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Studies on zooplankton egg bank diversity of ephemeral water body in the Loni area of the Ahilyanagar District by using the soil sediment rehydration method

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Abstract

Ephemeral pools, which are transient bodies of water, are essential habitats for invertebrates and vertebrate species, such as zooplankton. These short-lived rainy-season ponds are fast disappearing as a result of human activity and environmental elements including pH, salinity, and temperature. In addition to greatly enhancing regional variety and serving as a unique source of flora and wildlife, they also serve to manage flooding and replenish groundwater. However, owing to water management practices and climate change, they are at risk of habitat loss, changes in soil qualities, and altered hydrological seasons. In order to contribute to food chains and webs, comprehend variety patterns and species distributions, and create conservation plans, it is imperative that these water bodies be monitored.

Keywords: Rehydration, resting eggs, temporary pools, zooplankton

Introduction

Ephemeral water bodies, derived from the Greek word ephemeris (William, 2006) [9], are studied using artificial rehydration of dry sediments containing dormant eggs. This method can add data for species missed during field sampling, particularly in variable systems like shallow lakes and ephemeral pools (Waterkeyn *et al.* 2009) [8]. Banks of resting stages occur in most aquatic environments, particularly in variable systems like shallow lakes and ephemeral pools (de Stasio, 1989) [5]. Combined data from field sampling and rehydration provides better information to check biodiversity of aquatic organisms, including zooplankton. Zooplankton play a crucial role in aquatic systems due to their link between phytoplankton and higher trophic levels. Their composition of proteins, minerals, fatty acids, and lipids provides essential feed for fish. Many zooplankton that might be missed during field sampling can emerge through their resting eggs, which are deposited in sediments. The egg bank can be considered as an archive of local habitat due to changes in species assemblage and genotype from past to present due to natural or anthropogenic activities. A portion of resting eggs sinks to the bottom of the lake, contributing to the buildup of the resting egg bank. In present study, we focused on the soil egg bank diversity and emergence pattern of zooplankton by artificial rehydration of dry sediment.

Methodology

The study site was a temporary pool on Nandur Shingote-Loni state Highway in Maharashtra, India (Lat.19.61 6311[^]°, Long. 74.422335). Dried sediment was collected on March 25, 2022, from a small pond with a muddy bottom. The habitat lasts 4-5 months from the monsoon and is typically inundated again in the next season.

a) Dry sediment sampling

The study collected dry sediments from various pond sites and soil samples from 1-1.5 cm from the dried surface, as the most viable eggs in sediment cores occur in the upper

centimeters, and further sun dried for complete drying (Luc Brendonck & Luc De Meester 2003) [2].

b) Rehydration setup:

The study involved crushing dry sediment into fine powder and rehydrating it using modified SAR'S method. The

sediment was rehydrated in dechlorinated aged tap water and observed every 24 hours to check hatching. Water samples were taken from all three beakers, and physico-chemical parameters were checked daily. The experiment was terminated after three consecutive days of no further hatching (Bhusnale *et al.*, 2016) [1].



Image 1: a) Selection of Study site b) Dry sediment sampling c) Rehydration setup

