

Pharmacophore

(An International Research Journal)

Available online at <http://www.pharmacophorejournal.com>

Review Article

PHARMACOLOGY AND PHYTOCHEMISTRY OF *COCCINIA INDICA*

U.A. Deokate*, S.S. Khadabadi

Govt. College of Pharmacy, Kathora Naka,
Amravati-444604 (M.S.), India

ABSTRACT

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 *Coccinia indica* 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 *Coccinia indica*.

Keywords: *Coccinia indica*, Hypoglycemic, Antidiabetic, Saponin

INTRODUCTION

Indian system of traditional knowledge i.e. Ayurvedic 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.¹ Few of common examples includes *Allium cepa*, *Allium sativum*, *Aloe vera*, *Coccinia indica*, *Caesalpinia bonducella*, *Eugenia jambolana*, *Mucuna pruriens*, *Murraya koeingii*, *Mormodica charantia*, *Swertia chirata*, *Syzygium cumini*, *Tinospora cordifolia*, and *Trigonella foenum-graecum*. The present review highlights the phytochemistry and pharmacology of one of popular antidiabetic and hypoglycemic plant *Coccinia indica*. *Coccinia 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.² 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. Fresh juice of roots is used to treat diabetes; tincture of leaves is used to treat gonorrhoea, 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.³⁻⁷

Literature review (Table 2) clears that this plant is exhaustively studied for its hypoglycemic, antidiabetic potential with different animal models from 1953.⁸⁻¹⁶ 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 formulations for antidiabetic effect. Anti-inflammatory, analgesic and antipyretic activity of fruit and leaves were studied and found to be significant. Plant contains saponins, flavonoids, sterols and alkaloids which are summarized in Table 1. Saponin and flavonoid are found to be responsible for antidiabetic activity.

Table 1: Phytochemical review of plant *Coccinia indica*

Plant part	Constituent reported
Roots ³⁷⁻⁴¹	Triterpenoid, saponin coccinioside – k(i). C ₄₁ H ₆₆ O ₁₂
	Flavonoid glycoside ombuin 3-o- arabinofuranoside
	3- o- β- (α-1- 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 ⁴²⁻⁴⁵	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 ⁴⁶⁻⁴⁸	Heptacosane
	Cephalandrol, C ₂₉ H ₅₈ O tritriacontane C ₃₃ H ₆₈
	B- sitosterol alkaloids Cephalandrine a and Cephalandrine b.
Whole plant ⁴⁹	Aspartic acid, Glutamic Acid, Asparagine, Tyrosine, Histidine, Phenylalanine And Threonine Valine Arginine



Image 1: *Coccinia indica* fruits



Image 2: *Coccinia indica* leaves

Table 2: Pharmacological review of plant *Coccinia indica*

Sr.No.	Activity	Model	Plant Part	Remark
1	Antidiabetic activity ¹⁷	Alloxan diabetic albino rats	95% ethanolic extracts	Found to be active.
2	Antidiabetic activity ¹⁸	Streptozotocin included diabetic rats	n-hexane extract	Found to be active.
3	Antidiabetic activity with testicular disorders ¹⁹	Streptozotocin Induced Diabetic Rat For Testicular Dysfunctions	Formulation Of Musa paradisiacal, <i>Tamarindus indica</i> , <i>Eugenia jambolana</i> and <i>Coccinia indica</i>	Found to be active.
4	Antidiabetic activity ²⁰	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 compn. Of total lipids in liver, kidney and brain of
5	Antidiabetic activity ²¹	Alloxan diabetes in rabbits	Roots	Found to be active.
6	Antidiabetic activity ²²	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 ²³	Normal rats	Pectin isolated from the fruit	Glycogen synthetase activity was highly significant significant redn. in phosphorylase activity
8	Hypoglycemic activity ²⁴		Water soluble Alkaloid fraction	Found to be active.
9	MOA of hypoglycemic activity ²⁵	Glucose tolerance test	Alcoholic extaret of <i>Coccinia indica</i> (100mg/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 ²⁶	Rabbits	Alcoholic and aqueous extract of root powder	Found to be active.

