Indian J. Genet., **66**(4): 329-331 (2006)

Genetic diversity and parental selection for hybridisation in rose (*Rosa hybrida*)

Tejaswini and M. V. Dhananjaya

Division of Ornamental Crops, Indian Institute of Horticultural Research, Bangalore 560 089

(Received: May 2004; Revised: September 2006; Accepted: November 2006)

Abstract

The present study was conducted to analyse the potential of existing rose (*Rosa hybrida*) germplsm collection. Existence of wide variability in stalk length (16.86cm. to 103.17cm) and keeping quality (2.7 to 7 days) indicated the possibility of utilizing the germplasm to develop better cut flower varieties through recombination. All the varieties having stalk length of 42.36 cm or above and with keeping quality of 4.74 days or more were considered under selected group. Varieties of this selected group as well as distinct colour groups were analysed for their divergence. Based on the cluster centre values and distance between the clusters, clusters were identified for hybridization in rose breeding programme.

Key words: Rose, genetic divergence, diversity, recombination,

Introduction

Rose (*Rosa hybrida*) is the most important flower crop belonging to the genus Rosa. Rose breeding in India concentrated on garden types suitable for landscape and those with small pedicel. For the past 6-8 years, scenario of rose cultivation has been changing in India. From just being a beautiful garden flower, rose has emerged as the top most cut flower crop being cultivated in protected structures with huge investment.

Commercial units are demanding for varieties having long straight stalk not less than 40 cm and with long vase life. Based on the need and the changed demand, the existing rose germplasm was re-evaluated for their potential to be used as parents for combining long stalk and vase life characters.

Presence of sufficient variability for desired traits in germplasm collection is the prerequisite for efficient utilization of the genotypes for hybridization. Genetic diversity of parents used for recombination is important for recovering transgressive segregants [1, 2]. With this objective, the present study was taken up to evaluate variability in the existing germplasm along with assessing the genetic divergence of the varieties. The major objective of the study was to identify the parents for hybridization to recover the transgressive segregant progeny with long stalk and long duration of keeping quality.

Materials and methods

One hundred and twenty seven rose varieties are being maintained in germplsam collection with regular cultural practices. A completely randomized design was used where sampling of 10 flowers each from 127 accessions was carried out in three years. Observations on stalk length, vase life, flower diameter, number of petals per flower, presence of thorns and fragrance were recorded for all the rose varieties. Varieties were grouped in to major colour groups of white, pink, red and yellow.

The germplasm collection was analysed for the existing variability in various characters for each one of the colour groups. All the varieties with stalk length and vase life above the population means were considered under selected group. Mean values of each variety for all the characters were subjected to divergence analysis through hierarchical cluster analysis. Dendrograms were drawn for better understanding of the sub cluster of the major groups. Squared euclidean distance was estimated and utilized for clustering and for drawing of dendrograms [3]. Each colour group as well as group of selected varieties was clustered separately into four clusters.

Results and discussion

Existing rose germplasm had stalk length ranging from 16.86 cm to 103.17 cm with a mean value of 42.36 cm. Keeping quality ranged from 2.7 days to 7 days with a mode of 5 days. Flower diameter ranged from 3.43 cm to 10.90 cm. Petal number per flower varied from as low as 25 to a highest value of 75.

A perusal of characters across various colour groups indicated the highest mean value for stalk length (46.58 cm.) available in yellow colour group though keeping quality was lowest (4.40 days). Contrary to this, the varieties in pink colour group had lowest mean value for stalk length (37.15 cm) and highest mean

Table 1. Variability available in different colour groups for flower characters in rose germplasm

	Stalk length (cm)	Keeping quality (no.of days)	Flower diameter (cm)	Score for fragrance	No.of petals
I. Red group					
Mean	**42.71**	**4.91**	**6.08**	**1.18**	**40.09**
Standard error	2.49	0.22	0.22	0.06	1.88
Median	40.33	5.00	6.08	1.00	38.78
Standard deviation	14.94	1.31	1.30	0.38	9.03
Sample variance	223.07	1.73	1.70	0.15	81.62
Range	69.25	4.00	5.84	1.00	30.80
Minimum	20.75	3.00	3.59	1.00	30.00
Maximum	90.00	7.00	9.43	2.00	60.80
II. Yellow group					
Mean	**46.58**	**4.40**	**6.43**	**1.23**	**43.80**
Standard error	4.75	0.21	0.61	0.12	5.54
Median	45.00	4.70	6.00	1.00	40.00
Standard deviation	17.11	0.74	2.19	0.44	12.38
Sample variance	292.88	0.56	4.79	0.19	153.20
Range	59.50	2.00	7.07	1.00	33.00
Minimum	27.00	3.00	3.43	1.00	28.00
Maximum	86.50	5.00	10.50	2.00	61.00
III. Pink group					
Mean	**37.15**	**4.96**	**6.01**	**1.19**	**41.22**
Standard error	2.49	0.18	0.23	0.06	2.55
Median	33.25	5.00	5.98	1.00	41.00
Standard deviation	16.48	1.17	1.51	0.39	14.18
Sample variance	271.73	1.37	2.29	0.16	201.19
Range	71.39	4.00	6.90	1.00	74.00
Minimum	16.86	3.00	4.00	1.00	1.00
Maximum	88.25	7.00	10.90	2.00	75.00

