

Scientists reveal the importance of sponge-associated microbes in tackling metal pollution

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Freshwater sponges which host diverse microbial communities vital for ecosystem health, have been found to have the potential to act both as bioindicators and absorbents of toxic metals like arsenic, lead, and cadmium and can be a promising solution for bioremediation.

As pollution continues to threaten aquatic ecosystems worldwide, nature's own water purifiers are emerging as powerful allies in the fight for cleaner environments.

Freshwater sponges, among the earliest multicellular eukaryotes, filter large volumes of water and are vital for ecosystem health.

In a recent study published in *Microbiology Spectrum* (American Society for Microbiology) scientists from Bose Institute (an autonomous institute of the Department of Science and Technology, Govt. of India) studied freshwater sponges from the Sundarban delta and identified their potential to act as bioindicators of toxic metal pollution.

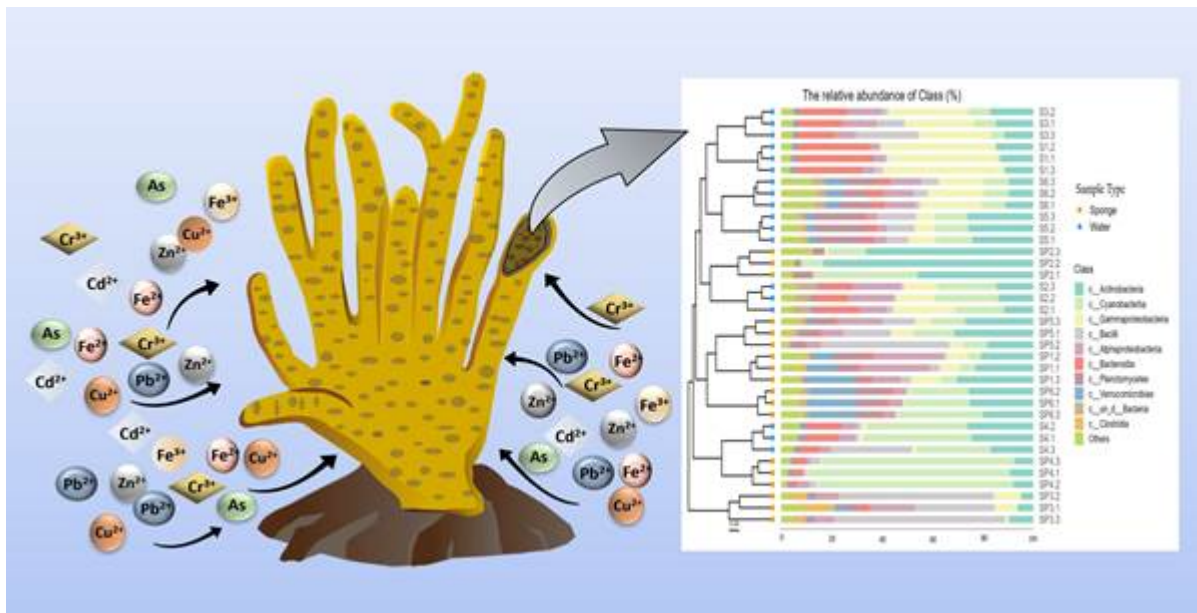


Fig: Diagram illustrating metal uptake and accumulation in sponges in situ, along with the diversity of associated bacterial communities capable of heavy-metal resistance and mobilization.

Dr. Abhrajyoti Ghosh and his team at the Department of Biological Sciences, showed that sponge-associated microbial communities play a crucial ecological role in detoxifying polluted waters and maintaining ecosystem health.

This study, supported by the DST SERB National Post-Doctoral Fellowship awarded to Dr. Dhruba Bhattacharya, is also the first to report on bacterial diversity among the freshwater sponges of Sundarban, providing new insights into an underexplored region.

This study revealed that sponge bacterial communities are distinct from the surrounding water, shaped by species and habitat. Importantly, sponges accumulated significantly higher levels of toxic metals like arsenic, lead, and cadmium, highlighting their strong bioaccumulation ability. Given the widespread heavy metal pollution in the Gangetic plain, these sponges offer a promising solution for bioremediation.

Beyond mere accumulation, the study uncovered that sponge-associated bacteria are functionally enriched with genes involved in metal ion transport, metal resistance, and antimicrobial resistance. These adaptive features suggest that bacterial symbionts not only survive but actively contribute to detoxifying and resisting environmental stress, especially in metal-contaminated habitats. The research highlights the ecological significance of the sponge-microbe consortium and reinforces the role of freshwater sponges as effective bioindicators for monitoring water quality and pollution levels in estuarine and freshwater ecosystems.

This pioneering work published in the journal *Microbiology Spectrum* broadens our understanding of sponge microbial ecology and opens new avenues for sustainable water quality management and bioremediation strategies.

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