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CITRUS MAXIMA: A REVIEW OF ITS PHYTOCHEMISTRY AND BIOLOGICAL ACTIVITIES

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Abstract:

Citrus maxima (Linn.), also called shaddock or pomelo, is the largest citrus fruit in the Rutaceae family. It has long been utilised in traditional medicine to treat a variety of illnesses and is readily available in India and Southeast Asian nations. The plant's varied pharmacological properties and rich phytochemical profile have drawn a lot of scientific interest. Bioactive substances like alkaloids, flavonoids, coumarins, carotenoids, monoterpenes, sesquiterpenes, steroids, amino acids, and carbohydrates have been found in Citrus maxima's fruit, peel, leaves, seeds, and flowers. Numerous biological activities, such as antioxidant, antidiabetic, anti-inflammatory, analgesic, antibacterial, hepatoprotective, hypocholesterolemic, angiotensin-converting enzyme inhibitory, central nervous system depressant, and anticancer effects, are caused by these ingredients.

Keywords *: Citrus maxima, phytochemical constituents, taxonomy, pharmacological actions*

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INTRODUCTION:

Citrus maxima, the Pomelo also known as Pummelo or Shaddock in the Rutaceae Family is scientifically called Citrus maxima because it is the largest Citrus fruit. [1] The fruit is large and round. It is simple to remove the pulp from the skin. The pulp is often coarse, pink or white in colour and has big, spindle-shaped juice sacks. Because of its big size and vibrant skin when completely mature, it is often grown as a decorative fruit.[2] Citrus is Citrus maximum, which is widely studied for its phytochemical, pharmacological, ethnobotanical, and pharmacognostic properties.[3] Antioxidative qualities such vitamin C, phenolics, carotenoids, and flavonoids, citrus fruits like pomelo are enhanced.[4] Pomelo fruits are also widely employed as flavouring or fragrance-enhancing ingredients in the food, cosmetics, pharmaceutical, and perfume sectors. The fruits and leaves are used as an ingredient in a variety of toiletry products since they are a rich source of essential oils. Additionally, the flowers are highly fragrant and frequently used by perfume manufacturers.[5][6] The leaves exhibit a variety of pharmaceutical effects such as antioxidant, hepatoprotection, anticancer, antimicrobial, antihyperglycemic, antidepressant, anti- inflammation and analgesic activity.[7] Leaves are used in the treatment of convulsive cough, cholera, epilepsy and hemorrhagic diseases.[8]

Fig 1 : *Citrus maxima*

TAXONOMY OF PLANT

Botanical name

Citrus maxima (Linn)

Common Names

Pamelo
Pomelo
Pommelo
Jabong
Shaddock
Chinese fruit

Taxonomical Classification

Kingdom : Plantae
Phylum : Tracheophyta
Division : Magnoliophyta
Class : Magnoliopsida
Subclass : Rosidae
Order : Sapindales
Family : Rutacea
Subfamily : Aurantioideae
Genus : Citrus
Species : maxima

Vernacular Name

Malayalam : Pamparamasan, Kambili narnga
Tamil : Pambalimasu
Telugu : Pampara
Hindi : Cakotaraa
Manipuri : Nobab
Bengali : Chakotra
Konkani : Toranji
Sanskrit : Madhukarkati
French : Pamplemmousse
German : Pomelo
Japanese : Zabon

ORIGIN AND DISTRIBUTION

The tree is 16–50 feet (5–15 meters) tall and has a 4–12-inch twisted trunk. Assam and Tirupura's northeastern area up to 1,500 meters. It is native to the eastern region of India.[9] South-east Asian nations like China, Japan, Indonesia, the Philippines, Thailand, and Malaysia are native to the pomelo. It is currently grown in southern China and may have been introduced to the country around 100 B.C. It is known to grow wildly on the banks of rivers in Fiji and the Friendly Islands. It is native to the east of India, it is grown commercially there. Pomelos are considered to be like unexpected guests who appear as a surprise and quickly disappear in Taiwan, southernmost Japan, southern India, New Guinea, and Tahiti.[10]

