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A review on Pharmacological and Phytochemical properties of Luffa echinata

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ABSTRACT

Background: Plants are the source of a variety of important secondary metabolites with pharmacological and pharmacognostic consequences that have the potential to become future "super medicines." The biotic and abiotic stressors have an impact on how these metabolites are produced in vivo, which causes a steady build-up of different phytochemicals. and their derivatives, which can help create and develop future medications. The current study's goal is to review the occurrence of potentially useful pharmacological and pharmacognostic secondary metabolites considering the possible uses of the understudied Ayurvedic medicinal plant species *Luffa echinata* inventing and creating pharmaceuticals for the future.

Main body of the abstract: *Luffa echinata*, a member of the Cucurbitaceae family, is a rich source of phytochemicals for therapeutic use, including Cucurbitacine B, Cucurbitacine E, Eletarin-2-glycoside, Beta-sterol glycoside, Chrysirol, Echinatin, Apigenin, Luteolin, Luteolin-7-glycoside, Datiscacin, Oleanolic acid. These substances all or some of which have
anti-cancer, antioxidant, antimicrobial, antibacterial, antiviral, analgesic, anti-inflammatory, antidepressant, anxiolytic, antiepileptic, hepatoprotective, antifungal, and antiulcer activity.

Short Conclusion: alkaloids, carbohydrates, proteins, glycosides, flavonoids, sterols, triterpenes, flavones, reducing sugars, and tannins. Potent bioactive compounds like CuB, eletarin (CuE), eletarin-2-glucoside, isocucurbitacin B, β-sitosterol, echinatol-A, and -B, chrysirol-7-glucoside, chrysirol-7-epiglucoside, echinatol A, echinatol B, echinatin have been reported from the fruits. Datiscacin (cucurbitin-20-acetate) found in *Luffa echinata* that have the potential to replace conventional drugs as therapeutic agents. Its uses may be attributed to important classes of phytochemicals present in it; a bitter compound known to have antitumor activity has been reported from *L. echinata*. Similarly, flavonoids (luteolin-7-glucoside and chrysoeriol-7-glucoside), triterpenes, fatty acids, and saponin (gypsogennin) have been also isolated from seeds. The present chapter gives a detailed review of *Luffa echinata* chiefly from its pharmacognostic, phytochemical, and utility perspective.

KEY WORD: Devadali, Cytotoxic, Cucurbitacine, Cucurbitaceae, TNBC, Pharmacological

Introduction:

The heritage of plant-based pharmacology and Pharmacognosy is closely related to the development of humankind. According to historical writings, the ancient civilisations used a significant number of plant-based medicines as basic sources of medication to treat different illnesses. Natural selection has created an alternative pharmacy of plants that can deal with human illnesses. The current pharmacopoeia offers accurate information about plant-based medications, plants that produce medications, and their pharmacological effects on the human body. The abundance of chemically diverse secondary metabolites present in plants is what gives them their pharmacognostic value. Different plant sections create these pharmacologically potent metabolites at various times of the plant's development.[1]

Medicinal practises used to treat human disease in India have good philosophical, experiential, and experimental foundations.[2] People in wealthy and developing nations alike rely on herbal medications due to growing side effects, expensive drug costs, a lack of effective root-cause treatments, and the emergence of new diseases.[3] More than 1.5 million practitioners use herbs or herbal formulations based on 25 000 medicinal purpose essential plants in India, which has 2.4 percent of the world's land and 8% of the world's biodiversity, to effectively manage and treat human disease..[4] Several medicines have entered the worldwide market as a result of research into ethanopharmacology and conventional medicine, despite the fact that many Indian botanicals have been the subject of scientific study.[5]

