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# REVIEW ON PHYTOPHARMACOLOGY OF DIFFERENT PARTS OF MANILKARA ZOPATA

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**ABSTRACT**

A well-known member of the Sapotaceae family, *Manilkara zapota*, also known as Sapodilla, Chikoo, or Sapota, is utilized for traditional medicinal reasons worldwide. It is a well-known commercial crop that is widely grown in Sri Lanka, Indonesia, India, and Malaysia. Numerous phytochemicals have been extracted from different portions of the plant, and various parts of the tree have historically been employed to cure illnesses like dysentery, fever, and diarrhea. This paper provides a summary of the botanical, taxonomical, pharmacological, and phytochemical components of *Manilkara zapota*. The plant's bioactivities, including its antibacterial activity, antidiabetic, anti-inflammatory, antidiarrheal, anthelmintic, anticancer, and antarthritic qualities, are also covered in this page. Multiple researchers have documented a plethora of phytoconstituents derived from the plant, contributing to a spectrum of biological impacts, such as anti-inflammatory, arthritics, antibacterial, antifungal, antioxidant, antitumor, and antidiabetic effects, as well as central nervous system (CNS) depressant action. Additionally, the extensive use of other plant parts, including as leaves, fruit, and seeds, was covered in this review. Antioxidants and phytochemicals are among the many bioactive substances found in *M. zapota* leaves. Investigating its chemical composition can assist find molecules that may have neuroprotective or anti-inflammatory properties related to Parkinson's disease. Antioxidants found in *M. zapota* leaves may lessen oxidative damage to neurons and delay the onset of illness.

**KEYWORDS:** Manilkara zapota, Traditional Uses, Phytochemistry, Pharmacology.

## I. INTRODUCTION

As stated below, plants have aided in the creation of contemporary synthetic pharmaceuticals and therapies in a number of ways. When physiologically active chemical compounds are extracted from plant sources and their structures are discovered, chemists are frequently inspired to create superior or comparable semisynthetic molecules.

The manilkara zapota plant thrives across Bangladesh. It is a member of the sapotaceous family and is frequently referred to as "sapodilla." It is used extensively as a tasty fruit. It is indigenous to the Caribbean, Central America, and Mexico. Naturally, the tree expands throughout the mangrove and coastal ecoregions. In Bangladesh, India, Pakistan, Thailand, Malaysia, Cambodia, Indonesia, and Vietnam, it is manufactured in large quantities. During Spanish colonization, it was transported to the Philippines (Azad et al., 2020). The edible fruit pulp of the Manilkara zapota is traditionally consumed as dried fruit or used to produce ice cream and sherbets (Mickelbart, 1996). Some people use the Manilkara zapota juice to produce syrup and vinegar, and the meat to manufacture preserves (García, 1988). The tree's dark red, tough, heavy, and long lasting wood has been utilized for flooring, tool handles, railroad crossties, and other things. Additionally prized for furniture bannisters and cabinetry are the sapodilla red heartwoods (García et al., 1998). Significant amounts of fermentation sugars, protein, phenolics, caratenoids, ascorbic acid, and minerals including potassium, copper, and iron are all present in the fruit. It has pantothinic acid, folate, vitamin C, and A.Manilkara zapota is said to have computational binding affinities against gastrointestinal

targets as well as anti-diarrheal, anti-secretary, anti-spasmodic, anti motility, and anti-ulcer properties in the current study (Riaz and others, 2020).

In order to explore the medicinal plants' scientific potential and possible uses in the future, this study included thorough and current information on the botanic characteristics, distribution, traditional uses, phytochemistry, pharmacology, and toxicological activities of Manilkara zapota.

