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# Polyphasic characterization of *Nostoc commune* (Cyanobacteria, Nostocaceae) isolated from rice growing agro-ecosystems of Dima Hasao district of Assam, North-East India

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## Abstract

Two strains of *Nostoc commune* have been isolated from the soils of two different rice-growing agro-ecosystems, viz. flat and terrace paddy fields of Dima Hasao district of the state of Assam, North-East India. Phenotypic characterization was made for both the strains and their growth, pigments (chlorophyll *a*, total carotenoid content and phycobiliproteins) and biochemical properties (total carbohydrate and soluble proteins) were studied. Phylogenetic comparison was made utilizing 16S rRNA gene sequences. Both strains presented higher phycocyanin content than other biliprotein pigments. Total carotenoid content (TCC) was higher in the strain isolated from flat paddy field, while the isolate from terrace paddy field was richer in phycobiliproteins. 16S rRNA gene sequences of the isolated *N. commune* strains were compared with available sequences of other strains of *Nostoc* and *Anabaena* from various geographical locations. Gene sequences were clustered according to their geographical origin, which also reflected the disputed taxonomic position of the Nostocacean genera *Nostoc* and *Anabaena*.

**Key words:** Assam, cyanobacteria, morphology, *Nostoc commune*, polyphasic characterization, taxonomy

## Introduction

Paddy cultivation in terraces and in the low lying flat valley lands are common land use practices in rice-growing countries of the world. Whereas flat paddy fields are very common, rice cultivation in terraces are restricted to the hilly parts of the world, including hilly terrains of Himalayan area (Sikkim, Himachal Pradesh and North-East India) in India. Such agro-ecosystems harbor diverse cyanophytes. Colonizing both terrestrial and aquatic habitats, *Nostoc* species-owing to their nitrogen fixing ability-constitute an important entity in rice fields (Dodds *et al*. 1995, Gao & Ai 2004). They are adaptive to a wide range of habitats due to their unique metabolic flexibility, with high dispersion capacities, large-sized populations and low extinction probabilities (Fenchel 2003).

*Nostoc commune* Vaucher ex Bornet & Flahault (1888: 203), known to be a highly drought-tolerant species (Takaichi *et al*. 2009), is one of the most dominant colonizers in the paddy fields of Dima Hasao district of Assam. This prokaryote is known to be a conspicuous cyanobacterial species in terrestrial microbial communities, with a worldwide distribution, particularly in nutrient-poor soils and on exposed limestone surfaces. Lipman (1941) mentioned the revival of *N. commune* from an 87-year-old herbarium specimen. Indeed, dried *N. commune* colonies can be successfully revived after more than one hundred years (Cameron 1962, Kvíderova *et al*. 2011). *Nostoc commune* colonies which are partially hydrated are also known to have the potential to carry out photosynthesis, and are capable of fixing nitrogen in Arctic hydroterrestrial habitats as well (Novis *et al*. 2007, Kvíderová *et al*. 2011).

Morphological diversity is known to have a strong correlation with biochemical parameters (Holton *et al*. 1968).These gram-negative prokaryotes exhibit a great morphological diversity along with wide spectra of physiological properties.

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