DOI: 10.46991/JISEES.2025.SI1.080

Antibiotic Potential of Mentha Arvensis Extract

Sona Sargsyan[1*], Silvard Tadevosyan[1], Anush Babayan[1], Alvard Minasyan[1], Andranik Davinyan[2], Armenuhi Moghrovyan[3], Naira Sahakyan[1]

[1] Research Institute of Biology, Department of Biochemistry, Microbiology & Biotechnology, Faculty of Biology, Yerevan State University, Yerevan, Armenia

[2] Scientific and Technological Center of Organic and Pharmaceutical Chemistry of NAS RA, 26, Azatutian ave., Yerevan 0014, Armenia

[3] Department of Pharmacognosy, Yerevan State Medical University after M. Heratsi, Koryun 2, Yerevan, 0025, RA

ABSTRACT

Many decades after the first patients were treated with antibiotics, bacterial infections have again become a threat. To mitigate the risk of antibiotic resistance, scientists now consider plant secondary metabolites to be a major organic antibacterial substitute. *Mentha arvensis* is widely used both as a culinary spice and as an important remedy in Armenian traditional medicine. Over 40 components were identified in the investigated extract by Ultra High-Performance Liquid Chromatography (UHPLC). Among the identified components are coumarins (3 components), organic acids (around 11 components), flavan-3-ols (2 components), stilbene (1 component), flavonols (3 components), and flavones (around 10 components). Current research emphasizes the antibacterial properties of *Mentha arvensis*. The bacterial strains used in this study included both gram-negative and gram-positive bacteria: *Escherichia coli* K12, ampicillin-resistant *E. coli* DH5a-pUC18, kanamycin-resistant *E. coli* pARG25, *Salmonella typhimurium* MDC 1754, *Bacillus subtilis* WT-A1, and *Staphylococcus aureus* MDC 5233. The disk-diffusion method (Kirby-Bauer antibiotic testing) was employed to assess the initial antimicrobial activity and estimate *in vitro* antimicrobial susceptibility. *M. arvensis* extract (MAE) formed bacterial growth inhibition zones ranging in size: 4.0-6.0 mm in the case of *B. subtilis*, 4.0-5.0 mm for *E. coli DH5a*-pUC18, and 3.0-4.0 mm for *E. coli* K12. Origanum exhibited no inhibitory effect on any tested bacteria in this test. MTT was performed to evaluate bacterial susceptibility to antibiotics after the treatment with MAE. The results indicated that the investigated extract showed no effect on kanamycin-resistant *E. coli*. However, it (0.25 mg/mL) reduced the MIC of ampicillin for *E. coli DH5a*-pUC18 *by* sixfold, and fourfold at the concentration of 0.125 mg/mL. To elucidate the potential mechanisms of the antibiotic activity of tested extract, the changes in H^+-fluxes across the cell membrane in ampicillin-resistant *E. coli* were explored. According to the results, MAE does not have any significant influence on the total proton flux of the reference strain, meanwhile, the extract reduces the flux twice in the resistant strain, indicating the influence of extract components on membrane-associated properties of bacteria.

Keywords: antibiotic resistance, *Mentha arvensis*, antimicrobial activity, Kirby-Bauer antibiotic testing, MTT, proton flux

References:

1. Ginovyan, M.; Babayan, A.; et al. The Action Mechanisms, Anti-Cancer and Antibiotic-Modulation Potential of *Vaccinium myrtillus* L. Extract. *Discov. Med.* **2023** *35*, 590–611. DOI:10.24976/Discov.Med.202335177.59
2. Vaou, N.; Stavropoulou E.; et al. Interactions between Medical Plant-Derived Bioactive Compounds: Focus on Antimicrobial Combination Effects. *Antibiotics* **2022,** *11*, 1014. DOI:10.3390/antibiotics11081014

[*]Corresponding Author:

Sona Sargsyan, Research Institute of Biology, YSU, 1 Alex Manoogian str.,Yerevan, 0025, Armenia.
Email: sona.sargsyan15@edu.ysu.am