

Role of Antimicrobial Peptides for Plant Disease Management

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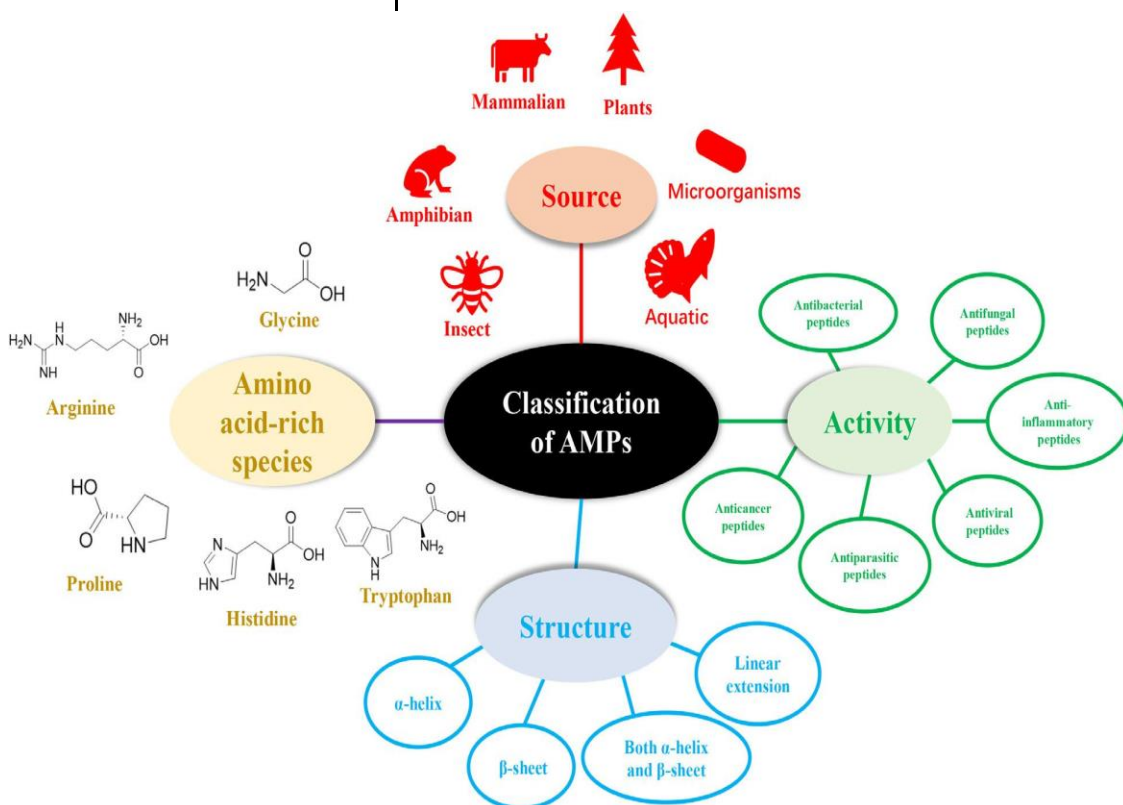
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In the natural ecosystem, the plants being sessile they usually coexist in an environment rich in wide variety of microorganisms and pests. They have developed complex, sophisticated defence mechanisms that enable them to effectively defend against deleterious organisms such as virus, bacteria, fungi, nematodes and insects. These includes physical barriers against their spread and infection; chemical barriers-to inhibit pathogen growth and development.

Along with the self-defense of the plants against various pathogens chemicals like fungicides, bactericides and antibiotics are being sprayed exclusively. Application of these same fungicides and chemicals leads to resistance of the pathogen against such chemicals. Even after, all these influence of disease factors on plants, it still tries to survive. This might be because of self-defence of the plants against such pathogens. So, antimicrobial peptides (AMP's) are among the plant defence molecules which are one of the most common and prominent chemical barriers that plants have developed to resist the biotic and abiotic stresses. AMP's are part of innate immune system inherent in almost all life forms, including microorganisms, arthropods, animals and plants which contribute greatly to host defense against pathogens.

What are Antimicrobial peptides (AMP's)?



