



Morphological diversity, cultivar groups and possible descent in the cultivated yams (*Dioscorea cayenensis*/*D. rotundata*) complex in Benin Republic

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Abstract

A better knowledge of traditional cultivars is a prerequisite to overcoming the various constraints of yam production in Benin. Using IPGRI's descriptors, 560 accessions of cultivated yams (*D. cayenensis* Lam./*D. rotundata* Poir. complex) collected throughout Benin, were characterised. Ninety morphotypes were identified and further classified into 26 cultivar groups based on their morphological similarities. An identification key is proposed for the cultivar groups. The geographical distribution of cultivar groups is also presented and two centres of diversity are identified. A comparative study between the cultivated forms and their wild relatives (*D. abyssinica* Hochst., *D. praehensilis* Benth and *D. burkilliana* Miège) has allowed us to establish linkages between the identified morphotypes and wild species and to postulate some hypotheses which will be further tested using isozyme and DNA markers. The flowering and the fruiting capacity of the morphotypes as well as their adaptability (based on tuber morphology) to mechanical harvesting are also discussed. Some collections in Nigeria (IITA, Ibadan) and Togo containing cultivars from many West African countries were inspected to verify the geographical distribution of Beninese cultivars.

Introduction

The genus *Dioscorea* belongs to the monocotyledonous Dioscoreaceae, the most prominent family within the Dioscoreales (Burkill, 1960; Ayensu & Coursey, 1972). More than 600 *Dioscorea* species exist worldwide. Their habitat is mainly in tropical or subtropical areas of Africa, America, Asia, and Polynesia, where some *Dioscorea* species represent economically important tuber crops (Coursey, 1967).

Food yams are grown principally for the carbohydrate they provide. The tubers, which are the only edible part, have a tremendous capacity to store food reserves. Although regarded mainly as a source of car-

bohydrate, some species are nearly as rich in protein as rice or maize (Hahn et al., 1987).

Among the several yams species (*D. alata* L., *D. esculenta* Bork., *D. dumetorum* (Kth.) Pax, *D. bulbifera* L., *D. cayenensis*/*D. rotundata* complex) cultivated in West Africa, the native *D. cayenensis*/*D. rotundata* complex (also referred to as Guinea yam) remains the most important. For example, in Benin, this species complex represents more than 95% of the total production (Dansi et al., 1997). Apart from its nutritional value, Guinea yam also plays a significant role in cultural life in West Africa (Ayensu & Coursey, 1972). However, despite its economic and cultural importance, Guinea yams have been poorly investigated

in several West African countries, including Benin. Consequently, farmers are reporting the disappearance of many cultivars and therefore a significant genetic erosion (Dansi et al., 1997). Many genotypes are reported to be susceptible to pests (nematodes) and diseases. To overcome these constraints, there is a need for a better knowledge of the diversity within the crop.

No sound characterisation or classification of cultivated yam cultivars has been conducted in Benin so far. Surveys carried out in 1996 and 1997 (Dansi et al., 1997) highlighted the existence of a considerable number of vernacular names. About 300 different names have been reported for 63 collection sites distributed over just 10 ethnic groups. Each locality has its own unique set of names for different cultivars with even very different cultivars sometimes referred to by the same name. This linguistic polymorphism constitutes an obstacle to the reliable identification of cultivars and therefore their eventual use for different research programmes.

The objective of the present work was to analyse the morphological organisation of the existing diversity in the germplasm of the *D. cayenensis/D. rotundata* complex in Benin using morphological descriptors in order to:

- Identify the different cultivars existing in the germplasm collection on the basis of morphological and flowering characteristics and to establish the correspondence between the different names assigned to the same cultivar.
- Constitute cultivar groups based on morphological resemblance.
- Define identification keys for the cultivar groups.
- Identify the cultivars which are widespread, those which are rare and also those endemic to a specific zone or locality.
- Conceive some hypotheses on both the origin and evolution of identified cultivars.
- Identify, on the base of tuber shape, the cultivars which can be mechanised in modern agricultural enterprise.

Material and methods

Material

The germplasm studied consisted of 560 accessions of yams belonging to *D. cayenensis/D. rotundata* complex. This was collected in 1996 and 1997 in different localities of Benin, and maintained as field collection

at the International Institute of Tropical Agriculture near Cotonou (Dansi et al., 1997)

Methods

Cultivation

Tuber sets were planted by 15 February every year in a randomised block design with three to six plants per accession, depending on the seed-tuber availability. The distance between two mounds was fixed at 2 m to avoid the mixture of stems. Aerial vegetative parts were monitored between March and August. Tubers were harvested only once in December for both early (two-harvest) and late (one-harvest) maturing cultivars and were described from December to January. Late cultivars usually take 9–10 months to mature, while early cultivars can be already harvested 6 months after planting.

Morphological descriptors

The descriptors used (Table 1) are mostly the ones selected by Hamon (1987) as the most pertinent for the identification and description for the cultivated yams encountered in West Africa and are among those recommended by Martin & Rhodes (1978) and IPGRI/IITA (1997). Because farmers' knowledge can be capitalised by geneticists and breeders (IPGRI, 1993), some additional characters (tuber striping or streaking, presence of specific figures, presence of coloured bands etc.) which are frequently used by farmers for identification were also considered. Quantitative characters were deliberately avoided because of phytosanitary problems leading to differences in the plants' development. However, to give an idea of the leaf and tuber dimension, some average values (based on twenty healthy leaves and on three or more tubers according to their availability) are indicated for each cultivar. The length of the leaf is the one of the main vein, while the width was measured at the widest part of each leaf.

For each plant, the flowering capacity, the sex, the fructification capacity were recorded. General appearance of the plant and the tuber has also been of capital importance for the cultivar's identification.

Multivariate analysis

Each character was scored as a Bernoulli variable (0, 1). If a character was present, it was scored '1', if

Table 1. Morphological descriptors

Stem	Leaf	Tuber
colour of the young stem	colour of the young leaf	presence of corn
colour of the adult stem	colour of the adult leaf	tuber shape
thorniness of the stem	leaf shape	roughness of the tuber surface
colour of the thorns	opening state of the limb	hairiness of the tuber
size of the thorn	undulation of leaf border	thorniness of the roots
spot at the thorn's base	coloured zone on petiole	colour of the tuber skin
roughness of the stem	upward leaf lobes folding	colour of tuber flesh
stem's internode length	downward folding of leaf lobes	thickness of the tuber skin

absent '0'. Using this methodology, 79 morphological variables were created and a binary matrix compiled. This matrix was used to generate a dendrogram based on simple matching coefficient of similarity, using the Unweighted Pair-Group Method with Arithmetic Average (UPGMA) provided by the computer program NTSYS-pc, version 1.8 (Rohlf, 1994).

Results and discussion

Cultivar classification and correspondence between names

Morphological analysis based on aerial and underground organs has shown significant diversity within the cultivated yams of the *D. cayenensis/D. rotundata* complex. As expected, not all the accessions collected do correspond to distinct cultivars. Many of them, although recorded under various names were morphologically identical and therefore clustered together, hence allowing the establishment of the correspondence between the different names (Table 2). In total, 90 morphological types (morphotypes or cultivars) were found within the collection. Some accessions which farmers considered as different, have been sometimes classified together for the simple reason that they were so similar that it was difficult to find a reliable and stable morphological trait to discriminate between them. This means therefore that there are certainly a few more cultivars in the collection than we have identified. This shows, as expected, some limits in the utilisation of morphological characters in yam classification. Farmers experienced in yam germplasm identification recognised that about 5% of the attributes used are others than morphological ones and are mainly concerned with the organoleptic traits and the

flesh odour. All this denotes how important it will be to recourse to isozymic and molecular markers to refine this classification.

Certain cultivars such as 'Banioure', 'Almon', 'Kinkerekou' and 'Oroutanai', have been collected under various different names. This can be explained by their high yielding and excellent organoleptic qualities which have made them well appreciated and which have facilitated their spread among different ethnic groups. On the other hand, some cultivars such as 'Morokorou' and 'Agogo', although widely spread, are known under a very limited number of names. This is due to their restricted movement mostly within the same ethnic group such as the Bariba. For other cultivars, it is either the consequence of an on-going genetic erosion or of recent domestication.

