

PHARMACOGNOSTICAL, PHYTOCHEMICAL AND PHARMACOLOGICAL STUDY  
OF SAPINDUS MUKOROSSI

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## ABSTRACT

The article provides a comprehensive overview of *Sapindus mukorossi*, a member of the Sapindaceae family, highlighting its botanical description, traditional applications, pharmacognostical profile, phytochemistry, and pharmacological activities. *Sapindus mukorossi*, commonly known as soapnut or aritha, is a deciduous tree found in the upper reaches of the Indo-Gangetic plains, Shivalik's, and sub-Himalayan tracts. It is valued for its environmentally friendly nature, biodegradability, and diverse uses in traditional medicine and cosmetic industries. The plant's major components include triterpenoid saponins, sugars, and mucilage, with various pharmacological activities such as antimicrobial, anti-inflammatory, insecticidal, and wound healing properties. Traditional applications include its use in Ayurvedic and Unani medicine for treating ailments like cough, skin infections, and poisoning. The morphological characteristics, taxonomical classification, and phytochemical composition of *Sapindus mukorossi* are discussed in detail. Furthermore, its pharmacological activities are highlighted, including antibacterial, spermicidal, anti-inflammatory, and molluscicidal properties.

**KEYWORDS:** *Sapindus mukorossi*, Triterpenoid saponins, bioactive compounds.

## INTRODUCTION

*Sapindus mukorossi* Geartn, a member of the family Sapindaceae. It is a deciduous tree widely grown in upper reaches of Indo-Gangetic plains, Shivalik's and sub-Himalayan tracts at altitudes from 200 m to 1500 m.<sup>[1]</sup> Its family consists about 150 genera and 2000 species, The fruits appear in July–August and ripens by November–December. Other species of genus have been investigated for their astringent and pharmacological uses.<sup>[2]</sup> Saponins from *Sapindus mukorossi* are natural, secondary plant

metabolites carrying properties of surfactant, synthesized by plants.<sup>[3]</sup> The tree is renowned for its versatile uses, the major components found in *S. mukorossi* are triterpenoid saponins of mainly three oleanane, dammarane and tirucallane types.<sup>[4]</sup> In addition, some pharmacological effects, such as molluscicidal<sup>[5]</sup>, anti-inflammatory<sup>[6]</sup>, antimicrobial, anthelmintic, antitussives, astringents and cytotoxic activities have been demonstrated in the saponins of plants.<sup>[7]</sup>

Figure 1: *Sapindus mukorossi* (Aritha) Tree.

**Need of Study**

- Environment friendly
- Reduce chemical exposure
- Biodegradability
- Natural and organic product demand
- Encouraging research and innovation

**Objectives of Study**

- To promote health and safety
- To preserve culture and tradition
- Research and innovation
- To preserve longevity and quality of clothes

**Traditional Application of Plant**

In Ayurvedic science, whole drug or the specific part of the drug is used for medicinal purpose. Arishtaka is one of the important herbal drugs mentioned in ayurveda science which is mainly used as cleansing agent. It is used for treatment of various disease such as Visha, Mutrakricchra, Daha and Kushta. The drug Arishtaka belongs to family Sapindaceae, and are called Soapnut trees, the fruits are widely used in cosmetics.<sup>[8]</sup> Fruits of *Sp. mukorossi* are popular ingredient in Ayurvedic shampoos and cleansers. The plant is an important remedy for relieving cough, detoxification, emetic, contraceptive, treatment of excessive salivation, epilepsy.<sup>[9-10]</sup> The etymology of the term *Sapindus* is sapa which means 'soap' and *Indicus* meaning 'from India'.<sup>[11]</sup> According to Ayurveda, reetha powder obtained from a reliable source helps in various skin infections like psoriasis, eczema, and pimples as it has Tridosha (Pitta, Vatta, and Kapha) properties.<sup>[12]</sup> In the Unani System of Medicine, roots of *Sapindus* are used as an expectorant, as a collyrium in sore eyes and in

