PERFORMANCE OF CERTAIN WILD *HEVEA* ACCESSIONS IN THE EARLY PHASE OF FURTHER EVALUATION

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In a second phase evaluation of 80 selected wild accessions of *Hevea brasiliensis* in the 1981 IRRDB Brazilian germplasm collection established at the Rubber Research Institute of India, girth, bark thickness, total number of latex vessel rows, density of laticifers and test tap yield at the age of four years were studied. RRII 105, a popular clone, was used as control. The accessions showed statistically significant differences for all the five traits in the early growth phase. In general, the wild accessions were poor yielders except for one from Mato Grosso, MT/IT/15 – 28/207, with yield (9.72 g/t/t), comparable to RRII 105 (9.40 g/t/t). Certain accessions showed early girthing and longer boles with high but few branches, which are indications of timber production potential. The accessions from Mato Grosso, in general, continued to be superior in the early phase of further evaluation also. Among the top 25 per cent of the wild accessions ranked using rank sum method based on the pooled performance for all the five characters, 20 per cent were from Mato Grosso. Most of the accessions identified earlier as superior for yield and other secondary characters were ranked high.

Key words: Bark anatomy, Brazilian germplasm, *Hevea brasiliensis*, Rank sum evaluation.

INTRODUCTION

The wild germplasm of *Hevea brasiliensis* is the basic raw material for the current crop improvement programme to meet the future demands of the NR industry. Considering the urgent need for broadening the narrow genetic base of *Hevea*, the International Rubber Research and Development Board (IRRDB) made considerable efforts in building up fresh germplasm collection representing the centre of diversity in Brazil during 1981 (Allen, 1984). Characterization and preliminary evaluation are the basic needs for utilization of the superior wild accessions from this collection. Two hundred wild accessions grown in an *ex situ* conservatory representing accessions from Acre, Rondonia and Mato Grosso provenances were subjected to preliminary evaluation of which 80 promising ones were identified based on their superior performance for individual traits. The present paper reports the results of the second stage evaluation of these accessions on the basis of some morphological and bark structural characters observed at the age of four years. An attempt to assess the performance of these accessions in the early growth phase has also been made.

MATERIALS AND METHODS

The material consisted of 80 wild accessions selected on the basis of a preliminary evaluation. These included 22, 20 and

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38 genotypes from Acre, Rondonia and Mato Grosso respectively. The experiment was carried out at the Regional Research Station of the Rubber Research Institute of India at Padiyoor, in Northern Kerala, situated at 75° 39' E and 11° 58' N. The statistical design adopted was simple lattice with four replications and a plot size of four plants at a spacing of 6.6 x 3.3 m. The popular clone RRII 105 was used as the control.

The characters studied included (a) girth of the plant at a height of 150 cm from the bud union, (b) bark thickness at 30 cm height from bud union, (c) total number of latex vessel rows (LVR), (d) density of laticifers per row per mm circumference of the plant (DLV), and (e) test tap yield.

Bark samples were collected from 30 cm above the bud union and fixed in FAA for anatomical investigations. Prior to fixing, the thickness of the sampled bark was measured. Sections at cross sectional (CS) tangential longitudinal (TLS) and radial longitudinal (RLS) planes were cut at 30μ thickness using a sliding microtome (Reichert-Jung). The sections were stained with 0.1 per cent Oil red 'O' (Philipose and Reghu, 2002), micro slides prepared and observed under microscope (Wild Leitz Aristoplan). The number and density of laticifers were analyzed using an image processing and analysis system (Leica Q 500IW, Cambridge, England). Yield was recorded by test tapping at 30 cm height from the bud union, adopting ½ S d/2 system of tapping, and the average yield of six test tappings was computed.

Analysis of variance for the different traits (Panse and Sukhatme, 1985) was carried out and the significance was tested with reference to the standard F Table (Fisher and Yates, 1963). Rank sum method (Kang and Pham, 1991) was used for ranking the accessions based on the pooled performance of the five characters studied.

RESULTS AND DISCUSSION

Significant differences for girth, bark thickness, LVR, DLV and test tap yield were observed (Table 1). The wide range observed for the characters studied indicated the presence of inherent genetic variability in this population, which will enable selection for these traits. A list of the accessions showing

Table 1. **Range and mean of characters in the selected wild *Hevea* germplasm**

Character	Wild accessions			Control	F value	CD
	Minimum	Maximum	Mean	(RRII 105)		(P≤0.05)
Girth (cm)	12.0 AC/S/9-39/66	20.19 AC/S/9-39/128	16.84	15.58	2.26**	3.50
Bark thickness (mm)	1.95 RO/C/8-2/458	3.39 MT/C/2-10/39	2.68	2.52	2.51**	0.59
No. of laticifer rows	1.99 AC/B/19-56/239	5.51 RO/A/7-25/329	3.42	4.01	2.62**	1.39
Density of laticifers (No/row/mm)	22.48 RO/CM/10-44/24	33.54 MT/C/1-18/9	28.24	33.29	4.35**	3.76
Test tap yield (g/t/t)	0.08 RO/PB/1-2/26	9.72 MT/IT/15-28/207	0.72	9.40	153.00**	0.34

better performance for secondary traits over control is presented in Table 2.

