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Pharmacognostic Standardization of the Leaves and Flowers of *Mucuna urens* L. (Fabaceae)

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ABSTRACT

Background: *Mucuna urens* is known for its soup-thickening and benefit in hemorrhoidal and asthmatic management. This study aimed to establish quality control parameters for the leaf and flower of *M. urens.*

Methods: Methods used included microscopy, micromeritics, chemomicroscopy, moisture content, ash values, extractive values, fluorescence, and phytochemical analyses.

Results: The leaf exhibited a hypostomatic stomatal distribution with paralytics, anisocytic, and anomocytic stomata on the abaxial surface. The stomatal index was 65.4% and stomatal number was 102.60. Micromeritics analysis of the leaf and flower samples showed poor flow properties with angles of repose of 40.75° and 42.49°, Carr's index of 41.31% and 31.70% and Hausner's ratios of 1.70 and 1.42 respectively. Chemomicroscopy identified mucilage, cellulose, starch, lignin and protein in the leaf while that of the flower were mucilage, cellulose, starch and lignin. Fluorescence analysis revealed solvent-dependent colour variations. Extractive values for water, methanol, and ethanol for the leaf and flower samples were: 16.7 % $^{w}/_{w}$, 16 % ($^{w}/_{w}$), 16 % ($^{w}/_{w}$), and 23.7 % ($^{w}/_{w}$), 18.7 % ($^{w}/_{w}$), 18 % ($^{w}/_{w}$), respectively. Moisture content for leaf and flower was 13% ($^{w}/_{w}$), and 17% ($^{w}/_{w}$). Phytochemical screening of the powdered leaf and flower revealed the presence of cardiac glycosides, saponins and tannin respectively but the leaf had alkaloid in addition.

Conclusion: These findings support the identification of *M.urens* establishing standards for quality, purity, safety, and efficacy in phytomedicine.

***Keywords*:** Hausner's ratio, Hypostomatic leaf, Micromeritics, Pharmacognostic standardization, *Mucuna urens,* Stomata

1. INTRODUCTION

Mucuna urens also called Horse-eye bean or Ox eye bean," is a climbing liana that grows primarily in the wet tropical biomes and native to West Indies and South America [1]. It belongs to the family Fabaceae and it's characterised by irritant hairs on seedpods and yellow flowers. It also has black dried seeds, and ovate leaves that climb into a canopy. The plant is rich in bioactive compounds like L-Dopa, amino acids, carbohydrate, alkaloids, saponins and tannins. Its high-water absorption capacity makes it a suitable thickening agent in the preparation of soups and baked products [2]. It is ethnomedicinally used to treat cholera, hemorrhoids, as anthelminthic, to relieve itching, sore and cramps. The seeds are a potent male anti fertility agent *Mucuna urens* has been used in traditional medicine for the treatment of Parkinsons disease and asthma [1,14, 15, 16]. Therefore, this study aimed to establish pharmacognostic and physicochemical standards for the leaves and flowers of *Mucuna urens* to ensure its quality, purity, and authentication.

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Classification of *M. urens* according to Angiosperm Phylogeny Group System (APG 2016) [14].

Kingdom:	Plantae
Clade:	Tracheophytes
Clade:	Angiosperms
Clade:	Eudicots
Clade:	Rosids
Order:	Fabales
Family:	Fabaceae
Subfamily:	Faboideae
Genus:	*Mucuna*
Species:	*Mucuna urens* Linn

Figure 1. *Mucuna urens* L. (Source: Field data (2024) NEPA Line Akamba Nsukara farm, Uyo, Akwa Ibom State, Nigeria.

2.0 MATERIALS AND METHODS

2.1 Materials

2.1.1 Biological Materials

Mucuna urens

2.1.2 Chemical and reagents

The chemicals and reagents used include; distilled water, glycerol, chloral hydrate, sodium hydroxide, 5% concentrated Hydrochloric acid, ferric chloride, concentrated sulphuric acid, dichloromethane, ethyl acetate, methanol, ethanol, n-hexane, Dragendorff's reagent, ferric chloride, phloroglucinol, ruthenium red, Millon's reagent, N/50 iodine, sodium hypochlorite.

2.1.3 Equipment and Apparatus

Materials used include: beaker, electronic weighing balance, test tubes, filter paper, oven, water bath, pen, pencil, funnel, glass stirrer, measuring cylinders, beakers, conical flash, sieves, spatula, marker, masking tape, foil paper, thongs, evaporating dish, silica gel, knife, mortar and pestle, desiccator, oven, furnace, ashless filter paper, electronic microscope, microscope slides, cover-slips, plain sheets, meter rule, Amscope MD 500.

