

# Endogenous Perception of the Diversity of Taro (*Colocasia esculenta*) Cultivars Produced in Benin

Richard Mahouton Akplogan<sup>1,\*</sup>, Gilles Habib Todjro Cacaï<sup>1</sup>, Corneille Ahanhanzo<sup>1</sup>,  
Serge Sètonджи Houédjissin<sup>1</sup>, Ernest Renan Traoré<sup>2</sup>

<sup>1</sup>Department of Genetic & Biotechnology, University of Abomey-Calavi, Cotonou, Benin

<sup>2</sup>Department of Biology & Plant Physiology, University of Ouagadougou, Ouagadougou, Burkina Faso

## Email address:

akploganrichard@yahoo.fr (R. M. Akplogan), caghat@yahoo.fr (G. H. T. Cacaï), corneillea@yahoo.com (C. Ahanhanzo),

sergesth01@yahoo.fr (S. S. Houédjissin), traoreernest@yahoo.fr (E. R. Traoré)

\*Corresponding author

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**Abstract:** Taro is a staple in many southern countries and an ancient starchy crop consumed by more than 400 million people. Taro is a tuber crop which the endogenous knowledge is still poorly investigated in scientific research of Benin despite its importance in food security. This work aims to evaluate farmers' knowledge of diversity, production constraints, cultural practices for tubers conservation and the management of taro seed system through 15 villages in three townships in southern Benin. The methodology consisted of participatory research through individual and group interviews. Information such as production constraints, variety recognition criteria were taken into account by group. At the individual level, data relating to socio-demographic aspects (age, sex, socio-cultural group), the seed system, tuber conservation techniques were collected. The results revealed two (02) taro cultivars; pink-fleshed taro and white-fleshed taro. The recognition of criteria varied from one socio-cultural group to another according to the group age ( $P = 0.00$ ). These criteria were leaf color, petiole color, tuber skin color and bud color. The selection criteria, seed availability and organoleptic quality of the cultivars varied with age ( $P = 0.000$ ) and socio-cultural group ( $P = 0.002$ ). These results can be directly used by a breeding program for the improvement of taro productivity in Benin.

**Keywords:** *Colocasia Esculenta*, Variety Diversity, Criteria of Preferences, Benin

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## 1. Introduction

Plant genetic resources for food and agriculture provide the biological basis for global food security and livelihoods for all people around the world [1]. They represent one of main components of biological diversity. Among these plant genetic resources are roots and tubers crops, whose nutritional value lies mainly in the fact that they are cheap sources of food energy like carbohydrates in developing countries. The energy they provide is about one third of that provided by an equivalent weight of cereals (rice, wheat) given the high water content of the tubers. However, the high yields of most root crops provide a much higher energy input per hectare per day than cereals [1]. Among the roots and

tubers crops, those of *Araceae* family are less interest but have a great value in food security. Only the edible such as taro and other are much cultivated in tropical and subtropical countries [2]. According to [3], taro is an ancient starchy crop consumed by more than 400 million people. In the Pacific, it provides between 15% and 53% of food energy [1], and is therefore of primary importance. It is rich in calcium, iron, vitamins, minerals and energy. It played an important medicinal roles such as intestinal transit, treatment of arterial hypertension and hepatic diseases by use of young leaves in Mauritius; eczema by its juice; boils and ulcers by corms in Madagascar [4]. Despite its socio-cultural and economic importance, taro is one of neglected research species in Benin and under used [5]. Likewise, it is confronted with the attack

of pests, parasites such as aphids, caterpillars, mealy bugs and viruses that cause significant damage [6]. Studies on taro diversity in Ghana [7]; in Burkina Faso [8]; in Togo [9] revealed low diversity in the sub-region. In Benin, no study integrating endogenous knowledge has been devoted to local varieties of taro. Studies [10] have shown that documentation of endogenous knowledge through ethnobotanical studies is important for the sustainable use of resources. Moreover a quantitative ethnobotanical study could allow to collect in a consistent way the information concerning the uses, the preferences of the products of the species [11]. It was for these different reasons that the present study on *Colocasia esculenta* is initiated and aims at documenting endogenous knowledge on taro production in Benin. Specifically, it is to inventory the local varieties, to identify the farmers criteria of varieties recognition and the criteria of varietal choice in the study areas.

