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COMPARATIVE PHYTOCHEMISTRY OF *VITELLARIA PARADOXA*: TOWARDS ESTABLISHING A CHEMOTAXONOMIC MARKER

IBRAHIM HADIZA MOHAMMED[1*], MSHELIA EMMANUEL HALILU[2], VALLADA ATINGA[1], IBRAHIM SABO[1], WARRA AHMAD ALIYU[3], ABDULRAHMAN ADAMA YUSUF[4], ABUBAKAR UMAR SULEIMAN[5], MOHAMMED ZAINAB[4], IBRAHIM GARBA[4] AND OYI RUKAYAT AVOSUAHI[6]

[1]Department of Pharmacognosy and Drug Development,
Gombe State University, Gombe, Nigeria
[2]Department of Pharmacognosy and Drug Development,
Usman Danfodio University, Sokoto, Nigeria
[3]Centre for Entrepreneurial Development, Federal University Gusau-Nigeria
[4]Department of Pharmacognosy and Drug Development,
Ahmadu Bello University, Zaria, Nigeria
[5]National Biotechnology Development Agency, Abuja, Nigeria
[6]Department of Pharmaceutics and Pharmaceutical Technology,
Ahmadu Bello University, Zaria, Nigeria

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ABSTRACT

Plants have been known to serve as source of food, income and in the maintenance of health, with their phytochemicals responsible for the biological properties of plants. All parts of shea tree (Vitellaria paradoxa) are consumed by human and livestock as medicine. The variations in the morphology and chemistry of shea tree and its product have been attributed to the various factors including their geographical sources among others. The phytochemical study of methanol extracts of the stem and leaf of shea tree collected from three locations were determined and compared. Qualitative phytochemical analysis indicated the presence of carbohydrates, cardiac glycosides, tannins, saponins, steroids, flavonoids, alkaloids and triterpenes. Alkaloidal contents in the leaf extracts ranged from 8.96 ± 0.05 to 16.96 ± 0.48 while the content in the stem extracts is 5.38 ± 0.04 to 14.93 ± 0.02. The phenol contents were higher in both extracts ranging from 43.05 ± 0.04 to 142.96 ± 0.07 and 85.05 ± 0.04 to 148.51 ± 0.07 in the leaf and stem extracts, respectively. Saponin contents in the leaf range from 3.56 ± 0.01 to 19.46 ± 0.01 in the leaf extracts and 9.93 ± 0.01 to 16.62 ± 0.01 in the stem extracts. Compounds such as myricetin, kaempferol-3-glucuronide,

[*]Corresponding author: hadeezai161@gsu.edu.ng

dihydroisorhamnetin, vanillic acid, 5,7-dihydroxy2-(4-hydroxy-3)methoxy)-3-{(3,4,5-trihydroxy-6 (hydroxymethyl)-oxan-2-yl)oxy}-4H-chromen4-one, 1H-indole-3-acetronitrille, 3,5-trihydroxy-10 methylacridone, syringin, gallic acid, anthranilic acid and quassin were identified in the liquid chromatography-mass spectroscopies (LC-MS) of the methanolic stem and leaf extracts of shea tree. The results of the phytochemical investigation indicate variation in the chemical composition of the plant across the study area.

Keywords: *Vitellaria paradoxa*, Stem, Leaves, Phytochemical, Chemotaxonomic

INTRODUCTION

Shea (*Vitellaria paradoxa* C. F. Gaertn.) is probably one of the most important plant species of environmental and socio-economic significance found in the arid and semi-arid zones of Africa (Zagga *et al*. 2021). It is a long-lived tree native to the Sahel and Savannah belt of African regions, growing naturally from Senegal in the West to the Kenya and Ugandan areas of the East and generally known as a significant source of edible fat and oil (Iddrisu, Didia and Abdulai 2019; Choungo-Nguekeng *et al*. 2021). The butter obtained from shea tree constitute the main cooking oil for an estimated 86 million people and contributes significantly to the economic growth of the country they are cultivated owing to its use in the pharmaceutical, cosmetic and confectionary industries (Zagga *et al*. 2021).

