Chonemorpha fragrans (Moon) Alston: Botanical Source, Chemical Constituents and Therapeutic Uses: An Overview

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Abstract

Chonemorpha fragrans (Moon) Alston is a remedial climbing plant belonging to the family Apocynaceae. It is commonly known as frangipani vine. It is traditionally use in ayurvedic systems of medicine. Different parts of Chonemorpha fragrans (Moon) Alston such as roots, bark and leaves. It has been traditionally used for conditions such as fever, gastrointestinal disorders, inflammation, skin disorders and certain gynecological ailments. Several types of secondary metabolites have been found in this plant like as alkaloids, phenolic compounds, flavonoids, glycosides, sterols and other components. In addition, camptothecin, a monoterpene indole alkaloid has been found anticancer activity. Compounds of this plant roots having chonemorphine, japindine, N-formylchonemorphine, sarcorucinine D, aromadendrin, β-sitosterol, dictyophlebin naringenin, vanillic acid, matairesinol, ferulic acid, and protocatechuic acid. It has also been found in recent studies of C. fragrans roots exhibited cytotoxic, antioxidant, antibacterial, antiparasitic, and antidiabetic and muscle-relaxant properties. These properties of plants suggested that need to do more experimental work to validation and confirmation of bioactive compounds. Further screening of pharmacological, toxicological, and clinical research performs by using in vitro tests, or conventional use. The botanical

identification, morphology, distribution, phytochemical profile, traditional uses, and therapeutic potential of C. fragrans are all summarised in this review.

Keywords: *Chonemorpha fragrans, Apocynaceae, Murva, frangipani vine, camptothecin, alkaloids, phytochemicals, pharmacological activity*.

1. Introduction

Traditional plants are the richest source of bioactive molecules which useful for the development of therapeutic agents. The family Apocynaceae contains several therapeutic plants that produce structurally diverse alkaloids and other secondary metabolites. Amongst these plants, *Chonemorpha fragrans* (Moon) Alston has concerned precise attention because of its traditional medicinal applications and its production of pharmacologically significant constituents.

Chonemorpha fragrans is a large, woody, laticiferous creeper usually used in numerous regions of South and Southeast Asia. It is usually called frangipani vine because of its large, fragrant flowers. Taxonomic databases at present recognize *C. fragrans* (Moon) Alston as the accepted name, while *Chonemorpha macrophylla*, *Chonemorpha grandiflora* and *Echites fragrans* occur among names related with the species in medicinal and taxonomic literature.

Chonemorpha fragrans has been related with the traditional drug Murva/Murva-like medicinal material, while its botanical identity in classical Ayurvedic sources has been complicated by the use of more than one species [1, 2].

Chonemorpha fragrans has attracted the attention due to its diverse phytochemical composition and reported biological activities. Especially, the detection and production of camptothecin in this species make it relevant to natural-product and anticancer research.

2. Botanical Source [2]

2.1 Scientific classification

Taxonomic category	**Classification**
Kingdom	Plantae
Group	Angiosperms
Family	Apocynaceae
Genus	*Chonemorpha*
Species	*Chonemorpha fragrans*

Botanical authority	(Moon) Alston
Common name	Frangipani vine
Traditional name	Murva/Murva-like drug

Chonemorpha fragrans (Moon) Alston scientific name and numerous synonyms are shown below [2]

2.2 Synonyms

Some reported synonyms of plants are:

- *Echites fragrans* Moon
- *Chonemorpha macrophylla*
- *Chonemorpha grandiflora*
- *Chonemorpha valvata*

The incidence of diverse names in older medicinal literature is significant when comparing phytochemical and pharmacological studies because older publications may have used a synonym rather than the currently accepted name [2].

2.3 Common and regional names

The plant is commonly known as climbing frangipani or frangipani vine. Murva and related regional names are examples of traditional names. The exact vernacular name differs according to the location.

2.4 Botanical description [2]

Habit: A robust, heavy, woody climber that can grow up to 30 meters (98 feet) in length.

Stem & Bark: When damaged, the stem's rusty brown or grey bark, which is coated in noticeable lenticels, produces white latex.

Foliage: Orbicular to broadly elliptic leaves, Opposite, large (bright green with a bronze hue when young, turning deep green and shiny at maturity). Plants leaves are characteristically hirsute on the abaxial surface.

Inflorescence & Flowers: White, Large, aromatic flowers with a yellow-hairy throat, closely resembling frangipani (*Plumeria*) in scent and visual appearance.

Fruit & Seeds: Flattened, long, lanceolate to oblong follicle seedcases containing flat seeds equipped with a long, white, silky coma that facilitates wind dispersal.

2.5 Distribution

Chonemorpha fragrans plant is resident to tropical and subtropical ecosystems across India (primarily the Western Ghats and Himalayan regions), Sri Lanka, Myanmar, Thailand, Malaysia, Indonesia and China. It thrives in semi-evergreen, humid deciduous and evergreen forests, ascending tall forest canopies at elevations ranging from 400 m to 1,800 m above sea level [3].

