

HYBRIDIZATION IN MODERN ROSES

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ABSTRACT

Diallel crosses among six strongly fragrant hybrid tea varieties of garden roses possessing flowers of pink and crimson colours revealed that these tetraploid varieties are mainly self-incompatible type. A good amount of seed set was observed in all inter-varietal crosses excepting in Gruss an Coburg which was highly female sterile. Stratification of seeds before sowing in October greatly facilitated germination and better establishment of plants thus making them more suited to stand against the prevailing high temperature during summers. The inheritance of fragrance did not follow a definite pattern as its expression is governed by the ultimate effect of many genes; therefore, considerable decrease or increase in intensity of fragrance was noticed in some of the hybrid flowers. The pink flower colour dominated over the crimson.

INTRODUCTION

PRESENT-DAY garden varieties of roses possess a highly heterozygous combination of characters on account of the role played by hybridization, mutation and a long selectional history. Maximum number of varieties with most of desirable character combinations are available in hybrid tea roses, but still a quest for perfection goes on among the breeders (Pal, 1966; Klimenko, 1969). Detection of strongly-scented seedlings from a cross between poorly-scented parents (Kordes, 1955; Klimenko, 1969) and *vice versa*, accompanied with a variation in quality of fragrance has drawn the attention of many rose breeders from a very long period but the nature and inheritance of this character has not yet been understood. Most of the cultivated roses show a marked decline in pollen fertility on account of extensive structural hybridity (Shahare and Shastry, 1963) operating at pollen meiosis which makes the material more difficult for hybridization experiments. The present investigations were conducted with the aim to study the extent of self-incompatibility, intervarietal crossability, pollen and seed sterility and inheritance of colour and fragrance in hybrid flowers.

MATERIALS AND METHODS

Six strongly scented H.T. varieties, namely, Aroma, Charles Mallerin, Crimson Glory, Edward Mawley, Gruss an Coburg and Hadley were selected owing to their good fruit setting habit. A preliminary survey on their pollen fertility and male meiosis was made to further facilitate the breeding programme. The anthers were fixed in Carnoy's fluid for cytological observations and later transferred to acetic alcohol (1:3), previously mordanted with iron. Observations on pollen stainability and meiosis were made with the help of aceto

carmine stain. Shrivelled, unstained and empty grains were considered as sterile. For hybridization, flower-buds were emasculated on the previous evening before anthesis and equal number of these were bagged for pollen. Pollen was applied over stigmatic heads the next day which were again bagged. Bags were removed after the stigmatic heads had turned brown or black and thus completely lost their receptivity. Fully ripe rose hips were collected approximately 4 to 6 months after pollination.

Freshly-harvested fruits were kept in a refrigerator at 8 to 10° C. for 150 days. Seeds were sown in two lots in sterilized soil after applying Agrosan G N powder over their surface. The first lot of seeds was sown in the last week of October (1967) and the other in the first week of January (1968). Observations were made on seed germination, growth of seedling, date of flowering and type of flower produced.

OBSERVATIONS

All the varieties included in the present experiment were tetraploids (unpublished data) and produced flowers of pink or crimson colour. The average pollen fertility in the varieties varied from 19 to 36% during the winter season (Table II).

Fruit set was either absent on selfing or was occasional and poor as in Hadley and Aroma where only one cross in each was successful out of 4 and 5 made, respectively. These seeds did not germinate (Table I). In Charles Mallerin fruit set was observed in three cases out of five; two seeds of which germinated (Table I). One seedling of Charles Mallerin was successfully raised which produced flowers of parental colour and fragrance but they were smaller in diameter and consisted of fewer petals.

Reasonably good fruit set was observed in all in any other cross of Gruss an Coburg. The the intervarietal crosses (Table I) excepting in fruit set was 63.6% in Charles Mallerin and

TABLE I

♂ ♀	AROMA	CHARLES MALLERIN	CRIMSON GLORY	EDWARD MAWLEY	GRUSS AN COBURG	HADLEY
AROMA	○○○○ 0/21	●● 2/20	○○○○● CRIMSON 2/40	● CRIMSON 5/30	○○● PINK 6/27	●● CRIMSON 4/30
CHARLES MALLERIN	○○● 0/20	○○●●● O CRIMSON 2/60	○○●●● CRIMSON 2/40	●●●● CRIMSON 3/30	○○● 0/11	●●●● O 0/40
CRIMSON GLORY	○○○ 0/20	○○● CRIMSON 3/35	○○○○ O 0/5	● CRIMSON 9/35	○○● 0/19	○○● CRIMSON 2/30
EDWARD MAWLEY	○○● 2/28	●● CRIMSON 4/21	○○● CRIMSON 4/23	○○○	●●● PINK 7/29	○○● CRIMSON 5/26
GRUSS AN COBURG	○○	○○○○ O	○○●● ○○○○ 0/5	○○○○	○○○	○○○○
HADLEY	○○● 1/30	○○●● O CRIMSON 1/25	○○●●● O CRIMSON 5/27	● 0/5	○○●● O PINK 8/32	○○○○ O 0/7

○ FRUIT SET ABSENT
● FRUIT SET PRESENT
COLOUR OF HYBRID FLOWERS
NO. OF SEEDS GERMINATED
NO. OF SEEDS SOWN

a cross of Crimson Glory with Aroma. The variety Gruss an Coburg showed exceptionally poor fruit set (8.7%) as eight crosses with Crimson Glory resulted only five seeds which also failed to germinate. No fruit set was seen to fruit set (Table II).

