

A SYSTEMATIC REVIEW ON NUTRACEUTICAL VALUES OF *COCCINIA GRANDIS*

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I. ABSTRACT:

Nutraceuticals is a booming field in healthcare where the medicinal values or therapeutic effects of the plants and their parts are explored to treat and prevent various diseases. As one of the traditional systems of medicine and household remedy, *Coccinia grandis* involved in the healthcare for past many years. *Cocciniagrands* produces enormous pharmacological activities such as insulin secretory effects, antiglycation, anti-inflammatory, antidyslipidemic, antioxidant and antidiabetic effects. These therapeutic values of *Coccinia grandis* due to the presence of various phytoconstituents such as flavonoids, phenolic acids, terpenoids, alkaloids, sterols and glycosides. This review is to reveal the various activities of *Coccinia grandis* and its geographical distribution.

II. INTRODUCTION:

The ivy gourd or *Coccinia grandis* is a cucurbitaceous perennial vegetable crop that is underutilized. The ripen fruit of *Coccinia grandis* is illustrated in {Fig.1}. Aggressive in nature, this climbing vine quickly cover trees, fences, and other structural supports. It is thought that *C. grandis* is indigenous to Asia, India, and central Africa. The ivy guard was first mentioned in India during the Mahabharata era [1]. The entire plant of *Coccinia grandis* is illustrated in {Fig.2}



Fig.1 Ripe fruit of *Coccinia grandis*



Fig.2 Whole plant of *Coccinia grandis*

A. BIOLOGICAL SOURCE:

Ivy gourd is a fruit or vegetable and it is a perennial herbaceous vine of family Cucurbitaceae. The scientific classification of *Coccinia grandis* is depicted in {Table.1}

TABLE.1: The scientific classification of the genus *Coccinia* is as follows:

Family	Cucurbitaceae
Subfamily	Cucurbitoideae
Tribe	Benincaseae
Genus	<i>Coccinia</i>
Species	<i>Grandis</i>

Ivy gourd is known by different names in different parts of the country. It is illustrated in the (Table 2)[21]

B. Microscopy:

The transverse section of the stem reveals that the stem's contour is hairy and wavy. The older stem has a hollow centre whereas the younger stem is solid. The single layered epidermis is made up of tightly packed, thin-walled cells. Outer surface is cutinized in the absence of intercellular gaps. There is collenchymatous hypodermis in addition to uniseriate and multicellular hairs covering the epidermis [2]. There are numerous open, bicollateral, and conjoint vascular bundles inside the cortex. Vascular bundles have patches of phloem followed by bands of cambium on either side of the xylem in the centre. In the core of the young stem is parenchymatous pith. The pith cells of a mature stem split and disorganized forming an uneven hollow. The transverse section of the root is made of a single layer of closely spaced, elongated cells with cuticle on the epidermis. Epidermal hairs are unicellular. Cortex is composed of cells called parenchymatous. The shape of cells is polygonal. The cortex is made up of large, intercellular areas with thin walls. Endodermis is pericyclic, uniseriate, and composed of parenchyma with thin walls. The vascular bundle has alternating strands of xylem and phloem, no cambium, and sparse pith in the middle. The upper and lower surface of a leaf are separated dorsoventrally. The lower epidermis is single layered, tubular and covered in a thin cuticle, while the upper epidermis is compactly organized cells are broken up by stomata. Mesophyll tissue, which is differentiated into loosely organized spongy tissue and single layered palisade parenchyma, is found between the top and lower epidermis. The thick midrib is divided into stele and collenchymatous hypodermis. The vascular bundle is closed, conjoint, and collateral. There is parenchyma with crystals of calcium oxalate beneath the hypodermis.

TABLE 2
VERNACULAR NAMES

Bengali	Telakucha
Hindi	Bimb, Bimba, Kanduri, Kunduru
Kannada	Kaagethoode, Thondeballi
Malayalam	Kova, Kovai
Marathi	Tondili
Sanskrit	Bimbi, Bimbika, Jivaka, Patuparni
Tamil	Covay, Kotturukanni, Kovai, Kovaikkay, Rattakovai
Telugu	Donda kaya
Urdu	Kundur
Punjabi	Kanduri

C. Geographic distribution:

Coccinia grandis the plant native to East Africa and is widely spread in tropical Asian countries. It grows abundantly in Indian states like Maharashtra; Cumilla district, Bangladesh; Lucknow, Uttar Pradesh; Eklagne village near Jalgaon. It is commonly found in countries like India, Indonesia, Malaysia, Philippines, Thailand, China, Pakistan, America [3]. It is also spotted in Pacific Islands such as Fiji, Hawaii, especially on Oahu and in the Kona/Kealahue area of the main Island and Tonga and Vanuata.