Traditionally, the roots, stem, leaves and barks of shea tree are used in the treatment of diarrhea, wound infections, dysentery, gastrointestinal infections, jaundice and abdominal pains, while the leaves are employed in northern Ghana to treat abdominal pain in adolescence and along with other herbs in the treatment of headaches and fever (Omara *et al*. 2020; Shehu *et al*. 2019). Historically, the bark is employed in treatment of leprosy and as eyewash to treat eye infections (Omara *et al*. 2020; Adetunde, Awo and Imoro 2023). In northern part of Nigeria, the root of shea tree is used as chewing stick and in the management of gastrointestinal disorders (Muotono, Maanikuu and Peker 2017). Pharmacological studies of the various parts of the plants were reported to have cytotoxic, anti-inflammatory, antioxidant, anti-rheumatic, antidiabetic, antimicrobial and antiaging activities (Sinan *et al*. 2020; Ojo *et al*. 2021).

The genetic composition and physiological stages of plant as well as environmental conditions have been reported to strongly influence the chemical profiles of certain phytochemicals such as polyphenols, fatty acids, steroids and glycosides (Agostini-Costa 2022). The environmental factors are observed to strongly influence the gene expression pathways in the biosynthesis of phytochemicals (Falahati-Anbaran *et al*. 2018). Studies on the genetic variability of shea trees across Ghana, Uganda and Nigeria have indicated that variation of the tree is within the population than across population (Ibrahim *et al*. 2022; Anyomi *et al*. 2023; Odoi *et al*. 2023). Also, variation in the physicochemical properties of shea butter have been attributed to the environmental factors (Akihisa *et al*. 2010), with no study found on the variation of the phytochemical constituents of the leaves and stem extracts of shea tree. Therefore, the present study was aimed at determining variation in the phytochemical constituents of the leaves and stem of *V. paradoxa* growing in Northern Nigeria.

MATERIALS AND METHODS

Study Area

The study areas were Ngaski (latitude 10° 24' 26" North; longitude 4° 43' 4" East), Bosso (latitude 9° 36' 53" North; longitude 6° 21' 57" East) and Yamaltu-Deba (latitude 10° 14' 18" North; longitude 11° 26' 30" East) of Nigeria, respectively (Figure 1).

Figure 1: A Nigerian map showing the three study areas.

Collection of Plant Material

The leaves and stem of shea tree were sourced across 20 trees in a farmland population of *V. paradoxa* in the months of August 2018 to September 2018. The plant samples were identified in the field and authenticated at the Herbarium Unit of the Department of Botany, Ahmadu Bello University, Zaria-Nigeria. A voucher number ABU900148 was assigned. The leaves and stem samples were dried at room temperature, pulverised and stored in airtight containers for further use.

Extraction and Qualitative Phytochemical Screening of *V. paradoxa* Extracts

Extraction of the powdered leaves and stem was carried out by maceration using methanol for 72 h with frequent agitation. The extracts collected were dried over hot water bath. Qualitative phytochemical screening was conducted for the determination the presence or absence of various phytochemicals (Sofowora 2008; Evans 2009).

Quantitative Phytochemical Screening of *V. paradoxa* Extracts

Deionised water (100 mL) was used to dissolve 0.01 g of each extracts to produce a solution of 0.01 mg/mL for saponins, tannins and flavonoids for the stem and leaf extracts. A similar concentration was used for the total phenols for the stem and leaves extracts from Ngaski and Yamaltu Deba but the stem and leaves extracts from Bosso were further diluted in 10 mL of water before viewing under the spectrophotometer. A concentration of 0.1 g to 100 mL of water to produce 0.1 mg/mL solution was prepared for determination of the alkaloid contents.

Determination of Saponin Content

The total saponin content was determined using the method reported by Makkar, Siddhuraju and Becker (2007). A concentration of 0.25 mL; 8% was added to each extract. Sulphuric acid (2.5 mL; 72% v/v) were added to each solution and the solutions were incubation for 10 min at 600°C, before cooling on ice. The absorbance of saponin content was taken at 544 nm (UV visible spectrophotometer). The standard calibration curve was obtained from different concentrations of saponins (0.1 mg/mL–0.01 mg/mL). The saponins contents were expressed in mg saponin equivalents (SE) per g dry weight (DW).

Determination of Phenol Content

The Folin-Ciocalteu colorimetric method was used to determine the phenol contents as expressed in mg gallic acid equivalent (GAE) per gram of sample. The extracts (0.5 mL) including gallic acids of concentrations between 0.01 mg/mL and 0.1 mg/mL were dissolved in methanol. Two millilitre of Folin-Ciocalteu reagent were added to each extracts before the addition of 4 mL sodium carbonate (7.5 % w/v). The covered tubes were incubated for 30 min at room temperature with shaking intermittently. Methanol was used as a blank with absorbance taken at 765 nm (Ainsworth and Gillespie 2007).

