



## Gas chromatographic-mass spectrometry-based chemotaxonomic profiling of *Senna*, *Cassia*, and *Albizia* species of the Fabaceae family

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### ARTICLE INFORMATION

### ABSTRACT

MS No. JOBAS\_2025\_006

Received: 11/08/2025

Revised: 30/10/2025

Accepted: 28/11/2025

Published: 12/01/2026

#### Keywords:

*Albizia* spp

*Cassia* spp

Chemotaxonomy

Fabaceae

*Senna* spp

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ISSN: 3121-8210

*Senna*, *Cassia* and *Albizia* are diverse genera within the Fabaceae family, characterised by complex taxonomy of morphological plasticity and hybridisation. This study employed Gas Chromatography-Mass Spectrometry (GC-MS) to profile the diethyl ether leaf extracts of nine species: *Senna alata*, *C. fistula*, *S. podocarpa*, *S. obtusifolia*, *S. occidentalis*, *S. siamea*, *Albizia lebeck*, *A. adianthifolia*, and *A. zygia*. A total of 117 phytocompounds were identified across all the species studied, with 28 to 40 identified per species. Alcohols (34.19%) and carboxylic acids (17.95%) were the most prominent compounds. Four compounds: -3,7,11,15-Tetramethyl-2-hexadecen-1-ol, Phytol, 9-Octadecenamide, and n-Hexadecanoic acid- were present in all the species. Similarity indices ranged from 19.61% (*S. siamea* and *S. podocarpa*) to 58.62% (*S. alata* and *S. occidentalis*). Multivariate analyses revealed distinct groupings, notably the divergence of *Albizia lebeck*, which formed a separate cluster characterized by a high abundance of 1-Monolinoleoylglycerol trimethylsilyl ether, Benzeneacetic acid, and 6,10-Dodecadien-3-ol, among other compounds. Conversely, *S. podocarpa* showed close affinity with *Albizia* species, defined by their shared abundance of alcohols (n-Nonadecanol-1 and 2-Pentadecyn-1-ol) and sterols (Lupeol and  $\beta$ -Sitosterol). These chemotaxonomic findings complement existing morphological data and provide refined differentiation among closely related species. The study demonstrates the value of GC-MS phytochemical profiling in resolving systematic relationships within Fabaceae.

### 1.0 Introduction

The Fabaceae (Leguminosae) is the third largest family of angiosperms, comprising approximately 22,500 species distributed across 750 genera [1]. Members of this family range from trees and shrubs to lianas and herbs, with considerable ecological and economic importance [2]. Traditionally, the family is divided into three major subfamilies: Caesalpinioideae, Mimosoideae, and Faboideae based on floral symmetry and pollen morphology has been progressively re-evaluated in light of molecular phylogenetic evidence [3].

The genus *Senna* (Caesalpinioideae) includes about 350 species worldwide, many of which are widely used in ornamental horticulture and traditional medicine [4]. In West Africa, approximately 22 indigenous species have been recognised [5]. Taxonomically, *Senna* was formerly classified under the genus *Cassia*, and later separated based on morphological and molecular evidence [6; 7]. However, species delimitation within the genus remains problematic due to morphological polymorphism in traits like leaflet arrangement and pod structure and frequent hybridisation, which often complicates precise species delimitation [8].

This taxonomic complexity is exemplified by *Cassia siamea* (Lam.) H.S. Irwin & Barneby and *Cassia fistula* L. which have received particular attention. *Cassia fistula* L., traditionally classified under the genus *Cassia* or sometimes *Senna* by some literature, remains taxonomically valid in *Cassia* placement. In contrast, *Cassia siamea* has been reclassified as *Senna siamea* (Lam.) H.S. Irwin & Barneby, reflecting modern consensus based on floral morphology, seed characters, and molecular evidence (9). However, their overlapping morphological traits and shared phytochemical constituents often blur genus boundaries, prompting ongoing debate about their taxonomic boundaries. These ambiguities underscore the need for complementary chemotaxonomic approaches, such as GC-MS, to clarify their systematic placement and assess whether chemical profiles corroborate or challenge traditional classifications. Similarly, the genus *Albizia* (Mimosoideae) comprises around 150 species, primarily distributed across tropical and subtropical regions of Africa and Asia [10, 11]. *Albizia* species are valued for timber, fodder, and their ability to fix atmospheric nitrogen [12]. As with *Senna*, taxonomic classification of *Albizia* is complicated by high morphological variability, overlapping characters, and potential hybridization events [13].

These challenges, particularly in *Senna* and *Albizia*, are compounded by the limitations of traditional taxonomy, which relies heavily on floral and foliar morphology. In light of these difficulties, chemotaxonomy, using chemical constituents as diagnostic taxonomic markers has emerged as a valuable complementary approach [8]. Gas Chromatography–Mass Spectrometry (GC-MS) is particularly effective for profiling plant secondary metabolites and generating chemical fingerprints, offering insight into phylogenetic relationships and aiding in species delimitation [13, 14].

Although phytochemical studies of individual *Senna* and *Albizia* species have been conducted [15, 16], comparative GC-MS-based analyses across multiple species are limited. Therefore, this study was aimed at profiling and comparing the phytochemical constituents of selected *Senna*, *Albizia* and overlapping *Cassia fistula* using GC-MS, with a view to identify intergeneric and interspecific similarities and differences that may assist in resolving taxonomic ambiguities.

