



A Comprehensive Review on *Coccinia grandis* (L.) and Their Pharmacological Activities

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ABSTRACT

Ivy gourd, or *Coccinia grandis* (L.) Voigt, is a permanent grower or hanging vines that grows quickly. Native medicine has historically utilized the leaves, roots, and berries of this plant to cure a variety of conditions, including diabetes, cancer, ulcers, diarrhoea, edema, inflammatory disorders, fever, bronchitis, asthma, burns, cutaneous blisters, bites from insects, allergic reactions, ocular infections, and urinary disorders. The alkaloids, flavonoids, coumarin-based ester ethers, fatty acid fatty alcohols, terpenoids, and phenolic substances are only a few of the many chemical types of phytochemical constituents found in this species.

The plant's benefits for the cardiovascular system along with its antidiabetic, antineoplastic, antiparasitic, antibacterial, liver-protective, antipyretic, analgesic, anti-Alzheimer's, anticataract, antileishmanial, anti-anaphylactic, anti-histaminic, and wound-healing properties have been confirmed by several in vitro and in-vivo investigations. This summary provides enough information to use these components of plants to make suitable medications [1].

Keywords: Peptic ulcer, *Coccinia grandis*, B-sitosterol alkaloids, Ivy gourd, Tritriacontane.

INTRODUCTION

Fruit, melon, and squash are typical names for members of the Cucurbitaceae family. There are 960 species in the Cucurbitaceae family of *Coccinia grandis*. The entire family is mostly found in tropical regions. Reddy (2009) states that the majority of plants in the Cucurbitaceae family are annual vines. Only tropical Africa is home to the rest 29 varieties of *Coccinia*. Although this vegetable is found across tropical Asia, the Central American region, and Africa, it is especially well-liked in Pakistan, Bangladesh, Malaysia, Indonesia, Philippines, Vietnam, Cambodia, Thailand, Myanmar, and Sri Lanka. Ivy gourd is referred to by a number of native names at Bangladesh, including Telakucha [1-2].

There are over 7000 varieties of plants in India, and the World Health Organization predicts that 80% of citizens in developing nations rely nearly entirely on conventional medicine as their primary medical needs. Plants were essential for maintaining human well-being and improving standard of life, especially for those who live in rural communities [2].

BOTANY

The perennial vine *Coccinia grandis* grows rapidly and to a length of many meters. It can produce dense vegetation in places where bushes and tiny trees are easily covered.

Leaves

This perennial climber has a single tendril and glabrous leaves. The leaves have five lobes and are 6.5–8.5 cm in length and 7–8 cm in width. This species is dioecious. Both male and female flowers emerge from the axils of the petiole and have three stamens [2]. The basal sinus is typically triangular, oblique, apical, approximately 5-lobed, far from dentate, fairly opaque on the two sides, rather fleshy, dull green colour above, a glaucous below, ciliate across the border, finely punctate, and has multiple massive flat round glands, via petiole lobes that are 2–3.2 cm long close to the axils line of veins below, especially at the bottom [6].



Flower

The hypanthium's calyx has five subulate with circular lobes, each measuring two to five millimeters in length, while the stem is one to five centimeters long. The white, campanulate flower is 3–4.5 cm long and has five sharply split oblong lobes.

There are three petals in every flower. The *Coccinia grandis* bloom's seed is not very attractive. The corolla petals are oval, white, and about 15 to 20 mm long; the pedicels are 15 to 50 mm long; the calyx lobes are elongated, bent, and 2 to 5 mm long; the pistillate shaped petals are isolated on stems that are 10 to 30 mm long, which have a hypanthium base that is 10 to 15 mm long [2]. Seldom found in terminal bunches of two or three, staining blooms are solitary.

Fruit

The fruit is 15–35 mm in diameter and 25–60 mm in length. It has smooth stalks; it is translucent, ovoid to circular, and red [2]. The seeds are oval-shaped, shiny, yellowish-grey, and strongly flattened; they are fusiform-ovoid, cylindrical, somewhat beaked, and marked with white streaks when young and vibrant scarlet when fully ripe.

