

PANDANUS TECTORIUS: A COMPRESSIVE OVERVIEW

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ABSTRACT:

In order to create novel lead molecules for pharmaceuticals, medicinal plants (MP) have been shown to be a rich source of physiologically active compounds. It has been known from the beginning of human history how valuable medicinal plants are as a source of healing. Approximately 600 species belong to the Pandanus family, also known as screw pine. There is value in every component of the plant. Plant extracts validate the existence of several phytochemicals in the chosen plants, including phenols, flavonoids, coumarin, terpenoid, carbohydrates, and cardiac glycosides. *P. utilis* and *P. leram*'s fleshy fruits and seeds are edible. Using hexane, ethyl acetate, and methanol in sequential extraction, extracts were produced. The results showed that the core and important portions of *P. tectorius* fruits had high phenolic content. Additionally, the fruit, which is potent, has pharmacological qualities that show promise, including wound healing, anticancer, antioxidant, antidiabetic, antibacterial, and anti-inflammatory effects. A comprehensive analysis and compilation of data pertaining to the pharmacognostic, phytochemical, pharmacological, and nutritional aspects of the Pandanus plant was conducted.

Keywords: *Pandanus tectorius*, Antioxidant, Antidiabetic, Anticaugulant, Analgesic.

INTRODUCTION:

Medicinal plants (MP) are now recognized to be a rich source of physiologically active molecules that can be utilized to produce new lead compounds with potential applications in pharmacology. A diocious, plam-like tree found throughout Nigeria's sandy and rocky coasts is *Pandanus tectorius*, a member of the *Pandanaceae* Family. It is unrelated to the pine family, although going by the name "screw pine." The *pandanus* (*P. tectorius*) is a huge shrub or small tree that is second only to the coconut in terms of attolls in the Pacific in terms of cultural, health, and economic significance. They have been employed historically for a variety of reasons. Every portion of the plant has a purpose. The 600 or so representatives of the pandanus

genus are distributed from Hawaii eastward through West Africa.^[1] The edible fruit of the species *Pandanus tectorius*, which includes *Pandanus leram* and *Pandanus fischerianus*, is farmed and is often red or yellow in color.^[2,3] Generally referred to as "marita," plants bearing edible fruit or seeds are greasy and primarily made up of proteins and carbs. The "karuka" of New Guinea (*Pandanus brosimos* / *Pandanus julianettii*) is the species of *Pandanus* that yields edible seeds. In Palau, a drink made from the root is used to ease stomach cramps, while the leaves are used to treat vomiting. It is also well known that the root is used in traditional medicine.^[4] Because of their healing qualities, medicinal plants have been employed for millennia in traditional medicine.^[5] In India, pandanus species number between thirty and forty. Kewda, also called *Pandanus odoratissimus*, is a member of the Pandanaceae family.^[6]

The chemical components of natural substances have a direct bearing on their medicinal impact. *Pandanus* oils have traditionally been used to treat rheumatism, smallpox, headaches, arthritis, debility, giddiness, laxatives, and spasms. Benzyl benzoate (11%), viridine (8.8%), ether (37.7%), terpene-4-ol (18.6%), α -terpineol (8.3%), 2-phenylethyl alcohol (7.5%), and germacrene (8.3%) are among the many essential oils found in its leaves, along with trace amounts of benzyl salicylate, benzyl acetate, and benzyl alcohol. Normal cellular metabolism results in the production of reactive oxygen species (ROS) from molecular oxygen. Hydrogen peroxide (H₂O₂), hydroxyl radical (OH), and superoxide anion are the three main ROS that are physiologically significant.^[7] As indirect biomarkers of oxidative stress, lipid peroxidation products like isoprostanes and thiobarbituric acid reactive substances have been employed. Elevated levels of these products have been found in the lung or bronchoalveolar lavage fluid of smokers or patients with chronic obstructive pulmonary disease.^[8,9] According to Ayurveda, it helps relieve rheumatic pain, headaches, and earaches. It has long been used to flavor meals and is frequently used as a breath freshener.^[10] Kewada oil and Kewada attar. About 30gm of kewda oil are produced from a thousand kewda flowers.^[11] Freshly picked leaves have a delicate scent akin to that of fragrant rice from the Basmati (Indian), Jasmine (Thai), and Kaorimai (Japan) varieties.^[12] In India, coconut oil is used to treat rheumatic problems after the leaves have been soaked in it. Both humans and animals can benefit from the use of the leaf and inflorescence juice in treating fevers, arthritis-related inflammation, and chest pain.^[13]

