6th International Electronic Conference on Medicinal Chemistry
1-30 November 2020
sciforum.net/conference/ECMC2020
sponsored by pharmaceuticals

Salvia pratensis L. as valuable source of phenolic compounds with promising antimicrobial activity

Nikola Srećković[1], Jelena S. Katanić Stanković[2], Vladimir Mihailović[1]

[1] University of Kragujevac, Faculty of Science, Department of Chemistry, Radoja Domanovića 12, 34000 Kragujevac, Serbia

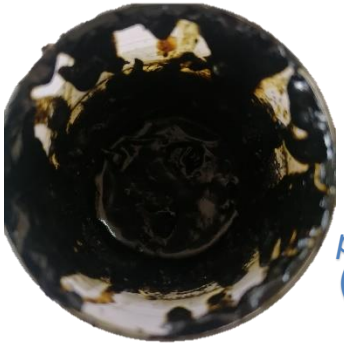
[2] University of Kragujevac, Institute for Information Technologies Kragujevac, Department of Science, Jovana Cvijića bb, 34000 Kragujevac, Serbia.

* Corresponding author: nikola.sreckovic@pmf.kg.ac.rs

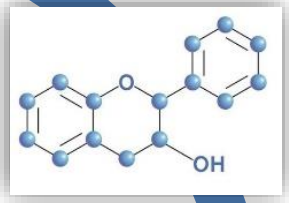
Salvia pratensis L. as valuable source of phenolic compounds with promising antimicrobial activity

CH_3OH

CH_3OH

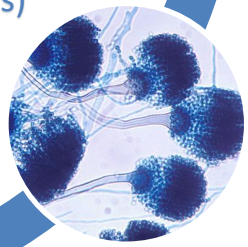


Salvia pratensis L. (aerial part and root methanol extracts)



Phenolic content

Antibacterial activity



Antifungal activity

Abstract:

The study aimed to determine phenolic content and antimicrobial activity of *S. pratensis* aerial part (SPA) and root (SPR) methanol extracts as a starting base for further pharmacological research and potential application. Spectrophotometric determination of phenolic compounds in extracts showed high content of total phenolic compounds in both investigated extracts. SPR was richer in the contents of total phenolic compounds (177.85 mg GAE/g), condensed tannins (96.36 mg GAE/g), and phenolic acids (37.95 mg CA/g) while SPA had higher content of total flavonoids (68.46 mg QUE/g), flavonols (1.59 mg RUE/g) and monomeric and total anthocyanins (17.83 and 29.92 mg Cy 3 glc/g, respectively). In order to evaluate the antimicrobial activity of SPA and SPR the microdilution method was used. SPR inhibited the growth of *E. faecalis*, *B. cereus*, *B. subtilis*, *S. epidermidis*, *S. aureus*, and *S. typhimurium* at a lower concentration than the lowest applied (MIC < 0.156 mg/mL). SPA possessed lower antibacterial activity compared to SPR. As for antifungal activity, the extracts showed moderate activity against most of the tested fungal strains. *S. pratensis* root extract possesses promising antibacterial activity and obtained results may be a good basis for further research.

Keywords: *Salvia pratensis* L.; phenolic content; antimicrobial activity;

Introduction

- The *Salvia* genus represents the most important source of compounds with a beneficial effect on human health.

- *Salvia pratensis* (L.) known as meadow clary or meadow sage is a flowering plant belongs to the genus *Salvia*, family Lamiaceae. Most of *Salvia* species have been widely used in the food, fragrance and drug industry.

Figure 1. *S. pratensis* aerial part and root

- Meadow sage has been traditionally used as a paste to remove particles from the eyes and to reduce inflammation or redness, as well as a gargle for sore throats and clean teeth.

Extracts preparation

The plant material (aerial parts and roots) was collected in May 2018 in central Serbia (village Veliko Krčmare).

