

Flowering Behaviour and Pollen Viability of Sugarcane Species at Ishurdi, Pabna

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ABSTRACT

There exists large variation in the flowering habit of the wild and cultivated sugarcane species. The wild species were always found to flower earlier than the cultivated ones. Among the cultivated flowering types maintained at this Institute, about one-fifth of the varieties flower every year while the rest flowers in alternate years or with gap. Varieties with less than 10% viable pollen were treated as female parent while those with more than 10% viable pollen were treated as male. Majority of the flowering wild species behaved as male parents, whereas the reverse case happened with the cultivated types. Pollen viability in almost all species were found to differ in different years, which was possibly due to a change in the environmental conditions. Flowering behaviour and pollen viability of 25 wild genotypes (*Saccharum spontaneum*) and 281 cultivated sugarcane varieties maintained at the Institute, were studied over a period of five years and they were categorized accordingly.

INTRODUCTION

Flowering in sugarcane is equally important to both the growers and the breeders. It is undesirable in a commercial variety since it stops further vegetative growth. However, in breeding works synchronization of the flowering dates of different varieties is necessary for the crossing. The sugarcane inflorescence consists of an open, branched panicle known as arrow and may contain as many as 1,00,000 flowers. The flowers are borne in paired spikelets, one sessile and another pedicellate. The flowers open in early morning usually between 5 and 6 A. M. About 7 to 14 days are required for an arrow to complete flowering. The flowering starts at the top of the arrow and proceeds downward. Normally cross-pollination occurs in sugarcane varieties. Sugarcane flowers show a wide range of fertility and seed production, from male sterility to high pollen productivity and from self-sterility, to complete self fertility. The self-sterility is presumably due to the presence of self-sterility alleles (Poehlman and Borthakur, 1969).

Vijayasaradhy and Narasimhan (1954) distinguished stages in the development of the inflorescence of sugarcane and revealed that early and late flowering varieties set floral initials at the same time, the only difference being in the rate of growth of the inflorescence between varieties. They reported that normal

day length (12 hours) is critical for flowering of sugarcane. Mc Martin (1949) reported differences in the amount of flowering in different varieties of sugarcane, some varieties flower rarely, some form inflorescence which do not emerge, while others flower profusely.

Less number of flowering plants and even fewer number of male parents in our germplasm stock really cause problems. Again, the sugarcane plants show varying degree of pollen viability in different years. Therefore, this work was undertaken to study the flowering habit of the wild and cultivated species that are maintained in this Institute.

MATERIALS AND METHODS

The Sugarcane Research & Training Institute has a collection of 25 wild and 281 cultivated variants. Ninety eye buds (30 setts) for each of the cultivated types were planted in single lines of 9.14 metre in the SRTI farm at the middle of November, 1980. Line to line distance was 1.52 metres. Recommended fertilizer dose was applied. Wild types were planted at the adjacent plot. The same materials planted in the four previous plantation years were also taken into account. The recorded data of five years were compiled and compared to obtain a full picture of the flowering behaviour of these materials.

The data for emergence of inflorescence were noted. The inflorescence of two to three days old (after its emergence) were tested for its pollen viability by staining with iodine solution. The pollens were smeared on the slide with one or two drops of iodine solution. Dark coloured and light coloured pollens were considered viable and nonviable, respectively.

If the pollen viability remained below 10%, the variety was considered female and if the pollen viability was over 10%, the variant was termed male.

RESULTS AND DISCUSSION

In 1981 flowering season, the emergence of flower in wild types started in October 10 and continued for 50 days, whereas the flower emergence in the cultivated types started on November 11 and continued upto late January (Fig. 1). The peak period for flower emergence of the wild and cultivated types were November 15 and 25, respectively. Sixty four percent of the wild types flowered in 1981, whereas only 24.56% of the cultivated types flowered in the same year (Table 1). More or less the same trend was observed in different years. The wild types were earlier in flower emergence than the cultivated types. Out of these 25 wild types, 24 were flowering although not more than 19 types (76%)

