LEAF PHARMACOGNOSY OF SENNOSOID YIELDING HERB
SENNA OCCIDENTALIS (L.) LINK FROM THE LATERITIC ZONE OF
SOUTHERN WEST BENGAL, INDIA

SK MD ISMAIL AL AMIN AND ASIS KUMAR NANDI*

*Department of Botany & Forestry, Vidyasagar University, Midnapore, West Bengal. PIN- 721102.

ABSTRACT

Senna occidentalis (L.) Link, of the family Caesalpiniaceae and locally known as ‘kalkasundha’ in India, is a medicinal plant of multifarious uses. Right from it’s earliest mentioning in ayurveda along with other earlier records claim its use as analgesic, antipyretic drug, to treat colitis, constipation, dysentery, jaundice, cholera, leprosy and many others. Its antibacterial, antifungal, antimutagenic, anti-tumour and hepatoprotective properties depends on host of chemicals like, achrosin, aloe-emodin, emodin, anthraquinones, anthrones, sennosoid G, D, C, B, A, isorhein, rhein, kaempferein etc. The plant product in raw and processed form is marketed by different companies. Pharmaceutical information help identify a species, even when plant parts are pounded to powder form. This information also proves to be invaluable as it comes to use in detecting spurious materials, mixed as an adulterant, from the original ones. The present study displays various characteristics of the species, the combination of which will be unique for it and of pharmacognostic significance.

KEYWORDS: Senna occidentalis (L.) Link, leaf pharmacognosy, fluroscence analysis, microscopical standardization,physiochemical standardization.

ASIS KUMAR NANDI
Department of Botany & Forestry, Vidyasagar University, Midnapore, West Bengal. PIN- 721102.
INTRODUCTION

*Senna occidentalis* (L.) Link, of the family Caesalpinioideae, has wide occurrence in wild in tropical and subtropical regions of the world\(^1\) including different agroclimatic zones of India\(^2\). Albeit the plant is being considered as a naturally growing weedy species a host of medicinal and economic importances as registered in the literature of different countries of the world and has also been acknowledged as a medicinal herb in recent works \(^3,\) \(^4\). ‘Kasamarda’ as mentioned in ayurveda, the species is also colloquially named in India as ‘Kasoundi’ or ‘Klakasundi’ and is recommended as a hepatoprotective drug and also used in cough and cold. The species is also mentioned in Unani medicine as an antidote of poison, blood purifier and alleviator of liver malfunctioning\(^5\). Elsewhere various other uses of *Senna occidentalis* are mentioned as antibacterial, \(^6,\) \(^7\) antifungal, \(^8\) antimalarial \(^9,\) \(^10\) and hepatoprotective \(^11,\) \(^12\) agent. It is also claimed to act as vermifuge \(^13\). Leaves of *S. occidentalis* are used in eye troubles \(^14\) and for the treatment of ulcer too \(^15\). Beyond these some other traditional ethnobotanical uses of the species have also been recorded \(^16\). According to the World Health Organization, 80% of the world's population depends on traditional medicine for their primary healthcare \(^17\). The plant parts of *Senna occidentalis*, specially the leaf in the form of powder or flakes are used widely as laxative \(^18\). One of the principal constituents of medicinal importance, available in this species, is sennoside, an anthraquinone glycoside which occurs in different forms as sennoside A, B, C and D. Besides, other biochemicals like rhein, emodin, aloe-emodin are also present. In view of its immense medicinal importance of the species and the paucity of its pharmacognosy in earlier literatures some features of the powdered plant parts have been worked out here in an attempt to provide information of pharmacognostic significance to characterize the species as well as for easy detection of its adulterants.

MATERIALS AND METHODS

Plant Material

The leaves of *Senna occidentalis* (L.) Link were collected from the lateritic zone of West Bengal, mainly from the district of Purba Medinipur, Paschim Medinipur and Purulia in the month of November and December. The source plants were taxonomically identified following Prain (1963)\(^19\). Herbaria of the species were also prepared and deposited in the departmental herbarium of Vidyasagar University. Collected leaves were shade dried for at least 48 hrs, pounded to prepare powder and were stored in a dry desiccator for further studies.

Pharmacognostic study

Fresh leaves were taken for morphological and anatomical studies and the pounded leaves for microscopical, physiochemical and phytochemical examinations. Quantitative studies of microscopic features of leaves of *S. occidentalis* were also carried out following the books of W. C. Evans (1996) and P. K. Lala (1993) \(^20,\) \(^21\).

