الوصف النباتي والتركيب الكيميائي والتأثيرات العلاجية لنبات المرسين

حنان محمّد ميلاد أبوزويتـه ، و فوزيـــة عامر أبوزيـــد ،
وآمنة المهدي لحضيري ، وآمنة صالـح القّذافي ، وإيمان ضـــو امحمّد .

الملـــــخص:

ستسلط هـــذه المراجـــعة على المكوّنات الكيميائية ، وهي وصف تفصيلي للشكل والتأثيرات الدوائيـــــة والعلاجيـــــة لنبات *Myrtu* L. *communis*. هذا النبات هو عشب دائم الخـضـــرة من العائلة الكافوريـــة Myrtaceae , ينتشـــر على نطاق واســـع في جميـــــع أنحاء العالم. حيث كانت نســـــبة الكربوهيدرات (88,69%) والبروتين الخام (5,97%) والزيت الخام (3,59%) ومحتـــوى الرطوبة (63,67%) وإجمالي الرّماد (1,75%) بالإضافة إلى أنه يحتـــوي على عناصر معدنية ومحتويات نشطة بيولوجيا . وله العديد من الأنشطة الدوائيـــــة مثل : مضادات الجراثيم , مضادات الفطريات , مضادات الســـــرطان , مضادات الفيروسات , مضادات الأكسدة ومضادات السكر والحماية الكبدية والعصبية ، وما إلى ذلك من مستخلصات نباتية مختلفة.

Myrtus communis L.phytochemistry, ethnobotany and pharmacology: A review

Iman D. Amhamed, Fouzeya A. Aboualgasem*, Hanan M. Abozweta, Amna E.Mohamed, Amna S. Elghdafi

Zoology Department, Faculty of Science, University of Al-Zentan, Libya

*Corresponding author: f.abulgasem@uoz.edu.ly

Abstract

This review will highlight the chemical constituents and detail description of morphology and the pharmacological and therapeutic effects of *Myrtus communis*. This plant commonly known as myrtle, is an evergreen and aromatic herb of the family Myrtaceae, it is widely distributed throughout the world. *M. communis* was reported to contain carbohydrates (88.69%), crude protein (5.97%), crude oil (3.59%), moisture content (63.67%) and total ash (1.75%) and mineral elements and many other bioactive contents. Many

pharmacological activities viz., antibacterial, antifungal, anticancer, antiviral, antioxidant, antidiabetic, hepatoprotective and neuroprotective etc. have been reported in different plant extracts.

Keywords: *Myrtus communis* L., pharmacological activities, chemical constituents, ethnobotany, traditional uses.

Abbreviations

DPPH, 2,2-diphenyl-1-picrylhydrazyl; bw, body weight; ABTS, 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid; i.p., Intra-peritoneal injection; ER, Oesophageal Reflux; MBJ, Myrtle Berries Juice; HSV-1,Herpes Simplex Virus-1; CQ, Chloroquine, FRAP, Ferric Reducing Antioxidant Power Assay; MIC_{50}, Minimal Inhibitory Concentration.

Introduction

Myrtly (*Myrtus communis*) of the Myrtaceae family is an evergreen and aromatic shrub with numerous branches and stems [1]. Myrtaceae family contains 3,000 species naturally growing in subtropical and tropical regions. [2,3] It is native to North Africa, Southern Europe and West Asia. It is distributed in Southern America, Australia and North western Himalaya and widespread in the Mediterranean region [2].

For a long time, different parts of this plant such as branches, berries, leaves, seeds and fruits have been extensively used in traditional medicine in various doses form to treat haemorrhoids, diarrhoea, palpitations, conjunctivitis, peptic ulcers, leucorrhoea, pulmonary and skin disorders [4,5,6]. In addition to use as antibacterial, antifungal, anticancer, antiviral, antioxidant, antidiabetic, hepatoprotective and neuroprotective [5].

M. communis contained coumarins, myricetin, myrtucommulone A and B, myrtenol acetate, Myrtenol, limonene pinene, geraniol, p-cymene, phenylpropanoid, methyl eugenol phospholipids, phenolic compounds and essential oil [7,8].

