Phytogeographic Distribution of Sorghum in Nigeria

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DOI: 10.29322/IJSRP.10.01.2020.p9736
http://dx.doi.org/10.29322/IJSRP.10.01.2020.p9736

Abstract- Sorghum cultivation and distribution in Nigeria spans the entire North and Southern Region (Savannah and Rain Forest Regions). Sorghum is generally not cultivated in the Southern region hence its attribute of not thriving in the Southern regions of Nigeria. Also, relegation of Sorghum to the *S. bicolor* is also responsible for this assertion since wild species such as *S. arundinaceum, S. vogellianum, S. aethiopicum* and *S. vociflorum* are grow as weeds and abound in most localities in the South except for the saline environment. Herbarium specimen review and field data collection were adapted as tools to determine the distribution of Sorghum in Nigeria. Results suggests that *S. arundinaceum* is the most abundant species of Sorghum (in terms of distribution) in Nigeria closely followed by *S. vogelleianum* before *S. bicolor*. Field studies also accounted for localities where Sorghum species exists but not recorded in the flora or herbarium archives.

Index Terms- Sorghum, Forestry Herbarium Ibadan (FHI), Morphology,

I. Introduction

Sorghum is a cereal crop that has over the years adapted to Nigeria ecosystem whilst expressing varying forms of characteristics both at morphological and molecular level. Sorghum has capacity to withstand adverse environment which confers it with a dynamic survival strategy that enables the plant thrive in the diverse ecosystems (especially the dry regions) of the world (Habindavyi, 2009). Sorghum is distribution spans the entire tropic and arid regions of the world (Wang *et al*., 2015). Some research works have also reported the occurrence of Sorghum in the temperate regions as well as tropics with altitudes of about 2.3 km (ICRISAT, 2012). Sorghum, grows in almost all the ecological zones of Nigeria, however, it is predominantly cultivated in the Northern part of Nigeria (House, 1985).

The top ten sorghum producing country in the world account for about 71% of global Sorghum production (FAOSTAT, 2013) cultivated on 22.25 m ha (Reddy *et al*. 2011).

In Africa (particularly in Nigeria, Niger, Mali, Senegal, Ghana and Burkina Faso), sorghum is cultivated in a large belt that spreads from the Atlantic coast to Ethiopia and Somalia, bordering the Sahara in the north and the equatorial forest to the south. West Africa produces about 25% of the world's sorghum. This figure has continuously increased over the past 25 years (Wang et al., 2015) at the rate of about 7%, due to release of improved varieties and resistant species as well as improved agricultural practices (CRP 3.6, 2012).

Nigeria ranks among the top seven major sorghum producer with others as; India, USA, Mexico, Sudan, China and Argentina (Wang *et al*., 2015). Similarly, in Africa countries like Burkina Faso, Chad, Ethiopia, Gambia, Ghana, Mali, Mauritania, Mozambique, Niger, Senegal, Somalia, Tanzania and Yemen also contribute their own quota to global Sorghum production.

Literature Review

Sorghum is a C4 (uses an alternative method of CO_2 uptake leading to a C4 carbon cycle and reduction of losses due to photo-respiration) plant having common ancestor with maize dating back to about 15 million years ago (Thurber *et al*., 2013).

Sorghum is the fifth most important cereal crop grown globally (Doggett, 2008) after wheat, maize, rice and barley. Nigeria is the largest sorghum producer in West Africa and accounts for over 71% of output from the region and over 35% of the entire Africa as at 2007. Nigeria ranks third in terms of sorghum production globally after USA and India (Mohammed *et. al*., 2011). However, most (90%) of the sorghum produced by USA and India are used for animal feed hence, making Nigeria the highest producer of sorghum consumed by humans globally (FAO, 2012).

Sorghum genus is made up of twenty (25) species (USDA ARS, 2007), tough different researchers have reported varying species numbers. Some authors classified the genus on the basis of wild and cultivated forms while others based on morphology (House *et. al*., 1995). The conflicting and diverse classification from different researchers has resulted to dynamic taxonomic characteristics of Sorghum which includes Garber who classified the Sorghum genus into five taxonomic groups namely *Eu-Sorghum, Chaetosorghum, Heterosorghum* , *Para-Sorghum, Stiposorghum* (Garber, 1950).

