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Virulence inhibiting peptides: an environmentally friendly and effective alternative to copper for the control of plant pathogenic bacteria

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The control of plant diseases caused by phytopathogenic bacteria is still mainly based on the use of copper-based compounds and antibiotics. In Europe antibiotics are not allowed to be used in plant protection, while copper is among the very few chemicals still authorised also in organic agriculture. However its use was also recently restricted because of its negative ecotoxicological impact and for its effect on the increase of antibiotic-resistant bacteria into agroecosystems. Promising alternatives to copper have been proposed against several phytopathogenic fungi, but no sustainable options are available yet for the control of Gram negative plant pathogenic bacteria. To this aim, an innovative strategy was developed in this work, based on the design and use of peptides targeting the translocation of bacterial pathogenicity and virulence effectors by the Type Three Secretion System (T3SS), highly conserved and essential for the pathogenicity of Gram-negative bacteria, both of plants and of mammalian hosts including humans (1). Accordingly, these virulence inhibiting peptides (VIPs) specifically compromise the injection of bacterial pathogenicity and virulence effectors by T3SS into plant cells, and not bacterial viability, thus preventing or decreasing disease and symptoms development without any antibiotic activity. This feature is essential to avoid or decrease the risk to develop any VIPs resistance. Using *P. savastanoi*, *P. syringae* pv. *tabaci* and *P. syringae* pv. *actinidiae* as model systems, VIPs were here demonstrated to compromise *in vitro* and *in vivo* bacterial pathogenicity on hosts, and HR on Tobacco. No negative side-effects on model membranes were found. VIPs effect on T3SS was investigated by mutagenesis and electrochemical approaches, and confirmed by autoagglutination and Congo Red assays. VIPs control effectiveness was preliminarly demonstrated by their transient expression in *Nicotiana tabacum* challenged by *P. syringae* pv. *tabaci*, and then definitely confirmed in VIPs transgenic *N. tabacum* plants. Experiments are ongoing about the production of VIPs transgenic *Actinidia chinensis* plants targeting *P. syringae* pv. *actinidiae* T3SS.

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1. Chatterjee, S.; Chaudhury, S.; McShan, A.C.; Kaur, K.; De Guzman, R.N. (2013): Structure and biophysics of type III secretion in bacteria. *Biochemistry*, 52 (15), 2508-2517.