## 2. Materials and Methods

### 2.1. Study Areas

The studies were conducted in southern Benin located between 6° 15 ' and 7° 30' north latitudes and meridians 1° 52 ' and 2° 36' east longitudes. With an area of 17019 km<sup>2</sup>, it is subjected to subequatorial climate characterized by two rainy seasons alternated by two dry seasons [12]. The rainfall is between 1100 mm and 1400 mm of rain. The temperature varies between 26° C and 28° C. The soil is variable from sandy to bar soils through vertisols. The population has 4,592,752 inhabitants according to INSAE (National Institute of Statistics and Economic Analysis). Agriculture is the first activity carried out followed secondarily by other activities such as breeding and fishing. The study area includes three (03) townships located in three (3) departments. The surveys were conducted in the townships (Dangbo, Sakété and Zè) of Benin. These townships are those where taro production is abundant (Figure 1).

### 2.2. Sampling and Data Collection

Fifteen (15) villages were selected on the basis of taro production after surveys of the deconcentrated structures of the Ministry of Agriculture, Livestock and Fisheries (MAEP). Information on farmer's knowledge of taro was collected using semi-structured questionnaires as describe [13]. Prospecting data were collected using a participatory approach in groups or individually at home or in fields between September 2016 and February 2017 from farmers of both sexes [14]. Farmers have been identified with the help chiefs of village or agents of the Communal Sector for Agricultural Development (SCDA). By township, five (05) villages were prospected. The number of farmers surveyed per village varies from eleven (10) to twelve (18). Information such as production constraints, variety recognition criteria were taken by group. At the individual level, data relating to socio-demographic aspects (age,

sex, socio-cultural group), the seed system, tuber conservation techniques were collected. In each village, tuber samples of available cultivars were collected from the field.

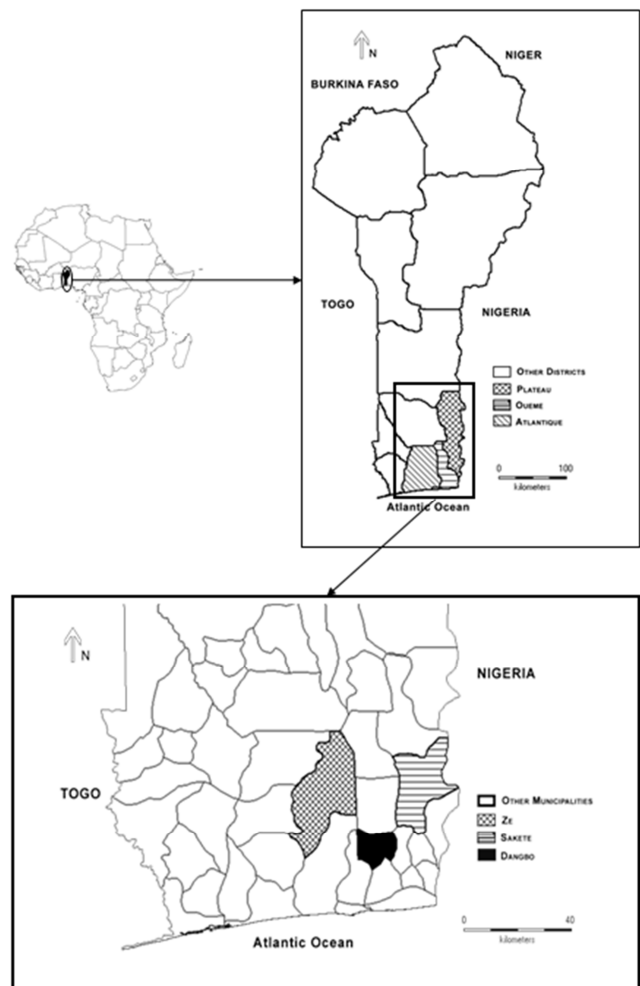


Figure 1. Study zone.

