



ECOLOGICAL DISTRIBUTION OF *Pterocarpus erinaceus* Poir IN NIGERIA USING FOREST HERBARIUM IBADAN (FHI) COLLECTIONS

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ABSTRACT

Pterocarpus erinaceus is a vulnerable plant species found in West Africa's dry and semiarid regions. It is heavily exploited for its wood, animal feed, and different medicinal purposes, posing a significant risk to its natural distribution. Geographical distributions of species can, to a large part, be explained by environmental factors. This paper used Forest Herbarium Ibadan specimen collections to study the ecological distribution of *Pterocarpus erinaceus*, before the indiscriminate exploitation period that started in early 2000. The cabinets housing the Leguminosae family were identified and *Pterocarpus erinaceus* files were removed for recordings. Information on the location, habitat, year of collection, the collector, and FHI number as stated on the vouchers were documented for the study. A total of 36 herbaria specimens collected in Nigeria between 1943 and 1993 were used to study the distribution of the species. The maximum collection was done between 1941/1950 and 1961-1970 with 9 collections each. This was followed by 1951-1960 (8 collections), 1971-1980 (6 collections), and 1981-1990 (3 collections). The low collection was between 1991-2000 (1 collection). Recorded locations ranged from natural forests, secondary regrowth forests, farmland, and free areas. The results reveal that *P. erinaceus* has a wider distribution in Nigeria, especially in the rainforest and derived savannah, Sudan savanna, Sahel savanna, and Mountain Forest zones.

Keywords: *Pterocarpus erinaceus*, herbarium, collections, distribution

Introduction

Ecological diversity deals with the variations in ecosystems within a geographical location and its overall impact on human existence and the environment (Cunningham, 2015). According to Brenda and Lee Lerner (2009), it considers the variety in a biological community's complexity, including the number of various niches, the number of tropical levels, and other ecological processes. *P. erinaceus*, commonly known as African kino, barwood, black camwood, African rosewood, Osun-dudu is a species of flowering plant in the family Fabaceae (legumes), also known as Apepe (Yoruba), Ukpeka (Edo), and Madobiya (Hausa), Aze

egu (igbo). The grated root is mixed with tobacco and smoked in a pipe as a cough remedy (Sandrine, 2006). Keay, (1989) reported that the Senegal (Tenda tribe) / Guinea uses to safeguard their granaries against termites. The greatest industrial potential of *P. erinaceus* is embedded in its wood properties. The need for expensive rosewood furniture has soared among the burgeoning middle class in China at an unprecedented rate, particularly since 2010 (Ahmed *et al.*, 2016).

Groves of the tree can be found in the savannahs of West Africa, but it is becoming increasingly rare and is sometimes cultivated (Tijani and Akinnesi 1996). The tree also



grows in forests of Comoé National Park in Côte d'Ivoire, a region geographically close to the Sahel but with a higher moisture regime due to its location between two large rivers. Also, the tree grows in abundance in Kurmi Local Government of Taraba State in Nigeria. (USDA, 2015). Their populations in Nigeria and other parts of West Africa have declined rapidly due to the high value of timber for exploitation (Burkill, 1995). The natural stands have experienced decline and tend to extinction in several countries. The first affected countries were Benin, Guinea Bissau, Côte d'Ivoire, Gambia, Ghana, and Nigeria. Facing that issue, some exporting countries of the wood of *P. erinaceus*, including Benin, Burkina Faso, Côte d'Ivoire, Mali, Nigeria, and Sierra Leone have taken restrictions to forbid wood logging and export for some years but, many tons of wood continue to leave these nations and go to China. (EIA, 2017).

The leaves of *P. erinaceus* are with a common stalk 10 – 20cm long; 9-15 leaflets 6-11cm long by 2.5-6cm broad, rather variable shapes, mostly elliptic to ovate, blunt at the apex or slightly acuminate, rounded at the base; closely but very shortly hairy beneath (Keay, 1989). It fruits between January and March. The prickly fruits distinguish it from other indigenous species (Keay, 1989). The species is a member of the Papilionaceae family, the biggest of the three families in the Leguminales order. *P. erinaceus* is a multi-use species in West Africa: it is a keystone fire-resistant nitrogen-fixing species within fragile semi-arid habitats, an important source of livestock fodder for traditional pastoral communities across its range, and it is an important element of the rural communities' pharmacopoeia.

