

**REVIEW ON COCCINIA GRANDIS (L) VOIGT (IVY GOURD)****\*Sujata Nagare, Deokar G.S, Nagare Rupali, Phad Nilesh**

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**ABSTRACT**

*Coccinia grandis* (Ivy gourd) belonging to Cucurbitaceae family, used as vegetable and grown throughout Indian sub continent. It is commonly known as kundru in India. Ivy plant has been used in traditional medicine as household remedy for various diseases. *Coccinia grandis* (Voigt) plays a major role in the medicinal properties. The plant part of *C. grandis* such as roots leaves and fruits are used for numerous medicinal purposes like wound healing, ulcers, jaundice, diabetes and antipyretic analgesic, anti-inflammatory, anti-tussive, antioxidant, anti-mutagenic, antibacterial, anti-protozoal,

hepatoprotective, expectorants. This review gives botany, Chemical constituents, morphological character, geographical distribution, medicinal values, physiochemical character, phytochemical character and pharmacological activities of *Coccinia grandis*.

**KEYWORDS:** *Coccinia grandis*, Cucurbitaceae.**INTRODUCTION**

The Ayurveda is the oldest system of medicine prevalent for about 5000 years in India. The Chinese system of medicine dates back to 200 B.C and is equally practised today.<sup>[2]</sup> The Unani system of medicine also called as Greco- Arab medicine is as old as the father of medicine 'Hippocrates' (460- 360 B.C). The World Health Organization (WHO) has listed 21,000 plants as herbs or medicinal plants.<sup>[15]</sup>

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**Fig.1 *Coccinia grandis* Flower and Fruit<sup>[17]</sup>**

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 World Health Organization (WHO) estimated that about 80% of the population living in the developing countries rely almost used traditional medicine for their primary health care need. *Coccinia grandis* plays a major role in the medicinal properties. The present review highlights the phytochemistry and pharmacology of *Coccinia grandis* plant belonging to the family Cucurbitaceae.

### **Botany of Plant Cucurbitaceae**

The cucurbits are characterized by having 5-angled stem and coiled tendrils. The leaves are alternate and usually palmately 5-lobed or divided without stipules. The flower is actinomorphic and dioecious. The calyx bears 3-6 lobes and a 3-6 lobed sympetalous corolla is found. The androecium is highly variable, consisting of basically 5 distinct to completely connate stamens that are twisted, folded or reduced in number. The gynoecium consists of a single compound pistil of 2-5 carpels. Generally with one style and many style branches. The ovary is inferior with one locule and usually numerous ovules. The fruit is a type of berry called pepo.

Different Variety of *Coccinia*<sup>[13]</sup>TABLE 1 Different Variety of *Coccinia*

Name of Variety	Synonym
<i>Coccinia abyssinica</i> (Lam.) Cogn	<i>Bryonia abyssinica</i> Lam
<i>Coccinia adoensis</i> (A. Rich.) Cogn.	<i>Coccinia parvifolia</i> Cogn., <i>Coccinia pubescens</i> (Sond.) Eyles, <i>Momordica adoensis</i> A. Rich.
<i>Coccinia grandis</i> (L.) J. Voigt	<i>Coccinia cordifolia</i> Wight, <i>Coccinia indica</i> , <i>Coccinia cordifolia</i> , <i>Cephalandra indica</i> , <i>Bryonia cordifolia</i> , <i>Coccinia grandis</i> (L.) Voigt
<i>Coccinia palmata</i> (Sond.) Cogn.	<i>Cephalandra palmata</i> E. Mey. ex Sond.

Taxonomical classification<sup>[27]</sup>

TABLE 2 Taxonomical classification

<b>Kingdom</b>	Plantae
<b>Super Division</b>	Spermatophyta
<b>Division</b>	Magnoliophyta
<b>Class</b>	Magnoliopsida
<b>Order</b>	Cucurbitales
<b>Family</b>	Cucurbitaceae
<b>Genus</b>	<i>Coccinia</i>
<b>Species</b>	<i>Coccinia grandis</i>

Essential Nutrient<sup>[40]</sup>

100 gm of the fruit has number of essential nutrient.

