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Review Article

RICINUS COMMUNIS: A REVIEW

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ABSTRACT

Ricinus communis, also known as castor oil plant, is a kind of flowering plant belonging to the family spurge. It is a native Indian species and can be found throughout tropical region especially in south eastern Mediterranean Basin, Eastern Africa, and India. It is a small tree with soft woods. Berks, leaves, flowers, seed etc. all the parts of the plant are essential and have some medicinal properties. Castor oil is extensively used in the fields of Ayurveda, Unani, Homeopathy and Allopathic systems. The plant shows several pharmacological activities viz. anti-inflammatory activity, anti-diabetic activity, anti-cancer activity. Although the plant shows some allergic potentials and toxicity when over dosing of the seeds due to the chemical constituent ricin, it can be considered as a useful medicinal plant. The evolution of the plant with other species is also being monitored. More evaluation the chemical constituents are needed to explore several other options like the use of it as a fuel source.

Key words: Castor, Anti-diabetic, ricin

INTRODUCTION

Since times immemorial nature has served as the sole source of medicinal agents. The significance of herbs in the management of human afflictions cannot be over underlined. It is an obvious fact that the plant kingdom nurses as renewable source of active ingredients priceless in the supervising of many unmalleable diseases. Nevertheless, these interdependent ingredient give the plant safety and efficiency which is much superior to that of its isolated pure active forms [1].

Several reports have been made on the antimicrobial activity of diverse herbal extracts in vast regions of the world [2-5]. Lately much observation has been paid to extracts and biologically active elements isolated for implementing in herbal medicine as of the side effects and the resistance that pathogenic microorganisms form against antibiotics, [6]. About 20% of the plants population in world have been put forward for pharmacological or biological test, and a satisfying number of new antibiotics extracted from natural or

semi-synthetic resources are being presented in to the market [7].

Tropical Africa is widely distributed with Euphorbiaceae, the fourth largest family of the angiosperms representing over 300 genera and around 7500 species in [8]. These euphorbiaceae plants are basically shrubs, trees, herbs or sometimes lianas [9]. The food is obtained from family [10] and their medicinal properties varies in ethnobotany [11- 14]. To exemplify, Ricinus communis contains ricin is a long familiar poisonous compound that evoke brutal purgative action in human [15]. Traditional use of euphorbiaceae plants is for treating a number of microbial diseases like dysentery, diarrhoea, gonorrhoea and also skin infections [16].A very wide researches have been done on the the action of plant extract on bacteria in various parts of the globe [17]. Several theoretical reports in the literature have been concering the antibacterial action of crude extracts procured from plants [18-21]. *Ricinus communis L.* is a small tree which can be found around the world throughout tropics and warm temperature regions [22]. In the Indian medicine system, the leaf, root and seed oil of this plant have been used for the management of the inflammation and liver upsets [23], Hypoglycemic [24], Laxative [25].

MORPHOLOGY

It is a rapid growth full plant with suckers or rarely a soft wooded small tree growing up to 6 meter or more, but it is not robust by nature. Previously this plants was cultured for its leaf, flower colours and as well for oil production. The structure of the leaves about 30-60 cm in diameter having a colour of green or reddish. The leaves bear 5-12 deep lobes on coarsely toothed sections that are alternate and palmate. The stems have varied pigmentation. They have monoecious flowers which are about 30-60 cm. long [26] and having three-celled thorny capsule as the fruit. The seeds have considerable differences in size and colour. They have an oval structure, compressed, 8-18 mm in length and 4-12 mm breadth. The testa is very even, fine and fragile. Castor seeds have caruncle, a warty appendage, present generally at one end from which runs the raphe to abort in a slightly raised chalaza [15].

HABITAT

Indian wild jungles are widely populated with this plant and are mostly cultivated all throughout the country, majorly in the

region of Madras, Bengal and Bombay presidencies.

There are two known varieties of this plant, a perennial bushy plant (large fruits and large red seeds), and a smaller annual shrub (small grey seeds with brown spots) [27].

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 seed of this plant contains castor oil obtained which is widely used as traditional and herbal medicine. The seed also have fertilizing action, after oil extraction from seed and cooked to destruct the toxin and merged into animal feeds. Castor oil is principally used as a purgative and laxative. It has also other uses like as a lubricant, a component of cosmetics, and in soap manufacture, fibres, lamp fuel printer's ink, plastics, hydraulic fluid, brake fluid, varnishes, paints, embalming fluid, leather finishes, textile dyes, waxes, adhesives and also as fungicides. In India, the leaves are utilized as food for feeding eri silk worms and the stalks are used for combustible purpose. Dune stabilization properties are the chief reason for planting this species. [29] [30].

PHYTOCHEMICAL CONSTITUENTS

Leaves: *U*sing capillary with electrophoresis with amperometric Detection on the dried leaves of *R. communis* L. presence of Disaccharide glycoside rutin, gentistic acid, quercetin, and gallic acid are determined [31] Flavonoids (kaempferol-3-*O*-beta-drutinoside and kaempferol-3-*O*-beta-d-xylopyranoid) [32] and tannins [33] have also been secluded from the leaves.

