TRADITIONNAL KNOWLEDGE ON MILLET (*PENNISETUM GLAUCUM* (L.) R. BR.) GENETIC RESOURCES CONSERVATION IN BENIN : LOCAL TAXONOMY AND CULTIVAR CHARACTERISTICS

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ABSTRACT

Pearl Millet (*Pennisetum glaucum* (L.) R. Br.) is one of the oldest grains grown in Benin and which plays an important role in food security in rural areas. Despite its substantial importance, it is considered as a subculture and its production is to date weakening. For better utilization of this important genetic resource in Benin, an ethnobotanical survey based on a participatory approach through discussions of group was conducted in 32 selected villages from four agro-ecological production zones (Benin extreme northern Zone, cotton area of northern Benin, Food Zone of South-Borgou and West-Atacora Zone) to document indigenous knowledge related to production, production constraints, cultural practices, local taxonomy, geographical distribution of cultivars and their uses. Analyse of variance (ANOVA) and factorial correspondence analyses (CFA) tools were used to describe the variation of number of cultivar per agro-ecological zone and the specific uses by ethnic group encountered and agro-ecological zone respectively. The study revealed a very low local diversity of cultivars (1-3 per village per household), the highest diversity was obtained in extreme northern zone (2.20 ± 0.20) and most low in South Borgou (1.16 ± 0.16) and West Atacora (1.00 ± 0.09). The vegetative cycle (84.38 %) and the color of the grains (71.88 %) were the main criteria of differentiation of cultivars. Cultural practices in these areas are similar and millet grains are often kept in the converted loft (70.54 %). A new form of conservation in the gourds was observed with Tchila's in West Atacora area. In total, 7 constraints have been identified and prioritized. The most important were the irritation of the skin, itching (overall score = 7.17) and the weeding (overall score = 6.27). Millet is grown mainly for food (59.09 %), cultural (11.48 %) and commercial (51.22 %) purposes. These results are useful to guide pearl millet genetic diversity studies in Benin and define appropriate strategies for its conservation.

Keywords : *Pennisetum glaucum*, local taxonomy, Ethnobotany, Conservation, Benin.

CONNAISSANCE TRADITIONNELLE SUR LE MIL (*PENNISETUM GLAUCUM* (L.) R. BR.) CONSERVATION DES RESSOURCES GÉNÉTIQUES AU BÉNIN : TAXONOMIE LOCALE ET CARACTÉRISTIQUES DES CULTIVARS

RÉSUMÉ

Le petit mil (*Pennisetum glaucum* (L.) R. Br.) est l'une des anciennes céréales, cultivées au Bénin et qui joue un rôle important dans la sécurité alimentaire dans les zones rurales. Malgré ses atouts et potentialités, il est considéré comme une culture secondaire et sa production s'affaiblit de jour en jour. Pour une meilleure valorisation de cette importante ressource génétique au Bénin, une enquête ethnobotanique basée sur une approche participative a été conduite dans 32 villages choisis dans quatre zones agro-écologiques de production (Zone extrême Nord-Bénin, Zone cotonnière du Nord-Bénin, Zone vivrière du Sud-Borgou et Zone Ouest-Atacora) afin de documenter les connaissances endogènes liées à sa production, les contraintes de production, les pratiques culturales, la taxonomie locale, la distribution géographique des cultivars et les diverses utilisations faites de ses cultivars. Les outils d'analyses statistiques comme l'Analyse de variance (ANOVA) et l'Analyse factorielle des correspondances ont été utilisée pour décrire la variation du nombre de cultivar par zone agroécologique et des utilisations spécifiques par groupe ethnique et zone agroécologique respectivement. L'étude a révélé l'existence d'une très faible diversité locale des cultivars (1 à 3 par village par ménage), la diversité la plus élevée a été obtenue dans la zone extrême Nord-Bénin (2,20 ± 0,20) et la plus faible dans zone vivrière du Sud-Borgou (1,16 ± 0,16) et la zone Ouest-Atacora (1,00 ± 0,09). Le cycle végétatif (84,38 %) et la couleur des grains (71,88 %) sont les principaux critères de nomination et de différentiation des cultivars. Les pratiques culturales dans ces zones sont similaires et les grains de mil sont souvent conservés dans le grenier (70,54 %). Une nouvelle forme de conservation dans les gourdes a été observée chez les Tchila dans la zone Ouest-Atacora. Au total, 7 contraintes ont été recensées et hiérarchisées dont les plus importantes sont l'irritation de la peau démangeaison (score global = 7,17) et le sarclage (score global= 6,27). Le mil est essentiellement cultivé à des fins alimentaires (59,09 %), culturelles (11,48 %) et commerciales (51,22 %). Ces résultats sont utiles pour guider les études de diversité génétique du petit mil au Bénin et définir des stratégies appropriées pour sa conservation.

Mots clés : Ethnobotanique, Taxonomie locale, Contraintes, Conservation, *Pennisetum glaucum*, Bénin.

INTRODUCTION

The millet (*Pennisetum glaucum* (L.) R. Br., Gramineae), also called pearl millet is an important cereal growning in semi-arid areas of Africa and Asia (Tostain, 1994). It is very popular in the human diet for grain quality with a high fat content and ash, and its protein content comparable to that of sorghum, maize and wheat; it is rich in iron and phosphorus, vitamin B and sometimes vitamin A (FAO, 1995).

