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Review Article

**THE PHARMACOGNOSTIC, PHYTOCHEMICAL AND PHARMACOLOGICAL  
PROFILE OF *LUFFA ACUTANGULA***

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**ABSTRACT:**

Many nutraceuticals are not very popular but they are having great potential to produce certain pharmacological properties. Study of evidence based scientific reportings can become the foundation for further research keeping in view of the phytochemical constituents and their pharmacological responses. *Luffa acutangula* is one such plant which has not grabbed considerable attention. This article was designed with an intention to provide complete review of its pharmacognostic details, phytochemical constituents and pharmacological activities.

**KEYWORDS:** *Luffa acutangula*, Hepatoprotective activity.

**INTRODUCTION:**

*Luffa acutangula* (Family: Cucurbitaceae) is commonly known as Ridge gourd. It is a widely growing vegetative climber. The fruits are base ball club shaped. Various pharmacological activities include hepatoprotective activity<sup>1</sup>, antidiabetic activity<sup>2</sup>, antioxidant activity<sup>3</sup>, fungistatic property<sup>4</sup>, CNS depressant activity<sup>5</sup> etc. Its chemical constituents were found to be carbohydrates, carotene, fat, protein, phytin, aminoacids, alanine, arginine, cystine, glutamic acid, glycine, hydroxyproline, leucine, lectin, serine, tryptophan, pipercolic acid<sup>6-8</sup>. It has a good hepatoprotective potential and supports the claims made in folklore medicine. Though many activities of *L.acutangula* were reported, its potential as a pharmacological aid has to be still explored.

**ANCIENT LITERATURE:**

Ancient literature revealed that the plant is significantly used as abortifacient and antifungal agent.<sup>9</sup>

**PHARMACOGNOSY:**

**Taxonomical classification:**

Kingdom : Plantae  
Division : Magnoliophyta  
Class : Magnoliopsida  
Order : Cucurbitales  
Family : Cucurbitaceae  
Genus : Luffa  
Species : *acutangula*

**Othernames:**

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

**Hindi:** Jhimani, Karvitarui, Karvituri, Sankirah, Rantorai.

**Punjabi:** Jhinga,Shirola.

**English:** Ridge gourd, Angled loofah, Chinese okra, Dish-clothgourd, Ribbed loofah, Silk gourd, Silky gourd, Sinkwa towelsponge, Siqua melon, Vegetable sponge.

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

**Kannada:** Kahire, Kahi Heere, Naaga daali balli.

**Malayalam:** Athanga.

**Marathi:** Divali, Kadudodaki, Kadushirali, Kadaturai, Ranturai, Kadudod-ka, Dadudodaka.

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

**Telugu:** Adavibira, Chedubira, Sendubirai, Verribira, Adivibeera, Verri beera, Chedu beera, Adavi beera, Chathi beera.

**DESCRIPTION:**

*Luffa acutangula* is a large monoious climber. It has 5 angled glabrous stem and 3-fid tendril. Leaves of this plant are orbicular, pale green in colour 15-20 cm across and palmately 5-7 angled or lobed. Veins and veinlets are prominent.



**Figure:1** Leaves of *L.acutangula*



**Figure:2** *L.acutangula* fruit & seed

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

**Distribution:** *Luffa acutangula* is pantropical and cultivated throughout India.

**Habit:** Herb.

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

**Native range:** India and naturalised tropic and subtropics.

**Cultivation:** *Luffa acutangula* can grow in all type of soils and can be grown in summer or in rainy season. Seeds can accordingly be sown either in february-march or june-july.

**Table No-1: Macroscopy of *luffa acutangula*<sup>24</sup>**

S.no	PART OF THE PLANT	LENGTH	THICKNESS	COLOUR	SHAPE
1	<b>Root</b>	8-12 cm	0.5-0.7 cm	Yellowish brown	Cylindrical.
2	<b>Stem</b>	-	0.2-0.4 cm	Brownish yellow	Angular.
3	<b>Leaf:</b> Petiole Lamina	3-8 cm 6-9 cm	- 6-9 cm	Brownish yellow Light green	Angular, wrinkled. Curled, corrugated.
4	<b>Flower:</b> Male flower Female flower	1.3 cm -	- -	Light greenish yellow Yellow	- -
5	<b>Fruit</b>	9-12 cm	2-4 cm	Pale yellowish brown	Cylindrical / Club
6	<b>Seed</b>	0.6-0.8 cm	0.5-0.6 cm	Black	Ovoid / Oblong

