Analysis of NPF and NRT transporter families regarding the nitrate nutrition in maritime pine (*Pinus pinaster*)

José Miguel Valderrama-Martín, Francisco Ortigosa, Concepción Ávila, Francisco Miguel Cánovas, Rafael A. Cañas

Grupo de Biología Molecular y Biotecnología (BIO-114). Departamento de Biología Molecular y Bioquímica. Facultad de Ciencias. Universidad de Málaga. 29071. Málaga, Spain.

Corresponding author: Rafael A. Cañas (rcanas@uma.es)

Nitrogen is an essential element for life and the main limiting nutrient for plant growth and development[1]. The main forms of inorganic nitrogen in soils are nitrate and ammonium, which relative abundances depend on environmental conditions such as temperature. In agricultural soils the most abundant nitrogen form is nitrate because the use of chemical fertilizers however in natural ecosystems nitrogen soil composition can be more complex. Conifers are tree gymnosperms with a wide distribution although their large forests dominate the boreal ecosystems where nitrification is limited and ammonium is the main nitrogen soil source[2]. In this context, conifers have an appreciable tolerance to ammonium.

Maritime pine (*Pinus pinaster* Aiton) is a conifer from the western Mediterranean region of high economic and ecological interest in Spain, France and Portugal. This pine is also a research model tree with different genomic resources such as a reference transcriptome and a gene expression atlas[3]. Taking advantage of these resources the members of the NPF and NRT transporter families involved in nitrate uptake and transport have been identified and analyzed in maritime pine[4]. Among the transporter families, the NRT3 one is expanded and composed by six members.

The capacity of maritime pine to use nitrate or ammonium has been analyzed in seedlings. The development and growth responses to nitrate nutrition are comparable to ammonium supply. At molecular level, there are strong gene expressions for genes involved in nitrate uptake and assimilation such as *Nitrate Reductase*, *Nitrite Reductase*, *Glutamine Synthetase 1a*, three *NRT3* genes and different *NPF* family members in the different organs. Since the NPF proteins can transport different metabolites, peptides and hormones, the NPF transporters involved in nitrate transport are being identified. Finally, the interaction between NRT3 transporters and NRT2 and NPF transporters are being analyzed to determine the nitrate uptake and transport regulation.

References

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