The Seed

Tan – coloured seeds with thicker edges that are 6-7 mm long [6].

Root

The plant's succulent, tuberous roots and stems probably allow it to withstand extended drought. Because of humans, *Coccinia grandis* is in a desperate situation. Unintentionally walking on wood or equipment can cause pigs, birds, and other creatures to grow where they land.

Two efficient techniques for creating an enhanced clone in ivy gour are hybridization and clonal selection [2].



Fig 1: *Coccinia grandis* [2].

Taxonomy

Table. 1: Taxonomical classification of *Coccinia grandis* [3].

Kingdom	Plantae
Order	Cucurbitales
Family	Cucurbitaceae
Genus	<i>Coccinia</i>
Species	<i>C. grandis</i>

Vernacular Names

Table. 2: Vernacular names of *Coccinia grandis* [4].

English	Ivy gourd, Scarlet
Hindi	Kundru
Kannada	Tondekay
Konkani	Tendli
Tulu	Manoli
Tamil	Kovai
Telugu	Dondakaya
Malayalam	Kovakka
Sanskrit	Tundika

Synonyms :- *Coccinia cordifolia* auct, *Bryonia grandis*, and *Coccinia indica* Wight and Arn

Bioactive Substances

The quantities of bioactive chemicals in *C. grandis* vary. Numerous chemical groups are among the bioactive substances that were isolated from various plant parts. Alkaloids such as luteolin and 1-tert-Butyl-5,6,7-trimethoxyisoquinoline were found in methanol-based leaf and dilute extracts of fruit. On the other hand, (S)-Norlaudanoline, Trachelogenin, Senecionine, Cathinone, Camptothecin, and (6S)-Hydroxyhyoscyamine were found in the ethyl fruit extraction.

Alkanes, such as tritriacontane and heptacosane, were extracted using ethyl acetate callus extract and petroleum ether callus and leaf extracts. The petroleum ether leaf extract contained the alkyl ether octadecane,1-(ethenyloxy). Pentadecanoic acid and octadecanoic acid were among the fatty acids found in a number of extracts, such petroleum ether callus, ethyl acetate leaf extractions, and methanolic extracts from fruit [3].

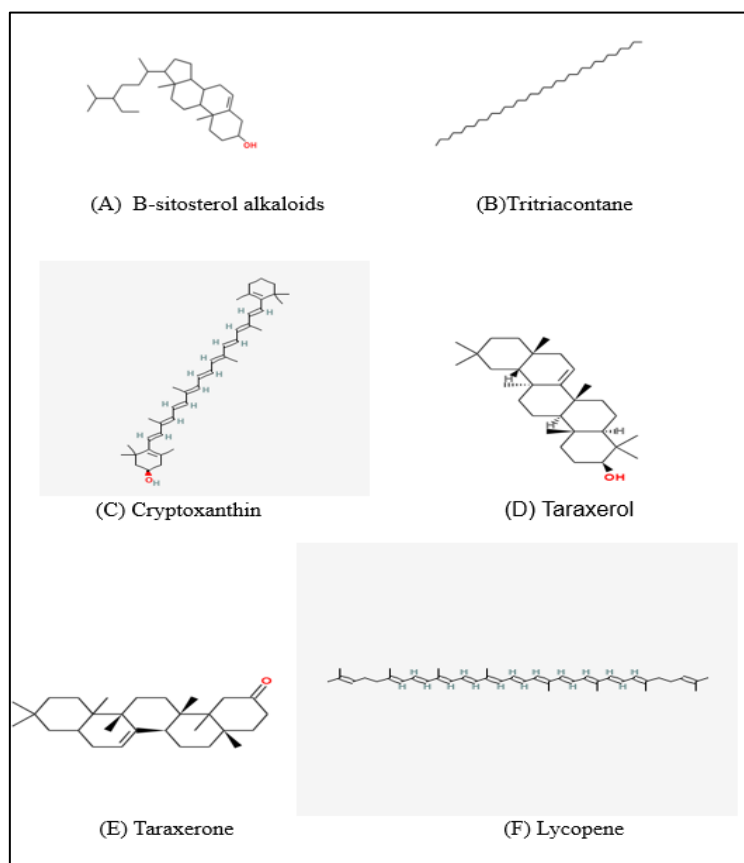


Figure 2: Some active phytoconstituents present in *C. grandis* [Molsoft]