Seeds: Three kinds of toxic proteins are contained in the seed are Ricin A, B and C and one ricinus agglutinin [34].

Fruit: Alkaloid and ricinine have been found in the pericarp of the fruits of R.communis [35].

A mixture of five diterpene hydrocarbon ent-kaurene, ent-beyerene [(+)-stachene],

ent-trachylobane, ent-sandaracopimaradiene, casbene (anti-fungal) is produced by cell free extract of seedling of castor bean [36].

PHARMACOLOGICAL ACTIVITY

Anti-inflammatory Activity

Petroleum ether is a extract of root of *Ricinus Communis* (150 mg/kg p.o) and its effect has been enquired against Carrageenan, 5-Hydroxytryptamin, Dextran, Bradykinin and Prostaglandin E, brought on rat's hind paw oedcma. A significant anti-inflammatory activity has been exhibited by the extract against all the phlogestic agents excluding PGE. It is revealed, the efficacy of extract against the phlogestic agents have been show in the following order due mean changes in the paw volumes:

Carrageenan>Bradykinin>5-HT>Dextran.

A comparison of the anti-inflammatory activity with standard drugs such as Phenylbutazone and Betamethasone, in drastic and persistent models of swelling in albino rats [37].

Antidiabetic activity

Favourable effects is seen not only on fasting blood glucose, after administering the effective dose of *Ricinus communis* to the diabetic rats for periodof 20 days, but as well on total lipid profile and liver and kidney functions on the 10^{th} and 20 th day. *Ricinus communis* appeared to bear a high tolerance of safety as no mortality and no statistically substantial deviation in alkaline phosphatase, serum bilirubin, creatinine, serum glutamate oxaloacetate transaminase, serum glutamate pyruvate transaminase and total protein was detected following the administration of the extract at a dose of 10 g/kg body weight. Thus *Ricinus communis* is presumed to have an assuring value for the expansion of a potent phytomedicine which can be used in diabetes [38].

Anti-inflammatory and free radical scavenging activity

A study of anti-inflammatory and free radical scavenging actions of the methanolic extract of *Ricinus communis Linn*. root in wistar albino rats was done. 250 and 500 mg/kg p.o. doses of methanolic extract demonstrated significant inflammatory activity in carrageenan-induced hind paw edema model. The extract also exhibited significant ($P < 0.001$) anti-inflammatory activity in cotton pellet granuloma model at the dose of 500 mg/kg p.o. The

methanolic extract displayed significant free radical scavenging activity by suppressing carbon tetrachloride and ferrous sulphate initiated lipid peroxidation in rat liver and kidney homogenates. The extract increased free radical scavenging activity of stout radical 2,2-diphenyl-1-picryl-hydrazyl,hydroxyl radical and nitric oxide in vitro assay methods. The methanolic extract of *Ricinus communis Linn*. root possess prominent anti-inflammatory action in acute and chronic inflammatory models in rats [39].

Gastric Ulcer and Secretion activity

A study on gastric ulcer and secretion in Pylorus ligated rats was carried in albino rats of either sex by administering *Ricinus communis*. Volume, acid output and peptic activity was estimated from the gastric juice. Ulcer index was calculated by adding the number of ulcers/erosions with severity in pluses (+) scored as per stomach [39].

Anticancer activity (Ricin)

Ricin has been shown to possess antitumor qualities although it has a very potent poisonous action, has been useful in cancer research and chemotherapy in recent times. One convincing use of ricin is in the manufacturing of immunotoxins, where the monoclonal antibodies are joined to protein ricin. The antibodies are produced in in vitro process in a test tube and possses protein receptor sites which discern the specific target cells of a tumor. The resultant ricin-antibody conjugate is termed as an immunotoxin. The deadly toxin can be transported directly to the site of the tumor in a cancer patient by arming these antibodies with ricin. Thus, without damaging other cells the ricin can destroy the tumor cells in the patient [40].

Anti-microbial and anti-fungal

In the immunocompromised oral cancer cases, a secondary infection occurs due to bacterial and fungal species. A significant result has been reported in treatment for the prevention of infection against oral cancer when *Ricinus communis* is co-adminstrered with the immunosuppressant drugs [41].

Insecticidal activity

The insecticidal activity of the castor oil plant (*Ricinus communis*) in containing the termites which vandalize the wood of *Mangifera indica* and *Pinus longifolia* was determined. Weight loss in wood pieces exposed to termites is significantly after all

treatments [42].

Anti-Implantation activity

Anti-implantation, anticonceptive and estrogenic activity is found in the ether soluble portion of the methanol extract of *Ricinus communis* var. *minor* when administered subcutaneously at a dose upto 1.2g/kg and 600mg/kg respectively in divided doses in adult female rats and rabbits [43].

