

**PHYTO-PHARMACOLOGICAL REVIEW OF *COCCINIA INDICA*****Lalit Kishore, Navpreet Kaur, Samrat Chauhan, Randhir Singh***

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ABSTRACT

Since ancient times, plants have been an exemplary source of medicine. Ayurveda, Chinese, Unani, Homeopathic, Siddha literatures mention the use of plants in the treatment of many disorders. *Coccinia indica* Wight & Arn (Cucurbitaceae), commonly known as Kundru and little gourd is a potential medicinal plant used traditionally in treating various diseases. *C. indica* is famous for its hypoglycemic and antidiabetic properties in Ayurvedic system of medicine. For the last few decades, some extensive work has been done to establish the biological activities and pharmacological actions of *Coccinia indica* and its extracts. The present review attempts to encompass the available literature on *Coccinia indica* with respect to its phytochemistry and pharmacological activities.

KEY WORDS: *Coccinia indica*, pharmacological activities, chemical constituents.

INTRODUCTION

Herbs are mine of medicinal agents and a large number of medicinal herbs are found to be efficacious, cheap and safe in preventing various diseases. Moreover, use of herbal medicines for the treatment of different ailments is very important in developing countries where the cost of conventional medicines is a burden to the population. More than 30% of the entire plant species, at one time or other was used for medicinal purposes.^[1]

Coccinia indica Wight & Arn (syn. *Coccinia grandis* (L.) Voigt, *Cephalandra indica* Naud.) belongs to family Cucurbitaceae, commonly known as little gourd and locally known as Kundru, grows abundantly and wildly all over India.^[2] *C. indica* is famous for its hypoglycemic and antidiabetic properties in Ayurvedic system of medicine. The plant has the

reputation in Bengal of having a remarkable effect in reducing the amount of sugar in the urine of patients suffering from diabetes mellitus.^[3] Fruits and leaves of *C. indica* are also prescribed in the treatment of snake-bite.^[4] Other applications include the therapy of various conditions such as skin diseases and gonorrhoea. 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.^[4-6] This review emphasize mainly on the phytochemistry and pharmacological activities of *C. indica* extracts (Figure 1).

