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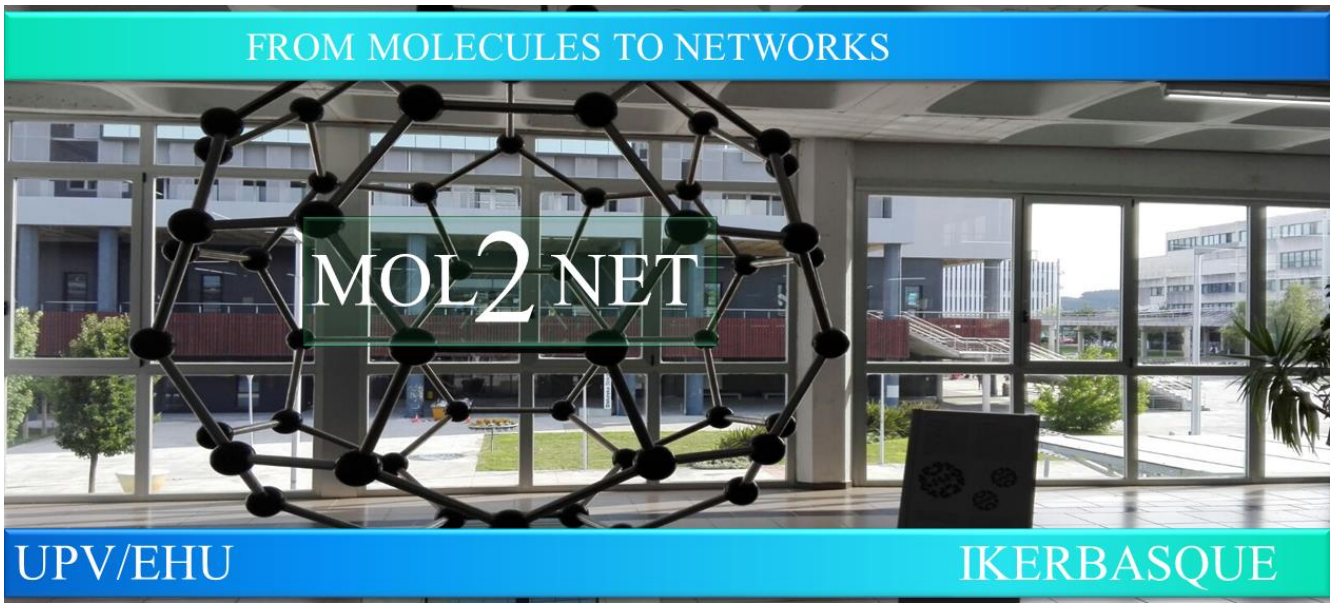

Determination of oleanolic acid and ursolic acid content in *Epilobium* spp. using HPLC

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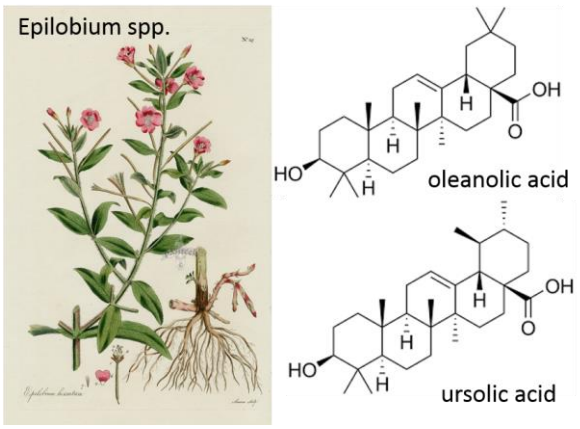
Graphical Abstract



Abstract

HPLC screening of pentacyclic triterpenoids (oleanolic and ursolic acids) in raw materials of ten Epilobium species (Epilobium parviflorum Schreb., Epilobium hirsutum L., Epilobium montanum L., Epilobium collinum C. C. Gmel., Epilobium roseum Schreb, Epilobium palustre L., Epilobium tetragonum L., Epilobium obscurum Schreb, Epilobium nervosum Boiss. & Buhse, Epilobium nutans F. W. Schmidt) from Ukraine were carried out. The absence of studied

	triterpenoids delimits E. parviflorum and E. hirsutum from other species. This distinction is not connected to climatic factors since the samples from different collection sites were tested for both species. The triterpenoid presence/absence criteria might be one of the marker in chemotaxonomic study of genus Epilobium. In the aerial part of other eight studied species ursolic acid was contained in moderate quantity (20.27±0.49 mg/100g - 74.84±2.24 mg/100g) and dominated the oleanolic acid (2.03±0,05 – 32.09±0.73 mg/100g). Aerial part of E. roseum had a lowest ursolic acid content (20.27±0.49 mg/100g) and oleanolic acid was not detected in this sample. Both identified triterpenoids can contribute to anti-proliferative effect of ethanolic and nonpolar extracts of Epilobium herbs on prostate cancer cells.