**II. Taxonomical Classification**
**Domain:** Eukaryote
**Kingdom**: Plantae
**Phylum:** Spermatophyta
**Subphylum:** Angiospermae
**Class:** Dicotyledonae
**Order:** Ebenales
**Family**: Sapotaceae
**Subfamily:** Sapotoideae
**Genus:** Manilkara
**Species:** Manilkara zapota (Rojas and Praci, 2017)

**Synonyms**
*Achras sapota L., Achras zapotilla Nutt., Achras zapota L., Achras mammosa L., Calocarpum mammosum (L.) Pierre, Lucuma mammosa (L.)* C.F. Gaertn, Manilkara achras (Miller) Fosberg, *Manilkara zapotilla* (Jacq.) Gilly, Pouteria mammosa (L.) Cronquist, Sapota zapotilla (Jacq.) Coville, Sapota achras Miller (Bano and Ahmed, 2017).

**Vernacular Names**
**Bangladesh**: Sofeda
**Brazil:** Sapoti, Sapotilha
**Bahamas:** Dilly
**Cuba:** Sapota, Sapote
**Puerto Rico:** Nispero
**Thailand:** Lamoot, Lamut, Lamut-farang
**English**: Sapodilla
**Indonesia:** Sawu
**India**: Chikoo, Chicku (Morton, 1987).

**Description**
Manilkara zapota is an evergreen tree with an uneven form that grows slowly and spreads upright to widely. It has a long lifespan. With an average trunk diameter of 1.5 m, it grows to 5–20 m in cultivation but can reach up to 40 m in the forest (Singh et al., 2011; Shafii et al., 2017).

**Fig. 1: Manilkara zapota Linn.**

**Table 1: Plant description of Manilkara zapota Linn.**

| Pictures | Part of plant | Description |
|---|---|---|
|  | Stem Bark | The tree has a thick crown and rough, dark grey bark |

| | | |
|---|---|---|
|  | Leaves | The elliptic or oblong leaves are coloured light green to pinkish while they are young, maturing to a glossy dark green. They cluster at the terminals of the shoots in an alternating and spiral pattern. Each leaf measures between 7.5 and 11.25 cm in length and 2.5 to 4 cm in width. |
|  | Fruits | The fruit has a rough skin and is round to oval in form, with a yellowish brown colour. Unripe fruit has an unpleasant taste and is hard. Its diameter is between 5 and 10 cm. The fruit's sweet, juicy, light yellow flesh tastes . |
|  | Seeds | Typically, fruits contain three to twelve dark, black seeds. The lustrous, long, round seed features a white border and a curving, roughly 2-cm-long hook |
|  | Flowers | The little, bell-shaped, off white or greenish bloom is carried alone on the leaf axils and is hardly noticeable. The six-lobed pale green corolla is encased in three inner and three brown, hairy outer sepals. |

(Morton, 1987; Aceves et al., 2009; Leong et al., 2002).

**Geographic Range**

**Distribution**

Most Manilkara zapota plants are found in tropical climates worldwide. It is cultivated across the Caribbean islands and Central America, where it becomes enormous trees in forests. It is indigenous to northeastern Guatemala, northern Belize, and southern Mexico. It is a famous fruit tree that is produced in big quantities in Mexico and tropical Asian countries including Bangladesh, India, Pakistan, Thailand, Malaysia, Cambodia, Vietnam, and Indonesia (Kirtikar and Basu, 1956; Bhowal et al., 2014).

**Habitat**

Manilkara zapotas thrive best in environments with medium to full shade and no need for irrigation. They need a minimum temperature of 1200 to 3600 degrees Celsius to flourish, neither too high nor too low. They have developed a habit of growing in dark, PH 6–8, alluvial sandy loam soil. The best times to seed sapota are from February to March and August to October in order to maximize output. FYM, Phosphorous, Potassium, and Nitrogen are the most often utilized fertilizers (Karle etal., 2019).

**Growth Stages**

Fruit development, fruit maturity, blooming, vegetative bud development, leaf development, shoot growth, and reproductive development (Kishore et al., 2016).

**Biology and Ecology**

**Genetics**

Since the 1950s, there have been hybridization-based genetic improvement projects aimed at enhancing the fruit yields and qualities of farmed Manilkara zapota (Sambamurty and Ramalingam, 1954). 2n = 26 is the number of chromosomes (Peiris, 2014).

