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RESEARCH PAPER

PHARMACOGNOSTIC CHARACTERIZATION AND DEVELOPMENT OF STANDARDIZATION PARAMETERS FOR THE QUALITY CONTROL OF *AIDIA GENIPIFLORA* (DC.) DANDY

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ABSTRACT
The stem bark and leaves of Aidia genipiflora (DC.) Dandy (Rubiaceae) have several ethnomedicinal uses and are recently being commercialized by some traditional healers in Ghana, as anti-inflammatory and antimicrobial agents. This study sought to establish pharmacognostic parameters for the stem bark and leaves of the plant in order to set standards for identification and quality control. The organoleptic, macro-morphological, qualitative and quantitative micro-morphological features were analysed for the whole and powdered leaves and stem bark. Fluorescence, physicochemical and phytochemical analysis and thin layer chromatography (TLC) were also performed using standard methods. The leaf is elliptical in shape with acuminate apex, entire margin, acute base, reticulate venation and pubescent on both the adaxial and abaxial surfaces. The leaf has wavy-walled epidermal cells with uniseriate clothing trichome. The midrib and petiole have concave-shaped vascular bundles. Starch grains, fibres, cork cells, stone cell, prismatic calcium oxalate crystals and uniseriate clothing trichomes were present in the leaves and stem bark powder. Physicochemical constants for ash content, solvent soluble extractives and pH revealed differences between the stem bark and leaves. The plant materials contained lead, cadmium and arsenic but below the limit values. They also contained varying levels of copper, zinc, calcium and potassium. Fluorescence analysis, Thin layer chromatography and UV-vis fingerprint also revealed notable differences in the stem bark and leaves. This result provides important diagnostic features to aid the correct identification and authentication of Aidia genipiflora for research and commercial purposes.

Keywords: *Aidia genipiflora, pharmacognostic, calcium oxalate crystals, organoleptic, trichomes*

INTRODUCTION

Plants are major sources of medicines due to their chemical diversity. The availability, accessibility and presumed safety of plant-based medicines continues to enhance the acceptability of herbal medicines in primary healthcare globally, especially in developing countries. However, a major setback to the use of plant as medicines has been the difficulty in identifying closely related species, and this often leads to

unintentional or intentional adulteration. These challenges affect the reproducibility and quality of batch to batch productions with consequent threat of health implications to consumers (Baidoo *et al.*, 2019). In addition, the lack of reproducibility affects research and development of herbal medicines. Therefore, establishing pharmacognostic standards and quality control parameters for plants is very important. This ensures correct sourcing through identification, selection, authentication, and standardization of plant material for research and development of plant-based medicines (Asante-Kwatia *et al*., 2019).

Aidia genipiflora (DC.) Dandy of the family Rubiaceae, also referred as *Randia genipiflora* is hard-woody shrub or tree. *Aidia genipiflora* is mainly distributed in countries such as Sierra Leone, Ivory coast, Guinea – Bissau, Sudan and Cameroon (Burkill, 1985). In Ghana, *Aidia genipiflora* is distributed in cape coast, Obuase, Kade, and Kwahu. The stem bark of *Aidia genipiflora* is used either alone or in polyherbal formulations with other plants for treating microbial infections or inflammatory conditions by traditional medicine healers. Both the stem bark and the leaf have been used to treat gout (Burkill, 1985). The plant is sourced from the wild by traditional healers for its medicinal purposes. The antimicrobial and anti-inflammatory activity has been reported in our previous work (Anokwah *et al.*, 2019).
However, there is no standard parameter for the correct identification and authentication of *Aidia genipiflora* to ensure correct sourcing for research and development of reproducible consumer products.

Hence, this study was done to establish pharmacognostic standards for the correct identification and quality control of *Aidia genipiflora*.

MATERIAL AND METHODS

Plant collection and processing

The leaves and stem bark of *Aidia genipiflora* were collected from Kwahu Asakraka in the Eastern Region of Ghana (06º36.704'N/ 000º 42.659'W). The samples were authenticated by Mr. Clifford Asare of the Department of Herbal Medicine, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana. Voucher specimen (KNUST/HM/2017/ SB016 and KNUST/HM/2020/LOO4) for the stem bark and leaf respectively, were kept at the herbarium of the Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana.

The fresh leaves and stem bark of *Adia genipiflora* were washed under running water and samples taken for organoleptic and macromorphological studies. Sample of the fresh leaves were also used for microscopic study. Washed plant materials were chopped into pieces and shade dried for one week. About 500 g each of the dried leaves and stem bark was pulverized into coarse powder using a mechanical grinder and stored in air-tight plastic bags at room temperature until required for use.

Organoleptic and macroscopic evaluation

The fresh leaves and stem bark were examined for their organoleptic and macroscopic features. Organoleptic or sensory parameters such as colour, taste, odour and texture were examined using the sense organs. The fresh leaves were examined for macroscopic features including leaf shape, apex, venation, base, margin, the type of leaf and presence or absence of petiole. Average length and width of 40 randomly selected fresh leaves (n=40) were determined. Also, the average length of petiole was determined. Samples of the fresh stem bark were examined for their thickness and surface characteristics (Evans, 2009; Baidoo *et al.*, 2019).

