

# Investigating the Phytochemical Constituents and Pharmacological Properties of *Annona Squamosa* Linn: A Comprehensive Analysis

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**Abstract:** *An effort has been made to compile the analysis of many pharmacological and phytochemical research conducted on Annona squamosa Linn in the current review. Since the dawn of human civilization, medicinal plants and their concoctions have been utilized to cure a wide range of illnesses. The characteristic of the growing family of derivatives of long chain fatty acids was the annonaceous acetogenins. Only species in the annonacea family have this trait. Due to their potential anticancer and antibacterial efficacy and minimal negative effects on human health, these chemicals are in great demand. In an attempt to further our understanding of Annona squamosa Linn's potential medicinal advantages, this review synthesizes data on the plant's phytochemicals, folklore uses, and bioactivities. It is based on many investigations on the plant.*

**Keywords:** Annona squamosa, Phytochemical constituents.

## I. INTRODUCTION

A deciduous plant with a wide range of pharmacological uses is Annona Squamosa Linn. The term "Annona" in the genus name comes from the Latin word "anon," which means "yearly produce" and refers to the several species within this genus that produce fruits. The custard apple family is the Annonaceae family. According to Kalidindi et al. (2015), it is a tropical endemic species found in the West Indies, Central and South America, Peru, Brazil, and India.

Because they had less negative effects and more beneficial effects than their chemical equivalents, the ethanobotanical advantages of plant-based therapeutic treatments were greater. Every portion of the plant has a variety of medicinal qualities and is thought to be helpful for conditions including cancer, diabetes, hyperthyroidism, microbial infections, and heart disease [16]. The anticonvulsant activity of roots was discovered (Vikas et al., 2017).

Research conducted both in vitro and in vivo has shown its anti-tumor activity [7]. Fruit and fruit juice are used to cure worms and parasites, decrease fevers, increase the production of postpartum milk, and as an astringent for diarrhea and dysentery. The crushed seeds are used to cure worms, internal and external parasites, and head lice. To offset such effects, a sedative, ulcer treatment, and nervine tonic tea made from the bark, leaves, and roots is used for a number of ailments. Root-derived acetogenins have been shown to have anti-carcinogenic properties via their inhibition of DNA synthesis. Using leaves as a treatment for hysteria and fainting episodes (Kaleem et al. 2008).

A decoction of bark is used for diarrhea. Root extract is a useful therapeutic medication for dysentery. Fruits are an ingredient in milk drinks and ice creams. While crushed leaves are helpful for boils and internal and external wounds, leaf decoction is used for gastritis. Dried unripe fruit powder is used to kill vermin, whereas ripe fruits of plants are given to malignant tumors to speed up suppuration. Seeds have an insecticidal effect because of their bitter and toxic qualities. Cattle wounds containing worms have been treated with seed paste to eradicate head lice [20]. Numerous phenol-based substances (proanthocyanidins), such as alkaloids and flavonoids, have been shown to be present in custard apples, according to phytochemical research (Vradharajan et al, 2012).

This plant demonstrates anti-tumor, antimicrobial, antidiabetic, and antioxidant properties due to the presence of glycosides, phytosterols, carbohydrates, oils, saponins, tannins, alkaloids, phenols, flavonoids, and various acetogenin compounds (Siegel et al., 2022).



**Taxonomical characterisation of *Annona squamosa* Linn.**(Cante and Garella,2021)

Figure 1:

Class : Magnoliopsida order: Magnoliales

Family: Annonaceae Genus: Annona Species: Squamosa English: Custard apple

**Growth Form:** Small tree with an open, irregular crown.

**Foliage Leaves** are elliptic to oblong with rounded to acute apex (5-15 cm long, 2 - 5 cm wide). Leaves are alternate with entire leaf margins.

**Flowers:** Beautiful yellow-green blossoms dangle down, either alone or in pairs or clusters of two to four. Three lengthy outer petals and three hardly noticeable inner petals (between 2.5 and 4 cm long) adorn each rectangular bloom.

