IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 07, 2022

CLADOCERAN ASSEMBLAGE IN KOLAVOI LAKE, CHINGLEPUT, TAMILNADU, INDIA

R. Sonia, and R.Ramanibai*
*Department of Zoology, University of Madras Guindy Campus, Chennai – 600 025.
Corresponding Author soniadr.san@gmail.com
ORCID ID: 0009-0009-1855-4371

Abstract:

To improve strategies towards the management and protection of aquatic biodiversity of water bodies, there is a need to collect information on the diversity present at different locations of aquatic habitats. Hence, the biodiversity of the cladoceran fauna of Kolavoi Lake, Chingleput was studied through weekly sampling programme advocated . Remarkably rich cladoceran community consisting of 10 species were recorded. *Macrothrix spinosa* and *Alona quadrangularis* were abundant whereas *Illyocryptus spinifer* and *Bosmina longirotris* were occurred rarely. During summer season, the diversity of organisms was low. *Ceriodaphnia cornuta* and *Macrothrix spinosa* were present throughout the year. *Alona macronyx* and *Illyocryptus spinifer* were recorded during monsoon season only. *Diaphanasoma excisum* and *Alona quadrangualaris* were observed during summer season. The quantitative and qualitative variability of Cladocerans recorded in Kolavoi Lake is not only attributed to seasonal changes but also with the locations.

Keywords: Cladoceran fauna, Kolavoi Lake, Zooplankton, Diversity, Chingleput.

Introduction:

Healthy freshwater ecosystems provide vital ecosystem services to human beings, including the provision of clean water for drinking, agriculture, fisheries and recreation. Freshwater habitats may be important in terms of micro crustaceans, especially the cladocerans. Planktonic crustaceans constitute an important link in the production of ecosystems. Zooplankters are a key component of aquatic ecosystems, their community structure reflecting a combination of physical, chemical and biological characteristics of the system they occupy. Cladocerans play a vital role in the energy dynamics of most lotic fresh water ecosystem (Giller and Malmqvist, 1998). Cladocerans are small sized crustaceans (0.3 – 5 mm long) occurring in various freshwater bodies such as large lakes, small ponds, temporary pools, swamps, ditches and so on. Worldwide, so far about 620 species were recorded. Most of the important species are known from the temperate zone and comparatively a small number of species were recorded from the tropical zone of Africa and Southeast Asia (Forro *et al.*, 2008). Dumont (1994) stated that around half of the cladocerans species occurred exclusively in the tropics and subtropics. In South East Asia, Cladoceran fauna are reported in Indonesia, southern part of Vietnam, Malaysia, Thailand, Assam and a brief report from Cambodia by Brehm (1933), Shiorta (1966), Idoris (1983), Sanoamuang (1998) and Maiphae *et al.*, (2005), Blache (1951), Brehm (1954) and Mizuano and Mori(1970). Rich cladocera fauna was recorded within excess of 100 species in Thailand (Sa-ardrit, 2002) ponds, swamps and lotic systems. Cladocerans are biological indicators of ecological changes. Their residues make available
information on past changes in lake environments . subfossil and contemporary Cladocera assemblages is predominantly constructive in characterizing water body conditions. (Uyanga

Tumurtogoo *et al.*, 2022). Species richness patterns varied according to water body type with water reservoirs having the relatively maximum number of species. Cladoceran communities consisted of a little unique elements considerably associated to a particular water body along with several species widespread to all water bodies(Sameer *et al.*, 2023). Environmental assortment plays a major role in structuring cladoceran communities (Yang-Liang Gu, 2021).

Materials and Methods:

Kolavoi lake:

Kolavai Lake is the second largest lake in the Kanchipuram District after the Madhuranthagam LakeKolavoi Lake is one of the biggest Lake which lies on the eastern side of the Chingleput town in Kancheepuram District. It is also known as Chingleput lake and is about 2Km from the town, adjoining the Chennai – Trichy railway line. Chingleput has railway station which is around 29 Km away from Mahabalipuram- Chennai. Kolavoi Lake is located in the Chingleput District which is 58 km away from Chennai City. It is one of the largest lakes in the Chingleput District. The total capacity of the lake is 13.50 Mm^3. The water spread area is 8.82 Km^2, 3.3 Km long and 1.6 Km wide mostly infested by the aquatic macrophyte vegetation. It is a perennial lake, water is being used for agriculture, recreation and fishing activities and irrigating about 2000h area covers 12 nearby villages. (Bharathi, 2003).