**Table No-2: Microscopy of *Luffa acutangula*<sup>24</sup>**

S.no	PART OF THE PLANT	CELL CONSTITUENTS
1	Root	Outer cork cells, secondary cortex containing disintegrated and few lignified cells, lignified stone cells, secondary phloem, secondary xylem tissues containing ray cells, simple pitted xylem vessel, oval starch grains, distinct hilum in secondary cortex.
2	Stem	Single layer epidermis covered by cuticle, cortex containing collenchymal and few lignified cells, ground tissue made of parenchyma containing open, bicollateral, conjoint, endarch vascular bundles, secondary phloem and secondary xylem, bordered pitted xylem vessel, starch grains, distinct hilum.
3	Leaf: Petole Lamina	Single layer epidermis covered by thick cuticle, parenchymatous secondary tissue, ground tissue containing bicollateral vascular bundles.  Single layered epidermis on both surfaces, mesophyll differentiated into palisade and spongy parenchyma, vascular bundles are bicollateral, stomata are anomocytic.
4	Fruit	Epicarp covered by thick cuticle is made up of single layered papillose epidermis, parenchymatous cells, stone cells, parenchymatous mesocarp having bicollateral vascular bundles.
5	Seed	Single layer of thick-walled sclerenchymatous testa ,tegmen made up of polygonal parenchymatous cells, endosperm made up of parenchymatous cells.

### Standards:

Studies conducted on identity, purity and strength of *Luffa acutangula* revealed that it contains<sup>24</sup>

- Total ash content not more than 16%,
- Foreign matter not more than 2%,
- Acid-insoluble ash not more than 4%,
- Water soluble extract not more than 13%
- Alcohol soluble extract not more than 6%.

## PHYTOCHEMICAL CONSTITUENTS:

Chemical constituents of *Luffa acutangula* mainly include carbohydrates, carotene<sup>19</sup>, fat, protein, phytin, aminoacids, alanine, arginine, cystine, glutamicacid, glycine, hydroxyproline, leucine, serine, tryptophan, pipercolic acid<sup>8</sup>, flavonoids<sup>20</sup>, saponins<sup>21</sup>. The fruit contains an amorphous bitter principle, luffeine. The seeds contain a fixed oil which consists of the glycerides of palmitic, stearic, and myristic acids.<sup>22</sup>

Lectin specific for chito-oligosaccharides was isolated from *Luffa acutangula* and has been purified to homogeneity by affinity chromatography and its macromolecular properties and combining affinity with different sugars was studied. The studies revealed that lectin has a molecular weight of 48,000 and stokes radius of 2.9 nm. When sodium dodecyl sulfate-polyacrylamide gel electrophoresis was performed, only single band corresponding to molecular weight of 24,000 was observed both in the presence as well as absence of 2-mercaptoethanol. The subunits in this dimeric lectin are therefore held by non-covalent interactions alone. The lectin is not a glycoprotein and circular dichroism spectral studies indicate that this lectin has 31%  $\alpha$ -helix and no  $\beta$ -sheet. The lectin is found to bind specifically to chito oligosaccharides and the affinity of the lectin increases with increasing oligosaccharide chain length as monitored by near ultra-violet circular dichroism and intrinsic fluorescence titration. The thermodynamic data revealed that binding site in lectin accommodates a tetrasaccharide and the values of  $\Delta G$ ,  $\Delta H$  and  $\Delta S$  for the binding process showed a pronounced dependence on the size of the oligosaccharide.<sup>7</sup>

A chito oligosaccharide specific lectin (*Luffa acutangula* agglutinin) has been purified from the exudate of ridge gourd fruits by affinity chromatography on soybean agglutinin glycopeptides coupled to Sepharose-6B. The affinity purified lectin was found homogeneous by polyacrylamide gel electrophoresis. Based on the thermodynamic data, blue shifts and fluorescence enhancement, spatial orientation of chito oligosaccharides in the combining site of the lectin were studied.<sup>10</sup> Luffangulin, a novel ribosome inactivating peptide with an N-terminal sequence, was isolated from seeds of *Luffa acutangula*. The 5.6 kDa-peptide designated luffangulin inhibited cell-free translation with an  $IC_{50}$  of 3.5 nM but lacked inhibitory activity toward HIV-1 reverse transcriptase.<sup>12</sup>

A bitter principle, Cucurbitacin B, an acid sapogenin, oleanolic acid were isolated from the seeds of *Luffa acutangula*.<sup>15</sup>

The study of nutritional and oil characteristics of the *Luffa acutangula* seeds showed that it has Iodine value, saponification value and acid value as 99.5, 190.8 and 10.5 respectively. The maximum melting and freezing points were found to be -3°C and -10°C respectively.<sup>14</sup>

