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Screening of Different Accessions of *Tabernaemontana divaricata* (L.) for High Flower Yield and Suitability to Commercial Loose Flower Production

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A B S T R A C T

Tabernaemontana divaricata (L.) (Crape jasmine) is gaining commercial importance as a loose flower during off-season production. Its ability to produce flowers year-round makes it a commercial flower crop alternative to jasmine. As there is no designated variety released in this crop, the farmers are using locally available plants without knowing the yield potential and quality of flowers. Hence, a field evaluation experiment was carried out in the floriculture unit, Department of Horticulture, Faculty of Agriculture, Annamalai University during 2019-2020 to screen 21 different accessions collected from different parts of Tamil Nadu. The growth and yield parameters of 21 accessions varied significantly. The correlation studies also revealed that all the growth parameters significantly contributed to the dry matter production and yield parameters have contributed to the follower yield. Growth and yield parameters suggest that accession TD 8 (Meenampalli local) as the best accession suitable for loose flower production. Next to this accessions TD 2 (Dharmapuri Local), TD13 (Hosur Local) and TD21 (Krishnagiri Local) were found performing better. The accession TD20 (Hosur Variegated Local) performed least in terms of growth and yield.

***Key words*:** *Tabernaemontana divaricata,* Crape jasmine, Screening, Accessions, Growth parameters, Yield parameters

There has been a considerable increase in the area, production, and consumptions of loose flowers for the past ten years. In India, flower crops are cultivated in an area of 307000 ha during 2019-20 that led to a production of 694 million cut flowers and 2300 Mt of loose flowers [1]. *Tabernaemontana divaricata* (Crape jasmine), an evergreen shrub containing large, glossy dark green leaves, white fragrant 5-petaled tubular flowers is being cultivated as loose flower. It is gaining commercial importance in landscape industry also. Though this plant is native to Indian subcontinent it has been used in homesteads and temples, it could not attain the status of a commercial flower crop as like that of jasmines, tuberose, crossandra, etc. The flower bud of Crape jasmine looks very similar to *Jasminum sambac*. When compared with jasmine, the crape jasmine is hardy, low input crop with high productivity and self-life. Hence, they are used as alternate loose flowers during off season production. As the Crape jasmine can bear year-round production, it could get a space in farmers filed as a commercial flower crop. In recent past, the floral crafts made using Crape jasmine viz., like veni, floral strings, etc. are at high demand. Hence, the area under jasmine production is increasing every year in Tamil Nadu. As there is no designated variety available in this crop, the farmers are growing single petal plants available from the local sources. Identification of high yielding jasmine genotype is the first step towards improvement of this crop.

Tabernaemontana divaricata is widely distributed in Asia, Australia, China, Japan and in India. It generally occurs in upper Gangetic plain, Garhwal, Khasia Hills, Assam, Myanmar, Bangladesh, Visakhapatnam, and West Bengal [2-3]. A number of *T. divaricata* cultivars are available in nature and at households, which bear good yield throughout the year. The natural variability available in *T. divaricata* cultivars are not researched upon to assess their suitability for commercial cultivation. Hence, *T. divaricata* accessions available from the commercial nurseries, farmers filed, and households can be screened to assess their growth and yield potential and identify high yielding accessions. Further, varietal evaluation needs to be done to recommend cultivars bearing good quality bold flowers. In crape jasmine, flowering parameter viz., number of flowers per plant, length of flower bud, bud weight, and corolla tube length, and no. of branches determine the crop yield of the genotype and its suitability for commercial production. As genotypic constituent and the effect of environmental condition largely affect the performance of any cultivar, the cultivar performed in one region may not perform well in another region [4]. Commercial cultivation of any flower crop in a region depends on the introduction of high yielding varieties with good

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quality parameters. Identification of high yielding accession will help for crop improvement programmes in *T. divaricata*. Hence, to enhance the area under commercial production of crape jasmine in Tamil Nadu, high yield genotypes need to be identified.

