International Journal of Pharmacy and Natural Medicines

Journal Home Page: www.pharmaresearchlibrary.com/ijpnm

REVIEW ARTICLE

Phytochemical and Pharmacological Properties of *Coccinia Indica*- A Review

Kumar Manish*, Mazumder Avijit, Chakraborthy G.S, Singh Aniruddh Pratap, Kushwaha Kumar Ashish

Pharmacy Institute, Noida Institute of Engineering & Technology, 19, Knowledge Park, Institutional Area, Greater Noida- 201306, Utter Pradesh, India

ABSTRACT

Many traditional medicines in use are obtained from medicinal plant, mineral, and organic matter. Herbal medicine has become a popular form of alternative medicine in different countries. During past several years, there has been increasing interest among the use of various medicinal plants from traditional system of medicine for treatment. There is a misconception that herbal medicines are safe for health but there are some risky sides of them too. So we need to learn which herbal medicines are referring for use. *Coccinia indica* is one of the herbal plant which is used for several diseases. *Coccinia indica* has been used in traditional medicine as a household remedy for various diseases. The whole plant of *Coccinia indica*, leaves, fruits, flowers, root having various pharmacological activities like analgesic, anti-inflammatory, antimicrobial, antiulcer, antidiabetic, antioxidant, hypoglycemic, antimalarial, antidyslipidemic, anticancer, antitussive, mutagenic, antistress, antipyretic, antifungal, anthelmintic. The present review gives botany, chemical constituents and pharmacological activities of *Coccinia indica*.

Keywords: *Coccinia indica*, Pharmacological, Medicine, Traditional.

ARTICLE INFO

***Corresponding Author**
Kumar Manish
Pharmacy Institute, Noida Institute of Engineering &Technology 19, Knowledge Park- II, Institutional Area
Greater Noida- 201306, UP, India
MS-ID: IJPNM3594

PAPER QR-CODE

ARTICLE HISTORY: Received 15 Sept 2018, **Accepted** 29 October 2018, **Available Online** 15 December 2018

Citation: *Kumar Manish, et al.* Phytochemical and Pharmacological Properties of Coccinia Indica- A Review. *Int. J. Pharm. Natural Med.*, 2018, 6(2): 71-76.

CONTENTS

1. Introduction

Herbal medicine is the oldest form of healthcare known to the mankind. Since thousands of years, the traditional health care systems have flourished all over the world. The World Health Organization (WHO) has listed 21,000 plants as herbs or medicinal plants. Among these 2500 species are found in India. Around 800 plants have been used in the indigenous system of medicine. Herbal drugs have many advantages over the synthetic formulations in having a longer pharmacological effect and lesser metabolic toxicity. The present review highlights the phytochemistry and pharmacology of well-known plant *Coccinia indica* (Synonym: *Coccinia grandis, Coccinia cordifolia)* belonging to the family Cucurbitaceae. Most of the plants in this family are annual vines but there are also woody lianas, thorny shrubs and trees. *Coccinia indica* Wight & Arm commonly known as little gourd and locally known askundru, grows abundantly and wildly all over India. Fruits and leaves of *C. indica* are also prescribed in the treatment of snake-bite. Other applications include the therapy of various conditions such as skin diseases and gonorrhea. 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 [11-13].