## 2.0 Materials and Methods

### 2.1 Plant Materials, Collection and Authentication

Fresh, mature leaves from nine plant species (*Senna alata*, *S. occidentalis*, *Cassia fistula*, *Albizia lebbekii*, *S. obtusifolia*, *S. siamea*, *S. podocarpa*, *A. adinathifolia* and *A. zygia*) were collected to account for phytochemical variation. Collection

was conducted during the early wet season (May–June 2023) between the 0600 and 0900 GMT from natural populations across various locations in Ilorin, Kwara State, Nigeria. Only fully expanded, healthy leaves from the mid-canopy were selected to ensure consistency. The collected specimens were identified and authenticated at the Herbarium Unit, Department of Plant Biology, University of Ilorin, where voucher specimens were deposited (Voucher Nos: UILH/001/1566/2025; UILH/002/1298/2025; UILH/003/1020/2025; UILH/004/993/2025; UILH/004/760/2025; UILH/005/881/2025; UILH/006/1821/2025; UILH/002/1819/2025 and UILH/008/1820/2025). Fresh leaves of *O. gratissimum* were harvested from a cultivated garden in Ilorin, Kwara State, Nigeria whilst healthy onion bulbs (2–3 cm in diameter) were obtained from a local market in Ilorin, Nigeria. The plants were authenticated at the Herbarium Unit, Department of Plant Biology, University of Ilorin, and the voucher specimen was deposited with the herbarium.

### 2.2 Preparation of Plant Samples

Leaves of each plant were washed thoroughly with sterile distilled water to remove dusts and surface contaminants. The samples were air-dried room temperature (25–27°C) for two weeks until completely desiccated. The dried leaves were ground into a fine powder using a laboratory-grade electric blender (Binatone, Model: ES-1731F), and stored in clean, airtight containers at room temperature until extraction.

For each species, 25 grams of powdered leaf sample were extracted with 250 mL of 100% diethyl ether via cold maceration for 24 hours at room temperature. The resulting extracts were filtered through Whatman No. 1 filter paper (Whatman International Ltd, Maidstone England), and the filtrates were concentrated using a rotary evaporator (Heidolph, Germany) at 450 mbar pressure for 30 minutes. Concentrated crude extracts were stored at 4°C in amber bottles before

### 2.3 Gas Chromatography–Mass Spectrometer Analysis

Chemical profiling of the extracts was conducted using a Shimadzu QP2010 GC-MS system equipped with an Elite-1 fused silica capillary column (30 m × 0.25 mm I.D.; film thickness: 0.25 µm; Varian Chrompack CP-Sil 8). Helium was used as the carrier gas at a constant flow rate of 1.0 mL/min. One microliter (1 µL) of each extract was injected in split mode (split ratio 10:1) at an injector temperature of 250 °C. The oven temperature was programmed as follows: initial temperature at 60 °C (2 min hold), ramped at 10 °C/min to 280 °C, and then held isothermally

for 10 min. The ion source temperature was set at 200 °C, the interface temperature at 250 °C, and electron ionization was performed at 70 eV.

Compounds were identified by comparing the mass spectra of each peak with those from the National Institute of Standards and Technology (NIST11) library. Only compounds with high similarity index (SI) scores were considered reliable and reported. The names, molecular weights, and chemical structures of identified compounds were recorded.

### 2.5 Statistical Analysis

Phytochemical profiles were represented as a binary presence-absence matrix (Supplementary Data 1). Interspecific relationships and chemical variation were assessed through Principal Component Analysis (PCA) and heatmap visualization using ClustVis [17], following chemotaxonomic standards [18]. To move beyond visual clustering, a quantitative similarity index was calculated for each species pair to objectively measure phytochemical congruence, as described by Sagaya and AbdulRahaman [19].

### 3.0 Results

The GC – MS analysis identified 117 compounds in the diethyl extracts across the nine species studied (Figure 1). The number of compounds detected per species was as follows: *Senna alata* (37), *S. fistula* (28), *S. obtusifolia* (39), *S. occidentalis* (37), *Cassia siamea* (28), *S. podocarpa* (40), *Albizia lebbbeck* (35), *A. adianthifolia* (35), and *A. zygia* (38). The retention times ranged from 4.792 min (Dimethyl Sulfoxide) to 24.273 min (1-Chloroeicosane). *Senna podocarpa* recorded the highest retention time, eluting between 9.173 and 24.273 minutes. The lowest were observed in *S. siamea* and *C. fistula*, ranges of 4.792–23.359 min and 9.844–24.127 min, respectively. The compound with the highest molecular weight (MW 652) was Cinnamic acid, 4-hydroxy-3-methoxy-, (5-hydroxy) ( $C_{31}H_{40}O_{15}$ ), identified in *S. podocarpa* at 21.726 min. The lowest molecular weight compound (MW 78) was Dimethyl Sulfoxide ( $C_2H_6OS$ ), detected in *S. siamea* at 4.792 min. The dominant metabolite varied across species, with Phytol being the most abundant in three *Senna* species (*S. obtusifolia* (35.67%), *S. alata* (20.81%), *S. occidentalis* (32.55%)), while unique compounds like 2,3-Diphenylcyclopropyl methyl phenyl sulfoxide (24.53%) in *A. lebbbeck* and Supraene (14.77%) in *S. podocarpa* were dominant. Four compounds (3,7,11,15-Tetramethyl-2-hexadecen-1-ol, phytol, 9-Octadecenamide and n-Hexadecanoic acid) were consistently detected in all nine species studied.

