

CUTTING PROPAGATION TECHNIQUE OF *VIBURNUM MACROCEPHALUM* FORT.

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Abstract

Viburnum macrocephalum Fort. is a fine flowering species for ornament and greening, but it is rare and scatters in cities or still be in wild fields at present. No seeds can be collected from the trees therefore the amount of seedlings is short for the markets. Low cutting propagation rate limits the industrial development. In this study the branches from low position of the tree were taken as the cutting scions and treated with 500 ppm IBA, providing 66.5 - 66.9% rooting rate. Considering the rare resources of *V. macrocephalum*, the branches from high position of the tree should be taken as the cutting scions although its rooting was 62% only. This study provides practical techniques for mass propagation of *V. macrocephalum* Fort..

Viburnum macrocephalum Fort., English name: Chinese snowball Viburnum, belongs to genus *Viburnum*, family *Caprifoliaceae*. It is a deciduous or half-deciduous shrub flowering in March and April in China. The cymose inflorescence is big and white like a ball of silk strips with 16 cm diameter. It is beautiful and excellent for bonsai and greening (Cai 2013, Huang 2004, Shen *et al.* 2009, Zhang 2007).

Previous studies mainly focused on flower morphology, seed dissection morphology, karyotypes, and interspecies cross (Cheng *et al.* 2014, Huang 1989, Song *et al.* 2006, Wu 1997). The cutting propagation technique of *V. macrocephalum* Fort. has not studied yet.

No seed or less seeds can be collected from *V. macrocephalum* Fort., and the artificial propagation and cultivation are not popular, therefore the amount of seedlings is short for the markets. Present day low cutting propagation rate limits the industrial development. It is urgent for people to study the difficulty of cutting propagation and satisfy the demand for flower markets.

The test site is located at the nursery of Fujian Academy of Forestry Sciences, Fuzhou, Fujian, China. It belongs to the subtropical maritime monsoon climate zone, and has mild climate and plentiful rainfall. The frost free period lasts for 326 days per year. Annual average temperature is 19.6°C, annual humidity 77%, and annual rainfall 1342.5 mm. The average temperature during the coldest January is 10.5°C, and the average temperature during the hottest July is 28.6°C.

The local new red-core soil was pulverized to form the media for cutting propagation. Plastic basins with drain holes, length 40 cm × width 30 cm × height 30 cm were filled with the soil then placed in a greenhouse with 70% shade level on the top. The media was then sterilized by 0.1% KMnO₄ and covered by the plastic film for 3 days prior to use.

In July, 2014 scions were taken from 20-year-old stock trees of *V. macrocephalum* Fort. in Fujian Academy of Forestry Sciences, Fuzhou city. Pests and disease free, vigorously growing branches were selected as scion material.

Two factors were investigated for optimization, the level of the plant growth regulator, IBA, and the branches from different position of the tree (low or high). Due to the low amount of scion material because of the rarity of the stock plants, factors were optimized sequentially. In the

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first experiment, IBA concentration of (1) 100 ppm, (2) 500 ppm, (3) 1000 ppm, or (4) 2000 ppm was tested. A randomized block design was used in this experiment, with 270 scions for each treatment and 3 replicates. After 60 days the root system was rinsed and the cleaned roots were assessed to derive rooting rate, root number per individual cutting, and root length parameters.

The 8 - 12 cm length branches with a couple of leaves were taken as the scions. The leaves were kept fully without cutting (Fig. 1A,B). The scions were immersed into the water in a large basin to prevent dehydration. Then all the scions were taken out and immersed into the solution of 1000 fold carbendazim (effective constituent 50%) for 10 - 15 min. The bases of scions were dipped in the concentration of rooting reagent: 100, 500, 1000 or 2000 ppm, respectively for 5 min, then put into the soil to a depth of 2/5 - 1/2 scion length by using a wood stick digging a hole prior to insertion of the scion. Thirty scions were put in each plastic basin. The soil was pressed tightly after the scions were inserted then the soil was fully watered.



Figs 1A-C. A. Rooted plantlet treated by 500 ppm IBA after 2-month cultivation. B. Rooted plantlets treated by 500 ppm IBA after 2-month cultivation. C. A rooted plantlet treated by 500 ppm IBA after 2-month cultivation using the scion from low position of the tree.



Figs 2D-F. D. A rooted plantlet treated by 500 ppm IBA after 2-month cultivation using the scion from high position of the tree. E. The scion from high position of the tree showed flower buds after 6-month cultivation. F. The scion from low position of the tree showed no flower bud after 6-month cultivation.

