

# Asian Journal of Research in Chemistry and Pharmaceutical Sciences

Journal home page: [www.ajrcps.com](http://www.ajrcps.com)



## SITAPHAL: UNEXPLORED THERAPEUTIC POTENTIAL

Ramninder Kaur\*<sup>1</sup>, Komalpreet Kaur<sup>1</sup>, Pawandeep Kaur<sup>1</sup>, Iqbal Singh<sup>1</sup>

\*Department of Pharmaceutical Chemistry, G.H.G. Khalsa College of Pharmacy, Gurusar Sadhar, Ludhiana, Punjab, India.

### ABSTRACT

Sitaphal frequently known as *Annona Squamosa* belongs to family Annonaceae. The plant is highly used traditionally in curing diverse disorders. Sitaphal is a multipurpose tree with edible fruits. Commonly it is used as cough and cold and sneezing nose, antibacterial, and anti-infective. The leaves of *Annona squamosa* contain valuable quantity of ascorbic acid and tannins. Sitaphal regularly can help to beautify skin naturally. The vitamin A content present abundantly in this fruit benefits to keep skin healthy. Sitaphal is very large and good commercial importance so considered as native fruit of country. This review particularly deals with the phytochemicals, medicinal importance of *Annona squamosa*.

### KEYWORDS

Sitaphal, Chemical constituents, Medicinal uses and Marketing formulations.

### Author for Correspondence:

Ramninder kaur,  
Department of Pharmaceutical Chemistry,  
G. H.G Khalsa College of Pharmacy,  
Gurusar Sadhar,  
Ludhiana. Punjab, India.

**Email:** [ramninder@gmail.com](mailto:ramninder@gmail.com)

### INTRODUCTION

In various indigenous and traditional sources of medicine plants have been extensively used for treatments. Various parts of plants such as the leaves, fruits, the barks, roots and even the seeds are being used for preparation of medicine. Sitaphal (Sugar-apple) is the fruit of *Annona squamosa*, Family: Annonaceae, and also cultivated for its edible fruit. It is originated in lowland Central America, where it is indigenous. It is also grown species of *Annona* and a native of known as custard apple (mainly *Annona reticulata*) in the Philippines. The genus name, 'Annona' is from the Latin word 'anon', which means 'yearly produce'. The fruit is round to conical, 5–10 cm (2.0–3.9 in) in diameter

and 6–10 cm (2.4–3.9 in) long and weighing 100–240 g (3.5–8.5 oz), with a thick rind composed of knobby segments. *Annona squamosa* also known as sweet apple<sup>1</sup>.

### Synonyms

It is well known by other names such as common seureuba, sugar apple, gishta, sweet apple, zimtapfel, sharifa, sitappalm, matomoko, aati, atis, anoda, fruta-pinha, aajaa thee, hairico, annona Guatemala, katu, Annone écailleuse, Cachiman cannelle (Haiti), Pomme cannelle (Antilles), atha Mela canella, Pomo canella, sweetsop<sup>2</sup>.

### Habitat and Morphology

The compound fruits are round to oblong, 6–10 cm (2.4–3.9 in) diameter, with a thick, scaly or knobby skin that gives them a pine-cone appearance. The fruit flesh is fragrant, sweet, and white to light yellow, with the texture and flavor of custard; the flavor is considered the best among fruits in the genus. Fruits are divided into 20–38 segments, each generally containing a hard, shiny brownish-black, seed, enmeshed in the flesh, although some trees produce seedless fruit. The leaves are brilliant green above and bluish green below; with petioles 0.7 to 1.5 cm in length. The leaves are oblong and elliptical in form. The flower measure 2.0 to 2.5 cm in length. The fruits are generally eaten fresh, or used to make juice beverages or sorbet, and are a good source of iron, calcium, and phosphorus<sup>3</sup>.

### History of the Name ‘Sitaphal’

This fruit has an interesting history attached to it in respect to its name i.e. Sitaphal. Mythologically it is said that Sita, wife of Lord Rama during her vanvaas used to eat this fruit. While some texts say that when Ravana was abducting Sita, at that time the drops of tears from her eyes and nose fell onto the ground and they gave birth to Sitaphal trees in the wilderness. Although, many people believe that sitaphal has nothing to do with Sita. Its origin is in Sanskrit i.e. “*sheet*” in Hindi means cold and “*phal*” is fruit and having excess of it can give you cold and also it has a cooling effect on your body so hence the name is Sitaphal. *Annona* is semi-evergreen shrub species of *Annona* and native to the tropical America and India.

### History of Plant

Sitaphal are native to the New World Tropics, particularly northern South America -- Columbia, Ecuador, Peru. It was cultivated by natives in the Andes and was first planted in California in 1871. Very highly regarded in tropical and subtropical areas. It is believed that it was first introduced into Brazil-“*fruta do cond*” It is later taken to the Philippines and Asia via West Indies. In India, there is very large and good commercial importance so considered as native fruit of that country. However, this is a secondary centre of diversity, created during the last 500 years.

