INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

CHARACTERIZATION OF *SOLANUM ETHIOPICUM* (KUMBA GROUP) IN BURKINA FASO

BATIONO-KANDO Pauline*, SAWADOGO Boureima, NANEMA K. Romaric, KIEBRE Zakaria, SAWADOGO Nerbéwendé, KIEBRE Mariam, TRAORE R. Ernest, SAWADOGO Mahamadou, ZONGO Jean-Didier
Laboratoire Biosciences, Unité de Formation et de Recherche en Sciences de la Vie et de la Terre, Université de Ouagadougou, 03 BP 7021 Ouagadougou 03
*Corresponding author's email: bationopauline@yahoo.fr

ABSTRACT
Ninety five (95) cultivars of the Kumba Group "bitter eggplant" of the *Solanuma ethiopicum* species collected in the agricultural region of West Burkina Faso have been assessed using 22 agro-morphological descriptors. The study has shown that the naming process of cultivars in this area by farmers is solely based on phenotypic traits such as fruit colour, size or shape. This eggplant is grown, by both men and women, for its fruit and leaves. It has also highlighted large agro-morphological variability distinct from geographical factors. Two main cultivar groups have been identified. The first group consists of early season cultivars which are featured by average vegetative development and yield many small-sized piece of fruit. The second group comprises late cultivars with high vegetative development and a fewer large pieces of fruit.

KEY WORDS: Varietal diversity, *Solanum aethiopicum*, genetic resources, land varieties, Burkina Faso.

INTRODUCTION

Solanum aethiopicum cultivars of Kumba Group "bitter eggplant", mainly found in warm and semi-arid Sahel areas (Sunseri *et al.*, 2010), are mainly grown in Burkina Faso for their fruit and leaves. This is one of the most popular leafy vegetable. Both fruit and leaves are cooked as sauce and sometimes eaten raw. They are used as a medicine to treat diarrhoea, hypertension, *etc*., (Adeniji and Aloyce, 2012). The steady increase in demand leads to increasing its production as a cash crop. Fruit and leaves marketing provides significant incomes for the population. Today, eggplant ranks third after tomato and onion, and is followed by okra. In 2013, over 5510 tonnes of eggplants were harvested in Burkina Faso (FAO, 2013). Despite its socio-economic significance, local genetic varieties of this species are still less known, while the adopted enhanced varieties introduced constitute a serious threat to the local ones. Indeed, the earlier enhanced varieties yielding beautiful and large pieces of fruit have better agronomic behaviour with farmers. They are therefore preferred to local species. It is therefore urgent to lay scientific foundations for better management, promotion and improvement of the species. In general, studies on African eggplants have focused on the *Gilo* Group eggplant (Chinedu *et al.*, 2011*;* Osei *et al.*, 2010 and Gisbert *et al.*, 2006). The various Kumba group eggplants have always been addressed in comprehensive studies (Lester and Seck, 2004). Thorough studies on morphological parameters and on resource management by farmers are nonexistent, except this study. This study is aimed at the following objectives: (i) know about how farmers deal with the species, (ii) build up a collection of local accessions, (iii) determine the level and structure of the agromorphological diversity of local varieties.

MATERIALS & METHODS

Plant material

Ninety-five (95) local accessions collected in May 2013 in Burkina Faso have been studied. Fifty-one (51) accessions were from the Boucle du Mouhoun region, 14 from the Haut Bassin region, 2 from the Cascades region and 26 from the Sud-Ouest region (Figure 1). The four agricultural regions are located in the North-Sudanian climate zone (51 accessions) and in the South-Sudanian climate zone (44 accessions). Villages selected are areas of higher production of Kumba. A survey was conducted among 104 farmers, including 74 men and 30 women, through semi-structured interviews. Exhaustive technique was used to collect the accessions. Indeed, all the producers in each investigated village have been interviewed; so that the accessions number highly vary from one village to another. Pâ village, in the Kossi province, is the most represented with 24 accessions. Eleven ethnic groups were concerned by the data collection. Among these, Mossi, Lobi, Bwaba, Dagara and Goin groups are the most representative with, respectively 59, 31, 13, 11 and 10 accessions. Each accession is represented by a fruit and is accompanied by a survey form with details about geographical origins, farmer descriptors, local names, uses and farming practices.

