

STUDY OF TUBEROSE HYBRIDIZATION

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Abstract

Tuberose (*Polianthes tuberosa* L.) has the characters of dichogamy and self-incompatibility. Crosses between single and double varieties produce fruits and seeds when the female parent is 2-3 days after anthesis. Reciprocal crosses between the single and double varieties of tuberose grown in Taiwan produced many single and few double plants in the progenies. Twelve seedlings with improved characteristics were selected from these progenies. Work is now in progress to test stability of these characteristics to produce more prolific and higher quality tuberose varieties. Selection from hybrid seedlings is a very promising breeding method for improvement of cut flower production in tuberose.

1. Introduction

Tuberose (*Polianthes tuberosa* L.), a native of Mexico, is one of the most important cut flowers in tropical and subtropical areas. The long spikes of flowers is excellent for cut flowers and people like their sweet fragrance. Tuberose flowers are also good sources of essential oil that can be used for preparation of various perfumes (Sadhu, et al. 1973). However, there are only two major varieties - single and double - cultivated in the world. Tuberose is not widely cultivated because there is a limited number of flower shapes, sizes, colors, and other characters. Furthermore, seeds are not produced under natural conditions. Mutation breeding was used by others in attempts to improve tuberose, but this approach did not get the satisfactory results (Abraham, et al. 1976). In the present study, crosses were made between single and double varieties of tuberose, and segregating seedlings were obtained. The seedlings were evaluated and some of them show great promise for improvement.

2. Materials and Methods

2.1. Test of stigma receptivity of tuberose at different ages:

Flower buds were emasculated and bagged. Then, at various flower ages, bags were removed and pistils were pollinated with fresh pollen of different varieties. After 6 hours, the pollinated stigmas were fixed in FAA solution. The fixing solution was removed 24 hours later, and the stigmas were washed 2 times with distilled water. The stigma was macerated in 4N NaOH for 6 hours, and then washed 3 times with distilled water. The plant tissue was stained in 0.1% aniline blue (dissolved in 0.1 N K₃PO₄) for at least 12 hours. The extent of pollen tube growth in pistils was observed with a fluorescence microscope (Kho et al. 1968).

2.2. Test of selfing and crossing:

There were self and cross pollinations involving the single

and double tuberose varieties, and the fruit and seed production were investigated from February 1983 to May 1983 in the nursery of National Chia-Yi Institute of Agriculture, Taiwan, R.O.C.

2.3. Investigation of seedlings of tuberose hybrids:

Hybrid seeds of tuberose were sowed on April 30, 1984. When seedlings grew to 10 cm in height, they were transplanted to the nursery (30 cm x 45 cm spacing) and subjected to normal cultivation and management. The following characters were observed: flowering time, flower shape, number of perianths, flower color and flower yield. Single and double varieties were grown as a check.

3. Results

Receptivity of tuberose stigmas as a function of flower age is shown in table 1. There was no pollen tube production if stigmas were pollinated when flowers were at the bud stage, the day before flowering, the day of flowering, or 1 day after opening. However, there was considerable pollen tube growth when flowers were pollinated 3 days after opening, and some pollen tubes were seen at 2 days.

Crosses between single and double varieties produced fruits and seeds when the female parent was 2-3 days after anthesis. These results are given in table 2. However, neither selfed double varieties nor selfed single varieties produced any seed due to self-incompatibility.

Seedlings obtained from hybrid seeds showed a great variation. Only 270 days elapsed from sowing seed to flowering in the earliest flowering plant, and 76% of the seedlings flowered within one year. Percentages of single and double plants in the hybrid progenies are given in table 3. Crossing between single and double plants showed more single progenies than double progenies. But double progenies usually had a tendency toward decreasing flower perianths (table 4).

Twelve seedlings with improved characters were selected from these progenies. The improved characteristics were higher flower yield, longer spikes, and more numerous florest than the original single and double varieties (table 4).

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Table 1. Stigma receptivity of *Polianthes tuberosa* at different flower ages.

Parents		Flower age (days)				
♀	♂	B	0	1	2	3
Single	Double	-	-	-	+	++
Double	Single	-	-	-	+	++

B : flower bud, one day before flowering

0 : flowering day

1, 2, 3 : flowering for 1, 2, 3 days, respectively

- : no pollen tube

+ : a few pollen tubes

++: more pollen tubes

Table 2. Results of selfing and crossing between "single" and "double" varieties.

Parents		No. of polli. flowers	No. of fert. fruits	% of fert. fruits	Fert. seeds per capsule
♀	♂				
S.	D.	72	16	22.2	15-23
D.	D.	65	0	0	-
D.	S.	45	7	15.5	19-31
S.	S.	42	0	0	-

S : Single D : Double

Table 3. Percentage of reciprocal crosses between the single and double varieties of tuberose in their progenies.

Parents		Percentage of single and double hybrid tuberose in the progenies				Total plants
		Single		Double		
♀	♂	no. of plants	%	no. of plants	%	
S.	D.	68	85	12	15	80
D.	S.	41	85.4	7	14.6	48

S : Single D : Double

Table 4. Improved characteristics of seedlings of tuberose hybrid in the progenies selection.

Symbol of hyb. seedl.	*Flower type	No. of perianths	**No. of spikes	Inflor. length (cm)	No. of fl. buds	Flower dia. (cm)	*** color
83-2.1-A12	S	6-7	12	20.1	54	4.06	+
83-1.2-B9	S	6-10	11	21.4	55	3.47	++
83-1.2-A10	S	6-9	8	12.9	52	4.11	+++
83-1.2-A9	S	6-8	6	27.7	50	4.05	+
83-2.1-D5	S	6-7	8	27.6	58	4.36	-
83-1.2-B7	S	6-8	8	27.2	46	4.08	++
83-1.2-B8	S	6	9	20.3	58	4.10	+
83-2.1-D8	S	6	8	29.0	48	3.76	++
83-2.1-C4	D	14-23	10	42.1	56	5.20	-
83-1.2-B3	D	12-24	6	33.3	67	4.09	+++
83-2.1-C8	D	18-22	4	46.3	58	5.46	-
83-2.1-D2	D	17-28	4	35.2	70	3.68	-
****CK ₁	S	6		16.7	25	3.63	-
CK ₂	D	12-31		37.4	48	3.68	+

* S : Single, D : Double

** : The amount of production total no. of spikes produced per plant from April 30, 1984 to March 7, 1985.

*** : Shows the color of outer perianths, "-" white; "+" pink; more "+" shows deeper pink

****CK₁ shows tuberose variety with single flowers originally, CK₂ shows the variety with double flowers originally.