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# Diversity of Sweet Potato Cultivars (*Ipomoea batatas* L. Lam.) According Farmers and the Constraints of Their Production in the Department of Ouémé in Southern Benin

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***Authors' contributions***

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Sweet potato (*Ipomoea batatas* L. Lam.) presents a great nutritional and economic importance in the tropical regions. It is a source of income for producers and an important food especially in period of welding. In spite of these importances, sweet potato belongs of the underused and neglected species as regards research in Benin. Sampling was carried out at *Dangbo*, *Adjohoun* and Bonou in department of *Ouémé* (south Benin), from August 2016 to May 2017. This study evaluated varietal diversity based on vernacular nominations and production constraints of sweet potato (*Ipomoea batatas* L. Lam.) in South Benin. Producers are identified using the snowball sampling method. In the first instance, a random draw was carried out among the producers targeted by the head of each

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of the six villages. Then, each of the selected producers is asked to identify other sweet potato producers. Statistical methods used to measure the varietal diversity include Shannon diversity indice, varietal richness and equitability (abundance). 23 local cultivars were listed including ten (10) regularly cultivated subject to synonymies. *Adjohoun* has cumulated average richness, index of Shannon and number equivalent most elevated (RC = 38; H = 2.49; Eq.E = 12.10). However, the most elevated equitability and more nearer to 1 (E= 0.71) is obtained at *Dangbo*. The main constraints enumerated by the producers are absence of flow market, attacks of the devastating and illnesses and the non availability of the quality seeds. For people in the study area, there are several sweet potato cultivars, but are subject to several constraints, in particular those related to pests and diseases, which have a serious impact on the productivity of cultivars, even those be more productive.

*Keywords: Diversity; Ipomoea batatas; vernacular names; constraints; Southern Benin.*

## 1. INTRODUCTION

The sweet potato (*Ipomoea batatas* L. Lam.) presents a great nutritional and economic importance in the tropical regions [1]. It is the sixth food crop most significant in world production after rice, wheat, potato, maize and cassava [2] with a world production estimated at 104 MT in 2013 [3]. Sweet potato is a source of income for producers and an important food especially in period of welding. Moreover, their agronomic capacities (good productivity, cycle short, climatic changes and edaphic adaptation) constitute major assets to face the challenge of the food security in the context of the climatic changes in West Africa [4]. In Benin it is adapted to various environmental conditions. In spite of these importances, sweet potato belongs of the underused and neglected species as regards research in this country [5]. But it is mainly cultivated by small producers within family small-scale farming where existing diversity is known and little valorized. Today, the cultures are in an environment very changing under the effect of the climatic changes which affect their development and their varietal diversity [6,7].

These threats which weigh on the species are likely to generate major difficulties for the socio-economic life of the current populations and for future generations. They have serious consequences such as species number reduction and their genetic diversity, disturbances of biotic interactions and flows of nutriments and dynamic processes of ecosystems. However, there is no centralized collection of sweet potato genotypes in Benin that would permit the conservation and use of genetic material adapted to different ecological and agronomic conditions. In the absence of collection, it is hardly conceivable to develop a breeding program, the genetic improvement of sweet potato that can meet the needs of local communities. Given the importance of sweet potatoes to rural communities, measures to manage residual resources are urgently needed to ensure their sustainability. Indeed, the sustainable management of speculation can not be a success without the inventory of the existing and especially without the active participation of the local population. Srisuwan et al. [8] revealed that the selection process is long and requires the use of a large number of individuals. However, Sanoussi et al. [9] showed that some local varieties of sweet potato disappear, leading to loss of diversity. Therefore, the inventory of existing local cultivars would be a great asset not only to have a base of local varieties of sweet potato but also to develop strategies for management and improvement of the species. The objective of this work is to inventory the different sweet potato cultivars and the constraints of their production in the department of *Ouémé* in South Benin.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was carried out in tree townships *Dangbo, Adjohoun* and Bonou in *Ouémé* chosed due to the high production of sweet potatoes in *Ouémé* [10]. In addition, sweet potatoes cultivation is dominant in the "valley" system [10], where the townships of *Dangbo*, *Adjohoun* and *Bonou* are located.

The department of *Ouémé* located in Southeast of Benin has a total area of 1281 $km^2$, with a population of 1096850 inhabitants in 2013 according to provisional results of the census General of Population and Habitat. It is bounded on the south by Atlantic Ocean and the

Department of Littoral, North by the Department of Plateau, West by the Department of Atlantic and East by the Federal Republic of Nigeria. It comprises nine townships: *Adjarra, Adjohoun, Aguégués, Akpro-Missérété, Avrankou, Bonou, Dangbo, Porto-Novo, Sèmè-Kpodji.* This department enjoys a subtropical climate with two rainy seasons: a large one from April to July, a small one from September to November, and two dry seasons, a small one from August to September, the big one from December to March. This favors the production of sweet potato during both seasons both on the plateau and in the liable to flooding plain.