*Albizia lebbbeck* contained Benzonitrile (9.19%), a unique marker, which is absent in all other species studied. Among the identified compounds, alcohols were the most abundant functional groups (86 total), with *S. podocarpa* and *A. zygia* containing the highest count (14 each). This was followed by carboxylic acids (55), most abundant in *S. occidentalis* (10). Other classes included are aldehydes, alkanes, alkenes, nitriles, esters, ketones and thiols

Chemical similarity based on Euclidean distance among the species is presented in Figure 2. Five pairwise combinations had similarity values  $\geq 50\%$ . The highest similarity was recorded between *S. alata* and *S. occidentalis* (58.62%), indicating a close phytochemical affinity. In contrast, the lowest similarities (19.61%) occurred in *C. siamea* and *S. podocarpa*, as well as *C. siamea* and *A. zygia*.

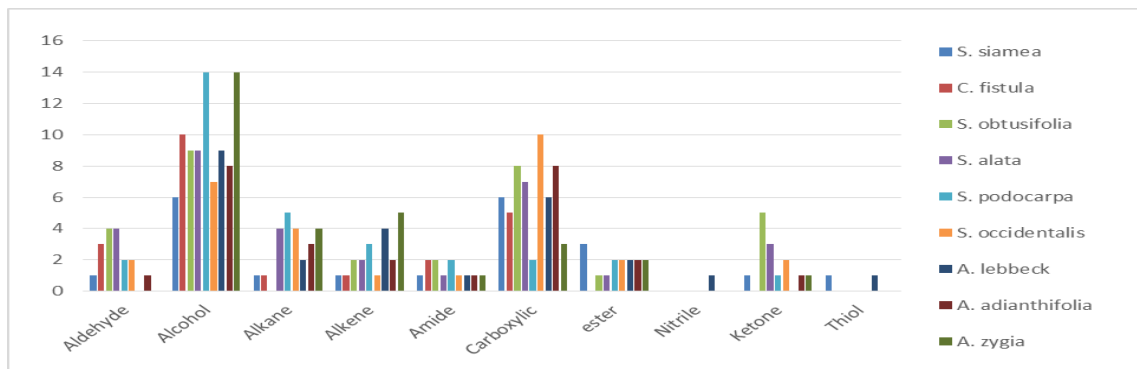
Interspecific similarity within *Senna* species ranged from 30% to 58% while the cross-generic similarities between *Senna* and *Albizia* species were generally lower (19%-30%), with few exceptions, such as *S. podocarpa* and *A. zygia* (46.67%) and *S. obtusifolia* and *A. adianthifolia* (36.36%). *Cassia siamea* shared moderate similarity with *Senna* species (up to 56%), supporting a close taxonomic affinity within Fabaceae.

The dendrogram (Figure 3) constructed from GC–MS data revealed two major groups based on the phytochemicals. The first group (*Senna* spp) revealed that *S. siamea* and *S. occidentalis* were sister taxa, while *S. alata* formed a paraphyletic relative to *S. obtusifolia*. The second cluster (*Albizia*) grouped *S. podocarpa* with *Albizia* species, particularly aligning closely with *A. zygia* and *A. lebbbeck*.

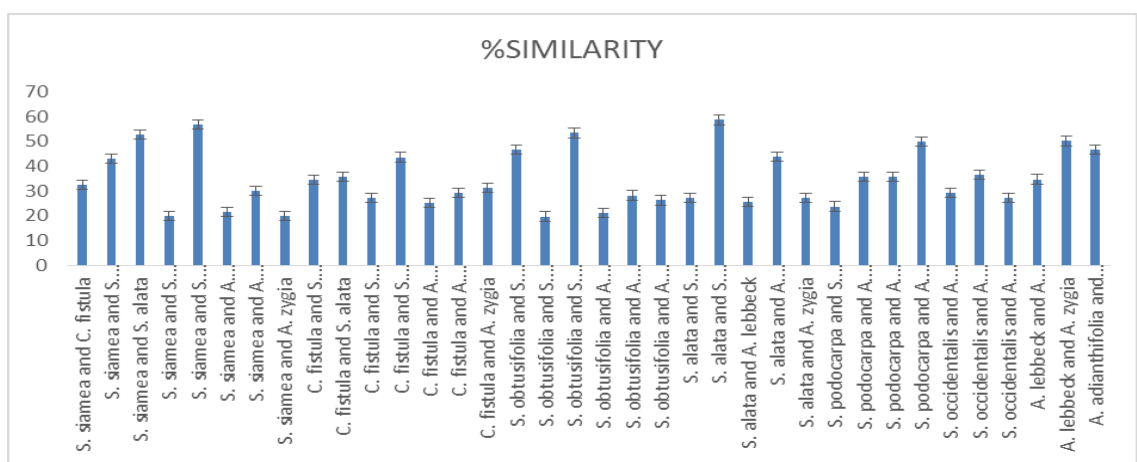
The Principal Component Analysis (PCA) scatter plot (Figure 4) supported the dendrogram findings, with clearly demarcated clusters for *Senna*, *Cassia*, and *Albizia*. The eigenvalues and the percentage of variance explained by each principal component are provided in Table (1). The first four PCs (PC1-PC4) were the most significant, collectively accounting for 86.3% of the total variance within the dataset. Specifically, PC1 and PC2, which are typically used for the primary visualization in a scores plot, together explained 55.5% of the variance (PC1: 33.9%, PC2: 21.6%). The contributions of the subsequent components (PC5-PC9) were comparatively minor, with each explaining less than 6% of the variance.

