Muscodor albus

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Effect of water activity on the production of volatile organic compounds by Muscodor albus and their effect on three pathogens in stored potato.

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Source

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Abstract

Muscodor albus (Xylariaceae, Ascomycetes) isolate CZ-620 produces antimicrobial volatile organic compounds (VOC), which appear to have potential for the control of various postharvest diseases. The effect of water activity (Aw) on the production of VOC by M. albus culture, and their inhibitory effects on the growth of three pathogens of potato tuber (Fusarium sambucinum, Helminthosporium solani, and Pectobacterium atrosepticum) and the development of diseases caused by the three pathogens (dry rot, silver scurf, and bacterial soft rot, respectively) were investigated. Rye grain culture of the fungus produced six alcohols, three aldehydes, five acids or esters, and two terpenoids. The most abundant VOC were: isobutyric acid; bulnesene, a sesquiterpene; an unidentified terpene; 2 and 3-methyl-1-butanol; and ethanol. However, the level of each of those VOC varied with Aw of the culture. Emission activity occurred mainly at Aw above 0.75 and high emission of most VOC occurred only at Aw above 0.90. The aldehydes (2-methyl-propanal and 3-methyl-butanal) were the only VOC produced in quantities below an Aw of 0.90. An Aw value of 0.96 favored maximum emission of acids, esters, and terpenoids. There was a higher production of alcohols and a decrease in aldehydes with increase in Aw. Isobutyric acid, which has been the main M. albus VOC monitored in previous studies as an indicator of antifungal activity, had a rather narrow optimum, peaking at Aw of 0.96 and declining sharply above 0.98. Results showed that substrate Aw affects the production dynamics of each group of VOC by the fungus, and suggest that VOC production can be prolonged by maintaining M. albus culture at a constant optimum Aw. The VOC was inhibitory to F. sambucinum, H. solani, and P. atrosepticum; and biofumigation with M. albus significantly reduced dry rot and soft rot development, and completely controlled silver scurf in inoculated tubers incubated at both 8°C and 22°C. The results show that Aw of grain culture affects the production of VOC by M. albus; and that the VOC inhibit the growth of the tested pathogens and the diseases caused by them in potato tubers.

Can J Microbiol. 2009 Feb;55(2):203-6.

Effect of biofumigation with volatiles from Muscodor albus on the viability of Tilletia spp. teliospores.

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Source

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Abstract

Volatile organic compounds produced by the fungus Muscodor albus inhibit or kill numerous fungi. The effect of these volatiles was tested on dormant and physiologically active teliospores of the smut fungi Tilletia horrida, Tilletia indica, and Tilletia tritici, which cause kernel smut of rice, Karnal bunt of wheat, and common bunt of wheat, respectively. Reactivated rye grain culture of M. albus was used to fumigate dormant teliospores in dry Petri dishes and physiologically active teliospores on water agar for up to 5 days at 22 degrees C. Teliospores of all 3 species were incapable of germination when fumigated on agar for 5 days. When T. tritici on agar was fumigated only during the initial 48 h of incubation, viability was reduced by 73%-99%. Fumigation of dry loose teliospores of T. tritici caused a 69%-97% loss in viability, whereas teliospores within intact sori were not affected. Dormant teliospores of T. horrida and T. indica were not affected by M. albus volatiles. It appears that M. albus has potential as a seed or soil treatment for controlling seedling-infecting smuts where infection is initiated by germinating teliospores prior to seedling emergence. The volatiles were not effective for postharvest control of teliospores under conditions used in these experiments.

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Muscodor fengyangensis sp. nov. from southeast China: morphology, physiology and production of volatile compounds.

Zhang CL, Wang GP, Mao LJ, Komon-Zelazowska M, Yuan ZL, Lin FC, Druzhinina IS, Kubicek CP.

Source

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Abstract

The fungal genus Muscodor was erected on the basis of Muscodor albus, an endophytic fungus originally isolated from Cinnamomum zeylanicum. It produces a mixture of volatile organic compounds (VOCs) with antimicrobial activity that can be used as mycofumigants. The genus currently comprises five species. Here we describe the isolation and characterization of a new species of Muscodor on the basis of five endophytic fungal strains from leaves of Actinidia chinensis, Pseudotaxus chienii and an unidentified broad leaf tree in the Fengyangshan Nature Reserve, Zhejiang Province, Southeast of China. They exhibit white colonies on potato dextrose agar (PDA) media, rope-like mycelial strands, but did not sporulate. The optimum growth temperature is 25°C. The results of a phylogenetic analysis based on four loci (ITS1-5.8S-ITS2, 28S rRNA, rpb2 and tub1) are consistent with the hypothesis that these five strains belong to a single taxon. All five strains also produce volatile chemical components with

antimicrobial activity in vitro, which were different from those previously described for other Muscodor species.

