

Cercosporin 生合成遺伝子クラスターの進化と拡張

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Cercospora は主要な食用作物に対する病原性を有しており、植物への感染には二次代謝産物である cercosporin が重要な役割を果たしている。Cercosporin の生産が唯一確認されている *C. nicotiana* において cercosporin の生合成を担う遺伝子クラスター (CTB クラスター) が同定されていた。今回著者らは進化的な比較ゲノム解析によって、CTB クラスターが重複や水平伝播を経て多様なカビの植物病原菌に分布していることを明らかにした。さらに、CTB クラスターに隣接する複数の遺伝子が CTB クラスターと同様な進化軌道を辿り、cercosporin の生合成に必須であることを見出した。

紹介論文

Gene cluster conservation provides insight into cercosporin biosynthesis and extends production to the genus *Colletotrichum*

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Abstract

Species in the genus *Cercospora* cause economically devastating diseases in sugar beet, maize, rice, soy bean, and other major food crops. Here, we sequenced the genome of the sugar beet pathogen *Cercospora beticola* and found it encodes 63 putative secondary metabolite gene clusters, including the cercosporin toxin biosynthesis (CTB) cluster. We show that the CTB gene cluster has experienced multiple duplications and horizontal transfers across a spectrum of plant pathogenic fungi, including the wide-host range *Colletotrichum* genus as well as the rice pathogen *Magnaporthe oryzae*. Although cercosporin biosynthesis has been thought to rely on an eight-gene CTB cluster, our phylogenomic analysis revealed gene collinearity adjacent to the established cluster in all CTB cluster-harboring species. We demonstrate that the CTB cluster is larger than previously recognized and includes cercosporin facilitator protein, previously shown to be involved with cercosporin autoresistance, and four additional genes required for cercosporin biosynthesis, including the final pathway enzymes that install the unusual cercosporin methylenedioxy bridge. Lastly, we demonstrate production of cercosporin by *Colletotrichum fioriniae*, the first known cercosporin producer within this agriculturally important genus. Thus, our results provide insight into the intricate evolution and biology of a toxin critical to agriculture and broaden the production of cercosporin to another fungal genus containing many plant pathogens of important crops worldwide.