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Ricinus communis L. – A Review.

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Abstract:- In the last few decades there has been an exponential growth in the field of Herbal medicine. It is getting popularized in developing and developed countries owing to its natural origin and lesser side effects. One such medicinal plant is *Ricinus communis* **(**Euphorbiaceae**),** which is commonly known as castor. It is a small tree which is found all over the India. All parts of plant are important *viz*. bark, leaves, flowers, seed, oil etc. Oil of this plant is extensively used in Ayurveda, Unani, Homeopathic and Allopathic system of medicines as cathartic. The plant is reported to possess antioxidant, anti-implantation, anti-inflammatory, antidiabetic, central analgesic, antitumour, larvicidal & adult emergence inhibition, antinociceptive and antiasthmatic activity. All these uses are due to the presence of certain phytoconstituent in the plant. The major phytoconstituent reported in this plant are rutin, gentistic acid, quercetin, gallic acid, kaempferol-3-*O*-beta-d-rutinoside, kaempferol-3-*O*-beta-d-xylopyranoid, tannins, Ricin A, B & C, ricinus agglutinin, Indole-3-acetic acid and an alkaloid ricinine. The aim of present article is to explore the medicinal importance of the plant *Ricinus communis*.
Keywords:- *Ricinus communis*, Ricin A, B and C, Lubricant, Castor cake.

INTRODUCTION:-

Ricinus communis, family – Euphorbiaceae, is also known as Castor oil plant in English; in Hindi: arand, erand, andi, rend; Sans: Gandharvahasta, vatari, rubu, urubu, pancangula, citra: Assam: eda, era; Bengali: bherenda; Gujrat: erandio, erando; Kanada: haralu, oudala, gida; Kashmiri: aran, banangir; Malyalam: avanakku; Marathi: errand. Ricinus communis is a tropical plant, known as castor bean, that is distributed widely across the world.[1] The plant is native of India and cultivated throughout the country in gardens and fields and also grows wild in waste places. *Ricinus communis* is a small wooden tree which grows to about 6 meters in height and found in South Africa, India, Brazil, and Russia. Stems of *Ricinus communis* have Anticancer, Antidiabetic and Antiprotozoal activity.[2] In the Indian system of medicine, the leaf, root and seed oil of this plant have been used for the treatment of the inflammation and liver disorders, Hypoglycemic, Laxative.[3]

MORPHOLOGY:-

Leaves are alternate, curved, cylindrical, purplish petioles, sub peltate, drooping, stipules large, ovate, yellowish, united into a cap enclosing the buds, deciduous, blade 6-8 inches across, palmately cut for three quarters of its depth into 7-11 lanceolate, acute, coarsely serrate segments, smooth blue green, paler beneath, red and shining when young. Flowers are monoecious, large, arranged on the thick rachis of an oblong, spicate panicle, which is at first terminal but becomes lateral by the growth of an axillary bud beneath it; male flowers shortly stalked, on branched peduncles at the base of the panicle, pedicels articulated about the middle; female flowers sessile, at the upper part; bracts broadly triangular. Fruit is blunt, greenish, deeply-grooved, tricoccus capsule, less than an inch long, with the prominences of the ovary becomes sharp, weak, spreading spines, 3-celled, dehiscing loculicidally and septicidally into 6 valves. Seeds are ovoid, flattened, nearly ⅝ inch long by ¼ broad, smooth,

shining, pinkish- grey, prettily mottled with dark brown, caruncle large, subglobular, raphe faintly raised, running down centre of ventral surface, embryo large in axis of the endosperm, cotyledons foliaceous, broadly ovate, with a cordate base, veined.[4] Roots are light in weight almost straight with few rootlets, outer surface dull yellowish brown, nearly smooth but marked with longitudinal wrinkels.[5]