Site and Experimental design

A trial was conducted at the experimental station of the Institute for Rural Development (*Institut du Développement Rural*) located in Gampela, in the vicinity of Ouagadougou (1°21'9, 6''W; 12° 24' 29'' N), in order to describe the agromorphological parameters of accessions. The sowing process was conducted in a nursery, and transplanting took place thirty days after

seedlings sprouted up. Since the transplanting date, the station had recorded 29 days rainfall spread over 3 months, with an average monthly rainfall of 15.3 mm. The experimental design consits of a randomized complete block with three repetitions. Each accession is sown over a 3.2 m long line with 0.8 m spacing of and 0.4 m gap.

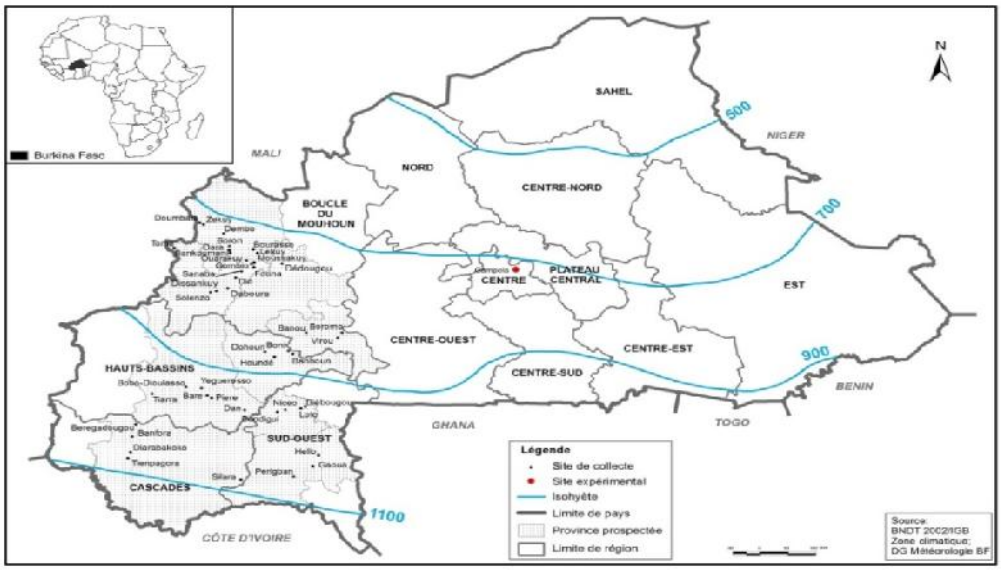

FIGURE 1: Villages and climatic zones (Guinko, 1984) prospected

Variables Observed

Fourteen (14) quantitative and eight (8) qualitative variables (Lester and Seck, 2004) were observed on 5 plants randomly selected by accession except for the sowing-flowering cycle for which the observation involved the whole line (Table 1).

TABLE 1: characters Observed

TRAITS	
QUANTITATIVE	QUALITATIVE
Plant Height (cm)	Stem colour
Petiole Length (cm)	Leaf shape
Leaf length (cm)	Pistil colour
Ground foliar coverage (cm)	Sepal colour
Days of 50% flowering	Petal colour
Number of flowers / inflorescence	Stamen colour
Number of sepals	Fruit colour
Number of petals	
Number of stamens	
Fruit diameter (cm)	
Fruit thickness (cm)	
Fruit weight (gm)	
Pedicel length (cm)	
Number of fruit / plant	

Data analysis

Analysis of variance (ANOVA) was conducted using XLSTAT-Pro 7.1 version software to determine quantitative traits discriminating the various accessions. For each of these traits, broad sense heritability (H^2) was calculated from the genotypic variance and phenotypic variance with the Genstat v4.10.3 software. Relationships between these traits were studied through to Pearson correlation tests at 1%. All accessions were subsequently consolidated from the hierarchical cluster analysis based on the Euclidean distance between individuals with the DarWin software (Perrier *et al.,* 2006). The groups were then characterized through the factorial discriminating analysis by the XLSTAT software.