MATERIALS AND METHODS

A field evaluation experiment was carried out in the floriculture unit, Department of Horticulture, Faculty of Agriculture, Annamalai University during 2019-2020 to screen 21 different accessions of *T. divaricata* (L.) for high flower yield and suitability to commercial loose flower production. The experiment was laid in Randomized Block Design with three replications. The rooted cuttings of following 21 accessions obtained from different places in Tamil Nadu were planted in plots of 3m x 6m dimension in a spacing of 1.5m X 2m for assessing their growth and yield performance. Standard package of practices were adopted throughout the experiment to grow a healthy crop.

Ac. No.	Name of the accession
TD 1	Kurinjipadi local
TD 2	Dharmapuri local
TD 3	Metupalayam local
TD 4	Virudachalam local
TD 5	Banrutti local
TD 6	Thali local
TD 7	Neyveli local
TD 8	Meenampalli local (Salem)
TD 9	Anthiyur local
TD10	Chidambaram local
TD11	Dindigul loacl

Ac. No.	Name of the accession
TD12	Vedasantoor local
TD13	Hosur local
TD14	Banrutti variegated local
TD15	Thali variegated local
TD16	Neyveli variegated local
TD17	Batlagundu vocal
TD18	Ottanchathiram vocal
TD19	Virudachalam variegated local
TD20	Hosur variegated loacal
TD21	Krishnagiri local

The plant protection measures were adopted to control weeds, pest and diseases. The plant bushes are pruned at 50cm height from the ground level. Harvesting of flower was done during evening hours by plucking the unopened flower buds. Initially harvesting was done once in two days. At peak flowering season harvesting was done every day. Four plants were randomly selected at each plot in all the three replications and were tagged for recording the non-destructive parameters. Data pertaining to growth and yield parameters were recorded at periodical intervals. The data recorded were subjected to statistical analysis by adopting the standard procedure [5]. The critical differences were worked out at 5% probability significance.

RESULTS AND DISCUSSION

Growth parameters

Results of screening studies revealed a significant variation among the twenty-one accessions with respect to all the growth parameters viz., plant height, internodal length, number of primary branches plant^{-1}, number of secondary branches plant^{-1}, number of leaves plant^{-1}, plant spread, leaf area, stem girth, and DMP (Table 1). The plant height was significantly varied between different genotypes from 75.24cm to 143.18cm. Among the 21 accessions, TD 8 (Meenampalli local) has recorded the highest plant height (143.18cm) followed by TD 2 (Dharmapuri Local) which recorded 139.89cm. Along with these two accessions. TD 3 (Metupalayam local), TD13 (Hosur Local) and TD21 (Krishnagiri Local) were also considered as tall cultivars. Plant heights of nine accessions were recorded less than the mean performance of 21 accessions. The least plant height of 75.24cm was recorded in TD20 (Hosur Variegated Local) and most of the variegated cultivars exhibited low height including TD19 (Virudachalam Variegated) and TD16 (Neyveli Variegated local). Among the genotypes, the maximum internodal length (12.64cm), number primary branches (5.58), and secondary branches per plant (12.48) were recorded in accession TD 8 (Meenampalli local). TD 8 was followed by TD 2 (Dharmapuri Local), TD13 (Hosur Local) and TD21 (Krishnagiri Local) which were on par with each other. The minimum internodal length (5.00cm), number primary branches (3.68), and secondary branches per plant (7.18) were recorded in accession was recorded in TD20 (Hosur Variegated Local). The other variegated cultivars TD19 (Virudachalam Variegated) and TD16 (Neyveli Variegated local) have also exhibited less growth in terms of intermodal length and number of branches. The enhancement in intermodal length observed in TD8, TD2, and TD13 might be attributed to the enhancement in plant height observed in these accessions.

The maximum values in number leaves per plant (12.48), plant spread (68.49cm), leaf area (30.25cm^2), stem girth (4.86cm), and dry matter production (6.50 g/plant) were also recorded the in TD 8 (Meenampalli local) followed by TD 2 (Dharmapuri Local), TD13 (Hosur Local) and TD21 (Krishnagiri Local). The least values in leaves per plant (12.48), plant spread (34.24cm), leaf area (11.80 cm^2), stem girth (0.55cm), and dry matter production (2.35 g/plant) were recorded in TD20 (Hosur Variegated Local) followed by TD19 (Virudachalam Variegated) and TD16 (Neyveli Variegated local). The enhancement of plant spread observed in TD8, TD2, and TD13 might be attributed by the increase in number primary branches and secondary branches observed in these accessions.

