Chapter V. *Saknotaka—Streblus asper* (Lour)
-cardiac stimulant.
Saknotaka—Stræblus asper Lour.

Saknotaka is a small tree found in the coastal regions. Its leaves are rough like sand paper and are used for polishing wood. The leaves are astringent which property is used in cleaning teeth. The leaves also yield a white latex which like rennet has the property of coagulating milk.

The plant is not mentioned as being of medicinal use by Charaka or Sushruta. Its medicinal value seems to have been recognised much later and the earliest mention of the plant is in Nighantus. The Raja Nighantu gives the properties to be:


Kausikya (Saknotaka) destroys the milk of goat. It is bitter to taste, hot, increases bile and eliminates the disturbances of vata.

The Dictionary of Economic Products by Watt (1889) gives the following relevant information regarding its medicinal use:

"The roots are used as an application on healthy ulcers and sinuses" — Thornton.

"The powder of dry root in 5-10 grains daily is used with effect in dysentery in certain parts of East Bengal" — N.C. Dutt.
"The juice is used externally to remove glandular swellings". - A.C.Mukerji.

Kirtikar and Basu (1934) mention that the milky juice has astringent and antiseptic qualities and is applied to sore heels and shoe-bites. The bark in decoction is given in fever, dysentery and diarrhoea. The roots are used as an application to unhealthy ulcers and sinuses. It is an antidote to snake poison. Nadkarni (1954) states "that the seeds are beneficial in epistaxis, piles, diarrhoea. The Siamese make an excellent preparation out of its bark."

More recently it has been reported that the local Ayurvedic physicians have successfully treated the root-bark decoction in cardiac disorders. Fernandes et al. (1961) have studied the root-bark of the plant. They report the presence of a glycoside which has interesting activity on the isolated frog's heart, rabbit's intestine and on guinea pig's uterus. Dr. Gaitonde, Professor of Pharmacology, Grant Medical College, Bombay in a private communication informed that he obtained an amorphous powder from the root-bark which gave tests for glycosides and possesses cardiotonic activities.

From the published work it seems to have been established that the root bark of Shakotaka produce cardiotonic activity and this is due to a number of glycosides some of which have been isolated.
As with other medicinal plants under study, the pharmacognostical aspects have been investigated. The microscopy, microscopy, phytochemical tests etc. have not been reported by others. Attempts have also been made to isolate the glycosides and to prepare a tincture from the root-bark to study its cardiac activity.

While these studies were in progress Khare et al. (1962) have published a paper on the subject. They report having isolated 13 glycosides, two of which are cardiac glycosides and behave like Digitoxigenin and Strophanthin.

**Experimental**

Kirtikar and Basu (1934) give the distribution of Saknotaka to be in the drier parts of India from Konilkind eastward and southward to Travancore.

Cooke (1907) mentions a number of places in Deccan in south. However Saknotaka was found to grow only in coastal regions. The material used for the present study was personally collected from Danisar near Bombay and from Anjarle in Ratnagiri District (Maharashtra).

**Botany:**

*Name:* Streblus asper Lour.

*Synonyms:* Trophis asper Retz, Epicarpus orientalis, Bl E.asper, Steud.

*Family:* Urticaceae.

*Local names:* Sanskrit, Saknotaka, kharvari, karera, karoli; Hindi, siora; Marathi, kavti, sahora; Tamil, palpirai; Kannada, mitli, punje, Telugu, pakki, barivenka.
fig. 17 Tree of Sakhotaka (Craeiim us asper Lour)

fig. 18 Sakhotaka root in P...
Plant characteristics: (fig.17) A small ever green tree, rigid and gnarled, attaining 15 to 20 feet in height. The wood is white, moderately hard, no heart wood and no annual rings. All parts are full of milky juice. Branchlets are many, tomentose or pubescent. Leaves elliptical or obovate, pinninerved, irregularly dentate, rough on both sides; blade 1 to 4 inches, petioles short. Flowers dioecious, male in globose heads, perianth compandulate sepals 4, imbricate, stamens 4, long, inflexed in the bud. Female flower solitary or axillary, usually fascicled, peduncle half an inch long, perianth yellow, 4 decussate, closely imbricate sepals. Ovary straight retuse, style filiform connate at base; ovule pendulous. Fruit yellow, one seeded pisiform berry, enclosed in enlarged fresh sepals. Seed globose and testa membranous.

Root bark: The roots were spreading out 15 to 15 ft. on the surface at a couple of feet of depth. They could be dug out with difficulty and the 3 to 10 ft. lengths were cut into convenient bits and transported to the laboratory. The bark is corrugated, soft and has a pale yellowish colour. It is bitter to taste and has no characteristic odour. The fracture is fibrous, the thickness varying from 1 to 7 mm. depending upon the thickness of the root. It can be easily peeled off from the wood.