The high demand for *P. erinaceus* has led to its illegal and unsustainable logging on an

alarming scale in some of the world's most endangered forests in Southeast Asia, and, increasingly in African and Latin American regions (Ahmed *et al.*, 2016). Supplies have dwindled from Gambia following an export ban, making traders exploit Guinea Bissau, Togo, Benin, Ghana and more recently, Nigeria (Bosu, 2013). Approximately 30,000 Chinese businesses traded products in 2014, resulting in domestic retail sales of about \$25 billion (Ayetan, 2016). By the end of 2014, *P. erinaceus* export from Nigeria was about 242, 203m³ (Ahmed *et al.*, 2016). Currently Nigerian timber traders moving across states depleting the trees without considering the long-term impacts of the product's unrestricted harvesting on the Nigerian ecosystem (Ayetan, 2016). Nigeria thus, has become the first in the list of China's seven biggest suppliers of *P. erinaceus* logs by volume in Africa (Akinsola, 2016). Akinsola (2016) claims that Chinese businessmen are taking advantage of slack regulatory and enforcement environments and legal gaps., lack of government policy and direction, as well as corruption by government officials to drive illegal trade in the export of the country's forest resources.

The herbarium is a term used to describe a book of such mounted specimens of medicinal plants (Stearn, 1957; Bridson and Forman, 1998). Studies in morphology, taxonomy, ethnobotany, pharmacology, biochemistry, cytology, genetics, molecular biology, material science, ecology, conservation, plant disease, plant breeding, and physiology are all connected to the usage of herbarium (Metsger and Byers, 1999). This paper examines the ecological range of *P. erinaceus* in Nigeria using the National Forest Herbarium, Nigeria.

Materials and Methods



Forest Herbarium Ibadan (FHI) is situated at the Forestry Research Institute of Nigeria (FRIN). It is a collection of around 101,000 vascular plant specimens, mostly from Nigeria, and some other regions of the world. FRIN is located at $7^{\circ}23'30.32''$ N and $3^{\circ}51'44.96''$ E. The specimens under study are collections during routine field exploration, floristic projects, and inventories between 1928 and 1995. The Leguminosae family of

P. eurenaceus was identified in the cabinet, and all the *P. eurenaceus* collected and preserved were carefully selected and recorded. Information on the location, habitat, year of collection, the collector, and FHI number as stated on the voucher were documented for the study. The picture below shows the important features of *P. erinaceus* (Fig. 1)



A. Leaf

B. Fruit



C. Tree

Fig. 1: Pictorial Pictorial Features of *P. erinaceus*



Data Analysis

The derived data from the herbarium collections were subjected to descriptive analysis, and to produce a distributional map in Nigeria.

Results and Discussion

Herbarium Collections of *P. erinaceus* in Forest Herbarium Ibadan, Nigeria.

Thirty-six collections were recorded between 1943 and 1993 (Table 1). The specimens were collected between 1928 and 1995. A total of 36 herbaria specimens collected in Nigeria between 1943 and 1993 were used to study the distribution of the species. The maximum

collection was done between 1941/1950 and 1961-1970 with 9 collections each. This was followed by 1951-1960 (8 collections), 1971-1980 (6 collections), and 1981-1990 (3 collections). The least collection was between 1991-2000 (1 collection) (Fig. 2). Collection locations ranged from natural forests, secondary regrowth forests, farmland, and free areas. *P. erinaceus*, was distributed to different ecological zones in Nigeria. They are the Lowland rainforest comprising Ondo and Enugu states, Guinea savanna (Kwara and Niger states), Sudan savanna (Zamfara and Bauchi state), Sahel savanna (Borno State) and Mountain Forest (Plateau State).

Table 1: Herbarium collections of *P. erinaceus* in the Forest Herbarium, Ibadan

Town	State	Ecological Zone	FHI No	Year	Collector
		Derived Savannah		28-Jan	J.D Kenedy
Olokemeji, Abeokuta	Ogun	Savannah	8704	Jan	J.D Kenedy
Zamfara	Zamfara	Sudan Savannah	15892	1946	G.A.E.Ogbe R and AA.K Jayesinmi
		Derived Savannah			
Ifedapo	Oyo	Savannah	103088	1980	Daramola & others
Missing			105493	1971	F.J Bretelar
		Derived Savannah			
Abeokuta	Ogun	Savannah	99167	1961	Dr Brian Hopkins
		Derived Savannah			
Missing	Ogun	Savannah	99167	1979	George E.Pilz
Abeokuta, Ilaro division	Ogun	Derived Savannah	15009	1947	Missing
Missing	Ogun		101526	1983	J.Lowe
		Guinea Savannah			
Jebba	Kwara	Savannah	101442	1984	Ogyeachusim/odewo/olorunfemi
		Guinea Savannah			
Ilorin	Kwara	Savannah	54535	1964	A.E. Eyol
Zaria	Kaduna	Sudan Savannah	37257	1957	R.W.J.Keay
Ibadan	Oyo	Rainforest	36910	1958	A.Binuyo
Onitsha	Anambra	Rainforest	50854	1960	R.J Lowe
Missing	Edo	Rainforest	101759	1984	Odewo/olorunfemi/Ariwaodo & okoro
Benin	Edo	Rainforest	60141	1967	J.A.Emwi Ogbon
Missing	Edo	Rainforest	50162	1960	R.E. Okeke
Benin	Edo	Rainforest	33068	1958	V.K. Ajao



