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Functional evaluation of defensins in grapevine provide evidence that these peptides could be exploited for their stress protective roles

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Abstract

In contrast to plant defensins' *in vitro* antifungal activity, little is known about their *in vivo* roles, especially in grapevine. The goal of this study was to evaluate the *in vivo* functions of plant defensins in grapevine in terms of growth, biotic stress and protective potential. The impact of the peptides on grapevine growth parameters, as well as fungal pathogens and a major insect pest was studied by functionally characterising four transgenic populations of two *Vitis vinifera* cultivars overexpressing two different plant defensin peptides. Follow-up experiments with a chemically synthesised version of one of the peptides were used to evaluate and confirm peptide-specific protective effects. The defensins had little effect on plant growth when evaluating their *in vivo* functions in the transgenic populations, but significant protection against specifically *Erysiphe necator* and *Planococcus* (mealybug) infestation was observed. This protection was confirmed as a peptide-specifc response in experiments where plants treated with peptides displayed the same resistance responses against the same pathogen/pest, as well as against *Botrytis cinerea* infection. The defensin gene families of grapevine should be studied more comprehensively, particularly in context of the additional genomic resources available for grapevine. Defensin peptides displayd protective *in vivo* roles in grapevine towards biotic stress and when applied exogenously and hold great potential to be developed into a natural control agent.

Keywords: Plant defensin peptides, *Vitis vinifera* (Grapevine), Rs-AFP2, Hc-AFP1, Vvi-AMP1, *Planucoccus ficus* (mealybug), *Erysiphe necator* (powdery mildew fungus), exogenous application.