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It is our great pleasure to present this Supplement Issue on “*Macedonian Pharmaceutical Bulletin*” to the scientific and professional community. This supplement includes the short communications accepted for the 11th Conference on Medicinal and Aromatic Plants of Southeast European Countries 2022 (CMAPSEEC 2022), which was held between October 6th and 10th, 2022 in Ohrid, Republic of North Macedonia.

The main theme of the CMAPSEEC was “*The apprising plants of the new era*” with topics such as phytochemistry, ecology, diversity, pharmacology and phytotherapy, production of herbal substances and their preparations, and 360° Cannabis were carefully selected for this special occasion in order to build up a highly interesting and comprehensive program. The conference enabled hybrid in-person/virtual solution which supported: online, pre-recorded or on-site oral scientific presentations; and, participation with e-poster (all posters were displayed in a gallery banner comprising QR-code links to posters).

Sincere thanks to the hosts of the 11th Conference on Medicinal and Aromatic plants of Southeast European Countries, Macedonian Pharmaceutical Association, Faculty of Pharmacy, Ss ‘Cyril and Methodius University’ in Skopje and the Association for Medicinal and Aromatic plants of Southeast European Countries (AMAPSEEC) for their vision and commitments.

We would also like to thank the companies that showed interest in supporting our efforts during the organization. We acknowledge the general sponsor VARUS, Skopje, and the sponsoring companies: SINCERITAS, NATUSANA, ALKALOID AD, REPLEK, GALAFARM, HEALTH AID, FARMATIVA, FARMAHEM, HEMERA, VEDRA.

We would also like to thank our members of the Scientific Committee for their volunteer time and dedication to the critical peer review process as well as to all members of the Organizing Committee, whose work and commitment was invaluable.

On behalf of the Advisory and Scientific Committees, we would like to express our special gratitude to all internationally prominent researchers, whose work was supposed to be an essential part of the Conference. The interest in publishing their short communications in this Special issue of the Macedonian Pharmaceutical Bulletin is of a crucial importance for reinforcing the overall quality and standards of the bulletin. They give the state of the art of the recent advances in the field of plant research.

The scientific program comprised of 1 plenary, 12 invited lectures, 14 oral presentations, and 70 posters, providing an opportunity for more than 100 natural product scientists to present their research. A total of 148 participants were attending the Conference from 21 countries (Albania, Austria, Bulgaria, China, Croatia, Czech Republic, Greece, Hungary, Kosovo, Marocco, Montenegro, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Turkey, United Kingdom, and USA).

The pharmaceutical sciences continue to grow as dynamic scientific interdisciplinary fields. We believe that published short communications will be an excellent source of scientific material in the fast-evolving fields in pharmaceutical sciences and practice.

Chair of the Scientific committee

Prof. Biljana BAUER



Chair of the Organizing committee

Prof. Gjoshe STEFKOV



Your hosts
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This issue of *Macedonian Pharmaceutical Bulletin* contains short communications accepted by the Scientific Committee for the presentation at the 11th Conference of Medicinal and Aromatic Plants of Southeast European Countries 2022 (CMAPSEEC 2022).

The authors are fully responsible for the contents of their short communications.

All reviewers that were involved in the short communications revision process are sincerely acknowledged.

Antimicrobial activity of ethyl acetate extract of an endemic *Centaurea glaberrima* Tausch (Asteraceae)

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Introduction

Global health and modern medicine are facing a worldwide issue nowadays – antimicrobial resistance of microorganisms. A great interest in the pursuit of bioactive compounds from plants that can be antimicrobial drugs has been triggered due to multidrug resistance in pathogenic microorganisms and undesirable side effects of certain antibiotics (Alviano & Alviano, 2009).

Ethnobotanical data suggest that many *Centaurea* species are traditionally used for treatment of various ailments in people and animals, as well as for nourishment (Khammar & Djeddi, 2012). Extracts obtained from *Centaurea* exhibit wide range of biological activity (Khammar & Djeddi, 2012) with a numerous studies concerning antimicrobial activity (Güven et al., 2005; Karamenderes et al., 2006; Özcan et al., 2019; Dimkić et al., 2020).

