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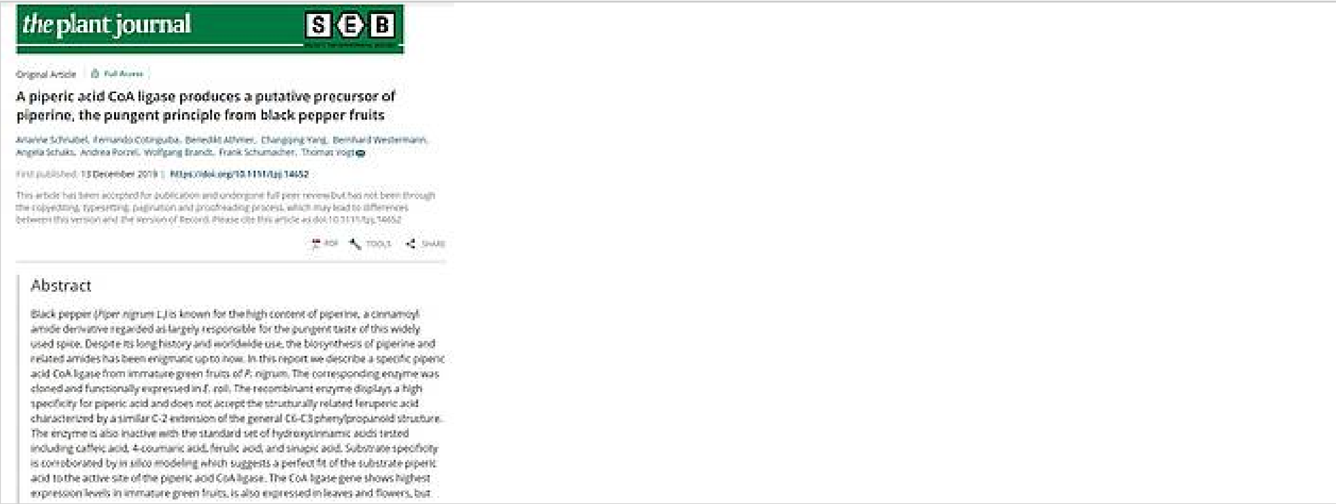
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A piperic acid CoA ligase produces a putative precursor of piperine, the pungent principle from black pepper fruits

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Abstract

Black pepper (*Piper nigrum* L.) is known for the high content of piperine, a cinnamoyl amide derivative regarded as largely responsible for the pungent taste of this widely used spice. Despite its long history and worldwide use, the biosynthesis of piperine and related amides has been enigmatic up to now. In this report we describe a specific piperic acid CoA ligase from immature green fruits of *P. nigrum*. The corresponding enzyme was cloned and functionally expressed in *E. coli*. The recombinant enzyme displays a high specificity for piperic acid and does not accept the structurally related feruperic acid characterized by a similar C-2 extension of the general C6-C3 phenylpropanoid structure. The enzyme is also inactive with the standard set of hydroxycinnamic acids tested including caffeic acid, 4-coumaric acid, ferulic acid, and sinapic acid. Substrate specificity is corroborated by in silico modeling which suggests a perfect fit of the substrate piperic acid to the active site of the piperic acid CoA ligase. The CoA ligase gene shows highest expression levels in immature green fruits, is also expressed in leaves and flowers, but

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Scientists at the IPB have described a specific piperic acid CoA ligase in immature green fruits of black pepper (*Piper nigrum* L.). The enzyme, which was functionally expressed in *E. coli*, displays a high specificity for piperic acid and does not accept the structurally related feruperic acid or other hydroxycinnamic acids as a substrate. Substrate specificity is corroborated by *in silico* modeling which suggests a perfect fit of the substrate piperic acid to the active site of the piperic acid CoA ligase. The CoA ligase gene shows highest expression levels in immature green fruits, is also expressed in leaves and flowers, but not in roots. Virus-induced gene silencing provided some preliminary indications that the production of piperoyl-CoA is required for the biosynthesis of piperine in black pepper fruits. Despite its long history and the worldwide use of black pepper, the biosynthesis of piperine and related amides has been enigmatic up to now.

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