

Chemical composition of the ethanol extracts of *Verbascum niveum* flowers and leaves

Maja Grigorov¹; Dragana Pavlović¹; Vanja Tadić²; Ivana Nešić¹; Bojan Zlatković³

¹Department of Pharmacy, Faculty of Medicine, University of Niš, Serbia, ²Department of Pharmaceutical Research and Development, Institute for Medicinal Plant Research "Dr Josif Pančić", Belgrade, Serbia,

³Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, Serbia

Verbascum species, commonly known as "mullein", are used in both traditional and regular medicine, in the treatment of internal and external diseases. European Medicines Agency (EMA) recommends the use of *Verbasci flos* in respiratory disorders, but traditional medicine recommends the use of the whole aerial parts of *Verbascum* species also to treat skin inflammations, wounds, and other dermatological problems. Numerous biological properties have been proven in different *Verbascum* species: anti-inflammatory, antioxidant, antimicrobial, antiviral, antinociceptive, antitussive, etc. All activities are related to plants' chemical constituents, so there are a lot of different compounds identified in *Verbascum* species.

Component	mg/g dry flower extract	mg/g dry leaf extract
Gallic acid	4,6219	2,7708
Protocatechuic acid	2,4117	7,1537
p-hydroxybenzoic acid	43,1694	/
Chlorogenic acid	/	2,3955
Vanilic acid	7,8160	47,0295
Caffeic acid	/	0,2877
Verbascoside	2,0600	73,8544
Luteolin	/	14,8039
Apigenin	0,2512	1,0219
Chrysoeriol	/	1,3247
Aucubin	1,7318	/
Catalpol	85,1365	67,8456

Botanical identification of the specimens was performed by prof. Bojan Zlatković and the voucher specimens were stored in the herbarium of the Faculty of Science and Mathematics, University of Niš (Herbarium code: 14615).

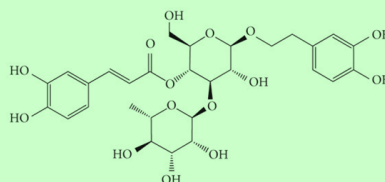


The plant material (flowers and leaves) was collected in the vicinity of Bosilegrad in July 2021. Extracts were prepared by percolation with 50% ethanol according to European Pharmacopoeia 10.0 (2019).

RP-HPLC coupled with DAD detection was employed for the detection and quantification. Chromatograms of extracts and standards were recorded under the same conditions.



Considering the numerous biological effects of *Verbascum* species studied so far, the aim of our study was to identify the secondary metabolites of ethanolic extracts of *Verbascum niveum* flowers and leaves, a species about which there is very little literature data.



Although we have not found much data on this species in the literature, based on our results *Verbascum niveum* has a significant amount of various secondary metabolites, which express numerous biological effects, and is, therefore, a plant species with great potential.

This research was supported by the Ministry of Education and Science of the Republic of Serbia (Grant No. 451-03-68/2022-14/200113) and the Faculty of Medicine University of Niš Internal Scientific Project No. 15.

1. Alipieva, K., Korkina, L., Erdogan Orhan, I., Georgiev, I. M., 2014. Verbascoside — A review of its occurrence, (bio)synthesis and pharmacological significance. *Biotechnol Adv.* 32(6), 1065-76. doi: 10.1016/j.biotechadv.2014.07.001. 2. Angeloni, S., Zengin, G., Sinan, K.L., Ak, G., Maggi, F., Caprioli, G., Kaplan, A., Bahs, M., Çakılcıoğlu, U., Bouyahya, A., Jugreet, S., Mahomoodally, M.F., 2021. An insight into *Verbascum bombyciferum* extracts: Different extraction methodologies, biological abilities and chemical profiles. *Ind. Crops Prod.* 161: 113201. doi: 10.1016/j.indcrop.2020.113201. 3. Council of Europe. *European Pharmacopoeia*. 10th Edition. Strasbourg: Council of Europe: European Directorate for the Quality of Medicines and Healthcare; 2019. 4. Ghahremania, A., Pirbaloutia, A. G., Mozafari, H., Habibib, D., Sania, B., 2020. Phytochemical and morpho-physiological traits of mullein as a new medicinal crop under different planting pattern and soil moisture conditions. *Ind. Crops Prod.* 145: 111976. doi: 10.1016/j.indcrop.2019.111976. 5. Pana, Y., Denga, Z., Chena, X., Zhanga, B., Fana, Y., Lia, H. Synergistic antioxidant effects of phenolic acids and carotenes on H2O2-induced H9c2 cells: Role of cell membrane transporters. 2021. *Food chemistry.* 341: 128000. doi: 10.1016/j.foodchem.2020.128000. 6. Panche, N.A., Diwan, D.A., Chandra, R.S. 2016: Flavonoids: an overview. *J. Nutr. Sci.*, 5(47), 1-15. doi: 10.1017/jns.2016.41. 7. Thabet, A. A., Ayoub, I. M., Youssef, F.S., Al-Sayed, E., Efferth, T., Singab, A.N.B., 2022. Phytochemistry, structural diversity, biological activities and pharmacokinetics of iridoids isolated from various genera of the family *Scrophulariaceae* Juss. *Phytomedicine plus.* 2: 100287. doi: 10.1016/j.phyplu.2022.100287