### 4.0 Discussion

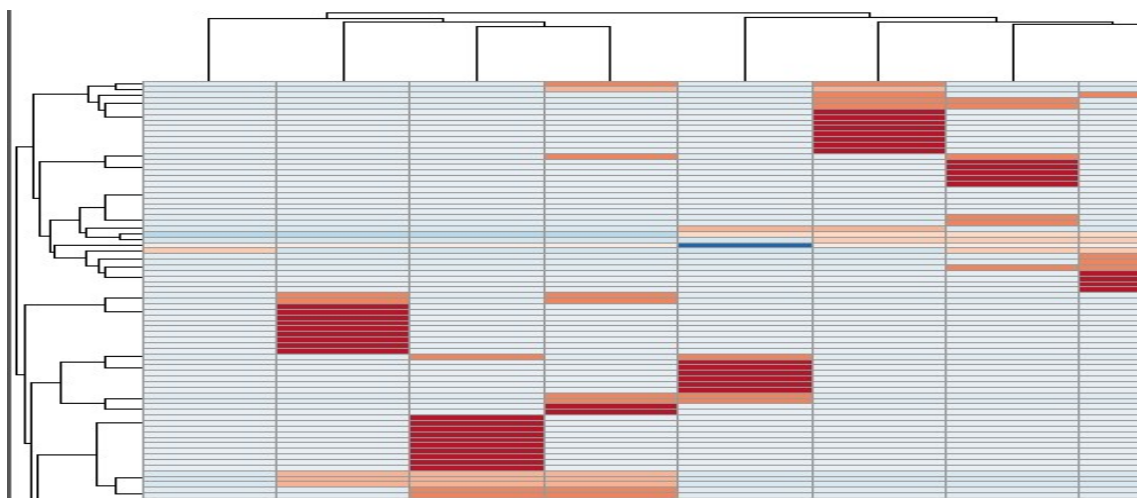
This study provides a comprehensive chemotaxonomic analysis of nine Fabaceae species, demonstrating the power of GC-MS-derived phytochemical profiles to clarify taxonomic relationship and validate secondary metabolites as



**Figure 1: The distribution of phytochemical compounds identified in the species studied**



**Figure 2: Percentage similarities phytochemical constituents identified in the species studied**



**Figure 3: UPGMA distant tree based on Euclidean similarity index showing the relationship among the phytoconstituents**

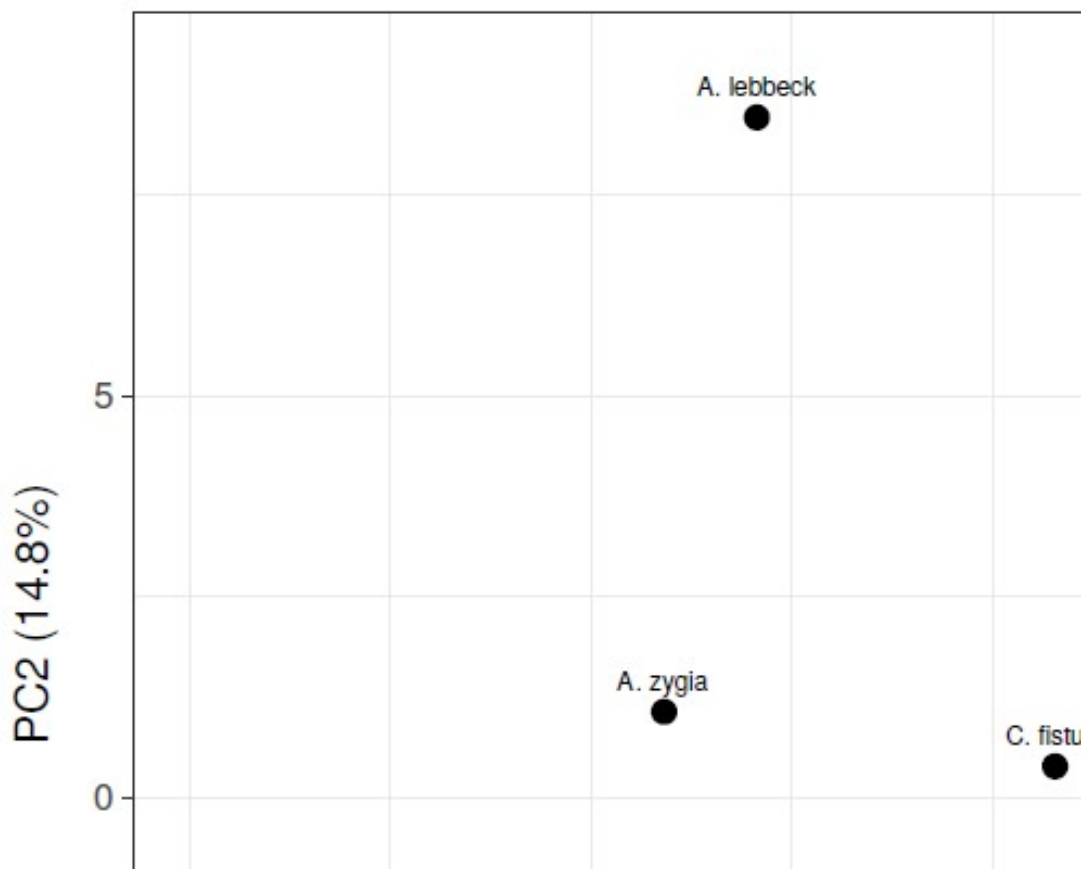


Figure 4: Scatter plot diagram based on the phytoconstituents of the nine species studied

Table 1: Eigenvalues and percentage contributions of the principal components (PCs)

Principal Component	Eigenvalue	Percentage of Variance Explained (%)	Cumulative Variance (%)
1	185.27	33.9	33.9
2	118.16	21.6	55.5
3	90.18	16.5	72.0
4	78.39	14.3	86.3
5	31.55	5.8	92.1
6	23.87	4.4	96.5
7	13.56	2.5	99.0
8	5.47	1.0	100.0
9	~0.00	~0.0	100.0

diagnostic markers. Our findings not only reinforce established classifications but also reveal significant anomalies, underscoring the value of chemotaxonomy as a complementary tool in plant systematics [11, 18].