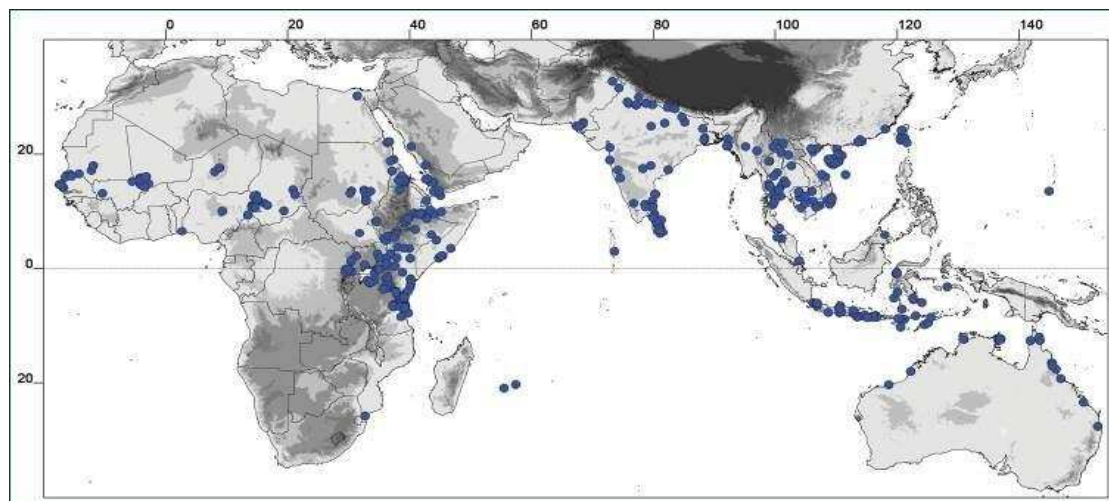


Fig.3 Geographical distribution of *C. grandis*

D. Cultivation:

Ivy gourds grow in semi-arid locations, dry forests, wooded grasslands, and frequently coastal areas [4]. Humid and warm climates are ideal for its growth. The optimal temperature range for its growth, quality, and good production is between 20°C to 32°C although it may grow in many different types of soil, well drained, rich, sandy, loamy soil is ideal for its growth [1].

Alkaline, acidic and heavy clay soils can be avoided. The ideal soil PH range for vegetable production and quality is 6.0-6.5. *Coccinia* may be planted alongside short duration crops like maize [4]. Though Summer and wet seasons are when the fruit peaks, it can be planted all year long. It can grow in both full and partial sun. *Coccinia* is propagated by using stem cuttings that are 10- 15 cm long and roughly 0.5 cm in diameter. Due to dioecious nature of ivy gourds, which produce 50% non-productive male plants, seed propagation is not often used. Planting takes place in February or March. In the field 30 cm depth by 60 cm diameter holes have been prepared. 20kg of farmyard manure was added and mixed with soil and water. To encourage the growth of side shoots, the cuttings are positioned either straight up or slightly angled. Plants are spaced 1.2 – 1.6 meter apart in plant holes. In about a month, cuttings begin to generate new leaves and shoots.

They start to produce suckers and begin to blossom after a month. At this point, the plants are irrigated every two days. Later on it is watered twice a week. The long stems are taught along a wooden pole, attached to vertical and horizontal wires. When the first new leaves and shoots appear, side dressing is applied. Nitrogen fertilizer up to 500g is required for each plant. They need extra fertilizer every month after the first fruits are picked. Weeding is done by using a machete or by hand. Aphids, whiteflies, mites and thrips are the main pests infesting ivy gourd plants and appropriate chemical measures should be taken to control these pests [1]. The plant starts fruiting 10-12 weeks after planting and flowering begins 50-60 days later.