Cultivar groups and identification keys

The cultivated yams can be subdivided in two classes: Early maturing (two harvests) class and late (one harvest) maturing class. Using the criteria of morphological resemblance between cultivars, 26 cultivar groups have been constituted. A group is defined as "a very particular cultivar or set of morphologically similar cultivars such that the intragroup variability is lower than the intergroup variability". The major characteristics of each cultivar group are cited below (Table 3). When there are many names, the cultivar groups are named by using the most frequent name or the most simple one. In the text, the groups' names are written in capital letters.

The variability of the different groups, the cultivars classified in each group as well as the average dimensions of their leaf and tuber are listed in Table 4. Five cultivar groups are entirely homogenous, eight

Table 2 List of the different morphotypes identified within the germplasm

Nos	Principal name	Ethnic group	Other names
1	Agangan	Ba	
2	Agogo	Na	
3	Ahimon	Ba	Sabi sagui, (Ba); Atchikakana, Heleabalo, Wetanam, Yoloukpa, (Lo); Akpantajo, Noudosse (Yom); Chambaabou, Taamaniakou, Troupeti (Nat); Kiwa sawa (Bo); Sotoboua (MF); Abo (Ad), Kakatili (Na); Miniehoun, Nehou, Tiniete (Ber); Eyonounon (Kot)
4	Akpazin	MF	Gibangbe (Na); Aye, Aroukpe (Ba); Assinakpeina (De); Iketile (Lo)
5	Alakissa	Na	Ikeni (Na); Bonousse (Ba), Kanlin (Adj)
6	Ala n'kojewoue	Na	Oboti, Gbidoko (Na)
7	Androki	Na	
8	Ankoloman	Lo	
9	Antawororou	Ba	Assi (Ba)
10	Assabone	Mb	
11	Baniakpa	Ba	
12	Banioure bagarou	Ba	Bononwirou (Ba)
13	Banioure montogue	Ba	B. yinteguerou
14	Banioure oloukobi	Ba	B. oloukaba, B. souan Wirou worou, Guini wogu (Ba); Outchankouehan, Damoko (Na); Banije (Peu); Woutantabou (Wam); Kiwa (Bo); Komopeina (Nat); Nouatonhon, Nwotowou (Ber); Soutra (Nat); Ofegui (Na)
15	Baridjo	Bo	
16	Boki	Peu	
17	Bonakpo	Ba	
18	Brizi	De	Tounouhe (Lo); Tchinguita, Tchinguibou (Nat); Wissakosso (Bo); Kounkounou (Ba); Esseadjinakou, Okoubou (Na)
19	Danwari	Ba	Kpakara (Ba); Hele abalo, Kotokiliana (Lo); Troupeti (Nat)
20	Deba	Ba	Nadeba, Gninoubokononkamion (Ba); Agada (Na); Assinadaha (Yom)
21	Djatouba	Na	Sokoun okpa (De)
22	Djikpiri	Ba	
23	Djiladja	Na	
24	Dikpiri	Ba	Moussougoussou (Ba)
25	Douba yessirou	Ba	Satouma (Ba); Wonkaabou (Wam); Nifawoun (Ber)
26	Doundoua	De	Igangan (Na)
27	Effourou	Na	
28	Feni	Na	
29	Gbera	Ba	
30	Gnalabo	MF	Aguida, Nam (Na)
31	Gnawoukoko	Bo	
32	Gnidou	Na	Agbantchounnonhin (MF); Daguidagui (Na); Doyesserou (Ba); Idjitedetedeke (Kot)
33	Gnifokpado	MF	
34	Guena	Bo	
35	Guirissa	Ba	Siwo koumassi (Bo)
36	Hounbonon	MF	
37	Ihdonou	Ba	
38	Issouagatou	Na	

Table 2. (continued)

Nos	Principal name	Ethnic group	Other names
39	Kagourou	Ba	Keke, Kokoro aghessi (MF); Tambiaha (Yom)
40	Kangni	MF	
41	Kee	Ba	Kea
42	Kinkerekou	Ba	Assourou, Awaya, Kagourou, Kokorogbanou (Ba); Kpadjibakowokpo, Wohounko (Na); Assinabaro (Yom); Kpakagnina, Ategue, Tchitchekoua, Nounihana, Nugnia, Tchigana, Tawouma.
43	Kokone	Ba	Kokowoude (MF); Kolekloe (De)
44	Kokouma	Ba	Kpehindje, Kpinhinkpinhin (Na)
45	Kologo	Lo	Gambârrougninon (Ba); Gbomina (De); Tchamba (Nat)
46	Kouragouroko	Ba	
47	Kpanhoura	Ba	Djirissa, Guihiwoga, Kpanhan, Tam-bakassou (Ba)
48	Kpirou kpika	Ba	
49	Kponan	Ba	
50	Kratchi	MF	Bakpanatini (Kot)
51	Laboko	MF	
52	Makpawa	Ba	
53	Maretassou	Ba	
54	Monji	MF	Akpawnanaye (Kouye-kouye (19))
55	Nonforwou	Nat	Dodo (MF); Gaketeie (Ani); Obawawoua (peu); Gbroudo (Ba); Odoe, Olodo (Na);
56	Nindouin	MF	Ewe (Bo)
57	Morokorou	Ba	Woho (Ba); Anago (Na)
58	Noualaye	Bia	Effoun, Lafoun (Na); Magbanatini (Kot); Tchambaafa, Yassi (Nat); Tchimehoum (Ber); Towoumbou (Wam);
59	Ofegui	Na	
60	Omoya	Ba	
61	Orountani	Peu	Adani (Ba); Akpekpe, Fananan, Kablitona, Koudjou, Mafobo, odo, Omoule (Na); Bebetinga, Peya (Ber); Koumassi nonbou (Wam); Koumassi kpeina (Nat); Tchoutchounga (Bo);
62	Orouyinsingue	Ba	Nondapechi (Nat); Ounonyahoun (Mb)
63	Ossoukpana	Ba	Agoua (Na); Akpantao (Yom); Biwokou, Wirou fanrou, Yaissourou (Ba)
64	Ourtchoua	Ba	Sekizan, Hossangui (Ba); Yaokononmon (Nat)
65	Ouwonpeotina	Nat	Wonmaaka (Wam); Tampihoun (De)
66	Piedje	Ber	
67	Porchehbin	Peu	Mareworoukorou (Ba)
68	Singou	Ba	Gonin, Singan (Ba); Nonwonnilibo, Nonwonnibou (Nat)
69	Soagoua	Ba	Fakoni (Wam); Sirigui (Ba)
70	Sobasson	Ba	Dinonyale, Inoutieleyagansori (Mb); Nonfonnanan (Nni),
71	Sogodo	MF	
72	Soussouka	Ba	Angbaobe, Koumagou (Ba); Dissoussoude (Mb); Taoumanin (nat); Sossorasse (yom); Soussouksi, Yessoutia (Ber); Nampro, Wokourou (Wam);
73	Soussoumin	Ba	
74	Soussou souanbou	Ba	
75	Tabane	Ba	Kabanoude (MF); Kandi, Komtan, Kpanantantangi (Na)
76	Tam-sam	Ba	Iberegnese (Ba)
77	Terfounto	Lo	

Table 2 (continued)

Nos	Principal name	Ethnic group	Other names
78	Terkokonou	Ba	Teroukpogorou (Ba)
79	Tognibo	MF	Glazoue (MF)
80	Walassi	Lo	
81	Wama	Yom	
82	Wolouchatabim	Peu	Ewotolo (Lo); Wajabin (Ko)
83	Wossou	Bo	
84	Yahou	Bo	
85	Yaka	Na	
86	Yakarango	Ba	Alossola (Lo); Sossouhan (Yom)
87	Yoble	Na	
88	Yoube	Na	
89	Youyouedota	MF	
90	Yorou tassou	Ba	

Abbreviations: Ad - Adja; Ani - Ani; Ba - Bariba; Ber - Berba; Bi - Biali; Bo - Boko; De - Dendi Kot - Kotokoli; Lo - Lopa; Mb - M'belimin ou Nbermin; MF - Mahi et Fon; Na - Nago; Nat - Natouba; Nni - Naténi; Peu - Peulli; Yom - Yom; Wam - Wama.

are heterogenous only at the tuber level and 13 are heterogenous for both aerial and underground traits.

