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Preliminary Evaluation of Pharmacognostic, Physicochemical, And Phytochemical Properties of Sansevieria Whitney Leaves

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ABSTRACT

The study examines the pharmacognostic, physicochemical, and phytochemical properties of Sansevieria whitney leaves, a medicinal plant with potential therapeutic benefits. The leaves have an erect, sword-like morphology with parallel venation and no petiole. Microscopy reveals diagnostic features like tetracytic stomata, collateral vascular bundles, lignified sclerenchymatous fibers, and acicular calcium oxalate crystals and Powder microscopy confirms fibers, annular vessels, colored content, and epidermal cell inclusions. Physicochemical investigations reveal a total ash value of 11.3%, acid-insoluble ash of 0.11%, and water-soluble ash of 1.0%. The hydroalcoholic extract showed the highest extractive value of 5.8%w/w. The hydroalcoholic extracts contained secondary metabolites like alkaloids, flavonoids, terpenoids, steroids, phenols, saponins, and carbohydrates, while glycosides, proteins, and tannins were absent. These findings support the plant's traditional medicinal claims and provide a baseline for further pharmacological, toxicological, and clinical investigations.

KEYWORDS: Asparagacea, Pharmacognostic, Physiochemical study, Phytochemical screening,Sansevieria whitney,

INTRODUCTION

Medicinal plants have been crucial for both preventing and treating sickness since ancient times. They are significant source of molecules with therapeutic characteristics and contain phytochemical components that support the process. Plant based medications are being used more frequently in different parts of the world. Many plants have been found to have bioactive secondary metabolites in their roots; stems, fruits, and flowers A variety of these secondary metabolites provide for the medicinal potential of the plants, most notably the antimicrobial properties [1]

Sansevieria whitney plant, commonly known as snake plant or mother-in-law-tongue [1]. Sansevieria whitney plant is originated from S outh Africa but also cultivated in india. Sansevieria species is reported with various pharmacological properties including Anti-bacterial, Anti-oxidant, Anti-inflammatory, Anticancer and Anthelmintic properties. [2]

The leaves of Sansevieria species has been studied for its Anti-inflammatory, Anti-bacterial,Anti-oxidant, Anti-tumour activities and other phytochemical studies on leaves has shown that the presence of various phytoconstituents i.e saponins, flavonoids, phenolic compounds, steroids, terpenoids, alkaloids, tannins, glycosides may be causative for its anti- inflammatory, anti-bacterial and anti-oxidant activity .[1,2]

Scientific classification [1]

- Kingdom – plantae
- Phylum – Tracheophyta
- Class – Monocotyledons
- Order – Asparagales
- Family – Asparagaceae
- Subfamily – Nolinoideae
- Genus – Sansevieria
- Species – whitney
- Vernacular name: Snake plant

MATERIALS AND METHODS

Collection, authentification and drying of plant materials

Leaves of Sansevieria whitney were collected on 13 February 2025 from Thrithala, Palakkad, Kerala. Taxonomically identified and authenticated by the Botanist, Dr.Sreekumar VB,Principal Scientist and Head,Forest Botany Department,KSCSTE- Kerala forest Research Institute Peechi. and Dried under shade for 20-25 days, Coarsely powdered using mechanical grinder and stored in an air tight container

Pharmacognostical analysis

Macroscopic evaluation

In accordance with WHO Quality Control procedures for herbal medicine, an organoleptic evaluation of leaves has been conducted with regard to colour, size, odour, shape, taste, surface, and fracture. The inner and exterior surfaces of the plant material were observed using the magnifying lens. The visual inspections confirmed the colour and form. A measuring scale was used to determine the size of the plant leaves. A little portion of the crude drug was placed in a beaker, and the odour was detected by repeatedly inhaling air over the substance. The little piece of plant leaf was moderately compressed between the palms of the hands and fingers. Prior to studying odour sensitivity, the intensity of the odor was ascertained. Taste was decided in a unique way. [3, 4]

