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Short Communication

Genetic variations and degree of correlation in four ecological variants of *Gaultheria fragrantissima* Wallich in Nilgiri Biosphere Reserve, Western Ghats, India

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The four ecological variants (ovate, lanceolate, elliptic-lanceolate and oblanceolate leaf types) of *Gaultheria fragrantissima* (family, Ericaceae) in Nilgiris are varied much between them in respect of 12 characters studied. The magnitudes of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were more or less equal for many characters and it indicates the least influence of environmental factors. Generally, the high heritability compared with high genetic advance as per cent of mean and high GCV observed for plant height, stem girth size, root length, number of branches, number of inflorescence, number of fruits, oil yield, plant biomass and population density indicate the presence of additive gene action for these characters. Leaf thickness and oil content in leaves showed significant positive correlation with the population density of the species. Hence, selection for these 2 characters in all the four variants must be effective in achieving high population density of *G. fragrantissima.*

Key words: *Gaultheria fragrantissima,* ecological variants, Nilgiri Biosphere Reserve.

INTRODUCTION

G. fragrantissima is a shrubby plant species distributed in Eastern Himalayas and high hills of Nilgiris in India and high altitudinal (>2100 ms above msl) regions of Sri Lanka, Nepal, Myanmar, Malaysia and Jawa islands. The leaves are medicinally important due to the presence of an active principle compound, methyl salicylate and are used in the preparation of pain balms and perfumes (Polunin and Stainton, 1984). In Nilgiri Biosphere Reserve of Nilgiri mountains, the Western Ghats, the species is present in the margins of shola forests and contains four ecological variants on basis of leaf shape such as ovate, lanceolate, elliptic-lanceolate and oblanceolate leaf types. From the wilds of these four forms, 'winter green oil' is extracted and being sold in the local markets of Nilgiris. No studies are carried out so far on variability and correlation for *G fragrantissima* in Nilgiris. Hence, the present investigation was aimed at to estimate the degree of variability present between the four variants of *G. fragrantissima* and to identify the characters which are highly correlated with population density.

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MATERIALS AND METHODS

In Western Ghats of southern India for the conservation of plants and animals, the Nilgiri mountains (latitude 11º 13' N and longitude 76º 39' E) spread over an area of ca.5520 km^2 was declared as Biosphere Reserve in the year 1986 by the Government of India. In that area, eight shola forest (subtropical montane evergreen type) (Champion, 1936) habitats of *G. fragrantissima*, all located above 2000 ms above msl were selected for the present study. Approximately more than 5 years old individuals in four variants were considered for the observations regarding 12 characters studied. Hundred individuals were selected randomly for each ecological variant to observe the changes in morphological characters such as shoot and root lengths, number of lateral roots, leaves, branches, inflorescences and fruits per plant and stem girth size. Random selection of 500 and 100 leaves from each variant were selected respectively for the determination of leaf thickness and stomata l index. To estimate chlorophyll content 500 leaves

Table 1. Genetic variability for the observed characters in *Gaultheria fragrantissima*.

Character	Range	Mean	GCV (%)	PCV (%)	Heritability (%)	GA as per cent of mean
Plant shoot length	76-189	113.75	23.52	24.05	95.6	47.39
Stem girth	6-9	7.44	10.10	11.77	87.3	21.17
Root length	43-65	57.88	9.20	9.73	89.4	17.91
No. of lateral roots	5.33-7.67	6.33	3.37	5.04	44.6	4.63
No. of leaves	47.67-66.67	58.61	5.03	6.06	68.9	8.60
No. of branches	6-10	7.31	7.68	8.89	74.6	13.67
No. of inflorescences	27.67-55.67	41.25	8.46	9.06	87.2	16.28
No. of fruits	251.7-458.7	364.1	7.21	8.03	80.6	13.33
Leaf thickness	0.38-.44	0.41	0.49	1.53	0.0	0.0
Oil content	0.77-1.28	1.00	4.46	4.69	90.4	8.73
Plant biomass	5047-6923	5960	5.30	5.59	89.8	10.34
Population density	235-606.7	406.4	12.42	13.87	80.2	22.91

GCV, Genotypic coefficient of variation; PCV, Phenotypic coefficient of variation; GA, Genetic advance.

from 100 individuals of each variant were collected and mixed together and from this composite sample, known weight of sub samples were taken for analysis.

For the estimation of variant-wise oil contents, 5 kg of leaves were randomly collected and they were made 5 equal sub samples and subjected to steam distillation in Clevanger apparatus. Genotypic and phenotypic coefficients of variation (GCV and PCV) were estimated by using the method by Burton (1952) and Johnson et al. (1955). The data were analysed for correlation coefficient as per the method of Falconer (1964).

