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Review

Pharmacology and phytochemistry of *Coccinia indica*

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Coccinia indica **(Bimba, kanduri, Cucurbitaceae) is famous for its hypoglycemic and antidiabetic properties in Ayurvedic system of medicine. Other applications include the therapy of various conditions such as skin diseases and gonorrhoea. The present review highlights the phytochemistry and pharmacology of *Coccinia indica*. There are many patented formulations derived from *C. indica* which are now distributed increasingly all over the world. This has given rise to a concomitant increase in research on the phytochemical constituents and biological activity of *C. indica*.**

Key words: *Coccinia indica,* hypoglycemic, antidiabetic, saponins, terpenoids, sterol.

INTRODUCTION

Indian system of traditional knowledge that is, ayurveda is well known for its effective herbal treatments. There are about 7000 plant species are found in India. Although most of them have a long history in folk medicine, there is lack of written data on their efficacy and safety, esp. from human studies. Many of them are used to treat highly prevalent disorder diabetes mellitus (Mankil et al., 2006). Few of this common examples includes *Allium cepa, Allium satium, Aloe vera, Coccinia indica, Caesalpinia bonducella, Eugenia jambolana, Mucuna pruriens, Murraya koeingii, Mormodica charantia, Swertia chirata, Syzigium cumini, Tinospora cordifolia* and *Trigonella foenum- graecum.* The present review highlights the phytochemistry and pharmacology of one of popular antidiabetic and hypoglycemic plant *C. indica*.

C. indica (Synonym: *Coccinia grandis, Coccinia cordifolia)* family Cucurbitaceae commonly called little gourd or Rantondli in Marathi, Bimba in Sanskrit and Kandutikibel in Hindi. It is indigenous to Bengal and other parts of India. *C. indica* grows abundantly all over India, Tropical Africa, Australia, Fiji and throughout the oriental countries. The plant has also been used extensively in Ayurvedic and Unani practice in the Indian subcontinent (Wealth of India, 1992). It has long tuberous fleshy roots, smooth and green fruits. Microscopy of root shows parenchyma, phelloderm, pericyclic fibers, stone cells, starch grains. TS of leaves show upper and lower epidermis, ranunculaceae stomata, uniseriate multicellular trichomes.

PHARMACOLOGICAL REVIEW

Fresh juice of roots is used to treat diabetes; tincture of leaves is used to treat gonorrhea, paste of leaves is applied to the skin diseases. Dried bark is a good cathartic. Leaves and stem are antispasmodic and expectorant. The fleshy green fruit is very bitter. Green fruit is chewed to cure sores on the tongue [Gupta and Variyar, 1964; Khan et al., 1980; Chandrasekar et al., 1989; Shibib et al.,1993; Platel et al., 1997).

Table 1 clears that this plant is exhaustively studied for its hypoglycemic, antidiabetic potential with different animal models from 1953 (Shakya, 2008; Venkateswaran et al., 2003; Venkateswaran and Pari, 2003; Yeh et al., 2003; Wasantwisut and Viriyapanich, 2003; Ajay et al., 2009; Mallick et al., 2009; Nahar et al., 1998). Indigenous people use various parts of the plant to get relief from diabetes mellitus. *C. indica* leaves showed that it depressed the activity of the enzyme glucose-6-phosphatase and possesses an antioxidant activity, which may be attributed to its protective action on lipid peroxidation and to the enhancing effect on cellular antioxidant defence contributing to the protection against oxidative damage in streptozotocin diabetes. Hypolipidemic activity was also studied but that was also in diabetic rats. Many clinical trial studies has also proven effectiveness and safety of this plant parts and derived

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Table 1. Pharmacological review of plant *C. indica.*

S/No.	Activity	Model	Plant part	Remark
1	Antidiabetic activity (Hossain et al., 1992)	Alloxan diabetic albino rats	95% ethanolic extracts	Found to be active.
2	Antidiabetic activity (Shakya, 2008).	Streptozotocin included diabetic rats	n-hexane extract	Found to be active.
3	Antidiabetic activity with testicular disorders (Mallick et al., 2007).	Streptozotocin Induced Diabetic Rat For Testicular Dysfunctions	Formulation Of Musa paradisiacal, *Tamarindus indica, Eugenia jambolana* and *Coccinia indica*	Found to be active.
4	Antidiabetic activity (Pari and Venkateswaran, 2003)	Normal and streptozotocin (STZ) diabetic rats	Leaves	Evaluated for effect on blood glucose, plasma insulin, cholesterol, triglycerides, free fatty acids, and phospholipids and fatty acid compound of total lipids in liver, kidney and brain.
5	Antidiabetic activity (Mukerji, 1953)	Alloxan diabetes in rabbits	Roots	Found to be active.
6	Antidiabetic activity (Kamble et al., 1998).	Normal and Streptozotocin-induced male diabetic rats	Leaves	Lowered blood glucose by depressing its synthesis, on the one hand though depression of the key gluconeogenic enzymes glucose-6-phosphatase and fructose-1,6- biphosphatase and on the other by enhancing glucose oxidation by the shunt pathway through activation of its principal enzymes G6PDH.
7	Hypoglycemic activity (Gupta, 1963)	Normal rats	Pectin isolated from the fruit	Glycogen synthetase activity was highly significant significant redn. in phosphorylase activity.
8	Hypoglycemic activity (Brahmachari and Augusti, 1963)		Water soluble Alkaloid fraction	Found to be active.
9	MOA of hypoglycemic activity (Kumar et al., 1993).	Glucose tolerance test	Alcoholic extarct of *Coccinia indica* (100 mg/kg.),	May be due to indirect stimulation of insulin secretion or to retardation of glucose absorption. Use of these drugs may prevent deterioration of pancreatic lesion in 8diabetics.
10	Hypoglycemic activity (Mukherjee et al., 1972).	Rabbits	Alcoholic and aqueous extract of root powder	Found to be active.
11	Clinical trial in type 2 diabetic patients (Azad et al., 1979).	Double- blind, placebo-controlled, randomized trial	Alcoholic extract of the herb	Have potential hypoglycemic action in patients with mild diadetes

Table 1. Contd.

