Industrial Crops & Products 112 (2018) 262–273

Contents lists available at ScienceDirect

Industrial Crops & Products

journal homepage: www.elsevier.com/locate/indcrop

Research paper

Analysis of phytochemical and morphological variability in different wild- and agro-ecotypic populations of *Melissa officinalis* L. growing in northern habitats of Iran

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ARTICLE INFO

Keywords:
Melissa officinalis L
Chemotype
Diversity
Limonene-10-ol
Geraniol
Caryophyllene oxide

ABSTRACT

Melissa officinalis L. is an aromatic and perennial bushy plant with interesting pharmacological and biological properties, which extensively distributed in the Mediterranean region and Asia. In order to domestication and breeding of this plant, an assessment of phytochemical and morphological diversity among 65 individuals of 7 wild and 6 agro-ecotypic populations at full flowering stage, collected from 5 northern provinces of Iran, was carried out on the basis of morphological and phytochemical traits. The average of essential oil content was 0.13% to 0.35% (w/w). The characterization of the essential oils by gas chromatography-flame ionization detector (GC-FID) and gas chromatography–mass spectrometry (GC/MS) analyses revealed that all 65 sampled individuals were divided into the 3 chemotypes; chemotype I (geraniol and limonene-10-ol), chemotype II (geranyl linalool and thymol), and chmotype III(caryophyllene oxide and bergamotolacetet), which are comprising 10, 1, and 2 accessions, respectively. The major constituents in all 13 accessions essential oil were limonene-10-ol, geraniol, and caryophyllene oxide. The number of lateral branches, the length of petiole, and the length of lateral stem (CVs of 34.07, 26.28, and 22.82%, respectively) were the main morphological features with high variability among the other studied populations. The high chemical differentiation among and within populations based on their geographical and bioclimatic distribution enforces a breeding approach to gain homogenous cultivars suitable for the agriculture and industry.

1. Introduction

The Lamiaceae (syn. Labiatae) contain many species known for their natural volatile oils with diverse therapeutic advantages and economic importance (Gören et al., 2002; Shadia et al., 2007; Sartoratto et al., 2004). Lemon balm (*Melissa officinalis* L.) is one of the valuable species belonging to this family, which also called bee balm, bee herb, balm mint and sweet balm as well as “Badranjboya” (in Persian) (Noorul Basar and Zaman, 2013). This plant is a native herb to South and Central Europe, Northern Africa, the Mediterranean region, Western Asia, the Caucasus and Northern Iran, but now it grows worldwide (Bahtiyarca and Bağdat, 2006). Lemon balm is a perennial, upright, bushy and hairy aromatic herb, grows from 70 to 150 cm tall, with oil rich leaves. The white or pale pink flowers consisting small clusters of 4–12 blossom during the summer (Ghahreman, 1994).

Essential oils and extracts of lemon balm may act as antioxidant and scavenger of free radicals, affecting lipid peroxidation of cell membranes (Lin et al., 2012; Meftahizade et al., 2010; Mimica-Dukic et al., 2004; Marongiu et al., 2004; Kırca and Arslan, 2008; Ponce et al., 2004; Katalinic et al., 2006; Capecka et al., 2005). Moreover, essential oil of lemon balm are widely used for several purposes such as antimicrobial (Iauk et al., 2003; Allahverdiyev et al., 2004; Lang and Buchbauer, 2012; Hussain et al., 2012; Stanojević et al., 2010; Minami et al., 2003) and antitumeral agents for cancer prevention or remedy in humans (Janina, 2003). Also, it has positive effects on moderate Alzheimer’s disease (Kennedy et al., 2006; Edris, 2007; Howes et al., 2003; Ballard et al., 2002), as well as antiulcerogenic, antihistaminic, antispasmodic,

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https://doi.org/10.1016/j.indcrop.2017.12.008
Received 10 August 2017; Received in revised form 2 November 2017; Accepted 4 December 2017
Available online 12 December 2017
0926-6690/