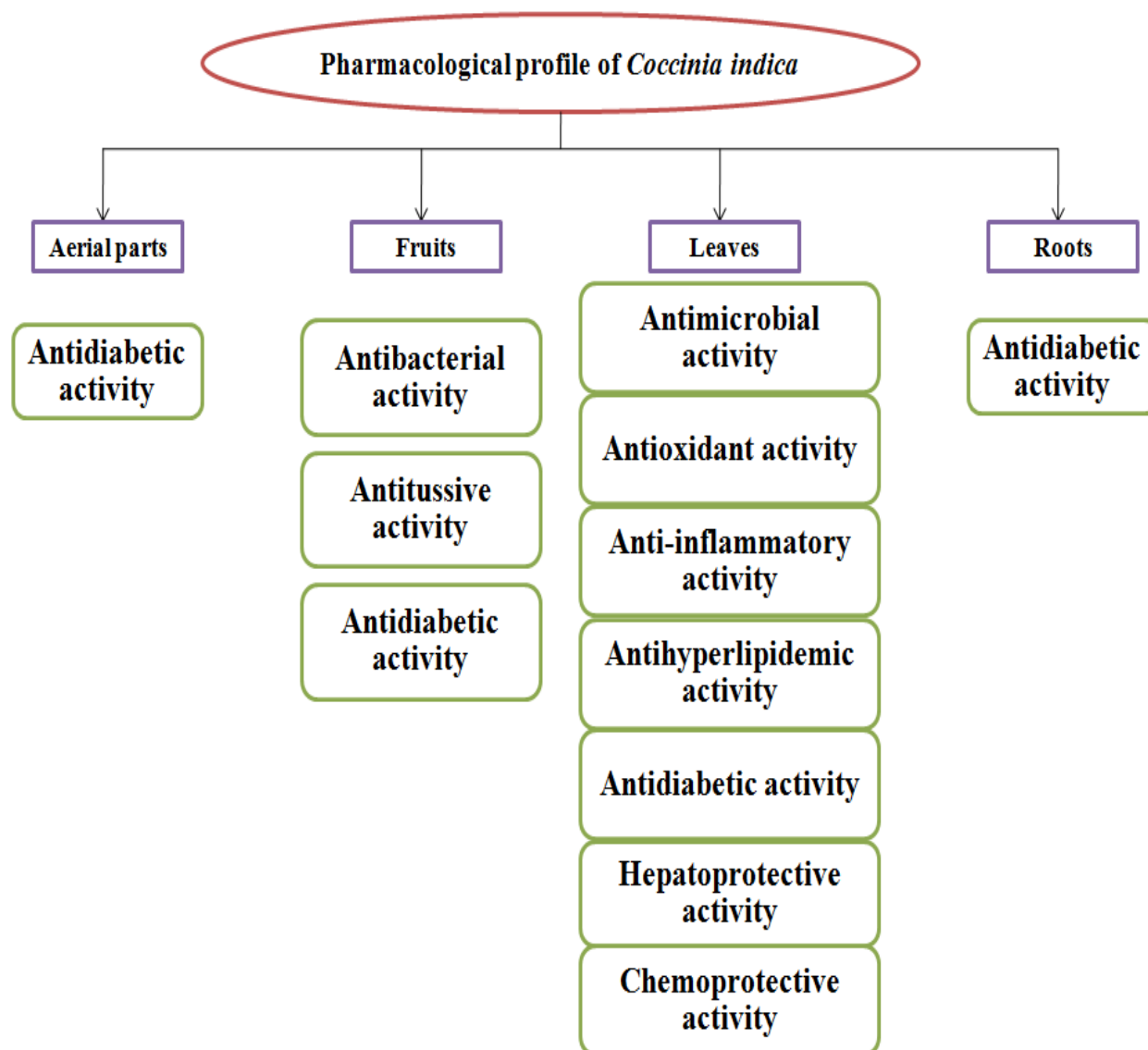


Figure 1: Pharmacological profile of various parts of *Coccinia indica*.

PHYTOCHEMISTRY AND PHARMACOLOGY OF AERIAL PARTS

Aerial parts of *C. indica* contain Heptacosane, Cephalandrol, tritriacontane, β -sitosterol alkaloids Cephalandrine α and β (Figure 2).^[7-8]