Millet is a species probably domesticated in West Africa and spread into the rest of Africa and Asia (Saïdou, 2011). The geographical distribution of the diversity of varieties of millet during domestication is related to its

adaptation to different regions, its ecosystems and its different uses. In some countries such as Australia, China, Canada, Mexico, Russia and the United States it is primarily developed as a forage crop for livestock production (Loumerem, 2004).

In West Africa, millet is widely grown in Niger, Nigeria, Burkina Faso and Mali which are at the same time the major producing countries of the world (Sédogo & Tostain, 1996 ; Saïdou, 2011). It remains in these countries the preferred crop because of its adaptation to the specific conditions of production, including lower water availability, high temperatures, land dominated by more or less sandy and traditional farming systems with extensive routes (ICRISAT & FAO, 1996).

In Benin, it is considered a as secondary cereal with an annual production of 26925.28 ton (MAEPStat, 2012). It occupies the fourth place among the most important cereal after maize (Zea mays), sorghum (Sorghum bicolor) and rice (Oryza spp). Its production has long been assured by ethnic groups Dendi, Bariba, Fulani, Berba, Ditarami, Djerrna, Dompago, Fon, Gourmantché, Haussa, Mokole, Niende, Pila found in the agro-ecological zones of northern Benin (Benin extreme northern Zone , cotton area of northern Benin, Food Zone of South-Borgou and West-Atacora Zone) Clement (1985). It plays an important role in the beninese agriculture and food especially in the tradition of the local people of the North Benin Republic. It is used in the preparation of porridge "Coco", yogurt "dégué" (millet grain mixture slurry with yogurt) and sometimes in the local production of alcoholic beverages (" tchapalo ", "tchoukoutou") (Hounhouigan, 2003).

Local communities around the world are agro-biodiversity dependent and conservative. Then, production of traditional crops is widespread through local varieties which are currently the main reserve of genetic diversity (Sédogo, 1994). Clement (1985) reported that the millet of West Africa are characterized by a wide variety of shapes and behaviors. This great diversity of forms observed in millet makes the plant a model of biological, physiological and genetic research in many areas (Tostain, 1994). For some authors, millet would be in the plant kingdom, the equivalent of the fruit fly or drosophila in the animal kingdom for study models (Hanna, 1987).

In Benin, millet genetic resources have been little evaluated regarding local knowledge. Indeed, research works were done so far about the food technology of millet (Hounhouigan, 2003 ; Missihoun *et al.,* 2012). Exploration and collection pearl mils of Benin conducted by Niangado &

Combes (1978) revealed the existence of 126 cultivated forms and significant phenotypic variability. This observed phenotypic variability provides a certain level of genetic diversity of local varieties of millet up to now not known.

Barnaud (2007) reports that farmers are carriers of knowledge and culture but also actor's practices that are part of a social and ecological environment they build and which they are themselves subject. Knowing the level of diversity involves their role in genetic resources of local varieties management and conservation. Indeed, the high level of genetic diversity of local varieties of sorghum in Benin remains partly the result of cultural practices and farmer seed management (selection, exchange and varieties of introductions, preservation methods and seed multiplication etc.) (Missihoun *et al.,* 2012a). But so far no study has been done on the role of local farmers in the management and conservation of genetic resources of local varieties of millet in Benin. This study evaluates the diversity of cultivars, indigenous knowledge related to the cultivation and use of millet in Benin using an ethnobotanical approach. It is specifically aiming to

(1) study the local diversity and geographic distribution of existing cultivars in Benin ;
(2) identify local criteria of peasant differentiation ;
(3) document the knowledge related to agricultural practices and post-harvest storage and
(4) analyze the importance of the constraints related to production and the different uses made of these cultivars.

METHODS

Environment Study

The study was conducted in four agro-ecological zones (AEZ) of Benin (Figure 1). The Table 1 shows the general characteristics of studied areas. Various soils types occurred (soils of the Niger Valley, Kandi's sandstone Soil, terrazzo floors basement gnessique), generally suitable for agriculture, which are mostly ferruginous , more or less drained according to ecological areas in the far north, one encounters little evolved soils and clay hydromorphic soils with high hydro-agricultural potential Agbahungba (2001) ; DDPD/B-A (2008).

