Vol. 16(1), pp. 1-7, January-March 2024
DOI: 10.5897/JPBCS2023.1027
Article Number: 3C8EF5371750
ISSN 2006-9758

http://www.academicjournals.org/JPBCS

ACADEMIC JOURNALS
expand your knowledge

Journal of Plant Breeding and Crop Science

*Full Length Research Paper*

# Perception of the preferences of the links in the Spider plant (*Cleome gynandra* L.) value chain in Burkina Faso

**SAKANDE Boureima[1]*, ZIDA Wendpagnagdé Félicien Marie Serge[2], SORY Siédou[1], KIEBRE Zakaria[1] and BATIONO/KANDO Pauline[1]**

[1]Laboratoire Biosciences, Unité de Formation et de Recherche en Sciences de la Vie et de la Terre, Université Joseph KI-ZERBO, 03 BP 7021 Ouagadougou 03, Burkina Faso.
[2]Centre National de la Recherche et Technologique, Institut de l'Environnement et de Recherches Agricoles, Kamboinsé (INERA / Kamboinsé), Burkina Faso.

Received 19 September, 2023; Accepted 10 January, 2024

**Spider plant (*Cleome gynandra* L, Cleomaceae) is used in many parts of the world as an emergency crop, enabling populations to survive periods of hunger and famine. It is a leafy vegetable much appreciated by local populations, whose tender leaves and stems are used to prepare a variety of local dishes. The aim of this study was to gain insight into the perceptions and preferences of stakeholders in the *C. gynandra* L. (Cleomaceae) value chain in Burkina Faso. One hundred and twenty stakeholders from different socio-professional groups took part in the study. The scoring matrix method was used. This scoring system assigns scores on a scale from 0 to 5. A score of zero (0) is assigned if the genotype is not interesting, and a score of five (05) if the genotype is considered very interesting for the traits considered by the stakeholders. Notes 1, 2, 3 and 4, respectively for the least interesting to the most interesting genotypes. Six selection criteria were thus identified by the players in the value chain. These included plant height, number of primary branches, leaf biomass, low pubescence, leaf and twig tenderness, ease of cooking, less bitter taste and high market value. The OUA10, OUA9, KOM2 and MAN genotypes were preferred by all players in the value chain. Further breeding work based on these genotypes will eventually enable the extension of high-performance varieties for the benefit of local populations.**

**Key words:** Value chain, selection criteria, *Cleome gynandra*, Burkina Faso.

## INTRODUCTION

Strategies that rely on participatory appraisal in the breeding process are often associated with the implementation of participatory selection (Ceccarelli et al., 2001; Sakandé et al., 2022b). Indeed, they enable selection to be integrated into numerous experimental sites where farmers have specific knowledge of environmental conditions and the characteristics of plants adapted to them. Exploiting genotype-environment interactions to develop locally adapted varieties through participatory breeding has been proposed as a solution

*Corresponding author. E-mail: cheickboureimasakande@gmail.com. Tel: +226 70461626/76004791.

for variety development (Sperling et al., 2001; Sakandé et al., 2022a, 2023b). The integration of this traditional knowledge is therefore an important step towards the adoption of new genotypes and the development of a sustainable management strategy for leafy vegetables, including *Cleome gynandra.*

In Burkina Faso, *C. gynandra* was once used in emergency food situations such as famine, floods and drought (Millogo-Rasolodimby, 2001). On a social level, several local dishes with identity connotations, including the best-known *Badenda* and *Kanzaga,* are prepared with the leaves and young stems of this leafy vegetable, and are highly prized by Burkinabè populations, especially during festive ceremonies (Tarnagda et al., 2019). The tender leaves and twigs of *C. gynandra* are also used to prepare leafy sauces, eaten with rice or "tô", and to prepare couscous mixed with cereal flour or peanut paste (Konkobo-Yaméogo et al., 2002). As a result, leaves and young stalks are increasingly sold on rural and urban markets, but demand is higher in towns than in the countryside (Bosire, 2014). The sale of *C. gynandra* leaves and young stems generates substantial income for the various players in the value chain, the majority of whom are women (Abugre et al., 2011). The use of *C. gynandra* in the preparation of *babenda* (a local dish) and other local dishes, and the marketing of the latter, earns sellers enormous foreign exchange (Tarnagda et al., 2019). In addition to the leaves, the seeds are also sold on local markets (Kiébré, 2016).

