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Myrtus communis Linn. — A review

Sabiha Sumbul[1]*, M Aftab Ahmad [1], M Asif[l] and Mohd Akhtar[2]

[1]Department of Ilmul Advia (Pharmacology), Faculty of Unani Medicine

[2]Department of Pharmacology, Faculty of Pharmacy, Hamdard University, New Delhi, India

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Myrtus communis Linn. or common Myrtle (Family — Myrtaceae) is one of the important drugs being used in Unani System of Medicine since ancient Greece period. It is recognized as *Aas* and its berries are known by the name of *Habb-ul-Aas*. It is often grown for its attractive foliage, flowers and berries. Its berries, leaves as well as essential oil are frequently used for various ailments like gastric ulcer, diarrhoea, dysentery, vomiting, rheumatism, haemorrhages, deep sinuses, leucorrhoea and cosmetic purposes like hair fall control. The leaves, berries and twigs are used in flavouring of food and wines. In past times, ripe fruits were used as food integrators because of their high vitamin contents. A wide range of biologically active compounds such as tannins, flavonoids, coumarins, essential oil, fixed oil, fibres, sugars, citric acid, malic acid and antioxidants are present in the plant. This contribution provides a comprehensive review of its ethno-medical uses, chemical constituents and pharmacological profile as a medicinal plant.

Keywords: *Aas*, Common Myrtle, *Habb-ul-Aas*, *Myrtus communis*, Myrtaceae, Phytochemical constituents, Traditional medicine.

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Introduction

Myrtus communis Linn. (Family — Myrtaceae) is an aromatic evergreen perennial shrub or small tree, 1.8-2.4 m in height with small foliage and deep fissured bark (Plate 1). It is native to Southern Europe, North Africa and West Asia. It is distributed in South America, North western Himalaya and Australia and widespread in the Mediterranean region. It is also cultivated in gardens especially North-west Indian region for its fragrant flowers[1,2]. *Myrtus*, the Greek name for Myrtle and *communis* means common plant growing in groups. The first reference of Myrtle in the Bible is in Nehemiah 8:15 in regard to the celebration of the feast of Tabernacles. The common Myrtle was introduced into Britain in around 1597 and was described by Linnaeus in 1753. Myrtle occupies a prominent place in the writings of Hippocrates, Pliny, Dioscorides, Galen and the Arabian writers[3,4].

The common myrtle has upright stem, 2.4-3 m high, its branches form a close full head, thickly covered with evergreen leaves. The stem of the plant is branched and dark green leaves are glossy, glabrous, coriaceous, opposite, paired or whorled, ovate to lanceolate with stiff structure, aromatic, entire margined, acuminate and 2.5-3.8 cm long, glands absent in the lamina. It has axillary white flowers on slender peduncles, medium sized about 2 cm in diam., stiff having yellow anthers. The petals are pure white with glands and somewhat tomentose margin covered with fine hairs. They give off a sweet fragrant smell. The berries are pea-sized, orbicular or ovoid-ellipsoid, blue-black or white with hard kidney

Plate 1 — *Myrtus communis* Linn.

*Correspondent author: E-mail: sabi.sumbul @gmail.com

shaped seeds. They are of varying sizes (0.7-1.2 cm) and shapes. The glabrous berry has rounded (vase-like) shape with a swollen central part and remnants of persistent 4-5 partite calyx at the outer part. The developed fruit is initially pale green, then turns deep red and finally becomes dark indigo when fully mature. They are bitter when unripe, sweet when ripe. It is highly drought tolerant and needs only little to moderate water. Soil should be allowed to dry in-between watering. It can grow in damp places, shades as well as full sun up to 800 m altitudes. Its blooming time is summer[2-7].

Medicinal and other uses

Berries are used as antiseptic, astringent[1], carminative[1,3,5], emmenagogue[1,3], demulcent, dessicant, analgesic, hair tonic, haemostatic[8], antiemetic, lithotripsic[9], cardiotonic, diuretic[3,9,10], anti-inflammatory[11], stomachic, brain tonic[3,9], haemostatic, nephroprotective, antidote[11], antidiaphoretic[10] and antidiabetic[12]. Various pharmacological actions of leaves are astringent, antiseptic[1], hypoglycaemic, laxative[12], analgesic[3,10], haemostatic[10], hair tonic[8,13] and stimulant[1]. Root is reported to have antibacterial property[14].