Coccinia grandis's Medical Value In Different Parts

Table 3: The medicinal efficacy of different Coccinia grandis components Part of a plant with medicinal value [2].

Leaf	Antidiabetic, oxidant, larvicidal, GI disorders, gonorrhea, hypolipidemic, skin conditions, and urinary tract infections.
Fruit	Hypoglycemic, analgesic, antipyretic, hepatoprotective, anti-inflammatory, and TB properties.
Stem	Antispasmodic, asthma, bronchitis, GIT issues, urinary tract infections, skin conditions and expectorant
Root	Hypoglycemic, antidiabetic, skin conditions, joint pain relief, and urinary tract infection.

PHARMACOLOGICAL ACTIVITIES

Anti-Ulcer Properties

The antiulcer effects of *C. grandis* leaf extract (2 g/kg), aqueous extract (2 g/kg), and powder (0.5-2 g/kg) were tested in albino Wistar rats. The standard drug was famotidine (20 mg/kg bw) in 1% salt; aspirin (200 mg/kg bw) was used for comparison. The powdered leaf and methanol extract showed a significant reduction in ulcers, however the water extract showed no appreciable reduction (19). The anti-ulcer effects of ethanolic, aqueous, and full aqueous extracts of *C. grandis* (Linn.) leaves at 200 and 400 mg/kg were investigated in another investigation [3].

Activity of antioxidants

According to Albano (2006), oxidative stress is a state of cell damage brought on by free radicals. The antioxidant activity of *C. grandis* has been directly attributed to the presence of several phytochemicals. A study found that at a dosage of 250 g/mL, flavonoids from methanolic fruit extracts of *C. grandis* inhibited 2, 2-Diphenyl-1-picrylhydrazyl (DPPH) by 60%. The IC₅₀ value for DPPH radical scavenging activities was 0.165 mg/mL. The fruit of *C. grandis* contains flavonoids that are known to have antioxidant qualities, including quercetin, rutin, and kaempferol. With an IC₅₀ value of 4.85 mg/mL, or 98.96 μmol Trolox equivalents per gram of extract combined, *C. grandis* methanolic leaf extract may be a potential herb for speeding up the wound healing process due to its antioxidant activity. This implies that by raising the cell survival rate by more than 20%, *C. grandis* leaf extract may mitigate H₂O₂-induced oxidative stress in human fibroblasts and keratinocytes. Cellular ROS (reactive oxygen species) were reduced even at the lowest test level (50 μg/mL). Antioxidants reacted with stable free radicals in the DPPH experiment, showing values indicating significant antioxidant activity in *C. grandis* leaves (IC₅₀: 0.008–0.025 mg/mL).

However, crude extracts of *C. grandis* leaves were found to have substantial antioxidant activity, with values of 0.164 mg/mL, 0.142 mg/mL, and 0.29 mg/mL corresponding to organic solvents such as petroleum ether, ethyl acetate, and chloroform.

With an IC₅₀ value of 386.6 μg/mL, the aqueous extract likewise showed significant DPPH radical scavenging activity, albeit it had less reducing capacity. A study was conducted to evaluate the effects of various drying methods on the phytochemical availability and antioxidant activity of ethanolic extracts from *C. grandis* leaves. Freeze-drying was discovered to be superior to oven and shade drying. At 100 μg/mL, 50 μg/mL, 95% DPTH, 84% hydrogen peroxide scavenging, 112% FRAP, and 181.5% total antioxidant capacity, ethanolic extracts of *C. grandis* leaf demonstrated strong antioxidant activity.