The strategic selection of diethyl ether as an extraction solvent was pivotal to the breadth of our findings. Its documented efficiency in isolating a

wide range of medium-polarity bioactive compounds directly enabled the robust identification of 117 phytochemicals [20, 21]. This methodological choice explains the significant disparities between our results and studies using more polar solvents. For instance, our identification of 37 compounds in *Senna alata* contrasts with the 11 reported in a methanolic extract [22]; this is a

direct consequence of solvent selectivity rather than a contradiction, highlighting a critical need for standardized protocols in comparative chemotaxonomic research. The dominance of alcohols and carboxylic acids in our profiles is consistent with earlier findings in *Senna* and *Albizia* [15, 23], and confirms the utility of this approach for targeting taxonomically informative antimicrobial and antioxidant compounds.

A central theoretical implication of our work is the identification of both conserved chemical signatures and highly specific diagnostic markers. The abundant presence of compounds such as Phytol and n-Hexadecanoic acid across all species suggests they represent evolutionarily conserved traits within the Fabaceae, potentially serving as chemical synapomorphies for the family [24, 25]. Their widespread occurrence is likely due to fundamental roles in primary and secondary metabolism.

Conversely, we identified species-specific markers with significant diagnostic value for species delimitation. The restriction of squalene to *Albizia* species and the exclusive presence of Benzonitrile in *A. lebbeck* provide a chemical basis for distinguishing morphologically similar taxa [16]. Notably, the absence of 1,4:3,6-Dianhydro- $\alpha$ -D-glucopyranose in *S. podocarpa*, otherwise present in all *Senna* species, offers a clear chemotaxonomic character for its differentiation. These distribution patterns support earlier reports on their diagnostic value [16] and are the product of divergent evolutionary pathways, making them reliable tools for authentication.

The phytochemical data robustly address the historical confusion surrounding *Senna siamea* and *Cassia fistula*. While sharing a core set of ubiquitous compounds, their overall chemical profiles are distinct enough to firmly support their current separation into distinct genera. *Senna siamea* clustered closely with congeneric species like *S. alata*, reflecting shared genetic determinants of secondary metabolism, while *C. fistula* formed a separate branch, corroborating its distinct status based on molecular and morphological evidence [13, 24].

The most significant and intriguing finding of this study is the atypical clustering of *S. podocarpa* with *Albizia* species, particularly *A. adianthifolia* and *A. zygia*. This challenges the current morphology-based classification and prompts two non-mutually exclusive hypotheses: Convergent Evolution: The species may have independently evolved similar phytochemical profiles (rich in long-chain alkanes and sterols) in response to parallel ecological pressures, such as herbivory or pathogen load in shared habitats [23].

The shared biosynthetic pathways may indicate a closer phylogenetic relationship than currently

recognized, suggesting a potential need for a phylogenetic re-assessment of *S. podocarpa*. This chemical affinity, coupled with the lowest similarity (19.61%) observed between *S. siamea* and both *S. podocarpa* and *A. zygia*, underscores a high degree of phytochemical divergence within the group. This corroborates the blurred taxonomic boundaries noted within Caesalpinioideae [26] and hints at complex evolutionary pressures that warrant deeper molecular investigation. The distinct, separate clustering of *A. lebbeck* further reinforces its recognized taxonomic distance, consistent with reports of its unique metabolite suite [27].

Finally, the phytochemical analysis served two key functions: it validates well-established taxonomic relationships (e.g., within *Senna*, within *Albizia*) and it challenges specific classifications (e.g., *S. podocarpa*), thereby highlighting the power of chemotaxonomy to corroborate and question the existing systematic frameworks. The case of *S. podocarpa* is particularly instructive; its chemical affinity with *Albizia* necessitates further investigation to distinguish between convergent evolution and potential taxonomic misplacement.

## 5.0 Conclusion

This study has demonstrated that secondary metabolite profiling is not merely a descriptive tool but a source of robust, hypothesis-generating evidence that can guide future phylogenetic and evolutionary studies within the complex and economically vital Fabaceae family.

## Acknowledgements

The authors expressed their appreciation to the curator of the Department of Plant Biology, University of Ilorin Herbarium, Mr Bolu Ajayi for his support in the provision and identification of the plant specimen. Also, to the laboratory technologist for the facilities provided and the time given during the research work.

## Disclosure of conflict of interest

None

## Disclosure of source of funding/grant

None

## Authors Contributions

AS and SAA conceptualized the study; SAO carried out the study; AIL carried out data acquisition and drafted the manuscript; AS and

AAA revised the manuscript for intellectual content; all the authors approved it for publishing.

