Banana cultivar diversity in the area of Morogoro, Tanzania.

G. EVERS*

BANANA CULTIVAR DIVERSITY IN THE AREA OF MOROGORO. TANZANIA.

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ABSTRACT Banana germplasm collection and cultivar identification were carried out in Morogoro area, Tanzania. About 60 accessions have been collected and at least 39 cultivars identified. The cultivar distribution in two selected zones of Morogoro was also studied. Results show that, in spite of a wide diversity of cultivars observed, mainly few AAA «Cavendish» cultivars are grown for cooking and as dessert banana. The recent outbreak of Black Sigatoka Disease (*Mycosphaerella fijiensis*) stressed the importance of germplasm collection with the objective to screen local material for BSD as well as for the prevailing Panama disease (*Fusarium oxysporum* f. sp. *cubense*).
Major findings on cultivar identification are presented in appendix. Unexpected variations were observed in most subgroups, especially of ABB and AAB groups. Finally, an «unknown» cultivar, named KIKUNDI, probably of AAA group, appeared to be of major interest for its BSD resistance. It is suggested that, besides introduction of cultivars tolerant to BSD, local variety screening be pursued to identify cultivars showing good resistance to diseases, adapted to the environment and meeting organoleptic and cooking demands of the consumers.

DIVERSITE VARIETALE DU BANANIER DANS LA ZONE DE MOROGORO EN TANZANIE.

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RESUME - Une collection de bananier a été établie dans la région de Morogoro en Tanzanie. Cette collection contient actuellement près de 60 specimens dont 39 cultivars ont été identifiés. Une étude de la répartition de ces cultivars dans deux zones de cette région montre que, malgré l'existence d'une grande diversité de cultivars, très peu sont cultivés à grande échelle. Tant pour les bananes consommées comme dessert que pour la cuisson, il s'agit de quelques cultivars «Cavendish» du groupe AAA.
La récente apparition de la maladie des raies noires (*Mycosphaerella fijiensis*) a montré toute l'importance de cette collection à partir de laquelle pourra s'effectuer un tri variétal résistant ou tolérant à la maladie des raies noires et à la maladie de Panama (*Fusarium oxysporum* f. sp. *cubense*), également présente dans cette région.
Des informations complémentaires sur l'identification des cultivars sont exposées en annexe. Des variations inattendues ont été observées parmi certains sous-groupe des AAB et ABB. Un cultivar non identifié, nommé KIKUNDI, très probablement du groupe AAA, présente une intéressante résistance à la maladie des raies noires.
Cet article suggère de poursuivre, parallèlement à l'introduction de variétés résistantes à la maladie des raies noires, la collecte et l'identification de variétés locales, bien adaptées à l'environnement, résistantes aux principales maladies, et correspondant aux goûts et habitudes culinaires des consommateurs.

INTRODUCTION

In Tanzania, the production of banana (cooking, dessert and plantain) is estimated at 2.7 millions of tonnes for the year 1989. It constitutes the second largest producer in Africa after Uganda and ranks among the 10 first world producers (FAO, 1990). This crop is mentioned as being the major staple food for 15 to 20% of the population, mainly in the high altitude areas with high rainfall like Kagera, Kigoma, Arusha and Kilimanjaro regions (Walker and Bridge, 1983). Banana production is however found in many other areas of the country like Mbeya, Morogoro and Coast regions as well as Zanzibar.

So far, information on banana cultivars is mainly available from the northern regions and Zanzibar. This is reflected in the compilation made by Stover and Simmonds (1987). As banana had not yet been studied in Morogoro area, the first step was to establish a local collection and to describe and identify the cultivars. This background knowledge is essential before initiating further research programmes. First results enabled us to study the relative importance of these cultivars in two selected zones of Morogoro.

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The recent outbreak of Black Sigatoka (*Mycosphaerella fijiensis* Morelet) in the area pointed out the relevance of such an approach. It allowed us to get a preliminary field assessment on the performance of these cultivars versus the new disease. The collection will constitute a basis for further research and for multiplication.

This paper outlines the information collected in the frame of cultivar collection and identification. The relative importance of the different subgroups in two selected areas of Morogoro is presented and the incidence of the outbreak of Black Sigatoka Disease is discussed. In the light of the data collected during the study, recommendations are drawn.

MOROGORO REGION

Morogoro region lies between 6° and 10° lat. South and 36° and 38° long. It enjoys a wide range of agroclimatic conditions, dry and wet, from tropical to temperate like conditions. The altitude is ranging from 300 to more than 2,000 m asl in the Uluguru Mountains. In this region, banana is not the major food crop, but it is commonly consumed as starch, beverage and dessert. Production, as a cash crop, is rather concentrated in lowland humid areas like Matombo, Ifakara, Kilombero and Turiani which are feeding local and regional markets. This region is also an important supplier of the Dar Es Salaam Market. In 1982, it provided 30% of the bananas for cooking (Walker and Bridge, 1983).

GERMPLASM COLLECTION AND CULTIVAR IDENTIFICATION

New accessions were collected around and within the Uluguru Mountains, inhabited by Waluguru, and in Morogoro township. Morogoro town was selected because it has an important population of immigrants from the region and other parts of Tanzania. These people often introduced cultivars from their home areas. Banana is commonly cultivated in the urban home gardens. The material already collected should not be considered to be exhaustive for Morogoro region. At the end of 1991, a collection of about 60 accessions have been planted at the Horticulture Unit of Sokoine University of Agriculture, Morogoro. These belong to the following groups : AA, AAA, AB, AAB and ABB.

The identification of these accessions was made through the morpho-taxonomic method to reach group or subgroup levels (Simmonds and Shepherd, 1955). Cultivar identification was done through litterature compilation. The use of MUSAID determination system (Perrier and Tezenas du Montcel, 1990) as well as exchange of information with INIBAP and IRFA experts assisted very much in identification and cross checking. Whenever possible, the relation with reference names of the international nomenclature was determined.

Results of the surveys and collections are shown in TABLE 1. The origin of the planting material and known synonyms are also presented. Specific notes on some cultivars is given in APPENDIX.

Many cultivars observed have «variation or mutants». In order to gain in clarity they are considered as subgroup (e.g. Mshale, Silk, Pome, Bluggoe) and a standard itinerary is adopted (GROUP - SUBGROUP - CULTIVAR) as recommended by the INIBAP - IBPGR workshop (1989).

