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## Evaluation of Brazilian wild *Hevea* germplasm in India for cold resistance: Genetic variability in juvenile growth

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### INTRODUCTION

The para rubber tree (*Hevea brasiliensis* Muell. Arg.), is a strategic industrial crop cultivated mainly in the Southeast Asian countries. In order to protect the fast depleting genetic resources and also to broaden the narrow genetic base of cultivated rubber in this region, a huge collection of wild *Hevea* germplasm was made at its center of origin in the Amazon rainforests of Brazil, by the International Rubber Research and Development Board during 1981. The expedition area comprised three states in Brazil viz., Acre (AC), Rondonia (RO) and Mato Grosso (MT) and the germplasm was distributed to member countries including India. Around 4500 accessions are being conserved in source bush nurseries in India, and are under different stages of evaluation for identification of desirable genes. The present study was undertaken in a cold prone region to evaluate their performance in the juvenile growth phase and to ascertain the extent of genetic variability in the population.

### MATERIALS AND METHODS

The study was conducted at the Regional Experiment Station of the Rubber Research Institute of India, Nagrakata, West Bengal, India. 18 wild accessions, 2 popular clones along with two control clones RRIM 600 and Haiken 1, were planted in a field trial in randomized block design during 2000, with three replications. The spacing adopted was 4.9 x 4.9 m with five plants per plot and the recommended cultural practices of Rubber Board were followed. Among the 24 wild accessions, eight were from Acre, seven from Mato Grosso and nine from Rondonia.

Data on number of leaves/plant- pre winter and post winter, no. of leaves/plant- increment, number of whorls/plant- pre winter and post winter were recorded. Plant height (cm) - pre winter and post winter, height increment (cm) and girth of the plant (cm) was recorded at 15 cm height in the first year. Plant height (cm) was measured from the bud union to the tip of the tree. The average increment (cm) in plant height over winter season and increase or decrease of no. of leaves and no of whorls/ plant during winter season in the juvenile phase was calculated using the pre and post winter growth data. The data were subjected to analysis of variance for randomized block design. Genetic components of variation and broad sense heritability were estimated following the method of Panse and Sukhatme (1978).

### RESULTS AND DISCUSSION

The range and population mean values in comparison with the control clone for each of the eight traits in the early growth phase are presented in Table 1. The genotypes exhibited highly significant clonal differences ( $P < 0.01$ ) for all the quantitative traits studied.

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**Table 1.** Mean and range of variability for various growth characters in wild *Hevea* germplasm.

Character	Wild accessions		General mean	Control		CV (%)
	Minimum	Maximum		RRIM 600	Haiken 1	
No of Leaves/ plant- pre winter	14.20 (AC 3074)	47.60 (MT 2229)	31.21	26.33	35.73	8.14
No of Leaves/ plant- post winter	0.00 (AC3293)	29.27 (MT900)	21.71	22.02	28.20	6.64
No of whorls/ plant- pre winter	2.78(RO 2948)	4.87(RO 2908)	3.87	3.40	4.33	0.60
No of whorls/ plant- post winter	3.47 (AC3074)	5.87(RO 2886)	4.78	4.07	5.13	0.99
Plant height- pre winter (cm)	78.08(RO 2901)	196.13 (MT900)	134.02	87.40	139.13	28.62
Plant height- post winter (cm)	87.48 (AC3074)	210.73 (MT900)	154.79	112.78	164.48	34.34
Plant height- increment (cm)	6.15 (AC3074)	45.01 (MT1020)	20.78	25.38	40.73	21.21
Girth of plant (cm)	5.36 (AC3293)	11.53 (MT915)	8.78	8.40	10.5	2.28

Note: Figures in parenthesis denotes the name of accession.

In the post winter period maximum leaves per plant was recorded in MT 900 (29.27) as compared to the control clone Haiken 1 (35.73), while the accession MT 2229 recorded very high loss in leaves. High increase in no of whorls per plant during winter period was noted in AC 3293 (2.07) as compared to the control Haiken 1 (0.80). Increment of plant height during winter ranged from 6.15 cm (AC 3074) to 45.01 cm (MT 1020) as compared to the control clone (40.73). Girth of a plant indicated its vigorous habit in the early growth phase of the plant. Girth of the trees at the juvenile phase ranged from 5.36 cm (AC 3293) to 11.53 cm (MT 915). Annamma *et al.*, (1989), Mercy *et al.*, (1995), Rao *et al.*, (1999) and Abraham *et al.*, (2002), Krishan *et al.*, (2010) have also reported wide variation in the wild germplasm with respect to certain growth traits in traditional rubber growing region in India.

Components of variation and heritability in the broad sense were estimated in the population (Table 2). In general the genetic constants for the characters revealed that the magnitude of phenotypic coefficient of variation (PCV) was higher than the corresponding genotypic coefficient of variation (GCV) for all the traits denoting environmental factors influencing their expression to some degree. Very high PCV (75.52) and GCV (43.28) was observed for increase in plant height during winter period suggested greater scope for selection of superior genotypes for this trait while for the remaining traits it was low indicated the greater role of environment in the expression of these traits. In this study very low PCV (17.95) and GCV (12.78) was observed for no of whorls/plant during post winter period.

**Table 2.** Phenotypic and genotypic coefficients of variation and heritability for various quantitative characters in *Hevea* germplasm

Characters	PCV	GCV	Heritability ( $H^2$ )
No of Leaves/ plant- pre winter	31.05	26.72	0.74
No of Leaves/ plant- post winter	26.47	18.98	0.51
No of whorls/ plant- pre winter	18.90	16.39	0.75
No of whorls/ plant- post winter	17.95	12.78	0.50
Plant height- pre winter	25.75	22.25	0.74
Plant height- post winter	23.84	19.69	0.68
Plant height- increment	75.52	43.28	0.32
Girth of plant	23.99	18.14	0.57

The amount of advance to be expected from selection can be achieved by estimating heritability along with coefficient of variability. Burton (1952) also suggested that GCV and heritability estimates would give better information of the extent of advance to be expected by selection. The heritability (broad sense) estimates ranged from high for no. of whorls during pre winter period (0.75) to medium (0.32) for height increment during winter period. Abraham *et al.*, (2002), Rao *et al.*, (2006) and Krishan *et al.*, (2010) have reported moderate to high  $H^2$  in the wild germplasm with respect to growth parameters.

## CONCLUSION

The present study confirmed the presence of wide variability in the germplasm for most growth contributing traits. Vigorous accessions such as MT 900, MT 1020 and MT 915 were identified which showed good growth during the juvenile phase in cold season in the sub-Himalayan region of India. These accessions will be of use in future crop improvement programmes after assessment of their mature performance.

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