Determination of Flavonoid Content

Flavonoid contents of the extracts were determined using the aluminium chloride colorimetric method as expressed in mg quercetin per gram of sample with absorbance taken at 510 nm. Aliquots of each extract (0.5 mL) including quercetin of concentrations between 0.01 mg/mL and 1.0 mg/mL were prepared by dissolving in distilled water (2 mL). Sodium nitrite (5% $NaNO_2$ w/v) solutions of 0.15 mL were added to each aliquot and left to stand for 6 min before addition of 0.15 mL aluminium chloride (10% $AlCl_3$ w/v), which was further allowed for 6 min. Two millilitre sodium hydroxide solution (4% NaOH w/v) was added before adjusting the solution to 5 mL with distilled water and allowed to stand for 15 min (Surana, Kumbhare and Wagh 2016).

Determination of Tannin Content

The Folin-Ciocalteu method was used to determine the tannin content expressed in mg of gallic acid per gram, with UV absorbance taken at 725 nm. A solution of 0.1 mL of each extracts and gallic acid (0.01 mg/mL–0.1 mg/mL) was transferred to a 10 mL volumetric flask containing distilled water (7.5 mL) and Folin-Ciocalteu (0.5 mL) was added. One millilitre of sodium carbonate (35%) solution was added to the solution, shaken and incubated for 30 min at room temperature before addition of distilled water to make up 10 mL of the solution (Afify *et al*. 2012).

Determination of Alkaloid Content

The alkaloidal content were determined using bromocresol green (BCG) with atropine used as the standard and UV absorbance taken at 470 nm. The phosphate buffer solution used was neutralised using 0.1 N NaOH. Five millilitre each of BCG solution and phosphate

buffer were added to 1 mL of the extracts and atropine (0.01 mg/mL–0.1 mg/mL) solutions, agitated to form complex which was extracted using chloroform and diluted to produce 10 mL of the solution using chloroform in a volumetric flask (Ajanal, Gundkalle and Nayak 2012).

LC-MS Analysis of *V. paradoxa* Extracts

The liquid chromatography-mass spectroscopies (LC-MS) of the extracts were determined using the Waters® e2695 Separation Module with W2998 PDA and couple ACQ-QDA MS Centre for Dryland Agriculture, Bayero University, Kano-Nigeria. The extracts were dissolved in methanol before filtering using the polytetrafluoroethylene (PTFE) membrane filter (0.45 µm). Injection of 10.0 µL of the filtrate into the LC system was carried out which was separated on Sunfire C18 5.0 µm 4.6 mm × 150 mm column, maintained at 25°C with flow rate of 1.0 mL/ min. The gradient dilution consisted of 0.1% of formic acid in water (0.1%) and formic acid in acetronitrille (0.1%) mobile phases for samples A and B, respectively. The setting of the PDA was at 210 nm–400 nm with sample rating of 10 points/sec and 1.2 nm resolutions. The mass spectra of the samples were generated using a scan range of 100 m/z to 1,250 m/z. The ESI was set in positive ion mode with capillary voltage at 0.8 kV, with temperature set at 600°C, flow rate at 10 mL/min and nebuliser gas at 45 psi. The mass spectra set were in an automatic mode applying fragmentation voltage of 125. The data generated were processed in the Empower 3 and compound identifications was based on fragmentation pattern, elution order, retention time and base m/z (Piovesana*,* Rodriguez and Norena 2018) The identification of the compounds was based on comparison of the information generated with those reported in Human Metabolome Database (HMDB) and FooDB version 1.0 database.

RESULTS

Percentage Yield of the Plant Extracts

The colour and texture of the methanol extracts of the leaves were all black and sticky except for the leaf extract from Ngaski that was brown. The methanol extracts of the stem were amorphous and brown in colour except for the stem extracts from Ngaski that was sticky. The percentage yields of the methanol leaf extract varied across the three locations with the leaf extract from Ngaski having the highest percentage yield of 41.1%, then followed by that of Bosso with yield of 33.1% and the least was obtained from the leaf extract from Yamaltu-Deba with yield of 21.1%. The percentage yield of the stem extracts also varied with that of Yamaltu-Deba having a higher percentage yield of 15.5%, then followed by the stem extract from Bosso with yield of 14.6% and the least was that of Ngaski with yield of 12.7% (Table 1).