Qualitative microscopy and histological studies

Free-hand thin sections of the lamina, transverse sections of both the midrib and petiole of the leaf were made with sharp razor blades. The lamina sections were cleared in 80% w/v chloral hydrate until the green pigment was cleared. The sections of the lamina, midrib and petiole were individually mounted either in water or stained with 0.1%w/v phloroglucinol in HCl (to identify lignified tissues) or N/50 iodine (to identify starch grains) under a microscope (Leica light microscope DM 1000 LED, Wetzlar, Germany) fitted with a camera (Leica IC-C50 HD, Jos Hansen and Soehne Gmbh, Ger-

many Photomicrographs were taken at various magnifications following standard procedures (Asante-Kwatia *et al*., 2019; Mireku-Gyimah *et al.*, 2018).

Quantitative microscopy
Thin sections of the cleared leaf were mounted in water and observed under light microscope for epidermal cell, palisade cells veinlets and vein islets. Photomicrographs were taken for the cells in six different fields of view and also taken for the stage micrometre. Standard procedures were followed to determine veinlet termination number, vein islet number and palisade ration per square millimetre for each surface data (Amponsah *et al.*, 2014).

Powder microscopy
The dried powders of the leaf and stem bark were mounted in water and observed under light microscope. They were subsequently stained with either phloroglucinol in HCl or N/50 iodine. Photomicrographs were taken for characteristic cell structures and contents including cork cells, stone cells, fibres, starch grains and calcium oxalate crystals (Evans, 2009; Baidoo *et al.*, 2019).

Physicochemical analysis
Powdered samples of both the leaves and stem bark were subjected to various physicochemical investigations including solvent soluble extractives in water, ethanol and methanol, the ash content (total ash, acid-insoluble ash and water-soluble ash), pH of 1% w/v water and ethanol extracts, and elemental content t were analysed for the leaves and stem bark according to standard methods ((Nkansah *et al.*, 2016; Chanda, 2014).

Fluorescence analysis
The dried powdered leaf and stem bark were examined for fluorescent characteristics on clean non-fluorescent glass slides with or without chemical reagent (picric acid, acetic acid, concentrated nitic acid, 5 % ferric chloride, 20 % aqueous potassium hydroxide, 10 % alcoholic potassium hydroxide, 0.5 M iodine solution and 25 % ammonia solution) in visible light, and under the short (254 nm) and long (365 nm) wavelength of the Ultraviolet light. The solvent extracts (aqueous, ethanol, methanol, ethyl acetate and petroleum ether extracts) were also examined for their fluorescent characteristics (Ishtiaq *et al.*, 2018).

Phytochemical screening
The presence of major secondary metabolites (alkaloids, sterols, triterpenoids, tannins, flavonoids, coumarins) in the powdered leaf and stem bark of *Aidia genipiflora* were determined by simple qualitative phytochemical screening methods (Evans, 2009).

UV–vis spectra
The UV-visible spectra of the aqueous and ethanol extracts of the dried powdered leaf and stem bark were recorded on a JENWAY 7315 UV spectrophotometer at a wavelength range of 200–700 nm, scan speed 50 nm/s.

Thin layer chromatography
About 5 grams of each powdered sample was cold-macerated in 50 ml of ethyl acetate for 24 hours. The extract obtained was concentrated and spotted on TLC silica gel plate (G60 F_{254}, 0.25 mm thickness). The plates were developed in pre-saturated chromatanks containing Petroleum ether: ethyl acetate (7: 3). The developed plates were dried and observed for characteristic fluorescence and quenching of the resolved spots for compounds under UV lamp at 365 nm and 254 nm. Pictures were taken of the plates in visible light and under UV (365 nm and 254 nm).The plates were sprayed with a detecting reagent which is vanillin in conc. H_2SO_4 and pictures were taken (Evans, 2009).

RESULTS AND DISCUSSION

Organoleptic and macroscopic evaluation of leaf and stem bark of A. genipiflora
The result presented in Table 1 provides the organoleptic and macroscopic description of the leaves and stem bark. Fig. 1 shows the pictures of the fresh leaves and stem bark of *A. genipiflora.* Although the study does not focus on the fruit of the plant, the presence of a globose fruit attached directly to the branch of the stem was noted (Fig. 1). According to Ridsdale (1996), leaves of *Aidia* species mostly have acuminate apex and elliptic shape with a few having either elliptic to lanceolate or elliptic to ovate with characteristic acute base. *Aidia geni-*

Table 1: Organoleptic and macro-morphology of the leaf and stem bark of *Aidia genipiflora*