Taxonomic Hierarchy

- Kingdom: Plantae
- Division: Spermatophytes
- Sub-Division: Angiosperms
- Class: Dicotyledone

- Order: Myrtales
- Family: Myrtaceae
- Genus: *Myrtus*
- Species: *communis* [9]

Common Names

- South Arabia: Habb-ul-Aas, Hadass
- China: Xiang tao mu
- English: Myrtle
- Greek: Mirtia
- Italy: Mirto
- Persian: Barg-e-murad (leaves)
- Russia: Mirt
- Turky: Mersin
- Urdu: Aass, Moorad
- Hindi: Sata Sova, Vilayati mehndi
- Sanskrit: Gandhamalati [10]
- Libya: Mersin [9]
- Iraq: Yas [11]

Botanical Description (Figures 1-5)

Leaves: are glossy, glabrous, dark green, 2.5-3.8 cm long, opposite, coriaceous, paired or whorled, ovate, lanceolate with stiff structure, aromatic.
Stem: 2.4-3 m high, its branches form a close full head, thickly covered with evergreen leaves.
Fruits: Berries are pea-sized, orbicular or oved ellipsoid, blue-black or white whit hard kidney. The developed fruit is initially pale green, then turns deepred and finally becomes dark indigo when fully mature. They are bitter when unripe, sweet when ripe.
Seeds: Varying shapes and sizes 0.7-1.2 cm, the glabrous berry has rounded (vase-like) shaped with a swollen central part and remnants of persistent 4-5 partite calyx at the outer part [12-17].
Flowers: Star-like, white, with five sepals, five petals with glands and somewhat tomentose margin covered with fine hairs and a tufted mass of stamens [10].

Nutritional Value

Myrtus communis is a rich source of carbohydrates (88.69%), crude protein (5.97%), crude oil (3.59%), moisture content (63.67%) and total ash (1.75%) [18]. It contained mineral elements such as, calcium, sodium, potassium, magnesium, phosphorus, iron, zinc, aluminium, cucopper and plumbum [19].

Traditional uses

The leaves are useful in cerebral diseases especially epilepsy, stomach diseases [20,21], dyspepsia, liver diseases, rheumatism [21, 22], aphthae, eczema, pulmonary disorders [20,23], piles, sores [22], intertrigo, wounds, ulcers [24], stomatitis, deep inuses, uterine prolapse, leucorrhoea, internal ulceration, haemorrhage [25], inflammation, diarrhoea, hair fall, burns, herpes, palpitation, mennorhagia [26], chronic bronchitis [27], abscess, sprain, diaphoresis [24] and chronic catarrah of bladder [27,28]. Various pharmacological actions of leaves are astringent, antiseptic [24], hypoglycaemic, laxative [27], analgesic [22,29], haemostatic [29], hair tonic [26] and stimulant [24].

Decoction of leaves and fruits is utilized orally for the cure of disbiosis, hypoglycaemia, stomachaches, cough constipation, poor appetite, externally for wound healing, urinary infections, enema and against respiratory diseases [30,3].

The berries are used in diarrhoea, dysentery, internal ulceration, rheumatism [22,21] foot ulcers, foetid ulcers, aphthae, deepsinuses, haemorrhages, leucorrhoea, lax vaginal walls [24], bronchitis [22], haemorrhoids [22], malaena, rhinitis, rectitis, conjuctivitis, piles, burns, dysurea, cough, epistaxis [29], earache, toothache, headache, palpitation [31], 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 and gastric ulcer [32]. They are used as antiseptic, astringent [24], carminative [20,22,24], emmenagogue [22,24], demulcent, dessicant, analgesic, hair tonic, haemostatic [26], antiemetic, lithotripsicb [33], cardiotonic, diuretic [22,29,33], anti-inflammatory [3], stomachic, brain tonic [22,33], haemostatic, nephroprotective, antidote [3], antidiaphoretic [29] and antidiabetic [27]. Different parts of the plant have been used in the food

industry, for example for flavouring meat and sauces, andin the cosmetic industry [27, 34].