2.2 Methods

2.2.1 Collection, Identification and Preparation of Plant Material

The leaves and flowers of the plant were collected in NEPA Line, Akamba Nsukara farm, Uyo, Akwa Ibom State, Nigeria in October 2024. It was identified by Dr I. I. Johnny of the Department of Pharmacognosy and Natural Medicine, Faculty of Pharmacy, University of Uyo. The voucher specimen number is UUPH A32(Zvi). The fresh leaves and flowers of the plant were air-dried, pulverized and packed in separate, well-labeled dry containers.

2.2.2 Microscopic Evaluation of Leaf

The standard median portion of the well-expanded matured leaf was obtained. Microscopical examinations of the transverse section were made, the Epidermis of both adaxial and abaxial surfaces were also made by placing the

leaf on a glass slide, scraping gently with a sharp razor blade, irrigated with water until loose cells from the epidermis were washed away and the desired epidermis was reached. The epidermal peels were further cleared with sodium hypochlorite rinsed gently with water and stained with an aqueous solution of safranin-O for (five) 5 minutes and mounted with 10% glycerol. The stained samples were mounted on a binocular microscope. Photomicrographs were taken from good preparations using the Olympus CX21 binocular microscope fitted with an MD500 amscope microscope eyepiece camera. Measurements were made at 10 while ×40 for photomicrographs.

2.2.2.1 Quantitative Microscopy of the Leaf

Quantitative microscopy parameters such as leaf constant studies namely stomatal length and width, guard cell length and width, stomatal number, stomatal index, epidermal cell length and width, epidermal cell number, epidermal cell thickness, trichome number were carried out using standard procedures. All measurements were made using a calibrated ocular micrometer and 10 microscopic fields chosen at random were used and data was presented as mean Standard Error of Mean (SEM) [3].

2.2.3 Stomatal Index Determination

The stomatal; index (SI) was determined using the formula:

SI = S/E+S ×100

Where S = Number of Stomata per unit area

E = the number of epidermal cells in the same area [3].

2.2.4 Evaluation of Powders

2.2.4.1 Micromeritic Analysis

The flow property was determined using standard methods [10]. Which consists of: Bulk Density and Tapped Density. The weight of 10 g of dried powdered leaf was weighed into a 100 ml measuring cylinder and the volume occupied was noted as the bulk volume (Vb). The cylinder was gently tapped repeatedly to obtain a constant volume noted as the tapped volume (Vt). Bulk density was calculated using the formula below;

$$B\rho = M / Vb$$

$$Tv = M / Tv$$

Where Bρ = Bulk density, M=Mass of powder, Bv = Bulk volume of powder, Tρ = Tapped density Tv = Tapped volume

2.2.4.2 Hausner's Ratio and Carr's index

Hausner's ratio, a function of interparticle friction, was calculated using the formula.

$$\text{Hausner's ratio} = Tp/Bp$$

$$\text{While Carr's index} = Tp - Bp/Tp \times 100$$

Where; Tp = Tapped density, Bp = Bulk density, Angle of repose(θ) = Tan-1 (Heap height of powder / Radius of heap base)

2.2.5 Chemomicroscopic Analysis of Leaf and Flower Powder

Powdered leaf and flower were examined for their chemomicroscopic properties namely mucilage, lignin, starch, oils, calcium carbonate and calcium oxalate crystals using standard procedures [4].

2.2.5.1 Fluorescence Analysis of Leaf Powders

The fluorescent analysis of dried leaf powder was carried out using the standard method [5].

2.2.5.2 Physico-chemical Evaluation of Leaf and Flower Powders

The physicochemical parameters such as moisture content, ash values (total ash, acid-insoluble ash and water-soluble ash values), soluble extractive values such as ethanol, methanol and water-soluble extractive values were performed according to the official method prescribed by the WHO guidelines on quality control methods for medicinal plant materials [11, 17, 18].

2.2.6 Phytochemical screening of Leaf and Flower Powder

Powdered leaf and flower were examined for their phytochemical constituents namely saponins alkaloids, cardiac glycosides, terpenes, anthraquinones and tannins using standard procedures [6].

2.3 Statistical Analysis

All quantitative data were expressed as mean ± standard error of mean (SEM). Statistical analysis was performed using SPSS version 25

3.0 RESULTS

Table 1: Microscopic Features of *Mucuna urens* and Standard Error of Mean (SEM)

