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A review on phytochemical and pharmacological properties of *annona muricata*

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Abstract---In the present evaluate, a strive has been made to congregate the conventional, phytochemical and pharmacological research achieved on the vital medicinal plant *Annona muricata*, (circle of relatives Annonaceae). Cyclo hexapeptides, acetogenins, annonaceousacetogenins have been the primary phytochemical compounds studied from this medicinal plant. The fruit is of financial price and consequently cultivated and used extensively as an fit for human consumption food. The plant possess the essential pharmacological sports includes cytotoxic, antileishmanial, wound recovery, anti-microbial interest. It also has the anticarcinogenic and genotoxic impact. Phytochemical analysis of the plant revealed the presence of tannins, steroids and cardiac glycosides which can be the primary phytochemical compounds. The pulp acquired from the plant suggests the thermal diffusivity assets. This evaluate encompasses the ability utility of the above plant in the pharmaceutical subject due to its extensive pharmacological sports. because the fruit of this plant is exceedingly nutritious this paves the ways to work in future on its capability to serve as an fit for human consumption vaccine.

Keywords---*annona muricata*, phytochemical compounds, pharmacological activities.

Introduction

All around the world the herbal remedy acts as the representative of the maximum crucial fields of traditional medicinal drug. The examine on the medicinal plants is essential to promote the proper use of herbal medicine with a view to decide their potential as a supply for the brand new drugs. Medicinal flora

were used for the remedy of infection for the reason that earlier than recorded records^[2]. The sacred Vedas courting again between 3500 B.C and 800 B.C offers many references of the utilization of the medicinal plants. “Virikshayurveda” is one of the remotest works inside the traditional herbal medication which turned into compiled even before the start of Christian era. “Rig Veda” is one of the oldest literatures which was written round 2000 B.C. and mentions the use of Cinnamon (*Cinnamomum verum*), Ginger (*Zingiber officinale*), Sandalwood (*Santalum album*) etc become used not most effective in the religious ceremonies however additionally inside the clinical preparations. the connection between meals and medication became quoted as “allow meals be thy medicinal drug and medicine be thy meals”. flora and plant-based medicaments are used as the premise of some of the present day pharmaceuticals that we use nowadays so as to deal with our numerous ailments. The better understanding of the plant derived medicinal drug depends mainly on factors which have gone hand in hand. One criterion involves the evidence to show that the formulated medicine does what it's far claimed to do and other is the identification of the active compound by the chemical evaluation^[1]

Annona muricata L. belongs to the circle of relatives of Annonaceae has a great pantropical distribution and has been proudly referred to as corossol. it's miles a sizable small tree and has its native in important America⁸. The fruit of *Annona muricata* Linn. is discovered to be fit for human consumption in Yunnan province of China and their culmination is used commercially for the production of juice, sweet and sherbets . intensive chemical investigations of the leaves and seeds of this species have resulted in the isolation of a tremendous number of acetogenins. The isolated compounds show some of the interesting organic or the pharmacological activities, together with antitumoral, cytotoxicity, antiparasitic and pesticidal residences. Roots of these species are utilized in conventional medicinal drug due to their antiparasitical and pesticidal residences.^[3]

Annoma. Muricata Plant



Taxonomical Classification

Kingdom: Plantae
 Species: *Annona muricata* L.
 Sub kingdom: Viridiplantae
 Infra Kingdom: Streptophyta
 Super division: Embryophyta
 Division: Tracheophyta
 Sub Division: Spermatophytina
 Class: Magnoliopsida
 Supeorder: Magnolianae
 Order: Magnoliales
 Family: Annonaceae
 Genus: *Annona* L.

