Utilizing Tobacco Mosaic Virus as a Viral Vector in the in Planta Production of Antimicrobial Peptides

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Despite major advancements in biological sciences and technologies, we have yet to tap into the full potential of plants. They have the ability to produce a variety of proteins, some of which can be life saving. One of these are antimicrobial peptides (AMPs), considered next-generation antibiotics with their broad-spectrum activity against a plethora of pathogens. Also, bacteria have a much lower propensity to develop resistance to them. However, the clinical application of AMPs is impeded by the economic challenges associated with their large-scale production. This study investigated the utility of Tobacco Mosaic Virus (TMV) to produce AMPs in the Nicotiana benthamiana plant to facilitate a simpler, quicker peptide production. Included was the genetic design of the previously reported AMP sequence called 1082 AMP in the TMV genome to facilitate its incorporation into the plant. Sanger sequencing was performed to confirm the successful cloning of the 1082 AMP gene into the TMV genome, followed by western blot analysis to detect the 1082 AMP expression in N. benthamiana plant confirming the TMV utilization to produce AMPs. Subsequently, the mean inhibitory concentration assessment and an NPN-dye permeability assay demonstrated a retained antimicrobial activity of the 1082 AMP on several pathogenic drug-resistant bacteria including K. pneumoniae, A. Junii, E.coli, and S. aureus. These results exhibited a successful production of the 1082 AMP in plants with a retained bioactivity, providing a promise for TMV uses to produce peptides for clinical use as an alternative as we move into the post antibiotic era.

Awards Won:
Fourth Award of $500