**Fruits** Fruits often have a rounded shape and a rough exterior. Each extended section of the delicious and luscious flesh surrounds an oblong, brown to black seed that is one centimeter long. Every fruit has 20–40 seeds.

**Others - Plant Morphology Habitat:** Widely cultivated in the tropics for its fruit.

Cultivation

This plant grows well in a range of soil conditions and has excellent drainage. Use a 3-10-10 NPK fertilizer to increase fruit yield. Use seeds, grafting, or budding to propagate. Most propagation is done via seeds. Before seeding, take the seeds out of the pulp and let them to dry for a week to optimize germination. When grafting is used instead of seed propagation, higher-quality fruit may be produced faster. susceptible to scale insects (*Philephedra* sp.), beetles, mealybugs, fungi (*Colletotrichum annonicola*, *Glomerella cingulata*), and seed borers (*Bephratelloides cubensis*, *Bephratelloides maculicollis*, *Bephratelloides ruficollis*, and *Bephratelloides paraguayensis*) (Sigel et al. 2022).

**Etymology** The genus "Annona" is the Latin American name for the harvest goddess. The species epithet "squamosa" is derived from the Latin word for scale or scale-like. The reference isto the immature fruit's scaly appearance.

**Ethnobotanical Uses** Edible Plant Parts (Edible Fruits)Food (Herb and Spice;Fruit & Vegetable)

Nutritional value

100 grams of edible portion of fruit consists of.[4]Vitamin C - 37gmCalcium -17gm

Iron	- 4.37gm
Carbohydrate	- 23.5gm
Fibre	- 3.1gm
Protein	-1.6gm
Phosphorus	- 47gm
Fat	- 0.4gm
Energy-	- 104 Kcal

**PHYTOCHEMISTRY**

With the use of 96% ethanol and distilled water, phytochemicals were extracted and sorted. Using a technique outlined by Trease and Evans, a qualitative phytochemical analysis was performed (1989). The presence of alkaloids, flavonoids (NaCl and HCl), carbohydrates (Molisch, Benedict, and Fehling's reagents), glycosides (Keller-Killiani and Borntrager's), protein and amino acids (Buret, Xanthoproteic, Ninhydrin, and Millon's reagents), tannin and phenolic compound (FeCl<sub>3</sub> and Gelatin), triterpenoid (thionyl chloride), steroid and sterols (Luermann, Burchard, and Salkowski's reagents), and fat and fixed oil (alcoholic KOH reagents) were all analyzed for their presence (Padhi et al., 2011).

The leaves of *Annona squamosa* were found to contain pharmacologically active substances include alkaloids, tannins, coumarins, flavonoids, cardiac glycosides, carbohydrates, phenols, and saponins. But phlobatannins and terpenoids were missing (Cante and Garella, 2021).

substances such as aporphine, coryline, isocorydine, norcorydine, glaucine, and anonaine. The leaves of the plant contain 4-(2-nitro-ethyl)-1-β-D-glucopyranosyl-β-D-glucopyranosyl-oxybenzene, Anonaine, Benzyltetrahydroisoquinoline, Borneol, Camphene, Camphor, car-3-ene, Carvone, β-Caryophyllene, Eugenol, Farnesol, Geraniol, 16-Hetriacontanone, Hexacontanol, Higemamine, Isocorydine, Limonine, Menthone, Methyl anthranilate, Methylsalicylate, Methylheptenone, p-(hydroxybenzyl). The plant's leaves, stems, and roots were used to isolate -6,7-(2-hydroxy,4-hydro) isoquinoline, n-Octacosanol, a- and b-pinene, rutin, Stigmasterol, β-Sitosterol, Thymol, and n-Triacontano (Neha Pandey).

*Annona squamosa* Linn. bark was recovered by steam distillation and subjected to GC-MS analysis, which revealed the existence of volatile oil. According to Madhuri and G. Pandey (2009), the oil exhibited strong antibacterial action against both *Bacillus subtilis* and *Staphylococcus aureus*.

