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Distribution, Habitat Adaptation and Conservation as integral approach to protection of *Anthocliesta* species in Nigeria's Niger Delta Landscape

[1]Edwin-Wosu, N.L., [2]T. Omara-Achong and [3]A. Nkang.

[1]Department of Plant Science and Biotechnology, Faculty of Biological Science, College of Natural and Applied Sciences, University of Port Harcourt, P.M.B. 5323, Choba, Port Harcourt, Rivers State, Nigeria
[2]Raw Materials Research and Development Council, Cross River State Liaison Office, Federal Secretariat, Calabar. [3]Department of Botany, University of Calabar, Cross River State

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ABSTRACT

The Niger Delta is a center of endemism for Africa and is the most extensive and lowland forest / aquatic ecosystem in West Africa. The area is undergoing conversion at a rapid rate. Investigation were carried out on the diversity and abundance of four commonly occurring species of the genus Anthocleista in Nigeria's Niger Delta, Anthocleista djalonesis A. Chev; A. vogelii Planch; A. nobilis G. Don; and A. liebrechtsiana De Wild. All the species are found in the wild. Assessment of distribution indicated that the species are generally mesophytic in habitat requirements. Examination of morphological features and geographical distribution patterns indicated that the species are perennial trees with marked preference for tropical climates. Disparities in ecological habitat were found. Anthocleista djalonesis and A. nobilis show preference for both normal terrestrial (low land dry rainforest) and wetland (seasonally flooded) environments. Anthocleista vogelii shows a preference for normal terrestrial habitat while A. liebrechtsiana prefers wetland or semi aquatic habitats. Also Anthocliesta djalonesis, A. nobilis and A. vogelii are prevalent in lowland secondary rainforests while A. liebrechtsiana is prevalent in fresh water swamp forests. Anthocliesta leibrechtsiana seems to be a 'habitat specialist' showing a narrow niche and limited geographical distribution. The present study revealed declining abundance and distribution of Anthocliesta species. The lack of concise conservation programme in the regions threatens these species and other plant genetic resources with extinction. The study highlights the need to promote the development and conservation of these and other economically useful plant genetic resources.

Key words: *Anthocliesta*, Habitats, Niche, Conservation, Niger Delta.

INTRODUCTION

A number of wild plants including those which occupy human-dominated landscape have been in use for various purposes since antiquity. High human density and resultant pressure on plant resources and habitats have pushed many species towards rarity and local extinction. Maintaining patches of natural vegetation within the human dominated landscape is the only way to conserve nature flora [1]. Therefore landscape level analysis of vegetation becomes vital for assessing the availability of plant resources, patterns of species diversity and identification of botanical hot spots [2]. In order to conserve maximum range of regional biodiversity better understanding of vegetation dynamics at spatio-temporal scale and successional trends would be required [3, 4]. A detailed study of endemism in the Niger Delta is necessary to define the priorities in conservation policy.

Conservation is essentially an umbrella term for traditional species and ecosystem management, which entails the need to manage the human use of species and ecosystem in a sustainable way, such that species harvest is lower than the intrinsic rate of increase of the species population. Conservation is the vital link between the acquisition and utilization of plant genetic resources and includes all the ways in which plant germplasm is stored and preserved [5, 6, 7]. The need of conservation and resource implication do vary widely with crop. Increasing pressure and subsequent threat on our plant genetic resources have been highlighted by various experts [8, 9, 10].

The report of the International Tropical Timber Organization (IITO) in 2005 on the state of Tropical Forest Management in Nigeria is a very useful document and concludes that there are several obstacles to sustainable Forest Management in Nigeria. These problems include: The discretionary power of Government to de-reserve or harvest the forest, lack of a coherent forest policy (and where any exist, lack of good will for a proper and justified amendment for effective implementation), the prevalence of illegal logging and harvesting of forest resources, chronic under resourcing of forest programmes and forest management, overlapping of responsibilities amongst Federal, State, and Local Governments and excessive bureaucracy, lack of inter-sectoral coordination and overall absence of reliable data on which to base forestry planning and development. In many parts of Niger Delta, the loss or extinction of biodiversity plant genetic resources is caused by a multitude of factors, the notable being rapid developmental drive, growing population demand and subsequent vegetation clearing for agricultural and infrastructural expansion. These have also resulted in a drastic decline to the endemic nature and habitat for *Anthocliesta* species in the wild.

