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## Research Article

# Assessment of Pharmacognostic Features and Phytochemical Constituents of *Senna occidentalis* (Linn.): Leaf

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### ABSTRACT

The study aimed to evaluate the pharmacognostical and phytochemical properties of *Senna occidentalis* linn (family- *Fabaceae*) leaves to explore its medicinal potential and establish quality control protocols. A thorough macroscopic and microscopic analysis revealed distinct morphological characteristics, including leaf shape, size, and venation pattern. The microscopic examination identified key features such as glandular trichomes, vascular bundles, and types of stomata, facilitating accurate identification and differentiation from other species. These pharmacognostical features play a crucial role in standardizing the plant material for use in herbal formulations. Phytochemical analysis was conducted to detect bioactive compounds present in the leaf, revealing the presence of several important secondary metabolites, such as alkaloids, flavonoids, saponins, tannins, phenolic compounds, and glycosides. These phytochemicals contribute to a range of therapeutic effects, including antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective properties. The results validate the traditional medicinal uses of *Senna occidentalis* in treating conditions like digestive issues and skin infections. This research not only emphasizes the pharmacognostical characteristics of the plant but also highlights its rich phytochemical composition, providing a scientific foundation for its medicinal applications. The detailed profiles of both pharmacognostical and phytochemical aspects are critical for ensuring the quality, safety, and effectiveness of *Senna occidentalis* in phytotherapeutic practices. The study also suggests the need for further clinical trials to assess its therapeutic potential in modern medicine.

## INTRODUCTION

Medicinal plants have been used to treat illnesses since ancient times (Gajalakshmi, 2012).

Medicinal plants have contributed a variety of plant-based therapeutic compounds to modern medical practices (MK Oladunmoye, 2009).

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Nearly 80% of the global population is found in low- and middle-income nations, where they often rely on plant-based resources for primary healthcare. Medicinal plants now play an essential role in scientific advancement and hold significant untapped potential (Chandaka Lavanya, 2018). Various phytochemicals present in medicinal plants can be utilized now or in the future to address chronic and infectious diseases (Veeramuthu Duraipandiyar, 2006). Herbal plants such as *Senna occidentalis* are commonly used by people in tropical and subtropical regions to treat a range of illnesses. It offers several therapeutic benefits in traditional medicine (J P Yadav 1, 4 June 2010).

### Plant profiles

#### Taxonomical Classifications:-

The taxonomical classifications of *senna occidentalis* (L.) is describe as following.

Kingdom	:-	Plantae (Plants)
Phylum	:-	Streptophyta
Class	:-	Equisetopsida
Subclass	:-	Magnoliidae
Order	:-	Fabales
Family	:-	<i>Fabaceae</i> (Legume family)
Subfamily	:-	Caesalpiaceae
Genus	:-	<i>Senna</i>
Species	:-	<i>Senna occidentalis</i> (L.)
Synonym	:-	<i>Cassia occidentalis</i> (L.)

#### Morphological studies:-

*Senna occidentalis*, commonly known as Coffee Senna or Chakunda, is a tropical species in the *Fabaceae* family. It typically grows as a short-lived perennial or an annual herb, reaching heights up to 2 meters, though it usually ranges between 50 cm and 1 meter tall. The plant has a taproot and gives off a strong, unpleasant smell from its leaves. Its leaves are alternate, compound, and paripinnate, measuring 10–15 cm in length, with oval to elliptical leaflets that are 3–8 cm long and 15–40 mm wide. At the base of the leaf stalks are small, triangular stipules measuring 2–4 mm. The plant bears flowers that are 1.5 to 3 cm across, appearing singly or in clusters of 2–5 at the ends of branches. Each flower consists of 5 green, elliptical sepals, 5 yellow, oval petals (around 13 mm long), 10 stamens (6 of which are fertile), and a smooth, curved ovary with a recurved, hairy stigma. Its fruit is a curved, flattened pod measuring 10–15 cm in length and 7–8 mm in width, turning beige as it matures. Inside, it holds 20–30 oblong brown seeds, each about 4 mm long and 3 mm wide, which rattle when shaken (Reda, 2007).