In all groups, the diversity of banana cultivars is high. So far, at least 39 cultivars have been recorded while other accessions await further observations. Unexpected cultivars not yet recorded in the litterature were found, mainly in two subgroups of AAB («Plantain» and «Silk») and two subgroups of ABB («Awak» and «Monthan»). A major finding is also the «unknown» cultivar falling probably under the AAA group, named Kikundi, which still needs to be categorized. This cultivar could appear very interesting for its Black Sigatoka Disease resistance.

In general, our findings seem comparable and complementary to those compiled by Stover and Simmonds (1987). However, many cultivars mentioned by these authors are now considered as subgroups having variability within the studied area.

The tentative translation and/or meaning of the cultivar names is given in TABLE 2. Names found in Morogoro are from Swahili, Kiluguru or other language from the country. These names can refer to the origin of the cultivar, morphological characteristics, organoleptic properties, traditional uses, etc. The distinction between Swahili and local languages (e.g. Kiluguru) is not easy, possibly because of the increasing importance of Swahili language over the last decades. For one given name, several rational meaning can be given (e.g. Kipakapaka). Some adjective used can lead to confusion : in the case of «ndefu - fupi» (long - short), it can refer to the height of the plant (e.g. Kimalindi) or to the length of the fruits (e.g. Mzuzu).

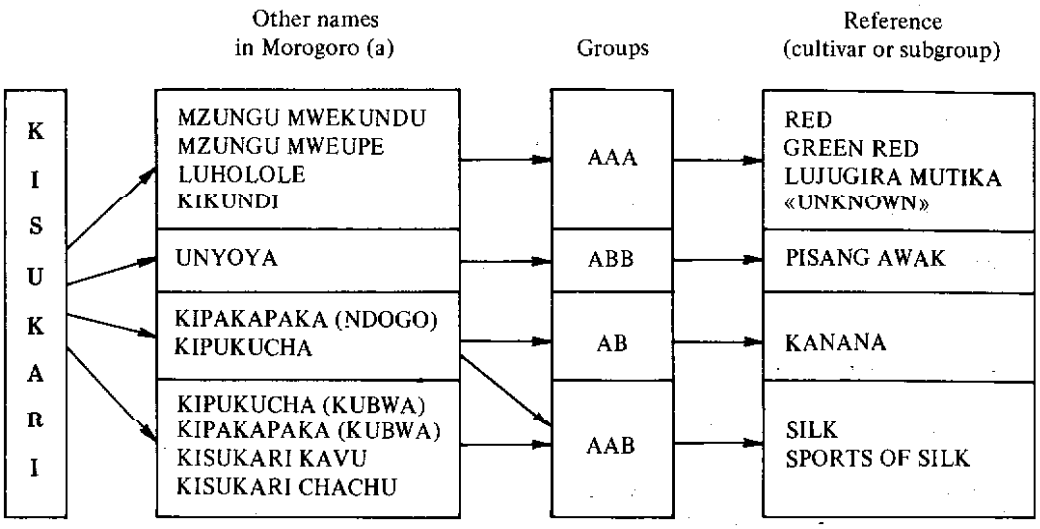
Finally, a given name can refer to different cultivars, either within the same area (e.g. Bukoba when used in Morogoro) or in different areas (e.g. Kisubi). Local names, however essential in our study, can not much assist in cultivar identification ; on the opposite, they often lead to confusion. The case of KISUKARI illustrated below is a typical example.

In Morogoro, at least 8 cultivars belonging to different genomes can be called KISUKARI or SUKARI. This is a good example of confusion. Even though most of them have alternative names or additional adjectives attached to the word Kisukari. But these are not known by all and at the market one is told «They are all Kisukari, there is no difference». Nevertheless, these cultivars are not equally performing for factors like yield, disease resistance and fruit quality. In addition to the confusion, diseased plants of other cultivars can produce abnormal small fruits which can be sold at the market as «Kisukari». This is observed, for example, with Gros Michel when badly affected by Panama disease. It is therefore important to identify them fully. A first attempt for clarification is given in Figure 1.

CULTIVAR DISTRIBUTION IN MOROGORO AREA

The distribution of banana cultivars was studied in two selected areas, an altitudinal transect along the Uluguru

FIGURE 1 - Dessert bananas called KISUKARI in Morogoro area ; their synonyms and relationship to groups and reference cultivars.



(1) - for synonyms, see Table 2.

mountains and Morogoro town. The altitudinal transect was chosen from Mlali (500 m asl) to Ngungulu (1900 m asl) while 10 wards were randomly selected in Morogoro town. A formal questionnaire was used to collect data and field observations were made. Farmers were selected on a random basis. The results of this survey are summarized in TABLE 3.

In Morogoro town the group AAA is the most important (72.6%). The subgroup «Cavendish» represents 55.7% of the total production, followed by «Lujugira-Mutika» (15.9%). The «Plantain» subgroup comes third with 14.2%. The comparison of Morogoro town with rural (Mlali) and the Uluguru transect show differences in the relative importance of «Cavendish», «Lujugira Mutika» and «Plantain». Morogoro rural is strongly dominated by «Cavendish» bananas (82.9%). Cultivars from non AAA groups are more represented in town than in the rural area. In the survey, all cultivars from AB/AAB groups of the «Kisukari» type were considered together because of the difficulty of distinguishing them rapidly in the field. These are not much grown comparing to other cultivars (from 0.3 to 3.7%).

An important part of Morogoro town population is composed of immigrants from all parts of the country. This factor contributes to the increased importance of some cultivars which are hardly grown along the studied transect.

According to our results, in spite of a wide diversity of cultivars available, only few, mainly from one subgroup («Cavendish») of AAA group are widely grown. These are consumed either as a dessert banana or for cooking.

On the altitudinal transect, it was observed that the number of cultivars grown is drastically decreasing with altitude. Between 1,500 and 1,700 m, only 7 cultivars are present and 4 above 1,700 m asl. Above 1,500 m, banana cultivation becomes rare as the plants are suffering from cold temperature and wind. At these altitudes only banana from AAA group are grown : MWTIKE and KIMALININDI FUPI of «Cavendish», KITOMBO and LUHOLOLE from «Lujugira-Mutika» subgroup.

Lastly, reconnaissance surveys in other parts of Morogoro region indicate that these figures cannot be extrapolated over the whole area. Variation seems well linked with agroclimatic conditions. As an example, ABB cultivars increase in dryer areas while «plantain» bananas increase in the lowland humid areas.