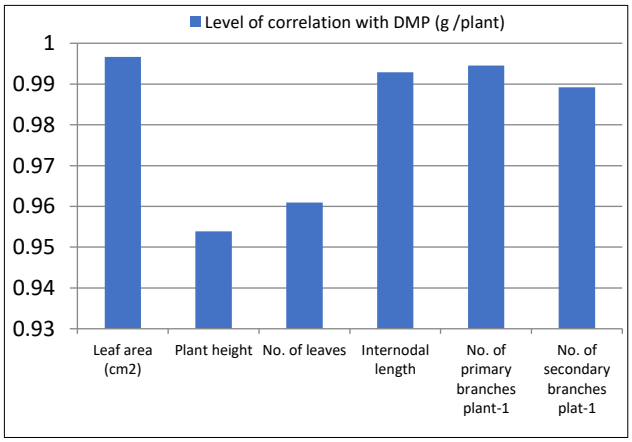

Fig 1 Correlation between DMP (g/plant) and other growth parameters

The accession TD 8 (Meenampalli local), TD 2 (Dharmapuri Local), TD13 (Hosur Local) and TD21

(Krishnagiri Local) which are green leaved and performed better than all other accessions with respect to all the growth attributes. The least performed accessions TD20 (Hosur Variegated Local) followed by TD19 (Virudachalam Variegated) and TD16 (Neyveli Variegated local) are having variegated leaf colour. Correlation studies revealed that all the growth parameters have significantly contributed tothe dry matter production (Fig 1). Hence, leaf area, no. of primary and secondary branches, number of leaves, plant height and internodal length branches must be considered most important growth attributes for bio mass production in this crop. The differences in morphological characters observed might be due to the genetic makeup and environmental conditions of the habitat where the plants grown for their adaptation. The present results are in accordance with the earlier observation on variation among wild type *T. coronaria*. I was also previously absorbed variations in plant height, leaves shapes (elliptic, elliptic oblong, acuminate, and narrowed), petiole length, and leaf colour [6]. Variation in growth attributes observed in present study is in line with the findings of Samanta [7] who observed variation in petiole length, leaf area, and plant height in Variegata variety, of *T. coronaria*.

Table 1 Mean performance of different accessions of *Tabernaemontana divaricata* (L.) for growth parameters

Accession No.	Plant height (cm)	Internodal length (cm)	No. of primary branches/plant	No. of secondary branches/plant	No. of Leaves/plant	Plant spread (cm)	Leaf area (cm^2)	Stem girth	DMP (g/plant)
TD 1	109.87	7.33	4.81	10.56	69.14	49.21	16.24	1.97	45.37
TD 2	139.89	11.5	7.01	16.33	89.03	66.51	28.99	4.62	81.51
TD 3	136.56	11.12	6.8	15.26	86.97	64.85	27.44	4.5	78.65
TD 4	120.58	8.75	5.52	12.25	76.21	55.57	19.89	2.78	56.42
TD 5	117.23	8.34	5.34	11.73	74.13	53.86	19.02	2.54	53.69
TD 6	134.2	10.53	6.47	14.65	85.04	63.12	24.81	3.95	71.11
TD 7	113.98	7.96	5.14	11.23	72.03	51.76	18.11	2.32	50.83
TD 8	143.18	12.64	7.2	17.31	91.09	68.49	30.25	4.86	84.5
TD 9	130.63	10.16	6.28	14.13	82.93	61.2	23.76	3.65	68.25
TD10	110.45	7.59	4.96	10.71	69.85	50.03	17.25	2.1	48.1
TD11	127.32	9.65	6.1	13.46	80.63	59.39	22.87	3.41	65.39
TD12	126.22	9.46	5.95	13.38	80.06	58.92	22.21	3.3	63.57
TD13	135.11	10.74	6.58	14.84	85.79	63.87	25.7	4.1	73.84
TD14	106.23	6.92	4.62	10.04	67.02	47.46	15.43	1.68	42.64
TD15	102.24	6.51	4.44	9.46	64.74	45.8	14.55	1.46	39.91
TD16	99.38	6.13	4.23	8.94	62.6	44.05	13.69	1.23	37.18
TD17	125.03	9.32	5.8	13.1	79.1	58.13	21.76	3.18	61.36
TD18	124.03	9.14	5.71	12.94	78.41	57.56	20.9	3.03	59.15
TD19	96.12	5.7	4.02	8.41	60.27	42.35	12.82	1.02	30.55
TD20	75.24	5.1	3.68	7.18	48.25	34.24	11.8	0.55	34.45
TD21	135.96	10.96	6.69	15.02	86.22	64.21	26.95	4.32	76.7
Mean	119.49	8.83	5.58	12.42	75.69	55.26	23.54	2.88	58.25
CD (p=0.05)	3.23	0.36	0.08	0.24	2.04	1.63	0.43	0.2	1.51
S. ED.	1.61	0.18	0.16	0.48	1.02	0.81	0.87	0.1	3.09

