Summary

Controlling the impact of diseases on crops is a major challenge of modern agriculture. This concern is an important aspect of optimizing productivity, notably in viticulture. In France, downy mildew caused by *Plasmopara viticola* is a fungal disease responsible for the most devastating epidemics. The preventive and systematic treatments are expensive, while the massive use of antifungal chemicals is a risk to both humans and the environment. Reducing the use of fungicide involves the development of diagnostic tools in the field, which requires understanding the interactions between plants and pathogens. The work of this multidisciplinary thesis focused on the pathosystem *Plasmopara viticola* - *Vitis vinifera*, especially to meet the growing interest in a real-time diagnostic tool of disease applicable in the vineyard. Stilbenes are phytoalexins involved in the defense of certain higher plants against biotic and abiotic stresses. The autofluorescence of these phenolic compounds, whose biosynthesis is induced in grapevine leaves by *P. viticola*, makes it a potential marker of natural infection. Indeed, the low blue-green autofluorescence of grapevine leaves is greatly enhanced by the violet-blue autofluorescence of stilbenes on the surface of leaves infected by *P. viticola*. This study showed that whatever the level of resistance in various genotypes, violet-blue autofluorescence induced by stilbene is present in the walls of epidermal cells. In addition to their concentration, viscosity proved the main physico-chemical variable affecting the intensity of the autofluorescence of stilbenes in different compartments of vine leaves. This explains the intense fluorescence of the walls, particularly rigid, of guard cells (stomata) of infected leaves. Daily monitoring revealed a kinetic with a transient rise of the autofluorescence of stilbenes during infection. The robustness and value of this signal was also validated by measuring at different levels (cellular to whole leaf) and with various fluorimetric methods (imaging, spectroscopy, proximal sensing). These results advance our understanding of the role of constitutive and induced phenolic compounds in plant defence