

**MORPHOLOGICAL DIVERSITY OF YAM ON IDJWI ISLAND IN THE
DEMOCRATIC REPUBLIC OF THE CONGO: CURRENT STATUS AND FARMERS'
KNOWLEDGE**

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ABSTRACT

Morphological characteristics of yam and farmers' perceptions is one of the factors necessary to improve and promote the cultivated yam. The aim of this study is to describe the current status and farmers' knowledge of yam on Idjwi Island. A total of three species of yam were recorded. Species of yam are commonly nominated Biriga, but farmers' give names to yam landraces based on the shape, size and color of tubers and productivity. However, the landraces were benefit for producers who sell their most important production in town. Also, this study revealed the existence of one morphological group within yam species as shown by morphometric measurements. These results shown that it's important to improve yam production in this region in order to create a food diversification.

Keywords: Yams, Diversity, Dr Congo, Knowledge, Morphology.

1. INTRODUCTION

Yam (*Dioscorea sp*) is the staple food for more than 300 million people worldwide (FAO, 1991; FAO, 2015). In addition to its importance in human nutrition, yam play an important role in the socio-cultural life of people of Africa, particularly in west and central Africa (Adoukonou-Sagbadja *et al.*, 2014; Scarcelli, 2005). In the Democratic Republic of the Congo (DRC), it is an important food crops in major production areas and there are currently several cultivated or wild species including *D. rotundata*, *D. cayenensis*, *D. alata*, *D. dumentorum*, *D. bulbilifera* or *D. esculenta* which are disproportionately distributed in this region (Anonymous, 2009). This shows enough that the choice made for these species or varieties is function of the region and ethno-agro-morphological considerations. However, the threats they face are handicaps to its development (Auriole, and Aboudou, 2006).

According to Babs (2015), the DRC is called upon to formulate food diversification programs and promote food crops at the national level; in the case of yams which represent 1% of the crops production in DRC, and yet able to substitute for other root and tuber crops of the region. This weakness can be explained on the one hand by the research on this culture which is almost non-existent and the adaptability of some species related to the agro ecological conditions of the region. Baco *et al.* (2007) indicates that in several country of sub-Saharan Africa, yam has remained orphaned of research. Weiskopf and Lossau (2000) show that the situation of yam biodiversity is worrisome in the face of market development, and if nothing is done, the future of generations may be compromised because they will have little genetic materials to adapt to the

realities of the environment. In this article, the results of an ethno botanical and morphological study of Idjwi yams in eastern DRC are presented and the aim was to determine the different farmers' perceptions of yam and describe the agro morphological characteristics of yam species or varieties cultivated in this region.

2. MATERIALS AND METHODS

The survey was conducted on Idjwi Island located on Kivu Lake and belonging to the South Kivu province. It covers an area of 680Km² or 1/9 of the entire Lake (PRSP, 2005) including 310Km² of land and 370Km² of territorial waters. Idjwi Island is located between latitude 1° 59' and 2° 28' Southern and 20 28' South and longitudes 29° 5' and 28° 26' Eastern following NNE SSW elongation in the axial zone of the lake with an average elevation of 1700m. It is characterized by mountain ranges including the mountains Muganzo in the North part (1829m above sea level) and Nyamusisi in center (2300m above sea level). According to the KÖPPEN classification, the island of Idjwi present different types of climates, including that of the Af type up to mountain types Cf through those with more or less marked dry season Am and Aw (PRSP, 2005). Generally, soil of Idjwi Island is volcanic, basaltic altered in red soil in the South-West and studies have shown that these soils would come from the lavas emitted by the old Kahuzi Biega volcano in the tertiary (PRSP, 2005). Different materials were used such as yams tubers and tools for morphometric measurements, etc.

