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Rheum emodi Wall ex. meissn (Indian Rhubarb): Highly endangered medicinal herb

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Abstract

Rheum emodi or Indian rhubarb is one of the important medicinal herb used in Chinese herbal medicine since 2700 BC and now days it is used in large number of pharmaceutical industries because of its highly valuable medicinal properties viz., anti-cancerous, anti-microbial, anti-ulcer as well as anti-fungal. It is also used as one of the important ingredient in ayurvedic medicines such as chinimco tablets, kankayan vati, arjin tablets etc. Roots and rhizomes are the main parts for uprooting that possesses various secondary metabolites viz., anthraquinone (emodin, aleo-emodin, rhein, chrysophanol, physcion), stilbene (piceatannol, resveratrol) which are used in treating various type of cancers and other ailments like jaundice, headache, migraine, paralysis, sciatica, asthma, diarrhoea and liver disorders etc.

Keywords: *Rheum emodi*, medicinal herb, kankayan vati, arjin tablets

Introduction

Medicinal plants are an important part of life. These are used by large number of people directly or indirectly in preparing herbal medicines. In the world, there are 30,000 medicinal plant species out of which India comprises 8000 medicinal plant species [1]. India also has one of the oldest traditional cultures known as 'folk traditional' which is associated with large number of uses of medicinal plants based on the indigenous belief, traditional knowledge and on skill [2]. *Rheum emodi* commonly known as rhubarb or Indian Rhubarb or Himalayan Rhubarb is an important medicinal herb widely used in Ayurvedic and in Unani system of medicine [3]. Word rhubarb was derived from latin word 'rha' and 'barb' which means 'river' and 'barbarian' land respectively. Romans were imported it from barbarian land across the rha river, and the plant become rhabarbarum [4]. The "Shen Nong Ben Cao Jing" is the earliest book on metrica medica in which *R. emodi* was documented first time [5]. It is used throughout the world in various ailments such as jaundice, headache, migraine, paralysis, sciatica muscular pain, swelling, inflammation and diarrhoea etc [6,7].

Occurrence and Distribution

It is native of central Asia and widely distributed in China, Nepal, Bhutan and India [8]. The plant is endemic to western and central Himalayan region. In China, *R. emodi* is mainly distributed to the west of the line from Daxinganling Mountains, Taihang Mountains, Qinling Mountains, Dabashan Mountains to Yunnan-Guizhou Plateau [9]. In India, it is distributed in the temperate and subtropical region from Kashmir to Sikkim at an altitude of 2800-3000 m [10]. It grows well on exposed or partially shaded habitat, rocky, well drained, porous and humus rich soil of alpine and sub-alpine area of Himalaya [11].

Botanical description: *Rheum emodi* Wall. ex Meissn. belonging to family Polygonaceae is a 3.0 m tall leafy perennial herb [12]. Leaves are large (40 cm long), broadly ovate, and radical with long, stout and scabby petiole (30 – 45 cm). Stem is very hard and greenish with brown streaks. Inflorescence is 0.6 – 0.9 m long panicle, pubescent, upright branched and leafy with erect stern branches [13]. Flowers are minute with 3 mm diameter, pale to reddish in colour. Fruits are 1-2 cm long, ovoid - oblong, winged, purple with cordiform base and erose apex. Seeds are also winged. Roots are very thick, strong, dark brown in colour with long rough texture. Rhizomes (16 – 12 inches long) are dull orange to yellowish brown in colour.

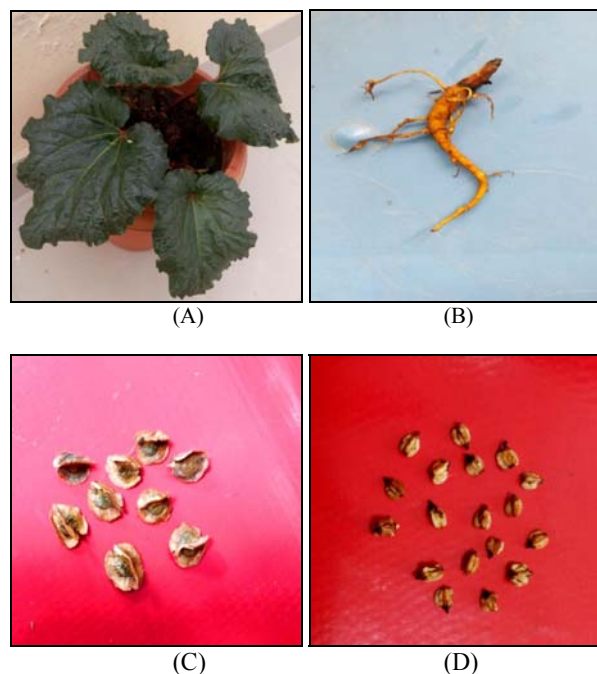


Fig 1: A. *R. emodi* habit, **B.** Rhizome. **C.** Fruits, **D.** Seeds

Classification

Kingdom	-	Plantae
Clade	-	Angiosperm
Clade	-	Eudicots
Clade	-	core eudicots
Order	-	Caryophyllales
Family	-	Polygonaceae
Genus	-	<i>Rheum</i>
Species	-	<i>R. emodi</i>

