

# INTERSPECIFIC CROSSES IN THE GENUS *HEVEA*

## A PRELIMINARY PROGENY TEST OF SALB RESISTANT DWARF HYBRIDS<sup>1</sup>

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**ABSTRACT** - Interspecific crosses between *Hevea camargoana* and *Hevea brasiliensis* were used to obtain good producers of dwarf ortet progenies of *Hevea* resistant to SALB. Correlations among yield, total height, stem diameter, number of leaf flushes, bark thickness, number of latex vessels rings, diameter of latex vessels rings, density of latex vessels per mm<sup>2</sup> per ring, and leaf thickness were also studied. Among these nine characters, latex yield was shown to be positively correlated with total height, diameter, bark thickness, number of latex vessels rings, density of vessels per mm<sup>2</sup> per ring and leaf thickness. Selection of the ortets was based on the occurrence of correlations between yield and yield determining factors. Seven ortets were selected based on yield, bark thickness, stem diameter and latex vessels ring number. It is supposed that both yield and *Microcyclus ulei* (P. Henn.) V. Arx, resistance resulting from the combination *H. camargoana* vs Fx 4098 should produce progenies with superior characteristics. Testing this hypothesis under graft conditions is recommended.

**Index terms:** *Hevea* sp., clone, progeny test, selection, *Microcyclus ulei*, pollination, ortet.

### CRUZAMENTOS INTERESPECÍFICOS DO GÊNERO *HEVEA* TESTE PRELIMINAR DE PROGÊNIE DE HÍBRIDOS DE PORTE BAIXO RESISTENTES AO MAL-DAS-FOLHAS

**RESUMO** - Foram realizados cruzamentos interespecíficos entre as espécies *Hevea camargoana* e *Hevea brasiliensis*, para se obter seringueiras produtoras de porte baixo resistentes ao mal-das-folhas. Também, foram estudadas as correlações entre produção e altura total, diâmetro do caule, número de lançamentos, espessura da casca, número de anéis de vasos laticíferos, diâmetro dos vasos, densidade dos vasos por mm<sup>2</sup> e espessura da folha. Entre estes nove caracteres, ficou evidente que a produção do látex está positivamente correlacionada à altura total da árvore, ao diâmetro do caule, à espessura da casca, ao número de anéis de vasos laticíferos, à densidade desses vasos em mm<sup>2</sup> e à espessura da folha. A seleção dos ortetes foi feita com base na ocorrência das correlações entre a produção e os seus fatores determinantes. Sete ortetes foram selecionados com base na produção, espessura da casca, diâmetro do caule e número de anéis de vasos laticíferos. Supõe-se que tanto a produção como a resistência ao *Microcyclus ulei* (P. Henn.) (v. Arx), resultantes do cruzamento *H. camargoana* vs. Fx 4098 deverão produzir progênies com características superiores. Recomenda-se fazer a experiência em condições de enxerto.

**Termos para indexação:** *Hevea* sp., clone, teste de progênies, seleção, *Microcyclus ulei*, polinização, ortete.

### INTRODUCTION

Numerous interspecific crosses have been attempted among several species in the genus *Hevea*. However, there is little descriptive information about the progenies from these crosses. The question of relationships among species in the genus

*Hevea* is not a new one, but it has generally been assumed that the species are freely intercompatible (Seibert 1947, Baldwin Junior 1947). Representatives of the genus are indigenous to the Amazon region, and several of the species are geographically isolated from each other.

Artificial interspecific hybridizations among *Hevea camargoana* and other *Hevea* species have not been undertaken so far. However, Pires (1981) observed natural hybrids in the range of this species. According to him, the hybrids had a height of twelve meters. It was supposed they were the result of natural pollination of this species with *Hevea brasiliensis*.

The great importance of *Hevea camargoana* for breeding work is its dwarf growth habit and its ever flowering habit. Also, its resistance to *Micro-*

<sup>1</sup> Accepted for publication on March 3, 1982.  
This research has been supported by SUDHEVEA/EMBRAPA agreement.

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*cyclus ulei* is considered. New research results have led to new knowledge on its use in breeding as a resistant species.