Parameter	Leaf
Type	Simple
Shape	Elliptical
Margin	Entire
Apex	Acuminate
Base	Symmetrical (acute)
Petiolation	Petiolate
Texture	Coriaceous
Venation	Reticulate
Colour (adaxial)	Green
Colour (abaxial)	Light green
Surface	Pubescent (both adaxial and abaxial)
Leaf arrangement	Whorled
Odour	Characteristic
Taste	Bland
Lamina length (mean ± SD, n= 40)	10.7 ± 0.7 cm
Lamina width (mean ± SD, n= 40)	4.6 ± 0.5 cm
Petiole length (mean ± SD, n= 40)	0.6 ± 0.1
	stem bark
Colour (outer bark)	Greyish-Green
Colour (inner bark)	Pale yellow
Odour	Characteristic
Taste	Bitter
Texture (outer bark)	Rough
Texture (inner bark)	Smooth
Thickness	5-7 mm
Fracture	Rough
Cut	No exudate

piflora leaves have acuminate apex and elliptic with acute base which is consistent with the leaf features of other *Aidia* species. The texture of the leaves of most *Aidia* species is coriaceous with glabrous surface on both adaxial and abaxial surfaces whereas a few species are pubescent on the abaxial surface (Ridsdale, 1996). From the result, the leaf of *A. genipiflora* has coriaceous texture but pubescent on both adaxial and abaxial surfaces which is different from other species of *Aidia* reported in literature (Ridsdale, 1996). In addition, the plant had globose fruit similar to those reported for most *Aidia* species. The Organoleptic and macro-morphological examination is a simple qualitative process for providing quick authentication of the identity and quality of crude drugs based on sensory perception and external morphology. This allows easy identification of plants during harvesting and prevent uninten-

Fig.1: Pictures of the fruit (A1), adaxial and abaxial lamina (A2) leaf arrangement (A3) and the stem (B1) and stem bark (B2-B4) features of *A. genipiflora*

tional substitution with closely related species during sourcing of plant for medicinal use. The descriptive parameters for the leaf and stem bark in table 1 are essential for identifying plants in their natural habitats, Therefore, the result is essential for prompt identification of *Aidia genipiflora*.

Qualitative microscopy and histological studies

Leaf microscopy

Thin sections of the leaf lamina revealed wavy epidermal cells on the abaxial surface (Fig. 2). Microscopic studies of the leaf reveal the cellular organization of the leaf which are important in distinguishing closely related plant species.

T/S of the midrib and petiole

The T/S of the midrib showed single-layered oblong epidermal cells enveloped by a thin cuticle on both the bulging ventral and the protruded (with curved apex) dorsal surfaces (Fig. 3). Closely packed collenchyma cells are found directly below and above a concave-shaped vascular bundle of the midrib. A uniseriate multicellular trichome was found on the bulging surface (Fig. 3b).

The T/S of the petiole displays a single-layered epidermal cell with uniseriate multicellular clothing trichomes. Closely packed collenchyma cells were found beneath the epidermal cells and a concave-shaped lignified vascular bundle was located at the centre (Fig. 4).

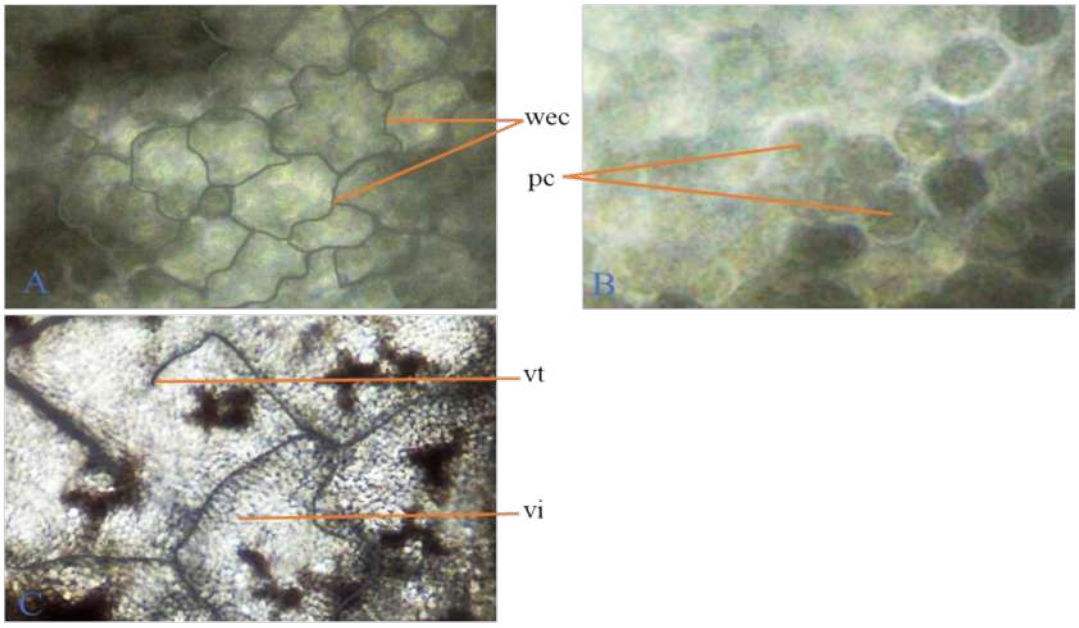

Fig. 2: Microscopy of *A. genipiflora* leaf lamina: wec- wavy walled epidermal cells, pc- palisade cell, vi- vein islet, vt- veinlet terminations (×10)