## 2.2 Data Collection

The inventory of sweet potato cultivars was carried out in six villages known to be accessible areas and producing sweet potato from the department of *Ouémé*. In each village, the varietal inventory was done in a participatory manner according to Kombo et al. [11]. Producers are identified using the snowball sampling method [12] . In the first instance, a random draw was carried out among the producers targeted by the head of each of the six villages. Then, each of the selected producers is asked to identify other sweet potato producers. The survey was carried out through individual interviews on the basis of a semi-structured questionnaire. After a brief presentation of survey objectives to producers, they were asked to list all local varieties (vernacular names) grown or not grown in the village. In the field with the producer, the samples were collected to ensure the actual presence of the different local varieties still cultivated. Information on socio-demographic data (age, sex and ethnic group), criteria for recognition of local cultivars by growers and their perceptions of this crop was identified.

## 2.3 Data Analysis

The survey data were processed using the Sphinx software (Version 4.5) to determine the abundance of different cultivars nominated by producers and the variability of the perceptions relative to the constraints. The chi$^2$ test was calculated on the table of citations (marginal numbers equal to the sum of the rows / columns).

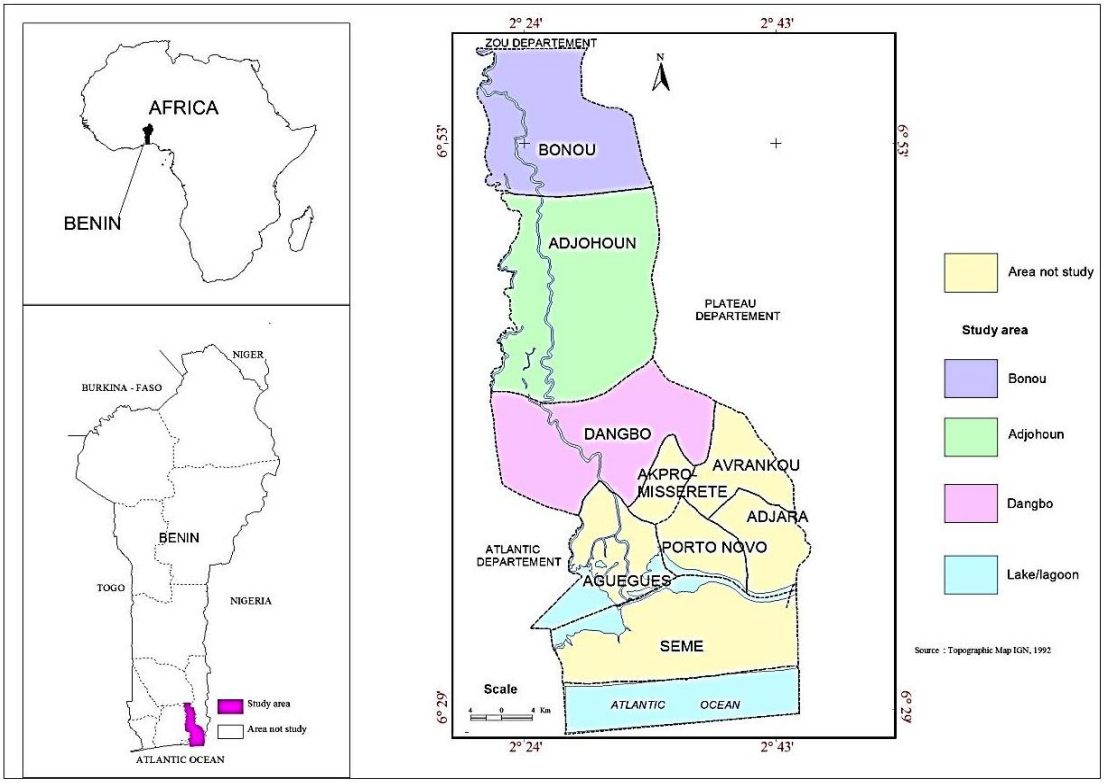


**Fig.1. Study area in the department of *Ouémé* in South Benin**

To characterize the diversity of cultivars, three indices such as cumulative wealth, Shannon diversity indices, and equitability were calculated at each village and township level.

Cumulative wealth is the number of times the cultivar was cited by producers and was calculated from villages and township from inventories. The Shannon diversity index denoted (H) is calculated by the following formula:

**H = -∑fi*Lnfi with fi = ni/N**

Where (fi) is the abundance of cultivar "i" in the study unit considered; ni is the number of fields where the first variety, N is the total number of fields in the study unit; Ln is the basic natural logarithm 2.

Equitability reflects differences in abundance between varieties. It is the ratio between the equivalent number of Shannon and the accumulated wealth **(RC): E = EqH / RC**.

## 3. RESULTS

### 3.1 Sociodemographic Data of the Respondents

In the three townships, 42 sweet potato producers were interviewed, of whom 92.86% were men compared with 7.14% women. The majority of respondents were between 30 and 50 years old (57.14%) and 35.71% were over 50 years of age (Fig. 2). In total, three ethnic groups were surveyed (*Ouémin*, *Aïzo* and *Fon*), of which the majority of the *Ouémins* were women (72%). Moreover, independence test of $Chi^2$ shows that the distribution of respondents according to sex, age and ethnicity is independent to villages and townships ($Chi^2$ = 23.32; 1-p = 38.57 %.).