Microscopic evaluation

The leaves were cut into small pieces and placed in a test tube. It was filled with enough water and boiled for a few minutes. The softened leaf was cut transversely into fine sections, preferably through the midrib. Sections were cut by hand with a sharp blade. The Thin sections were placed on a clean glass slide and it is cleared using chloral hydrate solution. The mount was gently heated over a micro-Bunsen flame until the sections became transparent. To prevent chloral hydrate from crystallizing, a drop of glycerin was added. To stain a section, apply a few drops of phloroglucinol solution and let it dry for 5 minutes before adding HCl. The cover-slip was placed on the mount and it is examined through Labomed microscope. Several characteristics were investigated, including the nature of stomata, epidermis, and trichomes. The microscope used to study different characters was a Labomed 300x Binocular microscope. [3, 4]

Powder microscopy

The dried powder of leaves was studied for microscopic characteristics. Powder were placed on a slide, apply a few drops of phloroglucinol solution and let it dry for 5 minutes before adding HCl. The cover-slip was placed on the mount and it is examined through a labomed microscope. Several characteristics were investigated, including fibres,raphides,annular vessels etc.. The microscope used to study different characters was a Labomed 300x Binocular microscope [3, 5]

Physiochemical evaluation

Moisture content

Moisture content of plant powder was determined by using loss on drying method. A moisture dish was used to remove moisture and volatile substances from a sample. It was first weighed on a calibrated balance and then added to a known quantity of the sample. The dish was then placed in a preheated hot air oven at 105°C ± 2°C for 3 to 4 hours, ensuring all moisture and volatile substances are removed. After drying, the dish was placed in a desiccator with a drying agent like silica gel and allowed to cool to room temperature for 30 minutes. The difference between the weight before and after drying is calculated and it represents the amount of moisture and volatile matter lost during the process. The percentage of moisture content present in powdered sample is calculated by using this formula. [3]

$$\text{Loss on Drying } (\%) = \frac{W2 - W3}{W2 - W1} \times 100$$

Ash value

(a)Total ash

Place 2g of dried leaf powder in a crucible and it is ignite at 500-600°C until it turns white colour. Cool in a desiccator and weigh. If carbon-free ash was not obtained, moisten the residue with water or ammonium nitrate. Dry on a water-bath and ignite on a hot-plate. Allow the residue to cool for 20 to25 minutes and then weighed the residue and calculate the total ash content by using the formula. [4, 7]

% Total ash = [Wt. of total ash / Wt. of crude drug taken] x 100.

(b) Acid-insoluble ash

To determine the content of acid-insoluble ash in air-dried material, add hydrochloric acid to a crucible containing total ash, boil for 5 minutes, and then rinse with hot water. Collect the insoluble matter on a filter paper, wash, and dry. Place the residue in a desiccator and it was cool and weiged.and Calculate the acid-insoluble ash content in mg per g of air-dried material. [4, 7]

% Acid insoluble ash = [Wt. of acid insoluble ash / Wt. of crude drug taken] x 100.

(c) Water soluble ash

25ml of water is taken in a crucible containing total ash and boiled it, after that collect the insoluble matter, wash, and ignite at 450°C for 20 minutes. Subtract residue weight from total ash, and calculate water-soluble ash content per g of air-dried material. [4, 7]

% Water soluble ash = [Wt. of total ash -Wt. of water insoluble ash / Wt. of crude drug] x 100.

Extractive value

(a) Water soluble extractive value

5g powder drug and 100 ml of water were mixed in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was noted and calculated as per the formula and expressing extractive value in % (w/w). [2,6, 7]

(b) Ethanol soluble extractive value

5g powder drug and 100 ml of ethanol were mixed in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was noted and calculated as per the formula and expressing extractive value in % (w/w). [2,6, 7]

(c) Ethyl acetate soluble extractive value

5g powder drug and 100 ml of ethyl acetate were mixed in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was noted and calculated as per the formula and expressing extractive value in % (w/w). [7]

(d) Chloroform soluble extractive value

5g powder drug and 100 ml of chloroform were mixed in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was noted and calculated as per the formula and expressing extractive value in % (w/w). [7]

