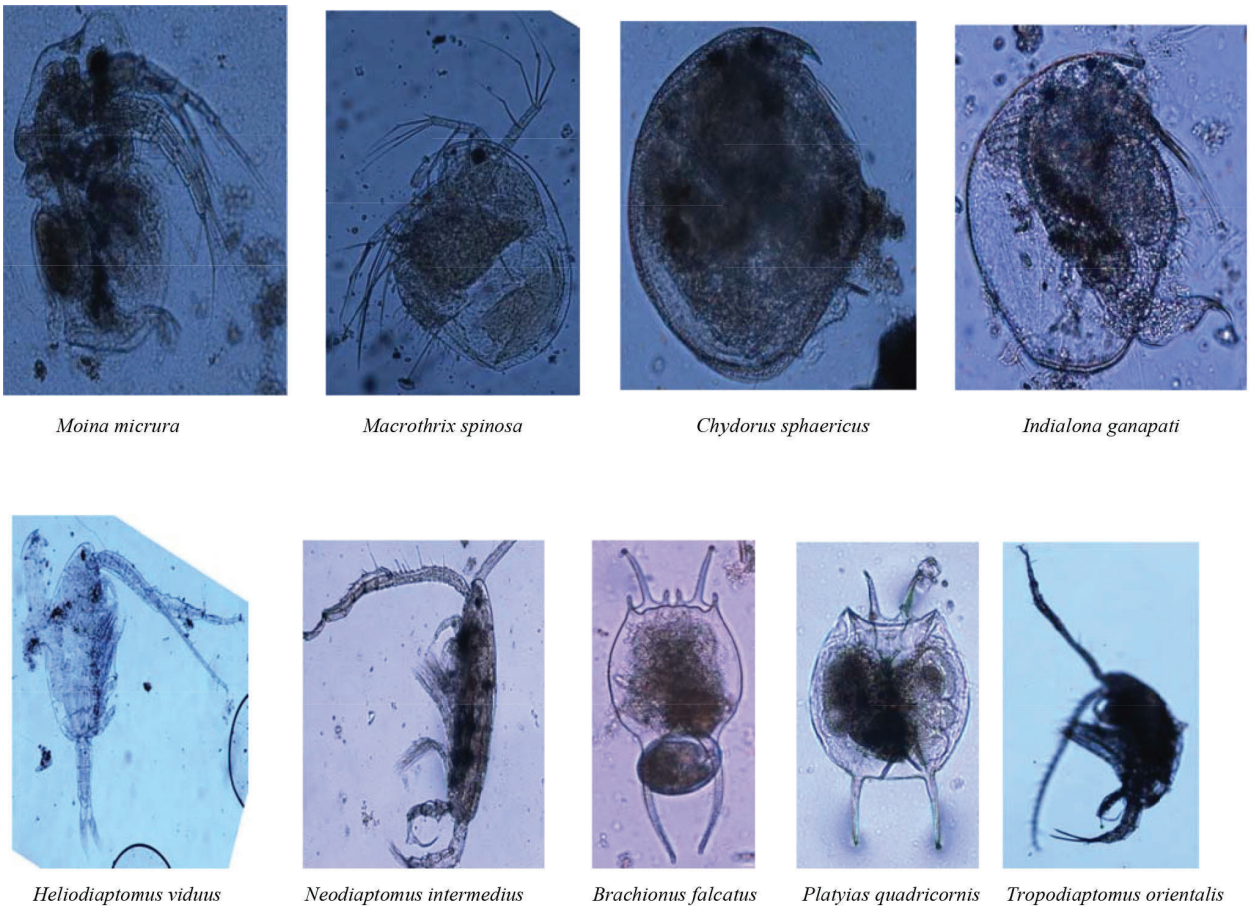


Fig. 1. Diversity of Zooplankton in Durgadahalli and Mydala lakes of Tumakuru

probably due to the use of fertilizers in croplands around the lake. The water was clear and no odour was observed.

