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ANGIOSPERMIC FLORA OF THE DEMARCATED AMBROSE ALLI UNIVERSITY BOTANICAL GARDEN EKPOMA, EDO STATE, NIGERIA

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ABSTRACT

The Ambrose Alli University (AAU) Botanical Garden, Ekpoma, Nigeria, is a defined area established for the conservation of indigenous plant species and the collection, cultivation, maintenance and display of a wide range of plants taxa. Functioning also as a teaching and research facility under the Faculty of Life Sciences, the garden serve critical and conservatory purposes. However, despite its institutional importance and potential utility to conservation biology, the angiospermic diversity of the AAU Botanical Garden has never been systematically documented This study was therefore conducted to provide a comprehensive inventory of the angiospermic flora within the demarcated section of the garden located in Esan West Local Government Area, Edo State. Plant samples were collected using a collapsable quadrant method and identified through standard taxonomic procedure. A total of 91 plant species belonging to 43 families were recorded. These included 36 trees species, 38 shrubs, 10 herb, 6 climbers and 1 grass species. Notably, species such as icacina trihantha (oliv.) and sphenocentrum jollyanum were observed to occur frequently across most quadrats. This study bridged a critical knowledge gap by documenting the angiospermic composition of the AAU Botanical Garden and provide a useful reference for future research, conservation planning and education purposes.

Keywords: Angiospermic flora, Botanical garden, Biodiversity, Conservation, Quadrat sampling

INTRODUCTION

Angiosperms, or flowering plants are the most diverse group of terrestrial plant within the kingdom plantae, distinguished from gymnosperm by the presence flowers, the development of endosperm within their seeds, and production of fruits that enclose the seeds. The term "angiosperm" is derived from the words *angeion* ('container, vessel') and *sperma* ('seed'), referring to plants whose seeds are enclosed within a fruit. Angiosperms comprise approximately 80% of all green plant species known, with an estimated 13,000 genera and over 300,000 species, classified into 64 orders and 416 families (Christenhusz and Byng, 2016). Their economical, ecological and educational importance makes them central to biodiversity conservation and plant science education.

Botanic gardens play a fundamental role in the conservation, research, and education of plant diversity. Globally, they serve as ex situ hubs of conservation, maintaining living collections of threatened, endemic, and economically important plant species (Hird and Kramer, 2018). According to Wyse Jackson and Sutherland (2000), botanical gardens are also institutions for the cultivation and research of a vast array of plant taxa, with angiosperms (flowering plants) being the most dominant group due to their staggering species richness and ecological diversity. Global initiatives such as the Botanic Gardens Conservation International (BGCI) help member gardens to catalogue and conserve threatened and rare flowering plants. According to BGCI (2021), more than 30% of known angiosperm species are cultivated in botanical gardens worldwide. Besides conservation, the gardens also enable research, education, and public awareness that promote further appreciation of plant biology and environmental stewardship. Through maintaining diverse plant collections, botanical gardens provide unique opportunities for ecological studies and species conservation activities, especially where natural habitats are threatened by anthropogenic activities (Wyse Jackson and Sutherland, 2000; Hird and Kramer, 2018). The institutions also engage in seed banking and genetic resource conservation to provide for the conservation of plant germplasm for future restoration and research activities (Blackmore *et al*., 2011).

Worldwide, assessment of botanical garden angiospermic flora shows enormous species richness and geographical distribution (Maunder *et al*., 2001). The Royal Botanic Gardens, Kew, UK, is renowned for harboring one of the largest living collections of angiosperms, comprising over 27,000 plant taxa, representing a wide array of families such as Orchidaceae, Fabaceae, Asteraceae, and Poaceae (Kramer and Huxley, 1980; RBG Kew, 2020). Similarly, Missouri Botanical Garden in the US and Singapore Botanic Gardens have been important in developing and conserving native and exotic angiosperm species (Chong, Tan, and Corlett, 2009). The gardens are also important centers of taxonomic, horticultural, and ecological studies (Maunder *et al*., 2001).

