Title: Spatial and Temporal Variations of Bacterial Communities in the Buriganga River, Dhaka, Bangladesh

Authur names: Md. Masud Alom Aksa Hossain Nizhum Ayman Bin Abdul Mannan Munawar Sultana Sheikh Mokhlesur Rahman

Abastact: The Buriganga River represents a complex ecosystem with severe pollution. While the degree of pollution is well studied, there is a lack of studies focusing on bacterial composition and diversity, which indicates ecosystem health and pollution impacts. This study investigated the spatiotemporal alterations of bacterial communities. Seasonally, 13 sampling sites (51 samples) were chosen to collect the samples during premonsoon, monsoon, postmonsoon, and winter. 16S rRNA gene-based metagenomics analysis revealed significant bacterial diversity in winter compared to the other three seasons. Bacterial diversity was higher in the downstream locations than upstream along the river. The analysis identified total phosphate, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, and zinc as key factors impacting the bacterial community's diversity and composition. The presence of metal-antibiotic-resistant bacteria like *Pseudomonas, Ralstonia,* and *Acinetobacter* suggested a link between antibiotic and heavy metal pollution from nearby hospitals and industrial effluent release points. Metabolically unique bacteria like *Geobacter* and *Dehalococcoides* consume iron, uranium, and chlorinated compounds, suggesting selective metal pollution from nearby industry. The investigation also identified pathogens like *Arcobacter, Acinetobacter,* and *Pseudomonas*, posing risks to the environment and human health. Thus, the Buriganga River belt may host metal-antibiotic-tolerant species disrupting indigenous river-flowing communities, nutrient cycling, and water quality.

Keywords: Buriganga River metagenome bacterial community physicochemical factors geochemical cycle metal resistance

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