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Review

Antimicrobial and antioxidative activity of extracts and essential oils of *Myrtus communis* L.☆

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ABSTRACT

Since synthetic antimicrobial agents and food additives can cause a number of adverse effects, there is a growing interest from consumers in ingredients from natural sources. Medicinal plants, such as *Myrtus communis* L. are a source of new compounds which can be used in both the food industry and for medical purposes, primarily as antimicrobial agents. In this review, the characteristics of myrtle essential oils and extracts are summarized, with particular attention to their chemical composition, biological activities and potential applications.

Contents

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1. Introduction

Myrtle (*Myrtus communis* L.) is a medicinal plant endemic to the Mediterranean area and it has been used by locals for its culinary and medicinal properties since antiquity (Atzei 2003). This is a well-established tradition in many countries however, despite the increasing scientific interest in this field, there is a lack of summarized data on herbal medicine composition, therapeutical applications and risks connected to their consumption. Therefore, this review summarizes results regarding chemical composition and biological activities of *M. communis* L.

1.1. Myrtus communis L.

Common myrtle belongs to the *Myrtaceae* family, which comprises approx. 145 genera and over 5500 species (Snow et al. 2011). The genus *Myrtus* includes flowering plant with approximately 16 species reported in areas of the Middle East and Asia (Twaij et al. 1988; Romani et al. 1999). *M. communis* L., known as true myrtle, is one of the important aromatic and medicinal species from this family. It is an evergreen sclerophyll shrub or small tree, 1.8–2.4 m in height, with small foliage and deep fissured bark (Mendes et al. 2001). True Myrtle is characterized by its branches, which form a close full head, thickly covered with ovate or lanceolate evergreen leaves (Fig. 1). Their leaves are 3–5 cm long and contain tannins, flavonoids and volatile oils (Baytop 1999). This species is a very aromatic plant because of the high essential oil content in its leaf, flower and fruit glands. It has solitary axillary white or rosy flowers, followed by black a several-seeded berry which is spherical in shape with dark red to violet in color (Mahmoud et al. 2010). There are two major fruit morphologies based on the color – whether dark or white. The dark color is more frequent, but there are also cultivated white-colored types, which yield much larger fruits than their wild counterparts (Klein et al. 2000).

1.2. Distribution

Myrtle (*M. communis* L.) is a common part of typical Mediterranean flora. The plant grows abundantly from the northwestern to the eastern Mediterranean, including bordering countries and western Asia, as well as Aegean regions (Baytop 1997). Myrtle is native to southern Europe, North Africa and west Asia. It is also distributed in Southern America, northwestern Himalaya and Australia. Myrtle is cultivated in gardens, especially in Northwest Indian region, because of its fragrant flowers (Nadkarni 1989).

Fig. 1. *Myrtus communis* L. plant (by courtesy of Prof. Michael Pascoe, www.wordplants.ca).

Being widespread throughout the Mediterranean region, the species is one of the most important evergreen shrubs in the Mediterranean maquis. In Italy it grows along the coasts and on the internal hills and it is abundant especially on the islands, where it represents one of the most characteristic species (Cannas et al. 2013). In Portugal, myrtle grows wild mainly in the central and southern parts of the country. The genus *Myrtus*, in Tunisia, is represented by only one species, *M. communis* L., which grows wild in the coastal areas, the internal hills, and the forest areas of northern Tunisia. Two myrtle varieties are described in old local Tunisian flora: *M. communis* var. *italica* L. and *M. communis* var. *baetica* L. (Pottier-Alapetite et al. 1979), which possesses the same vegetative characters. The morphological difference between the two varieties regards to size of fruits and leaves. This herb grows spontaneously Iran, Spain, France, Greece, Turkey, Algeria, Morocco, Croatia and Montenegro (Naserian 1997; Chryssavgi et al. 2008; Mimica-Dukić et al. 2010; Berka-Zougali et al. 2012; Mahmoud et al. 2010; Jerkovic et al. 2002; Gauthier et al. 1988).

1.3. Traditional application

Myrtle has been used since ancient times as a spice, as well as for medicinal and food preparation purposes.

Myrtle as a spice finds no wide application because of its bitterness, despite the pleasant odor. The taste is very intense, quite unpleasant and strongly bitter, so its culinary application is limited to the region of origin, such as Italy (Gortzi et al. 2008). In Italy, especially in Sardinia, berries and leaves are used to produce two well-known liquors (Mirto Rosso and Mirto Bianco, respectively) (Messaoud et al. 2012). Foods flavored with the smoke of myrtle are common in rural areas of Italy or Sardinia (Gortzi et al. 2008). However, some parts of the plant are used in the food industry, for flavoring meat and sauces (Chalchat et al. 1998), and its berries and leaves are mostly employed for the industrial formulation of sweet liquors with advertised digestive properties (Clark 1996; Mulas et al. 2000).

Its leaves are very fragrant and have been extensively used in the perfume and cosmetic industries, particularly in Portugal (Clark 1996) as well as Turkey (Baytop 1999).

It is traditionally used as an antiseptic, disinfectant and hypoglycemic agent (Elfellah et al. 1984). In Turkey myrtle leaves as well as fruits have been used as an antiseptic medicine in villages (Baytop 1999). Similarly, in Italian folk medicine, the fruit of this plant is used in the treatment of many types of infectious disease, including diarrhea and dysentery; the leaves are used as antiseptic and antiinflammatory agent, as well as a mouthwash, for the treatment of candidiasis (Gortzi et al. 2008). The essential oil obtained from myrtle leaves has been used in the treatment of lung disorders (Clark 1996). In traditional medicine, myrtle is frequently consumed as an infusion and decoction (Le Floch 1983). Generally, in folk medicine, a decoction of leaves and fruits is used orally for the treatment of stomach aches, hypoglycaemia, disbiosis, cough, constipation, poor appetite, as well as also externally for wound healing (Serce et al. 2010).

Different parts of the myrtle plant traditionally have assorted specific applications (Table 1). Infusions made from the leaves and young branches are approved to be stimulant, antiseptic, astringent and hypoglycemic, and they are considered to be a health remedy for asthma, eczema, psoriasis, diarrhea, gastrointestinal disorders and urinary infections (Ziyyat et al. 1997). The leaf decoction is used for vaginal washing, enemas and against respiratory diseases (Marchini and Maccioni 1998), while decoction from the fruits is used as antidiarrheal, antihemorrhoidal agents and in mouth and eyes disease treatment (Ziyyat et al. 1997). Flowers are traditionally