BLACK SIGATOKA DISEASE IN MOROGORO AREA

Early 1990, Black Sigatoka Disease (*Mycosphaerella fijiensis* Morelet) symptoms were observed in Morogoro Region. It was confirmed by laboratory diagnostic (Mourichon, CIRAD-IRFA, personal com.). The disease was observed in Kilombero and Matombo area earlier than in Morogoro town. Today, it is seen along the road between Dar Es Salaam and Morogoro. The movement of the disease is dis-continuous because many isolated spots are seen. At the end of 1991, symptoms were not yet observed everywhere. It is most probable that the disease is mainly spreading through the planting material commonly transported from one place to another. Black Sigatoka Disease is becoming a major threat in the area in addition to other prevailing pests and diseases like : banana weevil (*Cosmopolites sordidus*), nematodes, Yellow Sigatoka (*Mycosphaerella musicola* Leach) and Panama disease (*Fusarium oxysporum* f. sp. *cubense*).

First observations on cultivar resistance, non quantitative, are on the line of the information available in the literature (Simmonds an Stover, 1987 and Tezenas du Montcel, 1990). In subgroups «Mshale» (AA) and «Cavendish» (AAA), all cultivars observed show a very high susceptibility to the disease. Within other groups, interesting differences are observed. This is mainly the case of the AAB

TABLE 1 - List of banana cultivars at Morogoro SUA Horticulture Unit collection (1).

Group	Subgroup	Common name	Reference name	Use (2)	Origin of material	Synonyms (3)
AA	«MSHALE»	MSHARE	MSHALE	Bo, De, Rc	Horti TENGERU	HALAHALA
		KITWANGE	-	Bo, De, Rc	MATOMBO	MSHALE KIPUKUCHA
		MSHARE	MHALIHALI	Bo, De, Rc	MOROGORO	MHALIHALI (Zanzibar)
AAA	«CAVENDISH»	KIMALINDI FUPI	DWARF CAVENDISH	Bo, De	MOROGORO	KINGURUWE (Moshi)
						KIGURUWE
		KIMALINDI NDEFU	GIANT CAVENDISH	Bo, De	MOROGORO	KIMALINDI
		MTWIKE	GRAND NAIN	De, Bo	MOROGORO	-
		PAZ	PAZ	De, Bo	Horti TENGERU	PUZ, ISRAEL
		-	ROBUSTA	n. av.	Horti TENGERU	MTWIKE
		-	PISANG MASAK HIJAU	n. av.	Horti TENGERU	-
AAA (?)	«CAVENDISH» (?)	KIKUNDI	-	De	MOROGORO	KISUKARI
AAA	«LUJUGIRA/MUTIKA»	SMALL MATOKE	-	Bo, De, Rc	MOROGORO	-
		MATOKE	-	Bo, De, Rc	MOROGORO	BUKOBA
		UCANDA	-	Bo, De, Rc	Horti TENGERU	BUKOBA
		BUKOBA NDEFU	-	Bo, De, Rc	MOROGORO	-
		KITOMBO	-	De, Bo	MOROGORO	
		LUHOLOLE	-	De, Bo	MOROGORO	MWANAMKE, NYANUNDU
						KISUKARI
		NYELELE	-	De, Ro	MOROGORO	NDOSA, NYERERE
AAA	«GROS MICHEL»	JAMAICA	GROS MICHEL	De, Bo	MOROGORO	ENIOGE
AAA	«RED»	MZUNGU MWEKUNDU	RED	De, Bo	MOROGORO	WILLIAMS
		MZUNGU MWEUPE	GREEN RED	De, Bo	KINOLE	MUSOMA
AAA	-	EMBWAILUMA	-	n. av.	Horti TENGERU	MBWAZIRUME (Bukoba)
AB	«NEY POOVAN»	KISUKARI	KANANA	De	MOROGORO	KIPUKUCHA
						KIPAKAPAKA
						KISUBI (Bukoba)
AAB	«SILK»	KISUKARI	SILK	De	KINOLE	KIPUKUSA (Zanzibar)
						KIPUKUCHA (KUBWA/NDOGO)
						KIPAKAPAKA /KUBWA/NDOGO)
						KAMBANI (Mbeya)
		KISUKARI	SPORTS OF SILK	De	KINOLE	KISUKARI KAVU
					MOROGORO	KISUKARI CHACHU

Group	Subgroup	Common name	Reference name	Use (2)	Origin of material	Synonyms (3)
AAB	«PLANTAIN»	MZUZU NDEFU	GIANT FRENCH PL.	Bo, Ro	MOROGORO	MZUZU HALISSI NYAGONZI
		MZUZU NDEFU	MEDIUM FRENCH PL.	Bo, Ro	MOROGORO	CHIKONZI
		MZUZU FUPI	MEDIUM FRENCH PL.	Bo, Ro	KINOLE	LUMWOMBWE
		MZUZU KILUNDILA	MEDIUM FRENCH PL.	Bo, Ro	MOROGORO	NKONJWA (Bukoba)
		MKONO WA TEMBO	TRUE HORN PLANTAIN	Bo, Ro	KINOLE/MOROGORO	M.W.T. CHANA MOJA and CHANA MBILI
		MKONO WA TEMBO	FALSE HORN PLANTAIN	Bo, Ro	MOROGORO	M.W.T. CHANA MBILI, TATU and NNE
		MZUZU YA KATI	-	Bo, Ro	TURIANI	-
ABB	«AWAK»	UNYOYA	PISANG AWAK	Br, Bo, De	MOROGORO	KIPUNGARA (Moshi) KISUKARI NYEUPE (Kenya) HALALE (Mbeya) KIJIVU (Arusha) KISUBI
		UNYOYA NDOGO	-	Br, Bo, De	MOROGORO	-
ABB	«BLUGGOE»	BOKOBOKO	BLUGGOE	Bo, De, Ro	MOROGORO	MKOJOZI, MNGAZIJA MGOMBA (Dodoma) KOROBOI (Zanzibar)
		BOKOBOKO	SILVER BLUGGOE	Bo, De, Ro	MOROGORO	MKOJOZI, MNGAZIJA KOROBOI (Zanzibar)
		BOKOBOKO	-	n.av.	KINOLE	MKOJOZI, MNGAZIJA
ABB	«MONTHAN»	JENGA UA	MONTHAN	n. av.	KINOLE	MUSKAT MNGAZIJA KUBWA
		JENGA UA	SPORT OF MONTHAN	n. av.		BOKOBOKO KUBWA KOROBOI (Zanzibar)

(1) - for comments and notes, see Appendix.

