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Japan's breakthrough discovery of an plant enzyme could lead to anti-bacterial pesticides

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Plant diseases pose significant challenges to agricultural productivity, presenting formidable hurdles that require urgent attention. Left unchecked, these diseases can spread rapidly, inflicting widespread damage on crops and leading to reduced yields and substantial economic losses. Therefore, accurately identifying the pathogens responsible for these diseases is crucial. This identification allows for targeted interventions that minimize risks and effectively mitigate the agricultural impacts.

Xanthomonas species are notorious plant pathogens that affect a broad spectrum of hosts, including key crops like rice, wheat, and tomatoes. These pathogens augment their pathogenicity by utilizing Î±-1,6-cyclized Î²-1,2-glucohexadecaose (CÎ² G16Î±) to suppress essential plant defense mechanisms, such as the expression of pathogenesis-related proteins and the accumulation of callose.

In a recent breakthrough a team of researchers led by Associate Professor Masahiro Nakajima from Tokyo University of Science unveiled a significant discovery. They identified XccOpgD, a glycoside hydrolase (GH186) found inÂ*X*.Â *campestris pv campestris*Â which plays a pivotal role in the biosynthesis of CÎ²G16Î±. The research team also included Sei Motouchi from Tokyo University of Science, Principal Scientist Shiro Komba from the Institute of Food Research, NARO, and Hiroyuki Nakai from Niigata University.

The team conducted biochemical analysis to elucidate the role of XccOpgD in Cî²G16î± biosynthesis. Advanced techniques such as X-ray crystallography were employed as structural analysis to unravel the enzyme's catalytic mechanism and substrate specificity.

These efforts have yielded profound insights. XccOpgD belongs to the GH186 family, essential for regulating bacterial cell wall components. Unlike the first identified GH186 enzymes, XccOpgD exhibits an unprecedented enzymatic mechanism known as anomer-inverting transglycosylation.

The discovery of XccOpgD and its role in Cî²G16î± biosynthesis marks a major breakthrough in agriculture. It promises enhanced resilience and food security while mitigating environmental impacts linked to conventional pesticides. Overall, this advancement offers sustainable solutions to global agricultural challenges, promoting environmental stewardship and economic viability for farmers worldwide.

These findings deepen our understanding and open avenues for developing targeted strategies againstÂ Xanthomonas-induced plant diseases.Â "We are expecting a pesticide concept targeting this enzyme homolog in the future. Unlike fungicides that promote the emergence of drug-resistant bacteria in soil, targeting this enzyme could potentially inhibit pathogenicity without causing sterilization. Enzyme homologs identified in this study may serve as promising structure-based drug targets, offering a potential solution to the issue of drug-resistant bacteria,"Â says a hopeful Prof. Masahiro Nakajima from Tokyo University of Science.