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ALGAL DIVERSITY OF THE SHEKHAWATI REGION WITH SPECIAL REFERENCE TO CHURU DISTRICT (RAJASTHAN, INDIA)

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ABSTRACT

The Shekhawati area of Rajasthan state comprising Churu, Sikar, and Jhunjhunu districts is famous for its cultural heritage and deserts. Churu is one such place that is among the hottest parts of India with temperatures frequently crossing 48°C during summer and average rainfall of 250–300 mm per year. In spite of such extreme conditions, a surprising range of algae thrive in water bodies like ponds (talabs), stepwells (baoris), johads, canals, and seasonal rainwater pools. The present paper deals with a critical review of the diversity of algae in the Shekhawati region with special reference to Churu District. It discusses ecological functions of algae, their desert adaptations, climatic control, and cultural significance of traditional water harvesting systems in maintaining biodiversity. Seasonal surveys indicate that green algae control fresh ponds during monsoon, while cyanobacteria survive in saline, nutrient-poor waters all summer. Diatoms occur in permanent sediments and stepwells, while euglenoids thrive in nutrient-rich waters impacted by human actions. The research weaves global desert algal studies with local case histories like Sambhar Lake and Tal Chhapar Sanctuary, emphasizing the universal adaptability of algae in harsh climates. The discussion draws attention to algae's role in oxygen generation, soil fertility, and bioindication of water purity. It also identifies threats from climate change, water pollution, and neglect of traditional reservoirs. The paper concludes by recommending conservation of water bodies, community participation in water management, and further research into algae's potential applications in biofertilizers, biofuels, and nutraceuticals. By documenting algal diversity in Churu, this study contributes to both ecological understanding and the cultural appreciation of water heritage in arid India.

1. INTRODUCTION

Algae are simple, photosynthetic organisms that form the backbone of aquatic ecosystems across the globe. From the oceans to mountain lakes, from rice fields to temporary rain-fed puddles, algae flourish wherever water is available, however briefly. They produce nearly half of the Earth's oxygen, form the base of aquatic food chains, and contribute significantly to global carbon fixation. Yet, in deserts and semi-arid regions, algae are often overlooked due to the scarcity of visible water.

The ability of algae to colonize harsh habitats is remarkable. Many groups survive extreme salinity, desiccation, high temperatures, or nutrient scarcity. For example, blue-green algae (cyanobacteria) create biological soil crusts that stabilize dunes and fix atmospheric nitrogen into nutrient-rich soils otherwise bereft of nutrients. Diatoms survive by encapsulating themselves in silica frustules that withstand lengthy periods of dryness. Green algae do well in ephemeral pools, rapidly reproducing before water evaporates.

In India, Rajasthan is an ecological paradox. While famous for being a desert state, Rajasthan also supports rich aquatic life in its stepwells, ponds, and salt lakes. The Shekhawati zone—Churu, Sikar, and Jhunjhunu—has a combination of cultural heritage and ecological importance that is quite distinct. Renowned for its painted havelis, Shekhawati has wonderful instances of advanced water harvesting systems over the centuries. Talabs, baoris, and johads harvest and store rainwater, forming oases of biodiversity in semiarid conditions.

Churu, which is the subject of this research, is the most severe of the Shekhawati districts. Dubbed the 'Gateway to the Thar Desert,' it is notorious for hot summers with temperatures reaching 48°C and frequent dry spells. And yet, algae are found wherever water pools—whether it is Sethani ka Johara, a massive 19th-century stepwell built during times of famine relief, or temporary pools in Tal Chhapar Sanctuary. Seeing algae in such an environment is a reminder of their ability to thrive and their place in the ecosystem.

This paper seeks to examine algal diversity in Shekhawati with particular reference to Churu District. The goals are multifaceted: (1) to report the extent of algal groups found; (2) to examine how environmental parameters affect their distribution; (3) to evaluate their ecological and cultural value; and (4) to delineate conservation requirements and research potential. Through the integration of ecological information with the local cultural background, this research illustrates that algal richness in Churu is equally a tale of adaptation as it is of heritage.

