

***Rubia cordifolia* (Manjishtha): A review based upon its Ayurvedic and Medicinal uses**

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REVIEW ARTICLE

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ABSTRACT

Medicinal herbs have a rich history of their utilization for variety of ailments. India is categorized among those countries which have produced vast variety of medicinal plants. India is also called as “Botanical garden of the world”. Medicinal plants are the source of discovery of new drugs across the world. Most of the drugs available today have some herbal content of plants in them. *Rubia Cordifolia* (Manjishtha) is a climber herb having small flowers of greenish white colour which are grouped around the purplish fleshy fruits. The roots of *Rubia cordifolia* imparts red colour from where dye is obtained which is due to the presence of brownish red bark. This plant is mainly cultivated in the hilly areas. Manjishtha has a very significant place in Ayurveda which is one of the most ancient health care systems of the world. Charaka categorized this medicinal herb as varnya (for the enhancement of skin complexion), jvarahara (anti-pyretic), visaghna (a detoxifier) and a rasayana (rejuvenator). While it is categorized as pittasamsamana (one which maintains the pitta dosha of the body i.e. the fire component of the body) by Acharya Sushrut. Manjishtha has potential to pacify the pitta dosha. The phytochemical constituents of *Rubia Cordifolia* (Manjishtha) are associated with wide range of therapeutic properties. In this review, summary of its phytochemistry, its uses in different medicinal systems like Ayurveda and folk system and its scientific therapeutic properties are reported.

Keywords: *Manjishtha, Rasa panchak, Purpurin, Hepatoprotective, Anti-cancer*

1. Introduction

Medicinal herbs are the central part in all systems of medicine especially traditional systems like Ayurveda, Siddha, Unani, Chinese, Folk etc. These systems consider medicinal plants as their backbone. Almost half of the world population i.e. around 3.3 billion, relies upon medicinal plants for maintaining health. They utilize plants on regular basis for food, shelter and for the requirement of other basic needs. (1,2) These plants are considered as ecological health marker. (3,4) The drugs derived from medicinal plants are known as herbal drugs or phytomedicines which have been used for treating several health related problems since ancient times. (5) The principal phytochemicals of medicinal plants are alkaloids, phenols, tannins and flavonoids which are associated with several therapeutic properties like anti-

inflammatory, anti-bacterial, anti-viral, hepatoprotective, analgesic etc. (6) *Rubia cordifolia* (Manjishtha) (figure 1) also called as common Madder or Indian Madder, is a member of *Rubiaceae* family which is coffee family. It is a significant medicinal herb in Traditional medicine systems. (7) It is described as a detoxifying herb in Ayurvedic material medica. It removes the toxins from the blood which are called as “ama” in Ayurveda. The first recorded use of this herb as drug was mentioned in world famous pharmacy book of China, Divine Famer's *Materia Medica*, which has history of 2000 years. (8) As *Rubia* stands for colour red, it imparts red color to mother's milk and to urine when used internally. (9) *Rubia cordifolia* (Manjishtha) roots have great medicinal value which are available in the market with its commercial name “Manjith”. (10-12) The importance of its

roots is mentioned in many medical books for its uses against cancer, tuberculosis, rheumatism, hematemesis, metrorrhagia, epistaxis, contusion and men xenia etc. (13,14) It is used in many different ways by different tribes and cultures for treating several diseases. In Tibetan system of medicine it is used against blood disorders. (15) The phytochemical constituents present in *Rubia cordifolia* are glycosides, saponins, anthraquinones, tannins, hexapeptides, quinones, triterpenoids. (16) The main among all the phytochemical constituents of *Rubia cordifolia* are anthraquinones and naphthohydroquinones

and this herb is majorly known for these phytochemical constituents. (17) Each of its phytochemical is associated with significant therapeutic properties like anti-inflammation, anti-cancer, anti-bacterial, anti-viral, hepatoprotective, cardio-protective, nephroprotective, anti-oxidant, analgesic, acne etc. *Rubia cordifolia* has great wound healing potential. (18,19) Apart from its therapeutic properties, this medicinal herb is also used as a food color and has been used a natural dye since ancient times. (20) Taxonomy and vernacular names of Manjishtha are given in table no.1 and 2 respectively.



