

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.908.210>

Variation in Growth Traits of *Acrocarpus fraxinifolius* Wight and Arn Populations in Southern Karnataka, India

M. N. Ashwath*, B. N. Satish, G. M. Devagiri, R. K. Hegde and T. S. Hareesh

Department of Forest Biology and Tree Improvement, College of Forestry, Ponnampet,
University of Agricultural and Horticultural sciences, Shivamogga, Karnataka, India

*Corresponding author

ABSTRACT

Keywords

Acrocarpus fraxinifolius,
variation,
Population,
Growth character

Article Info

Accepted:
18 July 2020
Available Online:
10 August 2020

The present investigation was carried out to quantify the variation in growth characters of *Acrocarpus fraxinifolius* across the selected populations in the coffee growing regions of southern Karnataka. The growth parameters such as total tree height, clear bole height and girth at breast height were recorded and basal area and volume were estimated. Tree height varied significantly and the maximum tree height was recorded in Mudigere and Chikamagaluru (26.14 m) populations. The difference in GBH was found to be non-significant across the populations, which could be due to selection of trees in particular girth class. The clear bole height of trees varied across the populations from 9.19 m in Bhagamandala to 18.93 in Totadagadde. Basal area of *A. fraxinifolius* was relatively higher in Shuntikoppa (0.157 m²) and volume was maximum in Balehonnuru population (1.298 m³).

Introduction

Forests provide myriad tangible and intangible benefits for human wellbeing. In recent decades, wood has become one of the vital forest products and it is an important raw material for forest-based industries such as sawmills, composite and plywood, pulp and paper industries. *Acrocarpus fraxinifolius* is one of the fast-growing indigenous tree species which is considered to be the promising tree species suitable for making plywood, planks, panel and construction purpose with its other multi-purpose services such as erosion control, fodder, gum, fuel

wood, etc. (Nath *et al.*, 2012). *Acrocarpus fraxinifolius* is a large sized tree belongs to sub-family Caesalpinioideae under family Fabaceae. *A. fraxinifolius* is the only species under genera *Acrocarpus*. It is commonly known as Belanji and Havalige (Kannada), Mandane (Bengali), Nelarai (Tamil), Kurangadi (Malayalam), Pink cedar, etc. in different parts of the country. Belanji can grow up to 60 m tall with the cylindrical bole free from branches up to ¾ of its total height. Balanji, being timber yielding tree species; it is naturally distributed in high rainfall areas in the evergreen forests of Western Ghats, Sikkim, West Bengal and Assam. It is mostly

cultivated in Kodagu and South Canara as shade-tree in coffee estates (Troup, 1921; Ghildyal, 1989). Belanji is the most adapted tree species for shade purposes in the coffee plantation with its fast-growing nature and multi-utility purpose among diverse native shade trees viz., *Dalbergia*, *Syzygium*, *Lagerstroemia*, etc. (Nath *et al.*, 2011).

The sapwood of *Acrocarpus* is white and the heartwood is pinkish, which is commonly used in making veneers and plywood. It is also used as timber in furniture, door, windows, beams, rafters, etc. The wood is used as pulp for making paper (Orwa *et al.*, 2009). The pulp is best suitable for Kraft paper. Though the species is leguminous, it is not capable of fixing the nitrogen; however, it has been recommended for erosion control due to its strong taproot. Leaves are suitable for mulching. Timber is odourless and is suitable for fruit packing cases (Ghildyal, 1989). Trees exude gum like resinous substance when it is felled or cut. Belanji was termed as the tree for the future because of its multi-purpose utility (Mishra *et al.*, 2015) and also recommended as one of the promising species for Agroforestry. The evaluation of variation in growth character is necessary for the delineation of better provenances and the conceptualization of advanced breeding strategies.

For initiation of any breeding program knowing the variation or variability is essential. When the exception is more, there is scope for selection. Variation is influenced by genetic parentage as well as the environment where it is growing. In this context, an effort has been made to assess the variation among the populations from different populations in southern Karnataka.

Materials and Methods

The present study was carried in three major coffee-growing districts of Karnataka viz.,

Kodagu, Chikamagaluru, and Hassan. Nine populations of *Acrocarpus fraxinifolius* (Table 1) were selected from the three major coffee growing districts. In order to avoid the variation influenced by the age, 20 trees in the range of 120 cm to 150 cm girth at breast height (GBH) were randomly selected from each population in each district. Tree growth parameters such as total tree height, clear bole height and girth at breast height were recorded on each selected trees to study the variation in growth across the selected populations. The basal area and volume were estimated based on the standard formulas mentioned below;

$$BA = G^2 / 4\pi$$

$$V = BA \times H \times ff$$

Where,

BA is basal area, G is girth at breast height, V is volume, H is total tree height, ff is form factor (0.33).

Statistical analysis

The data obtained on growth parameters such as total tree height, clear bole height, girth at breast height (GBH) were subjected to the One-way ANOVA to understand the variation across different populations as described by Panse and Sukhatme (1978) using SPSS 16.0 software.

