

Cytogenetical Investigations in Musaceae II. Meiotic studies in eight male sterile triploid banana varieties of India¹

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India is one of the probable places of origin of bananas (Simmonds 1966), lot of variability exists in the cultivated forms and as many as 317 varieties have been identified, of which 28 are diploids, 190 are triploids and four are tetraploids (Gulick and Sloten 1984). The present investigations, second in the series, were undertaken to study the meiotic behaviour of eight triploid male sterile Indian banana varieties.

Material and methods

The material for present investigations included eight banana varieties namely Chakrapavan, Malai Kali, Nalla Chakrakeli, Ney Vazhai, Palayan Kodan, Suwandal, Virupakshi and Walha. These were collected from different locations in South India and planted at Indian Institute of Horticultural Research, Bangalore. The detailed procedure for study of meiotic behaviour was same as described in previous article (Agarwal 1983).

Observations

Chromosome count at metaphase I in all the eight varieties under investigation revealed 33 chromosomes, associated in various combinations. Being triploid in nature, none of the varieties had complete bivalent formation. Various chromosome associations observed at metaphase I have been shown in Table 1 and distribution at anaphase I has been shown in Table 2. Out of eight varieties studied, high frequency of bivalents was observed in all the varieties except Walha which was characterized by the presence of high univalent frequency. Quadrivalents and higher multivalents were found to a very limited extent in all the varieties excepting var. Chakrapavan and Palayan Kodan. Var. Palayan Kodan had a fairly high degree of bivalent formation. Anaphase distribution was not observed to take place in vars. Chakrapavan, Ney Vazhai, Suwandal and Walha and the pollen mother cells eventually distintegrated. In vars. Virupakshi and Malai Kali few PMCs showed the presence of anaphase I with 16-17 and other irregular distribution. Laggards were of common occurrence in var. Nalla Chakrakeli and Palayan Kodan. In none of the varieties studied any pollen was observed to have formed.

Discussion

These investigations were taken up in continuation to the previous one by Agarwal (1983) to study the meiotic behaviour of eight different varieties of South Indian bananas and to isolate the restitution nuclei forming ones for use as females in breeding programme. These females

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can further be crossed with normal superior diploids with resistance to diseases and having desirable characters, to obtain tetraploids for commercial use. Only two out of the eight varieties studied, showed the pollen mother cells undergoing anaphase I division (very few PMCs showed irregular distribution of chromosomes at AI in var. Virupakshi and Malai Kali) in the rest, the PMCs disintegrated after metaphase I, indicating there by, that the sterility in these varieties is genic. Similar observations on degeneration of microspores at various stages of development have been made in diploid banana varieties by Raman *et al.* (1970), which they have contributed, mainly to genetic causes, and little to chromosomal irregularities. In none

Table 1. Chromosomal association in PMCs of different varieties of *Musa*

<i>Musa</i> varieties	2n chromosome number	Genomic* grouping	Univalents/PMC	Bivalents/PMC	Trivalents/PMC	Quadri-valents/PMC	Higher multi-valents/PMC	Figs
Chakra povan	33	AAB	3.75	8.25	4.25	—	—	1
Malai Kali	33	AAB	6.2	10	2.2	0.1	—	2
Nalla Chakrakeli	33	AAB/AAA	3.88	10.87	2.25	—	0.12	3, 4
Ney Vazhai	33	AAB	6.43	11.43	1.00	—	0.14	—
Palayan Kodan	33	AAB	2.71	15.43	—	—	—	—
Suwandal	33	AAB	5.11	11.44	1.56	0.11	—	5, 6
Virupakshi	33	AAB	3.67	10.11	2.67	0.11	0.11	7, 8
Walha	33	AAB	24.37	3.0	0.5	0.25	—	9

*Simmonds 1966, Dass 1977.