**Reproductive Biology**

Manilkara zapota flowers are bisexual. This species frequently experiences open pollination, which increases genetic heterogeneity among populations. Insects, mostly bees, come and pollinate flowers. Clonal multiplication of chosen seedling trees produces cultivars. Big fruit size, high eating quality, and seedless fruit are the main goals of varietal development. In India, controlled hybridization was initiated in the 1950s, but new cultivars have not yet been introduced as a result of this (Coronel, 1991).

**Ecology and Environmental Requirements**

The sapodilla is a highly versatile species. It is found in vast quantities in Ecuador at heights of up to 2500 meters, where it flourishes in the tropics, as well as in the subtropics (Israel). Younger trees are less tolerant of dryness than mature trees, which thrive in India's monsoon environment. Close to the ocean, the tree can withstand severe gusts and salt sprays because to its sturdy branches. Mature trees can tolerate temperatures as low as -3°C for a few hours, while younger trees are harmed or killed by temperatures as low as 0 to -1°C. Trees can withstand windy and wet soil to a considerable extent (Balerdi et al., 2013).

**Natural Enemies**

*Maconellicoccus hirsutus, Planococcus citri, Ferrisia virgata, Phenacoccus solenopsis and Icerya seychellarum* (Marwa et al., 2023).

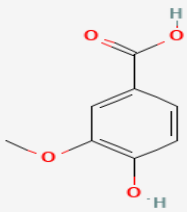
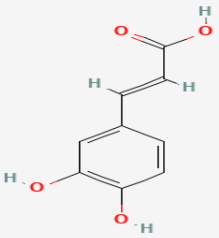
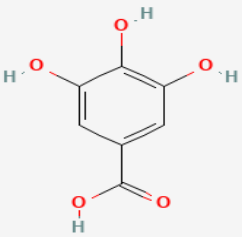
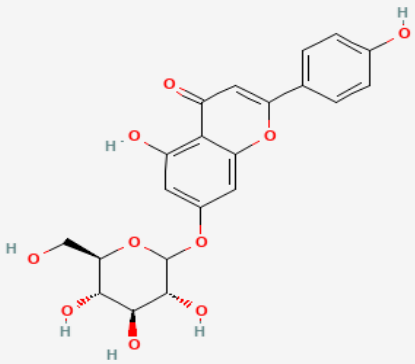
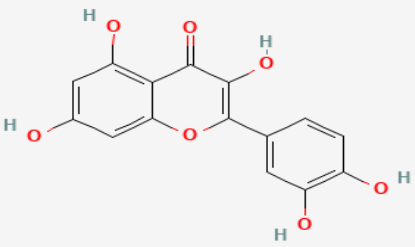
**III. Traditional Uses**

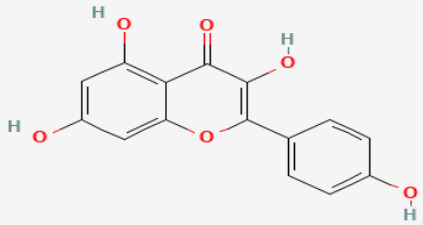
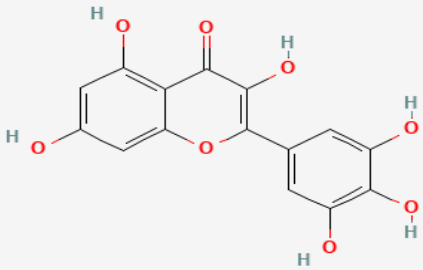
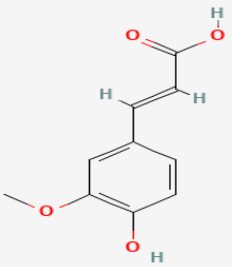
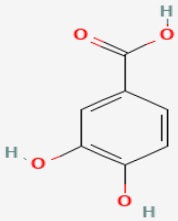
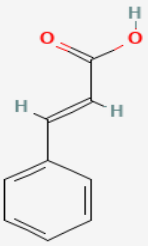
| Sections of the Plant Part | Traditional Uses | Reference |
|---|---|---|
| Bark | Fever and diarrhea can be treated with the bark decoction. | (Islam et al, 2013). |
| Leaf | Fever, bleeding, wounds, and ulcers can all decoction. be treated with leaf | (Bano et. al, 2017). |
| Seed | Rheumatism and kidney and bladder stones are both treated with crushed seeds. | (Bano et. al, 2017). |
| Fruit and flower | Ripe fruits are known to contain tannins, which provide the plant astringent, antioxidant, antiviral, antibacterial, and anti-inflammatory qualities. These qualities can be used to treat haemorrhage, dysentery, indigestion, and diarrhea. A fruit and flower infusion is used as an expectorant, to cure diarrhoea, to strengthen the mental system, and to address lung issues. | (Bano et. al, 2017). |