In Turkish folk medicine, the fruits and leaves have been used in the treatment of urinary diseases, for healing wounds and an antiseptic [35].The oil of leaves and dried leaves of the plant are used to lower blood sugar in diabetic patients. In the Mediterranean regions, the tea is used to treat urinary tract infections and bladder [36]. In Libya, the plant is used for the treatment of cough, bronchitis, tuberculosis, lung complaints [37].

Chemical constituents

M. communis contains many active biological compounds which contribute significantly to the medicinal properties of the plant. Table 1 summarized the active constituents recorded from different parts of *M. communis*.

Table 1: Chemical constituents of *M. communis*

Constituents	Plant part	Reference
• Acylphlorogucinols: Mytrucommulone B,C,D,E and usnic acid derivative usnone A.	The aerial parts	[38]
• Tannins, flavonoids such as quercetin, catechin and myricetin derivatives and volatile oils. • Alpha-pinene, 1V8-cineole, limonene and linalool.	The leaves	[35,39] [40]
• The five terpenoid compounds (myrtenyl acetate, 1, 8-cineole, limonene, linalool).	Leaf oil	[41]
Couenstitnts	**Plant part**	**Reference**
• Citric acid, malic acid, resin, tannin, fixed oil and sugar. • Flavonoids,anthocyanin arabinosides, anthocyanin glucosides. • Kaempferol, quercetin, myricetin 3-o-glucoside,	Berries	[42,43] [44] [45]

myricetin 3, 3-di-o-galactoside, myricetin 3 rutinoside, aesculin, scopoletin, caffeic acid.		
• 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.	Berries	[46]
• The five terpenoid compounds (myrtenyl acetate, 1, 8-cineole, limonene, linalool). • Flavonoids, such as alpha-pinene, 1V2-cineole, myrtenal, myrtenol, myrtenyl acetate, myrcene, Linalool and geraniol.	Flowers	[41] [47]
• Volatile oils, tannins, sugars, flavonoids and organic acids such as citric and malic acids. • 14 fatty acids, oleic acid being the dominant fatty acid followed by palmitic acid and stearic acid. • Flavonoids such as asquercetin, catechin, myricetin.	Fruits	[35,33] [30] [48]
• Tannins. • Alkaloids, glycosides, reducing sugars • Fixed oil. • Gallic acids, phenolic acids, quercetin and patuletin.	Roots	[31] [25] [21] [49]
Couenstitnts	**Plant part**	**Reference**
• Ellagic acid and ellagitannins(eugeniflorin D_2 and oenothein B) • Fatty oil (fixed oil) consisting of glycerides of oleic, linoleic, myristic, palmitic, linolenic and lauric acid	Seeds	[50] [20,51]

Pharmacological activities

M. communis is reported for antimicrobial, antioxidant, Anticancer, Anti-inflammatory, Cardiovascular, Antidiabetic, Antinociceptive, Antidiarrheal Antiviral, Anthelmintic and other beneficial effects which are mentioned in Table 2.

Table 2: Pharmacological activities of *M. communis*

Activity	Dose	Extract/ Constituent	Model	Results	Reference
Antioxidant	**DPPH: (4±0.3 to 21±0.1 g/ml), ABTS: 0.001 50±0.000 09 to 0.004 80±0.000 08 mg/ml**	**Methanol, chloroform, ethyl acetate and aqueous extracts**	**ABTS, DPPH, Hydroxyl radical scavenging activity, Metal chelating activity β-carotene/linoleic acid bleaching assay, , Reducing power,Ferric thiocyanate test, *in vitro***	**Ethyl acetate extract exhibited the highest activity in scavenging DPPH, ABTS, hydroxyl radical and reducing power**	**[52]**
	In lipid peroxidation IC_{50}: 160µg/ml and 220 µg/ml DPPH IC_{50}: 1.4µg/ml	**Myricetin-3-ogalactoside and -rhamnoside, isolated from the leaves**	**Xanthine oxidase, lipid peroxidation and DPPH/ *in vitro***	**Both compounds showed the most potent inhibitory effect in xanthine oxidase**	**[53]**
Activity	**Dose**	**Extract/ Constituent**	**Model**	**Results**	**Reference**
Antioxidant	**3 to5 grams**	**Fruit extract**	**DPPH and β**	**Protect against**	**[54]**