PANDANUS TECTORIUS:



Fig 1: Pandanus stem

Fig 2: Pandanus ripe and unripe fruit



Fig 3: Pandanus Shrub

Fig 4: Pandanus Tree

Taxonomical Classification: ^[14]

Kingdom	Plantae
Subkingdom	Viridiplantae
Supervision	Embryophyta
Division	Tracheophyta
Class	Mangnoliopsida
Order	Pandanales
Family	Pandanaceae
Genus	Pandanus
Species	Pandanus tectorius

PHYTOCHEMICAL CONSTITUENTS:

Its foundation in age-old Vedic wisdom has withstood the test of time and remains one of the most well-known therapeutic sciences today. Ayurveda, which has its roots in India and dates back thousands of years, is rightly called the "mother of all healing."^[10] Herbal remedies contain a variety of compounds with pharmacological effects; nevertheless, in certain instances, the precise phytoconstituents causing the therapeutic action are still unknown.^[11] Kewda oil, which is extracted from pandanus inflorescences, is the main ingredient. When subjected to high resolution GC (gas chromatography) and GC-MS (gas chromatography and mass spectrometry), the chemical composition of this essential oil, obtained by hydrodistillation of staminate inflorescences of kewda (*P. odoratissimus*), has been shown to yield ether (37.7%), terpene-4-ol (18.6%), α -terpineol (8.3%), and 2-phenylethyl alcohol (7.5%), benzyl benzoate (11%), viridine (8.8%), and germacrene-B (8.3%), along with a small amount of benzyl salicylate, benzyl acetate, benzyl alcohol, and so forth.^[11] According to certain research, the *P. tectorius* fruit extract has high levels of β -carotene and caffeoylquinic acids.^[12-15] The study of diabetic db/db mice revealed that the fruit extract of *P. tectorius* rich by caffeoylquinic acid enhances insulin sensitivity and regulates hepatic glucose and lipid metabolism.^[16]

Ethnobotanically, kewda oil is used in the treatment of headaches, earaches, arthritis, debility, giddiness, laxative, rheumatism, small pox, and spasms. A preliminary phytochemical screening was conducted on the methanol and aqueous extracts of pandanus leaves to determine the presence of alkaloids, carbohydrates, proteins, steroids, sterols, phenols, tannins, terpenes, flavonoids, gums and mucilage, saponins, and glycosides.^[17] It has been observed that rhizomes contain Physcion, circsilineol, n-triacontanol, β -sitosterol, camphosterol, daucosterol, palmitic acid, and steric acid.^[18] As seen in Figure 6a (Fig. 6c), the peculiar composite edible fruits are composed of discrete components called "keys" that are affixed to a fibrous core. The whole composite fruit—including the keys and the core—is referred to as a "bunch". According to Andriani et al. (2019), the interiors of the keys are bitten and licked for their delicious pulp.^[19]

