Original Research Article

Relative Frequency of Camel's Foot (*Piliostigma reticulatum* Hochst.) among Woody Species in Kebbi State, Nigeria

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Abstract

The study was carried out to determine the relative abundance of *Piliostigma reticulatum* commonly known as Camel's foot among the woody species within two locations (grazing reserves and fallow areas) in the three senatorial districts of Kebbi State. Three sample plots (100m x 100m) were laid out on transect of about 3 km in nine randomly selected areas and their locations across the senatorial districts. A total of 904 and 856 stands of woody species were encountered in the grazing reserves and the fallow areas respectively belonging to fifteen different species and fifteen genera. The results of the relative frequency of Camel's foot indicated that the study areas contained diverse woody species with shrubs; *Guiera senegalensis* and *Piliostigma reticulatum* dominating the sampled areas. The highest abundance of *P. reticulatum* was in the Ribah grazing reserve (71.27%) and Giron Masa fallow area (92.75%) of Kebbi south senatorial district. The highest woody species occurred both in the grazing reserve and fallow area of Kangiwa in the Kebbi north senatorial district. The most abundant tree species *Combretum micranatum* (31.33%) was encountered in the fallow area of Kangiwa. The specific uses expected from *Piliostigma reticulatum* and other multipurpose woody species should be taken into accounts when applying conservative measures.

Key words: Relative frequency, Camel's foot, woody species, Kebbi State

Introduction

There are several species of wild and uncultivated multipurpose woody plants worldwide which are referred to as browse plants, which also serve as alternative feed stuffs for livestock (Simbaya,

2000; Akinsoji, 2003; Ugbogu and Akinyemi, 2004; Fayemi *et al*., 2011). The nutritional importance of browse plants is particularly significant for free-ranging livestock in an extensive communal system of production (Palgrave, 1983). Among these plants is *Piliostigma reticulatum* commonly known as Camel's foot. *Piliostigma reticulatum* is a shrub tree growing up to 15m high with a dense spreading crown. It is considerably widespread in tropical Africa and usually found in the tall grass savannah forest (Keay *et al.*, 1964). It is a property tree around Sokoto State (Arnborg, 1988) because it is a good source of fodder, fuel wood and industrial raw materials (NEST, 1990).

Camel's foot is plentiful in the savannah region of Nigeria, and is greatly used for animal feeding (Keay, 1989; Nouhoun *et al.*, 2013) traditional medicine and hand crafting (Arbonnier, 2002, Kabore *et al*., 2007). In central Burkina Faso, the plant is considered to contribute to soil improvement, and farmers use the leaves for mulching (Yelemou *et al*., 2009). *P. reticulatum* exhibited fast decomposition rate in the savannah region of Nigeria, and it is considered as one of the most promising species to provide organic manure to crops (Keay, 1989).

The high rate of extinction of tropical woody species is aggravated by the conversion of rangelands into agricultural purposes. Bush burning, and cutting and felling of woody species for fuel and plantations are threats to eroding plant biodiversity to a large extent (Mishra *et al*., 2004; Laloo *et al*., 2006). These activities are having negative impact upon the woody plant species present in Kebbi State and Nigeria as a whole by limiting their distribution and abundance.

A study on the relative abundance of *P. reticulatum* is missing in the study area. Earlier studies (Aliero, 2004; Mukhtar, 2005; Bello *et al*., 2013) were on woody species without any emphasis on a particular species. However, Mbakwe and Isichei (1990), who worked on the ecological survey of *Piliostigma thonnongii* in early succession plots, revealed that the species is dominant in Kanji and Yauri in the Guinea savannah region of Nigeria.

It is a common practice that a plant of known diverse usage to a region is often not easily destroyed when clearing for agriculture and construction. Therefore there is urgent need to study the relative frequency of occurrence of *P. reticulatum* within grazing reserves and fallow areas of Kebbi State in order to plan for its utilization. This is the focus of this present study.