#### Literature review:-

*Senna occidentalis*, known in Ghana as 'Mmofraborodee' in Tiwan 'Devidevikpelimumu' in Ewe, is a pantropical plant widely distributed across open areas such as wastelands, rural communities, urban settings, and roadside locations. Although the seeds are the primary focus of use, the leaves and roots of the plant are also utilized for various purposes (JK.Francis., 2002)





Fig-1(a)



Fig-2(b)



Fig-3(c)

Figure-1(a,b,c): Plant and its part of *Senna* (Chakunda)**Traditional uses:-**

Almost all parts of the *Senna occidentalis* plant (leaf, root, seeds) are used for food and medicinal purposes by tribal populations in India. However, the consumption of Bana Chakunda seeds has been linked to cases of acute encephalopathy, which has caused the deaths of tribal children (see Acute HME syndrome). Once the plant's role in these deaths was identified, the number of fatalities significantly decreased.

**Chemical constituents:-**

Phytochemical investigation of *Senna occidentalis* led to the isolation of various compounds, many of which were reported for the first time and primarily belong to the glycoside class. Key constituents identified in the plant include achrosin, aloe-emodin, and emodin (Anton R, 1968), similarly another study identified several compounds in *Cassia occidentalis*, including

anthraquinones, anthrones, apigenin, aurantiobtusin, campesterol, cassiollin, chryso-obtusin, chrysophanic acid, chrysarobin, and chrysophanol (Kudav NA, 1974). An additional study on the phytochemical composition of *Senna occidentalis* found that the variety and concentration of phytochemicals are influenced by the climate. For instance, samples from the Ivory Coast in Africa revealed only minimal quantities of saponins in the stems, leaves, and root bark, with no detectable levels of alkaloids, sterols, triterpenes, quinones, tannins, or flavonoids. However, a considerable amount of alkaloids was found in the stems, leaves, and fruits from Ethiopia (Smolenski IJ, 1975).

**Pharmacological Activities:-**

The pharmacological activity of *Senna occidentalis* linn was listed in table 1.

Sr. No	Activity	Extract Type/Part's Used	Methodology
1.	Antimicrobial activity	Leaf extracts in different solvents (especially hexane).	High activity on <i>E.coli</i> at 900–1000 mg; Hexane extract active at 500-1000mg. No activity on <i>P. multocida</i> , <i>S. typhi</i> , <i>S. Typhimurium</i> , <i>S. pyogenes</i> , <i>S. pneumoniae</i> (SAGANUWAN, 2006; 3(3))
2.	CNS depressant	Ethanol extract of leaves.	CNS depressant effect, and serve as a good sedative by using Beam walking test for motor deficits. (A. Ukwubile cletus, 2017).
3.	Anti-inflammatory activity	Methanolic extract of <i>Cassia italica</i> leaves; petroleum ether + ethyl	Reduced edema in animal models; 400 mg/kg reduced paw edema by 36.68%; writhing inhibition at 200 mg/kg (39.9%) and

		acetate+methanol extract of <i>C. occidentalis</i> leaves	400 mg/kg (52.4%) (Thangapandian, 2013), (Kanakam, 2013).
4.	Anticonvulsant activity	Chloroform extract of whole plant	Showed significant anticonvulsant activity in MES and PTZ seizure models (Mahanthesh M C, 2016).
5.	Anti-diabetic activity	Aqueous leaf extract	Significantly reduced fasting blood glucose in normal and diabetic rats (Laxmi Verma, 2010), (Onakpa MM, 2012).
6.	Nephroprotective activity	70% hydroalcoholic extract (HACO)	Protected against gentamicin-induced nephrotoxicity, improved urinary/ blood parameters, showed antioxidant effects ( $\uparrow$ GSH, SOD, catalase; $\downarrow$ LPO) (Gowrisri M, 2012).
7.	Antitrypanosomal activity	Ethanol leaf extract	In vitro activity against <i>T. brucei brucei</i> ; abolished parasite motility within 10 min at 6.66 mg/ml (Ibrahim MA, 2010).
8.	Myostimulant effect	Leaf extract	Increased rhythm and amplitude of isolated intestinal muscle contractions (Mea Arsene, 2017).