Pharmacology and Clinical Traditional Medicine 5 (2024) 200150 125 μg/mL and 150 μg/mL, respectively. Additionally, the Trolox equivalent of cold ethanol extract was 0.197 mM for 1.315 mg/mL and 0.0263 mM for 0.329 mg/mL, while hot ethanol extract had 0.287 mM for 1.13 mg/mL and 0.101 mM for 0.326 mg/mL. Additionally, the antioxidant capability of diabetic rats treated with *C. grandis* extract improved ($P < 0.05$). The oxidative stress-related decline in glutathione and catalase in the liver and kidney tissues showed up to 60% recovery following treatment with *C. grandis* leaf extract. Samples comprising a 1:1 mixture of Averrhoa bilimbi fruits and *C. grandis* leaves exhibited the lowest IC₅₀ value (2.56 ± 0.29 mg/mL), suggesting the strongest radical scavenging activity, according to the results of the antioxidant activity test using the DPPH method. (Putra and others, 2020). According to a study, the EC₅₀ of isolated mucilage was 88.44 ± 0.020 μg/mL, and the maximal inhibition for 300 mg/mL of *C. grandis* fruit mucilage was $71.853\% \pm 0.023\%$ in terms of RSA%.

These findings demonstrate *C. gran-dis*' strong antioxidant activity [5].



Spasmolytic action

Calm contraction of muscles is thought to be caused by mast cell breakdown. Saponin, flavonoids, and glycosides have been identified in *C. grandis* fruit extracts of ethanol (ECGF). Flavonoids have been demonstrated to have bronchodilator and smooth muscle relaxant properties. It has been demonstrated that saponins and other glycosides have antiallergenic, spasmolytic, and tracheal smooth muscle relaxing qualities, making them helpful in the treatment of asthma. A study found that mice given ECGF significantly ($P < 0.001$) avoided mast cell degranulation, while animals in the placebo vehicle had 74% mast cell breakdown. ECGF provided 44.33% protection against degranulation at a dose of 150 mg/kg, while the traditional drug disodium chromoglycate provided 22.5% safety at a dose of 50 mg/L. Another study found that by stimulating presynaptic acetylcholine nerve the terminals, an aqueous leaf extract of *C. grandis* may cause a spasmodic reaction in rabbit jejunum smooth muscle. The aqueous extract of *C. grandis* leaves is a potent anti-constipation drug causing smooth muscle to spasm, based on this in vitro investigation [5].

Antipyretic Effects

Drugs that reduce body temperature are known as antipyretics that the methanolic extract of *C. grandis* leaves considerably lowers fever to a level comparable to that of prescription medication. A methanolic extract of *C. grandis* leaves successfully decreased yeast-induced pyrexia in a dose-dependent manner (50 mg/kg to 200 mg/kg). The 100 mg/kg dose was the most effective because it demonstrated a significant reduction ($P < 0.01$) in comparison to the other tested doses. Furthermore, the effectiveness of the extract was shown to be comparable to that of the rats receiving the recommended drug. In another study, the antipyretic activity of fresh leaves of *C. grandis* aqueous extract (CIAE) was evaluated in rats using the yeast-induced hyperpyrexia technique. There was a significant ($P < 0.05$) antipyretic effect at 200 and 300 mg/kg bw that was comparable to paracetamol. The body temperature of the normal rats did not decrease when the CIAE was given [3-5].

