Asian Journal of Research in Botany

Volume 7, Issue 2, Page 258-262, 2024; Article no.AJRIB.125577

Abundance and Density of *Acrostichum aureum* L. in Coastal Ecosystems of Southern Nigeria

Anwana, E. D. [a], Udo, E. D. [a*], Ogbemudia, F. O. [a] and Ita, R. E. [b]

[a] Department of Botany and Ecological Studies, University of Uyo, Akwa Ibom State, Nigeria.
[b] Department of Biological Science, Ritman University, Akwa Ibom State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/125577

Short Research Article

Received: 25/08/2024
Accepted: 26/10/2024
Published: 31/10/2024

ABSTRACT

Acrostichum aureum Linnaeus is a rhizomatous fern of the Pteridaceae Kirchner family, which is generally found in elevated areas of mangrove forests or around agricultural fields. Over the years, the mangrove ecosystems in Akwa Ibom State have been degraded due to anthropogenic activities and pollutants from oil mining activities that act as stressors to endemic mangrove vegetation. It acts as a natural sea wall against the incursion of sea water intrusion landward amongst several other important functions; thus necessitating explorative studies on the population status of plant species in the ecosystem. This study was carried out at three mangrove locations within Iko Town, Okoroutip and Uta Ewa in Eastern Obolo, Ibeno and Ikot Abasi Local Government Areas respectively. The abundance and density of the plant species was calculated by enumerating the total number of *A. aureum* individuals observed within each sample plot across two seasons. Iko Town mangrove recorded the highest abundance and density of *A. aureum* with 34.25±2.78 and

**Corresponding author: E-mail: ekaetedudo@uniuyo.edu.ng;*

Cite as: *E. D., Anwana, Udo, E. D., Ogbemudia, F. O., and Ita, R. E. 2024. "Abundance and Density of Acrostichum Aureum L. In Coastal Ecosystems of Southern Nigeria". Asian Journal of Research in Botany 7 (2):258-62. https://journalajrib.com/index.php/AJRIB/article/view/225.*

856.25±69.50 (st/ha) in the dry season and 42.00±2.86 and 1050.00±71.44 (st/ha) in the wet season respectively. While Okoroutip mangrove had the least abundance and density of 13.25±1.03 and 331.25±25.77 (st/ha) respectively for dry season and 21.50±1.19 and 537.50±29.76 (st/ha) respectively for wet season. Whereas, Uta Ewa had an abundance and density value of 27.75±1.11 and 693.75±27.72 (st/ha) and 36.00±1.29 and 900.00±32.28 (st/ha) for dry and wet seasons respectively. The variations in abundance and density values of *A. aureum* were significantly different ($p < 0.05$) across the mangrove locations in both seasons. However, the abundance of *A. aureum* was notably higher in the wet compared to the dry season. This signifies that increased precipitation positively influenced the abundance of this mangroves' species.

Keywords: Abundance; density; mangrove; Acrostichum aureum; seasonality.

1. INTRODUCTION

Nigeria's vegetation belts reflect a very close link between vegetation and climate [1]. Vegetation belts are demarcated on west-to-east zonation pattern characterized by transitional zones from one belt to another hence, resulting into different types of vegetation including the littoral vegetation that occurs along the shorelines of water bodies [2,3]. The study area is part of the Niger Delta Region (NDR) which is characterized by rich biodiversity, highly diverse and productive ecosystems, good agricultural land and excellent fisheries [4]. The ecological significance of the region is underlined by some important characteristics, biodiversity, ecosystem services, soil remediation etc [5]. The mangrove trees conserve water resources and serve as wind breaks in many communities. Specifically, in the Niger Delta, there are several uses of mangroves by the indigenous people, these include; fire wood, building materials, medicinal products, food baskets and fishing tools etc. [6]. *Acrostichum* (Linnaeus) is a rhizomatous fern of the Pteridaceae Kirchner family [7]. This plant is a common part of the understory of mangrove backwaters and is the only fern that can grow in brackish water [8]. In particular, the most characteristic habitat for *Acrostichum* is inshore marsh areas that receive some saline water from high tides and some fresh water from inflowing streams [9]. It grows in groups, sometimes gregariously colonising an area, and it is characterised by a pantropical distribution [10]. It usually develops in organic and clay-rich soils of high salinity, with pH acidic to neutral [11]. *Acrostichum* is one of the rare terrestrial erect fern belonging to the family Pteridaceae having woody glabrous stipes which arise from a stout woody rhizome, with unipinnate fronds, which are alternate, linear and oblong. *Acrostichum* is generally found in elevated areas of mangrove forests or around agricultural fields. Over the years, the mangrove ecosystems in Akwa Ibom State have been degraded due to anthropogenic activities from industrial, agricultural, urban and domestic sources [12,13]. Despite the high level of pollution *Acrostichum aureum* grows luxuriantly in these ecosystems. The fact that it survives in an ecosystem that is prone to pollution by anthropogenic activities within the area is of particular interest to ecologists. Thus, necessitating explorative studies on the population status of plant species in the ecosystem.