## MATERIAL METHODS:

### Collection and Authentication of plant:-

Fresh, mature, *Senna occidentalis* (L.) were are collected from the Husainganj, Belaisa, Azamgarh, Uttar-Pradesh, India in December 2024. The plant was further identified and authenticated from the department of Botany, Banaras Hindu University, Banaras, India by a Voucher Specimen no. Faba. 2024/01.

### Preparation of Plant Materials:-

The fresh leaves of *Senna occidentalis* Linn. (chakunda) plant are collect from Husainganj, Belaisa, Azamgarh. Then wash the leaves with water, dry at room temperature for 1 to 2 weeks. The dry leaves are grinding by using mortar - pestle and leaves for convert in to powder sample.

### Microscopy of *senna occidentallis*:-

#### Leaves:

The *Senna occidentalis* linn. To provide enough moisture for section cutting, (chakunda) leaves

were soaked in water. Thin transverse sections of leaves were made by hand and gathered in a water-filled borosilicate Petridis plate. The most excellent parts were desired, glycerine-mounted on a glass slide, covered with a slip, then examined under a light microscope. The presence of some anatomical characters and features were noted and photographed. (Organisation, 1998. )

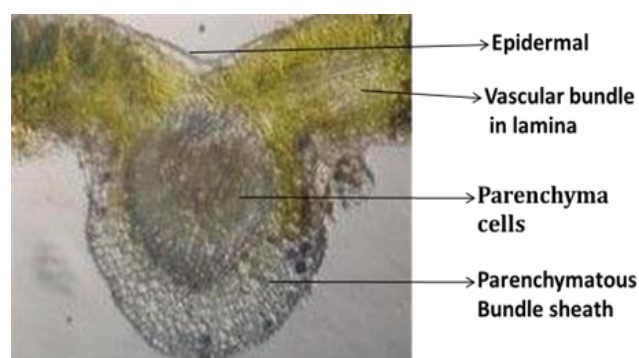


Figure-2:T.S. Section of *Senna occidentalis* linn (leaf)

#### Powder Microscopy:-

The *Senna Occidentalis* Linn. leaf powder was prepared by grinding by using mortar-pestle. Then the powder was placed on a glass slide, mounted

in glycerine and observed under the microscope for the examination of microscopic features (Organisation, 1998. ).



**Fig-3: (a) Fig-3: (b)**

**Figure-3: Powder Microscopy of *senna occidentalis linn***

### Physicochemical properties:-

The physic-chemical parameters of *senna occidentalis linn* like as: a total ash, moisture content, swelling index, foaming index, bulk density, tapped density, angle of repose, hausner ratio, and Carr's index extractive value was performed according to the standard methods (Mukherjee, 2002) (Manufacturers Association, 2002) (Lachman L, 1991).

### Determination of Ash value:-

#### Total Ash value:-

Weigh 2-4g of air-dried material and place it in a pre-ignite crucible (silica or platinum). The material is evenly distributed and steadily heated to 500-600°C until the ash turns white, indicating that carbon has been completely removed. Allow the crucible to cool in a desiccator and then weigh it. If carbon-free ash is not produced, add 2 mL of water or a saturated ammonium nitrate solution to the residue. Dry the sample in a water bath, then place it on a hot plate and ignite until the weight remains constant. After cooling for 30 minutes in a desiccator, weigh the sample right away. Finally, determine the total ash content in millilitres per gramme of air-dried material.

### Determination of Foaming Index:-

Using a 125-mesh sieve, grind around 1g of plant material into a coarse powder and weigh it. Pour 100 ml of boiling water into a 500 ml conical flask, add the powder, and bring to a moderate boil for 30 minutes. Transfer the mixture to a 100 ml volumetric flask once it has cooled, then dilute it with water to the appropriate volume. Fill ten stoppered test tubes with the decoction. tube in increments of 1 ml, 2 ml, 3 ml, and so forth, up to 10 ml each (16 cm height, 16 mm diameter). Fill each tube with 10 ml of water, close the tubes, and shake them back and forth for 15 seconds at a rate of two shakes per second. Let the tubes stand for 15 minutes before measuring the foam height.

