

In vitro antibacterial activity of Ceylon cardamom (*Elettaria cardamomum*) essential oil against selected bacterial pathogens

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Objective

This study aimed to investigate the chemical composition and the anti-bacterial activity of the essential oil of Ceylon cardamom against selected respiratory-associated bacterial pathogens using standard methods.

Introduction

Elettaria cardamomum (cardamom), known as the "Queen of Spices," is a highly valued spice belonging to the Zingiberaceae family. Its phytochemical composition and therapeutic properties vary with agro-ecological conditions. Sri Lankan-grown cardamom, known as Ceylon cardamom, is distinguished by its unique flavor and is mainly cultivated in Kandy, Matale, Kegalle, Ratnapura, and Galle districts. Although cardamom has long been used in traditional medicine, the antibacterial potential of Ceylon cardamom remains underexplored.

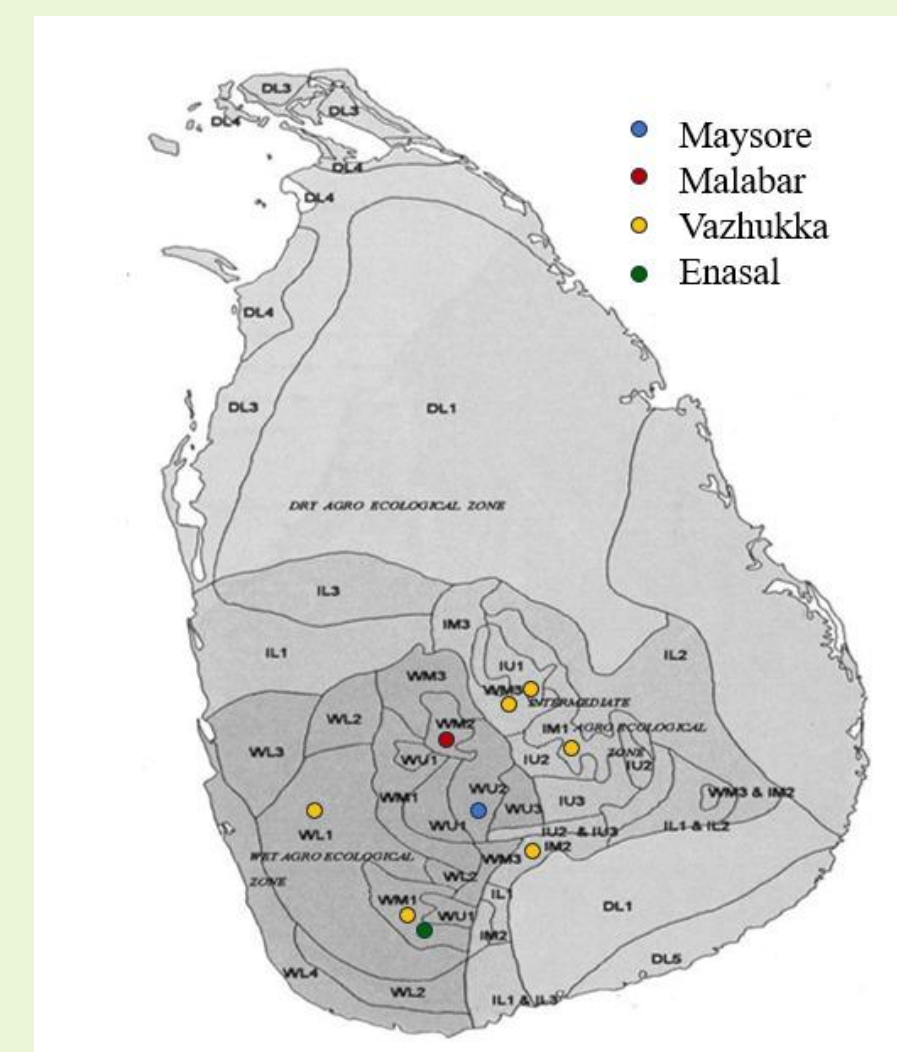


Figure 1 : Cardamom cultivating areas in Sri Lanka



Figure 2 : Ceylon cardamom plant



Figure 3 : Ceylon cardamom pods

Methodology

Essential oil of Ceylon cardamom was extracted by ultrasound-assisted hydrodistillation and GC-MS analysis was performed. The antibacterial activity of Ceylon cardamom essential oil (CCEO) was determined against the selected reference bacterial strains: *Staphylococcus aureus* (ATCC 25923), *Klebsiella pneumoniae* (ATCC 700603), *Pseudomonas aeruginosa* (ATCC 27853), and three drug-resistant clinical isolates: MRSA, meropenem-resistant *Klebsiella pneumoniae* (ATCC 1705), and MDR *Pseudomonas aeruginosa* clinical isolate. Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) were determined using the broth dilution method.