RESULTS

Bitter Eggplant Management by Farmers

Local names widely vary depending on ethnic groups (table 2). Among the Mossi, bitter eggplant is called *kumba* at 100%. However, among the Bwaba group the most common local name is M'padou (44.4%). Among the Lobi, the most frequently encountered name is "Koumon" (50%). In naming morphotypes, producers do resort to phenotypic characteristics of plants such as fruit colour, size or taste. Thus, it is found for instance that, among the *Mossi* such names as "kumbwobgo" ("elephant eggplant") characterise the big size of its fruit, "*kumbanogo*" ("small-sized eggplant") the small size of the fruit, "*kumpèlga*" ("white eggplant") the white colour of the fruit, "*kumsabèlga*" ("black eggplant") the green colour of the fruit, "*kumnongo*" ("sweet eggplant") refers

to the mildly sweet taste of its fruit and "*kumtoogo*" ("bitter eggplant") the bitterness of its fruit. The majority of producers claim that big-sized fruit and especially the white-coloured one is tastier than the small one. The bittest is the green small-sized fruit. Farming techniques used by all producers interviewed are the same. They grow mixed morphotypes.

TABLE 2: Local names and farmers' eggplant management practices

Characteristics		Frequency (%)
Farming Technique	Nursery and transplanting a month later	100
Seed Production Mode	Selection by farmers	61
	Purchased in market	15
	Gift/donation	10
	Both	14
Morphotypes Grown	Green fruit	66
	White fruit	34
Seed Saving Mode	Whole and dried fruit	73
	Washed and dried seeds	27
Local names in Mooré	Kumba	100
Local Names in Lobiri	Koumon	50
	Kumbre	12.5
	Konmye	12.5
	Others	25
Local Names in Bwamou	M'padou	44.4
	Gbô	33.3
	Others	22.2

FIGURE 2: Fruits suspended to the shed

FIGURE 3: variation of flows color of accessions

Seeds are sown in nurseries in April-May and seedlings are transplanted in vegetable gardens a month later (May-June) together with other crops (tomato, onion, okra, pepper, garlic etc.). Then, harvest takes place one to two months later, in July-August. Seed management: most producers (62%) select the best fruit as seeds. Others buy their seeds in market places (15%), or get them from other producers (10%) or through both modes (3%). For 73% of respondents, pieces of fruit are strung and hung on a tree or on the roof of the attic, their huts, kitchens, or a shelter (Figure 2). Pieces of fruit hanged from the kitchen ceiling are often smoked out so as to be protected from insects and other pests. And for 27% of respondents, the seeds are extracted, washed out, dried up and stored in bags.

Agro-morphological diversity of the collection

Table 3 shows the qualitative features observed in the collection. At flowering, the calyxes of accessions' flowers appear in two colors: green for 59.2% of them, and violet for 27.5%. Accessions with green sepals usually

have white petals or white petals with green veining (40.8%), and those with violet sepals have white petals with violet veining (37.7%) (Figure 3). All flowers are hermaphrodite endowed with yellow stamens surrounding pistils with white style and yellow stigma that turns orange after pollination. At fruiting, most of these flowers have yielded green fruit (64.3%) (Figure 4). Fifty-six percent (56%) of accessions have green stems, 10% have violet stems and 15% have variegated stems. The leaves are alternate, simple-bladed with generally a central vein having the same colour as the stem. Green-veined leaves are the most common (56.1%). The pigmentation of the different organs is usually homogeneous for each accession and heterogeneous in 12 to 21% of the accessions (intra progeny polymorphism marker). For all traits, accessions significantly differ from one to another at 1% and 5% (Table 4). The number of days to 50% flowering has varied from 68.4 to 94 days with 50.5% of accessions having less than 80 days cycle. Sepals and petals are almost equal in number. Their average numbers are 6.5, and their extreme values are 5 and 7.6. The mean total plant height is 46.99 cm, with predominantly less than 50 cm height accessions (69.5%). The number of pieces of fruit yielded by most of these plants (91.6% accessions) is less than 10. However, the average fruit weight is higher (115 g), with extreme values ranging from 57.2 to 216.8 g. Leaf sizes have varied: from 14.6 to 23.5 cm for limb length, and from 3.1 to 8.3 cm for petiole length. The coefficients of variation of such traits as number of flowers per inflorescence, fruit number, fruit weight and petiole length are higher (CV> 20%). However, they are lower (CV <20%) for all other traits. In general, the broad sense heritability values are higher, ranging from 56 and 93%. The highest values are noted for variables such as number of days to 50% flowering (93%), fruit diameter and weight (90%) and plant height (90%).

