

Species composition, substrate specificity, and seasonal abundance of periphytic algae in a tropical riverine system-Periyar, India

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ABSTRACT

The study was conducted to assess the species composition, substrate specificity, and seasonal abundance of periphytic algae from the river Periyar. Monthly samples were collected for one year (June 2016 – May 2017) from different substrates of five selected stations. Eight physicochemical variables such as temperature, dissolved oxygen, pH, conductivity, chloride, sulfate, nitrate, and phosphate were also monitored during the study. Taxonomic studies recorded 156 species of periphytic algae belonging to 56 genera, 36 families, and 5 classes. Naviculaceae was the most abundant family followed by Fragilariaceae and Pinnulariaceae. The principal component analysis revealed the dominance of periphytic algae in the pre-monsoon period. Canonical correspondence analysis indicates pH, conductivity, and sulfate plays a crucial role in periphytic algal assemblages. Correspondence analysis and percentage abundance among different substrates showed the preference of leaf substrate for primary colonization and subsequent succession. The study signifies the importance of substratum and environmental variables in the dynamics of periphytic algal community composition and abundance.

Keywords: Substratum, Periphytic algae, Principal component analysis, Periyar river

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a higher percentage of similarity in periphytic algal composition followed by leaf and root (85%) whereas rock forms an outlier showing the least similarity with the rest of the substrate (Figure 10).

Substrate plays a crucial role in the colonization and composition of periphytic algae compared to planktonic forms. All substrata are highly dynamic in their physical characteristics and functional interactions with the attached biota. Most of the periphytic algal forms are seen in the littoral zones of lotic systems and are easily encountered by all types of contaminants that originate from the nearby land area (Kanavillil & Kurisseryl, 2013). These littoral areas possess different substrata

like rock, leaf, wall, and log where periphytic algae can easily attach and grow. Estimation of percentage abundance of periphytic algae among different substrata showed the abundance of periphyton in leaf followed by root. The correspondence analysis plot also shows the importance of leaf as a suitable substratum for colonization. Periphytic algal mat is developed from the propagules of planktonic forms; leaves are continuously facing the water currents and due to its large surface area these planktonic propagules can easily attach and colonize (Kanavillil & Kurisseryl, 2013). Most of the periphytic algal assemblages choose leaf as their preferred substratum because of the large surface area, easy colonization, and attachment using specific modifications.

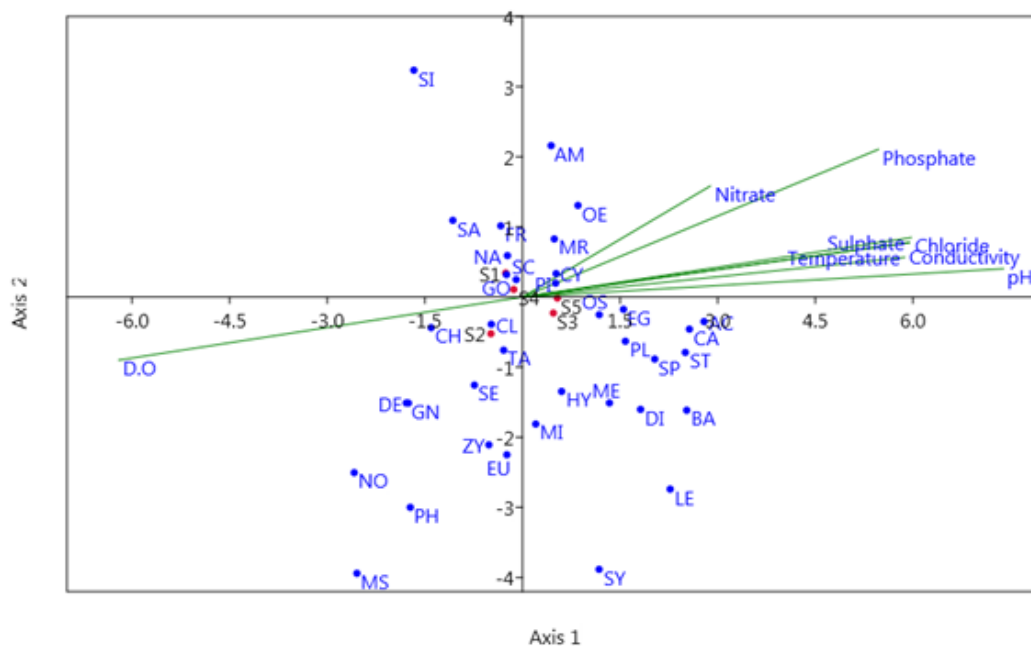


Figure 4. CCA ordination plot depicting the relationship between environmental parameters and algal assemblages. Environment variables were represented by vectors radiating from the origin. Algal families were represented by dots on the plot (abbreviations given in table2). Red dots denote selected stations (S1-station 1, S2-station 2, S3-station 3, S4-station 4, S5- station 5).