It is traditionally used as an antiseptic, disinfectant drug and hypoglycaemic agent[15]. Different parts of the plant have been used in the food industry, for example for flavouring meat and sauces, and in the cosmetic industry[16]. Dioscorides described the preparation of its oil and prescribed an extract in wine for lung and bladder infections. Foods flavoured with the smoke of myrtle are common in rural areas of Italy or Sardinia[17,18]. In folk medicine, a decoction of leaves and fruits is used as stomachic, hypoglycaemic, antimicrobic, cough and oral diseases, for constipation, appetizing, antihemorrhagic and externally for wound healing[19]. The essential oil of the leaves has been esteemed in France as a disinfectant and useful antiseptic, also used in Paris hospitals in certain respiratory and bladder diseases and recommended as a local application in rheumatic disease[1,3,5,20]. The fruit decoction was used to bath new-borns with reddened skin, while the decoction of leaves and fruits was useful for sore washing. The decoction of the leaves is still used for vaginal lavage, enemas and against respiratory diseases[11]. A fixed oil obtained from berries strengthens and promotes growth of hair due to hair tonic property[1,13,21]. Consumption of myrtle can probably offer some dietary benefits, as they contain antioxidant constituents, which can protect against lipid peroxidation and can scavenge free radicals[19]. In earlier times, ripe fruits of myrtle were used as food integrators because of their high vitamin contents[20]. The therapeutic dose of berries of *M. communis* mentioned in Unani literature is 3 to 5 grams[9-11]. The berries are used in diarrhoea, dysentery, internal ulceration, rheumatism[3,21], foot ulcers, foetid ulcers, aphthae, deep sinuses, hairfall, haemorrhages, leucorrhoea, lax vaginal walls[1], bronchitis[3], haemorrhoids[22], malaena, rhinitis, rectitis, conjuctivitis, piles, burns, dysurea, cough, epistaxis[10], earache, toothache, headache, palpitation[23], otorrhea[24], sprain, fractures, fever, polydipsia, burning micturition, scorpion sting, dandruff, melasma cholasma, menorrhagia, haemoptysis, uterine prolapse, rectal prolapse, eye ulcers, halitosis (bad breath), head ulcers, vomiting, inflammations[8] and gastric ulcer[25]. The leaves are useful in cerebral diseases especially epilepsy, stomach diseases[5,22], dyspepsia, liver diseases, rheumatism[3,22], aphthae, eczema, pulmonary disorders[5,14], piles, sores[3], intertrigo, wounds, ulcers[1], stomatitis, deep sinuses, uterine prolapse, leucorrhoea, stomatitis, internal ulceration, haemorrhage[2], inflammation, diarrhoea, hair fall, burns, herpes, palpitation, mennorhagia[8], chronic bronchitis[12], abscess, sprain, diaphoresis [24] and chronic catarrah of bladder [26].

Phytochemical constituents

The plant contains fibres, sugars and antioxidants and many biologically active compounds[27,28]. Phenolic compounds, flavonoids and anthocyanins are the major phytochemicals in berries. Seeds yield 12-15% of a fatty oil (fixed oil) consisting of glycerides of oleic, linoleic, myristic, palmitic, linolenic and lauric acid[5,29]. Studies on fatty acid analysis of myrtle fruits showed that it contains 14 fatty acids, oleic acid being the dominant fatty acid (67.07%) followed by palmitic acid (10.24%) and stearic acid (8.19%)[30]. Myrtle oil is the essential oil of *M. communis*, which is extracted from the leaves, branches, fruits and flowers through steam distillation[1,5]. It is yellow or greenish yellow in colour with a characteristic refreshing odour. The yield and quality of oil depends upon the region of production, the season of harvest and the length of distillation. The oil yields (w/w) of different parts of plant are different. The yields of the hydrodistilled oils are: leaves, 0.4-0.5; flower, 0.4; unripe fruits, 0.5; and ripe fruits, 0.02%. Terpenes and terpene alcohols make up nearly the whole of the

volatile compounds of the essential oil[31]. The five terpenoid compounds (myrtenyl acetate, 1, 8-cineole, limonene, linalool) are present in leaf oil (0.19-0.37%), fruits (0.03-0.13%) and flowers (0.21-0.26%) but in different propotions[32].

Composition of essential oil is: 1, 8-cineole, α-pinene, methyl eugenol, terpineole, trans-carveole, cis-carveole, geraniol, methyl geranate, α-terpinyl acetate, neryl acetate, β-caryophyllene, myrcene, sabinene, myrcene, p-cymene, c-terpinene, linalyl acetate[24], car-3-ene, phellandrene, methyl eugenol[33], methyl butyrate, methyl benzoate, benzyl alcohol, isobutyl butyrate[31], myrtenylacetate[32], limonene, α-terpineol, linalool[32,24], eucalyptol[34,35], p-cymol, β-pinene[36], geraniol, camphene, butyl butyrate and myrtenol[2].

