



Interaction among macrobenthic molluscan diversity of river Ganga and ecological variables by using multivariate indices

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Abstract

Ganga river is one of the important water bodies harbouring different aquatic communities especially sedentary benthic organisms. We determined several macrobenthic molluscan faunas including 24 species comprising of 18 gastropods and 6 bivalves. The maximum species diversity with a value of 2.08 was recorded during monsoon, whereas the species richness was found to be highest (0.809) during winter. To determine the correlation between the physicochemical parameters of water, sediment and macrobenthic organisms, we have employed the canonical correspondence analysis (CCA) for middle, lower and estuarine stretches of river Ganga. The water CCA components, CCA1 and CCA2, explained 48.64%, 47.01%, 45.11% ($p = 0.568, 0.019$ and 0.417) and 18.11%, 26%, 23.9% ($p = 0.98, 0.292$ and 0.978) between the environmental parameters and macrobenthos correlation, respectively. Similarly, the CCA components for soil showed a percentage of 41.82%, 41.58%, 24.73% in CCA1 ($p = 0.156, 0.026$ and 0.922) and the CCA2 revealed a percentage value of 24.23%, 25.58%, 23.59% ($p = 0.446, 0.174$ and 0.488) of the mentioned parameters. The present study explored a dual relationship between the organisms and environmental factors according to their abundance and distribution pattern.

Keywords Mollusca · River Ganga · Ecological parameters

Introduction

Freshwater ecosystems act as source and sink for those chemicals which are biologically important and operate as phosphorus, carbon, nitrogen, sulphur and silicon cycles (Fisher 1982). Macrobenthic organisms, inhabitants of the sediment, play an important role in maintaining the nutrient content of the soil as well as water for better primary production. It also helps in maintaining nutrient cycles for trace elements, radionuclides and xenobiotics (Jones and Bowser 1978). To understand well about a particular habitat and its importance, it is recommended to study a group of inhabitant organisms rather than studying an individual species (Rao 1991). Several studies have been conducted on the chief importance of the benthic macroinvertebrates in the lotic ecosystem (Sharma et al. 2011; Gupta et al. 2015;

Lau et al. 2017; Cha et al. 2018). To provide a congenial niche for an ideal aquatic biota, a lotic body requires certain criteria based on richness, composition, relative abundance of a species (either individual or in the group) and their ecological engagement with co-organisms (Gupta et al. 2015). Within the macrobenthic invertebrates, the molluscs play an important role in water biomonitoring and maintaining the health and integrity of the aquatic ecosystem. To understand well about temporal population dynamics and community alterations, it is required to investigate species specific interaction with the abiotic environment affected by endogenous and exogenous factors covering the core of ecology and evolution process (Higgins et al. 1997; Belyea and Lancaster 1999; Semseth et al. 1999; Lundberg et al. 2000). The presence and abundance of many molluscan species like *Filypsaludina bengalensis* provide relevant information on the status of the physico-chemical condition of water (Gupta et al. 2013). India, the land of rivers, produced a large number of publications based on the benthic community including lakes, wetlands and ponds but recent evidence on spatio-temporal variation, distribution and composition of the benthic molluscan fauna in relation to environmental factors is inadequate. Therefore, the objective of the present

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