PŮVODNÍ PRÁCE

Variability of the essential oil from three sorts of Echinacea MOENCH genus during ontogenesis

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SUMMARY

Variability of the essential oil from three sorts of *Echinacea* MOENCH genus during ontogenesis
The content and quality of the essential oil in relation to the main ontogenetic stages of plants were studied in three various sorts of *Echinacea* genus. The comparison included *Echinacea purpurea, Echinacea atrorubens*, and *Echinacea pallida.* The differences in the content of the oil in different parts of plants and the abundance of individual oil constituents in oils from the sorts under study at the optimum stage of ripeness for harvest were evaluated as well.
Key words: *Echinace purpurea* L. – *Ecinacea pallida* NUTT. – *Echinacea atrorubens* NUTT. – ontogenesis – essential oil

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SÚHRN

Variabilita silice troch druhov rodu *Echinacea* MOENCH v rôznych štádiách ontogenézy
V práci sa študoval obsah a kvalita silice vo vzťahu k hlavným ontogenetickým štádiám rastlín, u troch rôznych druhov rodu Echinacea. Porovnávali sa druhy: Echinacea purpurea, Echinacea atrorubens a Echinacea pallida. Ďalej sa sledovali rozdiely v obsahu silice v rôznych častiach rastliny a hodnotilo sa zastúpenie jednotlivých obsahových látok v silici sledovaných druhov v štádiu optimálnej zrelosti pre zber.
Kľúčové slová: *Echinacea purpurea* L. – *Echinacea pallida* NUTT. – *Echinacea atrorubens* NUTT. – ontogenéza – silica

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Introduction

After a stormy development of new synthetic, therapeutically usable drugs, we can see a world-wide trend of a come-back of natural drugs, which are most acceptable by the human organism. The medicinal plants which became important sources for the production of drugs with immunostimulatory activity in recent years include some sorts of the *Echinacea* MOENCH genus coming from North America. According to the ecological claims they can be divided into several groups. Thus, the *Echinacea* genus contains mainly mesophytes, which require moderate and/or high supplies of water. Longer soil drying can be withstood only by the sorts which possess high adaptability. The area of their original occurrence lies at the near woods – mountain

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localities on the one side, or at higher positioned sandy ones. The sorts occupying the second type of places do not require large water supply, since their cylinder-shaped long roots enable them to survive at worse conditions as well.

The data about the constituent compounds from the individual sorts along with their therapeutical effects were published by several teams of authors [1-4].

EXPERIMENTAL PART

Material and methods

The plant sorts of *Echinacea purpurea* (L.) MOENCH, *Echinacea atrorubens* NUTT., and *Echinacea pallida* NUTT. grown under multifactor cultivation conditions were taken into the experiments. Both underground and above-ground parts of the plant samples, i.e. roots, stems, leaves, flowers, and their individual parts, were examined. They were collected from three localities of their cultivation (Nitra I, Stará Ľubovňa II, Oponice III) differing in quality of soil and ecological and climatic conditions. Detailed agro-ecological characteristics of individual localities are archived at the research workplace.

a) Determination of the oil content in the drug

Twenty grams of dry flower heads were subjected to hydrodistillation for 3.5 hours in accordance with the European Pharmacopoea 2000 [5]. Isolated oil was diluted in n-hexane and dried over anhydrous sodium sulfate.

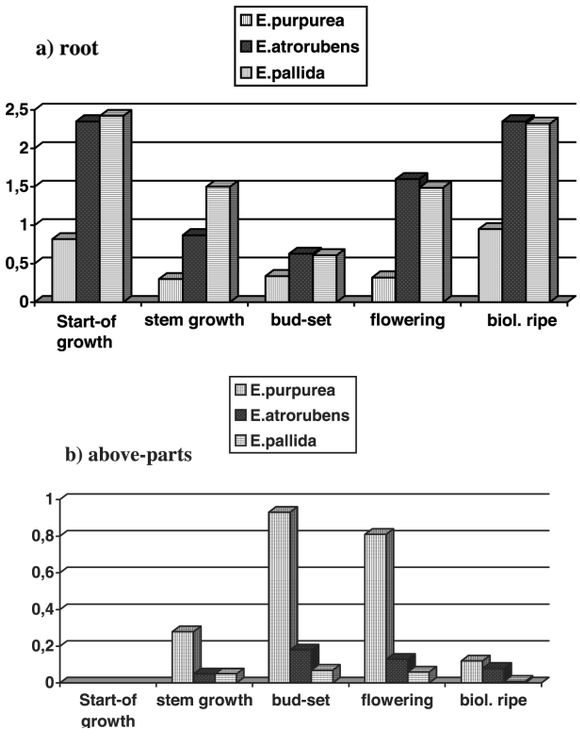


Fig. 1 a, b. The essential oil content (%, V/m) in the roots and above-ground parts of three different sorts of Echinacea MOENCH during ontogenesis