Microscopical: The T.S. of the root is more or less circular in outline with the major part occupied by secondary wood in the center (fig.18).
The bark consists of well defined ten to fifteen layers of cork cells (fig. 18). These rectangular cells measuring 16-23 to 16 u by 8-12 to 16 u, are regularly arranged and their contents give a positive test for suberin. The secondary cortical parenchyma lying below the cork contains large number of rhomboidal and conglomerate crystals of calcium oxalate, which measure 20 to 40 u. The secondary cortex is interrupted by triangular patches of fibres (fig. 18) with the broad base of the triangle resting on the secondary phloem. The fibres measure 16 to 20 u in breadth and do not answer the usual tests for lignin and cellulose. The test for hemicellulose, araban, xylan and methylpentoses were also not decisively positive and hence the fibre thickening may in all probability consist of hemicelluloses or non-celluloses. The phloem consisting of sieve tubes, phloem parenchyma etc. contains well defined Bast-fibres. A well defined cambium separates the circular patches of the wood in the centre from the peripheral region. The wood consists of radially arranged regular wood tracheids, interspersed with large xylem vessels. The vessel contains tyloses. The whole section of the wood region shows well-defined narrow concentric-patches of thick-walled wood fibres (fig. 18, 19). The uniseriate and multiseriate medullary rays run from the center of the wood to the secondary phloem. They open into the triangular patches, which interrupt the secondary phloem. There is no pith and the primary xylem lies in the centre.
Fig. 19  Sakotaka root in P.B. (magnified portion of the periphery to show the details of the bark. The bark seems to split into two regions the inner cork and the outer bark.)
Root-bark powder: The root bark was separated from the wood, air dried and powdered to pass through a sieve of 60 mesh.

Under the microscope, the powdered bark exhibits largely the parenchymatous cortex and fibres. The starch grains are few and are both simple and semi-compound. The simple ones are oval to spherical, concentric with a triradiate hilum in the centre. These measure from 12 to 36 u. The starch index is 43% 24 being the specific number. The rhomboidal, conglomerate and diamond shaped calcium oxalate crystals measure from 12 to 43 u.

Table 19 Phytochemistry of the root-bark of Sakothaka

<table>
<thead>
<tr>
<th>Test for</th>
<th>Reagents</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids (Alcoholic extract)</td>
<td>Mayer's reagent, Tannic reagent, Wagner's reagent, Picric acid</td>
<td>Negative</td>
</tr>
<tr>
<td>Tannins (Water infusion)</td>
<td>Ferric chloride</td>
<td>Present in trace</td>
</tr>
<tr>
<td>Reducing substances (Glycosides, sugar saponins etc.) (Water infusion)</td>
<td>Benedict's qualitative</td>
<td>Positive</td>
</tr>
<tr>
<td>Saponins (Water infusion)</td>
<td>Haemolytic test - 2% of human blood suspension</td>
<td>Negative</td>
</tr>
<tr>
<td>Starch (Microchemical test)</td>
<td>Iodine</td>
<td>Positive</td>
</tr>
<tr>
<td>Proteins (Water infusion)</td>
<td>Millons reagent, sulphosalicylic acid</td>
<td>Negative</td>
</tr>
</tbody>
</table>
Table 23 Extractives and ash of the root-bark of Sakathaka

(Percent of air dry material)

<table>
<thead>
<tr>
<th></th>
<th>Water</th>
<th>Alcohol</th>
<th>Ether</th>
<th>Petroleum ether (40-60°)</th>
<th>Total ash</th>
<th>Acid insol. ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min.</td>
<td>18.6</td>
<td>6.2</td>
<td>3.0</td>
<td>2.8</td>
<td>13.6</td>
<td>4.4</td>
</tr>
<tr>
<td>Max.</td>
<td>20.2</td>
<td>7.0</td>
<td>3.8</td>
<td>2.8</td>
<td>14.6</td>
<td>6.0</td>
</tr>
<tr>
<td>Mean</td>
<td>19.3</td>
<td>6.6</td>
<td>3.4</td>
<td>2.8</td>
<td>14.0</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Glycosides:

Rosenthaler's (1933) method was employed for isolating the glycosides. The aqueous extract of the powdered root bark obtained after soaking for 18 hours, is treated with excess neutral lead acetate, which is removed by disodium hydrogen phosphate. The resulting solution is extracted with chloroform and the glycosides precipitated with petroleum ether, as an amorphous powder giving a yield of 0.14%. The powder representing the total glycosides gives a positive Libermann-Burchard test andLegal's reaction and melts at 113-116°C.

