

OCCURRENCE AND DISTRIBUTION OF PTERIDOPHYTES IN PARTS OF LAGOS AND OSUN STATES

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ABSTRACT

Ferns make up an important component of tropical pteridoflora and serve important functions in ecosystem processes. The relative occurrence and distribution of ferns within the wetland area of Lagos and Osun States were studied with the aim of documenting the pteridophytic flora and habit in these areas. Four non-contiguous quadrats of 10 m x 10 m were established in each of the five study sites in consideration of the distribution pattern of the plants to be sampled. Non-random selective method was also adopted where the quadrats were preferentially located by sight to ensure that at least one individual pteridophyte was present in each quadrat. After sampling, the species were subsequently identified using reference collections at the herbaria of Forest Research Institute of Nigeria (FRIN) Ibadan, Oyo State and University of Lagos. A total of 16 species of ferns belonging to 11 genera and 9 families were recorded. On their distribution, the two study sites in Osun State recorded the highest number of species (11 species, 68.75%) most of which appear to be uncommon species while the three sites in Lagos recorded only 4 species (25%) which are relatively common species. In general, there were 46% terrestrial species, 32% lithophytes and 22% epiphytes in all the five sites studied and species diversity and evenness in Osun and Lagos States were 1.819, 1.444 and 0.4742, 0.7064 respectively. The occurrence and distribution of the pteridophytes varied considerably between the two sites studied, as only one species was common to both sites. This may be attributed to microhabitat, anthropogenic factors, climatic conditions and the nature and states of vegetation and thus there is need for *in-situ* and *ex-situ* conservation of fern species in Lagos and Osun States in order to avoid the loss of these rare species and biodiversity at large.

Keywords: Biodiversity, Composition, Ferns, Morphology, Species.

INTRODUCTION

Pteridophytes originated in ancient tropical habitats and have undergone major evolution to colonize different types of environment (Sharpe *et al.*, 2010). Ferns are diverse, estimated to a tune of 15,000 species of which 12,000 are described species of ferns and lycophytes (Chapman 2009). This group has a longer evolutionary history than any other vascular plant and as a result, many of the phylogenetically-informative characters may have been lost in the process. They were high in numbers during the carboniferous period (355-290 million years ago) and dominated part of the vegetation at that time (Rothwell and Stockey, 2008). During that era, some fern-like groups evolved seeds (the seed ferns) making up perhaps half of the pterido-form foliage in carboniferous forests (Rothwell and Stockey, 2008). Most of the early ferns vanished during two large extinction events at the end of the carboniferous (300 million years ago) and at the end of the Permian (240 million years ago), exceptions being ancestors of today's orders of ferns and fern allies

(Sharpe *et al.*, 2010). According to Nigerian First Biodiversity Report (2001), pteridophytes have been found to grow in almost all climatic zones under different habitats and represented by approximately 165 species distributed in 64 genera and 27 families.

Although pteridophytes occur abundantly in the tropical, sub-tropical and moist deciduous forests and their life-cycle depends on the availability of moisture, but due to habitat destruction many species have been reduced and the rare ferns are being endangered or are on the verge of extinction (Dixit, 2000). Any kind of disturbance in microclimatic conditions can hinder the growth and evolutionary processes occurring naturally in these plants thereby leading to decline in their population. Thus, factors like climate change, increasing urbanization, industrialization, encroachment of forest lands, unplanned developmental activities and over-exploitation of natural resources, pose a major threat to the survival of this group of plants. Due to unplanned

falling of trees in the forests, epiphytic pteridophytes have been reduced drastically (Dixit, 2000). Large-scale collection of ferns from the forests by the visitors and local people for ornamental and medicinal uses also increases the pressure on these plants. In the light of this, there is need to provide a checklist of fern species in the study sites which can be used for an adequate conservation measure for posterity. The present study is a contribution to the knowledge of pteridophytic flora of Osun and Lagos States in

Nigeria.

MATERIALS AND METHODS

The study was carried out within the wetland areas of Lagos and Osun states with the primary aim of documenting the Pteridophytic flora within the areas. Three sampling points were selected in Lagos (University of Lagos, Epe Lagoon and Nigerian Conservation Foundation) and two sampling locations in Osun States (Erin Ijesha and Oke-Ila waterfall) Table 1.