**Table No-3: Phytochemical constituents in each part of *Luffa acutangula***<sup>17</sup>

S.no	Fruit	Seed	Cotyledons	Callus
1	Moisture (94.71%).	Fatty oil (28.5%).	Total lipids (21.6%).	Total lipids (2.6%).
2	Protein (1.077%).	Lauric acid (1.78%).	Unsaturated fatty acids (68.63%).	Unsaturated fatty acids (28.80%).
3	Alanine (0.313%).	Myristic acid (9.84%).	Saturated fatty acids (31.37%).	Saturated fatty acids (71.20%).
4	Arginine (0.114%).	Palmitic acid (23.09%).	Lauric acid.	Lauric acid (4.54%).
5	Aspartic acid (3.383%).	Stearic acid (24.2%).	Myristic acid.	Myristic acid (6.94%).
6	Glycine (0.457%).	Oleic acid (1.48%).	Palmitic acid (21.23%).	Palmitic acid (53.61%).
7	Glutamic acid (1.0%).	Linoleic acid (33.56%).	Stearic acid (10.14%).	Stearic acid (6.11%).
8	Histidine (0.203%).	Trypsin inhibitors.	Oleic acid (28.42%).	Oleic acid (3.33%).
9	Isoleucine (0.295%).	-	Linoleic acid (40.21%).	Linoleic acid (8.43%).
10	Leucine (0.709%).	-	Linolenic acid.	Linolenic acid (17.04%).
11	Lysine (0.159%).	-	-	-
12	Phenylalanine (0.315%).	-	-	-
13	Proline (0.349%).	-	-	-
14	Serine (0.856%).	-	-	-
15	Threonine (0.419%).	-	-	-
16	Tyrosine (0.181%).	-	-	-
17	Valine (0.524%).	-	-	-

## **NUTRITIONAL COMPOSITION:**

The seeds of *Luffa acutangula* were studied for potential nutritional and oil characteristics. The fatty acid profile 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 certain amino acids, phosphorous, iron and magnesium.<sup>14</sup>

## **ETHANOMEDICAL PROPERTIES:**

The ethano medico botanical survey of the hilly areas in Maharashtra revealed that fruits of *Luffa acutangula* are used to protect from jaundice when taken in the form of very fine powder through nose.<sup>19</sup>

## **PHARMACOLOGICAL STUDIES:**

### **Hepatoprotective activity:**

Hydroalcoholic extract of *Luffa acutangula* (HAELA) was tested for hepatoprotective activity. Standard drug used was silymarin. HAELA showed significant hepatoprotection against CCl<sub>4</sub> and rifampicin induced hepatotoxicity in rats. Hepatoprotective action of HAELA was due to the decreased levels of serum marker enzymes (AST, ALT, ALP and LDH) and increased total protein including the improvement in histoarchitecture of liver cells of the treated groups as compared to the control group. HAELA also showed significant decrease in malondialdehyde (MDA) formation, increased activity of non-enzymatic intracellular antioxidant, glutathione and enzymatic antioxidants, catalase and superoxide dismutase. Results of this study demonstrated that endogenous antioxidants and inhibition of lipid peroxidation of membrane contribute to hepatoprotective activity of hydroalcoholic extract of *L.acutangula*.<sup>1</sup>

Investigations were made for hepatoprotective activity of saponin fraction of *Luffa acutangula* seeds in liver fibrocytic rat-induced with CCl<sub>4</sub> 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 bw twice a week, 20 mg/kg bw twice a week and 20 mg/kg bw once daily showed hepatoprotective activity and the highest effect was shown at a dose of 20 mg/kg bw once daily.

### **Developmental toxicity:**

The tea made from *Luffa acutangula* fruits was used to study abortive action in eleven pregnant wistar female rats. On the 15<sup>th</sup> gestational day, six rats are dosed with 10ml/kg of *L.acutangula* tea(50g of dried fruit in 100ml of water) and the other five rats were dosed with saline solution. On the 25<sup>th</sup> gestational day, all the rats were submitted to cesarean section. The study concluded saying the ingestion of *L.acutangula* during pregnancy may promote developmental toxicity.<sup>23</sup>

The ethanolic extract of *L.acutangula* was found to exhibit promising abortifacient activity in female rats. The drug in a dose of 400 mg/kg/day orally fed for 2 days exhibited expulsion of foetus in mid term pregnant rabbits.<sup>16</sup>

### **Antidiabetic activity:**

A comparative study of leaves of *Grewia asiatica*, fruits of *Luffa acutangula* and bark of *Bombax ceiba* has been conducted for screening of anti-diabetic activity. Ether, chloroform, ethanol and aqueous extracts (200 mg/kg b.w.) of leaves of *Grewia asiatica*, fruits of *Luffa acutangula* and bark of *Bombax ceiba* were screened. Among all extracts, chloroform and alcoholic extracts of fruits of *Luffa acutangula* has reported more significant ( $p<0.01$ ) reduction in blood glucose level in alloxan induced diabetic Wistar rats compared to control and glibenclamide (10 mg/kg b.w.).<sup>2</sup>