Three groups (ALAKISSA, BADIOURE and BARIDJO) classed as late maturing yams contain some early-maturing cultivars which cannot be classified otherwise due to the similarity of the aerial part of these different groups and secondly by the fact that they are most often grown as late maturing cultivar (harvested once a year) for better organoleptic qualities. In order to facilitate the identification of the cultivar groups, we have separately constructed a schematic identification key for both classes of late (Figure 1) and early (Figure 2A, B) maturing cultivars. The validity of the identification keys has been tested on most accessions and all the tested individuals have been easily classified.

The only one cultivar classified in the group TAM SAM remains peculiar and very different from the others. It is dwarf, unarmed, with very small leaves and very small male flowers and always with some non-chlorophyllous branches and/or some half-chlorophyllous leaves, clearly indicating that a chloroplast mutation has occurred. This cultivar presents exactly the same tuber characteristics as that of 'Tabane' and it ranks also in last position after 'Tabane' in terms of leaf size. It is likely that Tam Sam has been derived from 'Tabane' due to chloroplast mutation. The fact that these two cultivars have been shown to be genetically close based on molecular analysis of genomic DNA fingerprints using AFLP markers (Mignouna et

al., 1997) corroborates well with our hypothesis on their genetic relatedness based on morphology.

Based upon our cluster analysis (Figure 3), accessions were separated into two major clusters according to the colour of the tuber flesh. Hence, on the one hand, MAKPAWA, ALAKISSA and BARIDJO with yellow or yellowish tuber flesh cluster together. On the other hand, the remaining groups with white or rarely red-spotted flesh constitute another cluster. MAKPAWA and ALAKISSA, the two groups characterised by the absence of waxiness (white powdery exudate) cluster together. Considering the grouping at a similarity level of 0.8 (80%) seven cultivar groups (BADIOURE BARIDJO, KOKOROGBANOU, MONDJI NONFORWOU, TABANE, TAM SAM) appeared well identified and isolated. The cultivar 'Maretassou' previously classified in the ANTAWOROROU group appeared separate due to the small size of its leaves compared to the cultivars clustered in this group. All the other groups were separated into different clusters. At a higher level of the similarity, the sub-division of the group SOUSSOU into three parts show the high level of diversity within this group. The association of the cultivar 'Danwari' with the group GNIDOU is not surprising. In fact, apart from the presence of a large spot at the thorn's base in 'Gnidou', both are similar at the aerial level and are female. The association of Terlounto (GNALABO) with OURTCHOUA is not expected. How can the existence of the groups which are heterogenous only at the tuber level be explained?

Table 3. Major morphological characteristics of the cultivar groups

Cultivar groups	Major morphological characteristics
AGOGO	Young stem reddish, branches green with red and round spot at the base; adult stem thorny with brown thorn and spot. Leaf large, blackish, embossed and elongate with long and pointed lobe. Tuber variable.
AHIMON	Stem smooth, light green and little thorny. Leaf medium-sized, thick, cordiform and light green. Tuber medium-sized, yellowish and finely striate. Roots very thorny.
ALAKISSA	Stem green, smooth and very thorny without pruinescence. Leaf very large, thick, round and opened with smooth border. Tuber of variable shape with ligneous corm and yellow flesh. Roots unarmed.
ANTAWOROROU	Stem red purplish, smooth and very thorny. Leaf blackish green with red veins and red spot on the petiole. Tuber long and cylindrical. Roots thorny.
BANIOURE	Stem little thorny and very branched; branches whorled. Leaves small, elongate, green and whorled. Tuber long, medium-sized and more often curved. Roots very thorny.
BARIDJO	Stem very rough, thorny and multicoloured (green, blue and brown spotted). Leaf cordiform, thick, embossed and green blackish with very undulate border. Tuber very branched.
DIKPIRI	Stem smooth, green bluish and thorny. Leaf round, opened and green bluish with smooth border. Tuber cylindrical and sometimes branched. Roots unarmed.
DOUBA YESSIROU	Stem smooth and dark green with brown thorn and brown spot. Leaf medium-sized, slightly elongate, thick and blackish with very undulate border and round lobe. Tuber irregular and branched. Roots thorny.
GNALABO	Stem smooth, green and thorny. Leaf green with medium-sized and broad lobes curved inward like a funnel. Tuber regular (not branched).
GNIDOU	Stem smooth and very thorny, large and thick spot at the thorn's base. Leaf dark-green with undulate border and long lobe. Tuber regular, long, smooth and cylindrical. Roots thorny.
KOKOROGBANOU	Stem green, thorny and very rough. Leaf large and cordiform with undulate border. Tuber either globular, short, long, regular or branched.
KPANHOURA	Stem rough, green and very little thorny with very thorny branches. Leaf very large, cordiform, thick, embossed and blackish with undulate border and round lobes. Tuber long and branched. Roots few thorny.
KPONAN	Stem smooth and unarmed. Leaf green and cordiform. Tuber long and cylindrical; Roots unarmed.
KRATCHI	Stem smooth, pale green and very thorny with large, thick and undulate spot at the thorn's base. Leaf pale green and elongate with round lobes and smooth border. Tuber rarely branched. Roots unarmed.
MAKPAWA	Stem smooth, green and very thorny without pruinescence; thorns curved upward. Leaf round and opened with smooth border. Tuber with yellowish flesh and variable shape.
MONDJI	Stem smooth and very thorny; thorn big without spot at the base. Leaf cordiform. Tuber big and long. Roots generally very thorny.
MOROKOROU	Stem very thorny, rough, striated and green purplish; long and brown thorn with brown spot at the base. Leaf green, long and large with long and pointed lobe. Tuber big, smooth and cylindrical. Roots thorny.
NONI-ORWOU	Stem very smooth, bluish-green and almost unarmed with big, long and light green cataphylls. Leaf elongate, opened and green bluish with smooth border and round lobes. Tuber massif or long with pointed tip.

Table 3. - (continued)

Cultivar groups	Major morphological characteristics
NOUALAYE	Stem smooth, green and thorny. Leaf long and large with long and pointed lobe and very long petiole. Tuber long. Roots few thorny.
OURTCHOUA	Stem green, smooth and thorny. Leaf small and dark-green. Tuber of variable shape.
PORCHEHBIM	Stem little smooth, green bluish and thorny. Leaf light-green, medium-sized and elongate with smooth border. Tuber regular and medium-sized. Roots few thorny.
SOUSSOU	Young stem reddish; adult stem rough and very thorny. Leaf dark green with lobe curved outward. Tuber long of variable shapes. Roots most often very thorny.
TABANE	Stem green, rough and thorny. Leaf dark green, small and elongate with undulate border. Tuber short of variable shape.
TAM-SAM	Stem dwarf, green, smooth and unarmed. Leaf very small. Tuber short, conical and depressed at its base.
TERKOKONOU	Young stem reddish; adult stem purplish, very rough, longitudinally striate and very thorny with big, reddish and coalescent thorns spotted at the base. large cataphylls. Leaf thick, green, embossed and cordiform with round lobe. Tuber long and branched. Roots very thorny.
TOGNIBO	Stem green, very rough, thorny and striated with very large foliar cataphyll. thorn large and short with large spot at the base. Branches whorled. Tuber cylindrical. Roots with few thorns.

By comparing the morphology of the tubers for each of the concerned groups, three hypotheses can be ventured.

