ABSTRACT

Traditional system of medicine consists of large number of plants with various medicinal and pharmacological importances and hence represents a priceless tank of new bioactive molecules. *Coccinia grandis* L., (Ivy gourd) of the family *Cucurbitaceae* is distributed in tropical Asia, Africa and is commonly found in India, Pakistan and Srilanka. The *Cucurbitaceae* family is commonly known as gourd, melon, and pumpkin family. It is a rapidly growing, perennial climber or trailing vine. Traditionally different parts of this plant namely the roots, leaves and fruits are used in folklore medicine for several purposes like jaundice, diabetes, wound healing, ulcers, stomach ache, skin disease, fever, asthma, cough. The phytochemical analysis of the showed that the terpenoids, reducing sugar, flavonoids and proteins were found to present in significant quantity. The leaf and its constituents have been reported to possess anthelmintic activity, antioxidant activity, anti-inflammatory, analgesic and antipyretic activity, antimicrobial activity, antihyper-glycemic activity, hepatoprotecctive activity. The present review is the pool of information that highlights its various pharmacological activities.

KEYWORDS: *Coccinia grandis* (Ivy Gourd), Antioxidant, Antidiabetic activity, Antibacterial activity.

INTRODUCTION

Plants, the most wonderful gift from nature have been used as an origin of drugs. Various types of drugs are obtained from them. These types of plants are known as medicinal plants. We use one or more of its organ for therapeutic purpose as a precursor of synthesizing of many useful drugs. According to some generous estimates, almost 80% of the present day medicines are directly or indirectly obtained from plants.\[^{[4]}\]
Ivy gourd (Coccinia grandis) is a unique tropical plant that is a member of Cucurbitaceae family. The common names for Coccinia grandis fruit are ivy gourd, scarlet fruited gourd, Tindori, tindola and Kovaikai. It grows well in India, Thailand and in tropical areas such as Hawaii. The edible parts of plant ivy gourd are differing from place to place due to variation in food habit. In Thailand leaves are edible, in Hawaii both fruits and leaves and in India, raw fruits are mostly consumed as a vegetable. Two varieties of C. grandis are recognized; tender fruits are bitter in one variety and not bitter in another, and the latter is used in Asian cooking. The raw fruits are used to prepare an array of delicious dishes like stir fries, stuffed curries, stews, pickles and salads. The tender green fruits are nutritious and are good source of protein, calcium, fiber and beta-carotene - vitamin A as precursor.\[^{[3]}\]

It is a climbing perennial herb which spread vegetatively or by seed. Seeds may be the valuable sources for oils and proteins which can cover both industrial and edible demand. The stem is an herbaceous climber or perennial slender climber with occasional adventitious roots forming where the stem runs along the ground. The tendrils are long, elastic with coil like springy character that can wrap around the host to the entire length. The stem and root are the best used in skin disease, asthma, bronchitis, remove joint pains and many other. The most useful organ of these plants is leaves which are classified as palmately simple with five lobes while the shape varies from the heart to pentagon form. The leaves show anti-diabetic, anti-inflammatory, antipyretic, analgesic, antispasmodic, antimicrobial, and cathartic, expectorant activities. The fruit of this plant is ovoid in shape berry type which changes green to red color when become ripen. This part has also medicinal value in curing eczema, tongue sores and cerebral oxidative stress.

Coccinia grandis contain important raw material for drug production like bioactive compounds such as secondary metabolite like alkaloids, glycoside and saponin, bamyrine, lupeol, cucubbitacin, cephalandrol, cephalandrine and flavonoids.\[^{[4]}\]
**Table I: Botanical genesis**[^20] and native names of *coccinia grandis*.[^21]

<table>
<thead>
<tr>
<th>Botanical genesis</th>
<th>Native Names of <em>coccinia grandis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom: Plantae</td>
<td>Hindi: kunduru</td>
</tr>
<tr>
<td>Order: Cucurbitales</td>
<td>Kannada: tonde</td>
</tr>
<tr>
<td>Family: Cucurbitaceae</td>
<td>Konkani: tendale</td>
</tr>
<tr>
<td>Genus: Coccinia</td>
<td>Malayalam: kovakkai</td>
</tr>
<tr>
<td>Species: C. grandis</td>
<td>Marathi: bimba, tendali, tondli</td>
</tr>
<tr>
<td>Binomial name: C. grandis (L) J. Voigt</td>
<td>Punjabi: kanduri</td>
</tr>
<tr>
<td></td>
<td>Sanskrit: bimbaphala, tundika</td>
</tr>
<tr>
<td></td>
<td>Tamil: kovai</td>
</tr>
<tr>
<td></td>
<td>Telugu: bimbika, donda</td>
</tr>
</tbody>
</table>