TABLE 3 Essential Nutrient

Nutrient	g/mg
Water	93.5 g
Protein	1.2 g,
Energy	75 kJ (18kcal)
Fiber	1.6 g
Carbohydrate	3.1 g
Fat	0.1 g
Fe	1.4 mg
Thiamin	0.07 mg
Ascorbic acid	1.4 mg
Riboflavin	0.08 mg
Ca	40 mg,
Niacin	0.7 mg

## Geographical distribution

*Coccinia grandis* native range extends from Africa to Asia, including India, the Philippines, China, Indonesia, Malaysia, Thailand, Vietnam, Eastern Papua New Guinea, and the Northern Territories, Australia. Its documented introduced range includes the Federated

States of Micronesia, Fiji, Guam, Saipan, Hawaii, the Marshall Islands, Samoa, Tonga, and Vanuatu. Native to tropical Africa and Asia, it was introduced to Hawaii as a backyard food crop. It is sometimes tolerated along garden fences and other outdoor features because of its attractive white flowers. In Hawaii, this plant has spread quickly through Manoa Valley to Punchbowl and into Waimanalo, Oahu, and into the Kona area. In parts of the Caribbean it is known as *lizard food*.

### **Botany**<sup>[15, 27, 31]</sup>

*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**

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, where as 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 auxiliary 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 stalks 10-30 mm long, hypanthium 10-15 mm long.

### **Fruit**

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

### **Seeds**

Seed are 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 gourd.

### Chemical constituents<sup>[15, 27]</sup>

**TABLE 4 Chemical Constituents**

<b>Leaves and Stem</b>	$\beta$ - Sitosterol, Cephalandrol, Cephalandrine A & B, Heptacosane
<b>Roots</b>	Alkaloids, $\beta$ - Amyrin, $\beta$ - Sitosterol, Carbonic acid, saponin- Coccinoside, flavonoid- Ombuin 3- <i>o</i> -arabinofuranoside, Lupeol, Resins, Stigmast-7- en- 3-one.
<b>Fruit</b>	$\beta$ - Amyrin acetate, $\beta$ - Sitosterol, $\beta$ - Carotene, Cucurbitacin B, Lycopene, Lupeol, Taraxerol, Taraxerone
<b>Seeds</b>	The seeds contain fat and fixed oil which are mainly esters of linoleic, oleic and palmitic acids.

### Medicinal value<sup>[15, 27]</sup>

**TABLE 5 Medicinal Value**

<b>Plant part</b>	<b>Medicinal value</b>
<b>Leaf</b>	Antidiabetic, Oxidant, Larvicadal, GI disturbances, Cooling effect to the eye, Gonorrhea, Hypolipidemic, Skin diseases, Urinary tract infection
<b>Fruit</b>	Hypoglycemic, Cure sores on tongue, Analgesic, Antipyretic, Hepatoprotective, Tuberculosis, Eczema. Anti-inflammatory
<b>Stem</b>	Antispasmodic, Asthma, Bronchitis, GIT disturbances, Urinary tract infection, Skin diseases, Expectorant
<b>Root</b>	Hypoglycemic, Antidiabetic, Skin diseases, Removes pain in joint, Urinary tract infection.

### Traditional uses.<sup>[15]</sup>

**Leaves** Decoction of leaves is useful as antispasmodic, expectorant and in cases of chronic bronchitis. The paste of leaves is applied externally in ringworm, psoriasis and itching. Juice of leaves is also useful in treatment of diabetes and malarial infection. Leaf extract of the plant possesses mutagenic effect against *Neurospora crassa* fungus. Leaf extract is also useful in treatment of gonorrhea.

### Fruit

Green fruit cures sores on tongue and dried fruit removes eczema. Fruit juice is useful in treatment of infections caused by helminthes. Fruit is used in treatment of fever, leprosy, infective hepatitis and jaundice. Fruit is also useful in asthma, ulcer and cough.

**Whole plant**

Whole plant is useful in fever, cataracts, pyelitis, cystitis, snake bite, urinary gravel and calculi. Every part of the plant is valuable in psoriasis, ring worm, small pox, scabies and other itchy skin conditions. Oil of the plant is used as injection into chronic sinuses. Methanolic extract of whole plant shows a strong free radical scavenging activity.

**Roots**

Dried powdered root bark is useful as cathartic. The ash of root is applied on skin lesions. Root extract is used to remove pain in joints and in treatment of diabetes.