One of the challenges of conservation of rare, threatened and endemic plants is the identification of their ecological niches and the amplitude of distribution. Niches are defined as a cell of the multi-dimensional space formed by the environmental variables within which a particular species will always be found [11]. Ecological amplitude is the capability of a species to establish in various habitats lying along an environmental gradient. A species showing very low ecological amplitude has localized distribution because of the narrow range of conditions on which their growth depends. The species are called "*habitat specialist*" because they have a significant positive association with their habitat or they cannot survive outside of their habitat [12]. Specialist species have narrow niche breadths and occur only in a small geographical range, where appropriate resources are available.

In order to categorise threatened species, IUCN has updated the categories of the basis of geographical range, population and fragmentation. The threatened species categories now used in the Red Data Books and Red List are: critically endangered (facing an extremely high risk of extinction in the wild in the immediate future), endangered (not critical but facing a very high risk of extinction in the wild in the near future), and vulnerable (neither critical nor endangered but facing a high risk of extinction in the wild in the medium-term future). Taxa listed as critically endangered are said to be vulnerable and endangered and those listed as endangered are said to be vulnerable. Together these categories are described as threatened. Most of the endemic species with a small geographic range end up as rare species and later threatened species unless their habitat is protected. The present paper attempts to study the endemic and threatened tree species of *Anthocliesta*, their spatial and ecological distribution of niches with special attention to the scope of biodiversity conservation.

Though various studies on diversity distribution and population structure of plant species have been carried out by many workers in different forest ecosystems [13, 14, 15, 16, 17], thus while studies on the phytogeography and diversity of plant species in the Niger Delta landscape are building up, very scanty or no information has been generated on this aspect of *Anthocliesta* investigated under the local conditions of Niger Delta landscape analysis of vegetation. The information on diversity and habitat adaptation of tropical plant such as *Anthocliesta* is needed because of its potential usefulness and implication for conservation and management across the protected area of Niger Delta.

This paper therefore is part of an on-going effort aimed at re-awakening the interest of both scientists and local populace at large from that ugly situation and ways to conserve the species. It is hoped that the information obtained from the studies and the recommendation suggested will help to reverse the trend and subsequently engender new interests towards the development and conservation of this species.

MATERIALS AND METHODS

Geomorphological description of the study area and Location.

The Niger Delta area is the coastline parts of Nigeria approximately 853 kilometers facing the Atlantic ocean and lying between latitude 4^{o} 10^{1} to 6^{o} 20^{1}N and longitude 2^{o} 45^{1} to 8^{o} 35^{1}E. Geographically the area is the Southern segment of Nigeria, created by myriads of Islands segmented by lagoons and channels, which empty into the Bight of Benin in the East Atlantic Ocean. The Delta is supplied with water by the Rivers Niger and Benue. These Rivers (now joined) break up at Ebu-Otor into the Rivers Nun and Forcados (including their tributaries). The portion of the Niger Delta traversed by the River Nun is the present Bayelsa State, while the present Delta State is traversed by the River Forcados. The Nun River breaks out into many channels and creeks such as *Santa Barbara, St. Nicholas, Brass, Nun, Sangana, Fishtown, Koliama, Middleton, Digatoru, Pernnington, Dodo and Ramos* Rivers, which empty into the Atlantic Ocean [18].

