



Pilu: A Nutrient-Rich and Underutilized Treasure of Arid Regions

(*Rocky Thokchom¹, Ediga Amala², Ashish Sahoo³, Sabyasachi Mohanty³ and Ritesh Kumar³)

¹Central Agricultural University, Iroisemba, Imphal, Manipur

²Indian Agricultural Research Institute, New Delhi

³Siksha o' Anusandhan Deemed University, Bhubaneswar, Odisha

*Corresponding Author's email: rockythokchom@rocketmail.com

Pilu, commonly known as a toothbrush tree, is a bushy evergreen tree indigenous to India. In the Indian subcontinent, it is known as Vann in Punjabi, Mitha Jal or Pilu in Hindi, Sindhi jall in Pakistan, and Tuch in Iran. *Salvadora* is a widespread tree that thrives in Indian deserts, especially in Rajasthan and Gujarat. The fruits are consumed by locals, but the seeds contain high-quality oil (40-50%), which is not edible but has significant commercial value. This plant thrives in salty deserts and provides a nutritious diet for camels and goats. This tree thrives in saline environments and is resistant to drought. *Salvadora*, an underutilised tree in arid regions, has various uses. Camels consume the leaves. This plant is ideal for shelterbelts and windbreaks in deserts due to its ability to grow through root suckers and seedlings under the canopy. *S. persica* is classed as a facultative halophyte due to its presence in both non-saline and highly saline environments. This plant exhibits high salt tolerance and drought resilience, making it suitable for restoring salt-damaged soils. Recent marketing of beneficial preparations and compounds has piqued scientists' interest in studying this medicinal plant. The fruit contains sugars and is used to make fermented drinks, while the tender shoots are eaten as a salad. The seeds contain C12 and C14 acids, which are used in the soap and detergent industries.

The arid and semi-arid regions harbor a plethora of climate-resilient yet underutilized fruit crops, such as Pilu (*Salvadora oleoides* Decne) 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, also known as Bara jal or the toothbrush tree, is a small evergreen bushy tree indigenous to India, Pakistan, and southern Iran. In the Indian subcontinent, it goes by various names including Vann in Punjabi, Mitha Jal or Pilu in Hindi, while in Sindhi it is referred to as Jall. In Iran, it is known as Tuch. This species thrives in the arid landscapes of regions like Rajasthan and Gujarat in India, and is also reported in tropical Africa, Asia, Egypt, Mascarene Island, and China.

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 meters 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 is common in arid tracts but becomes scarce in better rainfall conditions. It can withstand great soil salinity and produces new leaves in April, which become thick and leathery. The tree coppices well and regenerates freely by root suckers and natural layering. It provides shade and is often lopped for camel and goat fodder. The fruit is sweet and eaten fresh, with its stem used as a medicinal tooth brush for dental care. 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 due to urbanization and climate change.

Composition and Uses

Salvadora persica 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 percent of the total, with a moisture content of 2.8%. Notably, they contain 45 to 48 percent fat, 18.94% albuminoids, 23.48 percent carbohydrates, 5.8% fiber, 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 harbors an array of potentially therapeutic compounds, including salvadoricine, salvadourea, β -sitosterol, trimethylamine, thioglucoside, dibenzylthiourea, rutin, as well as essential minerals like potash, chlorine, and sulfur. 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. Although no specific varieties of Pilu have been identified, considerable variability exists in fruit shape, size, and color attributed to seed propagation. Nonetheless, two discernible types, distinguished by red and green fruit variants, occur naturally.

Antioxidant properties of green and red fruited genotypes of pilu

S. No.	Attributes	Red fruited	Green fruited
1.	TSS (⁰ Brix)	22.9	25.3
2.	Ascorbic acid (mg/ 100g)	29.0	18.2
3.	Total polyphenols (mg/100g)	619.7	351.4

4.	Flavanol (mg/100g)	42.5	36.4
5.	Flavonoid (mg/100g)	118.9	93.5
6.	0-dihydric phenol (mg/100g)	27.35	26.6
7.	Total AOX activity (CUPRAC; mMTE/100g)	10.38	7.82
8.	Total AOX activity (FRAP; mMTE/100g)	8.31	4.95
9.	DPPH inhibition (%)	88.40	71.66

Nutraceutical value

Salvadora oleoides, commonly known as Pilu, presents significant nutraceutical value, particularly in its red-fruited variety, which harbors heightened antioxidant content and finds pivotal industrial applications. The seeds of these trees 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. Pilu 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 tons of oil.

