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COMPRHENSIVE REVIEW ON PALMYRA TUBER

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ABSTRACT

Palmyra sprout (*Borassus flabellifer L.*), the germinated form of the palmyra fruit, is a traditional herbal ingredient valued for its nutritional and medicinal properties. It is rich in vitamins, minerals, amino acids, and natural antioxidants that promote overall health. In addition, Palmyra sprouts contain bioactive compounds like phenolics, flavonoids, and alkaloids that contribute to their antioxidant, antidiabetic, and antimicrobial properties. These sprouts are traditionally used as functional foods for promoting digestive health and managing diabetes due to their low glycemic index and natural phytochemicals. Recent research highlights their potential in nutraceutical and pharmaceutical applications. Thus, Palmyra sprouts serve as a promising natural resource for developing value-added health products and for supporting sustainable rural economies.

KEYWORDS: Palmyra sprout, *Borassus flabellifer*, antioxidant, antidiabetic, phytochemicals, nutraceutical.

INTRODUCTION

The Palmyra palm was initially given the name Palmyra, which is taken from the Portuguese term Palmeira. The scientific name for the Palmyra tree is Borassus flabellifer. The palm in issue belongs to the group Arecaceae, subfamily Borassoideae, and genus Borassus. Because Palmyra trees are dioecious perennials that grow slowly, it is impossible to tell their sex until

they blossom. The palm tree doesn't start blooming until it is 12 to 15 years old **(Rao et al.**, 2021). Palmyra palms are widely cultivated and profitable, especially in South and Southeast Asia. The palmyra palm is one of the most important plants in India and Cambodia, with around 800 uses. Tamil Nadu's national tree is the palmyra tree.



FIGURE 1: PALMYRA TUBER.

Prebiotics are defined as "a non-digestible food component that favorable impacts on the host through selectively promoting the development and function of a single or small number of microbes in the colon, and then enhances host health." If a substance satisfies three requirements, it is considered a prebiotic: (i) it must be impermeable to the acidic pH of the stomach; (ii) it must be fermentable through the intestinal microbiota; and (iii) it must be able to specifically promote the growth and activity of the microbes in the gut. The host organism's health is improved by this technique**. (Saravanasingh karan et al., 2024).**

PLANT PROFILE

The subterranean sprout of the palmyra palm (Borassus flabellifer) is called the palmyra sprout or palmyra tuber. After the palm seed germinates, this sprout is collected below the soil's surface, usually after it reaches a height of 15 to 20 cm. The sprout can be eaten raw, cooked, or roasted. It is meaty, fibrous, and extremely nutritious.

Tamil - Panai kizhangu or Panam kizhangu
English - Palmyra sprouts
Hindi - Taad
Malayalam - Panamulakal
Telugu - Thegalu or Gaygulu or Gengulu
Bengali - Taala
Kanada - Olegari
Sanskrit - Taalah

Taxonomy

Kingdom - Plantae

Sub-Kingdom - Tracheobionta

Super division - Spermatophyta

Division - Magnoliophyta

Class - Liliopsida

Subclass - Arecidae

Order - Arecales

Family - Arecaceae

Genus - Borassus L

Species - Borassus flabellifer L. **(Saloman Behera et al., 2022).**

BOTANICAL DESCRIPTION

The Palmyra tuber, known as the haustorium of *Borassus flabellifer* L., is a swollen, fleshy storage organ formed during seed germination. It develops from the elongating cotyledon, which grows downward into the soil while absorbing nutrients from the endosperm. The tuber is usually round to ovoid in shape and measures about 5–12 cm in diameter. Externally, it appears brown to dark brown with a slightly rough surface, whereas the internal tissue is soft, white to cream-coloured, and highly starchy **(Raja Rajeshwari et al., 2024)**. Anatomically, the tuber contains large parenchyma cells packed with starch granules, minor vascular strands, and small quantities of proteins, sugars, and phenolic compounds. Functionally, it acts as the primary nutrient reservoir for the developing root and shoot system, supporting early seedling growth until photosynthesis begins. The structure also helps the seedling tolerate dry and nutrient-poor environments, making it an important survival adaptation of the Palmyra palm **(Veda Gomathi Nakkeeran et al., 2020).**