Paiva (1977) registered the occurrence of *Hevea marajoensis* now *Hevea camargoana* (Pires, personal communication)<sup>5</sup>, in Villa de Joanes, Marajó Island (Fig. 1). The author described the habitat of the species, found growing vegetatively in transition areas of prairies and "igapós" (seasonal flooded areas) in big clumps. Seeds and budwood were collected. The characteristic of the species was described as a small 3 m tall tree-like shrub. Leaves are not deciduous and mature leaflets horizontal to slightly reclinate, oblanceolate, shortly acuminate, swollen at the bases. Flowers' color is yellowish with hairy calyx. Staminate flowers are purplish red at the calyx basis. The anthers are normally eight in two regular whorls. Pistillate buds are bigger than staminate ones; disk is very conspicuous and ovary glabrous. Fruit maturing is green in color and small capsules ligneous, explosive valves thick, seeds very small, yet bigger than *Hevea camporum*.

In the National Rubber Research Center, located at Manaus, Amazonas, controlled pollination of *Hevea brasiliensis* primary of hybrids clones with *H. camargoana* have been carried out since 1978, with the following objectives:

1. To obtain a small to medium size tree with outstanding characteristics of yield, vigor and resistance.
2. Propagation of selected individual progenies.
3. To evaluate the genetic characteristics of selected trees.

This report summarizes and gives some preliminary information on the selection of interspecific crosses of 65 one-year old *H. camargoana* vs. *H. brasiliensis* hybrid ortets.

#### MATERIAL AND METHODS

The technique used for controlled pollination at the National Rubber and Oil Palm Research Centre follows that described by Dijkman (1951).

An account has been given by Waidyanatha & Fernando (1972) in Sri Lanka, and Mendes (1971) in Brazil, on

<sup>5</sup> Personal communication from Dr. João Murça Pires, Goeldi Museum, Belém, Pará, February, 1980.

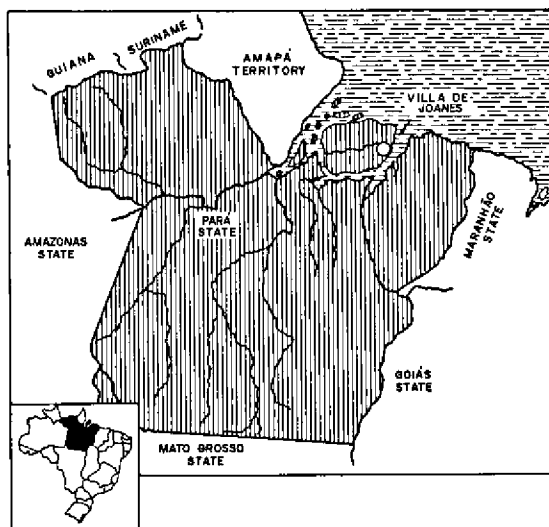


FIG. 1. Localization of Villa de Joanes in Marajó Island, Pará State, where *Hevea camargoana* species were collected. Manaus, AM, 1980.

a method for selecting high yielding seedlings from a population. Several steps are necessary for judging "a priori" the genetic qualities of the selected seedlings:

1. Yield, as a preliminary test by microtapping.
2. Growth, by measurement of height and stem diameter in the first year of nursery.
3. Resistance to disease.

The microtapping test was carried out as an additional aid to selection.

The interspecific pollination between *H. camargoana* and *H. brasiliensis* primary and hybrids was carried out in 1978 in two experimental areas. A total of nine different families with a total of 65 legitimate ortets were obtained. The number of ortets per family varied from one (IAN 873 x *H. camargoana*, IAN 873 x PFB 5, Fx 3810 x *H. camargoana*, PFB 5 x *H. camargoana*) to 26 (*H. camargoana* x Fx 4098). The *H. camargoana* plants used for breeding work were selected from plants originated from highly selected seeds growing in Villa de Joanes in the Marajó Island (Fig. 1).

The parental clones used in combination with *H. camargoana* were:

- PFB 5 - a primary clone of *H. brasiliensis* selected in Belterra.
- IAN 873 - the progeny of a cross between PB 86 and FA 1717, which were primary clones of Malaysia and Brazil, respectively. (Both *H. brasiliensis*).
- Fx 4098 - the progeny of a cross between PB 86 and FB 74, both primary clones from Malaysia and Brazil, respectively. (Both *H. brasiliensis*).