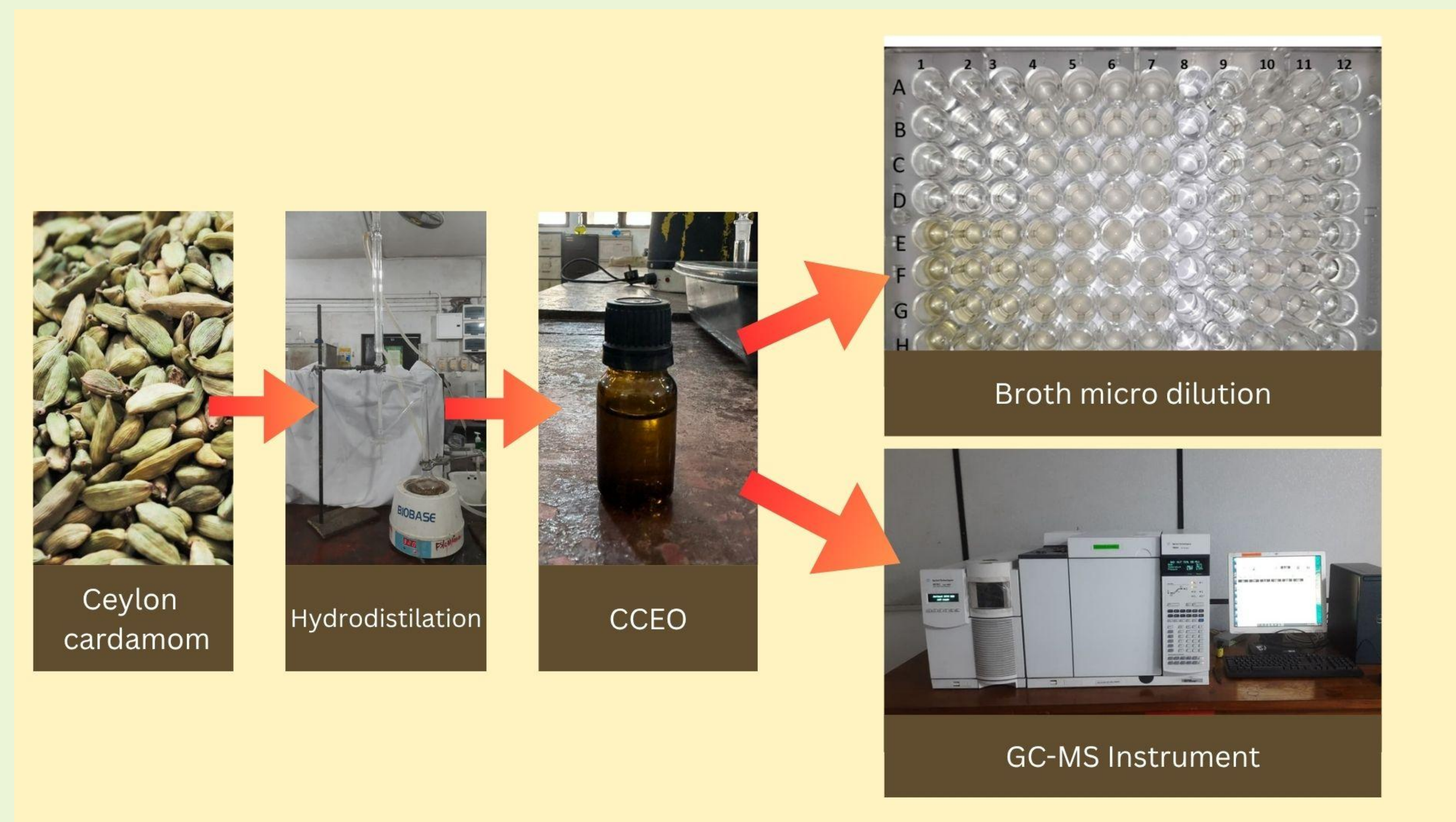


Figure 4: Work pipeline of the study

Results

- Ceylon cardamom essential oil (CCEO) was obtained as a transparent, pleasantly aromatic oil with a yield of 5.2% (w/w)
- CCEO exhibited antibacterial activity against all tested strains, with MIC and MBC values ranging from 2.5–5.0 mg/mL. The strongest inhibition was observed against *Staphylococcus aureus* (MIC: 2.5 mg/mL).
- Fifteen compounds of CCEO were identified by GCMS with α -terpinyl acetate (B) (47.52%) and 1,8-cineole (A) (24.18%) as majors.

