

Scientists Discover a Nuclear-localized Effector from Plant Vascular Fungus *Verticillium dahliae*

Verticillium dahliae (*V. dahliae*) is a soil borne fungal pathogen that infects a broad range of hosts. It is now becoming a major threat to many economically important crops, such as cotton and sunflower. Similar to most filamentous pathogens, *V. dahliae* secretes effector proteins to overcome plant basal defense for successful host colonization. Resistant plants can recognize effector by cognate R proteins to induce a second layer of immunity (known as effector-triggered immunity, ETI) against pathogen infection. However, very few R proteins were found to recognize *V. dahliae* effectors and trigger ETI.

The research group led by Prof. GUO Huishan at the State Key Lab of Plant Genomics, Institute of Microbiology, Chinese Academy of Sciences (IMCAS) has been working on *V. dahliae* pathogenesis and crop resistance against wilt diseases for over ten years.

Recently, they discovered a *Verticillium*-specific protein, namely VdSCP7, that functions as an effector and alters plant susceptibility to fungal and oomycete infection. VdSCP7 was selected by proteomic analysis of the cultural filtrate from a cotton-isolated *V. dahliae* strain (V592). The protein contains N-terminal signal peptide and a nuclear localization signal that is secreted by *V. dahliae* and accumulates in the plant nucleus (Fig. A). Expression of VdSCP7 in *Nicotiana benthamiana* induced immune responses such as ROS accumulation, callose deposition and HR.

Interestingly, VdSCP7-expressing *N. benthamiana* leaves showed resistance to the fungal pathogen *Botrytis cinerea* but enhanced susceptibility to the oomycete pathogen *Phytophthora capsici*. VdSCP7 gene knockout mutants showed enhanced virulence in cotton host, suggesting that there is a cognate R-gene in cotton that has triggered immunity against *Verticillium* infection (Fig. B).

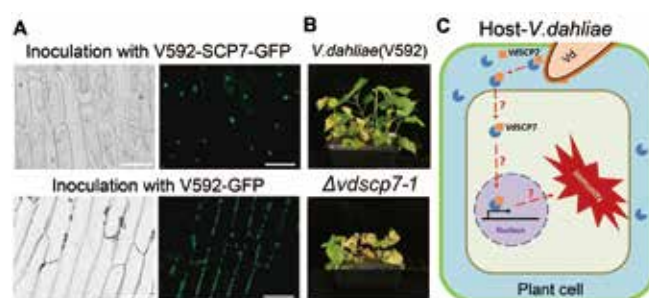


Fig. A. GFP-tagged VdSCP7 is secreted by *V. dahliae* and accumulates in the plant nucleus. Fig. B. VdSCP7 gene knockout mutant ($\Delta vds\text{scp}7-1$) showed enhanced virulence in cotton host. Fig. C. Hypothesis of VdSCP7 activating plant immunity by translocation from apoplastic space to the nucleus. (Image by Prof. GUO's group)

Based on the findings, they proposed a model that VdSCP7 could activate plant immunity by translocation from apoplastic space to the nucleus (Fig. C). VdSCP7 is the first nuclear effector discovered in *Verticillium* species.

The detailed results of VdSCP7 have been published in *New Phytologist* (<http://onlinelibrary.wiley.com/doi/10.1111/nph.14537/epdf>) with Dr. ZHANG Lisha and Dr. NI Hao as joint first authors, and Prof. GUO Huishan and Dr. HUA Chenlei as corresponding authors.

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