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Essential oil from two populations of *Echinodorus grandiflorus* (Cham. & Schltdl.) Micheli (Chapéu de couro)

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**ABSTRACT**

Analysis by Gas Chromatography and Gas Chromatography/Mass Spectrometry of the essential oils obtained from leaves of *Echinodorus grandiflorus* (“Chapéu de couro”) from two different populations (Big Leaves and Small Leaves), collected monthly between September 1998 and December 1999 revealed 17 components. Phytol was the major constituent for both populations. The main sesquiterpene representatives are (E)<sub>c</sub>-caryophyllene, α-humulene and (E)-nerolidol.

**Key words:** *Echinodorus grandiflorus*, Alismataceae, essential oil, sesquiterpenes, diterpenes.

**INTRODUCTION**

Alismataceae is a primitive monocotyledonous family comprising 11 genera and 75 species occurring in tropical, subtropical and subtemperate regions in the Eastern as well as the Western Hemisphere (Crow 2003). These plants are aquatic or semi-aquatic herbs with milky sap. Of the two largest genera, *Echinodorus* is restricted to the neotropics, native in tropical America and it is formed by 26 species that occur from northern United States to Patagonia (Haynes and Nielsen 1994). In Brazil *E. grandiflorus* and *E. macrophyllus* are popularly known as “chapéu de couro”. These plants have been used in the folk medicine as anti-inflammatory and diuretic. The chemical profile of *Echinodorus* species is represented basically by terpenoids (Manns and Hartmann 1993, Tanaka et al. 1997, Costa et al. 1999, Kobayashi et al. 2000a, b).

This paper aims to describe the leaf essential oils from two populations of *E. grandiflorus*.

**MATERIALS AND METHODS**

**COLLECTION OF PLANT MATERIAL**

Leaves of *E. grandiflorus* were collected monthly from September 1998 to December 1999, (except in February and July) in Tanguá, Rio de Janeiro State, Brazil. The plants have been cultivated in two different places in the area resulting in two morphologically distinct populations: one showing exuberant big leaves (BL), growing on the sandy...
bed of an irrigation ditch and the other, with scrubby small leaves (SL), occurring on a clayish bank formerly used as a decantation lake for fluorite mining residues. The mean of leaf dry weight along the fourteen months of collection was 4.0 g and 1.2 g respectively for BL and SL. Leaves of the specimens from the two populations were always harvested in the morning by 10.00 o’clock. The botanical materials were identified by the botanist Dr. Erika Santos Guimarães as Echinodorus grandiflorus (Chamisso and Schlechtendal) Micheli, and the vouchers are found at the Herbarium CESJ, Universidade Federal de Juiz de Fora, Juiz de Fora, MG, under the register number 30.707.

IDENTIFICATION OF THE OIL COMPONENTS
The compound identifications were carried out by comparison of their retention indices (RI) with literature values; and the MS data with those from Wiley 275.1 mass spectral data base besides literature records (Adams 1995).

RETENTION INDICES (RI)
These indices were calculated using a GC data of a homologous series of saturated aliphatic hydrocarbons within C8 to C22, performed at the same column and conditions as used in the GC analysis for the essential oils.

RESULTS AND DISCUSSION
The identified constituents of E. grandiflorus essential oils for the two analyzed populations (BL and SL) are shown in Tables I and II respectively, as well as with their percentage monthly recorded in GC analyses for the period September 1998 to December 1999, except in February and July. Both tables also show for each compound the mean percentage of oils, the mean retention time (RT) and the mean calculated retention indices (RI) as well as the literature RI recorded. Considering the relative area percentage, the total identified compounds was 58.9% for the BL and 60.3% for SL populations, being 39.9% / 32.0% due to mono- and sesquiterpenes and 19.0% / 28.3% to diterpenes for BL and SL populations respectively. Analyses of these tables show for the two populations phytol as the major oil constituent. The other significant sesquiterpene oil components are (E)-caryophyllene, (E)-nerolidol and α-humulene. Figures 1a and 1b shows the variability of the major sesquiterpene constituents from September 1998 to December 1999, for the two populations and (E)-caryophyllene showed to be the most representative product although for the BL population it has been closely followed by (E)-nerolidol.

The relative percentages of diterpenes in the E. grandiflorus essential oils for the two populations (Figures 2a and 2b) besides the production of huge...
### TABLE I
Identified constituents of E. grandiflorus essential oils from two populations with their mean percentage monthly recorded in GC-analysis for the period September 1998 to December 1999, together their mean percentage of oil (O), the mean retention time (RT), and the mean calculated retention indices (CRI) as well as the literature (RI, LRI).

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<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>O</th>
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* 18 = identified mono- and sesquiterpenes (1–13); 19 = identified diterpenes (14–17); 20 = identified constituents (1–17). LRI = Adams 1995; ** = Tanaka et al. 1997; *** = (C.M.A. Tanaka, unpublished data).
This exuberant phytol production is of great value since this compound has been responsible for some recorded important biological activities (Pongprayoon et al. 1992, Rajab et al. 1998) which may indicates *E. grandiflorus* as a potential plant source for phytopharmaceuticals. In conclusion, it is worth to point out that the prominent production of phytol in both populations may characterize this compound as a chemotaxonomic marker for this plant species.

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The authors wish to thank Erika S. Guimarães/USP for species identification, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Fundação Oswaldo Cruz (FIOCRUZ) for financial support and Far-Manguihnhos Analytical Center for chromatograms.

Análise por cromatografia com fase gasosa e cromatografia com fase gasosa acoplada à espectrometria de massas de óleos essenciais obtidos de folhas de *Echinodorus grandiflorus* (“Chapéu-de-couro”) em duas diferentes populações (folhas grandes e folhas pequenas), coletadas mensalmente entre setembro de 1998 e dezembro de 1999, revelou 17 componentes. Fitol foi o constitutiente majoritário em ambas populações. Os principais representantes sesquiterpênicos foram *(E)-cariofileno*, *(α-humuleno)* e *(E)-nerolidol*.
Fig. 2 – Monthly variability of the major diterpene constituents of the E. grandiflorus essential oil from the SL (a) and BL (b) populations (% of chromatogram oil).

Palavras-chave: Echinodorus grandiflorus, Alismataceae, óleo essencial, sesquiterpenos, diterpenos.

REFERENCES


