Original Research Article

Agromorphological purification of farmer's seeds and diversity of Corchorus olitorius Linn

ABSTRACT

Corchorus olitorius is commonly cultivated by household women for livelihood. No database has been found for gene bank tractability in Togo. This study develop a database of information on this neglected crop. Twenty seven accessions were collected in the 5 ecological regions in Togo, on which experiments were conducted. First experiment was an accession purification in order to access pure genotypes, second experiment was an Agro-morphological characterisation to give an identity to each genotype. RCBD design was considered with 3 replications and repeated in two ecological zones in Togo. The results showed accessions A24, A25 and A26 to be of pure source, other accessions were a mixed of genotypes. Qualitative data identified polymorphic characters among the genotypes, leaf margin was serrate (92.31%) or dentate (7.69%), with a Lanceolate or Ovate leaf shape, and a glossy (53.85%) and matte leaf surface (46.15%). Leaf colours were green (53.85%), dark green (38.46%), and light green (7.69%)); branching habits were either predominantly primary (92.31%) or predominantly secondary (7.69%). Five main clusters were structured from quantitative characters. Cluster II comprises only genotype1, which genetic distance is significantly isolated from other genotypes, this could be a good candidate for genetic improvement with genotypes from other clusters.The abstract should be concise and informative.

Keywords: Corchorus olitorius, purification, gene bank, diversity

1. INTRODUCTION

Biodiversity is the basis of food resources offered to the living world. According to [11], plant genetic resources for food and agriculture are the biological basis of global food security and provide livelihoods for all people on the planet. Plant genetic resources are important for plant breeding and solution to agronomic, agropastoral, and socio-economic problems. The incapacity to manage all this biodiversity tends to reduce the global food resources to a limited number of plant species [11]. These lead to the gradual genetic erosion of many cultivated species especially, neglected and underutilised species (NUS). Such species are found in particular tropical regions where secular traditions contribute to the conservation of these NUS [7]. This is the case of Corchorus olitorius (C. olitorius) which is an annual plant belonging to the Malvaceae family; erect up to 2–4 m tall [11] and is commonly called wild jute [20]. In many countries of the sub-Saharan region, this vegetable is mostly a source of income for women [11] and small households. Due to the richness of its young leaves in nutritional substances (vitamin C, provitamin A, mineral salts, proteins), C. olitorius could be a "powerful weapon" against nutritional deficiencies, especially in developing countries [18]; [7]. Therefore, this plant contributes in an essential way to food security by ensuring survival in times of scarcity and by providing rare nutrients in the food ration particularly in Africa [8]. Several studies across the world and in Africa have reported a high morphological and molecular diversity in C. olitorius [17]; [2]; [16]; [2]. According to [1] plant height, number of leaves per plant, number of branches per plant, leaf length, leaf width, fruit length, fruit diameter, and flowering are the main discriminating characteristics of Corchorus olitorius cultivars grown in Benin.

In Togo, Corchorus olitorius is known under the name "ademè" and mostly is used as leafy vegetable in human food. Despite the nutritional importance and socio-economic interest of C. olitorius, the research carried out so far is limited to incomplete inventories. Especially in Togo, research is at an embryonic stage. Scientific research conducted focused on the water deficiency stress [19], according to this author, C. olitorius varieties grown in Togo are highly sensitive to water deficiency stress. According to [3], C. olitorius is listed among NUS in the south of Togo (Ewe ethnic group). The national production of Corchorus olitorius is low to medium and represents 36% of the total leaf vegetable production behind Daucus carota (49%), Solanum macrocarpum (46%), Lactuca sativa (39%) and Lycopersicum esculentum (37%) [10].

The conservation and use of local plant genetic resources require the setup of an updated database on their diversity [11]. It is therefore needed to assess the diversity among varieties grown in Togo to build a database. This study focuses on the evaluation of the agro-morphological diversity of previously collected jute Nallow accessions from different ecological zones of Togo. It aims to contribute to a better knowledge of diversity in C. olitorius from Togo. This specifically involves: (i) identifying the different genotypes grown in Togo, (ii) Analyse the agromorphological variability among the accessions.

2. MATERIAL AND METHODS

2.1 Experimental site

This study was carried out in a multi-location trial. The first location was the Agronomic Experimental station of Ecole Supérieure d'Agronomie (ESA) characterized by an equatorial Guinean climate type with a bimodal pluviometric regime and an average annual rainfall of 1000 mm. The soil is ferrallitic and has a low rate of organic matter with a slope of 1% [9]. The second location was carried out in a rural environment, more precisely in the village of Yaokope (Latitude 7.56977; Longitude: 1.026 1) located in the region of the plateaux (Amou) with a climate straddling the sub-equatorial, equatorial and the humid tropical climate. The soils of the plateau region are ferralitic characterized by clayey soils, well drained with good water retention capacity and are relatively rich in organic matter ranging from 3 to 5%, and the vegetation is of forest type [12].

2.2 Plant materials

The plant material was made of 14 accessions collected from jute nallow producers in the five ecological zones within Togo (Table 2).

