

CROSS-COMPATIBILITY AND SEED SET IN BANANA CULTIVARS

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Abstract: In the studies undertaken to test the compatibility and seed set in banana cultivars, out of the 18 cross combinations only 3 combinations were found successful. The successful combinations were Palayankodan x Pisang Lilin; Rasthali x Pisang Lilin and Nendran x Pisang Lilin. Seed production was maximum in Palayankodan (102.96 seeds per bunch) followed by Nendran (13.65 seeds per bunch). Rasthali produced the least number of seeds per bunch (10.98). The fertility pattern with respect to position of hands in a bunch showed variation. In Palayankodan, fertility was maximum in the third hand (27.33); while in Nendran second hand was more fertile (7.00). Rasthali produced maximum number of seeds in second and third hands (2.66).

INTRODUCTION

Vegetative selection has given only minimal improvement in banana. Naturally evolved seedless bananas are perhaps the most conspicuously sterile of all cultivated fruits. The cultivars being both female and male sterile, it is the most important difficulty encountered in banana hybridization. The two wild diploid species, *Musa acuminata* Colla and *Musa balbisiana* Colla considered as the ancestors of the present day cultivated bananas (Simmonds and Shepherd, 1955) are both female and male fertile. The edible cultivars do not produce seeds when grown in pure stands. Recently, many cultivars set seeds on artificial pollination and many cultivars produce viable pollen (Karmacharya, 1984). The use of such cultivars as female and male parents in banana hybridization is gaining importance. Further, in banana, the fertility and seed set greatly vary in relation to position of hands, within a bunch. De Langhe (1969) reported that in seeded bananas all the hands were equally fertile, whereas in cultivated bananas, basal hands were more fertile than the other depending upon the variety. The present studies were undertaken to find the compatibility among six selected banana cultivars and variation in seed set in different hands of plants which were used as female parents.

MATERIALS AND MEHTHODS

Six commercially important cultivars Palayankodan (AAB), Rasthali (AAB), Nendravannan (AAB), Ney Poovan (AAB), Karpooravally (AAB), and Nendran (AAB) as female parents, and three edible diploids, Pisang Lilin (AA), Sanna Chenkadali (AA) and Tongat (AA) as male parents were taken for the study. The study consisted of testing compatibility and seed set pattern in 18 cross combinations involving six female and three male parents, and female fertility pattern in different hands of the female parents.

The method suggested by Simmonds (1966) and followed by Sathiamoorthy (1973) and Karmacharya (1984) was adopted to transfer the pollen from male parents to stigma of female parents. Each cross was repeated thrice. In order to study the female fertility pattern in different hands, all the hands were pollinated in an inflorescence.

The fully mature bunches were harvested and ripened in room. The ripe fingers were longitudinally cut with the help of a knife and were examined for seeds. The seeds when present were extracted, washed in tap water and were stored. The number of seeds produced

in each hand in all the crosses was counted and average number of seeds produced was worked out as per position of hand. The average number of seeds from each particular cross was also recorded.

RESULTS AND DISCUSSION

The results of the crosses showed that out of the 18 cross combinations tried, compatibility was obtained only in three crosses (Table 1). The successful combinations were, Palayankodan x Pisang Lilin; Rasthali x Pisang Lilin and Nendran x Pisang Lilin. With respect to seed set, maximum was found in Palayankodan (102.96 seeds per bunch) and the least Rasthali (10.98 seeds per bunch) all pollinated by Pisang Lilin (Table 2).

Comparison of the seed formation with respect to position of hands showed that, basal hands were more fertile than the distal ones. Palayankodan produced seeds up to tenth hand from the base. The maximum number of seeds were produced in the third hand (27.33) and the least in the tenth hand (0.33) (Table 2), Rasthali produced seeds up to sixth hand, producing maximum seeds in second and third hands (2.66) and least in the sixth hand (0.33). Nendran produced seeds up to fifth hand, producing maximum number of seeds (7.00) in the second and least in the fifth hand (0.33).

Palayankodan was found female fertile in many crosses (Cheesman, 1934; 1949; Nair, 1953; Sundaraj *et al.*, 1957; Alexander, 1976; Raman 1976; Karmacharya, 1984). The female fertility status of Nendran was first reported by Karmacharya (1984). He obtained seeds when Nendran was crossed with Sikuzani.

The results also indicated that

Rasthali although reported by Sundaraj *etal.* (1957) and Alexander (1976) to be female sterile, is female sterile. In the present studies, Rasthali produced seeds when crossed with Pisang Lilin indicating the fertility status of Rasthali.

The other three female parents, Nendravannan, Karpooravally and Ney Poovan were female sterile. However, Alexander (1976) and Karmacharya (1984) reported that Nendravannan and Karpooravally were female fertile as they produced seeds on artificial pollination. In the present studies, in spite of the several pollinations of these two clones with Pisang Lilin, not even a single seed was obtained. It has been reported that fertility in banana clones to a certain extent is controlled by location, climate and fertility of the area (Shepherd, 1954; 1960a; 1960b; Simmonds, 1966).

