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# Studies on cross compatibility in *Jasminum* spp.

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Jasmine (*Jasminum* spp.) belongs to the family Oleaceae with basic chromosome number x=13 (Taylor 1945, Krishnaswamy and Raman 1948). Jasmine is one of the most important ornamental flowering shrubs widely cultivated in the southern and eastern parts of India for its attractive and fragrant flowers. The most important barrier in most species and cross combinations is non-fruitfulness. Under natural conditions, seed set varies with varieties within the species (Veluswamy1981). Inter-specific hybridization is one of the methods to create variations in jasmine, although this may be restricted because of cross incompatibility. In India, efforts on evolving jasmine varieties/hybrids for cultivation are negligible.

Self and cross incompatibility of a crop is a major constraint in hybridization program. High cross compatibility of the selected parents along with other desirable horticultural traits accelerates success of any controlled hybridization program. It is necessary to find out the compatible relationship of the selected genotypes before attempting any inter-varietal or inter-specific hybridization. Development of hybrids or cultivars in jasmine is associated with many problems such as undescribed genetic variability, self-incompatibility and poor seed setting. For hybridization program, the knowledge of floral biology is mandatory in order to find out parents with desirable characters,viz. time and duration of flowering, anthesis, anther dehiscence and stigma receptivity.

The present investigation was undertaken during 2016–17 to study the compatibility among six *Jasminum* species,viz. *J. sambac* (L.) Aiton cv. Ramanathapuram Gundumalli, *J. auriculatum* Vahl cv. Parimullai, *J. grandiflorum* L. cv. CO.1 (Pitchi), *J. multiflorum* (Burm. f.) Andrews (= *J. gracillimum* Hook. f.=*J. pubescens* (Retz.) Willd.), *J. flexile* and *J. malabaricum*. Fully developed thirty flower buds per replication in all six species were taken for open-pollination and self-pollination. All possible cross combinations were tried among the species to study the cross compatibility behavior. The freshly collected pollens from 20-25 matured flower buds were dusted on the stigmatic surface at the time of anthesis (5:00 pm-7:00 pm).

Significant variations were recorded for time of anthesis (Table 1). Anthesis started from 5:10 pm (*J. auriculatum*) to 8.34 pm (*J. multiforum*) on the same day. However, duration of peak anthesis was recorded from 6:00 pm to 7:00 pm.The flower opening was delayed in February, while it was earlier during the subsequent months. The cool days and nights during the month might be appearing to promote delayed flower opening.

The anther dehiscence was more or less constant during the five months period ranging from 4:01 pm (*J. auriculatum*) to 7.21 pm (*J. multiflorum*). However, in *J. auriculatum,* anther dehiscence was recorded slightly early in April (3:30 pm) and May (3:00 pm). This indicates that the increasing of day and night temperatures in April and May is related with early anther dehiscence.Veluswamy *et al*. (1980) reported differential influences of season on flower opening of different *Jasminum* species.The differences in the time of anthesis and anther dehiscence among the species might be due to their genetic makeup and environmental effects.

The maximum fruit set was recorded in *J. malabaricum* followed by *J. auriculatum* and *J. flexile* (Table 2), however, it was recorded minimum in *J. multiflorum*. Veluswamy (1981) reported fruit set in *J. grandiflorum* under open pollination. Karmakar and Srivastava (1987) also reported that the species *J. auriculatum, J. calophyllum* and *J. flexile* set seeds under open pollination. The differences in the fruit setting in the species might be due to their genetic makeup and environmental effects. The probable reasons for higher fruit set might be due to availability of more number of genotypes in the germplasm. Similar results of higher fruit set under open pollination were also reported in tuberose (Uma 1990 and Hemanta 2015). There was no fruit set recorded in *J. sambac* as there was flowers pedicel

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Table 1 Time of anthesis and anther dehiscence in six jasmine species

| Species | Time of anthesis (pm) | | | | | Pooled (pm) | Time of anther dehiscence (pm) | | | | | Pooled (pm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | February | March | April | May | June | | February | March | April | May | June | |
| *J. sambac* | 7:00 | 7:00 | 6:30 | 6:15 | 6:45 | 6:58 | 6:30 | 6:40 | 6:00 | 5:45 | 6:30 | 6:09 |
| *J. auriculatum* | 6:30 | 5:15 | 4:30 | 4:30 | 5:45 | 5:10 | 5:30 | 4:15 | 3:30 | 3:00 | 4:30 | 4:01 |
| *J. grandiflorum* | 6:30 | 5:45 | 5:45 | 5:30 | 6:15 | 5:73 | 5:30 | 5:00 | 5:00 | 4:45 | 5:30 | 5:01 |
| *J. malabaricum* | 7:30 | 7:00 | 6:45 | 6:15 | 6:30 | 6:64 | 6:30 | 6:00 | 5:45 | 5:10 | 5:30 | 5:63 |
| *J. multiflorum* | 9:45 | 9:35 | 8:30 | 7:45 | 7:15 | 8:34 | 8:45 | 8:30 | 7:15 | 6:15 | 6:00 | 7:21 |
| *J. flexile* | 7:20 | 7:05 | 5:30 | 6:45 | 6:45 | 6:49 | 6:25 | 6:40 | 4:30 | 5:30 | 6:45 | 5:74 |