			-carotene-linoleic acid assays	lipid peroxidation and can scavenge free radicals	
	1 ml	Methanol of roots	DPPH, FRAP and Folin-Ciocalteu assays	This extract exhibited very good radical-scavenging activity.	[55]
Cardiovascular	0.04 to 12 mg/kg bw	Methanolic and ethyl acetate extracts of berries	In anaesthetized rats. Intravenous administration of both extracts	Decreased the maximum mean arterial blood pressure at12 mg/kg, indicated that both extracts have lowering effect for blood pressure	[52]
	Relaxed phenylephrine (1µM) and K+ (80 mM)-induced contractions	Crude methanol extract	Isolated rabbit aorta preparations	Results were identical to verapamil, a standard calcium channel blocker	[56]
Anti-inflammatory	0.3-10 µg/ml	Ethanolic extract of leaves	6-keto-prostaglandin F1α and [3H]-arachidonic acid	Significant anti-inflammatory activity at the maximum	[57]

			metabolite production in keratinocytes	concentration	
Activity	**Dose**	**Extract/ Constituent**	**Model**	**Results**	**Reference**
Anti-inflammatory	1 and 2 ml/kg	Essential oil	Croton oil induced ear oedema and cotton pellet induced granuloma in mice	1. Significant ↓ ear oedema 2. Inhibit cotton pellet-induced granuloma and serum TNF-α and IL-6	[58]
Anti-inflammatory	0.5 to 4.5 mg/kg i.p.	Myrtucommulone (isolated from leaves)	Carrageenan-induced paw oedema and Pleurisy in mice	1. ↓ the growth of paw oedema in a dose-dependent manner 2. At 4.5 mg/kg i.p. myrtucommulone exerted potent anti-inflammatory effects in the pleurisy model	[59]
Anticancer	(1 and 3µg/ml)	Ethanolic extract	*In vitro* on HaCat keratinocytes by using the BrdU incorporation assay	The result showed that extract inhibit keratinocyte proliferation by 27% (1	[60]

				µg/ml) and 76% (3µg/ml)	
		Essential oils	**In two human cell lines HL-60 and NB4**	**Is more effective on Ehrlish Ascites Carcinoma Cells in both *in vitro* and *in vivo* studies**	**[61]**
Activity	**Dose**	**Extract/ Constituent**	**Model**	**Results**	**Reference**
Antibacterial	**10,20, 40&80mg /ml**	**Hydroalcoholic of the leaves**	**Four pathogenic bacteria, *Staphylococcus aureus, Pseudomonas aeruginosa, Vibrio cholera & Escherichia coli***	**The concentration of 80mg/ml showed the greatest effect on the *S. aureus* and *V. cholera***	**[1]**
Antibacterial	**10µl**	**Ethanolic and petroleum ether of fruits**	***Enterobacter faecalis, Shigella Sonni, Micrococcs leutus, Bacillus subtlis, Staphylococcus aureus***	**Ethanolic extract showed antibacterial activity against *E. faecalis, S. aureus.* Petroleum ether extract had no effect on tested bacteria.**	**[18]**
	7.5 - 60 mg/ml	**Essential oil of fruits**	***Bacillus cereus,***	**It had a strong**	**[18]**

