Genomics of disease resistance and marker assisted selection in sunflower

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ABSTRACT

- Biotic stress is considered one of the most important factors affecting yield all over the world. In sunflower downy mildew, black rust, Sclerotinia rot, Verticillum wilt and Alternaria leaf spot are considered the most important fungal diseases. In the last ten years, several attempts have been made through conventional breeding and molecular biological studies to dissect the bases for fungal resistance to allow molecular assisted selection. The detection and genetic location of resistance gene candidates and QTL for complex diseases, together with the development of molecular markers, linkage maps and genetic association studies have largely contributed to that purpose. There exists a vast array of gene/gene complexes for disease resistance, tracing back to cultivated or wild sunflowers species. Linkage drag around disease resistance genes (DRG), especially when the resistance comes from wild species, is one of the most limiting issues which may decrease yield potential. However, molecular tools as marker assisted selection (MAS) have greatly increased the efficiency of resistance selection to different diseases.

- The detection of new downy mildew and black rust R genes, their close genomic location, their arrangement in clusters and its implication in breeding strategies is discussed. Main results of association mapping employed as a complementary tool of family mapping strategies for head rot resistance QTL location are presented. Stacking genes controlling the resistance to main Argentinean races of *Verticillium dahliae* have been obtained for the first time. Pyramiding major quantitative trait loci (QTL) to head rot and *Alternaria* is presented as a relative simple way to increase the resistance level for these diseases.

- The state of the art of the genomics of resistance and MAS in breeding processes for some of the main sunflower pathogens are reviewed, The collaborative work between public and private institutions has largely contributed to the elucidation of the architecture of disease resistance in sunflower which will provide many tools to build up durable and sustainable disease resistances in modern sunflower hybrids.

Key words: Alternaria leaf blight, black rust, downy mildew, *Helianthus*, Sclerotinia head rot, Verticillium wilt.