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Jatropha Curcas

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Abstract: *Jatrophacurcas belongs to family Euphorbiaceae, Jatrophacurcas is a preciousmulti-purpose crop, historically it was used as drug for injuries and leaves used as drinks against malaria, jatropha shops used to control soil declination, palliate corrosion, desertification and increase soil fertility, still, in last decades there's further attention to use jatropha oil painting for yield biodiesel, Jatrophacurcas is fluently propagated by seeds or stem slice, it's tolerant for failure for longtime, it's grow well with treated wastewater, also, it can be grown on borderline land.*

Jatrophacurcas seed have about 32- 40 precious oil painting used to produce biofuel, thus, it could be the source for biodiesel product particularly in thirsty and semiarid regions. curcas has been used as traditional drug to cure colorful infections. Experimenters had insulated and characterized multitudinous biologically active composites from all corridor of this factory. In addition, the mechanisms of action of these active composites have been studied in relation to the operations in traditional drug. Before exploiting any factory for medicinal operation, it's pivotal to have complete information about the medicinal uses of each part of the factory. The medicinal uses of the leaves, fruit, seed, stem dinghy, branches, outgrowths, latex and root ofJ. curcas are bandied in thisreview.However, much further exploration is needed to develop herbal drug using ultramodern wisdom and technology, If the full eventuality of the factory is to be revealed. A implicit aspect grounded on requests for all of its medicinal products should be conducted completely, to promote the capability of this factory to cure so numerous ails.

Keywords: jatropha curcas, future perspective, uses, treatment

I. INTRODUCTION

Jatrophacurcas a woody shrub, it's one of family Euphorbiaceae, it's utmost considerably specie across different regions all over the world due to its strength, It has multitudinous names in different regions like the physic nut, goat nuts,(pinhão- manso in Brazil), Barbados nut, purifying nut, nettle spurge, or just Jatropha(1), former inquiries showed that jatropha is native to Central and South America(2).

also, jatropha may be a proper solution for biofuel production from cultivation irrigated with treated wastewater [4]

Jatropha considered a multipurpose factory, it has been used in traditional mortal drug and for veterinary drug for over a long period of time(5), it can drop soil declination, desertification, and deforestation(6).

There are more intriguing about jatropha from the last decades use jatropha oil painting as a main source for biodiesel product rather of comestible crops(7), also, it's to combat desertification and reduce soil corrosion in thirsty regions, Jatropha has great yield eventuality and can be grows well under stress conditions, and it's claimed to be failure resistant and can be grown under saltness and on borderline lands conditions. The notable important of JatrophacurcasL. as biofuel crop, due to its seeds bearing 32 to 40 oil painting content, that can be simply converted intobio-diesel, accordingly, it has high eventuality to be used in biodiesel product(8- 10).

Biodiesel attained from jatropha provides transnational norms(11), jatropha had great rigidity to thirsty andsemi-arid surroundings(10), inquiry for wasteland recovery, explicatory environmental stress, supporting socio-profitable(12), short development period and being indigestible to scrape, also, Jatrophacurcas is also being studied for use as a carbon insulation factory in thirsty regions(13), Jatropha oil painting cutlet is rich in NPK and can be used as organic diseases(14).

Jatropha has been surfaced to growers in thirsty andsemi-arid regions as a promising renewable energy crop, and a new profitable crop for poor soil or borderline lands, and it's good adaption to differentagro-climatic conditions(15),

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the physiological characteristics of jatropha, associated with its profitable prospective put it into an indispensable biofuel factory for thirsty and semiarid regions(16).

For all the below- mentioned advantages and operationsJ. curcas remains a favorite feedstock for yieldbio-diesel and largely desirable for growing on borderline lands. For all the above-mentioned advantages and applications J. curcas remains a favorite feedstock for produce bio-diesel and highly desirable for growing on marginal lands.