RESULTS AND DISCUSSION

It is known from the data that there is significant genotypic variability among the genotypes of variants of *G. fragrantissima* (Table 1). There was a wide range of variation for all the 12 characters studied. In addition, generally, the magnitude of PCV and GCV were having only narrow difference for plant height, stem girth size, root length, number of branches, inflorescences and fruits per plant, oil content and plant biomass. It indicates that these characters were least affected by environmental variations. Hence, when the variants are attempted for commercial cultivation, selection may be made on basis of these characters. Similar trend of results for certain crop plants like white grain sorghum (Sankarapandiyan et al., 1996), red grain sorghum (Manonmani et al., 2002), forage grass (Khan and Sukumar, 2002), neem tree (*Azadirachta indica)* (Philomin et al., 2002) and forage maize (Srivas and Singh, 2004) were reported already. The magnitude of PCV was slightly higher than GCV for the characters viz., number of lateral roots and leaves, leaf thickness and population density.

The heritability was very high for the characters, plant height (95.6%), oil content (90.4%), plant biomass (89.8%), root length (89.4%), stem girth size (87.3%), number of inflorescences (87.2%), number of fruits (80.6%) and population density (80.2%) . High heritability will facilitate reliable selection for the improvement in terms of desired characters. In a similar fashion, high heritability for certain characters in *A. indica* was reported by Philomina et al. (2002) . The low variation between the values of phenotypic and genotypic coefficients of variation also reflects high heritability of the characters. High heritability was determined for other characters also such as number of branches (74.6%) and number of leaves (68.9%). Moderate and no heritability were determined respectively for number of lateral roots (44.6%) and oil content (0.0%).

Genetic advance is a measure of genetic gain that can be expected in the process of selection. Genetic advance as percentage mean was high for certain characters viz., plant height, population density, stem girth size, root length and number of inflorescence. The high genetic advance coupled with high to moderate heritability would give better scope for selection (Panse, 1957). In the present study, the high genetic advance as percentage mean combined with high heritability for certain characters such as plant height, stem girth size, population density, root length and number of inflorescences suggests that these characters are under the control of additive type of gene action. Moderate heritability for a character, number of lateral roots combined with low GCV and genetic advance as per cent of mean indicates the importance of both additive and non additive gene action for this character.

Correlation studies showed that plant height, number of lateral roots, stem girth size, number of leaves, number of branches, number of inflorescences, number of fruits, leaf thickness and oil content in leaves had direct positive correlation with population density, a character expected to have relation with conservation of wild in the present study (Table 2) . However, the traits like leaf thickness and oil content had significant positive correlation with population size. The two characters, root length and plant biomass were negatively correlated with the population density.

Table 2. Correlation coefficient between the characters observed in the four studied variants of *Gaultheria fragrantissima.*

Character	PSL	PRL	NOR	STG	NOL	NOB	NOI	NOF	LTH	OIC	PLB
PRL	0.588*										
NOR	0.015	-0.172									
STG	0.533*	0.389*	-0.292*								
NOL	0.373*	0.685*	0.012	0.315*							
NOB	0.435*	0.480*	0.011	0.433*	0.487*						
NOI	0.034	0.085	-0.057	-0.024	0.060	0.118					
NOF	0.021	0.097	-0.287*	-0.070	0.059	0.033	0.944				
LTH	-0.071	-0.066	-0.042	0.070	0.296*	-0.044	-0.263	-0.267			
OIC	-0.001	-0.252	0.552*	-0.010	-0.075	0.139	0.465*	0.188	0.068		
PLB	0.527*	0.242	-0.406	0.279	0.044	0.083	-0.263	-0.048	0.055	-0.670*	
PLD	0.249	-0.235	0.279	0.205	0.043	0.191	0.257	0.135	0.294*	0.460*	-0.017

*Significant at P=0.05.

PSL, Plant shoot length; PRL-Plant root length; NOR, Number of lateral roots; STG, Stem girth size; NOL, Number of leaves; NOB, Number of branches; NOI, Number of inflorescences; NOF, Number of fruits; LTH, Leaf thickness; OIC, Oil content in leaf; PLB, Plant biomass; PLD, Population density.

On basis of variability parameters, the present study emphasized that the characters viz., plant height, stem girth size, root length, number of inflorescence, number of fruits, oil content in leaves and population density were gene influenced for all the four ecological variants. Hence, to conserve the wild, selection for commercial cultivation can be done by considering these characters. Further, the correlation study showed that for the maintenance of better population size, the seeds from the individuals of higher leaf thickness and higher oil content in all the four ecological variants can be selected and shown in the shola margins of Nilgiri Biosphere Reserve.

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