InSight Bulletin: A Multidisciplinary Interlink International Research Journal
Peer Reviewed International, Open Access Journal.
ISSN : 3065-7857 / Website: https://ibrj.us / Volume-2, Issue-8 / August - 2025

Original Article

Investigation of Diversity of Some Diatoms in water of Purna river from Akola District

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Manuscript ID:
IBMIIRJ -2025-020836

Submitted: 15 July 2025

Revised: 25 July 2025

Accepted: 15 Aug 2025

Published: 31 Aug 2025

ISSN: 3065-7857

Volume-2

Issue-8

Pp. 141-145

August 2025

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Quick Response Code:

Web. https://ibrj.us

DOI: 10.5281/zenodo.17731076

DOI Link:
https://doi.org/10.5281/zenodo.17731076

Abstract

Diatoms are photosynthesising algae, they have a siliceous skeleton (frustule) and are found in almost every aquatic environment including fresh and marine waters, soils, in fact almost anywhere moist. Diatoms may occur in such large numbers and be well preserved enough to form sediments composed almost entirely of diatom frustules these deposits are of economic benefit being used in filters, paints, toothpaste, and many other applications. They are important source of food to aquatic animals. The present study analyses, the diversity of Diatoms of Purna river from Akola District, Maharashtra.

Keywords: *Diatoms diversity, Frustules, marine, sediments, Purna river.*

Introduction:

Diatoms, a type of microalgae distributed worldwide, are potential sources of biomass, lipids, and high-value compounds. Diatoms are commonly between 20-200 microns in diameter or length, although sometimes they can be up to 2 mm long. The cells may be solitary or colonial (attached by mucous filaments or by bands into long chains). Natural water contains different types of impurities that are introduced into aquatic systems in different ways, such as weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere, and several human activities, including mining, processing, and the use of metal-based materials. The increased use of metal-based fertilizers in the government's agricultural revolution could result in a continued increase in the concentration of metal pollution in freshwater reservoirs due to water run-off. (Pandey et al., 1993). Diatoms are found almost everywhere in photosynthesizing alga. They have a hard, glass-like shell called a frustule made of silica and can be found in almost all wet places such as fresh and salt water, soil, and even moist areas. They are tiny, single-celled, or sometimes live in groups in salt, brackish, and fresh waters. They can be simple, branched, or even covered by a jelly like layer or a tube. All diatoms are enclosed in a shell made of two parts that fit together, which are held together in a Bya band-like area called the girdle. do n to move much or only a little by secreting a sticky substance along a narrow groove or channel, called a raphe. Being able to make their own food, they live only in the top layer of water where there is light, usually not deeper than about 200 m, depending on the clarity of the water. There are types that live at the bottom and float. Diatoms are classified as protists, eukaryotic organisms that are not plants, animals, or fungi. They are officially grouped under the Cryophyte division in the class Bacillariophyceae. This group is known to have cell walls that are made of silica. Diatoms are divided into two main groups: Centrals, Biddulph ales, Penniless, and Bacillariales. The pennate diatoms have elliptical or rectangular shell shapes and are symmetrical along the central line. Centrals have shells that are circular, triangular, or square shaped and are seen as rectangles or oval-shaped when viewed from the side. Diatoms can be single or can form colonies. Each cell had two or more golden-brown chloroplasts, a large central vacuole, and a large diploid nucleus. Cryophytes are algae that form special protective structures inside their cells, store oils instead of starch, have a shell made of two parts, and produce silica at some point in their lives. The first known diatom shells that were found were of the centric type from the Early Jurassic period, but few remains were found before the Late Cretaceous. These diatoms were not significantly affected by the mass extinction that occurred at the end of the Cretaceous. Diatoms are very important producers in the ocean, playing a key role in the carbon cycle and helping to remove biogenic silica from the surface of water. Diatoms play an important role in the environment. They use sunlight to make their own food, which helps produce a large part of the oxygen and carbon that the Earth needs. Approximately 20–25 percent of the planet's total plant growth comes from diatoms. In the ocean, diatoms fix carbon equal to all carbon made by rainforests on land. This makes diatoms a major food source for many sea creatures, from tiny crustaceans to fish, seabirds, and whales. Because of heavy siliceous frustules, planktonic diatoms tend to sink through the water column, carrying organic carbon to the deep zones of the ocean (Reid et al.,1995).