Curbitaceae, which has 800 species of medicinally significant plants and 130 diverse genera. [6,7] In addition to other pharmacological effects like anti-diabetic, anti-hyperlipidemic, and anti-cancer effects, only a few members of this plant family contain triterpenes with immunomodulatory, antiretroviral, and anti-HIV activities. Ribosomal inactivation proteins (such MAP30, Luffin A and B), which also have anti-retroviral and anti-HIV properties, are among these proteins. Of the eight species, three are native to India: Luffa echinata is a widely distributed climber herb that grows in India, Pakistan, Northern Tropical Africa, and Bangladesh. It has strongly bitter flavour and bifid bristly or smooth tendrils. It is primarily present in Gujarat, Bihar, Rajasthan, and Madhya Pradesh in India. In addition to being known as Bristly Luffa in English, Koshataki in Sanskrit, and Bindaal, Bidali, Kukurlata, and Ghagerbel in Hindi, it also goes by many other names. Fruit infusions are applied topically for putrid fever and given orally for biliary and intestinal colic. The plant's roots are used as a laxative, analgesic, and painkiller as well as a treatment for bronchitis, piles, jaundice, and vaginal discharge. In addition, the entire plant is employed as a emetic, anthelminitic, and stomachic, dropsidic, nephrotic, abortifacient and chronic bronchitis.[8-11] It has been observed that saponins extracted from L. echinata fruits had diuretic activity in dogs and rats and an antihypertensive impact in cats and dogs.[12] The plant's hydroalcoholic extract has been shown to have hypoglycemic effects in rats[13] and to increase pentobarbitone-induced hypnosis in mice.[14]

Fruit aqueous extracts are helpful in treating jaundice because they significantly reduce serum bilirubin levels in rats and human patients with chlorpromazine-induced jaundice.[15] Fruits have a considerable therapeutic effect against viral hepatitis, according to clinical investigations, while seeds have anthelmintic properties.[16] Therefore, an effort has been made to gather information on L. echinata from the perspectives of its pharmacological, and phytochemical.[17]

Taxonomic profile of *Luffa echinata*

One of the largest genera, *Luffa echinata* is a member of cucurbitaceae family and contains more than 800 species of herbs, shrubs, and small trees.[18] An annual or perennial herb with distinctive genotypic adaptability and physiological and morphological characteristics is *Luffa echinata* [19] Due to the existence of a wide range of chemical compounds that give it benefits for adaptation and survival, it may grow luxuriantly in a variety of environmental circumstances.[20]

Morpho-taxonomical status of *Luffa echinata*

Luffa echinata commonly known as a Devadali, Bindaal, Ghagarabela in India, is a perennial or annual woody herbaceous plant that grows alongside roads.[22] A shrub with smooth or puberulous bifid tendrils. Sulcate, sparsely hairy to glabrous stem. Reniform, suborbicular, obscurely or profoundly 5-lobed leaves with a border that is minutely denticulate and an apex that is often round or acute. Strong, puberulous, petiole up to 12 cm long. White, pedicellate flowers measure around 2.5 cm in diameter. On the male flowers, the calyx tube is about 5.6 mm long, hairy, and has lanceolate, pointed lobes. which occur in a 15 cm long raceme with 5 to 12 blooms. The petals are hairy at the base, oval, and 1–1.2 cm long. Anthers come in two forms: entire and bifid. They have three connected filaments that range in length from 3 to 9 mm and are obtuse at the base. oval ovary a 2–5 cm long, ashy, oblong or ovoid fruit that is densely covered in bristles that are 4–7 mm long. oblong, black, slightly verrucose, emarginate seeds that are 4-5 mm long, 3-5 mm wide, and 2 mm thick. [23] (Figure. 1)

