



Review Article

A Review on Phytochemical and Pharmacological Properties of *Ricinus communis*

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Ricinus communis L. belonging to the family Euphorbiaceae is used in the treatment of various diseases. The Preliminary phytochemical studies of *R. communis* revealed the presence of Steroids, Saponins, Alkaloids, Flavonoids, and Glycosides. For such a common plant *R. communis* has a wide spectrum of activities ranging from Antimicrobial to smooth muscle relaxant to antiasthmatic. All parts of this plant are used in traditional medicine. Its seeds are known to be toxic but when used at specific doses they are showing potent pharmacological action. The objective of present review is to provide advance information including traditional uses, pharmacognostic and pharmacological nature of *R. communis* for the ease of researcher to study its wide range of active chemical constituents in it.

Key words: Phytochemistry, Pharmacology, *Ricinus communis*

1. INTRODUCTION

Castor plant (*Ricinus communis* L.) belongs to perennial shrub family of Euphorbiaceae. It is popularly known as Castor oil plant in English; Arandi or Erandi in Hindi; Mexico weed, Palma Christi in English, German, Portuguese; Ricin commun in French; Ritsin in Russian; Rizinus in Danish, German; Rikinsu and Rishin in Japanese; etc.,^{1,2}

The botanical name *Ricinus communis* was derived by Swedish naturalist Carlous Linnaeus in the eighteenth century. *Ricinus* is the Latin word for Mediterranean sheep tick (*Ixodes ricinus*) which the Castor plant seed has total resemblance to, and *communis* literally means common.³

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MORPHOLOGY

Castor plant has been cultivated as far back as 6,000 years ago. The castor oil plant is a fast-growing, suckering perennial shrub or occasionally a soft wooded small tree up to 6 meter or more, but it is not hardy in nature the leaves which is usually 30 – 60 cm in diameter may be green or reddish in color made of about 5-12 coarsely toothed lobes; the fruits which is usually a three-celled thorny capsule covered with soft spins encloses the seeds.⁴

Castor plant extracts have been used by numerous communities in different regions of the world for treatment and/or alleviation varieties of sicknesses. The extracts have been shown to possess essential and beneficial biological properties such as Antioxidant, Antimicrobial, Anthelmintic, Insecticidal, Diuretic, Anti-inflammatory, Laxative; in the treatments of Hypoglycemia, Edema, Rheumatism, Headache, Asthma, Dermatitis, Ringworm, Warts, Dandruff; external application on breast of nursing mothers shown to increase flow of milk and the oil shown to relieve labour pain and aid delivery^{1, 5, 6, 7, 8, 9}

Medicinal plants have been of great significance to human health. The medicinal potentials of these plants results from several bioactive phytochemicals constituents such as Alkaloids, Anthocyanins, Flavonoids, Phenolics, Tannins, Terpenoids, etc as well as vitamins that produce specific beneficial physiological and pharmacological functions in human body^{10, 11, 12}

Phytochemical is coined from the Greek word phyto which means plant. Thus, phytochemicals encompass large group of bioactive, non-nutritive chemical compounds that confer disease protection/reduction abilities in human body.^{13, 14}

HABITAT

This plant is common and quite wild in the jungles in India and it is cultivated throughout India, chiefly in the Madras, Bengal and Bombay presidencies. Two varieties of this plant are known • A perennial bushy plant with large fruits and large red seeds which yields about 40 P.C of oil; • A much smaller annual shrub with small grey (white) seeds having brown spots and yielding 37% of oil.^{4, 15}

ETHNOMEDICINAL USES:

The ethno medicinal uses of the plant *R. communis* suggested vital role in the treatment of various diseases. In the indigenous system of medicine the paste of leaves, fruits and roots of *R. communis* is applied locally for their anti-inflammatory effects. The castor oil obtained from the seed of the plant is still widely used traditionally and herbally as a medicine. The seed of the plant is used as fertilizer after the oil was extracted from the seed and cooked to destroy the toxin and incorporated into animal feeds. The principal use of castor oil is as a purgative and laxative. It is also used as a lubricant, lamp fuel, a component of cosmetics, and in the manufacture of soaps, printer's ink, plastics, fibers, hydraulic fluid, brake fluid, varnishes, paints, embalming fluid, textile dyes, leather finishes, adhesives, waxes, and fungicides. In India, the leaves are used as food for eri silk

worms and the stalks are used for fuel purpose. This species has been planted for its dune stabilization properties.^{16, 17, 18}

PHYTOCHEMICAL STUDIES:

The Preliminary Phytochemical study of *R. communis* reveals the presence of Steroids, Saponins, Alkaloids, Flavonoids, and Glycosides. The dried leaves of *R. communis* showed the presence of two alkaloids, Ricinine(0.55%) and N-Demethylricinine (0.016%), and six flavones, glycosides Kaempferol-3-O -D-xylopyranoside, Kaempferol-3-O- -D-glucopyranoside, Quercetin-3-O- -D-xylopyranoside, Quercetin-3-O- -D-glucopyranoside, Kaempferol -3-O- -Rutinoside and Quercetin-3-O- -rutinoside.¹⁹ The Monoterpenoids (1, 8-Cineole, Camphor and -Pinene) and a Sesquiterpenoid (-caryophyllene), Gallic acid, Quercetin, Gentisic acid, Rutin, Epicatechin and Ellagic acid are the major phenolic compounds isolated from leaves. Indole-3-acetic acid has been extracted from the roots.^{20, 21}

The GLC study of castor oil showed the presence of ester form of Palmitic (1.2%), Stearic (0.7%), Arachidic (0.3%) Hexadecenoic (0.2%), oleic (3.2%), Linoleic (3.4%), Linolenic(0.2%), Ricinoleic (89.4%) and Dihydroxy stearic acids.²²

The seeds contain 45% of fixed oil which consist glycosides of Ricinoleic, Isoricinoleic, Stearic and Dihydroxystearic acids and also lipases and a crystalline alkaloid, Ricinine.²³

The stem also contains Ricinine. The Ergost-5-en-3-ol, Stigmasterol, Y-sitosterol, Fucosterol; and 1- Probucoyl isolated from ether extract of seeds. The GC-MS analyses of *R. communis* essential oil using capillary columns are identified compounds like -Thujone (31.71%) and 1,8-Cineole (30.98%), -Pinene (16.88%), Camphor(12.92%) and Camphene (7.48%).²⁴

2. PHARMACOLOGICAL ACTIVITIES

Anti-inflammatory activity

Anti-inflammatory activities of the leaves and root extract were studied in Wistar albino rats in acute and chronic inflammatory models. The study indicated that the paw edema formation due to sub plantar administration of Carragennan, characterizing the cellular events of acute inflammation. The 250 and 500 mg/kg dose of *R. communis* methanolic leaves extract possess protective effect in prevention of cellular events during edema formation and in all the stages of acute inflammation. The anti-inflammatory activity of *R. communis* methanolic extract was due to the presence of Flavonoids because the Flavonoids have the protective effect against Carragennan-induced paw edema in rats.^{25, 26, 27}

Antioxidant activity

It is concluded that *R. communis* seed extracts produced the antioxidant activity by using lipid per oxidation by Ferric thiocyanate method and free radical scavenging effect on 2,2-diphenyl-1-picrylhydrazyl radical (DPPH) and hydroxyl radical generated from hydrogen peroxide. The high

antioxidant activity of the seed of *R. communis* at low concentration shows that it could be very useful for the treatment of disease resulting from oxidative stress. The responsible chemical constituent of antioxidant activity are Methyl ricinoleate, Ricinoleic acid, 12 octadecadienoic acid and methyl ester.²⁸ The stem and leave extracts also produce antioxidant activity due to the presence of flavonoids in their extracts.²⁹

Antimicrobial activity

The antimicrobial activities of *R. communis* were good against dermatophytic and pathogenic bacterial strains *Streptococcus progenies*, *Staphylococcus aureus* as well as *Klebsiella pneumonia*, *Escherichia coli*. The result showed that the petroleum ether and acetone extracts possess good zone of inhibition where as ethanolic extract having anti bacterial activity only on higher concentration³⁰. The different solvent extracts of roots of *R. communis* (200mg/ml) possess antimicrobial activity by using well diffusion method against pathogenic microorganisms such as *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *Proteus vulgaris*, *Bacillus subtilis*, *Candida albicans* and *Aspergillus niger*. The hexane and methanol extracts showed maximum antimicrobial activity where the aqueous extracts has no significant antimicrobial properties.³⁰

Antiasthmatic activity

The ethanolic root extract of *R. communis* is effective in treatment of asthma because of its antiallergic and mast cell stabilizing potential effect. Saponins has mast cell stabilizing effect and the flavonoids possess smooth muscle relaxant and bronchodilator activity; the Apigenin and Luteolin like Flavonoids were generally inhibit basophil histamine release and neutrophils beta Glucuronidase release, and finally shows in-vivo Antiallergic activity. The *R. communis* ethanolic extract decreases milk induced leucocytosis and eosinophilia and possess antiasthmatic activity due to presence of flavonoids or saponins.³¹