Sorghum has the characteristics of a typical Poaceae and a striking resemblance with *Zea mays* and *Sacharrum sp*. (Sally *et al*., 2007) but the stem is thin relative to those of *Zea mays*. Soghum height generally ranges from 0.5-6 m (Habindavyi, 2009) with tillers and branching roots which are visible on its main axis. Most taxonomy of Sorghum has been centered around the panicle and grain colour (Harlan and de Wet, 1972). Doggett in his work reported that domestication of sorghum started over 10,000 years ago (Doggett, 1970). Similarly, Smith and Frederiksen reported that anthropological evidence exists which suggests that as far back as 800bc hunters gathered sorghum for use (Smith and Frederiksen, 2000). Kimber reported that sorghum was first domesticated in North Africa (Nile and Ethiopian regions) as recently as 1000 BC (Kimber, 2000). Sorghum cultivation was pivotal in the migration of Bantu (black) group of people across sub-Saharan Africa (Diamond, 1998). Similarly, Ayana and

Bekele reported that Sorghum originated in North East (NE)-Africa this account is consistent with report of Kimber (2000) however, differed in the dates of domestication as dating back to 3000 bc in Ethiopia and Congo (Ayana and Bekele, 1998). Berenji and co-workers traced the secondary centre of origin to India, Sudan and Nigeria were Sorghum grain is mainly used for human food (Berenji *et al*, 2004). Sorghum is a viable and affordable food grain crop for many of the world's most food deprived communities, especially in Sub-Saharan Africa (ICRISAT, 1994).

II. Materials and Methods

The resources for this publication were sourced from field data gathering exercises, visit to Forestry Herbarium Ibadan and literature search.

III. Results and Discussion

Sorghum cultivation has been restricted to the Northern part of the country. This as a result of *Sorghum bicolor* and its land races being the predominant species and the only species known by most agriculturist and botanist. The distribution of the Sorghum genus actually spans all the geopolitical zones of the country. Sorghum grows in a wide range of climate (particularly tropical climate) ranging from the very high temperatures in the North with low moisture to minimal temperature in the South with higher volume of rainfall.

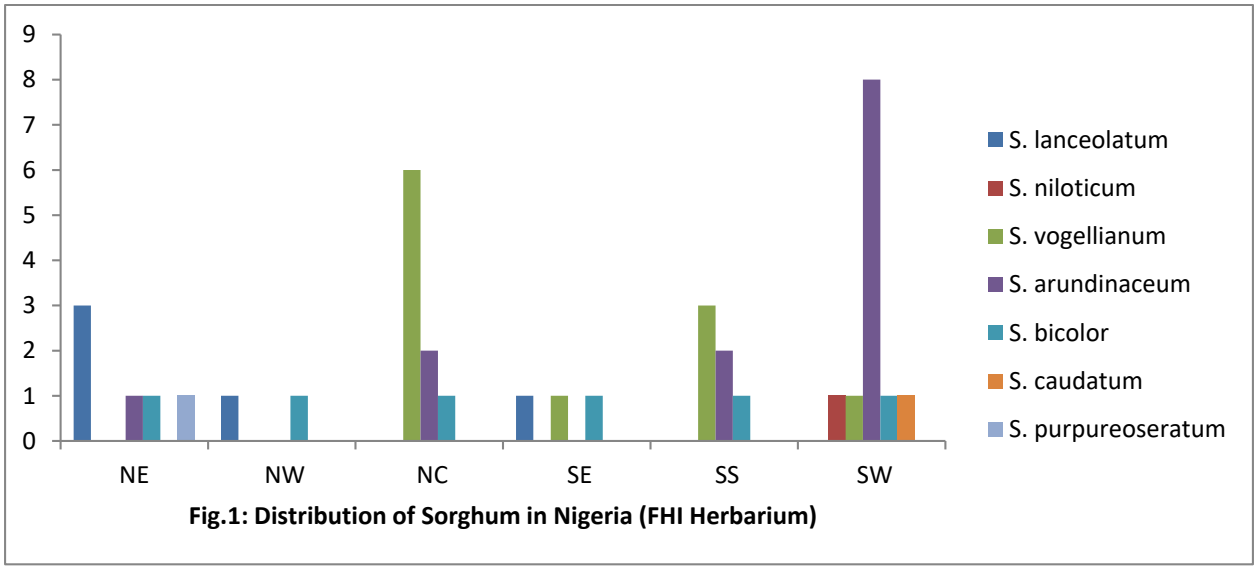
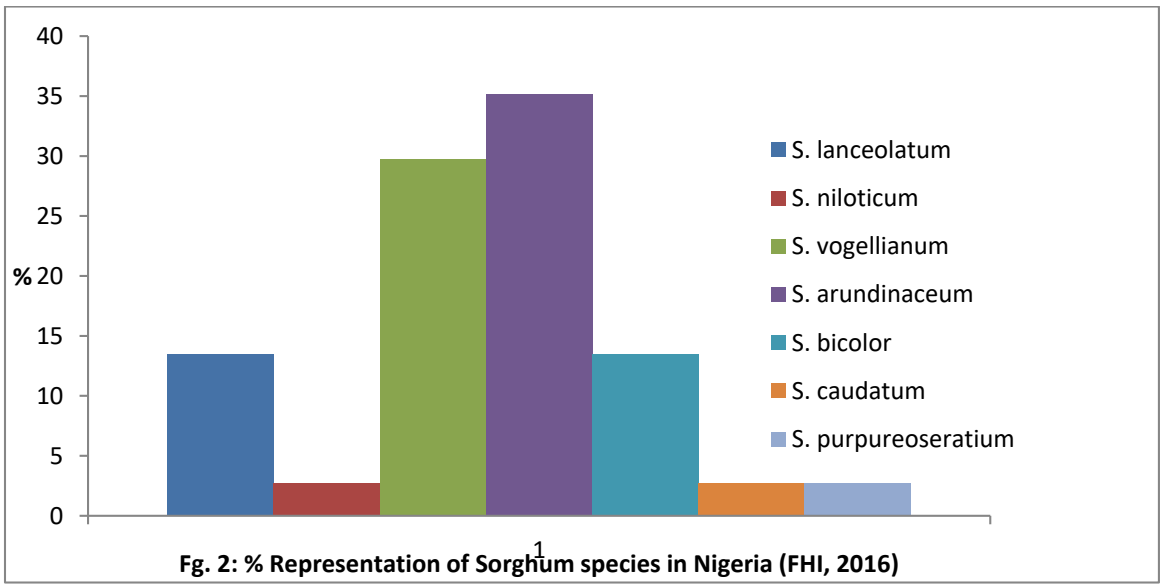