The Niger Delta has also been seen from the ecological perspective as that portion of the Southern Nigeria stemming from a Northern apex situated at Aboh, bounded in the East and West by the Imo River and the Benin River respectively and on the South by the Atlantic Ocean [19]. It is the Africa's largest Delta covering some 70,000 square kilometers (Km^2), of which one third of the area is made up of wetland [20]. The core Niger Delta area includes Rivers, Bayelsa, and Delta. Others include Akwa Ibom, Cross River, and Edo, Abia, Imo and Ondo States.
The Niger Delta which is one of the biogeographical regions of Nigeria is low lying and not more than 3.0 meters above sea level [21]. It possesses myriads of a complex landscape of sensitive vegetation and ecosystems ranging from coastal mangrove forest, brackish swamp forests, fresh water swamp forest, barrier island forest and low land rainforest which are attributes of a large river delta in a tropical region [22, 23]. The zone experiences a tropical climate consisting of a rainy season (April to November) and a dry season (December to March), with an annual rainfall ranging between 1500 and 4000mm [24]. The mean monthly temperature varies between 24^{O}C and 32^{O}C throughout the years, thus its climatic regimes exhibit maximum temperature. Seasonal and latitudinal variations do affect the maximum temperature, diurnal and seasonal ranges, relative humidity, high rainfall pattern, which is comparatively uniform due to the proximity of the region to the Atlantic Ocean [18]. The area is characteristically of sandy silt and clayey soils often alkaline and salty, sometimes acidic.

The aforementioned Southern parts of Nigeria, which include States like Rivers, Akwa-Ibom, Bayelsa and Cross River considered among others in this study are very important sections of the country. They are endowed with enormous human and natural resources including minerals and diverse vegetation types. However, a high level ecological demand in the area culminating to a gross environmental alteration and pollution of the area is contributing to the depletion of biodiversity and vegetation resources in the area. This has heightened the need for systematic studies especially of valuable species in the area. The current studies which aim to: provide data on the distribution of the taxon – *Anthocleista* across different physiognomic units in the tropical rainforest landscape of Niger Delta based on qualitative analysis is part of the effort at describing and documenting plant species of the study area under intensive human exploitative activities.

Species description

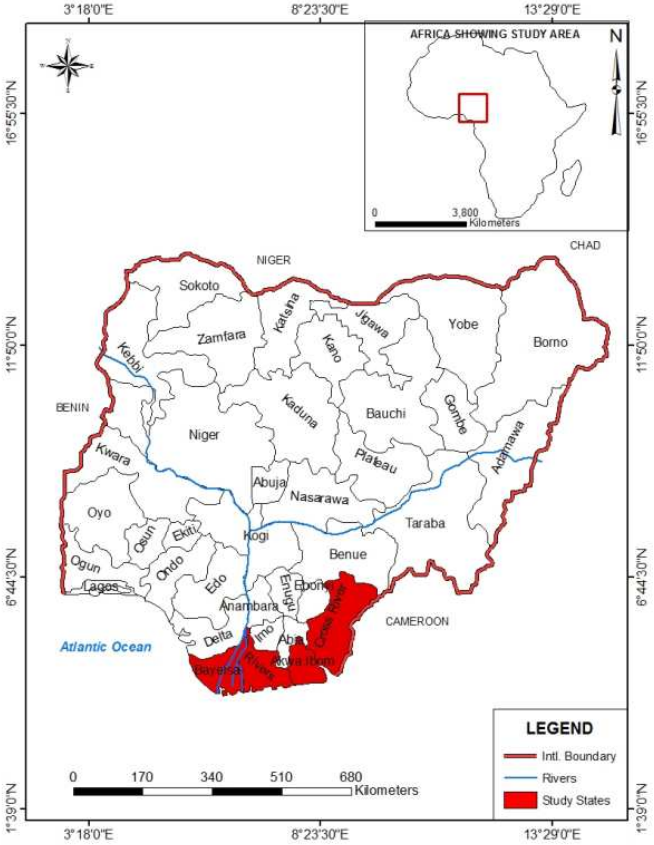
The Genus *Anthocleista* Afzel *ex*. R. Br, is a medium size tropical Africa genus composed usually of small trees or scrambling shrubs with soft white wood [25]. It belongs to the family Loganiaceae. There are about 50 species in the genus *Anthocleista*, native mainly to tropical Africa, Madagascar and Mascarene Island. Of the 50 species six (6) species are known to be found and of economic importance in various parts of Nigeria [25]. Of the six species in Nigeria, phytogeographical study has revealed four species of common occurrence in parts of Niger Delta [26, 27]. The species are completely glabrous and very large with rather leathering leaves; some of them being over 1-5 ft long even in mature trees and saplings. The base of the petiole is dilated (and sometimes more or less winged) running round the branchlet and joining the base of the opposite petiole, and leaving a conspicuous scar after falling. The stems of young trees of some species are unbranched or branched only at the top with huge leaves clustered at the end of the shoot giving rise to the popular name of cabbage tree. Some species have highly characteristics 2 – pronged spines close together or diverging. The inflorescences are terminal and very stout, completely hairless branching in trees with each lateral pairs of branches at right angles to the pair above and below [28].