It receives water from 12 tanks and flows enormously into Palar, Neenjal and Madura rivers. It is 894 hectares large with a maximum depth of 4.5 meters. M/s. Mahindra Industrial Park Ltd., used to draw 0.6 Md water from Kolavoi Lake with permission from the Government. Roughly 200 Kg of fishes/ day are caught by fishermen (Rameshbabu and Selvanayagam, 2012).

Kolavoi Lake is facing plenty of anthropogenic stress with domestic and sewage waters being discharged into it (Rameshbabu and Selvanayagam, 2013).

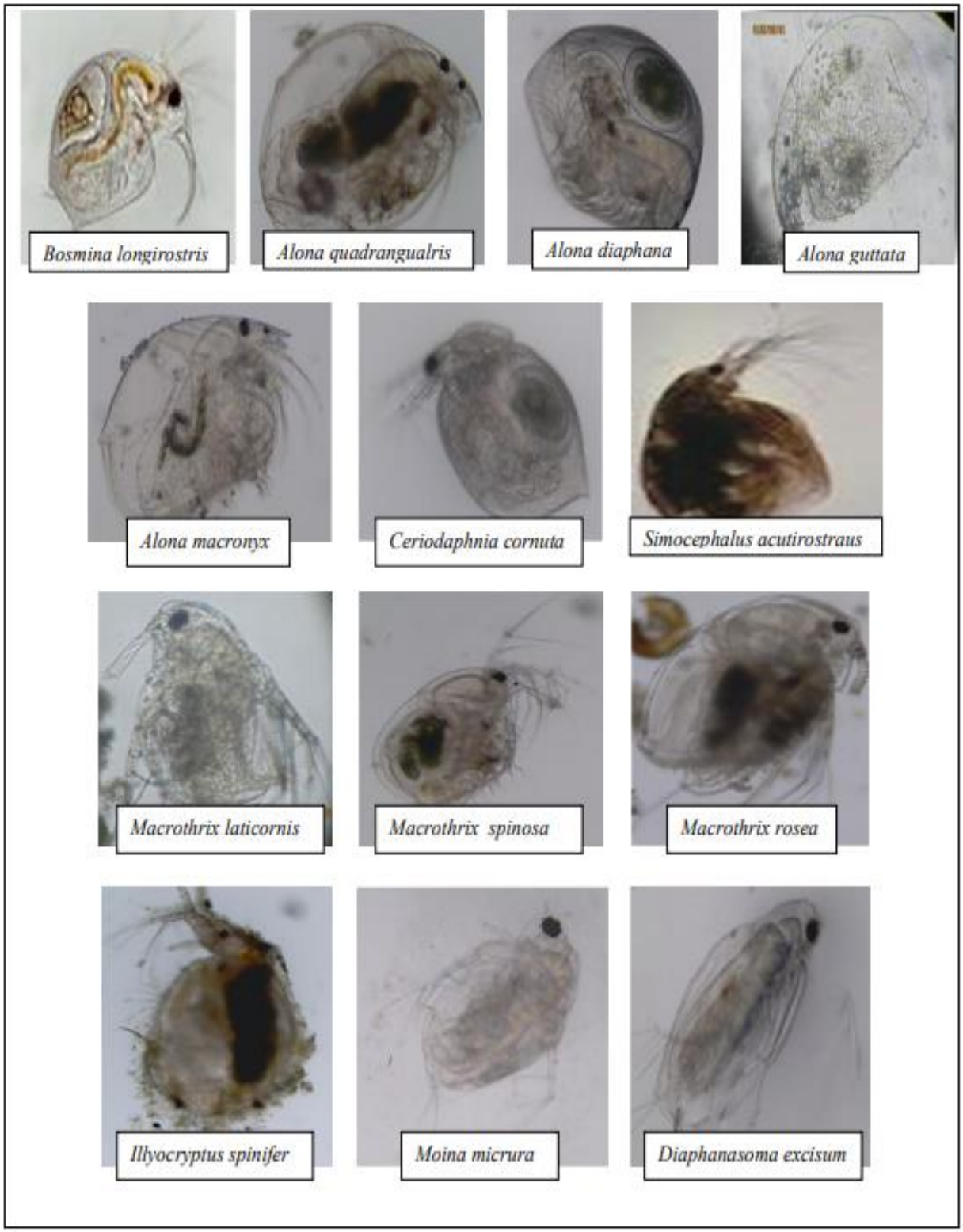
Location Description: (Fig II)

