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Genome-resolved evidence of cellulose-mediated interactions in the cyanosphere of Caatinga biome biological soil crusts

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Biological soil crusts are communities typical of semi-arid, arid, and hyperarid environments and have cyanobacteria as structuring organisms, due to the production of exopolysaccharides (EPS) that aggregate soil particles and promote the establishment of a diverse microbiome, including a cyanosphere composed of closely associated heterotrophic microorganisms which participates in carbon and nitrogen cycles. Despite their ecological relevance, metabolic interactions in this microenvironment remain poorly characterized. The aim of this study was to obtain metagenomes from non-axenic cultures of *Porphyrosiphon* sp. CENA670 and to investigate potential interactions with associated bacteria based on genomic evidence. The culture biomass was washed, and its DNA was extracted and sequenced using Illumina; the quality of the raw data was checked and the bacterial metagenomes were assembled and annotated. The highest-quality ones were taxonomically identified, and annotated. From the sequencing data, the genome of the cyanobacterial lineage and three high-quality bacterial genomes assigned to the families Fimbriimonadaceae, Chitinophagaceae and Hyphomicrobiaceae, typical of soil, were recovered. Functional annotation revealed, in the cyanobacterial genome, a cluster of the *bcs*-type associated with the biosynthesis and export of cellulose. In parallel, genes encoding glycosil hydrolases potentially involved in the degradation of cellulose and its oligosaccharides were identified in bacterial genomes. The results indicate a possible functional coupling between the production and export of cellulose by the cyanobacterium and its utilization by associated heterotrophic bacteria, suggesting an interaction mediated by EPS in the cyanosphere, with implications for carbon cycling in biological soil crusts of the Caatinga biome.

KEYWORDS: cellulose, cyanosphere, exopolissacharide, biological soil crusts, Caatinga biome.