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**Review Article** 

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# RHEUM EMODI: A REVIEW ON PHARMACOLOGY AND PHYTOCHEMISTRY

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## ABSTRACT

*Rheum emodi* commonly known as Rhubarb is a perennial herb belongs to family Polygonaceae. Traditionally plant is widely used as laxative, tonic, diuretic and to treat ulcers, diarrhea, fever, cough and indigestion. This review paper consists of detailed information of *Rheum emodi* regarding its pharmacology and phytochemistry. The material was collected from pharmacopeia, journals and books. The major constituents of *Rheum emodi* are anthraquinone, flavonoids, tannins and stilbene. Alkaloids are also present in minute amount. Various preclinical studies provide the potential of *Rheum emodi* against various diseases like cancer, inflammation, microbial and fungal infections, diabetes, liver and kidney disease. The plant is found

to have potent antioxidant activity. These studies raised the therapeutic efficacy of rhubarb. Recently antiulcer activity of plant has also reported. Further, It is essential that *Rheum emodi* should studied more extensively to validate its traditional uses and to confirm the therapeutic effects.

KEYWORDS: Rheum emodi (R. emodi), Pharmacological activities, Phytochemistry.

### **INTRODUCTION**

*Rheum emodi* is an important medicinal plant, endemic to the Himalayan region is commonly known as Himalayan Rhubarb. *R. emodi* Wall. ex Meissn (Polygonaceae) is a leafy perennial herb distributed in the temperate and subtropical region from Kashmir to Sikkim in india at altitudes ranging from 2800 m to 3800 m.<sup>[1]</sup> This plant has been included in Indian Pharmacopeia, since it is an important medicinal plant and explored traditionally in many system of medicine like Ayurveda and Unani systems of medicine.<sup>[2]</sup> It has been traditionally

used to treat pathological ailments like fevers, ulcers, bacterial infections and fungal infections<sup>3</sup>. It is also used to treat kidney stones and other liver associated diseases like gout and jaundice.<sup>[3]</sup> Literature review found that the most common constituents of *R. emodi* are anthraquinone (rhein, chrysophanol, aloe-emodin, emodin, physcion, and their glycosides) and stilbene (picetannol, resveratrol and their glycosides). Phytochemical screening done by S. A. Wani et al., revealed the presence of various phytochemicals present in plant responsible for various pharmacological activities. The study showed the presence of glycosides, flavonoids, saponins and terpenes ans alkaloids. Proeins are present in low quantity. Carbohydrates are absent in Plant.<sup>[4,5]</sup> The main aim of this review is to reveal the facts about its traditional uses, pharmacological activities and phytochemistry. The material was collected from research journals, review journals and books via electronic search and library.

#### **Botanical Description**

#### **Macroscopic characters**

This leafy perennial herb is 1.5-3.0 m in height. It grows naturally in humus rich soil in exposed areas of alpine and sub-alpine zones of the Himalaya. Radical leaves are long petioled, very large and often 60 cm in diameter. Leaves are dull green, very much wrinkled and distinctly rough with coarse short hairs on each side.<sup>[6]</sup> The flowers are small, greenish-white, and borne in large compound leafy inflorescences. Root of Indian Rhubarb is darker, inferior in aroma, coarser and untrimmed. Fresh rhizome is 6 to 12 inches long, and the freshly fractured surface is dull orange to yellowish brown. The roots and rhizomes contain 'star-shaped' spots (2.5mm – 4mm) in the pith.<sup>[6]</sup>

#### **Microscopic Characters**

Calcium oxalate rosettes (up to 200  $\mu$ m in diameter) are found abundantly in the leaf blades. Compound starch grains are also present. The reticulate vessels and other wood elements present in Rhubarb shows absence of lignin. The anthraquinone derivatives (yellow content) present in the medullary ray cells when treated with ammonia turn reddish pink and deep red when treated with caustic alkalis.<sup>[7]</sup>

#### Vernacular names

The plant is known by different names in different geographical regions.<sup>[6,7]</sup> Some of them are mentioned as - Sanskrit Name: Amlaparni, Revatchini; Bengali: Rheuchini,

Banglarevanchini; Gujarati: Gamnirevanchini; Hindi: Revand chini; English: Indian Rhubarb; Kashmiri Pumbehakh.