Indeed, the selection and development and/or dissemination of *C. gynandra* varieties require the participation of all stakeholders. Breeding work must be participatory, so as to take into account all the needs of the various players in the *C. gynandra* value chain. According to Weltzien et al. (2008), any breeding program must integrate growers as an integral component of the process, with a clear division of tasks between researchers and growers based on their specific skills and knowledge. However, Kiebré (2016) noted a concentration of farmers' selection criteria on a small number of *C. gynandra* (Cleomaceae) genotypes.

The aim of the present study was to gain insight into the perceptions of stakeholders in the *C. gynandra* genotype chain in Burkina Faso. Specifically, the aims were (i) to identify the selection criteria used by stakeholders in Burkina Faso; (ii) to identify the traits of interest to stakeholders in the value chain, and (iii) to select a batch of genotypes from which selection work will continue for the development of future *C. gynandra* varieties in Burkina Faso.

## MATERIALS AND METHODS

### Plant

The plant material consists of 36 genotypes of *C. gynandra* L. collected in 2019 from gardeners in Burkina Faso's three climatic zones: Sudan, Sudan-Sahelian, and Sahelian. As *C. gynandra* is still in protoculture, the number of genotypes varies from one zone to another. Thus, six genotypes were collected in the Sudanian zone, three genotypes in the Sahelian zone and 27 genotypes in the Sudano-Sahelian zone (Figure 1).

The collection comprises 17 genotypes with green morphotypes, 11 genotypes with light violet morphotypes and 9 genotypes with dark purple morphotypes (Figure 2 and Table 1).

### Experimental

The study was carried out in three climatic zones (experimental sites) and mobilized 120 value chain actors, including 40 actors per climatic zone (experimental site). At each site, stakeholders from the locality, taking into account gender and the different links in the value chain, that is, producers, retailers and consumers, took part in the activity.

As Spider plant is more commonly cultivated by women. In each climatic zone (experimental site), there were 40 actors, of whom 25 women (62.5%) and 15 men (37.5%) took part in the activity.
Each link, made up of men and women, determined its own selection criteria, ranked the genotypes in order of preference and identified the best ones.

The matrix scoring method was used (Diouf et al., 2007). This scoring system assigns scores on a scale from 0 to 5. A score of zero (0) is assigned when the genotype is uninteresting, and a score of five if the genotype is considered very interesting for the traits considered by the stakeholders. Notes 1, 2, 3, and 4, respectively for the least interesting to the most interesting genotypes. The methodology was explained to the participants and a demonstration given before their visit. Empty pots were placed on each line, and each participant placed cowpea seeds in each pot corresponding to the score he or she had assigned to the genotype. After each participant had passed through, the number of seeds for each genotype was counted and recorded on a sheet prepared for this purpose. From these scores, an average attribute score was calculated for each genotype. Finally, focus group discussions were held to find out the selection criteria and characteristics of interest to the players in the value chain, and to propose the genotypes preferred by the various links.

### Data analysis

The Excel V.16 spreadsheet and SPSS (Statistical Package for the Social Sciences) software (version 20) were used to process and analyze participatory breeding data.

The Excel V.16 spreadsheet was used to enter and process the data collected. It was used to produce descriptive statistics (frequencies, pivot tables, averages, standard deviations) with the aim of finding out the perceptions of value chain players on the preferences of *C. gynandra* attributes were ranked at the level of each link using the mean score.

SPSS. 20 software was used for Kendall's concordance test. This test assesses the concordance of the judgments made by the various links in the value chain. The closer the value of Kendall's coefficient is to 1, the more closely the rankings match.