Fig.1: Distribution of Sorghum in Nigeria (FHI Herbarium)



Fg. 2: % Representation of Sorghum species in Nigeria (FHI, 2016)

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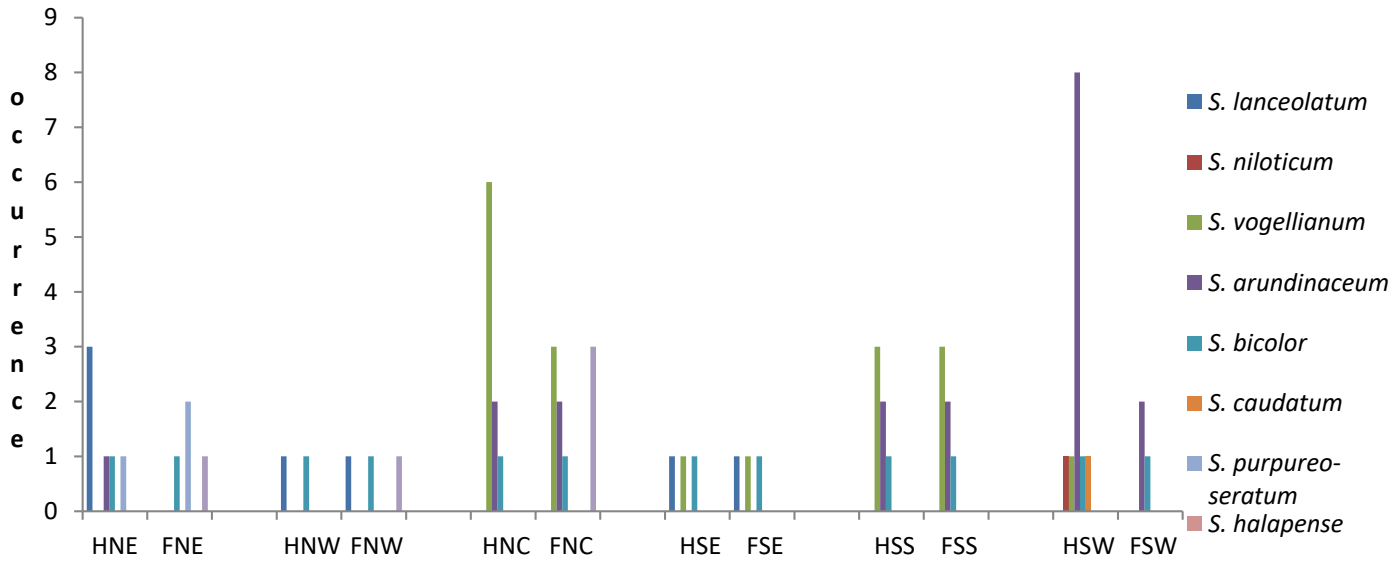

