

Year of CfP: 2007

Project No: 07032

Project title: Integration of genetic, genomic, and marker assisted selection approaches to construct a sustainable *Phytophthora* resistance in new cocoa varieties

Unit managing the project: AGAP (Genetic improvement and Plant adaptation) (CIRAD, INRA, Montpellier SupAgro)

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Countries involved in the project: Trinidad and Tobago, Ivory cost, Cameroon, Brasil

Research units from the Foundation's scientific network involved: BGPI

Subthematic axes: IPB-1 (Integrative Plant Biology 1: *Genetics and genomics, plant breeding, ecophysiology*), IPB-2 (Integrative Plant Biology 2: *Plant pests and diseases, integrated crop protection, population ecology*)

Objectives:

Oomycetes and especially *Phytophthora* are a permanent and serious threat to agriculture. *P. palmivora*, the most common species in the tropics and sub-tropics, attacks approximately 150 plant species, including cacao (*Theobroma cacao*).

Cocoa is mainly produced on smallholdings. It is estimated that approximately 14 million people around the world work in cacao plantations. *Phytophthora* sp. are responsible worldwide for 30% of losses in cocoa production.

Chemical treatments can be efficient but are pollutive and often too expensive. Several sources of genetic resistance exist in *T. cacao*, and an accumulation of different resistance genes is a better way to establish a sustainable *Phytophthora* resistance. A genetic QTL (Quantitative Trait Loci) approach is the most efficient way to identify the genetic bases of *Phytophthora* resistance and the different genetic sources of resistance genes among several resistant progenitors. High density maps have been previously established by the DAP team, and several QTLs for *Phytophthora* resistance identified in a number of genotypes confirming the quantitative nature of this resistance. However, these studies have to be completed for other important sources of resistance. This approach also provides markers for accumulation of resistance genes in new varieties by Marker Assisted Selection (MAS).

This project presents an integrated approach associating genetics and genomics, and marker-assisted breeding activities.

The specific objectives of this study are:

- to complete the identification of genome regions (QTL) involved in *Phytophthora* resistance.
- to identify candidate genes involved in *Phytophthora* resistance by integrating functional genomic and genetic mapping approaches.
- to validate the presence of favourable resistance QTL alleles identified in this project and in previous QTL studies on a resistant population collected farmers' fields in Cameroun
- to apply a marker assisted selection (MAS) in order to improve cocoa resistance to *Phytophthora*.

The search for candidate genes at the basis of *Phytophthora* resistance could provide more efficient tools to direct the accumulation of resistance genes and discover new source of resistance genes

among the germplasm collection. Moreover, a better understanding of *T. cacao* /*Phytophthora* interactions could also have a more general interest to understand other plant/*Phytophthora* interactions.

Total Agropolis Fondation funding: € 259,320 (salaries for 2 doctoral and 2 post-doctoral fellows, travel expenses, running costs)

Funding categorie(s): Agropolis Fondation doctoral and post-doctoral fellowships

Project duration: 2 January 2008 – 31 december 2010

Keywords: *Phytophthora* – cocoa- resistance – genetics – genomics – QTL