A review article on: Phytochemical and pharmacological activities of carica papaya

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Abstract---These are well-known health benefits of papaya (Carica papaya Linn.). Ayurveda, for example, recognises papaya’s therapeutic value. Herbalists have used it to cure bilious fever, gonorrhoea, eczema, rheumatism and headaches. It took four decades of amazing research to identify a critical nutraceutical compound. It is antibacterial, antipyretic, insecticidal, antimicrobial, and antimolluscan. Leaves have been studied using phytoextraction of heavy metals and phytoremediation of particle pollution. Long-term research on phytoconstituents and leaf composition. Malaria, dengue fever, inflammation, and skin infections are all treated by Carica papaya. C. papaya flowers were first tested for antioxidant and antibacterial properties using TLC and UV spectroscopy. Our tests included TLC and UV-visible spectroscopy. The methanol extract had the most alkaloids, flavonoids, saponins, and tannins. N-hexane had steroids and flavonoids while chloroform had saponins and tannins. In it, there were flavonoids and phenolic compounds.

Keywords---carica papaya, pharmacognosy, pharmacology, phytochemistry, ethanopharmacology.
Introduction

Papaya’s nutritional and medicinal properties (Carica papaya Linn.) Traditional medicine systems like Ayurveda recognise papaya’s therapeutic powers. Aside from headaches, it is supposed to treat bronchitis and asthma(1). Over 40 years of research on a crucial nutraceutical agent. Properties of Carica papaya Linn. Leaves are now analysed for heavy metals, particle pollution, and more. Phytoconstituents and leaf composition have been studied for decades. Inflammation and skin infections are treated by Carica papaya. First, TLC and UV spectroscopy were used to screen the C. papaya flowers for antioxidant and antibacterial activity(2,3). They were analysed by TLC and UV-visible spectroscopy. The methanol extract had the most alkaloids, flavonoids, saponins, and tannins. n-hexane extracts had saponins, steroids, and flavonoids. In this extract were flavonoids, tannins, saponins, and phenols.

![Fig 1. Papaya Tree](image)

Distribution and Botanical description

Geographical distributions

The native Papaya ranges are Grenada and Colombia; the Caribbean islands of Grenada and Colombia; and the Caribbean islands of Grenada and Colombia; as well as the Caribbean islands of Guadeloupe and Dominica(6).

Taxonomy

Papaya (Caricaceae, Brassicales) is a perennial plant. In India, the plant is known as Papita, Papaya, Omakai, Pepe, and Eerankari. Mamo is the Australian name
for pawpaw, whereas papaya plant is the British name for the plant. The botanical classification of C. papaya is as follows (7).

Table 1
Kingdom and their Plantae

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division</td>
<td>Magnoliophyta</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida</td>
</tr>
<tr>
<td>Order</td>
<td>Brassicales</td>
</tr>
<tr>
<td>Family</td>
<td>Caricaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>Carica</td>
</tr>
<tr>
<td>Species</td>
<td>Papaya L.</td>
</tr>
</tbody>
</table>

**Morphological Characteristics of Papaya**

Papaya is a tree-like herb that has a distinct structure than other herbs. C. papaya is often known as papaya. This plant is also known as Papye, Pawpaw, Lapaya, Tapayas, and Kapaya. Papayas, unlike trees, are herbaceous rather than woody\(^8\). Here are compound leaves. The palm-shaped leaves have an average diameter of 50-70 centimetres. Papaya flowers are usually dioecious. Depending on the bloom, the fruit can be shaped in many ways. Manipulation of the male bloom The corolla tube is a 2 cm cylinder. Female racemose flowers are used. The 5–30 cm long fruit is yellowish-orange in hue. The pulp of this delectable fruit is inedible\(^9\)-\(^10\).

**Roots**

There are distinct layers of endodermis, epidermis, and cortex in the early roots of papaya plants. These layers are dense and nonaxis\(^11\).

**Stem**

From the base to the crown, the stem has a soft, hollow, and cylindrical trunk that is 30 cm in diameter. Normally, papaya trees have a single trunk and a canopy of large palmate leaves growing from the tip of the trunk, but they can have several trunks if they are damaged.