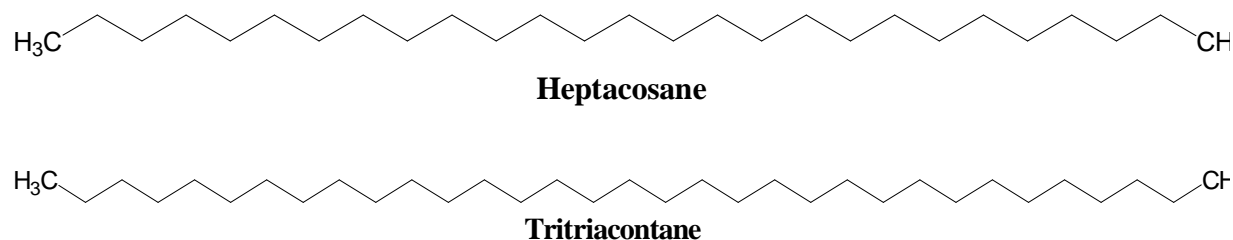


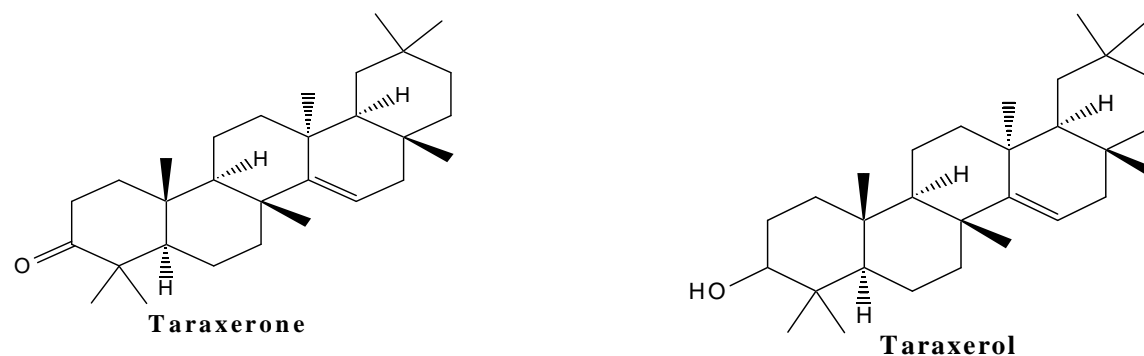
Figure 2: Compounds isolated from aerial parts of *Coccinia indica*

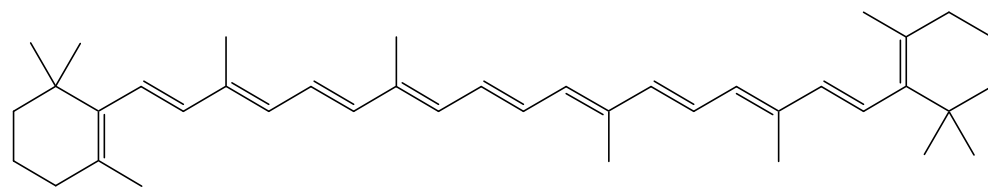
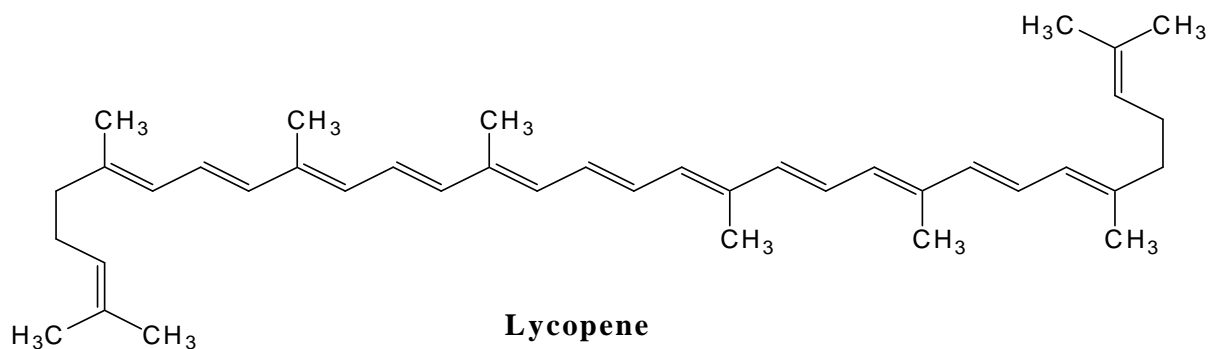
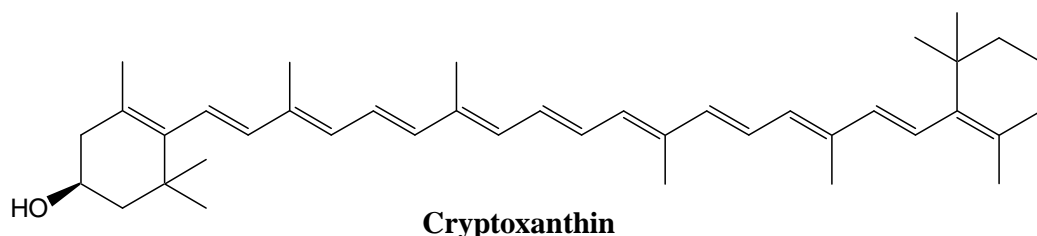
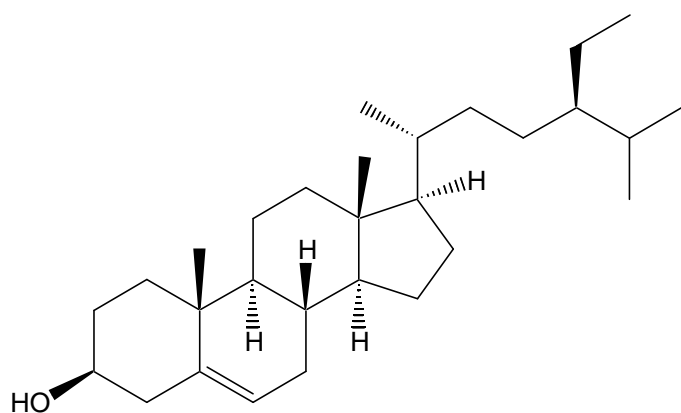
Antidiabetic activity