TABLE 3: Qualitative characters variations of the 95 eggplant accessions

Traits	Modality	Frequency (%)
Sepal colours	Violet	27.5
	Green	59.2
	Green and violet	13.3
Petal colours	White with violet veining	37.7
	White with green veining	26.1
	White	14.8
	Varied	21.4
Stamen colours	White net, yellow anther	100
Pistil colour	Yellow stigma	100
Fruit colours	Green	64.3
	Green and variegated	5.1
	White	1.02
	White and variegated	6.1
	Dark green	11.2
	Varied	12.2
Stem colour	Violet with green stripes	15.3
	Green	56
	Violet	10.2
	Varied	18.4
Leaf colour	Green with violet veining	20.5
	Green with green veining	56.1
	Varied	13.3
Leaf types	Simple	100
	Alternate	100
	No stipule	100

FIGURE 4: variation of fruits color of accessions

Correlations between the studied characters

Table 5 displays many positive and highly significant correlations obtained at α = 1%. And the most important are those observed between i) stem height and fruit diameter variables (r = 0.49), fruit thickness (r = 0.56), fruit weight (r = 0.49), leaf length (r = 0.44) and ground foliar coverage (r = 0.53); ii) fruit diameter and such traits as pedicel length (r = 0.40) and fruit weight (r = 0.86) as well as between limb length and petiole length (r = 0.62). The most significant negative correlations are observed

between fruit numbers and variables such as fruit diameter (r = - 0.50), fruit weight (r = - 0.51), fruit thickness (r = - 0. 43), stem height (r = - 0.32), and sowing -flowering cycle (r = - 0.29).

TABLE 4: Performance of the 95 accessions for the different quantitative traits and F Fisher observed as well as their Heritability

Variable	Min	Max.	Mean	CV (%)	F Fisher	H^2
Days of 50%flowering	68.4	94.0	79.7	6.8	15.3**	0.93
Number of flowers/inflorescence	1.3	6.3	2.2	31.5	4**	0.75
Number of sepals	5.0	7.5	6.5	6.8	3.9**	0.74
Number of sepals	5.6	7.6	6.5	6.1	2.6 **	0.61
Number of stamens	5.6	11.8	8.3	14	4.1**	0.75
Petiole Length (cm)	1.03	2.5	1.8	17.3	6.3**	0.84
Fruit diameter (cm)	6.2	9.9	7.7	11.4	10.2**	0.90
Fruit thickness (cm)	2.7	5.3	3.5	13.3	5.4**	0.82
Fruit weight (gm)	57.2	216.8	115	33.2	11.8**	0.90
Number of fruit	1.9	13.7	6.6	37.6	2.2 **	0.57
Plant Height (cm)	32.1	66.3	47	16.2	10.1**	0.90
Pedicel length (cm)	3.1	8.3	4.8	20.2	1.7 **	0.56
Leaf length (cm)	14.6	23.5	18.6	12.6	2.4**	0.63
Ground foliar coverage (cm)	43.1	77.6	62.7	11.3	5.1 **	0.81

