

Accepted Manuscript

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PII: S0734-9750(15)00057-9
DOI: doi: [10.1016/j.biotechadv.2015.03.007](https://doi.org/10.1016/j.biotechadv.2015.03.007)
Reference: JBA 6916

To appear in: *Biotechnology Advances*

Received date: 30 August 2014
Revised date: 25 February 2015
Accepted date: 10 March 2015



Please cite this article as: Holásková Edit, Galuszka Petr, Frébort Ivo, Tufan Öz M, Antimicrobial peptide production and plant-based expression systems for medical and agricultural biotechnology, *Biotechnology Advances* (2015), doi: [10.1016/j.biotechadv.2015.03.007](https://doi.org/10.1016/j.biotechadv.2015.03.007)

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Antimicrobial peptide production and plant-based expression systems for medical and agricultural biotechnology

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Abstract

Antimicrobial peptides (AMPs) are vital components of the innate immune system of nearly all living organisms. They generally act in the first line of defense against various pathogenic bacteria, parasites, enveloped viruses and fungi. These low molecular mass peptides are considered prospective therapeutic agents due to their broad-spectrum rapid activity, low cytotoxicity to mammalian cells and unique mode of action which hinders emergence of pathogen resistance. In addition to medical use, AMPs can also be employed for development of innovative approaches for plant protection in agriculture. Conferred disease resistance by AMPs might help us surmount losses in yield, quality and safety of agricultural products due to plant pathogens. Heterologous expression in plant-based systems, also called plant molecular farming, offers cost-effective large-scale production which is regarded as one of the most important factors for clinical or agricultural use of AMPs. This review presents various types of AMPs as well as plant-based platforms ranging from cell suspensions to whole plants employed for peptide production. Although AMP production in plants holds great promises for medicine and agriculture, specific technical limitations regarding product yield, function and stability still remain. Additionally, establishment of particular stable expression systems employing plants or plant tissues generally requires extended time scale for platform development compared to certain other heterologous systems. Therefore, fast and promising tools for evaluation of plant-based expression strategies and assessment of function and stability of the heterologously produced AMPs are critical for molecular farming and plant protection.

Key words: Antimicrobial peptides; Therapeutic peptides; Plant protection; Plant molecular farming; Agricultural biotechnology; Medical biotechnology; Heterologous expression; Screening tools; Genetically modified plants

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