Bracts are small but persistent triangular and / or rounded in shape. The flowers have stout stalks, 4 thick almost circular sepals over lapping in opposite pair in conspicuously tabular corolla with 6-16 narrow lobes over lapping each other to the right or left and equal number of stamens attached to the corolla - tube between the lobes with

elongated anthers and the filament fused into a very short tube. The long - slender style terminated in fat stigma. The fruits are ovoid or obovoid berries 1-3mm in diameter with a leathery coat enclosing numerous small seeds [28].

Species Assessment

The spatial distribution of plant and location, their degree of habitat nich specialization and the spatial distribution of sensitive habitats are some of the major aspects analysed. The Species of the genus -*Anthocleista* used for this Study were observed and collected from parts of Rivers, Akwa Ibom, Cross River, and Bayelsa States of Nigeria (FIG. 1). Despite the various hot spot in Niger Delta the areas under study were chosen for the reason of accessibility, availability and prevalence of the species. A systematic random sampling based on simple ecological procedure was carried out with various sampling points of different geographical precision coordinates noted in parts of the States under consideration. A hand-held geographic positioning system (GPS- *etrex* 12 channel model) was used to record the location coordinates of each sample point for the distribution status of the *Anthocliesta* species in the area under observation. Materials collected were identified and authenticated using relevant Flora. Confirmation of identification was done by matching the specimens with authenticated specimens available at the Forestry Herbarium Ibadan (FHI) of the Forestry Research Institute (FRIN) of Nigeria. The sampling areas covered include:



i Rivers State: Comprising areas such as Opu-oko town Nyokhana in Khana LGA, Sakpewa in Tai LGA (both areas covering a fallowed land along Bori/Ikot Abasi road. The Abuja campus Uniport, Choba in Obio/Akpor (covering the wetland / seasonally flooded forest within the UPTH axis, University conservation/Botanic garden axis and Rubber Plantation). Isiodu in Emuoha LGA (covering the wetland forest extension immediately after the Choba-Wilbros bridge of the new calabar river and Omuoko axis in Aluu town, Ikwerre LGA (covering a secondary fallowed land).

ii. Bayelsa State: Comprising the Yenagoa axis of the forest lying on both side of the road by the gate way to Edipie / Yenagoa.

iii. Akwa Ibom State comprising parts of Ikot Osuete town in Oruk Anam LGA along the Bori / Ikot Abasi high way (covering the wetland forest lying on both side of the road, few distance immediately after the Imo River bridge interface between Rivers and Akwa-Ibom States.
iv. Cross River State, comprising parts of Akai Effa - Idundu in Calabar Municipality (covering parts of the swamp forest lying on both side of Akai Effa-Idundu road in Calabar municipal, and parts of Atimbo forest along Atimbo road in Akpabuyo LGA.

RESULTS

Assessment made on these species has shown that 4 species of the genus are common in parts of the Southern Nigeria studied. The species commonly observed in these areas of study include: *Anthocleista djalonesis* A. Chev*; A. vogelii* Planch; *A. nobilis* G. Don; and *A. liebrechtsiana* De Wild. The assessment of the distribution of the various species shows that they are generally mesophytic in environmental and habitat adaptation and thus occurs in some parts of the tropical rainforest in the study zones of the Southern section of the country. Further observation on vegetative and floral features and information from the geographical distribution of the *Anthocleista* taxa investigated have also indicated that all the species, however their mesophytic inclination are perennial shrubby trees with marked preference for tropical climates.