Ney Poovan was reported female sterile by Alexander (1976). The present studies also agree with his report. He revealed that all the members of the genomic group AB (Kunnan group) which are of South Indian origin are both female and male sterile. De Langhe (1969) revealed that sterility in AB species hybrids is due to abnormalities in meiosis.

The two wild diploid species - *Musa acuminata* and *Musa balbisiana*, considered as ancestors of the present cultivated bananas (Simmonds and Shepherd, 1955) are both female and male fertile, producing seeds in their fruits on pollination and copious amount of viable pollen in their male flowers. Edible triploids do not produce seeds when grown in pure stands, some of them are entirely female sterile, others will produce an occasional seed when a source of viable pollen is available (Purseglove, 1975). The seed set in cul-

Table 1. Number of crosses made and seed set

Sl. No.	Crosses	No. crosses made			Total	No. of seeds obtained			
		1st cross	2nd cross	3rd cross		1st cross	2nd cross	3rd cross	Total
1	Palayankodan x Pisang Lilin	171	86	87	554	879	68	4	309
2	Rasthali x Pisang Lilin	5	5	110	308	10	17	6	33
3	Nendravannan x Pisang Lilin	80	5	8	269	Nil	Nil	Nil	Nil
4	Ney Poovan x Pisang Lilin	85	0	174	539	"	"	"	"
5	Karpooravally x Pisang Lilin	200	85	190	575	"	"	"	"
6	Nendravannan x Pisang Lilin	86	0	87	263	18	11	5	41
7	Palayankodan x Sanna Chenkadali	180	90	87	258	Nil	Nil	Nil	Nil
8	Rasthali x Sanna Chenkadali	111	1	5	323	"	"	"	"
9	Nendravannan x Sanna Chenkadali	98	90	5	0	"	"	"	"
10	Ney Poovan x Sanna Chenkadali	209	180	875	506	"	"	"	"
11	Karpooravally x Sanna Chenkadali	204	189	188	581	"	"	"	"
12	Nendran x Sanna Chenkadali	85	95	89	269	"	"	"	"
13	Palayankodan x Tongat	12	195	20	587	"	"	"	"
14	Rasthali x Tongat	115	130	112	337	"	"	"	"
15	Nendravannan x Tongat	50	135	110	325	"	"	"	"
16	Ney Poovan x Tongat	178	185	188	551	"	"	"	"
17	Karpooravally x Tongat	80	178	180	558	"	"	"	"
18	Nendran x Tongat	87	89	8	266	"	"	"	"

Table 2. Compatibility and pattern of fertility in parents with respect to position of hands

Sl. No.	Parents	Position of hand	Number of seeds in hands				Mean No. seeds per hand	Mean No. seeds per bunch	
			1st cross	2nd cross	3rd cross	Total seeds			
1.	Palayankodan x Pisang Lilin	1	23	10	6	39.00	13.00	102.96	
		2	38	15	14	67.00	22.33		
		3	56	8	18	82.00	27.33		
		4	23	8	5	36.00	12.00		
		5	18	7	7	32.00	10.66		
		6	13	6	4	23.00	7.66		
		7	4	9	4	17.00	5.66		
		8	4	3	3	10.00	3.33		
		9	-	1	1	2.00	0.66		
		10	-	1	-	1.00	0.33		
		11	-	-	-	-	-		-
	Total		179	68	62	309			
2.	Rasthali x Pisang Lilin	1	-	4	-	4.00	1.33	10.98	
		2	3	3	2	8.00	2.66		
		3	4	2	2	8.00	2.66		
		4	2	3	1	6.00	2.00		
		5	1	4	1	6.00	2.00		
		6	-	1	-	1.00	0.33		
		7	-	-	-	-	-		-
			Total		10	17	6		33
3.	Nendran x Pisang Lilin	1	5	3	-	8.00	2.66	13.65	
		2	8	6	7	21.00	7.00		
		3	1	2	3	9.00	3.00		
		4	1	-	1	2.00	0.66		
		5	-	-	1	-	0.33		

tivated bananas, on artificial pollinations has been reported by many workers (Covsins, 1927; Ceesman, 1934; 1949; Nair, 1953; Sundaraj *et al.* 1957; Dodds, 1958; Alexander, 1976; Raman, 1976; Karmacharya, 1984).

The fertility pattern with respect to the position of hands in a bunch showed much variation. Generally in all the three parents, basal hands were more fertile than the distal hands. In the clone, Palayankodan, the third hand (27.33), in Rasthali, the second and third hands (2.66) and in Nendran, second hand (7.00) produced more number of seeds. De Langhe (1969) reported that in seeded bananas all the hands were equally fertile, whereas in cultivated bananas, basal hands were more fertile than the other depending upon the variety, which is, in general agreement with the results of the present study.

The cultivated bananas even though are slightly female fertile, on pollination, yield only a few number of seeds as compared to their wild ancestors. Reviewing hybridization work at Bodles, Shepherd (1954, 1960a, 1960b) reported that even under the most favourable conditions the fertility of Gros Michel hardly exceeded three seeds per bunch. Many bunches were seedless.

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