**IV. Phytochemical Constituents**

**Chemistry of Manilkara zapota**

The majority of the phenolic chemicals identified as Manilkara zapota's primary components are found in the fruit, including phenolic acids and flavonoids. The fruit of the Manilkara zapota plant contains the following: quercitrin, myricitrin, epicatechin, gallocatechin, and gallic acid. In the fruit pulp, it was possible to find protocatechuic acid, vanillic acid, caffeic acid, syringic acid, coumaric acid, and ferulic acid. According to Shafii et al. (2017), protocatechuic acid is the most prevalent phenolic ingredient in Manilkara zapota fruit, followed by gallic acid and quercetin.

| Sr no. | Name of chemical structure | Chemical structure | Benefits |
|---|---|---|---|
| 1. | Vanilic acid |  | Help to identify Potential anti cancer targets. |
| 2. | Caffeic acid |  | It shows the anti-oxidant property. |
| 3. | Gallic acid |  | Efficient for screening phytoconstituents of manilkara zopata and shows anticancer property. |
| 4. | Apigenin 7-glucoside |  | This indicates high potential as a lead compound in anticancer drug design. |
| 5. | Quercetine |  | Quercetine demonstrates strong binding affinity ,multi-targets anticancer mechanisms ,acceptable ADME properties, and low toxicity |

| | | | |
|---|---|---|---|
| 6. | kaempferol |  | It offers significant potential as an anticancer agent and chemosensitization |
| 7. | myricetin |  | Antitumor and anti inflammatory activity |
| 8. | Ferulic acid |  | It show strong antioxidant activity |
| 9. | Protocatechuic acid |  | Multitarget mechanism , Apoptosis induction,antioxidant power and improved selection |
| 10. | Cinnamic acid |  | cinnamic acid and its derivatives found in plant like *m.zopata* are recognized significant anticancer potential, acting through mechanism that reduce the proliferation of cancer cell. |

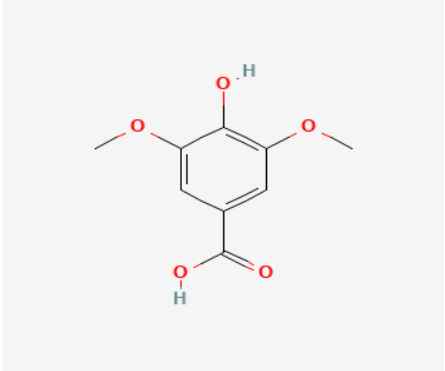
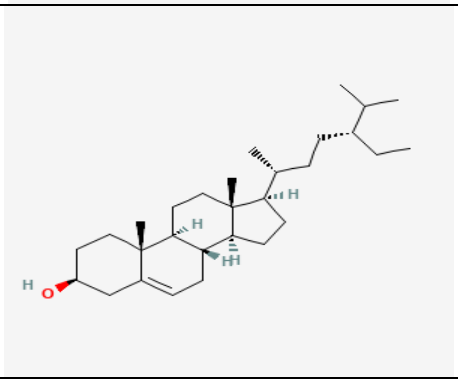
| | | | |
|---|---|---|---|
| 11. | Syringic acid |  | It is potent antioxidant,anti-inflammatory, |
| 12. | β –sitosterols |  | It shows strong binding affinity with cancer targets and anti-cancer potential. |