Antidiabetic activity

The ethanolic extract of roots of *R. communis* (RCRE) was investigated along with its bioassay-guided purification. By Administration of the effective dose (500mg/kg b. w) of RCRE to the diabetic rats for 20 days possess favorable effects not only on fasting blood glucose, but also on total lipid profile and liver and kidney functions. Amongst all fractions the R-18 fraction suggests the significant antihyperglycemic activity. RCRE showed no significant difference in Alkaline Phosphatase, Serum Bilirubin, Serum Creatinine, SGOT, SGPT and total protein which was observed even after the administration of the extract at a dose of 10 g/kg b.wt. Thus *R. communis* is a potent phytomedicine for diabetes.³²

Antihistaminic Activity

The ethanol extract of *R. communis* root resulted anti histaminic activity at the dose 100, 125, and 150 mg/kg

intraperitoneally by using Clonidine induced catalepsy in mice.³³

Antiulcer activity

The castor oil of *R. communis* seed possess significant antiulcer properties at a dose of 500 mg/kg and 1000 mg/kg, but at the dose 1000 mg/kg was more potent against the ulceration caused by pylorus ligation, aspirin and ethanol in rats. The result showed that the antiulcer activity of *R. communis* is due to the cytoprotective action of the drug or strengthening of gastric mucosa and thus enhancing the mucosal defence.³⁴

Antinociceptive activity

The methanolic leaves extract of *R. communis* possesses significant antinociceptive activity against acetic acid induced writhing test, formalin induced paw licking and tail immersion methods in mice. The antinociceptive activity showed due to the presence preliminary phytoconstituents like saponins, Steroids and Alkaloids.³⁵

Wound healing activity

The *R. communis* possess wound healing activity due to the active constituent of castor oil which produce antioxidant activity and inhibit lipid per oxidation. Those agents whose inhibits lipid per oxidation is believed to increase the viability of collagen fibrils by increasing the strength of collagen fibers, increasing the circulation, preventing the cell damage and by promoting the DNA synthesis. The study of wound healing activity of castor oil was in terms of scar area, % closure of scar area and epithelialization in excision wound model. Due to the astringent and antimicrobial property the Tannins, Flavonoids, Triterpenoids and Sesquiterpenes promotes the wound healing process, which are responsible for wound contraction and increased rate of epithelialisation. The study resulted that the Castor oil showed wound healing activity by reducing the scar area and also the epithelialization time in excision wound model. The comparison study of two different concentrations (5%w/w and 10%w/w) of castor oil was resulted that the 10 % w/w Castor oil ointment possesses better wound-healing property.³⁶

Larvicidal activity

The aqueous leaf extract of *R. communis* possess suitable Larvicidal activity against *Anopheles arabiensis*, *Callosobruchus chinensis* and *Culex Quinquefasciatus* mosquitoes.³⁷

Immunomodulatory agents generally increase the immune responsiveness of the human body against pathogens by activating the non-specific immune system. The phagocytosis is the engulfment of microorganism by leucocytes. In last the phagocytosis is the intracellular killing of microorganisms by the neutrophils. The presence of tannins in the leaves of *R. communis* significantly increases the phagocytic function of human neutrophils and resulted produces a possible immunomodulatory effect³⁸

3. TOXICITY

The seed contains 2.8-3% toxic substances, 2.5-20 seed is capable of killing a man, 4 rabbit, 5 sheep's, 6 oxes, 6 horses, 7 pigS, 11 dogs, but 80 for cocks and ducks. The principle toxin is the Albumin, Ricin. However, it produces antigenic or immunizing activity producing in small doses an antitoxin analogous to that produced against bacteria. The seeds of *R. communis* are poisonous to people, animals and insects. One of the main toxic proteins is "ricin" named by Still Mark in 1988 when he tested the beans extract on red blood cells. If the seed is swallowed without chewing it passes harmlessly through the digestive tract. However, if it is chewed or broken and then swallowed, the ricin toxic will be absorbed by the intestines. It is said that just one seed can kill a child, children are more sensitive than adults to fluid loss due to vomiting and diarrhea, and can quickly become severely dehydrated and die. Perhaps just one milligram of ricin can kill an adult. The symptoms of human poisoning begin within a few hours of ingestion and key are abdominal pain, vomiting, diarrhea, sometimes bloody. Within several days' severe dehydration, a decrease in urine and a decrease in blood pressure Occur.³⁸

4. CONCLUSION

R. communis or castor plant is a widely traditionally used and potent medicinal plant amongst all the thousands of medicinal plants. The pharmacological activities reported in the present review confirm that the therapeutic value of *R. communis* is much more. The presence of phytochemical constituents and pharmacological activities proved that the plant has a leading capacity for the development of new good efficacy drugs in future.

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