Hierarchical Grouping

Hierarchical grouping and dendrogram was done by cluster analysis method of Average Linkage (between groups) with the measure of Squared Euclidean Distance using SPSS 16.0 software as suggested by Pande *et al.*, 2013.

Results and Discussion

Phenotypic traits such as total tree height, GBH and clear bole height were considered as the variables and reported to be under adequate control of genotype and environment (Zobel, 1981). The results of the present study exhibited the noticeable dissimilarity among the populations (Table 2).

The total tree height was significantly varied across the populations with a maximum tree height of 32.00 m and a minimum height of 13.40 m. Among nine populations, Chikamagaluru and Mudigere populations showed maximum mean height of 26.14 m followed by Balehonnuru (25.81 m), Sakleshpura (25.68 m), Shuntikoppa (24.85 m), Totadagadde (23.61 m), Shreemangala (22.76 m), Bhagamandala (22.16 m) and Vanaguru (19.99 m) (Fig. 1 a). The clear bole height showed a significant difference (Fig. 1 b) with a maximum mean clear bole height of 18.93 m in Totadagadde and minimum of 9.18 m in Bhagamandala population.

Difference in GBH was found to be non-significant across the populations which could

be due to selection of trees in particular girth class (1.20 m to 1.50 m) to avoid the effect of age on other parameters. Across the populations GBH varied between 1.23 to 1.48 m among the selected trees (Fig. 1 c). The basal area was also showed statistically non-significant variation across the populations. Among the different populations, the highest average basal area of trees was recorded in Shuntikoppa (0.157 m²) and lowest in Vanaguru (0.135 m²) population.

The average basal area varied from 0.109 to 0.225 m². Estimated volume of the selected trees in different populations is presented in Table 2. Tree volume varied significantly across the populations (Fig. 1 d). The highest mean volume was recorded in Balehonnuru (1.298 m³) population whereas, the lowest mean volume was recorded in Vanaguru (0.886 m³) population. The average volume for populations was 1.298 m³, 1.296 m³, 1.276 m³, 1.267 m³, 1.264 m³, 1.129 m³, 1.111 m³, 1.075 m³ and 0.886 m³ in Balehonnuru, Shuntikoppa, Mudigere, Chikamagaluru, Sakleshpura, Totadagadde, Shreemangala, Bhagamandala and Vanaguru, respectively.

Table.1 Details of geographic locations and weather parameters of selected populations of *Acrocarpus fraxinifolius*

Districts	Population	Latitude (N ^o)	Longitude (E ^o)	Altitude (m) (a.m.s. l)	Mean annual rainfall (mm)	Temperature (°C)	
						Max.	Min.
Kodagu	Shreemangala	12°06'	76°00'	832	1986.40	28.98	17.95
	Shuntikoppa	12°27'	75°50'	981	1558.90	27.95	17.79
	Bhagamandala	12°23'	75°31'	946	4854.50	28.66	17.87
Chikamagaluru	Chikamagaluru	13°16'	75°43'	1084	1305.00	28.99	16.56
	Balehonnuru	13°22'	75°31'	727	1584.90	30.06	17.32
	Mudigere	13°10'	75°39'	1030	1964.00	28.49	17.91
Hassan	Sakleshpura	12°57'	75°48'	945	2103.23	30.70	18.67
	Vanaguru	12°47'	75°45'	929	3559.00	29.24	17.50
	Totadagadde	12°56'	75°46'	932	2304.50	29.73	17.82

Table.2 Variation in growth parameters across the populations

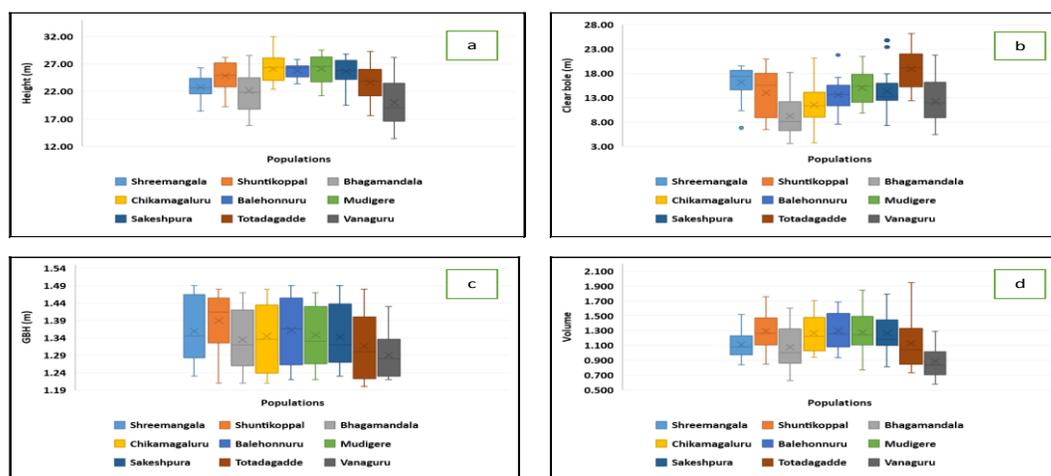
Populations	Total tree height (m)	Clear bole height (m)	GBH (m)	Basal Area (m ² /tree)	Volume (m ³ /tree)
Shreemangala	22.78 ^b	16.15 ^d	1.36	0.147	1.111 ^{bc}
Shuntikoppa	24.85 ^{cd}	14.03 ^{bcd}	1.41	0.157	1.296 ^c
Bhagamandala	22.16 ^b	9.19 ^a	1.35	0.145	1.075 ^b
Chikamagaluru	26.14 ^d	11.53 ^{ab}	1.35	0.146	1.267 ^c
Balehonnuru	25.81 ^d	13.61 ^{bcd}	1.38	0.152	1.298 ^c
Mudigere	26.14 ^d	15.02 ^d	1.36	0.147	1.276 ^c
Sakleshpura	25.68 ^d	14.38 ^{cd}	1.36	0.149	1.264 ^c
Totadagadde	23.61 ^{bc}	18.93 ^e	1.33	0.143	1.129 ^{bc}
Vanaguru	19.99 ^a	12.21 ^{bc}	1.30	0.135	0.886 ^a
Mean	24.13	13.89	1.36	0.147	1.178
SEm(±)	0.643	0.871	0.024	0.005	0.059
CD @ 5%	1.79	2.432	NS	NS	0.165