Antihyperglycemic and hypolipidemic effects of ethanol extract of aerial parts of *Melothriama deraspatana* and *C. indica* were evaluated in STZ induced diabetes in Sprague–Dawley rats. The rats were concurrently treated with 100 or 200 mg/kg b.w. *p.o.* for 14 days and Administration of ethanol extracts of aerial parts of *M. deraspatana* and *C. indica* to STZ-diabetic rats produced significant antihyperglycemic and hypolipidemic effects. Biochemical estimation of plasma glucose, cholesterol, triglycerides, LDL, HDL, SGOT, SGPT and ALP were done from blood sample. The extracts were also found to be significantly effective on recovery of altered biochemical parameters and attenuated the reduction of body weight in treated animals. The study concluded that combination of these two plants in treating diabetes may be expected to produce better significant results.^[9]

PHYTOCHEMISTRY AND PHARMACOLOGY OF FRUIT

Fruit of contains *C. indica* Taraxerone, taraxerol, and (24R)-24-ethylcholest-5-en- 3 β -ol glucoside, β -carotene, lycopene, cryptoxanthin, apo-6'-lycopenal and β -sitosterol (Figure 3).^[10-12]



**β-Carotene****Lycopene****Cryptoxanthin****β-Sitosterol****Figure 3: Compounds isolated from fruits of *Coccinia indica*****Antibacterial activity**

The fruits of *C. indica* were investigated for antibacterial activity against some pathogenic bacteria. The organic extracts (petroleum ether and methanol) showed the highest activity against the test bacteria. The activity was more pronounced on gram-positive organisms. These findings on antibacterial activity support the claim of the traditional healers that *C. indica* has been used to relieve pneumonia, dysentery, cough and cold.^[13]

Antitussive activity

Fruits of *C. grandis* were found to possess significant antitussive activity. Methanolic extract of *C. grandis* exhibited significant antitussive effect at dose of 100, 200 and 400 mg/kg, *p.o.* in Sprague-Dawley rats as compared to codeine phosphate within 90 min of performing the experiment. The extract might be acting *via* the central nervous system.^[14]

Antidiabetic activity

Administration of hydro-alcoholic extract (1:1) of *C. indica* fruit (200mg/kg) for 14 days significantly reduced blood glucose level in alloxan induced-diabetic animals and significant decrease in the blood glucose level was observed at the 7th and 14th days of the diabetes induction, exhibiting antidiabetic effect of *C. indica* fruit.^[15] Similarly, significant anti-diabetic activity of ethanolic extract (250 mg/kg) of *C. indica* Wight & Arn fruits was observed in alloxan (150 mg/kg) induced diabetic rats.^[16]

The effect of *C. indica* consumption on diabetes-mediated kidney damage was determined. Both control and diabetic rats were fed with AIN-76 diet supplemented with *C. indica* fruits and leaves individually at 10% and 5%, respectively, for a period of 2 months. They exhibited beneficial effects on key antioxidant enzymes of the kidney. Furthermore, an increase in laminin and fibronectin as a result of diabetes was alleviated in *C. indica*-fed rats. These results indicate that the consumption of *C. indica* is beneficial in attenuating diabetes-mediated deleterious effects on the kidney.^[17]

