Acacia concinna (Willd.) DC.

Scientific name: *Acacia concinna* (Willd.) DC.

Family: Fabaceae
Genus: Acacia
Species: concinna
Common names: Sikakai, Shikakai, Sappan, Soap pod
Parts used: Pods, bark, leaves

Plant Description: It is a climbing or scandent shrub. Branches with brown smooth stripes, thorny, the thorns short, broad-based, flattened. Leaves with caducous stipules not thorn-like; petiole 1-1.5 cm long with prominent gland about the middle; blade bipinnate, with 5-7 pairs of pinae, the primary rachis thorny, pubescent, the pinnae with 12-18 pairs of pinnae; pinnae oblong-lanceolate, 3-10 mm long, accrescent, acute and apiculate at apex, obliquely rounded at base, entire, glabrous. Inflorescences of 2 or 3 peduncled head in axils of upper reduced leaves, appearing paniculate; peduncles 1-2.5 cm long, pubescent; heads about 1 cm in diameter when mature. Flowers are pink, without or with reduced subtending bracts; ovary stipitate, glabrous. Pods thick, somewhat flattened, stalked, 8 cm long, 15-18 mm wide.

Chemical constituents: It contains saponins, lupeol and spinasterol and acacic acid, lactone, and in sugars glucose, arabinose and rhamnose upon hydrolysis. It also contains hexacosanol and spinasterone. Leaves contain oxalic, tartaric, citric, succinic and ascorbic acids, as well as two alkaloids, calyctomine and nicotine.

Structures of chemical constituents of *Acacia concinna* (Willd.) DC.
**Spinasterone**

**Spinasterol**

**Oxalic acid**

**Tartaric acid**

**Succinic acid**

**Ascorbic acid**

**Nicotine**

**Actions of herb**: Anti-dermatophytic, spermicidal, anti-microbial, expectorant, emetic, purgative.

**Medicinal Uses**: *Acacia concinna* has been used traditionally for hair care in the Indo-Pak subcontinent since ancient time. *A. concinna* extracts are used in natural shampoos or hair powders. It appears to have a hormonal effect, leading to its use for contraceptive purposes. An infusion of the leaves has been used in anti-dandruff preparations, promoting hair growth and strengthening hair roots. Extracts of the ground pods have been used for various skin diseases. Its leaves are used in malarial fever, decoction of the pods are used to relieve biliousness and acts as a purgative. An ointment, prepared from the ground pods, is good for skin diseases. It is reported as insect repellent and several farmers grow them to fight against insects during cultivation.

**Side effects & Toxicity**: It may cause asthma, gas, bloating.
Contraindications: None known

Drug interactions: None known

Physico-chemical parameters

The physico-chemical parameters include loss on drying 10\% w/w, ash value 0.597\% w/w, acid insoluble ash 16.66\% w/w, water soluble extractives 43.25\% w/v, alcohol soluble extractives 49.09\% w/v and saponin content 8.04\%.

Preliminary Phytochemical Screening

Preliminary phytochemical screening revealed that the fruit powder of *A. concinna* contains phenols, tannins, fats, fixed oil, saponins, alkaloids, sugars, quinine and flavonoids. Phytochemical analysis of various extracts of *A. concinna* pod revealed the presence of alkaloids, flavonoids, phytosterols, saponins, tannins, phenolic compounds, gums and mucilage.

Table: Phytochemical screening of various solvent extracts of *A. concinna* pod

<table>
<thead>
<tr>
<th>Phytochemical constituents</th>
<th>Aqueous extract</th>
<th>Benzene extract</th>
<th>Chloroform extract</th>
<th>Petroleum ether extract</th>
<th>Butanol extract</th>
<th>Methanol extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Phytosterols</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Saponins</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Tannins</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Phenolic compounds</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Gums and Mucilage</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

+ indicates presence of compound, - indicates absence of compound

Pharmacognostic evaluation

Macroscopic characters

Macroscopically drug was observed with naked eyes or with the aid of magnifying glass. Generally colour, odour, taste and texture of the drugs are noted (Anonymous, 2004).

