

Pharmacological Review of “*Luffa acutangula* (L) Roxb

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ABSTRACT

Our ancestors looked for the drugs to rescue from diseases. Many synthetic drugs were discovered but they have fewer efficacies and may contradictions. Now a day's most of the herbal drugs were evolved with the great potentials. The fruit of one of such herb *Luffa acutangula* (L) roxb, belongs to family Cucurbitaceae is used as common vegetable. The fruits, seeds and plant extracts have been used as antidiabetic, hepato protective, antioxidant, antimicrobial, anticancer, antiulcer, CNS depressant etc. The intention of this article is to focus on variety of pharmacological uses of *Luffa acutangula*. The present review is based on the areas which are needed to have immediate attention for preparation of herbal drugs based on the pharmacological evidences.

Keywords: *Luffa acutangula*, Hepato-protective, Antidiabetic, Antioxidant, Antimicrobial, Antiulcer, CNS depressant.

INTRODUCTION

Plant plays an important role from ancient times where man used plant as drug to cure various diseases. About 2000 species of medicinal plants in India have high potential values unfortunately; very few of them were studied chemically and pharmacologically for their medicinal benefit. *Luffaacutangula* (L) Roxb called as ridge gourd, angled gourd or angled Luffa is one of the potential herbs found in Asia. India is considered as a centre of its origin

This is common fruit vegetable cultivated in India, China, Southeast Asia, Egypt, Japan and other parts of Africa. The various pharmacological activities includes antidiabetic activity [4, 5], antioxidant activity, hepato-protective activity [1], CNS depressant activity [3], anticancer [24, 25] etc. *Luffa acutangula* (LA) as a whole is the source of the secondary metabolites i.e. amino acids, carbohydrates, proteins, flavonoids, anthraquinones, terpenoids, tannins, and saponins [6]. Seeds of this plant shows presence of saturated and unsaturated fatty acids, linoleic, palmitic, stearic, oleic and traces of lignoceric acid while fruits contain cucurbitacin B, E and oleanolic acid [7]. Although many activities of *L. acutangula* were reported but its potential as a pharmacological aid has to be studied for more applications.

PHARMACOGNOSY

Scientific Classification

Kingdom: Plantae

Division: Magnoliophyta

Class : Magnoliopsida

Order : Cucurbitales

Family: Cucurbitaceae

Genus : *Luffa*

Species: *L. acutangula*

Other Indigenous Names:

Assamese: Zika.

Bengali : Jhinga, Ghoshalata, Titotorai, Titojhinga, Titodhunda.

Chinese : Ling Jiao Si Gua, You Lin Si Gua, Sze Gwa, Sigw, sin qua or sing kwa.

English: Angled loofah, Chinese okra, Dish-clothgourd, Ridge gourd, Ribbed loofah, Silk gourd, Silky gourd, Sinkwatowelsponge, Sinquamelon, Vegetable sponge.

Gujarati : Turiya.

Hindi : Jhimani, Karvitarui, antorai, Sankirah.

Japanese : itouri, tokadohechima.

Kannada : Heere, Kahire, Kahi, Naagadaaliballi.

Malayalam: Athanga.

Marathi : Divali, Kadudodaki, Kadudod-ka, Kadushirali, Kaduturai, Ranturai.

Odia : Janhi.

Punjabi : Jhinga, Shirola

Sanskrit : Gantali, Kosataki, Ksweda, Mridangaphalika, Sutikta.

Tamil : Itukari, Itukarikkoti, Kacappi, Kacappuppirkku, Kaccam, Karniti, Karnitikkoti, Katiyavisava, Kirutacittirar, Kirutavetanai, Peerkangai.

Telugu : Adavibeera, Chedubira, Chathibeera, Sendubirai, Verribeera

DESCRIPTION

Luffa acutangula is a climber.

Roots: Roots of LA plants are yellowish- Brown in colour, almost cylindrical in shape, having 8-12cm length and 0.7cm thickness. They are rough in touch because of longitudinal wrinkles and also showed new adventitious roots.

Stems: It is with 5 angled glabrous stem and 3-fid tendril.