Similar results were also reported in Ameenpur tank, Ameenpur village, Medak district, Telangana by Karuthapandi *et al.,* (2016a) who investigated family Rotifera and reported it to be abundant followed by order Cladoceran and Copepoda respectively. Karuthapandi *et al.,* (2016b) again reported rotifers to be more predominant than other zooplankton communities, especially family Brachionidae and Lecanidae in the chosen pond at Medak district, they also observed a significant relationship between Physico-chemical parameters and zooplankton indices. Kar and Kar (2016) also reported diversity and density of zooplankton in Cachar lake, Assam and concluding family Rotifera to be the dominant group contributing 53% towards total abundance. Shaikh *et al.,* (2014) reported that rotifers were most abundant along with providing indication towards the eutrophic nature of the lake. Chopra and Jakhar (2016) reported family Rotifera representing highest number of species followed by Cladoceran, Copepoda, Ostracoda and Insecta respectively. Karuthapandi *et al.,* (2018) investigated in Osmansagar reservoir, Telangana reporting highest population density of zooplankton which was due to rotifer and copepods where rotifers were most dominant followed by Cladoceran and Copepoda. The study of zooplankton in two lakes revealed that Mydala lake showed greater number of species than that of Durgadahalli lake, the results influencing the diversity of fishes of the lake as plankton are primary food for the fishes and zooplankton are primary consumers in the aquatic food chain.

Conclusion

Zooplankton community structure is shaped prima-

Table 2. Physico-chemical parameters of Mydala and Durgadahalli Lakes of Tumakuru

Sl. No	Water parameters	Unit	Durgadahalli Lake	Mydala Lake
1	pH	pH unit	7.07	7.27
2	Biological Oxygen Demand (BOD) (3days @27°C)	mg/l	3.0	3.0
3	Dissolved Oxygen (DO)	mg/l	7.5	5.32
4	Chemical Oxygen Demand (COD)	mg/l	29.5	35
5	Conductivity		242.25	427
6	Nitrate Nitrogen	mg/l	0.922	0.765
7	Ammoniacal Nitrogen	mg/l	0.2375	0.37
8	Turbidity	NTU	8	2.65
9	Total Hardness	mg/l	40	81.5
10	Calcium ($CaCO_3$)	mg/l	22.5	45.5
11	Chloride (Cl)	mg/l	15	27.5
12	Sodium (Na)	mg/l	27	53.5
13	Potassium (K)	mg/l	6.5	10.25
14	Sulphate (SO_4)	mg/l	9.5	16.5
15	Total Suspended Solids (TSS)	mg/l	14.5	10.5
16	Total Dissolved Solids (TDS)	mg/l	167	272
17	Dissolved Phosphate (PO_4)	mg/l	BDL	0.032
18	Fluoride (F)	mg/l	0.155	0.165
19	Total solids	mg/l	181.5	307.5
20	Carbonate (CO_3)	mg/l	0.3	0.8
21	Bicarbonate (HCO_3)	mg/l	4.0	4.5
22	Colour		Little bit muddy	Clear
23	Odour		Slight Fishy	None
24	Temperature	°C	25.5	25

rily by the physical and chemical environment. However, these communities are also modified by biological interactions (Blancher, 1984). This study recorded 20 and 26 species of various zooplanktons in Durgadahalli and Mydala lake respectively. In which rotifera has a greater number of species than cladocera and copepoda. The planktons are the major food source for aquatic animals like fishes, these plankton influences on the productivity of fishes. In Durgadahalli lake fish productivity is lower (Shivaraju *et al.*, 2018) and in Mydala lake fish production is higher (Shivaraju *et al.*, 2017) its due to plankton diversity. Salinity and pollutants are the major significant factor affecting the diversity and abundance of zooplankton in lake water bodies. Elevated salinity reduces the diversity and abundance of zooplankton in aquatic media. The major implication of pollutants on zooplankton community structure is the loss of sensitive species which potentially affect the aquatic diversity and food chain. Knowing the relationship between the increasing pollution and the zooplankton can be used to estimate the ecosystem's sensitivity. Therefore, proper management of lake water bodies should be applied.

Acknowledgements

We express our sincere thanks to DOSR in Applied Zoology, Kuvempu University for providing the facility. We would like to express our deepest gratitude toKaruthapandi M, Scientist C, Freshwater Biology Regional Centre, Zoological Survey of India, Hyderabad and Dr. Shahnawaz Ahmad for their support and encouragement.