Figure 1: *Luffa echinata*

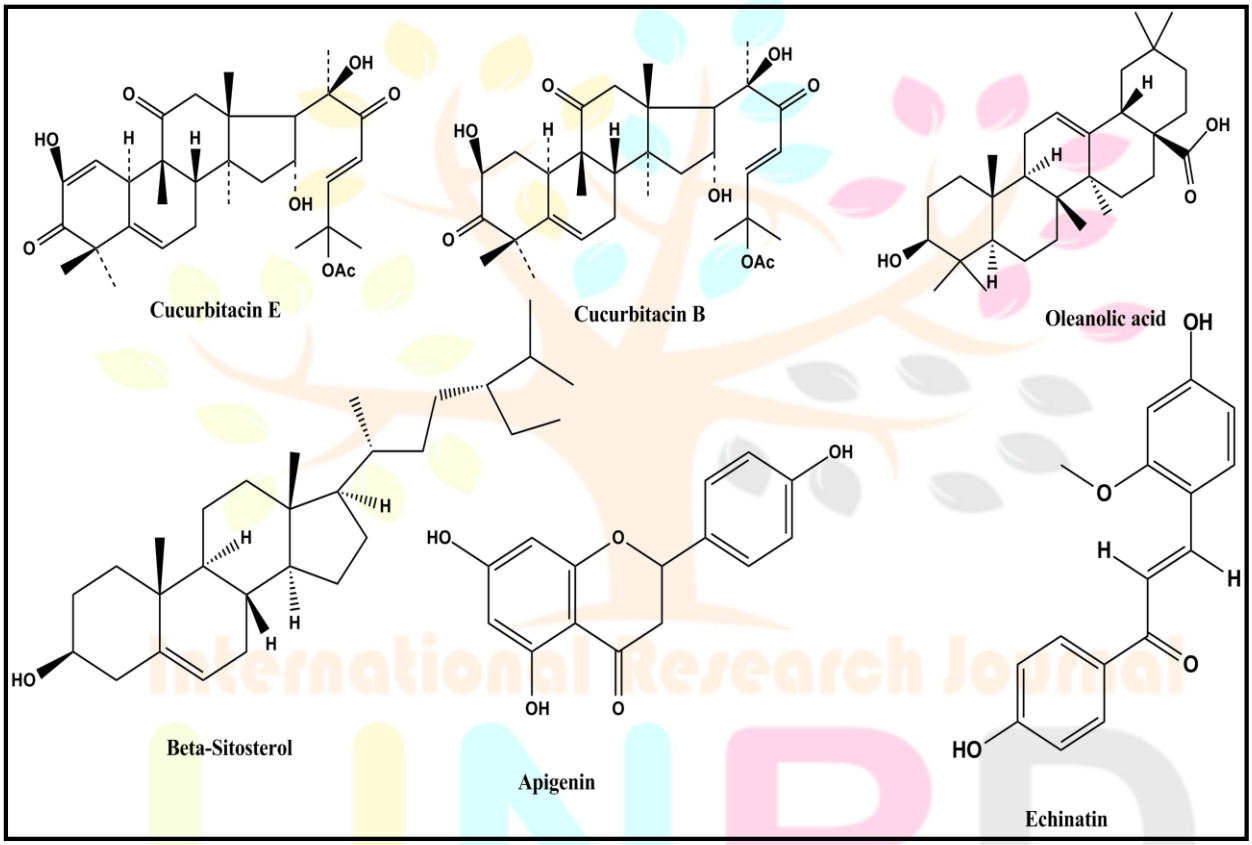
Phytochemistry of *Luffa echinata*

Luffa echinata is a fragrant medicinal herb distinguished by the presence of a variety of phytochemicals that make up the chemical profile of the plants, including Flavonoids, tannin, alkaloid, and terpenoids, carbohydrates, sterol, glycoside.[24]

The hydrolysis of graveobiosides-B results in the production of a number of compounds, including cucurbitacin-B, cucurbitacin-E (eletarin), isocucurbitacin-B, eletarin-2-glucosid, sitosterol glucoside, chysirol-

7-glucoside, chysirol-7-epiglucoside, echinatol A, echinatol B[25-27]. Along with 2-O-glucopyranosyl cucurbitacin B and S, Datiscacin (cucurbitacin-20-acetate), a bitter principal component with anticancer properties, has been isolated from the fruits of *Luffa echinata*. [28] *Two more flavonoids, luteolin-7-glycoside and chrysoeriol-7-glucoside, have been isolated from the leaves and flowers of Luffa echinata.* Rf values and colour characteristics have been compared to confirm the chemical structures of these compounds. [29]

The L. echinata seed was used to extract a potent diuretic saponin, and elemental analysis, molecular mass analysis, and infrared spectroscopy all validated the saponin's structure. [30] It includes the sapogenin form of gypsogennin along with a mixture of the sugars glucose, xylose, and rhamnose (3:2:1). Seeds also include cucurbitacin-B, triterpenes, fatty acids (25 percent saturated and 75 percent unsaturated), and saponins with oleanolic acid as sapogenin. (Table 1 and Figure 2) list the phytoconstituents that are present in different plant sections. [31, 32]