ophthalmia.<sup>[13]</sup> In India, the traditional healers used this species to treat the patients having poisonous bites, because of its anti-venom properties. *Sapindus* also has been used for decades to treat cold caused by infection and inflammation.<sup>[14]</sup> As mentioned, fruits are a valuable resource for the washnut tree.<sup>[15]</sup> Traditionally in Japan, *S. mukorossi* pericarps are called enmei-hi, which means life-prolonging pericarp, and in China, wu-huan-zi, as 'non-illness fruit' and 'sympathetic fruit'.<sup>[16]</sup> Since ancient times reetha has been used as a detergent for shawls and silks. The fruit of *Sapindus mukorossi* was utilized by Indian jeweller's for restoring the brightness of tarnished ornaments made of gold, silver and other precious metals.<sup>[17]</sup>

**PHARMACOGNOSTICAL PROFILE****A. Morphological Characteristics**

*Sapindus mukorossi*, which appears as a fairly large, deciduous tree usually up to 12 m and 1.8m in girth and rather fine leathery foliage (Fig.1). The plant's leaves contain **pinnate leaflets**. Also leaves of *Sapindus mukorossi* are used in baths to get rid of joint discomfort (Fig.2). Flowers bloom in May and June, and fruit on a tree without leaves ripens between October.<sup>[18,19]</sup> properties. The pericarp makes up around 56.5% of the fruit, with the remaining portion being the seed.<sup>[20]</sup> Fruit of the tree is a spherical nut, and is yellowish-brown in colour. The seed is enclosed in a black, smooth, and hard globose covering (Fig.2).<sup>[21]</sup>

The bark of this plant is dark to pale yellow, fairly smooth, having many vertical lines of lenticels and irregular wood scales. The heartwood is yellowish grey, the sapwood yellowish white. The wood is moderately hard, compact and close-grained.<sup>[22]</sup>



Figure 2: Parts of *Sapindus mukorossi*.

**B. Botanical Description**

A significant family with 2000 plant species in 150 genera is the Sapindaceae.<sup>[2]</sup> The three principal species that make up the genus Sapindaceae are.

1. American species
  - *Sapindus Saponaria*
2. Two Asian species
  - *S. mukorossi*, *Sapindus trifoliolate*

## 2. Taxonomical Classification

**Table 1: Taxonomical classification.**

Synonym	Aritha, soapnut, dodan
Botanical name	<i>Sapindus mukorossi</i>
Kingdom	Plantae (Plants)
Family	Sapindaceae
Genus	<i>Sapindus L.</i> (Soapberry)
Species	<i>Sapindus mukorossi</i> Geartn
Morphological parts used	Woods, seeds, pericarp extracts, kernelsetc.

### PHYTOCHEMISTRY

*Sapindus* plant contain many different types of active constituents. The major constituents of *Sapindus mukorossi* fruit are saponins (10%-11.5%), sugars (10%) and mucilage. Saponins are secondary plant metabolites with divergent biological activities.<sup>[23]</sup> *S. mukorossi* seeds have a crude protein content of about 21.6%. The fruit, seeds, roots, and leaves of *Sapindus mukorossi* contain more than 103 phytochemicals, including flavonoids,