AMP's are small defence peptides naturally produced by a wide range of microorganisms. They are short sequence of amino acids with positive charged residues and diverse plant proteins with amphipathic nature which helps them to interact with pathogen's membrane and affects its permeability. Act as first line of defence against phytopathogens.

Classification of antimicrobial peptides (AMP'S)

Structure of AMP's-

Antimicrobial peptides are made up of peptides. The basic structure of peptides consists of amino acids linked by carboxyl group of one amino group [NH_2] of other to produce peptide bond. And secondary structure of AMP's consists of α -helix, β -sheets connected by disulfide bonds ($\text{S}=\text{S}$), random coils and mixed structure.

Mechanism of action of AMP's-

Antimicrobial peptides (AMPs) are thought to combat microbes by interacting with their cell

membranes, although the exact mechanism remains

microbial demise. AMP-cell membrane interactions

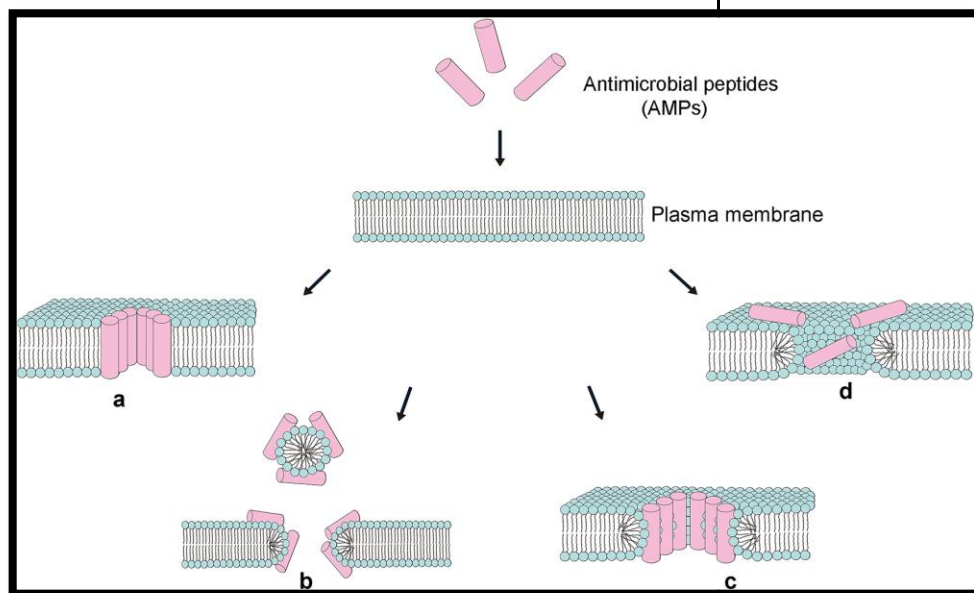


Figure 2: A. Barrel-Stave pore; B. Carpet mechanism; C. Toroidal pore; D. Disordered toroidal pore.

partially understood. Typically, these peptides, which carry a positive charge, engage with the negatively charged membranes of bacteria, enhancing permeability and triggering swift cell death. The AMPs' specific properties like sequence, size, charge and hydrophobicity influence their activity. Hydrophilic, positively charged segments enable them to interact with microbial membranes, disrupting transmembrane potential and pH gradients, disturbing osmotic regulation, and inhibiting cell respiration, ultimately causing

occur through various models, including barrel-stave pore, carpet mechanism, toroidal pore and disordered toroidal pore.

Functions of AMP's

1. Interaction with membrane
2. Affect biological activity
3. Transfer acyl monomer
4. Altering cell signals
5. Bursting of hyphal tip
6. Binding with phospholipids
7. Inhibition of cell wall synthesis

Conclusion

Antimicrobial peptides (AMPs) of plant origin have a variety of amino acid compositions and structures, many of which exhibit potent broad spectrum antimicrobial activities and prove capable of killing microbes rapidly. Plant AMPs are thus potentially valuable natural alternative to chemical antibiotics for use in both human healthcare and in agriculture to protect plants and animals from disease.

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