Among the 80 wild accessions, seven had a significantly higher girth than that of the control, 72 were on par and one lower. Majority of the wild accessions were vigorous in growth in terms of their girth and were comparable to the control clone. Among the seven accessions, which had significantly higher girth, five belonged to Mato Grosso and one each to Acre and Rondonia. Of the 72 accessions which were comparable with the control, 33 were from Mato Grosso, 19 from Rondonia, and 20 from Acre. These accessions are expected to have good potential as timber clones.

Nine wild accessions had significantly higher bark thickness than that of control. Seventy one accessions comprising 31 from Mato Grosso, 20 from Acre and 20 from Rondonia were found to be statistically on par with the control.

The analysis of variance indicated that only two accessions, one each from Mato Grosso (MT/C/1-18/9) and Rondonia (RO/A/7-25/329), showed superiority over the control for the number of latex vessel rows (Table 2) while 66 accessions were on par with control. The superiority of the accession, MT/C/1-18/9 for higher number of laticifer rows has been reported from the nursery and preliminary evaluation stages (Abraham *et al.*, 1992; Reghu *et al.*, 1996). Of those found on par with the control, 34 Mato Grosso accessions formed the majority followed by 18 and 14 accessions from

Table 2. **Accessions showing better performance over control for secondary characters**

Accessions	Girth (cm)	Back thickness (mm)	LVR	DLV
MT/C/2-10/39	S(20.11)	S(3.39)	P(3.00)	P(33.52)
MT/C/1-18/9	P(15.49)	P(3.05)	S(5.48)	P(33.50)
MT/IT/15-28/207	P(18.26)	P(2.98)	P(3.01)	P(31.49)
MT/IT/16-34/56	S(19.40)	P(2.98)	P(3.01)	P(30.22)
MT/IT/14-30/38	P(18.65)	S(3.34)	P(3.25)	NS(25.57)
MT/IT/15-28/142	S(19.48)	P(2.90)	P(2.75)	NS(26.25)
RO/OP/4-20/15	S(19.93)	P(2.96)	P(4.45)	NS(26.42)
MT/C/2-10/8	P(17.37)	S(3.22)	P(4.00)	P(31.18)
MT/IT/16-34/79	S(19.13)	P(2.64)	P(4.25)	NS(28.28)
MT/C/2-10/169	P(15.52)	S(3.37)	P(3.51)	NS(29.45)
AC/S/10-37/336	P(19.07)	S(3.11)	P(2.99)	NS(24.78)
MT/IT/15-28/70	S(19.57)	P(2.86)	P(2.75)	P(30.51)
MT/IT/16-34/199	P(19.45)	S(3.21)	NS(2.24)	NS(27.42)
RO/A/7-25/329	P(18.57)	P(2.65)	S(5.51)	NS(23.77)
MT/IT/14-30/100	P(17.36)	S(3.38)	P(2.73)	NS(29.93)
MT/IT/12-26/75	P(14.46)	S(3.27)	NS(2.24)	P(32.15)
AC/S/9-39/128	S(20.19)	P(2.86)	NS(2.03)	NS(27.78)
AC/B/19-56/239	P(17.25)	S(3.14)	NS(1.99)	NS(24.01)
RRII 105 (control)	15.58	2.52	4.01	33.29

Figures in parentheses are mean values
S : Significantly higher than control; P : On par with control; NS : Not significant

Acre and Rondonia respectively. For the tract density of laticifers, none of the accessions were superior to the control. However, 22 accessions comprising 20 from Mato Grosso and one each form Acre and Rondonian provenances were on par with that of the control.

As expected, the wild accessions were generally poor yielders. The magnitude of variation for test tap yield was very high (0.08 to 9.72 g/t/t). The control clone, RRII 105, had a mean test tap yield of 9.40 g/t/t. Out of the 80 accessions, only one from Mato Grosso (MT/IT/15-28/207) was on par (9.72 g/t/t) with the control. Another Mato Grosso accession, MT/C/1-18/19, showed 35 per cent yield (3.26 g/t/t) of the control while another six accessions *viz.*, one from Acre (AC/S/10-37/336), two from Rondonia (RO/JP/3-22/483 and RO/PB/1-2/25) and the three from Mato Grosso (MT/C/1-18/117, MT/C/1-18/47 and MT/C/9-15/34) had yields of 20 to 27 per cent of the control along with other desirable characters like higher girth, bark thickness and total number of laticifer rows. These genotypes, if confirmed to maintain such characters in the mature phase too, will be of considerable value in advanced breeding programmes.