**Pharmacological profile.**<sup>[27,35]</sup>**Antibacterial Activity**

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 aureus*. Hexane extract was found to be 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*.

**Anthelmintic Activity**

Methanolic extract of *Coccinia grandis* possesses the anthelmintic activity. The worm *pheretima posthuma* were used for antihelmintic activity. Different concentrations of the extract were 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.

**Antioxidant Activity**

Moideen K. (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* 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 (Deshpande S. *et al.*, 2011; Mongkolsilp S.*et al.*, 2004) Ethanol and methanol extract shows the antioxidant activity (Ashwini M.*et al.*, 2012) *Coccinia grandis* stem extract containing solvent petroleum, chloroform and ethyl acetate shows antioxidant activity. Ethyl acetate extract possess potent antioxidant activity than petroleum extract. (Deshpande S.*et al.*, 2011)

### **Antiulcer Activity**

The anti-ulcer activity of 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 C. *et al.*, 2011) (Manoharan P. *et al.* 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 Activity**

Extract of *Coccinia grandis* shows excellent antiplasmodial activity against the Plasmodium falciparum (Sundaram R. *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 A. *et al.*, 2011).The methanolic extract of *Coccinia grandis* is used larvicidal activity.(Rahumann A. 2008).

### **Anti inflammatory Activity**

The methanolic fruit extract of *Coccinia indica* Wight & Arn shows anti- inflammatory activity which may be contributed by the phytoconstituents such as flavonoids, tannins, saponins, reducing sugars and triterpenoids. A 60% methanolic extract produces a higher inhibition in the rat paw oedema induced by carrageenan than the standard drug, diclofenac sodium at a dose of 10mg/kg. The paw volume is measured by plethysmometer at 1, 2 and 3 hours after the carrageenan injection. The methanolic fruit extract shows 57. 24% inhibition in paw oedema at the dose level of 200 mg/kg which is comparable to that of diclofenac

treated group showing 51.97% inhibition respectively after 3 hours. The extract also significantly reduces the cotton pellet induced granuloma in rats. The percentage inhibition is 59.05% at the dose level of 200 mg/kg. This indicates its high efficacy to reduce the number of fibroblasts and synthesis of collagen and mucopolysaccharide, which are responsible for the granuloma tissue formation. Thus the anti inflammatory model shows that methanolic fruit extract of the plant possesses anti arthritic and antiproliferative activities.

### **Antipyretic Activity**

Aggarwal A.(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 Activity**

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.<sup>[11]</sup>

### **Hypoglycemic Activity**

Mallick C.(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 M.*et al.*, 2010).

### **Antifungal Activity**

Bhattacharya B.( 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*.<sup>[3]</sup>

### Hepatoprotective Activity

Vadivu R. (2008) evaluated the alcoholic extract of the fruit of *coccinia grandis* for hepatoprotective activity against Carbon tetrachloride 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.

### Antidyslipidemic Activity

Singha G. (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 polyphenol, lowers the plasma lipid profile then increasing high density lipid cholesterol and total cholesterol ratio. C60-polyphenol 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 R *et al.*, 2012).

### Anticancer Activity

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 S. *et al.*, 2012). Bhattacharya B. (2011) evaluated the aqueous extract of leaves of *coccinia grandis* for anticancer activity. Nitric oxide is a free radical which has important role in the pathogenesis of pain and 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) (Bhattacharya B. *et al.*, 2011).

### **Antitussive Activity**

Pattanayak S.(2009) evaluated the methanol extracts of the fruit of *Coccinia grandis* for analgesic activity. *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 alkaloids, tannins, steroids, triterpenoids, glycosides, 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.

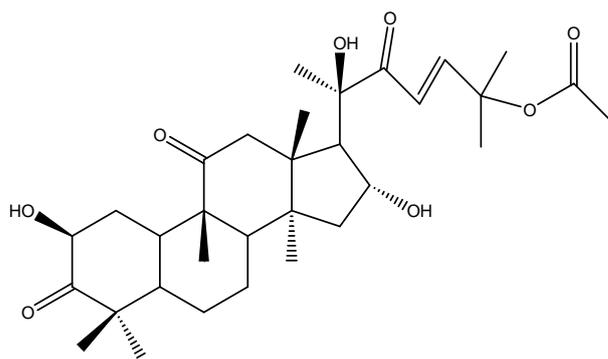
### **Mutagenic effect**

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 M.*et al.*, 2009).

