

# A Comprehensive Review on custard apple (*Annona squamosa*)

Jaswinder Kaur, Amit Mittal, Saurabh Singh, Dileep Singh Baghel\*

School of Pharmaceutical Sciences, Lovely Professional University, Jalandhar - Delhi G.T. Road, Phagwara,  
Punjab (India)-144411

## ABSTRACT

Herbal remedies were utilized from ancient time for the treatment and prosperity of human beings. A portion of the regular therapeutic plants are common to the point that we utilized them in every day existence without knowing their restorative significance. *Sitaphal* is one among of them usually known as custard apple, sugar apple; sweetsop is the fruit of *Annona squamosa* (Annonaceae). The leaves of the plant have been utilized as bug spray, anthelmintic and in healing of bleeding wounds. Fruit of custard apple is a tropical fruit mainly grow in tropical climate. The fruits are well known for their delicious taste and are heart shaped with light green skin, a soft creamy white flesh. Nutritionally, the fruits are rich in carbohydrates mainly in the form of sugar (23.5%), protein (1.6%), calcium (70mg/100gm), phosphorous (47mg/100gm) and iron (1.5mg/100gm). It is said to contain the qualities of the rejuvenating drugs. It is found to be very useful for brain and nervous system. It also enhances muscular strength and tone up the heart. *Annona* species have been widely grown throughout Central and South America. It is also grown in West Indies, Taiwan, USA other than India. It contains various chemical compounds such as alkaloid, isomeric hydroxyl ketones etc. and squamone from bark of it which show antibacterial, antidiabetic, antitumor, anti-malarial, anthelmintic, hepatoprotective, antioxidant, respiratory stimulant and have diuretics properties.

**KEYWORDS:** *Annona*, custard apple, phytoconstituents, *sitaphal*

## INTRODUCTION

The name *sitaphal* is originated [1] from the two *Sanskrit* words “*sita*” means cold and “*phal*” means fruit. It belongs to family *annonaceae*. It is regarded by way of numerous synonyms names including sugar apple, sweet cleaning soap, *sitaphal* and *sharifa*. Custard apple prospers properly in tropical and warmer sub tropics elements of India. It is cultivated in Maharashtra, Punjab, Bihar, Assam. It grows better in the dry region and in heavy rainfall. Fruit of *sitaphal* is rich in nutrition. Various pharmacological studies done on this plant. The plant grows better in the month of April [2]. It contains various chemical constituents. This plant is popular in a *Ramayana* period. Fruit of *sitaphal* is a rich source of sugar. *Sitaphal* also have an anti-ageing property. It provide glow to the skin [3]. Fruiting process starts after 2-3 years of germination. It grows better in the sandy soil. The leaf extract of *sitaphal* also reported to contain anti-bacterial properties against gram positive and gram negative bacteria [4]. During *Ramayana* period *Mata Sita* eat this fruit so this plant is named as *sitaphal* [5].

Parts of plant	Morphological characters
Leaves	Deciduous, rectangular, slender-lanceolate
Fruit	Compound, heart shaped, abnormal, yellow or brown color when ripped
Seed	Dark brown or black in color, glossy, oblong and smooth
Flower	Flowers present drooping clusters, fragrant, slender, greenish yellow in color

**SYNONYMS [6]**

English : custard apple, sugar apple, sweet sop

Sanskrit : *seetaphalam, sudha, subha*

Hindi : *seetaphal, sharifa, ata*

Malayalam : *athachakka, atha, seetapazham*

Kanda : *sitaphal*

Telgu : *sitaapandu*

Tamil : *sitaplam*

Bengali : *ata*

Arabic : *ghista*

Italian : *pomo canella*

French : *pomme de cannelle, attire*

Portuguese : *atta, fructa do conde*

**TAXONOMIC CLASSIFICATION [7, 8]**

Annona squamosa L.	
Kingdom	: Plantae
Subkingdom	: Tracheobionta
Super division	: Spermatophyta
Division	: Magnoliophyta
Class	: Magnoliopsida
Sub class	: Magnoliidae
Order	: Magnoliales
Family	: Annonaceae
Genus	: Annona L.
Species	: Annona squamosa