Centaurea glaberrima Tausch (Asteraceae), Circum-Mediterranean Clade *sensu* Hilpold et al. (2014), is an endemic plant species that inhabits fields as well as a rocky cliffs and waste places in the West Balkans (Dostál, 1976).

There is no information on biological activity of *C. glaberrima* therefore the aim of this study was to investigate antimicrobial potential of ethyl acetate extract of this endemic species.

Materials and methods

Plant material

Plant material of *C. glaberrima* was collected in August 2021 at the Orjen Mountain (Montenegro). Voucher specimen (BEOU 38660) was deposited at the Herbarium of the University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac" (Thiers, 2016).

Extraction

Plant material, 10 g of air-dried *C. glaberrima* aerial parts, was milled into powder using a laboratory mill and submerged in 150 mL of ethyl acetate for 24 hours. After that the sample was ultrasonicated for 15 min and filtered afterwards. In order to re-extract the plant residue, procedure was repeated twice for 48 hours each time using additional 150 mL of solvent. After last repeat, sample was evaporated to dryness using rotary vacuum evaporator.

Antimicrobial activity

Antimicrobial potential of extract was investigated on four bacterial strains (*Escherichia coli* ATCC 35210, *Klebsiella pneumoniae* ATCC 13883, *Pseudomonas aeruginosa* PAO1, and *Staphylococcus aureus* ATCC 6538) and three *Candida* strains (*Candida auris* ATCC 11903, *Candida parapsilosis* ATCC 22019, and *Candida tropicalis* ATCC 750) using microdilution method. Minimum inhibitory and minimum bactericidal

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concentrations (MIC/MBC) were determined by a serial microdilution of *C. glaberrima* extract in 96-well microtiter plates following the protocol described by Kostić et al., 2017. Minimal inhibitory and minimal fungicidal concentrations (MIC/MFC) were determined according to the modified EUCAST, 2002 procedure.

Results and discussion

Ethyl acetate extract of *C. glaberrima* showed moderate antibacterial and anticandidal activity. *Escherichia coli* ATCC 35210 and *Pseudomonas aeruginosa* PAO1 were more susceptible to the extract (MICs 0.5 mg/ml) than *Klebsiella pneumoniae* ATCC 13883 and *Staphylococcus aureus* ATCC 6538 (MICs 1 mg/mL). Extract exhibited the strongest anticandidal activity against *Candida parapsilosis* ATCC 22019 (MIC 0.25 mg/mL) while *C. auris* ATCC 11903 and *C. tropicalis* ATCC 750 were equally susceptible (MICs 1 mg/mL).

Previous study of antimicrobial activity of several *Centaurea* species showed that the ethyl acetate extracts were the most active against bacteria and *Candida* species (Güven et al. 2005). Species from Circum-Mediterranean Clade are scarcely investigated from the aspect of biological activity, including antimicrobial activity. It was shown that extracts of capitula and aerial parts of *Centaurea kilaea* inhibited the growth of *P. aeruginosa* at concentrations 312 µg/mL which is lower than MIC from current study (0.5 mg/mL). Extracts also exhibited activity against *C. albicans* (MICs 312 µg/mL), and it was more susceptible than *Candida* strains investigated herein, with an exception of *C. parapsilosis* (0.25 mg/mL). Extract of aerial parts of *C. cuneifolia* inhibited the growth of *S. aureus* (MIC 625 µg/mL) (Şen et al., 2014) more than *C. glaberrima* extract (MIC 1mg/mL). Extracts of *C. cariensis* ssp. *maculiceps* and *C. cariensis* subsp. *microlepis* were active against *E. coli* (MICs 2 and 4 mg/mL, respectively), and *S. aureus* (MICs 2 mg/mL) (Tekeli et al., 2011) in concentrations higher than obtained in this study. *C. virgata* exhibited activity against *E. coli* as well (MIC 1 mg/mL) (Tekeli et al., 2011).

Conclusion

Centaurea glaberrima ethyl acetate extract showed promising results in microdilution assay against tested bacteria and yeasts. To the best of our knowledge, this is the first study concerning biological activity of this species and outcome encourages further investigation.

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