Figure 1. *Rubia cordifolia*

Table 1. Taxonomy of *Rubia cordifolia* (Manjishtha) (21,22)

Taxonomic Rank	Taxon
Kingdom	Plantae
Class	Dicotyledons
Subclass	Sympetalae
Order	Rubiales
Family	Rubiaceae
Genus	Rubia
Species	cordifolia
Common name	Manjishtha

Table 2. Vernacular names of *Rubia cordifolia* (Manjishtha) (23)

English	Indian Madder
Sanskrit	Aruna, Bhandi, Bhandiralatik
Hindi	Manjit, Manjishtha
Urdu	Majith
Malayalum	Manjithi

Marathi	Manjestha
Kashmiri	Dandu, Mazait
Assammese	Majathi, Mandar
Tamil	Mancitti
Kannnada	Siragatthi, Bhandeera, Manjishta
Konkani	Itari
Punjabi	Kattha, Majitha
Gujrati	Majitha
Manipuri	Moyum
Oriya	Manjishta
Tibetan	Brtsod
Tulu	Manjishta
Nepali	Majito

2. Morphology of *Rubia cordifolia* (Manjishtha)

Rubia cordifolia (Manjishtha) is a perennial, herbaceous climbing herb. Its roots are long and cylinder in shape which are flexuose in nature having thin red bark. The stems are rough and grooved which are very long and woody at the base region. The bark is white in colour. *Rubia cordifolia* has quadrangular petioles which are shining and glabrous. The fruits of this plant are 4-6mm in size which are didymous/globose in structure. Fruits become purplish black on ripening and shiny in appearance. (24)

3. Geographical distribution of *Rubia cordifolia*

Rubia cordifolia is found in Asian countries like India, China, Japan, Afghanistan, Vietnam and Malaysia. In India, it is mainly found in the hilly regions from North Western Himalayas, eastward ascending to 2500m. It is also found in Greece and Africa. (25)

4. Phytochemical constituents of *Rubia cordifolia*

There are variety of phytochemical constituents present in *Rubia cordifolia* mainly anthraquinones and their glycosides, naphthoquinones and their glycosides, terpenes, bicyclic hexapeptides, and miscellaneous, which

includes iridoids, flavonoids, and carbohydrates. (26) Significant amount of quinones are present in *Rubia cordifolia*. Purpurin (trihydroxy anthraquinone) and manjistin (xanthopurpurin-2-carboxylic acid) are the two major quinones present in the root part of the plant. Purpurin has antigenotoxic activity. These two constitute 90% of the total anthraquinone content. Other anthraquinones present in this plant are mollugin, rubiadin, 1,3-dihydroxyanthraquinone, 7-hydroxy-2-methylanthraquinone, alizarin, lucidin, ruberythric acid, 1-methoxymethylanthraquinone, and lucidin 3-O-primeveroside, 2-methyl-1,3,6-trihydroxy-9,10-anthraquinone, 2-methyl-1,3,6-trihydroxy-9,10-anthraquinone 3-O-(6'-O-acetyl)- α -rhamnosyl-(1 \rightarrow 2)- β -glucoside and 2-methyl-1,3,6-trihydroxy-9,10-anthraquinone 3-O- α -rhamnosyl (1 \rightarrow 2)- β -glucoside. Mollugin is good anti-inflammatory agent and commonly used in arthritis and uteritis. Cordifoliol and cordifodiol are two novel anthraquinones isolated from the roots of the *Rubia cordifolia*. From the stem and roots of *Rubia cordifolia*, rubiasins and anthracene derivatives have been extracted. (27-31) Alizarin is associated with antigenotoxic property. (32) 5- or 8-methoxy-3-(3-methylbut-2-enyl)-1,4-naphthoquinone was the 1st ever isolated naphthoquinone form *Rubia* species. 6-methoxygeniposidic acid is the iridoid phytochemical found in

