

## Executive Summary

The strategic objectives of this project were to provide the methodological basis and molecular tools for improving the breeding efficiency in the tropical fruit crop guava by

- i) analyzing the biodiversity of guava indigenous to the three producer countries Brazil, Venezuela and Mexico through *in situ* and *ex situ* conservation, characterizing this guava germplasm by DNA marker technologies and agro-morphological descriptors, and using it in selected crosses, and
- ii) developing DNA marker-based breeding strategies via marker-assisted selection (MAS) by establishing a molecular linkage reference map for guava, mapping qualitative and quantitative QTLs, associating DNA markers to these QTLs, and developing a Molecular Marker Set (MMS) for breeding applications.

The consortium consisted of the following contractors:

Max Planck Institute for Plant Breeding Research	MPIZ	Germany
Instituto Vasco de Investigación y Desarrollo Agrario	NEIKER	Spain
Centre de Coopération Internationale en Recherche pour le Développement	CIRAD	France
Centro de Investigación Científica de Yucatán	CICY	Mexico
Universidad de los Andes	ULA	Venezuela
Embrapa Semi-Arido	CPATSA	Brazil

Project coordination was based at MPIZ ([rohde@mpiz-koeln.mpg.de](mailto:rohde@mpiz-koeln.mpg.de)). MPIZ had subcontracted the Instituto de Investigaciones en Fruticultura Tropical (IIFT, subcontractor S1) in Cuba. General and detailed information on objectives and results is presented by the project website [www.neiker.net/neiker/guavamap](http://www.neiker.net/neiker/guavamap).

The first objective (guava biodiversity analysis) was pursued by the Latin American partners Brazil, Cuba, Mexico, and Venezuela with Brazil and Mexico belonging to the main producer countries world-wide. The Universidad de Los Andes (ULA) in Mérida (Venezuela) was responsible for the execution of this task. On the topic of biodiversity analyses and germplasm prospection, the partners from Brazil (CPATSA) and Venezuela (ULA) completed the germplasm collections (both for guava and other *Myrtaceae*) and genebank establishment, while the CICY (in collaboration with INIFAP) started the collection of tropical

guava in order to complement the genebank of guava accessions adapted to semiarid conditions which are prevalent in the production areas of Northern Mexico. All accessions were characterized by UPOV characters and by molecular analysis using the SSR marker set established by the project through CIRAD. Important results were obtained with respect to the application of the collected germplasm and hybrids produced by controlled crosses for production: (i) The Brazilian guava accessions, in specific the identification of 11 wild-growing *Psidium* species ("araçá") by partner 6 (CPATSA) as sources of resistance to the devastating root knot nematode *Meloidogyne mayaguensis*, now form the basis for controlled crosses and development of new, nematode-resistant varieties for guava production. This nematode is the major pest disease of guava in Brazil and has destroyed more than 60% of the commercial production in Northeast Brazil. Grafting experiments with nematode-resistant accessions and commercial guava cultivars and experiments on cross-pollination have been initiated, and offer prospects for the development of new, pest-resistant varieties. (ii) The breeding program in Cuba with IIFT (subcontractor S1) was based on an existing germplasm collection. Within the GUAVAMAP project, a total of 25 genotypes (derived from the mapping populations MP1, MP2, and MP3) with low size have been selected for propagation and variety development. All of them are now being replicated in plots for the evaluation of important agronomic traits in order to select new cultivars for production in Cuba. In this context it is noteworthy to mention that an undated UPOV descriptor for guava (in English and Spanish) which serves as the basis for agro-morphological description of accessions and cultivars has been developed by subcontractor S1 in the frame of the project.

The second strategic objective of the GUAVAMAP project related to the molecular characterization of the prospected guava germplasm and complements the agro-morphological analysis of the guava accessions by updated UPOV descriptors. For this purpose and for integration into individual molecular linkage maps and establishment of an integrated, high-density reference linkage map of guava, CIRAD had pursued the massive development of microsatellite (SSR) markers and constructed a SSR guava linkage map of 378 marker loci integrating 153 SSR markers into 11 linkage groups. With respect to the AFLP-based linkage maps, by the end of the project the number of mapped markers increased to 1779 markers (projected: 960-1200 markers) on 3 integrated parental linkage maps derived from the three mapping populations (MPs) with 116 markers (AFLP, SSR, COS) per linkage group available on the three maps. QTL analyses in all three mapping populations included leaf length, leaf width, fruit length, fruit width, internal and external pulp thickness, seed numbers, average seed weight, vitamin C content, acidity, total soluble solids, maturity index, average fruit weight, plant height, and cumulative yields for the years 2005 to 2008. Certain QTLs from different progenies could be co-located or closely linked targeting the same genes that determine a trait.

Dissemination of project results culminated in the organization of the “2<sup>nd</sup> International Symposium on Guava and Other *Myrtaceae*” (<http://www.cicy.mx/eventos/guavasymposium2008>) in November 2008 in Mérida and Aguascalientes, Mexico. All publications from oral and poster presentations have been edited by the GUAVAMAP project and are now in press by ISHS as a special issue of *Acta Horticulturae*. The symposia were followed by practical courses at the CICY (Mérida, Mexico) on biotechnology (2 weeks) and bioinformatics (1 week). From project funds, four fellowships were awarded to young scientists (2 from Mexico, 2 from Cuba) to participate to the Mérida Symposium and the two practical courses. Partners P6 (CPATSA) and P5 (ULA) will host the 3<sup>rd</sup> and 4<sup>th</sup> International Symposium on Guava and Other *Myrtaceae* in Brazil (2011) and Venezuela (2014), respectively, under the auspices of the ISHS. Thus continuation of the international collaboration on guava which was initiated by the EC-funded GUAVAMAP project is warranted beyond the duration of the project.