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Madanaphala (*Randia dumetorum* lam.): A Phyto-Pharmacological Review

Review Article

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Abstract

In contemporary era medicinal plants have tremendous contribution in the healthcare system as a source of medicine to the rural population because plants are having nutritional as well as medicinal values. Literature of medicinal plants in ayurvedic classics is in scrupulous detail but it is randomly distributed. Even in Nighantu classics we found limited descriptions. To get thorough knowledge about any medicinal herb it is essential to go through all classical Ayurveda texts. *Madanphala (Randia dumetorum Lam).* is onymous as a usual drug of choice for Ayurvedic physicians since past due to its therapeutic properties like emetic, antipyretic, anti-inflammatory, antiallergic, antihelmenthic, immunomodulatory, analgesic, wound healing etc. It is also useful in the treatment of diseases like *kushtha* (skin diseases), *jwara* (fever), *shotha* (inflammation), *vidradhi* (abscess), *Pratishyaya* (common cold). It occurs throughout the India upto 4000 ft. Altitude. It is found in foothills of Himalaya from Jammu to Sikkim, it is seen in Gujarat, Tamilnadu, Bengal and South Maharashtra. Its extract mainly contains glycosides, triterpenoid glycoside, Saponins named as dumentoronin A, B, C, D, E and F etc. Reflecting its therapeutic importance, a review has been done under various aspects of Randia dumetorum lam. Apart from classical ayurvedic textual references; present article enlightens recent research studies carried on this plant for its clinical and pharmacological evaluation.

Key words: *Madanphala, Randia dumetorum Lam.,* Ayurveda.

Introduction

Ever since ancient times, in search of rescue for their disease, the people looked for drugs in nature. According to the World Health Organisation (WHO), more than 80% of the World's population relies on traditional herbal medicine for their primary health care needs. In last few years interest of researches in medicinal plants has increased significantly. Identification and validation of plant derived substances for the management of several diseases is the goal of current researchers. It is estimated that about 25% of the western medicines are directly or indirectly derived from plant sources (1). Indian medicinal plants are considered as a huge source of various pharmacological principles and compounds that are usually used as home remedies for common ailments. In ancient texts description of such plants is in scrupulous detail, but it is in randomly dispersed form. To get deep knowledge about any medicinal plant, it is mandatory to go through all available

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classical ayurvedic texts as well as review from modern researches. Randia dumetorum lam. (Madanaphala) which belongs to family Rubiaceae (2) is a large deciduous thorny shrub which grows up to 5 metres of height. It is found in all over India Up to 4000 ft. Altitude especially in sub-trophical Himalaya from
Jammu to Sikkim. It is seen in Gujarat, Tamilnadu, forests of Dehradun, suralik range, Orissa, Bengal, Bihar, South Maharashtra, coastal districts of South India and dry forests of India(3). It has been famous as a common drug of choice for Ayurvedic physicians from ancient time. *Randia dumetorum lam.*, is used as ingredient in many ayurvedic formulations like Mrutsanjivan agad(4), Siddharthak snana(5), Duralabhadi kshara(6), Bala tailam(7), Mahanil tailam(8). Also it is considered as drug of choice in *Vamana* (therapeutic emesis), *Asthapan basti* (decoction enema) and *Anuvasana basti*(9) (oil enema). This multiple use of *madanaphala* shows its importance among Ayurvedic physicians, still we didn't get its complete information under a single umbrella. The purpose of present review article is to furnish a comprehensive review on the phytochemical and pharmacological aspects of *Randia dumetorum lam.*

Review of Madanaphala (*Randia dumetorum lam.)*

I. Literary review

Etymology (10): Literary *Madanaphala* means fruit inducing emesis. In English, Randia = In memory of Issac Rand, botanist of Chelsea, London; dumetorum = of thorny bushes, of hedges-madanphala has many thorns.

Synonyms

Charaka Samhita has summarized 6 synonyms for *madanaphala* (11) and in *Bhavaprakash nighantu* we found 9 synonyms(12). These poecilonyms are not only for Sanskrit *Chhandashastra* which is helpful in recitation of verses, but it also gives immense information regarding identification, description, properties, functions and therapeutic uses of corresponding plant. Some of the significant synonyms of *madanaphala* with their meanings (13) are as:

1. *Madana* - Inducing emesis
2. *Pindi* - Having round shape fruits
3. *Shalyaka* - The tree has thorns
4. *Vishapushpak* - Flowers are poisonous
5. *Phala* - Excellent among fruits used in treatment
6. *Marubak* - Its poisonous flowers can cause ones death; grows in *marubhumi*
7. *Karhat* - Its thorns can prick painful or raises beauty of brides hands
8. *Shwasana* - Even grows in scanty water region.