Physiochemical and phytochemical analysis

Physiochemical studies like ash value, sulphated ash value, acid insoluble ash and water soluble ash, of the pounded leaf powder sample were carried out following K. R. Khandalwal (1999)\(^22\).

Fluorescence analysis

Leaf powder was treated with various organic and inorganic solvent and was analyzed under visible spectra, short and long ultra violet spectra to understand their florescence behavior according to C. K. Kokate (1994)\(^23\) and Mandal and Nandi (2013)\(^24\). In this study leaf powder shows different colours when it is treated with particular reagent and that reveals phytochemical nature of the sample.

RESULTS AND DISCUSSIONS

Morphological Studies

Leaves of the species collected were found to be 16 – 24 cm long and were pinnately...
compound with 4 – 5 pairs of leaflet. Petiole is 3.5 – 6 cm long with swollen base. Round extra floral nectar gland, blackish in colour, is present at the base of each leaf. A long groove like channel is present on the upper portion of the petiole and runs up to the apex of the leaf. The variation in the number of leaflet pair is found to be quite common, even a single plant bears leaves of both 4 and 5 pairs of leaflets. The size of the leaflets gradually decreases from the apices to base. The leaflets are shortly stalked; stalks hairy, margin entire, with acuminated apex. Whereas, the basal portion of the leaflets are found to be asymmetric. Venation is pinnate and surface texture leathery. An account of morphological and organoleptic studies of the leaf of *Senna occidentalis* is presented in the table 1 & 2.

### Table 1
**Organoleptic and Morphological properties of leaves of Senna occidentalis (L.) Link**

<table>
<thead>
<tr>
<th>No</th>
<th>Characters</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Colour</td>
<td>Deep Green</td>
</tr>
<tr>
<td></td>
<td>Upper Surface</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower Surface</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Odour</td>
<td>Penchant</td>
</tr>
<tr>
<td>3</td>
<td>Taste</td>
<td>Slightly bitter</td>
</tr>
<tr>
<td>4</td>
<td>Petiole</td>
<td>Length: 4.68±0.72 cm</td>
</tr>
<tr>
<td>5</td>
<td>Type of leaf</td>
<td>Pinnately compound</td>
</tr>
<tr>
<td>6</td>
<td>Leaf (Mature)</td>
<td>Length: 16-14 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Width: 12-8 cm</td>
</tr>
<tr>
<td>7</td>
<td>Leaflet</td>
<td>4-5 pairs</td>
</tr>
<tr>
<td>8</td>
<td>Size of leaflet</td>
<td>Detail on table no 2</td>
</tr>
<tr>
<td>9</td>
<td>Margin</td>
<td>Entire</td>
</tr>
<tr>
<td>10</td>
<td>Apex</td>
<td>Acuminated</td>
</tr>
<tr>
<td>11</td>
<td>Base</td>
<td>Asymmetric</td>
</tr>
<tr>
<td>12</td>
<td>Venation</td>
<td>Pinnate</td>
</tr>
<tr>
<td>13</td>
<td>Stipule</td>
<td>Absent</td>
</tr>
</tbody>
</table>

### Table 2
**Leaflet size of Senna occidentalis (L.) Link**

<table>
<thead>
<tr>
<th>Leaflet No (from apices)</th>
<th>Range (cm)</th>
<th>Width (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>8.16±0.93</td>
<td>2.74±0.44</td>
</tr>
<tr>
<td>L2</td>
<td>6.57±0.61</td>
<td>2.58±0.38</td>
</tr>
<tr>
<td>L3</td>
<td>5.55±0.59</td>
<td>2.43±0.27</td>
</tr>
<tr>
<td>L4</td>
<td>4.44±0.63</td>
<td>2.23±0.41</td>
</tr>
<tr>
<td>L5*</td>
<td>3.59±0.81</td>
<td>1.91±0.51</td>
</tr>
</tbody>
</table>

*Not all the leaf of the specie of the population have 5th pair of leaflet.
Quantitative microscopical study
Results of quantitative microscopical studies are presented in the table no 3. Microscopic study of powder also reveals the presence of calcium oxalate crystals, xylem and phloem parenchyma cells and non-glandular types of trichomes. The microscopic pictures of different elements of leaf powders are displayed in fig 2.