DISTRIBUTION OF PALMYRA

Borassus flabellifer is believed to be a varietal selection from the native *Borassus aethiopum*, of Africa. Few authors assert that the plant is native to Africa. It has been observed to be distributed from India to South-East Asia to New Guinea, however it is mostly found in India, Burma (Myanmar), and Cambodia. Despite the palm's widespread use, there are presently no reliable statistics on its area and yield from many of these countries because it is mostly harvested in the wild. According to **(Aman et al., 2018)**, two-thirds of Sri Lanka's 10 million palms, which span 25,000 hectares, are found in the district of Jaffna. Tamil Nadu is home to

two-thirds of India's 60 million palms. Central Burma (Myanmar) has 2.5 million palms on 25,000 hectares, whereas central Cambodia has 1.8 million palms. Toddy palms may be found in Madura, Indonesia, as well as Central and East Java **(T.R.Sridevi Krishnaveni et al., 2020).**



Figure 2: Distribution Of Palmyra Tuber.

COMPOSITION OF PALMYRA SPROUT

In contrast to immature tubers, which are pliable, adult tubers are brittle, readily break off, and less fibrous. The tuber contains a lot of starch. The ideal time to harvest tubers is 135 days after seeding, and they should weigh between 90 and 110 grams. The palmyra tuber flour had a moisture content of 5.19%. On a dry matter basis, the levels of fat and ash were 0.57% and 2.60%, respectively. The percentages of protein, fiber, and carbohydrates were 3.20%, 10.17%, and 69.38%, respectively. The calculated calorie value was 282.19 kcal/100g. The titratable acidity and pH values were 1.12% and 5.78, respectively. The palmyra tuber flour's bulk density (0.70 g/cm3), fat absorption capacity (14.0%), and water absorption capacity (18%) were measured. Swelling power, foam capacity, and foam stability had respective values of 4.55, 21.32%, and 29%. The flour may be used directly or in combination with other flours to prepare meals, and its values are somewhat greater than those of comparable flours. Good quality flour and suji (Rava) are produced by autoclaving tubers and then drying them in hot air. Under room temperature, tuber flour may be stored for 30 days in LDPE and 50 days in HDPE packaging. Mature palmyrah tubers were gathered and kept cold (4°C). The remaining outer layer of the tubers (apocolon) was cut and dried for 24 hours at 60 °C. Finally, a pulverizer was used to grind the dried tubers so they could fit

through a 250µm sieve. After that, the samples were placed in a polyethylene bag and kept in a refrigerator at 4°C until they were needed. **(Vengaiah, P. C. et al., 2024).**

METHODOLOGY

Palmyra tuber's hidden nutritional benefits are explained via nutritional analysis. When the Palmyra sprout is fully grown, the first layer is removed and the dirt in the layer is cleaned. After removing the layer, the Palmyra sprout is cooked for 30 minutes to remove the fibers from the boiled tuber. Next, cut the tuber into tiny pieces and let it dry for three days to eliminate any remaining moisture. Finally, grind the dried tuber to form flour. Analysis of the tuber flour reveals its hidden nutritional benefits. Additionally, the flour is utilized to create value-added goods. **(Sandhiyadevi et al., 2021).**

HEALTH BENEFITS OF PALMYRA SPROUTS

- **Rich in Fiber:** A natural form of dietary fiber that is very beneficial to digestion is Panankizhangu Powder. It is most likely well-known for its capacity to ease constipation by restoring regular bowel motions.
- **Rich in Calcium:** Palymra Sprout has a high calcium content, which is crucial for the contraction of muscles. It also aids in the development of strong teeth and bones. Osteoporosis, osteoarthritis, and other age-related bone problems are prevented by this calcium-rich sprout.
- **Digestion:** The exceptionally high concentration of enzymes found in sprouts is one of their finest qualities. This can support the body's many chemical reactions and metabolic activities.
- **Immune System:** Palmyra sprouts are an effective immune system enhancer. Its vitamin-C concentration alone makes it a potent stimulant for the body's white blood cells to combat illness.
- **Cancer Prevention:** Sprouts are an excellent anticancer option due to their chemical molecules' antioxidant action.
- **Nutrient Powerhouse**: It offers antioxidants, vitamins, and minerals for general health.
- **Blood Sugar Regulation**: This powder is a beneficial supplement to a balanced diet as it may help to stabilize blood sugar levels.
- **Food energy source**: **(Prasanna Muraleedharan et al. 2024)**, food is a source of energy for convalescents and provides vitamins such as B12 and C.