Leaf Surface	Abaxial	Adaxial
Stomatal Type	Paracytic, anisocytic, anomocytic	-
Stomatal length (µm)	26.64(21.588±0.778)17.35	-
Stomatal width (µm)	14.84(12.16±0.470)10.04	-
Stomatal pore width (µm)	3.29(2.34±0.129)1.96	-
Stomatal pore Length (µm)	13.31(11.08±0.625)7.36	-
Stomatal number	116(102.60±2.33)96	-
Stomatal index (%)	65.4%	-
Epidermal cell number	269(193.90±10.33)164	286(220±8.10)197
Epidermal cell length (µm)	52.14(38.41±2.38)28.17	59.84(42.33±2.86)32.35
Epidermal cell width (µm)	17.29(12.71±0.91)6.99	27.55(21.82±1.01)16.72
Epidermal cell thickness (µm)	5.58(2.08±0.40)1.10	8.79(4.28±0.60)2.17
Epidermal cell wall pattern	Undulate - Sinuous	Straight - Undulated
Epidermal wall Shape	Irregular	Polygonal - Irregular
Length of Trichome (µm)	455.79(268.20±32.55)180.37	-
Width of Trichome ((µm)	18.32(15.46±0.81)10.38	-
Length of Guard Cell (µm)	14.90(11.94±0.51)9.60	-
Width of Guard Cell (µm)	5.78(5.16±0.15)4.19	-
Type of Trichome	Unicellular	-

Values are represented as mean (10) replicates ± SEM

Table 2. Micromeritic properties of *M. urens* flower powder

Parameters	Flower Powder Value	Leaf Powder Value
Bulk volume (mL)	32.33±0.33	20.00±0.00
Tapped volume (mL)	22.66±0.33	11.66±0.33
Bulk Density (g/mL)	0.30±0.00	0.50±0.00
Tapped Density (g/mL)	0.43±0.00	0.85±0.02
Flow Rate (g/s)	0.26±0.01	0.24±0.02
Flow time (s)	37.25±2.27	41.38±3.97
Angle of Repose (^{0})	42.09±0.36	40.76±3.04
Hausner's Ratio	1.42±0.02	1.70±0.04
Carr's Index (%)	31.7±0.81	41.31±1.56
Diameter of Heap (cm)	6.33±0.18	5.61±0.17
Height of Heap (cm)	2.90±0.05	2.00±0.00

Values are represented as mean of three replicates (3) SEM

Table 3. Chemomicroscopy of *M. urens* leaf powder

PARAMETERS	LEAF	FLOWER
Mucilage	+	+
Lignin	+	+
Calcium Oxalate	+	-
Cellulose	+	+
Protein	+	+
Starch	+	+

Table 4. Fluorescence of *M. urens* Leaf powder

Extract	Ordinary Light	UV- 365nm
Water	Grey	Grey
Methanol	Green	Orange with white boundary
Ethanol	Green	Orange
Chloroform	Green	Orange
n-hexane	Green	Orange
Ethyl acetate	Green	Orange

Table 5. Fluorescence of *M. urens* Flower powder

Extract	Ordinary Light	UV- 365nm
Water	Grey	Grey
Methanol	Grey	Light-pink
Ethanol	Grey	Grey
Chloroform	Colourless	Grey
n-hexane	Colourless	Grey
Ethyl acetate	Colourless	Grey

3.6 Water-soluble extractive value, methanol-soluble extractive value, ethanol-soluble extractive value, moisture content, total ash value, water soluble -ash value, and acid insoluble ash value of Leaf and Flower of *M. urens*

Table 6. Powdered Flower Sample

Parameters	Result (g)	Percentage (%)
Moisture content	0.33 ± 0.005	17.00
Total ash value	0.09 ± 0.003	5.00
Acid-insoluble ash value	0.01 ± 0.003	0.80
Water soluble ash value	0.03 ±0.000	2.80
Water soluble Extractive value	0.23 ± 0.00	23.70
Ethanol soluble Extractive value	0.18 ± 0.01	18.00
Methanol soluble Extractive value	0.18 ± 0.19	18.70

Table 7. Powdered Leaf Sample

Parameters	Result (g)	Percentage (%)
Moisture content	0.25±0.002	13.00
Total ash value	0.11±0.002	11.00
Acid-insoluble ash value	0.02±0.003	1.30
Water soluble ash value	0.08±0.000	2.00
Water soluble Extractive value	0.16±0.006	16.70
Ethanol soluble Extractive value	0.16±0.005	16.00
Methanol soluble Extractive value	0.16±0.000	16.00

Values are represented as mean of three replicates (3) SEM for Water-soluble extractive value, Methanol-soluble extractive value, Ethanol-soluble extractive value. Values are represented as mean of Six replicates (6) SEM for Moisture content and Total ash value.
Values are represented as mean of three replicates (3) SEM for Water-Soluble -ash value and Acid-insoluble ash value.