11	Clinical trial in type 2 diabetic patients ²⁷	Double- blind, placebo- controlled, randomized trial	Alcoholic extract of the herb	have potential hypoglycemic action in patients with mild diabetes
12	Clinical trial in diabetic patients ²⁸		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 lipolytic pathway with the control of hyperglycemia in diabetes
13	Antidiabetic activity [29]	Dog	Dried extract of Whole plant	Found to be active.
14	Antioxidant activity ³⁰	Streptozotocin- diabetic rats	Ethanollic extract of leaves	Found to be active.
15	Anti-inflammatory activity ³¹	Carrageenin and histamine induced paw edema	fruit juice powder	Found to be active.
16	Antinociceptive activity ³¹	Writhing induced by acetic acid in mice	fruit juice powder	Found to be active.
17	Post- and pre- treatment anti-inflammatory activity ³²	Carrageenan- induced paw oedema method	Aqueous extract of fresh leaves	Found to be active.
18	Analgesic activity ³²	Tail flick model in rats	Aqueous extract of fresh leaves	Found to be active.
19	Antipyretic activity ³²	Yeast- induced hyperpyrexia in rats	Aqueous extract of fresh leaves	Found to be active.
20	Larvicidal activity ³³	Early fourth instar larvae of <i>Aedes aegypti</i> L. and <i>Culex quinquefasciatus</i> (say) (Diptera: Culicidae).	hexane, ethyl acetate, petroleum ether, acetone and methanol extracts of the leaf <i>Citrullus colocynthis</i> , <i>Coccinia indica</i> , <i>Cucumis sativus</i> , <i>Momordica charantia</i> , and <i>Trichosanthes anguina</i> ,	Found to be active.
21	Hypolipidemic activity ³⁴	Streptozotocin- diabetic rats	Ethanollic extract of leaves.	Found to be active.
22	Hepatoprotective activity ³⁵	CCL4 induced hepatotoxicity in rats	Ethanollic extract of fruits	Found to be active.
23	Antituberculosis activity ³⁶	Experimental tuberculosis in Guinea pigs	Extract of fruit	No effect found

CONCLUSION

Coccinia indica is famous plant for its safe antidiabetic property. It is proved the insulin stimulatory effect of *C. indica* leaves from existing β -cells in diabetic rats. It possesses hypoglycemic, antidiabetic, hypolipidemic, hepatoprotective, larvicidal, Anti-inflammatory, analgesic and antipyretic activities. It is found to devoid of antituberculosis properties. Various phytoconstituents reported in *C. indica* are cephalandrol, tritriacontane, lupeol, β -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.

REFERENCES

1. Mankil, Jung; Moonsoo, Park; Hyun, Chul Lee; Yoon-Ho, Kang; Eun Seok, Kang; and Sang, Ki Kim (2006), "Antidiabetic Agents from Medicinal Plants", *Current Medicinal Chemistry*, (13), 1203-1218.
2. (1992), "*Wealth of India*", A dictionary of Indian raw materials and industrial products. Raw material, New Delhi, Vol 4, 312.
3. Gupta, SS and Variyar, MC (1964), "Experimental studies on pituitary diabetes. Iv. Effect of *Gymnema sylvestre* and *Coccinia indica* against the hyperglycaemic response of somatotropin and corticotropin hormones", *The Indian journal of medical research*, (52), 200-7.
4. Khan, AK; AKhtar, S and Mahtab, H (1980), "Treatment of diabetes mellitus with *Coccinia indica*", *British medical journal*, 280(6220), 1044.
5. Chandrasekar, B; Mukherjee, B and Mukherjee, SK (1989), "Blood sugar lowering potentiality of selected Cucurbitaceae plants of Indian origin", *The Indian journal of medical research*, 90, 300-5.
6. Shibib, BA; Khan, LA and Rahman, R (1993), "Hypoglycaemic activity of *Coccinia indica* and *Momordica charantia* in diabetic rats: depression of the hepatic gluconeogenic enzymes glucose-6-phosphatase and fructose-1,6-bisphosphatase and elevation of both liver and red-cell shunt enzyme glucose-6-phosphate dehydrogenase", *The Biochemical journal*, 292 (1), 267-70.
7. Platel, Kalpana and Srinivasan, K (1997), "Nahrung Plant foods in the management of diabetes mellitus. Vegetables as potential hypoglycemic agents", 41(2), 68-74.
8. Shakya, VK (2008), "Antidiabetic activity of *Coccinia indica* in streptozotocin induced diabetic rats", *Asian Journal of Chemistry*, 20(8), 6479-6482.
9. Venkateswaran, Subramanian; Pari, Leelavinothan; Suguna, Lonchin; Chandrakasan, Gowri (2003), "Modulatory effect of *coccinia indica* on aortic collagen in streptozotocin-induced diabetic rats", *Clinical and Experimental Pharmacology and Physiology*, 30(3), 157-163.
10. Venkateswaran, S and Pari, L (1992), (2003), "Effect of *Coccinia indica* leaf extract on plasma antioxidants in streptozotocin- induced experimental diabetes in rats", *Phytotherapy research*, 17(6), 605-8.
11. Yeh, Gloria Y; Eisenberg, David M; Kaptchuk, Ted J and Phillips, Russell S (2003), "Systematic review of herbs and dietary supplements for glycemic control in diabetes", *Diabetes Care*, 26(4), 1277-1294.
12. Wasantwisut, Emorn and Viriyapanich, Thara (2003), "Ivy gourd (*Coccinia grandis* Voigt, *Coccinia cordifolia*, *Coccinia indica*) in human nutrition and traditional applications", *World review of nutrition and dietetics* (91), 60-6.
13. Das, Kuntal; Dang, Raman; Bhaskaran, Shyamala and Roopashree (2008), "Recent advances in medicinal plants in diabetes treatment", *Recent Progress in Medicinal Plants*, (19), 151-191.

