Evaluation of the Antimicrobial Activity of Phytocannabinoids

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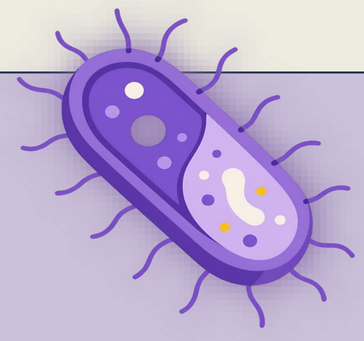
Introduction



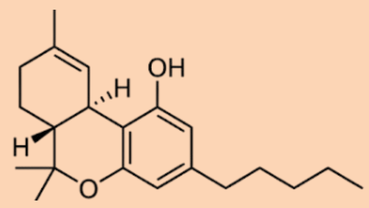
Antimicrobial resistance (AMR) represents a major global public health crisis, associated with an estimated 1.14 million deaths in 2021 and a critical lack of novel antibiotic discovery (Naghavi et al., 2024). This challenge is further intensified by the ability of certain Gram-positive bacteria to form dormant endospores under environmental stress. While conventional antibiotics eliminate vegetative cells, endospores persist within the host and environment, germinating to cause recurrent infections (Koopman et al., 2022).



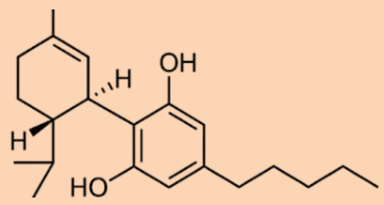
Although phytocannabinoids from Cannabis sativa L. exhibit strong antibacterial activity against Gram-positive pathogens by perturbing cytoplasmic membranes, their potential impact on bacterial sporulation dynamics, endospore structural resilience, and germination kinetics remains a major scientific gap (Blaskovich et al., 2021).

Objectives

The objectives of this work are to evaluate and compare the antimicrobial activity of four key phytocannabinoids: Δ9-THC, THCA, CBD, and CBDA on the spore-forming Gram-positive bacteria *Bacillus spizizenii*. We will analyze the impact of these compounds on vegetative cell growth, sporulation efficiency, spore resilience, and subsequent germination kinetics.



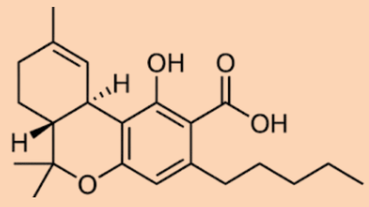
Δ9-THC



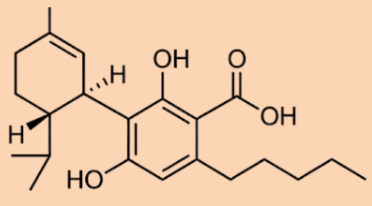
CBD



Figure 1: Cannabis Sativa L.



THCA



CBDA

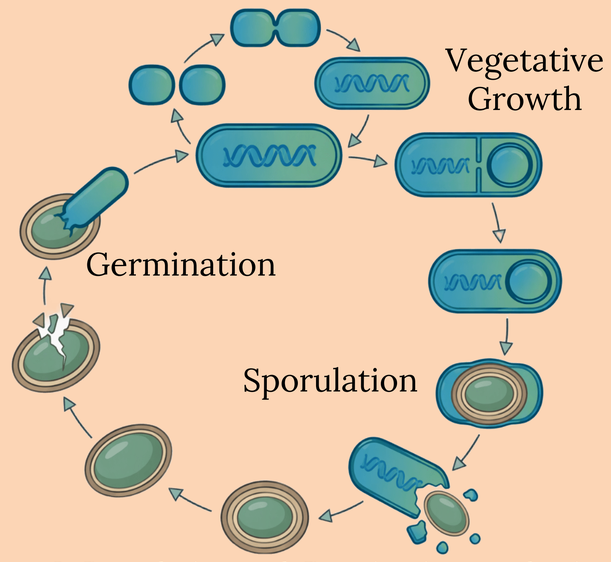


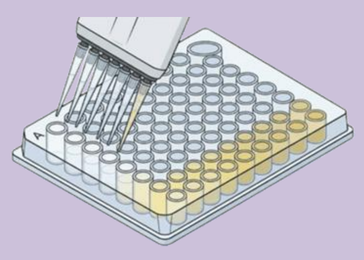
Figure 2: Sporulation and Germination synthesis