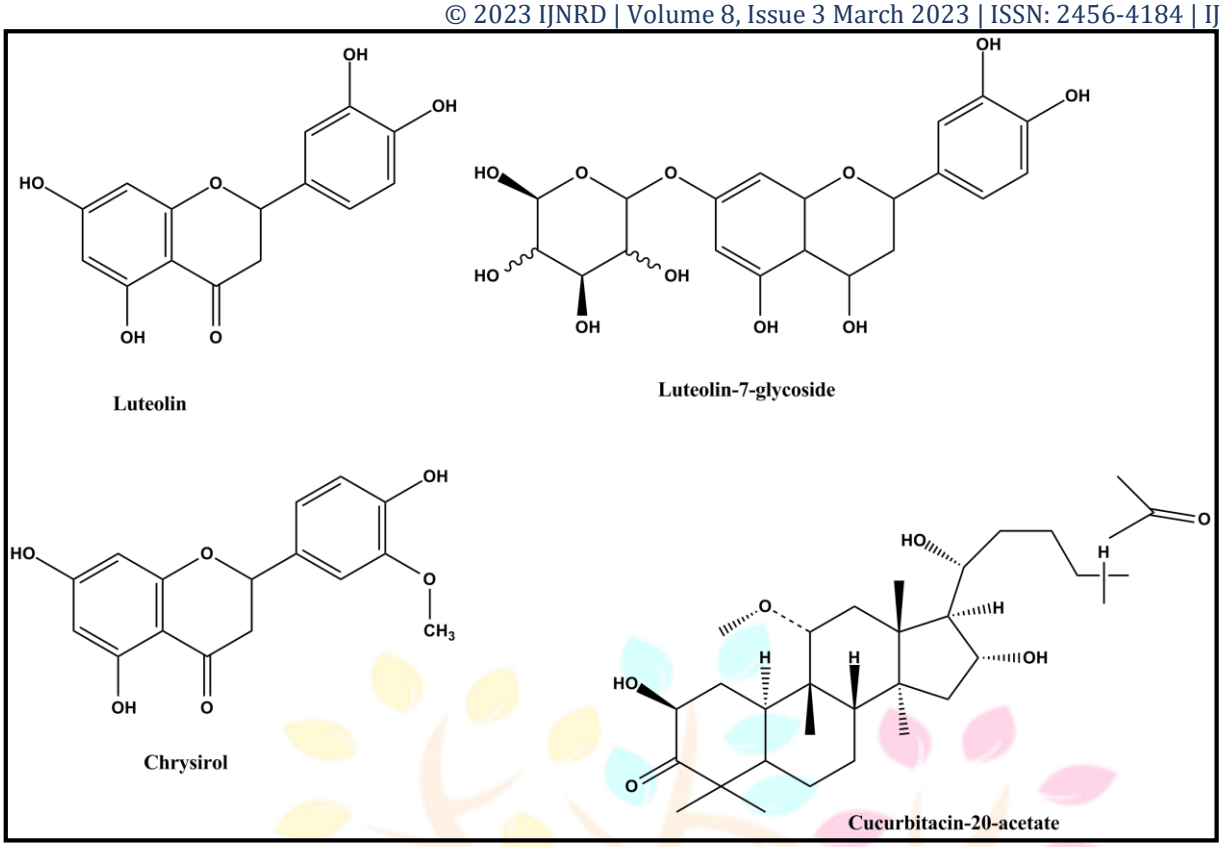


Figure 2: Chemical structure of phytoconstituent present in several *Luffa echinata* Regions.

Table 1 lists the chemical components of *Luffa echinata* in its different portions.