**AYURVEDIC PROPERTIES [6]**

*Rasa: madhur,kashaya*

*Guna: guru,snigdha*

*Virya: sheet*

*Vipaka: madhur*

*Karma: udar rog, hridaya etc.*

**HISTORY**

In the mythological literature of *Hinduism*, it is mentioned that the lord *Rama* who killed *Ravana* due to abducting lord *Rama's* wife *Sita mata*, he kept *mata sita* at *ashoka vatika* at *lanka* which is now situated in *Srilanka*. In *ashoka vatika* there were many different varieties of fruits and plants were present, *Mata Sita* used to have those fruits as a meal one of the main fruits was *sitaphal*. This fruit got renowned because of *Sita mata* eat it so named as *sitaphal* [1].

In few literatures it is mentioned that at the time of abduction of *Sita mata* by *Ramavana*, *Sita mata* was crying and her tears fall down on the ground, which result in production of *sitaphal* trees. Due to the tears of *Mata Sita* this fruit named as *sitaphal* [1].

**CHEMICAL CONSTITUENTS [9-13]****Fruits:**

Sugar (up to 28%), Vitamin C, Iron, Calcium, Thiamine, Amino acid, Potassium, Carotene, Riboflavin, Niacin, Ascorbic acid, Magnesium and dietary fibers.

**Leaves:**

Isoquinoline alkaloids, Acetogenine (annoreticulin and isoannoreticuin), Dopamine alkaloid, Salsolnol, Coclaurine, Carvone, Eugenol, Farnesol, Geraniol, Limonene, Linalool, Menthone, Atrophine, Roemerine, norisocoryline and sugars like rhamnoside and quercetin-3-glycoside. Leaf oil yielded 59 chemical compounds.

**Roots and Stem:**

Liriodenine, Oxoanalobine, Borneol, Camphene, Camphor, Car-3-ene,  $\beta$ -Caryphyllene, Eugenol, Farnesol, Geraniol, 16-Hetriacontanone, Hexacontanol, Higemamine, Isocorydine, Limonine.

**Bark:**

Bullatacin, N-Nitrosoxylopine, Roemerolidine, Duguevalline, Mosinone-A, Mosin-B, Mosine-C, Squamone.

**Seeds:**

Acetogenin, Solamin, triterpenoids (stigmasterol and sitosterol), Annotemoyin-1, Annotemoyin-2, Squamocin, cholesteryl, glucopyranoside.

**NUTRITIVE VALUE [13-15]**

Custard apple - Nutritive value per 100 g (Source: USDA National Nutrient data base)

<b>Principle</b>	<b>Nutrient Value</b>	<b>Percentage of RDA</b>
Energy	101 Kcal	5%
Carbohydrates	25.20 g	19%
Protein	1.70 g	3%
Total Fat	0.60 g	3%
Cholesterol	0 mg	0%
Dietary Fiber	2.4 g	6%
<b>Vitamins</b>		
Niacin	0.500 mg	3.5%
Pantothenic acid	0.135 mg	2.5%
Pyridoxine	0.221 mg	17%
Riboflavin	0.100 mg	8%
Thiamin	0.80 mg	7%
Vitamin A	33 IU	1%
Vitamin C	19.2 mg	32%
<b>Electrolytes</b>		
Sodium	3 mg	<1%
Potassium	382 mg	8%
<b>Minerals</b>		
Calcium	30 mg	3%
Iron	0.71 mg	9%
Magnesium	18 mg	4.5%
Manganese	0.093 mg	4%
Phosphorus	21 mg	3%
<b>Phyto-nutrients</b>		
Epicatechin	5.6 mg	--
Proanthocyanidin monomers	6.2 mg	--
Proanthocyanidin dimers	14.2 mg	--