Table 1: Locations of the Study Sites

SITE	NAME OF SITE	LATITUDE	LONGITUDE	ALTITUDE (m)
A	Epe, Lagos state	N06.62547°	E3.30762°	3
B	University of Lagos, Lagos State	N06.5187°	E3.3888°	11
C	Nigerian Conservation Foundation, Lagos State	N06.44168°	E3.53554°	5
D	Erin Ijesha waterfall, Osun State	N07.56527°	E4.90627°	295
E	Oke-Ila waterfall, Osun State	N07.92828°	E4.76462°	429

Lagos State is dominated by swamp forest of the coastal belt and the dry lowland rainforest. The temperature range in Lagos is 33°C - 21°C while the annual rainfall is 1,500 mm – 2,030 mm. (Nigeria Online, 2003). Osun State is covered by secondary forest and in the northern part, the derived savanna mosaic predominates. The temperature ranges between 21°C and 34°C while the annual rainfall is 1,500 mm – 2,000 mm (Nigeria Online, 2003).

Sampling Procedure

Four non-contiguous quadrats of 10 m x 10 m were established in each of the five study sites in consideration of the occurrence and distribution pattern of the plants to be sampled. The non-random selective method was also adopted where the quadrats were preferentially located by sight to ensure that at least one individual pteridophyte was present in each quadrat.

In all the quadrats, the pteridophyte species within reach were recorded including the epiphytes of the high forest canopy. After the samplings, specimens were subsequently identified using

reference collections at the herbaria of Forest Research Institute of Nigeria (FRIN) Ibadan, Oyo State and the University of Lagos (LUH).

DATA ANALYSIS

Data on presence/absence, and growth form of ferns were analyzed. The relative frequency was used to determine the distribution of the species (Odunfa, 1991).

$$\text{Relative frequency of species} = \frac{\text{Frequency of species}}{\text{Sum of frequency of all the species}} \times 100$$

Sorensen Similarity Coefficient was calculated to indicate the floristic similarity between the sites sampled as follows:

$$Sc = (2W / a + b) \times 100$$

Where Sc is similarity coefficient,

W is the species occurring in both communities under consideration

a – Number of species occurring in Lagos State

b – Number of species occurring in Osun State.

Pteridophytes diversity was also calculated using the Shannon – Wiener index (H') (Shannon and Weaver, 1949)

$$H = -\sum \frac{n1}{N} \ln n1/N$$

RESULTS

Occurrence and Distribution of the Ferns

In this study, a total of 16 species of ferns belonging to 11 genera and 9 families were recorded (Table 2). The distribution pattern of the fern species reveals that the two study sites in Osun State had the highest number of species (11 species, 68.75%) most of which appear to be uncommon species while the three study locations in Lagos recorded only 4 species (25%) which are relatively common species. *Nephrolepis biserrata* (6.25%) was the only species common to both

Lagos and Osun States. Of the nine families represented in all the sampled sites, Dryopteridaceae, Pteridaceae, Lygodiaceae and Thelypteridaceae had their representatives in all the sample locations while the remaining five families Adiantaceae, Aspleniaceae, Lomariopsidaceae, Tectariaceae and Nephrolepidaceae were found at one site each. (Table 1). Shannon-Weiner Index for the two study sites showed that Osun had the highest community diversity (1.819) while Lagos had the least values (1.444; Table 3). The result of species evenness for the two sites showed a reverse trend, with the evenness value higher in Lagos (0.7064) and lower in Osun (0.4742).

Table 2: Number of Species Recorded from the Five Study Sites Based on Quadrat Sampling.

