Devagiri Journal of Science 11(1),68-73

*www.devagirijournals.com*
SSN 2454-2091

# A Baseline Survey of Terrestrial Cyanobacterial Diversity in Selected Habitats of Kodungallur, Thrissur District, Kerala

*Ayisha Henna P.P. & Shaheedha T.M.

Department of Botany, M.E.S. Asmabi College, Kodungallur, Thrissur-680671

Received: 12-6-2025

Revised and Accepted: 17-10-2025

**Keywords:** Cyanobacteria, Nostocales,Chlorococcales, Kerala

**Abstract**

An investigation was carried out to assess the diversity of cyanobacteria in terrestrial habitats of the Kodungallur area, Thrissur District, Kerala, during the period from August 2023 to December 2023. Fresh samples were collected from various habitats, including tree trunks, soil surfaces, pots, cemented walls, and building walls. The present study was documented a total of 35 cyanobacterial species belonging to 14 genera, 7 families and 4 orders. *Nostocales* emerged as the most prominent order, comprising 26 species under 3 families, followed by *Chroococcales* with 7 species. Among the identified species, 10 were soil-inhabiting, 5 were epiphytic and the remaining 20 exhibited an epilithic mode of occurrence.

## 1. Introduction

Cyanobacteria, commonly known as blue-green algae, are among the earliest life forms on Earth. Phylogenetically, they represent a primitive group of Gram-negative, oxygen-evolving, photosynthetic prokaryotes characterized by a low level of cellular differentiation. Cyanobacteria are ubiquitous in distribution and grow in a wide range of habitats. In terrestrial environments, they play a significant role in the formation of subaerial biofilms in association with other microorganisms, enabling them to withstand harsh environmental conditions. Stal (1995) reported that cyanobacteria are the dominant organisms in microbial mats. These organisms form phototrophic biofilms on building façades and monuments, often imparting a black discoloration to surfaces. Cyanobacteria are capable of surviving at temperatures ranging from 45 to 70 °C and across a pH range of 4 to 10. In terrestrial ecosystems, they occur in diverse habitats, including tree bark, soil surfaces, building façades, monuments, bricks, painted walls, and as epiphytes on plants and animals.

Cyanobacteria are photoautotrophic organisms capable of performing oxygenic photosynthesis, similar to eukaryotic algae and higher plants. In addition to carbon fixation, they possess the unique ability to fix atmospheric nitrogen (Faldu *et al*., 2014). Certain nitrogen-fixing cyanobacterial species can assimilate both carbon and nitrogen directly from the atmosphere (Bhushan & Kumar, 2013). These organisms develop specialized, thick-walled cells known as heterocysts, which house the nitrogenase enzyme responsible for converting atmospheric nitrogen into biologically usable forms such as nitrites and nitrates (Stewart *et al*., 1987). The orders *Chroococcales* and *Dermocarpales* primarily consist of unicellular forms, whereas the order *Nostocales* comprises exclusively filamentous taxa. Cyanobacteria occupy a wide range of habitats, including lithophytic, free-floating, epiphytic, terrestrial, and epipelic environments. Numerous studies have documented the cyanobacterial flora across various regions of India, notably those by Desikachary (1959), Khare & Kumar

*Corresponding author
Email: hennappayisha@gmail.com

(2009), Mongra (2012), Bhushan & Kumar (2013), Sebastian & Joseph (2013), Maheshwari (2013), Ananya *et al*. (2014), Sandyhyarani & Kumar (2014), Jain (2015), Mukhopadhyay & Naskar (2015), Singh & Singh (2017) and Sharma *et al*. (2017).

## 2. Materials and Methods

### 2.1 Study Area

Kodungallur is a historically significant town located on the banks of the River Periyar along the Malabar Coast in Thrissur District, Kerala. It lies between 10°14′1.54″ North latitude and 76°11′40.68″ East longitude. Kodungallur is a port town situated at the northern end of the Kerala lagoons and is located approximately 35 km south of Thrissur on the western coast of the state. The town is surrounded by backwaters and the Arabian Sea and covers a total geographical area of about 145 km² (Fig. 1).