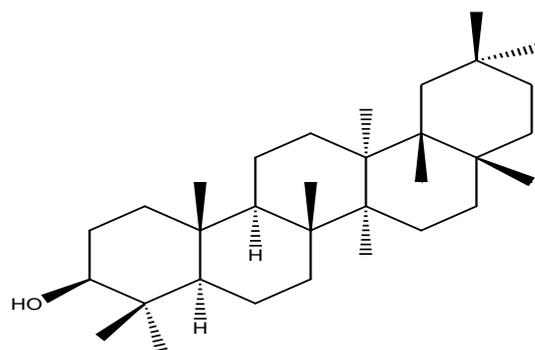
### **Alpha-amylase inhibition**

Jaiboon V. (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 118 114-119 wt.) and redissolved in 50% aqueous DMSO (10 ml/g dry wt.) and subjected to alpha-amylase inhibitory activity.

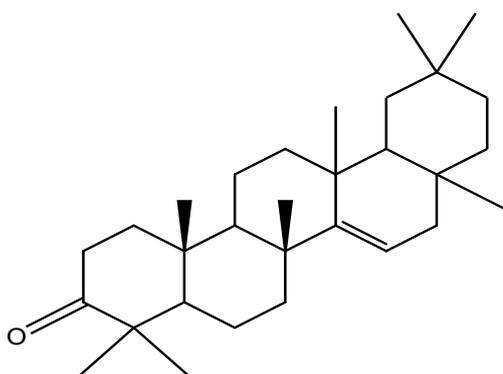
Structure of Chemical Constituent of *Coccinia grandis* fruit as shown in Fig. 2<sup>[15, 27, 35]</sup>