TABLE 5: Correlations between 14 quantitative characters in Kumba groupe

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1. DFl													
2. NFI	**0.19**												
3. NSe	**0.30***	-0.02											
4. NPe	**0.27***	-0.05	**0.86***										
5. NEt	0.14	-0.13	**0.34***	**0.51***									
6. PLe	0.18	0.07	0.15	0.17	**0.29***								
7. FrD	0.10	-0.13	**0.31***	**0.33***	**0.45***	**0.37***							
8. FrT	0.15	-0.06	0.17	0.14	**0.32***	**0.40***	**0.83***						
9. FrW	0.16	-0.08	0.25	**0.27***	**0.41***	**0.35***	**0.96***	**0.86***					
10. NFr	**-0.29***	-0.10	-0.17	-0.22	-0.26	**-0.36***	**-0.51***	**-0.43***	**-0.51***				
11. PlH	0.16	0.12	0.21	0.23	0.13	**0.32***	**0.49***	**0.56***	**0.49***	**-0.32***			
12. PeL	0.17	**0.27***	0.25	0.18	0.19	**0.33***	**0.41***	**0.41***	**0.41***	**-0.28***	0.25		
13. LeL	0.17	0.14	0.17	0.20	0.23	0.18	**0.52***	**0.57***	**0.53***	-0.23	**0.44***	**0.62***	
14. GFo	0.17	0.23	0.06	-0.00	-0.06	0.04	0.05	0.16	0.04	0.13	**0.53***	0.10	**0.32***

* indicate significant at 0.01 probability level

TABLE 6: Characteristics of Groups Based on the hierarchical cluster analysis

Group	1	2	3	4	F
Size	13	7	39	36	
Days of 50%flowering	79.8	82.1	79.6	78.8	**
Number of flowers/inflorescence	1.8	2.3	2.3	2.1	**
Number of sepals	6.7	6.8	6.4	6.5	**
Number of petals	6.6	6.9	6.5	6.5	**
Number of stamens	8.8	9.2	7.7	8.9	**
Petiole Length (cm)	1.9	2	1.8	1.8	**
Fruit diameter (cm)	8.8	9.3	6.9	7.9	**
Fruit thickness (cm)	4.3	4.3	3.2	3.6	**
Fruit weight (gm)	159.4	202.2	79.4	120.9	**
Number of fruit/plant	4.4	4.4	8.4	5.2	**
Plant Height (cm)	51	55.2	43.7	46.6	**
Pedicel length (cm)	6.6	6.0	5.2	5.4	**
Leaf length (cm)	21.9	22.1	18.6	19.4	**
Ground foliar coverage (cm)	67.1	62.2	63.1	61.5	**

Structure of the agromorphological variability of accessions

The hierarchical cluster analysis, performed with Ward aggregation criteria based on the adjusted average values of the 10 variables of the analysis of variance, gives the dendrogramme of Figure 5. An initial level of truncation regroups the accessions into two different sets of fruit weight and fruit number (Table 6) comprising respectively 20 and 75 individuals (sets I and II). Each set is then divided into two groups. The first set (set I) is made of

group 1 and group 2. Group 1 consists of 13 large-sized accessions with long leaves, which yield fewer average-weighted pieces of fruit carried by long pedicels. The average fruit number per plant is 4.4 with an average weight of 159.4 g. Group 2 also consists of large accessions featured by significant vegetative development, fewer numbers of pieces of fruit as in Group 1 but which are nonetheless bigger and heavier. The mean fruit weight is 202.2 gm. The second set (set II) is composed of groups 3 and 4. Group 3 comprises thirty-nine (39) accessions. It is the group of accessions with the lowest performance, except for the number of pieces of fruit yielded per plant. They have small-seized stems and leaves with short petiole and they yield more pieces of fruit. Group 4 comprises 36 accessions yielding average numbers of small and light pieces of fruit as in group 3. Wilks Lambda test in factorial discriminating analysis shows the observed F value equals 8.8, whereas the critical F value is 1.4 with p-value <0.0001 at 5% between the 4 groups, which evidence that they are different entities.