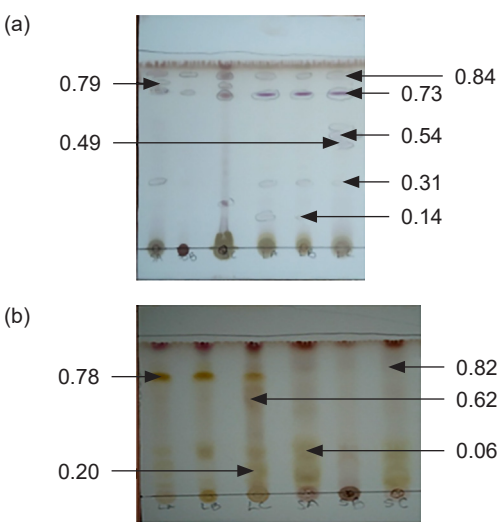
Table 1: Colour, texture and percentage yield of the methanol extracts of shea stem and leaves.

S/no	Sample	Colour	Texture	Percentage yield
1.	LA	Brown	Sticky	33.1
2.	LB	Black	Sticky	41.1
3.	LC	Black	Sticky	21.1
4.	SA	Brown	Sticky	12.7
5.	SB	Brown	Amorphous	14.6
6.	SC	Brown	Amorphous	15.5

Notes: LA = shea leaf from Ngaski; LB = shea leaf from Bosso; LC = shea leaf from Yamaltu-Deba; SA = shea stem from Ngaski; SB = shea stem from Bosso; SC = shea stem from Yamaltu-Deba.

Preliminary Phytochemical Analysis

The phytochemical screening on the methanol extracts of the leaf and stem of *V. paradoxa* revealed the presence of carbohydrates, saponins, cardiac glycosides, flavonoids, tannins, alkaloids, steroids and triterpenes while anthraquinones were absent in all the extracts. The TLC profile for the plant extracts using chloroform:methanol (7:1) and butanol:acetic acid:water (4:1:3) as solvent systems and sprayed with 10% sulphuric acid revealed that all the leaves and stem extracts showed two compounds at 0.73 and 0.84 Rf values, while all the leaf extracts and SA had a compound at 0.31 Rf value. SA and SC had compound at Rf value 0.79 and LC had compounds at Rf values of 0.54 and 0.49 (Plates 1a–b). The TLC profile for the plant extracts sprayed with aluminium chloride and viewed under UV-Vis 365 nm revealed that all the leaves and stem extracts had three compounds with 0.38, 0.55 and 0.77 Rf values (Plate 2).



Plates 1a–b: TLC plates of methanol extracts of the stem and leaves from the three study areas developed in chloroform:methanol (7:1) and butanol:acetic acid:water (4:1:3) sprayed with 10% sulphuric acid.

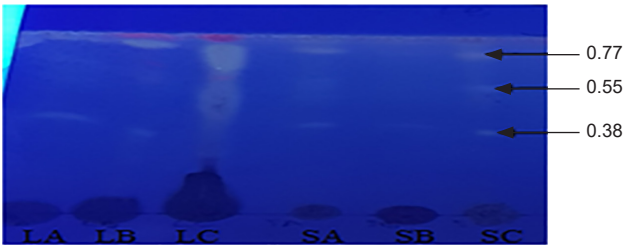


Plate 2: TLC plates of methanol extracts of the stem and leaves from the three study areas using solvent system-butanol: acetic acid: water (4:1:3) sprayed with AlCl3 and viewed under UV-Vis 365 nm.