Table 8. Results for Phytochemical screening of coarse *M. urens* leaf and flower powder

Parameters	Leaf	Flower
Alkaloid	+	-
Cardiac glycosides	+	+
Saponins	+	+
Tannins	+	+
Free Anthraquinones	-	-

Combined Anthraquinones	-	-
Flavonoid	-	-
Terpenes	-	-

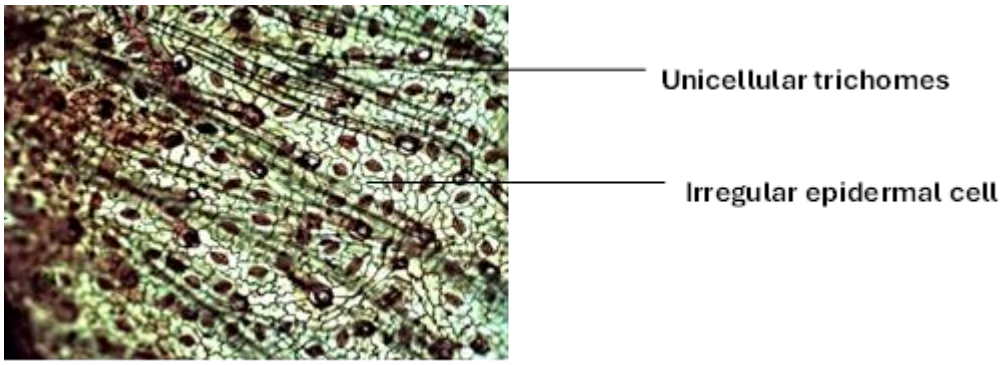
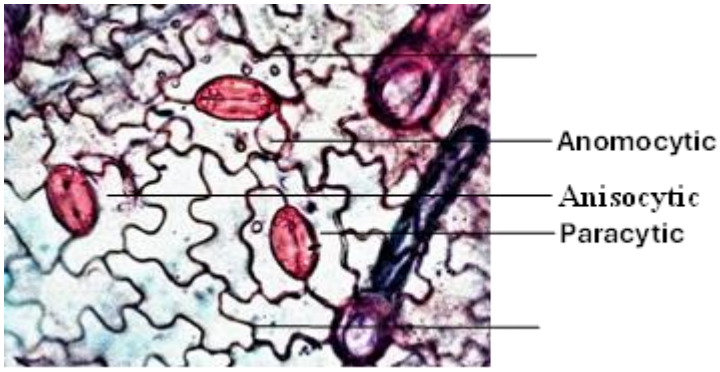


Figure 2: Abaxial surface of leaf of Mucuna Urens showing: unicellular trichomes and IEC (irregular epidermal cell shape)



UndulateACWP

Figure 3: Abaxial Surface leaf of *M. urens*showing: undulate – sinuous anticlinal cell wall pattern (ACWP), paracytic, anisocytic, ,anomocytic stomatal distribution at magnification ×40 microscopic features of fresh

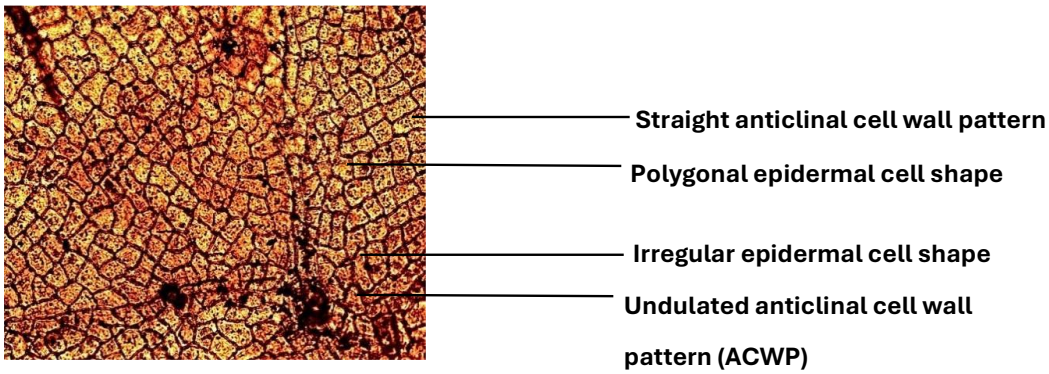


Figure 4: Adaxial Surface of freshleaf of *M. urens*showing:Polygonal- irregular epidermal cell shape and straight – Undulated anticlinal cell wall pattern (ACWP)

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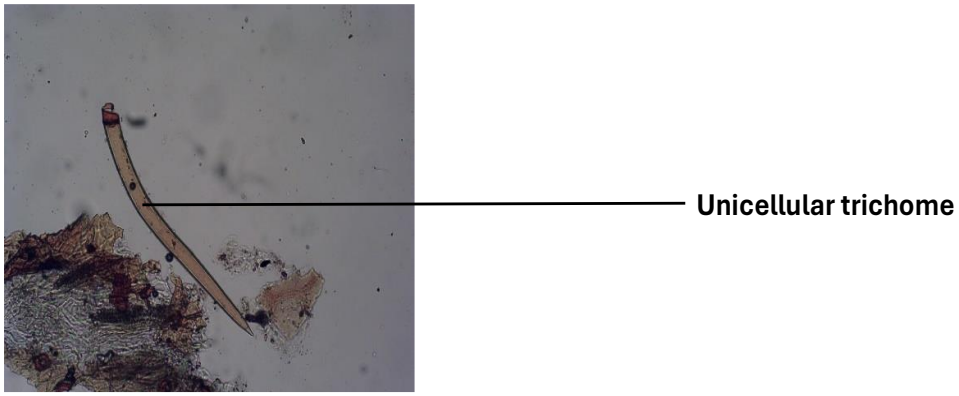

