Mitotic instability in banana varieties. Mitosis in accessions newly received as meristem cultures

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ABSTRACT
Cells from root tips of plants taken from shoot tip cultures introduced to Brazil were studied. Triploids of the subgroups Plantain (AAB group) and Bluggoe (ABB) were not less stable in their chromosomes than conventional plants of the same types. The AAB variety Muracho showed few numerical errors but a rather high frequency of much reduced chromosomes in some of its roots. Among five AA group diploids 100 cells displayed no visible abnormality.

Instabilité mitotique chez les variétés de banane. Mitoses dans les cellules de plantes issues de la culture de méristèmes.

RÉSUMÉ
Des cellules de bouts de racines prélevées sur des plantes issues de la culture de méristèmes, choisies parmi les derniers génotypes introduits au Brésil, ont été étudiées. Les triploïdes des sous-groupes plantain (groupe AAB) et Bluggoe (ABB) n'ont pas présenté plus d'instabilité chromosomique que les plantes des mêmes types multipliées de façon conventionnelle.
Les analyses de la variété Muracho (AAB) ont révélé peu d'anomalies numériques, mais dans certaines cellules de leurs racines, une fréquence assez élevée de chromosomes de taille très réduite a pu être notée.
Un comptage effectué sur 100 cellules prélevées sur les racines de cinq diploïdes du groupe AA n'a révélé aucune anomalie.

Instabilidad mitótica en las variedades de banano. Mitosis en las células de plantas a partir de la cultura de meristemas.

RESUMEN
Las células en ápices de raízes de plantas establecidas de culturas de meristemas, introducidas al Brasil, de triploides dos subgrupos Plátano (grupo AAB) y Bluggoe (ABB) no fueron menos estables en sus cromosomas que las plantas convencionales de los mismos tipos. La variedad Muracho (AAB) ha mostrado pocos errores numéricos pero una frecuencia bastante elevada de cromosomas bien reduzidas en algunas de sus raízes. Entre cinco diploides del grupo AA, 100 células no revelaron ninguna anormalidad.

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KEYWORDS
Musa, cytogenetics, chromosome number, chromosome aberration, triploidy, diploidy.

MOTS CLÉS
Musa, cytogénétique, nombre chromosomique, aberration chromosomique, triploïdie, diploïdie.

PALABRAS CLAVES
Musa, cytogenética, número de cromosomas, aberración cromosómica, triploidía, diploidía.

introduction

Earlier papers (SHEPHERD and DOS SANTOS, 1996; SHEPHERD and DA SILVA, 1996) revealed a surprising level of chromosomal aberration in root tip meristems of triploid banana plants, whether these were of conventional or laboratory origin. This could well have led to concern over the genetic safety of the storage, reproduction and dissemination of germ plasm in the form of shoot tip or other forms of meristem culture.

This paper hopes to offer some reassurance as to the state of the karyotype in some specified new accessions of triploids received in culture tubes. The relative mitotic stability of some diploid genotypes introduced in the same manner will also be examined.

materials and methods

As previously, this research was performed in the laboratories and greenhouses of EMBRAPA's Centro Nacional de Pesquisa de Mandioca e Fruticultura Tropical (CNPMF).

The triploid accessions studied and their origins were as indicated in table I. The five distinct diploids, which yielded counts, were received from the INIBAP Germplasm Transit Centre at the Catholic University of Leuven in Belgium. They are identified in the appropriate Results section.

All material evidently originated from shoot tip cultures. On arrival, these cultures were already rooting and in a state of limited proliferation, such that some subdivision was effected on transfer to the greenhouse.

The cytological methods used were the same as for previous contributions on this general theme, except for the definition of acceptable cells in the case of the diploids. Because of the greater ease of cell interpretation in these diploids, even some cells with quite minor defects (class 3 of SHEPHERD and DOS SANTOS, 1996) were excluded from the record. For the triploids, results were summarized as frequencies of apparently normal cells as well as frequencies per cell of extra chromosomes and of deficient ones ('mini-chromosomes' or 'minis').

results

chromosome morphology

The triploid mitotic cells generally reacted more or less favourably to 8-hydroxyquinoline, but a novel minor problem was encountered with the accession of 'Muracho' (AAB group). One of its chromosomes was markedly longer than any noted in other triploids, about twice as long as the average size. After some initial errors, it came to be easily recognized, to the extent that one mislabelled plant was first identified as spurious by the absence of the giant chromosome.

mitosis in the triploid accessions

These must be evaluated further in parallel with results from conventional material (SHEPHERD and DA SILVA, 1996).