### 2.3. Statistical Analysis

The average number of local varieties per department, township and village was determined and the frequencies of some local varieties in the study area were calculated to evaluate the extent distribution by the descriptive statistics. Descriptive statistics were also used to calculate the frequency averages of the varietal recognition criteria to identify the most commonly used criteria in the study area. The relationship between cropping pattern, cropping practices, seed management, tuber storage and consumption, taro production constraints, gender, age and ethnic groups have been possible by the test t of ( $x^2$ ) and the binomial and multinomial logistic model. The XLSTAT version 2014 software was used for data analysis. Finally, various results obtained were represented in tables, figures and graphs using Excel workbook.

### 3. Results

#### 3.1. Socio-Demographic Data

In the study area 76.69% of farmers are men and 22.30% women. These respondents belong to three socio-cultural groups. These are Oueminnou from the township of Dangbo, the Nago from the township of Sakété and the Aizo from the

township of Zè. The age of the respondents ranges from 18 to 60 years old. Respondents whose age is strictly less than 30 years represent 13.07% of respondents, those whose ages are between 30 and 40 years represent 36.93% of respondents and those whose age is greater than or equal to 40 years account for 50% of respondents (Table 1).

Table 1. Typology of respondents.

Sociological characters		Percentage
Sex	Male	77.69%
	Female	22.30%
Age	< 30ans	13.07%
	[30 ans- 40ans]	36.93%
	≥ 40ans	50%
	< 10000 m <sup>2</sup>	86.92%
Cultivated surface	[10000 m <sup>2</sup> - 30000 m <sup>2</sup> ]	12.30%
	≥ 30000 m <sup>2</sup>	0.76%

#### 3.2. Varieties Diversity

Table 2 showed varietal diversity according to the respondents' perception revealed the existence of two taro cultivars in the study areas: the pink flesh cultivar and the white flesh cultivar (Figure 2). Based on the *P* value associated with Chi<sup>2</sup> tests, the identification of different

cultivars varied significantly from one year class to another ( $P < 0.0001$ ), whereas no significant difference was observed for one sex to another ( $P = 0.214$ ). Thus, all age classes were able to identify pink-fleshed taro. For white-fleshed taro, only respondents whose age was less than 30 years or greater than 40 years were able to identify it (Table 2).

Table 2. Logistic linear regression test of varietal diversity.

Factor	Level	N	Taro Pink	Taro White	Chi <sup>2</sup> (LR)	Pr > LR
Age	<30years	17	94.11%	5.88%	68.083	<.0001***
	[30-40years]	48	100%	0.00%		
	≥40 years	65	38.46%	61.53%		
Sex	Male	101	70.29%	29.70%	1.538	0.214 ns
	Female	29	65.51%	34.48%		

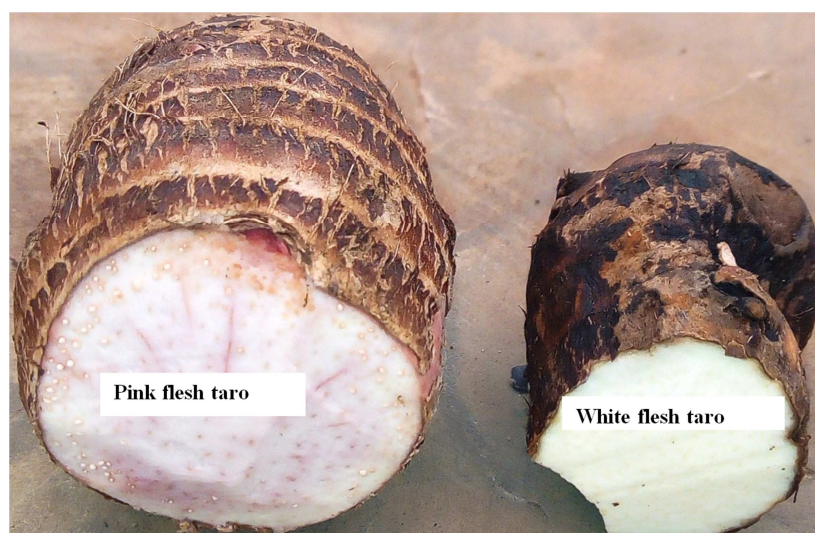


Figure 2. Morphotypes of taro.