Figure 5: Powder microscopy of powdered dried leaf of *M. urens* showing: unicellular trichome at magnification ×10mg

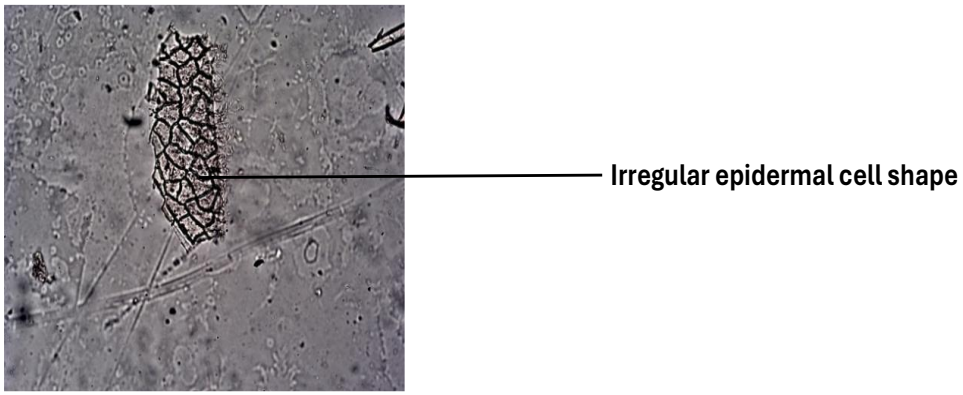

Figure 6: Powder microscopy of powdered dried leaf of *M. urens* showing: Irregular epidermal cell shape (IEC) at magnification ×10mg

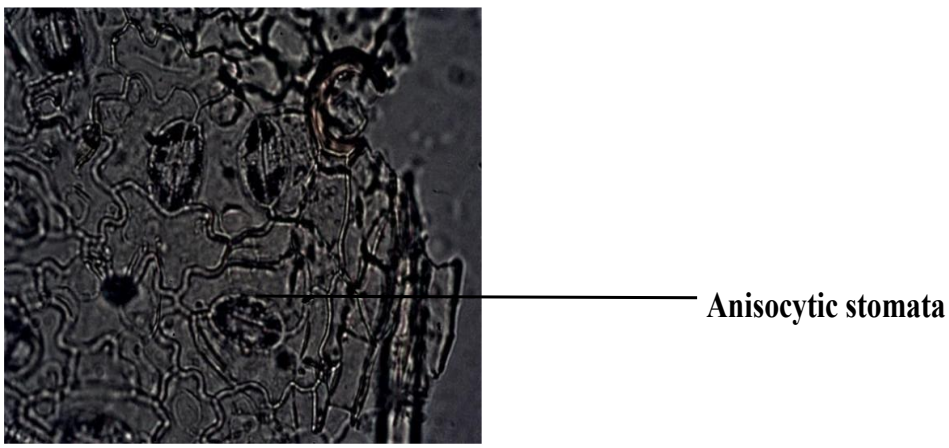

Figure 7: Powder microscopy of powdered dried leaf of *M. urens* showing: Anisocytic stomata at magnification ×10

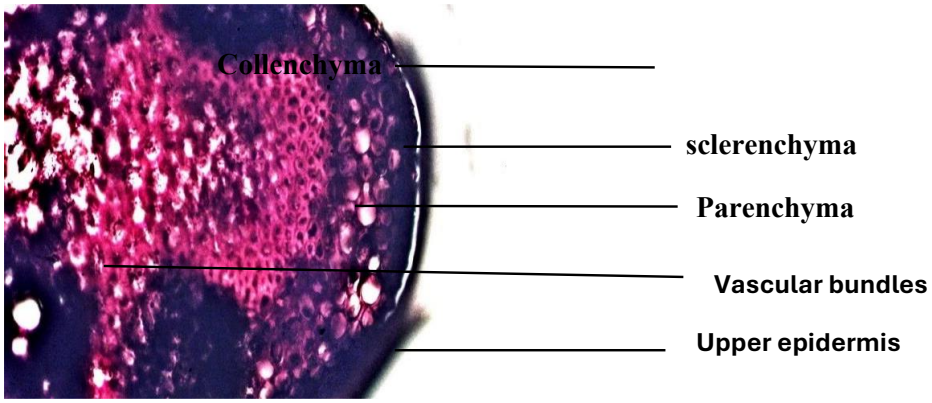

Figure 8: Transverse section of leaf of *M. urens* showing:(Ue) Upper epidermis, (Co)collenchyma, (Sc) sclerenchyma, (Pa) parenchyma and (Vb) vascular bundles at magnification ×4