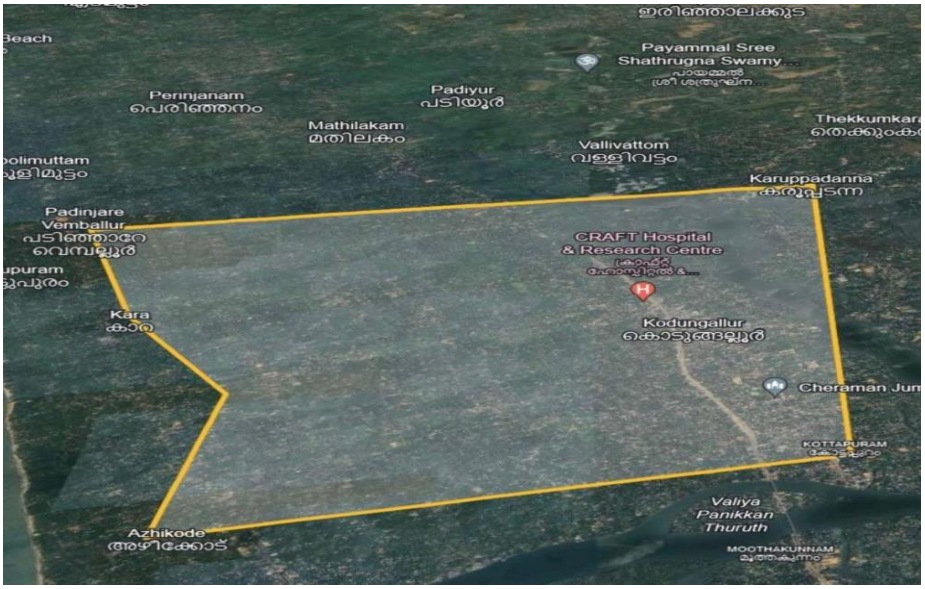


**Fig.1:** Satellite image of the Study Area

### 2.2 Methodology

Samples were collected by scraping the substrata with a sterile blade and transferred into sterile polythene zip-lock bags. Cyanobacterial samples were obtained from various habitats, including soil surfaces, tree bark, building façades, monuments, and concrete walls. One set of samples was maintained in an open beaker containing tap water for long-term storage of the organisms. The other set was cultured on BG-11 solid medium using the streak plate method. Identification of cyanobacteria was carried out using a light microscope. Photomicrographs were captured with a trinocular research microscope equipped with a digital camera. Cyanobacterial species were identified with reference to the standard publication by Desikachary (1959).

## 3. Results and Discussion

The present investigation provides a comprehensive account of the terrestrial cyanobacterial diversity of the study area, documenting a total of 35 species distributed across 14 genera, 7 families, and 4 orders (Table-1). The predominance of the order *Nostocales*, with the highest number of species and families, highlights its ecological adaptability and dominance in terrestrial environments. The dominance of the family *Oscillatoriaceae* and the genera *Oscillatoria* and *Lyngbya* further emphasizes the success of filamentous cyanobacteria in colonizing diverse subaerial habitats. Habitat-wise distribution revealed that epilithic forms constituted the majority, followed by

soil-dwelling and epiphytic species, indicating the suitability of exposed terrestrial surfaces for cyanobacterial growth. Overall, the study underscores the rich cyanobacterial diversity of the region and highlights the ecological significance of terrestrial cyanobacteria in maintaining ecosystem stability. The findings contribute valuable baseline data for future taxonomic, ecological, and conservation-oriented studies on cyanobacteria in similar tropical environments.

**Table-1** List Cyanobacterial species with respective of their orders, families and genera

| ORDER | FAMILY | GENUS | SPECIES |
|---|---|---|---|
| Chroococcales | Chroococcaceae | *Gloeocapsa* | *Gloeocapsa atrata*<br>*Gloeocapsa magma* |
| | | *Chroococcus* | *Chroococus tenax*<br>*Chroococus minutus* |
| | | *Aphanotheca* | *Aphanotheca castagnei*<br>*Aphanotheca saxicola* |
| | Entophysalidaceae | *Chlorogloea* | *Chlorogloea fritschii* |
| Chamaesiphonales | Cyanidiaceae | *Johannesbaptistia* | *Johannesbaptistia pellucida* |
| Nostocales | Oscillatoriaceae | *Oscillatoria* | *Oscillatoria princeps*<br>*Oscillatoria perornata*<br>*Oscillatoria psuedogeminata*<br>*Oscillatoria margaritifera*<br>*Oscillatoria vizagapatensis*<br>*Oscillatoria subbrevis*<br>*Oscillatoria curviceps*forma |
| | | *Phormidium* | *Phormidium rotheanum*<br>*Phormidium pachydermaticum*<br>*Phormidium calcicola*<br>*Phormidium purpurascens* |
| | | *Lyngbya* | *Lyngbya limnetica*<br>*Lyngbya connectens*<br>*Lyngbya polysiphoniae* |

