Year of CfP: 2009

Project No 0902-009

Project title: Population genetics and architectural-functional plant growth models. Application to *Mascarocoffea* (coffee trees natives from Madagascar) genetic resources preservation (MaGenA)

Unit managing the project: AMAP, Botany and computational plant architecture [IRAD, INRA, IRD, UMII, CNRS] & DIADE (Diversity, Adaptation and development of Plants) (IRD, UMII)

Project leaders: Sylvie Sabatier [sylvie-annabel.sabatier(a)cirad.fr] (AMAP), and Philippe de Reffye [philippe.de_reffye(a)cirad.fr] (AMAP)

Countries involved in the project: Madagascar

Subthematic axes: IPB-1 (Integrative Plant Biology 1: *Genetics and genomics, plant breeding, ecophysiology*), STDI-1 (Socio-Technical Dynamics of Innovation 1: *Agri-environmental innovations, agri-ecosystems, resources management*)

Objectives:

In the context of rapid environmental changes better data, particularly about species phenotypic plasticity, are needed on factors causing the extinction or persistence of small populations in species distribution modelling. The growth potential of plants in their natural environment depends on the adaptive genetic diversity and the phenotypic plasticity which enables plants to adjust to spatial and temporal heterogeneity, thus minimizing stress effects. The plant response to environmental constraints is characterized by both architectural and functional plasticity in woody plant. One major difficulty lies in the complex interactions between genotype and environment. The functional-structural model GreenlLab is a dynamic model taking into account architectural plasticity of the plants and biomass allocation to organ level.

The *Coffea* genus includes 103 species with 53 endemic to Madagascar (namely *Mascarocoffea*), which thus possesses the highest *Coffea* diversity. In this island however deforestation and human activities have led to strong forest fragmentation and modified ecosystems. Therefore, some forest species including *Mascarocoffea* could be threatened with extinction. Conservation strategies based on scientific data are needed and become urgent in terms of biodiversity preservation and sustainable development. Contrary to African *Coffea*, few studies have focused on *Mascarocoffea* at the molecular genetics and genomics levels. The size of *Mascarocoffea* genomes remains still unknown and none molecular genetic diversity study is reported until now.

The aim of this project is to:

- Analyze the phenotypic plasticity and adaptive capacity at the individual level within *Coffea* populations. Phenotypic plasticity is studied as the response in terms of architecture (which retrospectively provides growth data of individual trees at different developmental stages in their life) and assimilates production/biomass allocation (GreenLab model). We assess adaptive capacity by two complementary methods: the genetic diversity using molecular markers (genomic- and/or EST microsatellites) and the variability of adaptive traits between populations with different ecological niches

- Propose guidelines for *Coffea* genetic resources conservation

Total Agropolis Fondation funding: €92,102 (allocation for a doctoral student for 16 months, travel expenses, running costs, organisation of a meeting)

Funding category(ies): Agropolis Fondation doctoral fellowship

Project duration: 01 September 2009 - 31 December 2012

Key words: Genetics - architecture - growth - plants - coffee - Madagascar - phenotypic - plasticity - ability to adapt