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Review Article

GRANGEA MADERASPATANA (L.) POIR. – A COMPREHENSIVE REVIEW

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ABSTRACT

Grangea maderaspatana (L.) Poir. is a popular Indian medicinal plant belonging to the Asteraceae family. This plant commonly known as Madras Carpet grown in wet places. A wide range of phytochemical constituents have been isolated from this plant. It has long been used in traditional Ayurvedic Indian medicine for various diseases. This plant is pharmacologically studied for oestrogenicity, antifertility, analgesic, anti-inflammatory, antiarthritic, cytotoxic, antioxidant, hepatoprotective, diuretic and antimicrobial activities. A comprehensive account of the morphology, phytochemical constituents, traditional uses, pharmacological activities and toxicity study reported are included in view of the many recent findings of importance on this plant.

Key Words: Analgesic activity, *Grangea maderaspatana* (L.) Poir., Madras carpet, antiarthritic activity

INTRODUCTION

Herbal medicines have been used by the mankind since time immermorial. *Ayurveda*, the oldest traditional system of India, reveals that ancient Indians had a rich knowledge of medicinal value of different plants. India has been endowed with a very rich flora owing to the extreme variations in climate and geographical conditions prevalent in the country. With the advent in science, many of the crude drugs used in traditional system have been investigated scientifically. *Grangea maderaspatana* (L.) Poir. is a medicinal plant widely used in Indian traditional system of medicine for curing various ailments[1]. In this review a comprehensive account of the morphology, phytochemical constituents, traditional uses, pharmacological activities and toxicity study are included in view of the many recent findings of importance on this plant.

Taxonomy of *Grangea maderaspatana* (L.) Poir.[2]

Kingdom : Plantae

Subkingdom: Planta Tracheophyta

Subdivision: Spermatophyta

Division: Magnoliophyta

Class: Magnoliopsida (Dicotyledons)

Subclass: Asteriidae

Order: Asterals

Family: Asteraceae

Synonyms

Grangea maderaspatana (L.) Poir., *G. adansonia*, *Artemesia maderaspatana*

Vernacular name

Gujarati : Jhinkimundi, Nahanigora, Khamundi

Hindi : Mukhatari, Mustaru

Malayalam : Nelampala;

Marathi : Mashipatri

Tamil : Mashipatri

Telugu : Machi-Patri

Urdu : Afsantin

Kannada : Dodda gaadaari

Occurrence and distribution

It is a weed commonly known as *Madras carpet* usually growing in sandy lands and waste places. It is distributed throughout India, Baluchistan, Ceylon, tropical and subtropical Asia and Africa.

Macroscopical characters[1,3]

It is a prostrate, ascending to erect annual herb, which is up to 55 cm tall, branched from base with a tape root.

Stem: stems are many, prostrate, spreading from the centre, 10-30 cm long, hairy with soft white hairs.

Leaves: Leaves are numerous, sessile, 2.5-6.3 cm long, sinuately pinnatifid with 2-4 pairs of opposite or subopposite lobes smaller towards the base, the terminal lobe the largest, all coarsely serrate-dentate, pubescent on both surfaces. Heads globose, 6-8 mm diameter, solitary or 2-nate, on short leaf opposed peduncles.

Flowers: The inflorescence is terminal, truncate spherical head, 6-10 mm in diameter, solitary or 2-3 together, yellow and many flowered. The peduncle is 1-4 cm long. The involucral bracts are 2-3 seriate where the outer ones are oblong and acute while the inner ones are elliptical, yellow, involucral bracts elliptic, obtuse, rigid, densely pubescent, Pappus a short tube with fimbriate mouth. Achenes glandular, 2.5 cm long including the pappus-tube.

Fruits

The fruit is turbinate and compressed while the truncate achene is about 2mm long, smooth and sparingly glandular. The pappus consists of a ciliate cup. Seedling is with epigeal germination. The hypocotyls are 2-2.5 mm long. The cotyledons are subsessile and elliptical to widely elliptical while epicotyl is absent.