(2) - main use is given first, Meaning : Bo : boiling ; De : dessert ; Ro : roasting ; Br : brewing ; n.av. : not available.
Source : adapted from Kapilima (1989)

(3) - collected by the author or compiled from Baker and Simmonds (1987) and Stover and Simmonds (1987).

TABLE 2 - Tentative meaning of names used for banana cultivars in Morogoro (1).

NAME	MEANING (2)	NAME	MEANING (2)
Bokoboko	smooth, very soft	Kisubi	location in Uganda on Entebe road
Bukoba	town in North West Tanzania	Kisukari	which is sweet (with sugar)
Chachu	sour	Kitombo	breast of a young woman
Chana moja	one hand	Kitwange	which is for pounding
Chana mbili	two hands	Kubwa	big, large
Chana tatu	three hands	Luhololе	which tastes less (Kiluguru)
Chana nne	four hands	Matoke	for cooking (equivalent to Matooke) (from Luganda ?)
Embwailuma	see Mbwazirume	Mbwazirume	let the dog bites (Luganda)
Enjoge	?	Mgomba	a banana plant
Fupi	short	Mkojosi	who wets his bed
Halale	Harare, capital of Zimbabwe	Mkono wa tembo	elephant trunk
Halisi	genuine, original	Mshale	? (Kichaga)
Jamaica	refers to the country	Mshare	arrow
Jenga ua	building a fence (eventually building a flower)	Mtwike	so heavy that it needs help to load on the shoulders
Kambani	? (name from Mbeya)	Muskat	town from Oman
Kanana	?	Mwanamke	a woman
Kavu	dry	Mzungu mweupe	white european
Kiguruwe	like a little pig (also kinguruwe)	Mzungu mwekundu	red european
Kijivu	grey (colour)	Mzuzu	from msusu, a tail feather of a bird
Kikonde	like a fist, like the palm of the hand	Ndefu	long, tall
Kikundi	river in Morogoro area, also «group» in Swahili	Ndizi	banana fruit
Kilundila	compact (probably Kiluguru)	Ndogo	small
Kimalindi	Malindi, coast town in Kenya	Ndosa	? (Kiluguru)
Kipakapaka	maturing quickly after harvesting and dropping of fruits at maturity. Also related to «like a little cat».	Nyelele	? (Kiluguru)
		Nyeupe	white
		Ngazija	the Great Comoro Island (also Mngazija)
Kipukucha	dropping (of fruits at maturity, synonym of kipukusa and kipukuta)	Paka	a cat
		Sukari	sugar
Kipungara	possibly from «kibungala» which could refer to «Bengale» in India.	Unyoya	down (as for young bird), a feather
		Ya kati	of the middle, intermediate

(1) - Source : collected by the author and Baker and Simmonds (1952).

TABLE 3 - Banana distribution in Morogoro District (a) (in percent).

Group	Subgroup or cultivar	Morogoro town (b)	Morogoro Mlali (c)	Uluguru transect (a)
AAA	CAVENDISH	55.7	82.9	88.8
	LUJUGIRA MUTIKA	15.9	3.0	5.2
	RED	1.0	0.0	0.1
AA	MSHALE	2.6	1.8	1.0
AAB	PLANTAIN	14.2	9.2	3.4
	sub-total:	89.4	96.9	98.5
AB/ABB	«KISUKARI»	3.7	0.7	0.3
ABB	BLUGGOE	5.0	2.3	1.1
	PISANG AWAK	1.9	0.1	0.1
	sub-total :	10.6	3.1	1.5

Notes :

(a) : adapted from W. Kapilima (2) and M. Mapunda (3).

(b) : homegardens surveyed within the municipality.

(c) : Mlali, a nearby rural area having similar climatic conditions as Morogoro town (altitude between 500 and 700 m asl).

(d) : overall figures for the altitudinal transect along the Uluguru Mountains from 500 to 1900 m asl.



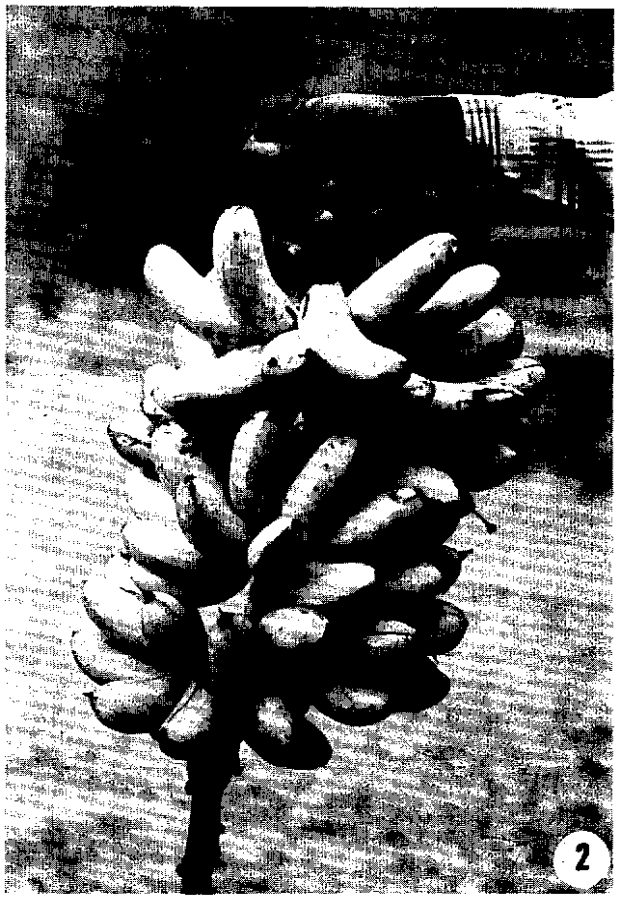
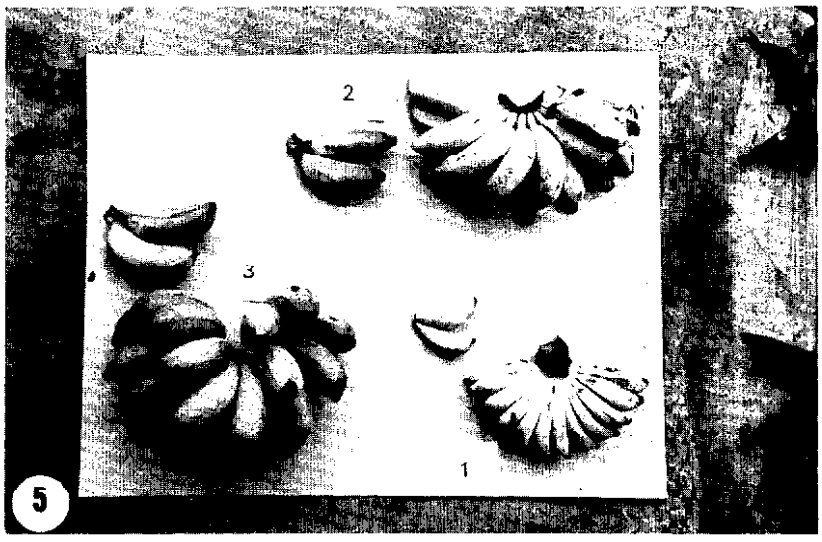




