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Ricinus Communis: A Dynamic Plant

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Abstract

Ricinus Communis is a perennial shrub. It is commonly known as Castor, belongs to the family Euphorbiaceae. The Castor leaf juice is a diuretic, purgative, galactogogue and emmenagogue, whereas Castor oil extracted from its seeds is famously known for its medicinal properties. Pharmacological action of the components extracted from castor plant is been determined, for that purpose extraction process is necessary, which is specially elaborated in work. As observed into the study, the dynamic nature of the pharmacological activity found in castor plant is at the peak such as, anti- microbial, anti-viral, anti-inflammatory, etc. Beside this some rare and mostly required pharmacological actions are found in it like anti-oxidant, anti-aging, anti-cancer. Considering its wide range of phytochemicals, its pharmacological activity and subsequent clinical trials, R.communis could be a very good source for discovering novel complementary drugs.

In order to introduce pharmacological activity of R.communis the current study is undertaken.

Keywords: Ricinus communis, Euphorbiaceae, Galactogogue

Introduction

In Ayurvedic medicine system, it is famously known for its medicinal properties. Original castor plant, castor bean plant, the hand of Christ all are common names of Ricinus. It is also known as 'Eranda' in Sanskrit[1]. As per the different places the names of the Rinicus changes, in another words also known as vernacular names. In Hindi it is known as Erand, Redi, Erend. In English it is said as Castor, African Coffee Tree. In Marathi popularly known as Erandi. Whereas when we consider foreign vernacular names of the Ricinus, in China it will be Pee-Ma. The botanical name of R. communis was coined by Swedish naturalist Carlos Linnaeus in the 18th century.[2]

Habitat of Ricinus can be depicted as it is originally located to the Middle East and northeastern Africa. Performing the role of weed it spread over everywhere in tropical and sub-tropical regions of the world. Castor plant grows optimally in tropical summer rainfall areas. It grows well from the wet tropics to the subtropical dry regions with an optimum temperature of 20°C–25°C. The high content of the oil in the seeds can be attributed to the warm climate conditions, but temperatures over 38°C can lead to poor seed setting. Additionally, temperatures low enough to induce the formation of frost is known to kill the plant. Generally it grows over waste lands, hilly regions.

Ricinus is a fast growing tree which is evergreen, herbaceous and semi woody large shrub gain height, up to 5mt and width is 4.5m wide. The glossy leaves are green to purplish in color and are palmate, with 5-11 deeply incised lobes and have long petioles. Stems contain hollow nodes and are green to reddish in color. Male flowers are on the lower spike of the flower with yellow colored anthers and the female flower is egg-shaped capsules, reddish brown and is thickly covered with soft flexible spines. Each capsule contains three seeds that look like fat, swollen and are deadly poisonous with brownish mottling.

The decoction of leaves is a purgative, lactagogue and emmenagogue.[3] A poultice of the leaves is applied to boils and swellings. The hot leaves are applied over the abdomen of children to relieve flatulence. In women the leaves promote menstrual flow. Tender leaves cure pain in bladder.[4] Tender leaves which is coppery red in colour are collected and fine paste is made. This is to administered earlier in the morning in empty stomach. This helps to decrease in the level of bile or bilirubin in case of jaundice. Castor leaf is dipped in to sesame oil and heated till it becomes hot. This is applied over blunt injuries,arthritis, painful joints to get relief from the pain. Castor oil leaf and root after being crushing and forming of paste with sesame oil, after slightly heating, it can be applied externally for the purpose of relief from migraine, low back ache, skin disorders associated with pain, etc.

Seeds of this plant are highly toxic due to presence of chemical compound ricin. It is most poisonous plant in the world. In adults fatal dose is considered to be about 5 – 10 seeds. Overdose may cause nausea, vomiting, diarrhea, hypertension, tachycardia, seizures and it may lead spontaneous death. Symptoms may begin in 2 – 4 hours or it may be delayed for up to 36 hours. Despite this toxicity we can use it after purification process. By soaking seeds into the ethanol, toxicity gets removed and after drying we can use it safely.