### 3.2 Diversity of Sweet Potato Cultivars in the Department of *Ouémé*

The results show that the producers listed 23 cultivars in the three townships subject to synonymies (Fig. 3). The diversity of cultivars based on vernacular nominations varies very significantly from one village to another ($chi^2$ = 392.40, ddl = 110, 1- p > 99.99%). However, the field visit with the growers revealed that in all six villages, out of 23 sweet potato cultivars cited, 10 cultivars were produced (Fig. 4). Moreover, the distribution of these 10 cultivars depends very significantly from one village to another ($chi^2$ = 128.62, ddl = 45, 1-p > 99.99%). The cultivar "*Vobodouaho*" is mainly produced in all municipalities. The cultivars "*Mêché*" and "*Tolican*" were produced only in Bonou and *Adjohoun*, respectively. On the other hand, cultivars such as "*Djlodou*", "Adogoué", "Amihouédé", "*Zohoungogo*", "*Adogbo*" and "*Madohouè*" were only found in the most diverse *Dangbo* (Figs. 4 & 5).

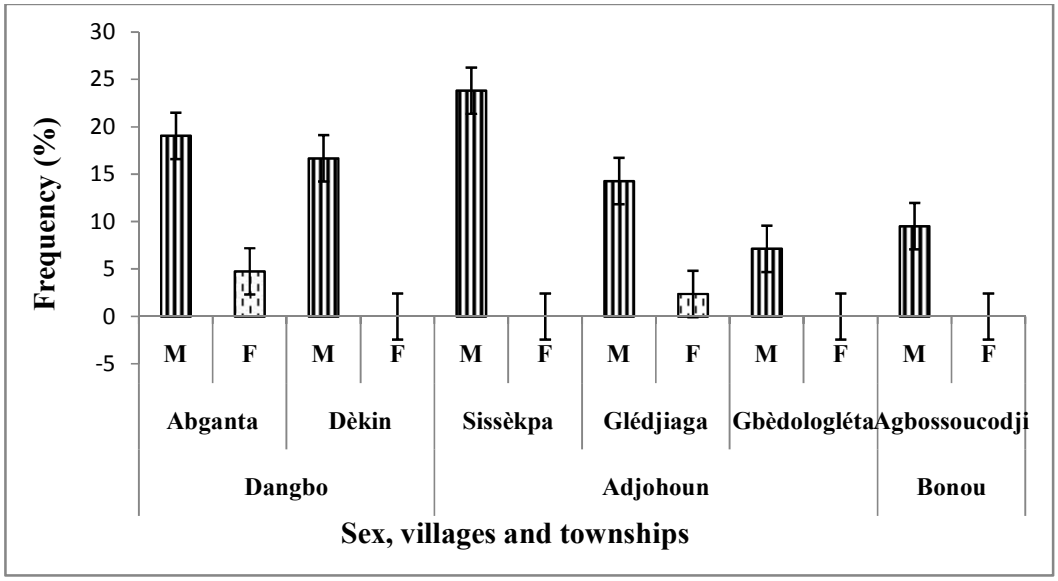


**Fig. 2. Distribution of respondents by sex by township**
*M: masculine F: feminine*

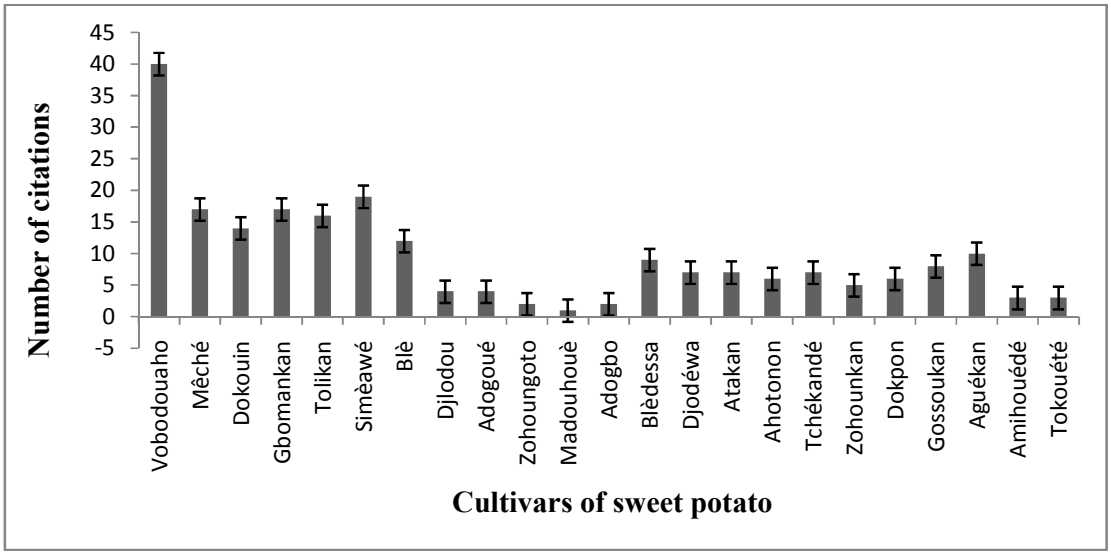


**Fig. 3. Local sweet potato cultivars cited by producers**

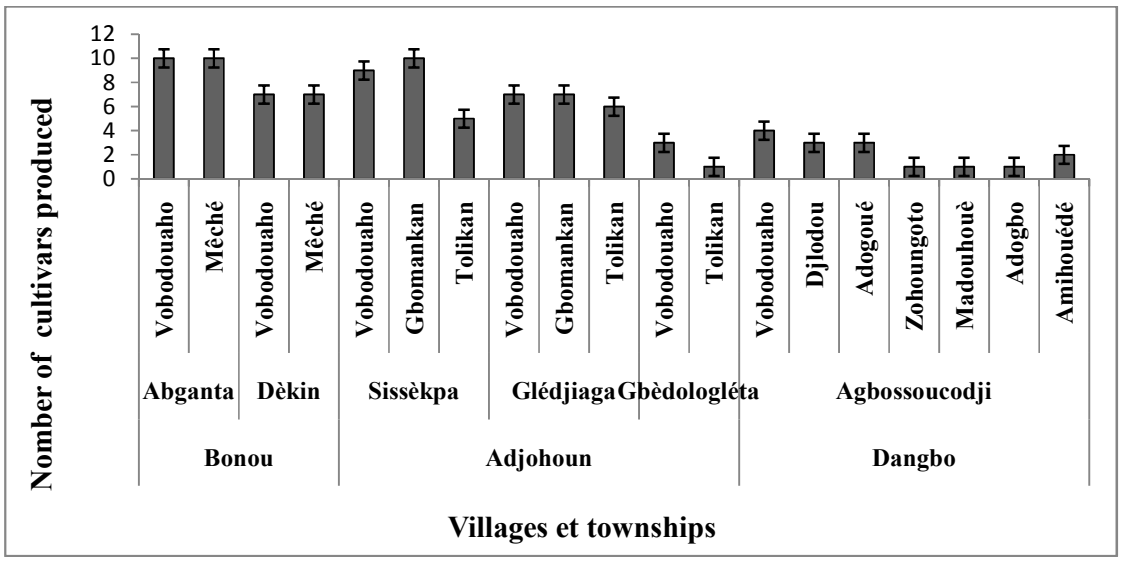


**Fig. 4. Abundance of cultivars produced by villages and townships**

### 3.3 Diversity Index: Cumulative Wealth, Shannon Index, Equivalent Shannon Number and Equitability

Table 1 indicates that the cumulative wealth of cultivars is higher in *Sissikpa* (18), *Glédjiaga* (15) and *Agbossoucodji* (15) but lower in *Gbèdologléta* (5). The index and the equivalent Shannon number of *Agbossoucodji* cultivars (H = 2.36, Eq.H = 10.60) were high. In comparison to the other five villages (*Agbanta, Dčkin, Glédjiaga, Sissikpa* and *Gbèdologléta*), the index and the equivalent number of Shannon of the cultivars were low. Thus, varietal equitabilities are close to draw and differ little between these villages (Table 1).