PHYTOCHEMISTRY AND PHARMACOLOGY OF LEAVES

The active chloroform-soluble fraction of ethanolic extract of *C. grandis* leaves was subjected to combination of silica gel column chromatography and reverse phase HPLC afforded a long chain isoprenoid alcohol, C₆₀-polyprenol (Figure 4).^[18]

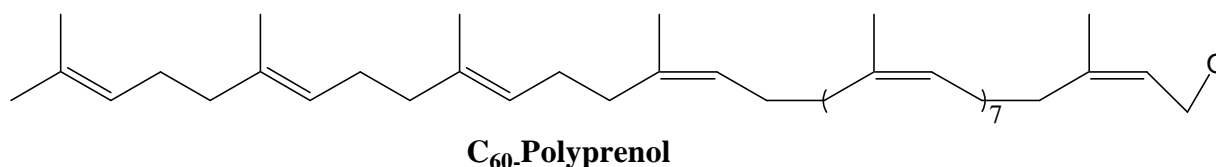


Figure 4: C₆₀-Polyprenol isolated from roots of *Coccinia grandis*

Antimicrobial activity

A protease inhibitor isolated from *C. grandis* (L.) Voigt. strongly inhibited pathogenic

microbial strains, including *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Escherichia coli*, *Bacillus subtilis* and pathogenic fungus *Candida albicans*, *Mucor indicus*, *Penicillium notatum*, *Aspergillus flavus* and *Cryptococcus neoformans*. Results reported in this study suggested that protease inhibitor may be an excellent candidate for development of novel oral or other anti-infective agents.^[19]

Antioxidant activity

The antioxidant effect of an ethanolic extract of *C. indica* leaves was studied in Streptozotocin-diabetic rats. Oral administration of *C. indica* leaf extract (200 mg/kg body weight) for 45 days resulted in a significant reduction in thiobarbituric acid reactive substances and hydroperoxides. The extract also caused a significant increase in reduced glutathione, superoxide dismutase, catalase, glutathione peroxidase and glutathione-S-transferase in liver and kidney of streptozotocin diabetic rats, which clearly shows the antioxidant property of ethanolic extract of *C. indica*.^[20]

Anti-inflammatory and analgesic activity

A study was designed to evaluate both post- and pre-treatment anti-inflammatory activities of the aqueous extract of fresh leaves of *C. indica* in rats using the carrageenan-induced paw edema method at various dose levels. Effectiveness of extract in the early phase of inflammation suggested the inhibition of histamine and serotonin release. The extract produced marked analgesic activity comparable to morphine at 300 mg/kg, which suggests the involvement of central mechanisms. A significant reduction in hyperpyrexia in rats was also produced by all doses of extract with maximum effect at 300 mg/kg comparable to paracetamol. The study concluded that *C. indica* exhibit significant anti-inflammatory activity, analgesic and antipyretic activity of.^[21]

Antihyperlipidemic activity

C₆₀-polyprenol isolated from the ethanolic extract of *C. grandis* (L.) Voigt leaves significantly decreased serum triglyceride, total cholesterol and glycerol in high fat diet (HFD)-fed dyslipidemic hamsters at the dose of 50 mg/kg body weight. Based on these investigations, it was concluded that the compound polyprenol isolated from leaves of *C. grandis* possess marked antidyslipidemic activity.^[18]

Antidiabetic activity

The oral administration of the pectin isolated from the fruit of the *C. indica* plant at a dose of 200 mg/100 g b.w. showed a significant hypoglycemic action in normal rats. The pectin administration resulted in a significant reduction in blood glucose and an increase in the liver glycogen. Glycogen synthetase activity was found to be highly significant. A significant reduction in phosphorylase activity was noted in the pectin-administered groups.^[22] Ethanolic extract of *C. indica* leaves lowered blood glucose by depressing its synthesis, on the one hand through depression of the key gluconeogenic enzymes glucose-6-phosphatase and fructose-1,6-bisphosphatase and on the other by enhancing glucose oxidation by the shunt pathway through activation of its principal enzyme G6PDH.^[5]