14. Ajay, SS; Bhaskar, VH; Teotia, Deepak (2009), "Quality standardization of *Coccinia indica* fruit", *Asian Journal of Chemistry*, 21(7), 5351-5354.
15. Mallick, Chhanda; De, Debasis; Ghosh, Debidas (2009), "Correction of protein metabolic disorders by composite extract of *Musa paradisiaca* and *Coccinia indica* in streptozotocin-induced diabetic albino rat: an approach through the pancreas", *Pancreas*, 38(3), 322-9.
16. Nahar, Nilufar; Mosihuzzaman, M; Khan, Md and Shahinul, Haque (1998), "Determination of free sugars in plant materials having antidiabetic activity", *Dhaka University Journal of Science*, 46(1), 167-170.
17. Hossain, MZ; Shibib, BA and Rahman, R (1992), "Hypoglycemic effects of *Coccinia indica*: inhibition of key gluconeogenic enzyme, glucose-6-phosphatase", *Indian journal of experimental biology*, 30(5), 418-20.
18. Shakya, VK (2008), "Antidiabetic activity of *Coccinia indica* in streptozotocin induced diabetic rats", *Asian Journal of Chemistry*, 20(8), 6479-6482.
19. Mallick, Chhanda; Mandal, Suvra; Barik, Bikashranjan; Bhattacharya, Atanu and Ghosh, Debidas (2007), "Protection of testicular dysfunctions by MTEC, a formulated herbal drug, in streptozotocin induced diabetic rat", *Biological & Pharmaceutical Bulletin* 30(1), 84-90.
20. Pari, L and Venkateswaran, S (2003), "Protective effect of *Coccinia indica* on changes in the fatty acid composition in streptozotocin induced diabetic rats", *Pharmazie*, 58(6), 409-412.
21. Mukerji, B (1953), "Effect of *Coccinia indica* on alloxan diabetes in rabbits", *Indian Journal of Medical Sciences*, (7), 665-72.
22. Kamble, SM; Kamlakar, PL; Vaidya, S and Bambole, VD (1998), "Influence of *Coccinia indica* on certain enzymes in glycolytic and lipolytic pathway in human diabetes", *Indian journal of medical sciences*, 52(4), 143-6.
23. Gupta, SS (1963), "Pituitary diabetes III. Effect of indigenous antidiabetic drugs against the acute hyperglycemic response of anterior pituitary extract in glucose fed albino rats", *Indian j of medical research*, 51(4), 716-24.
24. Brahmachari, HD and Augusti, KT (1963), "Orally effective hypoglycemic principles from *Coccinia indica*", *Journal of Pharmacy and Pharmacology*, 15(6), 411-12.
25. Kumar, G Presanna; Sudheesh, S and Vijayalakshmi, NR (1993), "Hypoglycemic effect of *Coccinia indica*: mechanism of action", *Planta Medica*, 59(4), 330-2.
26. Mukherjee, Kaveri; Ghosh, NC and Datta, Tapan (1972), "*Coccinia indica* as a potential hypoglycemic agent", *Indian Journal of Experimental Biology*, 10(5), 347-9.
27. Azad, Khan AK; Akhtar, S and Mahtab, H (1979), "*Coccinia indica* in the treatment of patients with diabetes mellitus", *Bangladesh Medical Research Council bulletin*, 5(2), 60-6.
28. Kuriyan, Rebecca; Rajendran, Ramaswamy; Bantwal, Ganapathi; Kurpad, Anura V (2008), "Effect of supplementation of *Coccinia cordifolia* extract on newly detected diabetic patients", *Diabetes care*, 31(2), 216-20.
29. Singh, N; Singh, SP; Vrat, S; Misra, N; Dixit, K and Kohli, RP (1985), "A study on the anti-diabetic activity of *Coccinia indica* in dogs", *Indian journal of medical sciences*, 39(2), 27-9.
30. Venkateswaran, S and Pari, L (2003), "Effect of *Coccinia indica* leaves on antioxidant status in streptozotocin-induced diabetic rats", *Journal of ethnopharmacology*, 84(2-3), 163-8.
31. Rao, GM, Rao, V; Sudhakara, M; Pandey, MM; Rawat, AKS; Sirwaikar, A and Joshi, AB (2004), "Anti-inflammatory and antinociceptive activities of *Coccinia indica* W. & A. fruit juice powder in animals", *Natural Product Sciences*, 10(1), 20-23.
32. Niazi, Junaid; Singh, Parabhdeep; Bansal, Yogita and Goel, RK (2009), "Anti-inflammatory, analgesic and antipyretic activity of aqueous extract of fresh leaves of *Coccinia indica*", *Inflammopharmacology*, 17(4), 239-44.

