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GERMPLASM COLLECTION OF HIGHLAND PALMS OF AFIKPO IN EASTERN NIGERIA

Okwuagwu, C. O.[1], Ataga, C. D.[1], Okoye, M. N.[1] and Okolo, E.C.[1]
[1]Plant Breeding Division, Nigerian Institute For Oil Palm Research (NIFOR) P.M.B 1030 300001, Benin City, Edo State, Nigeria
*Correspondence author: maxokoye2001@yahoo.co.uk

ABSTRACT
The need for extensive germplasm collection to broaden the genetic base of the oil palm breeding material and to safeguard against crop vulnerability, inherent in growing of uniform and closely related cultivars over wide areas has become imperative. This paper highlights the oil palm germplasm collections from the highland areas of Afikpo in Eastern Nigeria. Fourteen oil palm accessions were collected from ten locations in Afikpo which do not form part of the continuous stretch of the oil palm belt and hitherto unexploited. Data on stem height, bunch weight, bunch length, bunch width, bunch spine length, bunch stalk weight, fruit length and width were recorded in-situ. Mesocarp, kernel, and shell to fruit ratios were computed. Elementary statistics (mean values, range and coefficient of variation) were evaluated using standard procedures. Results revealed very high variation for the fruit and bunch quality traits. It was however interesting to note the inheritance of most of the qualitative traits and their frequencies in the wild. Only nigrescens fruits were encountered in the groves while the dominant genotype for shell, the dura occurred at high frequency. The Ufensi Edda tenera had the highest mesocarp to fruit ratio (73.42%) while heavy bunch weight was recorded for the duras in the Oso Edda and Ndiba Edda groves. Height differences were generally very small in the tenera accessions than in the duras. The prospected fruits have been used to raise seedlings for future planting in the field gene banks following introgression into the breeding programme.

Keywords: Afikpo, coefficient of variation, Edda grove, germplasm, mesocarp to fruit ratio, nigrescens

INTRODUCTION

The oil palm (*Elaeis guineensis* Jacq.) is endemic to the humid tropical rainforest of Eastern Nigeria and South East Cameroon. It is Nigeria's natural resource of great importance with an estimated grove area of 2.1 million hectares (Omoti, 2003). The Eastern part of the country has remained the centre for highest diversity of oil palm germplasm (Hartley, 1977; Maizura *et al*., 2001). Due to population pressure and rapid urbanization of oil palm grove ecologies, the Nigerian Institute for Oil Palm Research (NIFOR) has intensified her efforts to conserve oil palm genotypes with specific adaptations in the various ecologies. The existing collections from the various parts of the country include the 1954 Ufuma and Aba collections, 1960 Coastal Inland and marginal region collections, 1973 NIFOR/MARDI collections from 45 Nigerian locations and 1991 collections from the marginal zone of the old Nsukka province (Okwuagwu, 1985).

These germplasm accessions in NIFOR are not limited to Nigerian grove accessions and their progenies. A very liberal genetic exchange policy was adopted with oil palm growing countries. Hence, introductions of various African and Deli origins have been made and exploited for breeding and selection (Okwuagwu, 1985; Okwuagwu persn. comm.). Very detailed evaluation of these collections has been carried out both in Nigeria and elsewhere (Ataga and Fatokun, 1989; Rajanaidu *et al*., 2001).

It is obvious that there has been an extensive and large collection of oil palm genetic materials from the main oil palm belt. However, these collections are not exhaustive, hence the need for further collection especially in areas which previous mission paid no attention in the Eastern part of Nigeria where the greatest diversity of oil palm exists (Hartley, 1977; Maizura *et al*., 2001). These areas include the highland palms and ecotypes of Afikpo, Abakaliki, Okigwe and Umuahia which do not form part of the continuous stretch of the oil palm belt and hitherto unexploited. The need for further collection to broaden the genetic base of the breeding material and as a safeguard against crop vulnerability inherent in growing of uniform and closely related cultivars over wide areas has become imperative. This study highlights the oil palm germplasm collections from the highland areas of Afikpo and the variations observed in the collections.

MATERIALS AND METHODS

Study site

The main focus of collection was the highland area of Afikpo in Ebonyi State. Afikpo lies between latitude 5^0 53'N and longitude 7^0 56'E.

It is the highest part of Ebonyi State with elevation of about 170 meter above sea level and sand-stone ridges form the topographic highs.

The soil within this zone is mapped as hydromorpic soil (FAO-UNESCO 1990). The dominant vegetation is characterized by tree shrubs with abundant palm trees.

Fourteen oil palm accessions were collected from ten locations.

The number of locations sampled was dependent on the distribution of distinct ecotypes. These locations include Ogbu Edda, Oso Edda, Ufensi Edda, Ndiba Edda, Owutu Edda, Amosu Edda, Amaiyi Edda, Amaigbo Edda and Nguzu Edda. "Edda" is a vernacular name for highland or hill. The highlands were between 200 – 400 meters above sea level.