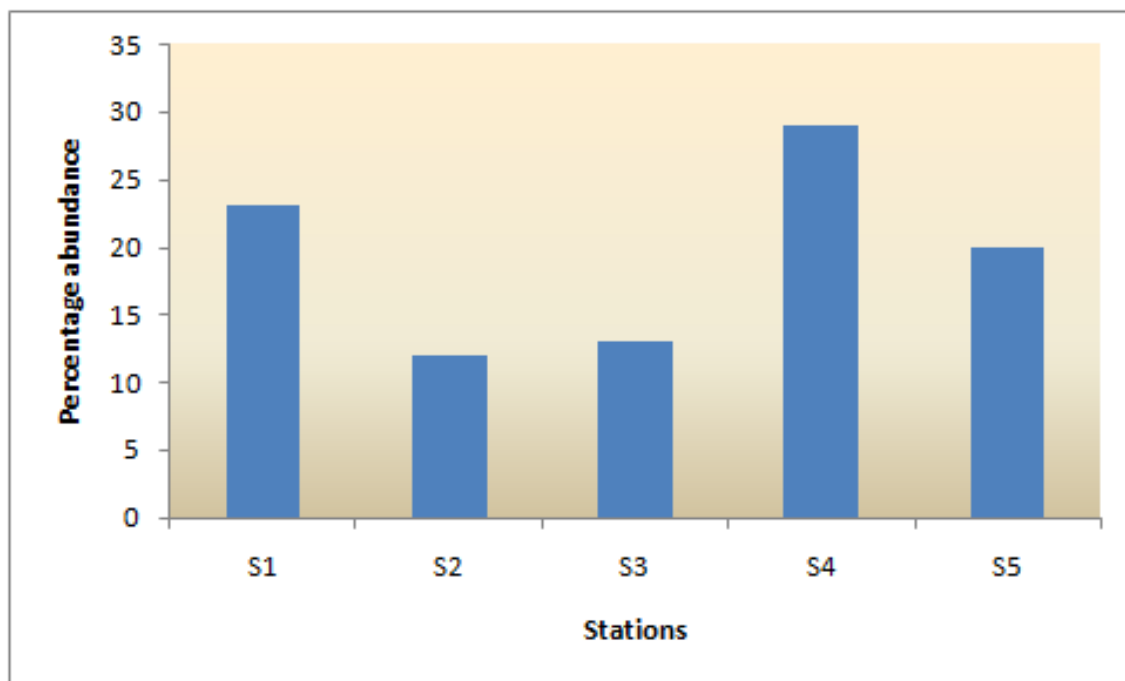


Figure 5. Percentage abundance of periphytic algae from selected stations of river Periyar