Values in column carrying same alphabets does not differ significantly at P<0.05
NS= Non-significant

Table.3 Population composition of different clusters

Cluster No.	No. of populations	Populations
I	5	Mudigere, Sakleshpura, Shuntikoppa, Balehonnuru, Chikamagaluru
II	2	Bhagamandala, Vanaguru
III	2	Shreemangala, Totadagadde

Fig.1 Variation in (a) total tree height, (b) clear bole height, (c) girth at breast height, (d) volume across the selected *Acrocarpus fraxinifolius* population



References

- Ghildyal, B. N., 1989. Introduction to *Acrocarpus fraxinifolius* - A fast growing species for Social Forestry in Himachal Pradesh. *Indian Forester*, 115(7):455-458.
- Meena, H., Kumar, A., Sharma, R., Chauhan, S.K. and Bhargava, K.M., 2014. Genetic variation for growth and yield parameters in half-sib progenies of *Melia azedarach* (Linn.). *Turkish Journal of Agriculture and Forestry*, 38(4):531-539.
- Mishra, G., Pandey, A. K., Arunachalam, M. K. and Rao, S., 2015. Global Scenario of *Acrocarpus fraxinifolius* Wight & Arn. – A future tree of Agroforestry. *International Letter of Natural Science.*, 3:25-29.
- Nath, C. D., Boura, A., Franceschi, D. D. and Pélissier, R., 2012. Assessing the utility of direct and indirect methods for estimating tropical tree age in the Western Ghats, India. *Trees*, 26(1):17–29.
- Orwa, C. A., Mutua, K. R., Jamnadass, R. and Anthony, S., 2009. Agroforestry Database: a tree reference and selection guide, *World Agroforestry Centre*, Kenya, letter no. 14
- Pande, P.K., Kumar, A., Ravichandran, S., Naithani, S., Kothiyal, V., Kishore, P.B.K., Raturi, A., Gautam, P., Dobhal, S. and Sharma, S., 2013. Genetic analysis of growth and wood variations in *Leucaena leucocephala* (Lam.) de Wit. *Journal of Forestry Research*, 24(3):485-493.
- Panase, V.G. and Sukhatme, P.V., 1978. Statistical methods for Agricultural workers. III Rev. Ed. ICAR, New Delhi.
- Prasad, A. G. and Sagheer, N. A., 2010. Variations in Tree Growth of *Dipterocarpus indicus* among different Populations in Western Ghats India. *International Journal of Environmental Science, Development & Monitoring*, 1(1):103–111.
- Rowth, N., 2016. Variability studies in *Dalbergia latifolia* Roxb. M.Sc. Thesis, University of Agricultural and Horticultural Sciences, Shivamogga, India.
- Sharma, K. B., Kumari, B., Johar, V. and Bisht, V., 2017. Plus tree Variation of Shisham (*Dalbergia sissoo*) in different Agro-Ecological Regions of Haryana. *Environment & Ecology*, 35(4A): 2996 – 2998.
- Troup, R. S., 1921. Silviculture of Indian Trees (2), Asiatic Publishing House, Delhi, pp.338-341.
- Zobel, B. and Talbert, J. J., 1984. Applied Forest Tree Improvement. John Wiley and Sons, New York, pp.75-116.

How to cite this article:

Ashwath, M. N., B. N. Satish, G. M. Devagiri, R. K. Hegde and Hareesh, T. S. 2020. Variation in Growth Traits of *Acrocarpus fraxinifolius* Wight & Arn Populations in Southern Karnataka, India. *Int.J.Curr.Microbiol.App.Sci.* 9(08): 1838-1843.
doi: <https://doi.org/10.20546/ijcmas.2020.908.210>