Title Identification and design of antimicrobial peptides to control fungal plant pathogens

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Citation Journal of Plant Pathology Volume 90 (2, Supplement) August 2008, Book of Abstract, 9th International Congress of Plant Pathology, August 24-29, 2008 Torino,Italy,. 507 pages.

Keywords fruit; antimicrobial peptides;

Abstract

Peptides and small proteins with antimicrobial activity have been characterized from a vast number of organisms from bacteria to humans, including plants. The use of antimicrobial peptides (AMPs) in plant protection has been proposed by several authors, and there are examples of expression of bioactive AMPs in transgenic plants. However, some natural AMPs have undesired properties such as non-specific toxicity and low stability that compromise their application in agriculture. The short sequence length of this class of peptides favours structure/activity studies in a holistic approach to increase their stability and activity towards specific pathogens, while also lowering toxicity. We summarize our group's contributions to the identification of AMPs from natural sources or by combinatorial chemistry methods, as well as to the rational design of improved sequences based on previous knowledge, to control fungal plant pathogens. These studies are aided by advances in peptide synthesis and high throughput activity screening, which have made possible the*de novo* design of novel AMPs with enhanced properties. Using as a working model the interaction between *Penicillium digitatum* and Citrus fruit that causes green mould postharvest disease, we highlight the differences between in vitro peptide activity and protection against disease achieved in laboratory bioassays. Differences in peptide protective effect are likely related to distinct modes of antifungal action. Unveiling the mechanism of antifungal action of selected model peptides as well as the corresponding cell targets in fungi is required to further advance towards the safe use of AMPs in plant protection