In Africa, the documention and assessments of angiospermic flora within botanical gardens are less extensive but are steadily growing in scope and depth. Notably, Kirstenbosch National Botanical Garden in South Africa has taking a leading role, with specialized focus on conserving indigenous angiosperms from the unique Cape Floristic Region, a global biodiversity hotspot known for its high endemic and ecological significant (Hitchcock and Cron, 2010). Beyond South Africa, most botanical gardens across the continent remained under-resourced and under-documented limiting their contribution to global biodiversity datasets. In the East African context, efforts have been aimed at inventorying flora in gardens such as the Nairobi Arboretum, though data remains patchy and inconsistence due to limited funding, personal and infrastructural capacity (Groombridge and Jenkins, 2002).

In Nigerian, botanical gardens are relatively young and under resourced compared to their global counterpart but are becoming more involved in conservation and education. A number of them, such as the University of Ibadan Botanical Garden and University of Lagos Botanical Garden, have

documented a number of indigenous and exotic angiosperm species (Olaniyi *et al*., 2013; Akinlabi, Olowokudejo, and Kadiri, 2020). Recent floristic studies of botanical gardens in Nigeria indicate the dominance of species from families such as Fabaceae, Euphorbiaceae, and Apocynaceae (Akinlabi *et al*., 2020). These collections play both research and pedagogical functions and indicate the potential for further development of plant conservation facilities. However, Olaniyi *et al*. (2013) elucidated that limiting factors such as inadequate funding, inadequate documentation, manpower shortage, and inadequate linkage with global networks 'such as BGCI' are hindering the complete role of Nigerian botanical gardens in angiosperm conservation and research. Sharrock *et al*. (2014) recommended that local herbaria should be strengthened, plant records computerized, and garden networks enhanced to align local action with global conservation targets.

The Ambrose Alli University (AAU) Botanical Garden, Ekpoma, Nigeria, is a defined area established with the primary aim of the conservation of indigenous plant, collecting, cultivating, maintaining and display of a specifically wide range of plants, which are usually labeled by their botanical names. As a component of Faculty of Life Sciences, the garden also function as a field laboratory for student training and academic research. However, despite its institutional importance and potential utility to conservation biology, angiospermic diversity of AAU Botanical Garden has never been systematically documented. Ogie-Odia *et al*. (2010), Ogie-Odia and Eseigbe (2022) and Ogbevire *et al*. (2025) documented some works which has identified a number of vascular plant species from the general university environment, yet there is no overall floristic survey of the botanical garden.

This study seeks to bridge this knowledge gap by conducting a comprehensive survey of angiospermic plants in the AAU Botanical Garden. The objectives are to document the species composition and associated plant families, analyze the density, frequency and abundance of angiosperms species and to establish baseline data to inform future research, conservation strategies and education activities within the university and beyond.

MATERIALS AND METHODS

Study Area

The study was conducted in Ambrose Alli University, Ekpoma Botanical Garden (latitudes 6°43′N and 6°45′N and longitudes 6°06′E and 6°08′E), in Ekpoma, Edo state, Nigeria. Ekpoma has a tropical climate characterized by two distinct conditions of wet and dry seasons. Often, while April to October is wet with a brief dry spell in August, November to March is dry. About 1666 mm of precipitation falls annually, and the average annual temperature in Ekpoma is 24.8 °C (Climate-data, 2019; Nigerian Meteorological Agency, Abuja, 2017). The area is characterized by rainforest vegetation.

Sample Collection

During the period of investigation, the samples were collected from the Ambrose Alli University Botanical Garden. A narrow foot path in the garden served as transect line in which quadrant was collected in both side of the garden using a collapsable quadrant measuring 5 meters by 5 meter at an interval of 5 meter apart from each quadrat. The samples were collected using four pairs of carved wood and rope. Each plant was identified, by writing their names on the masting tape.