Flowers and Fruits

August- December

Parts used

Leaves

Phytochemistry

Steroidal constituents, hardwickiic acid, the corresponding 1, 2- dehydro-derivative, acetylenic compounds[4], eight new clerodane diterpenes including five clerodane, a nor clerodane, a secoclerodane and a norsecoclerodane derivatives along with auranamide[5-7], grangolide and eudesmanolides have been reported from various parts of *G. maderaspatana*. A clerodane derivative, 15-hydroxy-16- oxo-15,16H-hardwickiic acid (15-hydroxycleroda – 3, 13-dien-15, 16-olide-18-oic acid) has been isolated from the aerial parts of *G. maderaspatana*[8]. Three components viz., eudesmanolide, (-) frullanolide, (-) -7-alpha-hydroxyfrullanolide and a new eudesmanolide (+) -4 alpha, 13-dihydroxyfrullanolide have been isolated from the whole plant of *G. maderaspatana*. A new eudesmanolide was named (+) – Grangolide[9]. Penta and hexamethoxy flavones have been isolated as 3"5- dihydroxy- 3,4",5",6,7-pentamethoxy flavone, 4",5-dihydroxy-3,3",5",6,7-pentamethoxy flavone (murrayanol) and 5-hydroxy-3,3",4",5"6,7-hexamethoxy flavone in addition to previously reported clerodane ditepenes from the Diethyl ether – Petrol – Methanol (1:1:1) extract of the aerial parts of *Grangea maderaspatana*[10]. Two new 5-deoxyflavones, 6-hydroxy-2′,4′,5′-trimethoxyflavone (1), 6-hydroxy-3′,4′,5′-trimethoxyflavone (2) and a known flavone, 7,2′,4′-trimethoxyflavone (3) have been isolated from the whole plant of *Grangea maderaspatana*[11].

The plant contains diterpenoid compounds of labdane and clerodatetrean type, such as the analgesic constituentent-15, 16-epoxy-7-hydroxy-3, 13, 14-clerodatrien-18-oic acid; steroids, chondrillasterone and chondrillasterol; diterpene, strictic acid, a phenylalanine derivative, auranamide and the allergenic compounds, eudesmanolides, (-)-frullanolide, (-)-hydroxyfrullanolide and (+)-grangolide[12].

A new diterpenoid has been isolated as 8-hydroxy- 13*E*-labdane-15yl-acetate from the acetone extract of *Grangea maderaspatana*[13] 1 Singh et al. (2013)[14] were identified 21 constituents constituting 91.5 % of the oil from aerial parts of *Grangea maderaspatana* (L.) Poir. It was characterized by the dominant presence of sesquiterpenoids (sesquiterpenoid hydrocarbons 36.1 % and oxygenated sesquiterpenoids (28.4 %). Most abundant compounds are γ-gurjunene (26.5%), terpinyl acetate (20.8%) and hinesol (11.7%).

Traditional uses[1]

The herb has a very bitter bad taste; antipyretic; good for pain in the eyes and ears. The root is an appetizer; astringent to the bowels, diuretic, anthelmintic, emmenogogue, galactogogue, stimulant; useful in griping, in troubles of the chest and lungs, headache, paralysis, rheumatism in the knee joint, piles, pain in the muscles, diseases of the spleen and the liver, troubles of the ear, the mouth and the nose; lessens perspiration (Unani).

Plant is stomachic and uterine stimulant. Infusion of the leaves with ginger and sugar added is used in dyspepsia, hysteria and obstructed menses. Externally it is useful as an anodyne and antiseptic fomentation to inflamed and painful parts. As an antiseptic application the powdered leaves are applied to wounds and ulcers. Juice of the fresh leaves is instilled into the ear for earache.

PHARMACOLOGICAL ACTIVITIES

Oestrogenicity and Antiimplantational Activities[15]

A mixture of flavonoids extracted from the plant *Grangea maderaspatana* exhibited oestrogenicity and antiimplantational activities, in the mouse. In the 3 day uterotrophic bioassay, administration of the drug at a dose of 20 mg/kg body weight per day, intramuscularly to ovariectomized females, resulted in a highly significant ($p<0.001$) increase in the wet uterine and vaginal weights. However, in comparison with conjugated oestrogen, the extract proved to be mildly oestrogenic. Flavonoids, administered orally at the same dose level effectively interfered with all stages of pregnancy. Maximum interceptory efficacy was recorded when the drug was administered from days 4-6 post coitum. However, there was a reduction in antinidational activity only if the drug was administered from days 1-3 and 7-9 post coitum.

Analgesic activity[16,20]

The methanol extract of *Grangea maderaspatana* whole plant (1 and 3 g/kg, p.o.) significantly and dose-dependently inhibited acetic acid induced writhing in mice. The lower dose (1 mg/kg, p. o.) found to as effective as aminopyrine (50 mg_kg, p.o.) which was used as a reference. Methanolic

extract of the plant (500 mg and 1 g/kg, p.o.) was also evaluated in tail flick model in our laboratory. The plant extract in both dose significantly increased latency for tail flick indicated analgesic activity.

Cytotoxic activity[17]

A crude chloroform extract exhibited strong cytotoxic activity (ED50=2 µg/ml) in the KB cell culture assay.