### CHEMICAL CONSTITUENTS

#### Fruits

The custard apple is a very sweet (up to 28% sugar) and aromatic fruit. It contains significant quantities of vitamin C, iron, calcium, thiamine, amino acid, potassium, carotene, riboflavin, niacin and ascorbic acid, magnesium and dietary fibres. Despite its high sugar content, the glycemic index of custard apple is low and the glycemic load moderate. Specific chemicals extracted include aliphatic ketones. e.g. palmitone.

Organic acids

Hexanoic and octanoic acid and purines<sup>4</sup>.

#### Leaves

Leaf oil yielded 59 compounds. Main components were  $\beta$ -caryophyllene (1) (31.4%) (natural bicyclic sesquiterpene)  $\delta$ -cadinene (6.7%),  $\alpha$ -muurolene (5.5%), T- and  $\alpha$ -cadinol (4.3%). Leaves gave isoquinoline alkaloids. Two acetogenins, annoreticuin (2) and isoannoreticuin (3) isolated from the leaves, were found to be selectively cytotoxic to certain human tumours. The leaves and stems also gave alkaloids dopamine, salsolinol and coclaurine. Others are anonaine, aporphine, coryline, isocorydine, norcorydine, and glaucine<sup>5</sup>.

#### Alkaloids

An alkaloid isolated from the custard apple tree was assigned the structure and christened with the name samoquasine A (4). Other Alkaloids include

Aporphine

Benzylisoquinoline

Protoberberine

#### Tetrahydroisoquinoline

Other constituents of *Annona squamosa* include Oxophoebine(5), reticuline(6), atidine, histisine, hetidine, hetisine, heterophyllisine, heterophylline, heterophylline, isoatisine, dihydroatisine, hetisinone benzoyl heteratisine and citronella oil. Flesh of fruit contains saccharose 2.53% dextrose 5.05 percent, and levulose 0.04.

#### Roots and Stem

The name of the compound are liriodenine (7), oxoanalobine (8) both of the compound belong to the group of oxoaporphines and were identified by spectra. The compounds were isolated from the root extract of the plant. Different chemical constituents like Borneol, Camphene, Camphor, car-3-ene, Carvone,  $\beta$ -Caryphyllene, Eugenol, Farnesol, Geraniol, 16- Hetriacontanone, Hexacontanol, Higemamine, Isocorydine, Limonine from stems, root extracts of *Annona squamosa* Linn<sup>6</sup>.

#### Bark

Bark yielded an amorphous alkaloid, found to be poisonous, causing tetanus-like convulsions when injected to mice. Different Bullatacin (9) Bullatacinone isolated form stem bark of *Annona squamosa* Linn<sup>7</sup>.

#### Seeds

Stem bark yielded one acetogenin, solamin and two triterpenoids, stigmaterol (10) and sitosterol (11). Isolation of about 30 Acetogenins from the seeds of *A.squamosa* Linn eg: Squamocins B to N, Coumarinologans. Annotemoyin-1, Annotemoyin-2, squamocin and cholesteryl, glucopyranoside are isolated from the seeds of *A.squamosa* Linn. These compounds showed remarkable antimicrobial and cytotoxic activities<sup>8</sup>.

### MEDICINAL USES

#### Antioxidant Activity

The antioxidant activity in mature fruits of 36 species and varieties produced in Taiwan was analyzed by the ferric reducing antioxidant power (FRAP) assay. In this study, sugar apple was categorized as having very high antioxidant activity i.e>70mmol/100g edible part. Many studies including conducted in India showed that extracts of *Annona squamosa*, *Annona cherimola* and *Annona*

*muricata* have high anti-oxidant activity<sup>9</sup>. Streptozotocin induced diabetic rats were used. It reduces the lipid peroxidation and increases the activity of antioxidant enzymes and strong super oxide radicals and singlet oxygen quenchers<sup>10</sup>.

#### Anti-infective Activity

The fruit of *Annona* spp. have been shown to have anti-microbial activities due to several compounds which include Ent-kauranes, Acetogenins, essential oils and Benzylisoquinolines alkaloids. The anti-bacterial activity of the crude methanol extract of sugar apple, and an isolated diterpene, against *Staphylococcus aureus* and *Streptococcus pneumonia* is being established. There are also reports of chemicals which are also active against *candida albicans*, *proteus* etc<sup>11</sup>.

#### Antibacterial Activity

Four different solvent extracts of leaves of Custard apple (*Annona squamosa* L.) were studied for its antibacterial activity. Agar diffusion Vohora method was selected to check antibacterial activity. Two Gram positive (*Staphylococcus aureus* and *Bacillus subtilis*) and two Gram negative (*Escherichia coli* and *Pseudomonas aeruginosa*) bacteria were selected for screening. Then phytochemical studies showed that Linalool, Borneol, Eugenol, Farnesol, and Geraniol present in extracts which provide antibacterial activity. *A. squamosa* contains flavonoids which exposes strong antibacterial activity<sup>12</sup>.

#### Antidiabetic Activity

Study carried out on *Annona squamosa* have revealed that the plant posses anti-hyperglycemic effect. The study was done using Male albino Wistar rats. The diabetes was induced using streptozotocin. The study resulted that Oral administration of *A. squamosa* aqueous extract to diabetic rats for 30 days significantly reduced blood glucose, urea, uric acid and creatinine, but increased the activities of insulin, C peptide, albumin, albumin/globulin ratio and restored all marker enzymes to near control levels<sup>13</sup>.