Berries are reported to contain citric acid, malic acid, resin, tannin, fixed oil[1,5], sugar[1], flavonoids, anthocyanin arabinosides, anthocyanin glucosides[36], kaempferol, quercetin, myricetin 3-o-glucoside, myricetin 3, 3-di-o-galactoside, myricetin 3 rutinoside, aesculin, scopoletin, caffeic acid[37], myricetin 3-o-rhamnoside or myricitrin, esculetin-6-o-glucoside or esculin, hesperetin 7-o-rhamnoglucoside or hesperidin, hesperetin-2-o-methylchalcone-4-o-rhamnoglucoside[38]. Leaves contain, tannins, flavonoids, coumarins[39], myrtucommulone A & B[29], semimyrtucommulone[40], galloyl-glucosides, ellagitannins, galloyl-quinic acids[41], caffeic, gallic and ellagic acids[42]. The roots showed the presence of tannins[23], alkaloids, glycosides, reducing sugars[2], fixed oil[21], gallic acids, phenolic acids, quercetin and patuletin[39].

Pharmacological activities

Antimicrobial

The antimicrobial activity of the crude preparation of Myrtle on *Escherichia coli, Staphylococcus aureus*, *Pseudomonas aeruginosa, P. vulgaris, P. mirabilis*, *Klebsiella aerogenes, Salmonella typhi* and *S. shigiella* was determined by Alem *et al* and preliminary study supported its traditional claim of effective anti-infective[43].

Mansouri *et al*[44] evaluated the antibacterial activity of methanol crude extract of *M. communis* against 10 laboratory strains of microorganisms, including 6 Gram positive (*Staphylococcus aureus, Micrococcus luteus, Streptococcus pneumoniae, S. pyogenes, S. agalactiae* and *Listeria monocytogenes*) and 4 Gram negative bacteria (*Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa* and *Campylobacter jejuni*). The crude extract inhibited the growth of all tested bacteria except *C. jejuni*[44].

Akin *et al*[34] also assayed antimicrobial activity of *M. communis* against seven pathogen bacteria (*Staphylococcus aureus*, *Listeria monocytogenes*, *Enterococcus durans*, *Salmonella typhi*, *Escherichia. coli*, *Pseudomonas aeruginosa* and *Bacillus subtilis*). It showed some activity on Gram positive and Gram negative bacteria. The higher efficacy of *M. communis* was confirmed by the agar dilution method[34].

Two methods were used by Al-Saimary *et al* to evaluate the antibacterial activity of various concentrations of aqueous extracts of leaves against *Pseudomonas aeruginosa* with comparison to 6 antibiotics; these methods determine the growth inhibition zones and minimal inhibitory concentration. Aqueous leaves extracts gave an excellent effect on bacterial growth and their effects were located within the limits of antibiotic effects[45].

Appendino *et al*[46] investigated polar glycosidic fraction obtained from the leaves for antibacterial activity and significant antibacterial activity was shown by gallomyrtucommulone. Yadegarinia *et al*[24] reported excellent antimicrobial activities of oil against *Escherichia coli, Staphylococcus aureus and Candida albicans.* The essential oil of Myrtle showed good antimicrobial activity against clinical strains of *Mycobacterium tuberculosis*[47]. The oil also showed significant results against *Helicobacter pylori*[48].

The methanol, ethanol and ethyl acetate extracts of leaves and berries were examined against food-borne pathogens and food spoilage bacteria, *Listeria monocytogenes CECT 4032* and *Pseudomonas aeruginosa IH*, to determine the effect of the extract on viable counts of bacteria using the bacterial cell-death time. It showed relatively high antibacterial activity against most of the tested microorganisms[49].

Antifungal

The essential oil inhibited (60%) growth of *R. Solani* at a dose of 1600 ppm *in vitro*[50]. Antifungal activity of the essential oil was also studied against *Aspergillus* by broth microdilution method and found effective against all isolates[51].

Activity against Trichomonas vaginalis

To investigate the effect of drugs other than metronidazole, 3 non-pregnant women infected with *Trichomonas vaginalis* were treated with

doxycycline, 2 × 200 mg/day for one week. It caused death of *T. vaginalis* at *p*H 4.65, but failed to do so at *p*H 6.00 (Ref. 52).