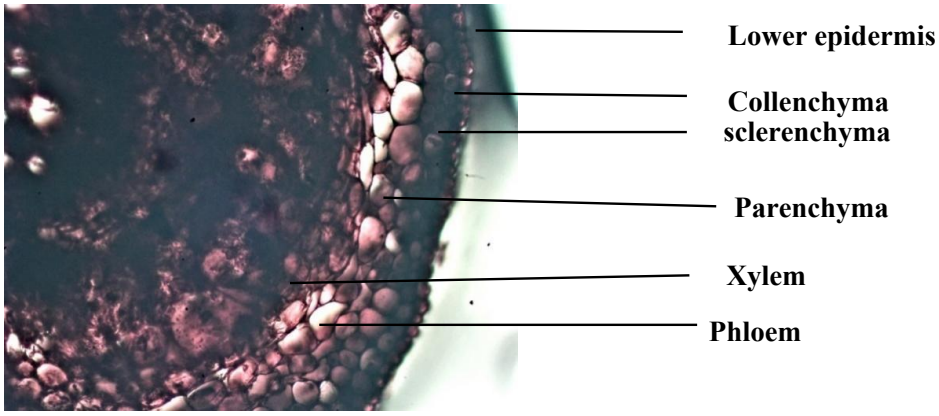

Figure 9: Transverse section of leaf of *M. urens* showing: (Le) lower epidermis (Co) collenchyma, (Sc) sclerenchyma, (Pa) parenchyma, (Xy) Xylem and (Ph) phloem at magnification ×4

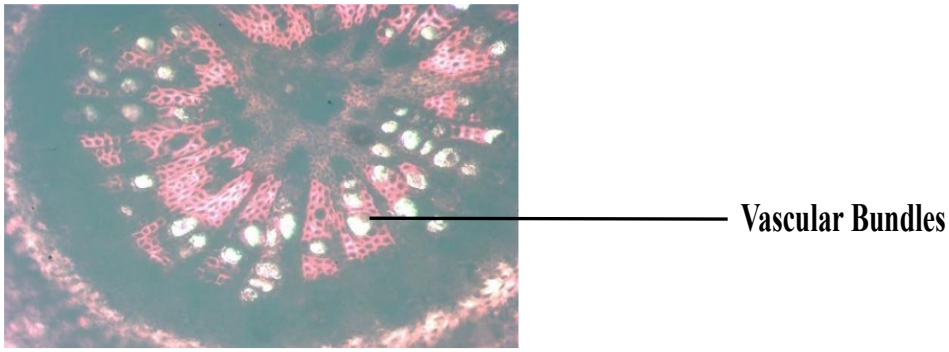

Figure 10: Petiole of leaf of *M. urens* showing: Vascular bundles at magnification ×10