Quantitative and LC-MS Phytochemical Analysis

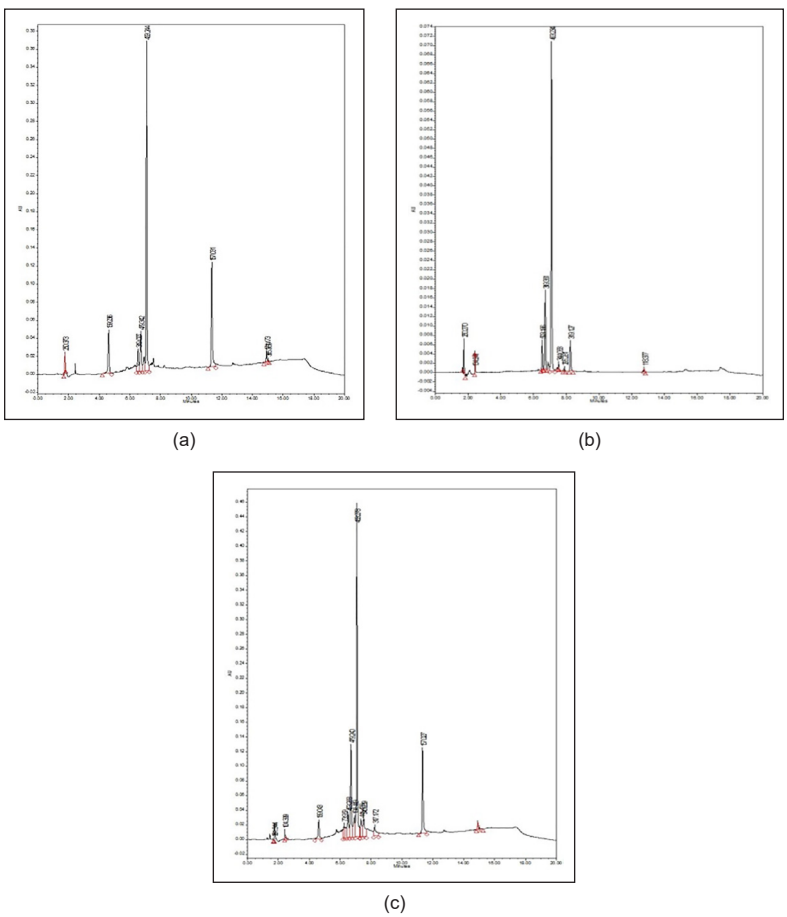
The results of the quantitative phytochemical studies revealed a wide variation in the phytochemical contents between the study samples. The leaf extract LA had the least phytochemical contents for phenols, flavonoids, tannins, alkaloids and saponins at 43.05 ± 0.04/gallic acid, 35.08 ± 0.14/quercetin, 3.13 ± 0.04/gallic acid, 8.96 ± 0.05/ atropine and 3.56 ± 0.01/diosgenin, respectively. The leaf extract LB had the highest quantity of flavonoids (43.58 ± 0.14/quercetin), alkaloids (16.96 ± 0.48/atropine) and tannins (20.59 ± 0.01/gallic acid), with the leaf extract LC having the highest quantity of phenols (142.96 ± 0.07/gallic acid) and saponins (19.46 ± 0.01/diosgenin). The stem extract SB had the highest quantity of phenols (148.51 ± 0.07/gallic acid), tannins (17.20 ± 0.04/gallic acid), saponins (16.62 ± 0.01/diosgenin) and alkaloids (14.92 ± 0.02/atropine) but the highest quantity of flavonoids was recorded on the stem extract from SA at 68.08 ± 0.14/quercetin. While the stem extract SC had the lowest quantity of phenols, flavonoids, tannins, alkaloids and saponins at 85.05 ± 0.04/gallic acid, 57.73 ± 0.02/quercetin, 8.63 ± 0.04/gallic acid, 5.38 ± 0.04/atropine and 9.93 ± 0.01/diosgenin, respectively (Table 2).

Table 2: Quantitative phytochemical of methanol leaf and stem extracts (mg/g).

No.	Phytochemical	Mean values (mg/g) of samples					
		LA	LB	LC	SA	SB	SC
1.	Phenols (gallic acid)	43.05 ± 0.04	125.80 ± 0.06	142.96 ± 0.07	127.92 ± 0.39	148.51 ± 0.07	85.05 ± 0.04
2.	Flavonoids (quercetin)	35.08 ± 0.14	43.58 ± 0.14	39.20 ± 0.18	68.08 ± 0.14	64.17 ± 0.14	57.73 ± 0.02
3.	Tannins (gallic acid)	3.13 ± 0.04	20.59 ± 0.01	13.40 ± 0.01	9.65 ± 0.04	17.20 ± 0.04	8.63 ± 0.04
4.	Saponins (diosgenin)	3.56 ± 0.01	14.86 ± 0.01	19.46 ± 0.01	13.39 ± 0.01	16.62 ± 0.01	9.93 ± 0.01
5.	Alkaloids (atropine)	8.96 ± 0.05	16.96 ± 0.48	12.46 ± 0.05	6.99 ± 0.53	14.93 ± 0.02	5.38 ± 0.04

Notes: LA = shea leaf from Ngaski; LB = shea leaf from Bosso; LC = shea leaf from Yamaltu-Deba; SA = shea stem from Ngaski; SB = shea stem from Bosso; SC = shea stem from Yamaltu-Deba.