Rubia Cordifolia. (33) This herb has triterpenoids like rupiprasin A, B and C, rubiarbonol A, B, C, D, E and F present in it. There is one more triterpenoid i.e. arborane present in it. (34,35) The pentacyclic triterpenes present in *Rubia cordifolia* are rubicoumaric acid and rubifolic acid. (36) Whereas the bicyclic hexapeptides are RA-V & RA-VII which possess antitumour properties. RA dimer A (3) is the novel pentacyclic hexapeptide dimer has been isolated from the root extract. RA-XVII is another novel pentacyclic hexapeptide which has been isolated from the roots. (37-39) Rubiaceae-type cyclopeptides (RAs) which is cyclic hexapeptide is associated with anti-tumor activity. (40) A novel cyclic peptide has been isolated from the roots named as O-Seco-RA-XXIV, cyclo-(dalanyl-l-glutaminy-N, O-dimethyl-l-tyrosyl - lalanyl-N-methyl-l-tyrosyl-N-methyl-l-tyrosyl). It is recognized as the precursor of RA-XXIV. (41) The phenolic contents of *Rubia cordifolia* are comprised of hydroxyanthraquinones, gallic acid, and tannins. Hydroxyanthraquinones has potent anti-oxidant property. (42) Figure 2 showing chemical structures of some of *Rubia cordifolia* phytochemical constituents.

Folk view on *Rubia cordifolia*

Medicinal plants are highly promoted by rural communities and tribal population of the world. They use plants as food and medicine. They have got medicinal

Table 3. Rasa panchak of *Rubia cordifolia* (Manjishtha) (50)

Sanskrit/English	Sanskrit/English
Virya/Potency	Ushna/Hot
Vipak/ Metabolic Property	Kattu/Pungent
Guna/Physical property	Guru/Heavy, Rukasha/Dry
Rasa/Taste	Kashaya/Astringent, Tikta/ Bitter, Madhur/Sweet

knowledge on the use of plants from their ancestors which have been verbally passed from one generation to another. *Rubia cordifolia* (Manjishtha) is one such plant which is famous among rural and tribal communities of the world. For instance, in Tamil Nadu tribal population of Kurumba orally administer the dried stem powder of *Rubia cordifolia* which is mixed with honey against snake bite. (43) It is a good remedy for vitiligo when administered with honey. It is used against itching in eczema, psoriasis, herpes, scabies. (44)

Ayurvedic view on *Rubia cordifolia*

Rubia cordifolia is called as “magic drug” in Ayurveda. It is one of the most commonly used drug in Ayurveda due to its multiple pharmacological actions. The description of *Rubia cordifolia* is found in almost all Ayurvedic literatures like Brihatrayi, Laghutrayi, and Nighantu (B.P. Nighantu, Raj Nighantu, Kaideva Nighantu, Dhanvantari Nighantu, Priya Nighantu). It is used to treat variety of ailments due to its diverse therapeutic properties. (45,46) As per Raja Nighantu, Manjishthais classified into four types; Chola, Yojani, Konchi, Sinhali. (47) *Rubia cordifolia* is categorized into Vishaghana mahakashya, Varnya dashemani, Jwara Ghana in Charak Samhita. (48) Whereas according to Sushruta Samhita it is categorized into Priyangvadi gana, Ambasthadi gana, Pitta sanshaman. (49) Table 3 shows Rasa panchak of manjishtha as per ayurveda is given in table no. 3.