Central analgesic activity

The crude extract from root bark of *R. communis* has central analgesic activity in tail flick response model [44]. Typical CNS stimulant and neuroleptic effects is determined in the ethanolic extract of pericarp of fruit *of R. communis.* The presence of the alkaloid ricinine seem to be the reason for the stimulant effects, such as exophthamus, hyperreactivity, memory improvement, and clonic seizures. Ricinine appears to be the main toxic compound of the extract, because animals that died after administration of extract or ricinine manifest alike indication: after an occurrence of clonic seizures accompanied by an apparent breathing arrest, they all died. On the other hand, the neuroleptic-like effects can be cause due to compounds other than ricinine, because reduction of locomotor activity or catalepsy in the mice is not caused by ricinine [45].

Antitumour activity

A lectin isolated from *R. communis* called Ricin A is determined possess antitumor activity. It was found to be more toxic to tumor cells than to non-transformed cells, determined from the ED_{50} of the lectin towards tumor cells and non-transformed cells [46].

Larvicidal and Adult emergence inhibition activity

Larvicidal effects with 100 % killing activities at concentrations 32-64 µg/mL, and with LC_{50} values 7.10, 11.64 and 16.84 µg/mL for *Culex quinquefasciatus*, *Anopheles stephensi* and *Aedes albopictus* larvae, have been exhibited by the seed extract of *R. communis*. The mixture of bioactive constituents present in the extract may be the reason for this synergistic activity. Thus according to reports it can be suggest that *R. communis* seed extracts render an excellent potential against the *Aedes albopictus, Anopheles stephensi, Culex quinquefasciatus* and mosquitoes vector [47].

Antinociceptive activity

Antinociceptive activity can be found through writhing test where methanol extract of R. *communis* leaves. This activity can also be shown by formalin induced paw licking and immersion method in mice [48].

Antiasthmatic activity

The antiasthmatic activity of ethanol extract from *R.communis* roots significantly decreases milk induced leucocytosis and eosinophilia and defend degranulations of mast cells in mice [49].

Cytotoxic Activity

Ricin extracted from the seeds *of R. communis,* is a heterodimeric protein possessing cytotoxic activity by virtue of its ability to fatally disrupt protein synthesis. The process of cell entry by ricin is involved to be a 10 step process, climaxing into the protein synthesis disruption. The cell can be killed if a single molecule of ricin reaches the cytosol due to this. Therapeutically, it can be used to specifically target and destroy cancer cells [50]. On the other hand the leaves, possesses another range of cytotoxic phytochemicals that induces apoptosis via translocation of phosphatidyl serine to the external surface of cell membrane and loss of mitochondrial potential. There are three monoterpenoids in this compound: 1,8-cineole, camphor and alpha-pinene and a sesquiterpenoid: beta caryophyllene [51]. It was encountered The *Ricinus communis* agglutinin I (RCA I), preferentially binds to and is internalized by tumour endothelial cells leading to VEGFR-2 down-regulation, vessel regression with endothelial cells apoptosis. It has no effect on normal blood vessels [52].

Bone Regeneration Activity

Ricinus communis polyurethane (RCP) has been studied for its biocompatibility and its ability to stimulate bone regeneration. Results showed that RCP blended with calcium carbonate or calcium phosphate could promote matrix mineralization and are biocompatible materials [53]. Incorporating alkaline phosphatase to RCP with subsequent incubation in Synthetic body fluid could improve the biological properties of RCP [51]. The advantage seen in RCP as compared to demineralized bone is that the former has a slower reabsorption process [54].

Toxicity

The presence of ricin in raw castor beans cause toxicity. Although the lethal dose in adults is considered to be four to eight seeds, reports of actual poisoning are relatively rare [55]. In 2007, *Guinness World Records* claimed this plant to be the most poisonous in the world. In spite of this, suicides due to ingestion of castor beans are unprecedented of in countries like India where castor cultivation is abundant on the roadsides. However, an extraction method of the poison from castor is by concentrating it with a fairly complex process alike that used for extracting cyanide from almonds.

Symptoms may be delayed by up to 36 hours if ricin is ingested, but usually commence within 2–4 hours. The symptoms include purging, abdominal pain, burning sensation in mouth and throat etc. Within respective days there will be severe dehydration, a fall in blood pressure and the urine output is reduced. If not treated, within 3–5 days death may be expected to occur, nevertheless in majority of the instances an entire retrieval can be made [56].

When animals, including humans, ingest broken seeds or break the seed by chewing poisoning occurs, an entire seeds may pass across the digestive tract without secreting the toxin [56]. The rate of toxic affect ranges among animal species: four seeds will kill a rabbit, five a sheep, six an ox or horse, seven a pig, and eleven a dog. A strong resistance to the seeds have been shown by the ducks: an average of 80 seeds is required to kill them [57]. Some degree of natural protection is provided by the toxic to castor oil plant from insect pests such as aphids. Investigation has also been made of Ricin as a potential insecticide [57]. Undecylenic acid, a natural fungicide is also found in the castor oil plant.

Commercially available cold-pressed castor oil can be used both internally and externally as it is nontoxic to humans in normal doses [58].

CONCLUSION

Although the phytochemical properties are not clear, *R. communis,* the native Indian plant has several important pharmacological properties. Numerous studies have been carried out for this plant and there is no doubt that castor oil plant is a useful medicinal plant. Moreover, it can be said that more research should be going on to fully understand the plants properties.

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