Observation has also shown that despite their profound preference for tropical and mesophytic environment, they also display disparity in restricted occurrence in certain ecological habitats. In the States under study, the following species with spatial amplitude and habitat distribution were recorded. (Summary of result presented in Table 1).

In Rivers State the Opu-oko town Nyokhana in Khana LGA which extend from latitude 04^0 40.974^1N to 04^0 41.225^1N and longitude 007^0 30.348^1E to 007^0 30.896^1E at an altitudinal range of 26-53ft was characterized by the abundance of *A. vogelii* and *A. djalonesis*, absence of *A. liebrechtsiana* with scanty occurrence of *A. nobilis*. Sakpewa in Tai LGA situated at Lat 04^0 43.087^1N and Long. 007^0 16.081^1E at an altitude of -21ft recorded abundance of *A. Vogelii* and *A. djalonesis* only. The UPTH axis of Uniport, Choba in Obio/Akpor LGA which extends from Latitude 04^0 53.279^1N to 04^0 53.580^1N and Longitude 006^0 55.465^1E to 006^0 55.672^1E at an altitude of 49-99ft was dominated by *A. liebrechtsiana* and little abundance of *A. nobilis*. The Rubber plantation axis with Latitude 04^0 54.171^1N to 04^0 54.197^1N and longitude 006^0 54.671^1E to 006^0 54.752^1E at an altitude of 37- 48ft was dominated by abundance of *A. vogelii*, *A. djalonesis* and *A. nobilis*, hence it was associated with the dryland area of the seasonally flooded forest, while the Biodiversity / Botanic Garden study area lying between Lat. 04^0 53.745^1N to 04^0 53.868^1 and Long. 006^0 54.913^1E to 006^0 54.955^1E at an altitude of –16 to 47ft was occupied by abundance of *A. liebrechtsiana* and *A. nobilis* and scanty number of *A. vogelii*. Isiodu in Emuoha LGA with its situate extending from Lat. 04 53.725^1N to 04^0 53.732^1N and Long 006^0 53.813^1E to 006^0 53.824^1E at an altitude of 27-37ft has a wild occurrence of *A. liebrechtsiana* in abundance. Omuoko study area in Aluu, Ikwerre LGA extending from Lat. 04^0 54.980^1N and 04^0 54.987^1N and long. 006^0 54.215^1E to 006^0 54.219^1E, altitude 48-70ft. This area was associated with an abundance of *A. vogelii* and *A. djalonesis*.

In Bayelsa State,Yenagoa town which extends from Lat. 04^0 02.819^1N to 04^0 03.005^1N and Long 00.6^0 24.894^1E and 006^0 25.153^1E at an altitude of 4-58ft was dominated by *A. liebrechtsiana*, *A. nobilis* and scanty *A. djalonesis.*

In Akwa Ibom, Ikot-Osuete town in Oruk-Anam LGA along the Bori / Ikot-Abasi high way study area extends from Lat 04^o 40.615^1N and 04^o 685^1N and long. 007^o 31.596^1E to 007^o 32.027^1E at an altitude of 2-21ft with abundance of *A. liebrechtsiana* and *A. nobilis.*

In Cross River State, Akai Effa-Idundu in Calabar municipal with the altitudinal range of 10-20ft extending from Lat. 05^o 60.579^1N and 05^o 00.610^1N and long. 008^o 22.011^1E and 008^o 22.166^1E was dominated by the abundance of *A. liebrechtsiana* and *A. nobilis*.