The Plantain subgroup clones, 'Harton' and 'Dominico Harton', from Colombia are treated jointly in table I. These clones were marginally less stable mitotically than 'Bobby Tannap' and slightly prone to chromosome addition; however, they were only slightly poorer than conventional material of these types. Also of the AAB group, 'Muracho' displayed a moderate frequency of breakage deficiencies (minis), less than that found in conventional plants of 'Prata Anã', of the same group. Inter-plant or inter-root variation was apparent in 'Muracho', since 24 of the 25 minis were identified in 43 cells from four roots of three different plants but only one in 40 cells from eight roots of five others.

Taken together, the two Bluggoe subgroup clones (ABB group) showed lower frequencies of aberrations of both types than the 'conventional' stock previously established in the CNPMF germ plasm bank. This latter strain had also been received as a shoot tip culture plant, but had spent some years in field cultivation before being evaluated mitotically.

mitosis in the diploid accessions

A total of 100 cells was recorded: 22 with all the chromosomes separated (class 1) and 78 with a small degree of superposition (class 2). The AA group clones which contributed and the number of cells were: 'Berlin', 26; 'Lilin', 27; 'Mambee Thu', 14; 'Mas', 28 and NBA14, 5. All of these cells presented 22 chromosomes without any

Table I
Chromosome counts from some triploid accessions introduced in the form of meristem cultures at CNPMF between 1990 and 1992.

Cultivar	*Plant source*[1]	*No*	*Useful roots*	*Total cells*	*Chromosomes (range)*	*F_N*[2]	*F_S*[3]	*'Minis' Most*	*F_M*[4]
AAB group									
Plantains									
Plantains	ICA	2	7	19	31-34	0.79	0.11	1	0.05
Bobby Tannap	KUL	9	15	51	33-34	0.94	0.06	0	
Other									
Muracho	KUL	8	12	83	32-34	0.61	0.10	2	0.30
ABB group									
Bluggoe type									
Cachaco	ICA	6	11	41[5]	33-34	0.76	0.17	1	0.10
Espermo	ICA	2	6	19	33-34	0.53	0.26	1	0.37

[1] ICA: Instituto Colombiano de Agropecuaria, Columbia; KUL: INIBAP Germplasm Transit Centre, Catholic University of Leuven, Belgium;
[2] F_N: frequencies of cells with 33 chromosomes and without minis; [3] F_S: frequencies per cell of supernumerary chromosomes;
[4] F_M: frequencies per cell of 'minis'; [5] another cell was seen with only 29 chromosomes.

segmental loss. One additional cell of 'Mas' did appear to have only 21 chromosomes plus a minute fragment, but this condition probably resulted from damage in preparation of the squash.

discussion and conclusion

Although only a limited sample of clones was studied as newly received shoot tip culture accessions, the results are as reassuring as might have been hoped. It appears to be possible to reproduce and distribute at least some triploid genotypes in the form of laboratory products, without major disturbance of the initial genotypes.

Among these, the Plantain subgroup accessions have justified the hypothesis, based on conventional plants (SHEPHERD and DA SILVA, 1996), that this subgroup should be among the types which offer fewer problems in micropropagation. Unfortunately in retrospect, no material in stem tip cultures was received at the CNPMF of any clone of the Cavendish subgroup (AAA group). There was therefore no opportunity to test the earlier contrary prediction that the resulting vitroplants from such an accession might be precariously unstable in their mitotic behaviour.

The most striking result was the high relative stability of diploids of the AA group. Not a single certain error was noted in 100 cells. This is an important finding for the support of genetic improvement programmes in *Musa*, which owe much to germ plasm sources in wild and cultivated AA forms.

references

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