Terpenoids, alkaloids, coumarins, and flavonoids were found in *Annona squamosa* seed extract, according to early phytochemical testing [11]. Strong anticancer effects are known to be shown by several drugs. According to Alimzhanova et al. (2012), terpenoids, flavonoids, alkaloids, and tannins are believed to possess strong antioxidant activity and have the ability to either prevent or cure a range of diseases, including cancer. **Table 1:** Preliminary Phytochemical screening of leaf extract of *Annona squamosa*. Constituents Pet ether ext chloroform ext methanol ext water ext

Steroids	+	+	-	-
Triterpine	-	+	-	-
Glycoside	+	+	+	+
Alkaloids	-	-	+	+
Flavonoids	-	-	+	+
Saponins	-	-	+	+
Phinolic compounds	+	+	+	+

+ Present

- Absent

**Table 2: List of various chemical constituents present in various parts of *Annona squamosa* Linn.**

S.No	Constituents isolated	Parts
1	Anonaine	Leaves, tender stem, bark, roots,
2	Anolobine	seeds, roots
3	Aporphine	Roots
4	Corydine	Leaves, tender stem
5	Isocorydine	Leaves, tender stem, bark
6	Norcorydine	Leaves, Tender stem
7	Glaucine	Leaves, Tender stem, Bark
8	Liriodenine	Roots