Identification

Survey of the plants collected were identified in the field *in situ,* while those that could not be identified were neatly parked, labeled and taken to our herbarium for identification using standard textbooks like (Keay, Onochie and standfield,1964; Akubundu and Agyakwa, 1987). The density of each plant were recorded within each quadrat. The data were summarized using three quarantative parameters as density, frequency and abundance. Density was recorded the mean number of plant per^{m2} for each plant expressed over all quadrat laid. Frequency was the number of quadrats in which a species occurred in at least one quadrat expressed as a percentage of the total number of quadrats, while abundance gave the total number of each plant species enumerated in the field.

RESULTS AND DISCUSSION

The table 1 below show the results of the identification performed for the study of the Angiospermic flora of the demarcated Ambrose Alli University Ekpoma Botanical Garden. A total of 91 species, in 43 plant families were recorded and identified from the study (Table 1). For each species, botanical name, families, habit, plant population, number of quadrat occurred, density, frequency and abundance were provided. Fabaceae and Euphorbiaceae (Fig. 1) were the biggest families. *Icacina trichantha* and *Sphenocentrum jollyanum* were the most frequent species, with occurrences in 46.7% and 43.5% of the quadrats, respectively. The surveyed flora included 36 tree (39%), shrubs 38 (42%), herb 10 (11%), climbers 6 (7%), grasses 1 (1%) (Fig. 2). These result indicate the role of the garden in the conservation of local plant diversity.

Table 1: Identified Key Species

S/N	Plant Species	Family	Habit	Total No.	Number Quadrant Occurred	Density	Frequency	Abundance
1	*Acalypha wilkesiana*	Euphorbiaceae	Shrub	2	1	0.067	3.33	2
2	*Afzelia Africana*	Fabaceae	Tree	3	2	0.1	6.67	1.5
3	*Albizia andianthifolia*	Fabaceae	Tree	8	5	0.267	16.67	1.6
4	*Albizia ferruginea*	Fabaceae	Tree	5	4	0.167	13.33	1.25
5	*Albizia lebbeck*	Fabaceae	Tree	9	6	0.3	20	1.5
6	*Albizia zygia*	Fabaceae	Tree	2	2	0.07	6.67	1
7	*Alchornea cordifolia*	Euphorbiaceae	Shrub	10	8	0.33	26.7	1.25
8	*Alchornea latifollia*	Euphorbiaceae	Tree	2	1	0.067	3.33	2