Fx 3810 - the progeny of a cross between F 4542 (*H. benthamiana*) and AV 363 (*H. brasiliensis*), which were primary clones from Brazil and Sumatra.

All clones were used either as male or a female parent of *H. camargoana* but some crosses combinations did not succeed. Thus, the number of successful combination was relatively small.

Apart from these controlled pollinations, we tried to carry out an intraspecific combination of *Hevea brasiliensis* (IAN 873 x PFB 5), in order to obtain information on its height, disease incidence and bark characters when compared with *H. camargoana* hybrids. Unfortunately, only one seedling was obtained, thus making any comparison difficult (Table 1).

In January 1979, the seed obtained from both breeding areas was sown in the seedbed; after germination and emergence it was planted in the nursery at 1.0 x 0.5 x x 0.5 m spacing.

Yield, growth vigor, disease incidence and leaf thickness were recorded at one year after planting. Characters of the bark, bark thickness, total number of latex vessels ring, density of latex vessels per mm<sup>2</sup> per ring, and diameter of latex vessels were included (Table 1).

The parameters were measured as follows:

1. Growth vigor was expressed by the diameter and height of the seedling; the former was measured at 5 cm from the ground.

2. Yield was estimated by use of microtapping test, utilized in Brazil (Mendes 1971) for testing progenies for selection.

3. Bark thickness was measured in laboratory from samples taken at 5 cm from the ground.

4. Latex vessels number was determined by examining the radial longitudinal sections of the same bark samples.

5. Latex vessel diameter was observed in the transverse section of the same bark samples.

6. Density of latex vessels per mm<sup>2</sup> was determined by the average density based on all rings.

7. Thickness of the mature leaf was expressed by the average of ten leaves per plant and measures were taken with a micrometer.

A source of pathogen inoculation, seedlings originated from controlled pollinations were planted between two rows of native seedlings considered highly susceptible to *M. ulei*. Classification and elimination of susceptible clones were started as soon as the first leaf flush showed susceptibility. A simple system of visual estimation followed by Bos & McIndoe (1965) was adopted, which comprehended four classifications:

- |                      |   |
|----------------------|---|
| Highly resistant     | 1. Plants exhibiting no disease lesions of a virtual absence thereof.                                       |
| Resistant            | 2. Plants exhibiting only a few of non-sporulating lesions.   |
| Moderately resistant | 3. Plants exhibiting more lesions than those of the resistant class, often on the borderline of the leaves. |

Susceptible 4. Plants exhibiting many lesions on stem, petioles and leaves.

In addition, *Thanatephorus cucumeris* attack was recorded.

Estimates of correlation between yield and other characters of the individual ortet data were computed as an aid for the nursery selection. Also, ortet data on yield, diameter, bark thickness, number of latex vessels rings and incidence of *M. ulei* were subjected to Duncan's Test. Differences as the 0.05 level were considered significant.

Data on vessels ring and disease incidence were transformed by the formula  $\sqrt{x + 0.5}$ , according to Steel & Torrie (1960).

## RESULTS AND DISCUSSION

The overall mean for the characteristics studied, their range, standard deviation, coefficients of variation and number of plants per mean are listed in Table 2.

Among the ortets, there was a wide range of variability for some characters. Yield appeared to be the most variable character (C.V. = 113.17%). Tan & Subramanian (1975), working with seedlings originated from intraspecific crosses of *H. brasiliensis*, found a 91% coefficient of variation for all studied population. The moderately variable characters were density of latex vessels per mm<sup>2</sup> ring (C.V. = 53.16%), total height (C.V. = 33.18%) and diameter (25.94%). Number of leaf flushes (5.84%) and diameter of latex vessels ring (9.11%) were the least variable characters.

Parentage, diameter, height, number of leaf flushes, leaf thickness, yield (micro-tapping), incidence of *Microcyclus ulei* and characters of the bark are shown in Table 1.

Narayanan et al. (1974) determined that latex yield in adult trees of *Hevea* is consistently correlated with bark thickness, number of latex vessels ring, girth increment and plugging index. In addition, correlations among characters on wild rubber trees originated from seed were in good agreement with the findings of Gonçalves (1979) and Tan & Subramanian (1975), who used seedlings.