## RESULTS

### Selection criteria proposed by value chain players

The criteria selected by value chain players can be grouped into six categories, namely agronomic performance (high leaf biomass), color of plant organs,

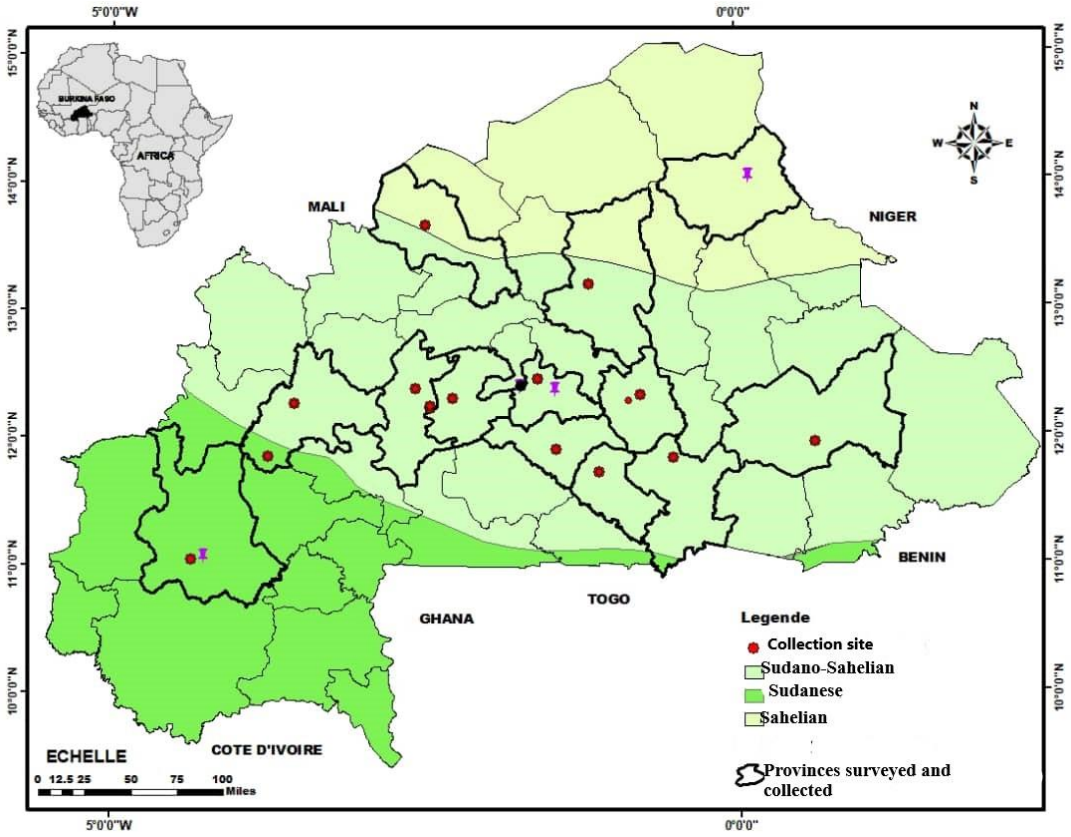


**Figure 1.** Map showing genotype collection locations.

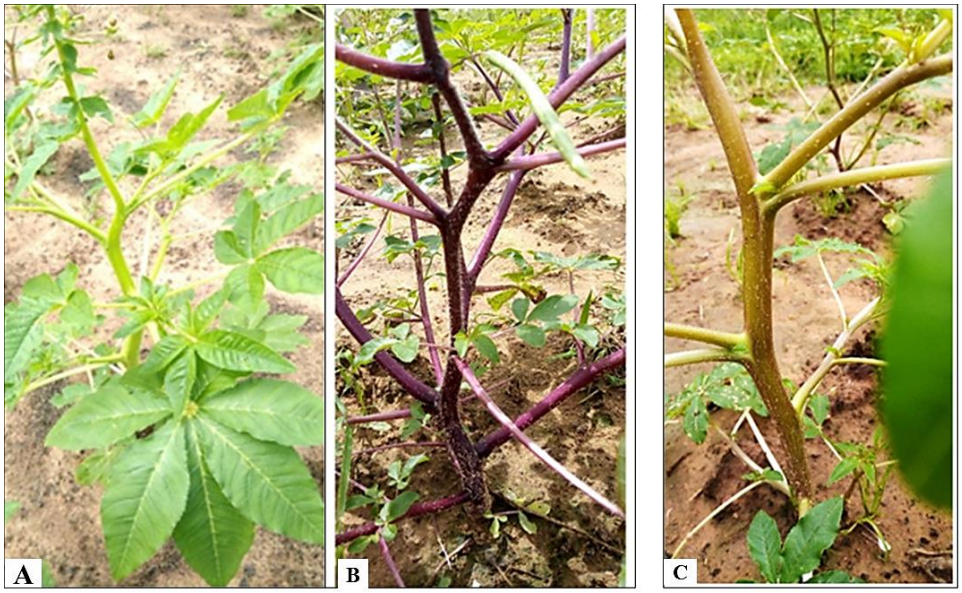


**Figure 2.** Different morphotypes observed at the three sites. A: Green morphotype; B: Violet-dark morphotype; C: Violet-light morphotype.

pest resistance, ease of cooking, taste and market value (Table 2). For growers, for example, agronomic

**Table 1.** Genotypes classification used, their morphotypes, and climatic origin.

| No. | Genotype code | Morphotype | Climate zone |
|---|---|---|---|
| 1 | OUA9 | Green | Sudan-Sahel |
| 2 | OUA10 | Green | Sudan-Sahel |
| 3 | OUA1 | Green | Sudan-Sahel |
| 4 | OUA3 | Green | Sudan-Sahel |
| 5 | OUA2 | Green | Sudan-Sahel |
| 6 | BOB3 | Green | Sudanese |
| 7 | KOU | Green | Sudan-Sahel |
| 8 | KOM1 | Green | Sudan-Sahel |
| 9 | KOM2 | Dark purple | Sudan-Sahel |
| 10 | OUA6 | Green | Sudan-Sahel |
| 11 | GAN | Green | Sudan-Sahel |
| 12 | BOB2 | Green | Sudanese |
| 13 | REO2 | Light violet | Sudan-Sahel |
| 14 | MAN | Light violet | Sudan-Sahel |
| 15 | TEN | Light violet | Sudan-Sahel |
| 16 | DED2 | Dark purple | Sudan-Sahel |
| 17 | ZOU | Light violet | Sudan-Sahel |
| 18 | DED3 | Dark purple | Sudan-Sahel |
| 19 | OUA7 | Green | Sudan-Sahel |
| 20 | GOU | Light violet | Sudan-Sahel |