– *Shape-based selection from an initial clone.* This is relevant to the groups PORCHEHBIM and KOKOROGBANOU (both homogenous for the aerial part) containing some cultivars always producing a set of tubers of a specific and different shape, and others producing uniform tubers of one or another of the associated shapes. It is therefore likely, that during the successive vegetative multiplication from the original type, there has been a fixation of one or the other of the different shapes therefore producing individuals which differ by their tuber. Hence, in the group PORCHEHBIM, cultivar 'Porchehbim' (with regular and medium-sized cylindrical tubers) might be derived from 'Wolouchahabim' (with a big and irregular tuber supporting some regular and medium-sized cylindrical ones) while in KOKOROGBANOU the cultivar 'Brizzi' (globular tubers) seems to be derived from 'Otoukpana' (a fan-shaped tuber associated with one or two globular tubers).

– *Somatic mutation in an initial clone.* It is highly probable, that during successive vegetative multiplications occurring over a very long period, some somatic mutations appeared affecting the general structure (striation, roughness etc.) of the tuber of a given initial clone. This has led to some morphologically different types but with a similar genetic background. Cultivar belonging to the same groups, and which differ from one another only by such characters might be the result of such evolutionary process.

– *Descendants of the same original parent.* Tubers of cultivars belonging to the groups BARIHO, TABANE and ALAKISSA (all homogenous for the aerial part) are so different that it is difficult to imagine a process such as shape-based selection or somatic mutation to explain their diversity. These cultivars are surely genetically different but with a very close background and probably have been domesticated among the progeny of the same original parents.

The fact that farmers recognise (without giving a precise example) that some cultivars have appeared spontaneously is in favour of our two former hypotheses. Further studies will be carried out using

Table 4. Structure of the cultivar groups and reproduction biology of the different cultivars

No	Cultivar groups	NA	NC	Intragroup variability		cultivar names	Ea	LL cm	LW cm	TS cm	Reproductive biology		
				aerial part	tuber						sex	flowering	fruit- setting
G 1	AGOGO	29	4	heterogenous	heterogenous	Agogo	P	10	6.6	71	F	poor	none
						Guanwoukoko	P	10	6.6	71	F	poor	none
						Soagona	P	10	6.6	80	-	-	-
						Wossou	P	10	6.6	78	F	poor	none
G 2	AHIMON	45	2	homogenous	heterogenous	Ahimon	P	11	5.5	46	FMO	profuse	high
						Feni	P	11	5.5	46	M	profuse	-
						Kee	P	11	5.5	58	F	profuse	high
G 3	ALAKISSA	12	3	homogenous	heterogenous	Agangan	P	13	12	73	M	profuse	-
						Alakissa	T	13	12	51	M	profuse	-
						Doundoua	P	13	12	72	M	profuse	-
G 4	ANTAWOROROU	10	3	heterogenous	heterogenous	Antawororou	P	11	6.5	78	-	-	-
						Djikpiri	P	11	6.3	77	F	poor	none
						Marelassou	P	8.5	4.5	34	-	-	-
G 5	BANIOURE	38	4	homogenous	heterogenous	B.bagarou	P	8.3	4.5	72	F	poor	none
						B. oloukobi	T	8.3	4.5	65	F	poor	none
						B.montogue	P	8.3	4.5	73	F	poor	none
						Walassi	P	8.3	4.5	69	-	-	-
G 6	BARIDJO	9	3	homogenous	heterogenous	Baridjo	P	8.8	6.3	62	M	profuse	-
						Ofégui	T	8.8	6.3	40	M	profuse	-
						Ouwonpeotina	T	8.8	6.3	60	M	profuse	-
G 7	DIKPIRI	2	1	homogenous	homogenous	Dikpiri	P	8.2	8.2	68	F	poor	-
G 8	DOUBA YESSIROU	16	2	homogenous	heterogenous	Ankpoloman	P	10	6.3	55	F	medium	low
						Douba yessirou	P	10	6.3	55	F	medium	low
G 9	GNALABO	17	3	heterogenous	heterogenous	Assabone	T	07	5.5	35	M	medium	-
						Gnalabo	T	8.5	7.2	45	F	poor	none
						Terfounto	T	10	6.8	32	-	-	-
G 10	GNIDOU	36	1	homogenous	homogenous	Gnidou	P	10	7.5	72	FMO	profuse	high
G 11	KOKOROGBANOU	63	14	homogenous	heterogenous	Akpazin	T	9.6	7.5	32	M	profuse	-
						Brizi	T	9.6	7.5	30	M	profuse	-
						Baniakpa	T	9.6	7.5	39	M	profuse	-
						Bonakpo	T	9.6	7.5	35	M	profuse	-
						Deba	T	9.6	7.5	33	M	profuse	-
						Kinkerekou	T	9.6	7.5	35	M	profuse	-
						Kpiroukpika	T	9.6	7.5	34	M	profuse	-
						Kokone	T	9.6	7.5	38	M	profuse	-
						Kologo	T	9.6	7.5	48	M	profuse	-
						Omonyia	T	9.6	7.5	35	M	profuse	-
						Ossoukpana	T	9.6	7.5	33	M	profuse	-
						Youeyouedota	T	9.6	7.5	32	M	profuse	-
						Singou	T	9.6	7.5	33	M	profuse	-
						Yakarango	T	9.6	7.5	36	M	profuse	-
G 12	KPANHOURA	10	2	homogenous	homogenous	Kpanhoura	P	13	9.5	67	M	profuse	-
G 13	KPONAN	12	1	homogenous	heterogenous	Kponan	P	11	8.8	78	M	profuse	-
						Laboko	P	11	8.8	55	M	profuse	-
G 14	KRATCHI	25	2	homogenous	heterogenous	Kratchi	T	11	5.2	37	F	profuse	none
						Kangnin	T	11	5.2	37	F	profuse	none
G 15	MAKPAWA	2	2	heterogenous	heterogenous	Makpawa	T	8.3	8.3	49	-	-	-
						Sogodo	T	5.5	5.3	53	-	-	-

Table 4. (continued)

No	Cultivar groups	NA	NC	Intragroup variability		cultivar names	Ea	LL cm	LW cm	TS cm	Reproductive biology		
				aerial part	tuber						sex	flowering	fruit-setting
G 16	MONDJI	51	11	heterogenous	heterogenous	Ala n'kojehoue	P	9.7	8.4	69	M	profuse	-
						Danwari	P	10	7.6	45	F	profuse	high
						Djiladja	P	9.8	6.8	53	F	profuse	medium
						Effourou	P	8.8	5.4	65	F	profuse	medium
						Gnifokpado	P	9.3	6.9	68	F	medium	low
						Monji	P	9.2	6.7	71	F	medium	low
						Nindouin	P	9.8	6.5	72	M	profuse	-
						Oroutanai	P	10	8.8	85	M	profuse	-
						Piedje	P	9.9	7.2	70	F	medium	low
						Yoble	P	9.8	6.8	68	F	medium	low
						Yoube	P	9.8	6.8	60	F	medium	low
G 17	MOROKOROU	29	2	heterogenous	heterogenous	Morokorou	P	12	5.8	78	F	poor	none
						Kokouma	P	12	5.8	78	F	poor	none
G 18	NONFORWOU	23	4	homogenous	heterogenous	Boki	P	11	8.5	78	F	profuse	low
						Djatouba	P	11	8.5	60	F	profuse	low
						Nonforwou	P	11	8.5	55	F	profuse	low
G 19	NOUALAYE	22	1	homogenous	homogenous	Nonforwou	P	11	8.5	63	M	profuse	-
						Yoroutassou	P	12	8.4	78	M	profuse	-
G 20	OURTCHOUA	21	3	heterogenous	heterogenous	Nouilaye	T	8.5	4.9	51	M	medium	-
						Gouroko	T	6.1	5.2	32	M	medium	-
						Ourtchoua	T	6.1	5.2	32	M	medium	-
G 21	PORCHEHBIM	11	2	homogenous	heterogenous	Sobasson	T	6.5	5.3	33	M	profuse	-
						Porchehbim	T	10.8	6.7	36	M	profuse	-
						Wolouchahabim	T	10.8	6.7	69	M	profuse	-
G 22	SOUSSOU	48	11	heterogenous	heterogenous	Androki	P	8.6	6.5	71	-	-	-
						Gibera	P	11.5	9.1	70	F	poor	none
						Guena	P	8.8	5.2	68	-	-	-
						Guirissa	P	11.4	5.8	69	-	-	-
						Issou agatou	P	8.2	8.2	69	F	poor	none
						Orounginsingue	P	12	6.2	71	M	profuse	-
						Soussouka	P	8.5	4.9	77	M	profuse	-
						Soussounin	P	6.8	5.7	72	M	low	-
						Soussou soumbou	P	8.5	4.9	78	F	medium	low
						Wama	P	10	5.7	68	-	-	-
						Yahou	P	10	5.4	68	M	profuse	-
G 23	TABANE	16	5	homogenous	heterogenous	Hombonon	T	7.1	4.1	33	M	profuse	-
						Ildonou	T	7.1	4.1	33	M	profuse	-
						Kagourou	T	7.1	4.1	33	M	profuse	-
						Tabane	T	7.1	4.1	33	M	profuse	-
						Yaka	T	7.1	4.1	33	M	profuse	-
G 24	TAM SAM	1	1	homogenous	homogenous	Tam sam	T	4.3	2.5	33	M	profuse	-
G 25	TERKOKONOU	6	1	homogenous	homogenous	Terkokonou	P	10.7	7.5	80	M	profuse	-
G 26	TOGNIBO	6	1	homogenous	homogenous	Tognibo	P	10	9.6	72	F	poor	none