Introduction

Oleanolic (OA) and ursolic (UA) acids, naturally occurring pentacyclic triterpenoids, were reported inhibiting cell survival and proliferation of human prostate cancer cells (Meng et al. 2015; Li et al. 2016). These compounds, along with other biologically active substances such as the ellagitannins, flavonoids, phenolic acids, steroids contribute to anti-proliferative effect of *Epilobium* plant raw materials (Granica et al. 2014; European Medicines Agency 2016; Yoshida et al. 2018). OA and UA were only identified in herb and leaves of *Ch. angustifolium* (L.) Holub (formerly *E. angustifolium* L.) among *Epilobium* species (Granica et al. 2014). Consequently, the aim of this study was identification and quantification of triterpenoids in *Epilobium* plant raw materials.

Materials and Methods

The plant raw materials of *E. parviflorum* Schreb., *E. hirsutum* L., *E. montanum* L., *E. collinum* C. C. Gmel., *E. roseum* Schreb, *E. palustre* L., *E. tetragonum* L., *E. obscurum* Schreb, *E. nervosum* Boiss. & Buhse, *E. nutans* F. W. Schmidt. were collected in differed Ukrainian sites in June-July 2018-2019. Compounds extraction and HPLC analysis were conducted according to the previously published paper (Bernatoniene et al. 2016)

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Results and Discussion

HPLC screening of triterpenoids of *Epilobium* species showed presence of OA and UA in aerial part of *E. palustre, E. collinum, E. montanum, E. tetragonum, E. obscurum, E. nervosum, E. nutans*. UA were contained in range from 20.36±0.55 mg/100g to 74.84±2.24 mg/100g and dominated OA (2.03±0,05 – 32.09±0.73 mg/100g) in all samples Aerial part of *E. roseum* had a lowest UA content (20.27±0.49 mg/100g) and OA was not detected in this species. OA and UA inhibit cell growth and induct apoptosis

in human prostatic cancer cell lines through modulation of the PI3K/Akt/mTOR and PI3K/Akt pathways respectively (Meng et al. 2015; Li et al. 2016). Therefore, these triterpenoids can potentiate anti-profilirative effect of ellagitannins in *Epilobium* preparations.

Conclusions

The oleanolic and ursolic acids were first identified in plant raw materials of E. palustre, E. collinum, E. montanum, E. tetragonum, E. obscurum, E. nervosum, E. nutans. Aerial part of E. roseum differed from previous seven species by the lowest UA content (20.27±0.49 mg/100g) and absence of OA. The study results revealed that plant raw materials E. parviflorum and E. hirsutum differed from other samples according to absence of such triterpenoid group. The separation of species on this basis makes possible to use ursolic and oleanolic acid as markers in further chemotaxonomic studies of genus Epilobium L.

References

Bernatoniene, J., Cizauskaite, U., Ivanauskas, L., Jakstas, V., Kalveniene, Z., Kopustinskiene, D. M. (2016). Novel approaches to optimize extraction processes of ursolic, oleanolic and rosmarinic acids from *Rosmarinus officinalis* leaves. Ind Crops Prod. 84: 72-79.

Constantin D., Coste A., Mircea T. (2013). *Epilobium* Sp. (Willow Herb): Micropropagation and Production of Secondary Metabolites. In: Chandra S., Lata H., Varma A. (eds). Biotechnology for Medicinal Plants. Springer, Berlin, Heidelberg; 149-170.

European Medicines Agency (2016). Assessment report on *Epilobium angustifolium* L. and or *Epilobium Parviflum* Schreb. Herba (final).

Granica S., Piwowarski JP., Czerwińska M.E., Kiss AK. (2014). Phytochemistry, pharmacology and traditional uses of different *Epilobium* species (Onagraceae): a review. J. Ethnopharmacol. 156: 316-346.

Hoch P.C., Crisci J.V., Tobe H., Berry P.E. (1993). A Cladistic Analysis of the Plant Family Onagraceae. Systematic Botany 18: 31-47.

Li1 X., Song Y., Zhang P., Zhu H., Chen L., Xiao Y., Xing Y. (2016). Oleanolic acid inhibits cell survival and proliferation of prostate cancer cells in vitro and in vivo through the PI3K/Akt pathway. Tumor Biol.: 7599-7613.

Meng Y., Lin Z., Ge N., Zhang D., Huang J., Kong F. (2015). Ursolic acid induces apoptosis of prostate cancer cells via the PI3K/Akt/mTOR pathway. Am. J. Chin. Med., 2015: 1471-1486.

Sheidai, M., Rahimi, S., Mehrabian, AR., Koohdar, F., Nourmohammadi, Z. (2018). Species delimitation in *Epilobium* (sec. *Epilobium*, Onagraceae): morphological, molecular and palynological data. Biologia. 73: 1-8.

Vitalone A., Allkanjari O. (2018). *Epilobium* spp: Pharmacology and phytochemistry. Phytother. Res. 32: 1229-1240.

Wagner W.L., Hoch P.C., Raven P.H. (2007). Revised Classification of the Onagraceae. Syst. Bot. Monogr. 83: 1-239.

Yoshida T., Yoshimura M., Amakura Y. (2018). Chemical and biological significance of oenothein B and related ellagitannin oligomers with macrocyclic structure. Molecules: 552.