

Essential Oil Variation in Red Oregano from Albania

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Red oregano (*Origanum vulgare* L. subsp. *vulgare*) is native to the mountainous slopes of Albania, thriving at altitudes ranging from 400 to 1300 m above sea level. The aerial components of oregano have been found to address a spectrum of health concerns. According to the Albanian Flora taxonomy, two subspecies of *Origanum vulgare* are recognized in Albania: *Origanum vulgare* L. subsp. *hirtum*, known as white oregano, and *Origanum vulgare* L. subsp. *vulgare*, known as red oregano. White oregano is rich in essential oil, about 5%, with carvacrol as the main compound, followed by its precursors p-cymene and γ -terpinene. It is primarily used as a spice, and its essential oils have stimulant, carminative, antispasmodic, and anticancer properties. Both subspecies contain considerable amounts of non-volatile phenolic compounds such as flavonoids and phenolic acids. Red oregano is commonly used to prepare tea. It contains less essential oil, up to 2%, and is characterized by Germacrene D as the main compound, followed by α -Cadinol, Elemol, and Bornyl acetate. However, this subspecies presents intriguing characteristics that require comprehensive exploration and analysis. This study extensively analyzes the *ex-situ* collection of various genotype populations of red oregano in Albania. Essential oils were extracted by employing the hydrodistillation method. Chemical analyses were carried out using gas chromatography coupled with a flame ionization detector and/or with a mass-spectrometer detector. We employed two statistical techniques, hierarchical cluster analysis (HCA) and principal component analysis (PCA), which allowed for a comprehensive examination of the relationships within the data set and more profound insights into the compositional patterns and interrelationships within the essential oils. The results revealed significant qualitative distinctions at the intraspecific level, particularly for sesquiterpenes, of populations originating from seven diverse geographic locations. All groups exhibit the hydrocarbon sesquiterpenes chemotype, comprising 49.02% to 71.09% of the essential oil content. Germacrene D and E-Caryophyllene were identified as the primary constituents, underscoring the pharmaceutical benefits of these compounds in chemotypes where they are more prevalent. The observed differences in essential oil compositions among red oregano populations in Albania are directly linked to genetic diversity, pinpointing specific clones with high potential for breeding programs. This study provides a practical foundation for selecting superior clones to enhance oil quality and yield, driving targeted improvements in red oregano in the case of its cultivation.

For the complete publication, please see:

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