9	Naulaureline	
10	Norushinsunine	Leaves
11	Reticuline	Roots
12	Annosqualine	Stem

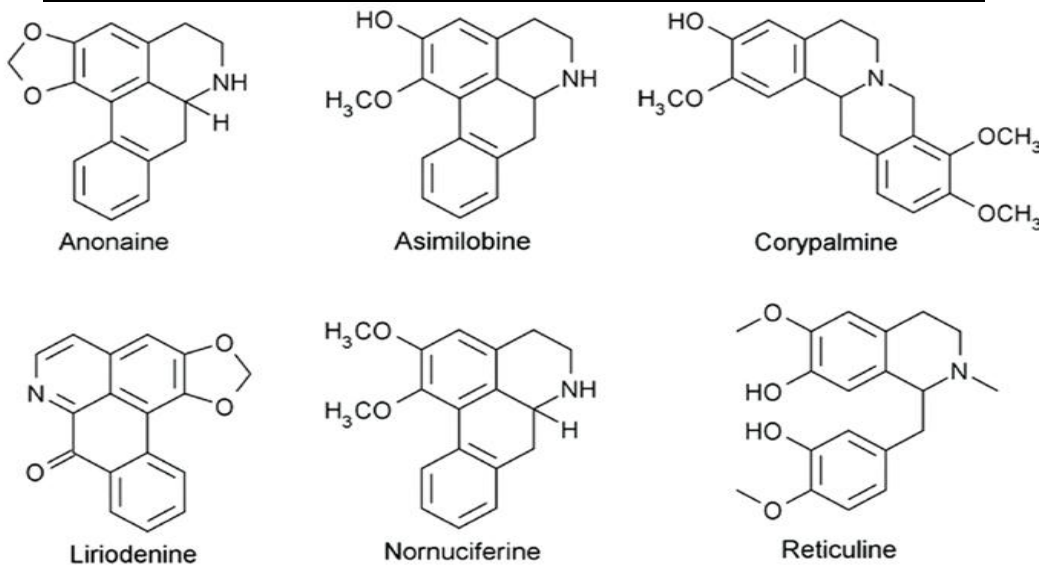


Figure 2: Constituents isolated

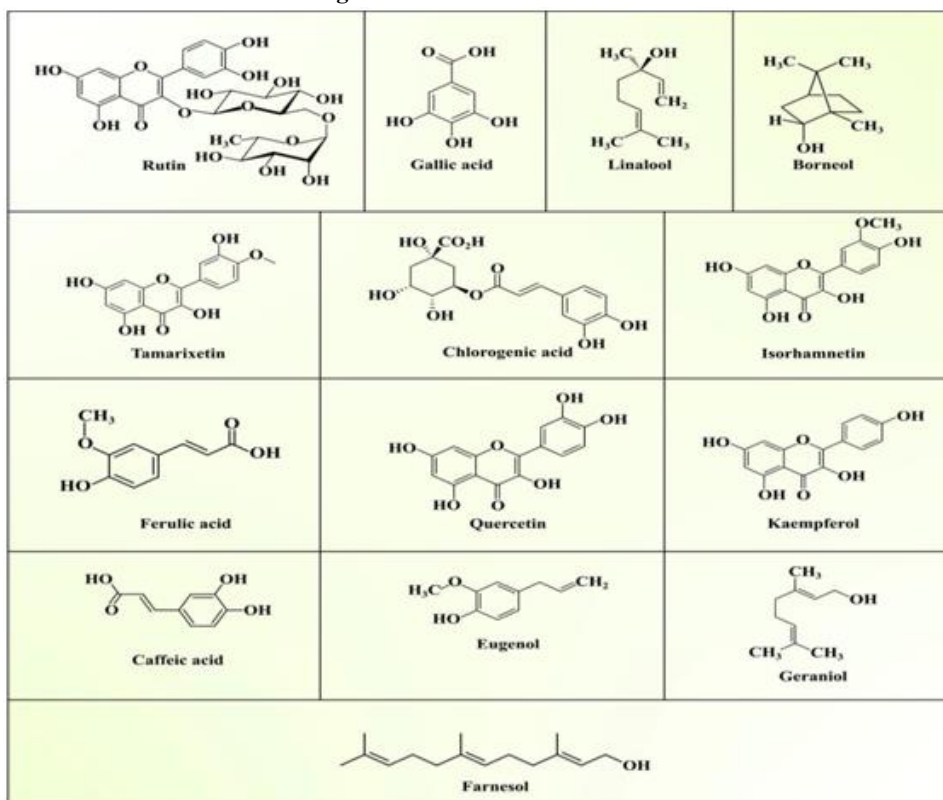


Figure 3 Constituents isolated

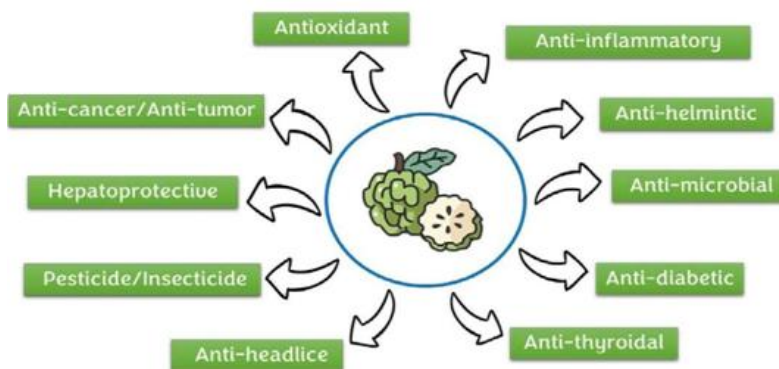


Figure 4 Pharmacological activities

**Antibacterial activity**

An agar cup method was used to screen the antibacterial activity of *Annona squamosa* extract against *Bacillus subtilis* MTCC 7164, *Staphylococcus aureus* MTCC 1144, *Staphylococcus epidermidis* MTCC 3615, *Escherchia coli* MTCC 1098, *Salmonella typhimurium* MTCC 3216, *Pseudomonas aeruginosa* MTCC 1034, *Vibrio cholerae* MTCC 3904, and *Vibrio alginolyticus* MTCC 4439. Gram-positive bacteria are more effectively targeted by the extraction's antibacterial activity than Gram-negative bacteria. The highest zone of inhibition was seen in the methanol extract of *Annona squamosa* leaf, followed by petroleum ether and aqueous extracts, as per the findings of the agar cup antibacterial screening. *Annona squamosa* extracts inhibited the development of all test pathogens except *Salmonella typhimurium*. Aqueous extracts have less activity than methanol extracts (Padhi et al., 2011).