b) Identification of the main oil constituents by gas chromatography

Oil samples were analysed using a Hewlett Packard HP 5971A mass selective detector directly coupled to an HP 5890 Series II FID gas chromatograph. A capillary column DB-WAX/25 m × 0.20 mm, 0.2 mm film thickness (Hewlett Packard, USA) was used. The temperature programme was as follows: 40 °C – 250 °C at 3 °C/min. The injection port temperature was 220 °C. Helium was used as the carrier gas, split ratio 1:50. Mass spectra were recorded at ionisation energy (EI)m of 70 eV.

Oil components were identified by comparison of their mass spectra with those from the databases NBS 75 K, INRA MASS (LRSA, Dijon, France), Wiley 138, and NIST.

RESULTS AND DISCUSSION

The three sorts of *Echinacea* MOENCH genus under study in various stages of their ontogenetic growth contained 0.30–2.42 % (V/m) of the oil in the roots, and 0.01–0.93 % in the above-ground parts, respectively. The root system of *Echinacea purpurea* and *Echinacea atrorubens* contained the highest oil amount at the stage of full biological ripe-

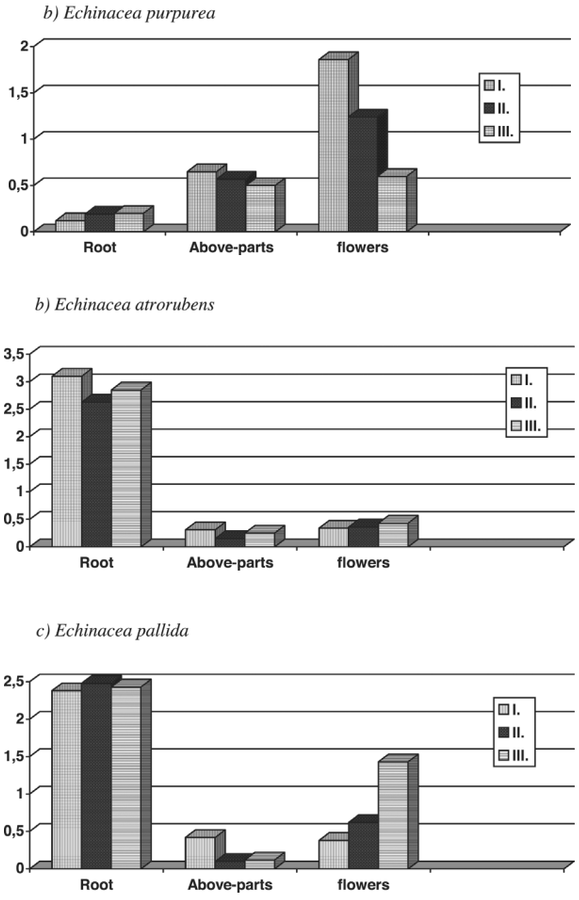
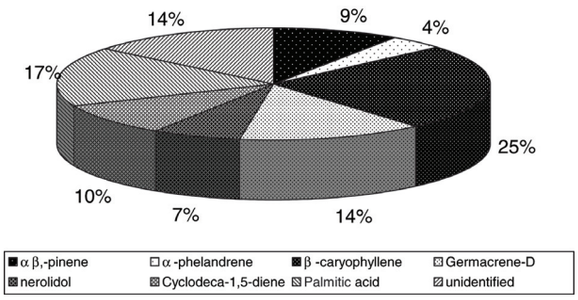


Fig. 2 a, b, c. The dependence of the essential oil content on the cultivation locality for three different sorts of Echinacea MOENCH