| 21 | BOB4 | Light violet | Sudanese |
| 22 | DED1 | Dark purple | Sudan-Sahel |
| 23 | KAY2 | Green | Sahelian |
| 24 | OUA5 | Green | Sudan-Sahel |
| 25 | OHG | Dark purple | Sahelian |
| 26 | BOB1 | Dark purple | Sudanese |
| 27 | DED4 | Dark purple | Sudan-Sahel |
| 28 | FAD | Light violet | Sudan-Sahel |
| 29 | MOG | Green | Sudan-Sahel |
| 30 | BOND | Green | Sudanese |
| 31 | ZOR | Green | Sudan-Sahel |
| 32 | KOM3 | Dark purple | Sudan-Sahel |
| 33 | KAY1 | Light violet | Sahelian |
| 34 | REO 1 | Light violet | Sudan-Sahel |
| 35 | DED5 | Dark purple | Sudan-Sahel |
| 36 | BOB6 | Light violet | Sudanese |

**Table 2.** Frequencies of criteria used by value chain players to select genotypes of interest.

| Leaf attributes and tender stems | Producers (%) | Consumers (%) | Retailers (%) |
|---|---|---|---|
| Color | 84 | 64 | 84 |
| Agronomic | 97 | 54 | 65 |
| Pest resistance | 82 | 34 | 28 |
| Easy to cook | 41 | 87 | 64 |
| Taste | 28 | 91 | 56 |
| Market value | 32 | 81 | 94 |

performance, morphotype color and pest resistance were the most important criteria. For consumers, market value,

**Table 3.** Characteristics of interest identified by the various links in the value chain.

| Features of interest | Producers (%) | Consumers (%) | Retailers (%) |
|---|---|---|---|
| Plant height | 80 | 64 | 61 |
| Fresh biomass | 94 | 54 | 65 |
| Plant vigor | 82 | 34 | 28 |
| Leaf tenderness | 71 | 96 | 92 |
| Aroma | 28 | 71 | 84 |
| Good germination | 62 | 33 | 43 |
| High nutritional value | 32 | 82 | 81 |