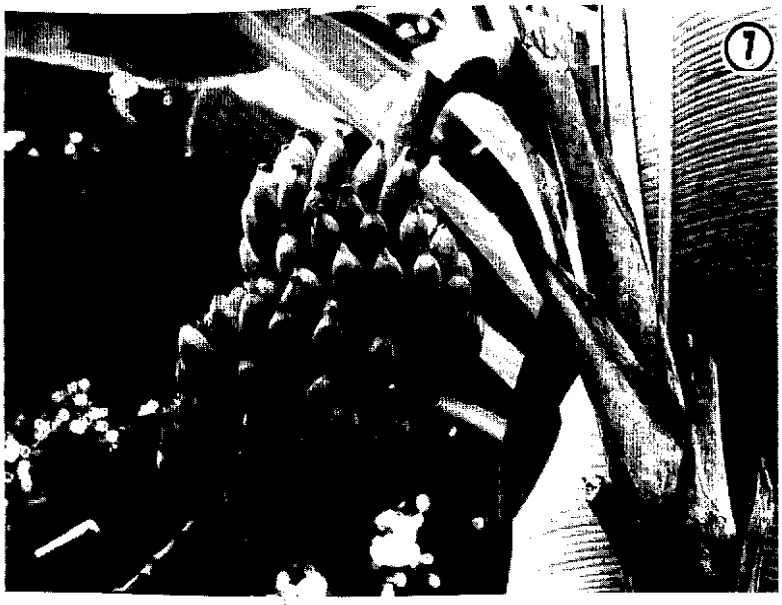
PLATE 1
CULTIVAR KIKUNDI (AAA)

1 - Kikundi, petiolar margins not clasping the pseudo-stem.
2 - Ripe bunch of about 11 kg.
3 - General view, bunch and inflorescence before maturity.
4 - Male bud and flowers.
5 - Comparison of Kikundi fruits (3) with a silk (2) and a sport of silk (1) having very small fruits.



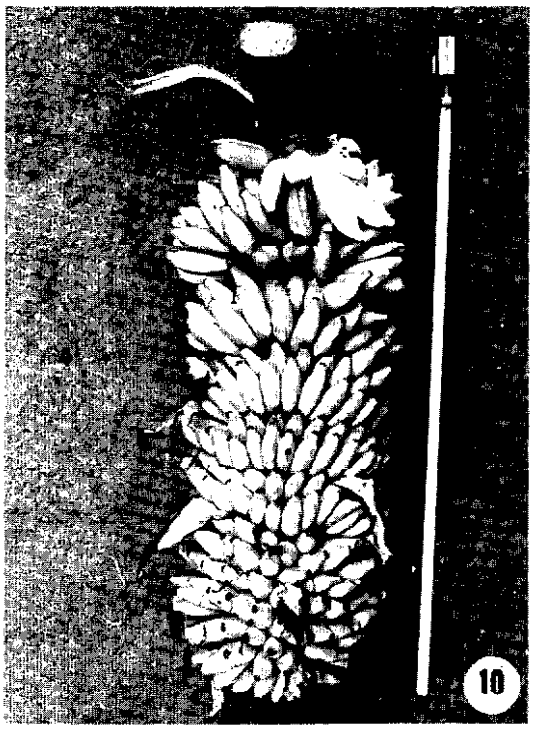












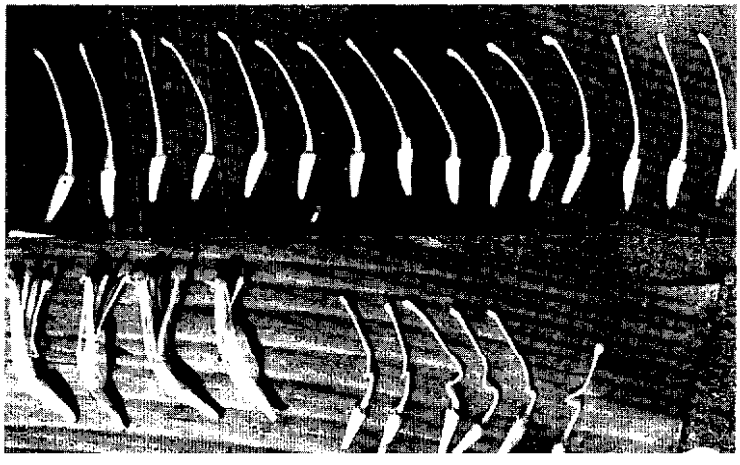


PLATE 2
SUBGROUP «SILK» (AAB)

6 - Giant cultivar, general view.
7 - A pale yellow cultivar at harvesting time.
8 - Splitting of fruits at maturity.
9 - Corrugation of fruits before maturity.
10 - Variant with very small fruits.
11 - Style of male flower straight (above) and hooked (below). Note that hooked is typical of some