#### Anti HIV activity

There was a positive result exhibited by the extract of *annona squamosa* when evaluated for anti HIV screening. In the above study new chemical

compound have been named and isolated. The structures of the new compounds were established by spectral analyses and chemical evidence. Among the 14 isolated compounds in the study, 16, 17-dihydroxy-entkauran-19-oic acid showed significant activity against HIV replication in H9 lymphocyte cells with an EC<sub>50</sub> Value of 0.8 µg /mL<sup>14</sup>.

#### **Rheumatism and Arthritis**

The symptoms of rheumatism and arthritis can be reduced with help of magnesium in custard apple that equalizes the water balance in the body and removes acids from the joints. It is also helpful in reducing the weakness of the muscles.

#### **Stress and depression**

Sitaphal is said to be a good source of vitamin B complex which helps in controlling the GABA neuron chemicals in the brain. This relaxes the mind and helps to calm down stress, tension, irritability and depression.

#### **During Pregnancy**

Sitaphal is helpful in the development of the brain, nervous system and immune system of a fetus. Regular consumption of sitaphal during pregnancy reduces the chances of miscarriage and minimizes the extent of labor pain during delivery. It is termed by some as the pregnancy wonder fruit that helps in coping with morning sickness, nausea and mood swing. This fruit is very useful for the improvement of the immune system, nervous system and also for the development of the brain in the fetus. It is a good source of copper. Generally pregnant women need to take 1000 micrograms of copper. Low copper in the body can cause premature birth. So consuming this fruit can be really helpful. It has Vitamin C and Vitamin A which is very useful for the fetus in the womb. It is brilliant for the right growth of eyes, skin, hair and also blood tissues.

#### **Prevents Ageing**

Sitaphal contains L-lysine and L-proline, the amino acids that help to create collagen in the body. Collagen is a substance that provides structure and elasticity of the skin tissues. The high levels of antioxidants in custard apple protect the cell membranes from the free radical damage, allowing the body to fight the signs of ageing. Sitaphal boosts the growth of new cells, making the skin look

young. It helps to reverse the discoloration and wrinkles associated with ageing. It also tones and firms the skin stand. Sitaphal is also helpful in increasing the production of breast milk after the childbirth<sup>15</sup>.

#### **Anticancer activity**

Annonaceous acetogenins may be good chemotherapeutic agents for cancer. These compounds inhibit mitochondrial and cytoplasmic production of adenosine triphosphate (ATP), which is the major source of energy for the cells and also a precursor of the nucleotides needed to produce DNA and RNA. Annonaceous acetogenins also inhibit the enzymes of complex I in the electron transport system in mitochondria. They also inhibit the NADH oxidases found in the plasma membranes of tumor cells. Their net effect is depletion of ATP levels. These supplements help in the treatment of several types of cancer and tumors. The fruit contains compounds like acetogenin and alkaloids that reduce the risk of cancer and renal failure. It acts against cancer cells, without adversely affecting healthy cells. Antioxidants such as asimicin and bullatacin are also found to have anti-cancer and anti-helminthes properties. These antioxidants neutralize the effects of free radicals, preventing cancer. It also contains significant fiber, which protects the colon membrane by warding off toxic substance from the gut, reducing the risk of liver and colon risk. It also provides protection from breast cancer. Bullatacin is one such compound that possessed antitumoral and pesticidal activity<sup>16</sup>.

#### **For A Stronger Digestive System**

It flushes out the toxins from the intestine, aiding in proper functioning of the bowels. It also prevents stomach related diseases like heartburn, ulcer, gastritis and acidity. This delicious fruit is very effective for treating indigestion. Custard apple in its unripe form is further dried and crushed to treat diarrhea and dysentery. One medium sized custard apple contains 6 grams of dietary fiber, amounting to almost 90% of the recommended amount. Fiber adds bulk to the stools, relieving constipation.

#### **Mosquitocidal activity**

The significant activity demonstrated by extracts of *Annona squamosa* suggests that the two plants may

have strong killing effects against insects particularly mosquitoes, hence giving a promising source of larvicidal agents. *A. Squamosa* showed a dose dependent ( $p \geq 0.05$ ) but also significantly a decreased activity from its parent fraction at the same concentration levels. This indicates that, several medium polar compounds in the extract are acting synergistically or competitively at the active sites. *A. squamosa* plant collected from Brazil indicated larvicidal effect against *Aedes adopictus* and *C. quinquefascinits* and against *Anopheles stephensi*. Present larvicidal activity result supports the reports and demonstrated that extract of *Annona* species are potential anti-mosquito agents<sup>17</sup>.

#### Traditional Uses

It uses as an insecticidal and antitumor agent, anti-diabetic, antioxidant, anti lipidemic, and anti-inflammatory agent which may be characterized due to the presence of the cyclic peptides. An infusion with 2 handfuls of fresh leaves in 1 L of water is prepared to fight against heart failure and palpitations (1 cup after meal). This infusion is also effective for proper digestion and has antispasmodic activities. The seeds are reported to have anti-parasitic activities (against lice). A cream consisting of 3 cl bee wax, 12 cl almond oil, 3 cl coconut oil, 6 cl of water, 6 cl glycerin, and 1 handful of crushed *A. squamosa* seeds is prepared and heated over a water bath for 3 hours before applying to the hair.