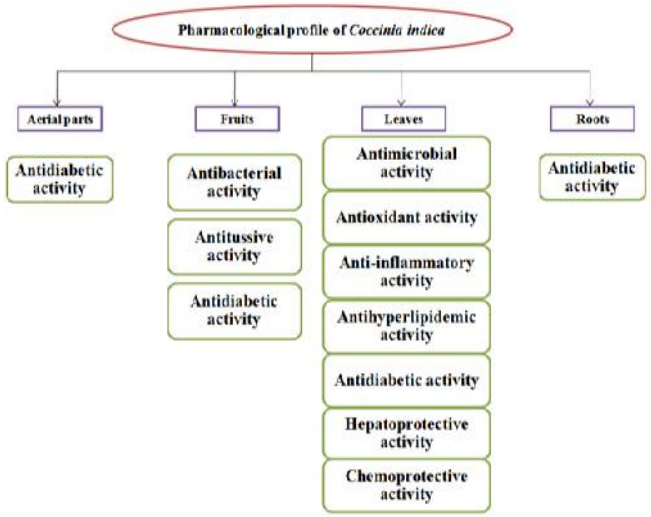

Figure 1: Pharmacological activities of different parts of plant

The plant has also been used extensively in Ayurvedic and Unani practice in the Indian subcontinent.It has long tuberous fleshy roots with smooth and green fruits. Microscopy of root shows parenchyma, phelloderm, pericyclic fibers, stone cells, starchgrains. Transvers section (T S) of leaves show upper and lower epidermis, ranunculaceae stomata, uniseriate multicellular trichomes. Green fruit is chewed to cure sores on the tongue [13].

Leaf:

Antidiabetic, oxidant, larvicidal, GI disturbances, cooling effect to the eye, Gonorrhea, hypolipidemic, skin diseases, urinary tract infection.

Fruit :

Hypoglycemic, analgesic, antipyretic, Hepatoprotective, tuberculosis, eczema, anti-inflammatory.

Stem:

Expectorant, antispasmodic, asthma, bronchitis, GITdisturbances, urinary tract infection, skin diseases,

Root Hypoglycemic, antidiabetic, skin diseases, removes pain injoint, urinary tract infection[14].

Scientific Classification

Kingdom-Plantae
Division-Magnoliopsida
Class–Magnoliophyta
Order-Violales
Family-Cucurbitaceae
Genus- Coccinia Wight &Arn
Species-Coccinia Grandis L.Vight

2. Phytochemical Constituents

Alcoholic extract of aerial parts of *Coccinia indica* yielded -Heptacosane, Cephalandrol, β -sitosterol, Alkaloids Cephalandrins A and B, as active compound [25]. Aqueous extract of fruit parts of *Cocciniaindica* resulted in following isolated compound as - β- Amyrin Acetate, Lupeol, Cucurbitacin B, Taraxerone, Taraxerol, β-carotene, Lycopene, Cryptoxanthin, Xyloglucan,Carotenoids, β-sitosterol, Stigma-7-en-3-one.[26].

Methanolic extract of *Cocciniaindica* of root yielded following secondary metabolites like - Resin, Alkaloids, Starch, Fatty Acids, Carbonic acid, Triterpenoid, Saponin Coccinoside, Flavonoid Glycoside, Lupeol, β-amyrin, β-sitosterol, Taraxerol (Deokate*et al.*, 2011)[27].

Ethanolic extract of aerial parts of *C. indica*contains-Heptacosane, Cephalandrol, tritriacontane, β-sitosterol alkaloids Cephalandrine α and β.Fruitcontains Taraxerone, taraxerol, and (24R)-24-ethylcholest-5-en- 3β-olglucoside, β-carotene, lycopene, cryptoxanthin, apo-6'-lycopenal and β-sitosterol[28].

Aqueous extract of the root of *C. indica*contains Triterpenoids, SaponinCoccinioside, Flavonoid glycoside, Lupeol, β-amyrin, and β-sitosterol[29]. Hydro-ethanolic extract of fruit of *Cocciniaindica* resulted in following active constitutes like- Triterpenoid, saponincoccinioside, flavonoid glycoside ombuin 3-o-arabinofuranoside [30].

Aqueous extract of root of *Coccinia indica* yielded following compound as-Taraxerone, taraxerol and ethylcholest- 5-en-3β B- carotene, lycopene, cryptoxanthin, and apo 6'- lycopenal B- sitosterol and taraxerol

3. Pharmacological Activity

Hepatoprotective activity

Kumar *et al.*, in 2010 studied the hepatoprotective activity of leaves diethyl ether extract of *Cocciniaindica* by CCl_4 induced method. The results were highly significant when it was compared with standard drug Silymarin, which reduced the biochemical parameters like SGOT and SGPT levels when they were administered to the rats [15].

Kundu *et al.,* 2012 also evaluated the hepatoprotective effect of crude ethanolic extract from the leaves of *C. grandis* against liver damage induced by Paracetamol and CCl_4 in rats. Administration of Paracetamol (750 mg/kg/day) and CCl_4 (3 ml/kg/day) showed a marked increase in SGOT, SGPT, ALP, bilirubin (total, direct), total proteins, globulin, cholesterol and decrease in albumin in comparison with the normal control group. The effect of ethanol extract of *C. grandis* at 150 mg/kg and 300 mg/kg doses reduced the serum activities caused by Paracetamol and CCl_4, which were observed to be statistically significant when compared with that of the control group [16].