### **Antiproliferative and antiangiogenic effects:**

The fruit of *Luffa acutangula* (*cucurbitaceae* family) as a potential anticancer agent was studied by examining its antiproliferative and antiangiogenic activities. Fruit methanolic extract showed significant antiproliferative activity (IC 50,  $131.63\pm 2.31$   $\mu\text{g/ml}$ ) on human lung adenocarcinoma epithelial cell line (A-549). Vascular endothelial growth factor(VEGF), Matrix metallo proteinases-2 (MMP-2) and Matrix metalloproteinases-2 (MMP-9) protein expressions were significantly inhibited in F2-3 treated A-549 cells compared to control cells (VEGF:  $4.36\pm 0.47$  and  $14\pm 0.75$   $\text{pg/ml}$ , MMP-2:  $10.17\pm 1.3$  and  $20.28\pm 1.68$ , MMP-9:  $12.93\pm 1.70$  and  $21.12\pm 2.12$

ng/ml, respectively). In conclusion, data provided a scientific proof for *Luffa acutangula* as a potential antitumor agent.<sup>11</sup>

#### **Antioxidant activity/Free radical scavenging activity:**

A comparative study of *Citrullus colocynthis*, *Clitoria ternata*, *Luffa acutangula* and *Madhuca indica* was made for free radical scavenging activity. The IC 50 value of *L.acutangula* was determined and was found to be 0.33µg/mg.<sup>3</sup>

A comparative study of extracts of vegetables traditionally consumed like angular loofah(*Luffa acutangula*), charungli(*Caralluma edulis*), okra(*Abelmoschus esculentus*), bitter melon(*Momordica charantia*) was made for free radical scavenging activity(antioxidant property). These extracts were prepared both by cold maceration and also by boiling the plant in the solvent under reflux. Extracts from angular loofah (*Luffa acutangula*) showed a significant difference in the antioxidant activity between the extract obtained by using cold maceration and that prepared by boiling the plant in the solvent under reflux, suggesting the chemical composition of the plant changed during the heating process, leading to an increase in the amount of antioxidant components.<sup>13</sup>

#### **CNS depressant activity:**

Ethanolic extract of *Luffa acutangula* fruits were studied for effect on behavioral changes, exploratory activity, barbiturate sleeping time in mice. The extract exhibited dose-dependent CNS depressant activity.<sup>5</sup>

#### **Fungistatic property:**

Extract from the seeds of *Luffa acutangula* produced 12% inhibition of spore germination of *Cephalosporium sacchari*.<sup>4</sup>

**Other properties:** The seeds of *Luffa acutangula* contain a saponin which cause haemolysis and also possess digitalis like action. In the indigenous system of medicine the pounded leaves are applied locally in splenitis, haemorrhoids and leprosy. It also contains cucurbitacin compounds which have got significant anti-neoplastic properties.<sup>15</sup> Studies on *Luffa acutangula* shows that it posses larvicidal activity.<sup>18</sup>

The oil obtained from the seeds of *L.acutangula* can be used both as an edible oil and also for soap-making.The plant is also used as an emetic. The juice of heated ridge gourd is good for diabetes.<sup>17</sup>

**Table:4**

S. no	Pharmacology	Plant part	Extract	Dose	Model	p value	Author
1	Hepatoprotective activity <sup>1</sup>	Fruit	Hydroalcoholic extract of fruit	200 mg/kg	Rat(CCl <sub>4</sub> & Rifampicin induced liver toxicity)	<0.01	Vishal etal (2010)
2	Antioxidant activity <sup>3</sup>	Aerial parts	Ethanol extract	500 µg/ml		-	Neha etal (2010)
3	Anti diabetic activity <sup>2</sup>	Fruit	Chloroform and alcoholic extracts	200 mg/kg b.w.	Healthy adult Wistar Rats.	<0.01	Priyanka etal (2010)
4	CNS Depressant activity <sup>5</sup>	Fruit	Ethanol extract	5-10 mg/kg b.w.	Swiss mice	<0.05	Misar etal (2004)
5	Developmental toxicity <sup>23</sup>	Fruit	Tea extract	10 ml/kg	Rat	<0.05	Fernandes etal (2010)
6	Antiproliferative and antiangiogenic activity <sup>11</sup>	Fruit	Methanolic extract	131.63 µg/ml	Human lung adenocarcinoma epithelial cell line	-	Mohan etal (2010)

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