**BOTANY OF C. GRANDIS:** From botanical description of *C. grandis*, it is a dioecious perennial herbaceous vine. Stems are mostly glabrous, produced annually from a tuberous rootstock, tendrils simple, axillary. Leaves are alternate, simple, blade broadly ovate, 5-lobed, [(5-9) to (4-9)] cm, acute and mucronate at the apex, cordate with a broad sinus at the base. Surfaces are glabrous or scaly, with 3-8 glands near the base, margins denticulate, petiole (1-5 cm) long. Inflorescence is usually of solitary, axillary flowers. Calyx is of 5 subulate, recurved lobes (2-5 mm) long on the hypanthium. Peduncle is (1-5 cm) long. Corolla is campanulate, white, (3-4.5 cm) long, deeply divided into 5 ovate lobes. Stamens are 3, present as staminodes in female flowers. Ovary is inferior. Fruit is a smooth, bright red, ovoid to ellipsoid berry (2.5-6 cm) long. Synonym of botanical name is “cephalandra indica” (ivy gourd).[^20]
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.[21]

Table II: Medicinal value of various parts of coccinia grandis.[21]

<table>
<thead>
<tr>
<th>Plant part</th>
<th>Medicinal value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf</td>
<td>Antidiabetic, oxidant, larvicidal, GI disturbances, Cooling effect to the eye, Gonorrhea, hypolipidemic, skin diseases, urinary tract infection.</td>
</tr>
<tr>
<td>Fruit</td>
<td>Hypoglycemic, analgesic, antipyretic, Hepatoprotective, tuberculosis, eczema. anti-inflammatory</td>
</tr>
<tr>
<td>Stem</td>
<td>Expectorant, antispasmodic, asthma, bronchitis, GIT disturbances, urinary tract infection, skin diseases,</td>
</tr>
<tr>
<td>Root</td>
<td>Hypoglycemic, antidiabetic, skin diseases, removes pain in joint, urinary tract infection</td>
</tr>
</tbody>
</table>

VARIETIES OF COCCINIA

Table III: It shows the different variety of Coccinia.[17]

<table>
<thead>
<tr>
<th>Name of Variety</th>
<th>Synonym</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coccinia abyssinica (Lam.) Cogn.</td>
<td>Bryonia abyssinica Lam.</td>
</tr>
<tr>
<td>Coccinia grandis (L.) J. Voigt</td>
<td>Coccinia cordifolia Wight, Coccinia indica, Coccinia cordifolia, Cephalandra indica, Bryonia cordifolia, Coccinia grandis (L.) Voigt</td>
</tr>
<tr>
<td>Coccinia palmata (Sond.) Cogn.</td>
<td>Cephalandra palmata E. Mey. ex Sond.</td>
</tr>
</tbody>
</table>

Pharmacological profile of coccinia grandis

The whole plant of Coccinia grandis having pharmacological activities like analgesic, antipyretic, antiinflammatory, antimicrobial, antiulcer, antidiabetic, antioxidant, hypoglycemic, hepatoprotective, antimalarial, antidyslipidemic, anticancer, antitussive, mutagenic. Coccinia grandis have been to possess expectorant, antispasmodic, antiperiodic, stimulant and diaphoretic properties.[22]

Antiulcer

Antiulcerogenic effects of Coccinia grandis (Linn.) Voigt leaves powder, its methanol and aqueous extracts were investigated on Aspirin-induced gastric ulcer model in rats, on the basis results, the leaf powder showed a significant increase in mucus secretion and decrease
in level of lipid peroxidation (LPO) and Superoxide dismutase (SOD) activity. Methanol extract at an equivalent dose to that of the powder also showed a significant decrease in ulcer index with significant changes in mucus secretion, LPO and SOD anti ulcerogenic potential of this plant due to increased gastric mucus secretion and has antioxidant activity. The Ethanol, aqueous and total aqueous extract for antiulcer activity in pylorus ligation induced gastric ulcer. Ethanolic extract showed the anti-secretory mechanism for their anti ulcerogenic activity. Ethanolic extract of plant extract at 400 mg/kg exhibited antiulcerogenic activity as that of Omeprazole.[5][22]