Location 1:Thirivandrum Gate. It is the inlet of the Kolavoi Lake. Lake water has been used for irrigation purposes. Location 2: It is situated nearby railway station of Chingleput. Dumping up of plastic wastes and food wastes were seen in this location. Location 3: Pulippakkam. Middle of the Kolavoi Lake. Bathing, washing and fishing activities were carried out in this location. Location 4: Paranur – situated nearby Paranur railway station. It is the outlet of the Kolavoi Lake. Here lake water has been used for bathing and animal washing purposes. Location 5: Paranur Situated nearby residential area. Household wastes are mixed with the lake water.

Weekly sampling programme was advocated. Zooplankton samples were collected using 53 and 120 µm Plankton nets. Samples were preserved in 4% formaldehyde for further identification. Specimens were sorted under dissection microscope and pictures were taken using Nikon Microscope and identified up to species level with help of standard keys (Edmondson 1959; Battish 1992; Michael and Sharma, 1988).

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 07, 2022

Figure. 1. List of species from Kolavai Lake.



Results and Discussion:

Table 1 : Distribution of cladocerans in Kolavoi Lake, Chingleput.

S.No.	Species Name	Family	L1	L2	L3	L4	L5
1	*Alona guttata*	***Chydoridae***	_	_	_	_	+
2	*Alona macronyx*	***Chydoridae***	_	+	_	_	+
3	*Alona quadrangularis*	***Chydoridae***	_	_	_	+	_
4	*Bosmina longirostris*	***Bosminidae***	_	_	+	_	_
5	*Ceriodaphnia cornuta*	***Daphnidae***	_	_	_	+	_
6	*Diaphanasoma excisum*	***Sididae***	_	_	_	+	_
7	*Illyocryptus spinifer*	**Macrothricidae**	_	_	+	_	_
8	*Macrothrix laticornis*	**Macrothricidae**	+	_	_	_	_
9	*Macrothrix rosea*	**Macrothricidae**	_	_	_	+	+
10	*Macrothrix spinosa*	**Macrothricidae**	+	+	+	+	+
11	*Moina micrura*	***Moinidae***	_	_	_	+	_
12	*Simocephalus acutirostratus*	***Moinidae***	_	_	_	+	_
13.	*Alona diaphana*	***Chydoridae***	-	-	-	+	-

Interestingly, rich cladoceran communities consisting of thirteen species were identified and recorded from five locations of Kolavoi Lake, Chingleput District, Tamil Nadu – India. Out of thirteen species recorded, four species - *Alona diaphana, Alona guttata, Alona macronyx, Alona quadrangularis* belonged to the family Chydoridae, four species – *Illyocryptus spinifer, Macrothrix laticornis, M. rosea, M. spinosa* belonged to the family macrothricidae and *Bosmina longirostris, Ceriodaphnia cornuta, Simocephalus acutirostratus, Moina micrura and Diaphanasoma excisum* were members of the family Bosminidae, Daphnidae, Moinidae and Sididae respectively (Fig.I). The relative abundance of cladocerans(Fig. IV) was *Alona diaphana (3%), Alona guttata (2%), Alona macronyx (4%), Alona quadrangularis (10%), Bosmina longirostris (3%), Ceriodaphnia cornuta (19%), Diaphanasoma excisum (9%), Illyocryptus spinifer (3%), Macrothrix laticornis (3%), M. rosea (12%), M. spinosa (22%) , Moina micrura (3%) and Simocephalus acutirostratus (3%).* Paranur location (L4 and L5) has more diverged fauna (6 species) followed by Pullipakkam (3 sps) , L2 Chingleput railway station nearby location (3 sps) and Thirivandrum Gate (3 sps) indicated

with the help of Shannon Weiner diversity indices of cladocerans (Fig.III).

