Research Article

A STUDY ON THE EVALUATION AND CROP IMPROVEMENT OF *NERIUM OLEANDER* L. ECOTYPES FOR YIELD AND QUALITY

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ABSTRACT

A research was conducted at Department of Floriculture and Medicinal Crops, Horticulture College and Research Institute, Periyakulam to evaluate the ecotypes of nerium collected for yield and quality during 2010–2013. A total of 9 accessions were collected from Dindigul district based on variation in flower color, plant form and foliage variegation and the germplasm was evaluated for growth characters and yield parameters in the first year. Among the nine accessions, the accession A_1 recorded the highest plant height (159.25 cm). However, the highest number of leaves per plant (1714.33), plant spread in East West direction (107.12 cm) and plant spread in North South direction (104.74 cm) were observed in accession A_8. The number of productive shoots, number of flowers per plant, flower diameter and single plant yield was highest in accession A_1. Hybridization was conducted using the germplasm A_1 to A_5 and A_8 as male parents and A_1 to A_4 and A_8 as female parent. Hybridization using red single and pink single as female parent was successful. Pod retention was also good in the same hybridization programme. Fruit set was highest in the cross A3 x A_5 (18%) and A_4 x A_1 (12 %). Fruit retention up to maturity was highest in the same crosses (158 % & 94 %). Further germination studies of hybrid seeds were also conducted. Seeds were sown without treatment and after treatment with GA_3 @100mg in 100ml of water, hot water (80°C and 100°C). Germination percentage was poor.

INTRODUCTION

Nerium oleander L. is an evergreen shrub or small tree monotypic to the genus *Nerium* (Kiran and Prasad, 2014). It belongs to the family Apocynaceae typically occurs around dry stream beds. It grows to 6'-20' (2-6 m) tall, with spreading to erect branches. It usually inhabits temporary streams, primarily ravines, and other highly seasonal streams with extreme variation in the flooding condition, typically with dry conditions for several months during summer (Herrera 1991). Oleander grows well in warm subtropical regions, where it is extensively used as an ornamental plant in landscapes, parks, and along roadsides (Barrios and Koptur, 2011). It is drought tolerant and will tolerate temperatures as low as 10°F (-10°C). In India, especially in South India the crop is important commercially as a loose flower. It is also useful for screens, informal hedges, colorful accents, beach plantings, and cityscapes. By removing suckers, and leaving just a few stems, oleander can be formed into very attractive small trees. Oleander is suitable for container gardens and is a fine choice for bringing color into gardens. Multi-colored oleanders lining the highways provide commuters a soothing display. Their ability to survive the heat and exhaust fumes is testimony to their durability. The plant is widely grown as an ornamental for its abundant and long-lasting flowering as well as its moderate hardiness. However, little research has been done to evaluate the various cultivars available. Hence a study was conducted with the objectives of assembling nerium germplasm and evaluating them and conducting hybridization programmes to develop types having dwarf stature and high yield with variation in flower colour.

MATERIALS AND METHODS

The study was conducted during 2010-2013 to study the evaluation of nerium cultivars for vegetative, flowering and

yield traits at Department of Floriculture and Medicinal Crops, Horticulture College and Research Institute, Periyakulam, Tamil Nadu Agricultural University. A total of 9 accessions were collected from Dindigul district based on variation in flower color, plant form and foliage variegation and the germplasm was evaluated for growth characters and yield parameters in the first year. In each replication five plants were selected in all the treatments and tagged for recording the observation on various vegetative and flowering characters. The statistical analysis was done by adopting the standard procedures of Panse and Sukhatme (1985). Randomized Block Design (RBD) designs were followed with three replications in each treatment. The critical difference was worked out at five percent (0.05) probability.

RESULTS AND DISCUSSION

Experiment I: Germplasm collection and evaluation

Nine accessions were collected from Dindigul highway. The plants were planted in the main field and germplasm evaluation was done (Table 1 & 2). The accessions A_1 to A_9 were collected from Dindigul district based on variation in flower color, plant form and foliage variegation. Cuttings were taken and planted in nursery for rooting. The main field was prepared, pits were taken up and the rooted cuttings of the accessions were planted and evaluated for various characters.