Materials and Methods

Experimental location

The study was conducted in Kebbi State, Nigeria, situated between latitudes 10° 8′ N and 13° 15′ N, and longitudes 3° 30′ E and 6° 02′ E. The annual rainfall varies between 500mm and 750mm, with over 60% falling during July and August (Mammam *et al*., 2000). The mean annual temperature of about 27°C is recorded in all locations, but temperature is generally high. However, during the harmattan season, the lowest temperature is 21°C. Temperatures can go up to 40°C

during the months of April to June (Onlinenigeria, 2012). The average relative humidity during the wet season is 80 %, but it is generally low (40 %) for most of the year. The variation in relative humidity explains the hot, dry environment which is in sharp contrast to a hot, humid environment in the southern parts of Nigeria.

The vegetation is classified as Guinea and Sudan savannah, and comprises of a variety of trees and shrubs such as *Piliostigma reticulatum, Combretum micranatum, Combretum glutuinosum, Azadirachta indica, Cassia arereh, Vitalleria paradoxa, Parkia biglobosa, Prosopis africana, Mimosa pigra, Daniella oliveri* and *Guiera senegalensis*. The herbaceous layer of natural pastures and fallow areas are patchy with many bare spots. In addition, important plantations of tree crops such as cashew, mangoes, guava, gum Arabic and *Moringa* are also found in the State. Other commonly grown crops in the State include millet, sorghum, cowpeas, groundnut, rice and cotton during the rainy season, while cattle, sheep, goats and poultry are the predominant livestock reared (KARDA, 2006).

Sampling of Camel's foot stands

Three (3) areas were selected from each of the three (3) Senatorial districts of the State using a Stratified Purposive Random Sampling. In Kebbi north, Arewa, Shiko and Tsamia were selected; in Kebbi central, Dalijan, Hilema and Andarai were selected; in Kebbi south, Ribah, Birnin Yauri and Giron Masa were selected (Table 1). A reconnaissance survey was conducted in the study area to determine the population of camel's foot stands. Each selected area was divided into two locations (fallow area and grazing reserve). Three sampled plots taken along a transect of about 3 km from the fallow area and the grazing reserve measuring 1ha each (100m x 100m) were mapped out at random using a measuring tape, and demarcated with pegs giving a total of six plots in each area selected.

Table 1: Geographical locations and Vegetation zones of the selected areas

Areas	Latitude	Longitude	Senatorial district	Vegetation zone
Kangiwa	12.5378^0 N	3.7740^0 E	Kebbi north	Sudan savanna
Shiko	11.7949^0 N	3.8452^0 E	Kebbi north	Sudan savanna
Tsamia	12.9487^0 N	5.7153^0 E	Kebbi north	Sudan savanna
Dalijan	$12^0 35^i 11^i$ N	$4^0 31^i 9^i$ E	Kebbi central	Sudan savanna
Hilema	12.3500^0 N	3.9000^0 E	Kebbi central	Sudan savanna
Andarail	11.8994^0 N	4.3886^0 E	Kebbi central	Sudan savanna
Ribah	11.3971^0 N	5.4856^0 E	Kebbi south	Guinea savanna
Birnin Yauri	$10^0 46' 56.28"$ N	$4^0 48^i 40.86"$ E	Kebbi south	Guinea savanna
Giron Masa	$11^0 11^i 45"$ N	$4^0 34' 3"$ E	Kebbi south	Guinea savanna

Source: KARDA (2006). N A (Not Available)

The type of vegetation used for determination of the relative frequency of camel's foot in this research was woody species. The entire woody species were enumerated, and tress was identified by using the key of Hopkins and Stanfield (1966).

Statistical analysis

The data collected were statistically analyzed using simple frequency counts and percentages to determine the relative abundance of *Piliostigma reticulatun* among the woody species in each area.

Results and Discussion

Table 2 presents the relative frequency of camel's foot encountered in the grazing reserves and fallow areas of Kebbi north senatorial districts respectively. A total of ten (10) tree species and 2 (two) shrub species and six (6) tree species and 2 (two) shrub species were identified across the grazing reserves and fallow areas respectively.