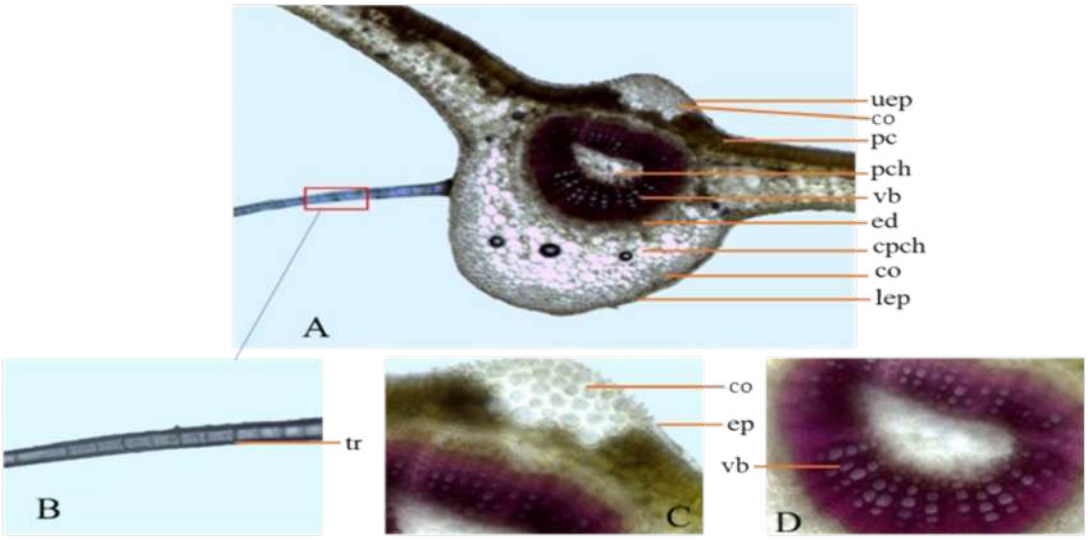

Fig. 3: T/S of *A. genipiflora* leaf midrib (x 10): co- collenchyma, lep- lower epidermal cell, cpch- cortical parenchyma, vb- vascular bundle, ed- endodermis, pch- parenchyma, uep- upper epidermal cell, cu- cuticle, ps- palisade cell (x 40)

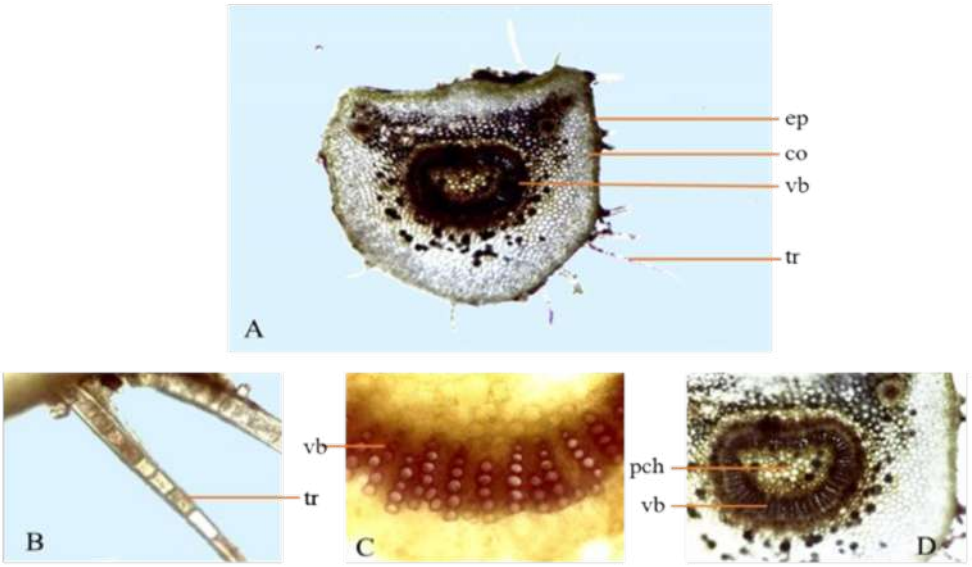

Fig. 4: T/S of *A. genipiflora* leaf petiole (x 10): vb- vascular bundle, ep- epidermal cell, co- collenchyma, trch- trichome (x 40)

Quantitative microscopy

Leaf constants such as veinlet termination number, vein islet number and palisade ratio are important constants for detecting adulteration in leaf drugs and distinguishing between closely related plant species. Table 2 shows the results of the leaf constant of *A. genipiflora* leaf.

Powder microscopy

The dried powdered leaf of *A. genipiflora* revealed the presence of partial stomata, straight-walled epidermal cells, stone cell, uniseriate clothing trichomes, fibre, prismatic calcium oxalate crystals and starch grains (Fig.5). The powdered stem bark revealed the presence of cork cells, stone cells, fibres, prismatic calcium oxalate crystals and starch grains (Fig. 6). Crude drugs are usually processed into powders for easy packaging, transportation, medicinal use and commercial purposes. (Baidoo *et al.*, 2019). Thus, setting standards for identification and quality assessment is very important for quality control of powdered crude drugs.