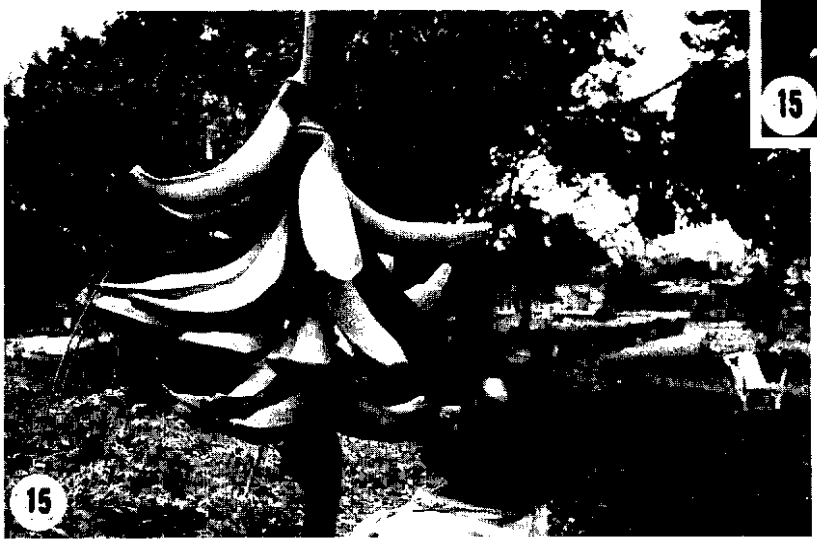


PLATE 3
SUBGROUP «PLANTAIN» (AAB)

12 - True Horn plantain (one hand).
13 - A medium French plantain (rather short hands).
14 - Medium French plantain with a compact bunch (Mzuzu Kilundila).
15 - Horn plantain, but with a typical French type male inflorescence (Mzuzu Ya Kati).

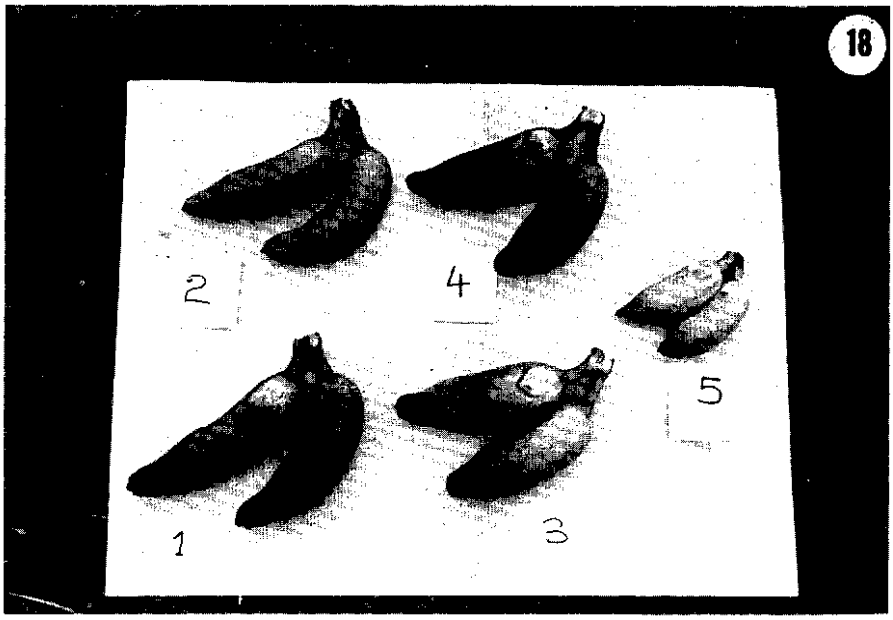
PLATE 4



16 - Group AA, Mhalihali. Note the yellow male bud.



17 - Group ABB, «Bluggoe». Note the bracts remaining attached above the male bud.



18 - Fruit variation in ABB group : «Monthan» (1,2), «Bluggoe» (3,4) and «Awak» (5).

subgroups including «Plantain» and AAA subgroup «Lujugira Mutika» where obvious variation appears from very susceptible to moderately resistant. High level of resistance is only found in ABB group, mainly for «Awak» subgroup. In addition, the most remarkable exception is the «unclassified» Kikundi (AAA) which did not show any symptom of the disease while it was surrounded by other cultivars heavily affected (see note in APPENDIX).

At this stage of the research programme, the difference observed in Black Sigatoka can be attributed, not only to the genetic background of the cultivar, but also to the strain of the pathogen (still unknown) or to the environmental conditions.

According to TABLE 3, few cultivars are resistant to the disease, they are hardly grown in the area and usually not very popular. In other words, more than 90% of the banana grown is susceptible or very susceptible to Black Sigatoka.

In Morogoro area, it is expected that, in the future, the relative importance of banana groups and cultivars will be modified, because of the high susceptibility of most of the banana presently grown. Dessert and brewing bananas are not all affected and acceptable cultivars will still be available ; they will increase in importance. The main problem will be to find good substitutes of cultivars commonly grown for cooking (Lujugira Mutika, Cavendish and Plantain).

Until resistant cultivars suitable and accepted for cooking can be identified, the ABB group («Bluggoe», «Awak», ...) could be a partial substitute and therefore increase in importance. Other ABB cultivars (SABA, CARDABA, PELIPITA, ...) have been introduced in the country for evaluation and possible multiplication.

It appears also urgent to introduce the cultivar MYSORE (called KIKONDE in Zanzibar) which has not been observed in Morogoro. Mysore is one of the rare cultivars showing high level of resistance to Panama and Black Sigatoka diseases as well as good resistance to nematodes and banana weevils.

The use of ABB cultivars as substitutes for Black Sigatoka susceptible plantains is being considered in West Africa (Hahn *et al.*, 1990). Besides the low acceptability of these cultivars by most of the population in Tanzania, many ABB cultivars are susceptible to Panama disease (*Fusarium oxysporum* f. sp. *cubense*). The disease is present in the area, farmers are usually not aware of it and thus of its way of propagation. Furthermore, some AAB dessert cultivars (e.g. Silk) showing resistance to Black Sigatoka are also susceptible to Fusarium Wilt. This disease has been totally ignored in the country by research and extension officers as most cultivars widely grown were resistant to it. There is a major risk of increasing the development of Fusarium Wilt while trying to limit the incidence of Black Sigatoka.

In addition to the potentiel of ABB cultivars, there is a need to attempt to look for cultivars resistant to Black Sigatoka and Panama diseases within the wide underexplored AAA germplasm of cooking bananas available in the country. The case of KIKUNDI brings hope for the success of such an alternative approach.

Finally, there is an need to screen dessert AAB and ABB cultivars, available within the area, for Fusarium Wilt resistance as recommended by Buddenhagen (1990).

CONCLUSIONS AND RECOMMENDATIONS

The diversity of banana germplasm already collected in Morogoro is impressive. The area surveyed remains modest and most of the country has never been covered. Other collections available in the country still need to be described and the material tested.