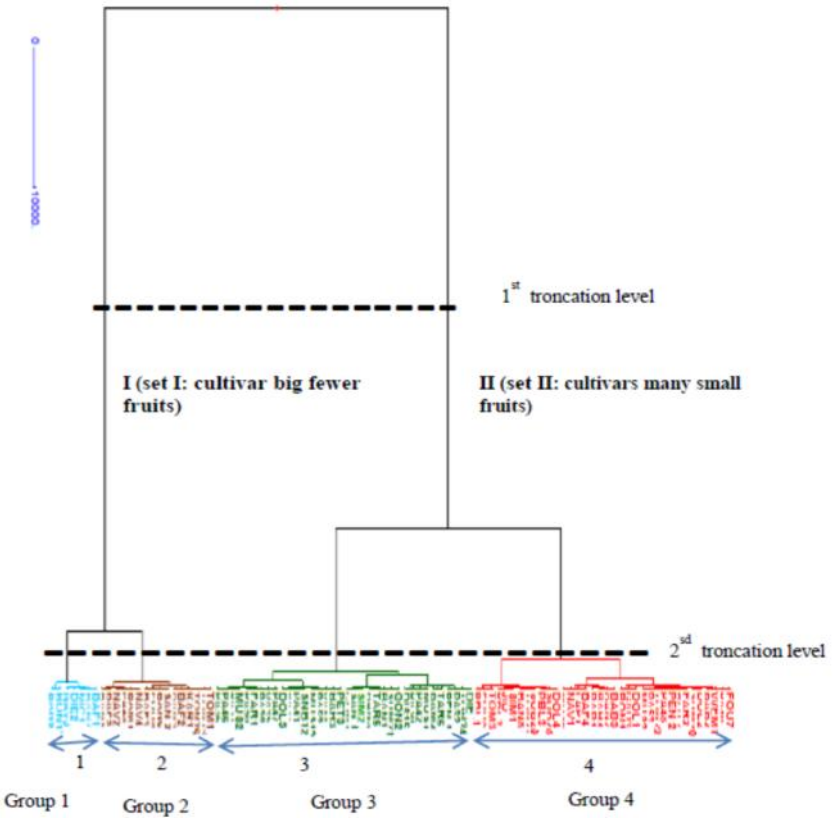

FIGURE 5 : Dendrogram of Dissimilarity among 95 accessions of kumba using Ward's Minimum Variance Method of Cluster Analysis.

PlH: Plant Height (cm), PLe: Petiole Length (cm), LeL: Leaf length (cm), GFo: Ground foliar coverage (cm), DFl: Days of 50% flowering, NFI: Number of flowers / inflorescence, NSe: Number of sepals, NPe: Number of petals, NEt: Number of stamens, FrD: Fruit diameter (cm), FrT: Fruit thickness (cm), FrW Fruit weight (g), PeL: pedicel length (cm), NFr: Number of fruit / plant

DISCUSSION

The study revealed various local names for bitter eggplant deriving primarily from the fruit agromorphological characteristics. In Burkina Faso, the identification of eggplant cultivars through fruit shapes and sizes has been dealt with by Bambara *et al.* (2011).The significant gaps between minimum and maximum values, the higher variation coefficients of traits and the presence of two or more qualitative modalities in each class of traits account for the existence of a great morphological variability within accessions. According to Chinedu *et al.* (2011); Osei *et al.* (2010) and Gisbert *et al.* (2006), www.technisem.com, African eggplants are highly variable in shape, colour and fruit size. Lester *et al.* (1990) also showed that regions of greater morphological diversity of *S. aethiopicum* are in Côte d'Ivoire and neighbouring countries, including Burkina Faso. This significant morphological diversity is explained by the mode of reproduction of the plant in relation to farmers' management and conservation practices of this phytogenetic resource. Indeed, *S. aethiopicum* is a hermaphrodite species. Its pollen matures 30 minutes before the opening of the flower, and its stigma becomes receptive 15 to 20 minutes before the release of pollen, which makes the plant a self-pollinator characterised by out crossing tendency that can reach up to 70% dependent on weather conditions and the presence of pollinators (Seka *et al.*, 2007; Oyelana and Ogunwenmo, 2012). Each collected sample is a whole fruit; and the same accession (fruit) consists of a single mother offspring originating from fertilisation by pollen grains of various origins (self-pollination and allopollinisation). Surveys have shown that producers keep mixed seeds and grow several morphotypes on their plots, which makes it possible for many combinations of traits. Thus, cross-pollination which favours such recombinations of traits accounts for intra

population heterogeneities. And, by enabling the binding of various alleles, allogamy contributes to inter-population heterogeneity and allows better adaptation to different local environments (wide spreading of,*S. aethiopicum* in Burkina Faso).The variation of the number of 50% flowering (68.44 to 94 days) and the number of inflorescences (1.32 to 6.25) are within intervals outlined by Sunseri *et al* (2010) for all African eggplants. Similarly, variations in fruit diameter, fruit weight and pedicel are within intervals provided by Lester and Seck (2004).