Results



Image 2: Zooplankton fauna emerged from soil sediment rehydration

1.Cyclopoid Copepod	-Cyclopods are distinguished from other copepods by having cost antennae shorter than the length of the head and thorax, and uniramous second antennae. - The main joint lies between the fourth and fifth segments of the body. -The body of copepods is year drop shape, contain a thin, almost transparent exoskeleton, and two pair of antennae. -Copepods lack a circulatory system and gills. Instead, oxygen is absorbed directly via the skin.
2. Calanoid Copepod	-Calanoids can be distinguished from other copepods by having first antennae at least half length of the body and biramous second antennae. -Gymnoplean tagmosis (boundary between fifth and sixth segments of the body). -However, their most distinctive anatomical trait is the presence of a joint between the fifth and sixth body segments. -The largest specimens reach 1-8 millimeters (0.71 in) long, but most do not exceed 0.5-2.0mm (0.02-0.08 in) long.
3.Cypretta (Ostracod Species)	-They are small crustaceans, typically around 1 mm (0.039 in) size, but varying from 0.2to 30mm (0.008to1.18 in) in the case of gigantocypris. -Their bodies are flattened from side to side and protected by a bivalve-like, chitinous or calcareous valve or "shell". -Ostracods are group together based on gross morphology. -These biological attributes predict them to from successful radiation in these habitats.
4.Heterocypris (Ostracod species)	-They are small crustaceans, typically around 1 mm (0.039 in) size, but varying from 0.2to 30mm (0.008 to1.18 in) in the case of gigantocypris. -Their bodies are flattened from side to side and protected by a bivalve-like, chitinous or calcareous valve or "shell". -They occur in temporary water bodies and produces drought- resistant egg, mixed/ parthenogenetic reproduction, and the ability to swim. -These biological attributes predict them to from successful radiation in these habitats.
5.Fairy shrimp (nauplii)	-Fairy shrimps are medium sized Branchiopods, usually 0.39 -1.18 in (1.3 cm) long; but a few raptorial species, such as Branchinecta gigas may grow as long as 3.9 in (10cm). -The fairy shrimps' thoracic limbs are flattened and leaf-like, without true joints; the body lacks a carapace. Having 11 pairs of limbs, some 10, 17 or 19 pairs.

	-The sexes are separate, except in some strains of artemia, which may be parthenogenetic, they swim upside down -Males have modified second antenna that serve to grasp females the antennae may also demonstrate structural complexity.
6. Triops (nauplii)	-Triops longicaudatus commonly known as a tadpole shrimp because the body superficially resembles a tadpole larva. -Triops longicaudatus is a fairly large tadpole shrimp, with a length of 10 to 40 mm long, a width of 3 to 8 mm and a mass of 2 to 2.59. -The body of T. longicaudatus tends to be a brown or grayish yellow colour and is segmented into a head, thorax and abdomen. -A female keeps her eggs in the egg sac for several hours after fertilization.
7. Brine shrimp (nauplii)	-Brine shrimp inhabit brine pools and other highly saline inland waters throughout the world, they are filter feeders & feed primarily on green algae -Measuring up to 15 mm (0.6 mm) in length, the body of brine shrimp has a discrete head with nauplius (larval) eye and stalked compound eyes, a thorax bearing a series of leaf-like limbs, and a slender abdomen without appendages. -Brine shrimp normally swim in an upside-down position by rhythmically beating their legs. -Young brine shrimp hatched from dried eggs are used widely as food for fish and other small animals, birds etc.
8. Rotifer	-Most rotifers are around 0.1-0.5 mm long (although their size can range from 50 µm to over 2mm) -They are common in fresh water environments throughout the world with a few salt water species. -Some rotifers are free swimming and truly planktonic others move by inchworming along a substrate. -Rotifers are an important part of the freshwater zooplankton being a major food source and with many species also contributing to the decomposition of soil organic matter.

Discussion and Conclusion

In high-altitude lakes, the accumulation of various species, generations, and genotypes in sediments represents a potential biodiversity reserve, and diapausing eggs is an essential survival strategy. From a freshwater pond, eight distinct species were found, including Rotifers, Copepods, Ostracoda, and prawns. The zooplanktons found in freshwater bodies in India offer valuable information about the local ecosystem. Because of changes in species composition and genotype brought about by anthropogenic or natural activity, the eggs bank may be seen of as an archive of the local ecosystem. The huge branchiopods from the temperate zone with a short hydroperiod of 4-5 months are studied in this study to depict their emerging pattern and population dynamics. The research also looks at the hatching dynamics of the nearby temporary body of water, which is in danger from trash. Our initial research in this area on the huge branchiopod emergence pattern serves as a foundation for understanding the hatching dynamics, which will be useful in further research on the rehydration of dry sediments from temperate climates.

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