Sunilson *et al.,* in 2009 studied the hepatoprotective activity of *Coccinia grandies* against carbon tetrachloride induced hepatic injury in rat. The crude ethanolic and aqueous extracts from the leaves of *C. grandis* against liver damage induced by CCl_4 in rats. The ethanolic extract exhibited a significant ($p<0.05$) protective effect as shown by lowering serum levels of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase, total bilirubin and total cholesterol and increasing levels of total protein and albumin levels as compared to silymarin, the positive control. These biochemical observations were supported by histopathological examination of liver sections. The activity may be due to the presence of flavonoid compounds.

Antihyperglycemic activity

Ravikant *et al.,* in 2016 evaluated that the antihyperglycemic effect of leaves of *Coccinia indica* A single dose of freshly prepared Streptozotocin was immediately injected intravenously (60 mg/kg) through intra-peritoneal (IP) in a volume of 1 ml/kg body weight. Streptozotocin induced diabetic rats showed loss of body weight significantly at 2 week after the Streptozotocin treatment compared to Control rats, which further decreased at 4, 6 and 7 weeks after the Streptozotocin treatment. Freshly prepared alcoholic extract of the *Coccinia indica* leavesattenuates hyperglycemia and diabetic neuropathy in STZ-induced diabetic rat, due to antihyperglycemic and analgesic activity. We also showed that higher dose of *Coccinia indica* plant extracts (500 mg/kg/day) have more blood glucose lowering effects when treatment started one week after the STZ injection [21].

S. Manjula *et al.,* in 2007 studied that hypoglycemic and hypolipidemic effect of *Coccinia indica* Wight &Arn in alloxan induced diabetic rats. Continuous administration of *Coccinia indica*leaf aqueous extract for 21 days prevents the elevation of the level of serum lipids secondary to the diabetes state. Alloxan induced diabetic rats showed a significant ($P<0.05$) in creasein blood glucose level. *Coccinia indica* leaf extracts not only showed hypoglycaemic effect but also hypolipidemic effect. There was a significant ($P<0.05$) increase of total cholesterol and triglycerides [18].

Sanket Kohli *et al.,* in 2014 evaluated that the combined effect of *Coccinia indica* leaf extract with acarbose in type II diabetes induced neuropathy in rats. Type2 diabetes was induced by two weeks of HFD treatment followed by low dose 35mg/kg of STZ dissolved in 0.1M/l of citrate buffer through i.p route. Diabetic rats treated with ethanolic extract of *coccinia indica* leaf alone and in combination with low dose of acarbose produced significant decrease in the blood glucose level. Untreated diabetic rats showed significant hypersensitivity towards thermal stimuli. Histopathological studies proved that there was no damage in the sciatic nerve of the groups treated with the ethanolic extract of *coccinia indica* and its combination with low dose of acarbose[17].

Doss *et al.,*in 2008 studied the anti-hyperglycaemic and Insulin Release Effects of *Coccinia grandis* (L.) Voigt Leaves in normal and alloxan diabetic rats. Alloxan monohydrate solution of 10 mg/ml was prepared in ice-cold citrate buffer 0.1 M, pH 4.5 and was administered to the rats within 5 min at a dose of 50 mg/kg body weight intraperitoneally. The antidiabetic effect of aqueous extracts of leaves of C. grandis was obtained by decoction method. Significant ($p < 0.05$) reduction in fasting blood glucose levels were observed in the normal as well as in the treated diabetic animals. Serum insulin levels were not stimulated in the animals treated with the extract. The changes in body weight, serum lipid profiles, liver glycogen levels were assessed in the extract treated diabetic rats and compared with diabetic control and normal animals [9].