In Burkina Faso, eggplants are grown for their fruit and their leaves. The organisation of the morphological diversity of accessions through multivariate analysis, mainly on fruit characters (fruit diameter, weight and number) and leaf traits (leaf width and length and petiole length) is undoubtedly linked to farmer's selection mode of bitter eggplant in Burkina Faso, based on noticeable phenotypic traits of interest such as biomass and yield. According to the factorial discriminating analysis, the four groups defined through the hierarchical cluster analysis can be divided into two types of plants: on the one hand, we have the relatively early plants with average vegetative development yielding many and small size pieces of fruit, and on the other hand, the late ones, with strong vegetative development yielding a fewer numbers of large fruit. Here, there are such peasant naming as "kumbwobgo" ("eggplant elephant ") and "kumbanogo" ("small eggplant") that are based on fruit size. The positive correlations observed could mean that morphotypes with strong size, great foliar surface, and great ground foliar coverage are those that produce large pieces of fruit. However, negative correlations lead to a decrease in fruit number with the 50%-flowering cycle, in stem height, in weight and in fruit diameter. This limits, while selecting Kumba, the possibilities of obtaining early season cultivars producing many and large pieces of fruit, and as such, tasty and more profitable fruit (sought by producers and consumers notably). Danquah and Ofori (2012) reported similar results on *gilo* group eggplants of Ghana. The random agromorphological variability structure, without any reference to the collection site (Province, Department, agro-climatic zone), and the low dissimilarity between accessions from the same village within the groups reminisce the existence of many duplications in the sample studied (based on the method by Ward Singh *et al.*, 2008*;* Traoré *et al.*, 2013) probably in response to the seed management method. In fact, farmers swap plant material either directly (donation) or indirectly in markets. Swapping leafy vegetable seeds can lead to the migration of the latter over a distance of 100 to 800 km (Diouf *et al.*, 2007). Similarly, mass selection carried out by the majority of producers (62% of producers) can contribute to reduce variability within the same village. However, the various morphological groups obtained provides for alternatives in selecting genitors for the creation of new varieties to meet the needs of producers. The objectives in eggplant enhancing are aimed at cycle shortening, size reduction, and research for more productivity through improved fruit size and taste. Group 1 and 2 cultivars, whose fruit average weights are respectively 159 gm and 202gm, are best suited to this type of performance. The weight of the improved variety fruit, N'Galam +, ranges from 150 to 200 gm (www.technisem.com). The higher values of heritability of fruit diameter, fruit length 50%flowering cycle and fruit weight indicate that selection could be made based on these agronomic traits. Denton and Nwangburuka (2011) and Danquah and Ofori (2012) reported almost similar result in *Solanum anguivi* and. *Solanum gilo Raddi* respectly.

CONCLUSION

The study has highlighted the relationships between farmers' nomenclatures of *Solanum aethiopicum* local varieties by farmers, and the agromorphological characteristics of the collection. The great phenotypic variability observed is attributable to the mode of reproduction of the plant and farmers' management practices of the phytogenetic resource. The studied discriminant characters of accessions (fruit weight, number of fruit per plant, fruit diameter, plant height and cycle time) are strongly heritable. Positive correlations between these characters of interest show possibilities for direct selection and improvement of bitter eggplants. Groups 1 and 2 show better performance in terms of fruit weight and fruit diameter. Regarding genetic resources conservation, our study shows the need for involving local communities in the eggplant diversity management in Burkina Faso. As morphological characters are influenced by the environment, using molecular markers will allow a more detailed analysis of the genetic diversity and a better use of local germplasm in breeding programs. The challenge is to maintain and promote original genetic diversity which is controlled by producers, well adapted to environmental conditions and which can meet consumers' needs. Eggplant production can help then to alleviate poverty in rural areas.

REFERENCES

Adeniji, O.T. & Aloyce, A. (2012) Farmer's Knowledge of Horticultural Traits and Participatory Selection of African Eggplant Varieties (*Solanum aethiopicum*) in Tanzania. *Tropicultura* 30,185-191.