(e) Benzene soluble extractive value

5g powder leave and 100 ml of benzene were mixed in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was noted and calculated as per the formula and expressing extractive value in % (w/w). [7]

(f) Toluene soluble extractive value

5g powder drug and 100 ml of toluene were mixed in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was noted and calculated as per the formula and expressing extractive value in % (w/w). [7]

(g) Hexane soluble extractive value

5g powder drug and 100 ml of Hexane were mixed in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was noted and calculated as per the formula and expressing extractive value in % (w/w). [7]

(i) Petroleum ether soluble extractive value

5g powder drug and 100 ml of petroleum ether were mixed in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was calculated, expressing the extractive value in % (w/w). [7]

(j) Hydro-alcohol soluble extractive value

5g powder drug taken were mixed with 100ml of hydro-alcohol (40:60,30:70and 20:80) in a conical flask for 24 hours, filtered and the filtrate was then transferred to a porcelain dish, dried and the weight difference was calculated, expressing the extractive value in % (w/w). [7, 2]

Swelling index

Weighing a powdered drug material into a 25-ml glass-stoppered cylinder, adding sufficient quantity of water, shaking it every 10 minutes for 1 hour, and allowing it to stand for 3 hours. The volume of plant material, including any mucilage, is then measured. [4]

Foaming index

To determine the foaming index of the plant material, about 1g of plant material converted to a coarse powder then weigh it accurately, and placed it to a 500-ml conical flask that containing around 100ml of boiling water and it was Boiled for 30 minutes, cool and filter, Dilute the decoction in a 100-ml volumetric flask AND Pour the decoction into 10 stoppered test tube and adjust the volume with distilled water, and shake each test tube for 15 seconds and finally measure the height of the foam in each test tubes and determine the foaming index.

If the foam height is less than 1 cm, the foaming index is less than 100. If the foam height is 1 cm, use the volume of the plant material decoction in the tube to determine the index. If the foam height is above1000, again repeating the procedure using a new series of dilutions in order to get an accurate result. [4]

Calculate the foaming index by using the formula:

1000/a

a = the volume in ml of the decoction

Foreign organic matter

Foreign organic matter was determined by accurately weighed powder spread to a thin layer on a tile and observe with the eye after using lens, it was identified, separated and weighed.

Phytochemical studies

EXTRACTION

EXTRACTION DONE BY MACERATION

Plant material was crushed in to small or moderately coarse powder. From this 12.5g of powder placed in a closed vessels, 250ml of menstrum (Hydro alcohol (20:80)) was added. Allow to stand for 7 days shaking occasionally. Liquid strained off and Solid residue pressed. Strained and expressed liquid mixed and Evaporation and concentration.[8,9]

Qualitative phytochemical screening

Preliminary phytochemical screening [10]

The hydro alcoholic extract was subjected to preliminary phytochemical screening using various reagents. The tests for the presence or absence of various primary and secondary metabolites like carbohydrates, proteins, phenols, flavonoids, glycosides, alkaloids, tannins, and saponins were carried out.

3. RESULT

Authentication of plant

Fresh plant of Sansevieria whitney was collected and authenticated by the Botanist, Dr.Sreekumar VB,Principal Scientist and Head,Forest Botany Department,KSCSTE- Kerala forest Research Institute Peechi. The authentication certificate dated 16th february 2025 and confirmed that the plant species is Sansevieria whitney.

Pharmacognostic studies

(a) Macroscopic evaluation

Table no: 1 macroscopic characters of the leaves of the Sansevieria Whitney

Features	Observation
Colour	Green
Size	30 to 45 cm long and 5-6 cm width
Odour	No significant odour
Taste	Bitter and possibly unpleasant
Texture	Smooth, leathery texture
Shape	Erect, sword-like leaves
Petioles	No true petiole
Apex	Pointed and tapered, forming a sharp or slightly rounded tip.
Margin	vivid
Venation	Parallel

Fig no: 2 Fresh Sansevieria whiney leaf

Fig no: 3 Powder form

Macroscopic characters revealed that the leaf was green in colour, Bitter and unpleasant in taste, and there is no significant odour. The macroscopic analysis also revealed that the leaves of Sansevieria whitney are erect sword like leaves, and absent of petiole. Size about approximately 30 -45cm long and 5-6 cm wide with Parallel venation. These characteristics used for the identification of the plant species.

