RANDIA SPINOSA (POIR.): ETHNOBOTANY, PHYTOCHEMISTRY AND PHARMACOLOGY -A REVIEW

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ABSTRACT

Randia spinosa (Poir.) Rubiaceae is a deciduous, thorny shrub or a small tree, up to 9 m in height and 90 cm in girth with a bole 2-3 m found throughout India, up to an elevation of 1350 m. in the hills. The various parts of the plant (leaves, roots, seeds and fruits) are widely used by various tribal communities and forest dwellers for the treatment of variety of ailments. The fruits of the plant are ascribed to posses medicinal virtues as it is used as emetic and antipyretic. The plant is also documented to posses beneficial effects as anthelminthic, antispasmodic, anti-inflammatory, antileishmanial, antitumor, astringent, and diaphoretic, nervine calmative, nauseant, expectorant and emetic. It is believed to be useful in bronchitis, asthma, leucoderma, and diseases of the brain. Following various folk claims for cure of numerous diseases, efforts have been made by researchers to verify the efficacy of the plant through scientific biological screenings. A scrutiny of literature revealed some notable pharmacological activities of the plant as anticancer, anti-inflammatory, immunostimulant, antileishmanial and antihelminthic. The present review is an attempt to highlight the various ethnobotanical and traditional uses as well as phytochemical and pharmacological reports on *R. spinosa*.

Keywords: *Randia spinosa*, ethnobotany, Pharmacological activities, Phytochemistry**.**

INTRODUCTION

Randia spinosa (Poir.) Rubiaceae, commonly known as 'Mainphal' is a large Neotropical genus of shrubs or small trees up to 9 m. in height and 90 cm. in girth, with a bole 2-3 m. found throughout India up to an elevation of 1350 m. in the hills[1,2]. The plant is found in Brazil, Malaya, China, Ceylon, Sumatra, and East tropical Africa. Bark dark brown or grey, rough, scaly; leaves obovate; flowers[3]. In India it is distributed in eastern coastal districts of Andhra Pradesh and Madras and parts of the Deccan. Leaves usually fascicled on the suppressed branches, 3.2 – 5.7 by 2-3.2 cm., obovate, obtuse, wrinkled, shining above, more or less pubescent above and on the nerves on the beneath (especially when young), base cuneate, main nerves 6-10 pairs, petioles 3-1 mm, long, densely pubescent, stipules ovate, acuminate. The flowers at the ends of short leaf- bearing branchlets, fragrant, solitary or 2 (rarely 3) together, peduncles short. Calyx 1.3 cm. long, ovate- oblong, subacute, often with small intermediate teeth between. Corolla 2 cm. long, at first white, afterwards becoming yellow with tube 5-6 mm. long, obovate- oblong rounded at the apex, pubescent outside, spreading. Fruit like a small crab apple, apple, yellowish, globose or broadly ovoid, smooth or obscurely longitudinally ribbed, crowned with the large calyx- limb, 2-celled, glabrous; pericarp thick. Seeds many, flat, imbedded in pulp. The various parts of *R. spinosa* such as bark, roots and fruits are documented to possess medicinal properties in ethnobotanical surveys conducted by ethnobotanists and in traditional systems of medicine such as Ayurveda[4]. Our thorough literature search revealed an interesting fact that though the plant is a popular remedy for a variety of ailments and is one ingredient in a number of important Ayurvedic formulations, very little effort have been made to verify its efficacy through scientific screenings in animal models and clinical trials. The present review highlights the various folk, Ayurvedic uses and pharmacognostical; a phytochemical and pharmacological study conducted on *R. spinosa* and also pinpoints unexplored potential of it.

Figure 1: Photograph of *R. spinosa*

MEDICINAL USES

Traditional uses [1,3,5,6]

Most of the parts of Mainphal are of medicinal importance and used traditionally for the treatment of various ailments. The roots of the plant are considered as insecticidal and insect repellant. The seeds of the plant are used as tonic to induce appetite. The bark is

astringent and is given in diarrhoea and dysentery. An infusion of the bark is used as an emetic. It is also reported to be abortifacient. As per Ayurvedic claim, Mainphal is bitter, aphrodisiac, emetic, antipyretic, carminative, alexiteric and cures abscesses, ulcers, inflammations, tumors, skin-diseases, piles etc. The fruits of the *R. spinosa* are most popular and considered as good remedy in tvakdosa (skin diseases), udararog (gastrointestinal tract diseases), vrana (wounds) etc.