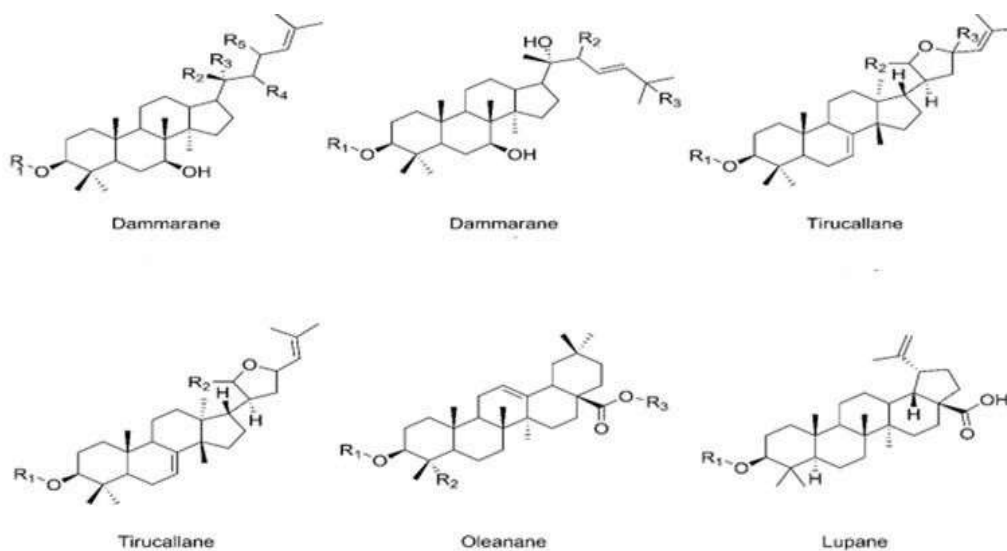
triterpenoids, carbohydrates, fatty acids, phenols, fatty oils, and saponins.<sup>[24]</sup> Different types of triterpenes, saponins of oleanane, dammarane and tirucullane type were isolated from the galls, fruits and roots of *Sapindus mukorossi*. Oleanane type triterpenoid saponins named Sapindoside A&B were reported from the fruits of *Sapindus mukorossi*.<sup>[25]</sup> Roots, flowers, and galls are also a source of triterpenoid saponins.<sup>[26]</sup>

**Table 2: Parts of *Sapindus mukorossi* with phytoconstituents.**

Sr. No.	Chemical constituent	Part of the plant
1.	Triglyceride ● Oleo-palmito-arachidin glyceride	Seed
	● Oleo-di-arachidin glyceride ● Di-olein	
2.	Lipid	Seed
3.	Sesquiterpenoid glycosides	Fruits
4.	Flavonoids Quercetin, Apigenin, Kaempferol, Rutin	Leaf
5.	Saponin	Gall, fruit &
	Triterpene	root
	● Oleanane	Fruit
	● Dammarane	Gall
	● Tricullane	Gall & root
	● Lupan	Fruit pulp

The galls, fruits, and roots of *Sapindus mukorossi* have yielded a variety of triterpenes, including

oleanane, dammarane, tricullane, and Lupane type saponins.



### PHARMACOLOGICAL ACTIVITY

In addition to isolated phytochemicals, *S. mukorossi* has been shown to have anti-microbial, free radical scavenging, skin wound healing, anti-gonorrhoeal,

spermicidal, anti-diabetic, hepatoprotective, anti-inflammatory, anti-protozoal, anti-lipid peroxidation activity in diverse extract types and isolated phytochemicals.

**Table 3: Pharmacological activity of parts of the plant with methods used.**

Sr. no.	Activity	Part used	Type of extract or saponins used
1.	Antibacterial activity	Leaf	Ethanollic and chloroform extracts.
2.	Spermicidal Activity	Fruit Pericarp	Isolated Saponins
3.	Anti-Trichomonas Activity	Fruit Pericarp	Saponins from pericarp
4.	Insecticidal Activity	Fruit Pericarp	Ethanollic extract
5.	Anxiolytic Activity	Fruit & Seed	Methanollic extract
7.	Hepatoprotective Activity	Fruit	Fruit pericarp extract
8.	Molluscicidal Activity	Fruit	Extract
9.	Piscicidal Activity	Fruit Pericarp	Methanollic extract
10.	Anti-Inflammatory Activity	Plant	Isolated saponin and hederagenin (Ethyl alcohol extract)