Missing	Edo	Rainforest	104873	1993	Glaxo Group Research
Missing	Edo	Rainforest	50155	1960	R.E. Okeke
Onitsha Udi	Anambra	Rainforest	6950	1943	A.P.D. Jones
Plateau Jos	Plateau	Mountain forest	48050	1964	Prof. Bevan
Owo	Ondo	Rainforest	5630	1943	Missing
Ilorin, Borgu	Kwara	Savannah	58126	1966	H.D. Onyeachusimi & Binuyo
Zaria Anchan	Kaduna	Sudan Savannah	7648	1944	Onyapochase
Zamfara	Zamfara	Sudan Savannah	16164	1946	R.W.J.Keay
Missing	Benin	Guinea	44324	1963	R.E.Okeke
Ilorin	Kwara	Savannah	5723	1948	M.O Adejumoh
Ilorin	Kwara	Savannah	27722	1957	J.A.D Jackson
Missing	Oyo	Rainforest	102970	1980	Daramola & others
New Bussa	Kwara	Savannah	91553		Herbarium Wildlife Staff
Ibadan	Oyo	Savannah	6389	1943	A.B.Tones
Igbo Ora	Oyo	Savannah	85281	1978	Odewo/Ibhanesebhor and Odebode
Eruwa	Oyo	Savannah	85250	1978	Odewo/Ibhanesebhor and Odebode
Not Available	Bauchi	Sudan Savannah	7238	1944	Lanakendudu
Koutagora	Niger	Savannah	39859	1957	D.C Eayton
Gombe	Bauchi	Sudan Savannah	17883	1967	J.A.D Jackson
Biu	Borno	Sahel savannah	62934	1969	B.O. Daramola
Mokwa	Niger	Savannah	56789	1965	W.J. Howard

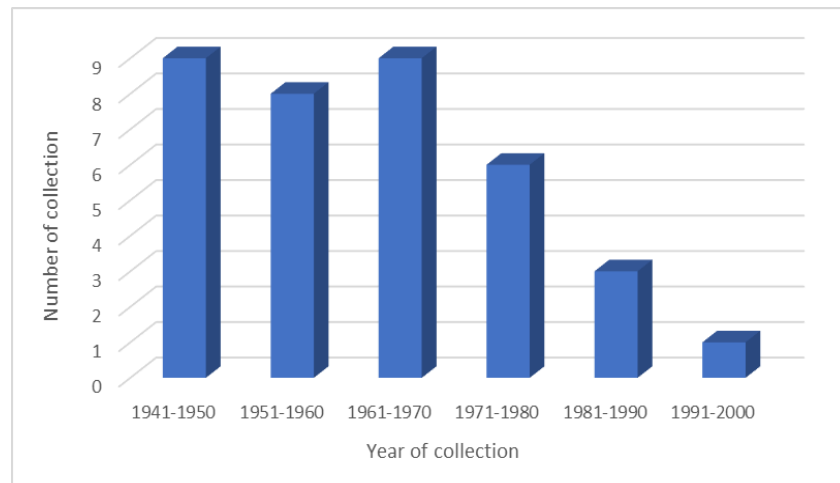


Fig 2: The graph showing the *P. erinaceus* collection pattern in Forest Herbarium Ibadan.

Ecological Distribution of *P. erinaceus* in Nigeria

The ecological distribution of *P. erinaceus* in Nigeria before the massive indiscriminate logging of the species is shown in Fig. 3. The species is distributed to nearly all Nigerian states in the rainforest ecological zone, followed by Sudan savannah and derived savannah. *P. erinaceus* is majorly distributed in Oyo and Edo States, followed by Niger, Anambra, and Ogun States. These states are located within the rainforest and derived savannah zones. Odewo (2021), reported that *P. erinaceus* is distributed to the Savannah part of some states in Oyo, Ogun, Kwara, Sokoto, Adamawa and Kaduna. He further reported that the species are more distributed in Eruwa, Shaki and Igbo-Ora in Oyo State. The ecological range of *P. erinaceus* in Ogun State is highly common in Olokemeji Forest Reserve. The result also agrees with Aliyu (2006), who listed some commonly