Using the parameters of the ortets as defined, coefficients of correlation were determined (Table 3). Selection of progenies on plant breeding programs is based on the occurrence of correlations between yield and various yield determining

TABLE 1. Parentage, height, diameter, number of leaf flushes, characters of the bark, leaf thickness, microtapping and incidence of *Microcyclus ulei* of the ortets of *Hevea camargoana* with *H. brasiliensis*. Manaus, AM, 1980.

No. of the ortet	Parents	Height	Diameter at 0.30m from the ground	Nº of leaf flushes	Characters of the bark				Leaf thickness	Micro-tapping mg/t/t	Incidence of <i>M. ulei</i>
					Thickness (mm)	Nº latex vessels/rings	Diam. of vesicle	Density			
1	PFB 5 x H.c.	0,98	1,27	3,24	0,5	1	15,3	57,37	0,26	0,36	1,22
2	PFB 5 x H.c.	1,34	1,92	2,74	0,8	1	15,3	65,57	0,25	0,80	1,22*
3	PFB 5 x H.c.	1,39	1,77	2,91	0,8	1	15,3	57,37	0,26	1,11	1,22
4	PFB 5 x H.c.	1,69	2,92	2,74	1,2	2	16,8	98,36	0,30	2,97	1,22*
5	PFB 5 x H.c.	2,16	2,21	3,08	1,1	4	15,3	204,91	0,27	1,35	1,87
6	PFB 5 x H.c.	2,01	2,60	2,91	0,9	1	16,8	65,57	0,29	2,50	1,22*
7	PFB 5 x H.c.	2,21	2,39	2,91	1,0	3	15,3	163,93	0,32	1,30	1,87
8	PFB 5 x H.c.	1,38	1,61	2,91	0,7	3	15,3	147,54	0,30	0,90	1,87
9	PFB 5 x H.c.	1,60	1,90	2,74	1,0	2	16,8	98,36	0,26	2,80	1,22*
10	PFB 5 x H.c.	2,04	2,68	2,74	1,2	2	16,8	106,55	0,31	3,17	1,58*
11	PFB 5 x H.c.	2,22	2,41	2,91	1,0	2	15,3	98,36	0,30	0,21	1,22*
12	PFB 5 x H.c.	1,43	1,87	2,91	0,9	1	15,3	57,37	0,31	0,20	2,12
13	PFB 5 x H.c.	2,93	2,45	2,91	1,0	3	15,3	172,13	0,34	2,36	1,87
14	PFB 5 x H.c.	1,42	2,19	2,91	0,8	1	15,3	57,37	0,31	0,84	1,87*
15	IAN 873 x PFB 5	1,74	2,89	2,91	1,3	2	17,2	106,55	0,28	2,85	1,58
16	H.c. x Fx 4098	0,84	1,05	3,08	0,5	1	15,3	57,37	0,29	0,46	1,22
17	H.c. x Fx 4098	2,74	2,57	3,24	1,0	2	16,8	106,55	0,35	3,53	1,58
18	H.c. x Fx 4098	1,70	1,85	3,08	0,8	1	15,3	57,37	0,26	0,22	1,58*
19	H.c. x Fx 4098	2,30	2,65	2,91	1,2	1	16,8	65,57	0,27	1,74	1,22*
20	H.c. x Fx 4098	2,72	2,70	2,91	1,0	1	16,8	65,57	0,31	0,16	1,22*
21	H.c. x Fx 4098	2,17	2,39	3,24	1,0	1	16,8	65,57	0,31	0,51	1,22*
22	H.c. x Fx 4098	2,33	2,47	3,24	0,9	1	15,3	57,37	0,31	0,97	1,87*
23	H.c. x Fx 4098	2,50	2,61	2,91	1,0	2	16,8	98,36	0,37	1,35	1,87
24	H.c. x Fx 4098	1,00	1,20	3,08	0,6	1	15,3	57,37	0,31	0,42	1,22*
25	H.c. x Fx 4098	1,00	1,01	3,08	0,5	1	15,3	65,57	0,29	-	1,22
26	H.c. x Fx 4098	0,98	1,21	3,24	0,7	2	15,3	106,55	-	0,35	1,22
27	IAN 873 x H.c.	2,58	3,45	3,08	1,6	3	17,2	188,52	0,32	4,39	1,58