- 1. Anti-bacterial activity:** Ethanollic and chloroform extracts of *Sapindus mukorossi* inhibited the growth of *Helicobacter pylori* (both sensitive and resistant), at very low concentrations, when given orally for seven days to male wister rats.<sup>[27]</sup>
- 2. Insecticidal activity:** Saponins possess insecticidal activity, causing mortality and/or growth inhibition in the insects tested, the cotton leafworm *Spodoptera littoralis* caterpillars and the pea aphid *Acyrtosiphon pisum*. Ethanollic extract of *Sapindus mukorossi* was investigated for repellency and insecticidal activity against *Sitophilus oryzae* and *Pediculus humanus*.<sup>[28]</sup>
- 3. Antipyretic, Analgesic, and Wound Healing Properties:** *S. mukorossi* has been demonstrated to have potential for lowering body temperature and pain. Rats given an injection of *Saccharomyces cerevisiae* to induce fever had their rectal temperature reduced by *S. mukorossi* stem bark extract. Additionally, *S. mukorossi* extract has analgesic (pain-relieving) effects.<sup>[29]</sup> When compared to untreated rats, *S. mukorossi* seed oil treatment sped up the healing of wounds on rat skin.<sup>[30]</sup>
- 4. Molluscicidal activity:** A plant molluscicide against *Lymnaea acuminata* may be found in the pericarp of *Sapindus mukorossi*. These snails serve as intermediate hosts for the liver fluke *Fasciola gigantica*, which is responsible for scoliosis in populations of north Indian water buffalo. Chloroform, ether, acetone, and ethanol are all soluble in the fruit of *Sapindus mukorossi* potent molluscicidal ingredient. Since the ethanol extract of *Sapindus mukorossi* fruit powder is more poisonous than other extracts, it is likely that the molluscicidal elements it contains are more soluble in ethanol than in other organic solvent.<sup>[31]</sup>
- 5. Anti-inflammatory activity:** *S. mukorossi* inhibit the development of carrageen-induced edema in the rat hind paw as well as on granuloma and exudates formations induced by croton oil in rats. Anti-

inflammatory activity on carrageenin oedema was observed after intraperitoneal and oral administration of crude saponin, whilst hederagenin and the other agents showed activity only when administered.<sup>[32]</sup>

- 6. Fungicidal activity:** Effects of *Sapindus mukorossi* have been studied on fish. Pericarp of *Sapindus mukorossi* is the most toxic parts yielding 100% mortality within 12 hours and mean survival time was found to be 1.18 hours. LD10, LD50, LD100 ranging between 3.5 ppm and 10 ppm at 48 hrs and possess high potential for fish eradication.<sup>[33]</sup>

### CONCLUSION

*Sapindus mukorossi*, commonly known as soapnut or aritha, is a versatile plant with a wide range of traditional and pharmacological applications. It belongs to the Sapindaceae family and is predominantly found in the upper reaches of the Indo-Gangetic plains, Shivalik's, and sub-Himalayan tracts. The plant is esteemed for its various properties, primarily attributed to its rich content of triterpenoid saponins of oleanane, dammarane, and tirucallane types. These saponins endow the plant with surfactant properties, making it an excellent natural alternative for various purposes such as cleaning, skincare, and medicinal uses. Traditional systems of medicine, including Ayurveda and Unani, have extensively utilized different parts of *Sapindus mukorossi* for treating ailments ranging from skin infections to respiratory disorders. Additionally, its use as a natural detergent for textiles and precious metal cleaning further underscores its cultural significance and historical importance. Phytochemical analysis reveals the presence of numerous bioactive compounds in different parts of the plant, including flavonoids, triterpenoids, and saponins. These compounds contribute to the diverse pharmacological activities exhibited by *Sapindus mukorossi*, including antibacterial, insecticidal, anti-inflammatory, hepatoprotective, and wound healing properties, among others. In essence, the comprehensive exploration of the botanical, phytochemical, and

pharmacological profiles of *Sapindus mukorossi* underscores its potential as a valuable resource for various industries, ranging from healthcare to agriculture, while also emphasizing the importance of preserving traditional knowledge and fostering further research and innovation in this field.

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