

Antarctic soils select copiotroph-dominated bacteria

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ABSTRACT

The life strategies of bacterial community determine their structure and function and are an important driver of biogeochemical cycling. However, the variations in these strategies under different soil resource conditions remain a fair amount of unclear. In this study, we explored the bacterial community life strategies and changes in structure and functions between Antarctic soils (lower resource conditions) and forest (temperate, subtropical, and tropical) soils (higher resource conditions). The results showed that the community weighted mean rRNA operon copy number in temperate soils was 19.5% lower than that in Antarctic soils ($p < 0.05$), whereas no significant differences were observed among Antarctic, subtropical, and tropical soils ($p > 0.05$). An unexpected result was that the bacterial communities in Antarctic soils tended to be copiotrophs (r-strategists), whereas those in temperate soils tended to be oligotrophs (K-strategists). Antarctic soils are enriched in Actinobacteriota, Bacteroidota, and other copiotrophs, whereas temperate soils are enriched in Acidobacteriota, Chloroflexi, and other oligotrophs. Functional predictions showed that in comparison to copiotrophs in Antarctic soils, temperate-inhabiting oligotrophic bacteria exhibited an 84.2–91.1% lower abundance of labile C decomposition genes (hemicellulose, cellulose, monosaccharides, and disaccharides), whereas genes involved in stable C decomposition (lignin) were 74.35% higher. The genes involved in N cycling (nitrogen fixation, assimilatory nitrate reduction, and denitrification) were 24.3–64.4% lower in temperate soils than in Antarctic soils. Collectively, our study provides a framework for describing the life strategies of soil bacteria, which are crucial to global biogeochemical cycles.

Key words: Antarctic soil, Forest soil, Life strategies, Soil bacterial community, Soil resource conditions