The combined effect of *Abroma augusta* and *C. indica* is known to be useful for the treatment of diabetes in Ayurveda. After 8 weeks of treatment of Streptozotocin (STZ) diabetic rats with 300 mg water extract of the mixture of dried powdered roots of *A. augusta* and leaves of *C. indica* in equal proportions, the blood glucose level reduced to normal and an improvement in glucose tolerance and serum lipid profile were also observed. From the study it appears that the water extract of combination *A. augusta* and *C. indica* possess good hypoglycemic and hypolipidemic effect.^[23] Oral administration of the ethanolic extract of *C. indica* leaves (200 mg/kg body weight) for 45 days to diabetic rats decreased the concentrations of blood glucose, lipids and plasma insulin was elevated. These results suggest that ethanolic extract *C. indica* exhibits hypoglycemic and hypolipidemic effects in STZ induced diabetic rats.^[24] In another study, the effects of *C. indica*, on aortic collagen content and its characteristics were assessed in STZ-diabetic rats. The α/β ratio of type I collagen and the type I/type III collagen ratio of pepsin-soluble collagen were significantly decreased in STZ diabetic rats. In conclusion, administration of ethanolic extract of *C. indica* for 45 days to STZ diabetic rats significantly reduced the accumulation and cross-linking of collagen.^[25]

A study was designed to evaluate the antihyperglycemic properties of aqueous-methanolic (40:60) extract of root of *Musa paradisiaca* and leaf of *C. indica* in separate as well as in combination on streptozotocin-induced diabetic rats. After treatment of aqueous methanolic extract of above plant parts in separate as well as in composite manner at a concentration of 80mg/100g b.w./day to streptozotocin-induced diabetic rat resulted in a significant remedial effect on blood glucose level as well as carbohydrate metabolic enzymes and the quantity of liver and skeletal muscle glycogen. Serum insulin level that was diminished in

streptozotocin-induced diabetic rat recovered significantly after the co-administration of extract of above plant parts.^[26]

Methanolic extract (200 mg/kg) of *C. indica* leaves was administered orally to alloxan induced Sprague-Dawley rats. There was a significant reduction in blood glucose, lipid levels and elevation of reduced glutathione and liver glycogen in *C. indica* treated group when compared with the diabetic control. This concluded that the ethanolic extract of *C. indica* leaves have significant hypoglycemic, hypolipidemic and antioxidant effects.^[27] Ethanolic extract of *C. indica* leaf was fed orally STZ-induced diabetic rats, resulted in significant reduction in blood glucose and lipid level. Moreover, the activity of hepatic arginase, a key urea cycle enzyme, was significantly attenuated in diabetic rats. Results suggested that *C. indica* extract had anti-hyperglycemic and anti-ureogenic effects on the diabetic rats.^[28] A study has been conducted to investigate the anti-diabetic potential of methanolic polyherbal extract of *C. indica* leaves in streptozotocin induced diabetic rats. The diabetic rats in different groups received treatment with two concentrations of the extract (150 and 300 mg/kg, *p.o.*) with standard drug and saline. The effectiveness of extract in the maintenance of blood glucose level in both normal and diabetic rats is indicated by significant reduction of the elevated blood sugar level after 10 days of treatment (up to 41.87%) which is comparable to glibenclamide (43.50%) under similar conditions. Based upon experimental results, it can be concluded that the polyherbal extract of leaves of *C. indica* shows distinct antidiabetic property on a concentration and time dependent manner with effects comparable to that of the standard prescribed antidiabetic drugs and can be used in the antidiabetic therapy.^[29]