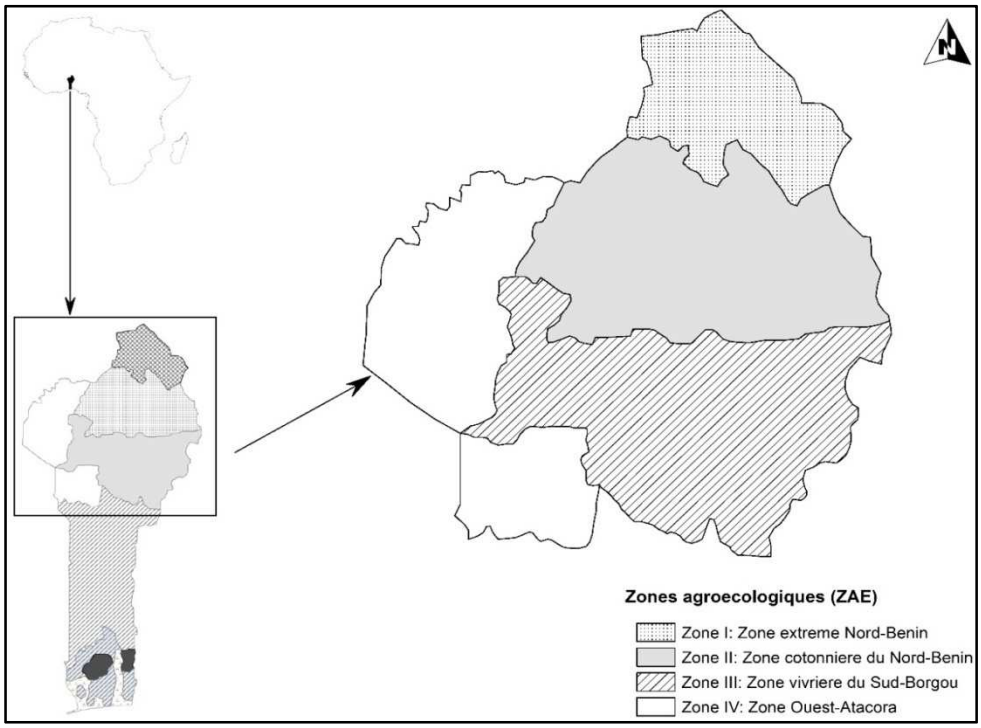

Figure1. Map of environment study with the agro-ecological zones (adapted from PANA-Benin)

Table 1. List of village per the AEZs, features and majority ethnic groups encountered

Agro-ecological zones (AEZ)	Covered districts	Localities	Climates	Rainfall	Ethnic Groups
I- Far North Benin (AEZ1)	Karimaman Malanville	Birni Lafia Toumboutou Madecali Garou-Tédji Guéné	Sudano-Sahelian has a rainy season	700 to 900 mm / year	Dendi
II- North Cotton zone (AEZ2)	Banikoara Kandi	Soroko Ouagou Pèdè Gogbèdè Bensékou	Sudanian with a rainy season	800 to 1200 mm / year	Bariba Mokole Bo
III- Food area of South Borgou (AEZ3)	Kouandé Bembèrèkè	Oroukayo Dangbinikou Saoré Travo Sakarou	Sudanian with a rainy season	900 to 1300 mm/ year	Natemba Otamari Niendé

Agro-ecological zones (AEZ)	Covered districts	Localities	Climates	Rainfall	Ethnic Groups
	N'Dali	Binansi			2% Bariba 3%
IV- West Zone Atacora (AEZ4)	Cobly	Tapoga	Sudanian pulling much to sahelian	800 to 1300 mm / year	Kountemba
	Ouaké	Tchalinga Gnagbakabia			Lokpa Peuhl
	Boukombé	Koutchagou Kounakokou Kouponkou Tabouota			Otamari
	Natitingou	Taghayè Tchoumi-Tchoumi Kokobrè			
	Toukountouna	Wabou Tchakalakou			Wama
	Copargo	Karum			Tchila
	Djougou	Sosso			Lokpa
	Matéri	Polohoun Merhoun			Berba

Sampling and data collection

Sampling and characteristics of respondents

Surveys and the collection of plant material were conducted in 32 localities. The choice is based on production (MAEPStat, 2012), geographic distance, the ethnic group. Ethnobotanical data related to production, production constraints, cultural practices, local taxonomy, geographical distribution of cultivars and their uses were collected through group discussions based on a semi-structured interview guide. A group discussion was conducted in each locality very well an overall 32 groups. The number of participants per focus group ranged from 10 to 38. Participants were mostly men with age ≥ 28. In total 531 producers participated in 32 group discussions. These producers were gather with the help of a local authority (king, king's counselors or village chief) (Christinck *et al.,* 2000 ; Adoukonou-Sagbadja *et al.,* 2006 ; Missihoun *et al.*, 2012a).

C*ultivars inventory and analysis of the distribution and extent*

The number of cultivars in each village and the local names, the traditional description, and management (conservation and traditional uses) were first collected during group discussion. Then, the analysis of the distribution and extent of cultivars of pearl millet was assessed in each village and group discussion by the participatory method " Four Square Analysis" described by

Brush (2000) used by Baco *et al.* (2008), Dansi *et al.* (2010 ; 2011) and Missihoun *et al.* (2012). This method allows classifying the varieties listed in each village taking into account the relative number of households cultivating it and the relative area under the variety. A variety cultivated by few households is that grown by less than 20 % of the farmers of the village and that grown on small surface in association with sorghum in the fields. To perform the analysis of four squares, varieties listed according to growth cycle by producers were assessed individually by these two parameters (relative number of households and the relative area). Four classes were defined by combining the results of the two parameters, namely, varieties grown by many households over large areas (+ +) ; varieties cultivated by many households in small areas (+ -); varieties cultivated by few households but over large areas (- +) and varieties grown by some households and small areas (- -). The reasons for the culture by few or many households and small and large surfaces were collected and documented.

Identification and prioritization of constraints millet production

The information collected is related to agricultural practices as well as millet production constraints. Millet Production constraints in the study area were identified and classified by the method of identification, phase-out and prioritizing the most important constraint used by Dansi *et al.* (2011) on yams (*D. rotundata* and *Dioscorea cayenensis*). It consists initially to list the constraints in general, lead producers to identify the most important for which an urgent solution must be found. The most identified constraint is ranked first and is removed from the list. The procedure is repeated until each time the classification of the latter constraint and the results are immediately returned to producers for approval. Finally, a classification based on average of three key parameters that are : i) : the total number of village where the stress is cited (the higher it is, the more stress is important), ii) : the number of villages in which the constraint is ranked among the first five (the higher it is, the more stress is important) and iii) : the number of villages in which the main constraint is (the higher it is more stress is important).