| | | | |
|---|---|---|---|
| | | | *Lyngbya dendrobia*<br>*Lyngbya sordida*<br>*Lyngbya martensiana*<br>*Lyngbya trunicola* |
| | | *Microcoleus* | *Microcoleus subtorulosus* |
| | Nostocaceae | *Cylindrospermum* | *Cylindrospermum doryphorum* |
| | | *Nostoc* | *Nostoc muscorum*<br>*Nostoc punctiform* |
| | | *Anabaena* | *Anabaena variabilis*<br>*Anabaena naviculoides*<br>*Anabaena anomala* |
| | Scytonemataceae | *Scytonema* | *Scytonema guyanense* |
| Stigonematales | Mastigocladaceae | *Mastigocladus* | *Mastigocladus laminosus* |

In the present study, the identification of *Lyngbya connectans*, *Lyngbya dendrobia*, and *Lyngbya martensiana* indicates that *Lyngbya* is the dominant bark-associated cyanobacterial genus, which is consistent with the findings of Thiyagarajan (2005). Rai et al. (2018) reported 22 cyanobacterial species from soil crusts along a rural–urban gradient, among which *Anabaena anomala*, *Anabaena variabilis*, *Cylindrospermum* sp., and *Nostoc muscorum* were also recorded in the present investigation. The occurrence of *Cylindrospermum doryphorum* in this study is in agreement with the observations of Sethi et al. (2012). Samad and Adhikary (2008) reported the presence of *Chroococcus*, *Aphanotheca*, *Phormidium*, *Phormidium purpurascens*, *Aphanotheca castagnei*, *Oscillatoria*, and *Chroococcus minutus* on wall surfaces.

Cyanobacterial Diversity of Una District of Himachal Pradesh, India was studied by Bhushan *et al*., (2018). Their study was aimed to explore the distribution of cyanobacterial diversity of Una District, Himachal Pradesh. The cyanobacterial samples were collected from different seasons i.e., summer, rainy and winter. The genera include the species of *Microcystis* (4), *Chroococcus* (2), *Gloeocapsa* (2), *Aphanocapsa* (1), *Aphanothece* (1), *Synechococcus* (1), *Merismopedia* (1), *Dermocarpa* (1), *Spirulina* (1), *Oscillatoria* (5), *Phormidium* (1), *Lyngbya* (1) and *Nostoc* (1). The number put in the parentheses represents the number of the species of a particular genus. Some of the species have the capability to assimilate both carbon as well as nitrogen from the atmosphere.

## 4. Conclusion

The present investigation provides a comprehensive account of the terrestrial cyanobacterial diversity of the study area, documenting a total of 35 species distributed across 14 genera, 7 families, and 4 orders. The predominance of the order *Nostocales*, with the highest number of species and families, highlights its ecological adaptability and dominance in terrestrial environments. The dominance of the family *Oscillatoriaceae* and the genera *Oscillatoria* and *Lyngbya* further emphasizes the success of filamentous cyanobacteria in colonizing diverse subaerial habitats. Habitat-wise distribution revealed that epilithic forms constituted the majority, followed by soil-dwelling and epiphytic species, indicating the suitability of exposed terrestrial surfaces for cyanobacterial growth. Overall, the study underscores the rich cyanobacterial diversity of the region and highlights the ecological significance of terrestrial cyanobacteria in maintaining ecosystem stability. The findings contribute valuable baseline data for future taxonomic, ecological, and conservation-oriented studies on cyanobacteria in similar tropical environments.