Abbreviations: NA - Number of Accessions; NC - Number of Cultivars; Ea - Earlyness; P - early maturing; T - late maturing; LL - Leaf Length; LW - Leaf Width (average of 20 observations); TS - Tuber Size (average of 3 observations); F - Female; M - Male; O - Monoecious; - no flowering

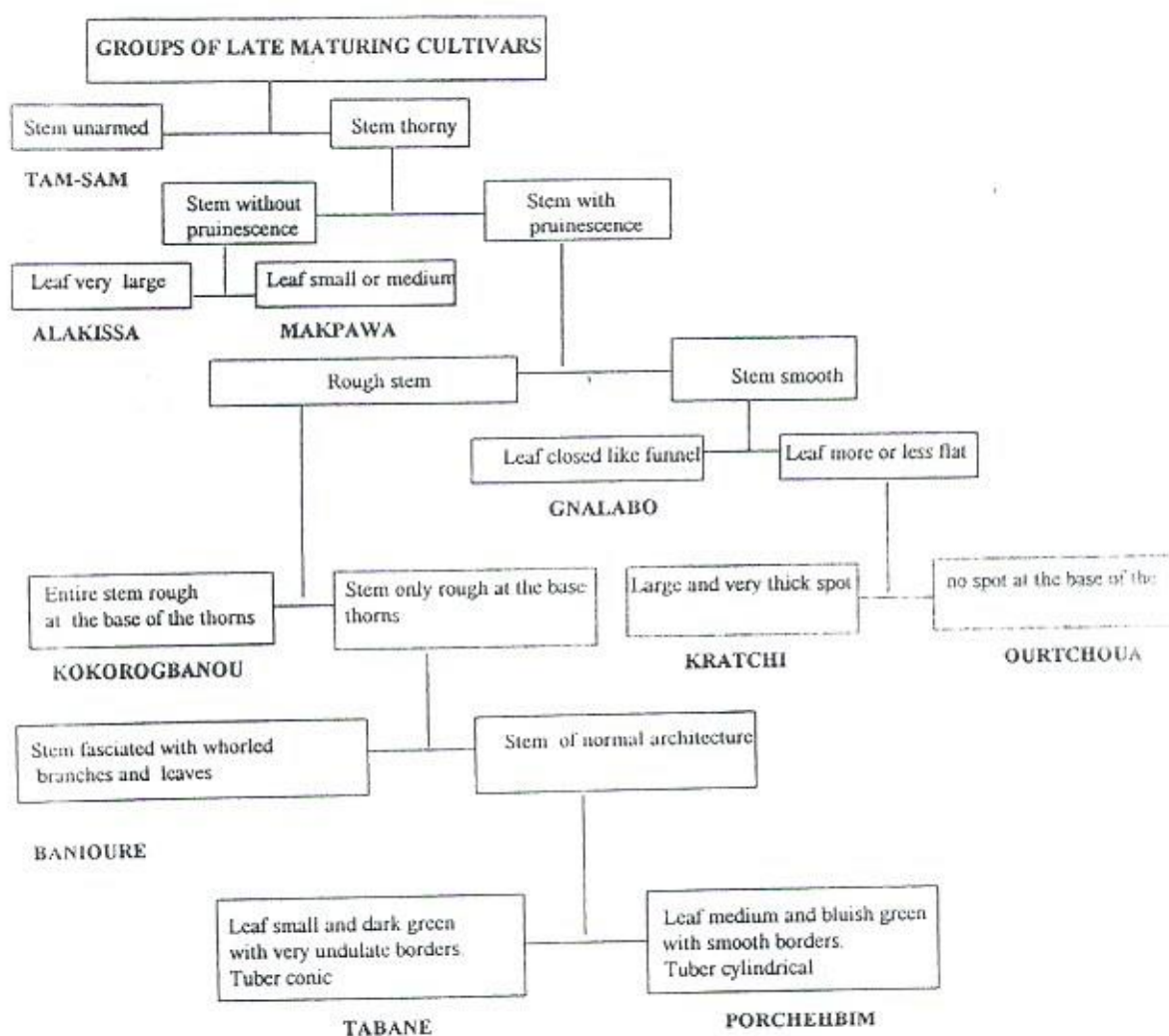


Figure 1. Identification key for late maturing groups.

molecular DNA markers to test the above-mentioned hypotheses.

Relationships between cultivated species and their wild relatives

There is no longer any doubt that all the cultivated forms of the *D. cayenensis*/*D. rotundata* complex are the products of an ancient or more or less recent domestication of the wild species. Farmers are unanimous about this fact and even if it is rare nowadays, this domestication process is still in progress in certain villages (Dumont & Vernier, 1997). Moreover, some isozymic (Hamon, 1987) and molecular (Terauchi et al., 1992) studies have indicated that four major species (*D. abyssinica* Miège, *D. praehensilis* Benth.,

D. burkilliana Miège, *D. mangelotiana* Miège) are likely at the origin of the complex. An exploration carried out by Zoundjiekpon & Tio-Touré (1992) has already allowed to determine the geographical distribution of these species (Hamon et al., 1995). Due to the absence of a collection of wild yams species in Benin, and in order to compare the different cultivars identified in the germplasm with the wild species, we have surveyed different savannahs, forests and gallery forests throughout the country for an *in situ* study of the morphological diversity of the wild related species.

D. mangelotiana has not been encountered during our exploration. This species, whose presence has never been reported in Benin, remains unknown to the farmers and none of the cultivated forms is similar to it.