At the township level, *Adjohoun* has the average cumulative wealth, the Shannon index and the highest equivalent number (RC = 38, H = 2.49, Eq.E = 12.10). On the other hand, the highest and closest equitability of 1 (E = 0.71) is obtained in *Dangbo* township (Table 2).

**Table 1. Equitable distribution of cultivars in villages**

| Villages | RC | H | Eq.H | E |
|---|---|---|---|---|
| Agbanta | 12 | 0.613 | 1.846 | 0.154 |
| Dèkin | 9 | 0.560 | 1.751 | 0.194 |
| Glédjiaga | 15 | 0.721 | 2.056 | 0.137 |
| Sissikpa | 18 | 0.866 | 2.377 | 0.132 |
| Gbèdologléta | 5 | 0.907 | 2.476 | 0.495 |
| Agbossoucodji | 15 | 2.361 | 10.603 | 0.707 |

*RC: Cumulative wealth; H: Shannon diversity index; Eq.H: Equivalent number of Shannon; E: Varietal Equitability*


**Fig. 5. Rare and endemic local varieties listed in the prospection area**
*A: Djlodou; B: Amihouèdé; C: Adogoué; D: Zohoungogo; E: Madouhouè; F: Adogbo*

**Table 2. Equitable distribution of cultivars in townships**

| Townships | RC | H | Eq.H | E |
|---|---|---|---|---|
| Bonou | 21 | 1.173 | 3.232 | 0.154 |
| Adjohoun | 38 | 2.494 | 12.106 | 0.318 |
| Dangbo | 15 | 2.361 | 10.604 | 0.707 |

*RC: Cumulative wealth; H: Shannon diversity index; Eq.H: Equivalent number of. Shannon; E: Varietal Equitability*

### 3.4 Producer Preferences

Producers referred to eight preference criteria that allowed them to continue producing the 10 cultivars (Fig. 6). These include criteria such as drought resistance, pest tolerance, high recovery, good taste, adaptation to all soils, good post-harvest conservation, high productivity and high market value. The $chi^2$ independence test reveals that the dependence is not significant between the preference criteria and the townships ($chi^2$ = 50.64, ddl = 54, 1-p = 39.51%).

