

GLOBAL USE OF *Pseudomonas fluorescens* IN THE CONTROL OF GRAPEVINE MILDEWS

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Grapevine (*Vitis vinifera* L.) is one of the world's most economically important fruit crops and is cultivated for wine, table grapes, raisins, and juice production. However, grapevine productivity and fruit quality are significantly affected by diseases, particularly downy mildew (*Plasmopara viticola*) and powdery mildew (*Erysiphe necator*), which can cause substantial yield and economic losses.

The aim of this review was to evaluate the potential of *Pseudomonas fluorescens* as a biological control agent against downy mildew (*P. viticola*) and powdery mildew (*E. necator*) in grapevine. The review also examined the mechanisms underlying its biocontrol activity and summarized its worldwide application in viticulture.

Materials and methods: A review of international scientific literature was conducted, encompassing laboratory, greenhouse, and field studies from Europe, North America, South America, Australia, and Asia. The analysis focused on the effects of *P. fluorescens* on disease incidence and severity, as well as on its mechanisms of action, including the production of antimicrobial metabolites, siderophore synthesis, hydrolytic enzyme activity, and the induction of systemic resistance.

Results: The reviewed studies indicate that *Pseudomonas fluorescens* is a promising biological control agent for integrated grapevine disease management. It suppresses pathogens through competition for nutrients and space, production of antimicrobial compounds, and activation of plant defense responses. Several studies reported reduced severity of downy mildew and powdery mildew, particularly when *P. fluorescens* was applied preventively as part of integrated disease management programs. However, its effectiveness varied depending on the bacterial strain, environmental conditions, disease pressure, and application method. Although it is generally less consistent than synthetic fungicides under high disease pressure, *P. fluorescens* can reduce disease incidence and contribute to lower fungicide use in sustainable and organic viticulture.

Conclusions: *Pseudomonas fluorescens* has considerable potential for the biological control of downy mildew and powdery mildew in grapevine. Its ability to suppress pathogens and enhance plant defense makes it a valuable component of integrated disease management. Nevertheless, optimal performance depends on appropriate strain selection, environmental conditions, and application strategy.

Keywords: *Pseudomonas fluorescens*; grapevine; biological control; *Plasmopara viticola*; *Erysiphe necator*.

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