BOTANICAL DESCRIPTION

The Pomelo is the biggest fruit among the Citrus family. The fruit ranges from nearly round to oblate or pear shaped; 10-30 cm wide; the peel, clinging, easily removed, greenish yellow or pale yellow, minutely hairy, dotted with tiny green glands. Pomelo peel is the largest and the thickest of all Citrus fruits weighing up to 30% of the fresh fruit's weight. Pulp It is divided into 11 to 18 segments, varies in colour from greenish yellow or pale yellow to pink or red and can be extremely juicy or slightly dry. The sacs can stick to one another or be loosely attached, and the segments are easily peeled. The pulp's flavour ranges from bland and little sweet to mildly or strongly acidic, sometimes with a hint of bitterness. The albedo is white and has a spongy texture, while the flavedo in the fruit's rind is green with oil glands visible as spots throughout the fruit peel. The segments of the fruit are covered with a tough skin called the lamella. Seeds are few, large,

yellowish white seeds, white inside, seldom some fruits may be quite seedy. [11]

PHYTOCHEMICAL CONSTITUENTS

Chemical constituents of *Citrus maxima* including alkaloids, amino acids, benzenoids, carbohydrates, carotenoids, coumarins, flavonoids, monoterpenes, sesquiterpenes and steroids.

- **Alkaloids**

5-hydroxyacronycine, acriginine A, Atalafoline, Baiyumine A&B, Buntanine, Buntanmine, Grandisine I & II, Pumiline, honyumine, natsucrin, Prenyl citpressine, Citropone A & B, Glycocitrine I are present in the roots and the bark of the plant. Caffeine are present in the flowers of the *Citrus maxima.*[12]

- **Amino acid**

Alanine, Asparigine, Aspartic acid, Coline, Glutamic acid, Glycine and proline are present in the leaves. [13]

- **Carbohydrates**

Fructose, Glucose and Pectin are present in the Leaf, peel and flowers. [14]

- **Carotenoids**

Carotene and Roseoside present in the peels. [15]

- **Coumarins**

Aurapte, Auraptene, Bergamottin are present in the peels.[16]

- **Flavonoids**

Apigenin, Hesperidin, Naringin, Rutin, Sinensetin, Cosmosiin, Acacetin. [17]

- **Monoterpenes**

α- pinene, β- pinene, camphene, citral, limonene, camphor. [18]

- **Sesquiterpenes**

α- bisabolol, α- cadinene, α- copaene, elemol. [19]

- **Steroids**

β- sitosterol, Campesterol, Stigmasterol, Daucosterol. [20]

MEDICINAL USES

- *Citrus maxima* fruit juice and peel are very nutritive and have good medicinal properties. [21]
- Pomelo peels and pulp are used as a cough treatment, stomach tonic, cardiac stimulant, and appetizer.
- The fruit juice has the potential to improve weight loss and lower cholesterol. [22]
- The pomelo peel extracts were evaluated for their hypolipidemic, hypoglycemic, antioxidative, antimicrobial, anti-inflammatory, and anti-cancerous properties.
- Rinds has effective as a brain tonic, sedative, anti - asthmatic, and to relieve headaches and eye problems. [23]
- Rinds are considered to be the most popular part in traditional medicine for treating diarrhoea and vomiting. [24]
- The fruit is used to cure gastrointestinal issues and cancer, and the seeds are used to treat lumbago, coughs, and dyspepsia. [25]
- Oil from fresh leaves possess anti dermatophytic activity, Fungicidal activity.
- Pulp has been used traditionally for cosmetic purpose. [26]

PHARMACOLOGICAL ACTION OF *CITRUS MAXIMA*

➢ ANTIOXIDANT ACTIVITY

Citrus maxima fruit juice's antioxidant properties were studied in rats, and results showed its protective function against DNA damage caused by hydrogen peroxide, streptozotocin, and nitric oxide producing systems. This protective activity may result from the action of various active principles, each with a single or a variety of biological activities against oxidative stress, working either independently or in combination. Thus, *Citrus maxima* fruit may have antioxidant and free radical eliminating qualities. [27]

➢ ANTIDIABETIC ACTIVITY

Alloxan-induced diabetic rats were used to test *Citrus maxima*'s antidiabetic properties. The fruit's ethyl acetate, alcoholic, and dried juice extracts all shown strong antidiabetic effects. The results were compared with the reference standard Glibenclamide. [28]

➢ ANALGESIC ACTIVITY

The analgesic effects of *Citrus maxima* fruit peel methanolic extracts at varying doses were evaluated in mouse models that included formalin-induced licking and biting responses and acetic acid-induced writhing responses. When compared to the reference standard Diclofenac sodium at a dose of 10 mg/kg, the extract demonstrated superior action at both tested levels.