The most frequent species were *Ceriodaphnia cornuta* and *Macrothrix spinosa* occuring throughout the study period. *Alona guttata, Illyocryptus spinifer* and *Simocephalus acutirostratus* were found during monsoon season but not during summer were generally infrequent. Most species recorded were present during monsoon and post monsoon season than during summer and premonsoon season. This peak is due to the consequence of the nutrient replenishment and subsequent development of edible phytoplankton species (Sommer *et al.,* 1986; Saunders *et al.,* 1999).

Cladoceran species show clear specializations that associate them with particular microhabitats within the water body; Family: Sididae cladocerans are well known for attaching to solid substrates(especially plants) by means of a dorsal gland to enable filter feeding from a sedentary position; Some members of the family Chydoridae scrape food from substrates (Gliwicz and Rybak, 1976) and are, therefore strongly associated with these habitats and favor vegetated or shallow areas rather than open water regimes.

Simocephalus is a filter feeder, particularly compared (feeding habits) to *Diaphanasoma* and *Bosmina*, at any food level (Hutchinson, 1967) making it very competitive in any mesohabitat. In shallow lakes with a well developed submersed aquatic plants littoral area, the littoral habitat can function as a refuge for zooplankton from fish and invertebrate predation that prevails in the open water. The changes in cladoceran assemblages with different vegetative mesohabitats are probably a reflection of the different requirements of cladocerans. Species may, therefore be better adapted to certain mesohabitats because of their morphological development (Body size, vision development) (Cotttenie *et al.,* 2001; Watkins *et al.,* 1983; Mass *et al.,* 1998) Feeding methods (Freyer 1985; Moss *et al.,* 1998; Watkins *et al.,* 1983), predator avoidance strategies (Blindow *et al.,* 2000; Cottenie *et al.,* 2001; Watkins *et al.,* 1983; Mass *et al.,* 1998) and migration behavior (Blindow *et al.,* 2000; Burks *et al.,* 2002). Bosminidae and Daphnidae occur in the pelagic zone, while Chydoridae mainly represent littoral benthos (Frey, 1988).

The species of *Ceriodaphnia* and *Moina* have exhibited a more sensitive nature with the changes of seasons and ecological conditions. The quantitative and qualitative variability of Cladoceran recorded in Kolavoi Lake is not only with season but also with the sites.

Research on the abundance and composition of the family Chydoridae in the littoral zone of lakes and ponds represents an important contribution to current knowledge of freshwater biodiversity. Representatives of this family make up a significant fraction of species richness of the invertebrate communities in most water bodies in temperate and tropical regions (*Santos-Wisniewski, et al.*2008)

Fig II: Satellite Image of Kolavoi Lake.

Figure III: Shannon Weiner indices for cladocerans diversity

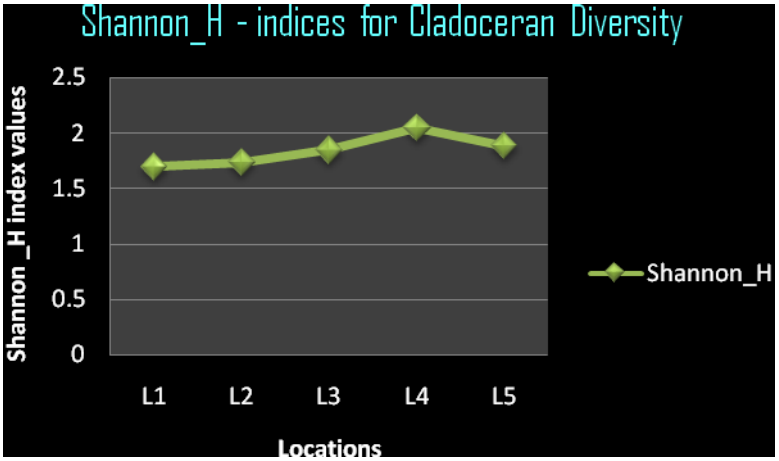
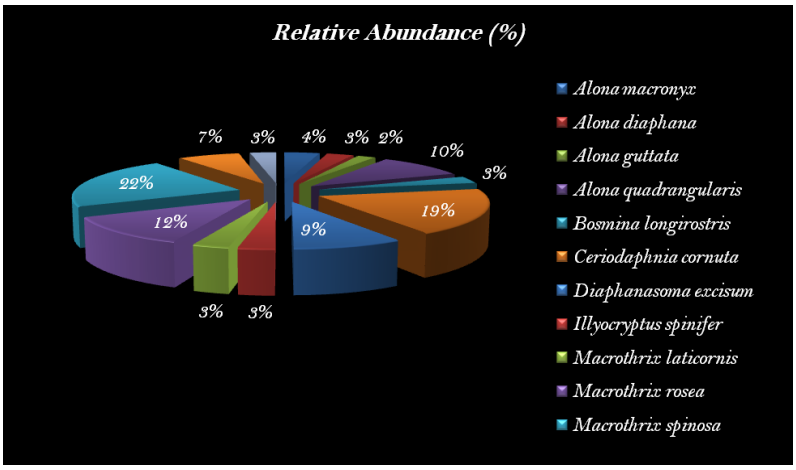