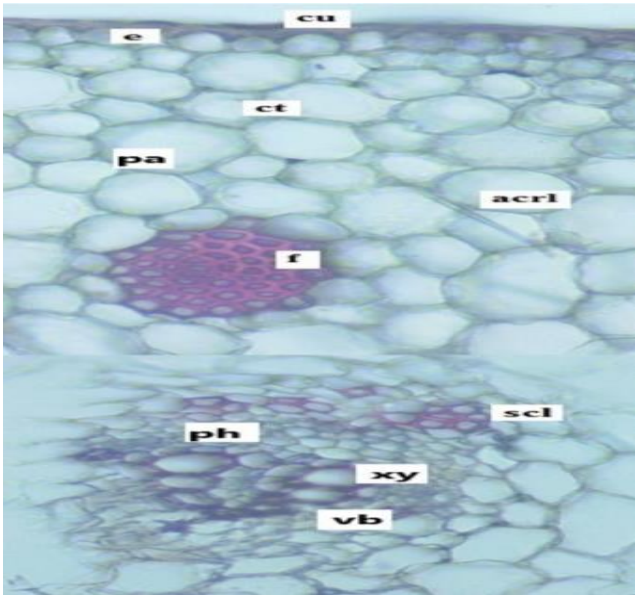
(b) Microscopic evaluation

The transverse section of the Sansevieria whitney leaf revealed the following anatomical features under the labomed 300 x microscope:

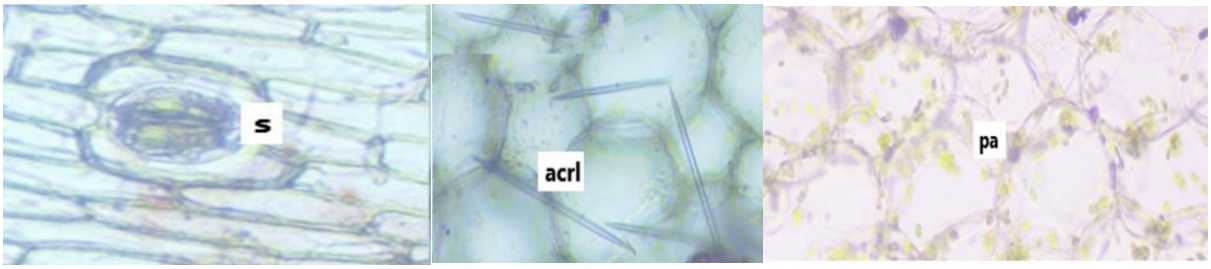
- **Epidermis**: A single layer of epidermis present on both upper and lower surfaces of the leaf covered with thick cuticle.
- **Stomata**: Tetracytic Stomata are present.

- **Vascular Bundles**: Collateral type of vascular bundles, arranged centrally in the midrib. Xylem located towards the upper epidermis and phloem towards the lower epidermis. Xylem and phloem provides mechanical support.
- **Sclerenchyma Cells**: Lignified sclerenchymatous fibers observed near the vascular bundles, providing structural support.
- **Acicular crystal of calcium oxalate**- needle shaped crystal present in leaf

Transverse section of Sansevieria whitney leaf



Cu- cuticle
e-Epidermis
Ct-cortex
Pa-parenchyma
acrl-acicular crystal of
Calcium oxalate
F-fibre
Scl-sclerenchyma
Ph-phloem
Xy-xylem
Vb-vascular bundle
Fig no-4 Transverse section of Sansevieria whitney leaf
Fig no-5 Cell inclusion of leaf lamina

