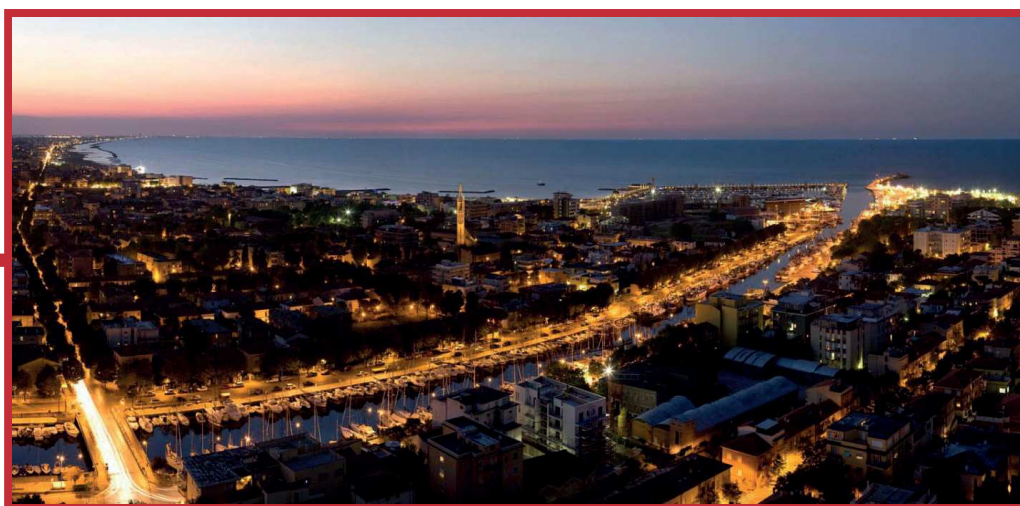


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Identification by HS-SPME/GC-MS and activity testing of *Trichoderma* spp. volatile organic compounds against grapevine downy mildew

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Downy mildew, caused by the biotrophic oomycete *Plasmopara viticola*, is one of the most destructive diseases of the grapevine [1]. Fungi of the genus *Trichoderma* are economically important biocontrol agents since they play a crucial role in plant-growth promotion, mycoparasitism of plant pathogens and priming of plant defence. *Trichoderma* spp. also release a high diversity of volatile organic compounds (VOCs), which play a decisive role against plant pathogens [2]. However, the possible contribution of *Trichoderma* VOCs in antagonistic processes against grapevine downy mildew has not yet been investigated.

In this work, VOC emission profiles of three *Trichoderma* strains belonging to *T. asperellum*, *T. atroviride* and *T. harzianum* were analysed using headspace-solid-phase microextraction gas chromatography-mass spectrometry (HS-SPME/GC-MS). Total ion current chromatograms were processed by an open source software [3], and statistical analysis on the obtained raw data was carried out using an in-house R-script. VOCs emitted by the *Trichoderma* strains at specific time-points were selected, and pure compounds were tested against downy mildew by leaf disks assays on susceptible grapevines. The development of downy mildew symptoms was reduced on leaf disks exposed to air treated with two sesquiterpenes, one hydrocarbon, or one heterocyclic compound, indicating the efficacy of these VOCs against downy mildew in plant tissues.

Our data suggest that VOCs emitted by the *Trichoderma* strains under study can effectively be detected and identified by HS-SPME/GC-MS, and can inhibit the development of downy mildew symptoms on susceptible grapevine.

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