### Determination of Swelling Index:-

Perform a minimum of three simultaneous determinations for every sample. Before being added to a 25 ml glass-stoppered measuring cylinder, the proper quantity of plant material needs to be precisely weighed and finely pulverised. The cylinder ought to have an approximately 16 mm in diameter on the inside, and a graduated section of 125 mm in length with 0.2 ml divisions ranging from 0 to 25 ml. Pour 25 ml of water into the measuring cylinder, and for one hour, shake vigorously every ten minutes, unless the test method specifies otherwise. Allow the mixture to remain at room temperature for three hours after shaking, or as directed. Determine the volume in millilitres that the plant material-including any mucilage-occupys. Finally, average the individual determinations per 1g of plant material.

### Determination of Moisture content:-

Approximately 2g of powdered medication was carefully weighed into a tared porcelain dish that had been pre-dried at 105°C in a hot air oven until it attained a steady weight before being weighed.

The percentage loss in drying relative to the air-dried substance was determined and recorded based on the weight difference.

$$\% \text{ Moisture content} = \frac{\text{Total moisture content}}{\text{Total wt. of powder}} \times 100$$

#### **Bulk Density and Tapped Density:-**

In this investigation, 20 gm of shade-dried and pre-sieved powder were precisely measured and introduced into a measuring cylinder with the help of a funnel to avoid any material loss. The initial volume observed was taken as the bulk density. The cylinder was then tapped repeatedly until the powder settled completely and no further change in volume was seen. The final volume after tapping was used to determine the tapped density.

#### **Carr's Index:-**

Carr's Index serves as an indirect technique for evaluating the flow characteristics of powders, derived from their bulk density. Introduced by Carr, this method measures the compressibility of a powder, which is indicative of its ability to form stable arches or bridges. The compressibility percentage is calculated by using the following equation.

$$\text{Carr's index (\% compressibility)} = 1 - \frac{D_b}{D_t} \times 100$$

Where:- $D_t$  = Tapped density,  $D_b$  = Bulk density.

#### **Hausner Ratio:-**

The Hausner Ratio is an indirect approach for evaluating powder flow properties, using bulk density values.

$$\text{Hausner ratio} = \frac{D_t}{D_b}$$

Where,  $D_b$  is the bulk density and  $D_t$  is the tapped density.

#### **Angle of repose:-**

For the determination of the angle of repose, it is typically used funnel method is used, the powder sample were poured through the funnel that is fixed in place with its lower tip positioned exactly 2.0 cm above a hard surface touched the lower edge tip of the funnel. The pouring continues until the upper rim of the funnel is reached. The angle of repose was calculated using the following formula.

$$\text{Angle of Repose } (\theta) = \tan^{-1} \frac{h}{r}$$

Where,  $h$ =height of pile (cm),  $r$  = radius (cm)

#### **Determination of Extractive value:-**

##### **Water soluble extractives:-**

In a sealed conical flask, 2 grammes of coarsely ground, air-dried plant material were macerated with 50 millilitres of water for 24 hours. The mixture was stirred regularly for the first 6 hours and left undisturbed for the last 18 hours. After that, a Whatman filter was used to filter the mixture. A 25 ml sample of the filtrate was dried at 105°C, weighed, and evaporated to dryness in a petri dish. The weight of the air-dried material was used to determine the percentage of water-soluble extractives.

##### **Alcohol soluble extractives (Methanol):-**

In a tightly sealed conical flask, 2 grammes of coarsely ground, air-dried plant material were macerated with 50 millilitres of 70% methanol for 24 hours. The flask was shaken repeatedly for the first 6 hours and left undisturbed for the following 18 hours. After that, the mixture was rapidly filtered to lessen the evaporation of methanol. A 25 ml sample of the filtrate was dried at 105°C, weighed, and evaporated to dryness in a petri dish. A percentage of the weight of the air-dried plant material was used to determine the extractive content that was soluble in alcohol.



