Biochemical and genetic basis of orsellinic acid biosynthesis and prenylation in a stereaceous basidiomycete.

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Abstract

The prenylphenols are a class of natural products that have been frequently isolated from basidiomycetes, e.g., from the genus Stereum (false turkey tail fungi) and other Russulales as well as from ascomycetes. Biosynthetically, these compounds are considered hybrids, as the orsellinic acid moiety is a polyketide and the prenyl side chain originates from the terpene metabolism, although no literature on the genetic and biochemical background of the biosynthesis is available. In a stereaceous basidiomycete, referred to as BY1, a new prenylphenol, now termed cloquetin, was identified and its structure elucidated by mass spectrometry and nuclear magnetic resonance spectroscopy. Genes for two non-reducing polyketide synthases (PKS1 and PKS2) were identified in the BY1 genome, and heterologously expressed in Aspergillus niger. Product formation identified both PKSs as orsellinic acid synthases. A putative prenyltransferase gene (BYPB) found in the BY1 genome was expressed in Escherichia coli. In vitro characterization showed that BYPB activity depends on bivalent cations and that it uses orsellinic acid as acceptor substrate for the transfer of a prenyl group. The two orsellinic acid synthases support the emerging notion that fungi secure individual metabolic steps or entire pathways by redundant enzymes.

Identifier

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