3. Phytochemical Constituents

Phytochemical investigations has been found that *C. fragrans* consists a number of bioactive secondary metabolites such as alkaloids, flavonoids, phenolic compounds, sterols, glycosides etc. Recent pharmacognostic research results reported that glycosides and saponins found in both *C. fragrans* and *Marsdenia tenacissima*, while alkaloids and phenolic constituents were detected in *C. fragrans*. HPTLC analysis has been detected gallic acid and quercetin, while β-sitosterol was observed in hydroalcoholic extracts.

Phytochemical screening evaluation results detected that *C. fragrans* synthesizes various spectrums of bio-active secondary metabolites [4, 5]:

Table1. Class bioactive compounds and their therapeutic significance

Compound Class	**Key Identified Phytoconstituents**	**Therapeutic Significance**[6,7,8]
Steroidal Alkaloids	Chonemorphine, Funtumafrine	Antiparasitic, antibacterial, intestinal infection control [7]
Indole Alkaloids	Camptothecin (CPT)	Topoisomerase I inhibition, potent antitumor activity
Phenolics & Flavonoids	Quercetin derivatives, Tannins	Antioxidant, free-radical scavenging, hepatoprotective [8]
Triterpenoids & Sterols	Beta-Sitosterol, Stigmasterol	Anti-inflammatory, membrane-stabilizing [9]

3.1 Alkaloids

Alkaloids characterize one of the most pharmacologically remarkable groups reported from *C. fragrans*. Earlier research work has reported camptothecin, chonemorphine and funtumafrine.

A more recent investigation of *C. fragrans* roots isolated five alkaloids names are

1. Japindine
2. Sarcorucinine D
3. Dictyophlebin
4. Chonemorphine
5. N-formylchonemorphine

The same study reported antibacterial activity associated with sarcorucinine D.

Camptothecin

Camptothecin bioactive compound is mainly important because it is a monoterpene indole alkaloid with recognized anticancer significance. *C. fragrans* has consequently been found as a possible botanical source of this vital natural product. Experimental studies have also examined callus cultures as resources of attractive camptothecin production [10].

Chitosan, salicylic acid, yeast extract and glycine are the examples of elicitors. These elicitors have been used in experimental studies and found that in during vitro culture change condition can influence secondary-metabolite accumulation like camptothecin of plant [11].

3.2 Non-alkaloid constituents [7]

Table2. A detailed investigation of the roots reported nine non-alkaloid compounds:

Chemical constituent	Chemical group
Sitostenone	Steroid/sterol-related compound
β-Sitosterol	Phytosterol
Naringenin	Flavonoid
Aromadendrin	Flavonoid
Matairesinol	Lignan
Vanillic acid	Phenolic acid
Ferulic acid	Phenolic acid
Protocatechuic acid	Phenolic acid
Sitosterol-3-O-β-D-glucopyranoside	Steroidal glycoside

Names of non-alkaloid constituents of this plants are sarcorucinine D, japindine, chonemorphine, dictyophlebin and N-formylchonemorphine were isolated from the ethanol extract of the roots. Some others chemical constituents of *C. fragrans* were reported that are shown in tabulated form below in table 3.

Table3. Summary of Major Chemical Constituents [6, 7, 12, 13]

Constituent/class	Examples	Reported significance
Indole alkaloid	Camptothecin	Major anticancer research interest
Alkaloids	Chonemorphine, japindine, sarcorucinine D, dictyophlebin, N-formylchonemorphine	Potential pharmacological activities
Flavonoids	Naringenin, aromadendrin, quercetin	Antioxidant and other biological potential [12]
Phenolic acids	Vanillic acid, ferulic acid, protocatechuic acid, gallic acid	Antioxidant and antimicrobial relevance
Phytosterols	β-Sitosterol, sitostenone	Various reported biological effects
Steroidal glycoside	β-Sitosterol-3-O-glucoside	Bioactive secondary metabolite
Lignan	Matairesinol	Potential biological activity
Saponins/glycosides	Detected in extracts	Contribute to phytochemical profile

4. Traditional Therapeutic Uses

Traditional *C. fragrans* have used in numerous therapeutic applications purposes. In modern times reported activities of this plant are fevers, stomach disorders or gastrointestinal, skin disorders, inflammatory conditions and gynecological complaints.

These modern research data related to diverse plant parts with traditional therapeutic categories, with antiprotozoal applications for the root and contraceptive and parasympatholytic uses associated with leaves/bark. These research studies results relations should be interpreted as records of traditional/medicinal use rather than proof of clinical efficacy [8, 9].

5. Pharmacological and Therapeutic Potential

5.1 Anticancer activity

The anticancer activity of *C. fragrans* is one of its most key areas of scientific examination. Extracts of *C. fragrans* was prepared from leaves, bark, roots and in-vitro cultures have been evaluated using cytotoxicity assays.