Data analysis

The number of cultivars was used to appreciate the diversity of accessions by village for each agro-ecological zone. These values were log-transformed and then subjected to analysis of variance (ANOVA) with a criterion to test the change in the number of cultivars by agro-ecological zone. The post-hoc test

Student-Newman-Keuls was used to separate the average. The citation frequency (Friedman *et al.,* 1986) of each local taxonomic criterion was calculated to highlight the most common criteria. The Chi - square test of Pearson was then used to test the change in the criteria of an agro-ecological zone to another. To highlight the most important constraints to the culture of the millet a score of importance (SIP) was calculated for each constraint. This score is the sum of three relative frequencies: the quote from relative frequency of constraints, citing relative frequency of stress as a major constraint and the quote relative frequency of duress as a main constraint. The SIP values range from 0 (not important constraint) to 3 (very important constraint). SIP of each strain was calculated by agro-ecological zone and for all study areas. Regarding uses of millet, citation frequency of each category of use were calculated to emphasize that the most widespread use. For the most common use category two factorial correspondence analyses (CFA) were performed to describe the change in specific uses depending on the one hand ethnic groups and other agro-ecological zones. All analyzes were performed in Minitab version 14 and SAS 9.2 software.

RESULTS

Diversity and geographic distribution of cultivars collected

The number of accessions vary significantly between agro-ecological zones (ANOVA, F = 7.70, Prob = 0.001). It was significantly higher in the AEZ1 (2.20 ± 0.20 by locality), which is followed by AEZ2 (1.40 ± 0.40 per locality). AEZ3 and ZAE4 have statistically the same number of cultivars, 1.16 ± 0.16 and 1.00 ± 0.09 by locality respectively (Figure 2).

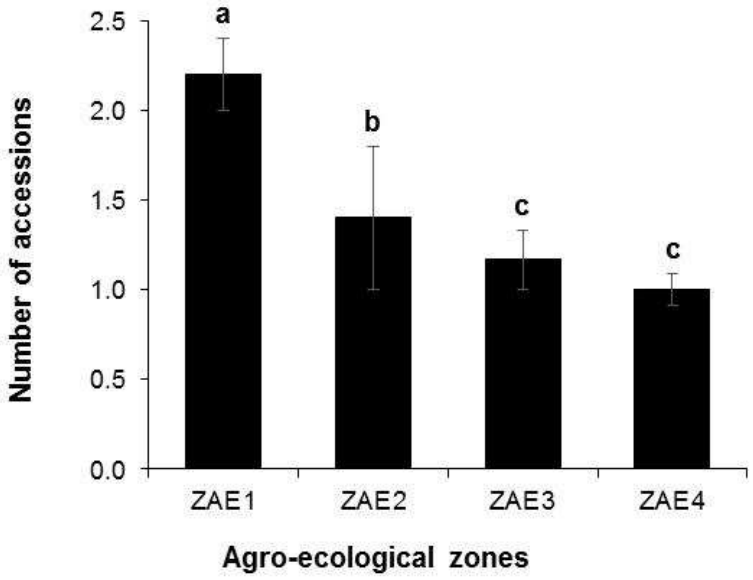

Figure 2. Number of accessions by agro-ecological zone

-Agro-ecological zones with different letters has significantly different accessions numbers at the 5 % level

Analysis of four squares revealed that 53.12 % of cultivars are growing by many households and over large areas (++), 37.5 % are cultivated by few households and small areas (--).

Table 2. Geographical distribution of local cultivars collected per localities

AEZs	Localities	Cultivars collected	+ +	+ -	- +	- -
AEZ1	Birni-lafia	2	0	0	1	1
	Toumboutou	2	1	0	0	1
	Madecali	2	1	0	1	0
	Garou-Tédji	3	1	1	1	0
	Guéné	2	1	0	0	1
AEZ2	Soroko	1	0	0	0	1
	Ouagou	1	0	0	0	1
	Pèdè	1	0	0	0	1
	Gogbèdè	1	0	1	0	0
	Bensékou	3	0	1	0	2
AEZ3	Oroukayo	1	1	0	0	0
	Dangbinikou	1	0	0	0	1
	Saoré	1	1	0	0	0
	Travo	1	1	0	0	0
	Sakarou	1	0	0	1	0
	Binansi	2	0	0	0	2

AEZs	Localities	Cultivars collected	+ +	+ -	- +	- -
	Taghayè	1	1	0	0	0
	Tchoumi-Tchoumi	1	0	1	0	0
	Polohoun	1	1	0	0	0
	Merhoun	1	1	0	0	0
AEZ4	Tapoga	1	0	0	0	1
	Koutchagou	1	1	0	0	0
	Kounakokou	1	0	1	0	0
	Kouponkou	1	1	0	0	0
	Tabouota	1	1	0	0	0
	Wabou	1	0	1	0	0
	Tchakalakou	1	1	0	0	0
	Kokobrè	1	0	1	0	0
	Karum	1	1	0	0	0
	Tchalinga	1	1	0	0	0
	Gnagbakabia	1	1	0	0	0
	Sosso	2	0	2	0	0
Average		01.31	00.53	00.28	00.125	00.375

