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Patrick Lambert, Jean-Luc Poessel, Camille Croset, Marie Noëlle Corre, Bénédicte Quilot-Turion, Veronique Signoret, Véronique Decroocq, David Tricon, Marie-Hélène Sauge, Sylvie Bureau, et al.

THE FRENCH PEACH BREEDING PROGRAM (INRA): AN INTEGRATIVE APPROACH FOR PEST/DISEASE RESISTANCE AND FRUIT QUALITY

P. Lambert [1], J.L. Poëssel [1], C. Croset [1], M.N. Corre [1], B. Quilot-Turion [1], V. Signoret [1], V. Decroocq [2], D. Tricon [2], M.H. Sauge [3], S. Bureau [4], C.G.M.C. Renard [4], T. Pascal [1]

[1]INRA, GAFL, BP 94 - 84143 Avignon-Montfavet Cedex, France, tpascal@avignon.inra.fr

[2]INRA, IBVM, UMR GDPP, Virologie, BP81, 33883 Villenave d'Ornon, France

[3]INRA, PSH, Domaine St Paul, Site Agroparc, 84914 Avignon-Montfavet, France

[4]INRA, SQPOV, Domaine St Paul, Site Agroparc, 84914 Avignon-Montfavet, France

Every year, a continuous stream of new varieties is proposed worldwide by peach breeders to fruit growers. However, whereas the demand and needs of consumers show an increase for a fruit production of high-quality free of pesticide residues, very few varieties improved for resistance to pests and diseases or for nutritional quality of the fruits are available on the market. With the objective to create innovative peach cultivars, our group has developed for several years a multidisciplinary research program aiming at (i) improving the resistance of peach to three of its main enemies, i.e. the green peach aphid (*Myzus persicae*), powdery mildew and the *Plum pox virus* (PPV), (ii) integrating both organoleptic (sugars and organic acids) and nutritional fruit quality traits (anthocyanins and other antioxidant phenolic compounds). This program takes support on an integrative approach including molecular, genomic and biochemical tools as well as well-tried phenotyping methods.

Mapping and marker-assisted pyramiding of R genes and quantitative resistance factors originating from peach and from a relative wild species (*Prunus davidiana*) are in progress to achieve durable resistance. Functional studies have been undertaken for elucidating the resistance mechanisms involved. For the resistance to the green peach aphid, a phenolic compound has already been identified as a main effector of the resistance and QTLs controlling its content in leaves and fruits have been identified. For the quantitative resistance to PPV candidate genes have been identified in the QTL regions, among which translation initiation factors such as eiF(iso)4E and eiF(iso)4G. Their validation is in progress.

The improvement of nutritional and organoleptic quality of fruit relies on the same genetic resources as the ones used for resistance to pests and pathogens. Red-fleshed varieties, originating from France and China and showing a different pattern of pigment accumulation along fruit growth, are also used in breeding programs for their high contents in anthocyanins and other antioxidant phenolics.

QTL analysis of fruit-quality traits in progenies developed for resistance to pests and diseases highlight that high levels of antioxidant compounds in the fruit and resistance traits could be introgressed simultaneously from *P. davidiana* into peach varieties. Furthermore, some phenolics could be relevant for improving both disease resistance and fruit health value.