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The molecular interplay between DNA damage and plant immune responses

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DNA damage repair and immune responses are two fundamental cellular processes that have been characterized extensively, but the links between them remain largely unknown. We previously identified multiple genes that play a dual role in homologous recombination and transcriptional regulation of plant-defense genes. Moreover, we discovered that microbial bacterial, fungal and oomycete plant pathogens with diverse lifestyles induce double-strand-breaks to host plant DNA. These suggested an interplay between DNA damage and plant immune responses. Here we report that poly(ADP-ribosyl)ation plays an important role in plant immune systems in response to infection. Poly(ADP-ribosyl)ation is a post-translational modification and contributes to multiple molecular and cellular processes with a prominent role in DNA damage repair. Human PARP1, the founding and most characterized member of the PARP family, accounts for more than 90% of overall molecular and cellular PARP activity in response to DNA damage while PARP2 supplies a minor portion of this PARP activity. We found that Arabidopsis PARP2 rather than PARP1 plays the predominant role in poly(ADP-ribosyl)ation and organismal resilience in response to either chemically-induced DNA damage or pathogen infections. Hence, core aspects of plant poly(ADP-ribosyl)ation are mediated by substantially different enzymes than in animals, indicating the likelihood of substantial differences in regulation. Collectively, our findings suggest that the two ancient surveillance mechanisms, DNA damage, and plant immune responses, are intricately interconnected.

Biography

Junqi Song is currently an assistant professor at the Texas A&M AgriLife Research Center at Dallas, with a joint position at the Department of Plant Pathology and Microbiology in the Texas A&M University. His research primarily focuses on how plants perceive and respond to microbial pathogens and how pathogens cause diseases in plants using a combination of genetic, biochemical, genomic and proteomic approaches. His research projects cover a wide range of pathogens with diverse lifestyles including bacteria, oomycetes, fungi, and nematodes. His long-term goal is to elucidate the complex network of signal transduction and pathway interactions in plant defense responses.

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