Casuarina glauca: A Model Tree for the Actinorhizal Symbiosis

Claudine Franche[1], Mathish Nambiar-Veetil[2], Chonglu Zhong[3], Jocelyne Bonneau[1], Daniel Moukouanga[1], Hassen Gherbi[1], Sergio Svistoonoff[1], and Didier Bogusz[1]

[1] *Equipe Rhizogenèse, UMR DIADE, IRD (Institut de Recherche pour le Développement), 911 avenue Agropolis, BP 64501, 34394 Montpellier Cedex 5, France.*
**Email : claudine.franche@ird.fr*
[2]*Institute of Forest Genetics and Tree Breeding Coimbatore 641 002, Tamil Nadu, India*
[3] *Research Institute of Tropical Forestry, Chinese Academy of Forestry, No.682 Guangshan Yilu, Guangzhou 510520, People's Republic of China*

Abstract

Many species of *Casuarinaceae* are fast-growing multipurpose trees which do not require chemical fertilizers due to their symbiotic association with the nitrogen-fixing actinomycete *Frankia* and with mycorrhizal fungi that contribute to improve phosphorous and water acquisition by the root system. They can grow in difficult sites, colonize eroded lands and improve the fertility, allowing the subsequent growth of more demanding plant species.

The IRD laboratory has developed genetic transformation procedures based on *Agrobacterium tumefaciens* and *A. rhizogenes* for the actinorhizal species *C. glauca*. Transgenic trees were obtained within six to nine months following genetic transformation of epicotyl fragments with the strain of *A. tumefaciens* C58C1. In addition, a procedure based on *A. rhizogenes* A4RS was set up for the rapid functional characterization of root symbiotic genes.

Transgenic casuarinas are important tools for understanding the molecular basis of the symbiotic process established between *Frankia* and *Casuarina*. Transformed plants are used for studying regulatory mechanisms that control the expression of the actinorhizal symbiotic genes, for discerning the roles of specific proteins in nodule development, and for comparing regulatory mechanisms of legume and actinorhizal symbiotic genes. Besides, in India and China, Casuarina plantations are faced with a number of problems including abiotic stresses resulting from saline soils, and biotic stresses linked to diseases and pests. Developing gene transfer techniques in Casuarinaceae trees is therefore a major issue which contribute to the genetic improvement of these valuable tropical tree species.