

2nd International Conference in Pharmacology: From Cellular Processes to Drug Targets Rīga, Latvia, 19–20 October 2017

MEETING ABSTRACT

A2.37

From forest to pharmacy: studies of pharmaceutically valuable compounds in wild black crowberry (*Empetrum nigrum*)

Zane VINCEVICA-GAILE^{1,*}, Sabine STRAUTA¹, Jorens KVIESIS¹,
Ruta MUCENIECE² and Maris KLAVINS¹

¹Department of Environmental Science, University of Latvia, Riga, Latvia; ²Department of Pharmacy, Faculty of Medicine, University of Latvia, Riga, Latvia

Background: Black crowberries (*Empetrum nigrum*) are higher plants distributed mostly in a circumboreal area of the Northern Hemisphere, including forests of Latvia. Although crowberries are described to be useful in ethnomedicine due to antioxidative, antimicrobial, anti-inflammatory and diuretic activity, their chemical composition has not been studied widely [1].

Objectives: The aim of this study was to identify pharmaceutically active compounds in berries and foliage of *Empetrum nigrum* collected in forests of Latvia to promote their use in new pharmaceutically valuable products.

Methods: Berries and foliage of black crowberries were hand-picked in the end of summer, 2015, in nature reserve Moorland of Cena (Latvia). Extracts from berries were obtained using different methods, but 5% solution of formic acid in 96% ethanol enhancing extraction by ultrasound was assessed as the most promising; extract of foliage was obtained using chloroform. UPLC, GC-MS analysis of extracts were performed to detect anthocyanins, lipids and flavonoids. Antiradical activity was detected using DPPH, total polyphenols with Folin–Ciocalteu reagent, and carbohydrates by the phenol–sulphuric acid method [2].

Results: Total content of polyphenols in berries was 2.80–8.32 g/100 g (as gallic acid equivalent, GAE); total flavonoids: 0.77–11.57 g/100 g (as quercetin dihydrate equivalent, QDE); sum of carbohydrates: 4.20–8.82 g/100 g (as glucose equivalent); antiradical activity varied 12–15% depending on the extraction method. Concentrated extract of black crowberries contained polyphenols 36.20 g/100 g (as GAE) and flavonoids 36.25 g/100 g (as QDE), thus resulting in 69.5% antiradical activity. Concentrated extract of polyphenols contained 48.7 mg/g of anthocyanins and it was possible to identify 13 anthocyanins, predominantly of those delphinidin-3-O-galactoside, cyanidin-3-O-galactoside and peonidin-3-O-galactoside which are more stable than arabinosides [3]. In total, 17 lipid compounds were detected, predominantly linoleic acid, linolenic acid and oleic acid. Nine compounds were identified in extract of foliage (mostly dihydrochalcones and flavanones) indicating potential antibacterial and antifungal activity [4].

Conclusions: High levels of polyphenols, especially anthocyanins (13 anthocyanins were identified by UPLC) with elevated antiradical activity were detected in extract of *Empetrum nigrum* berries. Berries and foliage of black crowberries can be a good source of phytosterols and unsaturated fatty acids; thus, their use for production of pharmaceutical products is promising.

Acknowledgements: This study was supported by the European Regional Development Fund within project no. 1.1.1.1/16/A/047 “Genus *Vaccinium* berry processing using ‘green’ technologies

and innovative, pharmacologically characterized biopharmaceutical products”.

Keywords: anthocyanins – antiradical activity – lipids – polyphenols – forest berries – *Empetrum nigrum*

References

1. Krasnov EA, Ermilova EV, Kadyrova TV, Raldugin VA, Bagryanskaya IY, Gatilov YV, Druganov AG, Semenov AA, Tolstikov GA: **Phenolic components of *Empetrum nigrum* extract and the crystal structure of one of them.** *Chem Nat Compd*, 2000; 36(5):493–496. doi:10.1023/A:1002887406817
2. Klavins L, Kviesis J, Klavins M: **Comparison of methods of extraction of phenolic compounds from American cranberry (*Vaccinium macrocarpon* L.) press residues.** *Agron Res*, 2017; 15(S2):1316–1329. <http://agronomy.emu.ee/index.php/category/volume-15-2017/special-issue-ii-volume-15-2017/?aid=5038&sa=0#abstract-5037> (last accessed 06/10/2017)
3. Kallio H, Pallasaho S, Kärppä J, Linko RR: **Comparison of the half-lives of the anthocyanins in the juice of crowberry, *Empetrum nigrum*.** *J Food Sci*, 1986; 51(2):408–410. doi:10.1111/j.1365-2621.1986.tb11142.x
4. Li H, Jean S, Webster D, Robichaud GA, Calhoun LA, Johnson JA, Gray CA: **Dibenz[b,f]oxepin and antimycobacterial chalcone constituents of *Empetrum nigrum*.** *J Nat Prod*, 2015; 78(11): 2837–2740. doi:10.1021/acs.jnatprod.5b00627

*Corresponding author: Zane Vincevica-Gaile, Department of Environmental Science, University of Latvia, 19 Raina Blvd., LV-1586, Riga, Latvia.
E-mail: zane.gaile@lu.lv