

**Title** Biological control of blue mould of apple by *Trichoderma* isolates  
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#### **Abstract**

In the present study, the antagonistic effects of 11 isolates of *Trichoderma* were evaluated as potential biological control agents for blue mould of apple caused by *Penicillium expansum*. *Trichoderma* isolates inhibited the mycelial growth of *P. expansum* in dual culture by 55.16 to 69.26%. Volatile metabolites emitted from all isolates inhibited growth of *P. expansum* and the inhibitory effects of *T. harzianum* (T.301.11, T.401.4) were greater compared with the other isolates. Cell-free metabolites of *T. viride* (T.193, T.301.4) and *T. harzianum* (T.301.11, T.404.8) inhibited the pathogen by 58.21, 81.67, 87.06 and 88.36%, respectively. The concentration of pathogen and antagonist for inoculation were  $1 \times 10^5$  cfu/ml and  $1 \times 10^7$  cfu/ml, respectively. The antagonists significantly reduced decay area caused by *P. expansum* at 23 °C and 5°C. *T. harzianum* (T.192) at 23 °C and *T. harzianum* (T.404.8) and *T. viride* (T.193) at 5 °C had the best effect on decay reduction.