The cultivars produced by many cultivars produced by the household on large area (++); cultivars grown by many households in small areas (+ -); cultivars grown by few households over large areas (- +); cultivars grown by few households in small areas (-)

Taxonomy of local cultivars of millet

The local name of millet varies between ethnic groups (Table 3) .On the forty-two (42) collected cultivars Twenty- six (26) names have been identified including twenty-one (21) that are still growing and sampled during the survey (Table 3). The identification of the local name by producers is following 5 criteria that are the vegetative cycle (very early cultivars --2 months early - 3 months and late - 4-6 months), the color of the grains (white cultivars, black and red); the size of the candle (long and short cultivars), the color of ear (cultivars violet) and other (cultivar Case Iyakou meaning mil death) (Figure 3). No significant relationship was detected between the AEZ taxonomy and local criteria (Chi-square test of Pearson Chi - Sq = 12.24, df = 8, Prob.= 0.141). The vegetative cycle (66.67 %) and the color of the grains (54.76 %), however, are the main criteria in all AEZ (Figure 3).

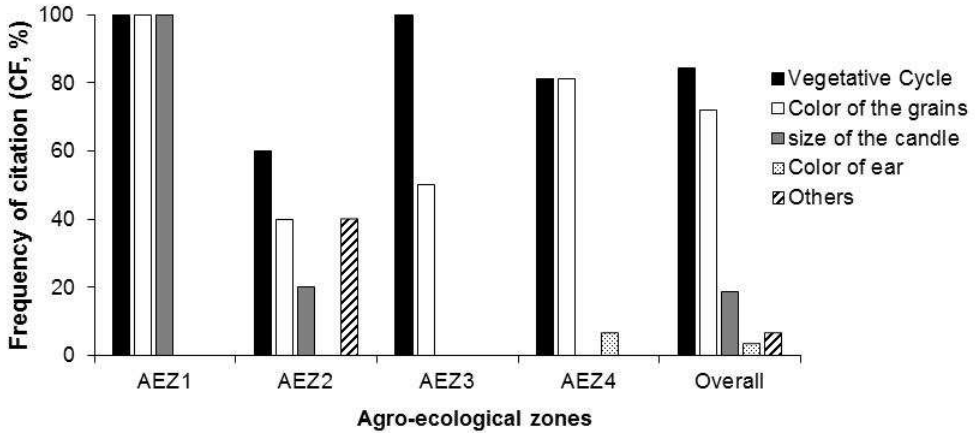

Figure 3. Used criteria by local people to identify cultivars of millet according to agro-ecological zones

Agricultural and post-harvest conservation practices

Agricultural practices on millet cultivation do not vary according to agro-ecological zones or ethnic groups. Then, 92.65 % of producers associated millet with other cultures. Some of them also practice monoculture in their field (7.35 %). Moreover, in rotational cropping systems, the position of millet is less. However, producers placed it in the 1st or 2nd place in a newly cleared field. In all of these cropping systems, farmers do not use chemicals fertilizers except some of them in the AEZ 2 and in AEZ4 (20.34 %) who grow cotton.

The different steps for obtaining and stocking millet grain are described in the same way by the producer's regardless ethnicity or AEZ (Figure 4).

Each year, producer's decision to cultivate a particular cultivar depend on socio-economic (subject to availability in attics, bags or bottles, land availability), agronomic (the growth cycle since the early cultivars reach maturity occurs when planting other crops or late cultivars, yield, control stress the importance of variety in the diet , the ability to withstand late harvest : labor Fouls) and cultural (use of certain cultivars for ceremonies and habits of an ethnic group) factors. Producers do not buy millet seed in the market but inherit from parents (90.47 % response), friends (4.76 % response), or from a project (4.76 %).

Table 3. Inventory of millet accessions in different ethnic groups surveyed

Ethnic groups	Local names of millet		Name of the accessions	Significance	Characteristic traits
	Singular	Plural			
Otamari	Diyo	Yèyo	Diyo matri	_	Late (4 - 6 months) ; White grains
			Diyo mani*	Purple millet	Late (4 - 6 months) ; Purple ear
			Ignati*	Early millet	Very early millet (2months)
			Ignati*	Remedy of the family	Very early (2months); Long ear
Niendé	Ayo	_	Ayoyantè	_	Late (5months) ; Short ear, White grains
Koutemba	Yotorika	_	Yotorika	_	Late (4-5months) ; White grains
Natemba	Yomali	Yomaka	Yomali	_	Late (4-5months) ; White grains
Wama	Sowawia/ Sowabia	–	Sowawia/ Sowabia	_	Late (4-5months) ; White grains
Tchila	Naali	Nawolo	Naasowli	Black millet	Early (3 months); Black grains
Lokpa	Amatè	Amala	Amala koupètè	Black millet	Late (4 months), Black grains
			Amala kouhloumè	White millet	Late (4 months); White grains
Peulh	Maowaïri	_	Maowaïri ranéïri	White millet	Late (4 months); White grains
			Maowaïri maléïri*	Black millet	Late (4 months); Black grains
Dendi	Haini	_	Guéro*	Early millet	Very early (2months); Short ear
			Hainikiré doubo	Short red millet	Early (3months) ; Short ear, very popular
			Hainikiré dogo	Long red millet	Early (3 months); Very long ear
			Somna	_	Late (4-5 months); White grains
			Bandadabou	Protect the secrecy	Very early (2-3months)
Bariba	Gbè	_	Gbè Kpika	White millet	Late (4 - 6 months) ; White grains
			Gbè wonka	Black millet	Late (4 - 6 months) ; Black grains
Bo	Wéa	_	Wéa gban	Millet with long ear	Late (4 months) ; Long ear
			Wéa guézénon	Millet with short ear	Late (4mois) ; Short ear, popular
			Naaténon	Early millet	Early (3 months); Very small grains
Berba/Biali	Itoura	_	Itoura	_	Late (5months); White grains
			Naara*	Early millet	Very early (2months); Sweetened long ear, poor yield
Mokolé	Iya	_	Iyakoun	Dead millet	Late (4 months)
			Iyassè	Cover the secrecy of the man	Very early (2month), short ear