Table 3
Pharmacognostic features of the leaves of Senna occidentalis (L.) Link

<table>
<thead>
<tr>
<th>No</th>
<th>Parameters</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Palisade ratio</td>
<td>7 - 10</td>
</tr>
<tr>
<td>2</td>
<td>Stomata frequency</td>
<td>160 - 210/mm²</td>
</tr>
<tr>
<td>3</td>
<td>Stomata index</td>
<td>22 - 31 %</td>
</tr>
<tr>
<td>4</td>
<td>Vein islet number</td>
<td>22 – 34/mm²</td>
</tr>
<tr>
<td>5</td>
<td>Veinlet termination number</td>
<td>16 – 22/ mm²</td>
</tr>
</tbody>
</table>

Fig 1: a) Leaf of S. occidentalis, with 4 pairs of leaflets. b) T.S. of midrib of S. occidentalis midrib. c & d) Leaflet surface showing venation pattern. e) Stomata and guard cell arrangement in upper surface of the leaflet. f & g) Clearing leaflet for the determination of palisade ratio and vein islet number.
Physiochemical study
Different physiochemical parameters like loss due to drying, ash value, sulphated ash value, and solubility in different solvents of the leaf powder of *Senna occidentalis* were recorded and their mean values are presented in the table 4.

Table 4
**Physiochemical characters of the leaves of Senna occidentalis (L.) Link**

<table>
<thead>
<tr>
<th>No</th>
<th>Parameters</th>
<th>Mean Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loss on drying</td>
<td>22.24%</td>
</tr>
<tr>
<td>2</td>
<td>Total Ash value</td>
<td>12.01%</td>
</tr>
<tr>
<td>3</td>
<td>Sulphated ash</td>
<td>3.07%</td>
</tr>
<tr>
<td>4</td>
<td>Water soluble ash</td>
<td>33%</td>
</tr>
<tr>
<td>5</td>
<td>Acid insoluble ash</td>
<td>4.5%</td>
</tr>
<tr>
<td>6</td>
<td>Water extractive values</td>
<td>19.1%</td>
</tr>
<tr>
<td>7</td>
<td>Ethanol extractive values</td>
<td>13.3%</td>
</tr>
<tr>
<td>8</td>
<td>Chloroform extractive values</td>
<td>6.5%</td>
</tr>
<tr>
<td>9</td>
<td>Acetone extractive values</td>
<td>9.4%</td>
</tr>
<tr>
<td>10</td>
<td>Ether extractive values</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

Florescence analysis of powder drug
A rough phytochemical screening of the leaf sample is obtained by examining its behavior against the application of different chemical reagents. The study confirms the presence of starch, alkaloid, and tannin in the powder. The presence of saponin and cardiac glycoside in very low quantity is also confirmed. The fluorescence behaviors of powder drug in contact with different chemical reagents have been studied in the presence of UV light (254nm and 366nm) and also in the visible spectrum, for preliminary screening of different phytochemicals in the sample; results of this study are presented in the table 5. Present findings comply with the earlier work in related species of the same genus.  

Table 5
**Properties of powder leaves of Senna occidentalis (L.) Link**

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Reagent</th>
<th>Observation</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Powder + Iodine</td>
<td>Greenish Brown</td>
<td>Presence of starch</td>
</tr>
<tr>
<td>2</td>
<td>Powder + HgCl₂</td>
<td>Blue colour not appeared</td>
<td>Absence of alkaloids</td>
</tr>
<tr>
<td>3</td>
<td>Powder + Ammonia</td>
<td>Light Pink Colour observed</td>
<td>Presence of cardiac glycoside in low amount</td>
</tr>
<tr>
<td></td>
<td>Powder + AgNO₃</td>
<td>Ppt formed</td>
<td>presence of protein</td>
</tr>
<tr>
<td>4</td>
<td>Powder + Picric Acid</td>
<td>Colour Changes</td>
<td>presence of alkaloid</td>
</tr>
<tr>
<td>5</td>
<td>Powder + Water (Shaking)</td>
<td>Foam appeared with low quantity</td>
<td>Presence of saponin in very low quantity</td>
</tr>
<tr>
<td>6</td>
<td>Powder + Conc H₂SO₄</td>
<td>Black colour appeared</td>
<td>Presence of starch</td>
</tr>
<tr>
<td>7</td>
<td>Powder + FeCl₃</td>
<td>Bluish Black colour appear</td>
<td>Presence of tannin</td>
</tr>
<tr>
<td>8</td>
<td>Powder + Conc HNO₃</td>
<td>Orange yellow colour appeared</td>
<td>Presence of starch</td>
</tr>
</tbody>
</table>
Table 6
Florescence properties of leave power of Senna occidentalis (L.) Link