**n-Hexane:-**

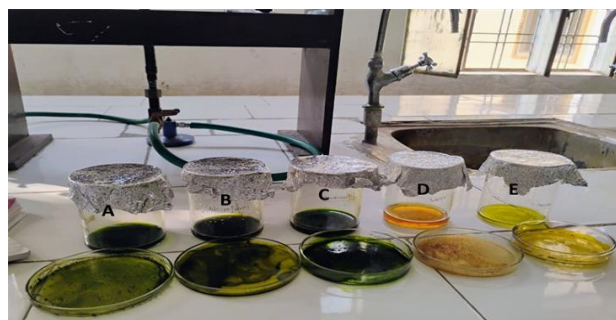
For 24 hours, 2 grammes of coarsely ground, air-dried plant material were macerated with 50 millilitres of n-hexane in a sealed conical flask. For the first 6 hours, the mixture was stirred frequently, and for the last 18 hours, it was left undisturbed. The mixture was thereafter quickly filtered to reduce the n-hexane loss. After being dried at 105°C, a 25 ml sample of the filtrate was weighed after being evaporated to dryness in a petri dish. In relation to the weight of the air-dried sample, the percentage of n-hexane-soluble extractives was computed.

**Chloroform:-**

Two grammes of coarsely ground, air-dried plant material were macerated with fifty millilitres of chloroform for twenty-four hours in a sealed conical flask. The flask was shaken periodically for the first six hours and left undisturbed for the remaining eighteen hours. Following a quick filtering of the mixture, being cautious to reduce the loss of chloroform. After being dried at 105°C and evaporated to dryness on a petri dish, a 25 ml sample of the filtrate was weighed. In relation to the weight of the air-dried material, the proportion of chloroform-soluble extractives was determined.

**Acetone:-**

In a sealed conical flask, 2 grammes of coarsely ground, air-dried plant material were macerated with 50 millilitres of acetone for 24 hours. The flask was shaken regularly for the first 6 hours and left undisturbed for the next 18 hours. After then, the mixture was promptly filtered to reduce the loss of acetone. A 25 ml sample of the filtrate was dried at 105°C, weighed, and evaporated to dryness in a petri dish. The weight of the air-dried sample was used to calculate the proportion of acetone-soluble extractives.



**A=Acetone, B=chloroform, C=Methanol,  
D=Water, E=n-Hexane**

**Figure-4: Extractive value**

**Fluorescence characteristics:-**

The leaf sample exhibited notable fluorescence characteristics. It appeared green in color, and its solvent extracts showed distinct fluorescence responses under both visible and ultraviolet (UV) light. The shade-dried powdered sample of *Senna occidentalis* (L.) demonstrated clear and characteristic fluorescence behavior, as presented in the accompanying data (Table-4).

**Extraction of *senna occidentalis linn* leaf:-**

Take total weight of **35gm** of powdered plant material was extracted using **500 mL of solvent**, consisting of **400 ml methanol** and **100 ml water (4:1)**. The extraction was carried out in a **Soxhlet apparatus** at a maintained temperature of **65°C** for **24-36 hours**. After extraction, the extracts were filtered and concentrated before being employed in qualitative phytochemical analysis.



**Fig-5: Extraction of *Senna occidentalis* linn leaf (Soxhlet apparatus)**

### **Preliminary Phytochemical Analysis:-**

The preliminary analysis involved testing for the presence of carbohydrates, amino acid, flavonoids, alkaloids, steroids, tannins, glycosides, terpenoids, saponins and phenols (Khandelwal, 2006.), (ZB, 1975), (Trease GE, 1989) (A, 1993; 289).

### **Test for Carbohydrate:-**

#### **Molish's Test:**

Add a few drops of  $\alpha$ -naphthol solution in alcohol to two to three millilitres of the aqueous extract, then shake gently. Then, without mixing, add concentrated sulphuric acid to the test tube's side. At the junction of the two layers, a violet ring appears, indicating the presence of carbs.

### **Test for Amino Acid:-**

#### **Ninhydrin Test:**

For ten minutes, heat three millilitres of the test solution with three drops of 5% ninhydrin solution. Free amino acids are indicated by the appearance of a purple or bluish tint.

### **Test for Flavonoids:-**

#### **Shinoda Test:**

Add around 0.5 g of magnesium turnings, 5 ml of 95% ethanol, and a few drops of strong hydrochloric acid (HCl) to a tiny amount of the dry powder or extract. When flavonoids are present, a pink or reddish colouration develops.

### **Test for Alkaloids:-**

#### **Dragendorff's test:**

Dragendorff's reagent was added in a few drops to two to three millilitres of the filtrate. Alkaloids were present because an orange-brown precipitate appeared.