2. Study Area: Churu District

Churu District lies in northeastern Rajasthan, forming the westernmost part of the Shekhawati region. Geographically, it borders Bikaner and Hanumangarh to the west, and Sikar and Nagaur to the south. The district landscape is dominated by sandy plains, dunes, and semi-arid scrub vegetation. Its soils are predominantly sandy and prone to erosion, making water retention difficult.

Climatically, Churu is classified as hot desert (BWh under the Köppen system). Summers are extremely hot, with maximum temperatures above 48°C. Winters can be surprisingly cold, with minimums dropping near freezing. Rainfall averages only 250–300 mm annually, most of which

falls during July to September. Rainfall variability is high, and droughts are common. High evaporation rates often exceed precipitation, causing water scarcity.

Despite this, traditional water management has enabled human settlement and biodiversity persistence. Sethani ka Johara, located near Churu town, is perhaps the best-known stepwell. Built by a merchant's widow in 1899, it continues to be a community pool where locals, animals, and birds come together. Tal Chhapar Sanctuary, located in the southeastern part of the district, is renowned for blackbucks and migratory harriers. Its wetlands also accommodate algal blooms post-rain, connecting aquatic microflora to terrestrial food webs.

Small johads and talabs punctuate villages, holding invaluable monsoon water. While some become saline through evaporation and provide an environment favoring halotolerant cyanobacteria and diatoms, others stay fresh for several months, hosting green algae and zooplankton. This patchwork of aquatic environments—permanent, seasonal, fresh, and saline—constitutes the ecological base of algal diversity in Churu.

3. Review of Literature

Algal studies in Rajasthan were undertaken a few decades ago, and researchers reported unexpected richness in dry regions. Singh and Kumar (2019) identified 323 species from 93 genera in dry districts such as Churu, Jodhpur, and Bikaner. The highest number of Chlorophyceae was followed by Cyanobacteria, Bacillariophyceae, Euglenophyceae, and Dinophyceae.

Sambhar Lake, India’s largest saline lake, has been the subject of detailed studies. Seasonal alternations in algal dominance have been recorded: green algae flourish in monsoon months, while cyanobacteria dominate in peak summer. Similar patterns have been observed in temporary pools of Jaisalmer, where desmids and Scenedesmus proliferate after rainfall but vanish with desiccation.

Globally, desert algal studies reveal parallel trends. In the Sahara, cyanobacteria form soil crusts that prevent erosion. In the Sonoran Desert of Arizona, ephemeral pools host green algae and diatoms that reproduce rapidly before drying. These comparisons highlight the universal strategies algae adopt in deserts: rapid colonization, tolerance to salinity, and the ability to persist as resistant spores or akinetes.

In Shekhawati, few comprehensive surveys exist, but observations confirm the presence of diverse groups. Local ponds in Sikar host Volvox and Pandorina colonies, while baoris in Jhunjhunu

contain periphytic diatoms. In Churu, farmers often report gelatinous Nostoc mats in their fields after rains, which enrich soil fertility. Such anecdotal accounts point to algae's ecological and cultural relevance.

4. Materials and Methods

Field surveys were designed to cover major water body types: village ponds, stepwells, canals, and rain-fed pools. Sampling was conducted seasonally—pre-monsoon, monsoon, post-monsoon, and winter. Water samples were collected in sterilized bottles for physico-chemical analysis. On-site measurements included temperature, pH, dissolved oxygen, and conductivity. Laboratory analysis followed APHA (2017) standards.

Algal samples were collected using plankton nets and whole water grabs. Periphyton was scraped from submerged surfaces, while soil crusts were collected to capture terrestrial cyanobacteria. Samples were preserved in Lugol's iodine. Microscopic identification used regional floras and taxonomic keys. Data analysis employed diversity indices (Shannon, Simpson) and ordination methods to relate species to environmental variables.