Methodology

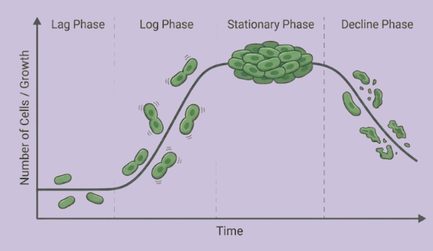
Antimicrobial Potential of CBD, CBDA, Δ9-THC, THCA



Sample Purification via High-Performance Liquid Chromatography (HPLC)



Minimum Inhibitory Concentration (MIC) Assays



Growth Curves

Sporulation and Germination Assays

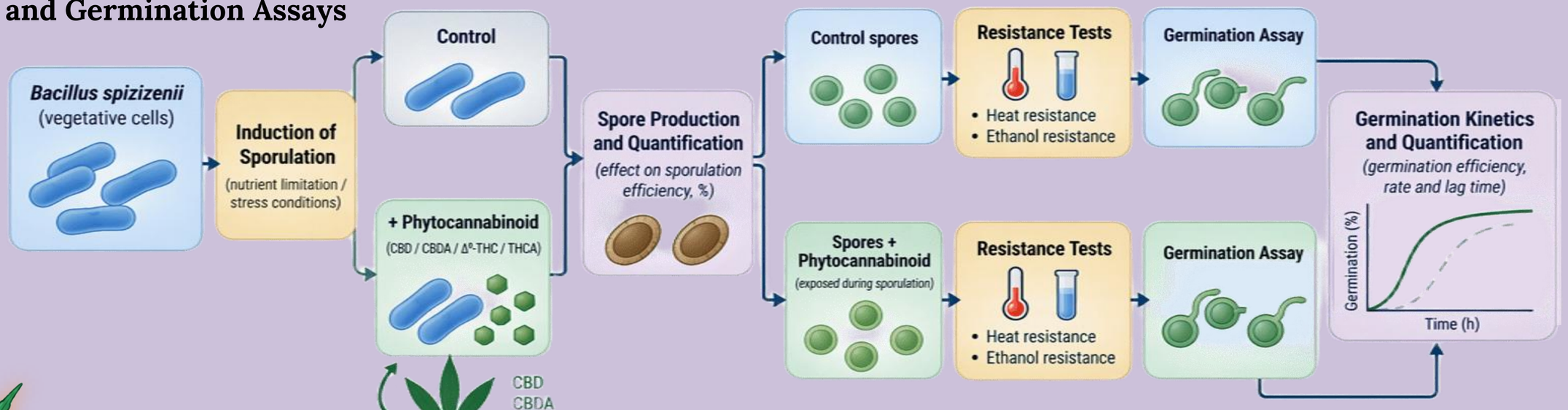


Figure 3: Sporulation and Germination Assays

Expected Results

Determine the broad-spectrum antibacterial efficacy of the isolated phytocannabinoids against vegetative bacterial strains.

Verify if cannabinoid exposure inhibits endospore formation, disrupts structural resilience, or impairs future germination kinetics.

Provide valuable empirical data to guide the development of innovative therapeutic formulations, alternative disinfectants, and infection-control protocols targeting resilient bacterial endospores.

References

Naghavi, M., et al. (2024). Global burden of bacterial antimicrobial resistance 1990–2021: A systematic analysis with forecasts to 2050. *The Lancet*, 404(10459), 1199–1226.

Blaskovich, M. A. T., et al. (2021). The antimicrobial potential of cannabidiol. *Communications Biology*, 4, Article 7.

Koopman, N., et al. (2022). Mechanisms and applications of bacterial sporulation and germination in the intestine. *International Journal of Molecular Sciences*, 23(6), Article 3405.

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