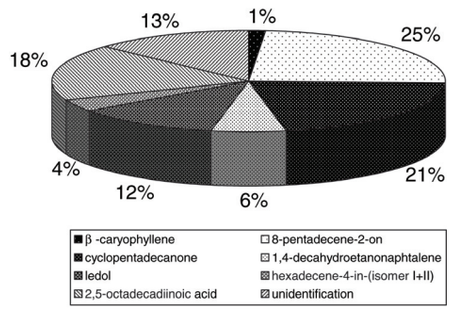
Tab. 1. Composition of essential oil from flower heads of Echinacea purpurea (L.) MOENCH

Component	Area %
α, β-pinene	9.47
α–phelandrene	4.23
β–caryophyllene	25.02
Germacrene-D	13.78
nerolidol	6.60
Cyclodeca-1.5-diene	9.51
Palmitic. linaloic acid	17.19
unidentified	14.20



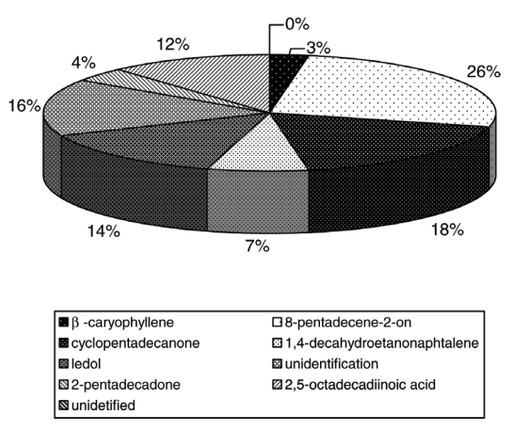
Tab. 3. Composition of essential oil from the roots of Echinacea atrorubens NUTT

Component	Area %
ß –caryophyllene	1.32
8-pentadecene-2-on	24.30
Cyclopentadecanone	21.25
1.4-decahydroetanonaphtalene	6.25
Ledol	11.87
Hexadecene-4-in- (isomer I+II)	3.93
2.5-octadecadiinoic acid	17.92
unidetified	13.16



Tab. 2. Composition of essential oil from roots of Echinacea pallida NUTT

Component	Area %
β–caryophyllene	2.67
8-pentadecene-2-on	26.10
Cyclopentadecanone	18.32
1.4-decahydroetanonaphtalene	7.25
Ledol	14.36
unidentified	15.75
2-pentadecadone	3.90
2.5-octadecadiinoic acid	11.65



ness, while *Echinacea pallida* at the beginning of growth. The highest oil content in the above-ground parts was found at the bud-set stage of all three sorts under study, i.e. 0.93 % for *Echinacea purpurea,* 0.18 % for *Echinacea atrorubens,* and 0.07 % for *Echinacea pallida* (Fig. 1).

Dependence of the oil content upon a cultivation locality has been most pronounced in the case of flowers of *Echinacea purpurea* (maximal difference of 1.26 %) and *Echinacea pallida* (maximal difference of 1.05 %). For *Echinacea atrorubens*, it has been found that the greatest sensitivity in this respect is exerted by its root system, where the differences in oil contents were up to 0.47 %. The most suitable cultivation locality was found to be Nitra for *Echinacea purpurea* and *Echinacea atrorubens,* and Oponice for *Echinacea pallida*, from which the highest oil amount was yielded (Fig. 2). The problem of the influence of various climatic conditions along with the quality of individual plant organs during the plant growth has been examined by several authors [5-9].

The relative abundance of individual constituents may be discussed as follows: *Echinacea pallida* is typical because of its high content of 8-pentadecene-2-one (26.10 %) and that of cyclopentadecanone (18.32). In general, *Echinacea atrorubens* does not differ much from *Echinacea pallida* in the composition of their oils, but *Echinacea purpurea* differs significantly in the oil composition and the content of individual constituents: it possesses a remarkably high content of α, β-pinene (9.4 %), caryophyllene (25.02 %), palmitic and linaloic acids (Tab. 1, 2, 3, Fig. 3, 4, 5).

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ZPRÁVY

● Nadnárodní kolo Studentské vědecké konference farmaceutických fakult 2007

Dne 18. května proběhlo ve farmaceutické společnosti Zentiva a.s. Praha nadnárodní kolo Studentské vědecké konference studentů farmaceutických fakult z Bratislavy, Brna a Hradce Králové. Do soutěže bylo delegováno 18 vítězných studentských prací z jednotlivých farmaceutických fakult, které byly rozděleny do tří sekcí: biologické, chemické a dalších farmaceutických disciplín. Hodnocení se ujaly tři poroty složené z akademických pracovníků výše jmenovaných fakult a tři poroty tvořené předními odborníky Zentivy a.s.