Atimbo in Akpabuyo LGA with the altitudinal range of 5-28ft, extending from lat. 04^o 57.922^1N and 04^o 57.958^1N, long 008^o 22.458^1E, and 008^o 22.640^1E was dominated by a wild abundance of *A. leibrechtsiana* and *A. nobilis.*

It was observed that in areas under investigation, all the species in question are found to exist in the wild. *Anthocleista djalonesis*, and *A. nobilis* shows an ecological preference for both a normal terrestrial and wetland (seasonally flooded) environment, though generally with preference for a terrestrial environment. *Anthocleista*

vogelii is preferentially a normal dry terrestrial habitat species while *A. liebrechtsiana* prefers wetland or semi aquatic habitats. Also *Anthocliesta djalonesis, A. nobilis and A. vogelii* are prevalent and in association with low land secondary vegetation forest while *A. liebrechtsiana* is prevalent and in association with fresh water swamp forest zone.

DISCUSSION

Niger Delta has been identified as one of the top mega-diversity in Nigeria among countries in the world and among the hot spot recognized in the world. The Niger Delta and its environs is one of the endemic centers of plant diversity in Nigeria. Plant often reflect temporarily integrated environmental conditions and are therefore particularly useful indicators when value averaged overtime are needed. When the value of an environmental factor in the past is required, the only possible approach may be to base it on historical vegetation data.

Ecological changes are always associated with developmental activity. Our planet is continually changing, causing habitats to be altered and modified. Natural changes tend to occur at a gradual pace, usually causing only a slight impact on individual species. However, when changes occur at a fast pace, there is little or no time for individual species to react and adjust to new circumstances. This can create disastrous result, and for this reason, rapid habitat loss is the primary cause of species endangerment. Endangered plant species entails a significant reduction in number of plant species in its natural habitat especially when such a species is placed in jeopardy as a result of human activity. The destruction and pollution of habitat are the major causes of endangerment. Other factors include overexploitation and competition. Therefore a good monitoring and evaluation system will indicate any probable changes and results of the activities.

Micro-environmental factors vary with seasonal changes which affect the growth stages of plant communities that maintain the population structure of any forest. Therefore it becomes an important issue to understand the tree diversity and population structure of forest communities for the maintenance of both natural and control forests [29]. Information from such distribution studies provides clues to agro-climate and environmental factors for plant development. The distribution status of the species studied indicated that all the species are mesophytic in environmental and habitat adaptation. Morphological observation has shown that all the species are perennial shrubby trees (whatever their inclination) with marked preference for tropical climates. Also all the species are highly evolved dicotyledons with obvious adaptive features fitted for their nature and survival. These observations are similar to those of Hutchinson and Dalziel [30]. Thus occurs in some parts of the tropical rainforest and fresh water swamp forest ecological zones of the southern part of Nigeria. So far information on the status of plant species is important to determine the potential of an area for biodiversity conservation.

A number of factor including available moisture, soil type, exposure and disturbance are known to influence the relative abundance of species in forested habitat [31, 32]. Though the study area of *Anthocliesta* species is mainly within the low land Tropical rainforest and fresh water swamp forest zones, one of the reasons for higher species diversity in the area could be variation in micro-habitat features and occurrence of several associations. This corroborate with the assertion of Shukla [33]. However, the four wild species of the *Anthocleista* genus in southern part of Nigeria displayed restricted pattern of occurrence in certain ecological habitats with *A. liebrechtsiana* preferring the wetland (flooded) rainforest areas of southern Nigeria while the other three species *A. nobilis, A . djalonesis and A vogelii* thrive best in the mesophytic terrestrial environment. Such amplitudinal variation in certain ecological habitats could be a result of innate variation in environmental cues. Ecological amplitude is the capability of a species to establish in various habitats lying along an environmental gradient. These species have also displayed some level of ecological amplitude. This argument corroborate with the assertion that landscape are never static, their element are in permanent temporal and spatial flux [34, 35].

