Review Article

A Comprehensive Review of the Phytochemistry, Cultivation and Therapeutic Uses of Roman Chamomile

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Submission Date: 24-09-2024; Revision Date: 15-10-2024; Accepted Date: 13-12-2024.

ABSTRACT

This review highlights the chemical constituents and traditional uses of Roman chamomile (*Chamaemelum nobile* L.), a botanically separate but equally useful member of the Asteraceae family compared to its counterpart, German chamomile. The ancestry of Roman chamomile is intertwined with recipes for the relief of anxiety, the uplift of mood and the speed up of wound healing due to this plant's distinctive array of bioactive compounds. It is solely composed of the terpenoids like bisabolol, matricin and chamazulene, also the flavonoids like apigenin, luteolin, quercetin and kaempferol. Cultivation techniques, from traditional methods to modern innovations such as precision agriculture, hydroponics and controlled-environment agriculture, are analyzed to optimize yield and essential oil content. This, therefore, highlights Roman chamomile's potent antioxidant, anti-inflammatory, analgesic, antibacterial, antidepressant, antipyretic, anti-allergic and anxiolytic capabilities. Roman chamomile is already known for its rich phytochemistry and ancient uses. This allows us to explore its huge alternative medicine potential in the treatment of different health conditions.

Keywords: Antioxidant, Anti-inflammatory, Bioactive, Chamazulene, Terpenoid.

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INTRODUCTION

Roman Chamomile (*Chamaemelum nobile* L.) is a creeping aromatic perennial belonging to the Asteraceae family with white or yellow flowers. It is native to UK and is found in dry fields together with bushy areas around gardens and cultivated fields.[1] It is a plant that has been used for treatment of many centuries in Greece, Rome and ancient Egypt for its medicinal effects. Roman chamomile contains many terpenoids and flavonoids, which make a great beneficial contribution to the aromatherapeutic properties of its dried flowers. [2] Chamomile flowers, either alone or in combination with other ingredients, are widely used as poultices and fomentations to alleviate external swelling, inflammatory pain, or congested neuralgia. The entire herb is utilized to make lotions intended for external application to alleviate discomforts like toothaches, earaches and neuralgia. The essential oil of Roman chamomile, obtained through steam distillation of its flower heads, carries a sweet, apple-like fragrance and appears as a light, clear blue liquid. This oil proves highly effective when administered to children experiencing teething or colic. Additionally, it is utilized to alleviate premenstrual symptoms in women, general abdominal pain, throat infections, allergies, hay fever and asthma. Like German chamomile, it demonstrates efficacy in treating various skin conditions such as acne, eczema, rashes, dermatitis and allergic reactions. This kind of practical use of chamomile preparations suggests a wide range of human ailments such as allergy, inflammation, muscle spasms, menstrual disorders, insomnia, ulcers,

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DOI: 10.5530/ajbls.2024.13.74

Figure 1: Roman Chamomile plant and its parts.

wounds, gastrointestinal disorders, rheumatic pain and haemorrhoids.[2,3] Chamomile essential oils are the most widely used in cosmetics and soothing therapy.[2] There has been a continually increasing curiosity about Romanus Chamomillae phytochemicals and folk applications. The present review aims to provide a general understanding of the chemistry of phytochemicals and traditional use of the Roman Chamomile.[3-5]

BOTANICAL CHARACTERISTICS AND GEOGRAPHICAL DISTRIBUTION

Roman chamomile (*Chamaemelum nobile*) is a low-growing, perennial herb belonging to the Asteraceae family. It is a small plant that is treasured for its small, fragrant daisy-like white flowers and foliage with lacy pattern that blooms in the spring. It has shallow roots forming a wide mat, up to six inches tall or twelve inches wide, preferring full sun or several hours of shade, well-drained loamy soil. Roman Chamomile is native to many regions of Europe like these, especially the Western and Southern parts of Europe, including France, Spain, Italy and some parts of Northern Africa.[6] It is widely grown as an ornamental plant and naturalized in temperate areas globally because of the aesthetic, food and medicinal value. As for the North American continent it can be frequently seen growing in the gardens, lawns and wild habitats especially wherever suitable climate conditions exist, for instance the United States and Canada.[7,8] In the same way, in Australia, Roman Chamomile is preferably cultivated as an ornamental plant and it is possible to find some of them growing as a wild species.[9] The feature of its adaptivity and popularity made it very common in the gardening and landscape worldwide.