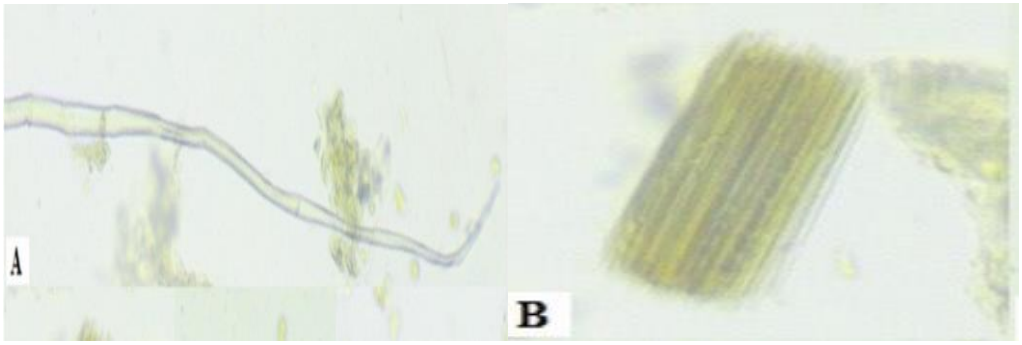


S-Tetracytic stomata **acrl-acicular crystal of calcium oxalate** **Pa-parenchyma**

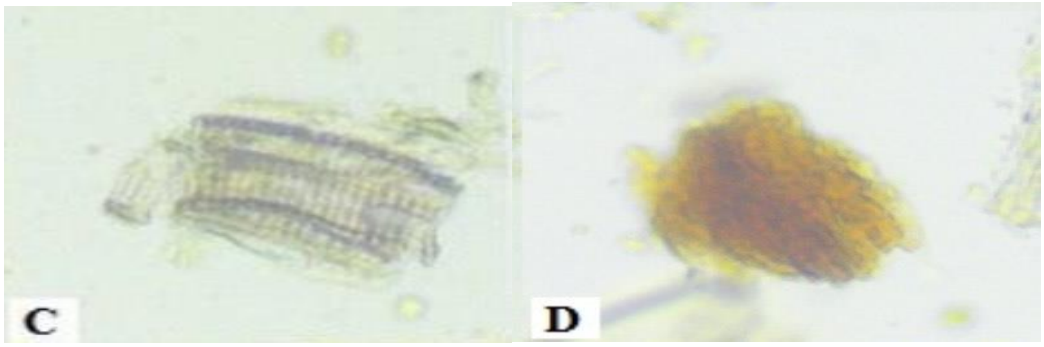
(c) Powder microscopy

Powder microscopy was used to identify and authenticate a powdered sample.the key feactures included long, elongated, thick-walled structures, amorphous pigmented matters, irregular shaped epidermal cells and stomatal complex structures. The analysis also revealed anomocytic type stomatal complex structure.

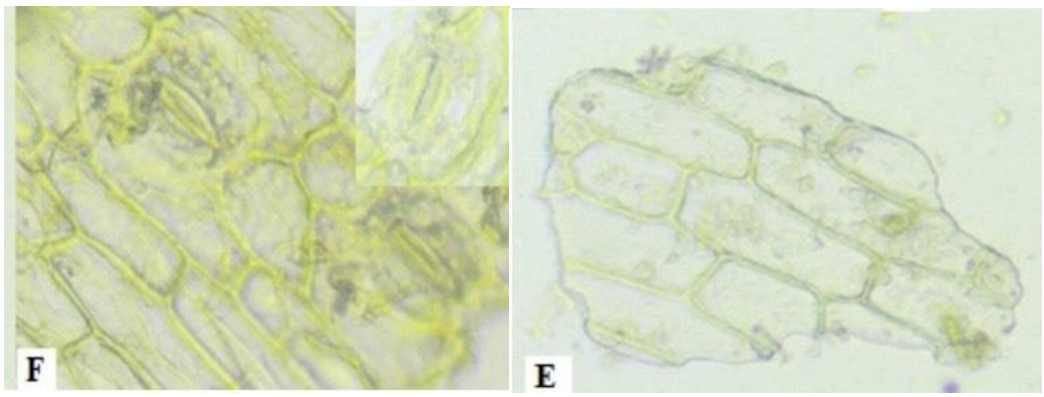
Fig no-6 Powder microscopy of Sansevieria whiney leaves