Parts of Plant	Chemical Constituents	References
Flowers	Luteolin-7-glycoside, Chrysirol-7-glycoside	[29]
Leaves	Luteolin-7-glycoside, Chrysirol-7-glycoside, Cucurbitacin B, Cucurbitacin E, Beta sitosterol, Luteolin, Apigenin	[29]
Fruits	Echinatin A, Echinatin B, Cucurbitacin B, Cucurbitacin S, Cucurbitacin-20-acetate	[31]
Seed	Cucurbitacin B, Cucurbitacin E, fatty acid, Oleanolic acid, Sapogenin	[32]

Pharmacological activity of *Luffa echinata*

Anti-cancer activity:

The in vitro anti-proliferative activity of L. echinata fruit methanolic extracts (50, 100, and 200 g/ m L) on human colon cancer cell (HT29). Using the MTT assay, cell viability was assessed at 6, 12, 24, 48, and 72 hours. A significant (P 0.05, IC: 80.6 g/ m L) dose- and time-dependent suppression of HT29 cell growth was seen with extract. According to one theory, by inducing apoptotic cell death, which resulted in cell arrest in the G2/S phase, the anti-proliferative impact was achieved. Additional factors included an increase in the ratio of apoptotic genes (Bcl-2 and Bax), the production of reactive oxygen species (65.85%), the loss of mitochondrial membrane integrity, and other factors. [33]

Anti-ulcer activity:

The ethanol extract of the purée aerial sections of Luffa echinata (200 and 400 mg/kg, p.o.) proved to considerably lower the risk of stomach ulcers produced by diclofenac sodium and pylorus ligation (P 0.001). Ranitidine (20 mg/kg) was used as the reference therapy. It was shown that the preservation was dose-dependent for both medications. [34]

Antidepressant, Anxiolytic, and antiepileptic activity

The antiepileptic, depressive, and anxiolytic effects of L. echianta fruit methanolic extract (200 mg/kg, p.o.) were evaluated. Using diazepam (2 mg/kg, p.o.) as a control, the behaviour model, open filed and elevated plus maze, was utilised to evaluate the effects of tranquillizers and antidepressants. The extract treatment considerably (P less than 0.05) increased the time spent in open arms while decreasing the frequency of square crosses and rearings (an indicator of antidepressant activity) compared to the control (anxiolytic activity). Antiepileptic activity was evaluated using the maximal electric shock model and phenytion (25 mg/kg, p.o.) as a control. Treatment with the extract considerably (P less than 0.05) reduced extension, stupor, and full recovery in comparison to the control. [35]

Anti-Inflammatory and analgesic activity

The various components of the Luffa echinata "Bindaal" plant have been historically and technically proven to be effective in treating liver problems, hepatitis, intoxication, and migraines as antioxidants, among other conditions. However, the seeds of this plant have not yet been thoroughly studied. The goal of the current study was to examine the potential of a methanolic extract of Luffa echinata seeds to fight free radicals, reduce inflammation, and provide pain relief (MELE). MELE's capacity to neutralise free radicals was assessed by DPPH (1,1-diphenyl-2-picrylhydrazyl method). In comparison to ascorbic acid, the extract demonstrated considerable (p0.05) dose-dependent scavenging of free radicals efficacy. By using the DPPH free radical scavenging method, it was discovered that MELE had a maximal free radical scavenging activity of 82.34% at a concentration of 150 g mL-1. Additionally, the qualitative effects of antioxidants were examined using 1,1-diphenyl-2-picrylhydrazyl. [36] By employing carrageenan-induced paw oedema in rats, the extract's anti-inflammatory properties were further examined. Using the tail immersion and hot plate procedures on mice, analgesic activity was assessed. The anti-inflammatory and analgesic effects of dosage levels of 50, 150, and 200 mg kg-1 were assessed. In comparison to the reference medication diclofenac sodium, the extract significantly reduced paw volume (60.57% reduction) and had analgesic effects at a dose level of 200 mg kg-1. The MELE may be helpful in the management of inflammation and pain as a source of antioxidants. [36]

Anti-oxidant activity

Recent years have seen a rise in interest in the role of free radicals in a variety of diseases, such as cancer, arteriosclerosis, and ageing, as well as how to prevent them by using antioxidants. [37] To determine the in-vitro antioxidant activity of crude plant extracts, many researchers have used DPPH scavenging activity as a quick

and reliable criteria. [38–39] While Luffa echinata has been shown to possess antioxidant characteristics in a number of in-vitro models, its trolox equivalent antioxidant capacity and oxygen radical absorption capacity lack confirmed evidence. The current study has looked at three in-vitro assays: the DPPH free radical scavenging assay for antioxidant capacities, the Trolox equivalent antioxidant capacity, and oxygen radical absorbance capacity. [40]