Antimicrobial activity

Shaheen *et al.,* in 2009 screened the antimicrobial effect of fruit extract of *Coccinia indica* .The bioactive compounds of fruits of *Coccinia indica* were investigated for antibacterial activity against some pathogenic bacteria. The aqueous extracts did not show much significant activity, while the organic extracts (petroleum ether and methanol) showed the highest activity against the test bacteria. The activity was more pronounced on gram-positive organisms with *Staphylococcus aureus*being more susceptible and *Salmonella paratyphiA*being more resistant. Eight different solvent extracts of *C. indica* fruit were tested against six gram negative and gram positive bacteria. The crude extracts of *C. indica* exhibited moderate to significant antibacterial activity against all tested bacteria with inhibition zone ranging from 1 - 19 mm and comparable to standard [22].

Hussain *et al.,* in 2010 studied the antibacterial activity of the leaves of Coccinia indica. About five human pathogenic bacterial strains were used. Both the Gram-negative (*Enterobacteraerogenes*, *Pseudomonasaeruginosa*, *Salmonellatyphimurium*) and Gram-positive bacteria (*Bacillussubtilis* and *Staphylococcusepidermidis*) were included. The aqueous and organic solvent (Petroleum ether, chloroform and ethanol) extracts from the leaves of *Cocciniaindica* (Cucurbitaceae) were tested against *Enterobacteraerogenes*, *Pseudomonasaeruginosa*, *Staphylococcusepidermidis*,

Bacillus subtilis and *Salmonella typhimurium* by agar well diffusion method and broth dilution method. Results showed promising antibacterial activity against the bacteria tested. Among these, ethanol and aqueous extracts were found to have a more potent inhibitory effect comparing with the other extracts. Which prove the potentiality of the plant extracts for the treatment of various skin and gastrointestinal infections in humans [12].

Israt Jahan Bulbul *et al.,* in 2011 evaluated the antibacterial activity of the extracts displaying antibacterial effect against different bacteria. The Chloroform extract of *Coccinia cordifolia* showed the highest 12 mm zone of inhibition against gram positive bacteria *Sarcinalutea*and *Bacillus subtilis*and an average zone of inhibition was 9mm to 12 mm. The ethyl acetate extract was also active in varying degrees. 7mm to 11 mm zone of inhibition was showed by the ethyl acetate extract and the highest zone of inhibition 11mm was showed against *Staphylococcus aureus*, a gram positive bacterium. The n-hexane extract showed the highest 10mm zone of inhibition against gram positive bacteria *Sarcina Lutea* and gram negative bacteria *Pseudomonas aeruginosa*[5].

Antioxidant

Venkateswaran *et al.,* in 2003 observed that the antioxidant effect of an ethanolic extract of *Coccinia indicia* leaves. Oral administration of *Coccinia indica* leaf extract (CLEt) (200 mg/kg body weight) for 45 days resulted in a significant reduction in thiobarbituric acid reactive substances and hydroperoxides. The extract also causesd 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 CLEt.

Bhadauria *et al.,* in 2012 evaluated the in vitro antioxidant activity of *Coccinia Grandis* root hydro methanolic extracts. The antioxidant activities of the fractions has been evaluated by using invitro assays and were compared to standard antioxidants such as ascorbic acid, α-tocopherol, curcumin and butylated hydroxyl toluene (BHT). It wasobtained, that all the fractions of the hydromethanolic extract of the roots of *C. grandis*showed strong antioxidant activity, reducing power ability, free radical scavenging activity and metal chelating ability whencompared to standards such as ascorbic acid, α- tocopherol, curcumin, and butylatedhydroxytoluene[2].

Deshpande S.V. *et al.,* in 2011 studied the anti inflammatory activity of the methanolic extract of the fruit of *Coccinia grandis*L. Voigt. (Cucurbitaceae).The aqueous extracts of *Coccinia grandis*L. Voigt leaves and stem were investigated in chemically-induced inflammation rodents model. The extracts inhibited formaldehyde-induced paw edema in rats. These inhibitions were statistically significant ($p<0.05$, 0.01, 0.001) as compared to control. Aqueous extract of leaves showed highest activity [6].

Bulbul *et al.,* in 2011 also evaluated the antioxidant activity of n-hexane, chloroform and ethyl acetate of leaf extracts of *Coccinia cordifolia*was determined on the basis of their scavenging potential of the stable DPPH free radical in both qualitative and quantitative assay**.** The crude chloroform, N-hexane, ethyl acetate extract of Coccinia cordifolia showed better antioxidant activity with IC50 values of 56.98 µg/ml, 51.33 µg/ml, 50.98 µg/ml in comparison with ascorbic acid as standard whose IC50 value 43.22 µg/ml. DPPH is one of the free radicals widely used for testing preliminary radical scavenging activity of a compound or a plant extract [4].