J Econ Entomol. 2009 Dec;102(6):2041-7.

Pupal mortality and adult emergence of western cherry fruit fly (Diptera: Tephritidae) exposed to the fungus Muscodor albus (Xylariales: Xylariaceae).

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Source

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Abstract

Western cherry fruit fly, Rhagoletis indifferens Curran (Diptera: Tephritidae), is a major pest of sweet cherry, Prunus avium (L.) L. (Rosales: Rosaceae), that is conventionally controlled using insecticides. One alternative to the use of insecticides alone for fly control could be fumigation of the fly's overwintering habitat using the fungus Muscodor albus Worapong, Strobel & Hess (Xylariales: Xylariaceae) in conjunction with reduced insecticide use. The fungus produces a mixture of volatile organic compounds (VOCs) that are biocidal for a variety of organisms. In this study, the main objectives were to determine the effects of M. albus VOCs on mortality of R. indifferens pupae and on adult emergence under laboratory conditions. In fumigation chamber experiments, a 14-d exposure of pupae in soil to VOCs resulted in 61.9% control, and exposure to VOCs for 7, 10, and 14 d reduced fly emergence by 44.2, 70.0, and 86.3%, respectively, relative to controls. In an experiment using plastic covers to retain VOCs in treated soil, a concentration of 1% M. albus formulation (fungus + rye grain) did not affect pupal mortality and fly emergence, but a concentration of 5% M. albus formulation resulted in 27.4% control and reduced fly emergence by 30.1% relative to the control. Larvae of R. indifferens that were dropped onto soil with 1% M. albus formulation were not affected by the fungus. Results indicate that prolonged exposure and high concentrations of M. albus VOCs can cause significant mortality of R. indifferens pupae in soil and delay adult emergence.

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Potential of the volatile-producing fungus Muscodor albus for control of building molds.

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Source

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Abstract

The possibility of using the volatile-producing fungus Muscodor albus for biofumigation against building molds was investigated. Several species of Aspergillus and Penicillium

as well as fungi belonging to nine other genera were inhibited or killed in vitro by volatiles produced by potato dextrose agar or rye grain cultures of M. albus. Trichoderma viride was the only fungus that was not inhibited by M. albus volatiles. To test biofumigation as a preventative treatment against fungal colonization of building material, dry pieces of gypsum drywall were fumigated with grain cultures of M. albus in closed boxes. After a simulated water damage and incubation under saturated humidity for 2 weeks, untreated drywall developed natural fungal populations of about 10(5)-10(6) cfu/cm2, while drywall fumigated with M. albus culture (20 g/11 L) had nondetectable fungal populations. To test for curative ability, moist pieces of drywall heavily colonized with Cladosporium cladosporioides, Aspergillus niger, or Stachybotrys chartarum were fumigated for 48 h with grain cultures of M. albus. Cladosporium cladosporioides was eliminated within 48 h, while A. niger and S. chartarum were usually more resistant. However, a longer curative fumigation of 96 h was effective in reducing A. niger or naturally occurring mold populations by about 5 log values. The production of volatile organic compounds from 20 g of rye grain culture in 11 L containers was monitored by solid-phase micro extraction and gas chromatography. Concentrations of isobutyric acid, the most abundant volatile, increased gradually in the headspace until it reached 25 microg/L (m/v) within 96 h. The second and third most abundant compounds, 2-methyl-1-butanol and isobutanol, peaked at about 10 and 5 microg/L (m/v), respectively, within the first 24 h and declined gradually afterwards

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Muscodor albus and its biological promise.

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Source

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Abstract

We have found a novel fungal genus that produces extremely bioactive volatile organic compounds (VOCs). This fungal isolate was initially discovered as an endophyte in Cinnamomum zeylanicum in a botanical garden in Honduras. This endophytic fungus, Muscodor albus, produces a mixture of VOCs that are lethal to a wide variety of plant and human pathogenic fungi and bacteria. It is also effective against nematodes and certain insects. The mixture of VOCs has been analyzed using GC/MS and consists primarily of various alcohols, acids, esters, ketones, and lipids. Final verification of the identity of the VOCs was carried out by using artificial mixtures of the putatively identified compounds and showing that the artificial mixture possessed the identical retention times and mass spectral qualities as those of the fungal derived substances. Artificial mixtures of the VOCs nicely mimicked the biological effects of the fungal VOCs when tested against a wide range of fungal and bacterial pathogens. Potential

applications for "mycofumigation" by M. albus are currently being investigated and include uses for treating various plant parts, and human wastes. Another promising option includes its use to replace methyl bromide fumigation as a means to control soil-borne plant diseases