

**RICINUS COMMUNIS LINN: A PHYTOPHARMACOLOGICAL REVIEW**

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**ABSTRACTS**

Medicinal plants have a vital role to preserve the human healthy life. The large family Euphorbiaceae contains nearly about 300 genera and 7,500 species. Generally they are the flowering plants. Amongst all, the *Ricinus communis* or castor plant has high traditional and medicinal value for maintain the disease free healthy life. Traditionally the plant is used as laxative, purgative, fertilizer and fungicide etc. whereas the plant possess beneficial effects such as anti-oxidant, antihistamic, Antinociceptive, antiasthmatic, antiulcer, immunomodulatory, Antidiabetic, hepatoprotective, Antifertility, anti inflammatory, antimicrobial, central nervous system stimulant, lipolytic, wound healing, insecticidal and Larvicidal and many other medicinal properties. This activity of the plant possess due to the important phytochemical constituents like flavonoids, saponins, glycosides, alkaloids and steroids etc. The aim of this paper is to explain the details of phyto-pharmacological properties of *Ricinus communis* for the future research work.

**Keywords:** *Ricinus communis*, Phytochemical constituent and pharmacology.

**INTRODUCTION**

It is truth that without nature human being life is not possible. The food, clothes and shelter are three basic necessity of human beings and an important one necessity is good health, which provided by plant kingdom. Plant kingdoms are the rich source of organic compounds, many of which have been used for medicinal purposes. In traditional medicine, there are many natural crude drugs that have the potential to treat many disease and disorders one of them is *Ricinus communis*; Family: Euphorbiaceae popularly known as 'castor plant' and commonly known as 'palm of Christ', Jada (Oriya), Verenda (Bengali), Endi (Hindi), Errandi (Marathi), Diveli (Gujarati)<sup>1</sup>. The plant is widespread throughout tropical regions as ornamental plants.

**MORPHOLOGY**

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. This plants was cultivated for leaf and flower colors and for oil production. Leaves are green or reddish in colour and about 30-60 cm in diameter. The leaves contain 5-12 deep lobes with coarsely toothed segments which are alternate and palmate. The

stems are varying in pigmentation. The flowers are monoecious and about 30-60 cm. long<sup>2</sup>. The fruit is a three-celled thorny capsule. The capsule of fruit covered with soft spines like processes and dehiscent in to three 2-valved cocci. The seeds are considerable differences in size and colour. They are oval, somewhat compressed, 8-18 mm long and 4-12 mm broad. The testa is very smooth, thin and brittle. Castor seeds have a warty appendage called the caruncle, which present usually at one end from which runs the raphe to terminate in a slightly raised calaza at the opposite end of the seed<sup>3</sup>.

**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<sup>1</sup>.



Fig. 1: Fruit



Fig. 2: Whole Plant



Fig. 3: Leaf



Fig. 4: Seed

### TAXONOMICAL CLASSIFICATION

Kingdom: Plantae  
 Order: Malpighiales  
 Family: Euphorbiaceae  
 Sub Family: Acalyphoideae  
 Tribe: Acalypheae  
 Sub Tribe: Ricininae  
 Genus: Ricinus  
 Species: R. Communis

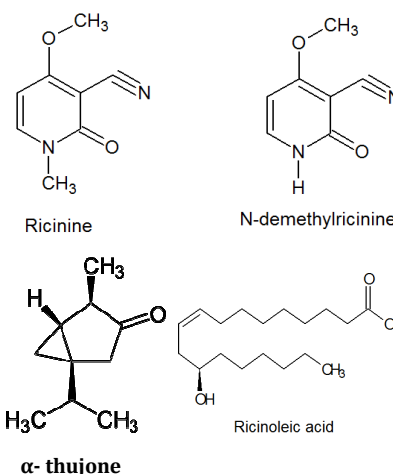
### BENEFITS OF THE PLANT

The castor oil obtained from the seed of the plant is still widely used traditionally and herballly 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<sup>4,5,6</sup>.

### PHYTOCHEMICAL CONSTITUENTS

The Preliminary Phytochemical study of *R. communis* revealed 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- $\beta$ -D-xylopyranoside, kaempferol-3-O- $\beta$ -D-glucopyranoside, quercetin-3-O- $\beta$ -D-xylopyranoside, quercetin-3-O- $\beta$ -D-glucopyranoside, kaempferol-3-O- $\beta$ -rutinoside and quercetin-3-O- $\beta$ -rutinoside<sup>7</sup>. The monoterpenoids (1, 8-cineole, camphor and  $\alpha$ -pinene) and a sesquiterpenoid ( $\beta$ -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<sup>8, 9</sup>. 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<sup>10</sup>. 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<sup>11</sup>. The stem also

contains ricinine. The ergost-5-en-3-ol, stigmasterol,  $\gamma$ -sitosterol, fucosterol; and one probucol isolated from ether extract of seeds. The GC-MS analyses of *R. communis* essential oil using capillary columns are identified compounds like  $\alpha$ -thujone (31.71%) and 1,8-cineole (30.98%),  $\alpha$ -pinene (16.88%), camphor (12.92%) and camphene (7.48%)<sup>12</sup>. Lupeol and 30-Norlupan-3 $\beta$ -ol-20-one are obtained from coat of castor bean<sup>13</sup>.