**Table 4.** Producer link attribute rankings.

| Genotype | OUA9 | OUA10 | BOB3 | MAN | DED3 | KOU | OUA2 | OUA1 | KOM1 | BOB4 |
|---|---|---|---|---|---|---|---|---|---|---|
| Morphotype | Green | Green | Green | Purple-light | Dark purple | Green | Green | Purple-light | Purple-light | Green |
| Average score | 3.83 | 3.78 | 3.79 | 3.64 | 3.61 | 3.58 | 3.55 | 3.47 | 3.38 | 3.36 |

Scale 1 to 5 (1=very poor, 2=poor, 3=average, 4=good, 5=very good) Kendall's Concordance Coefficient (W) = 0.72 Asymp. Sig = 0.000.

taste and ease of cooking were the criteria for choosing the local leafy vegetables consumed, including *C. gynandra.* On the other hand, color and market value were the decisive criteria for retailers.

### *C. gynandra* features of interest identified

The characteristics selected by the players in the value chain can be grouped into seven (7) categories. For growers, the characteristics of interest were plant height, high leaf biomass, leaflet length and width, plant vigor, high number of branches, good germination, and green color.

For consumers and retailers, leaf tenderness, less bitter taste, aroma, nutritional value, habit and pleasure of eating these leafy vegetables were the characteristics of interest (Table 3).

### Identification of preferred genotypes according to value chain players

#### *Identification of genotypes preferred by producers*

Among the 10 genotypes preferred by growers, there are six genotypes of the green morphotype, three genotypes of the violet-light morphotype and one genotype of the violet-dark morphotype. Kendall's coefficient of concordance is 0.72 and is highly significant for the assessment of the different links in the value chain (Table 4).

#### *Identification of retailers' preferred genotypes*

Of the 10 best genotypes rated by retailers, seven were of the green morphotype, one of the violet-light morphotype and two of the violet-dark morphotype (Table 5).

#### *Identification of consumer-preferred genotypes*

Of the top 10 genotypes preferred by consumers, six are of the green morphotype, two of the violet-light morphotype and two of the violet-dark morphotype (Table 6).

#### *Identification of genotypes preferred by all links*

The value chain players' preference for *C. gynandra* genotypes varied from one link to another and from one site to another. Indeed, genotypes OUA9, OUA10, BOB3 and MAN were the genotypes preferred by all links in the value chain.

## DISCUSSION

The perceptions of the players in the value chain enabled us to identify the main selection criteria, list the traits of interest to the various players and identify the genotypes preferred by the different links in the chain. Genotype selection criteria are identical at all three sites, but the order of priority varies according to the different groups of players in the value chain. For example, agronomic performance (especially productivity) is the main criterion used by growers when choosing varieties, while culinary aspects, notably ease of cooking (low fiber content) and taste, are the main criteria used by retailers and

**Table 5.** Merchant link attribute rankings.

| Genotype | OUA9 | OUA10 | BOB3 | MAN | GAN | DED4 | OUA2 | OUA5 | OUA1 | BOND |
|---|---|---|---|---|---|---|---|---|---|---|
| Morphotypes | Green | Green | Green | Purple-light | Dark purple | Dark purple | Green | Green | Green | Green |
| Average score | 4.14 | 4.11 | 4.07 | 4.04 | 4.00 | 3.93 | 3.86 | 3.7 | 3 .75 | 3.71 |

Scale 1 to 5 (1=very poor, 2=poor, 3=average, 4=good, 5=very good) Kendall's Concordance Coefficient (W) = 0.72 Asymp. Sig = 0.000.

**Table 6**. Consumer link attribute rankings.

| Genotype | BOB2 | BOB3 | MAN | BOB6 | OUA3 | DED3 | MOG | OUA10 | BOB1 | OUA9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Morphotypes | Green | Green | Purple-light | Dark purple | Green | Dark purple | Green | Green | Dark purple | Green |
| Average score | 4.15 | 3.82 | 3.79 | 3.76 | 3.71 | 3.59 | 3.50 | 3.47 | 3.41 | 3.35 |

Scale 1 to 5 (1=very poor, 2=poor, 3=average, 4=good, 5=very good) Kendall's Concordance Coefficient (W) = 0.72 Asymp. Sig = 0.000.

consumers. According to Broutin et al. (2005), preference criteria are above all visual (color, size, tenderness of leaves, etc.), agronomic, aromatic and taste-related.

