

## Pilu: An underutilized nutritious fruit of arid region

**Pilu, commonly known as, Jhal, Badapilu, Miswak, or the toothbrush tree, belongs to the Salvadoraceae family. It is an underutilized fruit with significant potential, especially wasteland regions like western Rajasthan and Gujarat. Even with its limited genetic diversity and lack of awareness for production, the tree has excellent chemical properties that makes it valuable in the pharmaceutical industry. The chemical compounds contribute to its impressive pharmacological profile, which includes anti-inflammatory, analgesic, anti-ulcer, anthelmintic, antibacterial, antifungal and diuretic effects. This article highlights the importance of Pilu, focusing on its phytochemical composition and the diverse pharmacological benefits it offers.**

**P**ILU (*Salvadora oleoides* Decne) is a drought-resistant, evergreen tree native to arid and semi-arid regions of India, particularly in Rajasthan and Gujarat, with some extended area in Punjab. It is an underutilizing fruit crop which is also known as Pilu (Haryana, Punjab, Rajasthan), *Khakh* (Gujarat), *Jhunjhuna* (Madhya Pradesh), *Miswak* fruit (Uttar Pradesh) and *Kharjur* (Maharashtra). It is a drought- and salinity-resistant tree, particularly grown in Jalore, Barmer, and Jodhpur regions of Rajasthan. It also grows along Gujarat's coastal areas and Maharashtra's tidal creeks, aiding wasteland development. Notably abundant in dune regions near the Indo-Pakistan border, it has been recorded at densities of 5 to 120 trees per hectare, depending on soil and rainfall (180–700 mm annually). Withstanding temperatures from 4°C to 50°C, Pilu acts as a windbreak, preventing soil erosion. It also provides shade and shelter for wildlife, enhancing desert landscapes during extreme summers.

The arid and semi-arid regions harbour a plethora of climate-resilient yet underutilized fruit crops, such as Pilu (*Salvadora oleoides* Decne) that belongs to family 'salvadoraceae'. It included 3 genera (*Azima*, *Dobera* and *salvadora*) and 12 species. Chromosome number is  $2n=24$ , which possess significant potential to address local food and nutritional requirements. Pilu is small evergreen, bushy tree indigenous to India, Pakistan, and southern Iran. Pilu fruits are consumed by local populations, while its seeds are notably rich in oil content (40-50%), albeit non-edible, with significant industrial value. The plant's adaptability to highly saline desert environments render it an excellent food source for camels and goats. Moreover, Pilu serves as an effective component in shelterbelts and windbreaks due to its ability to form dense growth through root suckers and seedlings, creating an almost impenetrable canopy. *Salvadora persica*, a close relative,

is commonly referred to as *Khara jal*, *Khara pilu*, salt bush, mustard tree, or toothbrush tree. It is classified as a facultative halophyte owing to its habitat ranging from non-saline to highly saline regions. Pilu exhibits high salt tolerance and drought resistance, making it suitable for reclaiming salt-affected soils. Recent market availability of therapeutically and industrially valuable preparations and compounds derived from Pilu has spurred scientific interest in further exploring its medicinal properties and industrial applications.

### Botanical description

The Pilu is a small evergreen shrub or tree with a dense round crown, growing up to 4-10 m in height. It produces simple leaves with greenish white or greenish yellow flowers in March-April and globose, smooth drupe fruits that ripen in May and June. The plant, prevalent



Pilu tree

in arid regions, experiences decreased abundance in areas with more abundant rainfall. It exhibits resilience to high soil salinity and undergoes leaf renewal in April, with the new foliage assuming a thick and leathery texture. Demonstrating effective coppicing capabilities and spontaneous regeneration through root suckers and natural layering, the species offers shade and is frequently pruned for use as fodder for camels and goats. Its fruit possesses a sweet flavour and is consumed fresh, while the stem serves as a traditional toothbrush for dental hygiene purposes. The wood has marginal timber value. The Pilu is slow growing and can tolerate temperatures ranging from -30°C to 45°C and pH 6.5 to 8.5. Protecting the genetic resource of these fruit crops is crucial due to their disappearance owing to urbanization and climate change.

### Composition and uses

Pilu stands as a versatile tree species, offering a spectrum of utility ranging from oil production, pharmaceutical applications, fodder provision, to serving as shelterbelts and windbreaks. Widely recognized as a source of chewing sticks for oral hygiene, it particularly thrives in South Arabia. Its fruits are esteemed for their delectable flavour, while the leaves are valued as excellent animal fodder. The seeds constitute a significant portion of the fruit, comprising 44 to 46% of the total, with a moisture content of 2.8%. Notably, they contain 45 to 48% fat, 18.94% albuminoids, 23.48% carbohydrates, 5.8% fibre, and 3.5% ash. Of particular importance is the light-yellow solid fat extracted from *Salvadora persica* seeds, which boasts approximately 47% lauric acid content. This makes it a compelling substitute for coconut and palm oil in various industrial sectors, particularly in soap and detergent manufacturing.

Pilu harbours an array of potentially therapeutic compounds, including salvadoricine, salvadoura, -sitosterol, trimethylamine, thioglucoside, dibenzylthiourea and rutin, as well as essential minerals like potash, chlorine, and sulphur. Its pure oil finds application in candles, addressing rheumatic ailments, and as an ingredient in ointments, while the residual oil cake serves as animal feed. Additionally, the leaves and root bark are utilized for treating coughs and possess vesicant properties.



Leaves, immature and mature fruits of Pilu

Although no specific varieties of Pilu have been identified, considerable variability exists in fruit shape, size, and colour attributed to seed propagation. Nonetheless, two discernible types, distinguished by red and green fruit variants, occur naturally.