2.3 Experimental design

Two main experiments were considered in this study. The first experiment implies purification of 27 accessions collected from jute nallow producers. The second experiment was an agro morphological characterisation of genotypes identified from collected accessions. The Randomized Complete Block Design (RCBD) with 3 replications was used for each experiment, distance between plots and between block was 1m x 1m. The seeding rate was at 100 plants per plots with a distance between plants of 70 cm x 70 cm.

2.4 Agro-morphological evaluation

A total of 14 quantitative and 10 qualitative agro-morphological characters (Table 1) were used to describe the genotypes based on a jute nallow descriptor from [14].

Table 1. Summary of quantitative and qualitative Agro morphological parameter

Quantitative variables	Code	Qualitative variables	Code
Plant height (cm)	PlH	Stem color	SCo
Days to first flowering	DFF	Leaf color	LeC
Days to 50% flowering	DHF	Leaf margin	LeM
Leaf petiole length (cm)	LPL	Leaf surface glossiness	LeSG
Leaf blade length (cm)	LeBL	Leaf shape	LeS
Leaf blade width (cm)	LBW	Branching habit	BrH
Stem width (cm)	StW	Flowers color	FlC

Number of primary branches	NPB	Pod shape	PoS
Number of leaf for plant	NLP	Pods color at maturity	PoCM
Fresh leaf weight (g)	FLW	Leaf surface hairness	LSH
Dry Leaf weight (g)	DLW		
Pod length (cm)	PoL		
Number of seeds per pod	NSPo		
100 seed weight (g)	SeW		

2.5 Statistical data analysis

R software version 4.2.2 was used for the various analyses. Statistical analysis involved descriptive analyses to determine mean values of quantitative traits and frequencies for qualitative traits. The analysis of variance (ANOVA) and an analysis of the correlation matrix were conducted for all the agro-morphological characters ($P < .05$). The structure of the morphological diversity was assessed by a principal component analysis (PCA) and an ascending hierarchical classification (AHC) was carried out to group the accessions into different homogeneous classes.

3. RESULTS

3.1 Purification of accessions

Based on agro morphological characters, 13 distinct genotypes were identified from the 27 accessions collected within the different regions in Togo. Apart from accession A24 (Kohé) with genotype G8, A25 and A26 (Apédokoé) with genotype G5 which are each harvested from single plant, all other accessions are made of mixed genotypes (Table 2). Table 3 showed that genotype 1 had dark green leaf colour with glossy leaf surface, an ovate leaf shape and dentate leaf margin, genotypes from this plant had light green stem colour, are short in height with predominantly primary branching habit. Plants from genotype 2 had matte leaf surface with lanceolate leaf shape, serrate leaf margin and dark green leaf colour, they are medium in height with predominantly secondary branching habit and short leaf petiole length. Plants from genotype 3 had glossy leaf surface with ovate leaf shape and dark green leaf colour with serrate leaf margin. The plants are tall in height with predominantly primary branching habit. Plants from genotype 4 had matte leaf surface with ovate leaf shape and green leaf colour. The plants are medium in height with predominantly primary branching habit. Plants from genotype 5 had glossy leaf surface with lanceolate leaf shape, dark green leaf colour and serrate leaf margin. The plants are medium in height with predominantly primary branching habit and long petiole length. Plants from genotype 6 had matte leaf surface with lanceolate leaf shape and green leaf colour. The plants are tall in height with predominantly primary branching habit. Plants from genotype 7 had matte leaf surface with lanceolate leaf shape and light green leaf colour. The plants are tall in height with predominantly primary branching habit; Plants from genotype 8 had matte leaf surface with lanceolate leaf shape and green leaf colour. The plants are medium in height with predominantly primary branching habit. Plants from genotype 9 had matte leaf surface with lanceolate leaf shape and green leaf colour. The plants are medium in height with predominantly primary branching habit and long pod length. Plants from genotype 10 had matte leaf surface with ovate leaf shape and green leaf colour. The plants are tall in height with predominantly primary branching habit. Plants from genotype 11 had glossy leaf surface with lanceolate leaf shape and dark green leaf colour. The plants are medium in height with predominantly primary branching habit. Plants from genotype 12 had matte leaf surface with long leaf and lanceolate leaf shape. The plants are medium in height with predominantly primary branching habit. Plants from genotype 13 had matte leaf surface with lanceolate leaf shape. The plants are medium in height with predominantly primary branching habit. This plant presents the highest number of leaves (2009 leaves) with medium pod length.