The green morphotype is preferred by all these players, as its demand and market value are higher than those of other morphotypes. What's more, according to the players, especially the growers, this morphotype has higher agronomic performance than the others. This assertion is confirmed by the results of Sakandé (2023) and Kiébré (2016), who also reported that, as a result of selection oriented towards this morphotype, its agronomic performance would be superior to that of the others. The choice of this morphotype would also be justified by the fact that the players consider the leaves of this morphotype to be less bitter, and well-flavored with a shorter cooking time than that of the violet-dark morphotype. According to Chalker-Scott (1999), the fiber content in the different morphotypes, which determines cooking time, is an adaptive trait to environmental stresses. This can be a major constraint to *C. gynandra* production in arid zones or in the off-season, where harsher climatic conditions lead to an increase in fiber in the various organs. As for the bitter taste, it is thought to be linked to the high levels of tannin present in the leaves and twigs of leafy vegetables (Ajaiyeoba, 2000). However, no studies have yet been carried out to determine the proportions of tannin in the different morphotypes of *C. gynandra*, to confirm or refute what the players have reported.

The color of morphotypes is an indicator of the presence of phytochemical compounds such as carotenoids, lycopene, and anthocyanin. Studies by Bonti-Ankomah and Yiridoe (2006) showed that consumer preferences for healthy leafy vegetables including *C. gynandra* are based more on perceptions of desirable product characteristics than on conventional production alternatives. In addition to the preference criteria identified, other traits such as nutritional value and medicinal properties influence consumer preferences. Verbeke et al. (2000) and Piyasiri et al. (2002) have shown that price is also a search attribute enabling the consumer to evaluate the product before purchase. In Burkina Faso, most consumers are becoming aware of their food needs and are becoming increasingly selective. In addition to the intrinsic attributes of leafy vegetables, Burkinabe consumers prefer inexpensive leafy vegetables.

In addition, Kendall's concordance coefficient, a measure of the strength of judgment in preference assessment, showed different levels of agreement on genotype ranking among actors in different links of the value chain.

The strongest agreement in rating was observed among the links in the value chain (W =0.72). This high value of the concordance coefficient shows a high degree of conformity in the assessment of the different players. Four genotypes, OUA9, OUA10, BOB3 and MAN, were also selected by all the links in the value chain. Three of these four genotypes preferred by value chain players are green morphotypes. As a result, their technical production itinerary needs to be mastered, and they need to be popularized.

## Conclusion

This study has enabled us to identify the selection criteria and traits of interest proposed by local players in the value chain. The most important criteria for growers were agronomic and morphological. Color and the market value of the leaves were the most important criteria for retailers. For consumers, the main criteria were market value, taste and ease of cooking.

Of the three morphotypes, the green morphotype is the most prized by value chain players in the three localities. The study identified a batch of four interesting genotypes (OUA9, OUA10, BOB3 and MAN) which are the favorites of the three links in the value chain. The results obtained

in this study represent an important step forward in the varietal selection of *C. gynandra* in Burkina Faso.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

### REFERENCES


Abugre C, Appiah F, Kumah P (2011). The effect of time of harvest and drying method on the nutritional composition of spider flower (*Cleome gynandra* L). International Journal of Postharvest Technology and Innovation 2(3):221-232.

Ajaiyeoba EO (2000). Phytochemical and antimicrobial studies of *Gynandropsis gynandra* and *Buchholzia coriaceae* extracts. African Journal of Biomedical Research 3:161-165

Bonti-Ankomah S, Yiridoe EK (2006). Aliments biologiques et conventionnels: examen de la documentation sur les facteurs économiques de la perception et des préférences des consommateurs. Rapport final. Présenté au Centre d'Agriculture Biologique du Canada. Collège D'agriculture de la Nouvelle-Ecosse pp. 1-73.