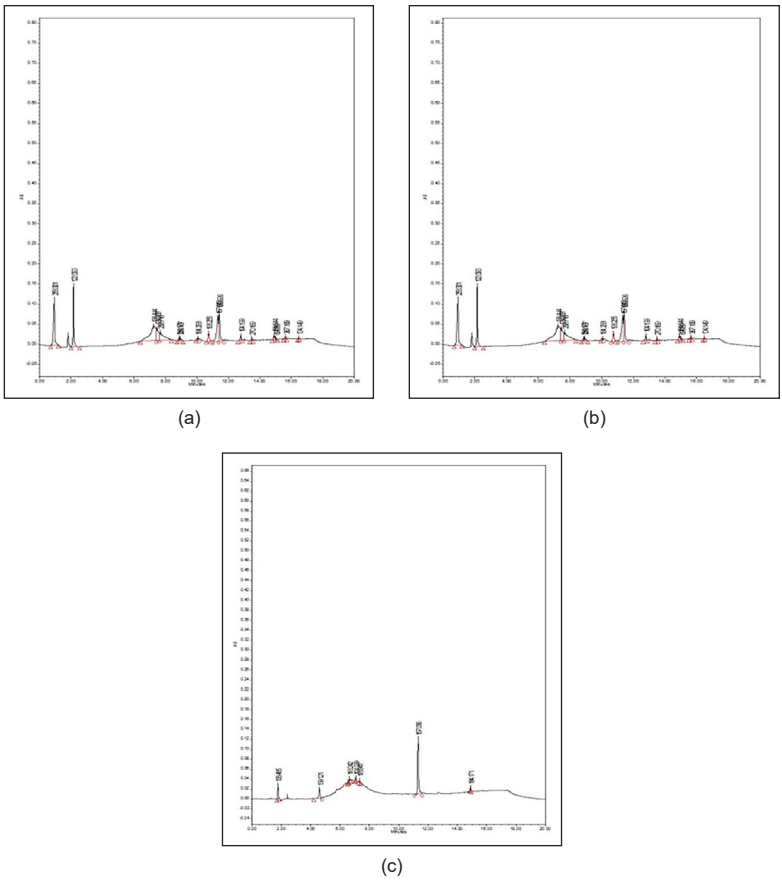
The LC-MS results of the shea leaf extracts from the three study areas showed that they are mainly rich in flavonoids. The MS spectra of all the leaf extracts had similar peaks at 319 m/z $[M+H]^+$ and 463 m/z $[M+H]^+$ which is found to correspond with the molecular weight of myricetin ($C_5H_{10}O_8$) and kaempferol-3-glucuronide ($C_{21}H_{10}O_{12}$), respectively. The LC-MS for LA and LB also showed a peak at 319 m/z $[M+H]^+$ which is proposed to be dihydroisorhamnetin ($C_{16}H_{14}0_7$). LA and LC showed similar peak of 169 m/z $[M+H]^+$, 479 m/z $[M+H]^+$ and 157 m/z $[M+H]^+$ which are proposed for vanillic acid ($C_8H_8O_4$), 5,7-dihydroxy-2-(4-hydroxy3)methoxy)-3-{(3,4,5-trihydroxy-6-(hydroxymethyl)-oxan-2-yl)oxy}-4H-chromen-4-one ($C_{22}H_{22}O_{12}$) and 1H-indole-3-acetronitrille ($C_{10}H_8N_2$), respectively. The LC-MS results for the methanol stem extracts of shea tree showed presence of peak at 157 m/z $[M+H]^+$ in all the three extracts which is proposed to be 1H-indole-3-acetronitrille ($C_{10}H_8N_2$), while SA and SB had a peak at 367 m/x $[M+H]^+$ which is proposed to be a fatty acid called (E)-3-tetracosonoic acid ($C_{24}H_{46}O_2$). Extract SA showed a peak at 258 m/z $[M+H]^+$ suggested to be 1,3,5-trihydroxy10-methylacridone while extract SB showed peak at 502 m/z $[M+H]^+$ suggested to be Garciduol B as shown in Figures 2–3 and Tables 3–4.



(a) (b)

(c)

Figure 2: LC-MS spectra of methanol leaf extract of shea tree from (a) Ngaski, (b) Bosso and (c) Yamaltu-Deba



(a) (b)

(c)

Figure 3: LC-MS spectra of methanol stem extract of shea tree from (a) Ngaski, (b) Bosso and (c) Yamaltu-Deba

DISCUSSION

The genetic makeup of plant has been reported to have influence on plant constituents, but studies have also shown that environmental factors also influence the quantity and quality of plant active constituents, which may have influenced the variation in the yield of the extracts as seen in the present study (Zargoosh *et al*. 2019).