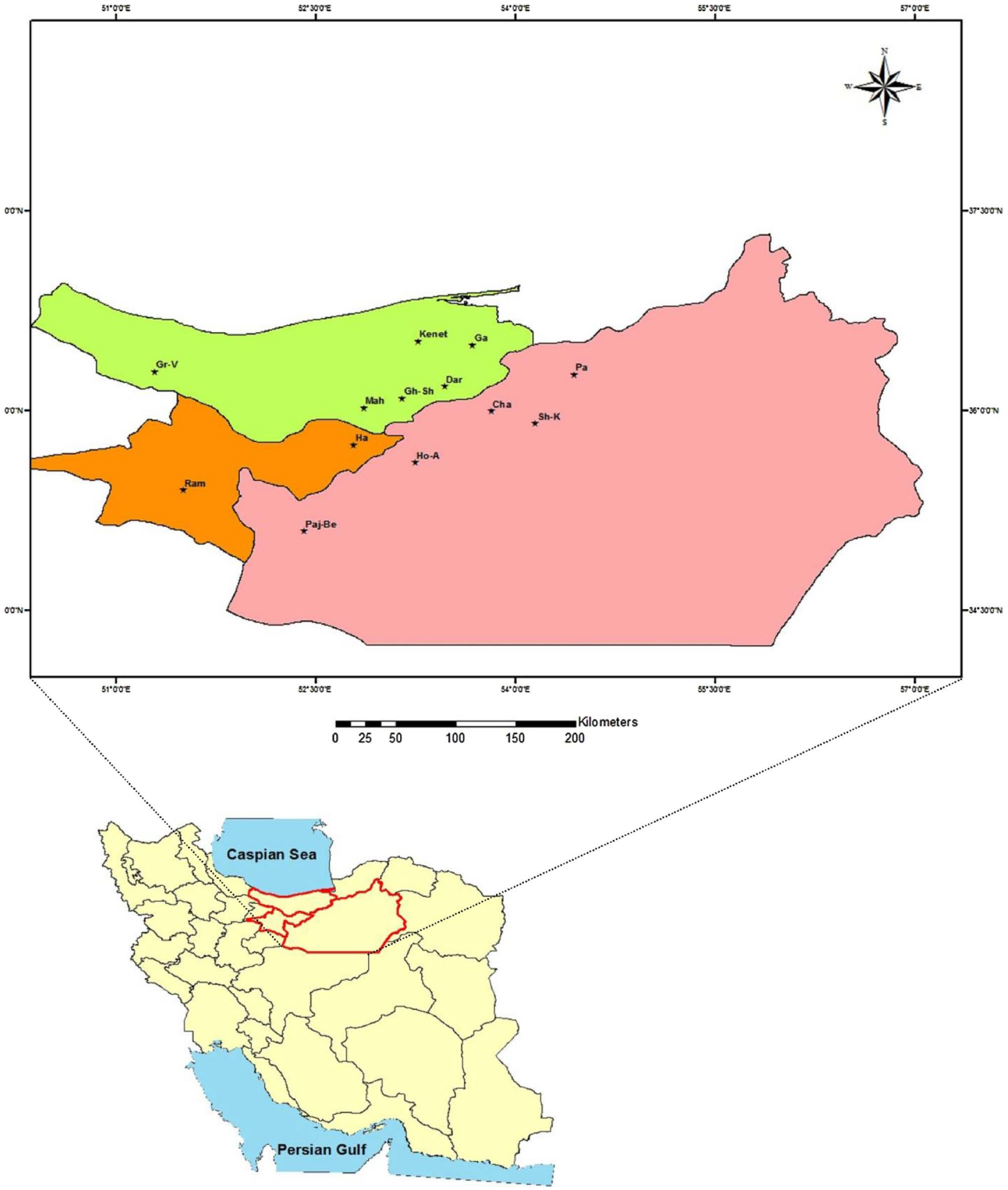

Fig. 1. Collection sites of the studied populations of *Melissa officinalis* L. from Iran.