## PHARMACOLOGICAL PROPERTIES OF ANNONA SQUAMOSA

1. Anti-arthritic, Anti-inflammatory and Analgesic Activity: Singh S screened and reported that the plant extract shows dose dependent analgesic and anti-inflammatory activity but significant reduction in neutrophils infiltration, pannus formation and bone of the animal treated with plant extract [16].
2. Antioxidant and Antibacterial Activity: El-Chaghaby et al. studied about the effect of different solvent extracts on the antioxidant and antibacterial activities of leaves. Kothari et al. studied about antioxidant activity of seed extracts. Nandhakumar et al. evaluated *In l. vitro* antioxidant potential of methanol and aqueous extract of fruit pulp. Shenoy et al. reported the antibacterial and wound healing activity of the leaves. [17-19].
3. Antimalarial Activity and cytotoxic effect: Rahman et al. reported the antimicrobial and cytotoxic constituents present in the seeds of sitaphal. He also reported that the extract of Annona species are potential anti-mosquito agents. In the recent studies on Annona squamosa all compounds showed moderate activity against a chloroquine sensitive strain and a chloroquine resistant strain of Plasmodium falciparum [20].
4. Anti-ulcer activity : Yadav et al. Identified and investigated the anti-ulcer constituents of Annona squamosa twigs [21].
5. Anti-tumour activity: Rakesh Ranjan and Mahendra Sahai reported the anti-tumor activities against human hepatoma cells in-vitro and in-vivo, indicating a potential for developing the extract a novel anti-cancer liver drug. Aqueous extracts of the seeds possess significant anti-tumor activity in-vivo against AD-5 tumor [22].
6. Hepatoprotective activity: Saleem et al. investigated the hepatoprotective potential of aqueous and alcoholic extract of leaves on experimental animal model
7. Anti-HIV : Saleem et al. reported that the 16 $\beta$ , 17-dihydroxy-ent- kauran-19-oic acid showed significant activity against HIV replication in H9 lymphocyte cells with an EC<sub>50</sub> value of 0.8  $\mu$ g/ml [23].
8. Larvicidal activity against Aedes aegypti mosquitoes: R. Kaushik & P. Saini studied about larvicidal activity of acetone leaves extracts. Parvin et al. reported that the chloroform extract of the seeds of have pesticidal activity against both adults and different instars of Tribolium castaneum (Herbst) under laboratory condition. [24, 25].
9. Anthelmintic activity and Anti-genotoxic Effect: Gupta et a. studied about the anthelmintic activities of the Annona squamosa and its leaf extract have been studied using various models. The hexane, ethyl acetate, ethanolic extracts of the crude drug at different concentrations were tested which involve determination of paralysis time and death time. Antigenotoxic effects of aqueous and ethanolic bark extracts of Annona squamosa was assessed by determining the frequency of micronucleated polychromatic erythrocytes (MnPCEs) and chromosomal aberrations [26].

**CLIMATE CONDITION [27-29]**

The plant of sitaphal is well grown in the hot and dry region. Summer rainfall and warm protected soil is most suitable for the growth of the plant. The cold weather and the -fog is not suitable for the growth of sitaphal plant. The plant bears fruits in 3-4 years.

**QUALITATIVE TEST FOR PHYTOCHEMICALS [2, 30]**

Sr. No.	Qualitative Test	Phytochemical constituents	Observations (Aqueous extract)	Observations (Ethanolic extract)	Observations (Chloroform extract)
1	Ferric chloride test	Tannins	Positive	Negative	Positive
	Lead acetate test		Positive	Negative	Positive
	Bromine water		Positive	Negative	Positive
2	Borntrager's test	Glycoside	Negative	Negative	Negative
	Liebermann's Test		Negative	Negative	Negative
	Keller-Kiliani Test		Negative	Negative	Negative
	Salkowski's Test		Negative	Negative	Negative
3	Foam test	Saponin	Positive	Positive	Positive
5	Benedict's solution test	Carbohydrates	Positive	Positive	Positive
	Fehling's test		Positive	Positive	Positive
	Molisch's test		Positive	Positive	Positive
6	Mayer's reagent	Alkaloids	Positive	Negative	Negative
	Dragendroff reagent		Positive	Negative	Negative
	Wagner's reagent		Positive	Negative	Negative