In India the crushed leaves are applied on ulcers and wounds and a leaf decoction is taken in cases of dysentery.

In Aligarh district of Northern India, villagers used to consume a mixture of 4-5 newly grown young leaves of *A. squamosa* along with black pepper (*Piper nigrum*) for management of diabetes. It is documented that this may ensure up to 80% of the positive results with continued therapy.

The bark decoction is given as a tonic and to halt diarrhea.

Throughout tropical America, a decoction of the leaves is imbibed either as an emmenagogue, febrifuge, tonic, cold remedy, digestive, or to clarify urine. The leaf decoction is also employed in baths to alleviate rheumatic pain. *Sitopaladi churna* is an

ayurvedic medicine for cough and cold and sneezing nose.

Administration of the aqueous extract of the leaves also improved the activities of plasma insulin and lipid profile and reduced the levels of blood glucose and lipid peroxidation, indicating that the high levels of triglyceride and total cholesterol associated with diabetes can also be significantly managed with the extract.

**Food:** To eat this seasonal fruit has several health benefits like enhancing vision, fighting fatigue, treating arthritis/rheumatism and many more.

**Fuel:** The tree is a good source of firewood.

**Timber:** The light yellow sapwood and brownish heartwood are soft, light in weight and weak.

**Poison:** Green fruits, seeds and leaves have effective vermifugal and insecticidal properties.

**For Pimple-Prone:** Consumption of custard apple decreases Skin sebum production, controlling acne and pimples. Mix custard apple paste with lemon juice and use it three times a week to control sebum production. The anti-inflammatory properties of custard apple fight acne and clear the pores to prevent further breakout.

Soursop tea is used in traditional medicine to heal wounds, for soothing knee pain and for reducing mucous in colds and in sinuses<sup>18</sup>.

#### Other Uses

Leaves-insecticide (see powder, mixed with leaf juice is used for removing lice from scalp). Seeds-abortionifacient. Root-purgative, used in blood dysentery. Fruit-invigorating, sedative to heart, anti-bilious, antiemetic, expectorant. Dried powdered unripe fruits - used for treating ulcers. Ripe fruit made into paste with betel leaves is applied to tumour to hasten suppuration. Leaves, bark, unripe fruit-strongly astringent; used for diarrhoea and dysentery.

**Natural Detoxifying Agent:** Sitaphal is loaded with soluble fiber and antioxidants, making it an excellent laxative. Regular consumption of custard apple helps to get rid of toxins and waste, giving you a healthy and glowing skin. Drinking custard apple juice evens out the skin tone and makes it firm by rejuvenating its appearance. The plant bears

some amazing medicinal qualities, like serving as an insecticide, antiovaratory and abortifacient.

The seeds (kernels) are not consumed as they are slightly poisonous. Fatty-acid methyl ester of the seed oil meets all of the major biodiesel requirements in the USA.

The leaves also provide ingredients used to make dyes, stains, inks, tattoos and mordants.

Paste of flesh of this plant or crushed leaves of the plant can be used for local application on ulcers, abscesses and boils.

Hyper-Thyroidism-Custard apples are good for those who need to gain weight<sup>19</sup>.

## MARKETED FORMULATIONS OF SITAPHAL

### Cosmetics

Bleaching preparations and other substances for laundry use; cleaning, polishing, scouring and abrasive preparations; soaps, perfumery, essential oils, cosmetics, hair lotions. Sitaphal protects and preserves the cells of the skin, making it more supple and radiant. It renews the skin by preventing it from the oxidative stress. This creamy fruit helps to even out the skin tone and rejuvenates the appearance. The antioxidants also shield the skin from the sun rays, thereby reducing sun damage. Topical application of custard apple pulp can lighten the appearance of dark spots, freckles and other skin imperfections. The fruit penetrates to the deep layers of the skin, transporting the important nutrients into it. Himalaya products like pimple creams, Anti-stress massage oil, Ayur slim capsules, cold balms, foot care creams, pain massage oils and lots more.

### SITAPHAL SEED OIL

#### For Better Hair Growth

It inhibits scalp inflammation, preventing hair fall. It also facilitates the absorption of nutrients, providing nourishment to the hair. The high amount of iron in custard apple improves blood circulation in the scalp, stimulating the follicles to promote hair growth.

This oil has a slight almond-like odor and a very mild, pleasant taste. In tropical countries, the oil is

used as normal cooking oil or a salad oil. It is also called Sapuyul oil.

### Shampoos

Mediker, from Marico, pioneered the switch from the traditional lice comb, which is painful to use, to an easy and effective way of treating lice using shampoo. The shampoo contains Coconut, Neem and Camphor. Mediker Anti-Lice Treatment has transformed lice removal into a painless activity, replacing the traditionally-painful lice comb with a wash-off format. Mediker contains actives such as neem, camphor and sitaphal extracts<sup>20</sup>.

## FOODS

### Ice-Cream

Fruit is used in making of ice creams and milk beverages. The fruit is generally eaten out of hand with a spoon or cut into fruit salads. It may be blended with orange juice, lime and cream to make a delicious ice-cream.