ETHANOBOTANICAL USES:-

Castor oil is widely used as a catharatic, and also for lubrication and illumination. The oil as such or after modification finds extensive applications in industry, particularly in USA. Bulk of the commercial oil is generally processed in a number of ways and then used for different purposes. The treated oil finds use in products like paints, enamels and varnishes, oiled fabrics, linoleum, patent leather, fly-paper, typewriting and printing inks, greases and special lubricants, polishes, waxes, cutting, dielectric and condenser oils, softening agent for gelatin in rayon sizing, nitrocellulose-baking finishes, hydraulic brake fluids, urethane foams and rubber substitutes, cosmetics, pharmaceuticals and insecticidal formulations. Oil from the perennial types is used for illumination and lubrication while that from the annual types is preferred for medicinal use. Castor oil is often given orally, alone or with quinine sulphate to induce labour in pregnancy at term. The oil can be used as a vehicle for parenteral administration of steroidal hormones. It is used in the preparation of liquid disinfectants like phenyls. It is an excellent illuminant and has been used in lamps from very early times in India. It is used in soap making.[6] Castor oil is a mild and most efficient purgative, and is well adapted for infants and young children, the puerperal state, and in irritable conditions of the alimentary canal or of the genito-urinary organs. It is one of the safest and most reliable purgatives we possess for the relief of obstinate constipation. The leaves have been also recommended in the form of a decoction or poultice, as an application to the breasts of women to increase the secretion of milk. The decoction has also been reputed to act as a lactagogue and emmenagogue when administered internally.[4] Castor cake is used as manure in India. It is rich in nitrogen and other minerals, and has been found to be suitable as a manure for paddy, sugarcane, tobacco etc. Leaves are occasionally fed to cattle. They are reported to increase the yield of milk. The powdered leaves are used for repelling aphids, mosquitoes, white flies and rust mites. The insectisidal activity is probably due to the presence of the alkaloid ricinine in them. Extracts of leaves and other parts of the plant have been marketed under the trade name 'Spra Kast' in USA; however, most of the claims regarding the use of the plant in combating pests have proved to be unfounded. Expressed juice and aqueous and alkaline extracts of the leaves were active against mycobacteria and yeast. Leaves are said to used in the form of a poultice or fomentation on sores, boils and swellings. Leaves coated with oil and warmed, are commonly applied over the abdomen to give relief in the flatulence in the children. An infusion of leaves is used for stomache-ache, and as a lotion for the eye. Pounded leaves are said to give relief in caries, and are applied over guinea-worm sores to extract the worm. Fresh juice of leaves is reported to be used as an emetic in the poisoning by narcotics like opium; it is also considered useful in jaundice. Leaves are considered lactagogue and are applied as poultice over the breasts or taken internally in the form of juice. Roots are administered in the form of a decoction for lumbago and allied complaints, in the form of a paste for toothache. Root bark is reported to be a powerful purgative.

Laboratory and pilot plant trials at the Forest Research Institute, Dehra Dun have shown that unbarked stems of both the annual and the perennial varieties of castor plant can be employed for the production of easy-bleaching chemical pulps suitable for making writing, printing and wrapping papers, and newsprint. Castor stems on digestion with lime yield pulps suitable for the production of straw-boards. Dried stems and branches of the plant are used in thatching and as wattle in the walls of mud huts. Dried stems and seed hulls constitute a highly combustible fuel.[6]

REPORTED PHARMACOLOGICAL ACTIVITY:-

Anti diabetic activity:- Ethanolic extract of root of plant significantly decreased the fasting blood glucose of the diabetic rats from an initial level of 386 ± 41 mg/dl to 358 ± 33, 293 ± 28, 191 ± 25, 133 ± 29, 96 ± 20 and 79 ± 16 mg/dl on 2nd, 5th, 7th, 10th, 15th and 20th day, respectively. The fasting blood glucose became normal by 20th day. Ethanolic extract of root also reduces the glucose level in normal as well as diabetic rats in a dose dependant manner up to 500mg/kg body weight. But the higher doses up to 2000 mg/kg do not show the dose dependant effect. [7]

Such a phenomenon of low hypoglycemic response at higher dose is common with indigenous plants and has been observed earlier with many plants like *Aegle marmelos*[8], *Murraya*

koenigii [9]. The decreased activity at a higher dose of the extract could be due to reduced or no effect of components present in the extract at higher doses [10,11,12]. It is also likely that the higher doses could not produce the expected higher hypoglycemic effect because of the presence of some other substances in root extract, which interfere with the hypoglycemic effect. In this context, it is worth noting that [13] have reported the presence of some hyperglycemic compounds also along with hypoglycemic compounds in three plants, Trigonella foenum graecum (fenugreek) seeds, Ficus bengalensis (banyan tree) bark and Momordica charantia (bitter gourds). So, higher doses of the extract might have higher doses of hyperglycemic compounds. Thus, 500 mg/kg b/w was found to be the effective dose of RCRE on FBG of normal as well as diabetic animals.