Ethnobotanical uses [6, 7]

There are over 400 different tribal and other ethnic groups in India. Each tribal group is having their own tradition, folk language, beliefs and knowledge about use of natural resources as medicines. In Chhattisgarh, very few traditional healers are aware of its medicinal properties and uses. In tribal belt, it is used as fish poison. To treat gastric troubles, the healers of Rajnandgaon region, recommend dry fruit powder with fresh milk internally. The traditional healers of Kondagaon region recommend it in treatment of breast related diseases. The traditional healer of Mudpar village use the dry fruit powder in treatment of liver related diseases. The natives of Chhattisgarh use this fruit with sugar, before sunrise, internally in treatment of Adhasisi (Migraine). In Ceylon, the root decoction is taken for diarrhoea and biliousness. In Indo-China the powdered fruit is used as an emetic; the pounded root is employed to kill fish. The seeds are said to be used as tonic to induce appetite. The fruit in combination with other drugs is prescribed for the treatment of snake- bite and scorpion sting (Sushruta, Charaka). The fruit is one of the ingredients which enter into the preparation of the Tanjore Pill, A famous snake remedy.

Pharmacognostical Studies [8, 9]

There are about 600 single drugs of vegetable origin presently used in the preparation of about 1000 Ayurvedic formulations. The systematic identification of many of these indigenous herbal drugs is still a subject of confusion and controversies, because several different species of herbs are available for one herb and on other hand, the same plant is being used for different crude drugs. The available literature on *R. spinosa* indicates about its microscopical features as below.

Leaf

The transverse section of the leaf shows single layered epidermis with thick cuticle. Mesophyll tissue consists of compactly arranged single-layered palisade and loosely arranged multilayered spongy tissue. Midrib region shows vascular bundle bound both upper and lower sides by sclerenchymatous girdles. Lower epidermis possesses unicellular trichomes and anomocytic type of stomata. The leaf constants like stomatal index (22.4) and stomatal number (177) are important parameters for identification of the plant. A transverse section through petiole (fig 2) is oval in outline and shows cuticularized single layered epidermis. Below epidermis 3-5 layered collenchymas are conspicuous.

