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Influence of growth phase on the essential oil composition of *Hyptis suaveolens*

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Abstract

The chemical composition of the essential oils of seven populations of *Hyptis suaveolens* in vegetative, flowering and fruiting stages and their interpopulation variability were investigated by GC–MS. Sabinene, limonene, 1,8-cineole, (*E*)-caryophyllene and spathulenol were the principal constituents. The results from the chemical analysis were submitted to Principal Component and Chemometric Cluster Analysis which allowed five groups of populations to be distinguished with respect to the stage of growth and high content of bicyclogermacrene/terpin-4-ol, sabinene, 1,8-cineole/spathulenol, limonene/γ-terpinene and spathulenol/(*E*)-caryophyllene. Pattern of geographic-variation in essential oil composition indicated that monoterpene hydrocarbons were mainly produced in plants from sampling sites located in higher latitudes and altitudes regardless of the phase of growth, while sesquiterpenes were

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mainly produced in fruiting samples grown at lower ones. The Canonical Correlation Analysis between the soil sampling sites with the populations revealed a significant relationship between oil components and edaphic factors. Sesquiterpenes and potential acidity, Al, and Al saturation load fairly strong onto the first canonical variate and are related to fruiting samples collected at lower latitudes. On the other hand, monoterpene hydrocarbons are strongly related to chemical balance in soils (P, Zn, Cu, Mn, base saturation, neutral pH), which is related to the vegetative/flowering sampling at higher latitudes.

Keywords: *Hyptis suaveolens*; Lamiaceae; Essential oil; Chemical variability; Multivariate analysis; Canonical correlation

1. Introduction

The genus *Hyptis* Jacq. exhibits a major morphological diversity in Brazilian Cerrado (Harley, 1988). Its species are quite aromatic and are reported in the treatment of gastrointestinal infections and pain, as well as in the treatment of skin infections (Corrêa, 1931). The aggressive annual weedy species, *Hyptis suaveolens* (L.) Poit., is distributed in tropic and subtropic regions, and normally restricted to places where soils have been profoundly disturbed (Wulff, 1973). Studies dealing with the composition and antifungal (Pandey et al., 1982; Singh et al., 1992; Zollo-Amvam et al., 1998; Malele et al., 2003), antibacterial (Iwu et al., 1990; Asekun et al., 1999), and anticonvulsant (Akah and Nwambie, 1993) activities of leaf oil have been previously reported. This species has showed a high degree of variability in quantity and composition of the essential oil, and differ according to the geographic origin of the plants (Gottlieb et al., 1981; Luz et al., 1984; Din et al., 1988; Iwu et al., 1990; Mallavarapu et al., 1993; Ahmed et al., 1994; Hac et al., 1996; Peerzada, 1997; Ngassoum et al., 1999; Asekun and Ekundayo, 2000; Sidibe et al., 2001; Malele et al., 2003). In earlier studies, we applied multivariate analysis techniques to quantitative data obtained for volatile constituents in different sample sites (Azevedo et al., 2001, 2002). We now report on the results obtained for the oil composition and variability of *H. suaveolens* in different growth phases and sampling sites in which organic matter, texture and aluminium are the principal differential edaphic factors. For that purpose, seven sites (Table 1) were chosen and the qualitative and quantitative analyses of the essential oil of a representative population sample in differing stages were performed by GC–MS. To study the interpopulation variability, the volatile constituents were submitted to Principal Component (PC) and Cluster Analysis in order to detect some pattern distribution of samples and to identify which constituents can differentiate the groups of individuals. In addition, the environmental factors affecting essential oils variability were studied through the application of Canonical Correlation Analysis between the oil component data set and an edaphic data matrix with 18 variables for each sampling site.