S/N	Species	Families	LAGOS			OSUN		Distribution
			A	B	C	D	E	
1.	<i>Adiantum sp</i>	Adiantaceae	-	-	-	-	+	U
2.	<i>Asplenium africanum</i>	Aspleniaceae	-	-	-	+	-	U
3.	<i>Ctenitis barteriana</i>		-	-	-	-	+	U
4.	<i>Ctenitis lanigera</i>	Dryopteridaceae	-	-	-	+	-	U
5.	<i>Dryopteris manniana</i>		+	+	+	-	-	C
6.	<i>Dryopteris variabilis</i>		-	-	-	+	+	C
7.	<i>Bolbitis acrostichoides</i>	Lomariopsidaceae	-	-	-	+	-	U
8.	<i>Lygodium microphyllum</i>	Lygodiaceae	-	+	+	-	-	C
9.	<i>Lygodium smithianum Presl</i>		-	-	+	-	-	U
10.	<i>Cyclosorus afer</i>	Thelypteridaceae	-	-	-	+	-	U
11.	<i>Cyclosorus striatus</i>		-	-	-	+	+	U
12.	<i>Nephrolepis biserrata</i>	Nephrolepidaceae	+	+	+	+	+	A
13.	<i>Acrostichum aureum</i>		-	+	+	-	-	C
14.	<i>Pteris atrovirens</i>	Pteridaceae	-	-	-	+	-	U
15.	<i>Pteris marginata Bory</i>		-	-	-	+	+	C
16.	<i>Tectaria fernandensis</i>	Tectariaceae	-	-	-	+	-	U
TOTAL			2	4	5	10	6	

Key: Site A- Epe, Lagos, site B-University of Lagos, site C- Nigerian Conservation Foundation Lagos, sampled site D- Erin Ijesha waterfall, Osun , Site E- Oke-Ila Waterfall,Osun.

Availability of species :(-) –Absent (+) –Present

Distribution: A - Abundant species C- Common species, U-Uncommon species

Table 3: Shannon-Wiener Index of the Pteridophyte Diversity in Each Sample Site

STATE	H'	E
LAGOS	1.444	0.7064
OSUN	1.819	0.4742

The distribution of fern species in the sampled sites of Lagos State showed that *Dryopteris manniana* (Hook.) C. Chr, *Nephrolepis biserrata* and *Acrostichum aureum* L. were the most widely distributed fern species in the study sites while *Lygodium microphyllum* (Cav.)R.Br. and *Lygodium smithianum* (Presl.) were least distributed (Fig 1). In Osun State, *Nephrolepis biserrata*, *Adiantum spp*,

Asplenium africanum, *Ctenitis lanigera*, *Cyclosorus striatus*, *Dryopteris variabilis* and *Pteris marginata* were the most widely-distributed species in the two sites constituting 83% of all the ferns identified in the sites while *Bolbitis acrostichooides*, *Ctenitis barteriana*, *Cyclosorus afer*, *Pteris atrovirens* and *Tectaria fernandensis* constitute 17% of the populations and so rated least distributed (Fig 2).