Table 2: Relative frequency of camel's foot in the grazing reserves and fallow areas of Kebbi North Senatorial District

		Kangiwa		Shiko		Tsamia	
Species	**Local Name (Hausa)**	**Grazing Reserve**	**Fallow Area**	**Grazing Reserve**	**Fallow Area**	**Grazing Reserve**	**Fallow Area**
Piliostigma reticulatum	*Kalgo*	92 (66.19%)	-	39 (34.82%)	44 (45.36%)	4 (5.97%)	36 (35.64%)
Guiera senegalensis	*Sabara*	-	60 (40.00%)	55 (49.11%)	50 (51.55%)	-	58 (57.43)
Deuterium microcarpum	*Taura*	-	-	-	-	39 (58.21%)	-
Combretum micranatum	*Geza*	17 (12.23%)	47 (31.33%)	-	-	-	-
Combretum glutuinosum	*Taramniya*	-	-	7 (6.25%)	-	-	-
Azadirca indica	*Dogon yaro*	-	-	-	-	6 (8.96%)	7 (6.93%)
Cassia arereh	*Malga*	13 (9.35%)	17 (11.33%)	-	3 (3.09%)	-	-
Vitalleria paradoxa	*Kade*	-	-	-	-	18 (26.87%)	-
Parkia biglobosa	*Dorowa*	4 (2.88%)	13 (8.67%)	5 (4.46%)	-	-	-
Prosopis africana	*Kirya*	9 (6.47%)	9 (6.00%)	-	-	-	-
Mimosa pigra	*Gumbi*	4 (2.88%)	4 (2.67%)	-	-	-	-
Daniella oliveri	*Maje*	-	-	6 (5.36%)	-	-	-
Total		139	150	112	97	67	101

Source: Field survey, 2015. Figures outside the parenthesis are the frequencies/ha.

The results indicated high abundance of *Piliostigma reticulatum* in Kangiwa grazing reserve which had the highest occurrence of 66.19%, and none in the fallow areas. There were generally more woody species in the fallow areas than in the grazing reserves of Kebbi central senatorial districts.

Table 3, which presents the relative frequency of Camel's foot encountered in the grazing reserves and fallow areas of Kebbi central senatorial districts revealed five (5) tree species and two (2) shrub species, and one (1) tree species and two (2) shrub species discovered in the grazing reserves and fallow areas respectively. There was low occurrence of *P. reticulatum* across the areas with the highest frequency in Andarail fallow area (28.46%) than the grazing reserves.

Table 3: Relative frequency of camel's foot in the grazing reserves and fallow areas of Kebbi Central Senatorial District

	Local	Dalijan		Hilema		Andarail	
Species	Name (Hausa)	Grazing Reserve	Fallow Area	Grazing Reserve	Fallow Area	Grazing Reserve	Fallow Area
Piliostigma reticulatum	*Kalgo*	28 (27.45%)	29 (26.36%)	19 (16.96%)	18 (17.65%)	-	37 (28.46%)
Guiera senegalensis	*Sabara*	62 (60.78%)	81 (73.64%)	75 (66.96%)	71 (69.61%)	65 (84.42%)	85 (65.38%)
Combretum nigricans	*Tsiri*	-	-	-	-	4 (5.19%)	-
Balanites eagyptica	*Aguwa*	-	-	-	-	1 (1.30%)	-
Combretum glutuinosum	*Taramniya*	12 (11.76%)	-	-	-	1 (1.30%)	-
Azadirachta indica	*Dogon yaro*	-	-	-	-	1 (1.30%)	-
Cassia arereh	*Malga*	-	-	18 (16.07%)	13 (12.75%)	5 (6.49%)	8 (6.15%)
Total		102	110	112	102	77	130

Source: Field survey, 2015. Figures outside the parenthesis are the frequencies/ha

Table 4 presents the relative frequency of camel's foot encountered in the grazing reserves and fallow areas of Kebbi south senatorial districts respectively. A total of seven (7) tree species and two (2) shrubs and three (3) tree species and one (1) shrub were discovered in the grazing reserves and fallow areas respectively. There was high concentration of *P. reticulatum* across the grazing reserves than the fallow areas. The highest occurrence was in Giron Masa fallow area having 92.75%.