TABLE II

Hybridization in six strongly-scented H.T. roses

Serial No.	Name of variety	Flower colour	Average pollen fertility %	Inter-varietal crosses						
				No. of crosses made	No. of fruit set	% of fruit set	No. of seeds sown	No. of seeds germinated	% of seed germination	No. of plants flowered
1	Aroma	Crimson	28	11	7	63.6	147	19	12.9	16
2	Charles Mallerin*	Blackish crimson	26	19	12	63.6	141	5	3.5	4
3	Crimson Glory	Deep crimson	36	13	4	30.7	119	14	11.7	10
4	Edward Mawley	Dark crimson	32	14	10	71.4	127	22	17.3	15
5	Gruss an Coburg	Apricot yellow reverse pink	19	23	2	8.7	5	0
6	Hadley	Rich crimson	36	19	10	52.6	139	15	10.8	13

* Self-compatible variety.

The number of seeds sown and germinated varied from variety to variety (Table I). The seeds sown in October showed better germination as compared with those sown in January. The percentage of seed germination varied from 12.9% to 10.8% in Aroma, Crimson Glory and Hadley. One to few seeds from all the inter-varietal crosses excepting Charles Mallerin \times Aroma, Charles Mallerin \times Gruss an Coburg, Charles Mallerin \times Hadley, Crimson Glory \times Gruss an Coburg and Hadley \times Edward Mawley have germinated (Table I). The seedlings gave rise to first bloom in a period of 160 to 176 days after germination of the seed. Fifty-eight seedlings of five varieties produced flowers of pink and crimson colours as apparent from the tables. Mainly the plants which resulted from seeds sown in January died after producing a bloom, whereas, those sown in October survived. Some of the casualties occurred on account of high temperature prevailing during summer, in the first year of growth. Seven hybrid seedlings comprising of 15 plants and one selfed seedling are still growing well even after a period of nearly three years.

Fragrance was present in all hybrid flowers though there was a marked decline in its intensity in some of them, e.g., in Aroma \times Crimson Glory and Aroma \times Edward Mawley. The pink flower colour of Gruss an Coburg dominated in crosses where this variety was used as the male parent (Table I). Two hybrid seedlings possessing intensely fragrant flowers are worth mentioning here, i.e., Aroma \times Gruss an Coburg and Edward Mawley \times Gruss an Coburg. The bud shape was excellent in the former and the flowers of latter developed dark pink colour on the outer petal surface. In the crosses where crimson flowered parents have participated, the parental colour was maintained (Table I). Out of two hybrid seedlings of Charles Mallerin \times Edward Mawley, one produced flowers of Edward Mawley colour and the other of Charles Mallerin colour the latter being darker in shade.

DISCUSSION

These six varieties are mainly self-incompatible though in some of the selfings, fruit set was obvious but the seeds either did not germinate or failed to establish themselves with the exception of a seedling in Charles Mallerin. The loss in vigour was apparent from the habit of this seedling which produced flowers with reduced size and petal number. This feature may be accounted for inbreeding depression which is usually apparent

in some of the cross-pollinated plants. The existence of such depression has been emphasized in roses by Wylie (1954) and Eva (1968). In general, fruit set with higher number of seeds was recorded in inter-varietal crosses as compared to selfed. Similar reports have been made in certain crop plants also.

Stratification of rose seeds before sowing as recommended by Semeniuk and Stewart (1964), has been helpful in enhancing seed germination besides other environmental factors. The seeds which were sown in October showed better germination and survival which may be considered as a more suitable period for rose seed sowing under Lucknow climatical conditions. Low percentage of seed germination was due to delayed sowing of the second lot. Seeds which germinated were indistinguishable from the ones which did not as both appeared to be well developed before sowing.

Excepting for Charles Mallerin, in general the varieties which possessed higher amount of fertile pollen resulted in better fruit and seed set and subsequently seed germination. In the present experiment the inheritance of fragrance followed the same pattern as that reported by various rose breeders (Kordes, 1955; Gamble, 1957; and Klimenko, 1969). Since this character depends on the interaction of many genes, therefore, loss or gain in intensity of fragrance in hybrid flowers can easily be expected. A detailed chemical analysis of qualitative and quantitative characters of rose oil of parents and offsprings on per seedling basis will throw more light on nature and mode of inheritance of fragrance. The pink colour of Gruss an Coburg flowers have dominated over crimson colour of the other parent, as represented by three kinds of inter-varietal seedlings. Such dominance has been reported in roses by Wylie (1954), Klimenko (1969) and others.

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