## References

1. Hughes, C., Ringelberg, J. J., & Bruneau, A. (2025). Legumes. *Current Biology*, 35(9), R323-R328.
2. Hasanuzzaman, M., Araújo, S., & Gill, S. S. (2020). The Plant Family Fabaceae: Biology and Physiological Responses to Environmental Stresses. Springer: Singapore. pp. 849.
3. Borges, L., Bruneau, A., Cardoso, D., Crisp, M., Delgado-Salinas, A., Doyle, J. J., & Wink, M. (2013). Towards a new classification system for legumes: Progress report from the 6th International Legume Conference. *South African Journal of Botany*, 89, 3-9.
4. Kumar, D., Jain, A., & Verma, A. (2017). Phytochemical and pharmacological investigation of *Cassia siamea* Lamk: an insight. *The Natural Products Journal*, 7(4), 255-266.
5. Hutchison, J., & Dalziel, J. M. (1958). Flora of West Tropical Africa. Vol I part 2. The Whitefriars press Ltd. London. pp. 516.
6. Irwin, H. S., & Turner, B. L. (1960). Chromosomal relationships and taxonomic considerations in the genus *Cassia*. *American Journal of Botany*, 47(4), 309-318.
7. Kumar, A., Tripathi, V., & Pushpangadan, P. (2007). Random amplified polymorphic DNA as marker for genetic variation and identification of *Senna surattensis* Burm. f. and *Senna sulfurea* DC. ex Collad. *Current Science*, 1146-1150.
8. Lu, Z., Sun, Y., Li, Y., Yang, Y., Wang, G., & Liu, J. (2021). Species delimitation and hybridization history of a hazel species complex. *Annals of Botany*, 127(7), 875-886.
9. Royal Botanic Gardens, Kew. (2025). *Cassia fistula* L. In *Plants of the World Online*. Retrieved August 5, 2025, from <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:484507-1>
10. Parrotta, J. A. (2014). *Albizia lebbek*. In: Tropical Tree Seed Manual. Agriculture Handbook. 721, (Vozzo, J. A. ed.). Washington, DC, USA: Forest Service, USDA. 4(3): 1-10. DOI:10.1002/9783527678518.ehg2006003
11. Lewis, G. P., & Rico Arce, L. (2005). Tribe Ingeae. In: Lewis, G., Schrire, B., Macinkler, B. and Lock, M. (eds.), Legumes of the World. Royal Botanic Gardens, Kew, UK., pp. 577.
12. Allen, O. N., & Allen, E. K. (1981). *The Leguminosae, a source book of characteristics, uses, and nodulation*. University of Wisconsin Press.
13. El Khodary, Y. A., Ayoub, I. M., El-Ahmady, S. H., & Ibrahim, N. (2021). Molecular and phytochemical variability among genus *Albizia*: a phylogenetic prospect for future breeding. *Molecular Biology Reports*, 48(3), 2619-2628.
14. Muhammad, A., Elinge, C. M., Musa, I., & Uma, A. (2023). Phytochemical evaluation and *in vitro* antimicrobial activity of *Senna alata* leaves extract. *Bayero Journal of Pure and Applied Sciences*, 12(1), 663 - 667.
15. Oladeji, O. S., Adelowo, F. E., & Oluyori, A. P. (2021). The genus *Senna* (Fabaceae): A review on its traditional uses, botany, phytochemistry, pharmacology and toxicology. *South African Journal of Botany*, 138, 1-32, <https://doi.org/10.1016/j.sajb.2020.11.017>.
16. Ghosh, A., Majumder, S., Saha, S., Sarkar, S., & Bhattacharya, M. (2021). Gas chromatography-mass spectrometry profiling and evaluation of antioxidant and antibacterial activity of *Albizia* spp. *Nusantara Bioscience*, 13, 177-184. <https://doi.org/10.13057/nusbiosci/n130207>
17. Metsalu, T., & Vilo, J. (2015). Clustvis: a web tool for visualizing clustering of multivariate data using Principal Component Analysis and heatmap. *Nucleic Acids Research*, 43(1), 566-570. doi: 10.1093/nar/gkv468.
18. Gamal, A. E., Soliman, A. H., Kamel, S., Abdelfattah, B. (2017). Systematics implications of GC-MS analysis of secondary metabolites in the ethanol extract of *Solanum* species from South West Saudi Arabia. *Egypt Journal of Botany*, 57(3), 429-444.
19. Sagaya, A., & AbdulRahaman, A. A. (2023). Systematic implication of GC-MS analysis of secondary metabolites in *Duranta erecta* L. forms in Nigeria. *Sri Lankan Journal of Biology*, 8(1), 23-33. <https://ibiol.ro/plant/Volume%2067/Articolul%205.pdf>
20. Ravichandran, Y. D., & Yetayih, M. M. (2022). The GC-MS analysis of the diethylether and ethylacetate fraction of the peel of *Solanum incanum* and the study of their antibacterial activity. *Advances in Traditional Medicine*, 22, 809-821. <https://doi.org/10.1007/s13596-021-00623-1>
21. Muhammad, S. L., Wada, Y., Mohammed, M., Ibrahim, S., Musa, K. Y., Olonitola, O. S., Ahmad, M. H., Mustapha, S., Rahman, Z. A., & Sha'aban, A. (2021). Bioassay-guided identification of bioactive compounds from *Senna alata* L. against methicillin-resistant *Staphylococcus aureus*. *Applied Microbiology*, 1, 520-536, <https://doi.org/10.3390/applmicrobiol1030034>.
22. Rajendra, R. P., Nawas, B., Veramuthu, M. & Thanthani, G. (2020). GC-MS analysis of the hydroalcoholic extract of *Senna alata*. *Journal of*