Physicochemical properties

Physicochemical properties provide useful physical and chemical parameters that are essential for identifying and assessing the quality of crude drugs. The extractive values were determined for both the dried powdered leaves and stem bark (Table 3). The solvents used were water, ethanol and methanol due to their wide use in crude drug preparations. From the result, water has the highest quantity of soluble extractives followed by methanol and ethanol respectively for the leaf whereas methanol has the highest extractive power followed by water and ethanol respectively for the stem bark (Table 3). The result can be used to assess whether a supplied plant material (leaves or stem bark) has been exhausted or otherwise and it can also be used to select a particular solvent for processing the dried crude powder of *A. genipiflora* (Folashade *et al.*, 2012).

The pH of the commonly used edible solvents extracts (waters and ethanol) was determined for the powdered leaf and stem bark of *A. genipiflora.* Assessing the pH of an extract is an important parameter for predicting the effect crude drug on the gastrointestinal tract (absence or presence of GIT irritation) when taken orally. From the result, the pH of the extracts (water

Table 2: Leaf constants for the fresh mature leaf of A. genipiflora

PARAMETER	RANGE
Vein islet number/mm^2	6 – 8 - 12
Veinlet termination number/mm^2	0 – 3 - 7
Palisade ratio	6 – 7 - 8

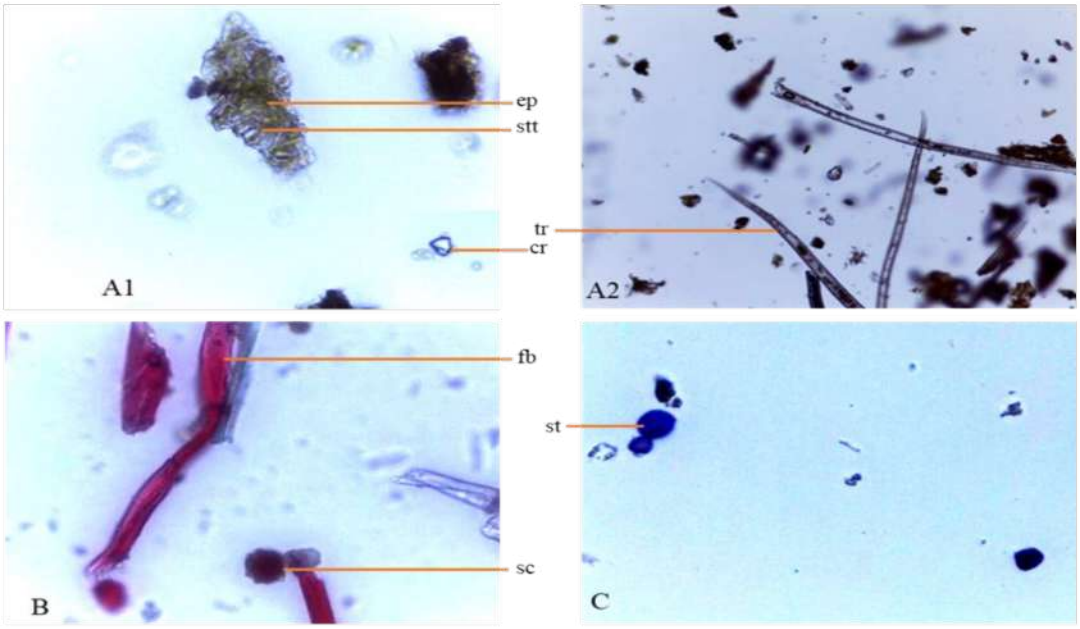

Fig. 5: Powdered leaf microscopy for unstained (A1-2) and stained with phloroglucinol in HCl (B) and N/50 iodine (C) showing various cell features; a piece of lamina showing epidermal cell (ep) and stomata (stt), cr – calcium oxalate crystal, tr – trichome, fb – fibre, sc – stone cell, st – starch grain

and ethanol extracts) of the stem bark are neutral to weak bases (between pH of 7 and 7.4) whereas the pH for respective extracts of the leaf are neutral to weakly acidic (between pH of 6.8 and 7). This implies that oral formulations of the leaf and stem bark of *Aidia genipiflora* is likely to have no irritating effect on gastric mucosa.