The qualitative phytochemical studies of the leaf and stem extracts revealed the presence of carbohydrates, cardiac glycosides, saponins, tannins, flavonoids, steroids, alkaloids and triterpenes similar to previous studies on the plant leaves and stem (Ndukwe *et al*. 2005; Ndukwe *et al*. 2007; Amlabu and Nock 2018). The TLC chromatogram of the extracts revealed that the extracts are rich in phenols based on the fluorescence produced by the TLC plate and had similar phytoconstituents based on their Rf values. The Rf values of the compounds identified from the TLC chromatogram were mostly above 0.5, which can be said to be attributed to polar phytochemicals as Gomathi *et al*. (2012) reported that compounds with Rf values below 0.5 are mostly attributed to non-polar compounds.

Table 3: Summary of the proposed compounds from the LC-MS spectra of the methanol leaf extracts of shea trees from the three study areas.

No.	$[M+H]^+$ m/z	Molecular weight	Proposed compound	Class of proposed compound	Molecular formular	LA	LB	LC
1	381	380	Tectorigenin 4'-sulfate	Flavonoid	$C_{16}H_{12}O_9S$	–	–	+
2	169	168	Vanillic acid	Flavonoid	$C_8H_8O_4$	+	–	+
3	453	452	5-androstene-3,17-diol,17-O-β-D-glucopyranoside	Phenolic glycoside	$C_{25}H_{10}O_7$	–	–	+
4	319	318	Myricetin	Flavonoid	$C_{15}H_{10}O_8$	+	+	+
5	319	318	Dihydroisorhamnetin	Flavonoid	$C_{16}H_{14}O_7$	+	+	–
6	319	318	2-(3,4-dihydroxyphenyl)-3,5,6,7-tetrahydroxy-4H-chromen-4-one	Flavonoid	$C_{15}H_{12}O_8$	+	–	–
7	503	502	Garciduol B	Xanthone	$C_{27}H_{18}O_{10}$	–	+	–
8	463	462	Kaempferol-3-glucoronide	Flavonoid	$C_{21}H_{18}O_{12}$	+	+	+
9	317	316	Isorhamnetic	Flavonoid	$C_{17}H_{19}NO_4$	–	–	+
10	479	478	5,7-dihyroxy-2-(4-hydroxy-3-methoxyphenyl)-3-{[3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl] oxy}-4H-chromen-4-one	Flavonoid	$C_{22}H_{22}O_{12}$	+	–	+
11	157	156	1H-indole-3-acetronitrille	3-alkylindole	$C_{10}H_8N_2$	+	–	–
12	171	170	Gallic acid	Flavonoid	$C_7H_6O_5$	+	–	–

Notes: LA = shea leaf from Ngaski; LB = shea leaf from Bosso; LC = shea leaf from Yamaltu-Deba; + = present; − = absence.

Table 4: Summary of the proposed compounds from the LC-MS spectra of the methanol stem extracts of shea trees from the three study areas.

No.	$[M+H]^+$ m/z	Molecular weight	Proposed compound	Class of proposed compound	Molecular formula	SA	SB	SC
1	258	257	1,3,5-trihydroxy-10-methylacridone	Alkaloid	$C_{14}H_{11}NO_4$	+	–	–
2	373	372	Syringin	Phenolic glycoside	$C_{17}H_{24}O_9$	–	+	–
3	270	269	4-hydroxy-2-quinolone	Alkaloid	$C_{16}H_{15}O_3$	+	–	–
4	367	366	(E)-2-tetracosoic acid	Fatty acid	$C_{24}H_{46}O_2$	+	+	–
5	389	388	Quassin	Terpene	$C_{22}H_{28}O_6$	–	+	–
6	157	156	1H-indole-3-acetronitrille	3-alkyindole	$C_{10}H_8N_2$	+	+	+
7	196	195	Leucodpachrome	Amino acid	$C_9H_9NO_4$	–	+	–
8	184	183	(R)-Synephrine	Alkaloid	$C_9H_{13}NO_3$	+	–	–
9	171	170	Gallic acid	Flavonoid	$C_7H_6O_5$	–	+	–

Notes: SA = stem extract from Ngaski; SB = stem extract from Bosso; SC = stem extract from Yamaltu-Deba; + = present; – = absence.