2. METHODOLOGY

2.1 Study Area

This study covered three mangrove locations in Akwa Ibom State. These were Iko Town in Eastern Obolo Local Government Area, Okoroutip community in Ibeno Local Government Area and Uta Ewa community in Ikot Abasi Local Government Area. The coordinates of the Mangrove locations were Latitudes and Longitudes 4° 33' N to 23 °02' N and 7° 44' E to 50 °60' E and 4° 33' N to 06° 74' N and 7° 32' E to 48 °64' E and 4° 32' N to 48 °50' N and 7°32' E to 4° 83' E Iko Town, Okoroutip and Uta Ewa respectively.

2.2 Determination of Abundance and Density of *A. aureum*

The quantification of *A. aureum* abundance was calculated by enumerating the total number of *A. aureum* individuals observed within each sample plot. The mean abundance of *A. aureum* was determined by counting the total number of individual species (Isi) and divided by the total number of species population (∑Nsi) and further multiplied by one hundred (100) to present your answer in percentage. This was calculated by the following formular:

$$A = \frac{Isi}{\sum Nsi} \times 100$$

Where
A = Abundance
Isi = Total number of individual species
∑Nsi = Total number of species population

While Density population was calculated by dividing the total number of individual samples (N) by the total number of individual samples (A). The formular is represented below:

Dp = N/A

Where Dp = Density Population
N = Total number of individual samples
A= Land Area covered by the population

3. RESULTS

3.1 Seasonal Abundance and Density of *Acrostichum aureum* across the Mangrove Ecosystems

The abundance and densities of *A. aureum* seasonally across the mangrove communities are presented in Table 1. In the dry seasons, the mangrove ecosystems recorded abundance value and density to range between 13.25±1.03 to 34.25±2.78 and 21.50±1.19 to 42.00±2.86 respectively. While in wet season, it ranged between 331.25±25.77 to 856.25±69.50 and 537.50±29.76 st/ha and 1050.00±71.44 st/ha abundance and density respectively for *A. aureum***.** The variations in abundance and density values of *A. aureum* were significantly different ($p < 0.05$) across the mangrove locations in both seasons.

4. DISCUSSION AND CONCLUSION

4.1 Discussion

This study observed differences in the number and density of *A. aureum* within the mangrove communities. The Iko town community mangrove exhibited the highest levels of abundance and density of *A. aureum*, whereas the Okoroutip community mangrove showed ed the lowest levels. The presence of diverse anthropogenic activities, such as encroachments, disturbances, and destruction, has led to the degradation of mangroves in these communities. The aforementioned disruptions are observed in the form of onshore prospecting conducted by corporations, wood cutting carried out by local communities, invasion, and secondary succession caused by *Nypa fruticans* [14]. The levels of disturbances in the mangroves of Okoroutip are significantly higher as compared to the mangroves of Iko Town. According to Ukpong [14], secondary succession by *Nypa fruticans* along the Atlantic coastal beachridge leads to the displacement of native mangrove species, such as *Acrostichum aureum* and *Phoenix reclinata*. This phenomenon contributes to the low abundance and density values observed in the Okoroutip community. There was a significant variation in the abundance and density of *A. aureum* between seasons, with higher values seen during the wet season compared to the dry season. This finding provides evidence for the impact of rainfall on the establishment and proliferation of this species within the ecosystem. The study conducted by Record et al. [15] and Ita [16] yielded comparable results, which indicated that increased precipitation positively influenced the abundance of mangroves. Furthermore, the promotion of mangrove growth can be achieved through the augmentation of nitrogen levels within the soil, as demonstrated by Fellar et al. [17]. The potential cause for the rise in soil nutrient levels can be attributed to runoff and intense precipitation [18]. Furthermore, the notable prevalence and concentration of *A. aureum* throughout the rainy season underscores the innate capacity of this plant to endure and adjust to elevated water levels and oxygen-deprived environments [16].