❖ **Taxonomical Classification:**

1. Kingdom – Plantae
2. Order – Malpighiales
3. Family – Euphorbiaceae
4. Sub-Family – Acalyphoideae
5. Tribe – Acalypheae
6. Sub- Tribe – Ricininae
7. Genus – Ricinus
8. Species – R. Communis [5]

❖ **Ayurvedic Properties:**

Sr.No.	Particulars	Properties
1	Taste	Sweet, Pungent, Astringent
2	Physical Property	Unctuous, Minute, Sharp
3	Potency	Hot
4	Metabolic Property (After Digestion)	Sweet

Extraction of ricinus communis plant:

For the purpose of finding of essential/required constituents from the castor plant the extraction process is necessary but, extraction of whole plant at a momentis nearly impossible and hence extraction process is done by differentiating the parts of the castor plant, which are further enlisted sequentially:

A] Seeds
B] Fruits
C] Roots
D]
Leaves

A] Extraction of Seeds of Ricinus Communis:[6]

The traditional procedures of castor oil extraction presently practice permits the extraction of about 20% oil from the kernel, which is very inefficient and time consuming. These procedures involve the following steps:

i. **Cleaning:** Unwanted materials such as stones and dirt are removed from thedehulled seeds by hand picking.

ii. **Boiling:** The decorticated seed is then heated in water to a temperature of about 90 - 96 degree celsius for about 10 minutes.

iii. **Drying:** Spread the boiled seeds into the sunlight for drying. The purpose of drying process is to reduce moisture content to about 5 – 7%

iv. **Grinding:** For grinding the grinding machine is operated manually, the productoccurs after this process is in the form of paste.

v. **Mixing of water:** The paste of castor seeds is then mixed with water in the proportion of 1 kg of paste to 2 liters of water.

vi. **Cooking:** The castor pastry is then placed on fire for heating, as the water evaporates and the product becoming sticky oil starts gushing out and settles on the surface.

vii. **Scooping of Oil:** The extracted oil is then scooped to a separate container and the remaining product or byproduct called cake is collected for drying.

viii. **Drying of Oil:** The scooped oil is then dried by heating to reduce the moisture from extracted oil.

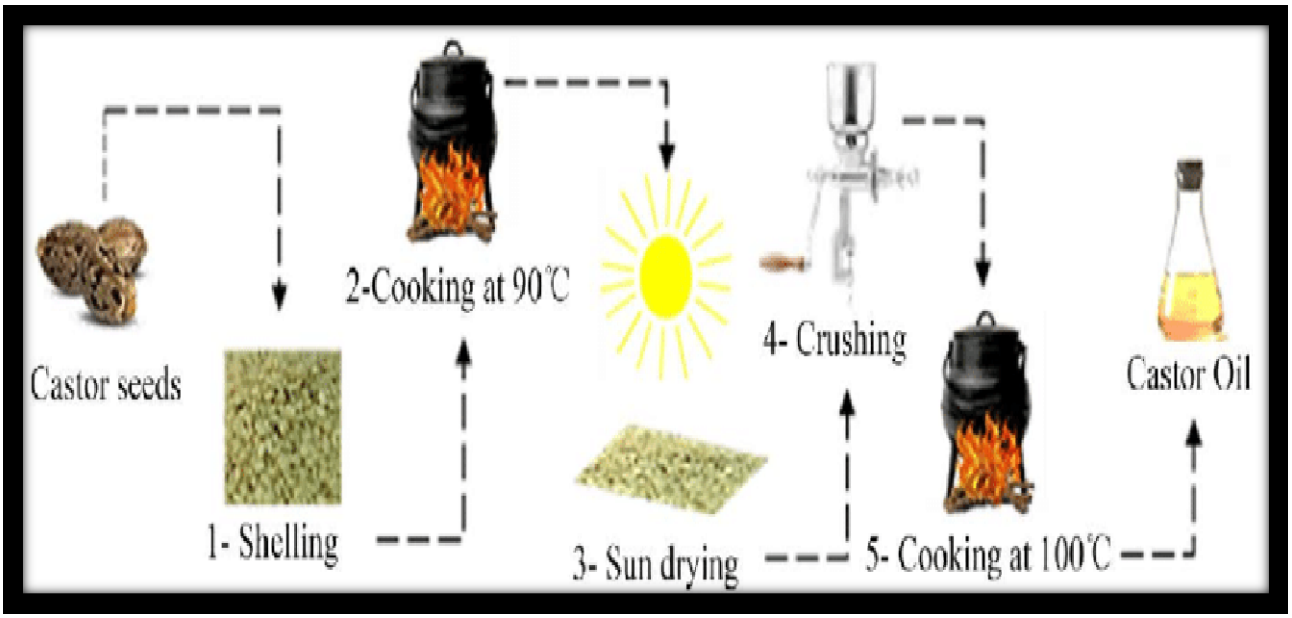


Fig .1: Traditional extraction process of castor oil

B] Fruits of Ricinus Communis:

Fig: Fruits of R.communis

The fruit is a globular spiny capsule which becomes hard and brittle when ripe. The Castor fruit is usually a schizocarp, typical regma; a capsular fruit with three cells each of which splits open at maturity into separate parts and then breaks away explosively, shattering the seeds. The period from seedling emergence to capsules' maturity varies with genotypes. On average, it varies from 140 – 160 days.