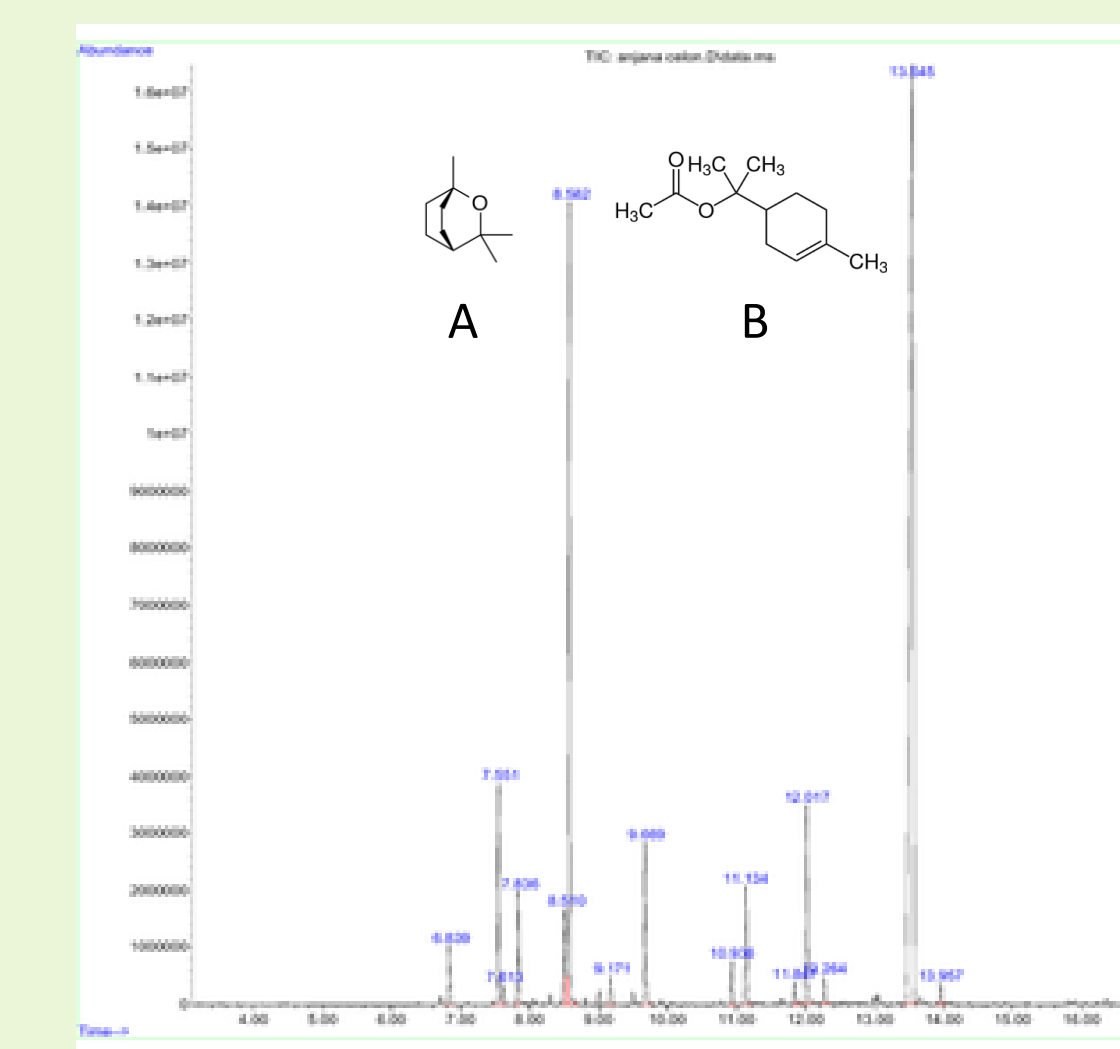


Figure 5: GC-MS result

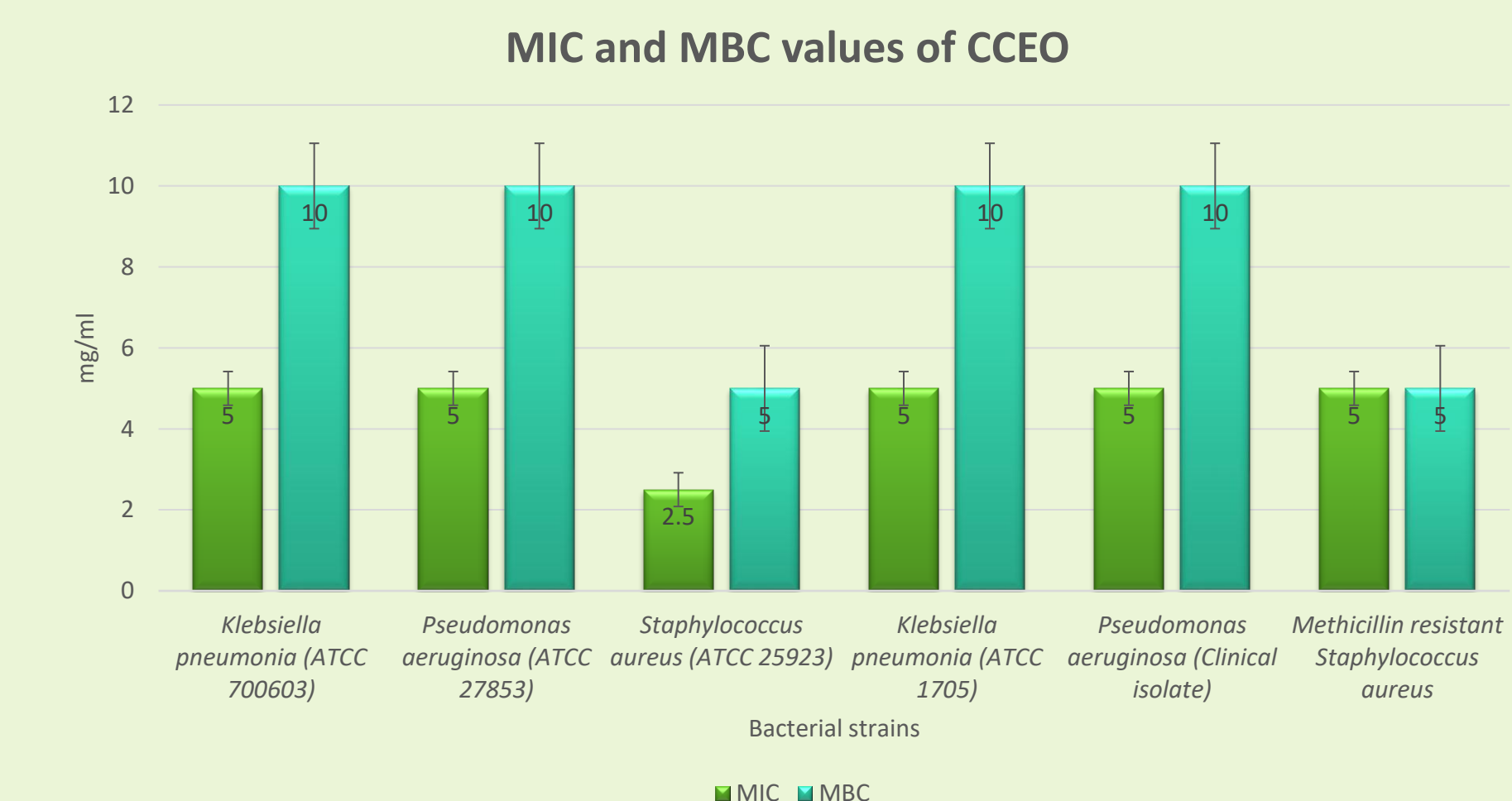


Figure 6: Antibacterial assay results

Conclusion

- CCEO shows antibacterial activity against all six tested strains and highest activity against the Gram-positive bacteria. The observed antibacterial activity may be attributed to the most abundant oxygenated monoterpenes' activity including α -terpinyl acetate and 1,8-cineole against bacteria by multiple mechanisms.

References

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