How to cite this article:
Badgujar, V. N. (2025). Investigation of Diversity of Some Diatoms in water of Purna river from Akola District. InSight Bulletin: A Multidisciplinary Interlink International Research Journal, 2(8), 141–145. https://doi.org/10.5281/zenodo.17731076

Aims And Objectives:

To Investigate the diversity of diatoms in Purna river from Akola District.

Review Of Literature:

Manoj et al.(2014) used drinking water quality standards to describe the quality parameter set for drinking water (Wiki). Groundwater is a major drinking water source. Approximately 65% of the human body consists of water. Of the total water consumed by human beings, more than 50% is consumed for industrial activity and only a small proportion is used for drinking purposes; Ghosh and Basu (1968) describe that 70% of the earth's surface is covered by water. Most of the water available on Earth is saline, and only 3% of it exists as fresh water. Freshwater has become a scarce commodity owing to over-exploitation and pollution. Diatom communities respond directly to physical and chemical changes in the environment. Previous studies on diatom ecology have shown that community structure depends on many factors, including organic matter pH, nutrient depth, and water temperature.

Afonina et al. (2020): Cormick and Stevenson (1998) studied the large diversity of ecological preferences between species, resulting in structural changes in the diatom community. In addition, the relatively short generation time causes diatoms to rapidly respond to environmental changes and consequently provide an early signal in the event of pollution.

Ruhland et al.(2008) used diatoms to track the effects of climate change and nutrient enrichment. They also often dominate algal communities in many freshwater systems.

Rana et al., (2019) introduced a topic named A systematic review on various diatom species associated with drowningWhen someone drowns in water that has diatoms, these tiny organisms can be forced into their lungs and then move to other parts of the body. There are not many tests available to help diagnose drowning deaths. The way diatoms are taken out of tissue samples depends on how well they can be digested, how much can be recovered, how much of the sample is destroyed, and how long it takes to completely breakdown the diatoms. This paper looks at recent progress in diatom testing, the types of samples used, and the specific kinds of diatoms linked to drowning. Scottetal.(2018) introduced a topic called "freshwater diatom transfer to clothing: Spatial and temporal influences on trace evidence in forensic reconstructions." This study aimed to explore three spatial and temporal factors that affect how much trace material, specifically freshwater diatoms, is transferred to clothing. A series of experiments were set up to look at how different factors like the characteristics of the surface being touched, the environment where the diatoms came from, and the physicalshape of the diatoms, affect the number and variety of diatoms found on clothing. The diatoms were taken out using a hydrogen peroxide extraction method and then examined under a microscope. The results showed that the transfer of diatoms to clothing varies, with more diatoms and a greater variety of species being found on woven surfaces like acrylic, linen, and viscose.Analysis of water samples for study of Diatoms: Water sample was collected by using plastic bottle, glass bottle or polythene bottles, no any reactive material containing container is use for sample collection to avoid contamination of water sample, before analysis the sample. The samples were taken during Summer (March 2024) onsite measurements were done. Monthly water samples were collected early in the morning from Purna river, Dist.Akola, Maharashtra, India. The analysis of sample were carried out at laboratory of P.G Department of Botany Shri. R.L.T. College of Science, Akola.

Discrption of Study Area: Akola is one of the most famous cities in Maharashtra. The Purna River begins in the Amravati district of Maharashtra and flows through Akola, Buldhana, and Jalgaon districts. It eventually flows into the Gulf of Khambhat near Navsari in southern Gujarat. The word Purna is complete and is also known as Sampoorna. The Purna River has its source in the Gawilgarh hills at 21°36' N and 77°36' E near Bhainsdehi in the Betul District of Madhya Pradesh.

Purna River:

The Purna River is located in Western India. The river runs parallel to the Tapi River. The river rises in the eastern Satpura range of southern Madhya Pradesh and flows westward, draining Maharashtra's Vidarbha region before flowing into the Tapi River at Changdev in Jalgaon, Maharashtra. The watershed lies mostly in the eastern Vidarbha region of Maharashtra State and is nearly 7500 km.. The word Purna means complete andis also called 'Sampurna. ' The Purna River has many smaller rivers that flow into it. These are the Aarna, Uma, Pendhi, Katepurna, Shahanur, Bhav Khuri, Bulsara, Chandrabhaga, Morna, Mann, Gandhari, Nirguna, Aas, and Vaan Rivers.