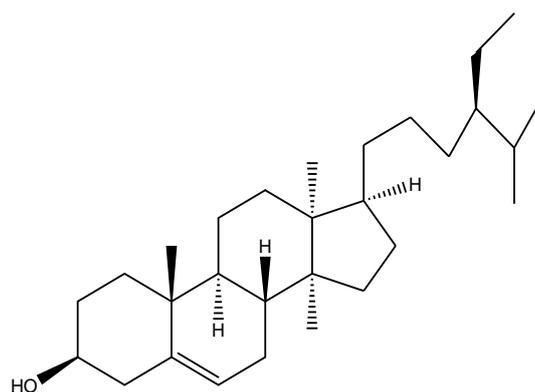
**Cucurbitacin B**



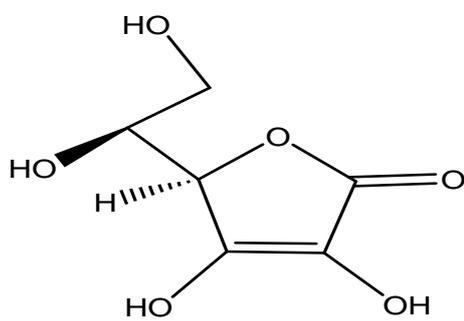
**Taraxerone**



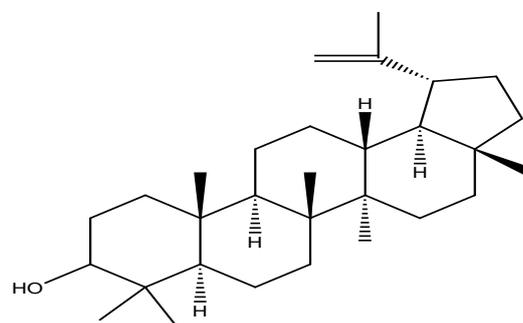
**Taraxerol**



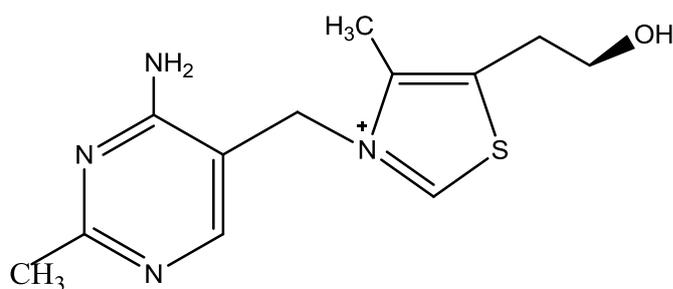
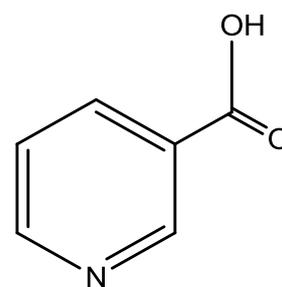
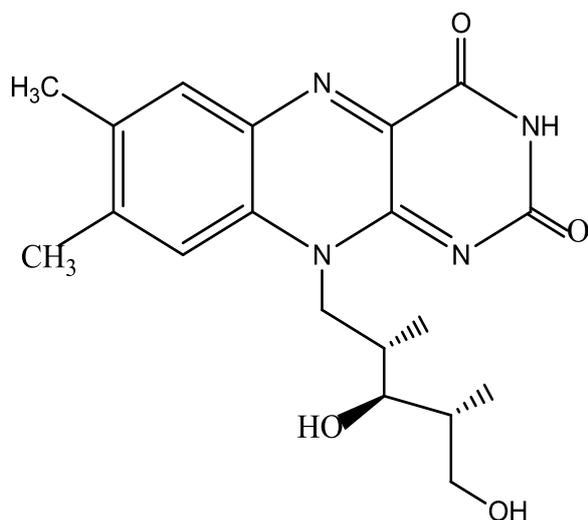
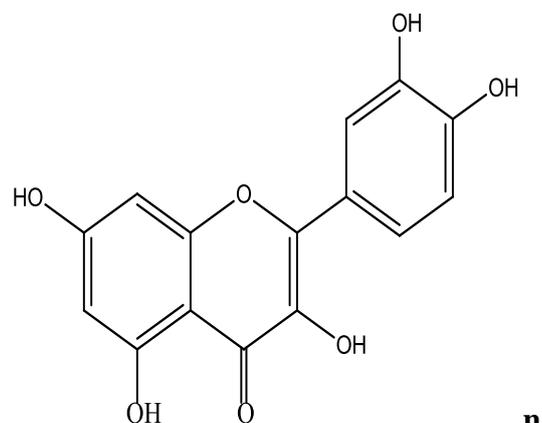
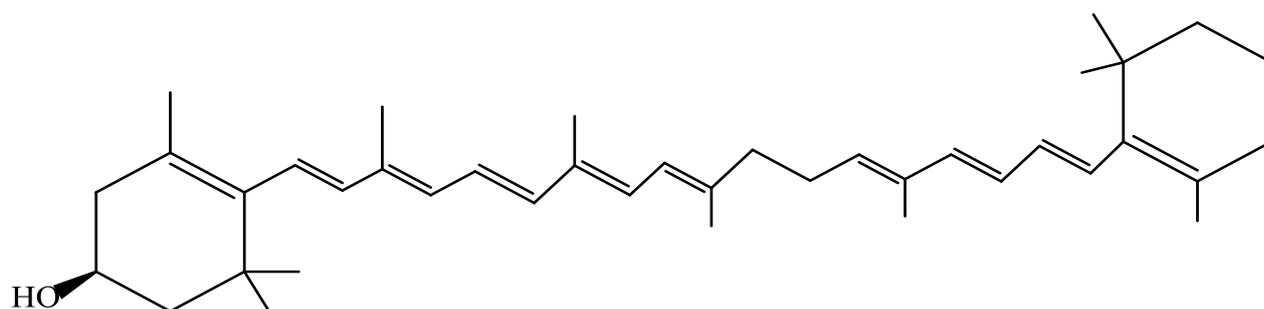
**Beta-Sitosterol**



**Ascorbic acid**



**Lupeol**

**Thiamine****Niacin****Riboflavin****Quercetin****Cryptoxanthin****Fig. 2 Structure of Chemical constituent of *Coccinia grandis* fruit****CONCLUSIONS**

The present study surely suggests that *Coccinia grandis* (L.) is a versatile medicinal plant. Every part of this plant is valuable as medicine. However seeds are yet to be explored for their therapeutic potential. Since seeds are the valuable part and possess vital role in plant activity, the medicinal value of seeds will be a subject of interest in near future.

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