Fibres **Raphides**



Annular vessels **Coloured content**



Epidermal cells **Tetracytic stomata**

Physiochemical Evaluation

Determination of Ash value and Extractive value

The acid insoluble ash value (0.11%) was lower than the total ash value (11.3%) and water-soluble ash (1.0%), with 1.8% moisture content and no foreign organic matter. The water and ethanol, Ethyl acetate,chloroform,benzene,toluene,hexane and petroleum ether soluble extractive values were reported as 3.6%, 3.2%,2.4%,2.7%,1%,1.3%,0.5% and 0.002% respectively whereas, water and ethanol extractive value was reported as 3.6%. and 3.2%.

Fig no-7.Extractive value determination by using different solvents

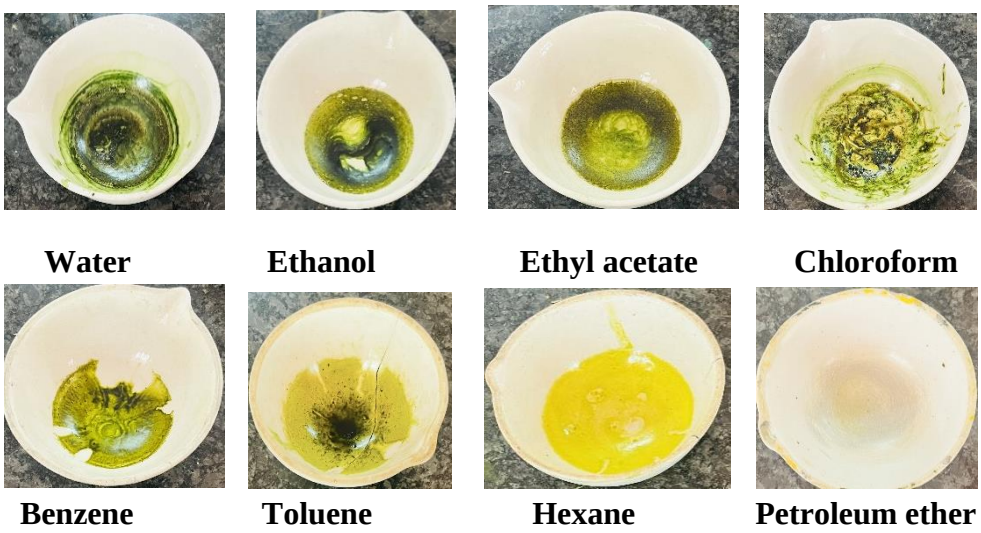
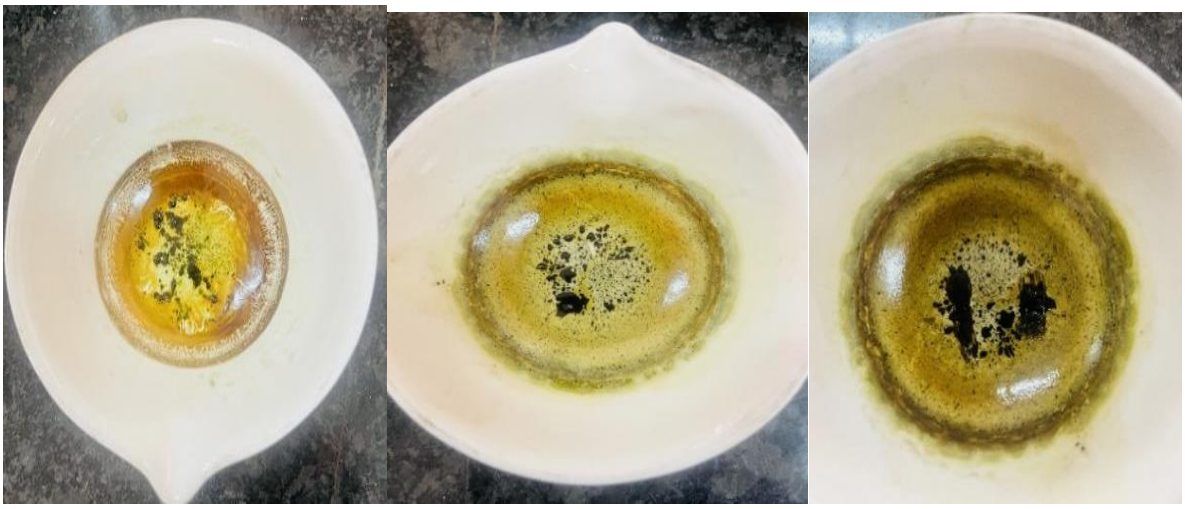