28	H.c. x PFB 5	1,26	1,63	2,91	0,7	1	16,8	65,57	0,31	-	2,12
29	H.c. x PFB 5	2,18	2,50	2,91	1,0	3	15,3	163,93	0,33	3,90	1,22
30	H.c. x PFB 5	2,21	2,45	3,08	1,0	2	15,3	106,55	0,37	3,05	1,58*
31	H.c. x PFB 5	2,40	2,53	2,91	1,0	1	16,8	73,77	0,28	0,26	1,22*
32	H.c. x PFB 5	2,14	2,19	2,91	1,0	1	16,8	73,77	0,33	2,57	1,22
33	H.c. x PFB 5	2,56	2,50	2,91	1,0	1	15,3	65,57	0,33	9,80	1,22
34	H.c. x PFB 5	2,31	2,00	2,91	1,1	2	16,8	106,55	0,29	0,40	1,58
35	H.c. x IAN 873	1,35	1,50	2,91	0,7	1	16,8	73,77	0,24	-	1,58*
36	H.c. x IAN 873	2,65	2,51	3,09	0,9	1	16,8	73,77	0,24	1,95	1,58
37	H.c. x IAN 873	3,50	3,21	3,39	1,0	1	17,2	73,77	0,32	1,68	1,22
38	H.c. x IAN 873	3,85	3,32	3,39	1,0	1	17,2	73,77	0,32	3,85	1,58
39	H.c. x IAN 873	3,34	3,17	3,24	1,2	2	16,8	131,14	0,30	5,63	1,58*
40	H.c. x IAN 873	3,05	2,98	3,39	1,0	1	17,2	65,57	0,31	1,72	1,58
41	H.c. x IAN 873	1,91	2,48	3,24	1,0	1	17,2	73,77	0,26	1,56	1,58*
42	H.c. x IAN 873	2,74	2,63	3,39	1,0	1	17,2	73,77	0,28	3,23	1,58*
43	H.c. x IAN 873	2,76	2,60	3,24	0,9	1	16,8	65,57	0,37	1,47	1,87*
44	H.c. x IAN 873	2,53	2,72	3,08	1,0	1	17,2	73,77	0,32	1,94	1,87*
45	H.c. x IAN 873	2,70	2,99	3,24	1,2	2	17,2	131,14	0,31	1,83	1,58*
46	H.c. x IAN 873	2,37	2,62	3,08	0,9	1	16,8	65,57	0,34	1,39	1,58
47	H.c. x IAN 873	2,33	2,30	2,91	0,9	1	16,8	73,77	0,25	0,62	1,22
48	H.c. x IAN 873	2,58	2,49	2,91	0,9	1	16,8	65,57	0,33	1,97	1,58
49	Fx 3810 x H.c.	2,97	2,51	3,24	0,8	1	16,8	73,77	0,26	0,43	1,87*
50	H.c. x Fx 4098	2,56	3,11	3,24	1,2	3	17,2	188,52	0,33	10,68	1,22*
51	H.c. x Fx 4098	3,20	3,19	3,24	1,2	4	17,2	254,09	0,33	9,57	1,22*
52	H.c. x Fx 4098	3,05	3,02	3,08	1,1	5	16,8	295,08	0,38	8,16	1,58*
53	H.c. x Fx 4098	2,08	2,49	3,08	1,0	3	16,8	263,93	0,31	2,49	1,58
54	H.c. x Fx 4098	2,57	2,94	3,24	1,0	2	16,8	122,95	0,30	4,31	1,22
55	H.c. x Fx 4098	3,05	3,16	3,24	1,1	3	17,2	177,13	0,37	12,80	1,58*
56	H.c. x Fx 4098	2,55	2,53	3,24	0,9	1	16,8	73,77	0,31	2,18	1,22
57	H.c. x Fx 4098	2,70	2,58	3,08	1,1	2	17,2	106,55	0,35	4,62	1,22*
58	H.c. x Fx 4098	2,95	2,99	3,39	1,1	2	17,2	114,75	0,34	1,19	1,58
59	H.c. x Fx 4098	2,67	3,31	3,08	1,1	2	17,2	114,75	0,31	5,63	1,22*
60	H.c. x Fx 4098	3,21	2,90	3,39	0,9	1	16,8	73,77	0,32	6,86	1,58
61	H.c. x Fx 4098	2,84	2,83	3,24	0,8	1	16,8	65,57	0,34	1,29	1,58
62	H.c. x Fx 4098	1,15	1,72	3,24	0,5	1	15,3	57,37	0,31	0,34	1,22
63	H.c. x Fx 4098	0,67	0,98	3,08	0,4	1	15,3	57,37	0,33	0,10	1,22
64	H.c. x Fx 4098	1,19	1,20	3,24	1,0	2	17,2	114,75	0,31	0,00	1,22
65	PFB 5 x H.c.	1,22	1,48	3,08	1,0	1	17,2	73,77	0,24	1,58	1,58