Antioxidant activity[14,18]

The antioxidant activity of the extract of this plant was evaluated using five in vitro assays and was compared to standard antioxidant ascorbic acid**.** The extract and ascorbic acid were found to have different levels of antioxidant activity in the systems tested. Methanolic extract of *Grangea maderaspatana* exhibited significant ($p<0.05$) reducing power ability, 1,1-diphenyl- 2-picrylhydrazyl (DPPH) radical scavenging activity, nitric oxide radical scavenging activity, hydrogen peroxide (H2O2) scavenging activity and inhibition of β-carotene bleaching. The antioxidant property depends upon concentration and increased with increasing amount of the extract. The free radical scavenging and antioxidant activities may be attributed to the presence of phenolic and flavonoid compounds present in the extract. The *in vitro* antioxidant potential of the oil obtained by steam distillation of extract of aerial parts of *Grangea maderaspatana* (L.) Poir., was evaluated using, DPPH radical scavenging, metal chelating and reducing power assays. The oil showed antioxidant potential with significant reducing power (ASE/mL 2.01 ± 0.00), chelating activity (IC50 1.80 ± 0.15) and DPPH radical scavenging activity (IC50 2.90 ± 0.96).

Hepatoprotective activity[19]

Aqueous and ethanolic extract (250 mg/kg, 500 mg/kg, p.o.) of *Grangea maderaspatana* Poir. effectively inhibited CCl_4 and paracetamol induced changes in the serum marker enzymes (SGOT, SGPT and ALP) in a dose-dependent manner as compared to the normal and the standard drug silymarin treated groups. Hepatic steatosis, hydropic degeneration and necrosis observed in CCl_4 and paracetamol-treated groups were completely absent in histology of the liver sections of the animals treated with the extracts. The results suggest that the extract of ethanolic extract of *G. maderaspatana* possess significant potential as hepatoprotective agent.

Antioxidant and Antimicrobial activity[14]

Antimicrobial activity of the oil obtained by steam distillation of extract of aerial parts of *Grangea maderaspatana* (L.) Poir. was tested against one gram positive, four gram negative bacteria and two fungi using agar well diffusion method. The zone of inhibition (ZOI) values of the oil was in the range of 2.67 ± 0.58 to 11.00 ± 0.00 mm and minimum inhibitory concentration (MIC) of the oil was ranged from 5 to 30 µL/ mL for tested microorganisms. The activity was more pronounced against *Candida albicans* (ZOI = 11.00 ± 0.00 mm, MIC = 5 µL/mL) followed by *Streptomyces candidus* (ZOI = 9.33 ± 0.58 mm, MIC = 5 µL/mL), while the oil was least effective against *Aeromonas hydrophila* and *Klebsiella pneumoniae*.

Antiinflammatory and Antiarthritic activity[20]

Anti-inflammatory activity of methanolic extract of *G. maderaspatana* (1000 mg/kg, p.o.) was evaluated using acute model of carrageenan induced rat paw edema. Indomethacin was used as standard in this model. The extract provided significant protection against carrageenan induced rat paw edema indicating its anti-inflammatory activity. Effect of 21 days treatment of methanolic extract of *G. maderaspatana* (1000 mg/kg, p.o.) was evaluated against Complete Freund's Adjuvant (CFA) induced arthritis in rats. Dexamethasone was used as a standard in this model. The degree of arthritis was evaluated by hind paw swelling, body weight changes, erythrocyte sedimentation rate, rheumatoid factor, C - reactive protein and arthritic index supported by histopathology of ankle joints. 21 days treatment of the significantly inhibited paw edema, revert arthritic index and loss of body weight. The extract treatment also declined CFA induced rise of erythrocyte sedimentation rate, rheumatoid factor, C-reactive protein significantly in rats. Histopathological study of ankle joint revealed that extract inhibited edema formation and cellular infiltration induced by CFA.

Diuretic activity[21]

Grangea maderaspatana (L.) Poir is reported for diuretic activity.

Acute toxicity study[19]

Acute oral toxicity was evaluated by following Organization of Economic Co- operation and Development (OECD) guidelines 420- Fixed Dose Procedure (FDP) [22]. Results indicated that the aqueous and alcoholic extract of *G. maderaspatana* up to a dose of 2000 mg/kg; p.o. did not produced any mortality.

CONCLUSION

Grangea maderaspatana (L.) Poir is widely distributed throughout India. The plant appears to have a broad spectrum of activity on several ailments. Various parts of the plant have been explored for oestrogenicity, antifertility, analgesic, anti-inflammatory, antiarthritic, cytotoxic, antioxidant, hepatoprotective, diuretic and antimicrobial activities. It is reported to contain flavonoids, diterepenes, sesquiterpenoids, steroid, and essential oil. The pharmacological studies reported in the present review confirm the therapeutic value of *Grangea maderaspatana* (L.) Poir. However, less information is available regarding the preclinical study, clinical study, toxicity study, phyto-analytical studies of this plant. With the availability of primary information, further studies can be carried out such as clinical evaluation, phyto-analytical studies, toxicity evaluation. The plant is pre-clinically evaluated to some extent; if these claims are scientifically and clinically evaluated then it can provide good remedies and help mankind in various ailments.

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