Table 2 Fruit and seed set under open and self pollinationin jasmine species

| Species | Open pollination | | | | | | Self pollination | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of fruit set | Fruit set (%) | Fruit set (days) | Number of seed set | Seed set (%) | Fruit maturation (days) | Number of fruit set | Fruit set (%) | Fruit set (days) | Number of seed set | Seed set (%) | Fruit maturation (days) |
| *J. sambac* | 0.00 | - | - | 0.00 | - | - | - | 0.00 | - | - | 0.00 | - |
| *J. auriculatum* | 17.50 | 58.33 | 28.00 | 12.75 | 42.50 | 50.25 | 7.00 | 23.33 | 27.50 | 7.00 | 23.00 | 51.75 |
| *J. grandiflorum* | 11.25 | 37.50 | 30.00 | 5.75 | 19.17 | 54.25 | - | 0.00 | - | - | 0.00 | - |
| *J. malabaricum* | 21.25 | 70.83 | 23.75 | 19.50 | 65.00 | 62.00 | - | 0.00 | - | - | 0.00 | - |
| *J. multiflorum* | 1.75 | 5.83 | 34.75 | 1.25 | 4.17 | 64.25 | - | 0.00 | - | - | 0.00 | - |
| *J. flexile* | 16.25 | 54.17 | 25.50 | 3.25 | 10.83 | 47.25 | 4.25 | 14.17 | 25.25 | - | 0.00 | - |
| SEm± | 0.11 | 1.90 | 0.04 | 0.13 | 2.05 | 0.04 | 0.11 | 1.38 | 0.01 | 0.06 | 0.84 | 0.04 |
| CD (P=0.05) | 0.34 | 5.79 | 0.12 | 0.40 | 6.19 | 0.13 | 0.34 | 4.18 | 0.04 | 0.28 | 2.55 | 0.12 |

senescence soon after anthesis. Pollinated flowers were dried with pedicel. Seed set varied greatly among the six species. Maximum seed set was recorded in *J. malabaricum* followed by *J. auriculatum* and *J. grandiflorum*, however, minimum seed set was recorded in *J. multiflorum*. The reduction in seed setting might be due to genetic and environment effects. The species *J. flexile* recorded earliest fruit maturation, while it was delayed in *J. malabaricum*.

On self pollination, the highest fruit set was recorded in *J. auriculatum* followed by *J. flexile* (Table 2). However, there was no fruit set in remaining four species. Self incompatibility might be one of the reasons for failure of fruit set or due to heterostyly (pin flower) of the species. These results indicated that the species under study were self-incompatible promoting cross pollination. Sandhya (1988) and Gurumurthy (1991) also reported self-incompatibility in rose. Aswath *et al.* (1989) reported that failure of seed setting in *Pyrostegia venusta* was due to the development of non-viable pollen grains and also due to occurrence of degenerating ovules at megaspore tetrad stage.

Among different crosses, highest fruit set was recorded in *J. malabaricum* × *J. flexile* followed by *J. flexile* × *J. auriculatum*, *J. malabaricum* × *J. auriculatum*, *J. auriculatum* × *J. flexile* and *J. flexile* × *J. malabaricum* and *J. auriculatum* × *J. malabaricum* (Table 3). It might be due to higher cross compatibility between the parents. The days taken for fruit set among different crosses vary from 24.25 days (*J. malabaricum* × *J. multiflorum*) to 30.25 days (*J. grandiflorum* × *J. flexile*).

