Talk

Diversity of N_2-fixing cyanobacteria from Andalusian paddy fields and analysis of their potential as bioinoculants

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ABSTRACT

The marshes of the Guadalquivir River contain the largest area of rice cultivation in Spain, where more than 40,000 ha are used every year for rice production. These wetland areas provide a perfect place for rice cultivation, and represent a unique aquatic-terrestrial habitat that hold more wintering waterfowl than any other European wetland.

Paddies require large amounts nitrogen and phosphorus for their growth, development and production. Though, flooded conditions used for rice cultivation drastically diminish efficiency inorganic nitrogen fertilizers, being only 30–40% used by the plant, and in some cases even less. Large amounts of nitrogen fertilizers are dissolved in the surface water and lost, causing environmental pollution and health problems due to losses through N_2O and NO volatilization, denitrification, and leaching (Ishii et al., 2011).

The paddy field ecosystem provides a favourable environment for the growth of phototrophic microorganisms including nitrogen-fixing cyanobacteria, as it meets their requirements for light, water, temperature and nutrient availability. The ability of this type of cyanobacteria to fix N_2 provides a natural source of fixed nitrogen to the plant that is evidently priceless, and encourages research to develop new cyanobacteria-based biofertilizers for rice cultivation.

In our laboratory, diversity of N_2-fixing cyanobacteria from Andalusian paddies has been studied by means of metagenomic analysis and classical microbiological approaches. We have found that agronomic techniques influence microbial diversity (Ramírez-Moncayo et al., 2018). We have also isolated Nitrogen-fixing cyanobacteria from the paddy fields and we have found that *Nostocaceae* and *Rivulariaceae* are the dominant N_2-fixing cyanobacteria families in these isolates (Alves-Martínez et al., 2017). Genetic analysis of the different isolates revealed the presence of new uncharacterized strains. We have evaluated their potential as bioinoculants for plant fortification. Some of the strains showed a strong attraction and attachment to rice roots, which could be an indication of possible supply to the plant of nitrogen-fixed metabolites by the cyanobacterium. These isolates might be used for the formulation of new ecological biofertilizers alternative to chemical synthetic fertilizers.

REFERENCES

Ishii, S. *et al*. (2011) Identification and isolation of active N_2O reducers in rice paddy soil. *ISME journal*, **5**, 1936-45.

Alves-Martínez, P. *et al.* (2017) Isolation and characterization of culturable N_2-fixing cyanobacteria from the paddy fields in marshes of Guadalquivir river. *FEBS3+ Congress*.

Ramírez-Moncayo, C. *et al.* (2018) Diversity of N_2-fixing cyanobacteria from Andalusian paddy fields and analysis of their potential as bioinoculants. *23rd European Nitrogen Cycle Meeting*. pp. 30.