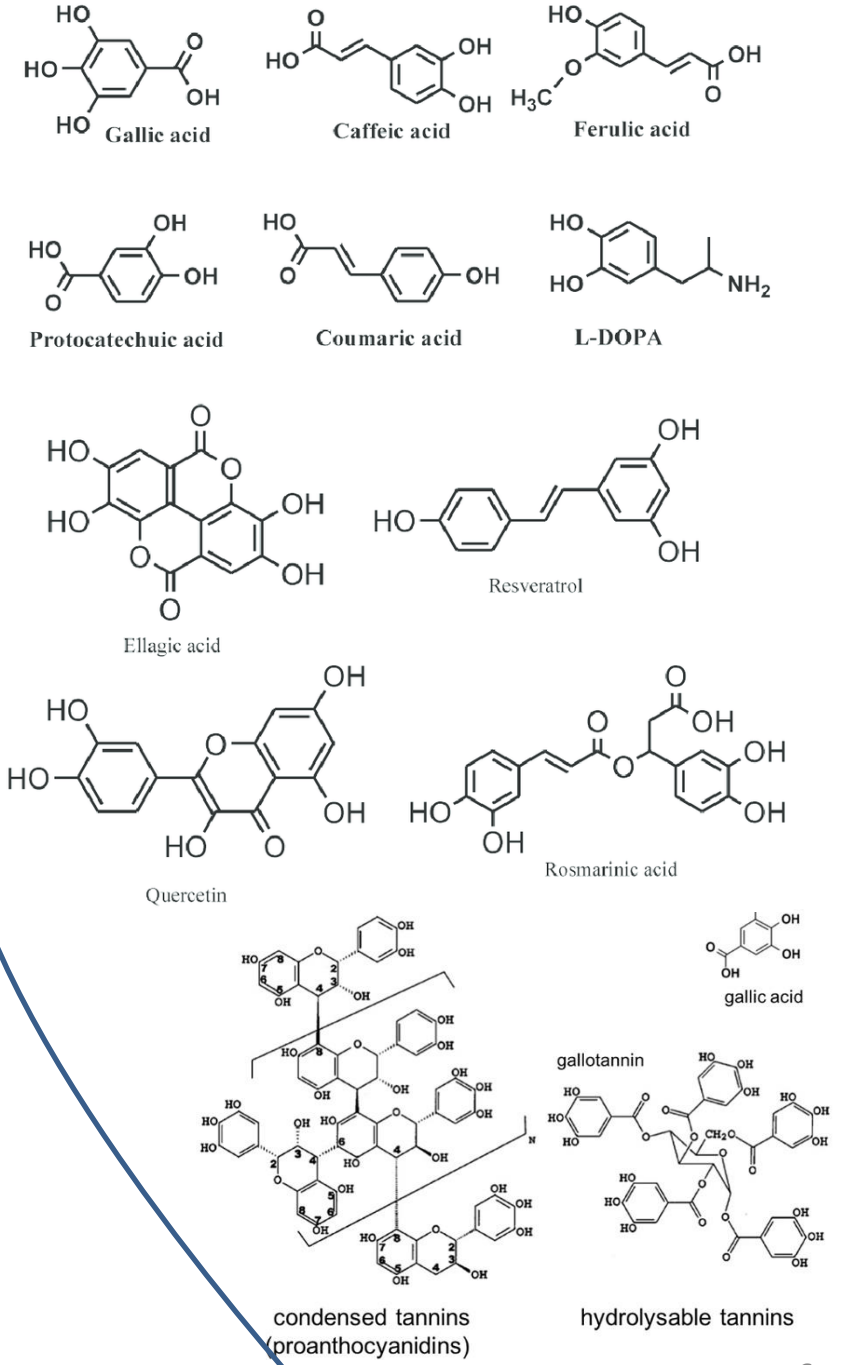
Fresh plant was harvested, and areal parts and roots were dried at room temperature in a ventilated oven in the dark place.

Dried and powdered aerial parts and roots of *S. pratensis* were macerated with 300 mL of methanol for 24 h three times.

Phenolic content

- The different classes of phenolic compounds were determined spectrophotometrically, using corresponding methods.