Table 1. Evaluation of Nerium accessions for growth characters

Treatment	Plant height (cms)	Number of Leaves per plant	Plant spread (cms)		Leaf area (cms^2)
			EW	NS	
A_1 - red	159.25	1289.50	96.34	96.21	28.87
A_2 - pink single	146.78	1387.67	98.39	97.19	24.39
A_3 - pink double	143.27	1484.25	100.92	99.17	23.16
A_4 - white single	149.36	1329.25	97.48	94.34	26.06
A_5 - white double	138.46	1524.08	100.05	98.71	21.47
A_6 - variegated Leaf	120.89	1570.83	101.74	99.49	16.71
A_7 - light pink	146.53	1420.58	99.26	95.72	25.68
A_8 - light pink Dwarf	94.53	1714.33	107.12	104.74	22.75
A_9 -white with yellow centre	128.10	1639.17	104.37	102.23	19.59
CD (0.05)	6.56	49.54	2.40	2.25	1.78

Table 2. Evaluation of Nerium accessions for flower characters

Treatment	Number of productive shoots /plant	Number of flowers/ plant	Flower diameter (cm)	Single Flower weight (g)
A_1 - red	5.51	137.75	4.64	0.40
A_2 - pink single	5.13	107.74	4.11	0.38
A_3 - pink double	5.04	106.64	3.44	0.37
A_4 - white single	4.77	101.64	3.84	0.36
A_5 - white double	4.32	93.13	3.76	0.34
A_6 - variegated Leaf	4.32	99.31	3.80	0.35
A_7 - light pink	3.88	84.53	3.66	0.33
A_8 - light pink Dwarf	4.04	85.43	3.73	0.33
A_9 -white with yellow centre	2.74	22.40	3.24	0.29
CD (0.05)	0.37	12.81	0.50	0.16

a. Evaluation of the growth parameters

The accessions planted in the main field were evaluated for their growth and flowering one year after planting. The vegetative characters like plant height, number of leaves per plant, plant spread in East West and North South directions. Among the nine accessions, the accession A_1 recorded the highest plant height (159.25 cm). The variation in plant height among the cultivars could be due to influence of the genetical makeup of the cultivars. Higher value for plant height is associated with rapid meristematic activity,

probably due to rapid cell division and elongation during the growth period (Sharova *et al*., 1977). This is in line with observation made by (Herrera 1991; Mackay *et al*., 2005; Mulas *et al*., 2008; Kumar and Haripriya, 2010) in nerium. However, the highest number of leaves per plant (1714.33), plant spread in East West direction (107.12 cm) and plant spread in North South direction (104.74 cm) were observed in accession A_8 (Table 1). The variation in plant spread was due to the additive gene effect. Similar observations were made by (Mackay *et al.,* 2005; Mulas *et al.,* 2008). The lowest plant height (94.33 cm) was observed in accession A_8. Number of leaves/plant (1289.50) and plant spread in East West direction (96.34 cm) and in North South direction (96.21 cm) was observed in accession in A_1.

b. Evaluation of the yield parameters

The number of productive shoots, number of flowers per plant (137.75), flower diameter (5.51 cm) and single plant yield (4.64) was highest in accession A_1 viz., red. The lowest number of productive shoots (2.74), number of flowers per plant (22.40), flower diameter (3.24 cm) and single plant yield (0.29) was recorded in A_9 accession *viz.*, plants bearing flowers with white with yellow centre. The variation in yield characters may be due to genetic nature of the cultivar and also the effect of agro climatic conditions. The varietal differences for yield potential may also be attributed to additive gene affect. This was in line with the observation made by with Kumar and Haripriya, 2010 in nerium.

Experiment II: Hybridization programme

The different crosses carried out with details of the parents involved are presented in Table 3 given below.

Table 3. Hybridization programme in Nerium

S. No.	Female parent	Male parent
1.	Red Single	White Single
2.	Pink Single	White Single
3.	White Single	Red Single
4.	Pink Double	White Double
5.	White Single	Pink Single
6.	White Double	Pink Double
7.	Light Pink Dwarf	Red Single
8.	Red Single	Light Pink Dwarf

The results of the experiment indicated that hybridization programme using Pink Double as female parent and White Double as male parent (Table 4) recorded highest percentage of fruit set and fruit maturity (60% & 158.83% respectively). This was followed by hybridization using White Single as female parent and Pink Single as male parent (Table 5) which recorded mean fruit set and fruit maturity of 94.71% & 94.91% respectively. Hybridization programme using White Double as female parent and Pink Double as male parent (Table 6) recorded mean fruit set and fruit maturity of 71.11% and 109.26% respectively.

