

**Title** Influence of storage conditions of apples on growth and patulin production by *Penicillium expansum*

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### Abstract

*Penicillium expansum* causes blue mould rot, a serious post-harvest disease of apples, and is the main producer of the mycotoxin patulin. The present study aimed to determine the influence of storage conditions (i.e. temperature and O<sub>2</sub> level) on growth and patulin production by different *P. expansum* strains on a simulation medium and on apples. Growth was strongly influenced by the temperature, while the used atmosphere (20, 3, and 1% O<sub>2</sub>; < 1% CO<sub>2</sub>) had no effect. Optimal growth was observed at 25 °C for every strain tested. Patulin production was stimulated when the temperature decreased (from 20 to 10 or 4 °C), while a further decrease of the temperature to 1 °C caused a reduction in patulin production. The temperature at which the stimulation was changed into suppression was strain dependent. Similar results were observed for the O<sub>2</sub> level. A reduction of the O<sub>2</sub> level from 20 to 3% O<sub>2</sub> could stimulate or suppress patulin production depending on the strain, while a clear decrease of the patulin production was observed when the O<sub>2</sub> level was reduced from 3 to 1%. These results show that the induction of limited stress to the fungus, such as lowering the temperature or lowering the O<sub>2</sub> levels stimulates patulin production. However, the combination of different stress conditions (e.g. low temperature and low O<sub>2</sub>) will result in a reduced formation of the toxin. The combination of stress conditions, at which the transition from stimulation to suppression is observed, is strain dependent. Moreover, patulin production is characterized by a high natural variability. The presented results show that the temperature and O<sub>2</sub> level has to be as low as possible during the storage of apples in order to suppress patulin production and to guarantee food safety.