Flowering parameters

The flowering parameters viz., days taken for flowering, flower diameter, length of flower bud, circumference of bud, length of corolla tube, weight of hundred flowers, number of flowers $plant^{-1}$ per day, flower yield (g $plant^{-1}$ per day), flower yield per plant (g), and estimated flower yield (g ha^{-1}) were significantly varied between different genotypes (Table 2). Among the 21 genotypes, the day taken for flowering was ranged from 40.25 days to 62.35 days. Early flowering was observed in accession TD 8 (Meenampalli local), followed by TD 2 (Dharmapuri Local) and TD 3 (Metupalayam local). The flowering was very late in accessions TD20 (Hosur Variegated Local). TD19 (Virudachalam Variegated), and TD16 (Neyveli Variegated local).

The maximum flower diameter (1.19cm), length of flower bud (2.65cm), circumference of bud (3.73cm), and length of corolla tube (1.64cm) were recorded in accession TD 8 (Meenampalli local) followed by TD 2 (Dharmapuri Local), TD13 (Hosur Loacal) and TD21 (Krishnagiri Local). The least flower diameter (0.48cm), length of flower bud (0.82cm), circumference of bud (1.49cm), and length of corolla tube (0.51cm) were recorded in accession TD20 (Hosur Variegated Local) followed by TD19 (Virudachalam Variegated), and TD16 (Neyveli Variegated local). This variation in qualitative parameters might be due to the genetic influence of the accessions and environmental influence as quoted by [8].

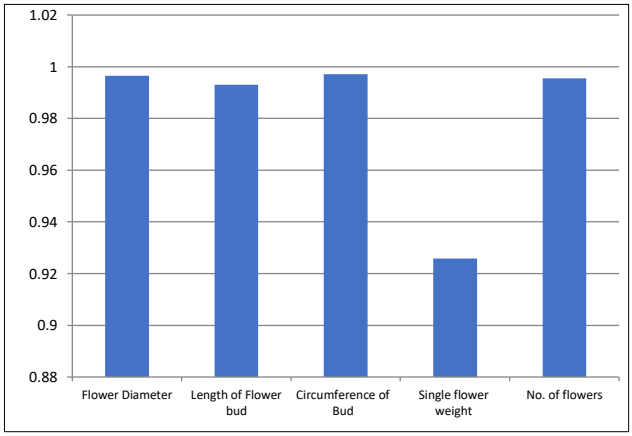

Fig 2 Correlation between flower yield and other yield parameters

The maximum weight of hundred flowers (21.95g), single flower weight (0.22g) number of flowers (40.57 plant^{-1} per day), flower yield (8.91g plant^{-1} per day), flower yield per plant (53.43g), and estimated flower yield (29.68 kg/ha/day and 8.9 t ha^{-1}) were recorded in TD 8 (Meenampalli local) followed by TD 2 (Dharmapuri local), TD13 (Hosur local) and TD21 (Krishnagiri local). The least weight of hundred flowers (14.27g), single flower weight (0.14g) number of flowers (21.16 plant^{-1} per day), flower yield (3.02g plant^{-1} per day), flower yield per plant (18.12g), and estimated flower yield (10.07 kg/ha/day and 3.02 t ha^{-1} were recorded in accession TD20 (Hosur Variegated Local) followed by TD19 (Virudachalam Variegated), and TD16 (Neyveli Variegated local). The varietal yield differences among the varieties may be due to the additive gene effect [9]. Similar observations were also recorded in chrysanthemum [10] and in Jasmine [11]. Correlation studies revealed that the yield parameters viz., flower diameter, length of flower bud, circumference of bud, single flower weight, and number of flowers have significantly contributed to the follower yield (Fig 2).

