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Genetic resources *Genomics* & Plant biotechnology

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Boosting rubber production through resistance to a fungus

In Latin America, industrial and local plantations of the hevea are decimated by the South American leaf blight vector *Microcyclus ulei*. Over half a century of work has failed to produce high-latex-yield varieties resistant to leaf blight. As a result, Latin America, the original home of hevea, now only accounts for 1% of natural rubber production worldwide.

To unravel the genetic determinism of resistance identified in Amazonian genetic resources, researchers at Cirad have used genome mapping to analyze Quantitative Trait Loci (QTL) or chromosomal regions implicated in resistance. The results have disproved previous hypotheses regarding the genetic origin of hevea's resistance to leaf blight. We now know that:

- the genetic determinism of resistance to leaf blight, whether partial or total, is complex and multigenic (controlled by several genes);
- 8 QTL of resistance have been identified on 7 chromosomes;
- 1 QTL with a major effect is common to all hevea varieties and to the two types of resistance, partial and total.

This work has yielded findings vital to strategies and to the development of new tools for the improvement breeding of variety resistance to *Microcyclus ulei*.

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Helping Brazil to come back into the rubber business

Solutions to these drawbacks are to be found through two alternative approaches pursued by the DGPC research group:

- **In situ conservation**, the conservation of plants in their natural environment, conserves diversity but above all maintains the plants' capacity to evolve and adapt. Plants conserved in situ continue dynamically to "create" diversity because they are subject to environmental constraints (diseases, pests…) and can interact and exchange genetic material with other plants;
- **Cryoconservation**, i.e. the storage of material at ultralow temperature, generally that of liquid nitrogen (-196°C), is the only technique that ensures inexpensive, long-term conservation of recalcitrant seeds. It is also applicable to the conservation of the buds of plants that propagate vegetatively.

Meeting the demands of tomorrow

Through their research into genetic resources, the scientists of Agro-Montpellier, Cirad, INRA, IRD and the University of Montpellier are anticipating the future needs of the whole agrifood chain, from producer to consumer, while paying particular attention to tropical species and the special requirements and demands of agriculture in southern countries. Increasing attention is being paid to the study of "diversity of expression", with a view to better understanding of the genetic determinants of the diversity and of gene function.

Through its development of more effective research tools, the DGPC research group has mainly focused on three major types of application of plant genomics:

- **product quality**, as in seedless grape varieties, the "in the cup" aroma of coffee varieties, and sunflower oils (stability of the oleic acid content);
- **sources of resistance to diseases** caused caused by viruses (e.g. rice yellow mottle virus) and fungi (e.g. powdery mildew of the vine or fusarium in the oil palm), but also by animal parasites (e.g. nematodes in rice, banana and *Solanaceae* or certain vectors of serious viral diseases in vines). This search for sources of disease resistance, together with studies of plant-pathogen interactions, leads to the identification of the most durable resistances;
- assessment of the risks associated with gene flow (genetic pollution, diffusion of transgenes) occurring between new varieties and neighbouring plants. ■