C] Roots of Ricinus Communis:

Castor plants can be grouped into tall and short types. The tall type has a large, well-developed tap-root which can reach several feet in length and has substantial laterals and secondary roots. Dwarf types roots always reflect peculiarity to particular variety or cultural system and show less apparent tap-root. In arid areas where the plant has only rainfall for subsistence, aerial growth tends to be slower in relation to root growth than under more favourable conditions [20]. The well-developed root system allows the plant to take maximum advantage of soil moisture, a major factor in the plants resistance to drought. Root system shows a strong correlation to yield because it allows the crop to tape necessary nutrient and water for proper accumulation of biomass. Planting castor in a soft and loose soil is an advantage for proper development of root which will in turn contribute to better yield.

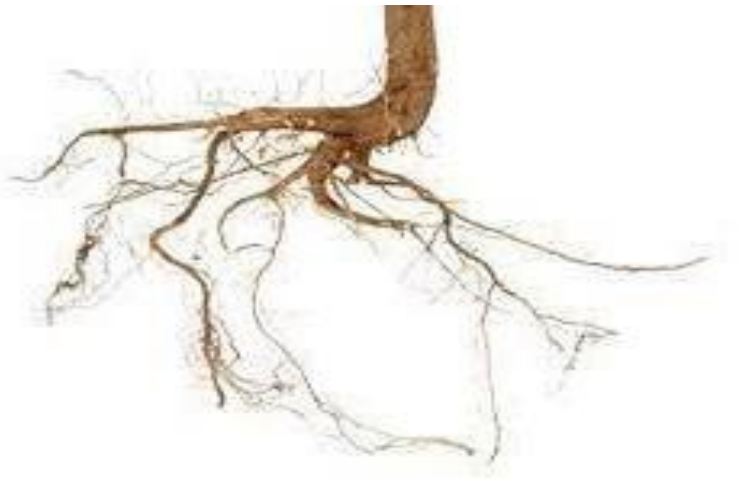


Fig: Roots of R.communis

D] Extraction of Leaves of Ricinus Communis:

Preparation of Extract:

Take 200 gm of dried powder of Ricinus communis and moisturize it with sufficient quantity of ethanol and subjected to soxhlet extraction with 3 cycles of solvent and concentrated. The concentrated extract obtained was about 16 gm. [7]

Leaves and fruits of R.communis

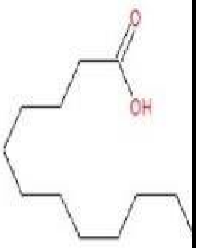
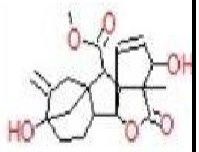
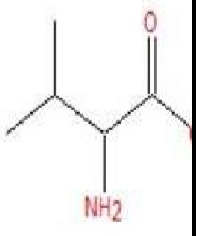
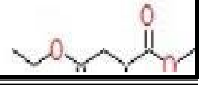
Serial No.	Phytochemical compound	RT (min)	Formula	Molecular weight	Exact mass	Chemical structure
1	n-haxadecanoic acid	15.177	$C_{16}H_{23}O_2$	256	256.24023	
2	Octadecanoic acid	17.043	$C_{18}H_{36}O_2$	284	284.27153	
3	1-hexadecanol. 2-methyl	17.300	$C_{17}H_{36}O$	256	256.276615	
4	Gibb-3-ene-1. 10decarboxylic acid ,2,4a. 7trihydroxy-1-methyl —8-methylene, 1.4a-lactone. 10-methyl	18.628	$C_{20}H_{24}O_6$	360	360.157288	
5	L-Valine, ethyl ester	4.088	$C_7H_{15}NO_2$	145	145.110279	
6	Butanedioic aciod hydroxyl. Diethyl ester	7.207	$C_8H_{14}O_5$	190	190.084124	

Fig .2: Phytochemical compounds extracted from R.communis leaves

Applications

There are numerous uses of R. communis plant which utilizes every part of the plant including roots, seeds, bark, leaves, flower, fruit and stem.