The leaves are 50-70 centimetres wide. The plant's most distinctive characteristic is a large palmate leaf with 5-9 pinnated lobes, 40-60 cm wide. The leaves spiral and cluster in mature tree branches\(^12\). The leaf’s dorsiventrally positioned endodermis, which ranges from 30 cm to 105 cm in length, may be crucial when cavitations occur. While squishy mesophyll has 4-6 cell layers, palisade parenchyma and epidermis in the leaf have only one. The leaves are drusy and shiny (calcium oxalate crystals). The stomata on the underside of papaya leaves are anisocytic or lack secondary cells\(^13\)-\(^15\). Water, temperature, and light can change the stomatal density of 400/mm sq. The sun shines on the leaves. The leaf microscope revealed xylem and phloem but no pith. Diagram of a C. papaya leaf, ventral and dorsal views \(^2\).
To describe the 'trioeciousness' of C. papaya flowers is to say that distinct plants can produce either male, female or bisexual blooms. When closed, the flowers of the female papaya have a pear shape, whereas the long stalks of the male papaya support little blooms, and the tubular flowers of the bisexual papaya\textsuperscript{16}. Bisexual plants are generally superior to male or female plants in terms of quality and preference. There is just one central axis through which the flowers are organised in the cluster, and they are actinomorphic, bracteolate and stationary. Ten stamens in two whorls comprise the androecium, which is epipetalous (on the petals or corolla). It has bilocular anthers that are both introrse and bilocular\textsuperscript{17}. There are five petals in the corolla that are long and yellow in colour in the calyx (gamopetalous) and the five petals in the corolla that are small and joined (gamosepalous). The androecium is absent from female flowers, which only have an ovary and stigma. Male or pistillate flowers have bracteolate petals. In pistillate flowers, the androecium is missing, and the gynoecium is sessile. The ovary is superior, with an infinite number of seeds, and has a short style with a five-lobed stigma\textsuperscript{18-20}. 

Large, oval plant fruits are sometimes referred to as "pepo-like berries" because of their melon-like shape and the presence of a seed cavity in the centre. On the main stem, fruit is borne axillary and is usually borne individually, but in
clusters can also be found\(^{(21)}\). In addition to its flavour, colour, and scent, fruit pulp offers a wide range of chemical, nutritional, and digestive qualities Fig 4. Depending on the cultivator and climate, plant fruits take anywhere from 5 to 9 months to mature. It’s green until it’s ripe, turning yellow or red-orange, and the fruit flesh is yellow-orange to pinkish orange when it’s mature\(^{(22)}\). Fruits can be oval or spherical in shape and are berries with seeds inside the fruit cavity. The unripe fruit had a thick cuticle, laticifers, epicarp parenchyma, mesocarp endocarp, and calcium oxalate crystals visible under a microscope, according to the research\(^{(23-25)}\).

![Fig 4. Papaya fruit](image)

**Seeds**

Papaya plants are often propagated by the use of seeds. Oval and flat cotyledons and the endosperm of plant seeds are blackish to brownish in hue. The fruit’s inside chamber is filled with a mucilaginous material that coats many black seeds. The seeds are edible, with a spicy flavor and antimicrobial characteristics that help prevent kidney failure caused by the toxin\(^{(26)}\).

**Phytochemical investigation**

The analysis of C. papaya fresh flower extract in various solvents was performed using standard protocols with slight changes as follows\(^{(27)}\).

**Test for alkaloids**

The plant extracts (3 ml) were infused with HCl and then steamed for a few minutes. Some Mayer regent was then added to the mixes. Turbidity is a sign that alkaloids are present\(^{(28)}\).

**Test for flavonoids**

The stock solution of C. papaya extracts was diluted with sodium hydroid solution and a few drops were added (0.5 ml). The plant crude extract had a
strong yellow color, which turned colorless when diluted H₂SO₄ was added, indicating the presence of a flavonoid[29].

**Test for saponins**

Test tube was shaken by hand for 15 minutes with stock solution from each crude extract C. papaya flowers (0.5 ml). Saponin was detected in the test tube by the creation of a foam layer at the top[30].

**Test for steroids**

Concentrated sulfuric acid (1 ml) was poured into the test tube through the walls after the plant extracts were dissolved in chloroform (10 ml). Fluorescent green tinged the sulfuric acid layer, which had previously been yellowish. Steroids were clearly present in this sample[31].

**Test for tannins**

It was mixed with distilled water and two milliliters of extract were added and swirled in. Solution of ferric chloride was added. The presence of tannins was demonstrated by the production of a green precipitate[32].

**Test for phlobatannins**

HCl hydrolyzed two milliliters of extract, and then the solution was heated for a few minutes. Phlobatannins are present when red precipitation forms.

**Test for glycosides**

Using chloroform and acetic acid, two milliliters of extracts were dissolved, followed by a few drops of sulfuric acid, and the color change from blue to green was noticed[33].

**Thin layer chromatography**

Chloroform: methanol (80:20) was utilized as the mobile phase in thin-layer chromatography. TLC tests were performed in a controlled environment with a temperature of RT and a relative humidity of 60%. A UV chamber (254 nm) was used for a short time to observe the varied spot positions of the compounds on the TLC plates (Merck-silica gel 60 F₉₅₄). Standard formulation was used to calculate the plant extract Rf value[34].