### PHYTO-PHARMACOLOGY

#### 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 *R. communis* which produce antioxidant activity are Methyl ricinoleate, Ricinoleic acid, 12-octadecadienoic acid and methyl ester<sup>14</sup>. The *Ricinus communis* stem and leave extracts also produce antioxidant activity due to the presence of flavonoids in their extracts<sup>15,16</sup>.

#### 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<sup>17</sup>.

### 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<sup>18</sup>.

### Anti-fertility activity

The methanol extracts of *R. communis* seed possess positive preliminarily Phytochemical tests for both steroids and alkaloids. The pituitary gland releases gonadotrophins due to Sex hormones by both positive and negative feedback mechanism and also the pituitary gland block the release of luteinizing hormone (LH) and the follicle-stimulating hormone (FSH) because of the effect of combined oestrogen and progesterone in the luteal phase of the menstrual cycle. Finally it helps the inhibition of maturation of the follicle in the ovary and prevents ovulation. The sex hormone being steroidal compound's (phytosterols) and the presence of steroids in methanol extract of *Ricinus communis* seed produces anti-fertility effects<sup>19, 20</sup>.

### 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<sup>21</sup>.

### In vitro immunomodulatory activity

The plant and animal origin 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 increased the phagocytic function of human neutrophils and resulted produces a possible immunomodulatory effect<sup>22</sup>.

### Hepatoprotective activity:

*Ricinus communis* leaves ethanolic extract 250/500mg/kg body weight possesses hepatoprotective activity due to their inhibitory activities of an increase in the activities of serum transaminases and the level of liver lipid per oxidation, protein, glycogen and the activities of acid and alkaline phosphatase in liver induced by carbon tetrachloride (CCL<sub>4</sub>). The *R. communis* ethanolic extract 250/500mg/kg body weight also treated the depletion of glutathione level and adenosine triphosphatase activity which was observed in the CCL<sub>4</sub>-induced rat liver. The presence of flavonoids in ethanol extract of *R. communis* produces beneficial effect the flavonoids have the membrane stabilizing and antiperoxidative effects. Hence the *R. communis* increase the regenerative and reparative capacity of the liver due to the presence of flavonoids and tannins. The anticholestatic and hepatoprotective activity was seen against paracetamol-induced hepatic damage due to the presence of N-demethyl ricinine isolated from the leaves of *Ricinus communis* Linn. The whole leaves of *Ricinus communis* showed the protective effect against liver necrosis as well as fatty changes induced by CCL<sub>4</sub> while the glycoside and cold aqueous extract provide protection only against liver necrosis and fatty changes respectively<sup>23, 24, 25, 26</sup>.

### 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<sup>27, 28, 29</sup>.

### Antimicrobial activity

The antimicrobial activities of *Ricinus 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 concentration<sup>30</sup>. The different solvent extracts of roots of *Ricinus 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<sup>31</sup>.

### Antidiabetic activity

The ethanolic extract of roots of *Ricinus 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, creatinine, serum glutamate oxaloacetate transaminases, serum glutamate pyruvate transaminases 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<sup>32</sup>.

### Wound healing activity

The *Ricinus 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 fibres, 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 epithelization 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 epithelization 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<sup>33</sup>.

### Lipolytic activity

The ricin produces the lipolytic activity by using the various substrates: (i) one analogue of triacylglycerol, BAL-TC<sub>4</sub>; (ii) various chromogenic substrates such as *p*-NP esters of aliphatic short to medium chain acids, and (iii) monomolecular films of a pure natural diacylglycerol, DC<sub>10</sub> in emulsion and in a Membrane-like model. The study concluded that ricin from *R. communis* act as a lipase and has the capability of hydrolyzing different lipid classes. Ricin also hydrolyses phospholipids which are the major components of cellular membranes. The lipolytic activities are maximal at pH 7.0 in the presence of 0.2 M galactose. The action of ricin on membrane phospholipids could occur through a phospholipase A<sub>1</sub> activity which is very often a minor activity of lipases<sup>34</sup>.

### Molluscicidal, Insecticidal and Larvicidal activity

The leaf extract of *R. communis* possess molluscicidal activity against *Lymnaea acuminata* and the seed extracts showed better insecticidal and insectistatic activity than the leaf extracts against *S.*

*frugiperda* due to the active ingredients like castor oil and ricinine<sup>35, 36, 37</sup>. The aqueous leaves extracts of *R. communis* possess suitable Larvicidal activity against *Anopheles arabiensis*, *Callosobruchus chinensis* and *Culex Quinqfasciatus* mosquitoes<sup>38</sup>.

#### 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<sup>39</sup>.

#### 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. It is an important source of compounds with their chemical structures as well as pharmacological properties. 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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