

Morphological Diversity of Banana and Plantain in the Province of Maniema in DR Congo

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ABSTRACT

The purpose of this study was to determine the morphological diversity of banana and plantain in the province of Maniema and to identify criteria for the choice of planting material, as well as the different uses of banana in the study area. To do this, a survey was carried out using the questionnaire established by Bioversity-CIALCA, on the morphological characterization of the different cultivars. These surveys identified 19 banana cultivars as follows: 4 French type plantains, 3 false horns, 2 true horns, 6 dessert bananas and 4 cooking plantains not belonging to the first three groups. The results also showed that dessert-type bananas are the most diversified in the study area (Maniema Province) with a proportion of 31% followed by French-type plantains with 27%. A small proportion of cooking plantains (7%) were recorded in this region. All these banana and plantain cultivars of the region have been described on the basis of previous knowledge, which allows to enrich the biodiversity knowledge of this crop in the Province of Maniema. Criteria for choosing planting material include flavor, taste, the amount of juice first and demand / price on the market for essential items (such as salt, soap, ...) and for sustainable production because they work for self-consumption. The main uses of banana in the region are food and the manufacture of indigenous alcohol.

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1. Introduction

Around the world, bananas (dessert and plantain type bananas) are the main fresh fruit that are the subject of major international trade. Its socio-economic and nutritional importance is considerable: far from being a simple dessert, bananas play a key role in the food security of more than 400 million people in developing countries in the tropics, and are a source employment and income for local populations (Mobambo et al., 2010).

The low levels of yield in Africa can be explained, among other things, by the attacks of pests and diseases that affect banana cultivation. Parasites and pests reduce yields by their effect on growth, number of productive plants or fruit quality. even makes some or all of the crop unfit for consumption. They may even prohibit the cultivation of a variety or plant species in a given area (Dhed'a et al., 2011).

In the Democratic Republic of Congo, banana and plantain constitute one of the main crops of self-consumption of the population, mainly in the Province of Maniema, where it contributes to the improvement of the food security together with the cassava, the rice or corn and palm oil. They are also an important source of income for households (Dhed'a et al., 2011). Banana (*Musa* spp) plays an important role in food security in the DRC. It is the fourth largest crop of fruits in the world after arguments and apples.

For Maniema, there is little knowledge of the constraints to banana production, the criteria of choice of planting material used by farmers, the preferences and uses of

plantains. This knowledge is important for improving banana cultivation to increase production and thereby improve not only food security, but also increase agricultural income and thereby reduce poverty. The Maniema deserves to be explored to collect, characterize and conserve these genetic resources for a rational use as well as to know the criteria and uses of banana and plantain.

Indeed, several studies are and have already been conducted in the field in several provinces of R & D. Congo, what fate for Maniema? Hence the importance of this study on the morphological characterization of banana and plantain. This region therefore deserves to be explored to characterize and conserve the banana diversity of the area. In fact, the characterization of genetic resources and the rational use of these resources make it possible to combat food insecurity and at the same time improve farmers' income. This work aims to identify the varietal diversity of banana and plantain, to determine the selection criteria and uses of this crop in the province of Maniema.

This study is based on the following facts:

- There is a large diversity of bananas and plantains in the province of Maniema in DR Congo;
- Crop selection criteria and the use of banana and plantain are diversified and vary by territory.

2. Material and methods

2.1. Study sites

The survey on the morphological characterization of different banana and plantain cultivars was carried out in

Table 1. Geographic coordinates of the villages surveyed in Maniema Province.

Territory	Village	Sector and /or Chiefdom	Altitude (m)	Latitude	Longitude
Kasongo	Lambalamba	Kabondo	652	S 04°44'96,8"	E 08°66'64,9"
	Benyengondo	Mamba kasenga	578	S 04°33'08,7"	E 02°67'36,7"
	Bazilanyoka	Bazilanyoka	557	S 04°31'86,9	E 06°67'47,2
Kibombo	Iwepenesula	Aluba	522	S 03°94'76,4	E 02°58'34,6
	Kiyeye	Mabila	524	S 03°92'25,0	E 02°59'31,1
	Lowe	Matapa	534	S 03°92'67,6	E 02°59'34,4
Kailo	Lopepo	Ambwe	538	S 02°56'56,7	E 04°33'07,7
	Musimba	Bendjongo	499	S 02°79'36,9	E02°61'15,8
	Betsaida	Bisilimu	506	S 02°45'91,1	E02°61'34,7
Pangi	Lungundji	Beia	533	S 02°67'80,7	E 02°62'49,9
	Mukandilwa	N'sanga	559	S 02°65'06,3	E 02°63'52,7

Maniema province in four territories whose geographical coordinates of the surveyed villages are recorded in Table 1.