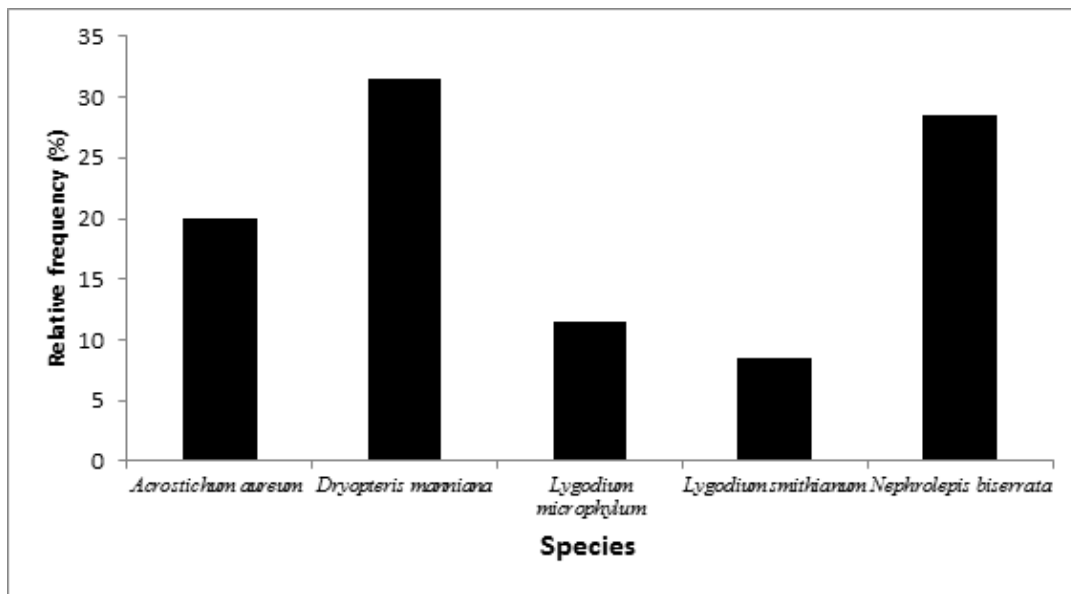


Figure 1: Distribution of Ferns in the Sites Sampled in Lagos State

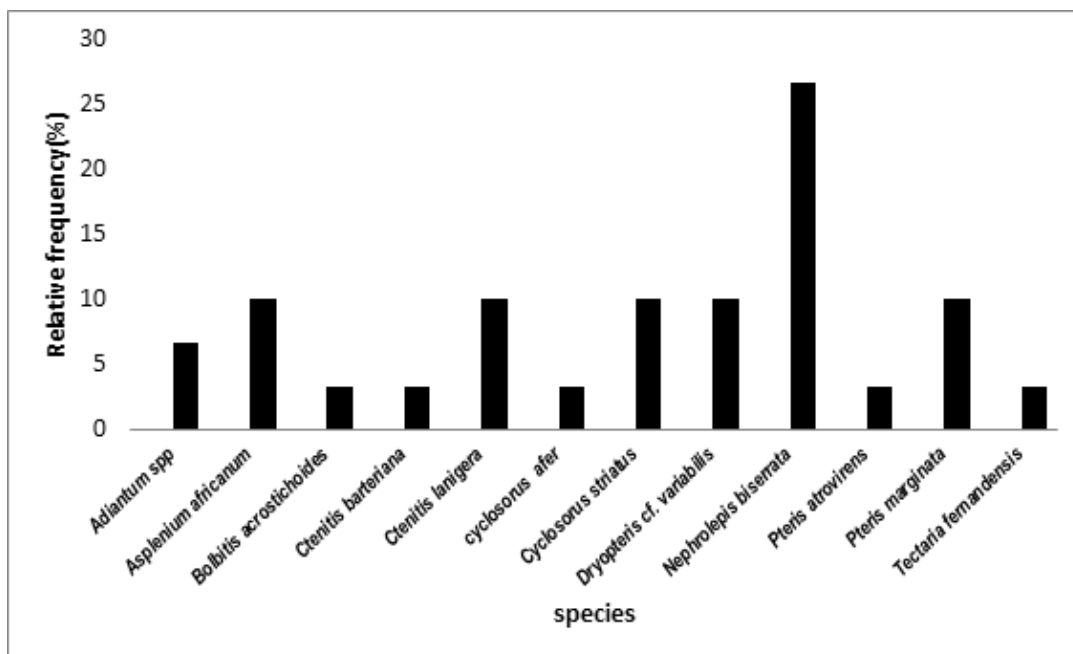


Figure 2: Distribution of Ferns in the Sites Sampled in Osun State

Life Forms of the Ferns

Ferns occurring in the study sites were categorized into three different life forms (Figure 3). This was based on their growth habits and classification

based on the habitats they occupy namely; terrestrial, epiphytes and lithophytes. There were 46% terrestrial species, 32% lithophytes and 22% epiphytes in all the five sites studied.