CULTIVATION PRACTICES

The Roman chamomile (*Chamaemelum nobile*) is often germinated from seed and it likes a somewhat acid to neutral to slightly-alkaline garden soil with a pH of 5.6 to 7.5 and adequate drainage. The plant loves the sun and does not require a very rich organic soil. Roman chamomile is either sown or transplanted into the ground, though transplanting is the recommended practice. Whenever sowing, the seeds must be pressed into the sponge soil or sprinkled on the surface, as they need light to germinate. The spacing of the plants should be 8-12 inches apart between the rows that should be 24 inches away. Collecting of the leaves and flowers are done when the plants are in full bloom and the harvested parts can be used fresh or dried later. The drying herbs or spices should be kept in a cool and dry place, protected from the light, with constant air circulation.[1,5]

MEDICINAL USES OF ROMAN CHAMOMILE

Roman chamomile possesses tonic, anodyne and antispasmodic properties. The popularly known chamomile tea, made from the infusion of flowers in boiling water, has been recognized for its calming and sedative effects for a long time. When ginger is combined with the infusion, it becomes an excellent remedy for indigestion (such as flatulent colic, heartburn, loss of appetite), gout and headache. The diuretic properties of Roman chamomile flowers are well-established.[10] Chamomile flowers, either on their own or combined with other ingredients, are extensively used as a poultice and fomentation for treating external swelling, inflammatory pain, or congested neuralgia. The entire herb is also utilized to create a lotion for external application in cases of toothache, earache and neuralgia. Roman chamomile oil, extracted through steam distillation of flower heads, has a sweet, apple-like fragrance and a very light, clear blue color. The oil is highly effective for teething children or those suffering from colic. It is also used to alleviate premenstrual symptoms, general abdominal pain and throat infections. Additionally, it can provide relief for allergies, hay fever and asthma. Similar to German chamomile, it is effective

in treating skin conditions such as acne, eczema, rashes, dermatitis and allergic reactions. Essential oils derived from Roman chamomile are fundamental components of aromatherapy. A recent research study on cancer patients has evaluated the positive impact of aromatherapy/massage on psychological well-being, distress and quality of life.[11] Roman chamomile is widely used in cosmetic preparations and has been traditionally used internally and externally as a household remedy for various health disorders such as dyspepsia, nausea, rheumatic pain, eczema, wounds, hemorrhoids and neuralgia. Pharmacological studies have indicated that Roman chamomile possesses therapeutic properties such as anti-inflammatory, hypoglycemic, anti-edemic and antioxidant activities.[12] It has a soothing and softening effect on the skin and has been utilized for centuries in hair preparations, particularly for blond hair, as it is believed to both lighten and condition it. Additionally, the water-soluble fractions of the essential oil, dissolved in the condensed steam from the distillation process, can be directly used in cosmetic preparations that involve a water base, such as soaps, shampoos and creams.[10] Roman chamomile is renowned for its delightful apple-scented aroma and is frequently used in traditional medicine, as well as in the food and cosmetic industries, due to its potential health benefits and aromatic properties. Decoctions and infusions in oral dosage forms are used for the symptomatic treatment of gastrointestinal disorders and the painful component of functional digestive symptoms. External applications of extracts and lotions are recommended as repellents, emollients, for the treatment of skin disorders and for eye irritation or discomfort of various causes. Moreover, it is utilized as an analgesic in diseases of the oral cavity, oropharynx, or both and as a mouthwash for oral hygiene.[13] Furthermore, the herb and its infusion are a source of phenolic compounds and organic acids that exhibit antioxidant and antitumor activities without causing liver damage.[13]

CHEMICAL CONSTITUENTS

The primary components of the volatile oil of Roman chamomile are chamazulene, angelic acid, tiglic acid and several sesquiterpene lactones. German chamomile also contains chamazulene, a-bisabol, a-bisabol oxides A and B, spathulenol and farnesene. Both plant species' extracts are known for their antiseptic, antibacterial, antifungal and antitumor properties.[1] Roman chamomile's essential oil has a lower chamazulene content and is primarily composed of esters of angelic acid and tiglic acid. It also includes farnesene and α -pinene. Roman chamomile contains up to 0.6% of sesquiterpene lactones of the germacranolide type, particularly nobilin and 3-epinobilin. The major bio-active ingredients in Roman chamomile are α-bisabolol, bisabolol oxides A and B, chamazulene or azulenesse, farnesene, spiroether quiterpene lactones, glycosides, hydroxycoumarins, flavonoids (apigenin, luteolin, patuletin and quercetin), coumarins (herniarin and umbelliferone), terpenoids and mucilage.[14,15] The flowers also contain various phenolic compounds, primarily the flavonoids apigenin, quercetin and patuletin as glucosides and acetylated derivatives. Among these, apigenin is the most promising compound, mainly existing in the form of various glycosides.[16-20] Roman chamomile shares important flavonoids with Matricaria, such as apigenin, luteolin and apiin, as well as phenolic carboxylic acids (caffeic, ferulic), coumarins and thiophene derivatives. The essential oil of Roman chamomile is light-blue but turns yellow during storage due to oxidation. Its chamazulene content is 5%.[19] In chamomile, Roman chamomile (*Chamaemelum nobile*) having essential oil 0.3-1.5% with the major compounds of esters are found. It consist a small amount of sesquiterpenes namely angelic acid, angelic acid butyl ester and chamazulene, respectively. The main application areas of essential oil are cosmetics and perfumes while the primary medical uses are as a sedative, anxiolytic and antispasmodic activity. The oil may be beneficial for treating slight skin irritations and inflammation.[21]