S/N	Plant Species	Family	Habit	Total No.	Number Quadrant Occurred	Density	Frequency	Abundance
9	*Alchornea laxifloria* (Benth)	Euphorbiaceae	Shrub	3	1	0.1	3.33	2
10	*Alstonia boonei*	Apocynaceae	Tree	2	2	0.07	6.67	1
11	*Amphimas pterocarpoids* (PROTA)	Fabaceae	Tree	5	4	0.167	13.3	1.25
12	*Anacardium occidentlae*	Anacardiceae	Tree	2	1	0.067	3.33	2
13	*Ananas comosus*	Bromellaceae	Herb	3	1	0.1	3.33	3
14	*Anthocleista nobillis* (G Don)	Loganiaceae	Tree	1	1	0.03	3.33	1
15	*Antiraris toxicaria*	Moraceae	Tree	2	1	0.07	3.33	2
16	*Baphia nitida*	Fabaceae	Shrub	15	10	0.5	33.3	1.5
17	*Blighia unijugata*	Saphindaceae	Tree	2	1	0.067	3.33	2
18	*Bridellia ferruginea*	Euphorbiaceae	Shrub	9	7	0.3	23.3	1.29
19	*Caesalpinia pulcherrima*	Fabaceae	Shrub	2	1	0.07	3.33	2
20	*Carpolobia lutea* G.Don	Polygalaceae	Shrub	5	4	0.17	13.3	1.25
21	*Cascabela thevetia*	Apocynaceae	Shrub	2	1	0.067	3.33	2
22	*Cassia podocarpa* (Guill. andPerr.)	Leguminosae / Caesalpinio-ideae	Shrub	3	2	0.1	6.67	1.5
23	*Celiba pentandra*	Maliaceaus	Tree	1	1	0.03	3.33	1
24	*Centrasema pubescens*	Fabaceae	Climber	7	3	0.23	10	2.33
25	*Chromolaena orderata*	Asteraceae	Shrub	6	5	0.2	16.67	1.2
26	*Citrus sinesis*	Rutaceae	Tree	2	2	0.67	6.67	1
27	*Cleistopholis patens* (Benth)	Annonaceae	Tree	2	1	0.07	3.33	2
28	*Clerodendrum splendens*	Lamiaceae	Tree	6	6	0.2	20	1
29	*Cnestis ferruginea*	Connaraceae	Shrub	12	8	0.4	26.7	1.5
30	*Cnidoscolus aconitifolius*	Euphorbiaceas	Shrub	2	1	0.067	3.33	2
31	*Cola acuminate*	Stercullaceae	Tree	2	2	0.07	6.67	1
32	*Cola milleni* (K.Schum)	Stercullaceae	Shrub	2	1	0.067	3.33	2
33	*Combretum racemosium* (P.Beau.)	Combretaceae	Shrub	4	3	0.13	10C	1.33
34	*Commelina communis*	Commelinaceae	Herb	2	1	0.07	3.33	2
35	*Corchorus olitotius*	Malvaceae	Shrub	4	3	0.133	10	1.33
36	*Crirum giganteum*	Amarylliadaceae	Shrub	1	1	0.03	3.33	1
37	*Cycas revolute*	Cycadaceae	Shrub	2	1	0.067	3.33	2
28	*Dalbergia sissoo*	Fabaceae	Tree	2	2	0.067	6.67	1
39	*Dialium guineensis*	Fabaceae	Tree	1	1	0.03	3.33	1
40	*Duranta erecta*	Verbenaceae	Shrub	3	2	0.1	6.67	1.5
41	*Dysphania ambrosioides*	Amaranthaceae	Herb	4	3	0.13	10	1.33
42	*Elaeis guineensis*	Arecaceae	Herb	7	7	0.23	23.3	1
43	*Ficus exasperate*	Moraceae	Tree	2	2	0.07	6.67	1
44	*Gongronema latifollium*	Apocynaceae	Climber	4	2	0.133	6.67	2
45	*Gossypium hurstum*	Ncuvaceae	Shrub	3	2	0.1	6.67	1.5