Anti-molluscicidal

Crude water extract and flavonoid fraction of *M. communis* were found to possess molluscicidal activity against the aquatic snail *Biomphalaria glabrata* involved in the transmission of schistosomiasis[53].

Insecticidal

The insecticidal activities of essential oil from leaves and flowers of *M. communis* against fourth-instar larvae of the mosquito *Culex pipiens molestus* Forskal were determined and oils were found to be toxic[54].

The essential oil showed insecticidal activity against 3 stored-product insects, i.e. adults of the Mediterranean flour moth *Ephestia kuehniella* Zeller, the Indian meal moth *Plodia interpunctella* Hubner and the bean weevil *Acanthoscelides obtectus* Say[55].

The essential oils of Myrtle showed insecticidal activity against body lice and nits (*Pediculus humanis capitis*) when it was tested by using micro atmosphere and distemper methods. Perhaps the activity is due to the presence of Lineol and α-pinene and linalool[56].

Essential oil showed anti-malarial activity against *Plasmodium falciparum* at concentration ranging from 150-270 μg/ml(Ref. 57).

Anti-inflammatory

Myrtucommulone (MC), semimyrtucommulone (S-MC) and nonprenylated acylphloroglucinols present in the leaves of *M. communis*, potently suppress the biosynthesis of eicosanoids by direct inhibiting cyclooxygenase-1 and 5-lipoxygenase *in vitro* and *in vivo*. Their ability to suppress typical proinflammatory cellular responses suggested their therapeutic use for the treatment of diseases related to inflammation and allergy[40].

The plant was assessed for the anti-inflammatory activity on rats by measuring the suppression of carrageenan-induced paw edema produced by 1/10 of the intraperitoneal LD_{50} doses for the respective 80% ethanol extracts. Acetylsalicylic acid was used as the standard drug. Results showed that it possessed anti-inflammatory activity[58].

Antioxidant

The antioxidant activities of the fruit extracts were determined by using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and β-carotene-linoleic acid assays. The methanol extracts of fruits exhibited a high level of free radical scavenging activity[19]. In another study antioxidant activity of methanol, ethanol, water and ethyl acetate extracts of the leaves and berries were measured. Antioxidant activity was assessed by measuring the ability of the extracts to scavenge the 2,20-azinobis (3-ethylbenzothiazoline-6-sulphonic acid) diammonium salt (ABTSþ) radical. All of the extracts showed significant antioxidant capacity and higher being in leaves[59].

Flavonoids and anthocyanins in berries extract were checked for antioxidant activity by TEAC assay and the free radical activity. The myrtle extract showed interesting free radical scavenging activity[60].

Radical scavenging activity of essential oil was studied by collecting the plant samples from the two distant localities. Both oils exhibited moderate DPPH (2,2-diphenyl-1-picrylhydrazyl) scavenging activity[61].

Protective effect on cholesterol and human low density lipoprotein (LDL)

Rosa *et al*[62] reported that semimyrtucommulone and myrtucommulone A extracted from *M. communis* have significant protective effect on LDL from oxidative damage, remarkable protective effect on the reduction of polyunsaturated fatty acids and cholesterol and inhibiting the increase of their oxidative products. Both the compounds have been suggested as natural dietary antioxidants with potential antiatherogenicity[62].

Antidiabetic

Administration of *Myrtus* extract significantly reduced the hyperglycaemia induced by streptozotocin. This effect was maintained by its repeated administration. The extract had no effect on the blood glucose level of normal mice. These studies confirm the folk-medicine indication of *Myrtus* extract as potentially useful in the treatment of diabetes mellitus[63].

The leaves as well as the volatile oil obtained from the leaves are used to lower the blood glucose level in type-2 diabetic patients. Myrtle oil exerts hypoglycaemic as well as mild hypotriglyceridemic activity in diabetic animals[64].

Myrtle oil exerts its hypoglycemic activity by enhanced glycolysis, glycogenesis and decreased glycogenenolysis. Data suggested myrtle oil treatment reduces intestinal absorption of glucose, hence myrtle oil could be a α-glycosidase enzyme inhibitor which had a hypoglycemic effect only on alloxan induced diabetic rabbits on the fourth hour and on orally glucose loaded group[65].

Phenolic compounds, extracted from the leaves of *M. communis* were investigated for the anti-diabetic activity in streptozotocin induced diabetic rats. Biochemical estimations namely serum glucose, cholesterol, triglycerides, HDL, LDL, AST, ALT, BUN, creatinine, total proteins, albumin and globulin were carried out. The studies suggested that phenolic compounds when administered in the dose of 800 mg/kg body weight could produce a remarkable antihyperglycaemic effect than administered at 400 mg[66].