Chemoprotective activity

Nitharwal and co-workers in 2013 investigated the chemoprotective potential of *C.indica* against cyclophosphamide induced oxidative stress, genotoxicity and hepatotoxicity. Rodents were orally pre-treated with *C.indica* methanolic extract (200, 400 and 600 mg/kg) for five consecutive days. *C. indica* extract significantly reduced the increased glutathione and malonaldehyde level in brain. It also significantly reduced the increased serum biomarker enzymes like alkaline phosphatase, alkaline aminotransferase and aspartate aminotransferase indicating the protective effect of *C. indica* extract against cyclophosphamide-induced oxidative stress, genotoxicity as well as hepatotoxicity.^[30]

Hepatoprotective activity

Ethanollic extract of *C. grandis* leaves at a dose of 200 mg/kg, *p.o.* exhibit significant hepatoprotective effect against carbon tetrachloride induced hepatic injury in Wistar albino rats as shown by lowering serum levels of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase, total bilirubin and total cholesterol.^[31]

PHYTOCHEMISTRY AND PHARMACOLOGY OF ROOTS

The root of *C. indica* contains Triterpenoids, Saponin Coccinioside, Flavonoid glycoside, Lupeol, β -amyrin, and β -sitosterol (Figure 5).^[32-36]

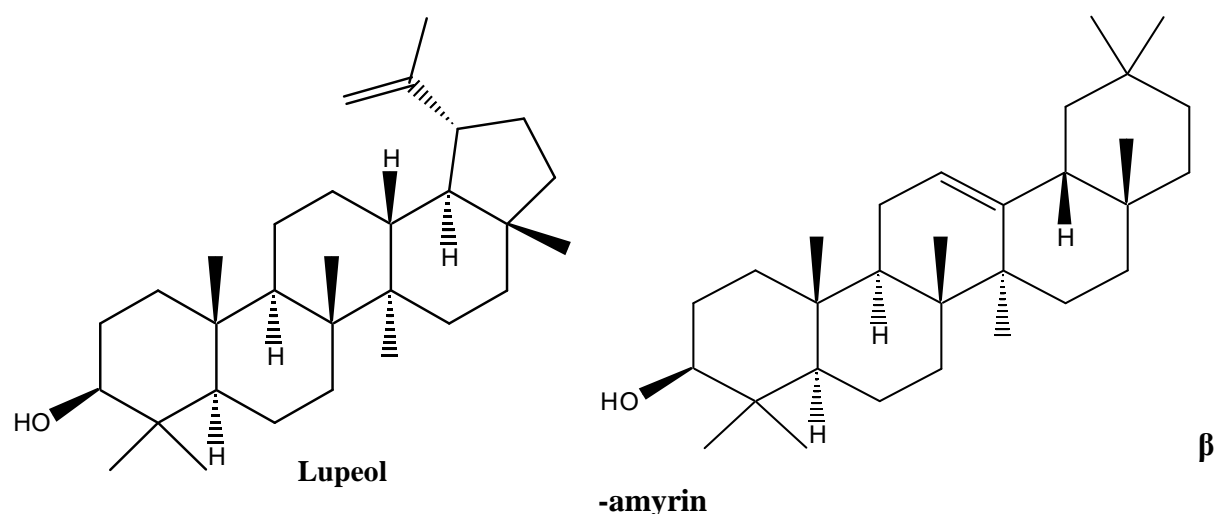


Figure 5: Compounds isolated from roots of *Coccinia indica*

Roots of *C. indica* administered in alloxan induced rabbits produce significant antidiabetic activity.^[37]

CONCLUSION

C.indica has been used traditionally to cure various ailments like skin diseases, urinary tract infections and hypoglycemia in Ayurvedic system of medicine. Despite the broad use of *C. indica* in traditional medicine, very few systematic pharmacological and phytochemical studies on various parts *viz.* aerial parts, fruits and roots are reported. There is still a need to explore the mechanism of action of *C. indica* extracts and their toxicity profile to determine their role in therapy of different diseases.

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