Table 4. Hybridization studies -Pink Double (female) x White Double (male)

(No. of flowers used in hybridization programme: 20 flowers)

Fruit set	Fruit maturity	% Fruit set	% Fruit maturity
10	10	50	100
6	6	30	100
5	5	25	100
7	6	35	85.71
15	10	75	66.67
11	10	55	90.91
7	5	35	71.43
9	9	45	100
12	10	60	88.33
3	3	15	100
10	10	50	100
5	3	25	60
4	3	20	75
3	3	15	100
3	3	15	100
3	3	15	100
6	5	30	83.33
7	5	35	71.43
7	5	35	71.43
4	3	20	75
5	2	25	40
4	3	20	75
3	2	15	66.67
3	3	15	100
2	2	10	100
5	2	25	40
6	5	30	83.33
12**	**9.85 ****	**60 ****	**158.83 ****

Table 5. Hybridization studies -White Single (female) x Pink Single (male)
(No. of flowers used in hybridization programme: 20 flowers)

Fruit set	Fruit maturity	% Fruit set	% Fruit maturity
18	4	90	22.22
20	6	100	30
15	3	75	20
15	5	75	33.33
10	4	50	25
5	2	25	40
10	10	50	100
12	10	60	83.33
6	5	30	83.33
7	3	35	42.86
6	5	30	83.33
5	2	25	40
5	3	25	60
10	3	50	30
12	4	60	33.33
5	4	25	80
18.94**	**8.59 ****	**94.71 ****	**94.91 ****

Table 6. Hybridization studies - White Double (female) x Pink Double (male)
(No. of flowers used in hybridization programme: 10 flowers)

Fruit set	Fruit maturity	% Fruit set	% Fruit maturity
2	2	20	100
5	5	50	100
4	3	40	75
3	1	30	33.33
2	1	20	50
5	3	50	60
6	2	60	33.33
5	2	50	40
7.11 **	**4.22 ****	**71.11 ****	**109.26 ****

Hybridization using Light Pink Dwarf as female parent and Red Single as male parent (Table-7) recorded mean fruit set and fruit maturity of 46.55 % and 63.89 Hybridization programme using Red Single as female parent and Light Pink Dwarf as male parent (Table 8) recorded the lowest fruit set and fruit maturity of 19.41% and 58.82 %.

Table 7. Hybridization studies - Light Pink Dwarf (female) x Red Single (male)
(No. of flowers used in hybridization programme: 10 flowers)

Fruit set	Fruit maturity	% Fruit set	% Fruit maturity
1	0	20	0
1	0	16.67	0
2	1	25	50
2	1	20	100
1	0	14.3	0
2	1	40	50
3	1	30	33.33
1	0	20	0
1	1	20	100
1	0	33.33	0
2	1	40	50
2.83**	**1****	**46.55 ****	**63.89****

Table 8. Hybridization studies - Red Single (female) x Light Pink Dwarf (male)

Fruit set	Fruit maturity	% fruit set	% fruit maturity
1	1	20	100
1	0	25	0
1	0	20	0
1	1	20	100
0	0	0	0
1	0	20	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
1	1	20	100
1	1	20	100
0	0	0	0
0	0	0	0
1	1	20	100
8 *	**5 ***	**165***	**500 ***
0.94 **	**0.59****	**19.41****	**58.82****

Table 9. Germination studies of hybrid seeds

Treatment	Details of Treatment	Germination %	Survival % after 1 month
T_1	GA_3 -100 mg in 100ml water on germination paper	5	0
T_2	Hot water treatment on germination paper	2	0
T_3	NaCl on germination paper	3	0
T_4	Control (without treatment on germination paper)	0	0
T_5	Diluted Cow urine on germination paper	5	0
T_6	Cow dung slurry on germination paper	10	0
T_7	Cow dung slurry On sand tray	25	0
T_8	Hot water On sand tray	20	0
T_9	NaCl On sand tray	20	0
T_{10}	Control (without treatment on sand tray)	5	0
T_{11}	Na Cl (On petridish + butter paper + germination paper)	10	0
T_{12}	Hot water (On petridish + butter paper + germination paper)	10	0
T_{13}	Cow dung slurry (On petridish + butter paper + germination paper)	10	0
T_{14}	Control (Without treatment on petridish + butter paper + germination paper)	5	0

Experiment III: Germination studies of hybrid seeds

Germination of the hybrid seeds was not successful under ordinary circumstances. Hence, germination studies of hybrid seeds were undertaken. The studies showed that treating seeds with cow dung slurry on sand tray (T_7) recorded 25 % germination percentage. However none of the seedlings survived after one month of germination (Table 9).

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