Scientific Classification

Kingdom : Plantae
Subkingdom : Tracheobionta
Superdivision : Spermatophyta
Division : Magnoliophyta
Class : Magnoliopsida
Subclass : Rosidae
Order : Euphorbiales
Family: Euphorbiaceae
Genus : Jatropha (1)

BOTANICAL

Jatropha(JatrophacurcasL.) is a evanescent oilseedm shrub, Jatropha genus one of Joannesieae lineage, as a member of Crotonoideae in the Euphorbiaceae family; native to tropical America(8 & 17), and mature Jatropha(further than 8 times old) reach to 7-13 cadence height(Fig. 1), the leaves are green, thick and the length is8.55 cm long and range about 5 cm, with heart- shaped, with long neck reach to 11 cm long, Jatropha has small greenish unheroic flowers, and the fruits are green at first stage and unheroic to brown on growing. Fruit contains frequently 2- 3 round black seeds, the seed contains kernels and shells, kernel contain protein(22- 28) and high oil painting content(ranging from 32- 40) according to the growing conditions and genotype(17) Jatropha is the scientific name for the species which was created by combining the Greek terms"Jatros" which means"croaker
" and"trophe" which means" food", including(18) Curcas is its motherland, and it can be set up throughout northeastern South America and the dry corridor of Mexico(19)

Description

Jatrophacurcas is a member of the Euphorbiaceae family and is employed as a medicinal factory as well as an cosmetic and multipurpose shrub. This factory has a variety of current and implicit operations, particularly in the medical field. There are multitudinous medical operations forJ. curcas. The experimenters had explored and studied the curcas factory sections. Traditional drug and veterinary drug have traditionally used all factors of the Jatropha factory(seeds, leaves, dinghy, and so on). It constantly contains fusions of several chemical factors that can help people's health in numerous ways singularly, additively, or synergistically(20)

Leaves

The leaves have significant variability in their morphology. In general, the leaves are green to pale green, alternate to subopposite, and three- to five- lobed with a helical phyllotaxis, A variety of chemicals have been linked from Jatrophacurcas isolates. The leaves contain the flavonoid apigenin, as its glycosides vitexin and isovitexin, as the sterols stigmasterol,- D- sitosterol, and its- D- glucoside, In addition, curcas leaves also contain alkaloids, steroid sapogenins, triterpene alcohol, 1- triacontanol, and tripene alcohol, which were uprooted using ethyl acetate from a admixture of 5-hydroxy pyrrolidin-2-one and pyrimidine- 2, 4- dione.(21)

Stem Bark

The stem and dinghy excerpts contained secondary metabolites similar as saponins, steroids, tannins, glycosides, alkaloids, and flavonoids. According to Shimada(2006), tannins have been discovered to form unrecoverable composites with proline-rich proteins, reducing cell protein conformation. Curcas stem dinghy excerpts were linked to

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contain saponin, which has been shown to help in inflammation treatment. Alkaloids retain excellent mortal goods, leading to the development of effective anodyne phrasings(22) Flavonoids, which have antibacterial,anti-inflammatory, antioxidant, and antiangiogenesis conditioning, are another secondary metabolic product discovered in curcas stem dinghy extrac(23)

Latex

Tannin, saponin, wax, and resin are all set up inlatex.Curcain, a proteolytic enzyme, may be uprooted from latex by pouring it with alcohol and acetone, both of which are abundant in latex, and curcacycline A, a new cyclic octapeptide produced from latex, inhibits the classic mortal complement and T- cell proliferation route(24). Incipiently, Curcacycline B, a new cyclic nonapeptide, can boost cyclophilin B's rotamase exertion.

Seeds

the seeds are mature when the capsule changes from green to pusillanimous. The seeds contain around 20 saturated adipose acids and 80 unsaturated adipose acids, and they yield 25 – 40 oil painting oil by weight. In addition, the seeds contain other chemical mixes, analogous as saccharose, raffinose, stachyose, glucose, fructose, galactose, and protein. The oil painting oil is largely made up of oleic and linoleic acids. likewise, the plant also contains curcasin, arachidic, myristic, palmitic, and stearic acids and curcin Humans and creatures are both poisoned by the seeds in general. Curcin is a poisonous protein uprooted from the seeds that are also high in phorbol esters. JEA esterase, JEB esterase, and lipase were also discovered in curcasseeds(25)