Figure 1 shows the province of Maniema with its different territories.

2.2. Plant material

The plant material used in this study consisted of banana and plantain plants; cultivars found in the different study sites in the province of Maniema.

2.3. Methods

The distribution by territory was as follows: Kailo Territory, 4 sectors: Ambwe, Beia, Wasongola, and Bangengele; Kibombo Territory: Matapa, Aluba and Ankutchu; Kasongo Territory: Wazimba, Maringa, Wakabongo and Mamba-Kasenga and finally Pangi Territory: Sanga, Djuwa, Mokandilwa and Lukundji. These different villages were selected, following a direction (for territories having only one principal axis) or following different directions (for territories having several main axes) because of a village every 20 Km.

The methodology used in this work was based on the Bioversity-CIALCA survey questionnaire, which consists of reasoned sampling due to the extent of the province. At first, it consists of choosing villages based on farmers' banana plantations. In each selected village, a group of at least 30 men separated from another group of 30 women will be selected for a participatory group survey. This survey will aim not only to assess farmers' general knowledge of agriculture and livestock, but also to determine their knowledge of the varietal diversity of banana and plantain present in their village.

At the end of participatory surveys, a list of all the banana and plantain cultivars known to the farmers is drawn up. Based on this list, banana and plantain cultivars in the villages will be directly observed by the author.

The new suspected cultivars will be identified and collected for cultivation in the characterization field of the Faculty of Agricultural Sciences of Kindu University for full characterization according to the descriptor of Bioversity International (INIBAP, 2001). It lists the main descriptors for the passport data of the variety. A package of digital photos is taken on a mature plant including a photo of the entire plant with inflorescence taken obliquely to the stem of the diet and a zoom on the fingers.

In addition, the tufts of each cultivar were counted in the fields of 5 households per village to determine the most common cultivars in the study area. In addition, other questions were asked to the head of the household in particular regarding the vernacular name of each cultivar, the meaning of this name, the origin of the cultivar, its positive and negative characteristics as well as its use. Other questions related to the criteria of choice of cultivars in each household, farmers' assessments of different cultivars, as well as some agronomic practices such as fallowing and agro-forestry systems. (See CIALCA-Bioversity Diagnostic Investigation Questionnaire, Appendix I).

3. Presentation of the results

3.1. Cultivars are listed in different territories.

The results obtained after surveys in the four territories namely Kibombo, Kasongo, Kailo, and Pangi including the town of Kindu by direct observation are shown in Table 2.

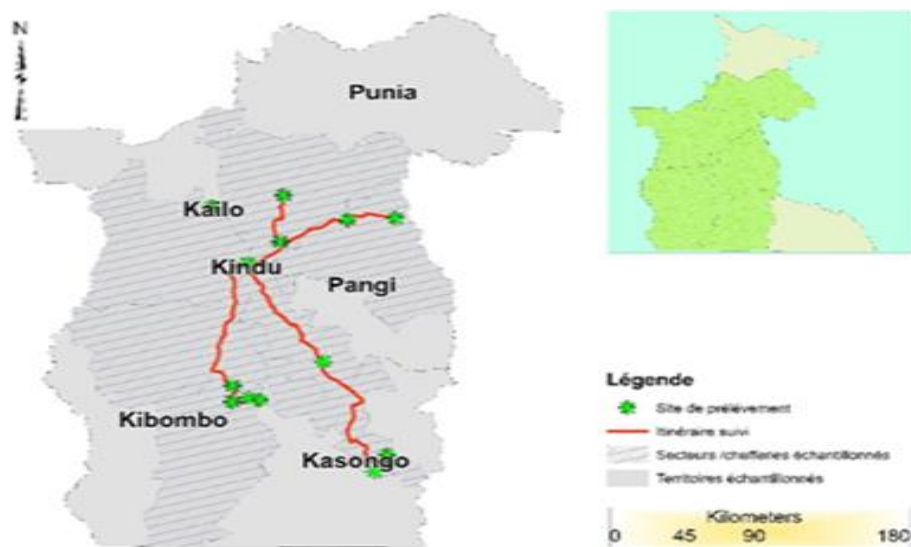


Figure 1. Survey sites and collection of banana and plantain in the study area.