PHYTOCHEMISTRY

Every extract underwent phytochemical screening. Mayer's tests were used for alkaloids, ninhydrin for amino acids, Barfoed's and Fehling for carbohydrates, FeCl3 for flavonoids, Legal for glycosides, FeCl3 for alcoholic vanillin for saponin, FeCl3 for tannins, and Libermanan-Burchard's test for triterpenoids. The tests for phenols and tannins were also conducted in accordance with conventional procedures.

Albuminoids and lipids are present in Borassus flabellifer, and fresh pulp is said to be high in vitamins A and C. According to reports, the fresh sap is an excellent source of vitamin B-complex. Male inflorescence constitutes spirostane-type steroid saponins like borassosides and dioscin. It also contains 20 known steroidal glycosides and carbohydrates like sucrose. It also contains a bitter compound called flabelliferrins; these are steroidal saponins. 28 chemical constituents have been identified from ethanol root extract of *Borassus flabellifer* by Gas Chromatogram-Mass spectrometry (GC-MS) analysis namely 2-Furanmethanol, Propane, 1-(1-methylethoxy), 2-Cyclopenten-1-one, 2-hydroxy-, 2,4-Dihydroxy-2,5-dimethyl-3(2H)-furan-3-one, Glycerin, 1,3-Propanediamine, 1,2-Propanediol 2-acetate, Butane, 1-(ethenyloxy)-3-methyl-, Propane, 1,1-diethoxy-,1H-Imidazole-4-carboxamide, 5-amino-, 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-, Resorcinol, Phenol, 2,6-dimethoxy-,6H-Purin-6-one, 2-amino-1,7-dihydro-,6H-Purin-6-one, 2-amino-1,7-dihydro-, 1,4-Benzenediol, 2-methoxy-, Phenol, 3,4-dimethoxy-, Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl-, Phenol, 4-[2-(dimethylamino)ethyl]-, 1-Butanol, 2-amino-, 3-Hydroxy-4-methoxybenzoic acid, Phenol, 3,4,5-trimethoxy-, Phenol, 5-(1,5-dimethyl-4-hexenyl)-2-methyl-, (R)-, 7H-Furo[3,2-g] benzopyran-7-one, n-Hexadecanoic acid, Pentanoic acid, 10-undecenyl ester, Octadecanoic acid **(Veda et al., 2016).**

PHARMACOLOGICAL ACTIVITY

Acute and chronic models, such as carrageenan-induced paw oedema like cotton pellet-induced granuloma and carrageenan-induced air-pouch model in rats, were used to assess the anti-inflammatory activity of the ethanol extract of male flowers. The animals were split into four groups (n = 6), with Group I serving as Control receiving the vehicle alone (1% Carboxymethylcellulose, CMC, 10 mg/kg b.w. as Standard receiving Diclofenac Sodium at a dose of 100 and 300 mg/kg b.w. p. o. as a test, respectively. **(Veda et al., 2016).**

Anti-arthritic properties

Freund's Complete Adjuvant (FCA)-induced polyarthritis was used to test the ethanolic extract of male flowers (inflorescences) of *Borassus flabellifer* L. (Arecaceae) for anti-arthritic potential. Rats received an injection of 0.1 ml of FCA in the right hind paw's sub-plantar area. The water column in a Plethysmometer was dislocated to determine the paw volume. For 21 days in a row starting on the day of FCA, each animal received either extract, diclofenac sodium, or vehicle (1% CMC) orally, based on their particular grouping.