Roots

Phytochemical analysis of the excerpts revealed the presence of numerous secondary metabolites, including steroids, alkaloids, and saponins.J. curcas roots contain diterpenoids, jatropholone A, jatropholone B, and jatropholo(26) The roots ofJ. curcas are used to produce cure for snake mouthfuls. The roots are used in decoction as mouth marshland for bleeding goo and tooth pang as well as for eczema, scabies and ringworm.J. curcas roots is also utilised in curing diarrhoea, which is a common ethnobotanical practice in Konkan, a part of the Western littoral area of India. The roots are been used for pharmacognostic studies and estimation of antidiarrhoeal action in albino mice. consecutive birth of methanol bit displayed some exertion counter to castor oil painting convinced diarrhoea and intraluminal figure- up of liquid. There's reduction in gastrointestinal motility after watercolor set mess administration in mice. The results indicated that the action of the excerpt containing methanol could be done by an arrangement of inhibition of elevated prostaglandin biosynthesis and abridged propulsive mobility of the small intestine(Bekalu 2020).

Figure 2. Jatropha tree shape

Figure 3. Jaliopha leaf shape

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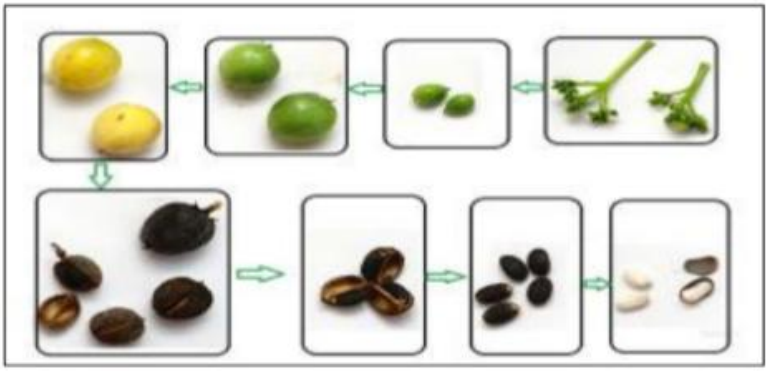

Figure 4.Jatropha seeds.

Traditional Uses

Jatrophacurcas(Euphorbiaceae) is located in South America's northeastern region, America and Mexico's drylands.It's a protean factory presently grown in tropical and tropical areas and is frequently used for folk drug to palliate affections. It possesses Antihypertensive, Antiinflammatory, Antioxidant, Antineoplastic, Analgesic, Anti diarrheal,Anti-bacterial conditioning that were set up on this earth(27). Infusion, decoction, maceration, and oral, topical, and bath treatments are each used to prize the factory's leaves, stems, roots, seeds, and latex.

Table 1. Different parts of Jatrophacurcas are used for various purposes.

Plant Part	Region	Form	Use
Leaves	West Africa	Decoction	Lactogogue, rubefacient, suppurative
		Decoction + Lime juice	Fever, convulsion, anthelmintic
		Ash from burn leaves	To draw out guinea worm sore
		Infused of young leaves	Urinary complaints
		Boiled(J.curcas + Azadirachta + Indian + Carica papaya)	Malaria (drink and bath)
	Nigeria	Boiled leaves (J. curcas + Syzygium guineense) + palm oil	Diabetes
	Cameroon	Raw leaves	Arthritis; against abscess in the stomach
	Benin	Leaf decoction	Oedemas and cough
		Decoction of leaves + roots + fruits of Xyæopia ethiopia	Drepanocytosis
		Fresh leaves + kaolin pounded in water	Haemorrhoids
	India	Leaf (paste + crude)	Jaundice and liver troubles
		Tender leaves	Headache
		Leaves paste	Burn spot; chest inflammation, congestion, headache, hypertension, eczema, galactagogue
		Leaf juice	Amenorrhea and oligomenorrhea
		Leaf paste oj J. curcas and J. gossypifolia	Night blindness
		Infusion	Diabetes