Pods: They are linear oblong, straight or bent constrictions between seeds. Surface is unevenly reticulate due to longitudinal and transversally running ridges; longitudinal lateral sutures are distinct, externally dark brown, internally pale brown to buff, fracture fibrous. Fine powder irritates the mucous membrane of the nostrils producing sternutatory effect.

Flower: In heads of terminal/axillary panicles/racemes; white. Flowering is from February-April.

Fruit: A flat pod, prominently nerved, apex acute; seeds up to 12. Fruiting is from March-April.

Field tips: Leaflets not overlapping. Petiole sparsely prickled with a gland at base; rachis grooved.

Leaf arrangement: Alternate-spiral

Leaf Type: Bipinnate

Leaf Shape: Elliptic

Leaf Apex: Subacute

Leaf Base: Obliquely auriculate

Leaf Margin: Entire

Chromatographic evaluation

2gm accurately weighed sample was taken and 6N HCl was added to hydrolyze the sample, reflux for 6 hours and taken out from water bath, filtered and evaporated. The remaining residue was taken in alcohol.
Chromatographic development (HPTLC)

HPTLC was performed for the normal phase separation of components present in methanol extract. The plate was developed in solvent system Toulene-Ethyl acetate-formic acid (6:2:0.5). The plate was scanned by UV (254 & 366nm) afterwards colour reaction was observed by spraying the plate with anisaldehyde $\text{H}_2\text{SO}_4$. *A. conncina* extract showed following Rf values at 254nm 0.15, 0.22, 0.37, 0.44, 0.59, 0.68, 0.92. At 366nm, the Rf value observed were 0.21, 0.39, 0.55, 0.62, 0.87 and 0.94. After spraying with anisaldehyde sulphuric acid Rf value were found at 0.15, 0.21, 0.39, 0.41, 0.56, 0.62, 0.74, 0.87, 0.92.

![HPTLC study of *A. conncina* extract](image)

**Figure:** HPTLC study of *A. conncina* extract


Microscopy of T.S. of *A. conncina* fruit

T.S. of fruit shows outer pericarp, epicarp, middle mesocarp and inner endocarp. Pericarp shows outer radially and inner tangentially elongated layer of cells of epicarp are covered with thin cuticle. Hypodermis consists of 3 – 5 layers of stone cells, the outermost two layers being very small in size followed by narrow bands of collapsed cells; Mesocarp is a wide zone of parenchyma traversed with obliquely cut vascular bundles encircled by collapsed cells. Large
saponin containing cells are located at mesocarp, plenty of simple starch grains and few rosette crystals of calcium oxalate traversed throughout the parenchymatous cells of mesocarp. Endocarp is composed of outer 4 – 5 rows of thick walled spherical parenchymatous zone followed by very narrow layer of sclereids and innermost layer with some stone cells followed by parenchymatous wider zone containing yellowish exudates.

Figure: Transverse section of *A. concinna* fruit


**Powder microscopy**

Various slides of the finely powdered drugs were prepared using distilled water and glycerin and observed for different tissue and cell contents. The powder microscopic exhibited following diagnostic characteristics stone cells, saponin containing cells, prismatic crystals, oil globules, sclereids, mesocarp cells, fibers, colouring matter, collapsed mesocarp cells, annular and pitted vessels, testa in surface view.
Figure: Powder microscopy of *A. concinna*


**Quantitative Microscopy**

Transverse section of fruit constituents of *A. concinna* were scientifically measured and calculated as follows: Epicarp to mesocarp 67.87µm, epicarp 4.05µm, mesocarp 28.27µm, endocarp 5.86 µm, saponin containing cavity 177.00 µm².

**Anti-microbial Activity**
The extracts of *A. concinna* were obtained using different solvents and they were found effective against different bacterial strains. Maximum inhibitory activity of *A. concinna* was observed against *K. pneumonia*, *B. subtilis*, *E. coli*, *P. aeruginosa* and *S. aureus*.