The results of the relative frequency of Camel's foot indicated that the study areas contained diverse woody plant species with shrub dominating as revealed by the highest percentages of *Piliostigma reticulatum* and *Guiera senegalensis* across the sampled areas in Kebbi State. The highest-occurring *P. reticulatum* were in the Ribah grazing reserve (71.27%) and Giron Masa fallow area (92.75%) of Kebbi South senatorial district. This was in agreement with the report of Yelemou. (2010) that

Table 4: Relative frequency of camel's foot in the grazing reserves and fallow areas of Kebbi South Senatorial District

Species	Local Name (Hausa)	Ribah		Giron Masa		Birnin Yauri	
		Grazing Reserve	Fallow Area	Grazing Reserve	Fallow Area	Grazing Reserve	Fallow Area
Piliostigma reticulatum	*Kalgo*	67 (71.27%)	-	54 (51.92%)	64 (92.75%)	49 (50.52%)	61 (76.25%)
Guiera senegalensis	*Sabara*	-	-	37 (53.58%)	-	25 (25.77%)	-
Combretum nigricans	*Tsiri*	-	-	7 (6.73%)	-	9 (9.28%)	11 (13.75%)
Acacia albida	*Gawo*	-	-	-	-	6 (6.19%)	8 (10.00%)
Deuterium microcarpum	*Taura*	7 (7.45%)	-	-	-	-	-
Diospyros mespiliforms	*Kanya*	7 (7.45%)	-	4 (3.84%)	-	8 (8.24%)	-
Cassia arereh	*Malga*	9 (9.57%)	-	-	-	-	-
Anagueissus leocarpus	*Marke*	-	-	4 (3.84%)	5 (7.25%)	-	-
Vitalleria paradoxa	*Kade*	4 (4.26%)	-	-	-	-	-
Total		94	-	104	69	97	97

Source: Field survey, 2015. Figures outside the parenthesis are the frequencies/ha

P. reticulatum is mostly available on the fallow areas. The highest woody species occurred both in the grazing reserve and fallow area of Kangiwa in the Kebbi north senatorial district. The highest tree species *Combretum micranatum* (31.33%) was encountered in the fallow area of Kangiwa. The tree species present were not evenly distributed as observed by the low frequency value which ranged from 1 to 39. The low composition of tree species in the grazing reserves and fallow areas as observed in this study was in agreement with the report of Aregheore (2009) that range lands in the Sudano-Sahelian zone are composed of few scattered trees. A similar study was also carried out by CERAD (2009) which indicated a low relative abundance index value of 2.31 in a forest reserve dominated by shrubs.

According to Yelemou *et al.* (2014), shrub plants have relatively rapid growth rate which supports their abundance over other plants, and also present a greater source of organic matter for traditional production systems. The shrub composition recorded in the present study was similar to the composition of the shrub species across the Zamfara reserve, Nigeria as reported by Malami (2005), indicating high abundance of shrubs across the areas.

Decline in some of the tree species in most of the areas may be due to anthropogenic pressure, cropland expansion and multipurpose uses by farmers. This agreed with the study of Ragbhubanshi and Tripathi (2009) that tress are declining at an alarming rates owing to deforestation for extraction of timber and other forest produce or total conversion to other uses.

Conclusion

From the results, it appears that the grazing reserves and the fallow areas were quite rich in terms of woody species, and that some species were facing the threat of extinction which may be as a result of over exploitation, climatic and edaphic factors. This had already exposed much of the soil surface which may likely be the reason for high erosion rate as observed in most of the locations in the study area. This therefore necessitates the need to plan an integrated conservative approach that will restore the diminishing potentialities of the reserves in particular. The specific uses expected from *Piliostigma reticulatum* and other multipurpose woody species should be taken into account when applying conservative practices.

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