	Hager's reagent		Positive	Negative	Negative
7	Liebermann	Steroids	Positive	Negative	Negative
	Burchard's reaction				
	Salkowski test		Positive	Negative	Negative
8	Ferric Chloride Test	Phenols	Positive	Positive	Positive
	Liebermann's nitroso reaction		Positive	Positive	Positive
	Lead Acetate test		Positive	Positive	Positive
	Gelatin test		Positive	Positive	Positive
9	Alkaline reagent test	Flavonoids	Positive	Negative	Negative
	Zinc hydrochloride test		Positive	Negative	Negative

### TEST DONE ON LEAVES:

#### Chlorophyll test:

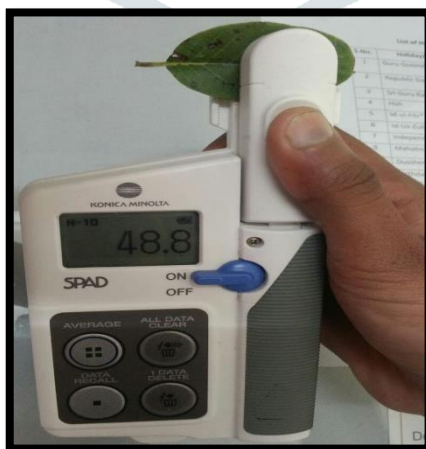
Chlorophyll a is the photosynthetic pigment that reasons the inexperienced colour in algae and plant life. The awareness of chlorophyll a gift inside the water is directly related to the quantity of algae residing within the water [2].

#### Instrument used: SPAD

SPAD 502 Plus Chlorophyll Meter immediately measures chlorophyll content or “greenness” of your vegetation to reduce the threat of yield-limiting deficiencies or high priced overfertilizing. The SPAD 502 Plus quantifies diffused modifications or tendencies in plant health lengthly earlier than they may be seen to the human eye.

#### Procedure:

Taken leaf from a plant, attached that leaf with the chlorophyll meter and measure the range of chlorophyll present in leaf.



**LEAF AREA METER:**

The area of the leaf is measured with the help of leaf area meter.

**Area of leaves:**

Sr.no.	Leaf area	Chlorophyll content
1	27.5	48.8
2	26.0	41.3
3	21.7	40.2
4	17.6	39.5
5	17.5	34.1