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		Leaf poultice	Furuncle, hair loss
		Crushed leaves	Haemostatic, styptic, hair loss, bleeding wounds, snake bite
	Colombia	Decoction	Venereal diseases
	Costa Rica	Poultice	Erysipelas and splenosis
	Barbados	Tea	Marasmus Jaundice
	Panama	Leaf Poultice	Rubefacient for paralysis rheumatism and galactagogue
	Guatemala	Heated Leaves	Lactagogue
		Crushed Leaves	Haemostasis, styptic, hair loss, bleeding wounds, snake bite
Latex		Paste	Dressing wounds, inflamed tongues and ulcer
	West Africa	Latex + Salt	Carious teeth, mouthwash and tooth came out in children
	Benin	Dried Latex	Leucorrhagia, urethritis
	Mali	Paste	Stop bleeding against infection
	Cuba	Paste	Toothache
	Columbia	Paste	Burns, haemorrhoids, ringworm, ulcer
	Bahamas	Decoction	Heartburn
	India	Latex + Salt	Eczema, scabies, wounds, burn cancer, toothache, mouth ulcer, cracked lips, otorrhoea, cold and cough itching of genital organs
Roots	India	Decoction	Mouthwash for bleeding gum and toothache, eczema, ringworm
		Root bark decoction	Mouthwash for toothache and sore throat;abortifacient
	Venezuela	Decoction	Dysentery
	West Africa	Decoction	Gonorrhea
		Powdered root bark	Dressing wound and sores
		Infusion of root	Rheumatism, dyspepsia,

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			diarrhea
		Rock pulp + Xylopia sp. fruits	Dysentery, incontinence
	Cameroon	Decoction of root 0.5 kg in 5.1 water + indigenous salt	Hypertension Sexualy transmitted disease Arthritis, gout, jaundice, purgative
Seed	India	Gargle of fresh stem juice	Arthritis, gour, jaundice, purgative Toothache; angular stomatitis Constipation Rheumatism, dermatitis, herpes, dropsy Dysentery, stomach disorders, rheumatism
	Mali		Laxative
Stem	West Africa	Roasted seeds + shea butter	Dropsy, gout, paralysis, skin ailments
		Preparations containing seeds	Guinea worm infection, tumors, syphilis, skin infestation, abortifacient
		Leafy twigs pounded in water	Glass of the filtrate is drunk once a day for malaria
		Young twigs paste + black pepper	White discharge (given twice a day)
		Twigs	Chewing for; pyorrhea, gum and teeth problems
		Juice	Dysentery (orally 3 times a day) Source, haemostatic, wound
		Crushed stem heated with oil	As massage for muscles pain, hematoma
Bark	India	Infusion + salt	Diarrhea, dysentery
		Water extract mixed with milk	Diabetes
		Bark powder paste	Muscular pain
		Bark juice	Scabies
		Bark	Mouth sore
		Gargle of fresh stem juice	Toothache, angular stomatitis,
Oil	West Africa		Itch, herpes, as rubefacient

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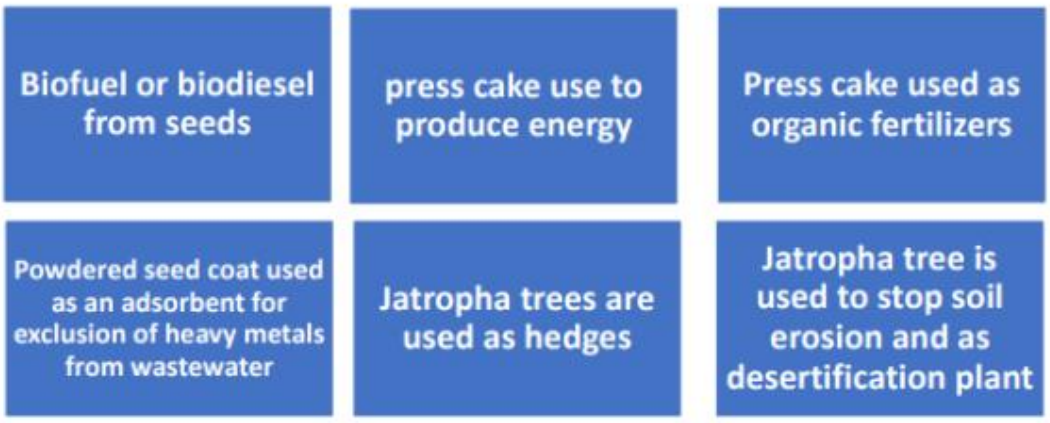
	India		Eczema, skin disease, rheumatism Leukoderma, sores and pimple Massage for arthritis, rheumatism, paralytic affections, leprosy
Fruit	India	Fruit powder	Constipation
	Nigeria	Fruit burnt into ashes and taken with oaoa	On fracture, swelling, headache Diabetes
	Benin	Fruit powder	Constipation
	Mali		Dysentery, stomach disorders, rheumatism Laxative