Collection of sample: Purna River lies towards the northern and southern parts of Akola district and parts of Washim district, forming near–190-200 meters thick lava flows covering an area of 941.39 sq.km. Samples collected from the Purna River were stored in glass bottles and immediately preserved by adding Lugol's iodine solution. The samples were analysed according to standard methods.

Handling and Preservation of Collected Water Sample: The water sample containers were labelled with the name of the sampling site, date, time of sampling,and type of sample. The samples were labelled and sealed tightly. They were brought to the laboratory in an ice box and stored in a deep freezer to stop any biological activity in the samples. Similarly, the water sample collected for diatom sampling was preserved by adding Lugol's solution immediately.

Fig. Collected Water Sample from Purna River

Diatom Sample Analysis and Identification: Diatom samples were collected from the Purna River, and the freshly collected samples were immediately transferred to a reagent bottle. Ther samples were preserved by adding Lugol's solution. The samples were collected during the summer, and on-site measurements were performed. Monthly water samples were collected early in the morning from the Purna River in Dist Akola, Maharashtra, India. The analysis of the samples was carried out at the laboratory of the P.G. Department of Botany Shri. R.L.T. College of Science, Akola. The identification of diatoms was based on the observation of morpho-anatomical characteristics using a light microscope, and taxonomic identification and nomenclature were made by consulting literature and monographs.

Observations And Results: In the present study, the diversity of Diatoms of Purna river of Dist. Akola and Maharashtra were analysed for a period of 3 months from (February to April 2024). During the present investigation, four species of freshwater diatoms belonging to the Class Bacillariophyceae were reported from the Purna River, Akola district of Maharashtra. *Tubularian*, *Amphipleura*, *Craticula*, *Fragillaria.*

Identification: Taxonomic identification and nomenclature were made by consulting the literature and monographs (Gandhi, 1955; Husted, 1959; Hendey, 1964; Prescott, 1975). Diatoms are microscopic and mostly unicellular algae that have the green pigment chlorophyll and yellowish-brown pigment xanthophyll. Members of the division bacillariophytes are known as diatoms. Diatoms belong to the kingdom Chromistan. (Bacillariophyta)

1.Tubularia
2. Amphipleura
3.Craticula
4. Fragillaria .

Taxonomic Account: Taxonomic description of freshwater diatom genera during the study period. Bacillariophyta comes from the Latin word Bacillus, which means little stick or rod, and the Greek word Phyta means plant. Diatoms are present in the river. Bacillariophyta is a pennate diatom that is elongated with surface markings at right angles to the long axis, an arrangement called bilateral symmetry.

Taxonomic Position of *Tubularia* :
Class: Bacillariophyceae
Order: Fragilariales
Family: Fragilariaceae
Genus: *Tubularia*

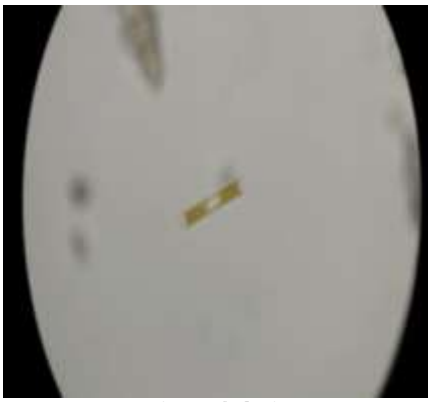

Fig: *Tubularia*

Valves 21-400 µm elliptic long and 3.1-5.3 µm broad, elliptic or elongate and variable in outline from narrowly linear to linear-lanceolate or lanceolate valves with rounded or capitate ends.

Taxonomic position of *Amphipleura*
Class: Bacillariophyceae
Order : Naviculales
Family : Amphipleuraceae
Genus: *Amphipleura*

Fig. *Amphipleura*

The genus was first describe by Fridscg througott kut Zing in 1844. The genus has cosmopolitan distribution. Amphipleura is a genus of Diatoms belonging to the family Amphipleuraceae.