Taxonomic Classification (14)

Kingdom	-	Plantae
Sub kingdom	-	Tracheobionata
Super division	-	Spermatophyta
Division	-	Magnaliophyta
Class	-	Magnoliopsida
Sub Class	-	Asteridae
Order	-	Rubiales
Family	-	Rubiaceae
Genus	-	Randia
Species	-	Dumetorum

Vernacular names (15)

It is usually recognized as 'Madanaphala' in India and its other vernacular names are as:

1. Hindi	-	Mainphala

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2. Bengali	-	Manphal, Mayanaphala
3. Marathi	-	Gel, Gelphala, Madanaphala
4. Gujarati	-	Mindhal, Mindhol, Mindhar
5. Kannada	-	Mangarikai, Karigidda, Kari
6. Malayalam	-	Malankara, Malamkarakka
7. Punjabi	-	Mindhal, Rara, Manphal
8. Telugu	-	Mrangakaya, Mongakaya
9. Assam's	-	Maen, Behmona
10. Tamil	-	Marukkarai
11. Urdu	-	Mainfal, Jauz- ul-Qai
12. English	-	Emetic nut tree
13. Kashmiri	-	Madanfal
14. Oria	-	Palova
15. Arabic	-	Jauzulaki, Ji jul kai.

Classification of *Madanaphala* in different Ayurveda texts

Table 1: Classification in different Ayurveda texts

Samhita	Gana / Varga	According to karma
Charaka Samhita	Asthapanopaga(16), Anuvasanopaga(16), Phalini virechana(17),	Vamana(18)
Sushruta Samhita	Aragvadhaadi(19), Mushkakadi(20),	Urdhwabhagahara(21)
Ashtanga sangraha	Aragvadhaadi(22), Tiktaskandha(23)	Vamanopayogi(24),
Ashtanga hridaya	Aragvadhaadi(25)	Vamanakarak(26), Niruhan(27)
Bhavaprakasha nighantu	Haritakyadi varga(28)	
Nighantu Adarsha	Manjishthadi varga(29)	
Kaiyadeva nighantu	Oshadhi varga(30)	
Dhanwantari nighantu	Guduchyadi varga(31)	
Raj nighantu	Shalmalyadi varga(32)	

II. Pharmacognostical review

a) Macroscopic(33):

A large deciduous thorny shrub which grows up to 5 metres of height. Leaves are simple, obovate, wrinkled, shiny and pubescent. Flowers are white, solitary and having honey like fragrance seen at the end of short branches. Fruits are globose, smooth berries with longitudinal ribs, yellow when ripe. Seeds many, compressed, embedded in the dark fetid pulp. Fruit 1.8 - 4.5cm long, globose or broadly wide, longitudinally ribbed or smooth yellowish brown, crowned with persistent calyx-limb, fruits contains numerous seeds 0.4 – 0.6 cm long, compressed, smooth, brown and very hard. These seeds are called as '*madanphala pippali'*.

a) Flowers

b) Leaves

c) Fruits

b) Microscopic:
Miscellaneous parts of plant studied microscopically shows features as depicted in Table 2.

Table 2: Microscopic characters of different parts of *Randia dumetorum lam.*

Part	Characteristics
Leaves(34)	Simple, opposite, sometimes with one of each pair arrested almost sessile or very short petioled obovate, obtuse or Sub acute at apex, the base tapering narrowed in to a very short petiole 3.8 or rarely up to 5 cm long and 1.8-3cm broad wrinkled when young, pubescent on one or both surfaces especially on the nerves beneath but glabrous when mature main nerves 6-10 pairs.
Flowers(34)	Fairly large, under 2.5 cm in diameter often terminal on short leaf bearing branchlets or young shoot or axillary or a leaf opposed short peduncle. Solitary or rarely 2 or 3 together sub-sessile or very short-stalked. Whitish pale greenish or yellowish white but turning yellow as they fade out, "highly fragrant"(Roxb) bisexual & epigynous.
Fruit(35)	transverse section shows epicarp consisting of single layered epidermis, sometimes obliterated in surface view, epidermal cells thin-walled and polygonal, mesocarp, broad zone consisting of thin-walled, parenchyamatous cells, some cells contain reddish-brown content, a number of vascular bundles found embedded in this zone, endocarp stony consisting of light yellow polygonal, sclerenchymatous cells of variable shape and size.
Seed(35)	Transverse section shows a seed coat, consisting of single layered, rounded to oval epidermal cells, a few layers of yellowish-brown pigmented cells and endosperm forms bulk of seed consisting of large oval and irregular shaped parenchymatous cells, albumen horny, translucent, cells of outermost layer smaller in size.
Powder(35)	Reddish brown, under microscope shows numerous, large, irregular, reddish brown cells sclereids of variable shape and size, pieces of xylem vessels with reticulate thickenings, thin-walled, crushed parenchymatous cells and yellow-orange pieces of seed coat

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III. Phytochemistry

Various parts of this plant shows variety of chemical constituents which are shown in following table-

Table 3: Chemical constituents

Plant part(36)	Chemical constituents
Bark(36)	Scopoletin, d-mannitol and a mixture of saponins
Root(36)	Scopoletin, d-mannitol
Root bark(36)	Triterpene-1- keto-3-hydroxyoleanane
Powered root(36)	Scopoletin
Leaves(36)	Ether extract- 5.7; protein 3.9; dig – carbohydrate 70; fibre, H_2O with ash 8.5; Calcium 2.8; phosphorus 0.04 and iron, 0.5% iridoid-10-methylixaside.
Fruit	Ripe fruit contains glycosides, randioside A, mollisidial triterpenoid glycosides and randianin, six saponins dumetoronins A to F (37). A haemolytic triterpenoid saponins that is Randianin, from fruit of R.dumetorum(38).
Seeds	Fat (1.5%), Protein (14.2%), mucilage resin, organic acid(1.4%) and volatile oil.