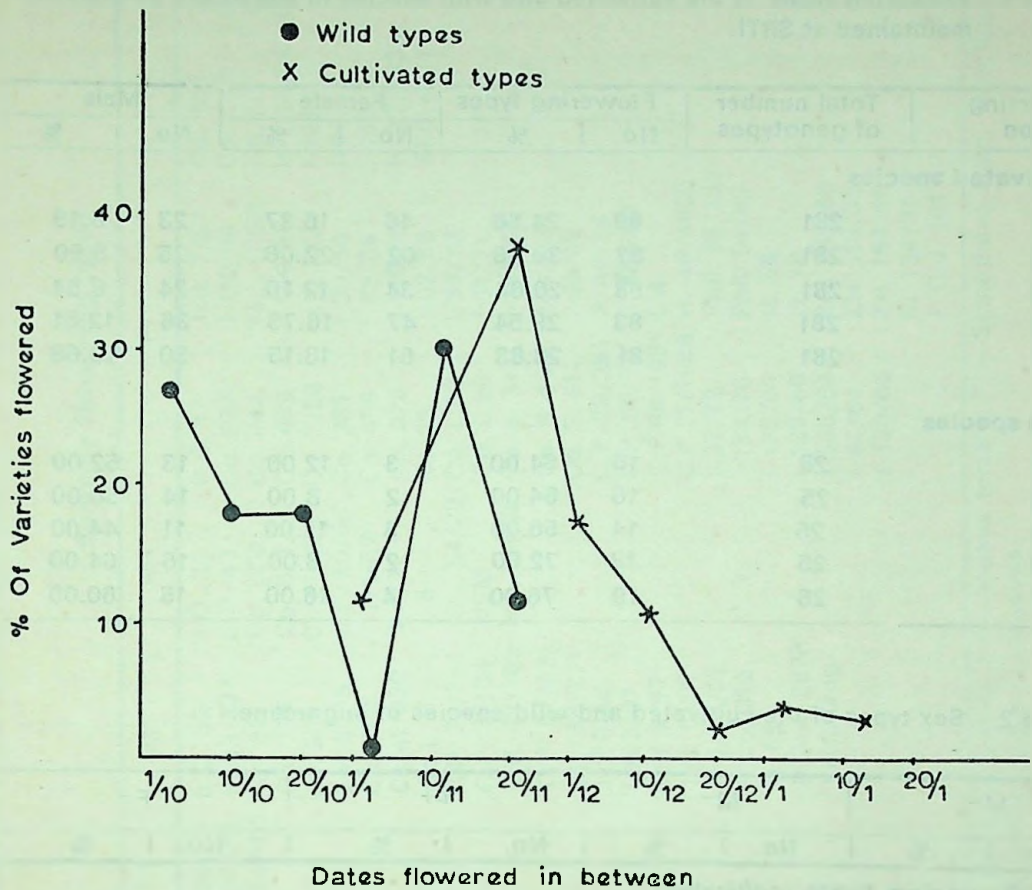


Fig. 1. Frequency of flowering at different dates in 1981-82 season.

flowered in one year. Out of 281 cultivated varieties 129 were flowering although not more than 87 (31%) flowered in one year. Of the 129 cultivated flowering types, 29 flowered every year but other 100 were sparsely flowering i. e. they flowered in different years with gap (Table 2). Out of 24 wild types, seven flowered every year and other 17 flowered with gap, in different years. Most of the wild flowering types (88%) were found to be male. But in the case of cultivated species only 37% were found to be male (Table 2). The wild and cultivated flowering types were categorized for their flowering behaviour in Tables 3 and 4.

Table 1. Flowering types in the cultivated and wild species of sugarcane germplasm maintained at SRTI.

Flowering season	Total number of genotypes	Flowering types		Female		Male	
		No.	%	No.	%	No.	%
* Cultivated species *							
1981	281	69	24.56	46	16.37	23	8.19
1980	281	87	30.96	62	22.06	25	8.90
1979	281	58	20.64	34	12.10	24	8.54
1978	281	83	29.54	47	16.73	36	12.81
1977	281	81	28.83	51	18.15	30	10.68
Wild species							
1981	25	16	64.00	3	12.00	13	52.00
1980	25	16	64.00	2	8.00	14	56.00
1979	25	14	56.00	3	12.00	11	44.00
1978	25	18	72.00	2	8.00	16	64.00
1977	25	19	76.00	4	16.00	15	60.00

Table 2. Sex types of the cultivated and wild species of sugarcane.