#### 3.3. Criteria for Recognition

The recognition criteria revealed the existence of four criteria based on leaf color, petiole color, skin color and bud color. The Chi-square tests showed significant variation from one socio-cultural group to another ( $P = 0.000$ ), from one age

class to another ( $P = 0.000$ ), but no significant difference between the sex is observed ( $P = 0.223$ ). Thus, 86% of Aïzo use the color of the leaves, 14% use the color of the petiole, 85% of the Nago use the color of the skin of the tuber, 15% the color of the petiole, 32.5% of the Oueminnou use the color of the skin of the tuber and 67.5% use the color of the

bud as criteria of recognition of the cultivars. With respect to age groups, all respondents aged less than 30 years use leaf color, 54.16% of respondents between 30 and 40 years old use the color of the leaves, 18.75% use the color of the skin

tubers and 27.08% use the color of the petiole, 52.63% of respondents aged over 40 use the skin color of the tuber and 47.36% use the color of the buds (Table 3)

**Table 3.** Logistic linear regression of recognition criteria

Factor Level		CoL	PeCo	CoST	MBCo	Chi <sup>2</sup> (LR)	Pr > LR
Sociocultural groups	Aïzo	86%	0%	0%	14%	210.758	0.000
	Nago	0%	85%	0%	15%		
	Ouéminnou	0%	32.5%	67.5%	0%		
Age	<30 years	100%	0%	0%	0%	143.459	0.000
	[30-40 years]	54.1%	18.75%	0%	27.08%		
Sex	≥40 years	0%	52.63%	47.36%	0%	1.484	0.223
	Male	34.65%	33.66%	20.79%	10.89%		
	Female	27.58%	44.82%	20.68%	6.89%		

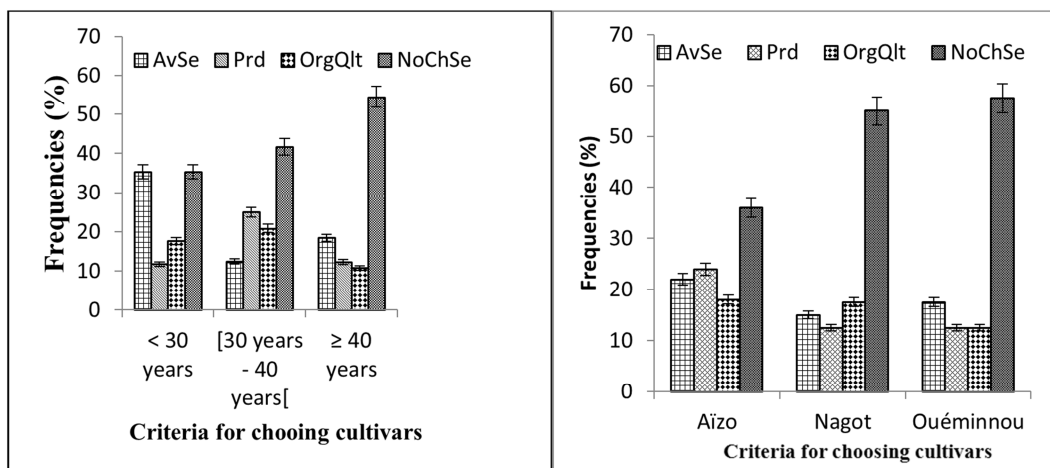
CoL: Color of the leaf, PeCo: Petiole color, CoST: Color of the skin of the tuber, MBCo: Main bud color