E. Collection:

Young fruits can be harvested about one week after flowering. Harvesting is done weekly as long as there is enough moisture to produce new leaves and flowers [4]. The immature fruits can be harvested and stored at room temperature for about a week. The average yield is 10-15 tonnes per hectare. During the month of May, the fruits start to ripe. The gathered fruits were transported to the storage facility for freeze drying and kept at -20 °C where they were sealed in plastic bags and placed in ice box. The *C. grandis* leaves are collected and dried under shade for further processing. In case of stems, they are immersed in a little water for a week to facilitate biological retting and eliminate any tough skin from the stalk [3]. To extract moisture from the fibre, the inner fibre layer was cleaned with purified water and exposed to sunlight and processed further.

F. Phytoconstituents:

Phytochemical tests of fresh sections of leaves, stem and root of *Coccinia grandis* indicates the presence of alkaloids, tannins, lignins and phenolic compounds.

Carbohydrates, saponins and gums, mucilages are moderately present in the aqueous extract of *Coccinia grandis*. The various parts of *Coccinia grandis* exhibit different phytoconstituents in each extract which is given in (Table.3). Through the pickle storage period, the amount of triterpenes reduced, and this tendency continued as the aging period lengthened. In particular, Cucurbitacin B dropped significantly from pickles to raw fruit. Thus, some of the endogenous glucosidase enzyme activity with aging could be responsible for Cucurbitacin glycosides. It is interesting to note that after 15 days of pickle storage, the level of Cucurbitacin D grew to over 3 times that of the raw fruit and then progressively reduced. Cucurbitacin I was also shown to have somewhat increased [20].

TABLE.3 Parts of the plant containing different phytoconstituents

PART	EXTRACT	CONSTITUENTS	AUTHOR
Root	Aqueous	Triterpenoid, Saponin coccinioside, Flavonoid glycoside, Lupeol, β -sitosterol, Stigmast-7-en-3-one	Deokate.U. A. et al
Stem	Aqueous	Lignin, Tannin, Mucilage, Protein, Starch	Deokate.U. A. et al

Leaves	Petroleum ether	Sterols	<i>Arshad Hussain et al</i>
	Chloroform	Sterols, Tannins, Proteins and amino acids, Glycosides, Saponins Alkaloids	
	Ethanol	Sterols, Tannins, Flavonoids, Proteins and amino acids, Glycosides, Phenols, Carbohydrates, Saponins, Alkaloids	
	Aqueous	Tannins, Flavonoids, Proteins and amino acids, Glycosides, Phenols, Carbohydrates, Alkaloids	
Fruits	Aqueous	Teraxerone, Taraxerol, and (24R)-24-ethylcholest-5-en-3 β -ol glucoside, B-carotene, Lycopene, Cryptoxanthin, and Apo-6-lycopenal, B-sitosterol	<i>Deokate.U. A. et al</i>
Whole plant	Aqueous	Carbohydrates Proteins Cardiac glycosides Resins Saponins Terpenoids	<i>Sakharkar.P Chauhan B</i>
	Ethanol	Alkaloids Flavonoids Tannins Phlobatannins Resins Saponins Terpenoids Steroids	
	Acetone	Flavonoids	

G. Uses:

Several health benefits are provided by each portion of the Ivy gourd. The extract of each part of *Coccinia grandis* produces various pharmacological actions which is shown in the (Table.4)