### SITAPHAL JUICE

Custard Apple (Sitaphal) Powder, which is one of the most enjoyed fruits that cultivate in the latter half of monsoon and rainy seasons. This fruit is soft and juicy and has a sweet taste. Moreover, our Custard Apple is widely used at homes, hotels and restaurants to make salads. Spray Dried Apple Powder. Spray Dried Apple Powder is extensively used to make juice, milkshakes, mango flavored yoghurt and in many other applications.

### Recepics of Sitaphal

Apart from taking the fruit as such, which is the most common form of intake of the fruit; there are certain preparations which make it more palatable especially for the children.

**Sitaphal firni:** Milk thickened with rice flour is flavoured with custard apple pulp and refrigerated to enhance the flavour and get the perfect consistency. It is served chilled for a fruit ilicious experience, which is much healthier than regular custards and puddings.

**Sitaphal Rabdi:** Mix saffron, cardamom after simming almonds, pista in stove. Combine with the pulp of sitaphal and can be served hot or cold.

Sitaphal kheer: It is a mixture of cooked rice and sitaphal in specific proportions with added flavor with cardamom.

#### Drug Interactions

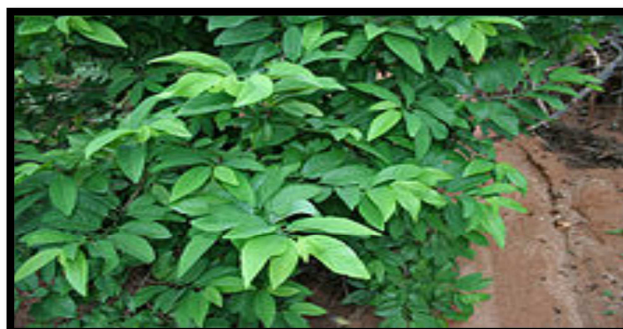
Handling the fruit may produce a skin rash in sensitive individuals. There are no interactions documented. None well documented.

**Table No.1: Taxonomical characterization of *Annona squamosa* Linn<sup>9</sup>**

Kingdom	Plantae
Order	Magnoliales
Family	Annonaceae
Genus	Annona
Species	Squamosa



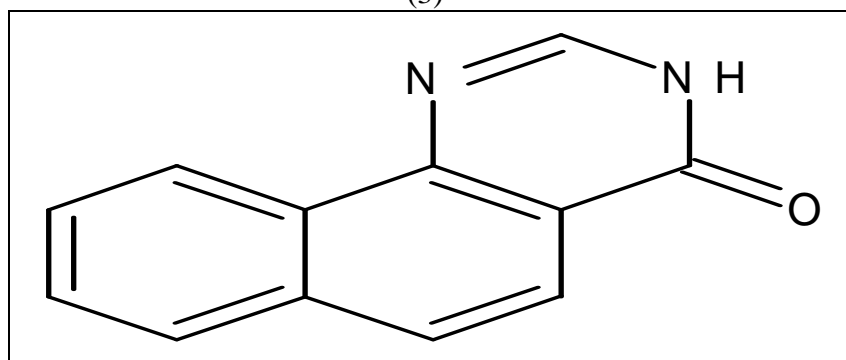
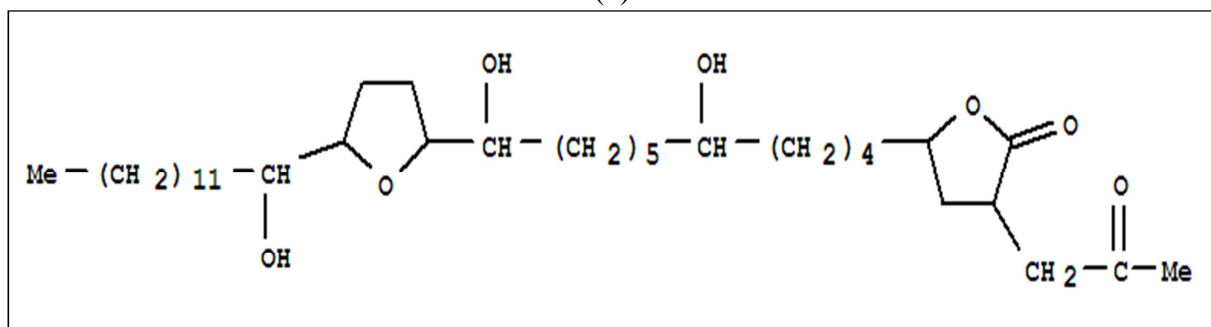
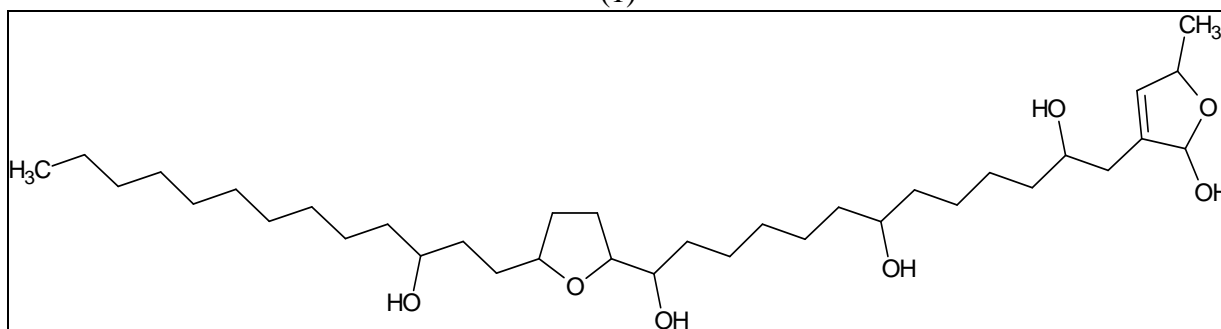
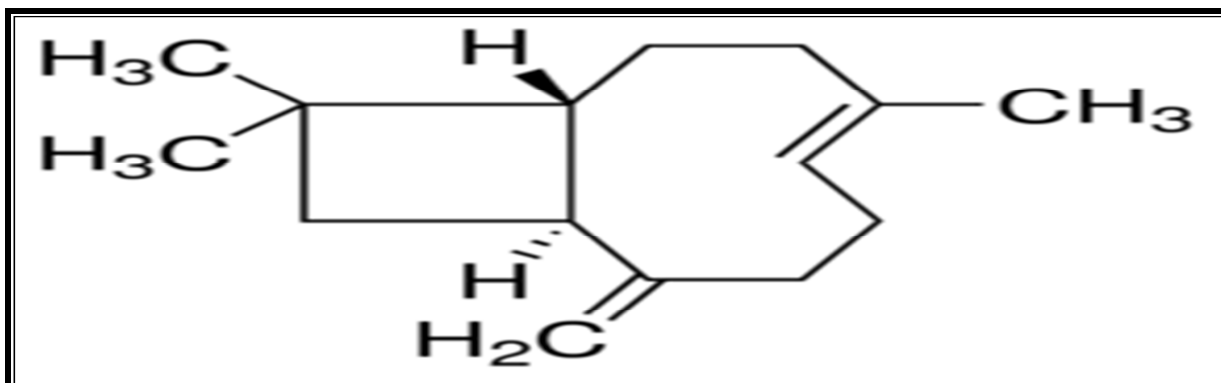
**Figure No.1: Fruits of sitaphal**



