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6

VARIABILITY AND ASSOCIATION OF CERTAIN BARK ANATOMICAL TRAITS IN *HEVEA BRASILIENSIS* MUELL. ARG.

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ABSTRACT

Bark anatomical traits of 10 rubber clones (*Hevea brasiliensis* Muell. Arg.) were used to estimate various genetic parameters as well as association between them. The PCV estimates were generally higher than the corresponding GCV values. Heritability was high for all the traits. Genetic advance ranged from very low to high. Based on the genetic parameters suitable breeding methods could be adopted for improvement of the tree.

INTRODUCTION

The latex producing capacity of the para rubber tree (*Hevea brasiliensis*) is influenced by the quantity of laticiferous tissue. The number of latex vessel rows, density of latex vessels per row per unit circumference, diameter of latex vessels and the girth of the tree are factors influencing productivity.

Genetic parameters, as well as the intercharacter association of yield and yield attributes, in the para rubber tree have received attention only recently (Huat, 1981; Alika and Onokpise, 1982; Hamzah and Gomez, 1982). Of the anatomical traits, bark thickness and the number of latex vessel rows have been studied by various workers (Bobilioff, 1923; Gomez et al., 1973; Narayanan and Ho et al., 1973). In the present paper an attempt has been made to study the intercharacter association and genetic parameters of certain anatomical traits influencing yield.

MATERIALS AND METHODS

Data were collected from 30 trees involving ten clones of *Hevea brasiliensis* planted in a randomised block design with three replications. Samples of virgin bark at a height of 150 cm from the bud union were collected from trees at the age of nine and fixed in FAA. Sections (80 μm thickness) in the tangential plane were cut from the soft bark region, stained in Sudan III and observed under light microscope. The characters studied were ray height, ray width, ray density, latex vessel density per row per unit circumference of the tree, latex vessel diameter and number of anastomeres per unit length. Genotypic and phenotypic coefficients of variation (GCV and PCV) were estimated. The heritability and genetic advance were calculated as per the standard procedures. Genotypic and phenotypic correlations among the various traits were estimated as per the method of Al-Jibouri et al. (1968).

RESULTS AND DISCUSSION

The estimates of genetic parameters for the different traits are presented in Table 1. The PCV estimates were higher for all the traits than the corresponding GCV values. Among the various traits studied, ray height had the highest GCV and PCV estimates, followed by density of ray groups and latex vessel diameter.

The comparatively high PCV signifies the involvement of environment in the expression of these traits. Heritability (broadsense) was very high for all traits except for ray width for which it was medium. The genetic advance ranged from 0.243 for density of ray group to 103.65 for ray height at 5 per cent selection intensity. Except for ray height all other traits had low or moderate genetic advance along with high heritability estimates. This indicates the predominant involvement of non-additive gene effects in the expression of these traits, whereas the variability for ray height be due to additive gene effect (Johnson et al., 1955; Allard 1960).

The genotypic and phenotypic correlation coefficients are

Table 1. Mean, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability and genetic advance for certain yield attributes in rubber (Hevea brasiliensis)

Characters	Mean	Genotypic variance	Phenotypic variance	GCV	PCV	Heritability (%)	Genetic advance (5 % selection intensity)
Ray height	336.23	3260.45	4161.10	17	19	78.36	103.65
Ray width	46.71	20.41	42.82	10	14	47.67	6 43
Latex vessel diameter	20.18	9.17	11.06	15	17	82.93	5.68
Number of connection for unit length	7.12	0.857	1.47	13	17	58.4	1.46
Density of vessel	27.16	3.41	5.28	7	8	64.6	3.06
Density of ray group	25.69	17.36	18.38	16	17	94.4	0.243

Table 2. Genotypic (rg) and phenotypic (rp) correlation coefficients among certain yield attributes (anatomical) in rubber (Hevea brasiliensis)

Ray height		Ray width	Latex vessel diameter	No. of connections per unit length	Density of vessel	Density of ray group
Ray height	(rg)	0.280	0.09	−0.05	−0.27	−0.98**
	(rp)	0.320	−0.33	0.08	−0.37	0.60
Ray width	(rg)		0.38	−0.13	−0.89**	−0.54
	(rp)		0.18	−0.10	−0.74*	−0.39
Latex vessel diameter	(rg)			−0.28	0.12	0.12
	(rp)			−0.17	−0.09	−0.87**
No. of connections per unit length of vessel	(rg)				0.23	0.003
	(rp)				−0.14	−0.007
Density of vessel	(rg)					−0.37
	(rp)					0.61

*p = 0.05. ** p = 0.01.

presented in Table 2. Ray height had significant negative association with density of ray group at the genotypic level. Ray width also had negative association with density of ray group though not significant. But this trait had significant negative association with density of the vessel both at the genotypic as well as phenotypic levels. Latex vessel diameter had significant negative correlation with density of ray group at the phenotypic level. Thus it emerges that the density of the latex vessel was considerably affected by the ray width. Similarly latex vessel diameter was also significantly affected by the density of ray group. It was also revealed that the number of connections per unit length of the vessel were independent of the density as well as diameter of the latex vessel. Similarly, the latex vessel diameter was also independent of the density of the vessel. The negative association of ray width with the density of the latex vessel might be due to the effect of ray width on the running direction of the latex vessel. It may therefore be possible to select clones simultaneously for high density as well as greater diameter of latex vessels. Since ray width and density of ray group have a negative association with latex vessel density, selection for higher latex vessel density will naturally reduce the former traits leading to more straight laticifers. The negative association of vessel diameter with density of ray groups is also a desirable relationship. Higher vessel diameter will also contribute the laticiferous tissue per unit area.

However, since all the traits studied except ray height had shown a predominant influence of non-additive genetic variance, it would be advisable to exploit heterosis or utilise recombination breeding to improve rubber clones for these traits.

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DISCUSSION

Q : Can polyploidy be used for improvement of *Hevea* clones for the traits studied?

Ans: All the traits studied, except ray height, had shown predominant influence of non-additive genetic variation. So we cannot expect any change by alteration of gene dosage. So polyploidy has little breeding value as far as the traits studied.