Accessions with a test tap yield ranging from 20 to 35 per cent of the yield of RRII 105 were also observed indicating a possible chance of using them for genetic improvement of clones for better rubber yield. In general, the accessions from Mato Grosso recorded relatively superior performance compared to those from Acre and Rondonia. This is in agreement with earlier reports on yield of wild *Hevea* germplasm in India (Abraham *et al.*, 1992; Mercy *et al.*, 1995; Reghu *et al.*, 1996; Rao *et al.*, 1999; Varghese *et al.*, 1999; Abraham, 2000).

The accessions were ranked using rank sum method based on the pooled performance of the five characters recorded in this study (Table 3). The accession from Mato Grosso namely, MT/C/2-10/39 was ranked first and RRII 105 was ranked sixteenth. Among the wild accessions, majority of the top rankers (16 out of 20) were from Mato

Table 3. **Ranking using rank sum method**

Genotype	Rank	Genotype	Rank
MT/C/2-10/39	1	MT/C/1-10/4	42
MT/C/1-18/9	2	MT/C/1-18/90	43
MT/C/1-18/47	3	AC/S/11-41/240	44
MT/IT/15-28/207	4	MT/C/1-18/99	45
MT/IT/16-34/56	5	MT/C/2-10/36	46
MT/IT/17-27/1	6	MT/C/2-10/51	47
MT/C/2-10/48	7	RO/PB/1-2/32	48
MT/IT/14-30/38	8	RO/C/8-24/128	49
MT/C/9-15/34	9	RO/JP/3-24/67	50
MT/C/1-18/117	10	AC/S/11-47/254	51
MT/IT/15-28/142	11	AC/S/11-41/253	52
RO/OP/4-20/15	12	RO/C/8-24/327	53
MT/C/2-10/8	13	AC/T/1-5/42	54
MT/C/2-10/3	14	MT/IT/16-34/94	55
MT/IT/16-34/79	15	MT/IT/15-28/89	56
RRII 105	16	MT/IT/14-30/67	57
RO/PB/1-2/38	17	AC/S/9-39/128	58
MT/IT/16-34/174	18	MT/IT/15-28/91	59
MT/C/2-10/169	19	AC/S/9-39/22	60
AC/S/10-37/336	20	RO/CM/10-44/105	61
MT/C/2-10/16	21	RO/C/8-24/458	62
MT/IT/15-28/70	22	AC/S/9-39/66	63
AC/F/5-21/6	23	MT/C/2-10/21	64
MT/IT/14-30/13	24	MT/C/1-18/107	65
MT/C/2-10/25	25	AC/S/11-47/356	66
RO/PB/1-2/26	26	RO/J/6-32/42	67
RO/JP/3-22/465	27	AC/T/1-5/109	68
MT/IT/16-34/7	28	AC/B/19-56/239	69
RO/JP/3-22/483	29	RO/PB/1-2/5	70
AC/S/12-42/23	30	RO/CM/10-44/24	71
AC/S/10-37/86	31	RO/CM/10-44/768	72
MT/IT/18-31/30	32	AC/T/1-5/70	73
RO/J/6-32/77	33	AC/S/9-39/105	74
MT/IT/16-34/199	34	AC/S/9-39/44	75
RO/A/7-25/329	35	AC/T/1-5/26	76
RO/PB/1-2/25	36	AC/S/9-39/10	77
AC/S/11-41/348	37	MT/C/2-10/29	78
RO/OP/4-20/6	38	RO/J/6-39/102	79
MT/C/2-10/41	39	AC/S/9-39/50	80
MT/IT/14-30/100	40	AC/S/9-39/169	81
MT/IT/12-26/75	41		

Grosso provenance, which is in accordance with earlier reports of the general superiority of Mato Grosso accessions (Abraham *et al.*, 1992; Reghu *et al.*, 1996; Rao *et al.*, 1999; Varghese *et al.*, 1999; Abraham, 2000). Majority of the accessions identified as better performers for secondary characters such as girth, bark thickness, number of latex vessel rows and density of laticifers compared to control formed the top rankers. The accession MT/IT/15-28/207 showing test tap yield statistically on par with RRII 105, MT/C/1-18/9 with higher number of latex vessel rows and seven accessions showing 20 to 35 per cent yield of RRII 105 (MT/C/1-18/9, MT/C/1-18/47, MT/C/1-18/117, MT/C/9-15/34, RO/PB/1-2/25, RO/JP/3-22/483 and AC/S/10-37/336) were ranked high. Superiority of these accessions will have to be confirmed in the mature phase also.

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