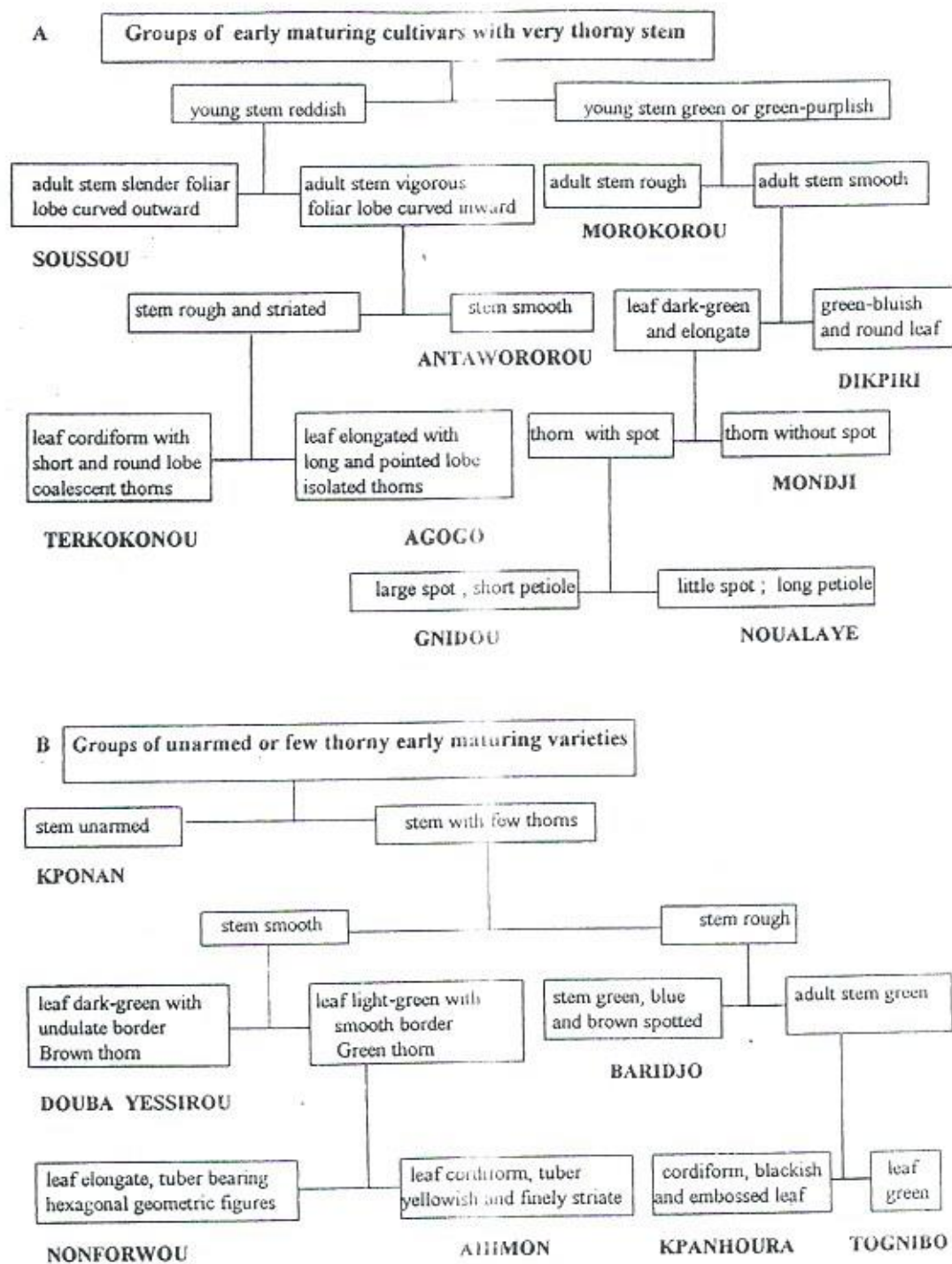


Figure 2. Identification key for early maturing groups.

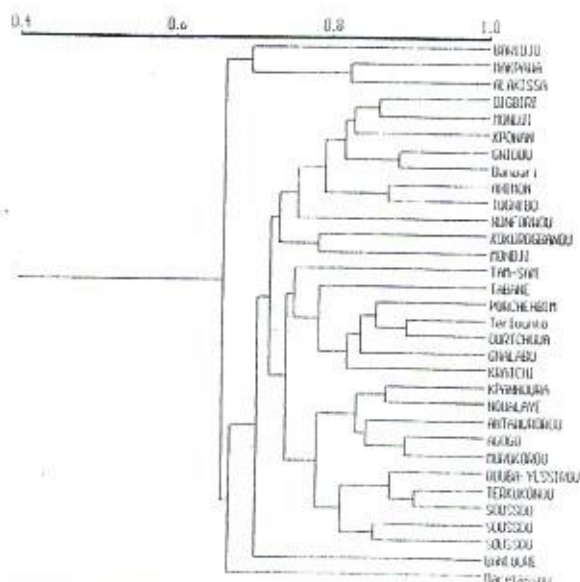


Figure 3. UPGMA dendrogram of yam germplasm based on simple matching coefficient of similarity. The axis on the top refers to similarity level.

D. togoensis is widely spread throughout the country. However, although recognised by the farmers as wild yam, it is never harvested (due to its long and fingerlike tuber) for nutritional or domestication purposes. Its contribution to the complex is very hypothetical since none of its characters have been found within the cultivated forms. Moreover, it has always appeared as distinct in all molecular (Hamon, 1987; Terauchi et al., 1992) and cytogenetic (Hamon et al., 1992) analyses carried out so far.

D. burkilliana is very rare and we have not seen it during our survey. However, morphological observations of two individuals from IITA's forest associated to the literature data (Miège, 1952; Burkill, 1960; Hamon et al., 1995) and the information gathered from farmers show that this species is at the origin of cultivars belonging to the groups ALAKISSA and MAKPAWA.

Although morphologically diverse, all the individuals of *D. praeheensis* encountered in the forest remain built on the same model: thick and green blackish leaf with undulated border and long acumen, very thorny root, very thorny stem, male flowers with sweet fragrance. These traits can be also recognised within the cultivated forms in many cultivars ('Oroutanai', 'Nindouin', 'Ala'nkojehoue') or cultivar groups (AGOGO, ANTAWOROROU, DOUMA YESSIROU, GNIDOU, MOROKOROU SOUSSOU, TABANA, TERKOKONOU). It is therefore possible that

these cultivars may be the domestication products of *D. praeheensis*.

Restricted to but widespread in the northern savannahs of the country, *D. abyssinica*, well known to farmers under the name of Dika, is the most diverse species. Various foliar shapes, from the round type to the long one, have been encountered. The thorniness of the stem as well as of the root vary widely from unarmed to very thorny. The morphology of the tuber is also very diverse. However, certain traits remain constant for all the observed individuals: pale or light green foliage, smooth stem, thorn without or with a little spot at the base. Many cultivars classified in the ten cultivar groups AHIMON, BANIOURE, DIKPIRI, KRONAN, MONDI, NONFORWOU, OUKTCHOUA, PORCHEBIM and TAM SAM are morphologically very similar to *D. abyssinica* and might have been domesticated from this species.

Three cultivar groups (KOKOROGBAROU, KPANHOURA, KRATCHI) combine the characters of both *D. praeheensis* and *D. abyssinica* and might be interspecific hybrids.

The case of BARIDJO is more peculiar. The leaves and the flowers of the cultivar classified in this group are neither of the 'praeheensis' type, nor of the 'abyssinica' type. Leaves are much more likely to be of the 'burkilliana' type while the stem is typically of the 'praeheensis' type. There is a strong chance that they have been derived from gene flow between *D. praeheensis* and *D. burkilliana*. In fact, although male flowering is prolific, the cultivars of this group have unexpectedly shown a very low fertility when used in controlled crosses trial carried out at IITA (unpublished data). Moreover, the clone 'Ofegui' introduced in Cote d'Ivoire under the name of 'Baniakpa' (although *Baniakpa* is a KOKOROGBAROU) and which had been analysed together with other cultivated and wild species using isozymes markers (Hamon, 1987) appeared to be linked to 'Yaobadou' ('Alakissa' in Benin), 'Kangba', *D. burkilliana* and *D. praeheensis*. These two different results strongly support our hypothesis that this group represented throughout the African 'yam belt' is of hybrid origin.