			Micrococcs leutus, Staphylococcus aureus, Shigella Sonni, Aeromonas hydrophilla	**antimicrobial effect on most tested bacteria specially on *A. hydrophilla* then *S. sonni***	
	1 and 3mg/ml	**Myrtacine (Ethanolic extract of leaves)**	***Erythromycin sensible (EryS)* and resistant *(EryR) P. acnes* strains**	**Compared with erythromycin, Myrtacine activity was much higher on the EryR strain**	**[57]**
Activity	**Dose**	**Extract/ Constituent**	**Model**	**Results**	**Reference**
Antiviral (antiherpetic)	**IC_{50} before cellular attachment 3.1 mg/ml, and after entering the cells 1.11 mg/ml**	**Hydroalcoholic extract**	**The target was Herpes simplex virus-1 (HSV-1) *In vitro***	**By increasing the extract concentration, percentage of inhibition of cytopathic effect was increased**	**[40]**
Anti-diarrhoeal	**100, 200 and 400 mg/kg**	**Methanol extract**	**Castor oil induced diarrhoea in mice**	**At dose 200 & 400 mg/kg, the extract significantly delayed the onset of diarrhea**	**[62]**
	5 and 10 ml/kg bw	**MBJ**	**Castor oil-induced**	**Acute pre-treatment**	**[63]**

	orally		diarrhoea in rat	with MBJ delayed the onset of diarrhea and also decrease the frequency and severity of defecation	
	25 to 100 mg/kg bw orally	Aqueous extract of berries	Castor oil-induced diarrhoea in rat	The extract induced a significant dose-dependent protection against diarrhoea and intestinal fluid accumulation	[64]
Activity	Dose	Extract/ Constituent	Model	Results	Reference
Antidiabetic	500 to 1000 mg/kg bw orally	Aqueous and methanolic extracts	Alloxan-induced diabetic mice	Aqueous extract significantly lowered mean blood glucose level at dose of 500 mg/kg by 61.8%	[65]
	2 g/kg orally	Ethanol-water extract	Streptozotocin-induced diabetes in mice	Significantly reduced the hyperglycaemia	[66]
Antinociceptive	Aqueous extract: 5 to 200	Aqueous and	Hot plate and	Both extracts showed	[67]

	mg/kg i.p., Ethanolic extract: 150 to 350 mg/kg i.p.	**Ethanolic Extracts of aerial parts**	**writhing tests in mice**	**Significant antinociceptive activity against acetic acid induced writhing and in Hot plate test**	
	50 to 150 mg/kg i.p.	**Essential oil**	**Acetic acid induced writhing test in mice**	**The oil showed dose dependent analgesic effect in comparison with diclofenac sodium**	**[68]**
Anti-plasmodial	**1–100 µg/ml**	**Essential oils**	**Chloroquine (CQ) -sensitive and resistant strains of *P. falciparum***	**Significant activity present against CQ-sensitive and the resistant strains of *P.falciparum***	**[69]**
Activity	**Dose**	**Extract/ Constituent**	**Model**	**Results**	**Reference**
Anti-helmintic	**0.78 to 50 mg/ml**	**Ethanolic and water extracts of leaves**	***In vitro* naturally infected cattle using the egg hatch and larval mortality assay**	**Both extracts have a potential anthelmintic activity on eggs and larvae of bovine strongly parasites**	**[70]**

Oesophageal reflux (ER)		**- Aqueous extract of seeds**	**ER-Induced damage in oesophageal mucosa of adult male Wistar rats**	**- Aqueous extract exerted a potential protective effect against ER-induced damage in rat oesophagus due to its antioxidant properties**	**[71]**
Antifungal	**20 mg/ml**	**Flavonoids, Terpenoids, of the leaves**	***Aspergillus* species**	**The highest percentage of inhibition (85%) was recorded at 20 mg/ml of Flavonoids**	**[11]**
	Dose-dependent manner with $MIC_{50} < 8$ to 64 µg/ml.	**Oenothein B isolated from seeds**	***In vitro Candida* strains: *C. albicans* *C. glabrata* *C. parapsilosis* *C. tropicalis***	**Oenothein B was able to inhibite the Candida growth.**	**[72]**

Figure 1: *M. communis* plant	Figure 2: Flowers of *M. communis*

Figure 3: Leaves of *M. communis*

Figure 4: Seeds of *M. communis*

Figure 5: Berries of *M. communis*

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