Table 2. List of accessions collected in Togo

Accession	**Genotypes**	Localities of collection	Ecologic zones
A1	G5-G6-G10	Baguida (Lomé)	V
A2	G1-G2	Dalavé (Tsévié)	V
A3	G4-G10-G11	Tchitchinda (Kara)	II
A4	G2-G3	Ketao (Kara)	II
A5	G7-G12	Danyi elavanyo (Danyi)	IV
A6	G7-G10	Dzogbefeme (Adeta)	IV
A7	G6-G13	Hiheatro	III
A8	G05-G11	Koumondè (Assoli)	II
A9	G5-G13	Doukpergou	I
A10	G8-G9	Asrama (Notse)	III
A11	G7-G11	Marché d'Akodessewa (Lomé)	V
A12	G6-G10	Djagble	V
A13	G1-G8	Kusuntu (Kpalimé)	IV
A14	G6-G7	Tsevié (Atchanvé)	V
A15	G6-G7	Tsevié (Atchanvé)	V
A16	G4-G10-G6-G7-G8	Pya (Kara)	II
A17	G4-G10-G6-G7-G8	Lama (Kara)	II
A18	G4-G6-G7-G10-G1-G9	Yokele (Kpalimé)	IV
A19	G4-G6-G7-G10-G9	Dahinou(Kpalimé)	IV
A20	G4-G6-G7-G10-G1-G9	Tove (Kpalimé)	IV
A21	G4-G6-G7-G10-G1-G9	Kpodzi(Kpalimé)	IV
A22	G4-G6-G7-G10-G1-G9	Kpodzi (Kpalimé)	IV
A23	G2-G3-G7	Sondè (Sotouboua)	III
A24	G8	Kohe (Adidogomé)	V
A25	G5	Apedokoe (Adidogomé)	V
A26	G5	Apedokoe (Adidogomé)	V
A27	G2-G7-G11	(Dollardvert) Lomé	V

A: Accession, G: Genotype.

3.2 Qualitative data analysis

Based on qualitative characters (Table 3), all jute nallow genotypes had absent leaf surface hairiness, light-green stem colour with yellow flower, sub-cylindrical pod shape and Dark pod colour at maturity. There are 53.85% of the genotypes having green leaf colour, 38.46% of dark green leaf colour and 7.69% with light green colour. Leaf margin of 92.31% of the genotypes are serrate while 7.69% are dentate. A total of 53.85% of genotypes exhibited glossy leaf surface against 46.15% with matte leaf surface. The leaf shape was ovate for 30.77% of the genotype and 69.23% were lanceolate. Branching habit was predominantly primary (apical) for 92.31% of genotype and predominantly secondary (axial) for 7.69% (Figure 1).