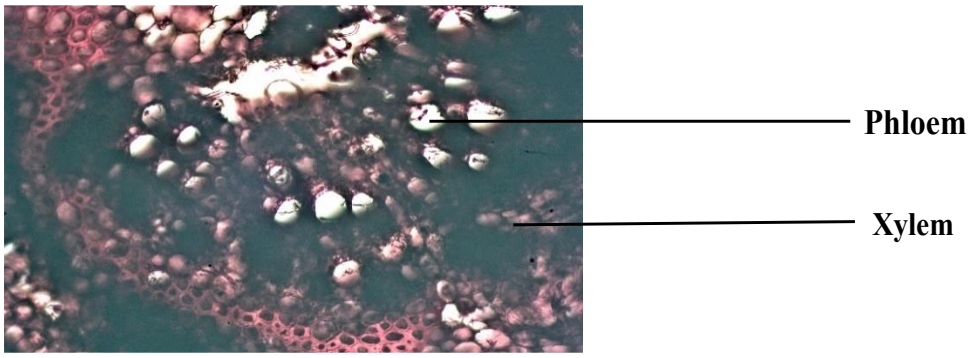

Figure 11: Petiole of *M. urens* showing Xylem and Phloem at magnification ×10

4.0 DISCUSSION

Mucuna urens of the Fabaceae family includes species valued for their soup-thickening and medicinal properties, as well as their toxicity. According to WHO, all drugs—synthetic or plant-based—must meet safety and efficacy standards. Hence, quality control of herbal drugs is critical for ensuring authenticity and detecting adulteration. Microscopic analysis of *Mucuna urens* showed the presence of sinuous and undulate anticlinal cell wall pattern, paracytic, anisocytic, and anomocytic stomata on the abaxial surface. Irregular and polygonal epidermal cell shape on the adaxial surface. Stomatal distribution was hypostomatic with a stomatal index was 65.4% and stomatal number was 102.60 (Table 1; Fig. 2, 3 and 4). The transverse section of the midrib revealed vascular bundles and supporting tissues (Fig. 8). Micromeritics indicated very poor flow properties, including an angle of repose (40.76±3.04) Hausner's ratio (1.70±0.04), and Carr's Index (41.31±1.56) (Table 2). Chemo microscopy studies revealed the presence of mucilage, lignin, starch, cellulose, and protein in the leaves and the absence of calcium oxalate crystals (Table 3). The presence of starch and protein justifies the high nutritional value of carbohydrates and protein found in this plant drug (Table 3). Water extractive value was higher than methanol and ethanol aligning with Umoh *et al*. [17]. Moisture content exceeded the African Pharmacopeial limit (Table 6), potentially causing microbial contamination or degradation of active constituents. Ash values (total, acid-insoluble, and water-soluble) were 11% ($^{w}/_{w}$), and 5% ($^{w}/_{w}$), 1.3 % ($^{w}/_{w}$), and 0.8 % ($^{w}/_{w}$), 2 % ($^{w}/_{w}$) and 2.8 % ($^{w}/_{w}$) respectively for leaf and flower. The hypostomatic stomata distribution gives reason to the fact that the abaxial surface of the leaf in the natural habitat is mostly wet and that is the side for most transpiration activity [7]. Extractive values are indicative weights of the extractable chemical constituents of crude drug under different solvents environment. It shows the percentage of constituents in that part of the plant that is soluble in a solvent [8]. For the leaves, water had the highest extractive value of 16.7% ($^{w}/_{w}$); while methanol and ethanol share similar values of 16% $^{w}/_{w}$. For the flowers, water had the highest extractive value of 23.7% ($^{w}/_{w}$); justifying the polarity of water as the most polar solvent, because it extracted more. While methanol had an extractive value of 18.7% ($^{w}/_{w}$) and ethanol had the least extractive value of 18% ($^{w}/_{w}$). The flowers have high sugar content and contain sugar, embryo and other soluble materials that are easily extracted by water which is reflected in its water-soluble extractive value. The moisture content of the powdered leaf and flower samples were 13% ($^{w}/_{w}$) and 17% ($^{w}/_{w}$) respectively; indicating that, the flower has more moisture than leaves. The moisture content obtained from the flower was 17% $^{w}/_{w}$ and this does not fall within the African Pharmacopoeia,1986 recommended range of 8-14% $^{w}/_{w}$. This high moisture content can encourage the growth of bacteria, yeast or fungi during storage. The total ash values for the powdered leaf and flower samples were 11% and 5% respectively (Table 6) and these are within the recommended limit [9]. The acid-insoluble ash values of the powdered leaf and flower samples were 1.3% ($^{w}/_{w}$) and 0.8% ($^{w}/_{w}$) respectively (Table 6) and these are within the recommended limit [9]. The water-soluble ash values of the powdered leaf and flower samples were 2% ($^{w}/_{w}$) and 2.8% ($^{w}/_{w}$) respectively (Table 6) and these are within the recommended limit [9]. Ash values are used to determine quality and purity of crude drug. It indicates presence of various impurities like carbonate, oxalate and silicate. Total ash contains inorganic radicals like phosphates, carbonates and silicates of sodium, magnesium and calcium giving an estimation about the purity and quality of the drug [10]. The water-soluble ash value gives an estimation of the ash soluble in that solvent (water) and the implication of acid insoluble shows the fraction that is insoluble in acid. The result from phytochemical screening justifies the presence of alkaloids, cardiac glycosides, saponins, tannins in the leaf extract and the presence of cardiac glycosides, saponins and tannins in the flower extract while free and combined anthraquinones, terpenes

and flavonoids were absent (Table 8). These findings have established the pharmacological potential and importance in quality control of*Mucuna urens.*

5. CONCLUSION

The results obtained from the pharmacognostic studies provide scientific evidence on the identity, authentication, quality, purity and diagnostic features of the plant and justifies its uses in phytomedicine.

DECLARATIONS

Acknowledgements

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Conflict of Interest

The authors have declared that no conflict of interest exists.

Ethical Approval: Not applicable as no human or animal subjects were involved in this study.

Contribution of Authors

This work was carried out in collaboration with all other authors. EJC designed the study, performed the experimental procedures, and EJC wrote the first draft of the manuscript. Authors RAU and IIJ supervised laboratory experiments. Authors IIJ, ERI, GEC, AEU, II, NAA, IIB, MAU and IAE organized data, managed the literature searches, and assisted in plant material preparation. All authors read and approved of the final manuscript.