*: Accessions millet uncultivated and not collected

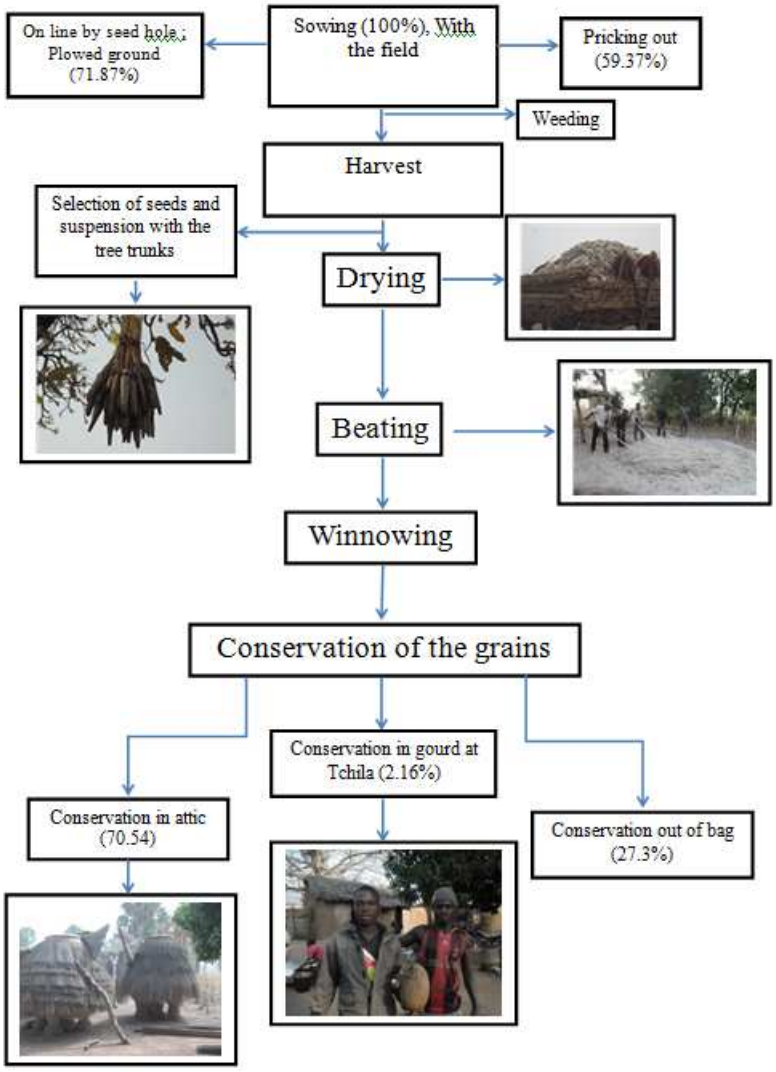

Figure 4. Steps for obtaining traditional conservation millet grains

Millet cultivation Constraints

Seven constraints for growing millet have been identified through the areas surveyed. The overall importance score (SIP), dispose by order of importance irritation of the skin, weeding, excessive rain , soil quality , attacks by birds, termites and livestock havoc the abandoned thinning and lodging. This ranking slightly varies from AEZ to other one. Then, irritation of the skin and

weeding appears as the first or second constraint in all AEZ except AEZ1 where it is the attack by animals that appears first (Figure5). These results show the difference in the assessment of the importance of the constraints by producers as required by their geographical environment or their usual practice.