A survey in yam fields was conducted using a semi-structured questionnaire to collect data on the perception of yam cultivation in the region. Data collected was the name of yam species or variety, their profitability, the cultural techniques, the constraints related to their production in the region. In addition of survey, different observations in the farmers' fields were organized in order to determine the length of the knots, the length of the petiole, the length and width of the blade, the average length of a tuber, the diameter of the tuber and the average weight of tuber to characterize the morphologically difference which existing on varieties of cultivated yam species in Idjwi Island. The yam descriptor developed by IPIGRI / IITA has helped to attend this objective (IPIGRI / IITA, 1997). For this purpose, the land was divided into five zones according to the climatic zones found in the region of which one zone on center of island and the others in the North, the South, the East and West. In each zone, studies were conducted in five fields depending on whether they are distant. The method consisted in plotting five of (10x10)m in the fields, two of them in the North and South part and one in the center. In field 10 plants were observed. The data collected were been submitted to the software Genstat Discovery editions 5 and SPSS 5.0

3. RESULTS

3.1. Denominations of yams in Idjwi

Yams cultivated in Idjwi are commonly called Biriga in their dialect; there are three species of which *D. cayenensis* is more cultivated and *D. rotundata* and *D. alata* are less cultivated. The farmers identify them from the color of their leaves and tubers. Despite the diversity of varieties, only four varieties of *D. cayenensis* are cultivated in this area such as Nyakadoke followed by Nyachumba, Nyamwaka and Nyabonjo. Among these varieties, only nyakondoke is cultivated widely and have real economic significance.

3.2. Income of cultivated yams

Yam cultivation remains profitable such for others food crops in this region. Yams tubers collected are divided in to group, the first constitute the big quantity which is estimated by more than half and the second is for family consumption. This shows that the majority of farmers’ find an economic interest in the production of yams; nevertheless, family consumption is justified by the fact that some farmers say that yam is endowed with therapeutic and traditional virtues.

3.3. Applied cultural techniques

Many techniques are applied; tubers are used for planting and its cultivation can range from less than one hectare for the majority of farmers’ and from 1 to 5ha for farmers' organizations receiving subsidies from governmental or non-governmental organizations. The use of staking remains the only way of cultivated yams in this region. Yams are conducted in cropping systems of the type of hut and the traditional type of permanent crops and are associated with other crops in several fields.

3.4. Production constraints of cultivated yams

The factors that affect production of yam in Idjwi Island are varying according their importance. The most important are root rot, foliar diseases, insects and nematodes damages on leaves and tubers.

3.5. Vegetative parameters of cultivated yams

The results for vegetative parameters of yams grown in Idjwi indicate that all cultivated yam have the same neck diameter, blade width, leaf length, interstellar and petiole length (Table 1).

Table 1 : Vegetative parameters of cultivated yams

Zones/parameters	Neck diameter (mm)	Blade width (cm)	Leaf length (cm)	Interstellar length (cm)	Petiole length (cm)
I	3,81	4,65	11,31	10,61	11,07
II	3,85	4,88	10,60	9,52	11,75
III	3,47	5,43	11,18	9,53	11,45
IV	3,51	5,47	10,51	9,92	12,04
V	3,35	4,97	9,97	10,11	11,39
Means	3,598	5,08	10,714	9,938	11,54
CV % (*)	15,4 %	14,8%	11,9 %	20,6 %	8,1 %
Decision	NS**	NS	NS	NS	NS

***Coefficient of variation; ** Not Significant**

These results show that yams cultivated at Idjwi do not present differences from a morphological characteristics.

3.6 Morphometric data of cultivated yams tubers

The results shows that diameter and length of tubers are varying across the varieties of yam in Idjwi (Table 2). They also show that the weight of the tubers is the same in all the growing areas. These results show that cultivated yam tubers have diversified forms.