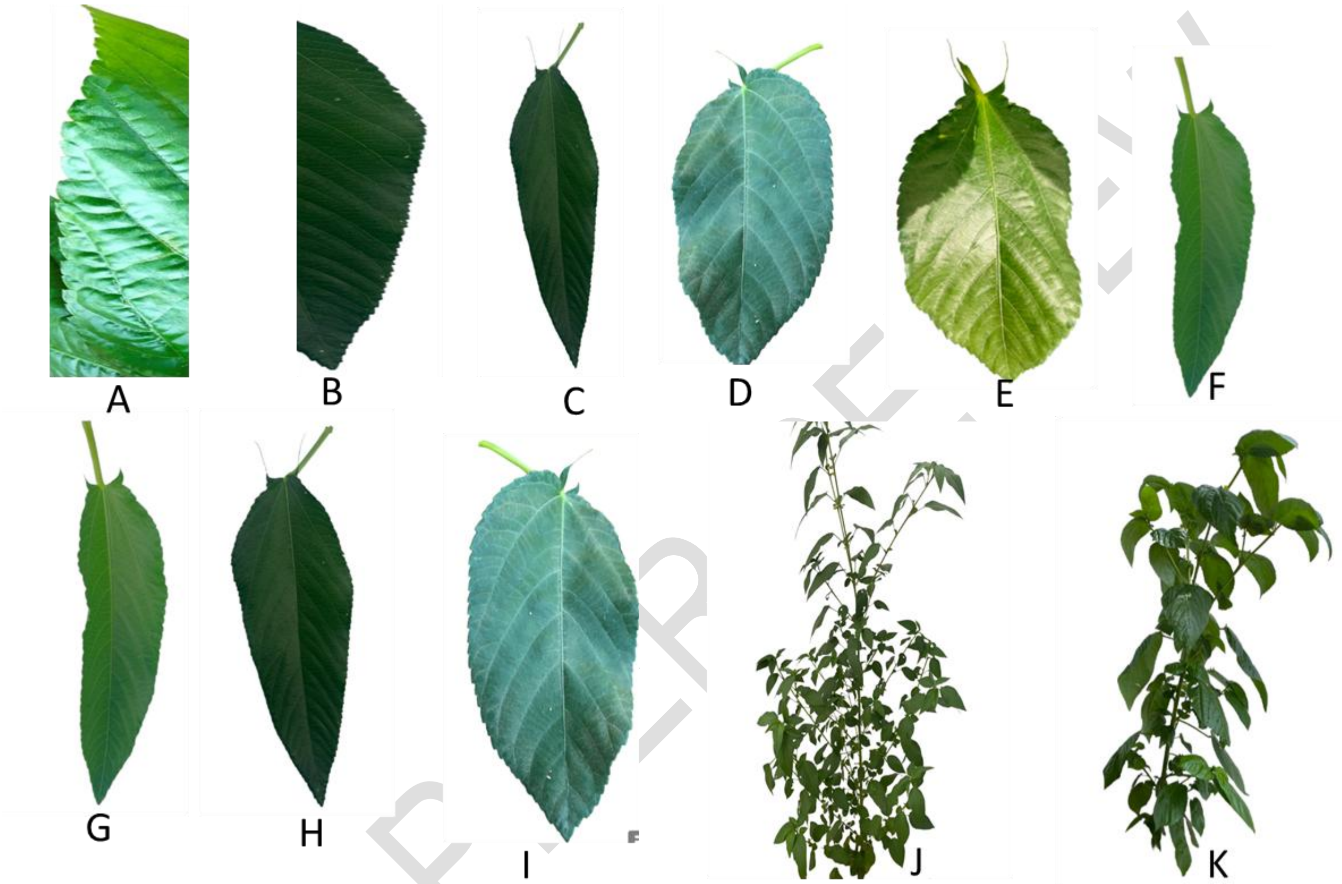


Figure1. Vegetative habit and leaf morphological traits of *C. olitorius*.

A: Dentate leaf margin; B: Serrate leaf margin; C- Lanceolate leaf shape; D: Ovate leaf shape; E: Glossy leaf surface; F: Matte leaf surface; G: Light green leaf colour; H: Dark green leaf colour; I: Green leaf colour; J: Predominantly primary branches; K: Predominantly secondary branches.

Table 3. Qualitative characters of 13 genotypes

Groups	Genotypes	Leaf color	Leaf margin	Leaf surface glosssiness	steam color	Leaf shape	branching habit	flowers color	Posd shape	pods color at maturity
GI	**G2**	Dark green	Serrate	Matte	Light-green	Lanceolate	PSB	Yellow	sub-cylindrical	Dark
	G5	Dark green	Serrate	Glossy	Light-green	Lanceolate	PPB	Yellow	sub-cylindrical	Dark
	G8	Green	Serrate	Matte	Light-green	Lanceolate	PPB	Yellow	sub-cylindrical	Dark
	G9	Green	Serrate	Matte	Light-green	Lanceolate	PPB	Yellow	sub-cylindrical	Dark
	G10	Green	Serrate	Matte	Light-green	Ovate	PPB	Yellow	sub-cylindrical	Dark
	G11	Dark green	Serrate	Glossy	Light-green	Lanceolate	PPB	Yellow	sub-cylindrical	Dark
GII	**G1**	Dark green	Dentate	Glossy	Light-green	Ovate	PPB	Yellow	sub-cylindrical	Dark
GIII	**G3**	Dark green	Serrate	Glossy	Light-green	Ovate	PPB	Yellow	sub-cylindrical	Dark
	G4	Green	Serrate	Glossy	Light-green	Ovate	PPB	Yellow	sub-cylindrical	Dark
GIV	**G6**	Green	Serrate	Matte	Light-green	Lanceolate	PPB	Yellow	sub-cylindrical	Dark
	G7	Light-green	Serrate	Matte	Light-green	Lanceolate	PPB	Yellow	sub-cylindrical	Dark
GV	**G12**	Green	Serrate	Glossy	Light-green	Lanceolate	PPB	Yellow	sub-cylindrical	Dark
	G13	Green	Serrate	Matte	Light-green	Lanceolate	PPB	Yellow	sub-cylindrical	Dark

PPB: Predominantly primary branches, PSB: Predominantly secondary branches

3.3 Descriptive statistics of quantitative characters

Significant variations were observed among genotypes. Days to first flowering varies between 29 to 46 days while days to 50% flowering varies between 26 to 60 days, plant height goes from 48.17 to 137.33 cm. Number of leaf per plant is from 189 to 4159 leaves with a fresh leaf weight between 20.86 to 101.67 and a dry leaf weight between 6.7 to 43.78. The longest leaf blade was of 13.52 and the shortest was of 7.08 while the width varies between 3.12 to 10.06 and a leaf petiole length between 2.3 and 5.96 (Table 4a). The number of primary branching are 4.33 for the lowest and 41 for the highest number with a stem width from 0.3 to 1.4 cm. Pod length varies from 3.47 to 7.14, with a number of seed per pod between 21 to 234 and a seed weight in a range of 117.8 to 205g (Table 4b).