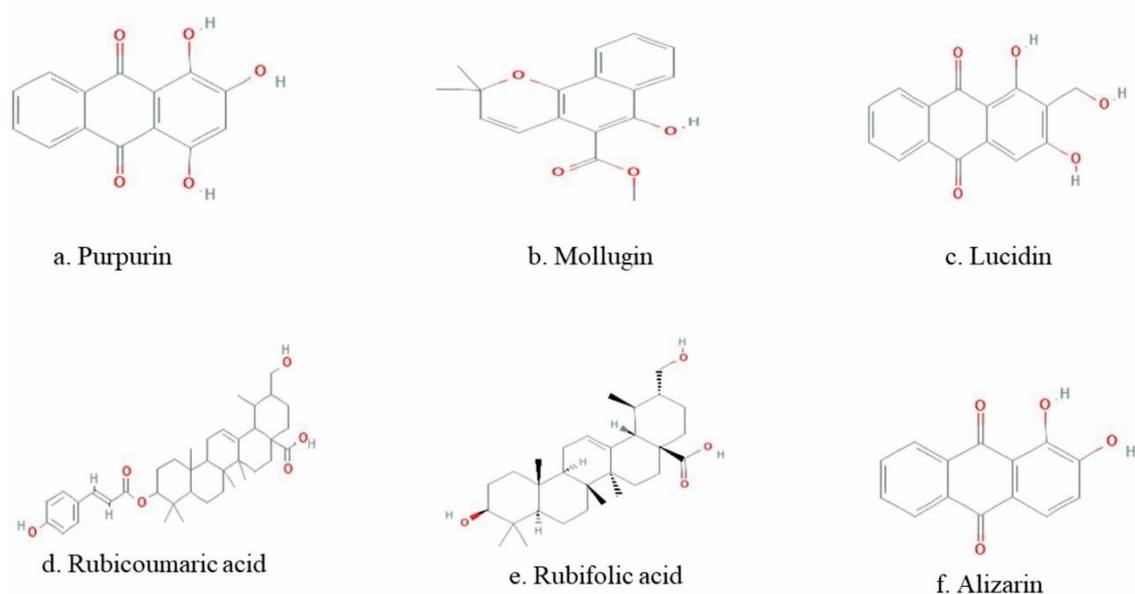


Figure 2. Chemical structures of some phytochemical constituents of *Rubia cordifolia*

5. Properties and Uses of *Rubia cordifolia* (Manjishtha) in Ayurveda (51,52)

Doshkaram: It is kapha and pitta sedative

Pachansansthān: It enhances the digestion and acts as an appetizer and antihelminthic agent. It is used in conditions like anorexia, indigestion, diarrhea and worm infestation.

Raktwahasnsthān: It has properties of blood purification.

Swasansansthān: It has mucolytic properties. It is used in cough and cold conditions.

Prajanansansthān: It enhances the overall reproductive health of females. It is used in dysmenorrhea, amenorrhea. It cleans out the uterus after delivery. It enhances the lactation and increases the nutritional value of mother's milk.

Mootrawahasnsthān: It has anti-diabetic property.

Twacha: It used in various skin diseases like leprosy, psoriasis eczema etc.

Taapkram: It has anti-pyretic properties. It is used in chronic fever.

Saatmikaran: It enhances strength, acts a Rasayana. It is good for skin and also used as an antidote for various poisons.

Polyherbal Ayurvedic formulations of *Rubia cordifolia* (Manjishtha) (53-56)

Aswagandharistam: It is used in fatigue, nervous system problems and issues related to digestion, piles. It mainly balances the vata component of human body.

Chandanasavam: It is used against burning micturition, leucorrhoea etc. It provides strength to the body and enhances the digestion.

Devadarvarishtam: This formulation is used in problems related to urination and skin. Also used in diabetes, rheumatic complaints, sprue syndrome and piles.

Eladyarishtam: It is used in the treatment of skin allergies.

Gulguluthikthkarishtam: It is used to treat skin problems, rheumatic conditions,

sinusitis, obesity. It is used in head, neck and throat problems.

Madhookasavam: It is used in diabetes, skin diseases, sprue syndrome and edema.

Manjishtasavam: It is used against various skin problems.

Nimbamrithasavam: It is used in head, neck, throat related problems.

Useerasavam: It is used to calm down the burning sensation of the body.

Jaatyaadi ghrita: It is used topically for treating ulcers.

Phal kalyaan ghrita: It is used to treat fertility.

Majishthaadi taila: This herbal formulation is used against eye problems and headaches.