TABLE.4 The pharmacological activities of *Coccinia grandis*

PART	EXTRACT	MODEL	RESULT	EFFECT	AUTHOR
Fruit	Methanolic extract	Sulphur dioxide induced cough in guinea pig and Swiss albino mice	Significant increase in antitussive effect of <i>Coccinia</i> extract than standard drug (Codeine)	Antitussive	<i>ShaktiPrasad Pattanayak et al</i>
Leaves	Aqueous extract,	Tail flick model	Dose dependent anti-inflammatory effect	Anti-inflammatory effect	<i>Niazi J et al</i>
Leaves	Aqueous extract	Pylorus ligated ethanol induced ulcer model	Comparable antiulcer activity as that of standard (Omeprazole)	Antiulcer activity	<i>C Girish et al</i>
Leaves	Ethanolic extract	Wistar rat model	Reduced cholesterol level, epididymal fat accumulation, liver wet weight	Anti dyslipidemic activity	<i>Shahnaz Siddiqua et al</i>
Leaves	Methanolic extract	Yeast induced pyrexia in rats	Significant reduction of pyrexia	Antipyretic effect	<i>Aggarwal Ashish S et al</i>
Fruits	Alcoholic extract	Carbon tetrachloride induced hepatotoxicity in rats	Decreased activity of serum enzymes, and bilirubin	Hepato protective activity	<i>Anil Kumar et al</i>
Leaves	Methanol extract	Acetic acid induced gastric pain writhing in Swiss Albino mice model	Number of writhings reduced which was significantly higher than that observed with a standard antinociceptive drug (Aspirin)	Antinociceptive activity	<i>Biplob Kumar Sutradhar et al</i>
Roots	Hydro methanolic extract	Invitro assay and compared with standard antioxidants such as ascorbic acid, α -tocopherol, curcumin and butylated hydroxyl toluene	Shows effective H donor activity, reducing power, free radical scavenging	Antioxidant activity	<i>Bhadauria P et al</i>
Fruits and leaves	Ethanol	Purified β -sitosterol fraction from extract by gradient silica gel column	Shows β -sitosterol hepatoprotective potential through anti hepatotoxic activity on serum transaminases and hepatic antioxidant	Anti hepatotoxic activity	<i>Shivaji P Gawade et al</i>

		chromatography which is administered in carbon tetra chloride intoxicated rats	enzymes		
Leaves	Aqueous methanolic extract	Streptozotocin induced rat model (combined extracts of <i>C. grandis</i> and <i>M. paradisiaca</i>)	Serum insulin level restored; the levels of glucose-6-phosphate dehydrogenase activity reversed to control level; levels of liver and muscle glycogen restored to control level.	Anti diabetic activity	<i>Mallick Chhanda et al</i>
Fruits	Ethanol extract	Diabetic induced animal shows anti diabetic activity by whole fruit extract alloxan induced diabetic rat	Reduces the blood glucose level. The effect was comparable to that of standard anti diabetic drug Glibenclamide	Anti diabetic activity	<i>Gunjan Manish et al</i>
Leaves	Methanolic extract	Oral glucose tolerance tests in glucose loaded Swiss albino mice	Shows highest level of serum glucose reduction	Anti hyperglycemic activity	<i>Biplob Kumar Sutradhaetal</i>
Leaves	Aqueous extract	Tissue culture	Inhibition of growth and mutagenesis	Mutagenic effect	<i>Harshitha etal</i>
Fruits	Hot and cold ethanol extract, acetone extract	Cell analysis	Cytotoxic effect was shown	Anticancer activity	<i>Sakharkar P et al</i>

H. Marketed formulation:

Plant preparations of *Coccinia grandis* are indigenously used for various practical applications as shown in the table.

TABLE.5 Marketed formulations of *Coccinia grandis*

MARKETED FORMULATION	TYPE	BRAND NAME	COMPANY NAME	DOSE	PRICE
Genius Herbs <i>Coccinia Indica</i> Leaf tablets	Tablets	Genius Herbs	Genius Nature Herbs Private Limited	500 mg	Rs. 220 / bottle (180 tablets per bottle)
Ivy gourd powder	Powder	KC Creation	Sehani Deshiya oushada PVT LTD	-	-

I. Home remedies:

Ivy gourd (*C. grandis*) is consumed in various ways,

SOUP: Young fruits, terminal green shoots, and leaves are consumed with soups, noodles, and rice whether they are fried, blanched, or even boiled.

KOLOBAN: Leaves and terminal shoots are used in Koloban for rice table as well as in Sayur and Sambelan in Indonesia

STIR FRIES: Young, lush terminal tips are blanched and then stir fried or dipped in chilli paste.

PORRIDGE: Young leaves are boiled, mashed, and added to porridge for young children.

COMFITED: Ripe fruit can be eaten either raw or comfited.

STEW: Red fruit are eaten raw, or they are peeled and cut into pieces and prepared as a stew with onions and tomatoes and other vegetable in East Africa [1].

III. CONCLUSION:

Coccinia grandis plays a vital role in both traditional system of medicine and as a nutraceutical in day-to-day life. It provides various pharmacological actions like anti-inflammatory, antitussive, anti-oxidant, anti-ulcer and anti hyperglycaemic activity and is thereby involved in the prevention and treatment of diabetes, respiratory disease, cancer, ulcer. These actions are achieved by the presence of enormous amount of phytoconstituents in every part of the *Coccinia grandis* which are extracted by using suitable solvents.

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