Table 4a. Quantitative traits of the 13 genotypes

C	V	Leaf blade length (cm)	Leaf blade width(cm)	Plant height (cm)	Number of primary branches	Leaf petiole length (cm)	Days to 50% flowering (days)	Pod length (cm)
CI	**G2**	9.33^{a}	3.62^{d}	69.83^{f}	5.46^{h}	3.36^{b}	45.33^{j}	7.03^{c}
	G5	9.01^{a}	4.23^{a}	60.38^{f}	10.2^{h}	4.91^{c}	29.33^{k}	5.44^{f}
	G8	8.64^{a}	3.44^{d}	76.11^{f}	5.51^{h}	2.64^{b}	31.66^{k}	4.89^{b}
	G9	9.79^{a}	3.58^{d}	65.27^{f}	7.12^{h}	2.89^{b}	27^{k}	6.33^{c}
	G10	7.90^{b}	4.108^{a}	67.05^{f}	13.9^{f}	3.58^{b}	45^{j}	5.55^{f}
	G11	9.25^{a}	5.5^{a}	56.55^{b}	14.84^{f}	4.76^{c}	41.33^{f}	5.57^{f}
CII	**G1**	12.46^{c}	6.67^{e}	58.11^{b}	10.88^{h}	3.97^{a}	35.33^{f}	5.13^{f}
CIII	**G3**	8.52^{a}	5.45^{a}	64^{f}	20.65^{i}	4.88^{a}	59^{j}	4.89^{b}
	G4	7.405^{b}	4.22^{a}	73.66^{f}	20.6^{i}	4.68^{a}	39.33^{f}	3.64^{b}
CIV	**G6**	9.25^{a}	3.90^{d}	132.44^{g}	40^{i}	5.22^{c}	49^{j}	4.50^{b}
	G7	7.72^{b}	3.36^{d}	97.66^{g}	23.7^{i}	4.26^{a}	59^{j}	5.45^{f}
CV	**G12**	11.12^{c}	4.09^{a}	81.83^{g}	16.64^{f}	5.63^{c}	41^{f}	6.05^{c}
	G13	9.27^{a}	4.45^{a}	136.55^{g}	30.75^{i}	4.92^{a}	45.33^{j}	5.83^{f}

C: Cluster, V: Variable, a: Intermediate, b: Short, c: Long, d: Narrow, e: Wide, f: Medium, g: Tall, h: Low, i: High, j: Late, k: Early.

Table 4b. Quantitative characteristics of 13 genotypes cont.

Groups	Variable	Stem width(cm)	Fresh leaf weight (g)	Dry Leaf weight (g)	Days to first flowering (days)	100 seed weight (g)	Number of seeds per pod	Number of leaf per plant
GI	**G2**	0.57^{b}	26.92^{a}	7.54^{a}	30.67^{a}	189.97^{b}	161.4^{a}	895.56^{b}
	G5	0.55^{b}	34.72^{a}	15.52^{a}	36.67^{a}	170.57^{a}	173.53^{c}	1098.44^{b}
	G8	0.59^{b}	28.44^{a}	16.98^{a}	32^{a}	188.1^{b}	100.27^{b}	719.22^{b}
	G9	0.57^{b}	21.06^{a}	11.81^{a}	32.67^{a}	148.63^{a}	83.67^{a}	1942.39^{d}
	G10	0.69^{b}	42.18^{b}	17.46^{a}	32^{a}	157.1^{a}	133.2^{b}	1547.56^{c}
	G11	0.35^{a}	34.29^{a}	19.69^{a}	31^{a}	170.2^{a}	124.27^{b}	1044.39^{b}
GII	**G1**	0.63^{b}	99.86^{c}	28.68^{b}	34^{a}	167.3^{a}	48.6^{a}	405^{a}
GIII	**G3**	0.69^{b}	43.83^{b}	15.84^{a}	35.33^{a}	205^{b}	56.56^{a}	1629.72^{c}
	G4	0.51^{b}	37.88^{a}	17.8^{a}	41.33^{b}	117.83^{a}	48.6^{a}	1512.33^{c}
GIV	**G6**	1.36^{c}	75.99^{b}	42.69^{b}	39^{b}	153.77^{a}	87.2^{a}	1205.17^{b}
	G7	0.87^{b}	53.98^{b}	35.1^{b}	45.33^{b}	178.17^{b}	148^{b}	960.67^{b}
GV	**G12**	0.75^{b}	46.22^{b}	16.41^{a}	29.67^{a}	136.67^{a}	169^{c}	1704.28^{c}
	G13	1.17^{c}	56.3^{b}	33.77^{b}	29.33^{a}	125^{a}	121.33^{c}	2009.33^{d}

Values with the same letter in a column are not significantly different from each other

3.4 The structure of morphological diversity

A significant correlation (*P* < .05) was observed between several pairs of variables (Table 5). The Kaiser-Meyer-Olkin (KMO) index which is 0.6 indicates that there is a statistically very acceptable factorial solution. Similarly, Bartlett's sphericity test on the variables shows that the factor model is appropriate (very significant Bartlett's test). The correlation matrix between the variables measured in the 13 genotypes of the C. olitorius collected highlights several significant correlations at the threshold of 0.05. Leaf blade width was positively correlated with leaf fresh weight (r =0.56). Plant height also has a positive correlation with number of primary branches (r=0.80), stem diameter (r=0.91), and mass of 100 dry leaves (r=0.74). As for the number of primary branches, it is positively correlated with the diameter of the stem (r=0.81), the length of the petiole (r=0.61), the mass of 100 dry leaves (r=0.80) and days to 50% flowering (r=0.53). Stem diameter is positively correlated with the mass of 100 fresh leaf (r=0.50) and the mass of 100 dry leaves (r=0.79); and the mass of hundred fresh leaves is positively correlated with the mass of hundred dry leaves (r=0.74). The days to first flowering is negatively correlated with the length of the capsule (r=-0.56) (Table 5).