**Fig. 2: Chemical structure of important phenolic compound isolated from manilkara zapota Linn.**

## V. Pharmacological Activities

### Anti-inflammatory and Anti-Pyretic Activities

The purpose of testing ethanolic extracts of Manilkara zapota leaves and their various solvent-soluble fractions on experimental albino Wistar rats for potential anti-inflammatory and anti-pyretic properties. The carrageenan-induced paw edoema technique was used to assess the anti-inflammatory activity, and the yeast-induced pyrexia method was used to assess the anti-pyretic potential in albino Wistar rats. Compared to normal diclofenac (86.08% inhibition) at 4 hours, the crude ethanolic (300 mg/kg) and ethyl acetate (300 mg/kg) extracts significantly inhibited paw edoema by 91.98% and 92.41% fraction was shown to have the greatest impact on reducing body temperature, measuring 36.86°C. The results of the investigations showed that Manilkara zapota leaves have anti-inflammatory and anti-pyretic properties, suggesting that they may be a useful treatment for pyrexia and inflammatory diseases (Ganguly et al., 2013).

### Antioxidant Activity

Four distinct in vitro techniques were used to examine the antioxidant capacity of the Manilkara zapota leaf extracts, which were prepared by sequential extraction with varying solvent polarities: DPPH, superoxide and hydroxyl radical scavenging activity, and reducing capacity evaluation assay. With an IC-50 value of 20 µg/ml, which is nearly similar to the normal ascorbic acid's IC50 value of 11.4 µg/ml, the acetone extract demonstrated the highest DPPH radical scavenging activity. Acetone extract (IC-50 = 140 µg/ml) demonstrated superior superoxide anion scavenging activity compared to normal gallic acid (IC-50 = 185 µg/ml). The evaluation of lowering capacity was good. The high phenolic content of acetone extract may contribute to its antioxidant potential. Because of the plant's strong antioxidant potential, acetone extract may find application in the food sector as an ingredient that offers strong defence against oxidative damage. It is necessary to establish its action in in vivo models, nevertheless. According to the research, there are no standard parameters for determining if antioxidant activity is present in a certain plant or not. It is essential to assess many antioxidant methods in multiple solvents on a single plant (Chanda et al., 2010).

### Antibacterial Activity

The antibacterial activity of extracts made from Manilkara zapota seeds was evaluated using the broth dilution and disc diffusion techniques. It was discovered that Manilkara zapota seed acetone extract has antibacterial properties. When the quantity of P. oleovorans was enhanced by just 2 µg/mL (from 323 to 325 µg/mL), the acetone extract of Manilkara zapota seeds induced an 18% greater inhibition (from 82 to 100%). Alkaloids, phenols, and flavonoids were detected in the acetone extract of Manilkara zapota seeds. More research should be done to determine the active ingredients in this extract. After being separated, active components may be studied structurally using appropriate methods including NMR and IR spectroscopy (Kothari et al., 2010).

### Antimicrobial Activity

The goal of the current investigation was to evaluate Manilkara zapota's antibacterial activity. Ethyl acetate extracts of Manilkara zapota's stem bark and leaves were

used in bioassays for antibacterial activity against a variety of pathogenic bacteria and fungi. The extracted extracts' TLC (thin layer chromatography) profile revealed the presence of chemicals of the flavonoid, glycoside, and terpenoids types. With inhibition zones ranging from 08 to 16 mm, the stem bark ethyl acetate extract demonstrated antibacterial action against all of the pathogenic bacteria employed in this investigation, including Aspergillus flavus, Vasianfactum sp., and Fusarium sp. Salmonella typhi, Bacillus subtilis, Bacillus megaterium, Sarcina lutea, and Escherichia coli were all moderately inhibited by an ethyl acetate leaf extract. It was discovered that the extracts' minimum inhibitory concentrations (MICs) ranged from 256 to 512 õg/ml. The cytotoxicity (LC-50) of ethyl acetate extract of leaves (16.17 εg/ml), ethyl acetate extract of stem bark (50.26 õg/ml), and ampicillintrihydrate (12.38 õg/ml) against brine shrimp nauplii (Artemia salina) were also assessed. Manilkara zapota Linn. was shown to contain terpenoids, flavonoids, and glycosides by phytochemical screening of the leaves and stem bark (Osman et al., 2011).