➢ ANTI- INFLAMMATORY ACTIVITY

The carrageenan-induced paw oedema model was used to assess the anti-inflammatory effect of the methanolic extracts of *Citrus maxima* fruit peel. The extract demonstrated activity comparable to that of the ibuprofen positive control group at both tested dosages**.**

➢ CNS DEPRESSANT ACTIVITY

Swiss albino mice were used in open-field and hole-cross experimental settings to investigate the methanolic extract of *Citrus maxima* fruit peel. The extract exhibited strong CNS depressing effect in a dose-dependent manner, according to the results**.** [29]

➢ ANTI- TUMOUR ACTIVITY

Ehrlich's Ascites carcinoma cell (EAC)-treated mice are used to examine the anti-tumor effect of *Citrus maxima* leaves. Swiss Albino mice were given EAC cells, obtained from the Chittaranjan National Cancer Institute (CNCI) in Kolkata, India, and the cells were kept alive in vivo. Administration intraperitonally *Citrus maxima* methanolic extract has been shown to extend life, reduce tumour

volume, and increase the number of nonviable cancer cells. The haematological values were in the normal range. [30]

- **ANTIMICROBIAL ACTIVITY**

Citrus maxima pulp and fruit peel aqueous and methanolic extracts were examined for their antibacterial efficacy against Escherichia coli, Staphylococcus aureus, and Klebsiella pneumoniae. According to reports, the fruit peel's methanolic extract showed antibacterial efficacy against Klebsiella pneumoniae and Escherichia coli but not against Staphylococcus aureus. However, the fruit pulp's methanolic and aqueous extracts demonstrated strong antibacterial activity against each of the three microorganisms. *Citrus maxima* pulp and fruit peel aqueous and methanolic extracts were examined for their antibacterial efficacy against Escherichia coli, Staphylococcus aureus, and Klebsiella pneumoniae. According to reports, the fruit peel's methanolic extract showed antibacterial efficacy against Klebsiella pneumoniae and Escherichia coli but not against Staphylococcus aureus. However, the fruit pulp's methanolic and aqueous extracts demonstrated strong antibacterial activity against each of the three microorganisms. [31]

- **HYPOCHOLESTEROLEMIC & ACE INHIBITORY ACTIVITY**

Citrus maxima and *Citrus paradisii* juices were tested for inhibition of Angiotensin converting enzyme and hypocholesterolemic properties. Citrus juices decreased ACE activity in a dose-dependent manner. Shaddock juice significantly inhibited ACE activity compared to grapefruit juice ($p < 0.05$). The juices demonstrated reduced inhibition of enzyme activity compared to captopril. When compared to the control, there was a decrease in total cholesterol with higher amounts of citrus fruit juice. Significant increase in HDL, significant decrease in LDL. As a result, it inhibits both hypocholesterolemia and a vital enzyme associated with hypertension. [32]

- **HEPATOPROTECTIVE ACTIVITY**

In Wistar rats treated for carbon tetrachloride-induced hepatotoxicity, *C. maxima* leaf and peel extracts had a protective effect on the liver. Its hepatoprotective action was demonstrated in experimental rats by a significant reduction in the levels of aspartate aminotransferase (AST), alanine transaminase (ALT), and alkaline phosphatase (ALP). [33] Another study found that *C. maxima* methanolic leaf extract (200mg/kg, b.w.) can protect the liver against paracetamol-induced toxicity in rats. This study employed leaf extracts for 7 days, paracetamol (2g/kg) on day 5, and silymarin (100 mg/kg, b.w.) as the standard drugs. [34] The liver function markers, total bilirubin, total protein in blood serums, and hepatic antioxidants in liver homogenate were all found to be normal when compared to the control group. Leaf extracts with antioxidant properties may reduce hepatocyte formation by increasing levels of hepatic antioxidant enzymes. [35]

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