Due to its multiple artificial operations and remedial benefits, Jatrophacurcas, a protean, failure- resistant imperishable factory of the Euphorbiaceae family, is getting decreasingly economically important.J. curcas has long been allowed to be helpful in the treatment of a number of ails, and the factory is still used to treat a variety of affectionsin numerous countries.(28)



Biofuel

When jatropha seeds are crushed, the performing jatropha oil painting can be reused to produce a high- quality biofuel or biodiesel that can be used in a standard diesel auto or farther reused into spurt energy, while the residue(press cutlet) can also be used as Biofuel Jatropha colony in the dry center/ west of the Paraguay Chaco biomass feedstock to power electricity shops, or used as toxin(it contains nitrogen, phosphorus and potassium). The cutlet can also be used as feed in digesters and gasifiers to produce biogas.

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Jatropha plantation in the dry center/west of the Paraguay Chaco

"From planting to picking. Treat your jatropha plant as well as possible to make the yield as large as possible!"(A reference to the compulsory planting of jatropha in Indonesia for the production of oil as machinery lubricant and fuel for the Japanese WWII war effort.)

There are several forms of biofuel, frequently manufactured using sedimentation, centrifugation, and filtration. The fats and canvases are turned into esters while separating the glycerine. At the end of the process, the glycerin settles and the biofuel floats. The process through which the glycerin is separated from the biodiesel is known as trans esterification. Glycerin is another derivate from Jatropha oil painting processing that can add value to the crop. Trans esterification is a simple chemical response that neutralizes the free adipose acids present in any adipose substances in Jatropha. A chemical exchange takes place between the alkoxy groups of an ester emulsion by an alcohol, generally, methanol and

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ethanol are used for the purpose. The response occurs by the presence of a catalyst, generally sodium hydroxide(NaOH) or acidulous soda pop and potassium hydroxide(KOH), which forms adipose esters(e.g., methyl or ethyl esters), generally known as biodiesel. It takes roughly 10 of methyl alcohol by weight of the adipose substance to start the transesterification process.(29) Estimates of Jatropha seed yield vary extensively, due to a lack of exploration data, the inheritable diversity of the crop, the range of surroundings in which it's grown, and Jatropha's imperishable life cycle. Seed yields under civilization can range from 1,500 to 2,000 kilograms per hectare, corresponding to extractable oil painting yields of 540 to 680 litres per hectare(58 to 73 gallons per acre). In 2009 Time magazine cited the eventuality for as important as 1,600 gallons of diesel energy per acre per time. The factory may yield further than four times as important energy per hectare as soybean, and further than ten times that of sludge(sludge), but at the same time it requires five times as important water per unit of energy produced as does sludge(see below). A hectare of jatropha has been claimed to produce 1,892 litres of energy. still, as it has not yet been domesticated or bettered by factory breeders, yields are variable. Jatropha can also be intercropped with other cash crops similar as coffee, sugar, fruits and vegetables. In 2007 Goldman Sachs cited Jatrophacurcas as one of the stylish campaigners for unborn biodiesel product. still, despite its cornucopia and use as an oil painting and recovery factory, none of the Jatropha species has been duly domesticated and, as a result, its productivity is variable, and the long- term impact of its large-scale use on soil quality and the terrain is unknown.(30)

Use in developing world

Currently the oil from Jatrophacurcas seeds is used for making biodiesel fuel in Philippines, Pakistan and in Brazil, where it grows naturally and in plantations in the southeast, north, and northeast of Brazil. In the Gran Chaco of Paraguay, where a native variety (Jatrophamatacensis) also grows, studies have shown the suitability of Jatropha cultivation and agro producers are starting to consider planting in the region. In Africa, cultivation of jatropha is being promoted and it is grown successfully in countries such as Mali.