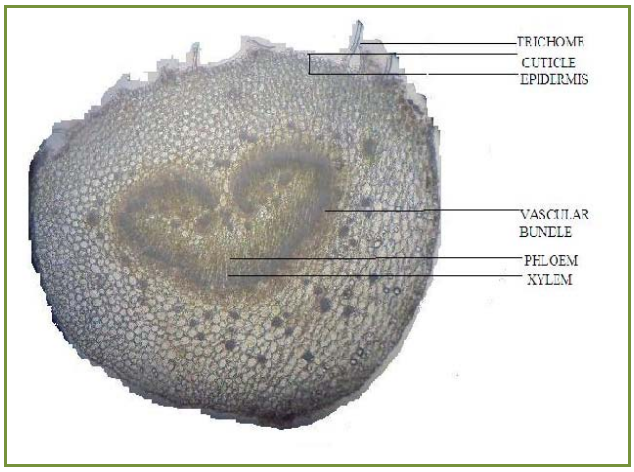


Figure 2: A transverse section of petiole of *R. spinosa*

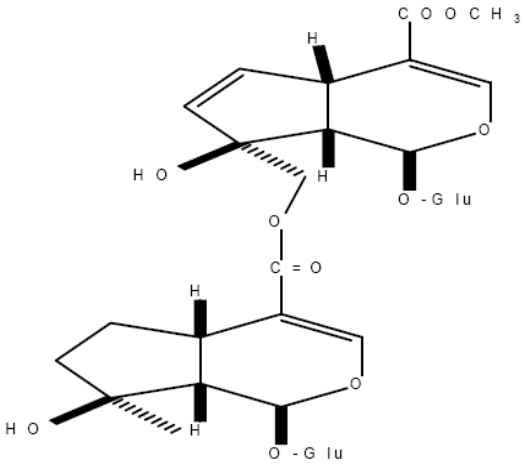
PHYTOCHEMISTRY

Mainphal has been explored phytochemically by various researchers and found to posses number of chemical constituents [Fig.3]. The phytochemical studies on the fruits of *R. spinosa* revealed presence of mixture of saponins viz. randia acid or acid saponin has been isolated from the pulp; the two saponins occur in the fruit at all stages of ripening[10]. The fruits of *R. spinosa* contain a toxic saponin of oleanolic acid. They also contain leucocyanidin and mannitol. The activity of the drug is attributed to the presence of saponins which occur to the extent of 2-3 % in fresh fruits and about 10 % in dried whole fruit [11,12,13]. The saponins are concentrated mostly in the pulp [14,15]. A mixture of two saponins, *viz.* randialic or neutral saponin (m.p. 289-290^{0}C decomp.) and randialic acid or acid saponin (m.p. 260^{0}C decomp.) has been isolated from the pulp[16-17]. On complete hydrolysis both the saponins yield Oleanolic acid as Sapogenin. Ursosaponin, isolated from the ethanolic extract of the dried whole fruit, gave ursolic acid and glucose. Randianin, isolated from the fruit, gave a haemolytic triterpenoid saponin.

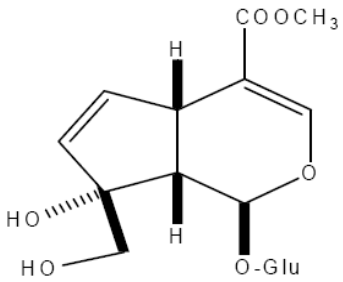
The seeds are reported to be free from saponins. They contain fat (1.5 %), protein (14.2 %), mucilage, resin, organic acid (1.4 %) and a minute quantity of an unidentified alkaloid. The bark contains scopoletin, d-mannitol and a mixture of saponins. The saponins on hydrolysis yield glucose, xylose, rhamnose, and two triterpenic acid sapogenins designated as randialic acid.One is [19 (α)-hydroxyursolic acid, $C_{30}H_{48}O_4$; methyl ester, m.p. 200-202^0] and another is randialic acid (19-dehydroursolic acid, $C_{30}H_{48}O_3$; m.p. 256-257^0) The roots contain scopoletin and d-mannitol[18,19].

Pharmacological uses

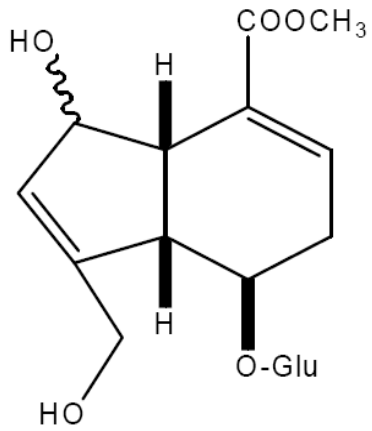
Following the folk and traditional uses of the plant, it has been investigated scientifically in animal models to validate the potential of the plant in cure of variety of ailments.



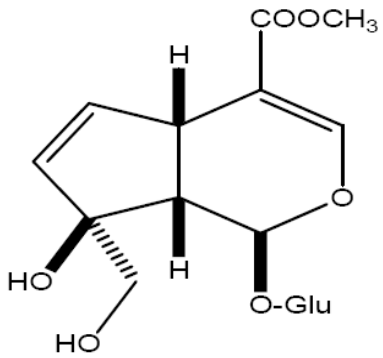
Randinoside



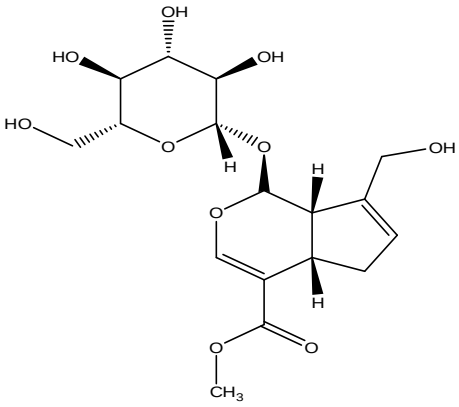
Galioside



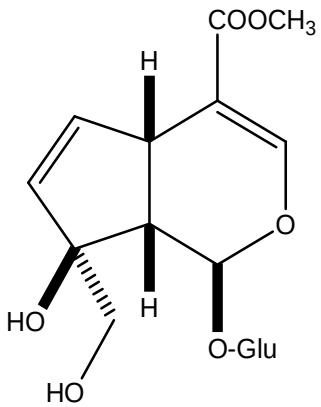
Deacetylasperulosidic acid methyl ester



Scandoside methyl ester



Geniposide



Gardenoside

Figure 3: Structure of some Phytoconstituents isolated from *Randia spinosa.*

GENERAL PHARMACOLOGICAL ACTIVITIES [15,20,21]