The AAPH is employed in the Oxygen Radical Absorbance Capacity (ORAC) experiment to diminish the fluorescence properties of fluorescein. Luffa eschinata RoxbORAC .'s value was discovered to be 253.7 moles/g. [41]

This test quantifies the millimolar trolox equivalents of the water-soluble tocopherol analogue trolox and compares it to the antioxidant content of the sample. Luffa eschinata has a TEAC value of 0.34 mmoles/g. [41]

A compound's capacity to serve as a donor for hydrogen atoms or electrons is assessed using spectrophotometry in the DPPH test. The main species responsible for lipid oxidation and serious biological harm are hydroxyl radicals. Inhibiting the process of lipid peroxidation appears to be closely related to the studied extracts' capacity to quench hydroxyl radicals. [42] Fruit from Luffa echinata was found to have an IC 50 value of 1880.87. [42]

Hepatoprotective activity

Several Luffa echinata Roxb. (Cucurbitaceae) fruit extracts were tested for their ability to protect albino rats' livers from the hepatotoxic effects of CCl(4). The level of protection was evaluated using biochemical markers such as serum Glutamic oxalacetic transaminase (SGOT), serum Glutamic pyruvate transaminase (SGPT), alkaline phosphatise (ALKP), total protein (TP), and total albumin (TA). The petroleum ether, acetone, and methanolic extracts had remarkable and comparable hepatoprotective properties to silymarin. [43]

Antifungal and Antibacterial activity

The antibacterial and antifungal properties of Luffa echinata fruits extract (dichloromethane:methanol; 1:1 v/v) against a range of microorganisms were evaluated using the agar dilution streak method with ciprofloxacin and amphotericin B as positive controls. At a dose of 500 g/mL, the extract totally inhibited Streptococcus faecalis, Bordetella bronchiseptica, and Streptococcus aureus. At a dose of 1000 g/mL, the extract entirely inhibited Micrococcus luteus, Staphylococcus aureus, and slightly inhibited Bacillus subtilis and Aspergillus niger. It had no impact on the growth of Staphylococcus epidermidis, Escherichia coli, Klebsiella pneumonia, pseudomonas aeruginosa, candida albicans, saccharomyces cerevisiae, or Aspergillus niger. [44]

Conclusion:

Despite being utilised for thousands of years in human healthcare, the idea that herbs are safe is false. For a variety of reasons, including poor cultivation and collection practises, a lack of quality assurance and control during manufacturing, a lack of procedures to study the safety of the drugs, and concurrent administration of the medication through multiple systems, many people experience negative or adverse effects from these medications. [45]

A growth in the use of herbal treatments calls for the development of credible scientific evidence of their effectiveness. [45] Thanks to developments in genomics and proteomics, a new gateway has been opened in therapeutics and drug discovery. Our understanding of human genomes and the scientific variances observed in persons has also enhanced as a result of this development. [46] The traditional Indian system of medicine can benefit in a number of ways from the thoughtful integration of modern science and medicine. [47] The development of basic research programmes must entail responsibilities such as providing for law, regulation, quality control, and safety regulation. [48] It is challenging to achieve the goal of becoming "a global leader in the herbal drug business" without taking all of these stages, even having access to gold mines of thoroughly studied and widely used traditional herbal remedies. On a variety of disorders, L. echinata appears to have a wide range of therapeutic effects. Various plant components have been studied for their antioxidant, anti-inflammatory, analgesic, depressive, antiepileptic, anxiolytic, hepatoprotective, antifungal, antibacterial, antiulcer, and anticancer properties. Numerous studies on phytochemicals have been published, however modern technology are still required to fully comprehend phytochemical analyses.

The availability of data on ethnomedicinal applications, active phytochemicals present and pharmacological viewpoints will aid in its scientific exploration as well as in establishing and validating the efficacy and use of this herbal medicine in the present context. Spreading climbing herb Luffa echinata has been used for centuries to treat a number of ailments Additionally, this plant has strong hepatoprotective properties and is used in commercial hepatoprotective formulations.

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Conflicts of interest:

No

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