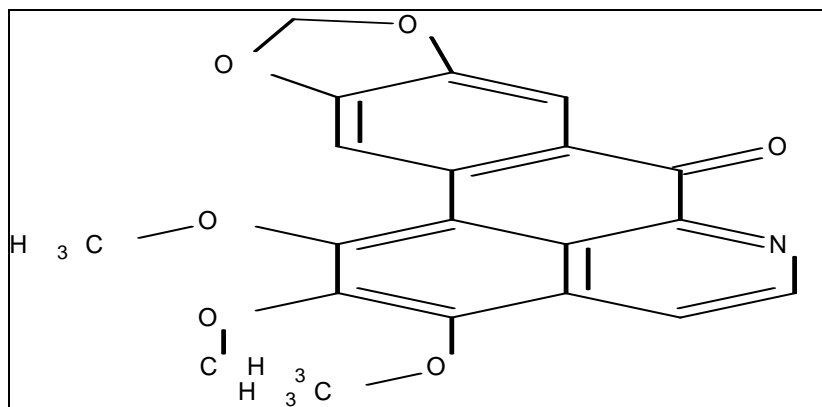
**Figure No.2: Leaves of sitaphal**



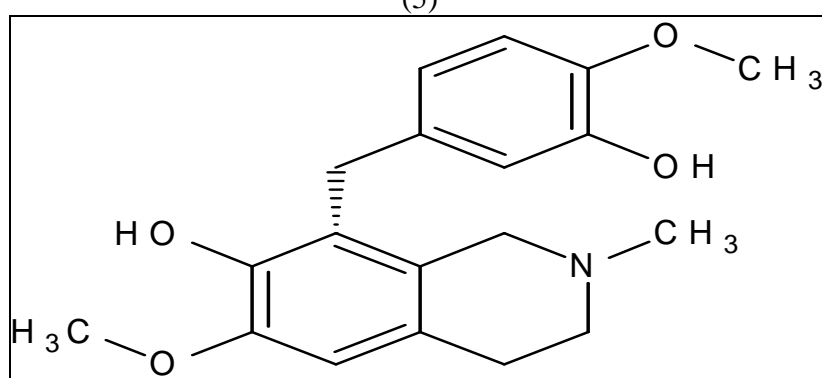
**Figure No.3: Flower of sitaphal**



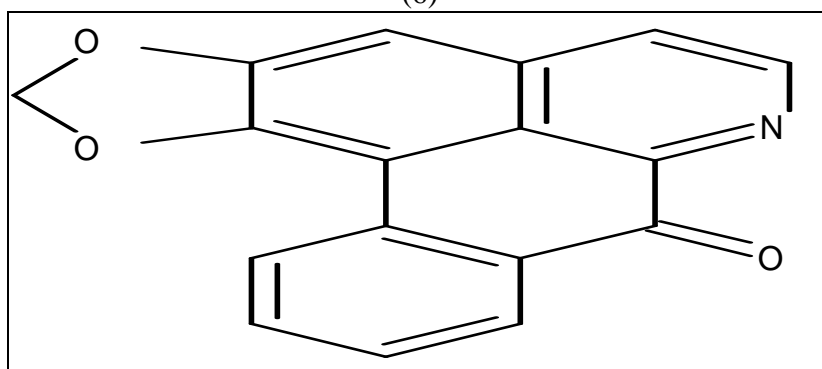




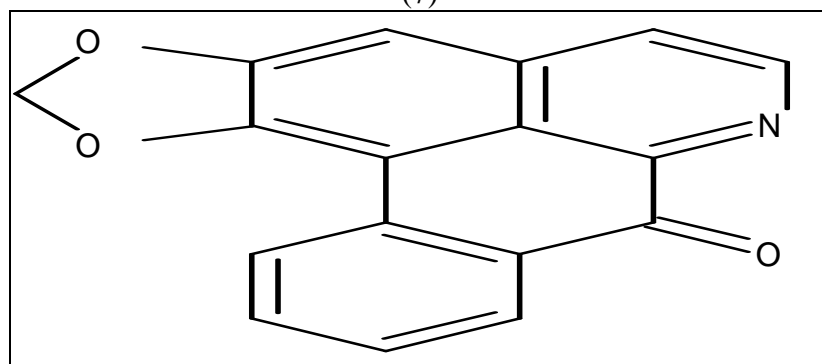
(5)



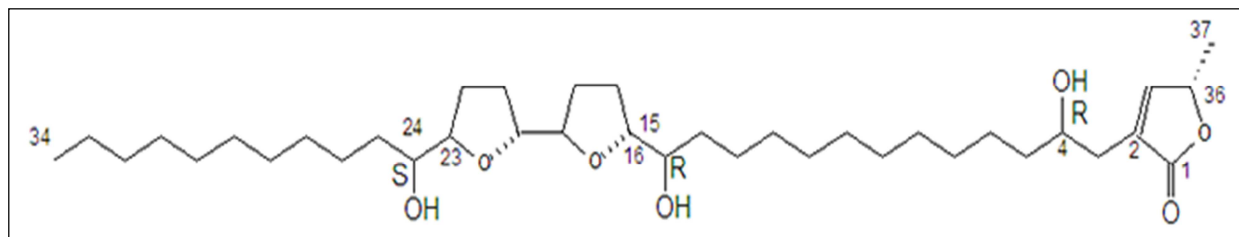
(6)



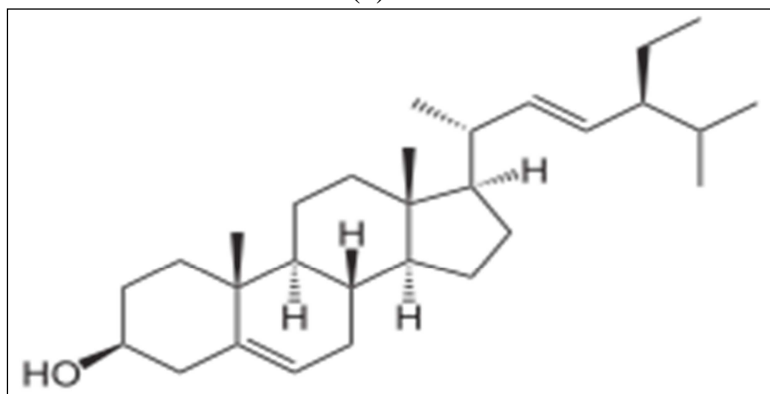
(7)



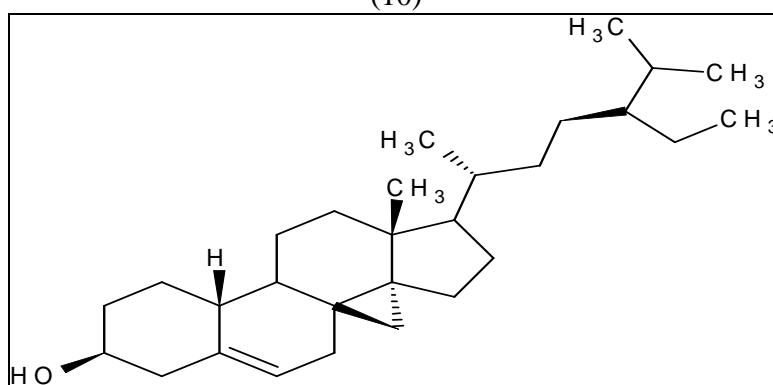
(8)



(9)



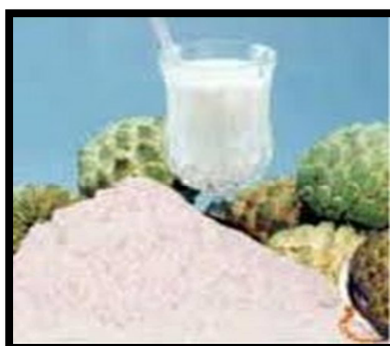
(10)



(11)







## CONCLUSION

Sitaphal is a fruit of *Annona Squamosa* is one of the vital multipurpose trees used for medicine, food and few other miscellaneous purposes. The use of sitaphal has shown success in curing different diseases. The crude extracts of diverse parts and pure isolates of sitaphal was reported to acquire anti-diabetic, antiviral, antioxidant activity, respiratory stimulant, during pregnancy and diuretics properties. This fruit is very useful for the improvement of the immune system, nervous system and also for the development of the brain in the fetus. Sitaphal can be the most effective remedy of choice for various diseases and this new research will definitely help mankind to lead a disease free and healthy life.

