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The pharmacological properties of *Annona squamosa* Linn: A Review

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ABSTRACT

Natural drug products have a special place and role in pharmacotherapy. Within them, herbs have been one of the important sources of medicinal products since the beginning of the human civilization. There is a growing demand for plant based medicines, health product, pharmaceuticals, food supplements, cosmetics etc. The present review was constructed using current medical information from abstracting systems such as PubMed, Medline and Google Scholar and other bibliographic databases. *Annona Squamosa Linn.* is a deciduous plant used in traditional medicines .It is reported to contain various chemical compounds such as alkaloid, isomeric hydroxyl ketones from leaf, acetogenin, samaquasine, annonacin and annonastatin from seeds, acetogenin, squamone from bark of *Annona Squamosa Linn.* Studies on *Annona Squamosa Linn* have reported the biological activity of the plant as an antibacterial, antidiabetic, antitumor, anti-malarial, anthelmintic and with anti-genotoxic potential. The present review attempts to encompass the up to date comprehensive literature analysis on *Annona Squamosa Linn.* with respect to its phytochemistry, pharmacognostic characters and its various pharmacological activities.

Key Words: *Annona Squamosa*, antibacterial, antidiabetic, anti-tumor.

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INTRODUCTION

The genus name, 'Annona' is from the Latin word 'anon', meaning 'yearly produce', referring to the production of fruits of the various species in this genus. Annonaceae, the custard apple family^[1] are a family of flowering plants consisting of trees, shrubs, or rarely lianas^[2]. With about 2300 to 2500 species and more than 130genera, It's type genus is *Annona*. The family is concentrated in the tropics, with few species found in temperate regions. About 900 species are Neo-tropical, 450 are Afro tropical, and the other species Indo malayan. Under Annonaceae family 130 genera^[4] are available, out of that genera are widely available ^[5].Annona, Anonidium, Rolliania, Uvaria, Melodorum, Asimina, Stelechocarpus.

As Annona genus is widely available in India this genus has been selected for the study. The bark, leaves, and roots of some species are used in folk medicines. The strong bark is used for carrying burdens in the Amazon Rainforest^[4] and for wooden implements, such as tool handles and pegs. The wood is valued as firewood^[5], Yellow and brown dyes. A recent study suggests that the alcoholic seed extract contains anti cancer compounds ^[6]. Leaf extract have anti-nociceptive effect^[7].

Roots were found to have anticonvulsant effect^[8]. In Mexico the juice is used for chills and fever^[9]. Pulp was found to have mutagenic property^[10]. It is mainly used as ornamental plant and it is cultivated along with banana plantation. It is a orange skin fruit native of Brazil, it is rarely available^[11].

It is found to have *In vitro*, *In vivo* studies exhibiting anti-tumor activity^[12]. Fruit and fruit juice are taken for worms and parasites, to cool fevers, to increase mother's milk after childbirth, as an astringent for diarrhea and dysentery. The crushed seeds are used against internal and external parasites, head lice, and worms. The bark leaves, and roots are considered sedative, ulcer treatment and a nervine tonic and a tea is made for various disorders towards those effects. Roots contain acetogenins proved to have anti-carcinogenic effect by inhibiting DNA synthesis^[13]. Leaves are used to treat hysteria, fainting spells.

Leaf decoction is used in the treatment of cold, cough, intestinal infections and acidity condition. Bark decoction is used in diarrhea. Roots are used in dysentery. Fruit is used in making of ice creams and milk beverages^[14]. Crushed leaves is used in internal and external wounds and boils, leaf decoction is used in gastritis.

Leaf, juice is used as vermifuge. Unripe dried fruits used in diarrhoea and dysentery treatment. Root, bark is used in tooth ache. Seeds leaves, young fruits have got insecticidal activity. Seeds are used in folk for their insecticidal activity, parasitic activity ^[15]. Roots are reported to have apomorphine alkaloids: Reomerine, Annonine and Dehydro reomerine produce skeletal muscle relaxant effect. Yellow resin extracted from seeds exhibits sympathetic action such as dilatation of pupil, dryness of mouth, decreases secretions. From the folklore usages three plants of Annonacea family, Annona genus- *Annona squamosa* Linn, *Annona reticulata* Linn, *Annona muricata* Linn. were selected. Leaf parts of these plants were taken for the study.

TAXONOMICAL CHARACTERISATION AND DESCRIPTION:

In various indigenous and traditional sources of medicinal 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 medicines. *Annona squamosa* Linn is also been extensively used as traditional medicine in various culture.

Taxonomical characterisation of *Annona squamosa* Linn.

Kingdom: Plantae

Order: Magnoliales

Family: Annonaceae

Genus: Annona

Species: Squamosa

Vernacular names: "Ata"

English: Custard apple

Annona squamosa a small well-branched tree or shrub that bears edible fruits called sugar- apples, species of the genus *Annona* and member of the family Annonaceae more willing to grow at lower altitudes than its relatives *Annona reticulata* and *Annona cherimola*. Custard apple tree does not require much care and will do well if watered regularly, along with enough light for it to grow. It grows well in hot dry climates and adjusts in any kind of soil, a job that is a little difficult for other plants in its family. If you have sowed the plant's seeds, it will bear fruits in 2 to 3 years. The fruits are generally conical or round in shape and will take around 3 to 4 months to ripen.

Table I: Morphological characterization of *Annona squamosa* Linn.