Anti microbial and anti fungal:- The secondary infections in the immunocompromised oral cancer cases were due to bacterial and fungal species. The co-adminstration *Ricinus communis* with the immunosuppressant drugs for the prevention of infection against oral cancer treatment patient show significant result. [14]

Insecticidal activity:- The insecticidal value of the castor oil plant (*Ricinus communis*) in controlling the termites which damage the wood of *Mangifera indica* and *Pinus longifolia* was examined. In comparative trials, the order of insecticidal activity was DDT = BHC > castor oil + castor cake (1:1) > castor oil > castor leaves > castor cake > neem oil > neem leaves. All treatments significantly reduced weight loss in wood pieces exposed to termites**.** [15]

Antioxidant activity: The DPPH (1,1-diphenyl-2-picrylhydrazyl)-mediated *in vitro* study reveals that gallic acid, quercetin, gentisic acid, rutin, epicatechin and ellagic acid are the major phenolic compounds responsible for the antioxidant activity of the dry leaves of *Ricinus communis Linn.* [16]

Anti-Implantation activity: The ether soluble portion of the methanol extract of *Ricinus communis* var. *minor* possesses anti-implantation, anticonceptive and estrogenic activity in adult female rats and rabbits when administered subcutaneously at a dose upto 1.2g/kg and 600mg/kg respectively in divided doses.[17]

Anti-Inflammatory and free radical scavenging activity: Anti-inflammatory and free radical scavenging activities of the methanolic extract of root of *Ricinus communis* (Euphorbiaceae) Linn. was studied in Wistar albino rats. The methanolic extract at doses 250 and 500 mg/kg *p.o.* exhibited significant ($P < 0.001$) anti-inflammatory activity in carrageenin induced hind paw edema model. The extract at the dose of 500 mg/kg *p.o.* also exhibited significant ($P < 0.001$) anti-inflammatory activity in cotton pellet granuloma model. The methanolic extract showed significant free radical scavenging activity by inhibiting lipid peroxidation initiated by carbon tetrachloride and ferrous sulphate in rat liver and kidney homogenates. The extract enhanced free radical scavenging activity of stable radical 2,2-diphenyl-1-picryl-hydrazyl (DPPH), nitric oxide and hydroxyl radical in *in-vitro* assay methods.[18]

Central analgesic activity: The crude extract of root bark of *R. communis* possesses central analgesic activity in tail flick response model to radiant heat at a dose of 250mg/kg. [19] The ethanolic extract of pericarp of fruit *of R. communis possesses* typical CNS stimulant and neuroleptic effects. The stimulant effects, such as exophthamus, hyperreactivity (evidenced by tremors or by the pinna and grip-strength reaction), memory improvement, and clonic seizures, seem to be due to the presence of the alkaloid ricinine. The main toxic compound of the extract also seems to be ricinine, because animals that died after administration of extract or ricinine showed similar signs: they all died after the occurrence of clonic seizures followed by an apparent breathing arrest. On the other hand, compounds other than ricinine may be responsible for the neuroleptic-like effects of the extract, because ricinine did not cause reduction of locomotor activity or catalepsy in the mice. [20]

Antitumour activity: Ricin A, a lectin isolated from *R. communis* possess antitumor activity, it was more toxic to tumor cells than to non-transformed cells, judged from the ED_{50} of the lectin towards tumor cells and non-transformed cells. [21]

Larvicidal and Adult emergence inhibition activity: The *R. communis* seed extract exhibited 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 respectively. This activity may be due to the synergistic activity of the mixture of bioactive constituents present in the extract. These finding suggest that *R. communis* seed extracts provided an excellent potential against the *Culex quinquefasciatus, Anopheles stephensi* and *Aedes albopictus* mosquitoes vector [22]

Antinociceptive activity: The methanol extract of *R. communis* leaves possesses antinociceptive activity in writhing test, formalin induced paw licking and tail immersion method in mice. [23]