23. Karuppanan, K., Priyadharshini, S., & Sujatha, V. (2013). Phytopharmacological properties of *Albizia* species: A review. *International Journal of Pharmacy and Pharmaceutical Sciences*, 5, 70-73.
24. Akwu, N. A., Naidoo, Y. M., Singh, N. N., & Lin, J. (2019). Phytochemical screening, *in vitro* evaluation of the antimicrobial, antioxidant and cytotoxicity potentials of *Grewia lasiocarpa* E. Mey. ex Harv., *South African Journal of Botany*, 2, 180-192, <https://doi.org/10.1016/j.sajb.2019.03.004>.
25. Usman, M., Khan, W. R., Yousaf, N., Akram, S., Murtaza, G., Kudus, K. A., Ditta, A., Rosli, Z., Rajpar, M. N., & Nazre, M. (2022). Exploring the phytochemicals and anti-cancer potential of the members of Fabaceae Family: A comprehensive review. *Molecules* (Basel, Switzerland), 27(12), 3863. <https://doi.org/10.3390/molecules27123863>
26. Pandey, S., Chaudhary, L. B., Singh, L., Srivastava, R. P., Singh, A., Msihra, A. K., & Saxena, G. (2023). Taxonomic implications of leaf epidermal characteristics in subfamily Caesalpinioideae (Leguminosae). *Phytotaxa*, 606(4), 237-258.
27. Balkrishna, A., Sakshi, Chauhan, M., Dabas, A., & Arya, V. (2022). A comprehensive insight into the phytochemical, pharmacological potential, and traditional medicinal uses of *Albizia lebbeck* (L.) Benth. *Evidence-Based Complementary and Alternative Medicine*, (1), 5359669. <https://doi.org/10.1155/2022/5359669>

**Supplementary Data: The combined table of the status of the phytochemicals in the nine species studied**

Phytocompound/Taxa	<i>S. siamea</i>	<i>C. fistula</i>	<i>S. obtusifolia</i>	<i>S. alata</i>	<i>S. podocarpa</i>	<i>S. occidentalis</i>	<i>A. lebeck</i>	<i>A. adianthifolia</i>	<i>A. zygia</i>
1,4:3,6-Dianhydro-.alpha.-d-glucopyranose	1	1	1	1	0	1	0	0	0
Tridecanedial	0	1	0	0	0	0	0	0	0
7-Hexadecenal	0	0	1	1	0	0	0	0	0
8-Hexadecenal	0	0	1	0	0	0	0	0	0
Tetradecanal	0	0	0	0	0	0	0	1	0
2H-3,9a-Methano-1-benzoxepin	0	1	1	0	0	1	0	0	0
5H-3,5a-Epoxy-naphth[2,1-c]oxepin	0	0	0	0	1	0	0	0	0
1,3:2,5-Dimethylene-1-rhamnitol	1	0	0	0	0	0	0	0	0
3,7,11,15-Tetramethyl-2-hexadecen-1-ol	1	1	1	1	1	1	1	1	1
Phytol	1	1	1	1	1	1	1	1	1
2-Furanmethanol	1	0	0	0	0	0	0	0	0
Ethanol	1	0	0	1	0	0	0	0	0
Ergosta-7	0	1	0	0	1	0	0	0	0
Z-11-Pentadecenal	1	0	1	0	0	0	0	0	0
Phenol	0	1	0	0	0	0	0	0	0
1-Heptatriacotanol	0	1	0	0	0	0	0	0	0
.gamma.-Tocopherol	0	1	0	1	1	1	1	1	1
.gamma.-Sitosterol	0	1	0	0	0	0	0	0	1
.beta.-Sitosterol	0	0	0	0	0	0	0	0	1
1H-Cycloprop[e]azulen-4-ol	0	1	0	0	0	0	0	0	0
Vitamin E	0	1	1	1	1	1	0	1	1
Campesterol	0	1	0	0	0	0	0	0	0
Tridecanol	0	0	1	0	0	0	0	0	0
4-Isobenzofuranol	0	0	1	0	0	0	0	0	0
3H-3,10a-Methano-1	0	0	1	0	0	0	0	0	0

Stigmasterol	0	0	1	0	0	0	0	0	1
1-Heptadec-1-ynyl-cyclopentanol	0	0	1	0	0	0	0	0	0
6-Methyl-cyclodec-5-enol	0	0	0	0	0	1	0	0	0
2,2,4-Trimethyl-3-(3,8,12,16-tetramethyl-) 1-Heptacosanol	0	0	0	0	0	1	0	0	0
n-Nonadecanol-1	0	0	0	0	1	0	1	0	1
Octacosanol	0	0	0	0	1	0	0	0	1
2-Pentadecyn-1-ol	0	0	0	0	1	0	1	0	1
Lupeol	0	0	0	0	1	0	0	0	0
1-Eicosanol	0	0	0	1	1	0	0	1	0
2,6,10,14-Hexadecatetraen-1-ol	0	0	0	0	1	0	0	1	0
2H-1-Benzopyran-6-ol	0	0	0	0	1	0	0	0	0
Z,Z-3,13-Octadecadien-1-ol	0	0	0	0	1	0	0	0	1
Cholest-22-ene-21-ol	0	0	0	0	1	0	0	0	0
1-Decanol	0	0	0	1	0	0	0	1	0
Z-9-Pentadecenol	0	0	0	1	0	0	0	0	0
Olean-12-ene-3,28-diol	0	0	0	0	0	0	1	0	1
1-Naphthalenepropanol	0	0	0	0	0	0	1	0	1
1-Monolinoleoylglycerol trimethylsilyl ether	0	0	0	0	0	0	1	0	0
6,10-Dodecadien-3-ol	0	0	0	0	0	0	1	0	0
1,5,9-Cyclododecanetriol	0	0	0	0	0	0	0	1	0
12-Methyl-E,E-2,13-octadecadien-1-ol	0	0	0	0	0	0	0	0	1
Oxirane	1	0	0	1	0	1	0	1	0
1,2-Oxathiane	0	1	0	0	0	0	0	0	0
1,2-15,16-Diepoxyhexadecane	0	0	0	0	0	1	0	0	0
4-Ethylthiane	0	0	0	0	0	1	0	0	0
13-Oxabicyclo[9.3.1]pentadecane	0	0	0	1	0	1	0	0	0
2-methyltetracosane	0	0	0	0	1	0	0	0	0