Examination of this table 2 shows the number of cultivars depending on the territory, 10 for Pangi, 13 for Kailo and 7 for the last two territories namely Kibombo and Kasongo.

3.2. Distribution by type of banana.

Observations were made on a total of 421 tufts of banana and plantain in farmers' fields in 20 villages in 4 territories of Maniema Province. A total of 19 banana and plantain cultivars have been identified and these are divided into four types as shown in Figure 2

Figure 2 shows that dessert-type plantain is the most diversified in the study area of the Maniema Province with a proportion of 31% and followed by French-type plantain with 27%. A small proportion of cooking bananas (7%) are recorded in this area. Farmers use maize much more, according to them, a good quality (high dose) alcohol, although all types of banana can be used for these facts.

Table 2. Varietal diversity of banana and plantain in the different territories under study.

Territory	name	Synonym	Genotype
Pangi			
1	Limbanga Likale	Limbulu	AAB
2	Ikpole rouge	Mbuzi	AAB
3	Bosaka Rakaka 1	Bonjilo	AAB
4	Magoma 1	Nkatomba	AAB
5	Kamaramaseng	Camera	AAB
6	Figue rose	Mukamata	AAA
7	Lokoka	Kakasa Nkamuzumbu	AAB
8	Prata	Mwasi zoba	AAB
9	Petite naine	Mumbote	AAA
10	Litete	Buzilo	AAB
Kailo			
1	Libanga Liaboelobokili	Nkondo	AAB
2	Leese	Ketota	AAB
3	Bosakaraka 1	Bonjilo	AAB
4	Libanga Likale	Kahumbe	AAB
5	Figue rose	Mekamata	AAA
6	Babele Bapoku	Elonga Lenkutchu	AAB
7	Ikpole rouge	Nkomo Nkomo	AAB
8	Egbe -o-Mabese 1	Botshinda	AAB
9	Mangoma 1	Mwabi	AAB
10	Afati	Mongokah	AAB
11	Gros Michel	Kitika	AAA
12	Ikpole rouge	Bundi	AAB
13	Prata	Mwasi somba	AAB
Kasongo			
1	Ikpole rouge	Mbudi	AAB
2	Mangoma 1	Kandikondo	AAB
3	Ikpole	Lohizi	AAB
4	Limbanga Likale	Atidi	AAB
5	Camara Masing	Camera	AAB
6	Pisang Awak	Kisamunyi	ABB
7	Gros Michel	Kitika	AAA
Kibombo			
1	Ikpole rouge	Mbudi	AAB
2	Egbe-o-Mabese 1	Otangala	AAB
3	Egbema	Tompulu Kindju	AAB
4	Ikolo	Lohose	AAB
5	Figue rose	Santumaria	AAA
6	Litete	Familia	AAB
7	Mangoma 1	Yohome	AAB

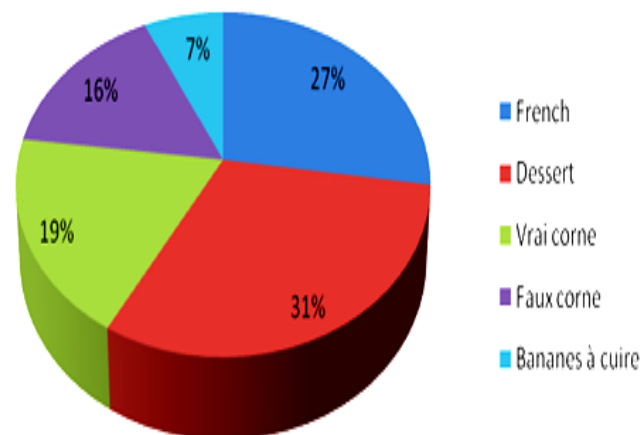


Figure 2. Proportion by type of banana and plantain in the study area of Maniema province.

3.3 Selection Criteria

The populations of Maniema choose bananas and plantains on the basis of four main criteria, namely: flavor, taste, the quantity of juice first and the demand / price on the market to obtain necessities (as salt, soap, ...) and for sustainable production, because they work for self-consumption. The trade in bananas and plantains faces price problems that may encourage producers and the conservation of products after purchase or harvest.