Annona muricata (Plant, Leave, Flower)



Botanical Description

A. muricata, called guanabana, soursop, graviola, or Brazilian paw paw [1,2], is a native plant of central the united states [3]. This plant is distributed broadly at some stage in Southeast Asia, South the united states, and the rainforests of Africa [1]. *A. muricata* is commonly known as soursop because of the sweet and bitter flavor of its fruit. In Portuguese, *A. muricata* is called graviola; in Latin the usa, it's far called guanabana; and in Indonesia, it's miles called nangkabelanda or sirsak. different traditional names consist of annone, araticum, araticum-manso, anona, anoda, coronsol, grande, grand corossol, gurusulu, quanabana, sauersack, taggannonna, and zuurzak. *A. muricata* is a fruit-bearing plant that belongs to the dominion Plantae, the division Angiospermae (Magnoliophyta), the elegance Magnolid, the order Magnoliales, the own family Annonaceae own family, and the genus *Annona* [6,7]. The *A. muricata* tree grows at altitudes below 1200 m above sea level, at a relative humidity of 60%–eighty%, a temperature stages of 25–28 °C, and with greater than 1500 mm of annual rainfall [6,7]. *A. muricata* is an evergreen plant that blooms and bears fruit almost at some stage in the year [6]. The leaves are obovate, oblate, and acuminate, with a dark green, thick, and sleek higher floor. determine 1 shows the *A. muricata*

tree, leaves, fruit, and flora.^[4] The fruit is inexperienced and heart-shaped, with smooth prickly skin containing juicy, fragrant, and acidic pulp .*A.muricata* has been extensively used to deal with many issues, which include parasitic infections, infection, diabetes, and cancer . All parts of *A.muricata* are used in conventional medicinal drug through folks who live in tropical areas, with the leaves, stem bark, roots, and seeds usually used as medicinal components.^[5] *A.muricata* leaves are used to deal with headaches, insomnia, cystitis, and cancer, the seeds are used to deal with parasitic infections, and the fruit is used to deal with diarrhea and neuralgia, cast off worms and parasites, boom milk manufacturing in lactating women, and reduce fever.^[6]

Fruit Description

The soursop from the Annonaceae circle of relatives is determined to be the maximum important tropical fruit that contributes an awful lot to the wider economic growth of a number of the tropical international locations consisting of tropical the usa, Australia, Africa and Malaysia. The soursop flavor possess a maximum of 114 risky compounds that is located to be responsible for the whole aroma profile, forty four esters, 25 terpenes, 10 alcohols, nine aldehydes and ketones, 7 fragrant compounds, 5hydrocarbons, three acids, three lactones and eight different miscellaneous compounds . Soursop gives a flavor of custard while it is ripen condition and consequently has a nice, unique aroma and fibrous pulp that can be consumed because of its very juicy, creamy and sweet person. The fruit has a weight of about four kilograms and it's miles located to be the biggest in its circle of relatives that lends itself to be the processed into numerous other merchandise including juice blends, nectars, syrups, jams, jellies and ice-lotions. This unique flavor of soursop increases its processed products to own a great deal potential in the global marketplace. Esters were determined to be the dominant compounds irrespective of the soursop's foundation, with methyl (E)-2-hexenoate, methyl (E)-2- butenoate, methyl butanoate and methyl hexanoate being the 4 primary compounds. There are specific methods which have been employed for the flavor compounds analysis, among which the maximum not unusual methods are solvent- and steam distillation

Starch which has been remoted from the sweetsop and soursop end result was also characterized and changed into found that both the starches isolated possess small granules of approximately 2.forty nine–2.76 μm and the same amylose composition of about 19% and gelatinization temperatures of approximately sixty four.12–72.99 °C for candy and sixty five.sixty seven–75.30 °C for sourso.^[7]

Traditional Uses

Ethnobotanical research have reported that *a.muricata* is used to treat bacterial and fungal infections, because it possesses anthelmintic, antihypertensive, and anticancer activities. It has also been used as an analgesic and to deal with fever, respiration and pores and skin illnesses, diabetes, and inner and external parasites. In numerous tropical sub-Saharan international locations including Uganda, all parts of the plant are used to deal with malaria, stomach ache, parasitic infections, diabetes, and cancer. Moreover, the seeds are used as anthelmintic and antiparasitic remedies, and the leaves, bark, and roots of