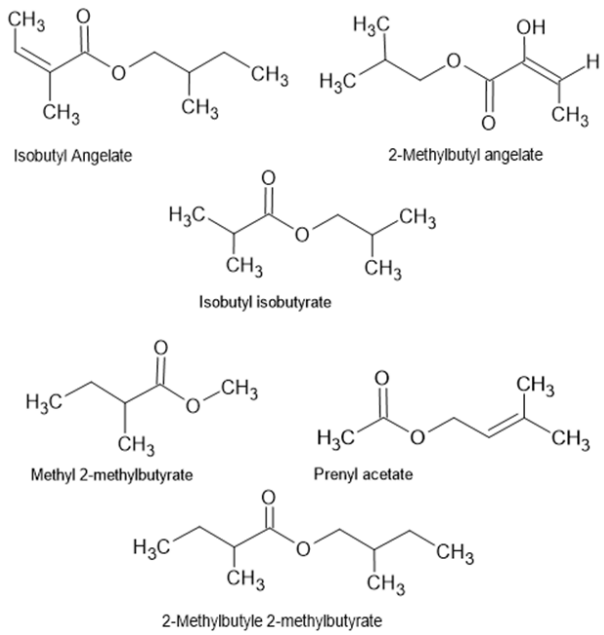

Figure 2: Molecular structure of Chemicals present in essential oil of *C.nobile*.[25]

Table 1: Chemical composition of Roman chamomile.[22]

Sl. No.	Chemical Components	%(w/w)	Biological Activity	References
1	Ester	75	Antispasmodic, sedative and anxiolytic effects.	[4]
2	Aliphatic Aledhyde	2	Antioxidant, antimicrobial and insect repellent properties.	[2]
3	Ketone	3	Antifungal, antibacterial and antioxidant properties.	[20]
4	Sesquiterpenes	3	Anti-inflammatory and analgesic effects, antimicrobial activity, Antioxidant activity.	[27]
5	Lactones and coumarins	2	Anti-inflammatory, Antioxidant effects, antimicrobial activity, Anticancer potential.	[20,4]
6	Monoterpenes	5	Anti-inflammatory properties, antimicrobial activity, Antioxidant effects, Sedative and anxiolytic effects.	[20,28]
7	Alcohol	5	Anti-inflammatory and analgesic effects, Antioxidant activity, antimicrobial activity, Hepatoprotective properties.	[2,20,4]
8	Apigenin and its derivatives	0.12	Anti-inflammatory properties, Antioxidant effects, Neuroprotective effects, Anti-cancer potential.	[29,20,30]
9	Total flavonoid content	0.16	Antioxidant properties, Anti-inflammatory effects, Neuroprotective effects, Potential anti-cancer properties.	[30,31,2]

PHARMACOLOGICAL ACTIVITIES

Several studies demonstrate the antimicrobial effects of Roman Chamomile essential oil against different bacterial and fungal strains and antifungal activity was demonstrated also for the aqueous extracts of Roman Chamomile.[23,24] The flavonoids quercetin and apigenin have been shown to have anti-inflammatory properties and to modulate heat shock protein. α-bisabolol, guajazulene and chamazulene have also been shown to have anti-inflammatory properties. The polysaccharides of RC exerted antiphlogistic effect *in vivo*.[25] Antibacterial activity of *C. nobile*, can be helpful to the treatment of antibiotic-resistant wound infections. *C. nobile* therapy in combination with antibiotics can also be useful because medicinal plants contents operate in synergy with antibiotics or possess compounds that able to sensitize the bacteria to ineffective antibiotic.[26]

CONCLUSION

In conclusion, this comprehensive review of the phytochemistry, cultivation and therapeutic uses of Roman chamomile highlights the rich history and diverse applications of this medicinal plant. From its use in ancient Rome for its calming properties to its modern-day applications in treating various ailments, Roman chamomile has proven to be a valuable natural remedy. Looking to the future, continued research on Roman chamomile and its bioactive compounds may lead to the development of new drugs and therapies. Additionally, the integration of traditional herbal medicine with modern medicine may lead to a more holistic approach to healthcare, with Roman chamomile playing a significant role.

ACKNOWLEDGEMENT

The authors express gratitude to Prof (Dr). Yashbir Dewan, Vice Chancellor of Shri Guru Ram Rai University in Dehradun, for his generous support.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR'S CONTRIBUTION

Sobha conceptualized the idea behind this review manuscript. The original draft manuscript was prepared by Subhdara and VKS contributed to the gathering of raw data, screening of articles for study selection, revised the manuscript. Sobha edited the final manuscript. All authors have read and approved the final manuscript.

FUNDING

The research was conducted within our available resources and without specific financial support from any funding agency.

ABBREVIATIONS

RC: Roman Chamomile, **UK:** United Kingdom.

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Cite this article: Sobha, Subhdara, Vijay Kumar Singh. A Comprehensive Review of the Phytochemistry, Cultivation and Therapeutic Uses of Roman Chamomile. Asian J Biol Life Sci. 2024;13(3):608-12.