Antiasthmatic activity: The ethanol extract of *R.communis* roots possess antiasthmatic activity, it significantly decreases milk induced leucocytosis and eosinophilia and protect degranulations of mast cells in mice. [24]

Antifertility activity:- The present findings indicate that the ether soluble portion of the methanol extract of *Ricinus communis* var. *minor* possesses anti-implantation, anticonceptive and estrogenic activity in rats and mice when administered subcutaneously. This is supported by the following observations: (i) Administration of the extract did not inhibit regular estrous in these animals; (ii) Laparotomy performed on Days 10 and 15 (rats and rabbits, respectively) did not reveal any uterine implantation sites; (iii) Mated female rats which were housed in the same cage with fertile male rats throughout the observation period did not deliver any pups and (iv) A dose-dependent increase in uterine weight and a premature opening of vagina with cornification of vaginal epithelium was seen in young ovariectomized rats and immature mice. The extract did not appear to delay implantation since no pups were delivered even after three gestation periods. [25]

Cytotoxic Activity: Ricin is a heterodimeric protein from the seeds of R. communis. It has cytotoxic activity by virtue of its ability to fatally disrupt protein synthesis. The cell entry process by ricin is postulated to be a 10 step process, which culminate into the protein synthesis disruption. A single molecule of ricin reaching the cytosol can kill the cell due to this. Therapeutically, it can be used to specifically target and destroy cancer cells.[26] The leaves on the other hand, have another range of cytotoxic phytochemicals which induces apoptosis via translocation of phosphatidyl serine to the external surface of cell membrane and loss of mitochondrial potential. These compounds included three monoterpenoids: 1,8-cineole, camphor and alpha-pinene and a sesquiterpenoid: beta caryophyllene.[27] The *Ricinus communis* agglutinin I (RCA I), was found to preferentially binds to and is internalized by tumour endothelial cells leading to VEGFR-2 down-regulation, endothelial cells apoptosis and tumour vessel regression. It has no effect on normal blood vessels.[28]

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.[29] Incorporating alkaline phosphatase to RCP with subsequent incubation in Synthetic body fluid could improve the biological properties of RCP.[(27)] The advantage seen in RCP as compared to demineralized bone is that the former has a slower reabsorption process. [30]

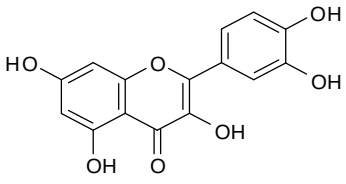
REPORTED PHYTOCONSTITUENTS:

Leaves- Disaccharide glycoside rutin, gentistic acid, quercetin, and gallic acid are determined in the dried leaves of *R. communis* L. by using capillary electrophoresis with amperometric detection.[31] Flavonoids (kaempferol-3-*O*-beta-d-rutinoside and kaempferol-3-*O*-beta-d-xylo pyranoid) [32] and tannins [33] have been isolated from the leaves

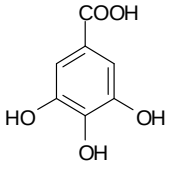
Seeds- Seeds contain three toxic proteins Ricin A, B and C and one ricinus agglutinin.[13] Indole-3-acetic acid [34] has been extracted from the roots.

Fruit- The pericarp of the fruits of R. communis contain alkaloid, ricinine.[20]

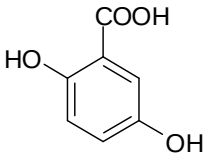
Cell free extract of seedling of castor bean produce a mixture of five diterpene hydrocarbon ent-kaurene, ent-beyerene [(+)-stachene], ent-trachylobane, ent-sandaracopimaradiene, casbene (anti-fungal) .[35]



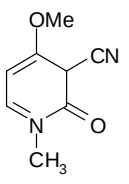
Quercitin



Gallic acid



Gentisic acid



Ricinine

CONCLUSION:

R. communis is native plant of India. It has various pharmacological actions some of them are reported above but the phytochemical responsible for it is not yet recognized. It contain chemical constitutions like Ricin A, B and C which have antitumor action, it also have alkaloid (ricinine) and glycoside which may be use full for various herbal formulation as anti-inflammatory, analgesic, antipyretic, cardiac tonic and antiasthamatic etc. So it may be concluded that *R. communis* is a very important indigenous medicinal plant which required more exploration to utilize its medicinal property.

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