Antimutagenic

Antimutagenic activity of the essential oil of myrtle was studied by collecting the plant samples from the two distant localities and they were assayed against spontaneous and *t*-BOOH-induced mutagenesis in *Escherichia coli oxyR* mutant IC202, a bacterial strain deficient in removing ROS. When the oxidative mutagen was used, essential oil expressed higher reduction of mutagenesis in a concentration dependent manner[61].

Antimutagenic activity of myricetin-3-o-galactoside and myricetin-3-o-rhamnoside, isolated from the leaves of *M. communis* was assessed using the SOS chromotest and the Comet assay. Both the compounds induced an inhibitory activity against nifuroxazide, aflatoxin-B1 and H_2O_2 induced mutagenicity; they modulated the expression patterns of cellular genes involved in oxidative stress, in DNA damaging repair and in apoptosis[67].

Induction of apoptosis in cancer cells

M. communis is reported to induce cell death of different cancer cell lines with characteristics of apoptosis, visualized by the activation of caspase-3, -8 and -9, cleavage of poly (ADP-ribose) polymerase (PARP), release of nucleosomes into the cytosol, and DNA fragmentation. It caused loss of the mitochondrial membrane potential in MM6 cells and evoked release of cytochrome c from mitochondria[68].

Cardiovascular activity

The aqueous extract of leaves showed a negative inotropic effect in guinea pig and atropine did not block this effect. The total extract caused concentration dependent depressive effect in anaesthetized rabbit which was not attenuated with propranolol, cimetidine and atropine but blocked by theophylline. These results suggest the presence of adenosine like compound in this extract as studied by Al-Zohyri *et al*[69].

Activity against recurrent aphthous stomatitis

A study was conducted to evaluate the clinical efficacy of a novel paste containing *M. communis* in the treatment of recurrent aphthous stomatitis. The study was a randomized, double-blind, controlled before–after clinical trial. This study showed myrtle to be effective in decreasing the size of ulcers, pain severity and the level of erythema and exudation, and improving the quality of life in patients who suffer from recurrent aphthous stomatitis[70].

Activity against hepatic ischemia

The effect of myrtle on a model of hepatic ischemia-reperfusion in rat was evaluated. To evaluate the effect of myrtle on ischemia-reperfusion, transaminases levels and the concentration of monoethylglycinexylidide were determined. The testing of myrtle extracts in this model of hepatic ischemia showed a significant effect against damage of ischemia-reperfusion[71].

Antiulcer

The study was conducted to investigate the protective effect of the dried berries of myrtle in gastric ulcer against ethanol, indomethacin and pyloric ligation induced models in Wistar rats. Two doses of aqueous extracts and methanolic extracts were administered orally to animals prior to the exposure of ulcerogens. The parameters taken to assess anti-ulcer activity were ulcer index, gastric juice volume, gastric *p*H, total acidity, gastric wall mucus and histopathological studies. Both the doses of aqueous and methanolic extracts showed significant gastroprotective effects[72].

Narcotic analgesic activity

A screening program of the narcotic analgesic activity of aqueous extract of *M. communis* was carried out. The myrtle extract exhibited significant narcotic analgesic activity[73].

Adverse reactions and contraindications

No health hazards or side effects are known with the proper administration of designated therapeutic dosages. In rare cases, internal administration of myrtle oil as a drug leads to nausea, vomiting and diarrhoea. Preparations containing volatile oil should not be applied to the faces of infants or small children because of the possibility of triggering glottal spasm, asthma like attacks or even respiratory failure. Overdoses of myrtle oil (more than 10 g) can lead to life threatening poisoning, due to high cineole

content. Symptoms include decrease in or loss of blood pressure, circulatory disorders, collapse and respiratory failure[74].

Conclusion

From the time immemorial, plants have been used extensively as curative agents for a variety of ailments. Extensive literature survey revealed that *M. communis* has a long history of traditional use for wide range of diseases. Many of the traditional uses have been validated by scientific research. A number of phytochemicals isolated from various plants like flavonoids, coumarins, tannins, terpenoids, glycosides, alkaloids, essential oil, etc. have shown a variety of pharmacological activities like anti-diarrhoeal, antiulcer, antidiabetic, antihypertensive, antioxidant, antimicrobial, antimutagenic, etc. in various clinical and pharmacological trials. In recent years, emphasis of research has been on utilizing the vast treasure of traditional medicines that have a long and proven history of treating various ailments. In this regard, further studies are required to be carried out on *M. communis* for its potential in preventing and treating different diseases.

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