India

Jatropha oil is being promoted as an easily grown biofuel crop in hundreds of projects throughout India. Large plantings and nurseries have been undertaken in India by many research institutions, and by women's self-help groups who use a system of microcredit to ease poverty among semiliterate Indian women. The railway line between Mumbai and Delhi is planted with jatropha and the train itself runs on 15–20% biodiesel

Myanmar

Myanmar Myanmar is also actively pursuing the use of jatropha oil. On 15 December 2005, then-head of state, Senior General ThanShwe, said “the States and Divisions concerned are to put 50,000 acres (200 km²) under the physic nut plants [Jatropha] each within three years totalling 700,000 acres (2,800 km²) during the period”. On the occasion of Burma’s Peasant Day 2006, Than Shwe described in his a message that “For energy sector which is an essential role in transforming industrial agriculture system, the Government is encouraging for cultivation of physic nut plants nationwide and the technical know-how that can refine physic nuts to biodiesel has also identified.” He would like to urge peasants to cultivate physic nut plants on a commercial scale with major aims for emergence of industrial agriculture system, for fulfilling rural electricity supply and energy needs, for supporting rural areas development and import substitute economy. (2005 from MRTV) In 2006, the chief research officer at staterunMyanma Oil and Gas Enterprise said Burma hoped to completely replace the country's oil imports of 40,000 barrels a day with home-brewed, jatropha-derived biofuel. Other government officials declared Burma would soon start exporting jatropha oil. Despite the military's efforts, the jatropha campaign apparently has largely flopped in its goal of making Burma self-sufficient in fuel. (2006 from MyawaddyTV) Z.G.S. Bioenergy has started Jatropha Plantation Projects in Northern Shan State, the company has begun planting Jatropha plants during late June 2007 and will start producing seeds by 2010. (20 July 2007 from New Light of Myanmar)

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Food for human consumption

Xuta, chuta, aishte or piñónmanso (among others) are some of the names given in Mexico to edible non-toxic Jatrophacurcas. It is grown in house gardens or other small areas. Although it is known as a toxic plant due to the presence of diterpenes named phorbol esters, the existence of edible non-toxic J. curcas without phorbol esters content has been Food for human consumption demonstrated. It is also similarly reported that Jatropha seeds are edible once the embryo has been removed. The process for analysis of phorbol ester contents in J. curcas is done through high.performance liquid chromatography (HPLC).Xuta is traditionally prepared for local celebrations or popular parties. The kernels are roasted and eaten as a snack or roasted and ground to prepare different dishes, such as tamales, soups and sauces like "pipian".

[31][32]The seeds in the zone around Misantla, Veracruz are very appreciated by the population as food once they have been boiled and roasted. Root ashes are used as a salt substitute. HCN and rotenone are present.

Other uses

Anticancer activity

J. curcas is among the plants utilized for cancer therapies in Mexico [33]. J. curcas produces a lot of diterpenes, a secondary metabolite. These chemicals have been shown to be both cytotoxic and tumor inhibitors [34]. J. curcas leaf methanolic extract fraction demonstrated antimetastatic activity [56]. On an HT-29 cell line, extracts out of the leaf, root, and stem bark displayed cytotoxic action. Root extracts were more active than leaf and stem bark extracts, suggesting that they could be used to treat cancer [35]

Several articles have revealed anticancer activity of diterpenes extracted from the J. curcas plant. There have been reports of curcusone B having antimetastatic activity against cholangiocarcinoma cell line [36] and four human cancer cell lines [37], gastro-protective property out of jatropholone in mice [38], caniojane cytotoxicity in African green monkey kidney fibroblasts, antituberculosis actions on M. tuberculosis H37Ra,[39] and antiproliferative [40].

In vitro, however, jatrophalactam exhibited no substantial inhibitory impact against a cell line of human lung cancer, colon cancer, or epidermal squamous cell carcinoma, according to a study [41]. Jatrophalactone was found to have cytotoxic action in another investigation [42]. Proteins extracted from J. curcas have been investigated for decades for their anticancer properties [43]. Ribosome-Inactivating Proteins curcins were identified from the seeds. These proteins are thought to be cell-killing substances, as they can prevent the creation of cell-free proteins. Curcin was also found to exhibit anticancer properties in E. coli strain M15 [44]. In the cell-free translation system, protein production was stopped.