Origin and distribution

Pilu is found in Southwest Asia, India, and Sri Lanka. *S. persica* distribution varies throughout countries due to factors such as water supplies, climate, geography, and anthropogenic influences along the elevation gradient. This plant thrives in arid and semi-arid regions of India, including Rajasthan, Gujarat, Punjab, Haryana, Karnataka, Andhra Pradesh, and Tamil Nadu. *S. persica* is the dominant species in saline deserts and arid areas, while *S. oleoides* is more common in dry and hot deserts.

Climate and soil This plant thrives in arid and salt-stressed environments, with limited rainfall and high temperatures. The ideal soil mixture is a 1:2:1 ratio of sand, clay, and FYM, with more clay content preferred.

Varieties

Fruit shape, size, and colour vary significantly depending to seed propagation. Pilu has no known varieties, however, it comes in two types: red and green fruited.

Propagation

Nursery technique Raising seedlings: Soak seeds for 24 hours in fruit pulp solution (*Salvadora perica*). They provided maximal germination and shoot growth. under June, two seeds are seeded per polybag at 1.0-2.0 cm depth under nursery circumstances. Planting one hectare at a 5 X 5-metre spacing requires 15 grams of seeds under field conditions.

Planting in the field

Land preparation and fertilizer application: Land is ploughed in the first week of June and left fallow for 20-25 days to allow for solar exposure, weed drying, aeration, and crop residue decomposition. After a second ploughing, the field is levelled using planking. The crop receives NPK at 30:20:15 kg/ha with hexameal treatment. Half of the N, P, and K are applied initially, followed by the whole amount after 120 days.

Spacing: For optimal growth in the field, a spacing of 5X5 metres is recommended.

Intercultural operations: Weeding and hoeing are done manually 20 days after planting, every 20 days during the rainy season, and every 45 days after rainfall until the plants reach 3-4 years of age.

Water management: Fortnightly irrigation improves collar diameter, biomass, bark and root yields, and Harvest Index. Monthly irrigation promotes plant growth and height.

Weed management: Weed control in *S. persica* plantations is best achieved through manual hand weeding.

Harvesting and yield

Seeded fruits take 4-5 months to mature, often from December to April/May. Meswak toothpaste is made from the roots of the plant, while the entire plant is used medicinally. After two years of growth, the plant can be uprooted at any time of year to promote root creation. The roots are separated and dried. The average yield is about 90 kg/tree.

Post-harvest management

Plants are uprooted and sorted into leaves, stems, and roots using steel knives/scalpels. Stem branches and roots are utilised fresh. If not utilised immediately, store in well-ventilated, shady areas to ensure ongoing moisture loss.

Future Prospects

Apart from the medicinal and nutritional importance, Pilu is a wild ignored crop with a high commercial potential for consumption and value addition. The prevalence of this plant is decreasing swiftly which may cause its extinction in the near future. Therefore, this valuable species could be conserved through exploring and promoting its commercial value.

References

1. Bhandari MM, Flora of Indian Desert, Scientific Publisher, Jodhpur, 1978. 471.
2. Meena, V. J., Gora, J. S., Singh, Akath, Ram, C., Meena, N.K., Pratibha, A., Roupshael, Y., Basil, B. and Kumar, P. (2022). Underutilized Fruit Crops of Indian Arid and Semi-Arid Regions: Importance, Conservation and Utilization Strategies. Horticulturae., 8; 171.
3. Mertia RS and Kunhamu TK, Seed germination trial on *Salvadora oleoides* Decne, J. Trop. For., 2000, 16, 50-52
4. Ministry of Environment & Forests: Kolkata, India.
5. Rao, C.K.; Geetha, B.L. and Suresh, G. (2003). Red List of Threatened Vascular Plant Species in India: Compiled from the 1997 IUCN Red List of Threatened Plants; ENVIS, Botanical Survey of India,
6. Rawat, H., Kothiyal, K., Jain, S. and Kiran, B. (2022). Pilu fruit breeding. Times of Agriculture., 26; 11
7. Shekhawat NS, Sharley M, Mahendra P, Harish and Shekhawat S (2012) Micropropagation of *Salvadora oleoides*-An oil yielding tree of arid forests, J Sustainable For., 31(7), 620-632.
8. Singh, R.S. and Tewari, J.C. .1994. *Salvadora*: A multipurpose tree in arid traits. Deco Mirror, 2: (2): 129-22.