6. REFERENCES

[1]. Fern, K. (2020). *Mucuna urens*. Useful Tropical Plants. Retrieved September 6, 2020, from https://tropical.theferns.info/viewtropical.php?id=*Mucuna+urens*

[2]. Monge, M. C. O., Rojas-Salas, M. F., Chavarría-Rojas, M., Carazo-Berrocal, G., and Madrigal-Redondo, G. (2022). Universal aspects of the genus *Mucuna* and the properties described of *Mucuna urens* and *Mucuna pruriens*. *Pharmacognosy Reviews, 16*(32), 74–81.

[3]. Evans, W. C. (2012). Trease and Evans' pharmacognosy (15th ed.). Bailliere Tindall

[4]. Kokoski CJ, Kokoski RJ, Slama FJ. Fluorescence of powdered vegetable drugs with particular reference to the development of ultraviolet light radiation.*Journal of the American Pharmaceutical Association*, 1958: 38: 715-719.

[5]. Kumar, D., Gupta, J., Kumar, S., Arya, R., Kumar, T. and Gupta, G. Pharmacognostic evaluation of *Cayratia trifolia* (Linn.) leaf. Asian Pacific Journal of Tropical Biomedicine. 2012: 2(1):6-10.

[6]. Umoh, R., Johnny, I., Udoh, A., Andy, N., Essien, A., Udoh, I. and Emeh, W. (2021). Micromorphological and pharmacognostic studies of leaf and stem of Solenostemon monostachyus P. Beauv (Lamiaceae). Journal of Complementary and Alternative Medical Research, 16, 230-240.

[7]. De Oliveira, E.C., and Miglioanza, È. (2014) Anatomy of Cassava Leaves. *European Scientific Journal,* 2, 167

[8]. Kunle, O. F., Egharevba, H. O., and Ahmadu, P. O. (2012). Standardization of herbal medicines: A review. *Department of Medicinal Plant Research and Traditional Medicine, National Institute for Pharmaceutical Research and Development (NIPRD), Abuja, Nigeria*. Accepted January 12, 2012.

[9]. European Pharmacopoeia limits of crude drugs. (2007). Strasbourg: Council of Europe (6th ed., pp 124-164).

[10]. Umoh, R., Johnny, I., Udoh, A., Andy, N., Essien, A., Udoh, I. and Emeh, W. (2021). Micromorphological and pharmacognostic studies of leaf and stem of Solenostemon monostachyus P. Beauv (Lamiaceae). Journal of Complementary and Alternative Medical Research, 16, 230-240.

[11]. African Pharmacopoeia (1986), General Methods of Analysis. Pharmacopoeia 11: 121-208.

[12]. Mbah, C. C., Builders, P. F., Akuodor, G. C. and Kunle, O. O. (2012). Pharmaceutical characterization of aqueous stem bark extract of Bridelia ferruginea Benth (Euphorbiaceae). *Tropical Journal of Pharmaceutical Research*, 11(4), 637-644.

[13] Angiosperm Phylogeny Group "An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV" *Botanical Journal of the Linnean Society*, 2016: 18(1): 1-20

[14] Mans, D. R. A., Pinas, N. M., Djotaroeno, M., Friperson, P., Pawirodihardjo, J., and Lichtveld, M. Y. (2022). Insight into the antioxidant activities of ten Fabaceae plant species that are medicinally used by the Aucan tribal peoples from the Republic of Suriname (South America). *GSC Biological and Pharmaceutical Sciences, 20*(3), 82–96.

[15] Quattrocchi, U. (2012). *CRC world dictionary of medicinal and poisonous plants: Common names, scientific names, eponyms, synonyms, and etymology* (5 Vol. set). Boca Raton, FL: CRC Press.

[16] Monge, M. C. O., Rojas-Salas, M. F., Chavarría-Rojas, M., Carazo-Berrocal, G., and Madrigal-Redondo, G. (2022). Universal aspects of the genus *Mucuna* and the properties described of *Mucuna urens* and *Mucuna pruriens*. *Pharmacognosy Reviews, 16*(32), 74–81.

[17] Umoh RA, Umoh UF, Johnny II, Umoh OT, Anah VU, Udoh AE, Elijah AA, Adefabi M. A, Matthew EA. Phytopharmacognostic Evaluation of the Leaves of *Gnetum africanum* Welw (Gnetaceae). *Journal of Complementary and Alternative Medical Research*, 2022: 11(3):32-41.

[18] Metcalfe CR, and Chalk L. Anatomy of the Dicotyledons. Clarendon Press, Oxford, 1979: 1(2):279.