Antibacterial activity

In vitro antibacterial activity of leaves and stem extracts of *Coccinia grandis* L., has been investigated against *Bacillus cereus*, *Corynebacterium diphtheriae*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Escherichia coli* (ETEC), *Klebsiella pneumoniae*, *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. Evaluated the aqueous extract of leaves of *Coccinia grandis* for antibacterial activity against *Shigella flexneri* N1CED, *Bacillus subtilis* Escherichia coli, *Salmonella choleraesuis*, *Shigella dysenteries*, and *Shigella flexneri*, Aqueous extract of *Coccinia grandis* showed more substantial antimicrobial activity when compared to ethanol extract. The extract's polar moiety is primarily in charge of its antibacterial qualities. *Coccinia cordifolia*'s chloroform extract has a moderate level of activity against *Bacillus subtilis* and *Sarcina lutea*. *Staphylococcus aureus* is effectively combated by ethyl acetate extracts. Hexane extract is effective against *Pseudomonas aeruginosa* and *Sarcina lutea* evaluated the antibacterial activity of *Coccinia grandis* leaf extract against five different bacterial species using solvents such as acetone, ethanol, methanol, aqueous, and hexane. High antibacterial action against *S. pigeons*, *E. Coli*, *B. Ceres*, *K. pneumoniae*, and *S. aureus* was demonstrated by an ethanol leaf extract of *Coccinia grandis* [2].

Anthelmintic property

Coccinia grandis methanolic extract has anthelmintic properties. The study found that the worm *pheretima posthuma* was employed in this investigation. The extract is utilized in various concentrations. *Coccinia grandis* methanolic extract works by paralyzing the worm.

The time it takes to paralyze and kill the worm is used to gauge the activity. An assessment of the anthelmintic properties of crude extracts from *Schima wallichii*, *Coccinia grandis*, and *Diospyros peregrina*. At the chosen concentrations, the extracts paralyzed all of the chosen worms before killing them [2].

Antimalarial activity

Excellent antiplasmodial action against *Plasmodium falciparum* is demonstrated by *Coccinia grandis* extract. SGPT, SGOT, ALP, total protein, and blood urea nitrogen content are all reduced by *Coccinia grandis* leaf extract in water. *Coccinia grandis* extract's hydrophilic component is what gives it its antimalarial properties. The extract dramatically lowers the number of *Plasmodium berghei* parasites in mice. *Coccinia grandis*'s larvicidal efficacy, which uses the plant's methanolic extract [2].



Antitussive property

The indigenous inhabitants of India have long utilized *Coccinia grandis* to treat cough and asthma. Alkaloids, tannins, steroids, triterpenoids, glycosides, carbohydrates, and reducing sugar are all present in the methanol extracts of *Coccinia grandis* fruit. Methanol extract's antitussive properties have been comparable to those of codeine, an antitussive medication. Similar to codeine phosphate, the methanol extract of *Coccinia grandis* fruit demonstrated a dose-dependent considerable reduction in cough caused by the chemical simulation. At 90 minutes, the methanol extract causes the most cough inhibition. The extract of the 400 mg/kg dose showed the greatest suppression of cough (56.71%).

Hepatoprotective effect

Vadivu (2008) assessed the alcoholic extract of *Coccinia grandis* fruit for hepatoprotective efficacy against CCl₄-induced hepatotoxicity in experimental rats. Treatment with 250 mg/kg ethanolic fruit extract significantly lowered the levels of bilirubin, SGPT, and SGOT. The antioxidant properties of the flavonoids found in the fruits may be the cause of the extract's hepatoprotective efficacy. *Coccinia grandis* contains flavonoids, triterpens, and tannin, which are antioxidants that may prevent the production of free radicals and have been shown to have hepatoprotective properties [5].

Conclusion

Coccinia grandis, or ivy gourd, is a significant medicinal plant with a variety of pharmacological qualities that are backed by both scientific research and traditional use. Its medicinal potential is enhanced by the presence of a variety of bioactive substances, including flavonoids, alkaloids, and phenolic ingredients. Numerous biological actions, such as antidiabetic, antioxidant, antibacterial, anti-inflammatory, hepatoprotective, and anticancer effects, are displayed by the plant.

These noteworthy activities suggest that *Coccinia grandis* is a viable option for additional in vivo research, which can aid in comprehending its effectiveness, safety, and modes of action in living systems. Such research will be essential to the creation of trustworthy and successful herbal remedies derived from this plant.

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