Leaves : Leaves of LA are orbicular in outline with the length 15-20 cm long, palmately 5-7 angled or sublobate, scabrid. Veins and vein lets are prominent.

Fruits : The fruits of *LA* are obovate, pale yellowish brown in color with 4-10 cm long, 2-4cm broad and outer surface being covered with 8 -10 prominent longitudinal ribs. It is tapering towards the base and longitudinally ribbed. The fruits are divided into 3 chambers. The inner part is fibrous in nature and easily detachable as a whole from the outer part. Taste is bitter. Transverse section of fruit through a rib shows a single layer of papillose epidermis covered with thick striated cuticle, followed by 4-6 layers of parenchymatous cells.

Seeds : Seeds are black in colored with bitter taste and having ovoid- oblong shape. The length is generally 0.6-0.8cm with width of 0.5-0.6cm.

Distribution : *Luffa acutangula* cultivated throughout India as it is pan tropic.

Habit: Herb.

Propagation: Propagation of *L. acutangula* by seeds.

Native range: India and Naturalized throughout the moister Tropics.

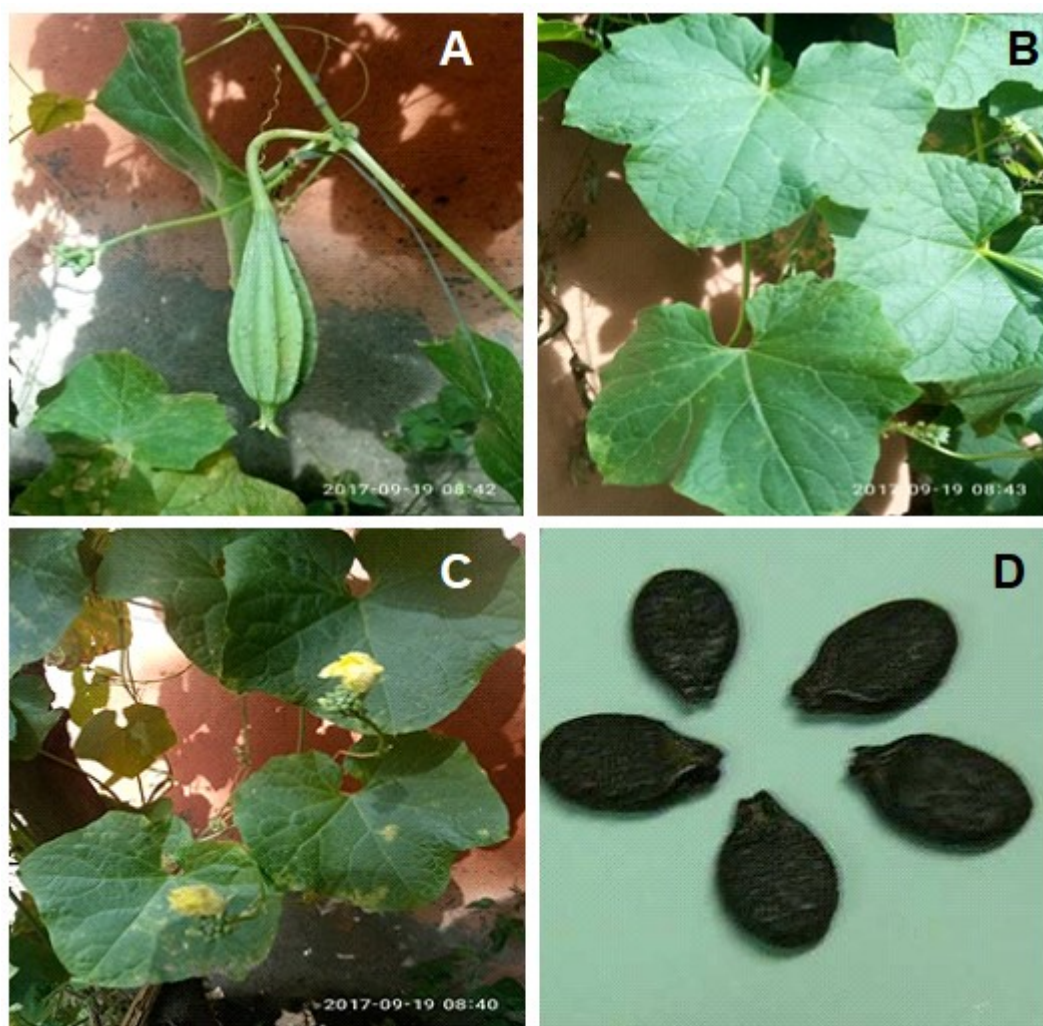


Fig. 1 A: Fruit of *Luffa acutangular* B: Leaves of *Luffa acutangular*
C: Flowers of *Luffa acutangular* D: Seeds of *Luffa acutangula*