## 5. References

**Ananya, A., Kamal, A. and Ahmad, Z. (2014).** Cyanobacteria "the blue-green algae" and its novel applications: A brief review. *International Journal of Innovation and Applied Studies*, 7: 251-261.

**Bhushan, B. and Kumar, M. (2013).** Nostocales of Jammu, J&K, India. *Indian Journal of Applied Research*, 3: 26-29.

**Bhushan, B., Himanshu, H. and Devender, K. (2018).** Cyanobacterial Diversity of H.P, India. *Journal of Plant Sciences*, 7(1): 1-6.

**Desikachary, T.V. (1959).** Cyanophyta, distribution and diversity. *Indian Journal of Plant Sciences*, 22: 36-42.

**Faldu, N., Patel, S., Vishwakarma, N.P., Singh, A.K., Patel, K. and Pandhi, N. (2014).** Genetic Diversity of Marine and Fresh Water Cyanobacteria from the Gujarat State of India. *Advances in Bioscience and Biotechnology*, 5: 1061-1066.

**Jain, N. (2015).** Diversity of blue-green algae and study on related physico-chemical parameters of paddy fields of Chhatarpur district of Madhya Pradesh. *International Journal of Research and Development in Pharmacy and Life Sciences*, 4(2):1456-1462.

**Khare, A. and Kumar, M. (2009).** *Habitat-wise diversity of Cyanobacteria in the sub-Himalayan belt of Kumaon region*. In: Srivastavas (edition) Proceedings of National Seminar on the Present Status of Medicinal Plants: Aspects and Prospectus, held at Varanasi.

**Maheshwari, R. (2013).** Distribution of Blue-green algae in Rice fields of Bundi district of Rajasthan, India. *International Journal of Recent Biotechnology,* 1(2): 24-26.

**Mongra, A.C. (2012).** Distribution pattern of Cyanobactria in hot water springs of Tattapani, Himachal Pradesh, India. *Journal of Academia and Industrial Research*, 1(7): 363-370.

**Mukhopadhyay, S.T. and Naskar, N. (2015).** Diversity of cyanobacteria from Barasat, Kolkata, West Bengal, India. *International Journal of Innovative Research and Review*, 3(1): 107-113.

**Rai, P.K., Rai, A., Sharma, N.K. and Singh, S. (2018).** Study of soil cyanobacteria along a rural-urban gradient. *Algal Research,* 35: 142-151.

**Samad, L.K. and Adhikary, S.P. (2008).** Diversity of micro-algae and Cyanobacteria on building facades and monuments in India. *Algae*, 23(2): 91-114.

**Sandhyarani, G. and Kumar, K.P. (2014).** Distribution of blue-green

algae in rice fields of Warangal district of Andhra Pradesh, India. *Indian Journal of Pharmaceutical Science and Research,* 4(3):162-164.

**Sebastian, S. and Joseph, A. (2013).** Filamentous algae of a hill stream of Kerala, India. Journal of Environmental Science, *Toxicology and Food Technology,* 4(3): 35-39.

**Sethi, S.K., Samad, L.K. and Adhikary, S.P. (2012).** Cyanobacteria and micro-algae in biological crusts on soil and sub-aerial habitats of eastern and north eastern region of India. *Phykos*, 42(1): 1-9.

**Sharma, S.D., Sahu, K. and Jain, P.K. (2017).** Cyanobacterial species biodiversity in Mohasamund district of Chhattisgarh region, India. *World News of Natural Sciences*, 7: 1-15.

**Singh, P. and Singh, M. (2017).** Diversity of sub-aerial coccoid cyanobacteria from Sirsi Taluk, Karnataka, India. *International Journal of Pharma and Bio Sciences*, 8(4): 199-207.

**Stal, L.J. (1995).** Physiological ecology of Cyanobacteria in microbial mats and other communities. *New Phytologist,* 131(1): 1-32.

**Stewart, W.P., Rowell, P., Kerbly, N.W., Reed, R.H. and Machray, G.C. (1987).** $N_2$-fixing cyanobacteria and their potential applications. Philosophical Transactions of the Royal Society of London. 317: 245-258.

**Thiyagarajan, V. (2005).** Biodiversity and seasonal distribution of cyanobacteria from Kolli Hills Tamilnadu India. *Journal of Science*, 12: 22-28.