Geographical distribution of the cultivar groups

Although they also exist in the north-west of the country, the groups AGOGO, AHIMON, BANIOURE, DOUBA YESSIROU, MOROKOROU and SOUSSOU as well as the cultivar 'Danwari' and 'Oroutanai' of the group MONDI are mainly found in the north-

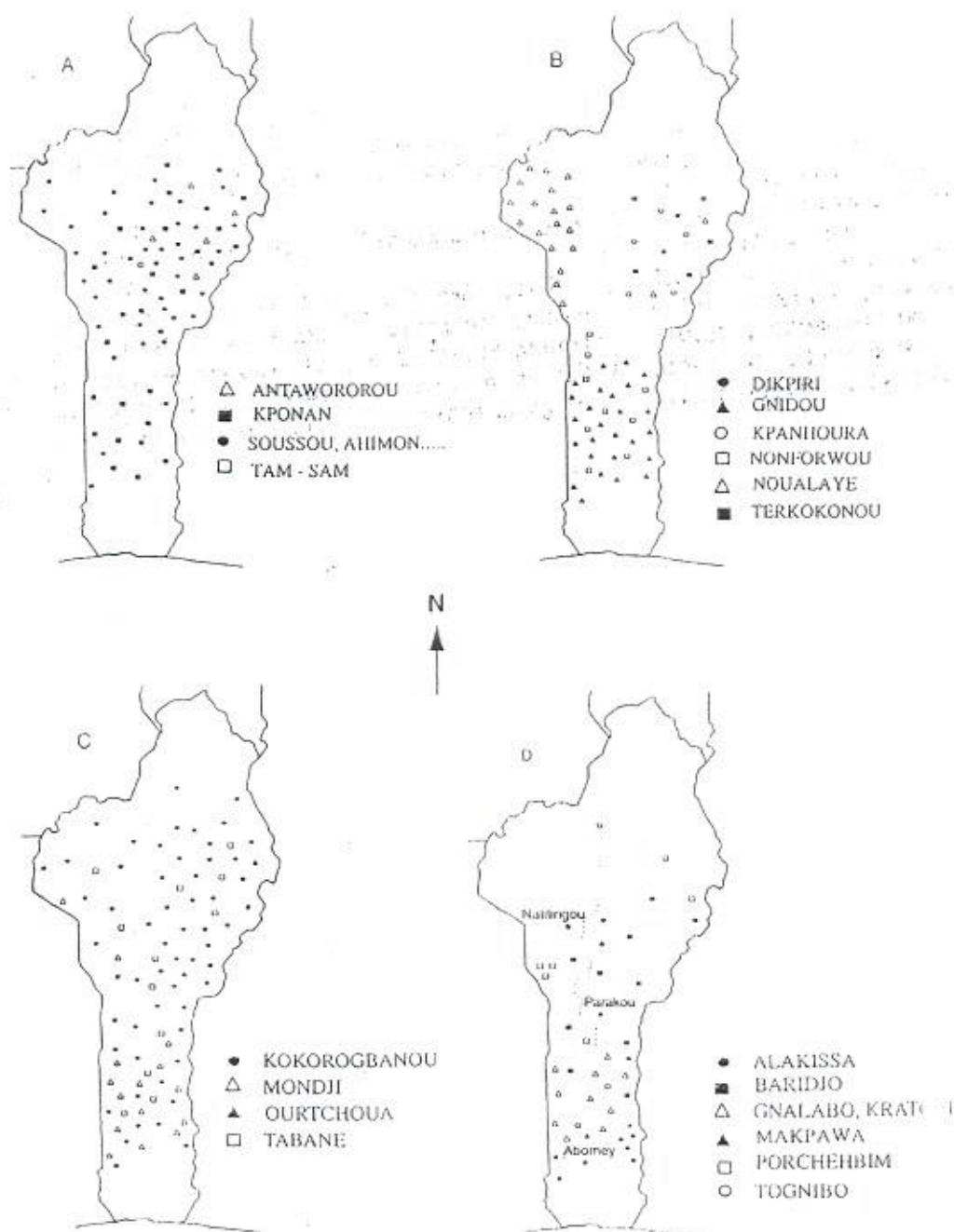


Figure 4. Geographical distribution of the varietal groups.

east (Figure 4A). They have the same distribution zones and are very common in local agriculture. The remaining cultivars of *MONDJI* are located in the south (Figure 4C) and are getting less and less common. 'Tam sam' (TAM SAM) and 'Antawororou' (ANTAWOROROU) seem endemic of Sonounon and

Macrogourou (two villages of Benin) respectively. 'Antawororou' is the product of a recent domestication of *D. praehensilis* (Dansi et al., 1997) and is gradually invading the Bariba (ethnic group) land due to its high yield and its appreciated taste. 'tam-sam' is nothing more than the rest of an endangered genotype.

The other cultivars of ANTAWOROROU have almost disappeared.

KPONAN is composed of two cultivars with distinct distributions: 'Kponan' in the north and 'Laboko' in the south of the country. Although each of them is still easily found in its production zone, both are becoming rarer.

NOUALAYE (Figure 4B) is endemic to the extreme north-west where it is widely spread while DIKPIRI, KPANHOURE and TERKOKONOU, strictly of the Bariba land, are disappearing. GNIDOU and NONFORWOU are mostly located in the south. 'Gnidou', product of a recent domestication of *D. praehensilis* (Dansí et al., 1997), is still spreading due to its high yield. From the NONFORWOU group, only the cultivar 'Nonforwou' is at an acceptable level. The others are disappearing.

KOKOROGBANOU (Figure 4C) is the most widely distributed group due to the adaptability to different environments of many cultivars belonging to it. Some cultivars of this group, sensitive to pests and diseases and environment such as 'Brizzi', 'Kologo' and 'Kokone', are becoming extinct. Presently, an intensive yam production based on some cultivars of this group is being developed in the centre of the country (Bassila zone) for the yam chips trade. MAKPAWA, constituted by two cultivars ('Makpawa' at the north and 'Sogodo' at the south) has almost disappeared. BARIDJO, OURTCHOUA and TABANA contain some isolated cultivars that appear in a critical situation.

The groups ALAKISSA, GNALABO, KRATCHI, and TOGNIBO are mostly located in the south (Figure 4D). All cultivars put together only 'Alakissa', is not threatened. The others are undergoing severe reduction. 'Alakissa' is endemic to the south-east forestry zone (Pobè, Sakété, Kétou) where it has been locally domesticated according to the farmers. PORCHEHBIM is mainly linked to the ethnic group Peulh and it is therefore mostly found in their encampments. However, its production is taking on new dimensions in the ethnic group Lokpa area (South of the North-west) for the yam chips trade.

In summary, the cultivar groups have distinct distributions and extents. With regard to genetic stability, it appears that very few cultivars are in a good situation. A significant genetic erosion is going on. The reasons for such genetic erosion (sensitivity to nematodes, fungi and viruses, intensification of cotton production, no perfect cultivar exchange between farmers, discovery of the high yielding cultivar 'Gnidou' in the south; lack of seed tubers) have already been cited

(Dansí et al., 1997) and a participatory approach for the sustainable conservation of the genetic resources has been proposed in the Benin context (Dansí et al., 1998).

From the juxtaposition of all the different maps (Figure 4), it emerges that:

- almost all the cultivars which are presumed to have been domesticated from *D. abyssinica* are located in the northern part of the country which is the ecological growing zone of this species. In the other hand, the cultivars mainly located in the south are mostly those considered to be related to *D. praehensilis* and *D. burkilliana* or presumed hybrids between these species and *D. abyssinica*. Therefore a correlation between domestication and production zones is apparent.
- there are mainly two diversity zones of the cultivated forms: the north-west and south of the country.

These two observations are important to take into consideration if one proposes to design an *in situ* conservation project for both cultivated forms and their related wild species.

