International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Diversity and Distribution of Rotifers in High-Altitude Aquatic Ecosystems

Romana Akhtar[1], Ram Kumar[2]

[1]PhD Scholar, Department of Zoology, School of Applied Sciences, Shri Venkateshwara University, Gajraula, Uttar Pradesh, India
Corresponding Author Email: *kamalromana123[at]gmail.com*

[2]Assistant Professor, Department of Zoology, School of Applied Sciences, Shri Venkateshwara University, Gajraula, Uttar Pradesh, India

Abstract: ***The present study investigates the diversity and distribution of rotifers inhabiting selected high-altitude lotic and lentic water bodies of Doda district, Jammu and Kashmir. A total of fifteen rotifer species were recorded from lotic systems, while seventeen species were documented from lentic habitats. Among lotic waters, Lepadella ovalis emerged as the most dominant species, whereas Lecane closterocerca showed maximum dominance in lentic ecosystems. Notably, three species—Keratella serrulata, Notholca labis, and Synchaeta oblonga—were recorded for the first time from the lentic water bodies of the district. Variations in species composition, abundance, and diversity indices reflect the influence of habitat type and physicochemical conditions on rotifer assemblages. The findings emphasize the ecological significance of rotifers as sensitive bio-indicators of trophic status and water quality in high-altitude freshwater ecosystems.***

Keywords: Zooplankton; Rotifers; Habitat preference; Bio-indicator; Trophic status

1. Introduction

Zooplankton form a fundamental component of aquatic ecosystems and play a vital role in energy transfer and nutrient cycling within freshwater food webs. The diversity and spatial distribution of zooplankton communities are governed by a range of biotic and abiotic factors, rendering them effective indicators of the ecological health of aquatic systems (Singh *et al*., 2013). Among various zooplankton groups, rotifers occupy a prominent position due to their rapid reproductive rates, high metabolic activity, and sensitivity to environmental changes.

The phylum Rotifera comprises microscopic metazoans generally ranging from 100–1000 µm in size, although some species may reach up to 2000 µm. Rotifers are cosmopolitan in distribution and inhabit a wide variety of freshwater environments. They exhibit diverse ecological roles, functioning as herbivores, predators, and occasionally as parasites (Wallace *et al*., 2015). Owing to their morphological diversity and feeding plasticity, rotifers serve as an important food source for fish larvae and play a crucial intermediary role between primary producers and higher trophic levels (Wallace and Snell, 2001).

Although rotifers contribute relatively little to total zooplankton biomass due to their small size, their ecological importance is disproportionately high. Their elevated ingestion and assimilation efficiencies allow rapid responses to environmental fluctuations. Consequently, their abundance and species composition closely reflect the trophic status and physicochemical characteristics of aquatic systems, making them reliable bio-indicators of water quality (Parmar *et al*., 2016; Loveson *et al*., 2020).

Rotifer diversity and distribution are strongly influenced by environmental parameters such as food availability, predation pressure, temperature, dissolved oxygen, and other physicochemical variables. While several studies have documented rotifer diversity in aquatic ecosystems of Jammu and Kashmir (Jamila *et al*., 2017; Kour *et al*., 2022), investigations from high-altitude regions such as Doda district remain limited. Therefore, the present study was undertaken to document the diversity and distribution of rotifers in selected lotic and lentic water bodies of Doda district, Jammu and Kashmir.

2. Materials and Methods

Study Area

Doda district lies between 32°53′–34°21′ N latitude and 75°01′–76°47′ E longitude in Jammu and Kashmir. The region exhibits wide altitudinal variation ranging from 841 to 4341 m above mean sea level. Five lotic (Chinta, Neeru, Bhaderwah Nallah, Puldoda and Banihal) and five lentic water bodies (Lake I, Lake II, Lake III, Fish Pond Lingai and Sarkoot) were selected for the present investigation.

Sample Collection

Rotifer samples were collected during morning hours by filtering 50 L of water through a plankton net made of bolting silk with a mesh size of 25 µm. In stations with marginal vegetation, submerged vegetation was vigorously shaken prior to filtration to dislodge attached organisms. The filtrate was preserved in 20 mL plastic vials using 5 % formalin.

Physicochemical Parameters

Air temperature, water temperature, dissolved oxygen, free carbon dioxide, calcium and pH were recorded following standard methods described by APHA (1992).

Identification and Data Analysis

Rotifers were identified under a compound microscope using standard taxonomic keys (Pennak, 1978; Adoni, 1985; Battish, 1992; Edmondson, 1992). Mastax structures were examined after treatment with sodium hypochlorite for species confirmation. Quantitative parameters such as frequency, density, abundance, relative values, Margalef's species richness index and Shannon–Weaver diversity index were calculated using standard ecological formulae.