Table 2 Mean performance of different accessions of *Tabernaemontana divaricata* (L.) for yield parameters

Accession No.	Days for first flowering	Flower diameter (cm)	Length of flower bud (cm)	Circumference of bud (cm)	Corolla tube length (cm)	Weight of hundred flowers (g)	Single flower weight (g)	No. of flowers / plant / day	Flower yield per plant (g/day)	Estimated flower yield (t/ha/year)
TD 1	55.89	0.66	1.26	2.07	0.78	18.58	0.19	26.12	4.85	4.85
TD 2	42.1	1.14	2.52	3.59	1.56	21.75	0.22	39.02	8.49	8.49
TD 3	44.35	1.11	2.6	3.48	1.61	21.34	0.21	38.05	8.12	8.12
TD 4	51.36	0.82	1.78	2.59	1.1	20.59	0.21	30.16	6.21	6.21
TD 5	52.65	0.78	1.64	2.46	1.02	19.97	0.2	29.15	5.82	5.82
TD 6	45.89	1.04	2.17	3.26	1.35	21.4	0.21	35.38	7.57	7.57
TD 7	53.94	0.73	1.54	2.29	0.95	19.6	0.2	28.16	5.52	5.52
TD 8	40.25	1.19	2.65	3.73	1.64	21.95	0.22	40.57	8.91	8.9
TD 9	46.97	0.99	2.27	3.11	1.41	21.26	0.21	34.33	7.3	7.3
TD10	55.32	0.69	1.44	2.17	0.89	18.99	0.19	27.17	5.16	5.16
TD11	48.21	0.94	2.12	2.97	1.31	21.17	0.21	33.21	7.03	7.03
TD12	48.97	0.92	2.05	2.9	1.27	21.26	0.21	32.41	6.89	6.89
TD13	45.2	1.07	2.24	3.37	1.39	21.47	0.21	36.43	7.82	7.82
TD14	57.16	0.62	1.29	1.94	0.8	18.02	0.18	25.17	4.54	4.54
TD15	58.23	0.58	1.18	1.83	0.73	17.34	0.17	24.21	4.2	4.2
TD16	60.05	0.54	1.06	1.71	0.66	16.32	0.16	23.22	3.79	3.79
TD17	49.15	0.89	1.98	2.81	1.23	21.05	0.21	31.83	6.7	6.7
TD18	49.74	0.87	1.91	2.74	1.18	21.05	0.21	31.16	6.56	6.56
TD19	61.29	0.51	0.95	1.6	0.59	15.68	0.16	22.11	3.47	3.47
TD20	62.35	0.48	0.82	1.49	0.51	14.27	0.14	21.16	3.02	3.02
TD21	44.6	1.09	2.32	3.42	1.44	21.27	0.21	37.62	8	8.01
Mean	51.12	0.84	2.49	2.64	1.12	19.73	0.2	30.79	6.19	6.19
CD (p=0.05)	1.05	0.14	0.09	0.03	0.06	0.32	0.05	0.46	0.26	
S. ED.	0.52	0.07	0.04	0.06	0.02	0.16	0.1	0.92	0.13	

CONCLUSION

Results of screening studies reveal that variation exists between the twenty-one accessions of *T. coronaria* collected from different parts of Tamil Nadu. The correlation studies also revealed that all the growth parameters significantly contributed to the dry matter production and yield parameters have contributed to the follower yield. Based on growth and yield parameters, the accession TD 8 (Meenampalli local) is considered as the best accession with high yield potential (8.9 t/ha) and good quality flowers. Next to Meenampalli local, accessions TD 2 (Dharmapuri Local), TD13 (Hosur local) and TD21 (Krishnagiri local) were found performing better. Hence, these accessions can be used for further breeding programmes.

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