A. muricata have been used for their, antihypertensive, sedative, antidiabetic, easy muscle relaxant, and antispasmodic outcomes. The leaves are used to deal with cystitis, diabetes, headaches, high blood pressure, insomnia, and liver problems and as an antidysenteric, , and antispasmodic agent. The cooked leaves are implemented topically to deal with abscesses. In tropical African countries, including Nigeria, the leaves are traditionally used to deal with skin illnesses. In South the usa, *A. muricata* fruit juice is used to deal with many illnesses, such as coronary heart and liver disease, and has antidiarrhea and antiparasitic consequences. The fruit flesh is used to growth breast milk production after childbirth and deal with rheumatism, arthritic ache, fever, neuralgia, dysentery, coronary heart and liver diseases, and pores and skin rashes, and it has antidiarrhea, antimalarial, antiparasitic, and anthelmintic homes. desk 1 summarizes the outcomes of previous studies at the pharmacological activities of *A. muricata* and the underlying molecular mechanisms.^[8]

Physiochemical constituent

The desk offers the statistics about the phytochemical elements that has been remoted from special elements of the plant with extraordinary solvents. Annonaceous acetogenins are a sequence of polyethers which includes either the adjoining or the non adjacent tetrahydrofuran (THF) or tetrahydropyran (THP) ring and also an α , β -unsaturated γ -lactone ring. They possess the maximum useful antitumor, cytotoxic, antimalarial and antifeedant residences. Acetogenins gets interacted with the NADH-ubiquinone oxidoreductase (complex I) in mammalian and inside the insect mitochondrial electron transport structures and/or with ubiquinone-linked NAD (P)H oxidase within the most cancers cells cytoplasmic membranes²⁰. the first cyclopeptide gramicidin S has been found in nearly twentieth century of round Nineteen Forties. certainly occurring cyclopeptides has been commonly remoted from various assets which incorporates marine invertebrates and better flowers and their feature shape and stability to enzyme offered them with the significant and terrific organic sports such as anti-tumor, antifungal, antiviral, enzyme inhibition, and many others. this is closely related to their molecular conformation. The cyclopeptides 3-dimensional molecular conformation systems in the solid state and lots of other studies on the crystal systems were mentioned by the technique of X-ray diffraction analysis eventhough maximum of the structures of cyclopeptides had been also clarified by using spectrum approach. but, the amino acid collection is not decided well everytime²¹.^[9]

Medicinal Uses

Everywhere in the global, based totally on an environmental condition, the ailment is probably emerging, medicinal plant life are probably used for diverse diseases. almost all elements of the *A. muricata* plant have capability in numerous ailments and life-threatening diseases which include most cancers (Yang et al., 2015) because of the unique structure and organic hobby of phytochemicals and secondary metabolites. In vivo studies display ability antimalarial, antiparasitic, and pesticidal activity (Moghadamtousi et al., 2015a). Six kinds of solvent extract from one-of-a-kind elements of *A. muricata*, which includes water, ethanol, methanol, ethyl acetate, chloroform, and n-hexane, display apoptosis

specifically tumor cells; in particular leaf extracts have capability in Brest most cancers (Rady et al., 2018). *A. muricata* leaves are used to govern fever and unexpected seizures. The *in vivo* look at display substantiates the anticonvulsant pastime of the leaves *in mice* (Moghadamtousi et al., 2015b). *In vivo* studies of *A. muricata*, leaf extract indicates sizeable antidiabetic interest (Agu et al., 2019; Justino et al., 2018). *A. muricata* leaf extract shows immunorecovery pastime effects from capability in the macro phase are tested (Wahab et al., 2018). It has reported the ability impact of fruit extract in opposition to protozoan result in lessen risk, expand illnesses. Leaf extract has reported insecticidal assets against vector burn sickness, inflicting mosquitos (Gavamukulya et al., 2017). The significance of this plant lies in its high ethnomedical and phytochemical properties (Moghadamtousi et al., 2015a).^[10]

