

PLENARY PRESENTATIONS

ADAPTATION POTENTIAL OF ENDOPHYTIC MICROORGANISMS IN BIOTECHNOLOGY AND AGRICULTURE

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Modern industrial crop production faces rapid development of phytopathogen resistance to traditional pesticides and commercial antibiotics [1]. Sustainable agriculture requires new approaches using protective microorganisms from wild extremophile plants. The plant microbiome, shaped by constant abiotic stress, serves as a unique source of biologically active compounds for biocontrol systems. Adaptation of endophytes to extreme environments involves the activation of silent biosynthetic gene clusters (BGCs) regulating the synthesis of specialized secondary metabolites [2]. Symbionts of arctic plants (*Saxifraga*, *Papaver*) produce modified non-ribosomal peptides and polyketides active below 10°C. Conversely, desert xerophytes (*Alhagi*, *Bassia*, *Hyssopus*) adapt to heat and drought by selecting strains that synthesize heat-resistant cyclic lipopeptides and broad-spectrum antibiotics [3-5]. Endophytic microbes produce various antibiotics: cell wall synthesis inhibitors, cytoplasmic membrane disruptors, and translation/transcription blockers. Cyclic lipopeptides (surfactins, iturins, fengycins) and bacteriocins cause irreversible lysis of pathogens like *Fusarium*, *Alternaria*, and *Clostridium* [6]. Bioinformatic platforms (antiSMASH) and genomic mining help identify new metabolic pathways for heterologous expression. Stress-resistant strains optimize bioindustry processes. In plant raw material bioconservation, *Saxifraga* endophytes enable low-temperature fermentation startup, while *Alhagi* strains provide fermentation in arid conditions and block spoilage flora. In textile biotechnology, endophytes combining pectolytic activity with antibiotic production improve dew-retting of bast crops, preventing fiber damage by mycotoxins. Practical implementation requires strict biosafety control. Some endophytes can synthesize hazardous mycotoxins (patulin, aflatoxins) or toxic alkaloids [7]. Mandatory whole-genome screening of candidate strains is a priority to exclude dangerous metabolites from agricultural products and ensure selective antimicrobial protection.

References:

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