Crude drugs may be contaminated with inorganic matter (silica) during harvesting and processing. Determination of the ash content of

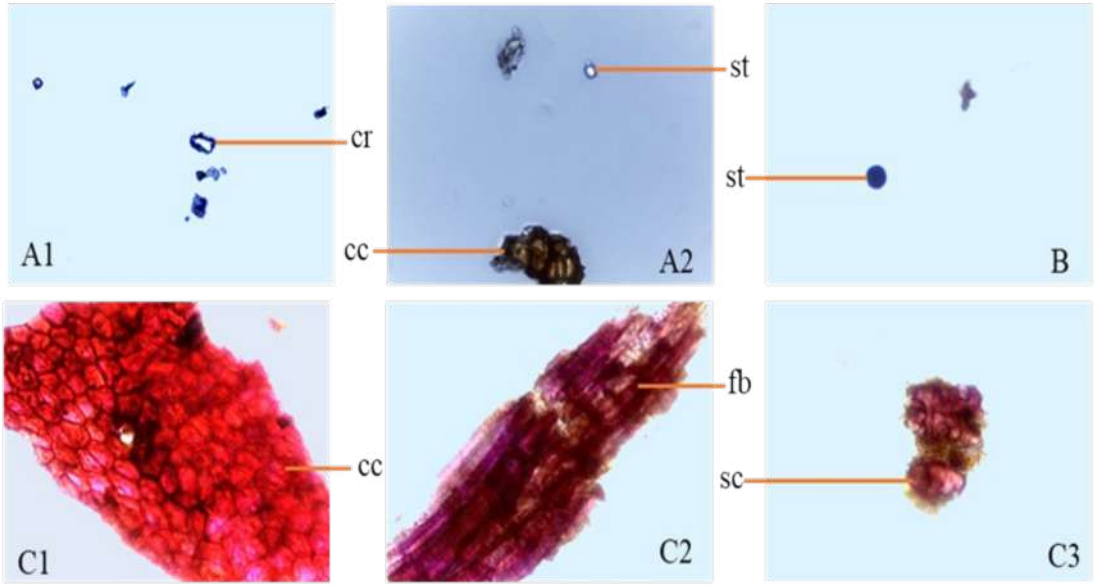

Fig. 6: Microscopy of powdered stem bark mounted in water (A1-2), stained with N/50 iodine (B) and phloroglucinol in HCl (C1-3) showing various cell features; cr – calcium oxalate crystal, cc – cork cell, st – starch grain, fb – fibre, sc – stone cell

crude drugs provide important quality assessment parameter for assessing the purity of crude drugs. The water-soluble ash content provides information on whether a crude drug has been previously extracted (exhausted) or the drug is still intact as originally sourced (Prakasia and Nair, 2016). The ash content for the stem bark and leaf of *Aidia genipiflora* therefore provides a standard for subsequent assessment of the plant material (Table 3).

The source of raw plant materials for the manufacturing of drugs affects the quality and hence the safety and efficacy of the final product. Agricultural activities such as application of fertilizer and weedicides pollute the environment. Pollutants from the environment such as toxic heavy metals (Hg, Pb, Cd, As) and also essential minerals (Ca, K, Ph, Zn, Cu, Fe,) accumulate in the soil. These elements subsequently accumulate in the root of plants and eventually get to the shoot (stem and leaves) (Maghrabi, 2014). However, the levels of these elements vary among plant species due to geographical location, differences in the botanical structure of plant as well as preferential absorbability in the plant (Maghrabi, 2014). Toxic and heavy metals such as Lead (Pb), Cadmium (Cd) and Arsenic (As) are considered widely, as contaminants in the environment due to their serious health hazards to humans. Minerals such as potassium, calcium, zinc and copper play vital roles in the health benefits of crude drugs as well as in the biosynthesis of phyto-constituents. For this reason, elemental content analysis was done to assess the levels of selected macronutrient (Ca, K), micronutrient (Zn, Cu) and trace toxic heavy metals (Pb, Cd and As) in the leaf and stem bark of *Aidia genipiflora*. Although, variations in the elemental content among plants is due to differences in the plant origin, botanical structure and preferential absorbability of the plants (Maghrabi, 2014), plants used as sources of medicine should meet the WHO permissible limit (Nkansah *et al.*, 2016). The elemental content values for the toxic heavy metals were compared with the WHO maximum permissi-

Table 3: Physicochemical properties of the leaf and stem bark of *A. genipiflora*

PARAMETER	STEM BARK	LEAVES	
Ash value (% w/w)			
Total ash	9.00 ± 0.87	8.33 ± 0.289	
Acid insoluble ash	1. 07 ± 0.06	0.37 ± 0.029	
Water insoluble	6.22 ± 0.029	4.67 ± 0.058	
Extractive value (% w/w)			
Water	13.33 ± 3.79	48.00 ±19.05	
Ethanol	7.00 ± 2.65	17.33 ± 1.53	
Methanol	13.67 ± 0.58	20.67 ± 5.36	
pH			
Water	7.07 ± 0.02	6.87 ± 0.02	
Ethanol	7.32 ± 0.08	7.00 ± 0.02	
Elemental content (mg/kg)			**Permissible limit (mg/kg)**
Calcium (Ca)	3.43 ± 0.012	1.12 ± 0.035	
Potassium (K)	0.14 ± 0.001	0.23 ± 002	
Zinc (Zn)	35.77 ± 0.635	44.82 ± 2.009	
Copper (Cu)	24.75 ± 1.028	36.11 ± 0.739	
Lead (Pb)	0.004 ± 0.00001	0.004 ± 0.0001	≤ 10
Cadmium (Cd)	0.143 ± 0.0116	0.167 ± 0.0116	≤ 0.3
Arsenic (As)	0.0145 ± 0.0009	0.028 ± 0.0017	≤ 10

ble limits (WHO, 2007). The maximum permissible limit for lead (Pb) is 10 mg/kg, cadmium (Cd) is 0.3 mg/kg, and for arsenic (As) is 10 mg/kg. The result shows that the levels of all the toxic elements (Pb, Cd and As) were very low with values below 0.005 mg/kg, 0.17 mg/kg and 0. 03 mg/kg respectively (Table 3). Although there are no set limits for the essential elements by the WHO, the presence of these essential elements (Ca, K, Zn and Ph) is considered important for the health benefits of plants (Mireku-Gyimah *et al*., 2018).