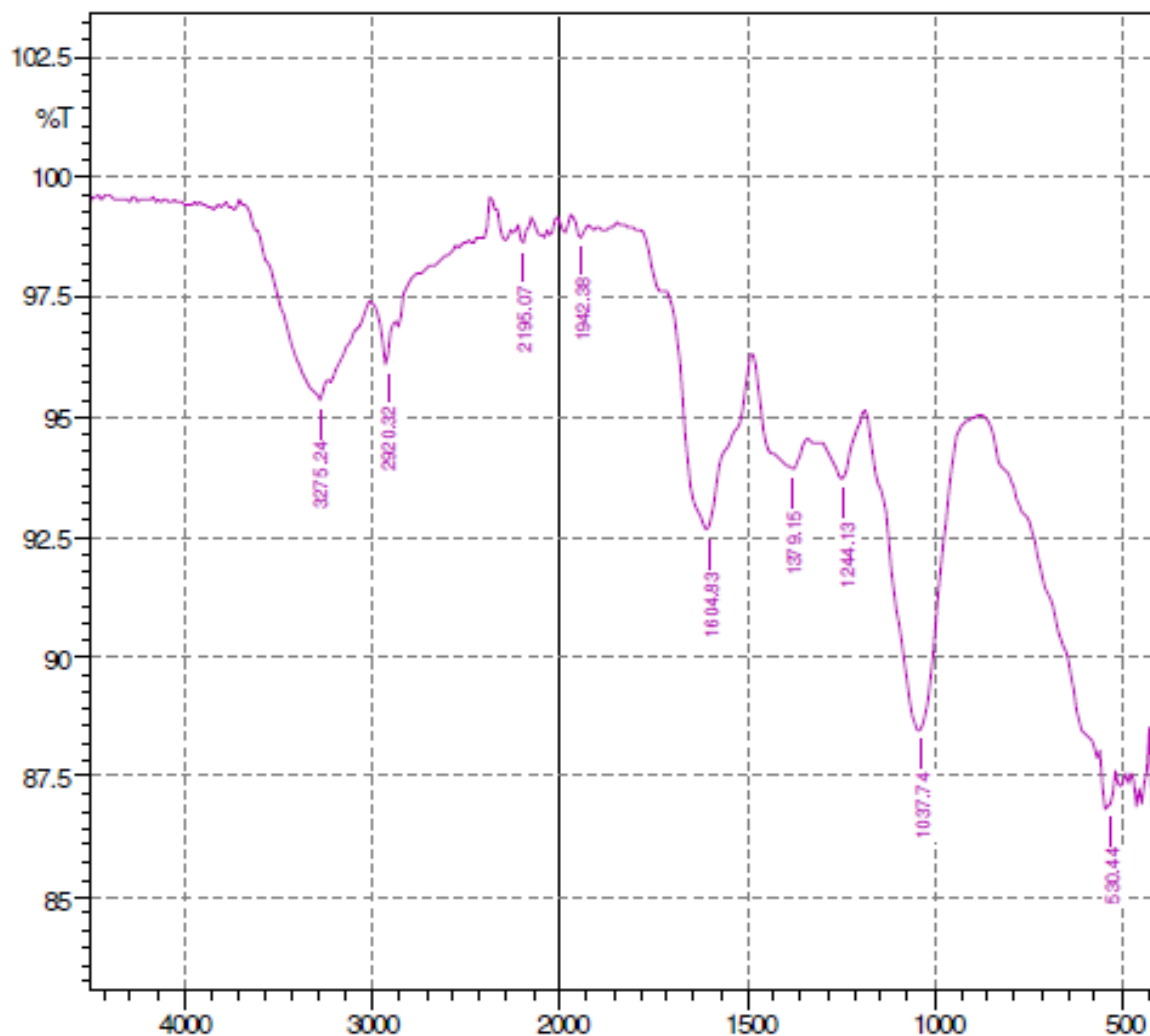
This results show that the biggest size of the leaf contain the high chlorophyll content and the smallest one contain the low chlorophyll content.

**FTIR [31]**

Significance:

- 1) It can identify unknown materials.
- 2) It can determine the quality or consistency of a sample.
- 3) It can determine the amount of components in a mixture.





### Readings of FTIR:

Sr.no.	Peak	Intensity	Area	Compound
1	530.44	86.902	1.153	organic halogen compounds (C–X stretching (X = F, Cl, Br or I), phosphorus compounds (P=S stretching, P–Cl stretching)
2	1037.74	88.466	10.886	infrared bands of aliphatic hydrocarbons, infrared bands of aromatic compounds (In-plane C–H bending), Alcohols and Phenols (C–O stretching, O–H) Ethers (C–O), stretching oxygen-containing compounds (C–O stretching)
3	1244.13	93.717	3.051	aromatic compounds (In-plane C–H bending) Alcohols and Phenols, Ethers, oxygen-containing compounds (C–O stretching), Aliphatic (C–O stretching), Anhydrides