#### Phytochemistry of R. emodi

*R. emodi* possess a number of phytoconstituents. Among all phytoconstituent the major one are free anthraquinones and their glycosides. The anthraquinones, both with and without carboxyl groups are found in *R. emodi* Linn. Anthraquinones with carboxyl group include rhein, while those without carboxyl group include chrysophanol, aloeemodin, emodin, physcion (emodinmonomethylether), chrysophanein and emodin glycoside.<sup>[8]</sup>





**Emodin glycoside** 

Some alkyl derivatives of anthraquinones, like 6-methyl rhein and 6-methyl aloe-emodin have also been reported.



6-Methyl rhein

6-Methyl aloe-emodin

Another chemical group which has been isolated from *R. emodi* Linn is anthrone C-glucosides. These anthrones occur in the form of 10- hydroxycascaroside C, 10-hydroxycascaroside D, 10R-chrysaloin 1-O-b-Dglucopyranoside, cascaroside C, cascaroside D and cassialoin.<sup>[9]</sup>



	$\mathbf{R}_1$	$\mathbf{R}_2$	R <sub>3</sub>	R4
10-Hydroxycascaroside C	Glc	Glc	OH	Н
10- Hydroxycascaroside D	Glc	OH	Glc	Н
10R-Chrysaloin 1-O-b-Dglucopyranoside	Н	Н	Glc	Glc
Cascaroside C	Glc	Glc	Н	Н
Cascaroside <b>D</b>	Glc	Н	Glc	Н
Cassialoin	Н	ОН	Gl	Н

Different derivatives of oxanthrone have been isolated. These include oxanthrone ether (revandchinone-4), oxanthrone esters (revandchinone-1 and revandchinone-2), and revandchinone-3.<sup>[10]</sup>



Other compounds namely, naphthoquinones, rutin, rheinal, rhein 11-O-b-D-glucoside, torachrysone 8- O-b-D-glucoside, the sulfated anthraquinone glycoside sulfemodin 8-O-b-D-glucoside , auronols (carpusin and maesopsin), epicatechin, b- asarone and some stilbene compounds (e.g., rhaponticin) have also been isolated. Stilbene include picetannol, resveratrol and their glycosides.



Maesopsin



Sulfemodin 8-O-b-D-glucoside



Epicatechin

Tannins are also present in rhubarb which includes hydrolysable tannins, containing ester or glycosidic bonds composed of gallic acid, glucose and other monosaccharides and condensed tannins, derived primarily from the flavone derivatives catechin and Leucocyanidin.<sup>[11]</sup>

#### Pharmacological activities of R. emodi

From the various published research articles it has been observed that *R. emodi* possess anticancer, antioxidant, antidiabetic, antifungal, antiulcer, hepatoprotective, nephroprotective, immunoenhancing, antimicrobial and antifungal properties and theses action are due to a number of different compounds isolated from it. Detailed description of various reported activities are described as follow.

#### **Antiulcer Activity**

*R. emodi* has effective antiulcer activity probably by potentiating the defensive factors through the gastric cytoprotection. Amandeep kaur et al. found that the oral administration of an ethanolic extract of *R. emodi* to albino rats at a dose of 100 mg/kg body weight prevented the occurrence of pyloric ligation-induced ulcers. It also strongly inhibited gastric ulcers induced by ethanol and reserpine in albino rats. It was found from the study that there is reduction in ulcer index along with the reduction in volume and total acidity, and an increase in the pH of gastric fluid. Thus the study provided the strong evidence about the antiulcer activity of *R. emodi*.<sup>[12]</sup>

#### **Hepatoprotective Activity**

Akhtar MS. et al., reported the hepatoprotective activity of aqueous and methanolic extracts of *R. emodi* against liver damage induced by paracetamol. To determine the hepatoprotection effect of the drug, various biomarkers like serum ALT, AST, ALP, albumin and bilirubin (total and direct) levels were judged. The aqueous extract did not significantly affect serum enzymes, albumin and bilirubin levels. However, methanolic extract at a dose of 0.6 g/kg significantly prevented the paracetamol-induced rise of serum enzymes and bilirubin levels whereas serum albumin was raised after treatment with these drugs. From the study it was concluded that methanolic extract of *R. emodi* possessed hepatoprotective activity.<sup>[13]</sup>

