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Pharmacological Activities of *Coccinia Grandis*: Review

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ABSTRACT

Many traditional medicines in use are obtained from medicinal plants, minerals and organic matter. During the past several years, there has been increasing interest among the uses of various medicinal plants from the traditional system of medicine for the treatment of different ailments. Coccinia grandis has been used in traditional medicine as a household remedy for various diseases. The whole plant of Coccinia grandis having pharmacological activities like analgesic, antipyretic, anti-inflammatory, antimicrobial, antiulcer, antidiabetic, antioxidant, hypoglycemic, hepatoprotective, antimalarial, antidyslipidemic, anticancer, antitussive, mutagenic. The present review gives botany, chemical constituents and pharmacological activities of coccinia grandis.

INTRODUCTION

A vast majority of the population, particularly those living in rural areas depends largely on medicinal plants for treatment of diseases. There are about 7000 plant species found in India. The WHO estimates that about 80% of the population living in the developing countries rely almost on traditional medicine for their primary health care needs. Plants have played a significant role in maintaining human health and improving the quality of human life (Tamilselvan et al, 2011).

The Cucurbitaceae family is commonly known as gourd, melon and pumpkin family. The family of Coccinia grandis is Cucurbitaceous, comprises 960 species. The family is predominantly distributed around the tropics. Most of the plants in Cucurbitaceae family are annual vines (Reddy., 2009). Coccinia includes 29 additional species and they are found only in tropical Africa. Coccinia grandis is used by humans mostly as a food crop in several countries in Australia, Asia, Caribbean, and the southern United States, Pacific Islands. Coccinia grandis hosts several insects such as Leptoglossus Australis, Aphis gossypii Glover, Diaphania indica, Bactrocera cucurbitae, Liriomyza spp., Aulacophora spp., that attack several commercially important species of the Cucurbitaceous (Bamba *et al.*, 2009). Chemical and mechanical methods of control proved to be unproductive, uneconomical, unacceptable, and unsustainable (Muniappan *et al.*, 2009).

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BOTANY

Coccinia grandis is a fast-growing perennial vine that grows several meters long. It can form dense mats on lands that readily cover shrubs and small trees.

Leaves

Its leaves are arranged alternately along the stems; the shape of the leaves varies from heart to pentagon shaped. (Up to 10 cm wide and long). The upper surface of the leaf is hairless, whereas the lower is hairy. There are 3–8 glands on the blade near the leaf stalk. Tendrils are simple. Coccinia grandis is dioecious.

Flower

Flowers are large, white and star-shaped. The calyx has five subulate, recurved lobes, each 2–5 mm long on the hypanthium; peduncle 1–5 cm long. The corolla is white, campanulate, 3–4.5 cm long, deeply divided into five ovate lobes. Each flower has three stamens. The ovary of Coccinia grandis flower is inferior.

Staminate flowers solitary, rarely in axillary clusters of 2-3, pedicels 15-50 mm long, lobes of calyx is subulate, recurved, 2-5 mm long, corolla lobes ovate, white, long about 15-20 mm; pistillate flowers solitary on stalks10-30 mm long, hypanthium 10-15 mm long (Starr *et al.*, 2003).

Fruit

The fruit is red, ovoid to elliptical, 25–60 mm long, 15–35 mm in diameter, glabrous, hairless on stalks.

Seeds

6-7 mm long, tan-colored, margins thickened.

Root

The roots and stems are succulent, tuberous and most likely facilitate the plant to survive prolonged drought. Desperations of Coccinia grandis are by the humans. Also spread by birds and other animals, pigs, moved unintentionally on equipment or on wood and germinate where they land. Hybridization and clonal selection are one of the viable methods to develop improved Clone in ivy gour (Sureshbabu *et al.,* 2001; Maurice *et al.,* 2012; Ajmal Ali *et al.*, 2005-2006).

Fig 1: Coccinia grandis.

Taxonomical Classification

Table. 1: Taxonomical classification of Coccinia grandis.

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

Geography

Coccinia grandis, a native of East Africa, has been spread in different parts of tropical Asia, America and Pacific, but it has become invasive only in the Hawaiian and Mariana Islands of the Pacific. Small populations are scattered throughout western Australia, the northern territory and the northern coastal parts of Queensland. (Maurice *et al.,* 2012).

Vernacular Names (Ajmal Ali *et al.,* 2005)

Table. 2: Vernacular names of Coccinia grandis.