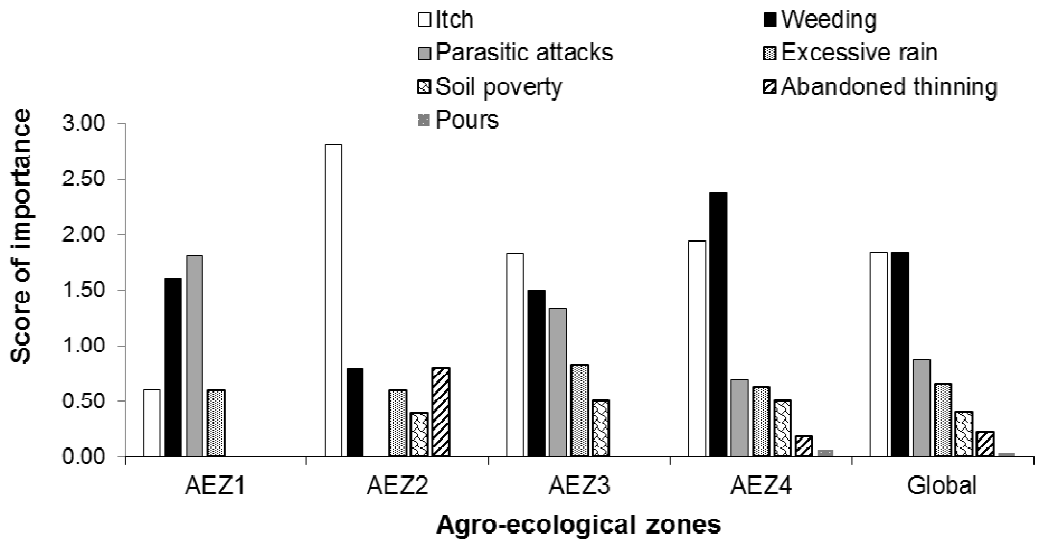

Figure 5. Importance of the constraints related to the cultivation of millet

Traditional uses of millet

Millet is grown for food purpose (59.09 %), cultural (11.48 %) and commercial (51.22 %) (Table 4). In the food use category, millet is used primarily in the preparation of the porridge (100%), paste (50.84 %), thrust (51.03 %) and other foods (34.46 %). The correspondence analysis (with 99.97 % and 79.70 % of initial variations respectively gathered on the first two axes) shows that the porridge is very characteristic of the ethnic from AEZ1 and AEZ2, thrust for ethnic groups in the AEZ3 and AEZ4 and finally paste for the ethnic groups of the AEZ4 (Figure 6). In addition, in the AEZ4, millet holds importance in certain ritual such as: the initiation of young boys into men (Difôni in Otamari); the ceremony of the new harvest and the new seed (the Minwana in Otamari), the Wantchusu (Berba), the Yomaka-Koudi (Natemba), the Karkou (Waama) and the ceremony of the first birth (Poyin-odo in Natemba). Millet market has a very high price than other cereals.

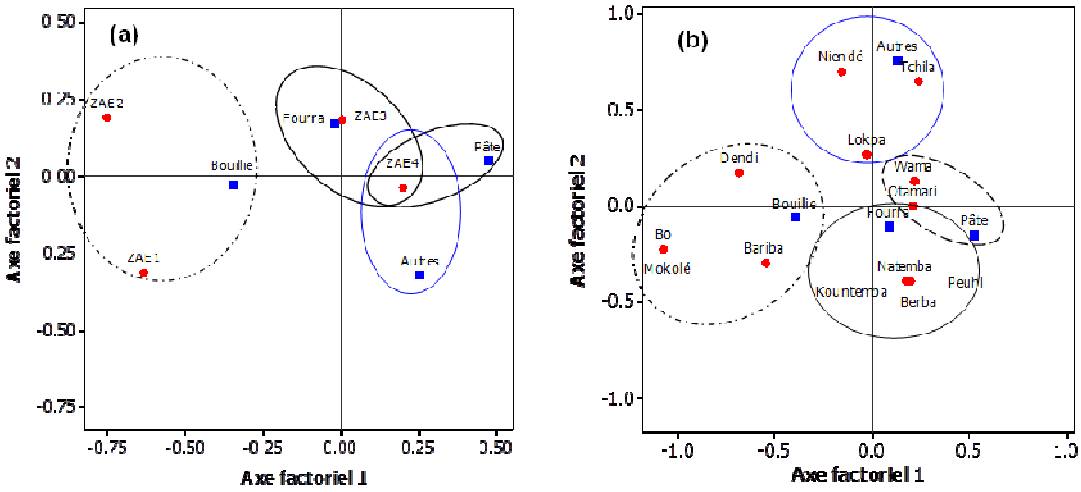

Figure 6. Relations between dietary uses and ethnic groups (a): dietary uses in agro-ecological zones (b): dietary uses with ethnic groups

Table 4. Categories of use, specificity and local names

Categories of uses	Specific uses	Local names (Ethnic groups)
Food (59.09%)	Porridge (100%)	Commandi (Dendi) Sorou (Bariba), Kpètè (Mokolé), Kpèlè (Bo), Bita (Otamari), Tchièti (en grain) Ebouotèyo (Simple) (Natemba), Boyiri (Peuhl), Tolo (Lokpa), Bèyala (Tchila), Berbou (en grain) Sotaya (simple) (Waama)
	Paste (50.84%)	Habourou (Dendi), Dibou ou Dihou (Bariba), Aka (Mokolé), Ou (Bo), Moutchia, Moutchiè, Matitchia (Otamari), Witchia (Niendé), Tchièbou (Natemba), Yiri (Peuhl), Monto (Lokpa), Saho (Tchila), Tchabou (Waama)
	Fourra (51.03%)	Donou (Dendi), Doun (Bariba), Tchaka (Mokolé), Oussi (Bo), Fourra (Otamari, Niendé, Peuhl, Lokpa), Sinakani (Waama)
	Other receipts (34.46%)	1-Iyé-Iya (Niendé), 2-Gouni (Dendi), 3- Ladunguè (Tchila), 4- Tontomiya et Kararé (Waama),
Cultural (11.48%)	Baptism (4.40%)	-
	Wedding (portion) (4.70%)	-
	Ritual (25.04%)	-
Commercial (5.22%)	Selling (51.22%)	-