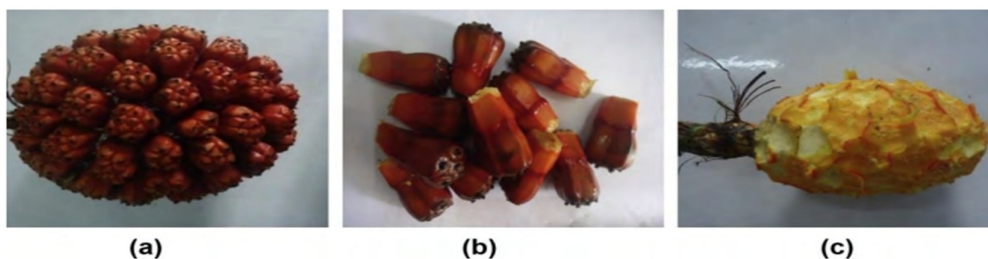
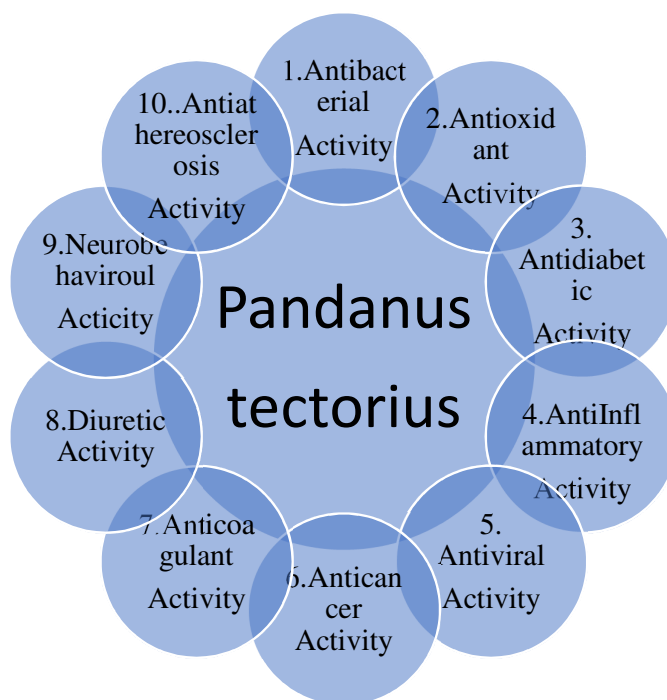


Fig No. 5 *P. Tectorius* fruits (a) its keys (b) core parts (c) *Pandanus Tectorius* Fruits

PHARMACOLOGICAL ACTIVITIES:



1. Antibacterial Activity:

By using the disc diffusion method antibacterial activity was measured. To create the aqueous methanolic extract of the key and core fruits of *P. tectorius*, 10 mg of crude were dissolved in 1 mL of dimethyl sulfoxide (DMSO). To extract the stock solution's solvent, samples (20 μ L) were placed onto each Whatman No. 1 filter paper disc (\varnothing , 6mm) and dried in a laminar flow. Separately, using a cotton swab, the four different target bacterial suspension types (with a bacterial concentration of 0.5 McFarland standards) were equally distributed onto the Mueller Hilton agar (MHA).^[20] Next, the discs were found on the previously infected agar's surface. As a control, ampicillin, penicillin, gentamycin, and tetracycline were utilized. After

being turned over, the plates were incubated at 37 °C for 24 hours. The discs' surrounding clear inhibition zones demonstrated the antibacterial activity present. The crudes and antibiotics' inhibitory zone diameters (mm) were measured and compared. The kinetic research of the active crude was carried out to confirm its antibacterial efficacy.^[21]

2. Antioxidant Activity:

The plant *pandanus tectorius* is noted for its antioxidant-rich flavonoids, phenolic acids, and terpenoids, among other bioactive chemicals.^[22] These substances aid in reducing oxidative stress and neutralizing free radicals, both of which can be linked to a number of illnesses.^[18] Research has indicated that *pandanus tectorius* extracts exhibit noteworthy levels of antioxidant activity. For instance, studies have shown that its leaf extracts have strong levels of scavenging action against free radicals such as ABTS (2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid)) and DPPH (2,2-diphenyl-1-picrylhydrazyl).^[23-24] The capacity of *Pandanus tectorius* to transfer electrons or hydrogen atoms to neutralize reactive oxygen species (ROS) is thought to be the source of its antioxidant action. By preventing oxidative damage to cells, this activity can lower the likelihood of developing chronic illnesses.^[24]

3. Antidiabetic Activity:

Research suggests that because *pandanus tectorius* extracts include bioactive substances including phenolic acids and flavonoids, they may help reduce blood sugar levels and increase insulin sensitivity. These substances may help control diabetes because of their antioxidant and anti-inflammatory properties.^[24]

Glucose homeostasis is critical for human health since glucose plays a critical function as an energy source and cannot be produced by brain tissues. In this sense, blood glucose regulation is essential for endurance. But diabetes, a well-known degenerative illness in the public domain, is characterized by abnormally elevated blood glucose levels. The maintenance of proper glucose homeostasis is largely dependent on insulin and glucagon. Thus, glucagon influences blood glucose levels differently than insulin does. Therefore, it is important to understand the implications of these two chemicals' connected bioactivities for glucose homeostasis in both healthy and diabetic settings.^[25]