### Nutraceutical value

Pilu, presents significant nutraceutical value, particularly in its red-fruited variety, which harbours heightened antioxidant content and finds pivotal industrial applications. The seeds of pilu tree yield lipid-rich extracts comprising 40-50% non-edible lipids, catering to industrial needs. Moreover, the fruits are utilized in the production of juices and beverages. It thrives in arid climates, predominantly inhabiting pastures and grasslands across regions such as Gujarat, Haryana, Punjab, Uttar Pradesh, Rajasthan, and Madhya Pradesh. Its annual seed yield is estimated at 47,000 tonnes, with the potential to produce 15,000 tonnes of oil.

**Anti-oxidant activity:** Extracts derived from the crude oil of fungal endophytes isolated from pilu demonstrated promising activity. The antioxidant efficacy of acetic extracts from all fungal sources exhibited notable potency in comparison to methanolic and aqueous extracts.

**Antimicrobial activity:** Pilu has significant antimicrobial activity in benzene extracts from roots and stems, as well as acetone and methanolic extracts from endophytic fungi. Stem bark extracts also has antimicrobial efficacy.



Harvested ripe fruits of Pilu

**Table 1.** Antioxidant qualities of green and red fruited cultivar of Pilu

Trait	Red colour fruit	Green colour fruit
TSS (°Brix)	22.9	25.3
Ascorbic acid (mg/ 100g)	29.0	18.2
Total polyphenols (mg/100g)	619.7	351.4
Flavanol (mg/100g)	42.5	36.4
Flavonoid (mg/100g)	118.9	93.5
O-dihydric phenol (mg/100g)	27.3	26.6
Total AOX activity (CUPRAC; mMTE/100g)	10.3	7.82
Total AOX activity (FRAP; mMTE/100g)	8.31	4.95
DPPH inhibition (%)	88.4	71.6

Alcoholic leaf extracts demonstrate mild antibacterial properties against various strains of microorganisms, with significant activity against *Staphylococcus aureus*. Polyamides from *S. oleoides* demonstrated promising activity against fungi as well as Gram-positive and Gram-negative bacteria.

**Hypoglycaemic and hypolipidemic activity:** Ethanolic extracts of pilu have shown promise in reducing blood glucose levels and positively impacting lipid profiles in both normal and diabetic rats. Additionally, the butanol fraction of its leaves has been found to lower cholesterol, triglycerides, LDL, and VLDL levels while increasing HDL levels. Combined with *Coccinia indica*, *S. oleoides* extracts display significant antidiabetic effects in rats.

**Anti-inflammatory activity:** Alcohol and water extracts

tested @ 400 mg/kg body weight exhibit significant anti-inflammatory effects. Its leaf extracts demonstrate notable anti-inflammatory activity, particularly in alcoholic and aqueous forms, comparable to standard drugs like Indomethacin.

**Larvicidal activity:** Seed oil of pilu exhibits larvicidal activity against various mosquito species, displaying significant toxicity against *Anopheles stephensi* larvae at low concentrations.

## SUMMARY

*Salvadora oleoides* (Pilu) is vigorous, multi-purpose tree with high nutritional, medicinal purpose, ecological and industrial value. It can acclimatize to arid and saline habitats, offering food, forage and therapeutic value. It exhibits significant medicinal and nutritional attributes including antioxidant, antimicrobial and hypoglycemic activity in its fruits, seeds and extracts which is used in nutraceutical and pharmaceutical industries. Yet it remains an underutilized wild crop with substantial commercial prospects for consumption and value augmentation. Rapid declines in its prevalence pose a serious threat of extinction in the foreseeable future. Consequently, conservation efforts should prioritize the exploration and promotion of its commercial viability to safeguard this valuable species.

For further interaction, please write to:

**Prakash**, ICAR-Indian Institute of Horticultural Research, Bengaluru, Karnataka 560 089. \*Corresponding author email: prakashsingathiya1998@gmail.com

### SUSTAINABLE DEVELOPMENT GOALS RELATED TO FRUITS AND VEGETABLES



**SDGs 2 3**  
**Health benefits of fruit and vegetables**  
*Harness the goodness*  
Fruit and vegetables have multiple health benefits. They strengthen the immune system, combat malnutrition and help prevent non-communicable diseases.



**SDGs 2 3**  
**Diversified diet and a healthy lifestyle**  
*Live by it, a diverse diet*  
Adequate amounts of fruit and vegetables should be consumed daily as part of a diversified and healthy diet.



**SDGs 2 8 12 13 14 15**  
**Food loss and waste**  
*Respect food from farm to table*  
Fruit and vegetables are worth more than their price. Maintaining their quality and assuring their safety across the supply chain, from production to consumption, reduces losses and waste and increases their availability for consumption.  
*Innovate, cultivate, reduce food loss and waste*  
Innovation, improved technologies and infrastructure are critical to increase the

efficiency and productivity within fruit and vegetable supply chains to reduce loss and waste.

**SDGs 1 2 12 15**  
**Sustainable value chains**  
*Foster sustainability*  
Sustainable and inclusive value chains can help increase production, and help to enhance the availability, safety, affordability and equitable access to fruit and vegetables to foster economic, social, and environmental sustainability.

**SDGs 1 2 3 4 5 8 11 12 15**  
**Highlighting the role of family farmers**  
*Growing prosperity*  
Cultivating fruit and vegetables contributes to a better quality of life for family farmers and their communities. It generates income, creates livelihoods, improves food security and nutrition, and enhances resilience through sustainably managed local resources and increased agrobiodiversity.

**Source:** *Fruit and vegetables – your dietary essentials*, FAO background paper, FAO, Rome