**Antidiabetic activity**

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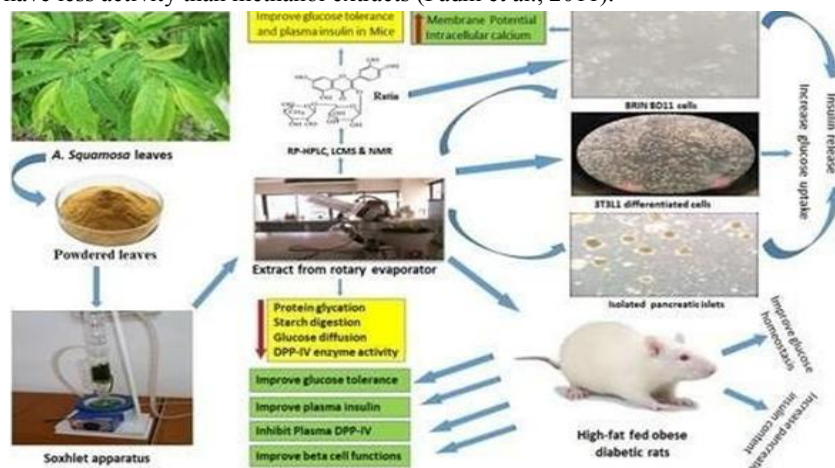


Figure 5 Schematic representation of antidiabetic activity



**Anticancerous activity**

Cancer is a terrible illness that accounts for over 610,000 fatalities in the United States in 2022, making it the second-highest cause of death from cancer [17]. Alternative cancer treatments that do not need chemotherapy have been the subject of recent research. Because they have fewer side effects, anticancer medications made from plant sources are in high demand these days. Additionally, they don't harm healthy cells—only the cancer cells are their target (Abd-Elgany et al., 2022).

According to Wang et al. (2016), the existence of phytochemicals such as terpenoids, flavonoids, glycosides, alkaloids, and phenols has the antioxidant property that squelches free radicals and acts as a cancer-prevention agent. Effective interaction articles may be used to target the administration of medicinal medications because of their large surface area. Because niosomes are stable, inexpensive, and biodegradable, they may function as nanocarriers (Fahmy et al., 2021).

The MTT test (mtc) colorimetric technique was used to quantify the proliferation of cells in comparison to HeLa cells. The basis of this test is the idea that live mitochondria may reduce MTT (yellow tetrazolium salts) to formazan crystals (purple formazan crystals) (Abdel –Hameed) In this mechanism, MTT is taken up by living cells and reduced to formazan by succinate dehydrogenases in the electron transport chain of the mitochondria (Cante R.c). The leaf isolate of *A. squamosa* L. demonstrated moderate cytotoxic activity (IC<sub>50</sub>) against HeLa cells, with a value of 70.9021 ppm. Annonaceous Acetogenin and unsaturated fat in *Annonas squamosa* seed oil significantly inhibit the formation of H22 solid tumors. It may eventually aid in the creation of innovative cancer treatments (Alimazhanova.,2012).