Cytotoxic effects

HeLa cell lines were used to assess the inhibitory impact of *Borassus flabellifer* seed coat extracts. The MTT test was used to assess *Borassus flabellifer's* cytotoxicity on HeLa cells. 32 µg/ml to 750 µg/ml is the concentration range. HeLa cell proliferation was shown to be considerably decreased when Borassus flabellifer was supplied at various doses, including 32, 64, 128, 256, 500, and 750 µg/ml.

Antimicrobial activity

Using the agar well diffusion technique, the antibacterial activity of a methanol extract of the soft outer shell of *Borassus flabellifer* L. (Arecaceae) seeds was investigated in vitro. Gram-positive bacteria, such as *Staphylococcus aureus* and *Bacillus subtilis*, and Gram-negative bacteria, such as *Klebsiella pneumonia* and *Serratia marcescens*, were used to test the antibacterial capability. When tested on several bacterial species, the methanol extract of the seed coat consistently shown strong inhibitory action. Additionally, tests using the broth dilution assay revealed that the minimum inhibitory concentration (MIC) ranged from 100 µg to 1 mg/ml, suggesting the importance of *Borassus flabellifer's* antibacterial activity.

Analgesic activity

The ethanolic extract of male flowers (inflorescences) of *Borassus flabellifer* L. (Arecaceae) were investigated at doses 150 mg/kg b.w. and 300 mg/kg b.w. using acetic acid induced writhing, hotplate, tail-clip method. Oral administration of *Borassus flabellifer* ethanolic extract (BFEE) produced significant ($P<0.0001$) reduction in no. of writhes induced by acetic acid. Moreover, in the hot-plate test, (BFEE) significantly ($P<0.0001$) raised the pain threshold at the different time of observation (0-60 min) in comparison with control. In tail-clip test also, the extract caused a significant ($P<0.0001$) inhibition of pain at both the doses used. There was a significant dose-dependent inhibition of both phases of the formalin-induced pain response in mice.

Antipyretic activity

The technique outlined was significantly modified to test antipyretic activity. The antipyretic properties of an ethanolic extract of the male flowers (inflorescences) of *Borassus flabellifer* L. (Arecaceae) were examined. Both stages of the formalin-induced pain response in mice were significantly inhibited in a dose-dependent manner. BFEE substantially ($P<0.0001$) reversed hyperthermia at both doses when tested on rats with yeast-induced pyrexia.

Hypoglycemic activity

In both normal and diabetic rats, the hypoglycemic effects of *B. flabellifer* alcoholic extract were examined. Rats were given either a single dose of alloxan (120 mg/kg, i. p.) or an injection of dexamethasone (10 mg/kg, i. p.) for ten days to induce diabetes. After repeated dosing for seven days, (100, 200, and 400 mg/kg) dramatically reduced the blood glucose level in normal rats in a dose-dependent manner. At the conclusion of the first, second, third, and fourth weeks following extract test therapy, alloxan-induced diabetic rats showed reduced blood sugar levels and better glucose tolerance. However, after receiving the extract for 28 days, the insulin levels in the extract-treated group did not alter noticeably.

Antioxidant activity

According to reports, the fruits of *Borassus flabellifer* Linn., a member of the Areaceae family, have antioxidant properties. Additionally, the extracts' antioxidant activity has been assessed in vitro using the DPPH (2, 2-Diphenyl-1 picrylhydrazyl) and ABTS (2, 2-azinobis-(3-ethylbenzo-thiazoline-6-sulfonic acid) assays. With a few modest adjustments, the approach was used to evaluate the impact of the DPPH plant extract. The spectrophotometric technique of pellegrin was used to conduct the ABTS diammonium salt radical cation decolorization test.

CONCLUSION

Palmyra tuber is a highly nutritious and medicinally valuable plant component with strong relevance in herbal therapy. Its rich composition of starch, fiber, minerals, vitamins, and bioactive compounds contributes to antioxidant, antidiabetic, antimicrobial, and digestive benefits. Traditionally used for energy and wellness, it is safe, affordable, and widely accessible. With growing interest in natural remedies, Palmyra tuber holds great potential for developing herbal formulations, functional foods, and nutraceutical products that support sustainable and holistic healthcare.

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