The highest seed set was recorded in the cross *J. auriculatum* × *J. malabaricum* followed by *J. auriculatum* × *J. flexile*, *J. malabaricum* × *J. flexile* and *J. auriculatum* × *J. grandiflorum*. It might be due to their less compatibility between the parents involved in crossing. All the fruits were dropped after 35-40 days of setting in the crosses of *J. grandiflorum* × *J. flexile, J. grandiflorum* × *J. malabaricum, J. grandiflorum* × *J. sambac, J. flexile* × *J. grandiflorum* and *J. flexile* × *J. auriculatum* indicating incompatibility. The phenomena on underlying crossing barriers were incompatibility and incongruity. Ranchana (2014) also reported fruit drop in different crosses in tuberose, indicating presence of cross incompatibility among the species. The days taken for fruit maturation ranged from 47.25% (*J. flexile* × *J. multiflorum*) to 64.50% (*J. malabaricum* × *J. auriculatum*).

The successful seed set was recorded in the crosses *J. auriculatum* with *J. grandiflorum* and *J. malabaricum* and in their reciprocal crosses, and *J. malabaricum* × *J. flexile* and their reciprocal cross. Successful seed set was observed in many crosses when *J. auriculatum* and *J. malabaricum* was used as a female parent indicating higher degree of compatibility.

## SUMMARY

The present investigation was carried out to study the compatibility among six *Jasminum* species during 2016–17.

Table 3 Fruit set and seed set under artificial cross pollination in jasmine species

| Crosses | Number of flowers pollinated | Number of fruit set | Fruit set (%) | Fruit set (days) | Number of seed set | Seed set (%) | Fruit maturation (days) |
|---|---|---|---|---|---|---|---|
| *J. auriculatum* × *J. flexile* | 15 | 6.50 (2.64) | 43.33 (41.12) | 27.25 | 5.00 (2.33) | 33.33 (35.07) | 50.50 |
| *J. auriculatum* × *J. grandiflorum* | 15 | 3.50 (1.98) | 23.33 (28.58) | 27.00 | 3.00 (1.86) | 20.00 (26.41) | 50.50 |
| *J. auriculatum* × *J. multiflorum* | 15 | 3.25 (1.92) | 21.67 (27.54) | 27.75 | 2.50 (1.71) | 16.67 (23.67) | 50.50 |
| *J. auriculatum* × *J. malabaricum* | 15 | 6.25 (2.60) | 41.67 (40.20) | 27.00 | 5.75 (2.50) | 38.33 (38.24) | 50.00 |
| *J. grandiflorum* × *J. flexile* | 15 | 1.50 (1.40) | 10.00 (18.19) | 30.25 | - | 0.00 (0.74) | - |
| *J. grandiflorum* × *J. malabaricum* | 15 | 3.25 (1.93) | 21.67 (27.70) | 30.00 | - | 0.00 (0.74) | - |
| *J. grandiflorum* × *J. auriculatum* | 15 | 5.00 (2.34) | 33.33 (35.16) | 30.00 | 1.25 (1.31) | 8.33 (16.58) | 54.25 |
| *J. grandiflorum* × *J. sambac* | 15 | 0.75 (1.10) | 5.00 (11.41) | 31.25 | - | 0.00 (0.74) | - |
| *J. malabaricum* × *J. flexile* | 15 | 7.75 (2.87) | 51.67 (45.96) | 24.50 | 3.25 (1.92) | 21.67 (27.54) | 62.75 |
| *J. malabaricum* × *J. multiflorum* | 15 | 2.75 (1.79) | 18.33 (25.12) | 24.25 | 1.25 (1.31) | 8.33 (16.58) | 62.00 |
| *J. malabaricum* × *J. auriculatum* | 15 | 6.75 (2.68) | 45.00 (42.09) | 26.50 | 2.50 (1.72) | 16.67 (23.84) | 64.50 |
| *J. flexile* × *J. malabaricum* | 15 | 6.50 (2.64) | 43.33 (41.16) | 25.25 | 0.75 (1.06) | 5.00 (9.47) | 47.00 |
| *J. flexile* × *J. grandiflorum* | 15 | 4.00 (2.12) | 26.67 (31.00) | 25.25 | - | 0.00 (0.74) | - |
| *J. flexile* × *J. multiflorum* | 15 | 2.00 (1.56) | 13.33 (21.09) | 25.50 | 0.25 (0.84) | 1.67 (4.30) | 47.25 |
| *J. flexile* × *J. auriculatum* | 15 | 7.00 (2.73) | 46.67 (43.07) | 25.00 | - | 0.00 (0.74) | - |

Figures in parenthesis are the arcsine transformed means for fruit set and seed set percent and square root transformed means for number of fruit set and seed setper cent

Among open, self and artificial cross pollination, the open pollination resulted in maximum degree of fruit and seed set proving the open pollination to be the best method of pollination. The best time for pollination was the time of anthesis. The species *Jasminum malabaricum* and *Jasminum auriculatum* were superior as seed parents.

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