### **Test for Steroids:-**

#### **Salkowski reaction:**

After adding two millilitres of chloroform and two millilitres of concentrated sulphuric acid, take two millilitres of the extract. Shake the ingredients gently. The presence of steroids and triterpenoids is confirmed by the development of a red colouring in the chloroform layer and greenish-yellow fluorescence in the acid layer.

### **Test for Tannins:-**

Add two to four drops of 5% ferric chloride solution to two to three millilitres of the alcoholic/aqueous extract. The presence of tannins is indicated by the creation of a deep blue/black colour.

### **Test for Glycoside:-**

#### **Test for cardiac glycoside:**

Legal's test (Test for cardenoloids):

Add 1 millilitre of pyridine and 1 millilitre of nitroprusside solution to the alcoholic/aqueous

extract. The development of a pink to red colour indicates the presence of cardenolides.

### Test for Saponins:-

Five millilitres of distilled water were used to boil 0.2 grammes of leaf extract, which was

subsequently filtered. Three millilitres of distilled water were added to the filter, and the mixture was violently agitated for approximately five minutes. When heated, persistent foaming was interpreted as proof that the presence of saponins.

## RESULTS

### Physicochemical properties:-

S/N	Physicochemical parameter	Result
1.	Total ash value	10%
2.	Foaming index	Null
3.	Swelling index	0.03%
4.	Moisture content	10%
5.	Bulk density	0.11 g/ml
6.	Tapped density	0.14g/ml
7.	Carr's Index	21.42%
8.	Hausner Ratio	1.27
9.	Angle of repose	26.57

### Extractive value:-

S/N	Extractive value	Result (%)
1.	Water soluble	6.5%
2.	Alcohol soluble (methanol)	4%
3.	n-Hexane soluble	1.5%
4.	Chloroform soluble	1%
5.	Acetone soluble	3.5%

### Fluorescence Analysis of leaf:-

S. No.	Solvent	Visible	Short UV (100-280nm)	LongUV (315-400nm)
1.	Acid ( H <sub>2</sub> SO <sub>4</sub> )	Light green	Dark green	Yellow
2.	Petroleum ether	Dark green	Dark green	Black
3.	Chloroform	Black	Black	Black
4.	Ethyl acetate	Black	Dark green	Dark green
5.	Hydrogen peroxide	Dark green	Light green	Dark green
6.	Benzene	Dark green	Light green	Black
7.	Methyl salicylate	Black	Light green	Popinjay green
8.	Light paraffin	Dark green	Light green	Dark green
9.	Thioglycolic acid	Dark green	Light green	Light green
10.	Water	Pale brown	Brown	Dark brown

**Preliminary Phytochemical Analysis:-**

S/N	Phytochemicals	Abundance
1.	Carbohydrate	+
2.	Amino Acid	+
3.	Flavonoids	+++
4.	Alkaloids	+++
5.	Steroids	++
6.	Tannin	++
7.	Glycosides	+++
8.	Saponin	+++
9.	Terpenoids	+++

**Key: + -low concentration; ++ - moderate concentration; +++ -high concentration.**

**CONCLUSION**

The present study successfully highlights the pharmacognostical and phytochemical properties of *Senna occidentalis* Linn., offering valuable insights into its potential as a medicinal plant. The detailed macroscopic and microscopic evaluations provide definitive identification features essential for standardization and quality control in herbal formulations. The presence of key secondary metabolites such as alkaloids, flavonoids, tannins, and glycosides underscores the plant's therapeutic potential, supporting its traditional use in managing various ailments. These findings lay a scientific foundation for the development of safe, effective phytotherapeutic products derived from *Senna occidentalis*. However, further pharmacological and clinical investigations are warranted to fully validate its efficacy and safety in contemporary medicine.

**DISCUSSIONS**

Phytochemical screening of *Senna occidentalis* Linn leaves revealed a variety of bioactive compounds such as tannins, alkaloids, glycosides, flavonoids, steroids, terpenoids, amino acid and carbohydrates. These results underscore the plant's potential medicinal value due to its abundance of therapeutic constituents. Furthermore, the leaves exhibited fluorescence,

supporting the presence of biologically active substances.

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