Phytochemical Review

The quality controlled studies on fruit of *Luffa acutangula* shows that water has maximum extractive power as compared to other solvents such as hexane, ethanol, chloroform, ethyl acetate. The LA extracts when examined for the following test for purity e.g. acid insoluble ash, loss on drying water soluble and sulphated ash shows that sample is rich in drug having large polar compounds. Simple preliminary analysis reveals that these extracts contain carbohydrates, reducing sugars, alkaloids, saponins, steroids, glycosides, phenolic compounds, flavonoids, quinines, tannins and lignin's. The flavonoids and tannins are important in treating the cancers and heart related problems, so it is suggested that it is included in dietary supplement for such patients.

The XRF and FPM study indicates that the plant is good source of Ca, Mg, K and P. It also contains moderate concentration of Si and S. The entire elements play an important role in efficient and smooth biological functioning. LA hexane extract on GC-MS analysis indicate that it contain forty-five different class of compounds viz. Hexadecanoic acid ethyl ester, 9, 12, 15-octadecatrienoic acid, 3, 7, 11, 15-Tetramethyl - 2 - hexadecenl-ol, 9, 12 octadecanoic acid ethyl ester, Hentriacontane and Hexadecanoic acid methyl ester while GCMS of chloroform extract indicate that it contain 35 different compounds such as n-Hexadecanoic acid, Triacontane, Tetratriacontane, 9, 12, 15-octadecatrienoic acid methyl ester, (z, z, z), citronellyltiglate. Different spot under HPTLC at 366nm with different Rf values differentiate the drugs [8].

Nutritional Composition

The seeds and fruits of *Luffa acutangula* were studied for potential nutritional and oil characteristics. The fatty acid profile of seeds indicates that the glycerides of oleic and linoleic acid constitute 68% of the total kernel oil. The seeds were also found to be a good source of amino acids, phosphorous, iron and magnesium. The fruit is a major source of moisture, crude fiber, vitamin B, calcium, iron and magnesium [9].

Ethno pharmacology Review

The ethno pharmacological survey in Rajasthan, Katewa et al., (2008) collected the information on medicinal uses of plants. They found that half tea spoon of LA seeds powder plays an important role if given orally with water for 3-4 days for urinary bladder stone [10].

The tribal's of Western Madhya Pradesh of India uses this plant for the treatment of jaundice. They enlisted 13 plants as drug in common practice as herbal drug. Among these the extensively used herb was found to be LA. The LA commonly known as Kadwi Turai, and their leaves and fruits were used for treatment of jaundice. The 2-3 drops of leaf or green fruit juice without using water are administered into one of the nostrils for 4 successive days [11].

Kanaka et al, (2013), during their ethno botanical survey in Reserve Forests of Mahadevpur Karimnagar, AP they noticed that LA fruit were widely used by local inhabitants for treatment of Diabetes [12] also.

Pharmacological review on LA Hepato-protective activity

The aqueous ethanolic extract (Hydro alcoholic extract) of LA was tested for hepatoprotective activity by using silymarin as a standard reference drug for comparison. The Hepatoprotective action of this extract was due to the decreased levels of serum marker enzymes (AST, ALT, ALP and LDH) and increased total protein including the improvement in histo-architecture of liver cells of the treated groups as compared to the control group. LA extract showed marked decrease in malondialdehyde (MDA) formation, increased activity of non-enzymatic intracellular antioxidant, glutathione and enzymatic antioxidants,