Figure IV: Relative abundance of Cladoceran from Kolavoi Lake, Chingleput.



Acknowledgement:

The authors are grateful to the UGC for their financial support.

References:

1. Battish SK., 1992. Freshwater zooplankton of India. Oxford and IBH Publ. Co. Pvt. Ltd. **1-114.**
2. Bernadette Pinel-Alloul,.; Adrien André.; Pierre Legendre.; Jeffrey A. Cardille.; Kasimierz Patalas Alex Salki., 2013. Large-scale geographic patterns of diversity and community structure of pelagic crustacean zooplankton in Canadian lakes. Global Ecology and Biogeography, (Global Ecol. Biogeogr.): 1 -12

3. Bernadette Pinel-Alloul,.; Adrien André.; Pierre Legendre.; Jeffrey A. Cardille.; Kasimierz Patalas .; Alex Salki., 2013. Large-scale geographic patterns of diversity and community structure of pelagic crustacean zooplankton in Canadian lakes. Global Ecology and Biogeography, (Global Ecol. Biogeogr.): 1 -12
4. Bernadette Pinel-Alloul.; El-Amine Mimouni ., 2013. Are cladoceran diversity and community structure linked to spatial heterogeneity in urban landscapes and pond environments? Hydrobiologia. Published online. 10 pages.
5. Bharathi D., 2003. Limnological studies of few fresh water habitats in and around Chennai City. Ph.D Thesis submitted to University of Madras, Chennai
6. Blache J., 1951. Apercu Sur le Plancton des eaux douces der cambodge Cybium 6:62-94. Blindow I,; Hargeby A,; Wagner BMA ,; Andersson G., 2000. How important is the crustacean plankton for the maintenance of water clarity in shallow lakes with abundant submerged vegetation? Freshwater Biology, Vol. 44. Pp 185- 197.
7. Brehm V., 1959. CladoceraExploration hydrobiologique des Laci Kivu, Edward et Albert (1952- 1954). 3(3): 69 – 100.
8. Brehm V., 1933. Die Cladoceran der Deutschen Limnologischen Sunda – Expedition. Archiv. Hydrobiol. Suppl. 11(4): 631- 771.
9. Burks RL,; Lodge DM,; Jeppensen E ,; Lauridsen TL., 2002. Diel horizontal migration of zooplankton : Costs, benefits of inhabiting the littoral. Freshwater Biology Vol 7. Pp 343- 365.
10. Cottenie K,; Nuytten N,; Michael E ,; De Meester L., 2001. Zooplankton community structure and environmental conditions in set of interconnected ponds, Hydrobiologia. Vol. 442, pp. 339 – 350.
11. De Bernardi R,; M Manca,; G Gicussani., 1989. Zooplankton in Lago Magggiore : An overview. Mem. Ist. Ital. Idrobiol. 46: 103 -123.
12. Dumont HJ., 1999. On the diversity of the cladocera in the tropics. Hydrobiologia 272: 27- 38.
13. Edmondson WT. 1959. Freshwater Biology, II edition, John Wiley and Sons Inc. New York. 420 – 494.
14. Forro' N. Korovchinsky,; AA Kotov ,; A Petrusek., 2008. Global diversity of cladocerans (Cladocera Crustacea) in Freshwater . Hydrobiologia, 59:177- 184.
15. Frey DG., 1987. The taxonomy and Biogeography of the Cladocera. Hydrobiologia 145: 5- 17.
16. Freyer., 1985. Crustacean diversity in relation to the size of water bodies: some facts and Giller PS,; Malmqvist B., 1998. The biology of streams and Rivers. Oxfor Univ. Press.Inc., New York.
17. Gliwicz ZM ,; Rybak. JI., 1976. Zooplankton, Pieczynsks E(ed) selected problems of lake Littoral ecology, University of Warsaw.
18. Hessen DO,; Anderson T,; Lynche A., 1990. Carbon metabolism in a humic lake: pool sizes and cycling through zooplankton, Limnology & Oceanography. 35: 84- 99.
19. Hutchinson GE., 1967. A treatise on Limnology. Vol.2. Introduction to the lake Biology and the Limnoplankton. John Wiley & Sons. New York. 1115pp.
20. Idris.BAG., 1983. Freshwater Zooplankton of Malaysia (Crustacea Cladocera). Penerbit