**Anti-Cancer Activity**

Ethanolic extracts of Manilkara zapota seeds and skin were tested for their ability to inhibit the growth of HeLa cell lines using the Methyl Thiazolyl Tetrazolium bromide (MTT) and lactate dehydrogenase (LDH) assays. Ethanol was used to create a crude extract of the MZ seeds and skin following normal techniques. On the water bath, it was filtered and then evaporated. The extract was dissolved in 65% ethanol, and the supernatant was utilized after centrifuging the mixture for ten minutes at 4,000 rpm and -4 degrees. Using HeLa cancer cell lines, the MTT and LDH test was used to evaluate the anticancer efficacy of the extracts. A 96-well plate was seeded with 5000 HeLa cells per well and incubated at 37ºC with 5% CO2 for the MTT Assay. Following a 24-hour period, the cells were subjected to extracts (0.5–12 mg/ml for seed and skin) and paclitaxel (0.03–1 mg/ml). Following 48 Following a 24-hour period, the cells were subjected to extracts (0.5–12 mg/ml for seed and skin) and paclitaxel (0.03–1 mg/ml). Following a 48-hour period, 50µl of dimethyl sulfoxide (DMSO) and 100µl of 0.2% MTT were added, and the optical density was measured at 570 nm. The supernatant cell suspension, LDH reagent, and absorbance measured at 490 nm were used for the LDH assay. The extracts were discovered to possess anticancer properties; the extracts' IC-50 (Inhibitory Concentration - 50) values for Paclitaxel, seed, and skin extracts were, respectively, 4µg/ml, 8µg/ml, and 2 µg/ml. Manilkara zapota seeds and skin ethanolic preparations have demonstrated antitumor efficacy against HeLa cells in vitro by MTT and LDH assay (Saradha, 2022).

**Food value**

One of the important fruit crops farmed and cultivated in India is the sapota (Manilkara zapota), which belongs to the Sapotaceae family. Fibre, vitamins, calcium, phosphorus, iron, and polyphenolic chemicals are all abundant in sapota. It has antibacterial qualities, helps prevent colds and coughs, aids in weight loss, and acts as a cleansing agent. It also prevents constipation, dental decay, viral infections, and coughing fits. Through the creation of silver nanoparticles, recent studies have demonstrated its significance in the treatment of cancer as well as its antibacterial activity. So, because of its nutritional value, sapota was used in a lot of food formulations together with probiotics, wine, and other foods and dairy products. In order to possibly use the fruit in food applications, the current study considers the fruit's nutritional value (Chaudhary and Kumar, 2020).

## CONCLUSION

These review highlights the phytochemical composition and pharmacological potential of different parts of Manilkara zapota, including leaves, fruits, seeds, bark, and latex. Various studies have reported that these plant parts contain diverse bioactive compounds such as flavonoids, tannins, saponins, alkaloids, and phenolic compounds which contribute to their medicinal properties. Scientific investigations demonstrate that extracts from Manilkara zapota exhibit significant biological activities including antioxidant, antimicrobial, anti-inflammatory, antidiabetic, and anticancer effects. These pharmacological activities support the traditional use of the plant in various herbal medicinal systems. Furthermore, different plant parts show varying levels of bioactive constituents, indicating the importance of exploring each part for specific therapeutic applications. However, more detailed studies, including clinical trials and advanced molecular investigations, are required to fully understand the mechanisms of action and to develop safe and effective phytopharmaceutical products from Manilkara zapota. Overall, this review emphasizes the potential of Manilkara zapota as a valuable source of natural therapeutic agents for future drug development.

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