Bosire KO (2014). Effects of Chinsaga *(Gynandropsis gynandra) on Haematological* Profile and Markers of Iron Metabolism in Kenyan Breastfeeding Women. Ph D thesis submitted to the University of Nairobi 212 p.

Broutin C, Gel P, Sokoke K (2005). *Le maraîchage face aux contraintes et opportunités de l'expansion urbaine: cas de Thiès, Sénégal*. Document de travail Ecocité 2:36.

Ceccarelli S, Grando S Bailey E, Amri A, El-Felah M, Nassif F, Rezgui S, Yahyaoui A (2001). Farmer participation in barley breeding in Syria, Morocco and Tunisia. Euphytica n° 122:521-536.

Chalker-Scott L (1999). Environmental significance of anthocyanins in plant stress responses. Photochemistry and Photobiology 70(1):1-9

Diouf M, Lo C, Gueye M, Mbengue NB (2007). Sélection participative de nouveaux cultivars de quatre (4) espèces de légumes feuilles (*Hibiscus sabdariffa* L., *Amaranthus* spp, *Vigna unguiculata* (L.) WALP et *Moringa oleifera* Lam) au Sénégal. African Journal of Food Agrucultre Nutrition and Development 7(3):1-17.

Kiébré Z (2016) Etude de la diversité génétique d'une collection de Caya blanc (*Cleome gynandra* L.) du Burkina *Faso*. Thèse Doct. Université de Ouagadougou 121 p.

Konkobo -Yaméogo C, Karimou AR, Kaboré S Diasso K, Diawara B, Ouedraogo JB (2002). *Les pratiques alimentaires à Ouagadougou, Burkina Faso:* Céréales, légumineuses, tubercules et légumes. CNRST, CIRAD 148 p.

Millogo-Rasolodimby J (2001). *L'Homme, le climat et les ressources alimentaires végétales en périodes de crise de subsistance au cours du 20e siècle au Burkina faso.* Thèse Doctorat., Université de Ouagadougou.249 p.

Piyasiri A, Ariyawardana A (2002). Market potentials and willingness to pay for selected organic vegetables in Kandy. Journal of Agricultural Economics 4:107-119.

Sakandé B, Traore AK, Kiebre Z, Sawadogo B, Bationo Kando P (2022a). Multi-local evaluations of agromorphological performances of *Cleome gynandra L*. in Burkina Faso. International Journal of Innovation and Applied Studies 36(1):9-20.

Sakande B, Sawadogo A, Kiebre Z, Kiebre M, Bationo P (2022b). Sélection participative de génotypes d'intérêt de *Cleome gynandra* L. dans les deux principales villes du Burkina Faso. Journal of Applied Biosciences 171(1):17838-17848.

Sakandé B, Sawadogo P, Tiendrébeogo J, Kiébré Z and Bationo/Kando P(2023b). Assessment of the stability and genotype-environment interaction of a spider plant (*Cleome gynandra* L.) collection in Burkina Faso: Application of the AMMI and GGE models. African Journal of Biotechnology 22(11):265-272.

Sakandé B (2023). Diversité génétique d'une collection de Cleome gynandra L. et sélection participative au Burkina Faso. Thèse Doctorat Unique. Université Joseph *KI-ZERBO* 115 p.

Sperling L, Ashby JA., Smith ME, Weltzien E, McGuire S (2001). A framework for analyzing participatory plant breeding approaches and results. *Euphytica* n° 122:439-450.

Tarnagda B, Cissé H, Nzambe JUM, Ouattara-Sourabié PB, Itsiembou Y, Guira F, Zongo C, Traoré Y, Savadogo A (2019). Technologie de production du « *babenda* » un aliment à base de céréale et de légumes feuilles au Burkina Faso. American Journal of Innovative Research and Applied Sciences pp. 11658-11668

Verbeke W, Scholderer J, Frewer L (2000). Consumer perception of safety in agri-food chain. Safety in Agri-Food Chain 619-646.

Weltzien E, vom Brocke K, Touré A, Rattunde F, Chantereau J (2008). Revue et tendances pour la recherche en sélection participative en Afrique de l'Ouest. Cahiers Agricultures 17:165-171