Table 5. Correlation matrix between the measured variables in the 13 genotypes from accessions of vegetable knotweed collected

Variables	LBL	LBW	PlH	NPB	StW	LPL	FLW	DLW	DHF	DFF	SeW	PoL	NSPo	NLP
LBL	1													
LBW	0.38	1												
PlH	-0.09	-0.24	1											
NPB	-0.17	-0.01	**0.80**	1										
StW	0.04	-0.14	**0.91**	**0.81**	1									
LPL	0.10	0.30	0.28	**0.61**	0.33	1								
FLW	0.10	0.39	0.33	0.49	**0.50**	0.49	1							
DLW	0.04	0.07	**0.74**	**0.80**	**0.76**	0.36	**0.74**	1						
DHF	-0.30	0.00	0.33	**0.53**	0.38	0.31	0.22	0.38	1					
DFF	-0.44	-0.14	0.14	0.38	0.16	0.17	0.21	0.42	0.35	1				
SeW	-0.05	0.08	-0.39	-0.38	-0.25	-0.31	-0.30	-0.16	-0.01	0.02	1			
PoL	0.29	-0.11	-0.12	-0.40	-0.14	-0.26	-0.30	-0.35	-0.10	**-0.56**	0.18	1		
NSPo	-0.04	-0.25	0.06	-0.14	0.04	0.13	-0.19	-0.06	0.08	-0.08	-0.29	0.03	1	
NLP	-0.09	-0.09	0.22	0.16	0.21	0.12	-0.19	-0.06	0.08	-0.09	-0.27	0.04	0.15	1

LBL= Leaf blade length ; LBW= Leaf blade width ; PlH= Plant height (cm) ; NPB= Number of primary branches ; StW= Stem width ; LPL= Leaf petiole length ; FLW= Leaf blade width ; DLW= Dry Leaf weight (g) ; DHF= Days to 50% flowering ; DFF= Days to first flowering ; SeW=100 seed weight (g) ; PoL = Pod length ; NSPo= Number of seeds per pod ; NLP= Number of leaf for plant.

Five axes with an Eigen value greater than 1.00 were obtained, explaining 81.43% of the variance present in the variables. However, the variance accumulation test shows that the first three axes (axis 1, axis 2 and axis 3) are the most relevant. These axes were used to describe the total variability of the genotypes, which were 49.09% of the total variance. The first axis describes 33.77% of the variation, this component is defined on the positive side by the plant height (PlH), the number of primary branches (NPB), the stem width (StW), the fresh leaf weight (FLW), dry Leaf weight (DLW), leaf petiole length (LPL), and days to 50% flowering (DHF). The second component describes 15.24% of the variation. It is defined by leaf blade length (LeBL), leaf blade width (LBW) and fresh leaf weight (FLW). Component 3 defines genotypes with a longer first flowering days, Pod length and Leaf blade length (Figure 2).