  - Total phenolic content
  - Total flavonoid content
  - Total flavonol content
  - Condensed tannins content
  - Total phenolic acid content
  - Monomeric anthocyanins content
  - Total anthocyanins content



MIC

- In order to evaluate the antimicrobial activity of the of *S. pratensis* aerial part and root methanol extracts the microdilution method was used.
- The suspension of test strains prepared from a fresh overnight culture of bacteria and fungi were adjusted using a colorimeter to a concentration of 1.0×10^6 CFU mL^{-1} for bacteria and 1.0×10^4 CFU mL^{-1} for fungi.

- 11 bacterial species
- 9 fungi species

Results and discussion

Table 1. The content of different classes of phenolic compounds in the aerial part (SPA) and root (SPR) extracts of *S. pratensis*

Samples	Total phenolic content (mg GAE/g extract)	Total flavonoid content (mg QUE/g extract)	Total flavonol content (mg RUE/g extract)	Condensed tannins content (mg GAE/g extract)	Total phenolic acid content (mg CA/g extract)	Monomeric anthocyanins content (mg Cy-3-glc/g extract)	Total anthocyanins content (mg Cy-3-glc/g extract)
SPA	128.94 ± 2.65[a]	68.46 ± 6.73	1.59 ± 0.41	69.68 ± 4.83	3.91 ± 0.61	17.83 ± 2.27	29.92 ± 2.75
SPR	177.85 ± 0.35	33.27 ± 1.66	0.36 ± 0.06	96.36 ± 3.29	37.95 ± 2.99	10.20 ± 0.71	15.40 ± 0.76

[a] Results are mean values ± SD from three measurements; GAE – gallic acid equivalents; QUE – quercetin equivalents; RUE– rutin equivalents CA – caffeic acid equivalents; Cy-3-glc – cyanidin-3-O-glucoside equivalents

Results and discussion

Table 2. Antibacterial activity of *S. pratensis* aerial part and root methanol extracts

Bacterial species		MIC*		
		SPA (mg/mL)	SPR (mg/mL)	Ciprofloxacin (µg/mL)
M. lysodeikticus	ATCC 4698	10	20	10
E. faecalis	ATCC 29212	10	<0.156	20
E. coli	ATCC 25922	10	>20	2.5
K. pneumoniae	ATCC 70063	20	>20	2.5
P. aeruginosa	ATCC 10145	20	20	<0.156
B. cereus	ATCC 10876	1.25	<0.156	0.625
B. subtilis	ATCC 6633	5	<0.156	20
S. epidermidis	ATCC 12228	20	<0.156	5
S. aureus	ATCC 25923	5	<0.156	5
S. enteritidis	ATCC 13076	20	>20	2.5
S. typhimurium	ATCC 14028	5	<0.156	20

*MIC- minimum inhibitory concentration values.

Results and discussion

Table 3. Antifungal activity of *S. pratensis* aerial part and root methanol extracts

		MIC*		
Fungi species		SPA (mg/mL)	SPR (mg/mL)	Nystatin (µg/mL)
C. albicans	ATCC 10259	20	20	1.25
F. oxysporom	FSB 91	0.3125	5	2.5
A. brasiliensis	ATCC 16404	10	10	1.25
A. alternata	FSB 51	10	20	1.25
D. stemonitis	FSB 41	10	20	2.5
T. longibrachiatum	FSB 13	10	10	5
T. harzianum	FSB 12	5	2.5	5
P. canescens	FSB 24	2.5	2.5	2.5
P. cyclopium	FSB 23	1.25	5	2.5

*MIC-minimum inhibitory concentration values.

Conclusions

- High phenolic content in both extracts. SPR was richer in the contents of total phenolic compounds, condensed tannins, and phenolic acids, while SPA had higher content of total flavonoids, flavonols, and monomeric and total anthocyanins.

- *S. pratensis* root extract possesses promising antibacterial activity and obtained results may be a good basis for further research for its application and development of new antimicrobial natural products for pharmacy and/or foods.

Acknowledgments

This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Agreements No. 451-03-68/2020-14/200122 and 451-03-68/2020-14/200378).

Република Србија

Министарство просвете,
науке и технолошког развоја