Many cultivars have already been identified in Morogoro area and many more are expected to be found. This exercice will have to be pursued and further identification will greatly benefit from the assistance of MUSAID computerized determination system. Comparative trials can be established to collect quantitative data on morphological characters influenced by the environment, but also on agronomic performance, pest and disease resistance, etc.

Today, it is not possible to compare data on cultivar performance from one area of Tanzania with another or with other countries. There is a need to initiate this systematic identification in other parts of the country and to gradually set up a national collection and list of cultivars with their local names and synonyms for all regions and languages.

Besides introduction of cultivars resistant to Black Sigatoka Disease, there is also a scope for identifying cultivars within the wide germplasm available in Tanzania showing good resistance to Black Sigatoka and Panama disease. Efforts should also focus on this alternative approach. This prospect could result in proposing varieties adapted to the environment and meeting the organoleptic and cooking demands of the population. Future experiments on Kikundi cultivar could confirm that it is feasible.

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APPENDIX

NOTES ON SOME GROUPS, SUBGROUPS AND CULTIVARS COLLECTED IN MOROGORO

AA GROUP.

Even though it is mentioned in other parts of the country (Mbwana, 1982), SUCRIER has not been identified in Morogoro.

Another type of AA is the MSHALE (or MSHARE). It is the most popular banana grown in Kilimanjaro area where several cultivars are reported. It is mainly used for cooking. In Morogoro, the cultivar remains marginal. The plants are usually giant with erected leaves and fairly large bunches. Male bracts are violet/purple and the rachis is either bare or with persistant bracts and male flowers. The cultivar collected within the area (KITWANGE or MSHALE KIPUKUCHA) is known for their fruits dropping at maturity.

A related cultivar seldom observed in Morogoro, but also called Mshale is similar to MHALIHALI described in Zanzibar by Baker and Simmonds (1952). It has large fruits with persistant bracts and male flowers with a typical yellow male bud (plate, 4, 16). Mhalihali should not be confused with PAKA (present in Zanzibar), another related AA cultivar but which has a bare rachis (not yet in collection at Morogoro).

Mshale could be considered as a subgroup for which too little is known so far.

AAA GROUP.

«Lujugira mutika» subgroup.

Tanzania is part of the center for diversification of the highland cooking bananas which are gathered under this subgroup (Shepherd, 1957). The research station of Maruku (near Bukoba) reports about 300 cultivars of these highland bananas (INIBAP/IBPGR, 1989). In Morogoro, this subgroup is less important but can be separated in two categories. One consists of varieties which have been present for a long time in the area, they have specific names (e.g. Kitombo, Luhololc, Nyelele, etc.). Others, probably introduced more recently and mainly present in the urban area, have general names which refer to their origin (e.g. Bukoba, Uganda, Matoke). These were - and still are - introduced by immigrants. Cultivars present in the collection were described by Kapilima (1989).

The cultivars present in Maruku have not yet been fully described and it is therefore not easy to relate our representatives of this subgroup with these grown in Bukoba area. It would however be interesting to determine the origin of the cooking cultivars which have been grown for a long time in Morogoro area.

Kikundi (unclassified).

This cultivar was found incidentally in a banana farm outside Morogoro town. Few clumps were randomly mixed with two other cultivars, Gros Michel and Green Red. Surprisingly, no one could give us a name (except ... Kisukari !). After investigation, it appeared that it could have been introduced, by mistake, from Ifakara, together with all the planting material needed to establish that farm in 1977. Since that time no replanting was done and the fruits have been sold as dessert bananas. It is very well distinguished by the people from the cooking highland cultivars.

The cultivar kept all our attention because it appeared to be highly resistant to Black Sigatoka Disease. No symptoms at all were observed while the other cultivars were heavily affected. Also, no symptom of Fusarium Wilt was observed even where clumps were surrounded by Gros Michel showing all symptoms of the disease. These observations will need to be verified through laboratory tests.

According to Simmonds and Shepherd (1955) method, the score is 19. The general appearance lead to a triploid, meaning AAA. This is confirmed by MUSAID determination which relates it to Cavendish subgroup, close to Lacatan (Perrier, CIRAD-IRFA, pers. comm., 1991). The fruits are however quite different. They are short, round and plumpy, the fruit tips are blunt. The colour at maturity is deep yellow, except the former angles which remain greenish. When not fully ripe, fruits are astringent and acidic but sweet and pleasant if fully ripe. First cooking tests indicate that it is generally preferred from ABB cultivars (e.g. Bluggoe) but some people considered it as good as the cooking highland cultivars. Few consumers referred it - both ripe and for cooking - to Cavendish bananas (Kimalindi). These are traditionally cooked in the area.

Another working hypothesis emerging from MUSAID determination system is that it could be a tetraploid AAAA. This could eventually explain - better than in the «Cavendish» hypothesis - the shortness of the fruits and the observed hardiness to diseases.

The name Kikundi was given by the team working at the Horticultural Unit of Morogoro. Plate 1, illustrates this cultivar.

AAB GROUP.

«Plantain» subgroup.

This subgroup is mainly found in the lowland humid pockets of the area. The general name for French plantain is MZUZU and MKONO WA TEMBO for Horn plantain.

At least three FRENCH PLANTAIN cultivars have been observed, but it is expected that more are grown. MZUZU NDEFU (or HALISSI) refers to vigourous cultivar(s) having long light green fingers. Difference in height of the pseudo-stem exists (giant, medium). This cultivar is considered as the best quality plantain. It is also the most resistant (or least susceptible) plantain to Black Sigatoka Disease.

MZUZU FUPI, also a medium french plantain, refers to a less vigourous cultivar, having shorter fingers and with pinkish pseudo-stem and petioles (plate 3, 13). The pink colour is however not as pronounced as for MCHINJA DAMU present in Zanzibar. It is unstable as variations were observed on the bunch shape, fruit orientation and persistence of neuter flowers and male bracts on the rachis. A horn type bunch was also seen as a second harvest after a normal french type bunch.

MZUZU KILUNDILA, another medium french plantain, is typical for its long compact trunconic bunch with fingers of the upper hand much larger than those of the lower (plate 3, 14). The petiolar margins are pink. The male bud, however, is small and degenerates quickly with a bend showing inverted geotropic effect. One horizontal ridge was observed on the upper part of the first male bracts. It resembles NKONJWA described by Baker and Simmonds (1952).