Table 2 : Morphometric data of cultivated yams tubers

Zones/Parameters	Diameter of tuber (cm)	Length of tuber (cm)	Weight of tuber (Kg)
I	12,11a	39,76a	2,26
II	12,15a	39,25a	2,36
III	12,39a	40,02a	2,38
IV	11,96a	41,44a	2,97
V	8,15b	26,68b	0,66
Means	11,35	37,43	2,127
CV %	12,6 %	8,8 %	38,8 %
Décision	HS***	HS	NS
PPDS****	1,918	4,405	

The column with numbers followed by the same letter are not significantly different

*** Highly significant; **** Smallest significant difference

4. DISCUSSION

A total of three yam species are identified in the Idjwi Island. There are *Dioscorea cayenensis*, *D. rotundata* and *D. alata*. Only *Dioscorea cayenensis* is mainly cultivated in this area and often grown in association with other yam species or crops in the region. The yam farmers' of Idjwi attribute to all cultivated yams the name " Biriga " in their local dialect, but farmers' recognize the existence of four different landraces on the species *Dioscorea cayenensis* called Nyachumba, Nyamwaka, Nyabonjo and Nyakadoke. The last landrace is the most cultivated and appreciated by farmers and consumers due to its short crop cycle and sweet taste. These results corroborate those of Dumont *et al.* (2010) show that the species *D rotundata* is mainly cultivated in West Africa. Anonymous (2002) states that, alongside *D. alata*, *D. cayenensis* and *D. rotundata* constitute about 95% of world production.

Much of the yams produced are destined for sale in major consumption markets like the Bukavu and Goma town and the rest of the production is consumed at the family level. The reason of low consumption in the farmers' environment is that the yam is the second root and tuber crops after cassava, which is consumed by the major part of the population, and yams are used when there is a deficiency of cassava in the market or for the traditional rituals and medicine for several species. These results contradict those of Bricas and Attaie (1998) who show that in West Africa, only in the yam producing zones, the consumption of this crop is highly and most of the population in these areas has a cultural attachment to yams. Ake (1998) and Razafinimpiasa (2010) also shown that some yam species are used in traditional medicine in Africa.

Yams are grown on areas ranging from less than one hectare to more than 5ha depending on the objectives or land availability of the farmers' so that this crop is integrated into the system of the traditional type of permanent crops or box and can be conducted alone or associated with other crops as mentioned by Anonymous (2002) which shows that in Africa, yam is still grown under strata dominated with coffee, banana. Dumont and Verncer (2000) and Miede (1968) indicate

that certain cultural practices such as ridging and staking are mandatory in the management of yam cultivation.

The most important constraints of cultivated yam in Idjwi Island are root rot, foliar diseases, insects and nematodes damages on leaves and tubers. Dansi *et al* (2013) indicate that in Togo, the main constraints of yam production are insects that cause damage to leaves and tubers. In addition, nematodes which attack the tubers, the soil poverty and the wilting of the plant.

Morpho-metric data of neck diameter, leaf width and length, inter-node length and petiole length indicated that yam species produce in this region are same. This leads us to say that yams species in Idjwi are morphologically close to one another. The yam tubers grown in Idjwi have different lengths and diameters in weight, so the results showed that they had almost the same weights. These results show that the difference found in terms of length and diameter does not sufficiently explain the existence of a large specific or varietal diversity. These results corroborate with those of Razafinimpiasa (2010), which show that the variability of the forms may be due to the types of soils that carried the yam crop.

5. CONCLUSION

The results reported here show that cultivated yams in Idjwi Island are low diversified. There is only two yam species of yams, commonly called biriga in the local language, whatever their morphotype, are cultivated, among others *D. cayenensis* having four varieties determined according to their agronomic and organoleptic characteristics and *D. rotundata*. These cultivated yams are play a different role in the nutritional and income of households. These surveys show that the promotion of cultivated yams deserves the attention of local and foreign partners in the context of the dietary diversification of the population of this region, which sees only cassava as the only staple food. Molecular characterization and epidemiological study would be interesting to clarify the diversity of yam and to overcome the problems that prevent their production regardless of the potential agro-ecological it abounds.

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