Characters	Seeds	leaves	Stem	Roots	Fruits
Color	Black	Green	Green to brown	Light brown/Dark brown	Greenish outside , whitish pulpy inside
Odor	Odorless	Characteristic odor	Characteristic odor	Odorless	Sweetish
Taste	Tasteless	Bitter	Sight bitter	Bitter	Sweetish

The ripe sugar apple is usually broken open and the flesh segments enjoyed while the hard seeds are separated in the mouth and spat out. It is so luscious that it is well worth the trouble. In Malaya, the flesh is pressed through a sieve to eliminate the seeds and is then added to ice cream or blended with milk to make a cool beverage. It is never cooked. The seed kernels contain 14- 49% of whitish or yellowish, non-drying oil with saponification index of 186.40. It has been proposed as a substitute for peanut oil in the manufacture of soap and can be detoxified by an alkali treatment and used for edible purposes.

The leaves yield an excellent oil rich in terpenes and sesquiterpenes, mainly B-caryophyllene, which finds limited use in perfumes, giving a woody spicy accent. Fiber extracted from the bark has been employed for cordage. The tree serves as host for lac-excreting insects. In India the crushed leaves are sniffed to overcome hysteria and fainting spells; they are also applied on ulcers and wounds and a leaf decoction is taken in cases of dysentery.

In India, the crushed ripe fruit, mixed with salt, is applied on tumors. The bark and roots are both highly astringent. The bark decoction is given as a tonic and to halt diarrhea. The root, because of its strong purgative action, is administered as a drastic treatment for dysentery and other ailments.

The average sugar content is 14.58% and is about 50-50 glucose and sucrose. The plant is reported to contain different chemical constituents like Borneol, Camphene, Camphor, car-3-ene, Carvone, β - Caryphyllene, Eugenol, Farnesol, Geraniol, 16- Hetriacontanone, Hexacontanol, Higemamine, Isocorydine, Limonine from stems, root extracts of *Annona squamosa* Linn^[16].

The volatile constituents of *Annona squamosa* Linn bark were identified from the essential oil obtained by the steam distillation and studied by GC/MS^[17]. Chloroform extract of the plant *A.squamosa* Linn contain an active constituents Annotemoyin^[18].

Flavonoids isolated from aqueous extract of *Annona squamosa* Linn has been showed antimicrobial activity. Bullatacin is one such compound that possesses antitumoral and pesticidal activity^[19]. In another study two major alkaloids have been isolated. The names of the compounds are liriodenine and oxoanalobine both of the compound belong to the group of oxoaporphines and were identified by their spectra. The compounds were isolated from the root extract of the plant^[20].

Leaves: Ovate to lanceolate shape, simple margin, lamina measures about 10×5 cm, they are simple, alternated to spirally arrange with zig zag pattern. Sides some times are slightly unequal and the leaf edges are without teeth, inconspicuously hairy when young.

Flowers: Hermaphrodite, usually somewhat fragrant, solitary or in fascicles with 2 to 4 flowers, with three green sepals and six petals arranged in two containers. The flowers have several conglomerated and spirally arranged stamens below and around an upper globose shaped dome of numerous united carpels.

Seeds: Black colour with ovoid shape, numerous scattered over the white pulp.

Stems: Cylindrical with characteristic odour and bitter taste. Outer side thick cork cells are found upon maturation.

PHARMACOLOGICAL PROPERTIES OF *ANNONA SQUAMOSA*

ANTIBACTERIAL ACTIVITY

The leaves of *Annona squamosa* Linn have reported to have antibacterial properties. Studies have shown the high potency of antibacterial action of the plant^[21].

ANTIDIABETIC ACTIVITY

Recent studies have reported that the root extracts of *A.squamosa* have reported anti-diabetic effects in streptozotocin (STZ) induced diabetes mellitus and insulin deficiency lead to increased glucose level^[22].

ANTIOXIDANT ACTIVITY

Results from previous studies showed that polar extracts were found to be better free radical scavengers compared with those less polar. The leaves extracts of the two parts showed high flavonoid content^[23].

ANTI-TUMOR ACTIVITY

The plant *Annona squamosa* Linn traditionally known as Custard apple possesses potent bioactive principals in all its parts. *Annona squamosa* seed extract have shown, in previous studies, significant anti-tumor activities against human hepatoma cells in vitro and in vivo, indicating a potential for developing the extract as a novel anti-liver cancer drug. Aqueous

extracts of *Annona squamosa* seeds possess significant antitumour activity in vivo against AD-5 tumor ^[24].

ANTIMALARIAL ACTIVITY

In the recent studies on *Annona squamosa* all compounds showed moderate activity against a chloroquine-sensitive strain and a chloroquine-resistant strain of *Plasmodium falcifarum* ^[25].

ANTHELMINTIC ACTIVITY

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 ^[26].

ANTI- GENOTOXIC EFFECT

Studies on the genotoxicity potential of *Annona squamosa* have shown that the plant extract treatment significantly altered serum enzyme levels in oxidative stress conditions ^[27].

CONCLUSION

Medicinal plants are the potential source of human health due its active compounds that is responsible for its various pharmacological activities. *Annona squamosa* a traditional medicinal plant was investigated and showed that the phytochemical constituents and the bioactive compounds posses the medicinal properties which makes them to be a potential species in the family of Annonaceae.

The chemical constituents of the plant *Annona squamosa* has shown the potentially useful source of nutraceutical and flavoring agents. It is reportedly understood from previous studies that the fruit is a rich source of bioactive compounds and may be used to develop value added products and other food applications to enhance the health benefits.

Furthermore, the high correlation observed between the various assays employed in previous studies and their reported findings depict that the plant has a latent source of phenolic contents, which is a strong indication that these phenolic compounds are among the predominant source of antioxidant activity in *Annona squamosa*.

Hence, there is enormous scope for future investigations into the phytochemistry and pharmacological aspects of the plant to render its justified position in evidence based phyto-therapeutic medicines for the purpose of the putative cure of human ailments. Further evaluation needs to be carried out on *Annona squamosa* in order to explore emerging areas and their possible clinical applications, which can be used for the welfare of the mankind.

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