Cultivar-Dependent Plant–Insect Interactions Explain Differential Incidence Of Flavescence Dorée In Swiss Vineyards

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While vector biology is a central focus in the study of vector-borne plant diseases, chemical and physiological interactions between plants and insect vectors at the cultivar level remain poorly understood, particularly for bacterial vector-borne pathogens. This is especially true in the Flavescence dorée-*Scaphoideus titanus*-grapevine pathosystem, where such interactions may critically shape epidemiological outcomes. Flavescence dorée (FD) is a major quarantine disease of grapevine associated with a phytoplasma transmitted by the leafhopper *S. titanus*. In Switzerland, FD incidence in the field differs between cultivars, with *Vitis vinifera* cv. Chasselas being markedly less affected than cv. Pinot noir. Nevertheless, laboratory susceptibility assays performed under no-choice conditions showed no difference in infection rates between the two cultivars, suggesting that epidemiological patterns are more likely driven by plant–insect vector interactions than by direct differences in pathogen susceptibility.

We therefore investigated cultivar-specific interactions with the insect vector using a combination of field surveys and laboratory assays. In vineyards, *S. titanus* populations and egg hatchings were consistently lower on Chasselas than on Pinot noir. Under controlled conditions, several life-history traits indicated reduced vector performance on Chasselas. Short-term choice assays (9 h) revealed no clear host preference, whereas longer-term choice tests (72 h) showed an increased use of Pinot noir, suggesting that differences between cultivars emerge with prolonged interaction rather than through immediate attraction.

To explore the chemical basis of these interactions, we analysed grapevine phytohormone profiles at the constitutive level and after exposure to healthy or FD-infected *S. titanus*. Marked cultivar-specific differences were observed, with Chasselas displaying hormonal signatures potentially less favourable to sap-feeding insects. In addition, preliminary metabolomic analyses of phenolic profiles revealed higher levels of certain flavonoids in Chasselas leaves. These compounds are widely reported in the literature to play a role in plant defence against herbivorous insects, although their functional contribution in this pathosystem remains to be demonstrated.

Overall, our results suggest that the lower susceptibility of Chasselas to FD is primarily shaped by antibiosis-based effects on the insect vector rather than by differences in its interaction with the pathogen, although the key metabolites underlying these effects remain to be identified. These findings highlight the relevance of chemical ecology in plant-pathogen-vector systems and open perspectives for more sustainable FD management strategies based on plant-vector interactions.