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Exploitation Of Synteny For Positional Gene Cloning In Coffee

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Coffee leaf rust caused by the obligate parasitic fungus Hemileia vastatrix is an economically important disease and a major limiting factor for arabica coffee (Coffea arabica) production. While the rust resistance genes identified in C. arabica, a recent allotetraploid species, have not provided durable resistance, resistance genes from diploid related coffee species such as C. liberica (i.e. SH3 gene) and C. canephora have provided long-lived protection under field conditions. Positional cloning of the SH3 gene has been therefore undertaken in order to enhance opportunities for genomics-enabled breeding and to gain molecular insight into rust durable resistance. Hence, we explored the possibility to utilize the exponentially increasing sequence information from model plants such as Arabidopsis and Tomato. By combining a search of Arabidopsis sequences homologous to coffee BAC-end sequences belonging to the related SH3 BAC contig and use of orthologous sequence markers, we demonstrated microsynteny between coffee and Arabidopsis duplicated counterparts. The complex duplication history of Arabidopsis did not prevent the use of Arabidopsis as a genetic and genomic model for coffee species. Furthermore, an extended colinearity between the coffee and tomato genomes was revealed for the chromosome arm carrying the SH3 locus using comparative genetic molecular mapping. In particular, plant disease resistance (R gene) loci appeared to be positionally well conserved and several candidate genes have been identified. These finding highlight the possibility to develop detailed comparative genome study and to share genomic and genetic information among these two related crop plants.