Tandon et al., showed antileishmanial activity, Baghdikian et al., and Recio et al., displayed anti-inflammatory activity, Abdel- Kader et al., showed antitumor activity of various extract of *R. spinosa*. The ethanolic extract of the pulp showed a stimulant action on isolated guinea pig uterus. In experimental animals, crude saponin produced salivation; on contact it caused a generalized irritation of the mucous membranes producing sneezing, vomiting, and bleeding from the urinary tract. The cornea was inflamed and the drug caused haemolysis both *in vitro* and *in vivo*. The perfused frog heart was arrested in a few minutes, or with higher concentration practically instantaneously. The drug was rapidly detoxicated by the liver.

Anti-inflammatory activity [22]

In a study, anti-inflammatory activity on alcohol and aqueous extract of *R. spinosa* was evaluated using carageenan induced rat paw edema in albino rats. Inflammation in rats was induced by carageenan (0.1 ml of 1% Soln. in water). All the extracts were administered orally to animals daily for seven days. Indomethacin (10 mg/kg of body weight) was given as reference standard. The extract treated group of rats showed significant reduction in paw volume when compared to indomethacin treated group of rats.

Antimicrobial activity [23, 24]

The air dried powdered fruits at room temperature extracted with a mixture of dichloromethane and methanol (1:1%, v/v) (2X50 ml) under reflux was evaluated for antibacterial and antifungal activity and it was carried out by agar dilution-streak method. Incubated Plates at 37^0 C (for bacteria) and 28^0 C (for fungus) were observed after 24 h for bacteria and 48 h for *Candida albicans*. Growth of *Saccharomyces cerevisiae* and *Aspergillus niger* were observed after 4 days.

It has been reported that the extract prepared in DMSO were evaluated for *Bacillus cereus var mycoides* ;*Bacillus pumilus* ;*Bacillus subtilis*; *Bordetella bronchiseptica*; *Micrococccus luteus*; *Staphylococcus epidermidis*; *Escherichia coli*; *Klebsiella pneumonia*; *Pseudomonas aeroginosa*; *Streptococcas foecalis*; *Candida albicans*; *Aspergillus niger*; *Saccharomyces cerevisiae* and concluded that the crude extract of *Randia spinosa* exhibited significant antimicrobial activity and properties that support folkloric use in the treatment of some diseases as broad spectrum antimicrobial agents.

CONCLUSION

In current scenario, ethnobotanical and traditional uses of plant originated compounds has gained much attention as they are well tested for their efficacy and generally believed to be safe for human use. They obviously deserve scrutiny on modern scientific lines such as phytochemical investigation, biological evaluation on experimental animal models, toxicity studies, investigation of molecular mechanism of action(s) of isolated phytoprinciples and their clinical trials. It is a best classical approach in search of new lead molecules for management of various diseases. Thorough screening of literature available on *R. spinosa* depicted the fact that it is a popular remedy among the various ethnic groups, Vaidyas, Hakims and Ayurvedic practitioners for cure of variety of ailments. Following the traditional and folk claims, very little efforts have been made by the researchers to explore the therapeutic potential of this plant. It is interesting to note that crude organic and aqueous extracts of only stems and leaves of *R. spinosa* have been screened for some pharmacological activities and found to posses antitumor, free radical scavenging, anti-inflammatory and analgesic potential. Till other parts of plant such as fruits, roots and bark which are documented to posses important medicinal virtues, are not explored scientifically for their biological potential. In future study, the isolated principles from Mainphal needs to be evaluated in scientific manner using specific experimental animal models and clinical trials to understand the molecular mechanism of action, in search of lead molecule from natural resources.

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