Table: *In vitro* anti-bacterial activity of different extracts of *A. concinna* pod

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Aqueous</th>
<th>Benzene</th>
<th>Chloroform</th>
<th>Petroleum ether</th>
<th>Butanol</th>
<th>Methanol</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>12.5</td>
<td>14.2</td>
<td>6.8</td>
<td>6.8</td>
<td>6.2</td>
<td>11.4</td>
</tr>
<tr>
<td><em>Bacillus subtilis</em></td>
<td>10.4</td>
<td>11.2</td>
<td>7.4</td>
<td>6.4</td>
<td>5.5</td>
<td>10.2</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>10.2</td>
<td>10.4</td>
<td>6.4</td>
<td>6.8</td>
<td>4.2</td>
<td>7.8</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>5.4</td>
<td>6.4</td>
<td>6.3</td>
<td>4.6</td>
<td>4.2</td>
<td>6.2</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>5.4</td>
<td>5.0</td>
<td>5.4</td>
<td>4.2</td>
<td>4.0</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Values are mean of three replicates

Significant anti-fungal activity of various extracts of *A. concinna* was found against the three tested fungal strains.

Table: Anti-fungal activity of various extracts of *A. concinna* pod

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Aqueous</th>
<th>Benzene</th>
<th>Chloroform</th>
<th>Petroleum ether</th>
<th>Butanol</th>
<th>Methanol</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aspergillus niger</em></td>
<td>12.5</td>
<td>6.6</td>
<td>7.6</td>
<td>6.8</td>
<td>10.2</td>
<td>10.4</td>
</tr>
<tr>
<td><em>Penicillium sp</em></td>
<td>10.4</td>
<td>5.5</td>
<td>-</td>
<td>6.4</td>
<td>9.2</td>
<td>-</td>
</tr>
<tr>
<td><em>Candida albicans</em></td>
<td>8.2</td>
<td>4.2</td>
<td>6.4</td>
<td>-</td>
<td>8.4</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Values are mean of three replicates

**GC-MS analysis**
The GC-MS analysis resulted in the chromatogram shown in Fig. 1. The compounds identified are listed in Table 1 together with their relative percentages.

Table: Volatile compounds of *Acacia concinna* (Willd.) DC.

<table>
<thead>
<tr>
<th>Peak Number</th>
<th>Compound</th>
<th>Relative Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Furfural</td>
<td>15.50</td>
</tr>
<tr>
<td>2</td>
<td>5-Methyl-2-furfural</td>
<td>9.98</td>
</tr>
<tr>
<td>3</td>
<td>Phenylacetaldehyde</td>
<td>1.76</td>
</tr>
<tr>
<td>4</td>
<td>Cis-Linalool oxide</td>
<td>1.18</td>
</tr>
<tr>
<td>5</td>
<td>Trans-Linalool oxide</td>
<td>1.41</td>
</tr>
<tr>
<td>6</td>
<td>Methyl salicylate</td>
<td>2.30</td>
</tr>
<tr>
<td>7</td>
<td>α-Terpinolene</td>
<td>0.97</td>
</tr>
<tr>
<td>8</td>
<td>Geranyl acetone</td>
<td>0.61</td>
</tr>
<tr>
<td>9</td>
<td>Tetradecanoic acid</td>
<td>1.36</td>
</tr>
<tr>
<td>10</td>
<td>6,10,14-Trimethyl-2-pentadecanone</td>
<td>2.62</td>
</tr>
<tr>
<td>11</td>
<td>Methyl palmitate</td>
<td>1.14</td>
</tr>
<tr>
<td>12</td>
<td>Palmitic acid</td>
<td>22.92</td>
</tr>
<tr>
<td>13</td>
<td>Isopropyl palmitate</td>
<td>1.35</td>
</tr>
<tr>
<td>14</td>
<td>Methyl linoleate</td>
<td>0.63</td>
</tr>
<tr>
<td>15</td>
<td>Linoleic acid</td>
<td>16.52</td>
</tr>
</tbody>
</table>
Figure 1. Chromatogram of volatile compounds of Acacia concinna.

Comparison of mass spectra of identified compounds with reference compounds
The mass spectra of some identified compounds compared to those of reference compounds are shown in Fig. 2 to 5.

Fig. 2. Mass spectrum of compound number 1 compared with mass spectrum of furfural.

**Fig. 3.** Mass spectrum of compound number 2 compared with mass spectrum of 5-methyl-2-fufural.


**Fig. 4.** Mass spectrum of compound number 3 compared with mass spectrum of phenylacetaldehyde.


9

References


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