Tannins have been proven to have anticancer properties and can be utilized to prevent cancer, propsing that the plant could be an origin of essential bioactive chemicals for treating ang preventing cancer [45]. Curcin, a ribosome inactivating protein, could be a promising anticancer and immunosuppressive therapeutic candidate. Curcusone B, a compound derived from the root, exhibits antiproliferative properties and inhibits the proliferation of cancer cell lines [46].

Antiviral activity

In cultured human lymphoblastoid CEM-SS cells, a methanol extract from the plant was found to have a mild cycloprotective activity against HIV [47]. J. curcas branch preparations were investigated for their effects on HIV reverse transcriptase, HIV-induced cytopathic effects in cultured cells, and HIV-protease enzymes [48]. With minimal cytotoxicity and a high selectivity index, the plant's branch aqueous extract showed noteworthy suppression of HIV-induced cytopathic effects [49]. It was discovered that phorbol esters from the plant may be used to synthesize prostratin and DPP. Thiscompound promotes the characterization of excellent clinical candidates for HIV treatment [50]. J. curcas latex has an inhibiting effect on the Water Melon Mosaic Virus. Steroids' antiviral properties have been proven [51], hence steroidal substances found in J. curcas stem bark isolates are of great interest.

Antidiabeticactivity

Because of its long history of use in blood sugar management, a study found that a 50 percentethanolic extract from J. curcas leaves had antihyperglycemic benefits when given orally to alloxan-induced diabetic mice [52]. The extract had

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strong antihyperglycemic properties. The reduction was comparable to that seen in rats given conventional glibenclamide. Furthermore, the extract considerably decreased the rats' cholesterol and triglyceride levels.

Analgesic activity

With a writhing test induced by acetic acid, researchers found that methanolic extract from J. curcas leaves has analgesic efficacy in mice. When contrasted to the analgesic effect of the reference medicine paracetamol, the methanolic extract significantly lowered the amount of mice writhing [53]. A hot plate and acetic acid-induced writhing reflex in mice and a tail flick test in rats were used in another investigation in vivo to analyze the analgesic effects of the methanolic leaf extract from the plant. Oral therapy with the leaf extract and reference medicine acetylsalicylic had a considerable analgesic effect in mice and rats, increasing pain time dose dependently. Also, the extract reduced the amount of abdominal contortions [54]. When compared to the traditional treatments pentazocine and paracetamol, another study found that its stem and roots' alcoholic extract had a remarkable effect and reduced yeast-induced pyrexia [55].

Hepatoprotectiveactivity

In rats, methanolic fractions from its leaves were tested for their ability to prevent hepatocellular carcinoma caused by aflatoxin B1 when given orally [56]. The methanolic fractions lowered serum enzymes, lipid and bilirubin levels, but elevated uric acid and protein levels. It lowered the occurrence of aflatoxins-induced liver lesions, hepatic necrosis, and lymphocytic infiltrations, according to liver histopathology.

Wound healing activity

Many cultures throughout the world have documented the usage of various sections of J. curcas for wound healing [57,58-59]. In mice, the proteolytic enzyme Curcain produced from latex through alcohol and acetone precipitation, demonstrated to have wound healing action [60].

J. curcas extract was found to have cicatrizant action in mice [61]. In Wistar albino rats, the efficacy of crude bark extract was also examined. By enhancing the breaking strength of granulation tissue, wound constriction, skin breaking strength, dry granulation tissue weight, and hydroxyproline levels, the extract speeds up the healing process [62].

A herbal ointment with methanolic leaf extract was combined with 10g of basic ointment base to evaluate wound healing potential. Every three days, the wound was treated with ointment that was applied topically until it healed entirely. In a dose-dependent way, methanol preparation mixed in an ointment base promoted faster wound healing rates and shortened epithelialization duration compared to blank and gentamicin ointment (1%) [63].

Using an incision and excision wound model, researchers investigated wound healing activity of ointment with a white soft paraffin core and 5 and 10% (w/w) extract of J. curcas stem bark in albino rats [64]. In both wound models, the extract ointment's effect was significantly greater than the control group, indicating significant wound healing. All tensile strength, tissue repair, hydroxyproline content, and histological investigations demonstrated remarkable differences to the control.

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