A quantity of the mixed glycoside preparation was sent to the Pharmacy Department of Grant Medical College, Bombay. They reported it to possess cardiac activity. It has a definite action on the myocardium. 100 mg. of the total glycoside produced increased concentrations of the isolated rabbit's hearts.
The Infra-red spectrum graph of the material indicates that the substance is a steroid lactone glycoside and needs further purification.

Chromatographic study on silica gel column yielded 37 fractions out of which 10 fractions gave positive Liebermann-Burchard reactions. The material seems to be a mixture of several glycosides a few of which only are of the cardiac type.

Tincture: A tincture was prepared from the root-bark powder by percolation as is given in the Pharmacopoeia India (1955) - "Moisten the powdered drug or mixture of drugs with a sufficient of the prescribed menstrum; set aside for four hours in a well closed vessel, pass the damp powder through a sieve with wide meshes, and pack it in a percolator. Pour on enough of the prescribed menstrum to saturate the powder, leaving a layer above the drug; cover the top of the percolator and, when the liquid commences to drip, close the outlet and allow the drug to macerate for twenty-four hours.

If no assay is directed, allow the percolation to proceed slowly at the rate of 1 ml. per minute, gradually adding sufficient menstrum to maintain a layer above the drug, until about three-fourths of the volume required for the finished tincture has been collected. Press the marc, mix the expressed liquid with the percolate and add sufficient of the prescribed menstrum to produce the required volume. Mix well and clarify by substance or by filtration.
If an assay is directed, collect only three fourths of the volume required for the finished tincture, mix thoroughly and assay a portion of it as directed. Dilute the remainder with a calculated quantity of the prescribed menstrum to produce a tincture of the required strength."

The tincture was prepared to contain 1 percent of total solids. This was also sent for pharmacological trials at the Grant Medical College, Bombay. It was standardized on cats weighing 2-3 kg. in dilutions of 1 in 20 normal saline, injected in the femoral vein under chloralose anaesthesia. Injections in various doses with positive controls of Tincture Digitalis I.P. were compared.

Table 21 - Comparative physiological activity of tincture

<table>
<thead>
<tr>
<th>Tincture Digitalis</th>
<th>Tincture Sakhotaka</th>
</tr>
</thead>
<tbody>
<tr>
<td>ml./kg.</td>
<td>ml./kg.</td>
</tr>
<tr>
<td>14.7</td>
<td>9.5</td>
</tr>
<tr>
<td>11.6</td>
<td>11.6</td>
</tr>
<tr>
<td>13.2</td>
<td>9.4</td>
</tr>
<tr>
<td>13.2</td>
<td>11.7</td>
</tr>
<tr>
<td>17.3</td>
<td>10.0</td>
</tr>
<tr>
<td>11.3</td>
<td>10.6</td>
</tr>
<tr>
<td>Mean</td>
<td>13.5</td>
</tr>
<tr>
<td>S.D.</td>
<td>2.1</td>
</tr>
<tr>
<td>S.E.</td>
<td>0.85</td>
</tr>
</tbody>
</table>

| Mean | 10.5 ml./kg |
| S.D. | 1.01        |
| S.E. | 0.42        |

The results indicate that the mean lethal dose of the tincture of Sakhotaka was 10.5 ml./kg. of body weight while that of Tincture Digitalis was 13.5 ml./kg. with standard deviations of 1.01 and 2.1 respectively, thus showing that the tincture of Sakhotaka was slightly more toxic as compared with the standard.
Stem bark: This was also tried for glycosides and it yielded by the Rosenthaler's method only 3.028% of the material. It answered the usual tests of cardiac glycosides. Thus the stem bark also contains the cardiac glycosides but in much smaller quantities - about a fourth of the quantity present in root bark.
Summary

1. The medicinal use of Sakhotaka—Streblus asper Lour.—does not find mention in the earlier Ayurvedic texts. The decoction of the root-bark is being used by a few Ayurvedic practitioners in cardiac disorders.

2. Glycosides have been reported to be present in the root-bark. Some of them have cardiotonic activity.

3. Plant characteristics and detailed microscopy of the root-bark are presented.

4. Using Rosenthaler's method the total glycosides have been isolated and are shown to produce contraction on isolated rabbit's heart. I.R. spectrum shows it to be a steroid lactone glycoside.

5. A tincture of the root bark prepared according to Indian Pharmacopoeia, has been compared with tincture Digitalis I.P., on cats. The results indicate that tincture Sakhotaka is slightly more toxic than tincture Digitalis.

6. Stem bark also has been shown to contain similar cardiac glycosides though in much lesser quantities.
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