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Chemical and genetic differentiation of two Mediterranean subspecies of *Teucrium scorodonia* L.

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ABSTRACT

Chemical and genetic diversity of *Teucrium scorodonia* L. subsp. *scorodonia* from Corsica and *T. scorodonia* L. subsp. *baeticum* from western Algeria were investigated. Diversity within and among the two populations of subspecies was assessed according to the chemical composition of their essential oils, and genetic diversity was evaluated using three polymorphic genetic markers. Chemical analysis was performed using a combination of capillary GC-RI and GC/MS after fractionation using column chromatography. Genetic structures were mapped using two chloroplast markers (*RPL32-TRNL* and *TRNL-F*) and ribosomal nuclear markers (ITS region). The statistical analysis showed that the two subspecies were clearly distinguished by these chemical and genetic markers. The chemical composition of oil differed qualitatively and quantitatively between the subspecies. Corsican oil samples contained germacrene B (4.2–8.8%) and γ -elemene (2.6–5.7%), which were not detected in Algerian oil samples. The oils of the *scorodonia* and *baeticum* subspecies were dominated by sesquiterpene hydrocarbon compounds (75.6–82.9% and 69.6–79.4%, respectively), but they differed in oxygenated sesquiterpene content (3.1–8.9% and 8.4–20.3%, respectively). Neighbor-joining trees constructed from chloroplast DNA and ITS region sequences showed the existence of two groups associated with taxonomic and chemical characteristics. One group consisted of *T. scorodonia* subsp. *scorodonia* and the other of *T. scorodonia* subsp. *baeticum*, indicating that variation in the essential oil composition of *T. scorodonia* subspecies depends more on genetic background than environmental characteristics.

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1. Introduction

The genus *Teucrium* (Lamiaceae family) includes 300 species that occur all over the world, with most concentrated around the Mediterranean basin (Beni Maleci et al., 1995). Many species of *Teucrium* are used in traditional folk medicine and it is claimed they have hypoglycemic, antipyretic, antiulcer and antibacterial properties (Menichini et al., 2009). Some *Teucrium* species are valuable as alimentary plants; hydroalcoholic extracts of wild germander (*Teucrium chamaedrys*) are currently used in the preparation of flavored wines, bitters and liqueurs (Bosisio et al., 2004).

The genus *Teucrium* is one of the richest sources of neoclerodane diterpenes: more than 220 diterpenes have been described, many of which are of interest because of their insect-repellent and medicinal properties (Coll and Tandron, 2005; Menichini et al., 2009). *Teucrium* essential oils have been the subject of several investigations and their diverse chemical compositions were

recently reviewed (Awadh Ali et al., 2008). It appears that *Teucrium* essential oils are characterized by mono- and sesquiterpene hydrocarbon compounds.

Teucrium scorodonia L. is a pubescent rhizomatous dwarf shrub 15–50 cm in height. The leaves are triangular-ovate, crenate and cordate at the base and are petiolate. The inflorescence, which may be up to 15 cm, is simple or branched with ovate to lanceolate bracts and may be much shorter than the calyx. The calyx is villous and more or less glandular and it is strongly veined in fruit. The corolla (9 mm) is villous and pale greenish-yellow; white or reddish corollas occur, although rarely (Jeanmonod and Gamisans, 2007; Quezel and Santa, 1963; Tutin et al., 1972).

From a taxonomic point of view, *T. scorodonia* L. has three subspecies according to *Flora Europaea* (Tutin et al., 1972): (i) *T. scorodonia* subsp. *scorodonia*, which is the most common in Europe; (ii) *T. scorodonia* subsp. *baeticum* (Boiss and Reuter), commonly named *Teucrium pseudoscorodonia* Desf., which occurs in southwestern Spain and North Africa (Quezel and Santa, 1963); and (iii) *T. scorodonia* subsp. *euganeum* (Vis.) Arcangeli, which is localized to mainland Italy and Sicily. Therefore, Pignatti (1982) describes

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