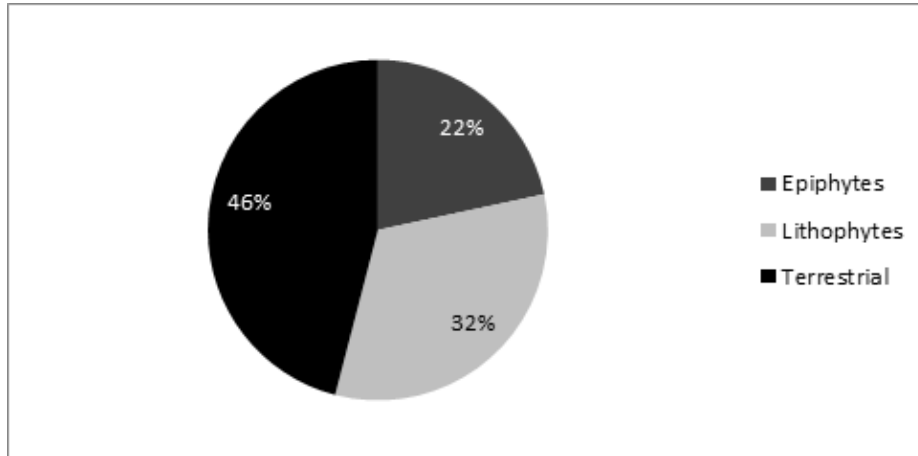


Figure 3: Composition of Life Forms.

Of the three life forms, terrestrial species (46%) were the most widely spread species occurring across the five study locations in the two sites studied (Lagos and Osun States; Figure 4) while lithophytes (32%) were distributed only in Osun State (Erin Ijesha waterfall and Oke-Ila waterfalls) and epiphytes (22%) were distributed in all the

study locations. This result showed that the number of pteridophytes found in terrestrials was higher, followed by lithophytes while epiphytes had the least. However, the epiphytic ferns were found in all the sites studied but more prominent in Lagos.

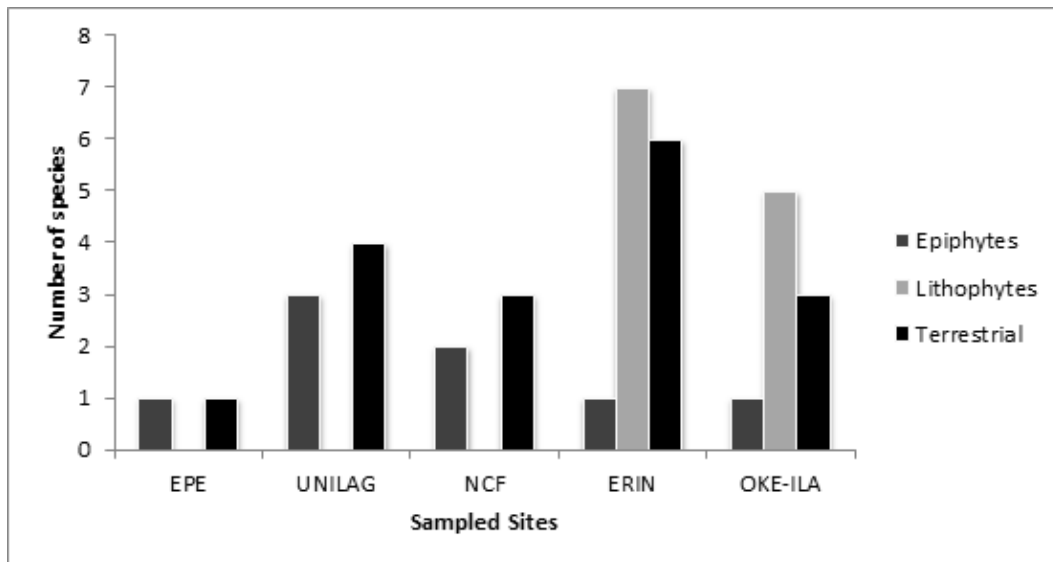


Figure 4: Distribution of Life Forms of Pteridophytes in the Sites Sampled

DISCUSSION

The occurrence, distribution and composition of the pteridophytes varied considerably between the two states studied with only one species common to them. Jones *et al.* (2011) reported that some species had high plasticity and occupied nearly all habitats available and occur in various life forms. *Nephrolepis bisserata* which occurred in the two study sites existed as epiphyte, lithophyte and terrestrial species. Kamau (2007) was of the opinion that the occurrence of ferns in different sites is a good indicator of ecological condition in tropical vegetation. The relatively high number of ferns (12 species) found in Osun State was probably due to a combination of suitable microclimatic conditions favourable to the species there. According to Richard *et al.* (2000), high species composition in areas with high moisture, humidity and shaded microhabitats suggests that the species there have adaptation for the environment. The relatively low number of species (5) recorded in Lagos State might be due to human activities such as deforestation, urbanization, industrialization which characterize the State thus leading to loss of more biodiversity.