value of 4.96 days for keeping quality (Table 1). Irrespective of mean values, a wide range is observed in each group suggesting the possibilities for assorting them into various clusters. Maximum value of stalk length and keeping quality available in each one of these colour groups suggested the possibilities of selecting potential sources for hybridization.

Dendrograms presented for each group of varieties gives a clear view of the closeness between varieties and clustering formed among them (Fig. 1). Cluster centre along with the Euclidean distances between them, facilitates the selection of varieties for hybridisation and improvement of particular traits. Selecting the superior varieties from distant clusters for realizing transgressive segregants in breeding programme is highlighted in different crops [4, 5].

Vase life and stalk length are the major characters where transgressive segregants are aimed in rose breeding programme. Hence, cluster centres for both the characters are presented to facilitate the selection of right varieties for recombination. Maximum value of cluster centre for stalk length does not correspond with maximum value of keeping quality (Table 2). Among varieties belonging to yellow group, cluster 4 had maximum value for both stalk length (86.5 cm) and keeping quality (5 days). In case of red group, cluster 4 had maximum stalk length (90 cm) whereas cluster 1 had maximum keeping quality of 5.1 days (Table 2). Considering varieties belonging to pink group, cluster 3 exhibited maximum stalk length (82.3 cm) and maximum keeping quality (5.7 days). Considering cluster centre values across various groups, cluster 4 of red group had highest value and cluster 2 of pink group had minimum value for stalk length. Similarly for cluster centre values of keeping quality, cluster 2 of yellow group had minimum value.

Table 2. Final Cluster Centres for each colour group

Clusters	1	2	3	4
I. Red group				
Stalk length (cm)	43.4	27.1	66.2	90.0
Keeping quality (days)	5.1	4.7	4.5	5.0
II. Yellow group				
Stalk length (cm)	30.3	42.6	61.6	86.5
Keeping quality (days)	4.5	4.1	4.5	5.0
III. Pink group				
Stalk length (cm)	59.3	22.5	82.3	37.0
Keeping quality (days)	5.7	4.8	5.0	4.9

Eucledian distance for different cluster combinations for each group is presented in Table 3. Cross combinations involving the parents belonging to the most divergent clusters are expected to result in maximum amount of heterosis [6]. Among the selected varieties, Euclidean distance between cluster 1 and cluster 3 was found to be maximum indicating the possibility of recovering transgressive segregants in this cross combination (Table 3). In case of yellow group,

Table 3. Euclidean distances between cluster centres within each colour group

Cluster	1	2	3	4
I. Red group				
1.		16.303	22.860	46.704
2.	16.303		39.144	62.990
3.	22.860	39.144		23.857
4.	46.704	62.990	23.857	
II. Yellow group				
1.		12.464	31.370	56.490
2.	12.464		18.980	44.059
3.	31.370	18.980		25.171
4.	56.490	44.059	25.171	
III. Pink group				
1.		36.80	23.04	22.33
2.	36.80		59.77	14.48
3.	23.04	59.77		45.29
4.	22.33	14.48	45.29	