Pharmacological Activities

Antimicrobial Activity

The Gram-fine and Gram-terrible bacteria, such as *Escherichia coli* ATCC8739, *Staphylococcus aureus* ATCC29213, *Proteus vulgaris* ATCC13315, *Bacillus subtilis* ATCC12432, *Streptococcus pyogenes* ATCC8668, *Salmonella typhimurium* ATCC23564, *Enterobacter aerogenes* NCIM No. 2340, and *Klebsiella pneumoniae*, which are forming diverse infections that lead to excessive sickness. The available antibiotics are very specific to the particular bacterial stress simplest, and it isn't always safe for long time usage. *A. muricata* with methanol and aqueous extracts showed capacity antimicrobial pastime in opposition to diverse bacterial lines, as point out earlier than. Leaf further investigates to treat numerous infections caused by microbes along with fever, pneumonia, urinary tract infections, diarrhea, liver illnesses, and pores and skin sicknesses to broaden a capability drug from *A. muricata* extract (Errayes et al., 2020).^[11]

Immunomodulatory Activity

The adaptive immune machine to the adaptive immune machine is a defense mechanism to prevent the invasion by means of microorganisms or exogenous substances. natural merchandise, derived especially from flora, are relatively immunomodulatory research, especially for sufferers with immune diseases along with HIV infection and senile. *A. muricata* extract with ethanol contains flavonoid, phenolic acid suggests numerous properties like antioxidant serve to heal the immune system. The look at said that inpatients with avulnerable immune system may want to construct capability host the protection device (Kim, Tran, Choi, music, tune, Shim, Park, et al., 2016).^[12]

Antiparasitic Activity

Protozoal infections motivate diseases, such as leishmaniasis and trypanosomiasis, which ends up in a weak spot, and both have distressed a superb percentage of the sector population. The development of resistance to experientially discover tablets for to treatment of protozoal diseases. moreover, all of them show that the toxicity and facet results of lengthy-time period utilization aren't sufficient. *A. muricata* leaf extract of ethyl acetate indicates antiparasitic

interest in opposition to 3 *Leishmania* species (PH8, M2903, and PP75), and *Trypanosoma cruzi*. The annonaceous acetogenin compounds (ages) from *A. muricata* seeds showed enormous antiparasitic activity against the infective larvae of *Molineria desperata*. *A. muricata* leaf in numerous doses suggests antiparasitic activity towards various species (Moghadamtousi et al., 2015b).^[13]

Cytotoxicity And Antileishmanial Activity

Annona muricata pericarp When the hexane, ethyl acetate and methanol extracts of *Annona muricata* pericarp were tested in vitro against *Leishmania braziliensis* and *L. panamensis* promastigotes and also against the cell line U 937, ethyl acetate extract was found to be more active than Glucantime^W which was used as the reference substance and the other extracts. Further fractionation of the extract has resulted in the isolation of three acetogenins namely annonacin, annonacin A and annomuricin A22.^[14]

Antidiabetic Activity

Diabetes mellitus is a metabolic ailment ensuing in insulin secretion deficiency, which leads to excessive glucose awareness inside the blood, also being characterized as persistent hyperglycemia. Diabetes is quite caused by the effective presence of carbohydrates inside the eating regimen. The ethyl acetate and n-butanol fractions from *A. muricata* extracts confirmed higher inhibitory sports in opposition to α -amylase, α -glucosidase, and pancreatic lipase leads to govern glucose attention in blood, superior glycation from lipid peroxidation end product, and lower cytotoxicity. *A. muricata* with different biochemical suggests abortable secure and potential use inside the management of diabetes mellitus.^[15]