IV. Analytical review (39):

Foreign matter	-	Not more than 2 %
Total Ash	-	Not more than 6 %
Acid-insoluble ash	-	Not more than 0.25 %
Alcohol-soluble extractive	-	Not less than 19 %
Water-soluble extractive	-	Not less than 16 %

V. Pharmacological review

In modern pharmacology, action of drug depends up on its active principle where as in Ayurveda the mode of action of drug depends on *Rasapanchaka*(40) (Five principles on which drug acts).

Table 4: Ayurvedic properties(41)

Rasa	Virya	Vipaka	Guna	Prabhava
Madhura, Kashaya, Tikta, Katu.	Ushna	Katu	Laghu, Ruksha, lekhana	Vamak

All the qualities of madanaphala are almost same in *ayurveda* and *nighantu* classics but according to charaka it is of *aruksha* (less rough), *Vijjal* (*picchila*), *Ashukari* (Fast acting) properties(42). Due to these properties Madanaphala has been used as excellent drug in many diseases like *kushtha* (skin diseases), *jwara* (febrile conditions), *shotha* (inflammation), *vidradhi* (abscess), *Pratishyaya* (common cold), *vrana*(wound), *Gulma*(abdominal tumour) (43).

Table 5: Action of *madanaphala.* Emphasized in Ayurveda classics.

Action	Efficacy	Effect on Dosha
Vamaka(44)	Adhoga raktapitta(46)	Kaphashamaka
Sarvagadavirodhi(45)	Hrudaya daha(46)	Pittashamaka
Kapha-pitta hrida(45)	Tamakashwasa(46)	Vatanulomaka
Aashukaari(45)	Kushthagna	
Pavananulomi (45)	Shophahara	
Lekhana(41)	Vidradhi	

VI. Pharmacological activities.

1. Antibacterial activity: "The preliminary antibacterial activity of Methanolic extract of *Randia dumetorum lam.,* Was done on some standard and wild pathogenic strains. The inhibition of the bacterial growth was more pronounced on E.coli as compared to the other tested organisms (47)". This shows the anti-bacterial action of Randia dumetorum Lam.

2. Anti-Allergic activity: In Ayurveda, *Randia dumetorum Lam.* is used in treatment of Asthma (*tamakshwasa*), Rhinitis, cold, pain etc. "Extract and its fraction on milk induced leucocytosis and eosinophilia in mice, passive paw anaphylaxis and mast cell degranulation in rat models (48)"**.**

3. Anti-inflammatory activity: "The crude methanol extract of fruit of *Randia dumetorum* effectively reduced the carrageenin induced oedema in hind paw of the rats, significant reduction in granular tissue formation was recorded. This activity seems to be significant at various acute phases of inflammation and on formation of granular tissue" (49).This proves the action of madanaphala on *shopha* (inflammation).

4. Analgesic activity: Analgesic activity was tested in mice weighing between 20-250 with six numbers of animals in each group by Acetic acid induced writhing response and Hot-plate response in mice. 500 mg/kg methanolic extract of fruit *Randia dumetorum* give analgesic activity in both models(50). This proves its *shoolanashaka* (pain killer) action.

5. Immunomodulatory activity: "*Randia dumetorum* has immunostimulant activity and chloroform fraction which strongly affected immune system seems to be bioactive fraction of this plant" (51).

Conclusion

The plant has been attributed with a number of activities in the classics. The multi-dimensional activities of Randia *dumetorum lam.,* have been revalidated in recent times on several experimental models and even in well designed clinical trials. It is known as good source of saponins, glycosides, d-mannitol, Scopoletin present in *Randia dumetorum lam.,* might be either medicinally important or nutritionally sound. It possesses therapeutic potential in diseases like *kushtha* (skin diseases), *jwara* (febrile conditions), *shotha* (inflammation), *vidradhi* (abscess), *Pratishyaya* (common cold), *Gulma* (abdominal tumours), *Vrana* (wound), *Adhoga Raktapitta* (Blood disorders) etc. Though there are certain properties which are still to be evaluated out, almost all these utilities have been revalidated through relevant experimental models in recent past. Various parts of this medicinal thorny shrub reveals Antibacterial, Anti-Allergic, Anti-inflammatory, Analgesic, Immunomodulatory, therapeutic emetic and also used to check wound healing etc Shows us multiple precision of the plant.

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