catalase and superoxide dismutase. The result of this study indicates that hepatoprotective activity of hydro alcoholic extract of LA was due to contribution of endogenous antioxidants and inhibition of lipid peroxidation of membrane. Investigations were made to study hepatoprotective activity of saponin fraction of LA seeds in liver fibrocytic rat-induced with CCl₄ male Wistar rats were divided into six groups consisting of normal group, control group, comparator group and three test groups (given saponin fraction of *Luffa acutangula*). The study concluded that administration of saponin fraction at dose 10 mg/kg b.w twice a week, 20 mg/kg b.w twice a week and 20 mg/kg b.w once daily showed hepatoprotective activity and the highest effect was showed at a dose of 20 mg/kg b.w once daily. Thus, saponins present in LA extract plays an important role in prevention of oxidative hepatic damage. The reactive oxygen species is stabilized by the flavonoids and saponins which are present in the LA extract [1].

CNS depressant activity and cerebro-protective effects

The study of evaluation of protective effect of *Luffa acutangula* extract against bilateral carotid artery occlusion (BCAO) induced stroke in rats by Sathianarayanan. S (oct 2012) confirmed that ELA protects rats from ischemia induced brain injury. This protection was manifest from in-vivo behavioral tests. Petroleum ether extracts of Whole plant of *Luffa acutangula* produced cerebroprotective effects in global cerebral ischemia as evident from reduction in behavior pattern, hyper locomotion and neuronal damage [2].

The allied species of *Luffa echinate* Roxb has reported to possess CNS depressant activity and alkaloid isolated from it acts as important local anesthetic and antispasmodic action. On this basis A.V. Misar (2004) studied the CNS depressant activity of the ethanolic extract of LA fruit in mice. The extract shows the effect on behavioral changes, exploratory activity, and barbiturate sleeping time in mice. The extract exhibited dose-dependent CNS depressant activity [3].

Antibacterial and Antifungal Activity

It is found that LA fruit methanolic extract prevent the growth of *B. Subtilis*, *S. Aureus*, *P. aeruginosa* and *E.*

coli, but did not prevent the growth of *E. Aerogenes* and *S. Thyphi*. The other extracts of LA fruits which had the highest antibacterial activity were ethyl acetate extract followed by chloroform, butanol and hexane extracts. Chemical screening indicates that extract does not contain a class of alkaloid, saponin and terpenoid compounds except hexane extracts contained only terpenoid compounds. Antibacterial activity of ethyl acetate extract of LA fruits is less when it is compared with Ampicillin [13].

The comparative study of display aqueous fruit extract of LA shows more better antibacterial activity as compared to the leaf extract of LA. Among fungi *Curvularialunata* was found highly sensitive to leaf and fruit extract of LA while to same extract *Phomasorghina* showed poor sensitivity [14].

The silver nano-particles prepared using leaves extract of LA shows the antibacterial activity against the human pathogenic bacteria such as *Escherichia coli*, *Klebsiella pneumonia*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Salmonella paratyphi* and *Staphylococcus aureus*. The zone of inhibition was higher in *Klebsiella pneumonia* and zone of inhibition lower in *Staphylococcus aureus* [15].

Antidiabetic Activity

The antidiabetic activity of *Luffa acutangula* fruit extracts in streptozotocin induced NIDDM rats. The study reveals that both the methanolic extract (LAM) and aqueous extract (LAW) shows activity. The LAM extract was found to be superior to LAW extract in management of diabetes and its associated lipid imbalance. The methanolic extract shows the significant activity ($p < 0.01$) at a dose of 200 and 400 mg/kg. Both LAM and LAW appeared to be beneficial in treatment of type-II diabetes mellitus. The extracts act as inhibitors for suppressing postprandial hyperglycemia in the management of Type II diabetes [4].

Multicomponent formulation of herbal drugs for evaluation of antidiabetic activity was studied by Harpreet Singh (2014). The formulation of hydro-alcoholic extract of *Luffa acutangula* with *Madhuca longifolia* shows the antidiabetic activity. The formulation was design in solid dose form is used as

tablets. Significant ($p < 0.05$) reduction in fasting blood glucose levels were observed in the normal as well as in the treated diabetic animal. The activity was evaluated in alloxan monohydrate induced diabetic model [5].

