Betulinic acid confers antiviral resistance to turnip mosaic virus through boosting the phytosulfokine signaling in plant

Pengbai Li¹, Xinxin Jing¹, Pengyue Wang¹, Ziting Huang¹, Xiaoli Zhang¹, Meirong Xiang¹, Chaonan Wang¹, Bingjian Sun¹, Honglian Li¹, and Chao Zhang¹

¹Henan Agricultural University

August 28, 2023

Abstract

Plant virus disease is one of the most threatening diseases in agricultural production, and the availability of effective drugs against viral diseases remains limited. Here, we discovered that betulinic acid (BA), a pentacyclic triterpenoid derived from natural plants, exhibits stable resistance to turnip mosaic virus (TuMV) in Nicotiana benthamiana. Through transcriptomic analysis and RT-qPCR assay, we have demonstrated that BA treatment specifically induces the expression of phytosulfokine 3 (PSK3), a plant pentapeptide hormone that fulfills a wide range of functions, while TuMV infection suppresses its expression. Further study showed that NbPSK3 positively regulates TuMV infection. Disruption of PSK signaling by targeting the membrane-bound PSK receptors (PSKRs) also promotes viral infection. Furthermore, exogenous PSK treatment could significantly enhance the resistance of N. benthamiana to TuMV compared with the dPSK or control treatments, and the silencing receptor NbPSKR1 abolishes the ability of PSK to inhibit TuMV infection. Meanwhile, BA inhibition of TuMV infection is dependent on PSK-PSKR signaling pathway. Overall, these results not only highlight the potential of BA as a promising and environmentally friendly agent for preventing plant viral diseases but also emphasize the importance of the PSK signaling pathway in enhancing TuMV resistance for crop improvement.

Hosted file