Scientific Name: *Salvadora persica* (L.) Garcin

Local Name: Rak, Souwak

Arabic Name(s): Arak, Miswak, Souwak, Seawak, Lushlush

Common Name(s): Toothbrush tree

Family: Salvadoraceae
**Description:**
Large shrub with opposite branches, 3 m high sometimes growing as dense thickets on sand hummock. Leaves leathery, elliptical to broadly lanceolate, entire, acute or obtuse, 2-5 cm long, 1-2 cm wide, on petioles 5 mm long. Flowers 3 mm long, in panicle racemes, on 1-2 mm long pedicles. Fruits globular, berry, fleshy, reddish, 3-6 mm in diameter.

**Habitat & Distribution:**
The plant is widely distributed from Africa through Arabia to China. In UAE found native in few places but widely cultivated in farms and along street as wind barriers.

**Part Used:**
Shoots, Roots and fruits

**Traditional & Medicinal Uses:**
The plant is mentioned in holy Quran and Sonnah, and the roots and shoot sticks have been used for centuries as oral hygiene tools in many parts of the world. It was reported that fresh and dried leaves, dried fruits and stems are used to treat swellings, ulcers and blisters, scorpion stings, regulating menstruation, gases and worms.
In UAE the roots used as toothbrushes and the crushed leaves used with oil to treat joint and knee pains while the fruits also are edible. The plant is used in many countries; fruits edible and used as a carminative, anthelmintic, vulnerary, stomachic, antiseptic and anti-inflammatory and good for spleen, gum, scabies, syphilis, gonorrhea and the fruit edible as appetizer. Leaves and flowers used for toothache, gum problems, joint pains, skin diseases, snake bites, kidney stones, constipation, as antidote carminative and anthelmintic, The plant browsed by sheep and goats and the leaves used as fodder and a purgative for camels. Also the plant has been incorporated into commercially available toothpaste.

**Pharmacognosy and Phytochemistry**
Parts studied: Leaves

**Microscopic Description:**
The leaf is unilateral. Both epidermises compose of small polygonal cells and the upper epidermis is covered with a raised thick striated cuticle. Both epidermises bear many unicellular conical covering trichomes of different sizes and they are easily detachable. The stomata are oval and they are very small in size and of the paracitic type. They are distributed on the lower epidermis. The upper epidermis is underlain by a hypodermis which is composed of large broad cells having thick cell walls. The hypodermis is discontinuous and it is interrupted by one or two layers of palisade tissues of different sizes having wavy cells walls. All cells are fairly rich in chlorophyll and granular structures of various shapes including greenish cluster crystals. The spongy tissues compose of large cells of irregular shapes. They also contain granular structures and they embed a group of adjacent sclereids with angular shapes and thick pitted cell walls. The spongy tissues are also traversed by vascular tissues that contain reticulately and spirally thickened vessels and pitted tracheids. (DPS ZCHRTM unpub. Results).
(a). Surface view of the lower epidermis showing small polygonal cells and only one small oval stoma is detected and it is of the paracytic type. (b). A portion of the leaf showing the lower epidermis in a surface view and a typical detached conical covering trichome. (c). Surface view of a portion of the leaf showing the upper epidermis with polygonal cells and a stoma. (Magnifications: All x 400).

**Organoleptic characteristics:**
- **Appearance:** Solid powder
- **Colour:** Light yellowish brown
- **Odour:** Aromatic
- **Taste:** Acrid

**Physicochemical constants:**

**Loss in weight on drying at 105°C (%):** 10.0-10.60

**Solubilities (%)**
- Alcohol solubility: 4.80
- Water solubility: 40.0-41.60
- 10% ethanolic extractive: 45.00

**Ash values (%)**
- Total ash: 25.80-26.60
- Water soluble ash: 6.20-6.60
- Acid-insoluble ash: 3.60-4.30

**Successive extractive (%)**
- Petroleum ether (60-80°C): 2.60
- Chloroform: 1.30
- Absolute alcohol: 10.6-12.10
- Distilled water: Not done

**pH values**
- pH of 1% solution: 5.84
- pH of 10% solution: 5.45
The above results are under process of publication (DPS ZCHRTM Unpub. Results).

**Chemical constituents:**
Carbohydrates, alkaloid (salvadoreine), steroids, terpenoids, saponins, flavonoids (quercetin & kaempferol) and glycosides (Kaempferol 3-α-L rhamnosyl-7-β-xylopyranoside) are present. Kaempferol and quercetin glycosides were confirmed by the hydrolysis of isolated glycosides and co-TLC of their aglycones with authentic samples using benzene, pyridine & formic acid (36:9:5) as mobile phase. (Kamil et.al 1999 a,b,c; 2000 a,b)

**Pharmacological and Toxicological studies:**

The plant stem extracts on the potentiation of sodium pentobarbitone activity and on generalized tonic-clonic seizer produced by pentaylenetetrazole (PTZ) on rat and also on extended sleeping time and decreased induction time induced by sodium pentabarbitone (Monforte et. al., 2002) The plant has adverse effect on male and female reproductive system and fertility (Darmani et. al., 2003).

Volatile oil extracted from *Salvadora persica* L. leaves, showed antibacterial effect on several different oral aerobic bacteria (Al-Ali and Al-Lafi, 2003). The aqueous extract of *S. persica* found in Pakistan and other Asian countries showed antimicrobial activity (Almas, 2001). The plant showed antimycotic effect (Al-Bagieh et. al., 1994).