4. Anti-inflammatory Activity:

The process of inflammation is normal and healthful. It is the body's tissues' physiological immunological reaction to any outside stimuli, including infections, irritants, or damaged cells. The activation of several immune cells, including neutrophils, lymphocytes, and macrophages, is the first step in an inflammatory response. Acute and chronic inflammation are both possible; acute inflammation is highly helpful when necessary, while persistent inflammation can lead to certain issues.^[26] In general, macrophage cells generate inflammatory mediators such as nitric oxide (NO) and inflammatory cytokines that take an essential role in host survival and tissue repair.^[27] Research have demonstrated that *pandanus tectorius* extracts can lower inflammation by preventing the synthesis of pro-inflammatory cytokines and enzymes, like cyclooxygenase-2 (COX-2). This may help in the treatment of illnesses linked to persistent inflammation. A creature's nonspecific immune response to guard and repair against the effects of detrimental enhancements is called irritation.^[28]

Numerous main causes of death in the Philippines and globally, such as vascular illnesses, malignant growths, chronic lower respiratory issues, and diabetes mellitus, are associated with persistent irritation.^[29] Studies have indicated that extracts from *Pandanus tectorius* can reduce inflammation by inhibiting the production of pro-inflammatory enzymes and cytokines, such as cyclooxygenase-2 (COX-2). This could aid in the management of conditions associated with chronic inflammation. Irritation is a creature's generic immune response to protect and heal from the impacts of harmful enhancements. Persistent irritation is linked to a number of major causes of death in the Philippines and around the world, including diabetes mellitus, malignant growths, vascular disorders, and chronic lower respiratory problems.^[30] Research has been done on the anti-inflammatory properties of tangeretin and ethyl caffeate derived from various plants, as well as their mode of action.^[29] This substance exhibits a number of bioactivities in addition to antioxidant qualities, such as anti-inflammatory.^[31] Therefore, we presume that the anti-inflammatory properties of *P. tectorius* fruits extract or fraction may have been influenced by these three chemicals, which were found to be present in the fruits. While there have been a number of prior research on *P. tectorius*'s ability to reduce inflammation, the majority of them used extracts from the plant's leaves.^[32-33]

5. Antiviral Activities:

Studies have found bioactive substances in *Pandanus tectorius* preparations, including phenolic acid and flavonoids, which may be responsible for the plant's antiviral qualities. *P.*

tectorius contains naringenin, which is associated with a high content of phenolic compounds. One of the most significant flavonoids is naringenin, often referred to as 4' 5 7-trihydroxyflavanone, due to its possible biological actions, which include antiviral, anti-inflammatory, and antioxidant characteristics (Hartogh & Tsiani, 2019a).^[34]

Naringenin can stop viral particles from accumulating or from being produced. Naringenin's counter-ZIKV movement can also be explained by a contact between the protease space of the NS2B-NS3 ZIKV protein and naringenin.^[35]

6.Anticancer Activity:

Possible anticancer effects of *Pandanus tectorius*, also called screw pine or pandanus, have been investigated. Studies show that the plant has a variety of cytotoxic effects on cancer cells. *P. tectorius* fruit extract ethyl acetate fractions were used to test the fruit extract's anticancer potential against HeLa cell lines using the MTT assay.^[36] *Pandanus tectorius*, a coastal plant, is a potentially valuable but neglected source for health. The fruit of *P. tectorius* was used to extract two substances, trangeretin and trans ethyl cafeate and its fractions, which shown excellent inhibitory effect against the 3-hydroxy-3-methylglutaryl-coenzyme. An enzyme called reductase.^[37-38] In addition, *P. tectorius* leaf (PTL) alcoholic extract has antioxidant activity.^[39-40] It has been demonstrated that the SNEDDS carriers increase the antioxidant activity of Ptectorius fruits.^[40] Therefore, *P. tectorius* leaf extracts' antioxidant and anticancer properties may be enhanced by SNEDDS carriers.^[41]

7.Anticoagulant activity:

Blood coagulation was first described in studies published in Nature and Science by Davie, Ratnoff, and Macfarlane in the 1960. ^[42-43] There are two paths in the coagulation system: intrinsic and extrinsic. Exposure of tissue factor initiates the extrinsic pathway, which is activated in response to tissue trauma. In vivo, the intrinsic pathway's function is less evident, but it plays a significant role when blood is stimulated by contact with artificial surfaces like those of a mechanical circulatory assist device (MCAD) or cardiopulmonary bypass circuit.^[44] Anticoagulants are recommended for deep vein thrombosis, stroke, transient ischemic episodes, and peripheral vascular embolism.^[45]

8. Diuretic activity:

By blocking ion transporters that lessen the reabsorption of sodium ions at various nephron sites, diuretics are substances that speed up the production of urine and change its pH and ionic composition.^[46] These medications have been demonstrated to reduce cardiovascular morbidity and death when used as first-line antihypertensive therapy.^[47] More than 200 plant species, including the *Pandanus tectorius* Parkins, are used as diuretics in the Philippines, according to an ethnopharmacological investigation conducted by Quisumbing in 1978.^[48] Leprosy, rheumatism, headaches, and dysuria are among the conditions that *P. tectorius* treats.^[49] Diuretics are commonly categorized into thiazide, loop, potassium sparing diuretics, and carbonic anhydrase inhibitors based on the primary sites of action they have on the renal tubule and the rise in sodium excretion and urine volume that follows.^[50]

Filipinos stimulated urination using water from a cut close to the base of the trunk.^[51] The *pandanus tectorius* Triterpenoids and flavonoids have previously been discovered to be present in Parkinson (Pandanaceae), often referred to as "Kewado" in the Gujarat region of India.^[52] According to a review of the literature, triterpenoids make up a significant portion of the *Pandanus tectorius* plant. Scabies, leucoderma, heart conditions, and brain disorders can all be treated with leaves.^[53]

10. Anti-atherosclerosis:

The anti-atherosclerosis properties of *Pandanus tectorius* are linked to its potential ability to prevent or reduce the development of atherosclerosis, a condition characterized by the buildup of fatty deposits (plaque) in the arteries.^[54] This activity is primarily attributed to the plant's rich antioxidant content, including flavonoids, phenolic acids, and other bioactive compounds.^[55] By reducing oxidative stress and inflammation, which are key contributors to atherosclerosis, these compounds may help in preventing the oxidation of low-density lipoproteins (LDL), a major factor in plaque formation.^[56] The anti-atherosclerosis properties of *Pandanus tectorius* leaves are largely associated with their high concentration of antioxidants and anti-inflammatory compounds.^[57] One cardiovascular condition that has been the main cause of death in developed nations like the USA, Europe, and Asia is atherosclerosis.^[57] The hallmark of atherosclerosis is the arteries' progressive hardening and thickness, which leads to the accumulation of plaque.^[58] Currently available medications to prevent aberrant cholesterol-related atherosclerosis include 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitors, often known as statins.^[59]

It is necessary to look into the fruits' potential as a source of chemicals and novel medicinal properties, such as anti-atherosclerosis properties. Many researchers have focused their attention on studying *P. tectorius* leaves, with relatively little research being done on the fruit. Tangeretin and ethyl trans-cafeate have also been investigated as possible antiatherosclerosis agents via HMG-CoA reductase. ^[60]

CONCLUSION:

The review of *Pandanus tectorius* highlights the plant's significant cultural, medicinal, and ecological importance, particularly in Pacific Island communities. It is highly valued for its wide range of uses, from weaving and food production to traditional medicine. The results showed that *P. tectorius* plant parts had high levels of total phenolic content as well as chemical constituents (phenolic, flavonoid, steroid, triterpenoid, saponin, and glycosides) that contributed to their potential health benefits. *Pandanus tectorius* stands out as a versatile species with both practical and cultural relevance. Studies have shown that the plant exhibits various pharmacological properties, including antioxidant, anti-inflammatory, antimicrobial, antidiabetic, and anticancer activities etc. *Pandanus* plant research reveals a great deal of biological potential. More research on *Pandanus tectorius* leaves will reveal other pharmacological properties, such as anti-fungal and anti-ulcer properties.

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