Flowering and fruit-setting

Only one (MAKPAWA) of the 26 cultivar groups is non flower-bearing. Eleven are strictly male, eight are female and six mixed (male, female and monoecious). Among the 90 morphotypes identified in the germplasm, 11 are non flower-bearing, 33 are female, 44 are male and 2 are complex with male, female and monoecious clones (Table 4). The rate of the non-flowering cultivars (12.25%) is relatively low if compared to difficulties reported with flowering by many authors (Akoroda, 1983; Dokou, 1973; Segnou et al., 1992; Zoundjihékpon, 1993) for the cultivars belonging to the *D. cayenensis/D. rotundata* complex. Within the flowering cultivars, the flowering intensity appears a genotypical characteristic and seems to be a function of sex. In fact, the lower flowering rates were observed within the female plants. Hence, cultivars such as 'Agogo', 'Baniouré', 'Dikpiri', 'Gnalabo', 'Gnawounkoko', 'Issou agatou', 'Kangni', 'Kokouma', 'Kratchi', 'Morokorou', 'Moussougoussou', 'Tognibo' and 'Wossou', all females, rarely flower and produce only a limited number of flowers (one to five). Apart from 'Soussounin' which has relatively low flowering, all the male flowering cultivars, whenever they flower, produce flowers in abundance.

An intraclonal variation in sex determination has been observed in the cultivar 'Ahimon', where two individuals derived from the same original tuber have flowered as male and female respectively. Moreover the flowering in 'Ahimon' and 'Gnidou' seems to be complex. They are either male, female or monoecious with sometimes both male and female flowers arranged on the same inflorescence axis. 'Mondji' and 'Soussou' are bisexual cultivars with male and female clones. In the particular case of 'Soussou', a correlation seems to exist between sex and geographical origin. In fact, all the accessions collected in the North-West region have flowered female whereas those collected from the North-East were all male. Among the 33 females, only those flowering profusely ('Ahimon', 'Danwari', 'Gnidou') have a good fruiting rate and could be used as female genitors in genetic and breeding programmes. The others set either few or no fruits.

The great majority of the male cultivars are late (one harvest) and combine at the same time most favoured agronomic and organoleptic characters, such as good storability, high yield, high number of tubers per mound, good quality of yam chips, good poundability etc. Therefore a better knowledge of their floral biology will be useful since some of them could serve as male genitor in breeding schemes.

In summary, our observations show once again that the flowering and the sex determination in yam is complex and unlikely to be under simple genetic control. They are probably the result of an interaction between genotype and numerous physiological and environmental factors, such as planting date and growth of the plant (Edem, 1975; Dumont, 1977; Trouslot, 1983; Faderin, 1991); light intensity and photoperiod (Bulle-Legrand, 1983); climatic conditions (Dumont, 1977a; Touré & Ahoussou, 1982); the nature of seed tuber (Zoundjihékpon, 1993); nutrition (Dumont, 1977; Faderin, 1991) and the growth hormones (Chailakhyan, 1979; Bulle-Legrand, 1983; Dian, 1989).

For a better knowledge of the reproductive biology of Beninese yams, three research lines should be considered in the near future:

- evaluation of the male cultivars' fertility and comparison between fertility rate and flowering intensity
- study of the cross-compatibility between male and female in order to detect eventual pre-zygotic or post-zygotic reproduction barriers.

- analysis of the relationship between DNA content, ploidy level, flowering capacity and fertility of the different cultivars.

Some growth anomalies that are characteristic of different cultivars

Some characteristic growth anomalies have been observed in certain cultivars and we ignore the reasons:

- tubers of the cultivar 'Agogo' always contain a characteristic internal cavity and which is at the origin of its name.
- at the beginning of the sprouting, tubers of cultivar 'Baniouré' (rarely 'Agogo') always develop a flat stem composed of variable number (two to ten) of merged regular stems (fasciation) which at the height of one meter, separate and grow individually. This leads to a particular architecture (whorled leaves and branches) characteristic of the group BANIOURE.
- during our surveys, farmers reported a frequent tuber formation at the stem's nodes (when in contact with the soil) in the cultivars 'Agogo', 'Douma yessirou', 'Gnidou', 'Nonforwou', 'Ourtehoua' and 'Soagona'. We observed a production of callosities at the nodes of certain plants of these cultivars in the collection. Unfortunately, these callosities had not correctly grown for the simple reason that all the plants were staked and the stems were not in contact with the soil.
- seed-tubers of cultivar 'Soagona' planted in February 1996 grew normally and produced tubers as expected, but without degeneration of the original tuber. Both newly formed and the planted tuber were harvested in December 1996. Planted again in February 1997, the original seed-tuber germinated and produced big tubers. This property had been already reported to us by farmers in the south of the country for the cultivars 'Nonforwou' and 'Mondji'.

Tuber shape and aptitude to mechanised harvesting

A yam cultivar can be appropriate for mechanised agriculture only if it produces a regular (non-branched) short tuber. Aiyelari & Akoroda (1996) have indicated a maximum tuber size of 35 cm. The morphological analysis of the tubers and the numerical data of Table 4 show that the early maturing cultivars produce long and often branched tubers for which no mechanisation can be envisaged. In general, the shortest tubers are

encountered with the late maturing cultivars. Taking into account the criteria indicated above and the size variation (sometimes 10 cm or more) of the elongated tubers between years, only two cultivars ('Brizi' and 'Otoutkpana') can be mechanised. The tuber of the cultivar 'Brizi' is globular and can also be easily manually harvested. 'Otoutkpana' very close to 'Brizi', has a globular tuber associated with a short and fan-shaped one. As mechanisation is always done for economic purposes, only high yielding cultivars can be recommended. If one takes into account this aspect, none of the cultivars can be mechanised unless a larger tuber size is tolerated. 'Brizi' and 'Otoutkpana' being low-yielding cultivars.

Situation of Benin yams in comparison to those of some other countries

In order to know whether Benin's yams are restricted to the country or not, using field collections at IITA and in Togo, we have carried out a comparative analysis between Benin's germplasm and that of some other countries. The International Institute of Tropical Agriculture (at Ibadan) has, for its yams research program, a considerable collection of cultivated forms (*D. cayenensis/D. rotundata* complex) composed of accessions of different countries: Nigeria, Togo, Burkina Faso, Ghana, Guinee and Cameroon. Only the germplasm from Cameroon and Guinee is representative. The other countries are poorly represented. Although Togo has lost a great part of its accessions during recent political events, those maintained in the field collection at Lomé (Institut National des Cultures Vivrières, INCV) still remain interesting. From both the results of our observations in these different collections and those published on Ivory Coast germplasm (Hamon, 1987), it emerges that:

- Eight cultivar groups (AGOGO, ANTAWOROROU, BANIOURE, DIKPIRI, DOUBA YESSIROU, KPANHOURE, OURTCHOUA, TOGNIBO) seem to be restricted to Benin.
- All the cultivar groups from Togo were found in Benin and quite often under the same names. Conversely, not all cultivars from Benin were identified in Togolese germplasm. The eight cultivar groups (cited above) which are found mostly in the north-east of Benin are absent in Togo. This is due to the imperfect transfer of cultivars in the north of Benin (from the north east to the north west) and which will allow their introduction into Togo by the neighbouring ethnic groups.

- Six cultivar groups are present in all areas under investigation. These are: ALAKISSA, BARIDJO, GNALABO, KOKOROGBANOU, KPONAN and MONDJI, corresponding to YAOBADOU, BANIAPKA, KRENGLE, KROUKROUPA, KPONAN and SOPERÉ respectively as described from Côte d'Ivoire (Hamon, 1987).

AHIMON, NONFORWOU and MOROKOROU are also present in Togo as well as in Nigeria. According to the farmers, 'Ahimon' originated from Nigeria and was introduced into Benin by the Bariba ethnic group (north-east).

Conclusions

This study has allowed a complete morphological characterisation of the cultivated yams (*Dioscorea cayenensis/D. rotundata* complex) of Benin. The proposed keys facilitate the identification of the cultivar groups. The established synonymy of the diverse names given to the same cultivar will allow at last a more efficient use of the germplasm. However, many questions still remain, and may be solved with isozyme and/or DNA markers. *Dioscorea cayenensis/D. rotundata* complex being polyploid, the determination of the different cultivars' ploidy level will be necessary allowing a better orientation for crosses in future breeding programmes.

To better respond to the need of the scientific community, an identification key of the cultivars within the cultivar groups as well as a practical directory is being prepared for the cultivated yams (*D. cayenensis/D. rotundata* complex) of Benin.

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