S/N	Plant Species	Family	Habit	Total No.	Number Quadrant Occurred	Density	Frequency	Abundance
46	*Harugana madagascariensis*	Hypericaceae	Tree	3	3	0.1	10	1
47	*Hevea brasiliensis*	Euphorbiaceae	Tree	7	6	0.23	20	1.17
48	*Hibiscus rosa – sinensis*	Malvaceae	Shrub	6	4	0.2	13.3	1.5
49	*Hibiscus sabdariffa* .L.	Malvaceae	Herb	2	1	0.067	3.33	2
50	*Icacina trichantha* (Oliv)	Icacinaceae	Shrub	18	14	0.6	46.7	1.29
51	*Ixora coccinea*	Rubiaceae	Shrub	5	3	0.167	10	1.25
52	*Kalanchoe pinnata*	Craussulaceae	Herb	4	2	0.13	6.67	2
53	*Lecaniodiscus cupaniodes* (Planch.)	Sapindaceae	Tree	2	2	0.07	6.67	1.5
54	*Lupines arboreus*	Fabaceae	Shrub	2	1	0.067	3.33	2
55	*Macaranga barteri* (mull .Arg .)	Euphorbiaceae	Tree	3	2	0.1	6.67	1.5
56	*Marantochloa cuspidate* (Roscoe.)	Marantaceae	Herb	5	2	0.167	6.67	2.5
57	*Mareya micranthaBenth* .mill.Arg.	Euphorbiaceae	Shrub	2	1	0.07	3.33	2
59	*Margaritaria discoidea*	Phyllanthaceae	Tree	3	3	0.1	10	1
59	*Megathysus maximums*	Poaceae	Grass	8	4	0.27	13.33	2
60	*Melicocus bijugatus*	Sapindaceae	Tree	2	1	0.067	3.33	2
61	*Milicia excels*	Moraceae	Tree	1	1	0.03	3.33	1
62	*Murraya Raniculata*	Rutaceae	Shrub	3	1	0.1	3.33	3
63	*Myrianthus arboreus* (P.Beauv.)	Urthicaceae	Tree	5	4	0.167	13.3	1.25
64	*Nauclea latipolia* (smith.)	Rubiaceae	Shrub	2	1	0.067	3.33	2
65	*Newbouldia laevis*	Bignoniaceae	Shrub	4	3	0.133	10	1.33
66	*Ouratea flava* (schum.and thin.) (Hutch. and Dalz)	Ochnaceae	Shrub	2	1	0.07	3.33	2
67	*Palisota barteri*	Commenlinaceae	Herb	7	5	0.23	16.67	1.4
68	*Palisota hiruta* (thumb.) k schum	Commelinaceae	Herb	6	4	0.2	13.33	1.5
69	*Pandiaka involucrate* (moq.)	Amaranthaceae	Herb	6	3	0.2	10	2
70	*Paraquentina nigrescens*	Asclenadaceae	Shrub	3	2	0.1	6.67	1.5
71	*Paullinia pinnata* L.	Sapindaceae	Shrub	2	1	0.067	3.33	2
72	*Persea Americana*	Lauraceae	Tree	1	1	0.03	3.33	1
73	*Piptadensiastrum africanum*	Fabaceae	Tree	1	1	0.033	3.33	1
74	*Prunus Africana* (Hook .F.)	Rodaceae	Tree	2	1	0.07	3.33	2
75	*Pycanthus angolensis* (PROTA)	Myristicacea	Tree	5	5	0.167	16.7	1
76	*Pyrenacantha staudtti*	Icacinaceae	Shrub	3	2	0.1	6.67	1.5

S/N	Plant Species	Family	Habit	Total No.	Number Quadrant Occurred	Density	Frequency	Abundance
77	*Quassia amara* (quassi .)	Simaroubaceae	Tree	5	4	0.17	13.3	1.25
78	*Rauvolfia vomitoria*	Apocynaceae	Shrub	8	6	0.267	20	1.33
79	*Ricinodendron heudelotii*	Euphorbiaceae	Tree	1	1	0.03	3.33	1
80	*Secamone afzelii* (schult.)	Asclephidaceae	Climber	3	1	0.1	3.33	3
81	*Senna occidenatalis*	Fabaceae	Shrub	2	1	0.07	3.33	2
82	*Smilax aspera* L .	Smilacaceae	Climber	10	8	0.33	26.7	1.25
83	*Smilax kraussiana* (melsn.)	Smilacaceae	Climbers	7	5	0.23	16.7	1.4
84	*Sphenocentrum jollyanum*	Menispermaceae	Shrub	16	13	0.53	43.5	1.23
85	*Streculia tragacantha* (Lindi.)	Sterculliaceae	Shrub	10	8	0.3	26.7	1.25
86	*Synclisia scabrida* (miers exoliv .)	Menispermaceae	Climber	12	9	0.4	30	1.33
87	*Tetracera alnifolia* (wild .)	Dilleniaceae	Shrub	2	2	0.07	6.67	1
88	*Tetrapleura tetraptera*	Fabaceae	Tree	1	1	0.03	3.33	1
89	*Thevetia nerillpolia* (JUSS .)	Apocynaceae	Shrub	3	2	0.1	6.67	1.5
90	*Xylopia qethiopica*	Annonaceae	Tree	2	1	0.067	3.33	2
91	*Zanthoxylum zanthoxyloides*	Rutaceae	Shrub	6	4	0.2	13.3	1.5