Ameliorative Effect

The ethanolic extract suspended in the carboxy methyl cellulose called HAELA of *Luffa acutangula* shows ameliorative effect against doxorubicin induced cardiac and nephrotoxicity in mice. There is major decrease in certain enzymes such as serum biomarkers, lactate dehydrogenase, alanine amino transferase and creatinine phosphokinase in kidney and heart in doxorubicin treated mice. It also plays an important role in restoring the low levels of catalase, glutathione and superoxide dismutase in the tissues of kidney and heart. The HAELA plays an important role in membrane stabilization in doxorubicin induced cardiac and nephrotoxicity in mice [16].

Antioxidant Activity

Antioxidants are compounds which protect cells from the damage caused by unstable molecules known as free radicals. The antioxidant activity of methanolic extract and its derived fractions of LA fruit by β -carotene bleaching method. Statistical analysis shows that antioxidant activity decreases in the order: Residual aqueous fraction (LAA) > n-Butanol fraction (LAB) > Methanol Extract (LAM) > Ethyl acetate fraction (LAE) > Chloroform fraction (LAC) > n-Hexane fraction (LAH)

When all evaluated with β -carotene bleaching method. This study shows that the antioxidant activity is not totally related to the phenolic content but other fractions also i.e. presence of carotenoids in those fractions [17]. In Vitro antioxygenic activity of Ridge Gourd (*Luffa acutangula*) Pulp, Peel and their extracts on per-oxidation Models. LA peel powder and its extracts showed slightly higher antioxygenic activity than LA pulp powder and its extracts. This may be due to higher amounts of phenolics and flavonoids contain [18].

DPPH assay studied with the five different extracts of LA. The vegetable peel aqueous extract showed comparatively more radical scavenging activity (24.71

%) followed by ethanol (18.87), acetone (13.05), methanol (11.13) and ethyl acetate extracts (7.14) respectively. Aqueous extract was found to be a potent free radical scavenger with IC₅₀ value 0.05 µg mL⁻¹ followed by ethanol (0.07 µg mL⁻¹) in another study of DPPH radical-scavenging assay. The radical-scavenging activity LA fruit pericarp was estimated by comparing IC₅₀ of the extracts and those of ascorbic acid. The radical scavenging ability was found to be in descending order as: Ethanol extract>Ethyl acetate extract>Aqueous extract>Petroleum ether extract

The ethanolic extract of this plant shows the greater antioxidant activity than others but less than ascorbic acid [19]. The photochemical study of LA seeds shows that it contains carbohydrates, triterpenoid, flavonoids coumarin glycoside and phenolic compounds. Naresh sing gill and his colleague (2011) evaluated the antioxidant activity of ethanolic extract of seed of LA by DPPH and hydrogen peroxide method. The ethanolic extract at concentration 200 µg mL⁻¹ shows 75.33 ± 0.592 by DPPH model and 76.50 ± 0.281 by Hydrogen peroxide method as compared to ascorbic acid method. The reduction in free radical scavenging is measured by determination of their absorbance at 517 and 230 nm wavelengths. Antioxidant activity increases with increasing concentration of extract [20]. The oil extracted from seeds of LA by petroleum ether shows antioxidant activity by DPPH method. The radical scavenging activity was compared with the standard butylated hydroxytoluene (BHT) [21]. In another study carried out in Bangladesh by Israt Jahan Bulbul LA leaves extracts of solvent in n-hexane, chloroform, ethyl acetate shows greater antioxidant activity with the concentration range 50.95 µg mL⁻¹, 57.81 µg mL⁻¹, 51.77 µg mL⁻¹ as compared with the standard ascorbic acid concentration 43.22 µg mL⁻¹ by DPPH radical scavenging activity method [22]. Out of hexane, methanolic and aqueous extract of LA fruit, the methanolic extract shows higher antioxidant activity by DPPH model. Further partially purified methanolic extract antioxidant activity was evaluated in lipid per-oxidation, superoxide dismutase, catalase and glutathione in t-butyl hydro peroxide (t-BHP) treated-erythrocytes [23].