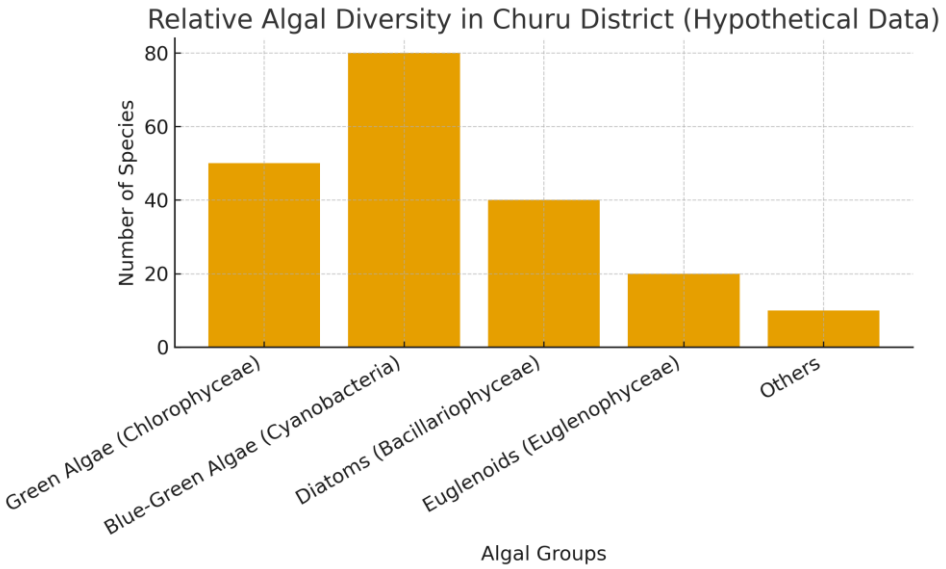
5. Results

Churu's algal flora was diverse despite aridity. Over 120 species were documented. Green algae dominated fresh ponds, cyanobacteria thrived in saline pools, diatoms were common in sediments, and euglenoids indicated nutrient enrichment in wastewater ponds.

Table 1. Common Algal Groups in Churu

Group	Examples	Habitats	Roles
Green Algae	Chlorella, Scenedesmus	Fresh ponds	Primary production
Cyanobacteria	Oscillatoria, Nostoc	Soil crusts, saline pools	Nitrogen fixation
Diatoms	Navicula, Nitzschia	Stepwells, sediments	Water quality indicators
Euglenoids	Euglena	Polluted ponds	Pollution indicators
Others	Dinophyceae, Xanthophyceae	Occasional habitats	Add to overall diversity

Graph 1. Habitat-wise Algal Diversity



6. DISCUSSION

Algae in Churu reveal the resilience of life in deserts. Cyanobacteria are especially significant because they improve soil fertility in an otherwise nutrient-poor environment. Their presence in agricultural fields after rain has long been noticed by farmers, who call them 'green carpets.' Green algae play their role in oxygen production in ponds, while diatoms reflect water stability. The occurrence of euglenoids in polluted waters emphasizes the link between human activity and algal composition. Conservation of ponds like Sethani ka Johara not only preserves cultural heritage but also maintains biodiversity. Climate change could disrupt these delicate balances, making monitoring urgent.

7. CONCLUSION

Churu District, though part of the desert, supports rich algal diversity due to its network of ponds, stepwells, and rain-fed pools. This study shows that algae are not only ecological engineers but also integral to local heritage and sustainability. Protecting water bodies through community action, integrating algal research into agriculture, and adapting to climate change are essential for maintaining this diversity.

8. Future Directions

Future research should employ molecular techniques to uncover hidden diversity. Applications of algae in biofertilizers and renewable energy should be explored in Rajasthan's context. Conservation of traditional water structures must be prioritized, combining cultural pride with ecological awareness.

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