However, the wetland landscapes of the tropical rainforest tend to harbour a high prevalence of *A. leibrechtsiana* endemics because they act like 'Island amidst Island'. This isolation has facilitated the process of speciation leading to a phenomenon of vicariance between sister species derived from common ancestor, two of which (*A. djalonesis and A vogelii*) thrives in the normal terrestrial habitat and the other (*A. nobilis*) in close proximity and adjacent to the wetland. This could be reaffirmed by a macro scale study, which has attributed species diversity richness to be a product of water energy dynamics [36]. *Anthocliesta leibrechtsiana* tend to be a 'habitat specialist' with a narrow niche breadth and occur only in a small geographical range, where appropriate resources are available. It shows very low ecological amplitude hence it has a localized distribution because of the narrow range of conditions on which

their growth depends. It has a significant positive association with their habitat, thus can not survive outside their habitat. Extremely restricted areas have been reported as type localities for a number of plants species, many of which are endangered or rare [37].

In many parts of the Niger Delta States in question the loss or extinction of biodiversity plant genetic resources is caused by rapid developmental drive, growing population demand and subsequent vegetation clearing for agricultural and infrastructural expansion. These have also resulted in a drastic decline to the endemic nature and habitat for *Anthocliesta* species in the wild. The on-going Federal Government dualization and expansion project of the East – West road linking the Eastern and Western part of Nigeria to Southern Nigeria is a case in point of human activity that has drastically threatened the existence of *Anthocliesta* species along the Isiodu- Emuhoa and Bori / Ikot Abasi axis in parts of the study areas.

Attempts have also been made to analyse the patterns of plant species diversity in the human dominated landscape, especially in relation to time scale [38, 39]. While Lomolino [40] had pointed out that many components of climate and local environments such as temperature, precipitation, seasonality and disturbance regimes vary along species amplitudinal gradient, which ultimately creates variation in their richness, similar studies on analysis of vegetation have also been carried out particularly in terms of phytosociology, species diversity, richness and abundance across different physiognomic unit in various parts of the world [41, 13, 14, 15, 16]. One of the reasons for higher species diversity could be variation in micro-habitat features and occurrence of several associations [33].

Table 1: Summary of GPS Co-ordinates and species in different sample stations

S/N	Stations	Latitude	Longitude	Alt. (Ft)	Species
1	**Rivers State**				
i	Opu-oko town, Khana LGA. (The fallowed land along Bori/Ikot Abasi Road).	04^0 41.225^{1}N 04^0 40.974^{1}N	007^0 30.348^{1}E 007^0 30.896^{1}E	53 26	**Abundance of *A. vogelli* and *A. djalonesis*, absence of *A. liebrechtsiana* with scanty occurrence of *A. nobilis*.**
ii	Sakpewa, Tai LGA. (the fallowed land along Bori/Ikot-Abasi Road)	04^0 43.087^{1}N	007^0 16.081^{1}E	-21	**Abundance of *A. Vogelii* and *A. djalonesis* only**
iii	Abuja Campus Uniport Obio/Akpor LGA				
	UPTH axis	04^0 53.279^{1}N 04^0 53.580^{1}N	006^0 55.465^{1}E 006^0 55.672^{1}E	99 49	**Dominated by *A. liebrechtsiana* and little abundance of *A. nobilis*.**
	Rubber Plantation	04^0 54.185^{1}N 04^0 54.171^{1}N 04^0 54.180^{1}N 04^0 54.197^{1}N	006^0 54.694^{1}E 006^0 54.671^{1}E 006^0 54.702^{1}E 006^0 54.751^{1}E	37 38 48 47	**Abundance of *A. vogelii*, *A. djalonesis* and *A. nobilis*, hence it was associated with the dryland area of the seasonally flooded forest.**
	Biodiversity/Botanic garden axis	04^0 53.745^{1}N 04^0 53.774^{1}N 04^0 53.792^{1}N 04^0 53.817^{1}N 04^0 53.807^{1}N 04^0 53.868^{1}N	006^0 54.913^{1}E 006^0 54.923^{1}E 006^0 54.925^{1}E 006^0 54.943^{1}E 006^0 54.952^{1}E 006^0 54.955^{1}E	-16 37 47 27 41 45	**Abundance of *A. liebrechtsiana* and *A. nobilis* and scanty *A. vogelii*.**
	Isiodu Emuoha LGA. (Covering the wetland forest extension immediately after the Choba-Wilbros bridge).	04^0 53.732^{1}N 04^0 53.725^{1}N	006^0 53.824^{1}E 006^0 53.813^{1}E	37 27	**Occurrence of *A. liebrechtsiana* in abundance.**
	Aluu Ikwerre LGA Omuoko axis. (Covering a secondary fallowed land).	04^0 54.987^{1}N 04^0 54.980^{1}N	006^0 54.215^{1}E 006^0 54.219^{1}E	70 48	**Abundance of *A. vogelii* and *A. djalonesis*.**