Table 1. Mean values of seasonal abundance and density of *A. aureum* across the mangrove communities

Mangrove location	Dry season		Wet season	
	Abundance	Density (st/ha)	Abundance	Density (st/ha)
Iko Town	34.25±2.78^{a}	856.25±69.50^{a}	42.00±2.86^{a}	1050.00±71.44^{a}
Okoroutip	13.25±1.03^{c}	331.25±25.77^{c}	21.50±1.19^{c}	537.50±29.76^{c}
Uta Ewa	27.75±1.11^{b}	693.75±27.72^{b}	36.00±1.29^{b}	900.00±32.28^{b}

Mean± Standard error
Different letters within a column indicates significant differences among the mean values with p<0.05

4.2 Conclusion

Acrostichum aureum were observed in both dry and wet seasons at different abundance and densities in the mangrove vegetation at Iko Town, Okoroutip and Uta Ewa, Akwa Ibom State. This signifies that the presence and availability of *Acrostichum aureum* indicates its ability to thrive in polluted ecosystem.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ubom RM, Ogbemudia FO, Ita RE. Floristics and structure of fallow vegetation. Sci J Biol Sci. 2012;1(2):61–69.
2. Wang L, Mu M, Li X, Lin P, Wang W. Differentiation Between True Mangroves and Mangrove Associates Based on Leaf Traits Salt Contents. J Plant Ecol. 2011;4(4):292–301.
3. Olowokudejo JD, Oyebanji OO. Floral diversity of the littoral vegetation of Southeastern Nigeria. Int J Biodivers Conserv. 2016;8(12):320–333.
4. Ogbemudia FO, Ita RE, Essien KI. Modelling the Vegetation and Soil Characteristics of Imo River Basin Mangrove Ecosystem, Akwa Ibom State, Nigeria. World J Appl Sci Technol. 2018;10(1):91–98.
5. Niger Delta Environmental Survey (NDES). Niger Delta Environmental Survey Phase 1 report: Volume 1-Environmental and Socio-Economic Characteristics. Lagos: Environmental Resources Managers Limited; 1997.
6. Ukoima HN, Abere SA, Omokhua GE. Andoni Marine Ecology: Emphasis on the Biological importance of some of the useful plants. J Environ Earth Sci. 2014;4(18): 2224–3216.
7. Smith AR, Pryer KM, Schuettpelz E, Korall P, Schneider H, Wolf PG. A classification for extant ferns. Taxon. 2006;55:705–731. doi:10.2307/25065646.
8. Tomlinson PB. The Botany of Mangroves. Cambridge: Cambridge University Press; 1986.
9. Arnold CA, Daugherty LH. The fern genus *Acrostichum* in the Eocene Clarno Formation of Oregon. Contrib Mus Paleontol Univ Mich. 1963;18:205–227.
10. Nooteboom HP, Kramer KU, Chambers TC, Hennipman E. *Pteridaceae* subfam. *Parkerioideae*. In: Nooteboom HP, editor. Flora Malesiana-Series II, Pteridophyta. Leiden: National Herbarium of the Netherlands-Leiden Branch. 2012;4:137–144.
11. García-Massini JL, Jacobs BF, Tabor NJ. Paleobotany and Sedimentology of Late Oligocene Terrestrial Strata from the Northwestern Ethiopian Plateau. Palaeontol Electronica. 2010;13:1.6A. 51.
12. Akpabio JU, Okon AO, Ebong GA, Udoinyang EP, Essien EA, Josiah IU, Akpan AW. Perturbation of Road Construction and Inorganic Sedimentation on the Macroinvertebrate Fauna in the Midstream Segment of Qua Iboe River, Nigeria. Asian J Adv Res Rep. 2024; 18(4):24–33.
13. Morris P. Methods of Environmental Assessment. London: University College London Press; 1995. 236p.
14. Ukpong I. Mangrove Swamp at a Saline/Freshwater Interface Near Creek Town, Southeastern Nigeria. Catena. 1997;29:61–71.
15. Record S, Charney N, Zakaria R, Ellison A. Projecting Global Mangrove Species and Community Distribution Under Climate Change. Ecosphere. 2013;4:1–23.
16. Ita R. Influence of Seasonality Gradients on Phytodiversity Richness in Rural and Urban Wetlands. Earth Atmos Sci. 2018;1(1):25–30.
17. Fellar I, McKee L, Whigham F, O'Neill J. Nitrogen versus Phosphorus Limitation Across an Ecotonal Gradient in a Mangrove Forest. Biogeochemistry. 2013; 62:145–75.

18. Castaneda-Moya E, Twilley V, Rivera-Monroy K, Zhang S, Davis I, Ross M. Sediment and Nutrient Deposition associated with Hurricane Wilma in Mangroves of the Florida Coastal Everglades. Estuaries Coasts. 2010;33: 45–58.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/125577