Modern View on *Rubia cordifolia*

The primary issue which is faced by the Global herbal drug industry in today's scenario is the practice of making these drugs adulterated. This is the reason behind the lost faith of people in these herbal drugs nowadays. (57-62) Adulteration can be either intentional or unintentional. In today's time intentional adulteration is practiced in many different ways like by substituting standard commercial variety, by substituting superficially similar but inferior drug, by substituting artificially manufactured drug, substitution of exhausted drugs and by substituting toxic materials. These practices ultimately degrade the quality of the original drugs. The herbal plant vendors use these adulteration techniques so smartly that these remain undetectable until and unless examination on microscopic level and chemical level are implied. (63-65) The major disadvantages associated with the adulteration are deterioration and degradation of drugs. Adulteration also increases the costing of drugs and produces adverse effects instead of showing actual biological affect. (66) The traditional herbal drugs and their

formulations are associated with negligible toxicity and are free from any kind of adulteration. Traditional Ayurvedic herbal formulations of *Rubia cordifolia* are associated with the wide range of therapeutic properties too which cures variety of ailments without causing any severe harm to the human body. Health risks are usually associated with the modern adulterated drugs. For instance, the modern anti-inflammatory drugs have side effects associated with them where as the anti-inflammatory activity of *Rubia cordifolia* is well demonstrated by many studies where least toxicity and adverse effects were observed.

6. Therapeutic uses of *Rubia cordifolia* (Manjishtha)

Anti-cancer

A study on human carcinoma cell line, HeLa was carried out to evaluate the anti-cancer activity of *Rubia cordifolia*. Results suggested that the ethanolic root extract of this plant is effective against the cancer cell line. (67) The result of another *in-vitro* study showed that methanol extract of *Rubia cordifolia* have inhibitory action against human cervical cancer cell line and human larynx carcinoma cell line. (68) RC-18, a pure extract of *Rubia Cordifolia* showed potent anti-cancer activity against P388, L1210, L5178Y, B16 melanoma cancer cell lines. (69) An *in-vitro* study on human leukaemia cell line and human histolytic lymphoma cell line was carried out to evaluate the anti-tumor potential of *Rubia cordifolia* and results showed that methanol fraction, pet-ether fraction, dichloromethane fraction of the plant are associated with the anti-tumor activity. (70)

Hepatoprotective: As per the reports of a study conducted on carbon tetrachloride (CCl₄)-induced hepatic damage in rats, rubiadin was found to be a potent hepatoprotector. It lowered down the enzymatic activities of serum glutamic oxaloacetic transaminase (SGOT), serum

glutamate pyruvate transaminase (SGPT), serum alkaline phosphatase (SALP) and beta glutmyltransferase which were increased due to the induction of carbon tetrachloride (CCl₄). This indicated that *Rubia cordifolia* is good hepatoprotective agent. (71)

Anti-inflammatory: Ethanolic extract of stem of *Rubia Cordifolia* Linn. was tested in an *in-vivo* study which was carried out on carrageenan induced paw edema rats. It was found that ethanolic extract at high dosage level exhibited anti-inflammatory activity. (72) Another *in-vivo* study on carrageenan induced paw edema rats demonstrated that methanol extract of *Rubia Cordifolia* root has anti-inflammatory property. (73) Anti-inflammatory activity of 'Pinda thailam' which is an herbal formulations made up of *Rubia cordifolia* (*Rubiaceae*) and *Hemidesmus indicus* (*Asclepiadaceae*), was checked in carrageenin induced paw edema in albino rats. The herbal formulation showed significant anti-inflammatory activity. (74) Mollugin was tested for its anti-inflammatory potential against tumor necrosis factor (TNF)- α -induced inflammatory responses in HT-29 human colon epithelial cells. Results showed that mollugin has inhibitory actions, which showed its anti-inflammatory property. (75)

Wound healing: The alcoholic extract and hydrogel of *Rubia cordifolia* both have wound healing potential. A study on excision wound model in mice demonstrated wound healing property of *Rubia cordifolia*. Ethanolic extract significantly helped in the recovery of wound. (76)