Figure 3 illustrates the degree of appreciation of the different types of banana trees identified by farmers in Maniema.

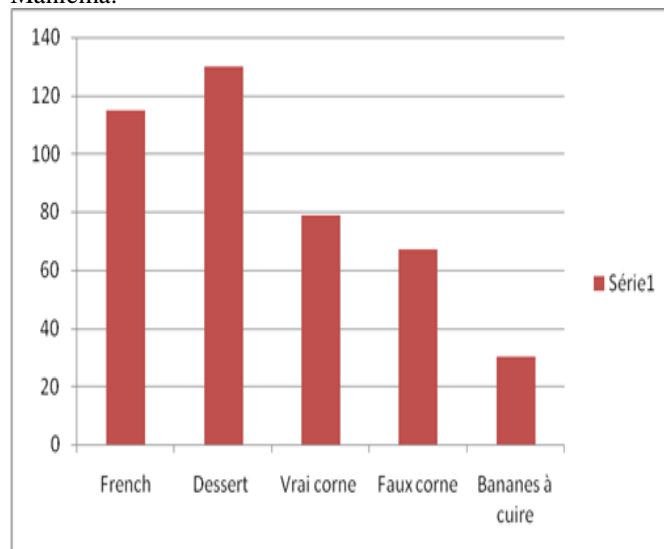


Figure 3. Degree of appreciation of banana and plantain by the population of Maniema.

From the reading of Figure 3, we note that banana dessert type are the most popular followed in descending order of French, real horn, false horn and cooking bananas respectively.

As for those concerning resistance to diseases and pests, cooking bananas show a high level of resistance that plantains and dessert bananas. The population does not have the exact knowledge on the diseases and plagues, attributes attacks of these often to the edaphic conditions (sand-clay). Planting materials are distributed from one family to another, from one neighbor to another, from one village to another.

This testifies to the unavailability of quality planting material in the growing environment. This practice causes the proliferation of diseases from one field to another.

3.4. Uses

Bananas and plantains have some uses in the Maniema mainly food (dessert banana, cooked banana, fried banana) and the manufacture of local beer for few people

4. Discussion

4.1. Varietal diversity

From the varietal diversity point of view in the 4 territories of Maniema a total of 19 cultivars were found including 4 french, 3 false horn, 2 true horn, 6 banana desserts and 4 cooking banana. From a genotype point of view, the majority of registered plantains were in the AAB group, however, some AAA genotypes were inventoried in the region in each territory. Of the 3 different genotypes found in banana plants, the ABB genotype was not found in the study area. The group Musa AAA are numerous and are represented by the cultivars big Michel, small dwarf, pink fig and Bisamunyo. The Musa AAB group represented by the cultivar Kamara Masenge and Musa ABB occupy the last position with the cultivars Pisang Awak (Dhed'a et al., 2011). During the survey conducted by Adheka (2010), out of a total of 9,168 tussocks of banana analyzed in the farmer's fields surveyed in the 27 villages of territories in the province of Tshopo, 57 banana cultivars were listed, including 26 French type plantains, 13 False Horns, 8 dessert bananas, 6 True Horn 2 Cooking Bananas, 1 French Horn and 1 hybrid. In addition, 5 new banana plantain cultivars. These differences in results are attributable on the one hand to the selection criteria of the cultivars cultivated in each province and on the other hand to the cultivation systems practiced by the farmers of each region.

4.2. Distribution by type of banana.

In this study we found the following distribution: 31% dessert bananas, 27% French, 19% real horn, 16% fake horn and 6% cooking banana. This distribution is mainly due to the uses. According to Adheka (2010), bananas are the most cultivated in DR Congo with a proportion of 73%. The same author asserts that in the province of Tshopo, there is a predominance of banana cultivars of the French type, but poorly represented, that is 10% of tufts of all the banana trees found in farmers' fields. In this study 3 new cultivars have been described, including "Ifelete, Ndika tinda and Tala lola". Contrary to this author, we found that in Maniema it is the banana cultivars of the dessert type which are the most cultivated with a proportion of 31%. In the province of Ecuador 30.1% cultivars of Litete and 5.3% in Orientale province. Muhindo "2010", meanwhile, found that in South Kivu, French-type banana trees are the least representative with 1.36% of the clumps in the fields although they are found everywhere with a low diversity. Only one new cultivar was described by him in this province "Plantain Idjwi"