Concerning HORN PLANTAIN, different stages of degeneration of the inflorescence are observed : from the TRUE HORN towards the FALSE HORN. So far, the true horn has been seen with one (plate 3, 12) and two hands. They are called M.W.T. CHANA MOJA and CHANA MBILI. The false horn has been seen with two, three and four hands. They are called M.W.T. CHANA MBILI, CHANA TATU and CHANA NNE. Usually, the number of hands is not specified and the distinction between true and false horn does not seem to be known.

MZUZU YA KATI is a spectacular giant (up to 5m) cultivar with a bunch resembling Horn type but a large male inflorescence typical of French type. Few bunches observed had from 7 to 12 hands, with one row of fruits per hand, having 1 to 4 fingers only. Fingers were unusually large and big. The male inflorescence was fully developed with all bracts remaining attached to the rachis until fruit maturity (plate 3, 15). This plantain cultivar was collected from Turiani, but the farmer reported that this clump was originally a normal horn plantain.

Silk subgroup.

This subgroup is quite large in the area. Our field observations led us first to identify cultivars from «Silk», «Pome» and «Mysore» subgroups (Mtenga, 1991). After cross checking with MUSAID determination system and with the help of slides and a video film, it appears that all cultivars observed belong to the subgroup «Silk». Neither Kikonde («Mysore») and Kijakazi («Pome», Prata) present in Zanzibar are observed in Morogoro.

Generally, the cultivars have small fruits, short, plumpy, bottlenecked, sweet acid, splitting transversally and dropping from the bunch when fully ripe. This last characteristic justifies the names kipukucha (Kipukusa in Zanzibar) and Kipakapaka often given in the area. They are very popular on the Morogoro urban markets where they are sold as Kisukari.

At least 7 different cultivars (sports of Silk) are present. Main variations observed are the following :

- Size of the plant : medium to giant.
- Black Sigatoka disease : from susceptible to tolerant.
- Fusarium Wilt disease : observed, but to be checked in standard condition.
- Petiole and petiolar margins : intensity of pink colour.
- Shape of the style of male flowers : either hooked or strait.
- Fruit quality at maturity : from very sweet to slightly sour.

- Fruit texture at maturity : from slightly hard to soft and dry with brownish parts in the flesh.
- Fruit corrugation before maturity : present or absent.
- Fruit colour at maturity : from deep to pale yellow.
- Fruit pedicel colour transition at maturity : progressive or abrupt transition from green (rachis side) to yellow (fruit side).
- Fruit arrangement on the bunch : regular or irregular.

Finally, one clump appeared to be very different from the others only for its bunch which had the following characteristics : bunch very compact with 23 hands and 455 fruits not longer than 8 cm. The fruits were pleasantly sweet but the presence of hardiness was recorded close to the pedicel. The farmer claimed that the planting material originated from a clump having all the characteristics of «Silk» . His intention was to uproot this clump. We can add that the next bunch appearing on that clump had the same characteristics. We therefore assume that it could be a variant incidentally found in Morogoro town but that would not have been further multiplied because of its poor organoleptic characteristics.

Plate 2 illustrates some variation of «Silk» in the area. This collection of «Silk» accessions needs further description and screening to identify and multiply cultivar(s) of good quality showing the best resistance to Black Sigatoka and Panama diseases.

ABB GROUP.

«Awak» subgroup.

It is one of the most vigourous banana available, resistant to leaf spot (including Black Sigatoka) but somewhat susceptible to Panama Disease (Stover and Simmonds, 1987). Pisang Awak is not popular (except for making local beer) but it can be acceptable as a dessert banana if fully ripe. Still, there are traditional habits restricting its use to brewing and animal feeding (e.g. Kilimanjaro area). In Morogoro, two cultivars are probably present, one is typical of Pisang Awak and the other, Unyoya Ndogo, differs mainly by its smaller fruits without the typical bottlenecked tip which are slender.

«Bluggoe» subgroup.

So far the following differences have been observed on the fruits : blue waxy (silver), light and dark green (non waxy), persistence of bracts on the rachis above the male flower (plate 4, 17). Other variations have been observed, but not yet described, on fruits, height and vigour of plants.

In our collection, another cultivar has smaller fruits than the typical Bluggoe, with dark green fruits dirty in appearance (black spotted). This cultivar is also called BOKOBOKO.

«Monthan» subgroup.

These cultivars are not common and can be confused with Bluggoe. They were not yet reported with certainty outside India (Stover and Simmonds, 1987). One cultivar is characterized by blunt-bulbous bottle necked big fruits with loose hands. The fruits are light green and non waxy or dark green with cracks. Another cultivar differs from the above described by its more compact bunch and slightly waxy fruits.

Some variation in ABB fruits are shown on plate 4, 18.

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DIVERSIDAD VARIETAL DEL BANANO EN LA ZONA DE MOROGORO EN TANZANIA.

G. EVERS.

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RESUMEN - Una colección de banano fué establecida en la region de Morogoro en Tanzania. Esta colección tienen actualmente cerca de 60 especímenes, de los cuales han sido identificados 39 cultivares. Un estudio de la repartición de estos cultivares en las dos zonas de esta región, muestra que a pesar de la existencia de una gran diversidad de cultivares, muy pocos son cultivados en gran escala. Tanto para los bananos consumidos como postre, como para la cocción, se trata de algunos cultivares «Cavendish» del grupo AAA.
La reciente aparición de la enfermedad de la raya negra de las hojas (*Mycosphaerella fijiensis*) a mostrado toda la importancia de esta colección a partir de la cual se podrá efectuar una selección varietal resistente o tolerante a la enfermedad de la raya negra de las hojas y al mal de Panamá (*Fusarium oxysporum* f. sp. *cubense*), igualmente presente en la región.
Informaciones complementarias sobre la identificación de los cultivares se presentan en anexo. Variaciones inatendidas fueron observadas dentro de ciertos sub-grupos de los AAB y ABB. Un cultivar no identificado, nombrado KIKUNDI, muy probablemente del grupo AAA, presenta una interesante resistencia a la enfermedad de la raya negra de los hojas.
Este artículo sugiere continuar, paralelamente a la introducción de variedades resistentes a la enfermedad de la raya negra de las hojas, con la colecta e identificación de variedades locales bien adaptadas al medio, resistentes a las principales enfermedades, y correspondiendo a los gustos y hábitos culinarios de los consumidores.