DISCUSSION

Diversity and distribution of local cultivars related to their traditional use

Distribution of varieties at one region is generally dictated by their adaptability to environmental constraints Konan *et al.* (2007) but is also intimately related to their preference criteria Missihoun *et al.* (2012). This was also observed on the distribution of fonio varieties Dansi *et al.* (2010) and sorghum grown in Benin Missihoun *et al.* (2012). The low distribution of cultivars noted by locality in this study demonstrates their low availability in households. The great local diversity observed in AEZ1 is related to the importance of some local cultivars specifically used in some preferred food. This is the case of Hainikiré cultivars (early red millet grain) used to make porridge (Commandi) in Dendi. This porridge comes into the customs of this ethnic group "the Commandi saves man". It can also be explained by the fact that millet production is an ancient practice in this zone. The proximity of AEZ1 to Niger, Nigeria and Burkina Faso which are millet great world production should certainly favored introductions by trade or transhumance (Case of Haini Bandadabou cultivar introduced by the project of Burkina Faso).

Although most cultivars are either elite cultivars (++), most of them are threatened with extinction. In some localities the cultivars are dropout. The reasons are related to production constraints cited by producers. Proposals for varietal introduction can be developed based on these constraints.

Local Classification of cultivars

Several authors have stressed the value of the local taxonomy in conservation of crop genetic resources van Oosterhout (1990); Berlin (1992); Uguru (1998); Sambatti *et al.* (2001); Adoukonou–Sagbadja *et al.* (2006); Barnaud (2007); Missihoun *et al.* (2012). Then, the study of local names for such and such varieties and understanding of the traditional classification system is of importance since the local names of the varieties is the basic unit used by producers in the management and selection. This is also the address with which they recognize and manage the consequences of changes in the diversity of cultures. Producers of millet in different ethnic groups recognize and select their different local varieties on the basis of specific traits such as vegetative cycle, the color of the grain, the ear and the size of the candle. The role of the growth cycle which is the main specific feature in the local taxonomy has also been observed in other cereals such as fonio Adoukonou-

Sagbadja *et al.* (2006); Dansi *et al.* (2010) but not on sorghum Missihoun *et al.* (2012). This similarity between millet and fonio is certainly they are most similitude with the two spesies and indicates the variability of local taxonomic criteria depending on the species and the need to conduct specific investigations for efficient management of their diversity. The color of the grains was also noticed on sorghum in most producing sorghum ethnic groups in Benin Kayodé *et al.* (2006); Missihoun *et al.* (2012) and in Duupa in northern Cameroon Barnaud (2007). It is remarkable that so many local names as ethnic groups obtained unlike variables cultivars collected by group. This is related to the low local diversity of cultivars collected in localities and within groups. This result confirms that obtained in the case of fonio Adoukonou *et al.* (2006) and in the case of yams Dansi *et al.* (2011); Loko *et al.* (2011) where the common names vary from one ethnic group to another and one village to another within the same ethnic area. This observation figure out the limits of local classification on the basis of specific differentiation, suggests the use of approaches based on morphological and molecular markers to clarify and establish equivalence between local names in the research framework for the development of cultures.

Agricultural practices and its constraints

Agricultural practices related to the management and cultivation of millet varieties observed and described by the producers are well known and previously reported on other crops such as sorghum in Burkina Faso vom Broke *et al.* (2004), Benin Missihoun *et al.* (2012); fonio in Togo Adoukonou-Sagbadja *et al.* (2006); yams in Benin Dansi *et al.* (2010). Also, the predominance of the culture associated to millet varieties with other field crops by farmers in these areas has already been observed in other crops in northern Benin such as yam Baco (2007), Egusi (*C. Lanatus subsp* and *mannii subsp*) Achigan (2008) and in Cameroon in the Duupa which like sorghum are grown mostly mixed with other crops Barnaud (2007). It's a cultural behavior used to respond to climate hazards, to maximize the cultivable area Clement (1985), to diversify sources of income Mertz *et al.(* 2005) or to modulate the abandonment or millet disaffection Clement (1985).

The increase of millet production is mainly due to its ability to adapt to Sahelian constraints. Prioritization of constraints listed by producers of millet identifies an order of importance varies slightly according to the AEZ. Excessive rain fall , soil quality , lodging (abiotic stresses) , parasitic attacks : birds, *Striga hermontica* , insects (biotic constraints) observed in this study has already been reported by some authors Tostain (1993); Bezançon *et al.*

(1994); Sédogo (1994); Saïdou (2012). Weeding and irritation of the skin that are socio-cultural constraints related to cultural practices were never mentioned upmost important in one country but appear here as millet first constraints in AEZ study.

CONCLUSION

AEZ of Benin contains a large number of ethnic groups involved in the production of millet but not totally in the control of agricultural practices. The designations of local cultivars are primarily along the growth cycle, the color of the grain size of the candle and the color of the ear. The study also revealed a very low local diversity and distribution of cultivars per locality. Although, most cultivars are grown by many households and over large areas there partly endangered varieties because of production constraints. Most cultivars are grown by many households and over large areas because of their importance in the three categories of use mentioned. The need to develop strategies for the conservation and recovery of millet in Benin is necessary. In order to ensure efficient management and sustainable use of genetic resources for the improvement of millet, agro- morphological characterization work and molecular genetics of local varieties seem essential.

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