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Treatment</th>
<th>Observation under normal light</th>
<th>Observation under Short wave length (254 nm)</th>
<th>Observation under long wave length (366 nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Powder as such</td>
<td>Light green</td>
<td>Greenish Brown</td>
<td>Blackish</td>
</tr>
<tr>
<td>2</td>
<td>Powder + 1(N) NaOH in Methanol</td>
<td>Yellowish green</td>
<td>Light brown</td>
<td>Bluish black</td>
</tr>
<tr>
<td>3</td>
<td>Powder + 1(N) NaOH in Water</td>
<td>Yellowish green</td>
<td>Yellowish</td>
<td>Dark brown</td>
</tr>
<tr>
<td>4</td>
<td>Powder + 50% HCl</td>
<td>Yellowish Green</td>
<td>Greenish Brown</td>
<td>Dark brown</td>
</tr>
<tr>
<td>5</td>
<td>Powder + 50% HNO₃</td>
<td>Greenish black</td>
<td>Dark black</td>
<td>Dark black</td>
</tr>
<tr>
<td>6</td>
<td>Powder + 50% H₂SO₄</td>
<td>Dark Brown</td>
<td>Blackish</td>
<td>Deep Black</td>
</tr>
<tr>
<td>7</td>
<td>Powder + Petroleum Ether</td>
<td>Greenish</td>
<td>Light Green</td>
<td>Dark Green</td>
</tr>
<tr>
<td>8</td>
<td>Powder + Chloroform</td>
<td>Greenish</td>
<td>Yellowish Green</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>9</td>
<td>Powder + Picric acid</td>
<td>Light Brown</td>
<td>Light Brown</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>10</td>
<td>Powder + 5% Ferric Chloride solution</td>
<td>Light Brown</td>
<td>Light Brown</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>11</td>
<td>Powder + 5% Iodine Solution</td>
<td>Yellowish green</td>
<td>Deep greenish brown</td>
<td>Blackish brown</td>
</tr>
<tr>
<td>12</td>
<td>Powder + Methanol</td>
<td>Light Green</td>
<td>Greenish Brown</td>
<td>Blackish</td>
</tr>
<tr>
<td>13</td>
<td>Powder + HNO₃ + NH₃</td>
<td>Yellowish Brown</td>
<td>Greenish Brown</td>
<td>Dark Brown</td>
</tr>
<tr>
<td>14</td>
<td>Powder + CH₃COOH</td>
<td>Light brown</td>
<td>Dark brown</td>
<td>Blackish brown</td>
</tr>
<tr>
<td>15</td>
<td>Powder + Acetic Acid</td>
<td>Greenish Brown</td>
<td>Deep greenish brown</td>
<td>Blackish brown</td>
</tr>
</tbody>
</table>

Fig 2: Powder microscopy studies of the Senna occidentalis (L.) Link leaves showing the following portion, a) portion of xylem vessel, b) phloem fiber, c) portion of tracheae or vessel d) phloem fibers and aggregated mass of calcium oxalate crystals, e) & f) portion of xylem parenchyma, g) trichome, h) phloem fiber, i) fragments of stomata and crystals of calcium oxalate.

CONCLUSION

Leaves of Senna occidentalis have been characterized in detail at different levels starting from the gross morphological level through micromorphological features, including characteristics of stomata, veins, trichomes, conducting tissues etc., physicochemical characters, even aided with FTIR. Even though any single or couple of characters may get similarity with those of other species, a combination of multiple or all
characters, thus revealed, would certainly help identify the species not only at a state of its normal configuration, but also when its leaves are pounded to powder form. Such pharmacognostic characterization will also enable to distinguish the original powder product of the species from any spurious adulterant.

ACKNOWLEDGEMENT

Financial assistance from the Department of Science & Technology, India for the award of DST- INSPIRE Fellowship to the author Sk Md Ismail Al Amin is gracefully acknowledged here.

REFERENCES

19. Prain D., Bengal plants: A list of the phanerogams, ferns and fern-allies indigenous to, or commonly cultivated in, the lower provinces and Chittagong, with definitions of the natural orders and genera and keys to the genera and species (Volume II). Botanical Survey of India (Calcutta), (1963).