4	1379.15	93.932	3.653	nitrogen-containing compounds, Aliphatic nitro compound (NO <sub>2</sub> symmetric stretching), Heterocyclic Compounds, Boron Compounds (B–O stretching),
5	1604.83	92.67	5.565	Aliphatic, hydrocarbons, Alkenes
6	1942.38	98.733	0.207	No compound is found at this peak
7	2195.07	98.569	0.198	aliphatic hydrocarbons (Alkynes), organic compounds Combination (N–H stretching), combination (O–H stretching)
8	2920.32	96.095	1.781	No compound is found at this peak
9	3275.24	95.371	0.549	No compound is found at this peak

### QUANTITATIVE ESTIMATION OF PHENOL

Chemicals required:

- 1) Folin ciocalteau reagent.
- 2) 20% sodium carbonate(0.2gm of sodium carbonate in 100ml distilled water.

Sample preparation:

- 1) Take the leaves.
- 2) Clean them properly.
- 3) Dry the leaves with the help of tray drier.
- 4) After drying crush them properly to make fine powder with the help of mortar pestle.
- 5) Take the powdered sample in test tube.
- 6) Add 10ml of 80% ethanol in it.
- 7) Boil it for 10 minutes with the help of water bath.
- 8) Filter it with the help of filter paper.

Procedure:

- 1) Take 0.25ml of extracted sample in test tube.
- 2) Boil and evaporate the supernatant extract.
- 3) Add 5ml of distilled water in above test tube.
- 4) From the above test tube take 0.2 ml.
- 5) With the help of distilled water make up the volume upto 3ml.
- 6) Add 0.5ml folin- ciocalteau reagent.
- 7) Leave for 3 minutes.
- 8) Add 2ml of 20% sodium hydroxide.
- 9) Boil it for 1 minute.
- 10) Check absorbance at 650nm.

Blank sample:

Distilled water.

Calculation:  $(O.D./0.002) \text{ mg}(100\text{gm})$

Result:  $(0.147/0.002)$

$=73.5\text{mg}(100\text{gm})$

### **IN-VITRO ANTIOXIDANT ACTIVITY**

Chemicals required:

DPPH: 0.0236gm of DPPH in 1000ml methanol.

Sample preparation:

- 1) Take the leaves.
- 2) Clean them properly.
- 3) Dry the leaves with the help of tray drier.
- 4) After drying crush them properly to make fine powder with the help of mortar pestle.
- 5) Take the powdered sample in test tube.
- 6) Add 10ml of 80% ethanol in it.
- 7) Boil it for 10 minutes with the help of water bath.
- 8) Filter it with the help of filter paper.

Procedure:

- 1) Take 0.1ml of extracted sample in a test tube.
- 2) Add 3.9ml of the DPPH in the test tube.
- 3) Keep it in dark for 30 minutes.
- 4) Check the O.D at 517nm.

Blank sample:

Distilled water and DPPH.

Calculation:  $\frac{\text{DPPH O.D.} - \text{sample O.D.}}{\text{DPPH O.D.}} * 100$

Result:  $0.416 - 0.212 / 0.416 * 100$

$= 50.54$

### **SUMMARY AND CONCLUSION**

*Annona squamosa* most famous plant semi deciduous found in the form of shrub it is not very long in height and consists spreading branches. that are usually cultivated all over the World mainly in tropical regions. This plant is having very sweet and edible fruit that is why it is known as custard apple. This plant is not only useful for the edible purposes but also in the field of medicines. According to experiments performed it has been proven that this plant mainly consists chemical constituent's tannins, phenols, sugars, flavonoids, etc. It has been also observed that this plant possess antioxidant, antibacterial, antimalarial, anti-inflammatory, antiaging and many more. According to literature this plant is also useful in curing dysentery, diarrhoea, rheumatism, colds, chills, and insomnia. Evidence also shows that this plant is having anticancer property and it also