Names of *Rheum emodi* in different languages and tribes

English - Indian rhubarb, Himalayan rhubarb; Hindi - Dolu, Revandchini; Afghanistani - chukri, Rawash; Arabic - Revanch chini, Rawind; Bengali - Revandchini; Himachal Pradesh- Ladu, Bombay - Ladakirevand chini; Canarese - Naturevalchini; Deccan - Nahirevandchina; French - Rhubarb de parse; Gujarathi - Revandchini, Gamni; chuchi; Kamaun - Archu; Kannada - Revalchini; Ladak- Lachu; Marathi name - Mulkarvand chini, Revanchini; Nepalese - Padamachal; Persian - Bikrewas, Revandchini; Punjab - Atsu, Chotial, Chuchi, Pambash, Chutial, Khabium, Lachu, Rewand chini; Tamil - Variyattu, Naturevandchini; Telugu - Nattupampuch, Natureval chini; Urdu - Rewand chini; German - Himalaya - Rhabarber; Chinese - Zang bian da huang ^[14].

Cultivation: *R. emodi* can be propagated both through seeds as well as by vegetative means, although seeds show poor germination and seedling survival rate ^[15]. The age factor of seeds of *R. emodi* also affects their germination. The older seeds show less germination percentage and more prone to infection. Even one year old seeds show poor germination ^[16]. Flowering occurs during summer season and fruits were seeded in month of September and October. Six to seven year old plants were uprooted in month of October and November to obtain the raw drugs ^[17].

Chemicals constituents and their uses

Most commonly found chemical constituents are as follows: Anthraquinones, anthrones, stilbenes, oxanthrone, ethers and esters, flavonoids, lignans, phenols, carbohydrate and oxalic acid.

Chemical constituents		Their functions
Anthraquinone - are the polycyclic aromatic hydrocarbon that occurs naturally in some plants, fungi, lichens and insects. In plants it's mainly found in members of family Rubiaceae, Rhamnaceae, Scrophulariaceae, Liliaceae, Polygonaceae, Begoniaceae, Fabaceae and Verbenaceae. In fungi, it is mainly found in <i>Penicillium</i> and in <i>Aspergillus</i> species. <i>Caloplaca erythrantha</i> and <i>Xanthoria parietina</i> are lichens from which anthraquinones are obtained. The four basic anthraquinones that are found in <i>R. emodi</i> are emodin, aloë-emodin, rhein and chrysophanol ^[18] .	Emodin (1,3,8-trihydroxy-6-methyl anthraquinone)	Induces apoptotic cell death in Bcap- 37 and ZR-75-30 human breast cancer cells that are mediated by down regulation of the Bcl 2 and up regulation of caspase -3, PARP, p53 and Bax ^[19] . Inhibited the proliferation of human gastric cancer cell line MKH45 by arresting the cell cycle at G2/M phase ^[20] .
	Aloë-emodin [1,8- dihydroxy-3-(hydromethyl) -9,10-anthraquinone]	Inhibit the proliferation of human lung squamous cell carcinoma cell line CH27 by expressing Bcl-2 family proteins and activation of caspase 3, caspase 8 and caspase 9 ^[21] and gastric cancer cell lines MKH45 by arresting cell line at Go/G1 phase ^[20] .
	Rein (4,5- dihydro-9,10 – dioxoanthracene - 2 – carboxylic acid)	Induces apoptotic cell death in human colon cancer cell line COLO 32DM cells ^[22] and in tongue cancer cells, nasopharyngeal carcinoma cells and promyelocytic leukemia cells ^[23] .
	Chrysophanol (1,8-dihydroxy -3- methyl anthraquinone)	Induces the non apoptotic cell death (necrosis) in J5 human liver cancer cell line. It stimulates ROS production, DNA damage, mitochondrial dysfunction, loss of ATP and promotion of LDH activity, which leads to cell necrosis ^[24] .
	Physcion	Induces apoptotic cell death in HeLa cells by expression of p53, p21, Bax, Bcl2, caspase-9 and caspase 3 protein. It used as anticancerous drug against human cervical cancer ^[25] .
Stilbene possess a broad spectrum of pharmacological and therapeutic effects, such as antioxidative, anti-cancerous, anti-atherosclerotic, cardioprotective, hepatoprotective and neuroprotective effect ^[26] .	Piceatannol	Possesses anti cancerous properties against breast cancer, colon cancer, prostate cancer, melanoma cancer, leukemia and lymphoma. It show all these activity simply by arresting cell cycle and upregulation and down regulation of Bid, BiK, BoK, Fas: P21 and Bcl-xl; BCL-2, cIAP respectively, activation of caspase, loss of mitochondria potential and release of cytochrome ^[27] .
	Resveratrol (3,5,4'-trihydroxystilbene)	Possesses anti cancer, anti- aethrogenic, anti-oxidantive, anti-inflammatory, anti-microbial and estrogenic activity. It also used to treat cardiovascular disease and neurodegenerative diseases ^[28] .
Oxanthrone's derivatives	Oxanthrone esters (revandchinone-1) Revandchinone-3, Oxanthrone ether (revandchinone-4)	Exhibits antifungal activity against <i>Aspergillus niger</i> and <i>Rhizopus oryzae</i> and antibacterial activity against gram positive and gram negative bacteria (<i>Bacillus subtilis</i> , <i>Bacillus sphaericus</i> , and <i>Staphylococcus aureus</i>) and (<i>Klebsiella aerogenes</i> , <i>Chromobacterium violaceum</i> , and <i>Pseudomonas aeruginosa</i>) respectively ^[29] .