They were reported that a chloroform extract of *C. fragrans* callus showed shows probable cytotoxic activity against numerous cancer cell lines. The extracts also inhibited enzymes

involved in DNA replication, topoisomerase II, including topoisomerase I and DNA polymerase, as long as a possible mechanistic basis for the observed antiproliferative effects. However, these findings are mainly preclinical, and they should not be interpreted as confirmation that crude *C. fragrans* preparations are clinically effective anticancer medicines [14].

5.2 Antibacterial activity

It has been reported that roots of *C. fragrans* having several alkaloid and non-alkaloid constituents with possible antimicrobial activity such as sarcorucinine D. It has been isolated from the roots and found antibacterial activity in experimental studies. Sarcorucinine D compound was found as non-cytotoxic activity on cytotoxicity model.

These results revealed that *C. fragrans* could be used as source of antimicrobial molecules, although additional studies are required to establish their therapeutic usefulness [15].

5.3 Antidiabetic potential

Literature studies results have been found that *C. fragrans* antihyperglycemic and antidiabetic activity. However, the scientific confirmation remains inadequate to establish standardized clinical use. Therefore need to do more studies involving purified compounds, validated animal models and controlled clinical investigations are needed [16].

5.4 Antiparasitic and antiamoebic potential

It has been found that *C. fragrans* having antiparasitic and antiamoebic activity. These findings offer a basis for further examination of the plant's alkaloids and other secondary metabolites [17].

5.5 Antioxidant activity

The antioxidant activity of *C. fragrans* has been reported. Therefore, this plant could enhance antioxidant activity along with secondary-metabolite accumulation. The antioxidant activity may be associated to phenolic and flavonoid constituents such as quercetin, gallic acid, protocatechuic acid, ferulic acid and related compounds [18, 19].

5.6 Muscle-relaxant activity

Traditional *C. fragrans* has been used as skeletal muscle-relaxant potential. The presence of biologically active alkaloids has been suggested as one possible contributor to its pharmacological effects. More detailed mechanistic and clinical studies are required before therapeutic recommendations can be made [20].

5.7 Anti-inflammatory and dermatological potential

Traditionally C. fragrans peoples are useing in treatment of skin disorders and inflammatory conditions. The presence of anti-inflammatory and dermatological activity may due to presence of phenolic acids, flavonoids and sterol-type compounds. These compounds are provides a probable therapeutic effects, but need to do clinical studies for the validation [21].

6. Pharmacognostic and Quality-Control Considerations

In modern research has emphasized the need for standardized identification and quality control of *C. fragrans*. In modern times various sophisticated techniques using for the standardization of plant such as HPTLC and GC-MS/MS fingerprinting [3].

Other standardization methods for plant are:

1. Correct botanical identity.
2. Geographical source.
3. Plant part used.
4. Moisture and ash values.
5. Extractive values.
6. Total phenolic and flavonoid content.
7. HPTLC/HPLC fingerprint.
8. Quantification of marker compounds.
9. Contaminant and microbial evaluation.
10. Stability of the finished herbal preparation.

7. Future Perspectives

Although *C. fragrans* has significant ethnomedicinal and phytochemical significance, numerous areas need further investigation. First, the common of pharmacological confirmation is based on crude extracts or in-vitro models. The active constituents responsible for individual biological

effects need to be established through bioassay-guided isolation. Second, the presence of camptothecin makes the plant chiefly attractive for biotechnology-based production. Optimization of cell suspension, callus culture, elicitation and metabolic engineering could significantly get better production of valuable alkaloids. Recent research has already demonstrated that elicitors can modify secondary-metabolite and camptothecin accumulation in *C. fragrans* cultures [22]. Third, comprehensive toxicological studies are necessary. Traditional use alone cannot establish the safety of concentrated extracts or isolated compounds. Finally, because *C. fragrans* may be alternative for other plants used, pharmacognostic authentication and chemical standardization should be careful necessary components of future research [23, 24].

8. Conclusion

Chonemorpha fragrans (Moon) Alston is a vital medicinal herbal plant of Apocynaceae family with traditional use. The roots bark and leaves contain a varied variety of phytochemicals, particularly flavonoids, alkaloids, sterols, phenolic acids and glycosides. These compounds such as chonemorphine, camptothecin, sarcorucinine D, dictyophlebin, japindine, N-formylchonemorphine, naringenin, β-sitosterol, matairesinol, aromadendrin and several phenolic acids have been reported from the plant. Past experimental studies represented antibacterial, antioxidant, anticancer, antiparasitic, antidiabetic and muscle-relaxant potential, while earlier times of medicine; it has been used the plant for stomach disorders, fever, skin diseases, inflammatory conditions and other ailments. The presence of camptothecin and other bioactive alkaloids makes *C. fragrans* particularly precious for natural-product and pharmaceutical research. However, the obtainable confirmation does not yet justifies treating crude *C. fragrans* preparations as well-known clinical therapies. Further in-vivo studies, toxicity investigations, pharmacokinetic studies, molecular-mechanism studies and well-designed clinical research are required. Correct botanical authentication and chemical standardization are also necessary, particularly because *C. fragrans* has historically been used as an alternate for other plants.

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