In Osun State, the occurrence of some species such as *Nephrolepis biserrata*, *Adiantum spp*, *Asplenium africanum*, *Ctenitis lanigera*, *Cyclosorus striatus*, *Dryopteris variabilis* and *Pteris marginata* with high relative frequency shows that those species are likely to persist there while *Bolbitis acrostichoides*, *Ctenitis barteriana*, *cyclosorus afer*, *Pteris atrovirens* and *Tectaria fernandensis* all with low relative frequency may become rare in the future. Similarly, the occurrence of *Dryopteris manniana*, *Nephrolepis biserrata* and *Acrostichum aureum* with high relative frequency in Lagos State indicates that they are likely to persist there while *Lycopodium microphyllum* and *L. smithianum* with low relative frequency may be rare in the future. The species diversity indices of the sites studied also corroborate the fact that Lagos has been more disturbed than Osun State.

CONCLUSION

The present study has shown that the two study locations in Osun State recorded the highest number of ferns most of which are uncommon species while the locations in Lagos recorded only four species which are common. This high diversity may be due to the incidence of high

amount of rainfall in the locations of these forests. The presence of different microhabitats suitable for establishment and survival of pteridophyte flora distributed across various habitats also contribute to high species diversity. Owing to increasing climatic, vegetational and anthropogenic factors, there is need for *in situ* and *ex situ* conservation of fern species in Lagos and Osun States.

REFERENCES

- Ajit, P.S., Vineet, K.R., Sandip, K.B. and Prem, B.K. 2010. National Conference on Biodiversity, Development and Poverty Alleviation 22nd May, 2010. *Perspectives of Pteridophytes Biodiversity: A Source of Economy Elevation*. pp46-49.
- Chapman, A. D. 2009. *Numbers of Living Species in Australia and the World*. 2nd Edn. Australian Biodiversity Information Services. A Report for the Australian Biological Resources Study. Commonwealth of Australia
- Dixit, R.D. 2000. Conspectus of Pteridophytic diversity in India. *Indian Fern Journal* 17: 77–91.
- Jones, N. A., Ross, H., Lynam, T., Perez, P. and Leitch, A. 2011. Mental models: an interdisciplinary synthesis of theory and methods. *Ecology and Society* 16(1):46. [online] U R L : <http://www.ecologyandsociety.org/vol16/iss1/art46/> - accessed 14th January, 2015.
- Kamau, P.W. 2007. Systematic Revision of *Pteris* L. In *Tropical Africa and Ecology of Ferns and Lycophytes in Lowland Tropical Rainforests*. Tesis de doctorado, Universidad de Koblenz-Landau, Alemania.
- Kornas, J. 1983. Pteridophyta Collected in Northern Nigeria and Northern Cameroon. *Acta Societatis Botanicorum Poloniae* 52(4):321-335.
- Kromer, T. and Gradstein, S.R. 2003. Species richness of vascular epiphytes in two primary forests and fallows in the Bolivian Andes. *Selbyana* 24:190–195.
- Richard, A. F., Dewar, R. E., Schwartz, M. and Ratsirarson, J. 2000. Mass change, environmental variability and female fertility in wild *Propithecus verreauxi*. *Journal*

- of Human Evolution* 39:381-391.
- Rothwell, G.W. and Stockey, R.A. 2008. Phylogeny and evolution of ferns: a paleontological perspective. In: *Biology and Evolution of Ferns and Lycophytes*, (eds.), T.A. Ranker, and C.H. Haufler. Cambridge University Press 332-366pp.
- Sharpe, J.M., Mehlreter, K. and Walker, L.R. 2010. Ecological importance of ferns. In: *Fern Ecology*, K. Mehlreter, L.R. Walker. and J.M. Sharpe (eds.). Cambridge University Press, 1-21pp.
- [www.cbd.int/doc/world/ng/ng-nro1](http://www.cbd.int/doc/world/ng/ng-nro1/nigeriafirstbiodiversityreport2001-) "nigeriafirstbiodiversityreport2001- accessed 14th October, 2008