Anticancer Activity

Luffa acutangular have been reputed to possess an anticancer activity. In vitro anticancer effect of LA leaves extract in human lung cancer cell line (NCI-H460) was studied. The anticancer activity was compared with that of paclitaxel as positive control and the effect was assessed by MTT assay, mitochondrial membrane potential (MMP) alteration, intracellular reactive oxygen species (ROS) measurement and nuclear morphology with the appearance of apoptosis. This extract displays high anti proliferative activity against cell line tested, as determined with MTT assay. The concentrations of growth inhibition at 50% (IC₅₀) ranges from 1 to 50 µg/mL after 24 h treatment and the IC₅₀ was found to be 20 µg/mL for LA. Further study is needed to formulate natural compounds with anticancer activities [24]. Anticancer activity of ethanolic and aqueous extracts of *Luffa acutangular* was evaluated in Ehrlich Ascites Carcinoma (EAC) Swiss albino mice at the doses of 200 and 400 mg/kg body weight orally. Antitumor effect of both extracts was determined by evaluating tumor volume, viable and nonviable tumor cell count, tumor weight and hematological parameters of EAC bearing host. Ethanolic and aqueous extracts showed significant decrease in (p<0.0001) tumor volume, viable cell count, tumor weight and elevated the life span of EAC tumor bearing mice. The investigation of Blood reveals that red blood cell (RBC), hemoglobin, and white blood cell (WBC) count reverted to normal level in treated mice. The study manifest that the extract has potent dose dependent anticancer activity compare to cisplatin. Aqueous extract at 200mg/kg and 400 mg/kg dose and ethanolic extract at 400 mg/kg dose showed potent anticancer activity [25].

Analgesic Activity

The analgesic activity of *Luffa acutangular* was studied with the help of ethanolic extract on adult albino rats using tail flick method and tail immersion method. This extract showed significant activity with the reaction time of 6.25±0.52 in tail flick method and 5.80±0.50 in tail immersion method at the dose of 400 mg/ml as compared to pentazocin (standard). The analgesic activity is may be due to its free radicals scavenging activity and central modulation of pain by dopaminergic, noadrenergic and seratonergic systems [26].

Antiulcer Activity

The gastro protective effect of *Luffa acutangula* methanolic and aqueous extracts on gastric ulceration in NIDDM rats was studied by inducing type II diabetes with help of *Streptozotocin* (65mg/kg, i.p.) along with nicotinamide (120 mg/kg, i.p.) and gastric ulceration to diabetic rats was induced by aspirin. LA methanolic extract shows significantly ($P < 0.01$) increased mucosal glycoprotein and antioxidant enzyme level in gastric mucosa of diabetic rats than LA aqueous extract ($P < 0.05$). Methanolic extract of LA was found to be efficient in reversing delayed healing of gastric ulcer in diabetic rats close to the normal level. LA methanolic extracts exhibit both anti-hyperglycemic and mucosal defensive actions it is better in ulcer healing than glibenclamide and LA aqueous extract. This shows that methanolic extract of LA is a better alternative for treating gastric ulcers co-occurring with diabetes [27].

Cytotoxic and Anthelmintic activity

The LA plant methanolic and petroleum ether extract of aerial parts shows cytotoxic and anthelmintic activity. The activity was evaluated by Brine Shrimp lethality bioassay and anthelmintic activity by in-vitro test using earth worm *Pheretimaposthuma* (Annelida) as test animals. The methanolic and petroleum extract shows the moderate cytotoxic and anthelmintic activity [28].

CONCLUSION

The detailed pharmacological review it is reveals that the plant is a potential source of drugs that may be used as a dietary supplement in the treatment of liver related diseases. Apart from this, the plant has to be standardized for pharmacological applications. The most of the research work reported on fruits of LA and less on other plant parts such as roots, Leaves, flowers and seeds. LA has hepato-protective, CNS depressant, antibacterial, antifungal, antidiabetic, ameliorative effect, antioxidant, analgesic, antiulcer activity, anticancer, cytotoxic and anthelmintic activity. Thus, indicates the need of pharmacological evaluation with phytochemical correlation. It further reflects a hope for the development of bioactive

molecules that may be used as an alternative medicine for various diseases.

Conflicts of interest: The authors stated that no conflicts of interest.

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