21. Infante A ,; AH Litt., 1985. Differences between two species of Daphnia in the use of 10 species of algae in lake Washington Limnol. Oceanogr. 30: 1053 – 1059.
22. Maiphae S,; Pholpunthin P ,; Dumont.HJ., 2005. Species richness of the cladoceran (Branchiopoda: Anomopoda and Ctenopoda) in southern Thailand, and its complementaity with neighbouring regions. Hydrobiologia. 537: 147 – 156.
23. Maria José Santos-Wisniewski,; Odete Rocha,; Adriana Maria Guntzel,; Takako Matsumura- Tundisi., 2008. Species richness and geographic distribution of the genera of Chydorus and Pseudochydorus (Cladocera: Chydoridae) in São Paulo State.
24. Michael RG ,; BK Sharma., 1988. Indian Cladocera (Crustacea:Branchiopoda: cladocera). Fauna of India and adjacent countries. Zool. Surv. India. Calcutta: 262 pp.
25. Mizuano T Mori S. 1970. Preliminary hydrobiological survey of some Southeast Asian inland waters. Biol. J.Linn.Soc. 2: 77- 117.
26. Moss B, Kornijow R ,; Measey GI ., 1998. The effects of Nymphaeid (Nuphur lutea) density and predation by Perch (Perca fluviatilis) on the zooplankton communities in a shallow lake. Freshwater Biology,, Vol 39. Pp 689 – 697.
27. Sa ardrit P., 2002. Diversity and distribution of freshwater cladocera from Trang province thesis. Prince of Songla University.(in Thai)
28. Sameer M. Padhye , Avinash Isaac Vanjare , Kay Van Damme 2023, Cladoceran community composition and diversity patterns from different lentic freshwater bodies in peninsular India. Fundam. Appl. Limnol. 196/2 (2023), 121–135
29. Sanosamuang L., 1998. Contributions to the knowledge of the cldocera of north east Thailand. Hydrobiologia 326. Pp .45 – 53.
30. Saunders P,; Porter K ,; Taylor B., 1999. Population dynamics of Daphnia spp. And implications for trophic interactions in small, monomictic lake. J.Plankton Res. 21: 1823- 1845.
31. Shiorta A., 1966. The Plankton of South Vietnam: Freshwater and marine Plankton Over. Tech. Coop. Agen. Japan.489 pp.
32. Sommer UZM,; Gliwicz W Lampert ,; A Duncan., 1986. The PEG model of seasonal succession of planktonic events in fresh waters. Arch. Hydrobiol. 106 : 433 - 471.
33. University Pertanian. Malaysia.
34. Uyanga Tumurtogoo , Aida Figler , János Korponai , Zsófi Sajtos , István Grigorszky ,Csaba Berta and István Gyulai (2022) Density and Diversity Differences of Contemporary and Subfossil Cladocera Assemblages: A Case Study in an Oxbow Lake, Water 2022, 14, 2149 Watkins ICE,; Shireman JV ,; Haller WT., 1983. The influence of aquatic vegetation upon zooplankton and benthic macroinvertebrates in orange lake,, Florida. The Journal of Aquatic Plant management Vol. 21. Pp. 78 – 83.
35. Yang-Liang Gu,Qi Huang,Lei Xu,Eric Zeus Rizo,Miguel Alonso,Henri J. Dumont and Bo- Ping Han, 2021, Species Diversity and Community Assembly of Cladocera in the Sand Ponds of the Ulan Buh Desert, Inner Mongolia of China, Diversity 2021, 13(10)