Israt Jahan Bulbul *et al.,* in 2011 reported the cytotoxic activity of chloroform, n-hexane and ethyl acetate extract of plant *Coccinia cordifolia*. The crude chloroform, n-hexane, ethyl acetate extract of *Coccinia cordifolia* showed better cytotoxic activity with LC_{50} values of 23.96µg/ml, 14.12µg/ml, 15.49µg/ml in comparision with vincristine sulphate as standard whose LC_{50} value is 7.55 µg/ml [3].

Antiulcer

Santharam *et al.,* in 2013 screened that the effect of antiulcer activity of ethanolic, aqueous and total aqueous extracts of *cocciniagrandis*linn. Voigt in pyloric ligature induced ulcers in albino rats. Ulcer was induced *by* pylorus ligature in Wistar albino rats. Though all three extracts of *Coccinia grandis, dose* dependently reduced, the total acidity, ulcer index, and increased pH of gastric juice, ethanol extracts exhibited markedly significant results. However, ethanol extract had shown (78.57%) a highly significant ulcer curative potential and decreased ulcer formation also. Anti-secretory and cytoprotective mechanisms of different extracts of *Coccinia grandis*exerted protective effect [23].

Diuretic activity

Randhir K. Gupta *et al.,* in 2015 evaluated the diuretic activity of *Coccinia grandis* in rats. The results clearly showd that aqueous and alcoholic extracts of *C. grandis*enhanced considerably the urine excretion equivalent to furosemide control values. These finding may provide a lead for further investigation of overall pharmacological action of *C. grandis*in a more appropriate model. The significant alteration of cation excretion is observed in aqueous and alcoholic extracts treated animals, which is nearly equivalent to furosemide [10].

Antitussive activity

Pattanayak *et al.,* in 2009 evaluated the In vivo antitussive activity *of Coccinia grandis* against irritant aerosol and sulfur dioxide-induced cough model in rodents. The antitussive effect of aerosols of two different concentrations (2.5%, 5% w/v) of methanol extract of *C.grandis*fruits were tested by counting the numbers of coughs produced due to aerosols of citric acid. Itshowed significant reduction of cough number obtained in the presence of both concentrations of methanol extract as that of the prototype antitussive agent codeine phosphate. Also, methanol extract exhibited significant antitussive effect at 100, 200 and 400

mg/kg, per orally by inhibiting the cough by 20.57, 33.73 and 56.71% within 90 min of performing the experiment respectively [20].

Mutagenic activity

Bhuiyan *et al.,* in 2009 screened the mutagenic Effect of *Coccineacordifolia* (Linn.) Cogn. Leaf Extract on Neurosporacrassa Fungus. *Coccineacordifolia* (Linn.) Cogn. leaf extract showed significant mutagenic effect on *Neurosporacrassa fungus.* Observation after 24 hours, control showed 2.9 cm linear vegetative growth of the mycelia where *C. cordifolia leaf* with *N. crassa*showed 0.25 cm growth and it is 12 times less than the control. Besides, 0.5, 1.0, 1.5, 2.0, 3.0 and 4.0 ml extract showed gradual decrease of growth of mycelia[1].

4. Conclusion

The literature survey revealed that *Coccinia indica* has been widely studied for its pharmacological activities and regarded as Universal Panacea in Ayurvedic medicines. *Coccinia indica* has itself traditional value and the extract of plant parts like fruit, roots, leaves and aerial parts in different solvents like ethanol, chloroform, water, petroleum ether, methanol and ethyl acetate are widely used in traditional and as herbal medicines. It can be concluded that *Coccinia indica* is an important source of many pharmacological and medicinally important chemicals. From this study, it is clear that the medicinal plants play a fundamental role against various diseases. Plant extracts have significant analgesic, antipyretic, anti-inflammatory, antimicrobial, antiulcer, antidiabetic, antioxidant, hypoglycemic, hepatoprotective, antimalarial, antidyslipidemic, anticancer, antitussive, mutagenic activity in different animal models.

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