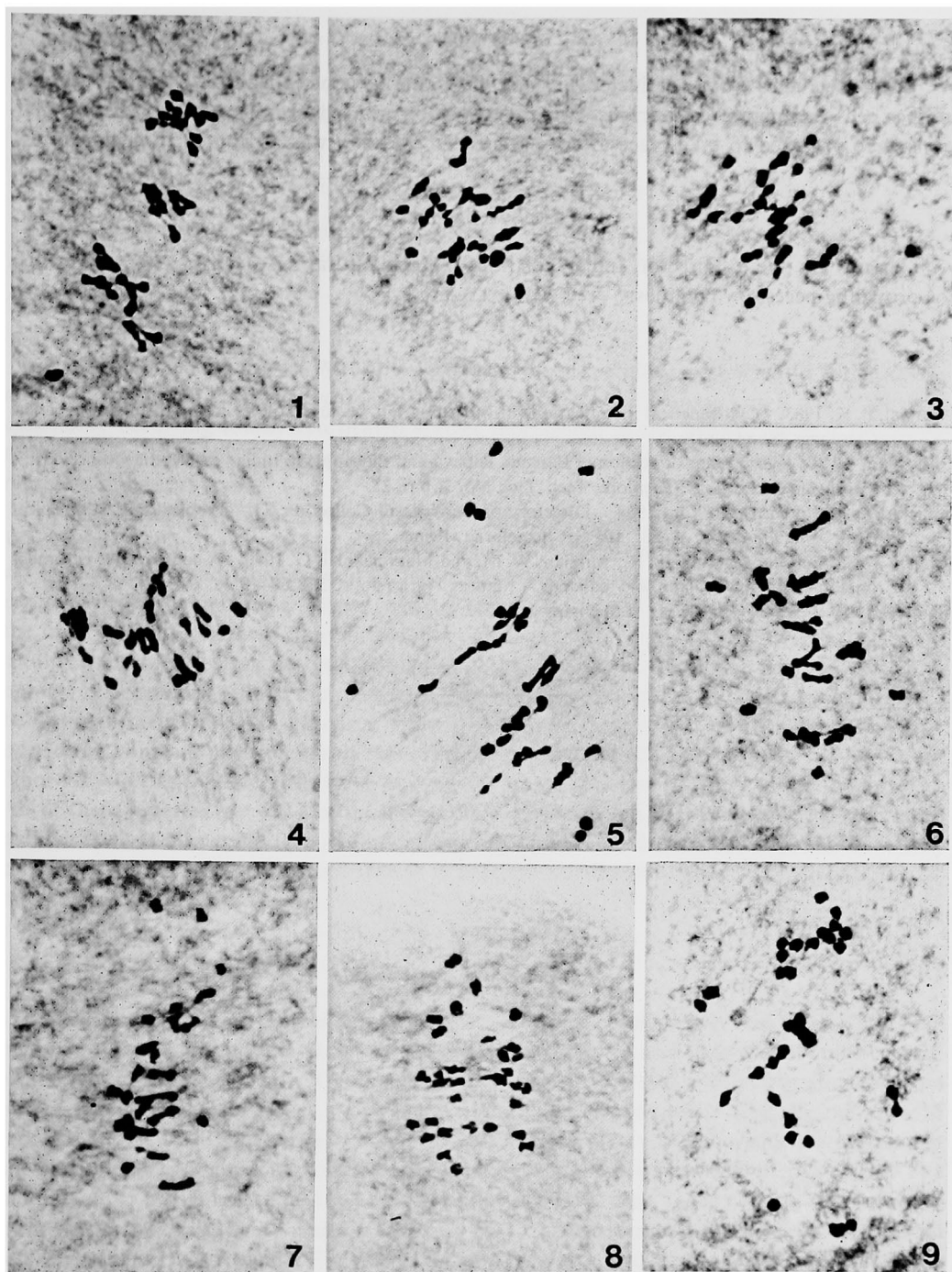
Table 2. PMCs showing chromosomal distribution at anaphase I in different varieties of *Musa*

<i>Musa</i> varieties	AI distribution				Laggards per PMC	
	16-17 %	15-18 %	14-19 %	Others %	Range per PMC	% PMCs showing laggards
Chakra povan*	—	—	—	—	—	—
Malai Kali**	100	—	—	—	—	—
Nalla Chakra Keli	22.22	33.33	—	44.44	0-6	44.44
Ney Vazhai*	—	—	—	—	—	—
Palayan Kodan	—	25.0	37.50	37.50	0-1	37.50
Suwandal*	—	—	—	—	—	—
Virupakshi**	—	—	—	100	—	—
Walha*	—	—	—	—	—	—

* Anaphase I was not observed to take place.

** Very few PMCs showed the anaphase I.

of the varieties studied, metaphase II or anaphase II was observed to take place. The absence of restitution nuclei formation further excludes the possibility of using them as female parents in banana improvement programme. However, the possibility of chromosomes undergoing restitution stages in EMCs can not be ruled out. Further studies by pollinating these vars. with normal pollen from diploid fertile males and cytologically examining the progeny for tetraploidy will be helpful in determining the usefulness of the varieties in breeding programme.



Figs. 1-9. 1, var. Chakra povan—PMC at M1 showing five trivalents and nine bivalents. $\times 1235$. 2, var. Malaikali—PMC at M1 showing five trivalents, 7 bivalents and 4 univalents. $\times 1235$. 3, var. Nalla Chakrakeli—PMC at M1 showing 3 trivalents, 10 bivalents and 4 univalents. $\times 1235$. 4, var. Nalla Chakrakeli—PMC at M1 showing 2 trivalents, 13 bivalents and one univalent $\times 1235$. 5, var. Suwandal—PMC at M1 showing 2 trivalents, 10 bivalents and 7 univalents. $\times 1235$. 6, var. Suwandal—PMC at M1 showing 3 trivalents, 7 bivalents and 10 univalents. $\times 1235$. 7, var. Virupakshi—PMC at M1 showing 1 trivalent, 12 bivalents and 6 univalents. $\times 1235$. 8, var. Virupakshi—PMC at A1 showing unequal separation of chromosomes. $\times 1235$. 9, var. Walha—PMC at M1 showing 1 trivalent, 7 bivalents and 14 univalents. $\times 1235$.

Summary

Meiotic studies were conducted in eight male sterile triploid banana varieties. Pollen mother cells degenerated at various stages of development and in none of the varieties, divisions were observed to take place after anaphase I. Sterility was attributed to genic causes.

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