However, the preference criteria for 'pest resistance', 'drought tolerance' and 'adaptation to all soils' are only cited in *Dangbo* and *Adjohoun*. Moreover, the results showed that these criteria varied very significantly ($chi^2$ = 154.68, ddl = 66, 1 - p => 99.99%) from one ethnic group to another (Fig. 7). There is no dependence on age and sex.

### 3.5 Production Constraints of Sweet Potato

Sweet potato producers interviewed face some constraints such as insufficient cutting, labor shortages, pest and disease attacks, irregular rainfall, funding and the flow market (Fig. 8). It should be noted that labor shortages, pest and disease attacks as well as the market for the sale exist in the three townships. The constraint on seeds has been identified in the townships of *Dangbo* and *Adjohoun*. The $Chi^2$ test showed a very significant dependence ($chi^2$ = 111.17, dd1 = 30, 1-p => 99.99%) between the constraints identified and the townships. Producers have also suggested that pests cause enormous damage such as tuber rot and stem drilling (Fig. 9). According to the producers, this damage entails a significant loss of production. The $Chi^2$ test revealed that pest damage was recorded in all townships without distinction ($chi^2$ = 2.82, ddl = 4, 1- p = 41.10%).

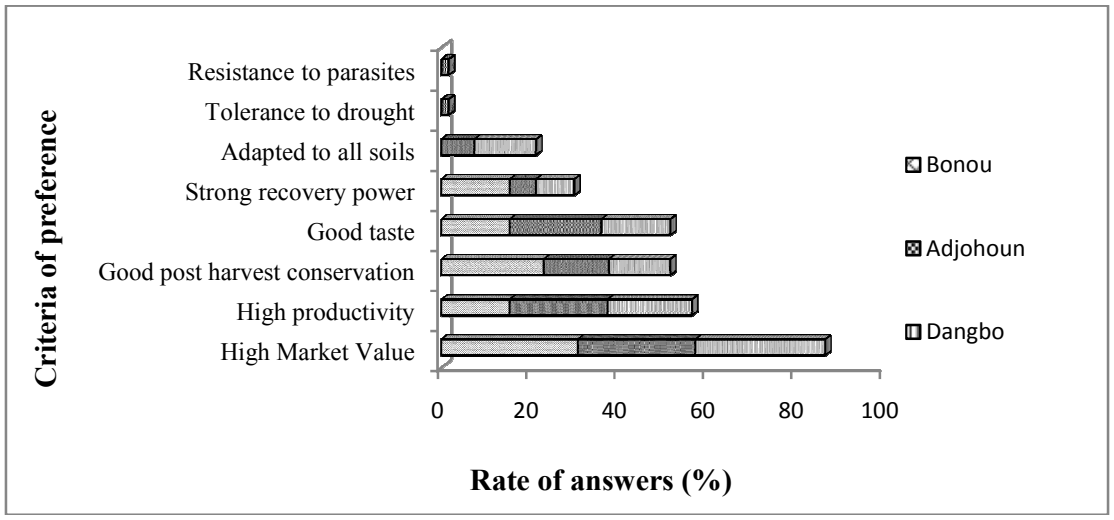


**Fig. 6. Preference criteria for local cultivars in the townships**

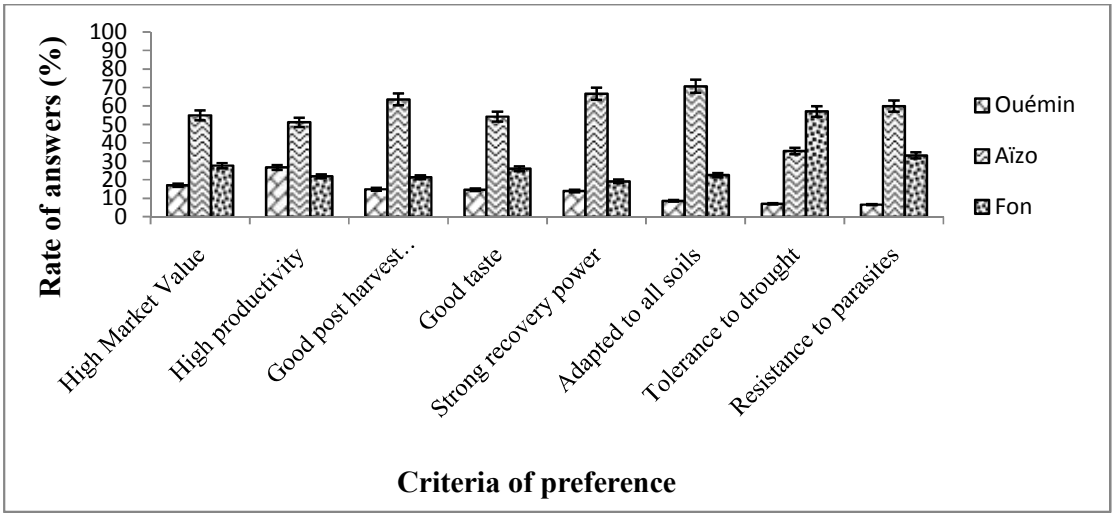


**Fig. 7. Preference criteria for local cultivars by ethnicity**

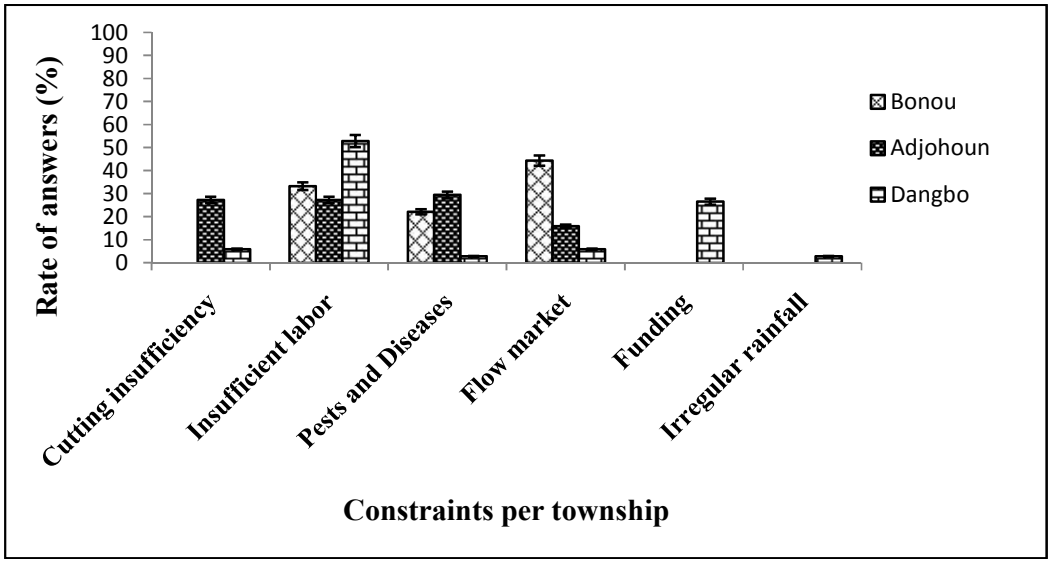


**Fig. 8. Production constraints of sweet potato in the three prospective townships**

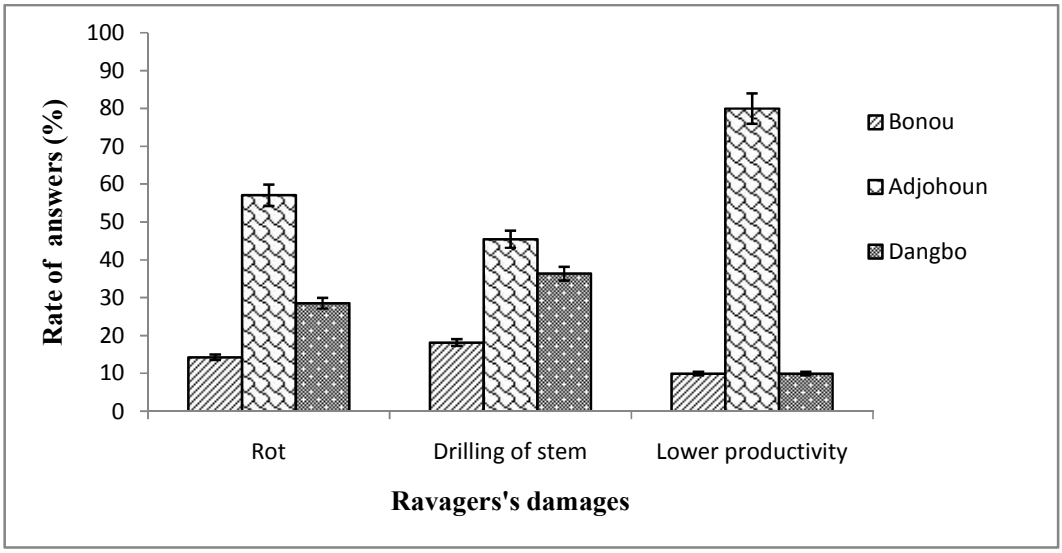


**Fig. 9. Damage due to sweet potato pests in the three prospective townships**

## 4. DISCUSSION

The information obtained in this study on the diversity of sweet potato is collected based on endogenous taxonomy and the random ethnobotanical survey method which are retrospective survey methods. Indeed, these methods solicit the memory of the persons interviewed and could induce biases related to the personal evaluation of the respondent [13]. According to Dossou et al. [14] the individuals interviewed implicitly take into account a personal assessment often referring to their preference. Despite these few biases, these methods are widely used in ethnobotanics. They have the privilege of highlighting conclusive results because peasant representation based on variety names is an important entry point for the study of varietal diversity [15].

