

Examining the Role of Soil pH on the Composition and Abundance of Nitrite Oxidising Bacteria

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Abstract : Nitrification, the microbial oxidation of ammonia to nitrate (NO₃⁻) via nitrite (NO₂⁻) is a vital process in the biogeochemical nitrogen cycle and is performed by two distinct functional groups; ammonia oxidisers (comprised of ammonia oxidising bacteria (AOB) and ammonia oxidising archaea (AOA)) and nitrite oxidising bacteria. Autotrophic nitrification is said to occur in acidic soils, even though most laboratory cultures of isolated ammonia and nitrite oxidising bacteria fail to grow below neutral pH. Published studies revealed that soil pH is a major driver for determining the distribution and abundance of AOB and AOA. To determine whether distinct populations of nitrite oxidising bacteria within the lineages of Nitrospira and Nitrobacter are adapted to a particular range of pH as observed in ammonia oxidising organisms, the community structure of Nitrospira-like and Nitrobacter-like NOB were examined across a pH gradient (4.5-7.5) by amplifying nitrite oxido-reductase (nxrA) and 16S rRNA genes followed by denaturing gradient gel electrophoresis (DGGE). The community structure of both Nitrospira and Nitrobacter changed with soil pH, with distinct populations observed in acidic and neutral soils. The abundance of Nitrospira-like 16S rRNA and Nitrobacter-like nxrA gene copies contrasted across the pH gradient. Nitrobacter-like nxrA gene abundance decreased with increasing soil pH, whereas Nitrospira-like 16S rRNA gene abundance increased with increasing pH. Findings indicated that abundance and distributions of soil NOB is influence by soil pH.

Keywords : nitrospira, nitrobacter, nitrite-oxidizing bacteria, nitrification, pH, soil

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