Marathi	Tindora, Tondli
Hindi	Parval, Tindora, Tinda, Kundru
Danish	Skariagenagurk
English	Scarlet
Telagu	Dondakaya
Kannada	Tondekayi
Malayalam	Tendli, ghiloda, kundri, kowai.
Chinese	Hong Qua
Japanese	Yasai, karasuuri
Malay	Pepasan, Kovakka, Kovai
Spanish	Pepino, cimaron

Synonyms

Coccinia indica Wight and Arn, Bryonia grandis and Coccinia cordifolia auct

CHEMICAL CONSTITUENTS

Aerial part - Heptacosane, Cephalandrol, β -sitosterol, Alkaloids Cephalandrins A and B,

Fruits- β- Amyrin Acetate, Lupeol, Cucurbitacin B, Taraxerone, Taraxerol, β-carotene, Lycopene, Cryptoxanthin, Xyloglucan, Carotenoids, β-sitosterol, Stigma-7-en-3-one.

Root - Resin, Alkaloids, Starch, Fatty Acids, Carbonic acid, Triterpenoid, Saponin Coccinoside, Flavonoid Glycoside, Lupeol, β-amyrin, β-sitosterol, Taraxerol (Deokate *et al.,* 2011).

MEDICINAL VALUE OF VARIOUS PARTS OF COCCINIA GRANDIS

Table 3: Medicinal value of various parts of Coccinia grandis

Plant part	Medicinal value
Leaf	Antidiabetic, oxidant, larvicadal, 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, GIT disturbances, urinary tract infection, skin diseases,
Root	Hypoglycemic, antidiabetic, skin diseases, removes pain in joint, urinary tract infection.

PHARMACOLOGICAL ACTIVITIES

Antibacterial

Bhattacharya *et al.,* (2010) evaluated the aqueous extract of leaves of Coccinia grandis for antibacterial activity against Shigella flexneri NICED, Bacillus subtilis Escherichia coli, Salmonella choleraesuis, Shigella dysenteries, and Shigella flexneri,. Aqueous extract of Coccinia grandis showed more significant antibacterial activity in comparison to ethanol extract. A polar moiety of the extract is more responsible for antibacterial properties. The chloroform extract of Coccinia cordifolia moderately active against Sarcina lutea, Bacillus subtilis. Ethyl acetate extracts active against staphylococcus aurous. Hexane extract active against the sarcina lutea, Pseudomonas aeruginosa (Bulbul *et al.,* 2011). Sivaraj *et al* (2011) evaluated the antibacterial activity of Coccinia grandis leaf extract with solvents

such as acetone, ethanol, methanol, aqueous and hexane against five bacterial species. Ethanol leaf extract of Coccinia grandis showed high antibacterial activity against S. pigeons, E. Coli, B. Ceres, K. pneumonia and S. aureus (Sivaraj *et al.,* 2011).Antibacterial activity of Coccinia grandis extract tested against the six gram positive and gram negative bacteria, ethanol extract of stem active against all except Klebsiella p and Proteus mirabilis. Hexane extract moderately active against all gram positive and gram negative bacteria except Proteus mirabilis. Ethyl acetate extracts moderately antibacterial against all except Proteus mirabilis and staphylococcus aeruginosa (Farukhh *et al.,* 2008 ;Tamilselvan *et al.,* 2011).

Anthelmintic

Methanolic extract of Coccinia grandis posses the anthelmintic activity. The worm pheretime posthuma were used for Antihelmintic activity. Different concentrations of the extract are used. Methanolic extract of Coccinia grandis acts through paralyzing the worm. The activity is measured by the time taken to paralyzing the worm and death (Tamilselvan *et al.,* 2011).

Antioxidant

Moideen (2011) evaluated Ethanol extract of root of Coccinia grandis contain flavonoids which are responsible for antioxidant activity. Methanol extracts of the fruit of Coccinia grandis posses the potent antioxidant activity. The methanol extract of Coccinia grandis contains glycoside and flavonoid. The antioxidant activity of Coccinia grandis is due to the reducing power ability, hydrogen peroxide scavenging potential (Deshpande *et al.,* 2011; Mongkolsilp *et al.,* 2004) Ethanol and methanol extract shows the antioxidant activity (Ashwini *et al.,* 2012) Coccinia grandis stem extract containing solvent petroleum, chloroform and ethyl acetate shows antioxidant activity. Ethyl acetate possess potent antioxidant activity than petroleum (Deshpande *et al.,* 2011) Coccinia grandis methanol extract and leaf powder contain the antioxidant principle (Mujumder *et al.,* 2008)

Antiulcer

The anti-ulcer activity aqueous extract of leaves of Coccinia grandis was investigated in pylorus ligation and ethanol induced ulcer models in experimental rats. Ulcer index was determined in both models. Aqueous extract of Coccinia grandis at doses of 250 and 500 mg/kg produced significant inhibition of the gastric lesions induced by pylorus ligation induced ulcer and ethanol induced gastric ulcer .The extract showed significant reduction in ulcer index, free acidity and gastric (Girish *et al.,* 2011)

Manoharan (2010) evaluated the Ethanol, aqueous and total aqueous extract for antiulcer activity in pylorus ligation induced gastric ulcer. Ethanolic extract showed the antisecretory mechanism for their anti ulcerogenic activity. Ethanolic extract of plant extract at 400 mg/kg exhibited antiulcerogenic activity as that of omeprazole .