Bambara D., Bilgo A., Lompo F., Hien V. (2011) Influence du changement climatique sur la diversité inter et intra-spécifique des plantes cultivées à Tougou au nord du Burkina Faso. *International Journal of Biological and Chemical Sciences* 5, 2415-2433.

Chinedu, S.N., Olasumbo, A.C., Eboji, O.K., Emiloju, O.C., Arinola, O.K. and Dania, D.I. (2011) Proximate and Phytochemical Analyses of *Solanum aethiopicum* L. and *Solanum macrocarpon* L. Fruits. *Resources Journal of Chemical Sciences*1, 63-71.

Danquah,J.A. and Ofori, K. (2012) variation and correlation among agronomic traits in 10 accesssions of garden egg plant (*Solanum gilo Raddi*) in Ghana. International Journal of Science and Nature 3(2), 373-379

Diouf, M., Mbengue, N.B. and Kante, A. (2007) Caractérisation des accessions de 4 espèces de légumes-feuilles traditionnels (*Hibiscus sabdariffa*L., *Vignaunguiculata*(L.) WALP, *Amaranthus* L. spp et

Moringa oleifera LAM) au Sénégal. *African Journal of food agriculture and nutrition* 7, 1- 16.

FAOSTAT (2013). http://faostat3.fao.org/ home/ index. html# SEARCH_DATA

Guinko, S. (1984) *Végétation de la Haute Volta*. Thèse de doctorat, Université de Bordeaux III

Gisbert, C., Prohens, J. and Nuez, F. (2006) Efficient regeneration in two potential new crops for subtropical climates, the scarlet (*Solanum aethiopicum*) and gboma (S. marcrcarpon) eggplants. *New Zealand Journal of Crop and Horticulture Science* 34, 55-62.

Lester, R.N., Jaeger, P.M.L., Bleijenoaal-Spierings, B.H.M., Bleijenoaal, H.P.O. and Holloway, H.L.O. (1990) African eggplants: a review of collecting in West Africa In: Charrier A, Jacquot M, Hamon S, Nicolas D (Editeurs). Amélioration des plantes tropicales. ClRAD et ORSTOM, France, 1997, 82-107.

Lester, R.N. and Seck, A. (2004). *Solanum aethiopicum* L. In: Grubben GJH, Denton OA (Editeurs). PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA, Wageningen, Pays Bas.

Osei, M.K., Banfull, B., Osei, C.K. and Oluoch, M.O. (2010) Characterization of African eggplant for morphological characteristics. *Journal of Agriculture Science and Technology* 4, 33-37

Oyelana, O.A. and Ogunwenmo, K.O. (2012) Floral biology and effects of plant-pollinator interaction on pollination intensity, fruit and seed set in Solanum. *African Journal of Biotechnology* 11, 14967-14981.

Perrier, X. and Jacquemoud-Collet, J.P. (2006) DARwin software http://darwin.cirad.fr/darwin

Seka, A., Cebula, S.and Kunicki, E. (2007) Cultivated eggplants-origin, breeding objectives and genetic resources a review. *Folia Horticulturae Annales* 19, 97 – 114.

Singh, D., Mace, E.S., Godwin, I.D., Mathur, P.N., Okpul, T., Taylor, M., Humer, D. *et al.*, (2008) Assessment and rationalization of genetic diversity of Papua New Guinea taro (*Colocasia esculenta*) using SSR DNA fingerprinting. *Genetic Resources Crop Evolution* 55, 811-822.

Sunseri, F., Polignano, G.B., Alba, V., Lotti, C., Bisignano, V., Mennella, G. *et al*., (2010) Genetic diversity and characterization of African eggplant germplasm collection. *African Journal of Plant Science* 4, 231-241.

Traore, E.R., Nanema, R.K., Bationo/Kando, P., Sawadogo, M., Nébié, B., Zongo, J.D. (2013 Variation agromorphologique dans une collection de taro (*Colocasia esculenta* (L.) Schott) adapté aux conditions de culture pluviale au Burkina Faso. .*International Journal of Biological and Chemical Sciences* 7, 1490-1502.