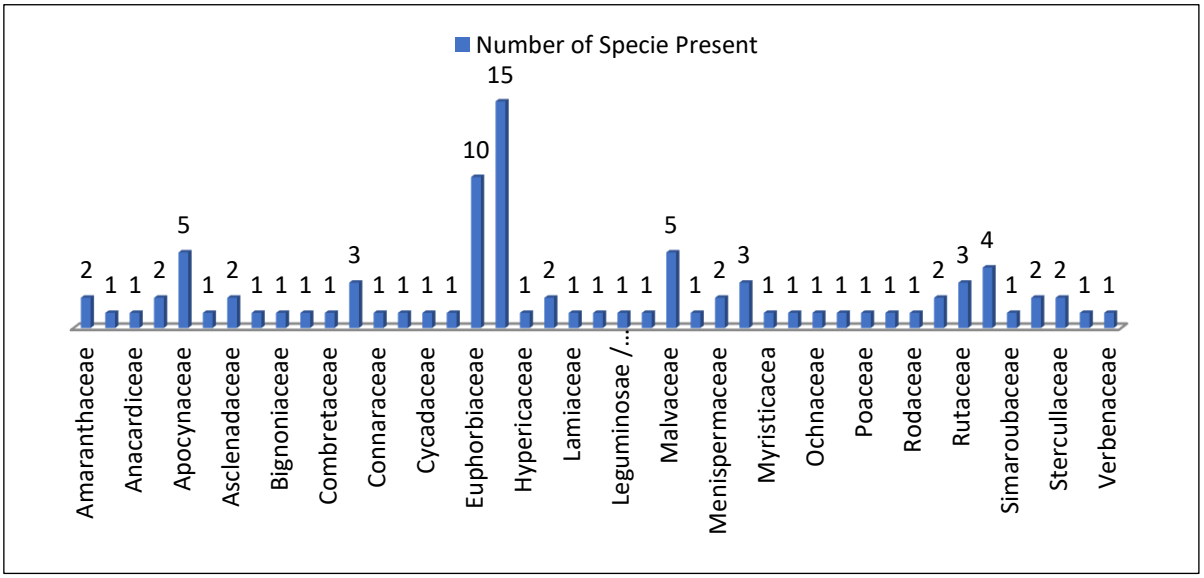

Figure 1: Number of species per family

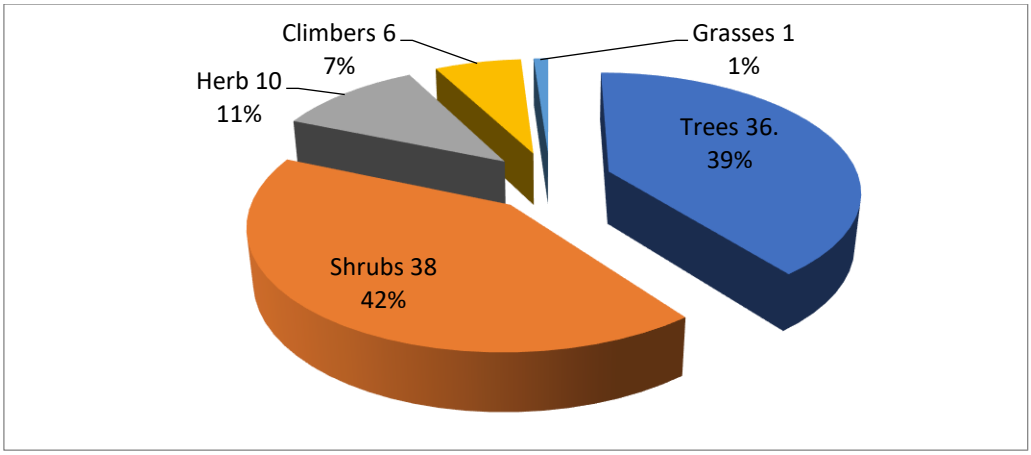

Figure 2: Distribution of plant in relation to their major plant habit

Discussion

The current study offers a baseline inventory of the angiospermic species found within the demarcated Ambrose Alli University (AAU) Botanical Garden Ekpoma. A total of 91 plant species belonging to 43 families were documented, indicating a moderate degree of species richness. This discovery emphasizes how important the garden is to the conservation of indigenous flora and serves as a living repository for educational and research purpose. Worldwide, botanical gardens are acknowledged as essential resources for scientific research, environmental education, and ex situ conservation (Smith et al., 2019). The composition of plant habits recorded in Ambrose Alli University Botanical Garden reflects a modest representation of regional angiosperm diversity. Rather than a balanced distribution, the data reveals a dominance of wooden species, particularly trees and shrubs- which accounted for 36 and 38 species respectively indicating a possible preference for long-lived significant plant which is a reflection of the garden`s contribution to regional biodiversity conservation. The tree and shrub richness aligns with data from other tropical botanical gardens, where woody species tend to dominate due to their longer lifespan, ecological adaptability, and suitability for controlled landscapes (Okali, 2010; Westwood et al., 2021). However the species richness is minimal when compared to botanical gardens around the world. There are 1,000 to 4,999 live plant species in national botanical gardens around the world, with some having as many as 50,000 (Zhou *et al*., 2023). Its small size, scarce resources, and unique biological circumstances account for its very low diversity as clearly seen from the recent study of which Ogbevire *et al*. (2025) documented 173 indigenous plant species belonging 59 family across the main campus excluding the garden. Similarly, Jeyol and Yerima (2023) documented a total of 203 individuals representing 20 tree species from 15 families across four sampling sites in Federal University Wukari futher supporting the relatively limited diversity at AAU.

Nonetheless, despite these limitations, the AAU Botanical Garden is part of greater worldwide conservation efforts by serving as a conservatory for native plants and giving forums for ecological education and research. Globally, botanical gardens are important for scientific research, education, and ex situ conservation. Collectively, they conserve more than one third of all described plant species, including more than 41% of species classified as threatened species (Smith *et al*., 2019). However, their ability to preserve the growing number of threatened plant species is undermined by limits of space and resources (Brockington, 2025). By preserving species of regional importance and encouraging scholarly participation, the AAU Botanical Garden continues to play a crucial role in this regard, especially at the regional level