4.3. Selection criteria.

In light of the results obtained in this study, the selection criteria used by banana growers in Maniema are the flavor, taste, the amount of juice first and the demand / price on the market to obtain food items. first necessities (like salt, soap, ...) and for sustainable production, because they work for self-consumption. There is also resistance to diseases. These materials are exchanged between farmers. According to Issoliwei (2014), in the province of Ecuador, planting material is distributed from one family to another, from one neighbor to another, from one village to another. This demonstrates the unavailability of quality planting material in

growing media. Adheka (2010) stated that in Tshopo province, bananas and plantains are grown primarily for their taste, so to be eaten. The criteria for choosing Planting materials most often reflect farmers' understandings by putting a cultivar in their field,

4.4. Uses.

Although banana may have other importance, the important role it plays lies in human nutrition. Unripe or half-ripe plantains are eaten boiled (Makenge) or looted in a much appreciated paste (Lituma).

This may comprise, in a mixture, boiled and larded cassava in variable proportion according to the taste or the availability of one or another component. Plantains can also be eaten grilled. Thus, a large proportion of farmers (96.1% of households surveyed) consume grilled or cooked plantains. Plantains can also be transformed into local liquor called lotoko (3.8% of households) or flour after drying (0.1% of households (Adheka, 2010).) Plantains can also be transformed into local alcoholic drink called lotoko (3.8% of households) or flour after drying (0.1% of households). This use of plantains is not well known in Tshopo province, but it was used extensively in the Kilo region (Ituri province), where plantains were very abundant (Dhed'a, 2010, personal communication). According to Issoliwei (2014), the use of bananas and plantains in the province of the Equator are numerous including cultural ceremonies, treatment of various diseases "tooth decay, malaria ..."

5. Conclusion

The purpose of this study was to determine the morphological diversity of banana and plantain in the province of Maniema and to identify criteria for the choice of planting material, as well as the different uses of banana in the study area. To do this, a survey was carried out using the questionnaire established by Bioversity-CIALCA, on the morphological characterization of the different cultivars. . These surveys identified 19 banana cultivars as follows: 4 French type plantains, 3 false horns, 2 true horns, 6 dessert bananas and 4 cooking plantains not belonging to the first three groups. The results also showed that dessert-type bananas are the most diversified in the study area (Maniema Province) with a proportion of 31% followed by French-type plantains with 27%. A small proportion of cooking plantains (7%) were recorded in this region. All these banana and plantain cultivars of the region have been described on the basis of previous knowledge, which allows to enrich the biodiversity knowledge of this crop in the Province of Maniema. Criteria for choosing planting material include flavor, taste, the amount of juice first and demand / price on the market for essential items (such as salt, soap, ...) and for sustainable production because they work for self-consumption. The main uses of banana in the region are food and the manufacture of indigenous alcohol.

In terms of agronomic practices taken into account in this work, research has shown that many farmers leave their fields fallow after the first harvest. On the other hand, many of these farmers also do not practice agroforestry because of lack of information. This poses a threat to the forest and thus confirms that agricultural practices appropriate for sustainable production in the forest environment related to banana cultivation would still be ignored by farmers in Maniema Province.

Bibliographical references

Mobambo, P., Staver, C., Hauser, S., Dhed'a, B. and Vangu, G. (2010). An Innovation Capacity Analysis for Identificative Strategies for Improving Plantain and Banana (Musa spp.)

Productivity and Value Addition in the Democratic Republic of Congo. *Acta Horticulturae*, 879, 821-828.

Dhed'a, D., Moango, M. and Swennen, R., 2011. Banana and plantain cultivation in the Democratic Republic of Congo, Didactic support, Saint Paul, Kinshasa, 85 p

INIBAP, 2001: Annual Report, International Network for Improvement of Banana and Plantain. Montpellier. La France.

Adheka, G., 2010: Morphological diversity of banana and plantain used in the Congo Basin and their cultivation in the

Tshopo district forest region in Orientale province in the Democratic Republic of Congo. Memory of unpublished DES, University of Kisangani.

Muhindo, H., 2010: Morphological diversity of cultivated banana and plantain and their uses in the province of South Kivu. DES, IFA / Y4'bi, RD.Congo.96p

Issoliwei, 2014. Morphological characterization, uses and culture of banana and plantains in the province of ecuador in dr congo.79p.