33. Rahuman, A Abdul and Venkatesan, P (2008), "Larvicidal efficacy of five cucurbitaceous plant leaf extracts against mosquito species", *Parasitology research*, 103(1), 133-9.
34. Kumar, G Presanna; Sudheesh, S; Ushakumari, B; Valsa, AK; Vijayakumar, S; Sandhya, C and Vijayalakshmi, NR (1997), "A comparative study on the hypolipidemic activity of eleven different pectins", *Journal of Food Science and Technology*, 34(2), 103-107.
35. Rao, GM Mohana; Vijayakumar, M; Rao, Ch V; Rawat, AKS and Mehrotra, S (2003), "Hepatoprotective effect of coccinia indica against CCl₄ induced hepatotoxicity", *Natural Product Sciences*, 9(1), 13-17.
36. Mukerji, B and Gupta, SK (1958), "Indigenous drugs in experimental tuberculosis", *Chemotherapy, Proc. Symposium Lucknow*, 90-101.
37. Vaishnav, MM; Jain, Praveen; Jogi, SR and Gupta, KR (2001), "Coccinioside-K, triterpenoid saponin from *Coccinia indica*", *Oriental Journal of Chemistry*, 17(3), 465-468.
38. Vaishnav, MM and Gupta, KR (1996), "Ombuin 3-O-arabinofuranoside from *Coccinia indica*", *Fitoterapia*, 67(1), 80.
39. Vaishnav, MM and Gupta, KR (1995), "A new saponin from *Coccinia indica* roots", *Fitoterapia*, 66(6), 546-7.
40. Khastgir, Hari N; Choudhuri, Sailendra; N, Gupta and Pasupati, Sen (1958), "Roots of *Coccinia indica*", *Journal of the Indian Chemical Society*, 35, 905-6.
41. Sucrow, Wolfgang and Reimerdes, Anna (1968), "7-Sterols from Cucurbitaceae", *Biologie*, 23(1), 42-5.
42. Kundu, Sujata and Ray, AB (1987), "Chemical examination of *Coccinia indica* fruits", *Journal of the Indian Chemical Society*, 64(12), 776-7.
43. Barua, AB and Goswami (1979), "Carotenoids of *Cephalandra indica*", *Current Science*, 48(14), 630-2.
44. Basu, K and Ghosh, BK (1972), "Chemical investigation of *Coccinia indica*", *Transactions of the Bose Research Institute (Calcutta)*, 35(2), 43-4.
45. Bhakuni, DS; Srivastava, SN; Sharma, VN and Kaul, KN (1962), "Chemical examination of the fruits of *Coccinia indica*", *Journal of Scientific and Industrial Research, Section B: Physical Sciences*, 21B, 237-8.
46. Khaleque, A; Miah and MA, Wahed (1968), "Chemical investigations on *Cephalandra indica*. II. Constituents of dry aerial parts", *Sci. Res. (Dacca, Pakistan)*, 5(1), 71-2.
47. Qudrat-i-Khuda, M; Khaleque, KA and Miah, MAW (1965), "Chemical investigations on *Cephalandra indica*. I Constituents of dry aerial parts", *Dacca, Sci. Res. (Dacca, Pakistan)*, 2(1/2), 27-31.
48. Dhargalkar, IM and Guha, SK (1959), "Nutritional values of Indian vegetables", *J. Proc. Inst. of Chemists*, (31), 109-12.
49. Rahman, M Mahbubur; Chowdhury, Tofail A and Mosihuzzaman, Mohammed (1990), "Analysis of water- and alkali-soluble polysaccharides of *Coccinia indica* (Telakucha) plant", *Journal of the Bangladesh Chemical Society*, 3(2), 199-204.