The richness of tree and shrub species in the AAU Botanical Garden reflects distribution patterns in most tropical botanical gardens, where woody plants are more dominant due to their ecological versatility and longer life span. The predominance of these species may also be influenced by local climatic condition, composition of the soil and historical land use which shape species establishment and persistence. Temperate botanical gardens, in contrast, may have a higher representation of herbaceous species, which reflect differences in climatic conditions and vegetation types (Okali, 2010; Westwood *et al*., 2021). Furthermore, the observable pattern in AAU support the fact that tropical gardens serve as vital reservoirs of woody plant diversity, reinforcing their value in *ex situ* conservation and ecological restoration effort (Aronson, Blignaut and Aronson, 2017).

The regular appearance of species such as *Icacina trichantha* and *Sphenocentrum jollyanum* speaks in favor of their adaptability to the ecological needs and potential use in the local environment (Gill, 1992; Burkill, 1995). These species can be set at the top of the list of species for conservation and are worthy of additional study due to their potential in plant adaptation research.

Although the species diversity of the AAU Botanical Garden is generally lower than that of larger international botanical gardens, it has a valuable role in research that is directed at ecological issues and the conservation of the local flora. The garden's contribution to the conservation of plant species could be improved by focusing on the expansion of its potential through greater financial input, enlargement, and incorporation in global conservation networks.

CONCLUSION

This study presented the first systematic documentation of the angiospermic flora within the demarcated section of the Ambrose Alli University Botanical Garden Ekpoma. A total of nine-one (91) species distributed across 43 families were identified, representing a diverse range of life forms including trees, shrubs, herbs, climbers and a grass. The frequent occurrence of species such as *Icacina trihantha (oliv.) and Sphenocentrum jollyanum* shows the ecological richness and conservation value of the garden. By bridging the existing knowledge gap on flora composition, this work reinforces the significance of the AAU Botanical Garden as a vital resource for biodiversity conservation, education and research. It is therefore recommended that continuous floristic assessment, proper documentation and effective management practices be

sustained to preserve the garden`s biological diversity and support its academic and ecological role.

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