3. Results and Discussion

Fifteen rotifer species belonging to eleven families were recorded from the lotic water bodies of Doda district. *Lepadella ovalis* was the most frequently occurring and abundant species. Among the lotic systems, Chinta stream exhibited the highest species diversity index, whereas Banihal showed complete absence of rotifers during the study period, possibly due to unfavorable physicochemical conditions.

Seventeen rotifer species belonging to six families under two orders (*Ploima* and *Bdelloidea*) were recorded from lentic water bodies. The fish pond supported the highest diversity index, indicating favorable and relatively stable environmental conditions. The occurrence of *Keratella serrulata*, *Notholca labis* and *Synchaeta oblonga* represents the first report of these species from the lentic waters of Doda district. *Philodina sp*. and *Lepadella ovalis* were the most frequently encountered species, whereas *Lecane closterocerca* exhibited maximum density and abundance.

Overall, lentic water bodies supported higher rotifer diversity than lotic systems, which may be attributed to greater habitat stability and availability of food resources. Variations in temperature, dissolved oxygen, calcium concentration, pH and free carbon dioxide were found to influence rotifer community structure. Similar relationships between abiotic factors and rotifer diversity have been reported in earlier studies (Langer *et al*., 2007; Sharmila and Rajeswari, 2015; Manickam *et al*., 2018).

4. Conclusion

The present study demonstrates marked variation in rotifer diversity across different aquatic habitats of Doda district. Lentic water bodies and vegetated littoral zones supported higher rotifer diversity due to stable environmental conditions and enhanced food availability. The first-time record of three rotifer species from this high-altitude region significantly enriches the existing knowledge of regional freshwater biodiversity. The findings highlight the importance of rotifers as sensitive bio-indicators for assessing trophic status and ecological health of freshwater ecosystems in mountainous regions.

References

[1] Adoni, A.D. (1985). Workbook on Limnology. Pratibha Publishers, C-10, Gour Nagar Sagar, India, p. 216.
[2] APHA (1992). Standard Methods for the Examination of Water and Waste Water. American Public Health Association, Washington, D.C.
[3] Battish, S.K. (1992). Freshwater Zooplankton of India. Oxford and IBH Publishing Co., New Delhi.
[4] Edmondson, W.T. (1992). Fresh-Water Biology (2nd ed.). International Books and Periodicals Supply Service.
[5] Jamila, I., Yousuf, A.R. & Parveen, M. (2017). Abundance, species diversity and spatial distribution of rotifer community of Dal Lake, Kashmir, India. Indian Journal of Ecology, 44(2), 308–313.
[6] Kour, S., Kour, S., Sharma, N. & Slathia, D. (2022). Zooplankton diversity and water quality assessment of lentic waters of Jammu, India. Indian Journal of Ecology, 49(1), 187–194.
[7] Langer, S., Jan, N. & Bakhtiyar, Y. (2007). Effects of some abiotic factors on zooplankton productivity in a subtropical pond in Jammu, India. Current World Environment, 2(1), 27–34.
[8] Loveson, E., Laxmilatha, P., Sreeramulu, K., Ranjith, L. & Megarajan, S. (2020). Influence of certain environmental parameters on mass production of rotifers: A review. Journal of the Marine Biological Association of India, 62(1), 49–53.
[9] Manickam, N. *et al*. (2018). Impact of seasonal changes in zooplankton biodiversity in Ukkadam Lake, Coimbatore, Tamil Nadu, India. The Journal of Basic and Applied Zoology, 79, 1–10.
[10] Parmar, T.K., Rawtani, D. & Agarwal, Y.K. (2016). Bioindicators: the natural indicator of environmental pollution. Frontiers in Life Sciences, 9(2), 110–118.
[11] Pennak, R.W. (1978). Freshwater Invertebrates of the United States (2nd ed.). Wiley-Interscience Publication.
[12] Sharmila, R.J. & Rajeswari, R. (2015). A study on physico-chemical characteristics of selected ground water samples of Chennai City, Tamil Nadu. International Journal of Innovative Research in Science, Engineering and Technology, 4(1), 95–100.
[13] Singh, U.B. *et al*. (2013). Planktonic indicators: A promising tool for monitoring water quality. Ecology, Environment and Conservation, 19(3), 793–800.
[14] Wallace, R.L. & Snell, T.W. (2001). Phylum Rotifera. In: Ecology and Classification of North American Freshwater Invertebrates.
[15] Wallace, R.L., Snell, T.W. & Smith, H.A. (2015). Rotifers: ecology and general biology. In: Thorp, J. & Rogers, D.C. (Eds.), Thorp and Covich's Freshwater Invertebrates. Elsevier, Waltham (MA), pp. 225–271.