

Title Improvement of *Hanseniaspora uvarum* biocontrol activity against gray mold by the addition of ammonium molybdate and the possible mechanisms involved

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Abstract

The efficacy of *Hanseniaspora uvarum* against gray mold by adding ammonium molybdate ($\text{NH}_4\text{-Mo}$) and the mode of actions were evaluated. The results showed that *H. uvarum* at 1×10^6 CFU ml^{-1} plus 1 mmol l^{-1} $\text{NH}_4\text{-Mo}$ greatly reduced gray mold in grape fruits. $\text{NH}_4\text{-Mo}$ at concentrations of 1, 5, 10 and 15 mmol l^{-1} significantly inhibited spore germination and mycelium growth of *Botrytis cinerea*. Population growth of *H. uvarum* was markedly inhibited by $\text{NH}_4\text{-Mo}$ at 5 mmol l^{-1} *in vitro* and not affected by addition of $\text{NH}_4\text{-Mo}$ at 1 and 5 mmol l^{-1} in wounds combination of $\text{NH}_4\text{-Mo}$ and *H. uvarum* induced higher activities of peroxidase (POD), polyphenoloxidase (PPO), phenylalanine ammonialyase (PAL), superoxide dismutase (SOD), catalase (CAT) and β -1,3-Glucanase than individual application of *H. uvarum* or $\text{NH}_4\text{-Mo}$. The enhancement of disease control may be directly because of the inhibitory effects of $\text{NH}_4\text{-Mo}$ on spore germination and mycelial growth of *B. cinerea in vitro*, and indirectly because of the induced defense reactions by $\text{NH}_4\text{-Mo}$ in grape berries.