2	**Bayelsa State**				
	Yanagoa Town. (The forest lying on both side of the road by the gate way to Ede-pie / Yenagoa.	05^0 03.005^{1}N 05^0 02.963^{1}N 05^0 02.892^{1}N 05^0 02.819^{1}N	006^0 25.153^{1}E 006^0 25.098^{1}E 006^0 24.994^{1}E 006^0 24.894^{1}E	41 30 58 44	**Dominated by *A. liebrechtsiana*, *A. nobilis* and scanty *A. djalonesis*.**
	Akwa Ibom				
	Ikot Osuete Ikot-Osuete town in Oruk-Anam LGA, along the Bori / Ikot-Abasi high way (covering the wetland forest lying on both side of the road, few distance immediately after the Imo River bridge interface between Rivers and Akwa Ibom States.	04^0 40.639^{1}N 04^0 40.629^{1}N 04^0 40.617^{1}N 04^0 40.615^{1}N 04^0 40.618^{1}N 04^0 40.685^{1}N	007^0 31.596^{1}E 007^0 31.640^{1}E 007^0 31.687^{1}E 007^0 31.783^{1}E 007^0 31.831^{1}E 007^0 31.027^{1}E	9 4 2 11 21 15	**Abundance of *A. liebrechtsiana* and *A. nobilis*.**
4.	**Cross River State**				
	Akai Effa-Idundu. (covering some part of Akai Effa swamp rain forest lying on both side of Akai Effa-Idundu road in Calabar municipal)	05^0 00.579^{1}N 05^0 00.582^{1}N 05^0 00.591^{1}N 05^0 00.601^{1}N 05^0 00.610^{1}N	008^0 22.011^{1}E 008^0 22.025^{1}E 008^0 22.070^{1}E 008^0 22.117^{1}E 008^0 22.166^{1}E	15 11 14 10 20	**Abundance of *A. liebrechtsiana* and *A. nobilis*.**
	Atimbo in Akpabuyo LGA (covering some part of Atimbo forest along the Atimbo-Akpabuyo Road).	04^0 57.958^{1}N 04^0 57.950^{1}N 04^0 57.950^{1}N 04^0 57.954^{1}N 04^0 57.922^{1}N	008^0 22.458^{1}E 008^0 22.503^{1}E 008^0 22.547^{1}E 008^0 22.578^{1}E 008^0 22.640^{1}E	5 26 28 26 12	**Abundance of *A. leibrechtsiana* and *A. nobilis*.**

CONCLUSION

Pollution and diverse environmental degradation has seriously affected multiple terrestrial and aquatic species, and limited distributions are frequently a consequence of other threats; population confined to few small areas due to habitat loss, for example, may be disastrously affected by random factors.

In view of these problems the following areas of needs are highlighted for urgent attention through national and international collaborative initiatives.

i) Exploration, collection and conservation of some threatened and endangered plant genetic resources.
ii) There is need for routine phonological observation and study on *Anthocliesta* species.
iii) Sustainable utilization of *Anthocliesta* plant genetic resources.
iv) Inventory and demarcation of *in-situ* conservation sites.
v) Training in the area of gene bank administration, biotechnology and seed management of *Anthocliesta* species.
vi) Review existing laws in support of plant genetic conservation in general.
vii) Enhance the National Herbarium by providing facilities and staffing to facilitate identification and biosystematics.

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