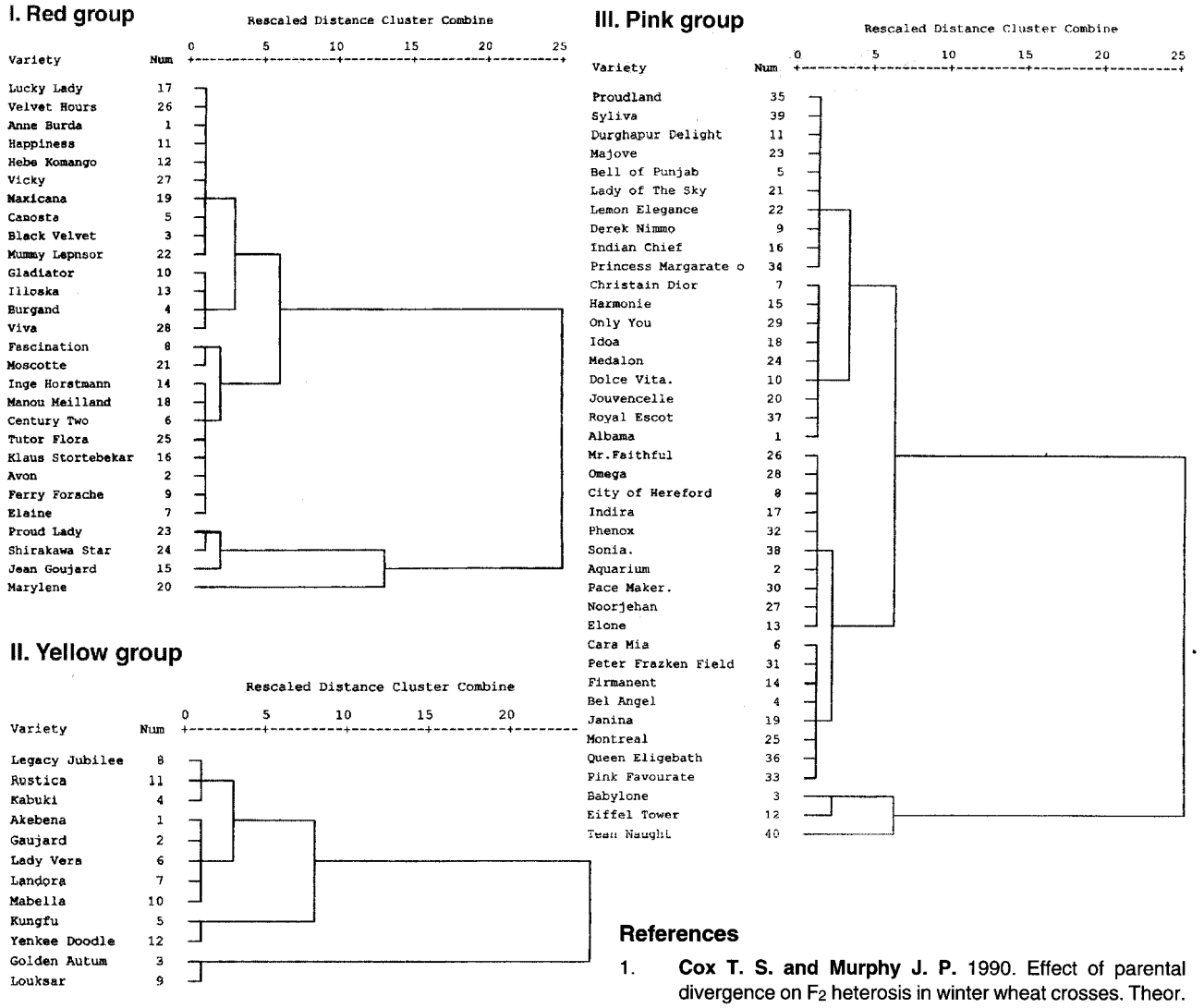

Fig. 1. Dendrogram using Average Linkage (Between Groups)

cluster 4 is the preferred choice, which is found to be at maximum distance from the cluster 1. In case of red group, cluster 4 is at maximum distance from cluster 2 and cluster 1. Preferred clusters 3 and 1 are at maximum distance from the cluster 2 in pink group.

In conclusion, available diversity present in the existing germplasm indicated the possibility of selecting the right variety for developing cut flower varieties. Genetic divergence analysis indicated the right cluster combinations as parents for hybridization to develop progenies with long stalk and keeping quality.

References

1. **Cox T. S. and Murphy J. P.** 1990. Effect of parental divergence on F_2 heterosis in winter wheat crosses. Theor. Appl. Genet., **79**: 241-250.
2. **Jatsara D. S. and Paroda R. S.** 1983. Genetic divergence in wheat. Indian J. Genet., **43**: 63-67.
3. **Anderberg M. R.** 1973. Cluster Analysis for Applications. Academic Press Inc. New York.
4. **Mishra M., Mahapatra K. C. and Mohanty C. R.** 2001. Classification analysis for genetic diversity in dahlia. Indian J. Genet., **61**: 187-189.
5. **Santha V. Pillai.** 2002. Variability and genetic diversity in exotic germplasm of cassava (*Manihot esculenta* Cranz). Indian J. Genet., **62**: 242-244.
6. **Singh S. P. and Sharma J. R.** 1989. Genetic improvement of pyrethrum. IV. Selective divergence, heterosis and potential hybrid clones. Theor. Appl. Genet., **78**: 841-846.