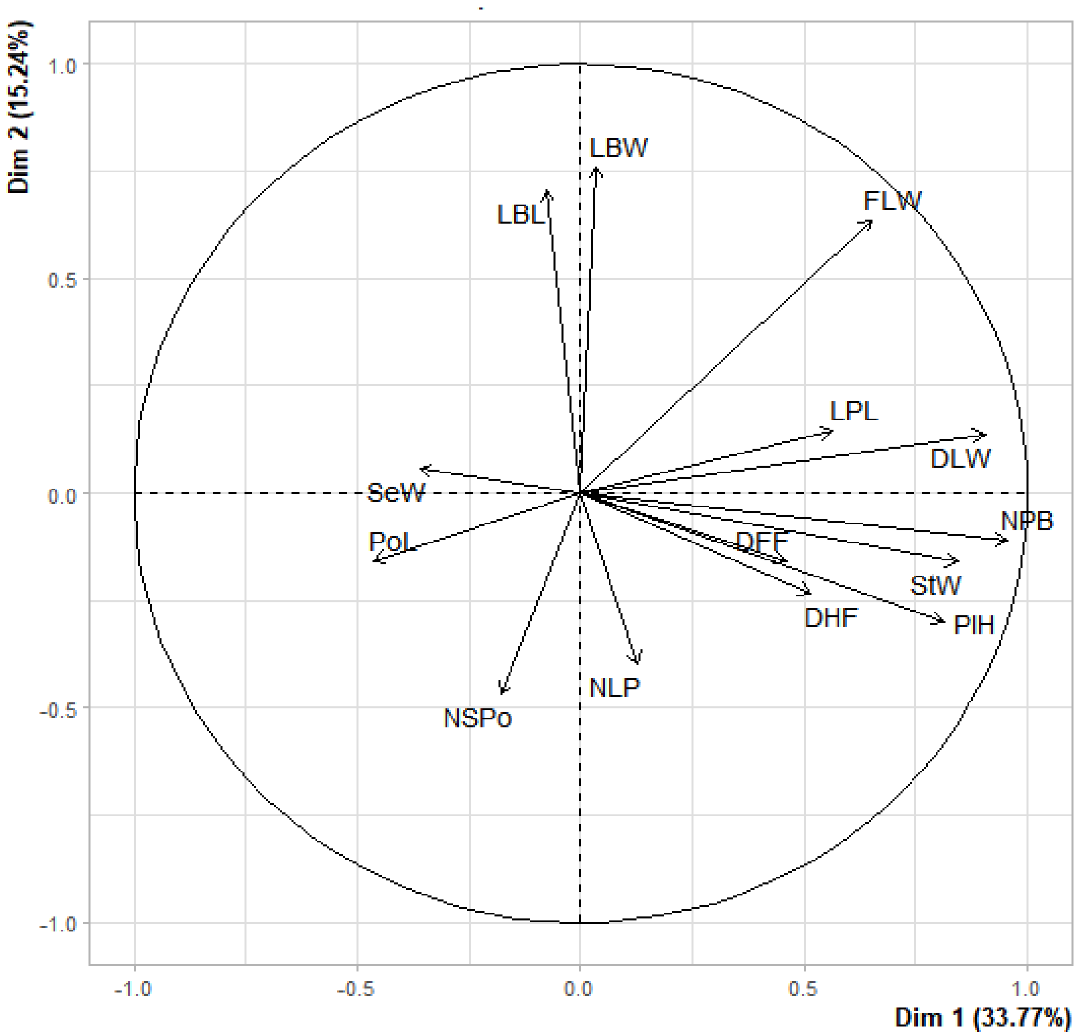
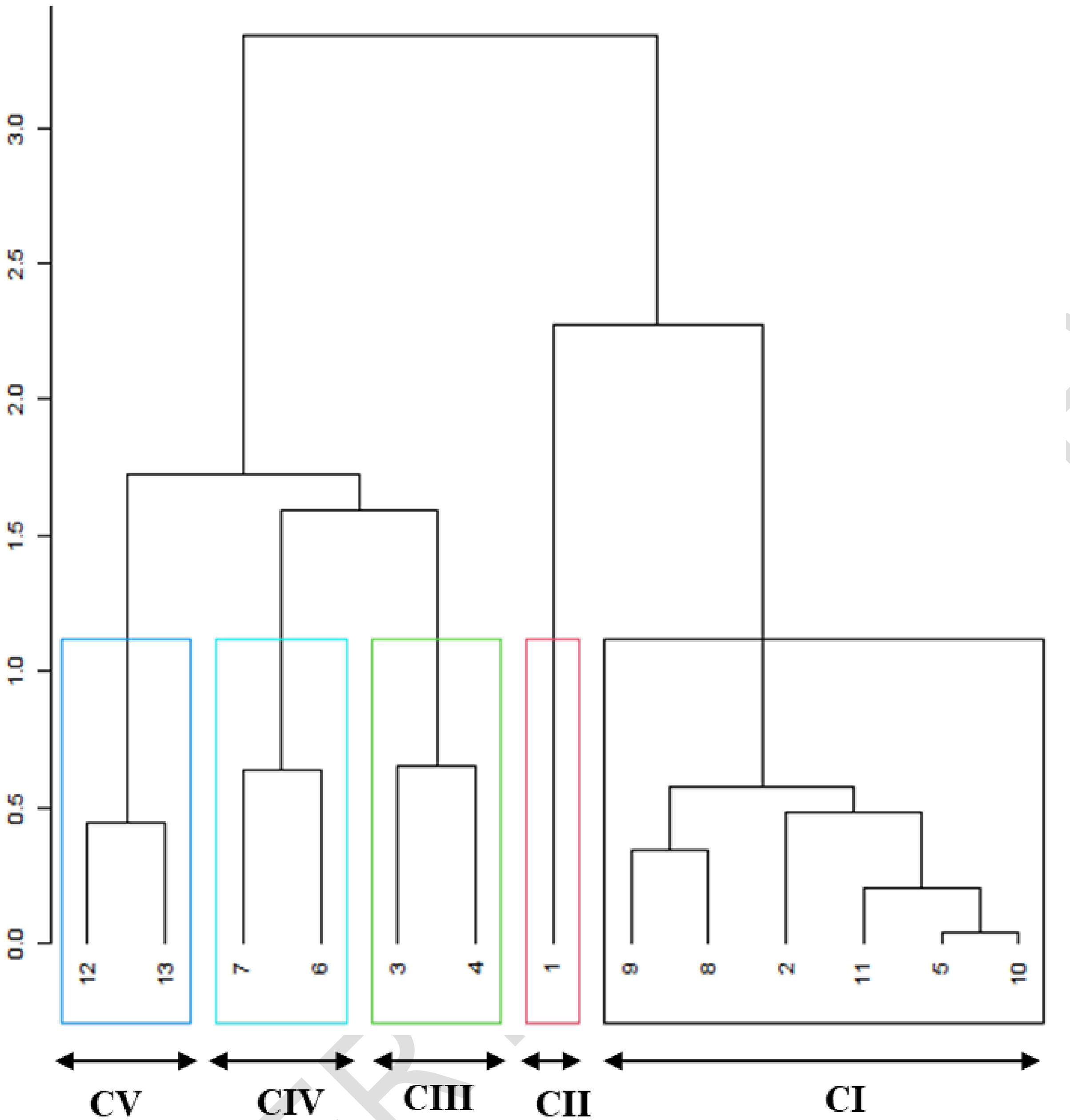


Figure 2. Circle of correlations from agro-morphological variables of 13 genotypes of *C. olitorius*.