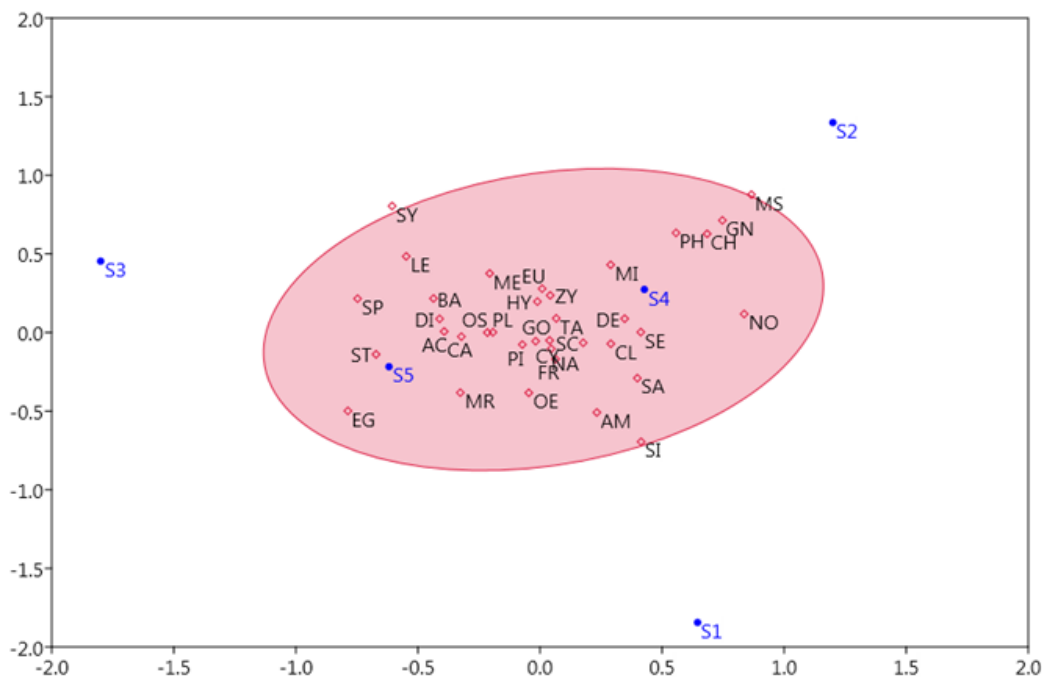


Figure 6. CA ordination plot depicting the distribution of periphytic algal families on selected stations. The ellipse encloses 95% confidence level. Diamond denotes periphytic algal families (abbreviations for were provided in table 2). Stations were represented by dots on the plot (S1-station 1, S2-station 2, S3-station 3, S4- station4, S5-station 5)

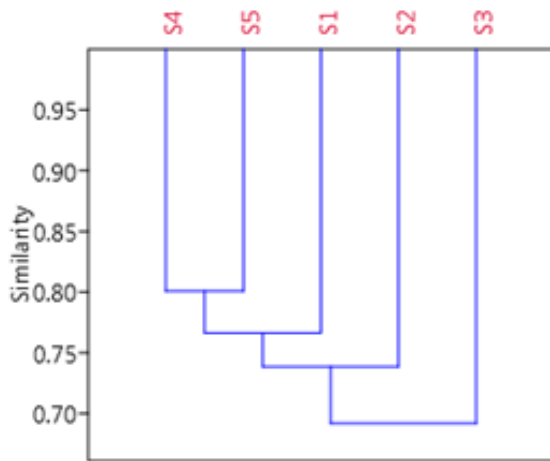


Figure 7. Dendrogram(UPGMA) based on Bray Curtis similarity index depicting the taxonomic composition of periphytic algal families along with different stations

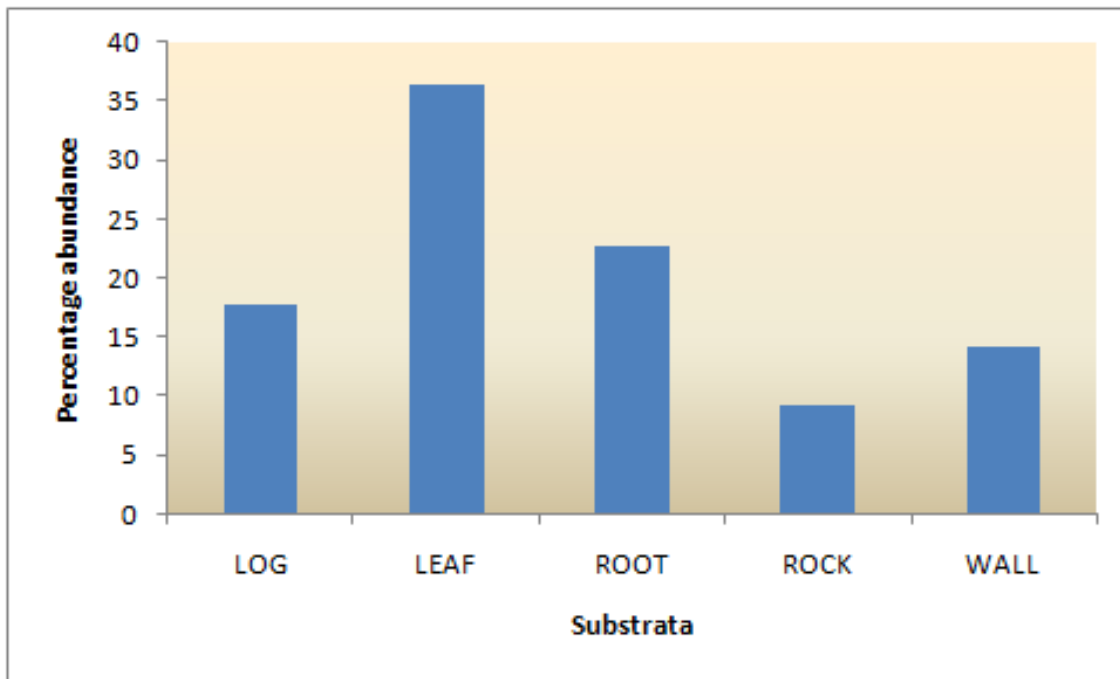


Figure 8. Percentage abundance of periphytic algae from different substrata of river Periyar