**Antioxidant**

The plant, C.grandis could be a prospective resource of natural antioxidant owing to the presence of secondary metabolites like terpenoids, saponin and flavonoids, proteins and carbohydrates and thus could be used as therapeutic agent used as antioxidant, antidiuretic, anti-inflammatory, antianalgesi Two methods were used to estimate the amount of antioxidant activity in the fruits of Coccinia grandis. Among the two methods, antioxidant activity was more when performed with phosphomolybdate assay. Ethanol and methanol extracts show more antioxidant activity than any other antioxidant.[15]

Evaluated Ethanol extract of root of Coccinia grandis contain flavonoids which are responsible for antioxidant activity. Methanol extracts of the fruit of Coccinia grandis possess 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. Ethanol and methanol extract shows the antioxidant activity. Coccinia grandis stem extract containing solvent petroleum, chloroform and ethyl acetate shows antioxidant activity. Ethyl acetate possess potent antioxidant activity than petroleum. Antioxidant activities of different fractions from different extracts were evaluated by using InVitro antioxidant assay models like phosphomolybdenum and reducing power assay. The result obtained by this study C.grandis has potent antioxidant activity.

C.grandis could be a prospective resource of natural antioxidant owing to the presence of secondary metabolites like terpenoids, saponin and flavonoids, proteins and carbohydrates.[8]

The antioxidant activity of the fruit has been evaluated by using three in vitro assays and was compared to standard antioxidant, Butylated hydroxyanisole (BHA). The results obtained in
the present study indicate that the fruit of Coccinia grandis is a potential source of natural antioxidant.

The antioxidant activities of the fractions have been evaluated by using nine in vitro assays and were compared to standard antioxidants such as ascorbic acid, α tocopherol, and curcumin and butylated hydroxy toluene (BHT). All the fractions showed effective H donor activity, reducing power, free radical scavenging activity, metal chelating ability and inhibition of β-carotene bleaching. None of the fractions exerted an obvious pro-oxidant activity. The antioxidant property depends upon concentration and increased with increasing amount of the fractions.\textsuperscript{[21]}\textsuperscript{[22]}

Both cold and hot ethanol extracts showed antioxidant property when compared with standard Trolox.\textsuperscript{[19]}

**Hypoglycemic**

Alcoholic extract of Coccinia grandis leaves and stem have the capacity to lower the blood glucose level in normal fasted rats. Ethyl acetate extract and petroleum ether extract of Coccinia contains triterpines, alkaloid, flavonoid, B-carotene which is responsible for the hypoglycemic activity. Anti-hyperglycaemic and Insulin Release Effects of Coccinia grandis (L.) Voigt Leaves in Normal and Alloxan Diabetic Rats. In Vitro Antioxidant Profile of Alcoholics extracts of Coccinia grandis leaves Antidiabetic and Antioxidant Activities of Decoctions of Coccinia grandis Linn. And Centella asiatica (L.) on Alloxan induced Diabetic rats. Blood Sugar Lowering Effect of Coccinia grandis (L.) leaves as a hypoglycemic agent has a blood sugar lowering effect.\textsuperscript{[22]}

Methanolic extract of Coccinia grandis leaf and fruit (400 mg/kg) significantly decreased blood glucose level in glucose fed rats at 120 minutes when compared with the control group. It also decreased the elevated blood glucose at 60 minutes after the glucose administration. The control group showed significant increase in blood glucose level when compared with the normal group.\textsuperscript{[12]}

Double-blind phase I clinical trial was conducted at the general hospital and a private hospital in Matara using 122 healthy volunteers in August 2009 and observed that Coccinia grandis has a blood sugar lowering effect.\textsuperscript{[7]}
The extracts showed increase in the glucose tolerance of the rats and decrease in the fasting blood glucose level of diabetic rats, showing the hypoglycemic activity of the plant which is most pronounced in methanolic extract.\textsuperscript{[12]}

**Antimalarial**

Extract of Coccinia grandis shows excellent antiplasmodial activity against the Plasmodium falciparum.\textsuperscript{[22]}

Leaves extract of Ivy gourd is effective against malarial parasites.\textsuperscript{[18]}

**Anti-inflammatory**

Evaluated the aqueous extracts of Coccinia grandis leaves and stem for the anti-inflammatory activity against formaldehyde-induced paw edema in rats. Formaldehyde induced inflammation results production of endogenous mediators, such as; histamine, serotonin, prostaglandins, and bradykinin treated with Coccinia grandis extract.\textsuperscript{[22]}

**Antipyretic**

Methanolic extract of Coccinia grandis was evaluated for antipyretic activity.\textsuperscript{[22]}

**Analgesic**

Tail immersion and Hot plate models were used to evaluate the analgesic activity.\textsuperscript{[22]}

Acetic acid induced analgesia is treated by using a methanol extract of Coccinia grandis.