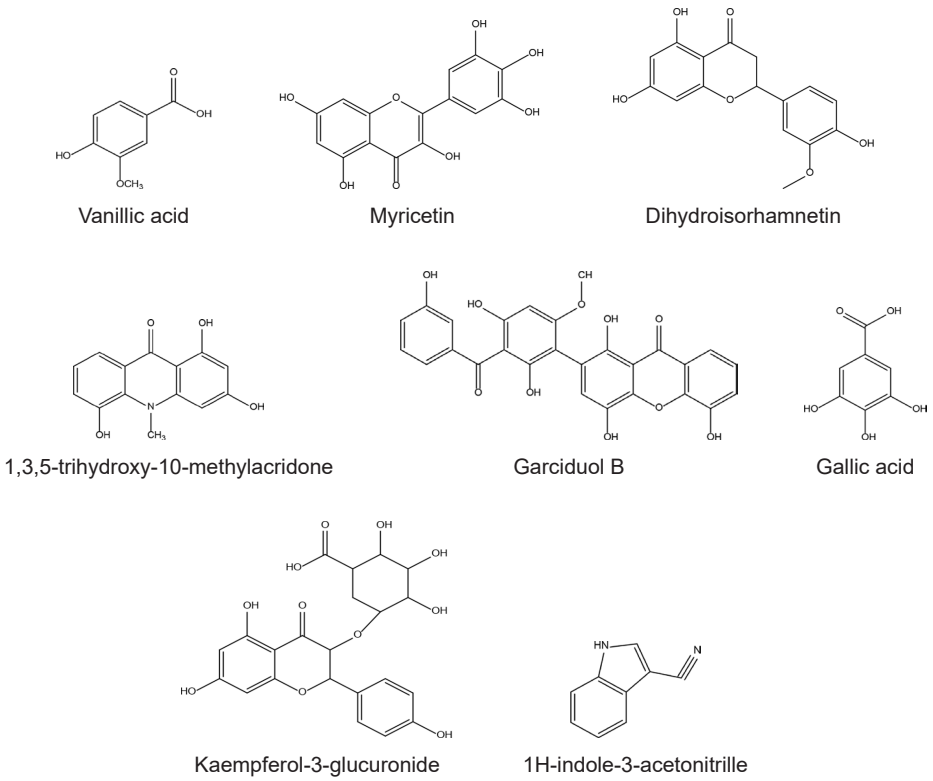


Figure 4: Structures of some of the proposed compounds identified in the LC-MS spectra of shea leaf and stem methanol extracts.

Environmental factors such as temperature, sunlight, humidity and other biotic factors are major limiting factors that determine the quality and quantity of secondary metabolites they produce in order to compete favourably with environmental stress (Pant, Pandey and Dall'acqua 2021; Pacheco-Hernández *et al*. 2021). The quantitative phytochemical studies of the phenolic, tannins, alkaloids and saponin contents from the plant extracts varied greatly across the study areas. This variation in the phenolic contents can be attributed to factors such as UV radiation and sunshine duration which greatly influences the accumulation of phenols in plants (Ma *et al*. 2016; Mykhailenko *et al*. 2020). The variation in the alkaloid content from this study can also be attributed to the genetic makeup and environmental conditions, although the developmental stage of plant growth may also play a vital role in the accumulation of this secondary metabolite (Sun *et al*. 2018).

The composition of phytochemicals in the leaves and stem extracts of *V. paradoxa* varies greatly from the TLC profile and quantitative phytochemical analysis. Also, the LC-MS results of the leaves extracts had m/z intensities between 300 m/z and 500 m/z with m/z intensities of the stem extracts between 122 and 387. This result can be an indication of differences in the composition of the plant based on the plant parts as was reported by Sinan *et al*. (2020) on similar differences in the chemical composition of the leaves and stem extracts of *V. paradoxa*.

The TLC profile and quantitative phytochemical studies of the plant extracts in this study is an indication of the presence of high concentrations of phenols. This may has greatly influences the LC-MS results with prediction of phenolic compounds such as myricetin, kaempferol-3-glucuronide, gallic acid, vanillic acid and dihydroisorhamnetin in the leaves extracts. This also supports the claim that plants from Sapotaceae family are rich in phenols, with gallic acid and myricetin which were from isolated *V. paradoxa* (Baky *et al*. 2016; Eyong *et al*. 2018). The present study showed all the shea stem extracts contains 1H-indole-3-acetonitrille, which is a 3-alkylindole compound commonly found in Brassicaceae family and recently reported in *Stixis suaveolens* of the Capparaceae family (Ciska and Pathak 2004; Anh *et al*. 2020).

CONCLUSION

The preliminary phytochemical, TLC profile and LC-MS analysis of the methanol leaves and stem extracts of *V. paradoxa* is an indication that the plant contains similar phytochemicals across the study area, although the quantitative phytochemical analysis showed variation in the quantity of these phytochemicals, which may be attributed to environmental factors.

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