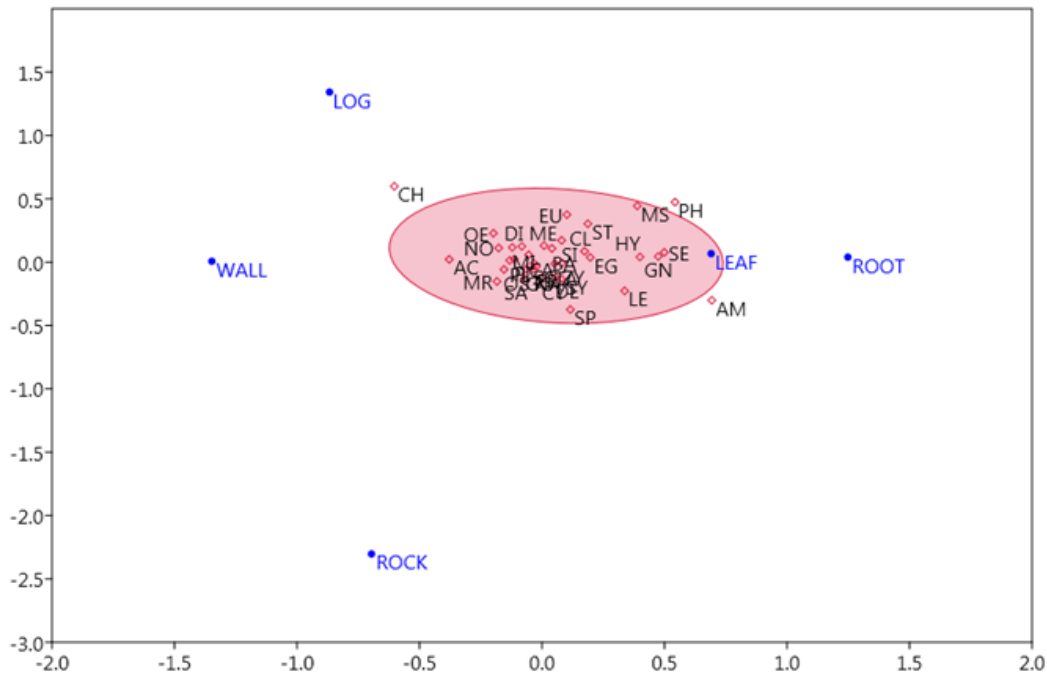


Figure 9. CA plot depicting the distribution of periphytic algal families along the selected substrate. The ellipse encloses 95% confidence level. Periphytic algal families were represented by the diamond symbol (abbreviations for were provided in table 2). Dots on the plot denote different substrata.

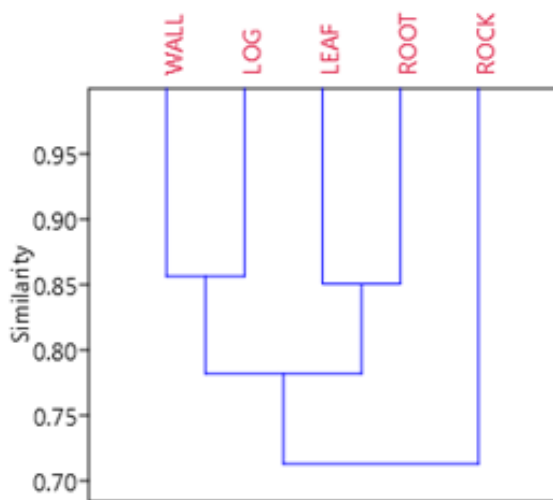


Figure 10. Dendrogram (UPGMA) based on Bray Curtis similarity index depicting the taxonomic composition of periphytic algae on varying substrate.

Conclusion

Algae possess a pivotal space among periphytic organisms. Due to its photoautotrophic nature algae acts as a power source for the whole periphytic biota and a regulator for nutrient fluxes. Its short life cycle and the ability to respond to slight environmental variations make periphytic algae as a good bioindicator. The present study deals with species composition, substrate specificity, and environmental preference of periphytic algae of river Periyar. The maximum abundance of periphytic algae was reported from station 4, which also experienced the maximum nutrient load. Most of the periphytic algal species choose leaf as their preferred substratum followed by root and log. PCA revealed the dominance of Naviculaceae and Fragilariaceae families in the pre-monsoon period. CCA illustrates that the combined actions of several environmental variables like pH, conductivity, sulfate, temperature, phosphate, and DO determine the periphytic algal composition, diversity, and richness along river Periyar. Since adequate and accurate information regarding periphytic algae of river Periyar is too scarce, the data obtained will serve as a base-line for future studies.

Compliance with Ethical Standard

Conflict of interests: The authors declare that for this article they have no actual, potential or perceived conflict of interests.

Ethics committee approval: All authors declare that this study does not include any experiments with human or animal subjects.

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