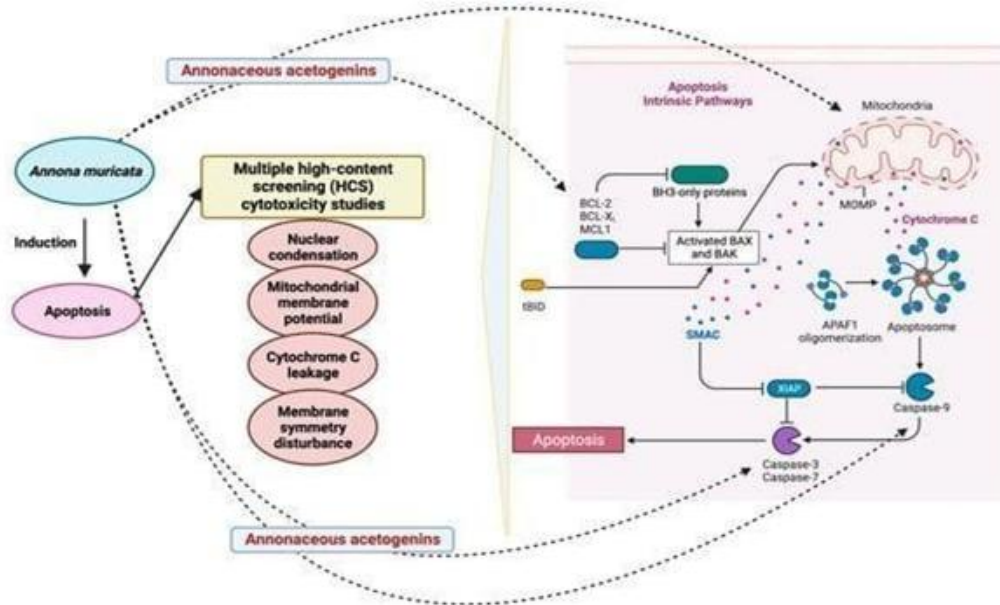


Figure 6 Schematic representation of anticancerous activity

**Anti-arthritic, anti-inflammatory and analgesic activity**

According to recent study, the plant may include anti-inflammatory components such as tannins, sterols, triterpenoids, and flavonoids that might be helpful in the creation of herbal remedies for inflammation. To induce arthritis in Sprague-Dawley rats, an injection of Complete Freund's Adjuvant (CFA) was given into the metatarsal footpad. The degree of inflammation was determined by measuring the size of the rear paws and body weight; AST, ALT, and TP were estimated based on the knee joint's histology. Paw volume was significantly reduced, body weight increased, and the raised levels of ALT, AST, and TP decreased as a result of the combination extract. The histological investigation showed that the animal treated with plant extract had much decreased bone damage, pannus development, and neutrophil infiltration for anti-arthritic action. The extract claims to have anti-inflammatory and analgesic qualities (Raj Sobiya et al.,2009).

To precisely determine *Annona squamosa* alcoholic extract's anti-inflammatory mode of action, further investigation is required (Yadav DK.,2021).

#### Antiulcer activity

*Annona Squamosa* plant twigs and branches were used to extract 1-4-D-GLUCOPYRANOSYLOXYMPHENYL (2-D-GLUCOPYRANOSYSTEMANO)-ETHANE. Both alcohol-induced gastric ulcer/histamine-induced duodenal ulcer and cold restraint/aspirin-induced pyloric ligation models were used to test patients for antulcer activity. The conventional medication, omeprazole, was utilized after a comparison of the outcomes. The evaluation's findings showed antulceractivity in vivo as shown by lower pepsin and total acidity in gastric ligation models. These findings were further supported by inhibition of h(+)K(+)-ATPASE activity in vitro and a concomitant drop in plasma gastrin levels (Yadav DK., 2021).

#### Antimalarial activity

These two mechanisms are suggested by the notable activity of *Annona squamosa* cell carcinoma extracts. The plant is very effective in repelling insects, particularly mosquitoes. An encouraging source for larvicides. A few medium-polar molecules in the extract have the ability to function both competitively and synergistically. live webpage. Plants gathered in Brazil shown larvicidal properties against *Anopheles*, *C. quinquefasciatus*, and *Aedes aegypti*. The report was validated by the outcomes of ongoing larval control efforts, which also demonstrated the ability of *Annona squamosa* species extracts. anti-mosquito medication. On *Annona squamosa*, all the chemicals have been shown in recent investigations. Moderate efficacy against *Plasmodium falciparum* isolates that are resistant to and susceptible to chloroquine (Kumar VA. And Girish C,2021).

## II. CONCLUSION

Natural cures and alternative medicine have been employed for human health and well-being since prehistoric times. Because of the highly therapeutic phytoconstituents they contain, all plant components of *Annona squamosa* have substantial medicinal qualities to cure a variety of human illnesses. The medicinal plant-based remedies are less likely to cause adverse effects than contemporary medication, and they may be used in conjunction with certain biotechnology methods. Therefore, further research and analysis are needed to fully comprehend the vast range of contemporary uses for *Annona squamosa* Linn.

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