M ⁺			M ⁻			F ⁺			F ⁻		
No.	I	%	No.	I	%	No.	I	%	No.	I	%
Free flowering types (cultivated)											
5		3.88	8		6.20	13		10.08	3		2.33
Sparsely flowering types (cultivated)											
23		17.83	12		9.30	52		40.31	9		6.98
Free flowering types (wild)											
3		12.50	3		12.50	00		00	1		4.17
Sparsely flowering types (wild)											
12		50.00	3		12.50	1		4.17	1		4.17

M⁺—Always maleM⁻—Sometimes female, moretimes maleF⁺—Always femaleF⁻—Sometimes male, moretimes female

Table 3. Flowering behaviour of all the sugarcane germplasm (*cultivated*)

Free flowering types				Sparsely flowering types					
M ⁺	M ⁻	F ⁺	F ⁻	M ⁺	M ⁻	F ⁺	F ⁻	M/F	
B. 34/231	Co. 640	Co. 513	B.O. 65	B.O. 32	B.O. 22	B.O. 17	Isd. 7/57	Co. 661	B.O. 35
Co. 604	Co. 6502	Co. 630	C.P. 50/20	B. 33/337	B.O. 43	Co. 635	I-119/64	Co. L.29	B.O. 71
Co. 642	C.P. 36/105	Co. 631	C.P. 44/155	Co. 313	Co. 530	Co. 644	Isd. 11/58	I-5/71	C.P. 55/30
C.P. 44/154	C.P. 44/101	Co. 1148		Co. 775	Co. 671	Co. 649	I-149/66	Isd. 14/60	C.P.27/139
I-101/66	C.P. 50/6	Co.L. 33		Co. 969	Cl. 41/229	Co. 1158	Isd. 3/54	I-127/63	
	C.P. 50/72	Co.L. 73		Co. 6806	C.P. 50/55	Co. 381	I-30/54	I-46/63	
	I-70/64	C.P. 36/13		Co. 540	I-171/67	Co. 458	I-89/54	I-166/66	
	Mishrilal	I-112/67		Cl. 41/220	I-4/71	Co. 625	I-119/66	H. 37/1933	
		Farm		Co.L. 5	L.5	Cl. 29	I-92/66	Phil. 48/15	
		L.7		C.P. 31/294	My. 54/29	Co. L.50	I-38/72		
		Phil. 55/61		C.P. 38/34	NSM	Co. L.66	I-11/71		
		Phil. 55/33		C.P. 47/193	Isd. 13/58	Co. K. 31	I-156/66		
		ZH. 179/66		C.P. 52/43		Co. S. 146	I-147/67		
				C.P. 28/271		Co. S. 611	I-96/59		
				I-110/66		C.P. 29/291	F. 40/96		
				I-143/67		C.P. 50/70	F. 36/762		
				Isd. 8/57		C.P.69/1061	L.4		
				Isd. 6/56		C.P.71/1086	H. 48/4605		
				Isd. 10/58		I-37/72	Phil. 55/292		
				N.Co. 310		I-134/70	Phil. 54/60		
				Q. 68		I-170/64	Q. 66		
				P.O.J. 2878		I-139/66	Q. 79		
				Lohadang.		I-145/64	ZH. 238/65		
						I-42/64	ZH. 110/65		
						I-130/65	ZH. 164/65		
							M. 134/31		
							P.O.J. 161		

M⁺—Always male, M⁻—Sometimes female, moretimes male, F⁺—Always female, F⁻—Sometimes male, moretimes female, M/F—varieties behave equally as male and female in different seasons.

Table 4. Flowering behaviour of all the sugarcane germplasm (*wild*).

Free flowering types					Sparsely flowering types				
M ⁺	M ⁻	F ⁺	F ⁻		M ⁺	M ⁻	F ⁺	F ⁻	
S ₂	S ₈		S ₁₅		S ₁	S ₁₆	S ₁₁	S ₁₀	S ₁₉
S ₃	S ₁₃				S ₄	S ₁₇	S ₂₂		
S ₉	S ₁₃				S ₆	S ₁₈	S ₂₃		
					S ₇	S ₂₀			
					S ₀	S ₂₁			
					S ₁₄	S ₂₄			

M⁺—Always male.

M⁻—Sometimes female, moretimes male.

F⁺—Always female.

F⁻—Sometimes male, moretimes female.

Two problems were encountered with the materials studied are :

- the flowering dates of wild and cultivated types did not synchronize fully in the natural condition and
- the number of male varieties among the cultivated types were very few every year (Table 1).

However, these problems could be solved by constructing a controlled glass house as was done in Louisiana (Matherne et. al., 1977). Such facility will ensure synchronization of flowering and production of more male parents needed for effective breeding programmes.

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