dominated Olokemeji Forest Reserve species in which *P. erinaceus* is included. *P. erinaceus* was also reported to be found in the central and eastern states of Benue (EIA, 2017), Ogun, Oyo, Kwara, Kogi, Nasarawa, Plateau, Gombe, Taraba, Adamawa, and Borno (CITES, 2020). Ahmed *et al.* (2016) reported the distribution of *P. erinaceus* to Lagos and Ogun states. *P. erinaceus* is also distributed to the Sudan savannah zone of the country. The states are Zamfara, Kaduna, Katsina, Bauchi and Gombe. Duvall (2008) reported that *P. erinaceus* is a savannah plant that spreads from Senegal, Gambia, and Chad to the Northern part of Nigeria, which covers states like Plateau, Anambra, Bornu, Edo, Niger, and Oyo. The species is native to the Guinean Forest Savanna Mosaic ecoregion of West Africa, which lies between the Guinean rainforest and the Sudanian savannah (WWF, 2015).

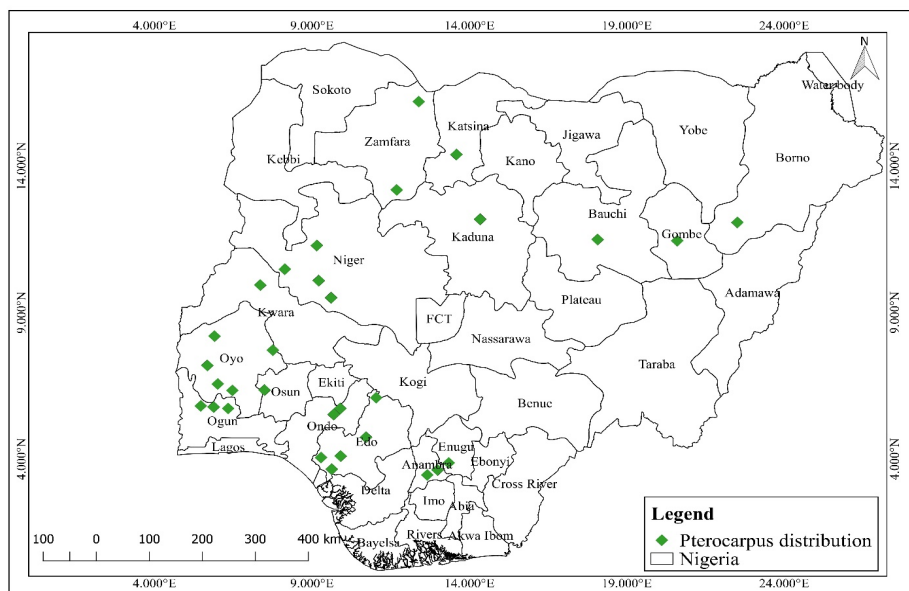


Fig. 3: Ecological distribution of *P. erinaceus* in Nigeria

The distribution of the *P. erinaceus* to the identified areas could be due to the availability of some environmental factors required for the growth of the species. The wide range of climatic tolerance could have been responsible for its distribution across the locations as recorded from herbarium collections between 1928 to 1995. The distribution of the species falls within the range of environmental variables as reported by Aubreville, (1950) and Segla *et al.*, 2015a. *P. erinaceus* is a species of African savannahs and Sudano-Guinean dry woods, according to Duvall (2008). Its mean annual rainfall ranges from 600 to 1500 mm/year and its mean annual temperatures range from 15 to 35°.

These climatic conditions allow for the natural regeneration and growth of *P. erinaceus* stands in nearly all climatic zones of the West African sub-region. Tosso (2013) highlighted annual rainfall as another crucial factor in understanding *P. erinaceus*'s distribution as one of the most significant factors. The tree grows at low altitudes (0–600 m) and thrives even on shallow soils. It is

drought tolerant and once established it survives yearly dry seasons. It also survives the yearly savanna bushfires and readily colonizes fallow lands. *P. erinaceus* was reported to be found mostly in the central senatorial district of Taraba State, with high densities reported in the Local Government Authorities of Ardo Kola, Mutum Biyu, Gassol, Bali, Gashaka, Donga, Kurimi. In Taraba State, high densities of the plant spp are found in the Central senatorial district. The tree species has also been reported in the Southwest, most especially, in Ekiti, Ondo and Ogun States (Akinsola, 2016). Ussa and Takum (FRIN, 2019); the vegetation in these areas was described as a “fairly undisturbed Guinea savannah ecosystem, dominated by open savannah woodland”.

Conclusion

The distribution of *P. erinaceus* between 1928 and 1995, reveals that the species has a wide distribution in Nigeria, especially in the rainforest and derived savannah zones. One of the purposes of a general herbarium is to



assemble data for working out ranges and ecological distributions. The recent study by CITES (2020) on the distribution of *P. erinaceus* is in tandem with this study using herbarium collections. The Forest Herbarium Ibadan must make efforts on timely and adequate collections to update the present collections.

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