Thus, the results show that in the townships of *Bonou*, *Adjohoun* and *Dangbo*, the production of sweet potato is mainly made by the men. Women are in small proportions and are not represented in all the townships, notably Bonou. This means that this culture is an activity reserved for men in

these prospective townships. Adegbola [10] showed that in the south-valley system, this activity is reserved for men. The distribution of ages within the townships has generally shown a small percentage of producers in the 20-30 age group. The majority of these people are from 30 to 50 years old. This observation could be explained by the exodus of young people to Nigeria and especially to the cities in search of work less laborious than the work of the land.

Twenty-three (23) local names of sweet potato cultivars were identified. However, from one township to another the same cultivar can be found fewer than two different names. According to Mamba-Mbayi et al. [16] and Robooni et al. [17], in the vernacular nomenclature of cultivars of cultivated plants, vernacular names generally vary from one ethnic group to another, from one village to another within the same ethnic area and sometimes from one household to another within the same village. In this context, the same cultivar throughout the villages can be designated by different names and different cultivars can sometimes be designated by the same name ([18],[19]). Therefore, to avoid overestimating or underestimating varietal diversity and to facilitate the efficient use of local cultivars, these should be collected and characterized both on the basis of agro-morphological and molecular markers ([20],[21]). In addition, ten cultivars have been produced for agronomic and financial reasons: good yield, adaptability to all soils, high market value and good organoleptic quality are the most important.

The index and the equivalent number of Shannon of the *Agbossoucodji* cultivars are high and the varietal equitability is close to 1 indicating that there are a high number of different cultivars. In addition, these cultivars are produced by producers with almost the same frequencies. On the other hand, the index and the equivalent number of Shannon of the cultivars are low in the villages of *Dèkin*, *Agbanta*, *Glédjiaga*, *Sissikpa* and *Gbèdologléta.* Thus, varietal equitabilities are close to zero and differ little between these villages, showing that there are a small number of cultivars in which a small proportion is frequent and the majority of these cultivars are very rare. Moreover, the results show that there are one or two dominant cultivars which are found in almost all the villages because of their agronomic performances (productivity), in particular the cultivar "*Vobodouaho*". These differences observed in terms of varietal richness, equitability and abundance of cultivars between villages and between townships can be explained by the preferences of producers, especially those linked to the agronomic performance of varieties (productivity and adaptability to all Soil types). Indeed, farmers tend to cultivate only those cultivars that they consider to be more productive and to leave other cultivars, which reduce varietal diversity. According to Otabo et al. [22], the agronomic performance of varieties is factors that negatively influence varietal diversity. Dansi et al. [23] also showed on yams that agronomic performance (productivity) is the most sought after for all crops by producers and influences varietal diversity. Although the diversity of sweet potato cultivars is low and some cultivars (*Mêché*, *Tolican*, *Djlodou*, *Adogoué*, *Amihouédé*, *Zohoungogo*, *Adogbo* and *Madohouè*) are endemic, it faces several constraints, Pests and diseases. The study showed that these pests and diseases have serious consequences on the productivity of cultivars even those recognized to be more productive. At this pace, the few rare cultivars existing in these townships will disappear which could significantly affect food security if nothing is done. The establishment of a participatory selection and decentralized conservation program is essential and will enable sweet potato producers to maintain varietal diversity at the village level.

## 5. CONCLUSION

Based on vernacular nominations, this work revealed a diversity of sweet potato cultivars in *Dangbo*, *Adjohoun* and *Bonou* townships. Some cultivars such as *Mêché*, *Tolican*, *Djlodou*, *Adogoué*, *Amihouédé*, *Zohoungogo*, *Adogbo* and *Madouhouè* are endemic, but are subject to several constraints, in particular those related to pests and diseases, which have a serious impact on the productivity of cultivars, even those be more productive. The establishment of conservation strategies is necessary to protect the genetic resources of sweet potato in Benin.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES


1. Sihachakr D, Haïcour R, Cavalcante Alves JM, Umboh I, Nzoghé D, Servaes A, et Ducreux G. Plant regeneration in sweet potato (*Ipomoea batatas* L., Convolvulaceae). Euphytica. 1997;96:143-152.
2. Ogero KO, Gitonga NM, Mwangi M, Ombori O, Ngugi M. African Crop Science Conference Proceeding. 2011;10:411-415.
3. FAO. FAO statistical databases. Food and agriculture organization of the United Nations; 2013.
   Available:http://faostat.fao.org
4. Glato K, Aïdam A, Odah K, Tozo K, Atto-Mensah ML, Etse KD. Régénération in vitro par organogenèse directe de pousses à partir de boutures de trois cultivars de patate douce (Ipomoeabatatas) originaire du Togo. European Scientific Journal. 2014;10 (27):276-291.
5. Dansi A, Adoukonou-Sagbadja H, Vodouhe` R. Diversity, conservation and related wild species of Fonio millet (*Digitaria* spp.) in the northwest of Benin. Genet Resour Crop Evol. 2010;57:827–839.
6. Luka EG, Yahaya H. Sources of awareness and perception of the effects of climate change among sesame producers in the southern agricultural zone of Nasarawa State, Nigeria. Journal of Agricultural Extension. 2012;16(2):134-143.
   DOI: http://dx.org/10.4314/jae.v16i2.11
7. Rahman MdZ. An innovation-cycle framework of integrated agricultural knowledge system and innovation for improving farmers' climate change adaptation and risk mitigation capacities: A case of Bangladesh. Journal of Agricultural Extension and Rural Development. 2015; 7(7):213-220.
   DOI : 10.5897/JAERD2014.0653
8. Srisuwan S, Sihachakr D, Siljak-Yakovlev S. The origin and evolution of sweet potato (*Ipomoea batatas L. Lam*.) and its wild relatives through the cytogenetic approaches. Plant Sci. 2006;171:424-433.
9. Sanoussi A, Dansi A, Bokossa-yaou I, Dansi M, Egounlety M. batatas based infant flours fortified with soybeanand sorghum flours. Int. J. Curr. Microbiol. App. Sci. 2013;2(7):22-34.
10. Adégbloba PY. Analyse de la filière patate douce au Bénin. PDRT/MAEP, Rapport final. 2003;162.
11. Kombo GR, Dansi A, Loko LY, Orkwor GC, Vodouhè R, Assogba P, Magema JM. Diversity of cassava (*Manihot esculenta* Crantz) cultivars and its management in the department of Bouenza in the Republic of Congo. Genetic Resources and Crop Evolution. 2012;59(8):1789-1803.
12. Wilhelm M. Echantillonnage boule de neige: La méthode de sondage déterminé par les répondants. 2014.
    ISBN:978-3-303-00515-6.
    Available:www.statistique.admin.ch
13. Lykke AM, Kristensen MK, Ganaba S. Evaluation of the local dynamics of 56 woody species in the Sahel, Biodiversity and conservation. 2004;13:1961-1990.
14. Dossou ME, Houessou GL, Lougbégnon OT, Tenté AHB, Codjia JTC. Etude ethnobotanique des ressources forestières ligneuses de la forêt marécageuse d'Agonvè et terroirs connexes au Bénin, Tropicultura. 2012;30(1):41-48.
15. Jarvis D, Myer L, Klemick H, Guarino L, Smale M, Brown AHD, Sadiki M, Sthapit B, Hodgkin T. A training guide for in situ conservation on-farm: Version 1, International Plant Genetic Resources Institute (IPGRI). Italie, Rome; 2000.
16. Mamba-Mbayi G, Nkongolo KK, Narendrula R, Tshilenge Djim P, Kalonji-Mbuyi A. Molecular relatedness and morphoagronomic characteristics of Congolese accessions of cassava (*Manihot esculenta* Crantz) for breeding purposes. Brit. Biotech. J. 2014;4(5):551-565.
17. Robooni T, Paul S, Rob M, Robert K. Combining ability analysis of storage root yield and related traits in cassava at the seedling evaluation stage of breeding. J. Crop Improv. 2014; 28(4):530-546.
18. Otoo E, Akromah R, Kololesnikova-Allen M, Asiedu R. Ethno-botany and morphological characterisation of the yam pona complex in Ghana. African Crop Science. 2009;9:407-414.
19. Tamiru M, Becker CH, Maas BL. Diversity, distribution and management of yam landraces (*Dioscorea* spp.) in Southern Ethiopia. Genetic Resources and Crop Evolution. 2008;55:115-131.
20. Lekha SS, da Silva JA, Pillai SV. Genetic variability studies between released varieties of cassava and central Kerala

cassava collections using SSR markers. J Stored Prod Postharvest Res. 2011;2(4): 79–92.

21. Mezette TF, Blumer CG, Veasey EA. Morphological and molecular diversity among cassava genotypes. Pesq. Agropec. Bras, Maio. 2013;48(5):510-518. DOI:10.1590/S0100-204X2013000500007
22. Otabo FR, Labeyrie V, Duval MF, Mabanza J, Mialoundama F. Diversité variétale de manioc sur la base des nominations vernaculaires des agriculteurs dans 4 bassins de production (Hinda, Loudima, Odziba et Oyo) en République du Congo. Journal of Applied Biosciences. 2016;104:9932 – 9941. ISSN 1997–5902
23. Dansi A, Dantsey-Barry H, Agre AP, Dossou-Aminon I, Assogba P, Loko YL, N'Kpenu EK, Kombaté K, Dansi M, Vodouhè R. Production constraints and farmers' cultivar preference criteria of cultivated yams (*Dioscorea cayenensis- D. rotundata* complex) in Togo. International Journal of Applied Biology and Pharmaceutical Technology. 2013; 4(2):191-199.



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