Pharmacological uses: Ethanolic extract of rhizome of *R. emodi* exhibit the antidiabetic activity in rat by decreasing the activity of glucose-6-phosphate, fructose-6-phosphate and aldolase, and increasing the activity of hexokinase and phosphoglucosomerase^[30]. Methanolic extract of rhizome possesses antifungal activities against *Candida albicans*, *Cryptococcus neoformans*, *Aspergillus fumigates* and *Trichophyton mentagrophytes*^[31] and antimicrobial activity against *Pseudomonas aeruginosa* (MTCC 3541) and *Bacillus megaterium* (MTCC 3784)^[32]. It also possesses the anticancerous activity against metastatic stage of breast cancer^[33]. Ethanolic extract of *R. emodi* exhibit gastroprotective and anti-oxidant activities^[34].

Ayurvedic medicines in which Rubarb used as ingredient:
Chininco tablet

is an ayurvedic medicine used in the treatment of profuse bleeding from nose, mouth, intestine, piles and also in painful complaints of uterus fallopian tubes ovaries (lower abdomen) in females. Arjin tablet is used in the management of dizziness, hypertension, sleeplessness, loss of concentration, heart palpitation and in neuro circulatory asthenia. Bleminor cream used in preventing hyper-pigmentation that occurs due to recurrent inflammation as it show anti-inflammatory property and also aids in correcting skin discoloration resulting from injury. Kankayan vati medicine used to treat abdominal ulcer, piles and stomach pain. Ayurvedic Panchamla taila used externally for the treatment of ascites, rheumatoid arthritis and joint pain^[14].

Other uses: Leaf stalk is used as fresh salad and vegetable in Assam. It is used to make pies, pickled and desserts due to its tart taste and also added in some fruit juices. Roots and rhizomes are used in treating type II Diabetes mellitus and also good for blood stagnation associated with acute stabbing pain and bruises. This herb acts as antispasmodic, antiseptic, anticholesterolemic, antitumor, astringent, chalogogue, diuretic and stomachic^[35]. It also exhibits anti-cancerous properties in human pancreatic cancer. Root powder is used to cure ulcer, wounds for dental purposes, treating gingivitis, used as an astringent tonic and treat hepatomegaly and jaundice^[36]. Root powder is used to treat cough and rhinitis when used with honey and also used to treat muscular pain, body ache, arthritis, swelling and inflammation, abscess and sciatica. Roots are used for dyeing red colour on silk and wool clothes^[37].

Current status of *Rheum emodi*

According to IUCN (International Union for Conservation of Nature and Natural Resources) one in ten species of vascular plant on earth come under threatened categories due to their over exploitation for commercial and industrial purpose^[38]. It has been estimated that in near future 60,000 plant species may be come under threatened categories and *R. emodi* is one of the plant species that is identified as top priority for their conservation and cultivation in Garhwal Himalaya^[39]. In natural habitat, it is continuously come under threatened status because of their high demands in pharmaceutical industries^[40]. Illegal extraction, lack of conservation and cultivation, environmental factors viz., global warming, dwindling forest areas, soil erosion, human interference and lack of awareness related to importance of species, its conservation, cultivation and commercial utilisation are major reasons for their threatened status. Research institutes like Agricultural Universities, IIM (CSIR) J&K, Forest

Department, Medicinal Plants Board should develop better agro-techniques and qualitative Planting Material for *R. emodi* and other endangered species for fulfilling the demands of pharmaceutical industries as well as save these species for future generations^[41].

Conclusion

In the present study, it is stated that *R. emodi* is an important medicinal herb of Ayurvedic and Unani system of medicine. Roots and rhizomes exhibit anti-cancerous, anti-bacterial, anti-fungal and anti-ulcer activities. Due to their medicinal properties, it is over exploited from their natural habitats. Various other anthropogenic factors such as grazing, uncontrolled deforestations, selective extraction, rapid industrialization also leads to rapid declination in their population. Therefore, in Northern India mainly in Garhwal Himalayas, the plant has come under threatened category, where it needs immediate attention for its conservation and cultivation.

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