Table no: 2 physicochemical parameters of leaves of Cylindrical

Sl. No.	Physico-chemical constants	Result (% w/w)
I	Moisture content	2.46
II	Ash values:	
	a) Total ash	11.3
	b) Acid insoluble ash	0.11
	c) Water soluble ash	1.0
III	Extractive values:	
	water	3.6
	Ethanol	3.2
	Ethyl acetate	2.4
	chloroform	1.5
	Benzene	1
	Toluene	1.3
	n-hexane	0.5
	Petroleum ether	0.002

Due to the higher extractive value of alcohol and water, the hydro-alcoholic soluble extractive value was also determined by using different ratios of water and alcohol such as 30:60,40:70 and 20:80 whereas 20:80 ratio shows higher extractive value compared to other two

Fig-no -7 Hydro-alcoholic extractive value of plant extract



40:60 **30:70** **20:80**

Hydro alcoholic ratio (Ethanol: Water)	Extractive values(%W/W)
Hydro alcohol (40:60)	5.58
Hydro alcohol (30:70)	5.23
Hydro alcohol (20:80)	5.8

Table no: 3 Hydro-alcoholic extractive value of plant extract

Sl. No.	Physico-chemical constants	Result (% w/w)
IV	Foreign organic matter	Less than one
V	Swelling index	4ml
VI	Foaming index	> 1000

Table no:4 Physicochemical parameters of leaves of S.cylindrical

Phytochemical study

Extraction

Extraction done by maceration process and the extractive value was found to be **9.68%w/w.**

Phytochemical screening

Preliminary phytochemical screening results indicate the presence of flavonoids, alkaloids, phenols, steroids, terpenoids, carbohydrates and saponins.

Table no: 5 Phytochemical screening

Constituents	Observation
Carbohydrate	+
Alkaloid	+
Flavonoids	+
Proteins	-
Glycoside	-
Phenols	+
Tannins	-
Saponins	+
Steroids and terpenoids	+

(++) Abundance (+) Present, (-) Absent.

The result of phytochemical analysis have shown in the table. Phytochemicals like Terpenoids, carbohydrates, alkaloids, flavonoids and steroids, phenols are present in Sansevieria whitney but glycosides, tannins,proteins are absent.
The presence of different phytoconstituents in the plant are responsible for the different properties of the plant. In this study almost all the phytochemicals tested yield a positive results and this yields the plant medically significant.

SUMMARY AND CONCLUSION

The study examines the pharmacognostic, Phytochemical and physicochemical assessment of Sansevieria whitney leaves.The macroscopic analysis revealed that the leaves of Sansevieria whitney are erect sword like leaves, and absent of petiole. Size about approximately 30 -45cm long and 5-6 cm wide with Parallel venation. These characteristics used for the identification of the plant species.Powder microscopy identifies key diagnostic features, useful for botanical identification and quality control. Physicochemical parameters indicate drug purity and quality, with high total ash content and hydroalcoholic extract yielding more constituents. Preliminary phytochemical screening confirms the presence of secondary metabolites, including alkaloids, flavonoids, phenols, terpenoids and steroids.The pharmacognostic, physicochemical evaluation of Sansevieria whitney leaves will establish a standard for identification and authentication, aiding further investigations into its bioactivity, toxicity profile, safety, and efficacy in clinical studies.

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