Anti-Viral Activity

Annona muricata extract was screened against Herpes simplex virus-1 (HSV-1) and clinical isolate (obtained from the human keratitis lesion) in order to check whether they inhibit the cytopathic effect of HSV-1 on vero cells which is the indicative of anti-HSV-1 potential. The minimum inhibitory concentration of ethanolic extract of *A. muricata* was found to be 1 mg/ml which shows that the *A. muricata* could be used as the potential antiherpetic drugs.^[16]

Anticarcinogenic And Genotoxic Effects Acetogenins (Ace)

Are the chemicals which possess various biological properties including the cytotoxic effect against the neoplastic cells which suggests their potential usage as the antitumoral agents. Acetogenins also possess the capacity to reduce the mouse colon crypts that is induced by azoxymethane (Azo) and was found that 50% reduction in the amount of crypts in the animals treated with acetogenin when compared with the level determined in mice treated with Azo24. Wound Healing Activity Wound is the first medical problem that is faced by the human race.^[22] The knowledge about wounds and their management remains still in the primitive and stunted stage. A wound is a disrupted state of tissue that is caused by the physical, chemical, microbial or immunological Insult which heals either

by the regeneration or fibroplasias finally. The wound healing activity of alcoholic extract of stem and bark of *Annona muricata* was found to show the marked reduction in area of the wound which was tested in the albino rats which proves their possible use in the healing the wound²⁵.^[17]

Anti-Microbial

Activity The antibacterial effect of the methanolic and aqueous extract of the leaves of *Annona muricata* was tested against various bacterial strains such as *Staphylococcus aureus* ATCC29213, *Escherichia coli* ATCC8739, *Proteus vulgaris* ATCC13315, *Streptococcus pyogenes* ATCC8668, *Bacillus subtilis* ATCC12432, *Salmonella typhimurium* ATCC23564, *Klebsiella pneumonia* NCIM No.2719 and *Enterobacter aerogenes* NCIM No. 2340. Among the above organisms tested, *B. subtilis* and *S. aureus* was found to be the most susceptible Gram positive bacteria while *K. pneumoniae* and *P. vulgaris* was found to be the most susceptible Gram-negative bacteria.^[21] Leaf extract of *Annona muricata* is used in the treatment of various bacterial infectious diseases such as pneumonia, diarrhoea, urinary tract infection and even some skin disease. *Annona muricata* extract contains a wide spectrum of activity against a group of bacteria that are responsible for the most common bacterial diseases. Thus, the plant possesses an abundant of the antibacterial compounds²⁵.^[18]

Other Studies

Phytochemical analysis Phytochemical analysis of the leaf extract of the above plant revealed the presence of secondary metabolites like tannins, steroids, cardiac glycosides, etc. were present in very trace amounts. Secondary plant metabolites which are called as the phytochemicals possess some of unknown pharmacological activities. Phytochemicals with adequate antibacterial efficacy can be used for the treatment of bacterial infections²⁵.^[19] Thermal diffusivity of soursop (*Annona muricata* L.) pulp Studies on the thermal diffusivity of foods are very much essential for the designing and optimizing of every process that is involved in heat transfer at the unsteady state. The thermal diffusivity of soursop pulp was determined by means of the usage of the heat penetration curves in 8Z short cans that is considered as the cylindrical objects. The pulp that is obtained from fruits were tested in both ripen and in the unripe condition at three different temperature ranges including the freezing zones. The study conducted showed no difference in the thermal diffusivity values at a 5% significance level.^[20]

Conclusion

Medicinal plants have been a mighty source of human fitness due to its energetic compounds that is accountable for its diverse pharmacological sports. *Annona muricata*, a conventional medicinal plant was investigated and showed that the phytochemical ingredients and the bioactive compounds possess medicinal properties which makes them to be a potential species within the circle of relatives of Annonaceae. research works carried out on this plant reveal its beneficial issue in the field of pharmacy. Ayurvedic instruction in the shape of fruit would be the target of the existing generation. this may be performed in the case of the above plant.

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