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The ABC of Small Molecule Transport in Fungal Pathogenesis

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Abstract

Rice-Blast disease, caused by the ascomycete fungus Magnaporthe oryzae, is the most important disease in this crop given that it destroys rice enough to feed around60 million people every year. Importantly, an outbreak of the disease can completely eliminate a high-yielding domestic rice variety from a region or a country. M. oryzaeinvades its host via specialized infection structures called appressoria. Previously, weshowed that ATP-Binding Cassette 3 (Abc3) transporter is indispensable for appresssorial function of host invasion in M. oryzae. However, the cause of in viable appressoria and impaired host entry in the abc3Δ remained unclear. ABC transporters are known to efflux xenobiotic or toxic molecules to the cell exterior. Therefore, wehypothesized that the loss of Abc3 pump leads to excessive accumulation of its physiological substrate to likely inhibitory levels resulting in appressorial dysfunction. We devised an innovative yeast-based strategy to successfully purify the Abc3 Transporter Substrate (ATS). We show that ATS is a digoxin-like endogenous steroidal glycoside primarily involved in modulating ion homeostasis and host invasion in M. oryzae. Furthermore, we identified Translational Elongation Factor 2(Tef2) as the target for ATS, and find a mechanistic link between ATS, ion homeostasis, Tef2 function, and F-actin dynamics during M. oryzae pathogenesis. Weuncover a unique ability of ATS to induce the hypersensitive (Programmed-Cell-Death-like) response and consequently disease resistance in host plants. Lastly, digoxin-like steroidal glycosides promise to be novel antifungal agents to combat the destructive blast disease in crop plants.