References

Adoni, A.D. 1985. Workbook on limnology. Pratibha Publishers, C-10, Gour Nagar, Sagar, India, 216.

APHA, 1998. *Standard Methods For The Examination Of The Water And Waste Water.* 20th Edition. American Public Health Association, Washington Aquaculture Engineering, 19:119-131.

Blancher, C.E. 1984. Zooplankton-trophic relationship in some north and central Florida lakes. *Hydrobiologia*. 109: 251-263.

Chopra, G. and Jakhar, P. 2016. Diversity and Community Composition of Zooplankton in Three Wetlands of Fatehabad, Haryana. *Curr World Environ.* 11(3).

Dhanapathi, M.V.S.S.S. 2000. Taxonomic notes on the Rotifers. *Indian Association of Aquatic Biologists,*

Hyderabad. pp 1- 178.

Jhingran, V. G. 1982. *Fish and fisheries of India*. 2nd Edn., Hindustan Publishing Corporation, India.

Kar, S. and Kar, D. 2016. Zooplankton Diversity in a Freshwater lake of Cachar, Assam. *Int. J. App. Bio. Pharm. Tech*. 7(1): 301-305.

Karuthapandi, M., D.V. Rao and B. Xavier Innocent. 2016a. Zooplankton Diversity and Physicochemical Profile of Ameenpur Tank, Telangana, India. *Rec. zool. Surv. India.* 116(4) : 347-366.

Karuthapandi, M., Rao, D.V. and Xavier Innocent, B. 2016b. Zooplankton Composition, Diversity and Physicochemical Features of BandamKommu Pond, Medak District, Telangana, India. *Proc Zool Soc.* 69(2): 189–204.

Karuthapandi, M., Rao, D.V. and Xavier Innocent, B. 2018. Zooplankton Diversity of Osmansagar Reservoir, Telangana, India. *Proc Zool Soc.* 71 : 229–238.

Kudesia, V.P. and Ritu Kudesia, 1998. Water Pollution. Pragati Prakashan, Meerut (India). 728 pp. 11

Michael, R.G. and Sharma, B.K. 1988. Indian Cladocera (Crustacea: Branchiopoda: Cladocera). Published by Director, Zoological Survey of India, Calcutta. pp 1-262.

Ranga Reddy, Y. 1994. Copepoda: Calanoida: Diaptomidae. In: Guides to the *Identification of Microinvertebrates of the Continental Waters of the World,* Edited by H.J.F. Dumont, SPB Academic Publishing bv. Netherlands. Viii+220.

Segers, H. 1995. The Lecanidae (Monogononta). In Nogrady T. (Ed.) Rotifera 2 In: Dumont H.J (Ed.) Guides to the *Identification of the Continental Waters of the World 6. SPB Academic, The Hague, Netherlands. 226 pp.*

Shaikh, A.L., Rao, K.R., Salunkhe, P.S. and Nikam, D.S. 2014. Zooplankton diversity of Ashti lake, Dist: Solapur (M.S.). *Bionano Frontier.* 7(1) : 118-122.

Sharma, B.K. 1992. *Freshwater rotifers (Rotifera: Eurotatoria).* In: Fauna of West Bengal. State Fauna Series, *Zoological Survey of India, Calcutta.* 3(13): 1-121.

Sharma, S. and Sharma, B.K. 2008. Zooplankton diversity in floodplain lakes of Assam. *Rec. Zool. Surv. India* (Occ. Paper) 290 : 1-370.

Shivaraju, M. Venkateshwarlu, Shahnawaz Ahmad. 2017. Ecology and icthyofaunal diversity of Mydala lake of Tumakuru, Karnataka State, India. *International Journal of Zoology Studies.* 2(5) : 216-221.

Shivaraju, M., Venkateshwarlu and Shahnawaz Ahmad. 2018. Fish diversity in Durgadahalli Lake of Tumakuru, Karnataka, India. *International Journal of Academic Research and Development*. 3(1) : 1128-1131.