12	Clinical trial in diabetic patients (Kuriyan et al., 2008).		Dried extract of whole plant	Ingredients present in the extract act like insulin, correcting the elevated enzymes G-6-P (ase), LDH in glycolytic pathway and restore the LPL activity in lypolytic pathway with the control of hyperglycemia in diabetes.
13	Antidiabetic activity (Singh et al., 1985)	Dog	Dried extract of whole plant	Found to be active.
14	Antioxidant activity (Venkateswaran and Pari, 2003).	Streptozotocin-diabetic rats	Ethanolic extract of leaves	Found to be active.
15	Anti-inflammatory activity (Rao et al., 2004)	Carrageenin and histamine induced paw edema	fruit juice powder	Found to be active.
16	Antinociceptive activity (Rao et al., 2004).	Writhing induced by acetic acid in mice	Fruit juice powder	Found to be active.
17	Post- and pre- treatment anti-inflammatory activity (Niazi et al., 2009).	Carrageenan-induced paw oedema method	Aqueous extract of fresh leaves	Found to be active.
18	Analgesic activity (Niazi et al., 2009).	Tail flick model in rats	Aqueous extract of fresh leaves	Found to be active.
19	Antipyretic activity (Niazi et al., 2009).	Yeast- induced hyperpyrexia in rats	Aqueous extract of fresh leaves	Found to be active.
20	Larvicidal activity (Rahuman and Venkatesan, 2008).	Early fourth instar larvae of *Aedes aegypti* L. and *Culex quinquefasciatus* (say) (Diptera: Culicidae).	Hexane, ethyl acetate, petroleum ether, acetone and methanol extracts of the leaf *Citrullus colocynthis, Coccinia indica, Cucumis sativus, Momordica charantia,* and *Trichosanthes anguina*,	Found to be active.
21	Hypolipidemic activity (Kumar et al., 1997).	Streptozotocin-diabetic rats	Ethanolic extract of leaves.	Found to be active.
22	Hepatoprotective activity (Rao et al., 2003)	CCl_4 induced hepatotoxicity in rats	Ethanolic extract of fruits	Found to be active.
23	Antituberculosis activity (Mukerji and Gupta, 1958).	Experimental tuberculosis in Guinea pigs	Extract of fruit	No effect found.

Table 2. Phytochemical review of plant *C. indica.*

Plant part	Constituent reported
Roots (Vaishnav et al., 2001; Vaishnav and Gupta, 1996; Vaishnav and Gupta, 1995; Khastgir et al.,1958; Sucrow and Reimerdes, 1968)	Triterpenoid, saponin coccinioside – k(i). $C_{41}H_{66}O_{12}$ Flavonoid glycoside ombuin 3-o- arabinofuranoside 3- o- β- (α-l- arabinopyranosyl)-(1→2) –β-d-glucopyranosyl- (1→3)- β- hydroxylup – 20(29)- en-28- oic acid. Lupeol, β-amyrin, and β- sitosterol. Stigmast -7- en-3-one,
Fruits (Kundu and Ray,1987; Basu and Ghosh, 1972; Bhakuni et al., 1962)	Taraxerone, taraxerol, and (24R)-24- ethylcholest- 5- en- 3β- ol glucoside. B- carotene, lycopene, cryptoxanthin, and apo- 6'- lycopenal B- sitosterol and taraxerol
Aerial parts (Qudrat-i-Khuda et al., 1965; Dhargalkar and Guha,1959)	Heptacosane Cephalandrol, $C_{29}H_{58}O$ tritriacontane $C_{33}H_{68}$ B- sitosterol alkaloids Cephalandrine a and Cephalandrine b.
Whole plant (Rahman et al., 1990)	Aspartic acid, Glutamic Acid, Asparagine, Tyrosine, Histidine, Phenylalanine And Threonine Valine Arginine

Figure 1. *C. indica* fruits.

Figure 2. *C. indica* leaves.

formulations for antidiabetic effect. Anti-inflammatory, analgesic and antipyretic activity of fruit and leaves were studied and found to be significant.

PHYTOCHEMICAL REVIEW

Plant contains saponins, flavonoids, sterols and alkaloids which are summarized in Table 2.

Saponin and flavonoid are found to be responsible for antidiabetic activity (Figures 1 and 2).

CONCLUSION

C. indica is a famous plant for its safe antidiabetic property. It proved the insulin stimulatory effect of C *indica* leaves from existing b-cells in diabeticrats. It possesses hypoglycemic, antidiabetic, hypolipidemic, hepatoprotective, larvvicidal, anti-inflammatory, analgesic and antipyretic activities. It is found to be devoid of antituberculosis properties. Various phytoconstituents reported in *C. indica* are cephalandrol, tritriacontane, lupeol, b-sitosterol, cephalandrine A, cephalandrine B, stigma-7-en-3-one, taraxerone and taraxerol. Terpenoids are found to be responsible for antidiabetic activity. Despite the broad use of *C. indica* in traditional medicine, very few systematic pharmacological and phytochemical studies are reported till date assessing its therapeutic properties.

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