Antimalarial

Extract of Coccinia grandis shows excellent antiplasmodial activity against the Plasmodium falciparum (Sundaram *et al.,* 2012). Aqueous leaf extract of Coccinia grandis decreases the SGPT, SGOT, ALP, total protein, blood urea nitrogen concentration. Hydrophilic moiety of Coccinia grandis extract is responsible for antimalarial activity. The extract reduces the significantly the Plasmodium berghei parasite count in mice (Samanta *et al.,* 2011).The Larvicidal activity of Coccinia grandis in which methanolic extract of Coccinia grandis is used (Rahumann., 2008).

Anti inflammatory

Deshpande (2011) evaluated the aqueous extracts of Coccinia grandis leaves and stem for the anti-inflammatory activity against formaldehyde-induced paw edema in rats. The formaldehyde causes the cell damage and which provokes the production of histamine, prostagrandis bradykikin and serotonin. Aqueous extract of leaves showed more significant percentage inhibition of paw edema than the aqueous extract of the stem and standard, used as indomethacin. Formaldehyde induced inflammation results production of endogenous mediators, such as; histamine, serotonin, prostaglandins, and bradykinin treated with Coccinia grandis extract (Bernard *et al.,* 1998).

Antipyretic

Aggarwal (2011) evaluated methanolic extract of Coccinia grandis for antipyretic activity at the doses of 100 and 200 mg/kg in yeast-induced fever. The extract showed antipyretic activity by influencing the prostaglandin biosynthesis. Prostaglandin is considered as a regulator of body temperature. Coccinia grandis extract contains glycosides, alkaloids, flavonoid, terpenoids, phenols and tannins.

Analgesic

Acetic acid induced writhing, Tail immersion and Hot plate models were used to evaluate the analgesic activity. Acetic acid induced analgesia is treated by using a methanol extract of Coccinia grandis. A Methanolic extract of the leaves of Coccinia grandis revealed the presence of glycosides, alkaloids, flavonoid, terpenoids, phenols and tannins. Analgesic action of the active compound(s) in the methanol extract of Coccinia grandis May be mediated through peripheral but not central mechanism. Coccinia grandis reduce the complications produced by acetic acid (Aggarwal *et al.,* 2011).

Hypoglycemic

Mallick (2007) evaluated Combined extracts of Musa paradisiaca and Coccinia indica aqueous extract of leaf for antidiabetic activity in streptozotocin induced diabetes rats. The ethanolic extract of the aerial part decreases blood glucose levels and lipid parameters in streptozotocin induced diabetic rats at 100 or 200 mg/kg. Chronic administration of fruit extract 200 mg/kg for 14 days reduces the blood glucose level in alloxan induced

diabetic rat (Gunjan *et al.,* 2010). The aqueous extract of Coccinia indica reduced the blood glucose level; also reduced the cholesterol, protein and urea with prolonged treatment. Coccinia grandis stimulated gluconeogenesis, or inhibited glycogenolysis in the diabetic rat liver. Treatment with Coccinia extract increases the total protein, SGPT, SGOT (Doss *et al.,* 2008). The Coccinia indica leaves extract exerts hypoglycemic activity on blood glucose and cholesterol, TG, LDL, VLDL level in alloxan induced diabetic rats (Manjula *et al.,* 2007). The hypoglycemic activity of Coccinia grandis fruit evaluated by using alloxan induced diabetic rat. Ethanolic extract shows the decreased blood glucose level. Pectin from fruit reduces the blood glucose by decreasing the absorption of glucose from the intestine and increasing liver glycogen and decreasing glycogen phosporylase (Ramakrishnan *et al.,* 2011). Combined Methanolic extract of leaves of Coccinia indica and salvadora oleoides shows the hypoglycemic activity (SaklaniI *et al.,* 2012). Alcoholic extract of Coccinia grandis leaves (Eliza Jose, 2010) And stem have the capacity to lower the blood glucose level in normal fasted rats (Doss *et al.,* 2008) Ethyl acetate extract and petroleum ether extract of Coccinia contains triterpines, alkaloid, flavonoid, B-carotene which is responsible for the hypoglycemic activity (Ariful Islam *et al.,* 2011).