Fig. 3: Sorghum distribution in Nigeria as recorded by Flora and Herbarium

Table 1: Phyto-distribution of Sorghum species in Nigeria

Species name	Collector name	State	Locality	Province	Habbit
S. lanceolatum (FHI 6277) 01-03-1942	APD Jones	Anambra	Onitsha	Onitsha	Onitsha bathing pool
S. lanceolatum (FHI 27126) 14-12-1949	J.T. Dovey	Borno	Dikwa	Dikwa	
S. lanceolatum	Sampson	Sokoto	Kwarre	Kagatum	
S. niloticum (FHI-39957) 08-01-1958		Oyo	Ibadan	Ibadan	Moor Plantation
S. vogelianum (FHI 59929) 07-07-1966	E.A. Macaule	Kwara	Illorin	Borgu	7miles, Shagunu bus road
S. vogelianum 09/1950	J.H.B Appah	Oyo	Ejigbo-Iwo	Iwo	Farmland
S. vogelianum (FHI 96563) 18-12-1981					
S. vogelianum 778	Lely	Makurdi			
S. vogelianum L135	Ward	Kogi	Ajaokuta		
S. vogelianum 37	Sampson	Benue	Makurdi		
S. vogelianum 11	Vogel	Bayelsa	Nun		Nun River
S. vogelianum 153	Holland	Bayelsa	Idu		
S. vogelianum FHI 40248	Onochie	Niger	Jebba	Bandekwoi	
S. vogelianum 13733	Baldwin	Anambra	Onitsha	Onitsha	
S. vogelianum 887	Tuley	Bayelsa	Yenagoa		

S. lanceolatum (FHI 27157) 05-1956	W.D. Clayton	Borno	Wulge	Ngala	Riverine vegetation
S. arundinaceum (FHI 69) 15-07-1974	Onyeachusim	Ondo	FUTA	Akure	
S. arundinaceum	Onyeachusim Onijanowo Ibhanesebhor	Ondo	Idanre	Akure	
S. arundinaceum (FHI 70652) 27-02-1975	Olorunfemi and Pagbemi	Ekiti	Ido, Igo	Ekiti	
S. arundinaceum (FHI 38705)		Oyo	Oyo	Ibadan	Forestry Hill
S. arundinaceum 1379	Barter	Niger	Nupe		
S. arundinaceum 1713	De Leeuw	Benue	Katina Ala		
S. arundinaceum 1322	Dalz.	Lagos	Lagos		
S. arundinaceum (FHI 7940)	Onochie	Oyo	Oke Ado	Ibadan	
S. arundinaceum (FHI 8143)	Onochie	Oyo	Eruwa		
S. arundinaceum 21	Maggs	Edo	Benin		
S. arundinaceum 50	T. Vogel	Bayelsa	Nun		Nun River
S. arundinaceum (FHI 64974) 24-02-1972	P. Wit and Fagbemi	Ogun	Ogun River, 6 miles South of Abeokuta near Oba Village	Abeokuta	

Species name	Collector name	State	Locality	Province	Habbit
S. arundinaceum (FHI 93843)	Ekwuno and Fagbemi	Borno	Baga	Baga	Riverine area
S. arundinaceum (FHI 53683)					
S. arundinaceum	Ohichi				
S. bicolor (FHI 10965)		Kwara	Omuaran	Omuaran	Farmland
S. bicolor (FHI 63819) 25-01-1971	P.O. Ekwuno	Lagos, Western State, Midwest State, Rivers State, East Central, Southern State, Kwara State, Northern State, Delta State, North West States	Bukana	Bukana	Streamside
S. bicolor					
S. caudatum (FHI 47514)		Oyo	Ibadan	Ibadan	Roadside
S. lanceolatum (FHI 27)		Borno	Gumare	Dikwa	Fadama cotton soil
S. purpureo-sericeum		Bauchi	Magaji	Magaji	Clay soil
S. halapense					
S. aethiopicum N72	Johnston				

S. aethiopicum FHI 27155	Davey		Tilum	Rann	
S. aethiopicum FHI 27157	Davey		Wulgo		

IV. Discussions

Contrary to the assertions that Sorghum thrives only in the Northern part of Nigeria, current study suggests that the unpopular nature of Sorghum in Southern Nigeria is associated with lack of interest for the crop. Also, most research work are centred around *S. bicolor* (cultivated Sorghum) which is not cultivated in Southern Nigeria due to its unpopular nature, has fueled the speculation that Sorghum does not thrive in the Southern part of Nigeria. Also, another unempirical/unscientific assertion is that rainfall duration is higher in the South. However, this is not true as the plant has been adjudged to thrive in moisture levels of between 100-600mm (Wang *et al*., 2015).

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