3.5 Diversity study of genotypes

The ascending hierarchical classification using Unweighted pair group method with arithmetic mean (UPGMA) displayed the presence of 5 clusters from the 13 genotypes of C. olitorius based on 14 quantitative characters (Figure 3). Cluster 1 comprise genotype G2, G5, G8, G9, G10 and G11. Cluster 2 had only genotype G1 while Cluster 3 contain genotype G3 and G4. Cluster 4 comprise of genotype G6, G7 and Cluster 5 genotype G12 and G13.



C: Cluster.

Figure 3. Hierarchical clustering (CHA) of 13 genotypes from *C. olitorius* using Unweighted pair group method with arithmetic mean (UPGMA).

4. DISCUSSION

The study aimed to set up a scientific basis on the diversity of *C. oliturius* in Togo, thereby increasing its production and use. It highlighted the existence of an agro-morphological diversity within the 27 accessions underlining the unreliable source of pure seed except for A24, A25, A26 which seeds are each from single plant collected directly from the field. The present results obtained on the *C. oliturius* are similar to those obtained by [11] who showed that there is variability within accessions. The purification of these accessions identified 13 different genotypes based on their qualitative and quantitative traits. Characterisation based on qualitative characters data highlighted various phenotypes such as (Dark green, green and light green) leaf colour, (serrate and Dentate) leaf margin, (lanceolate and ovate) leaf shape which corroborate with the results of previous reports by [13]. Leaf surface glossiness exhibited matte and glossy phenotype, branching habit were of predominantly primary branch and predominantly secondary branch. Other characters were uniform among the genotypes, these are light green steam colour, yellow flower colour, sub-cylindrical pod shape and dark pods colour at maturity.

All quantitative characters showed significantly important variability between the 13 genotypes cultivated in Togo. Variability on *Corchorus Oliturius* genotypes were previously observed based on quantitative data such as plant height, stem width, number of primary branches, days to 50% flowering by [16] ; [1] and [15]. The best genotype identified based on yield was G13 exhibiting long days to flowering, highest number of leaves and high number of primary branches, this probably due to long vegetative growth. These results corroborate of the results of [11]. According to these authors, accessions with long vegetative stage are able to develop their vegetative parts and best express their growth potential by producing high number of ramifications and the more the size increases, the more the ramifications appear.
Ascending Hierarchical Classification (CHA) grouped the 13 genotypes of *C. oliturius* into 5 main clusters based on qualitative traits. According to [5] genetic variability and performance of Tossa Jute, due to the significant genetic distance between groups, genotypes from different group can be used in breeding programs for varietal improvement according.
The clustering revealed a single genotype in cluster II (genotype 1) which genetic distance is significantly isolated from other genotypes, this can be used for improvement with genotype from other clusters. There is a subset of the genotype in cluster I, suggesting that there was still variation within this cluster, these genotypes are more diverse and should be given special consideration during selection, as suggested by [6] on subset within a main cluster. The quantitative variable (plant height, stem width, number of primary branches and days to 50% flowering) also showed significant variability among genotypes, thereby highlighting the existence of a high diversity among cultivated *C. oliturius* in Togo. This confirms the results obtained by [16]; [1] and [15] who observed variability in different *C. oliturius* morphotypes based on quantitative traits.
Strong correlations were observed among variable, thereby highlighting heritability of several morphological traits for future breeding use. For example, the more growth in plant height, the thicker the stem, the more primary branches and the higher dry leaf weight; the higher number of primary branches, the higher the dry leaf weight and the thicker the stem. Moreover, early flowering genotype had positive correlation with the number of primary branches, the less in primary branches the earlier the genotype. These results corroborate with that of [11]. According to these authors, taller plants with thicker stems reveals the ability of the stem to give stronger support to the development of its larger canopy and also demonstrates that the plant is more tenacious. A strong positive correlation between plant height and stem diameter is an indicator of plant vigor as suggested by [2].
Principal component analysis (pca) explained the agro-morphological diversity of the assessed accessions. The first two components accounted for 49.01% of the total gap. Axis 1 accounted for 33.77% and axis 2 (15.24%) of the variation. These results are similar to those of [16]. Most of the variables are correlated with axis 1, which explains their implication in the diversity the genotypes of *C. oliturius*.

5. CONCLUSION

This study reports a purification and morphological characterization of several C. oliturius landraces collected from the five ecological zones of Togo. Results of purification show that there is an important diversity managed by leaf vegetable producers as well as households. Morphological analyses indicate that the accessions collected have a high degree of variability. Some morphological traits were efficient in differentiation C. olitorius accessions from Togo, i.e. leaf colour, leaf margin, leaf shape, leaf surface glossiness, branching habit, plant height, stem width, number of primary branches and days to 50% flowering. These traits gave a high variance among the assessed traits and can be recommended to be used in veritable evaluation studies on C. olitorius. Correlation observed among variable highlighted heritability of several morphological traits for future breeding use. Results of this study are a suitable database for a breeding program on C. olitorius in Togo.

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