Antifungal

Bhattacharya(2010) evaluated the antifungal activity of the Coccinia grandis leaves extract against the Candida albicans-II, Candida tropicalis, Aspergillus Niger, Saccharomyces cerevisiae, Candida tropicalis II, Cryptococcus neoformans and Candida albicans ATCC. Ethanol extract is more significant in producing antifungal activities. Nonpolar fractions in the extract possess a higher level of antifungal properties. Aqueous extract is more sensitive for both strains of Candida albicans and Ethanolic extract is more sensitive for Aspergillus Niger and both strains of Candida albicans (Bhattacharya *et al.,* 2010).

Hepatoprotective

Vadivu (2008) evaluated the alcoholic extract of the fruit of coccinia grandis for Hepatoprotective activity against CCl4-induced Hepatotoxicity in experimental rats, Treatment with 250 mg/kg ethanolic extract of fruit significantly reduced the SGPT, SGOT and bilirubin level. Hepatoprotective activity of the extract may be due to the antioxidant effects of flavonoid found to be present in the fruits. Flavonoids, triterpens and tannin were antioxidant agent present in coccinia grandis and may interfere with free radical formation confirmed that Hepatoprotective activities of certain flavonoids are known. (Vinothkumar et al.,2009; Anil Kumar *et al.,* 2012; DR. Krishnkumari *et al.,* 2011;Sunilson., et al 2009).

Antidyslipidemic

Singha (2007) evaluated chloroform extract of Coccinia grandis leaves for antidyslipidemic activity by lowering the triglycerides and cholesterol level in hamsters. Chloroform extract of Coccinia grandis leaves containing polyprenol, lowers the plasma lipid profile then increasing high density lipid cholesterol and total cholesterol ratio. C60-polyprenol isolated first time from this plant. It drastically decreased serum triglycerides by 42%, total cholesterol 25% and glycerol 12%, in high fat diet feed dyslipidemic hamsters at the dose of 50 mg/kg body weight. Aqueous and ethanolic extracts of leaves can be used for control of obesity (Mishra *et al.,* 2012).

Anticancer

There are a number of vegetables occurred to reduce the risk of cancer. One of them is Coccinia grandis. The anticancer activity of the Coccinia grandis is due to the antioxidant nature. The antioxidant nature of Coccinia grandis reduces the ferrocynaide to ferrous. Hydrogen peroxide scavenged from Coccinia grandis neutralizes to water (Behera *et al.,* 2012). Bhattacharya (2011) evaluated the aqueous extract of leaves of coccinia grandis for anticancer activity. Nitric oxide is a free radical which acting an important role in the pathogenesis of pain, inflammation. The antioxidant principle of Coccinia grandis decreases the nitrite generated by decomposition. Graded response produced by the cell is comparatively less. Coccinia grandis significantly reduced viable cell count and increased non viable cell count suggesting comparable anticancer property with that of the reference drug (vinblastine) (Nanasombat *et al.,* 2009; Bhattacharya *et al.,* 2011).

Antitussive

Pattanayak (2009) evaluated the methanol extracts of the fruit of coccinia grandis for analgesic activit**y.** Coccinia grandis has extensively used to get relief from asthma and cough by the indigenous people of India. The methanol extracts of the fruit of Coccinia grandis show the presence of alkaloid, tannin, steroid, triterpenoid, glycoside, carbohydrates and reducing sugar. The Antitussive activity of methanol extract has been compared with that of codeine (Antitussive drug). The methanol extract of Coccinia grandis fruit showed the significant decrease in cough induced by the chemical simulation similar to codeine phosphate in a dose dependant manner. The methanol extract produces maximum inhibition of cough at 90 min. The highest inhibition of cough (56.71%) was produced by the extract of the 400 mg/kg dose level at 90 min. The methanol extract act through the central nervous system.

Mutagenic effect

Aqueous extract of leaves of Coccinia grandis showed inhibition of growth and mutagenesis on Neurospora crassa by a gradual decrease of growth of mycelia. This result indicates that Coccinia grandis plant shows mutagenic effect on Neurospora crassa. (Bhuiyan *et al.,* 2009).

Alpha-amylase inhibition

Jaiboon (2011) evaluated the methanolic extract of Coccinia grandis for alpha amylase inhibitory activity. The dried plant material extracted with 50% aqueous methanol (10 ml/g dry

wt.) and redissolved in 50% aqueous DMSO (10 ml/g dry wt.) and subjected to alpha-amylase inhibitory activity. The Coccinia grandis showed the 81.13% of alpha amylase inhibitory activity.

CONCLUSION

The literature survey revealed that Coccinia grandis has been widely studied for its pharmacological activities and regarded as Universal Panacea in Ayurvedic medicines.

It can be concluded that Coccinia grandis 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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