Všechny příspěvky byly na velmi dobré úrovni, a tak měly poroty obtížný úkol vybrat ty nejlepší. V jednotlivých sekcích se umístily na předních místech následující práce.

SEKCE BIOLOGICKÁ

1. **Katarína Mackovičová a Michael Ölvedy**, studenti 2. ročníku FaF UK Bratislava (Katedra farmakológie a toxikológie): Pozorovanie arytmie typu Torsade de Pointes po chronickom podávaní klaritromycínu a furosemidu u potkanov
Školitel: PharmDr. Ján Klimas, Ph.D.

2. **Lenka Vildová**, studentka 4. ročníku FaF UK Hradec Králové (Katedra biochemických věd): Vliv vybraných cytostatik na aktivitu redukčních enzymů v cytosolu MCF7 buněk
Školitelka: Mgr. Martina Gavelová, Ph.D.

3. **Pavlína Doubková**, studentka 3. ročníku FaF UK Hradec Králové (Katedra biologických a lékařských věd): Hodnocení antropometrických parametrů v graviditě
Školitel: PharmDr. Miloslav Hronek, Ph.D.

Cena Zentivy:

Kateřina Holáňová, studentka 4. ročníku FaF VFU Brno (Ústav humánní farmakologie a toxikologie): Model indukované tachykardie u laboratorního potkana a její ovlivnění enantiomery potenciálních beta-blokátorů
Školitelka: RNDr. Ladislava Bartošová, Ph.D.

SEKCE CHEMICKÁ

1. **Hana Bémová**, studentka 4. ročníku FaF UK Hradec Králové (Katedra farmaceutické chemie a kontroly): Syntéza prekurzorů pro biologicky aktivní laktony
Školitelka: Mgr. Marta Chlupáčová, Ph.D.

2. **Matúš Pupák**, student 3. ročníku FaF UK Bratislava (Katedra chemickej teórie liečiv): Príprava, vzťah štruktúry, fyzikálno-chemických vlastností a biologickej aktivity nových dimérnych katiónových tenzidov
Školitel: doc. Ing. Ivan Lacko

3. **Iva Kapustíková**, studentka 4. ročníku FaF VFU Brno (Ústav chemických léčiv): Stanovenie fyzikálno–chemického profilu potenciálnych liečiv metódou kapilárnej zónovej elektroforézy a micelárnej elektrokinetickej chromatografie
Školitelka: RNDr. Anna Lišková

Cena Zentivy:

Matúš Pupák, student 3. ročníku FaF UK Bratislava (Katedra chemickej teórie liečiv): Príprava, vzťah štruktúry, fyzikálno-chemických vlastností a biologickej aktivity nových dimérnych katiónových tenzidov
Školitel: doc. Ing. Ivan Lacko

SEKCE DALŠÍCH FARMACEUTICKÝCH DISCIPLÍN

1. **Gabriela Škrabáková**, studentka 5. ročníku FaF VFU Brno (Ústav technologie léků): Pelety s obsahem chitosanu připravené metodou extruze/ sferonizace
Školitelka: Mgr. Lucie Janovská

2. **Lucie Valíčková**, studentka 5. ročníku FaF UK Hradec Králové (Katedra sociální a klinické farmacie): Nepoužitelná léčiva v lékárnách ČR
Školitelka: RNDr. Jana Kotlářová, Ph.D.

3. **Katarína Gatialová**, studentka 3. ročníku FaF UK Bratislava (Katedra organizácie a riadenia farmácie): Tvorba systému kvality vo verejných lekárňach
Školitelky: doc. RNDr. Magdaléna Fulmeková, CSc.; PharmDr. Lubica Lehocká, Ph.D.

Cena Zentivy:

Lenka Vocilková, studentka 5. ročníku FaF VFU Brno (Ústav technologie léků): Hydrofilní matricové systémy s obsahem bronchodilatancia
Školitelka: PharmDr. Kateřina Dvořáčková

Všem oceněným studentům a jejich školitelům blahopřejeme.

M. Rabišková