

ABSTRACT

The birch genus (*Betula* L.) includes about 50 species of trees and shrubs. Birches are characterized by a wide range of occurrences and high morphological variability. Additionally, they often form interspecies hybrids, which results in numerous problems in the systematics of the *Betula* genus. Nowadays, information about the chemical composition of birch tissues is often used for the taxonomic classification of birches.

Birch belongs to plants, that has been used in folk medicine since ancient times. Birch leaves or buds extracts are characterized by a broad spectrum of biological activity due to the rich contains of numerous sesquiterpenes, triterpenes, flavonoids and phenolic acids. The European Pharmacopoeia includes chapter devoted to pharmacological application of birch leaves that are currently used in the production of drugs, dietary supplements and cosmetics. Whereas, birch buds are not widely used in industrial production. Probably, it is the result of insufficient knowledge about the chemical composition of birch buds, as well as, the pharmacological activity of the chemical compounds contained in this raw material.

For this reason, within this doctoral dissertation, a detailed chemical composition study of buds from silver birch (*B. pendula*) and downy birch (*B. pubescens*) was decided to be conducted, which are the most widespread species of a birch on the Eurasian continent. Furthermore, it was decided to analyze the volatile compounds emitted from the buds of different birch species.

Extracts from *B. pendula* and *B. pubescens* buds were obtained using five-step sequential extraction, using successively: supercritical CO₂ (scCO₂), *n*-hexane, chloroform, diethyl ether, and methanol: water (4: 1). The analysis of chemical compositions of extracts was performed using GC-MS. As a result of the chromatographic separations, three triterpenes were isolated, and the structures of these compounds were determined using ¹H and ¹³C NMR spectroscopy. Isolated compounds, i.e. 3,4-*seco*-dammara-4(29),20(21),24(25)-trien-3-oic acid, 20-hydroxy-3,4-*seco*-dammara-4(29),24(25)-dien-3-oic acid and cabraleone were further subjected to research of their anti-cancer activity. Furthermore, the quantitative determinations of flavonoids and selected triterpenes in scCO₂ extracts from birch buds were performed. Moreover, the analysis of volatiles emitted from buds of 22 species and 2 varieties of birch were realized. Based on obtained research results, three groups of birches were distinguished. It was revealed, that the results of this research can be useful for chemosystematic purposes of *Betula* genus.

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