To maintain high humidity the tubs containing the scions were enclosed in a plastic tent. The soil and atmosphere was kept moist with an automated misting system by a supplementary hand-watering with the frequency of once a day on sunny day or once per 2 - 3 days on cloudy or rainy day. The plastic tent was removed for hand watering but immediately replaced after watering. To

control the diseases, the scions were sprayed on with 1/1000 dilution of difenoconazole wettable powder (effective constituent 10%), 1/800 dilution of carbendazim wettable powder (effective constituent 50%) or mancozeb wettable powder (effective constituent 80%) once a week. After two months most of the buds emerged, and the film was gradually taken off. The mist frequency was increased and the soil was kept wet. After the film was taken off, the survival rate, rooting number per individual and root length were determined.

The data were analyzed using the software SPSS Statistics 17.0. A post-hoc Tukey's test was performed if the analysis of variance (ANOVA) was significant. Means are provided with standard errors, and means considered significantly different at $p < 0.05$.

The cutting propagation test was performed in July 2014, and the data were collected in September 2014. The effects of different concentration of IBA on the rooting of *V. macrocephalum* Fort. were listed on Table 1.

Table 1. The effects of different concentration of IBA on the rooting of *V. macrocephalum*.

Test No.	Concentration of IBA /ppm	Average rooting rate /%	Average root number per individual	Average root length /cm
1	100	72.38 ± 2.04 a	13.02 ± 1.74 a	0.63 ± 0.012 b
2	500	66.93 ± 5.71 ab	12.36 ± 1.06 a	0.72 ± 0.145 a
3	1000	64.78 ± 2.01 ab	11.84 ± 0.58 a	0.59 ± 0.017 b
4	2000	52.50 ± 2.73 b	10.97 ± 1.80 a	0.63 ± 0.057 b

Significant differences among treatments tested by Tukey's test; treatments with post-scripted with different letters were significantly different at the 95% level.

Table 2. The effects of the scions from different position of the trees on the rooting of *V. macrocephalum*.

Test No.	Different position of the tree	Average rooting rate /%	Average root number per individual	Average root length /cm
5	High	61.95 ± 5.99 b	11.51 ± 0.77 b	0.65 ± 0.017 a
6	Low	66.47 ± 4.31 a	12.53 ± 1.52 a	0.62 ± 0.029 b

Significant differences among treatments tested by Tukey's test; treatments with post-scripted with different letters were significantly different at the 95% level.

From Table 1 significant differences were observed among the different concentration of IBA on average rooting rates and average root length respectively, and no significant difference among the different concentration of IBA on average root number per individual. The test No. 2 (i.e. the scions treated with 500 ppm IBA) was the best because there was three "a" ("a" was better than "b"), i.e. the average rooting rate, the average root number per individual and the average root length reached "a" at the same time (Table 1), whereas the other three treatments could not achieve three "a" (Table 1). Therefore, the treatment with 500 ppm IBA was optimal for the cutting propagation of *V. macrocephalum* Fort.. (Fig. 1A,B).

The effects of the scions from different position of the trees on the rooting of *V. macrocephalum* Fort. were listed on Table 2.

From Table 2, the significant difference were seen between the low and high position of scions on average rooting rate, average root number per individual branch and average root length, respectively. The test No. 6 i.e. the scions from low position of the trees provided best effects on average rooting rate and average root number per individual (double "a"). On the aspect of cutting propagation, the most important factors for assessment were the rooting rate, and the position of

scions in the mother plant during collection. The scions collected from low position of the trees were suitable for cutting propagation of *V. macrocephalum* because of their high efficiency of producing healthy roots (~66%) with 500 ppm IBA treatment (Figs 1C, 2D).

Because stock trees of *V. macrocephalum* are very rare, in order to maximize available materials for cutting propagation, it is recommended that although the rooting rate for the high position of the trees was only 62.0%, this position of the branch should also be utilized until stock plant resources are increased.

In March, 2015 the flower buds emerged from the cutting seedlings using the scions from high position of the tree in this experiment (Fig. 2E), whereas the flower bud could not be seen from the cutting seedlings using the scions from low position of the tree (Fig. 2F), which indicated the age of the stock was mature and the scion position of the tree was higher, i.e. its genetic age was old leading to the emergence of the flower buds.

Chen *et al.* (2004) studied the cutting propagation of *Cinnamomum micranthum* (Hayata) Hayata. The scions were treated by 500 ppm IBA providing 70.6% rooting rate, which was similar to that of this study.

Bhandari *et al.* (2015) studied the hardwood cutting propagation of *Hibiscus rosa-sinensis* L. The scions were treated by 750 ppm IBA providing 90.5% rooting rate, which proved IBA from 500 - 750 ppm was more popular used in cutting propagation in woody plants.

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