Cholestane	0	0	0	0	1	0	0	0	0
Heptacosane	0	0	0	0	1	0	0	1	1
Octacosane	0	0	0	0	1	0	0	0	0
1-Chloroeicosane	0	0	0	0	1	0	0	0	1
Octadecane	0	0	0	1	0	0	0	0	0
2-methylhexacosane	0	0	0	1	0	0	0	0	1
Cyclobutane	0	0	0	0	0	0	1	0	0
3-Butoxy-1,1,1,5,5,5-hexamethyl-3-(trimethylsiloxy)trisiloxane	0	0	0	0	0	0	1	0	0
2-Bromotetradecane	0	0	0	0	0	0	0	1	1
Butylated Hydroxytoluene	1	0	1	1	1	1	1	1	1
1,1,6-trimethyl-3-methylene-2-	0	1	0	0	0	0	0	0	1
Spiro[androst-5-ene-17,1'-cyclobutan]-2	0	0	0	0	1	0	1	0	1
Supraene	0	0	0	0	1	0	0	0	0
17-Pentatriacontene	0	0	0	1	0	0	0	0	0
Stigmasta-5,22-diene	0	0	0	0	0	0	1	0	0
Squalene	0	0	0	0	0	0	1	1	1
cis-Z-.alpha.-Bisabolene epoxide	0	0	1	0	0	0	0	0	0
1-Hexacosene	0	0	0	0	0	0	0	0	1
9-Octadecenamide	1	1	1	1	1	1	1	1	1
8-Methyl-6-nonenamide	0	1	0	0	0	0	0	0	0
2-Myristinoyl-glycinamide	0	0	1	0	0	0	0	0	0
2-Dodecen-1-yl(-)succinic anhydride	0	0	0	0	1	0	0	0	0
[1,1'-Bicyclopropyl]-2-octanoic acid, 2'-hexy	1	0	0	0	0	0	0	0	0
Hexadecanoic acid	1	1	1	1	0	1	0	1	0
Phthalic acid	1	0	1	1	0	1	0	0	0
n-Hexadecanoic acid	1	1	1	1	1	1	1	1	1
Octadecanoic acid	0	0	0	0	0	0	1	1	1
6-Octadecenoic acid	1	0	0	1	0	1	0	0	0

9,12-Octadecadienoic acid ( <i>Z,Z</i> )-	1	1	1	1	0	1	0	0	0
9,12,15-Octadecatrienoic acid	0	0	1	1	0	1	1	1	0
Cyclopentaneundecanoic acid	0	1	0	0	0	0	0	0	0
Cyclopropaneoctanoic acid	0	1	0	0	0	1	1	0	0
Sulfurous acid	0	0	1	0	0	1	0	0	0
Trichloroacetic acid	0	0	1	0	0	0	0	0	0
3-Chloropropionic acid	0	0	1	0	0	1	0	0	0
[1,1'-Bicyclohexyl]-4-carboxylic acid	0	0	0	0	0	1	0	0	0
Cinnamic acid	0	0	0	0	1	0	0	0	0
Benzeneacetic acid	0	0	0	0	0	0	1	0	0
Thiocarbamic acid	0	0	0	0	0	0	1	0	0
Methoxyacetic acid, 3-tetradecyl ester	0	0	0	0	0	0	0	1	0
Eicosanoic acid	0	0	0	0	0	0	0	1	1
18,19-Secoyohimban-19-oic acid	0	0	0	0	0	0	0	1	0
1,2-Cyclohexanedicarboxylic acid	0	0	0	0	0	0	0	1	0
Acetic acid	0	0	0	1	0	0	0	0	0
11-Dodecen-1-ol trifluoroacetate	1	0	0	0	0	1	0	0	0
Bis(2-ethylhexyl) phthalate	1	0	1	1	0	1	0	0	0
13-Tetradecen-1-ol acetate	1	0	0	0	0	0	0	0	0
Ethyl iso-allocholate	0	0	0	0	1	0	1	0	1
.alpha.-Tocopheryl acetate	0	0	0	0	0	0	1	0	0
Tributyl acetylcitrate	0	0	0	0	0	0	0	1	0
Diisooctyl phthalate	0	0	0	0	0	0	0	1	1
Bis(tridecyl) phthalate	0	0	0	0	1	0	0	0	0
Benzonitrile	0	0	0	0	0	0	1	0	0
1-Pyrrolid-2-one	1	0	0	0	0	1	0	0	0
trans-.beta.-Ionone	0	0	1	0	0	0	0	0	0
Ethanone	0	0	1	0	0	0	0	0	0
2-Pentadecanone	0	0	1	0	0	1	0	0	1

<b>9,9-Dimethoxybicyclo[3.3.1]nona-2,4-dione</b>	0	0	1	1	0	0	0	0	0
<b>1-Coprosten-3-one semicarbazone</b>	0	0	1	0	0	0	0	0	0
<b>4,22-Stigmastadiene-3-one</b>	0	0	0	0	1	0	0	0	0
<b>6-Hydroxy-3-methyl-9-oxabicyclo[3.3.1]nonan-2-one</b>	0	0	0	1	0	0	0	0	0
<b>Cyclopentadecanone</b>	0	0	0	1	0	0	0	0	0
<b>2,2-Dibromocholestanone</b>	0	0	0	0	0	0	0	1	0
<b>Dimethyl Sulfoxide</b>	1	0	0	0	0	0	0	0	0
<b>(2,3-Diphenylcyclopropyl)methyl phenyl sulfoxide</b>	0	0	0	0	0	0	1	0	0

Key: 0 = Absence; 1 = Presence