**Pharmacological Studies**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Part of Plant</th>
<th>Pharmacological Activities</th>
<th>Phyto-chemical Constituents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Roots</td>
<td>• Skin Infection</td>
<td>Carposide</td>
</tr>
<tr>
<td></td>
<td>Leaves</td>
<td>Anti-Dengue activity</td>
<td>Anti-Malarial activity</td>
</tr>
<tr>
<td>---</td>
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<td>-----------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Fruits</td>
<td>Anti-Cancer activity</td>
<td>Anti-Diarrheal responses</td>
</tr>
<tr>
<td>4</td>
<td>Seeds</td>
<td>Wound healing activity</td>
<td>Anti-Cancer activity</td>
</tr>
</tbody>
</table>

**Anti-inflammatory and immunomodulatory effects**

The pulp, leaves, and seeds of papaya have anti-inflammatory and immunomodulatory effects. After eating papaya, participants' IFN+CD4+ T cells, which are important in inflammatory responses, decreased. Papaya leaf extract significantly reduced paw oedema, cotton pellet granuloma, and formaldehyde-induced arthritis in rats. Its immunomodulatory characteristics boosted anti-tumor immunity-related cytokines (IL-12p40, IL-12p70, IFN-, and TNF-) from human cells. Similarly, when exposed to the seed extract, human blood cells demonstrated enhanced phytohemagglutinin reactivity. So the seed extract may contain immunomodulatory compounds or growth-promoting components. Some bioactive components of the seed extract can reduce cell lysis in vitro through the traditional complement-mediated hemolytic pathway\(^{(37)}\). This shows it may be anti-inflammatory. Papaya's flavonoids, saponins, tannins, and glycosides have been associated to anti-inflammatory benefits. Anti-inflammatory properties may be due to one or more of the identified components.
Anticancer effects

Papaya contains glucosinolates, isothiocyanates, and BITC, all of which have anticancer effects. BITC slows tumour growth by causing apoptosis in cancer cells. They may haveanticarcinogenic qualities by stimulating phase II enzymes as glutathione S-transferases, nicotinamide ADP and quinine reductases. Plant glucosinolates have been studied for their cancer-preventive effects. This can be done by plant-derived myrosinase or human gut bacteria. The anticancer properties of C. papaya leaf extract on tumour cell lines were discovered lately. In vitro, the leaf extracts significantly reduced the proliferation of solid tumour cell lines derived from cervical carcinoma, breast adenocarcinoma, prostate cancer, hepatocellular carcinoma, lung adenocarcinoma, and mesothelioma. These findings suggest that leaf extracts have anticancer properties and may one day be utilised to treat and prevent diseases like cancer and to stimulate the immune system during vaccine therapy. There is no existing scientific data on the particular chemical that shown the anti-cancer and immunological modifying advantages of papaya isothiocyanates. One study indicated that Pappy leaf fractions with molecular weights under 1000 might enhance Th 1 cytokine production and slow tumour cell proliferation, thus protecting against allergies. Papaya had a high lycopene content. Lycopene induces apoptosis in human cancer cells in vitro, particularly prostate cancer cell lines, indicating chemotherapeutic potential.


**Wound healing effects**

The wound healing properties of papaya have been extensively researched in animal studies. Unripe green fruit peel extract heals epidermal wounds faster than ripe fruit peel extract in mice and rats. Skin latex was utilised to assess wound healing in mouse burn models. However, the latter notion suggested that latex has healing properties. Protease inhibitors, glutaminyl cyclase and other unknown function proteins are detected in the latex of unripe papaya fruits. Many proteolytic enzymes have been demonstrated to help debride necrotic tissues, reduce infection, promote growth, and improve scar quality. Papain, chymopapain, and leukopapain. According to traditional beliefs, papaya can effectively cure wounds\(^\text{(38)}\).

**Anti-ulcer effects**

Papaya leaves and unripe fruits may help avoid stomach ulcers. These rats had fewer stomach ulcers than those given alcohol or the standard drugs cimetidine and indomethacin. This fruit's ability to halt digestion has been shown. By delaying gastrointestinal motility, increasing oral anti-ulcer drug absorption is useful in ulcer therapy. The unripe fruit also has antibacterial properties that may help treat or prevent stomach ulcers by killing Helicobacter pylori. Premature C. papaya preparations contain terpenoids, alkaloids, flavonoids, carbohydrate glycosides, saponins, and steroids\(^\text{(39)}\). Saponin's anti-ulcer activities include protecting the gastric lining from stomach acid by producing protective mucus. The anti-ulcer properties of the leaves and unripe fruit extracts are cytoprotective and antimotility.

**Conclusion**

Unlike synthetic products, which have been demonstrated to harm the body, herbal items are considered as a symbol of protection. This study found that Carica papaya leaves have numerous uses. By studying the plant's active compounds, we can learn about the plant's many biological roles. The potential of Carica papaya leaves has to be explored further. Various cutting-edge investigative techniques can be used to investigate the active compounds in Carica papaya L. leaves. C. papaya plants flourish all over the planet. They have a variety of nutrients in various parts of the plant that have been used medicinally for ages. A papaya's demonstrated pharmacological actions can treat several diseases such as anti-inflammatory, antioxidant, antibacterial, and immunomodulatory activity. Dengue fever is treatable with commercial drugs.

**References**

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