### 3.4. Criteria of Choosing Cultivars

The regression equations for crop selection criteria revealed that the choice of cultivars varied significantly from one age class to another ( $P = 0.000$ ) and from one socio-cultural group to another ( $P = 0.002$ ). The equations with the sex variable did not discriminate the best choice of cultivars ( $P = 0.324$ ) (Table 4). Thus, 35.29% respondents under 30 years choose the cultivars according to the availability of seeds, 11.76% choose them according to their productivity, 17.64% choose them according to their organoleptic quality and 35.29% have no choice of selection. Compared to the respondents aged between 30 and 40, 12.5% choose the cultivars according to the availability of seeds, 25% choose their productivity, 20.83% choose them according to their organoleptic quality and 41.66% have no choice of selection. Finally, compared to the respondents over 40 years of age, 18.46% choose the cultivars according to the availability of

seeds, 12.3% choose them according to their productivity, 10.76% choose their organoleptic quality and 54.46% have no choice of selection.

Compared with socio-cultural groups, 22% of "Aïzo" respondents choose the cultivars according to the availability of seeds, 24% choose them according to their productivity, 18% choose them according to their organoleptic quality and 36% do not have any selection. Compared to the "Nago" respondents, 15% choose the cultivars according to the availability of seeds, 12.5% choose them according to their productivity, 17.5% choose them according to their organoleptic quality and 55% do not have selection choice. Finally, compared to the respondents "Ouéminnou", 17.5% of them choose the cultivars according to the availability of seeds, 12.5% choose their productivity, 12.5% choose them according to their organoleptic quality and 57.5% have no selection choices (Table 4; Figure 3).



AvSe: Availability of seeds; Prd: Productivity; OrgQlt: Organoleptic quality; NoChSe: No choice of selection

**Figure 3.** Criteria for choosing cultivars.

**Table 4.** Logistic linear regression of selection criteria for cultivars.

	Beta	Standard error of B	B	Standard error	T (130)	Level P
OrdOrig.			20.516	19.170	1.070	0.286
Sex	0.0495	0.050	0.144	0.145	0.989	0.324
Age	0.508	0.109	0.162	0.035	4.646	0.000
Socio-cultural group	0.338	0.109	0.493	0.159	3.087	0.002

## 4. Discussion

Two taro cultivars identified based on the flesh color (pink and white) were reported by farmers in the study areas, indicating the existence of low taro diversity in Benin. This low diversity was also noted in Togo with the same cultivars [9]. This general finding is justified the most vegetative mode of reproduction noted within the species [3].

Four recognition criteria, including leaf color, petiole color, tuber skin color and bud color were identified to distinguish cultivars. These recognition criteria varied according to socio-cultural groups and age. Among these criteria, the skin color of the tuber and the color of the bud were used in Togo [9] and in Ghana [7]. In Burkina-Faso, the color of the petiole, the shape of the cormels, the size of the main corm and cormels, the number of cormels and flowering were the criteria for identification of taro by farmers [8]. This shows that the farmers distinguish by their own way the different taro cultivars.

In terms of selection criteria for cultivars, some farmers choose cultivars based on seed availability, productivity, and organoleptic quality. These identified criteria were highly influenced by age and socio-cultural group. Farmers under the age of 30 and those over 40 mostly use seed availability for the choice of cultivars as seed selection criteria, while those between the ages of 30 and 40 used mostly productivity. This could be explained by the fact that farmers over 40 years of age grow taro for profit. But the majority of farmers interviewed have no choice of selection. This shows that taro crop was not yet a priority for these farmers in the study area. This is also confirmed by the area planted which does not exceed 3 ha even in associated crops while other root crops such as cassava and yam go beyond 3 ha.

## 5. Conclusions

This study, which aimed to document endogenous knowledge on taro production in Benin, as part of a valorization of taro produced in Benin and has identified two (02) taro cultivars in southern Benin. Farmers use various criteria to recognize these two cultivars. These are leaf color, petiole color, tuber skin color and bud color. These included leaf color, petiole color, tuber skin color and bud color. The valorization of this culture is therefore essential by the implementation of in vitro culture techniques to improve seed quality and availability.

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