*S. persica* decoction was able to reduce cholesterol and LDL plasma levels. Mice injected with *S. persica* extract also showed a significantly lower number of stereotype movements of the mice. Stems of *S. persica* reduced cholesterol and LDL plasma levels. However experiments on HDL and triglycerides were unchanged (Galati et. al., 1999).

The plant extract possessed significant protective action against ethanol and stress-induced ulcers (Sanogo et. al., 1999).

The pharmacological and toxicological studies carried out in our laboratory and the results in brief, on *Salvadora persica* (10% ethanolic extract) have been given below. The results presented without references showed unpublished data (UPD, ZCHRTM, DBMS):
<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>EXPERIMENTS CARRIED OUT</th>
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<tbody>
<tr>
<td>Anti-inflammatory activity-Rat paw oedema</td>
<td><em>Salvadora</em> extract, at both doses showed significant anti-inflammatory activity in rats paw oedema model (Zakaria et al., 1998).</td>
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<tr>
<td>Anti-inflammatory activity-Cotton pellet</td>
<td><em>Salvadora</em> extract, at both doses showed significant anti-inflammatory activity in cotton pellet mode (Zakaria et al., 1998).</td>
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<tr>
<td>Antinociceptive activity-Hot plate</td>
<td>Extract did not show analgesic activity (Zakaria et al., 1998).</td>
</tr>
<tr>
<td>Antinociceptive activity-Tail flick</td>
<td>Extract did not show analgesic activity (Zakaria et al., 1998).</td>
</tr>
<tr>
<td>Studies on gastric ulcers-Phenylbutazone induced</td>
<td>Extract produce gastroprotective activity (Islam et. al., 1998).</td>
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<tr>
<td>Studies on gastric ulcers-Indomethacin. Induced</td>
<td>Extract produce gastroprotective activity (Islam et. al., 1998).</td>
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<tr>
<td>Studies on gastric ulcers-NaOH induced</td>
<td>Extract produces gastroprotective activity (Islam et. al., 1998).</td>
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<tr>
<td>Studies on gastric ulcers-Ethanol induced</td>
<td>Extract produce gastroprotective activity (Islam et. al., 1998).</td>
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<td>Extract produce gastroprotective activity (Islam et. al., 1998).</td>
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<tr>
<td>Thermocautery-induced ulcers</td>
<td>Extract produces gastroprotective activity</td>
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<tr>
<td>Anti-secretary activity-Gastric acidity</td>
<td>No anti-secretary activity was observed (Islam et. al., 1998).</td>
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<tr>
<td>Anti-diabetic activity-STZ</td>
<td>Extract did not show any effect on blood glucose levels in STZ-diabetic mice.</td>
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**Diuretic activity**
Extract did not show diuretic activity. No significant change were observed in urine output electrolytes.

**Anti-hypertension activity - Anesthetic rats**
Extract significantly increased blood pressure. No significant effect on the heart rate was found (Radhakrishnan et. al., 1998).

**Locomotor activity**
Extract reduced locomotor activity at various period of treatment.

**Cardiotonic activity & HR - Isolated rat atria**
Produced a dose dependently persistent increase in force of contractions of the isolated atria. No significant change in heart rate was observed (Zakaria et. Al., 1998).

**Skeletal muscle relaxing activity - Phrenic nerve-diaphragm**
Extract did not block the electrically stimulated contraction of diaphragm.

**Anti-asthmatic activity - Tracheal chain of Guinea pig**
Extract did not cause any relaxation of histamine pre-contracted tracheal chain.

**Acute toxicity studies**
Lower doses studied did not show signs of toxicity but higher doses produced toxic effect and recorded mortality (Islam, et. al., 2000).

**LD₅₀ evaluation**
3650 mg/kg. (Islam, et. al., 2000).

**Haematological and Biochemical studies**
Biochemical parameters were remained unchanged. However, serum urea slightly increased and Na and P showed a slight increase (Islam, et. al., 2000).

**Teratogenicity**
No teratogenic effect was observed (Islam, et. al., 2000).

**Mutagenicity**
No mutagenic effect was observed with the model tested (Islam, et. al., 2000).

**Summary of the results:**
The plant showed anti-inflammatory activity, increased force of contraction of rat atria in vitro; varying degree of gastric protection; no analgesic activity and anti-diabetic activity was observed. Toxicity studies were also carried out.

**Microbiological studies:**
A marked reduction of *Streptococcus faecalis* and *Streptococcus mutans* groups and *Candida albicans* (Almas et al., 2004; Alali et al., 2003; Almas, 1999; Al-Bagieh et al.,
The reduction of streptococcus mutans was significantly greater using miswak in comparison to toothbrushing (p = 0.013), and there was no significant difference for lactobacilli reduction (p = 0.147). It may be concluded miswak has an immediate antimicrobial effect. Streptococcus mutans were more susceptible to miswak antimicrobial activity than lactobacilli. Dietary intake of sugar and oral health status may be considered for controlled clinical trials with special emphasis on the antibacterial activity of miswak on cariogenic bacteria for a longer period of time. It was found that the extract of the leaves has a considerable antibacterial effect on several different oral aerobic bacteria with comparable results to known antibiotics. The extract can be used effectively as a natural tool for teeth cleaning and as a natural analgesic for the disturbing toothache.

Reference:

- Andrews, F.W. The Flowering Plants of Anglo-Egyptian Sudan; (1950&1952) vol 1+II; Arbroath, Scotland.
- Department of Biomedical Sciences, Zyed Complex for Herbal Research and Traditional Medicine, Unpublished results.
- Department of Pharmacognostic Sciences, Zyed Complex for Herbal Research and Traditional Medicine, Unpublished results.