#### Antidiabetic activity

Study done by Radhika. R et. al., revealed the antidiabetic potential of *R. emodi* rhizomes. The author has also reported the activities of hexokinase, aldolase and phosphoglucoisomerase, and gluconeogenic enzymes such as glucose-6- phosphatase and

fructose -1,6-diphosphatase in liver and kidney of normal and alloxan-induced diabetic rats. From the study it was found that oral administration of 75 % ethanolic extract of *R. emodi* at dose 250 mg/kg body weight for 30 days, resulted in decrease in the activities of fructose-1,6-disphosphatase, glucose-6-phosphatase, aldolase and an increase in the activity of hexokinase and phosphoglucoisomerase in tissues. The study clearly showed that *R. emodi* rhizome extract exhibited antidiabetic activity by enhancing the peripheral utilization of glucose by correcting the impaired liver and kidney glycolysis and by limiting its gluconeogenic formation similar to insulin.<sup>[14]</sup>

#### **Bidirectional effect on Intestinal function**

Qin Y et. al., revealed the reasons responsible for the adverse effects of long-term use of rhubarb as a purgative. The Authors evaluated the total extract of rhubarb (TR), the total anthraquinones extract (TA) and total tannins extract (TT) of rhubarb. The pharmacological effects of each extract on the intestinal function of mice were evaluated by defecation test and the antidiarrhoeal activity of rhubarb tannins as well as its mechanism was studied by different animal models and histopathological examination. From the whole study it was confirmed that rhubarb had bidirectional effect (diarrhoeogenic and antidiarrhoeal) due to the coexistence of anthraquinones and tannins. The bidirectional effects might be the reason or one of the reasons for the adverse effects of long-term use of rhubarb as a purgative.<sup>[15]</sup>

#### Antiplatelet and Anticoagulant activity

Seo EJ et. al., examined the antiplatelet activity of four anthraquinone derivatives isolated from rhubarb. The author examined that among four isolated derivatives chrysophanol-8-O-glucoside (CP-8-O-glc) have the most potent inhibitory effect on collagen- and thrombin-induced platelet aggregation. CP-8-O-glc-treated mice showed significantly prolonged bleeding times. From this study it has been demonstrated that *R. emodi* has potent antiplatelet and anticoagulant effects and CP-8-O-glc compound might be of therapeutic benefit for the prevention of platelet-related cardiovascular diseases.<sup>[16]</sup>

#### Immuno-enhancing effect

Kounsar and Afzal evaluated the effects of *R. emodi* rhizome extract on signal pathways on expression of iNOS gene and release of NO in murine macrophage RAW 264.7 cell line. The data indicated that *R. emodi* may have an immuno-enhancing effect through the release of various cytokines. The study reported that plant extract probably exerts directly by modulating various cytokines levels.<sup>[17]</sup>

#### Nephroprotective activity

Alam MM, reported the nephroprotective activity of *R. emodi* due to the presence of tannins. Two alcoholic extracts (water-soluble (W-S) and water-insoluble (W-INS) portions) of *R. emodi* was evaluated against cadmium chloride, mercuric chloride, potassium dichromate and gentamicin-induced nephrotoxicity in rats and normal rats by monitoring the levels of urea nitrogen and creatinine in serum. The results obtained reported that W-S fraction has nephroprotective effect on all the proximal tubule segments (S1, S2 and S3) possibly through antioxidant action of the tannins present in the fraction. W-INS also improved the renal function by protecting S2 segment of proximal tubule nephrotoxicity.<sup>[18]</sup>

#### Antioxidant activity

*R. emodi* has been reported to possess protective effect in many inflammatory diseases and oxidative stress-related injuries. Chai YY reported the antioxidant activity of Isolated stilbenoid piceatannol-4'-O- $\beta$ -D-glucopyranoside (PICG) and its aglycon piceatannol (PICE) from R. emodi, Antioxidant activity of these stilbenoids was examined by measuring 2,2-diphenyl-1-picrylhydrazyl (DPPH) and superoxide anion radical scavenging, ferric reducing power, and inhibition of lipid peroxidation in vitro. Both PICG and PICE displayed promising antioxidant activity in all the four assays. Comparisons among the tested compounds indicated that PICE has the most potent antioxidant activity and the presence of 3'-hydroxyl group may enhance antioxidant activity of stilbenoids.<sup>[19]</sup>

#### Antifungal activity

Agarwal SK et. al., reported the antifungal activity of *R. emodi* rhizome extract against Candida albicans, Cryptococcus neoformans, Trichophyton mentagrophytes and Aspergillus fumigatus (MIC 25-250 microg/ml). It was found from the study that anthraquinones isolated from *R. emodi* Rhein, physcion, aloe-emodin and chrysophanol Such as rhizomes are responsible for antifungal activity.<sup>[20]</sup>

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