Methods

The sample size did not exceed 5 palms per location. The procedure which was adopted in sampling within each location was in consonance with the IBPGR collection protocol (1987). Sampled palms within each location were at least 50km apart to avoid selection and evaluation of closely related individuals. Data on stem height, bunch weight, bunch length, bunch width, bunch spine length, bunch stalk weight, fruit length and fruit width were recorded in-situ. The mesocarp to fruit ratio (M/F), kernel to fruit ratio (K/F) and shell to fruit ratio (S/F) were recorded after bunch and fruit analysis of the sampled palms following the procedures outlined by Blaak *et al*., (1963). The mean values, range and coefficients of variation of the different characters were computed following standard statistical methods (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

A wide range of variations in the population size, ecology, height, bunch weight, fruit form and the associated components were observed in the collections. The natural groves at Ogbu Edda and Amaiyi Edda were sparse while the rest of the groves were dense and actively exploited for the oil (Table 1). It is interesting to note the inheritance of some of the qualitative traits in oil palm and their frequencies in the wild. Only nigrescens fruits were encountered in the groves while the dominant genotype for shell, the *dura* occurred at high frequency. Oso Edda and Ndiba Edda *duras* produced heavy bunch weight while Ogbu Edda had the lowest bunch weight. The poor bunch weight could probably be explained by age effect as all the sampled palms were fully grown (>30 years) smooth stemmed palms. Height differences among the different *tenera* accessions were lesser than it was observed in the different *dura* accessions. It ranged from 11.5m – 12m with a low coefficient of variation (15.72%) and a mean of 12.7m in case of *tenera* accessions. Low stem increment has always been desired by the oil palm breeders due to the advantages of reduction in harvesting costs and extension of the economic life of the palm. The *tenera* palms from the groves were not statistically different with respect to bunch weight.

The overall variation of the different characters of *dura* and *tenera* fruits form was studied (Tables 2 and 3). For *dura*, the mean bunch weight was 15kg, bunch stalk weight 2.7kg, M/F 39.32%, K/F 13.23% and S/F 47.52%. The corresponding figures for *tenera* were bunch weight 11.8kg, bunch stalk weight 2.8kg, M/F 64.12%, K/F 15.22%, and S/F 20.82%.

Differences in *dura* and *tenera* fruit as regards bunch weight are in tandem with the differences in sex ratio (Okwuagwu *et al*., 2005, Okoye *et al*., 2007, Okoye *et al*., 2009). Breure and Corley (1992) concluded that the bigger the bunch, the larger the frame weight (bunch stalk and spikelet) because it is a constituent of the bunch weight. This assumption however, does not corroborate with the data presented in Tables 2 and 3 respectively. This is unexpected as the present materials were wild/semi-wild unimproved oil palm accessions. Very high variation was observed for the fruit composition of the sampled palms. The Ufensi Edda *tenera* material had the highest M/F (78.42%) unlike the rest of the *teneras* in the groves.

CONCLUSION

From the present data it is however, clear that wide variation exists in the accessions evaluated. The prospected fruits have been used to raise seedlings in the nursery for future planting in the field gene banks. These palms will be progeny tested for yield following introgression into the breeding programme. More collection missions will be planned for the other highland areas. It is strongly recommended that the use of molecular markers will aid in germplasm acquisition and utilization.

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Table 1: Collection environments and their oil palm population structure.

Location	Collection source	Population size	Ecology	Fruit form	Fruit colour	Stem height (m)	Bunch weight (Kg)	Mesocarp to fruit ratio (%)	Kernel to fruit ratio (%)	Shell to fruit ratio (%)
Ogbu Edda	Semi wild	Scattered	Steeply dissected (valley)	D	Nigrescens	16.8	11	44.8	15	40.22
Oso Edda	Wild	Dense	Level undulating	D	Nigrescens	12	22	31.3	13.4	55.3
Ufensi Edda	Wild	Dense	Level undulating	T	Nigrescens	15	12	78.4	14.8	6.6
Owutu Edda	Wild	Dense	Level undulating	D	Nigrescens	21.8	12.5	38.5	10.7	47.8
Item Edda	Wild	Dense	Level undulating	D	Nigrescens	12.2	15	40	11.6	48.4
Amosu Edda	Wild	Dense	Level undulating	D	Nigrescens	13.4	12	36	11.4	52.6
Ndiba Edda	Semi wild	Continuous	Swamp	D	Nigrescens	10	21	43	14	43
Amaigbo Edda	Wild	Dense	Level undulating	T	Nigrescens	11.6	13.5	56.7	15.5	27.8
Amaiyi Edda	Semi wild	Scattered	Level undulating	T	Nigrescens	11.5	10	64.4	14.8	20.8
Nwuzu Edda	Semi wild	Dense	Flood plain	D	Nigrescens	13	12	38.4	17	44.6

Where D = *dura* and T = *tenera*

Table 2: *Dura* fruit form trait characteristics.

Trait	Range	Mean	CV (%)
Stem	5-30	14.2	49.13
Bunch Weight (Kg)	10-24	15	32.05
Bunch Length (cm)	39-55	44.7	13.99
Bunch Width (cm)	28-42	35.5	13.16
Bunch Spine Length (cm)	2.7-6.9	4.8	25.9
Bunch Stalk Weight (Kg)	1.5-4.0	2.7	27.5
Average Fruit Length (cm)	1.3-5.0	3.8	28.04
Average Fruit Width (cm)	1.0-2.9	2.2	26.92
Mesocarp to Fruit ratio (%)	31.2-48.2	39.3	15.05
Kernel to Fruit ratio (%)	9.4-17	13.2	18.23
Shell to Fruit ratio (%)	38.2-53.2	47.5	13.19

Table 3: ***Tenera* fruit form trait characteristics.**

Trait	Range	Mean	CV (%)
Stem	11.5-12	12.7	15.7
Bunch Weight (Kg)	10-13.5	11.8	14.8
Bunch Length (cm)	44-45	44.3	1.3
Bunch Width (cm)	31-35	33	6.1
Bunch Spine Length (cm)	3.9-4.5	4.2	7.3
Bunch Stalk Weight (Kg)	2.5-3.0	2.7	10.8
Average Fruit Length (cm)	2.7-4.5	3.4	27.5
Average Fruit Width (cm)	1.6-2.1	1.9	13.5
Mesocarp to Fruit ratio (%)	55-78.4	64.1	16.1
Kernel to Fruit ratio (%)	14.8-15.6	15.2	2.4
Shell to Fruit ratio (%)	6.6-29.4	20.8	48.6