Anti-arthritic: *Rubia cordifolia* has anti-arthritic property. It was demonstrated by an *in-vivo* study conducted on Freund's Complete Adjuvant and Bovine type II Collagen induced arthritis in albino rats. It was found from the study that ethanolic extract of *Rubia cordifolia* possess anti-arthritic property. (77)

Antidiabetic: Alcoholic extract of *Rubia cordifolia* has antidiabetic property and this activity has been demonstrated by study conducted on alloxan treated rat model. It was found that alcoholic extract significantly lowered down the blood glucose level. (78)

Cardioprotective: This activity of *Rubia cordifolia* was demonstrated by *in-vivo* study carried out on wistar rat model. The model was induced with cyclophosphamide. Root extract was found to be very effective in providing cardioprotectivity against cyclophosphamide. (79)

Anti-oxidant: The *in-vivo* study on Swiss male albino rats showed anti-inflammatory activity of *Rubia cordifolia*. Models were administered with lead nitrate which decreased the RBC count, WBC count, Hb level and serum total protein contents. Whereas alcoholic root extract of *Rubia cordifolia* caused enhancement of hematological and serum biochemical changes. (80) Another *in-vivo* study on FeSO₄ induced lipid peroxidation in rat model showed that alcoholic extract and rubiadin have inhibitory actions on lipid peroxidation which proved the anti-oxidant potential of *Rubia Cordifolia*. (81)

Gastroprotective: A study was conducted on swimming stress induced ulcer to evaluate the gastroprotective activity and results revealed that methanol and chloroform root extracts of *Rubia cordifolia* have gastroprotective property. (82)

Nephroprotective: The *in-vivo* study on rats having artificially induced urolithiasis by ethylene glycol showed that hydro-alcoholic root extract of *Rubia cordifolia* significantly inhibited the formation of urinary stones. (83) The findings of another *in-vivo* study on swiss albino mice in which nephrotoxicity was induced artificially by cisplatin, revealed that hydroalcoholic root extract of *Rubia*

cordifolia exhibits nephroprotective activity. (84)

Anti-bacterial: The findings of an *in-vitro* study on 6 species of gram positive and 6 species of gram negative bacteria, suggested that the chloroform and methanol extract of *R. cordifolia* had inhibitory actions against all the six species of gram positive bacteria. While methanol extract (at particular dose) of *R. cordifolia* had inhibitory action against one species of gram negative bacteria i.e. *P. aeruginosa*. (85)

Anti-viral: The reported study on *Rubia cordifolia* to examine its anti-viral activity suggested that furomollugin, mollugin and rubilactone, which are naphthohydroquinones, suppressed the hepatitis B surface antigen secretion in human hepatoma Hep3B cells. (86)

Anti-platelet: As per the study, *Rubia cordifolia* has inhibitory actions against the platelet activating factor (it promotes the platelet aggregation) and binding of 3H-PAF to the platelets in a particular dose. (87)

Anti-allergic: As per the study, the extract of *Rubia cordifolia* has potent anti-allergic potential. The result revealed that it has inhibitory actions against the production of immunoglobulin E (IgE) both in the *in-vitro* and *in-vivo*. (88)

Anti-urolithiasis: This activity was examined in rat models in which urolithiasis was induced artificially by ethylene glycol. The findings of this study revealed that hydro-alcoholic extract of *Rubia cordifolia* root inhibited the changes in calcium, oxalate and phosphate secretion in urine. This *in-vivo* study proved *Rubia cordifolia* utilization as an anti-urolithiasis agent. (89)

7. Conclusion

The present study is an attempt to provide detailed information about the most common medicinal plant species named *Rubia Cordifolia* (Manjishtha).

Modern pharmacological studies indicated that this plant has extraordinary biological potential. It is strongly believed that the data presented in this review on utilization of *Rubia Cordifolia* (Manjishtha), plant in Ayurveda and folk cultures might draw the attention of researchers to use this plant in modern medicines. The diverse kind of phytochemicals present in this plant can be the promising source of anti-microbial, hepatoprotective, cardioprotective, nephroprotective drugs.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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