Fluorescence analysis

Table 4 represents the fluorescent characteristics of the powdered stem bark and leaves of *A. genipiflora* and their respective extracts when viewed under UV light with or without derivatising agents. Plants contain constituents with fluorophores which emit colours under UV light and sometimes in visible light. Derivatising agents such as acid and bases when added to crude drugs enhance its fluorescence characteristics (Asante-Kwatia *et al*., 2019). The reproducible fluorescence colours produced by crude drug when observed under ultraviolet radiation makes fluorescence analysis adjunct parameter to support other parameters in assessing the quality of crude drugs.

Preliminary phytochemical screening

The results of the preliminary phytochemical screening revealed the presence of major secondary metabolites as presented in Table 5. Both the leaf and stem contained similar constituents except alkaloids which was not detected in the leaf sample.

UV fingerprint

Characteristic UV fingerprint of medicinal plant extracts is useful for the quality evaluation of crude drugs. The UV spectra showed two absorption peaks each for the aqueous extracts of the stem bark (202 and 284) and leaf (204 and 266) (Fig. 7). For the ethanol extracts, four absorption peaks at (206, 234, 284 and 316) were seen for the stem bark whereas seven absorption peaks at (212, 274, 330, 414,

Table 4: Fluorescence analysis of the leaf and stem bark of *A. genipiflora*

POWDER + REAGENT/ SOLVENT	VISIBLE LIGHT	UV- 254	UV- 365
***Aidia genipiflora* leaves**			
Powder + Water	Dark green	Dark brown	Dark green
Powder + Ethanol 95%	Green	Brown	Red
Powder + Methanol	Dark green	Brown	Reddish brown
Powder + Ethyl acetate	Green	Brown	Red
Powder + Pet ether	Yellow	Light brown	Red
Powder + Picric acid	Green	Dark green	Dark green
Powder + Acetic acid	Green	Dark green	N. F
Powder + Conc. HNO_3	Brown	N. F	N. F
Powder + Ferric chloride (5%)	Green	Dark green	N. F
Powder + Aqueous KOH (20%)	Green	N. F	Brown
Powder + Alcoholic KOH (10%)	Green	N. F	Yellow
Powder + Iodine solution (0.5M)	Green	Dark brown	N. F
Powder + Ammonia solution (25%)	Green	N. F	Green
***Aidia genipiflora* stem bark**			
Powder + Water	Dark brown	Brown	Brown
Powder + Ethanol 95%	Pale yellow	Brown	Bluish green
Powder + Methanol	Yellow	Amber yellow	Yellowish brown
Powder + Ethyl acetate	Pale yellow	Pale yellow	Pink
Powder + Pet ether	Pale yellow	Pale yellow	Pink
Powder + Picric acid	Yellow	N. F	Pale yellow
Powder + Acetic acid	Brown	N. F	Brown
Powder + Conc. HNO_3	Reddish brown	N. F	Blue-black
Powder + Ferric chloride	Brown	Dark green	Blue-black
Powder + Aqueous KOH (20%)	Brown	N. F	N. F
Powder + Alcoholic KOH	Brown	N. F	Green
Powder + Iodine solution (0.5M)	Brown	N. F	N. F
Powder + Ammonia solution (25%)	Brown	N. F	Green

Key: N. F – No fluorescence

Table 5: Phyto-constituents detected in the leaf and stem of *A. genipiflora*

PHYTOCONSTITUENT	LEAF	STEM
Alkaloid	-	+
Triterpenoid	+	+
Phytosterol	+	+
Flavonoid	+	+
Coumarin	+	+
Tannin	+	+
Reducing sugar	+	+
Saponin	-	-