Acetic acid induced writhing model represents pain sensation by triggering localized inflammatory response. Acetic acid, which is used to induce writhing, causes Algesia by liberation of endogenous substances, which in turn excite the pain nerve endings. Increased levels of PGE2 and PGF2α in the peritoneal fluid have been reported to be responsible for pain sensation caused by analgesic administration of acetic acid. The ethanol extract of Ivy Gourd (Coccinia grandis) produced significant writhing inhibition comparable to the standard drug diclofenac sodium. On the basis of this result it can be concluded that the ethanol extract of Coccinia grandis Linn. might possess analgesic activity.\textsuperscript{[4]}
Antifungal
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.[22]

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.[21]

The phytochemicals in Coccinia grandis remained active even after thermal processing, Coccinia grandis instant juice powder could be a good source of phytochemical with potential antibacterial and antifungal property.[10]

Hepatoprotective
Evaluated the alcoholic extract of the fruit of Coccinia grandis for Hepatoprotective activity against CC14- induced Hepatotoxicity in experimental rats. Ethanolic extract of the leaves of Coccinia grandis possessed significant hepatoprotective activity against Carbon tetrachloride intoxication in rats.[14][22]

Antidyslipidemic: Evaluated chloroform extract of Coccinia grandis leaves for antidyslipidemic activity by lowering the triglycerides and cholesterol level in hamsters. Aqueous and ethanolic extracts of leaves can be used for control of obesity. Ivy gourd (Coccinia grandis L. Voigt) root suppresses adipocyte differentiation in 3T3- L1 cells.[22]

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.[21]

Anthelmintic
Methanolic extract of Coccinia grandis possess the anthelmintic activity. The worm pheretime posthumata were used for Anthelmintic 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.\textsuperscript{[20]}[21][22]

**Antibacterial**

In vitro antibacterial activity of leaves and stem extracts of Coccinia grandis L., has been investigated against Bacillus cereus, Corynebacterium diphtheria, Staphylococcus aureus, Streptococcus pyogenes, Escherichia coli (ETEC), Klebsiella pneumonia, Proteus mirabilis, Pseudomonas aeruginosa, Salmonella typhi and Shigella boydii. Water extract of leaves and ethanolic extract of stem showed significant activity against Shigella boydii and Pseudomonas aeruginosa respectively.\textsuperscript{[22]}

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. 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.\textsuperscript{[21]}[1][16]

Both cold and hot ethanol and acetone extracts of C. grandis fruits showed some degree of bacterial growth inhibition. Acetone extracts exhibited higher antibacterial activity.

Coccinia grandis showed poor antimicrobial activity having highest zone of inhibition of 13.33 mm against Staphylococcus aureus. Coccinia grandis has extremely good scavenging activity having the IC50 of 1.67 µg/ml. Coccinia grandis also showed moderate analgesic activity having percent inhibition of writhing 57.67.\textsuperscript{[19]}

Coccinia grandis instant juice powder contains high total ash content which is attributed to high mineral value. The phytochemical screening is an evidence of antibacterial and antioxidant property of Coccinia grandis instant juice powder.\textsuperscript{[10]}

**Anticancer**

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. 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.²¹

**Antitussive**

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 dependent 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.²⁰²¹⁹

**Snakebite**

Decoction of root along with leaves of Adhatoda vasica, Alangium salvifolium and Coccinia grandis is taken internally by the tribals of Tirunelveli hills, Tamil Nadu, India.¹³

**CONCLUSION**

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, anticancer, antitussive hypoglycemic, hepatoprotective, antimalarial, antidyslipidemic in different animal models.

The multiple benefits of Coccinia glandis are true miracles of nature. A detailed and systematic study is required for identification of plants, which may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plant.
REFERENCES


