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Breeding for durable resistance to downy and powdery mildews in grapevine

D. Merdinoglu*, P. Blasi, S. Wiedemann-Merdinoglu, P. Mestre, E. Peressotti, E. Prado, C. Schneider

INRA-UDS, UMR1131 Santé de la Vigne et Qualité du Vin, Colmar, France

*Corresponding author: didier.merdinoglu@colmar.inra.fr

A wide range of pathogens threatens viticulture. The current strategy to control grapevine diseases relies totally on the use of fungicides. This practice not only is expensive but also causes a slow and progressive damage to the environment. A cost-effective and environment friendly alternative to the use of chemicals is the development of varieties resistant to pathogens. All traditional European grapevine varieties are susceptible to the main pathogens responsible to the chemical treatments. However *Vitis* species closely related to cultivated grapevine were already shown to be potential sources of resistance to a wide spectrum of grapevine diseases. The absence of private grapevine breeders in France led the INRA to design a breeding program dedicated to create new resistant varieties. The main goal of this programme is to create varieties durably resistant to downy and powdery mildews with a berry quality suitable to produce high quality wines. In order to successfully reach the double objective of high resistance efficiency and durability, the use of multiple sources of resistance was planned as soon as the project was designed. The project was developed in close interconnection with upstream research programmes which mainly aimed at understanding the genetic bases of the resistance to downy mildew derived from grapevine-related wild species by addressing four key questions: exploring the diversity available in genetic resources to chose original genitors; identifying and characterising the relevant genes/QTLs to genetically improve the targeted traits, using the data acquired on genes/QTLs (position, effects) to assist the selection with markers, and assessing the durability of the identified resistance genes/QTLs. Moreover the data from the programmes carried out on the determinism of resistance to powdery mildew, berry quality components, sex and phenology are progressively integrated.