Taxonomic position of *Craticula*:

Class: Bacillariophyceae
Order : Naviculales
Family: Stauroneidaceae
Genus: *Craticula*

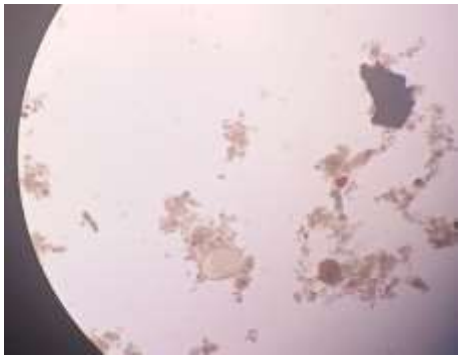

Fig:*Craticula*

Craticula is a type of diatom that lives in or on the top layers of freshwater sediment. Besides its shape, this genus is different from similar species because it moves in response to light.

Characters**:** Members of the division Bacillariophyta are diatoms. These organisms are named based on the cell walls of diatoms, which are divided into two parts. Diatoms belong to the kingdom Protista. The protists secrete extracellular enzymes. These enzymes convert complex or compound substances to simple substances.

Taxonomic position of *Fragilaria*:

Class: Bacillariophyceae
Order :Fragillariale
Family :Fragillariaceae
Genus :*Fragillaria*

Fig. *Fragillaria*

Fragillaria is a type of diatom that lives in both fresh and salt water. It usually grows in groups, forming long strands of cells. These cells are connected by small parts on the front and middle of their shell-like structures. Each diatom looks rounder in the middle part of its body.The genus currently accounts for around 93% of all diatoms in the river. Fragillaria has been the dominant genus of Diatoms.

Economic importance of Diatoms: Diatoms are the greatest agency in the water for converting inorganic into organic matter; hence, knowledge of diatoms is fundamental to the study of the food supply of fish and other aquatic animals. Diatoms also play an important role in the energy and nutrient cycles of water resources. Diatoms are used in the biotechnology industry to produce cellulose and chitin, which can be used to make biodegradable plastics. Diatoms are used to filter water, particularly water, in hot tubes and swimming pools. Diatoms are used in the production of alcohols, sugar filters, antibiotics, and syrups**.**

Discussion:

Diatoms are a widely distributed group of algae whose representatives populate both aquatic (marine and freshwater) and terrestrial ecosystems, such as soils, mosses, wet walls, and rocks (Round et al., 1990, Smol and Stoermer 2010) and play a key role in the nutrient cycle and energy flux (Benoiston et al.,2017). In seas and oceans, the organic carbon produced by diatoms is consumed rapidly and serves as a base for marine food webs. In coastal waters, diatoms support the most productive fisheries. In the open ocean, a relatively large proportion of diatom organic matter sinks rapidly from the surface, becoming food for deep-water organisms (Armbrust 2009). Soils and other terrestrial ecosystems have more severe effects on diatoms and differ from aquatic ecosystems in diatom species composition, although diatoms can be the dominant algal group during periods of the year with high soil moisture (Foets et.al., 2020).

Diatoms are regularly used as biological indicators for environmental water quality assessments (Reid et. al, 1995). The analysis of diatom communities and their biodiversity is a useful tool for securing the ecological and sustainable use of water resources and the correct elaboration of guidelines for their preservation, particularly in specially protected natural areas. Recent studies have shown that natural springs in protected areas may act as biodiversity hotspots. In the present study, four diatoms

were identified from the collected samples across the Purna River: Tubularia, Amphipleura, Craticula, and Fragillaria. The distribution pattern of diatoms was strongly influenced by environmental factors. The preliminary analysis of selected study sites showed rich diatom diversity, indicating the presence of both pollution and good health, which is a matter of interest for further investigation in the future.

Conclusion

In the present investigation, four diatom species were obtained from pure cultures from the Purna River, Maharashtra, India, which is an evidently rich diatom species at this site. As diatoms play very important roles from an ecological point of view, the present basic information from the diatom database and their distribution and diversity would form a useful tool for further ecological assessment and monitoring of the Purna River.

Acknowledgment

The author expresses heartfelt gratitude to the Principal and Management of Shri R.L.T. College of Science, Akola, for providing necessary laboratory facilities and encouragement during the research work. Sincere thanks are also extended to the Head, Department of Botany, for valuable guidance, constant motivation, and support throughout the study.

The author is deeply thankful to colleagues and laboratory staff of the Department of Botany for their timely help and cooperation in sample collection, preservation, and analysis. Appreciation is also due to all those who directly or indirectly contributed to this investigation.

Finally, the author extends special thanks to her family members for their patience, inspiration, and constant encouragement during the completion of this research work.

Financial support and sponsorship

Nil.

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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