Key: + detected, - not detected

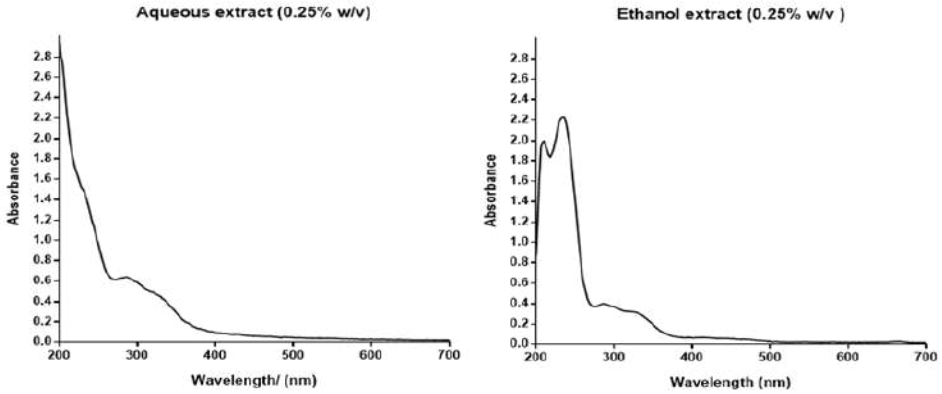

Fig. 7: UV spectra of *A. genipiflora* aqueous and ethanol stem bark extracts

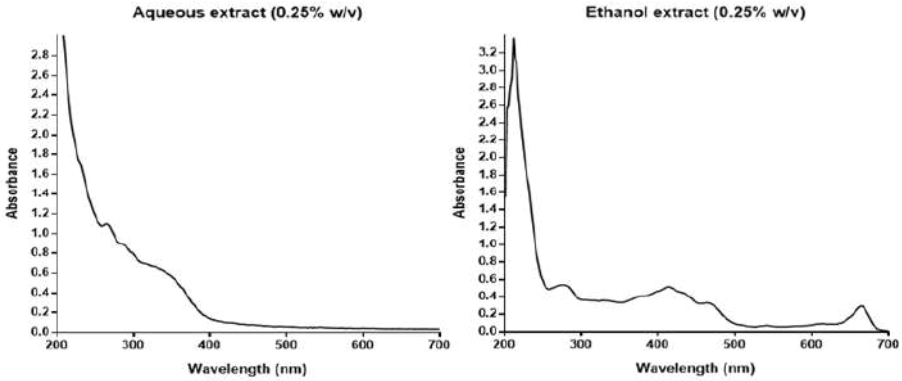

Fig. 8: UV spectra of *A. genipiflora* aqueous and ethanol leaf extracts

462, 612, 542 and 664 were obtained for the leaf (Fig. 8). Differences in their respective aqueous and ethanol extracts indicate differences in the conjugated systems (alternating double and single bonds) in the constituents of the leaf and stem bark of *A. genipiflora.* This implies that adulteration of the stem bark with the leaf could be detected with the UV fingerprint. The UV spectra was the aqueous extract of the stem bark was relatively different from the ethanol extracts. Similar observation was made for the leaf indicating differences in constituents of solvent soluble extracts.

Thin layer chromatography

Thin layer chromatography (TLC) provides simple and rapid chemical profiling of plants for quality assessment and detection of adulterants. Fig. 9 shows the thin layer chromatogram showing differences in constituents for the stem bark (left spots) and leaf (right spots) extracts of *A. genipiflora.* The resolved spots for the leaf extracts seen in visible light (A) is consistent with the UV absorption spectrum (Fig.

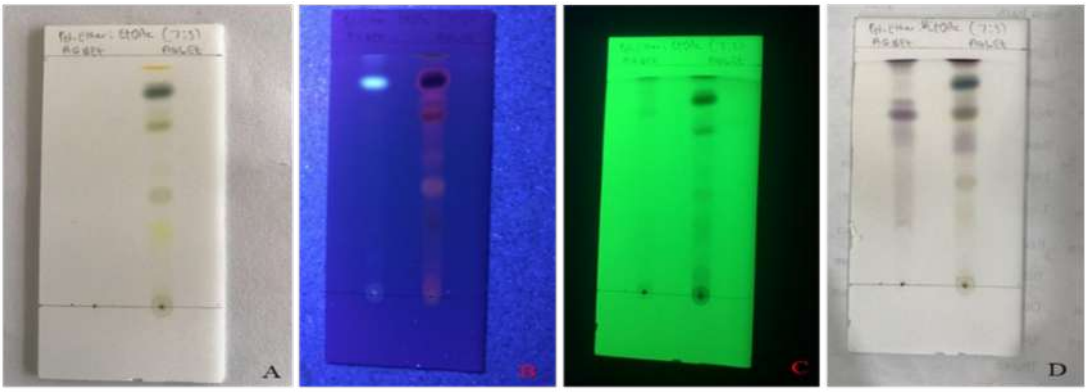

Fig. 9: TLC chromatogram for the stem bark and leaf extract of *A. genipiflora* in visible light (A), under UV (B- 365 nm and C-254 nm) and sprayed with vanillin in conc. H_2SO_4. Solvent system: Pet. Ether: EtOAc (7:3)

8), where absorption peaks were recorded in the visible light region between the wavelength of 414 – 664 nm.

CONCLUSION

This study has provided comprehensive report on the pharmacognostic parameters of *Aidia genipiflora.* These standards are useful for identification and quality assessment of the leaves and stem bark of *Aidia genipiflora.* The parameters can also be used to develop a standard monograph for correct sourcing and quality control of the plant and its products for research, manufacturing and consumer purposes. This is the first established standards for *A. genipiflora.*

CONFLICT OF INTEREST

None

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