A poultice of the leaves is applied to boils and swellings. The hot leaves are applied over the abdomen of children to relieve flatulence. In women the leaves promote menstrual flow. Tender leaves cure pain in bladder.[4] Tender leaves which is coppery red in colour are collected and fine paste is made. This is to administered earlier in the morning in empty stomach. This helps to decrease in the level of bile or bilirubin in case of jaundice. Castor leaf is dipped in to sesame oil and heated till it becomes hot. This is applied over blunt injuries, arthritis, painful joints to get relief from the pain. Castor oil leaf and root after being crushing and forming of paste with sesame oil, after slightly heating, it can be applied externally for the purpose of relief from migraine, low back ache, skin disorders associated with pain, etc.

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Antifungal activity of aqueous and alkaline extracts against Mycobacterium tuberculosis and yeast was also reported[8]. Seeds are the primary source of oil which is in use both as a herbal medicine and as a conventional therapy for various ailments [9].

Pharmacological activity

Pharmacological Activity and Phytochemicals of R.communis

A] Anti – Bacterial Activity:

R. communis and its phytochemicals have been found to have antimicrobial properties against various microorganisms. Some of the reported antimicrobial activity of the crude extract includes inhibition of various bacteria such as Staphylococcus aureus, Escherichia coli, Streptococcus mutans, Enterococcus faecalis and methicillin-resistant Staphylococcus aureus[10]. In one study, methanolic extract exhibited maximum activity against Escherichia coli and lowest activity against Bacillus subtilis[11]. Inhibition of biofilm formation is due to the presence of sodium ricinoleate in R. communis oil, which damages cell wall and leads to cell death by loss of cytoplasmic components [12]. By the above results, it can be concluded that R. communis can be a good source for an antibacterial drug against various bacterial pathogens.

B] Anti – Cancer Activity:

Some studies have been carried out using fractions with 100% ethanol, methanol and an aqueous phase which have shown activity against specific cancer cell lines such as melanoma, MCF7 (Breast cancer), HepG2 (Hepatic cancer), PC3 (Pancreatic cancer), and cervical cancer[13]. Both in vitro and in vivo studies have confirmed the anti- cancer activity of R. communis using various plant parts and ricin lectins[14,15].

C] Anti – Oxidant:

Antioxidants are the first line of defence towards free radical damage and play a significant role in maintaining cell viability and optimum health. Many of the neurodegenerative diseases are related to free radicals exposure to the cell. The DPDH (1,1- diphenyl-2-picryohydrazyl) mediated in vitro study, reveals the antioxidant activity of R. communis due to the presence of compounds such as gallic acid, quercitin, gentisic acid, rutin, epicatechin and ellagic acid in leaves and methanolic extract[16].

Highest antioxidant activity was shown by butanol fraction of Ricinus[17]. Ethyl acetate extract of R. communis was also found to be a potent antioxidant. The antioxidant activity of R. communis is attributed more to flavonoids as compared to tannins[18, 19].

D] Anticonvulsant Activity:

Epilepsy is a pervasive disorder with seizure formation due to neuronal discharges of the brain. Some isolated compounds from R. communis have been tested for anticonvulsant activity and proved to be reliable epileptic. After electric shock treatment, all the animals exhibited convulsions. Animals receiving a dose of 60 mg/kg of a compound from R. communis seeds exhibited an inhibition of seizure to about 82% compared to a standard drug which exhibited an 8.89% seizure inhibition [21].

E] Laxative and Uterine Contracting:

Castor oil induces laxation and uterus contraction by involving ricinoleic acid activating prostaglandin receptors 2. Castor oil and ricinoleic acidinduce contraction of the intestinal smooth muscle. Both gut and uterus motility is affected.Prostaglandin receptors 2 are proved to be potential targets for drugs to induce laxation [22].

F] Analgesic Activity:

R. communis was found to possess potent central analgesic activity. Various studies have been conducted for demonstrating the analgesic activity of R. communis extract. It is studied and proved that R. communis extract has typical central nervous system stimulant and neuroleptic effects. The stimulant effects such as hyperreactivity, memory improvement and clonic seizures are due to the alkaloid ricinine in R. communis. Ricinine is non-anxiogenic as it does not reduce exploratory behaviour of the brain [23].

CONCLUSION:

The way information elaborated in to the project is gets explained in very disciplined manner on the topic “Ricinus Communis : A Dynamic Plant”. The topic further extended through explanation of the topic in detail. Information presented, thoroughly covers the dynamism of the castor plant.

The information covers the pharmacological activity of the plant such as anti – oxidant, anti – inflammatory, anti – microbial, etc. Most important property of the plant i.e. laxative , is also designed in to the pharmacology of plant section.

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