## ACKNOWLEDGEMENT

The authors are sincerely thanks to GHG Khalsa College of Pharmacy, Gurusar Sadhar, Ludhiana, Punjab, India for providing the facilities to complete this manuscript.

## BIBLIOGRAPHY

1. Rajsekhar Saha. Pharmacognosy and pharmacology of *Annona squamosa*, A review, *International Journal of Pharmacy and Life Sciences*, 2(10), 2011, 1183-1189.
2. Richard Wunderlin and Bruce Hansen. Synonyms of *Annona squamosa*, *Atlas of Florida Vascular Plants*, 4(2) 2008, 24-27.
3. Morton and Julia. Fruits warm of climate, *Annona squamosa*, Retrieved, Volume – 6, 2013, 69.
4. Patel, Jayshree D and Kumar Vipin. *Annona squamosa* Linn, Phytochemical analysis and Antimicrobial Screening, *J. of pharmacy research*, 1(1), 2008, 34-38.
5. Pandey N and Barve D. Phytochemical and Pharmacological Review on *Annona squamosa* Linn, *Inter. J .of Research in Pharma and Biomedical Sci*, 2(4), 2011, 2229-3701.
6. Perez-Amador M C, González-Esquinca A, Morales M C and Toriz F. Oxoaporphine alkaloids in *Guatteria diospyroides* Baill and *Annona squamosa* L, (Annonaceae), *Int. J. of experimental botany*, 53(4), 2004, 53-55.
7. Li X H, Hui Y H and Rupprecht J K. bullatacinone and squamone, A new Acetogenin from the bark of *Annona squamosa*, *J. Nat. Prod*, 53(1), 1990, 81-86.
8. Yu J G, Luo X Z, Sun L, Li D Y, Huang W H and Liu C Y. *Chemical constituents from the seeds of Annona squamosa*, 40(2), 2005, 153-8.
9. Babu C, Rama Devi P and Kombiah P. Screening of biological actives extracts from *Annona squamosa*, *Inter. J. of Biological Research*, 2(1), 2014, 18-20.
10. Baskar R, Rajeswari V and Satish Kumar T. *In vitro* antioxidant studies in leaves of *Annona* species , *Indian J. of Experimental Biology*, 45(5), 2007, 480-485.
11. Kumar Ashok J, Rekha T, Devi Shyamala S, Khannan M and Jaswanth A, Gopal V. Insecticidal activity of ethanolic extract of *Annona squamosa*, *J. of chemical and pharm Research*, 2(5), 2010, 177-180.
12. Padhi L P, Panda S K, Satapathy S N and Dutta S K. *In vitro* evaluation of antibacterial

- potential of *Annona squamosa* Linn, and *Annona reticulata* L, from Similipal Biosphere Reserve, Orissa, India, *J. of agricultural Technology*, 7(1), 2011, 133-142.
13. Atique A, Iqbal M, Ghouse A K M. Use of *Annona squamosa* and *Piper nigrum* against diabetes, *Fitoterapia*, 56(3), 1985, 190-2.
  14. Wu Y C, Hung Y C, Chang F R, Cosentino M, Wang H K and Lee K H. Identification of ent-16 beta, 17-dihydroxykauran-19-oic acid as an anti-HIV principle and isolation of the new diterpenoids *Annona Squamosa*, *J Nat Prod*, 59(6), 1996, 635-637.
  15. Vohora S B, Kumar I and Naqvi S. Phytochemical, pharmacological, antibacterial and anti-ovulatory studies on *Annona squamosa*, *Planta Medica*, 28(1), 1975, 97-100.
  16. Vinut S, Nandagaon, Kulkarni A R. *In vitro* Antioxidant and Cytotoxicity Activity of Aqueous and Alcoholic Extracts of *Annona Squamosa*, *Res J Pharm Biol Chem*, 3(4), 2012, 479.
  17. Magadula J. Joseph, Innocent Ester and Otieno N. Joseph. Mosquito larvicidal and cytotoxic activities of 3 *Annona* species and isolation of active principles, *J. of Medicinal Plant Research*, 3(9), 2009, 674-680.
  18. Fabricant D S and Farnsworth N R. The value of plants used in traditional medicine for drug discovery, *Environmental Health Perspectives*, 1(109), 2001, 69-79.
  19. Singh Sanjiv. Pharmacological screening of combined extract of *Annona squamosa* and *Nigella sativa*, *Inter. J. of Pharma and Bio Sciences*, 2(2), 2011, 1183-1189.
  20. Junya Intaranongpai, Warinthorn Chavasiri and Wandee Gritsanapan. Anti-head lice effect of *Annona squamosa* seeds, *Southeast asian j trop med public health*, 37(3), 2006, 532-535.

**Please cite this article in press as:** Ramninder Kaur et al. Sitaphal: unexplored therapeutic potential, *Asian Journal of Research in Chemistry and Pharmaceutical Sciences*, 3(4), 2015, 129 - 141.