\* Susceptible to *Thanatephorus cucumeris*.

TABLE 2. Overall means, range, units, standard deviation, coefficient to variation and number of trees for characteristics of the one-year old controlled pollinations. Manaus, AM, 1980.

Character	Mean	Range	Units	Standard of deviation	Coefficient of variation (%)	Nº of plants
Yield (microtrapping)	2.43	0.10 - 12.80	mg	2.75	113.17	61
Total height	2.20	0.67 - 3.85	m	0.73	33.18	65
Diameter	2.39	0.98 - 3.45	cm	0.62	25.94	65
Nº of leaf flushes	3.08	2.74 - 3.39	unid.	0.18	5.84	65
Bark thickness	0.95	0.40 - 1.60	mm	0.21	22.10	65
Nº of latex vessels ring	1.44	1.22 - 2.34	unid.	0.29	20.14	65
Diameter of latex vessels ring	16.57	15.30 - 26.80	unid.	1.51	9.11	65
Density of latex vessels per mm <sup>2</sup> per ring	100.73	57.37 - 295.08	unid.	53.55	53.16	65
Leaf thickness	0.30	0.24 - 0.38	mm	0.03	10.00	65

TABLE 3. Linear correlation coefficients among yield and various morphological characters. Manaus, AM, 1980.

Characters	Symbol	P	Th	D	Lf	Bt	Nvr	Dvr	Div	Lt
Yield	MTP	1.000	0.5214***	0.6015***	0.1921	0.4882***	0.4990***	0.0879	0.5569***	0.3487***
Total height	Th		1.0000	0.8629***	0.4084***	0.6021***	0.2234*	0.3188***	0.3004**	0.3962***
Diameter	D			1.0000	0.2210*	0.7735***	0.3071**	0.3199***	0.3620***	0.4277***
Nº of leaf flushes	Lf				1.0000	0.0273	0.0606	0.0638	0.0756	0.0480
Bark thickness	Bt					1.0000	0.3876***	0.3289***	0.4955***	0.1838
Nº of latex vessels rings	Nvr						1.0000	0.0613	0.9442***	0.2074**
Diameter of latex vessels rings	Dvr							1.0000	0.0231	0.0158
Density of latex vessels per mm <sup>2</sup> per ring	Div								1.0000	0.2052*
Leaf thickness	Lt									1.0000

\*\*\* P < 0.001  
 \*\* P < 0.05  
 \* P < 0.1

factors. Based on them, selection was practiced on several simple characters which explicitly or implicitly showed correlated responses with yield.

Table 3 shows the linear correlation between yield and several morphological characters of the ortets. Significant results were found for the correlations of yield with total height (0.5214), diameter (0.6015), number of flushes (0.1921), bark thickness (0.4882), number of latex vessels ring (0.4990), diameter of latex vessels rings (0.0879), density of latex vessels per mm<sup>2</sup> per ring (0.5569) and leaf thickness (0.3487). Therefore, the selection was only concentrated on yield, bark thickness, number of vessels rings, stem diameter and incidence of *M. ulei*. Except for the latter one, these characters were correlated with yield.

Brookson (1959) showed that there was a positive correlation between the yield of individual mature seedlings and that of the clones derived from them in small-scale trials. According to Tan & Subramanian (1975), a similar situation may also exist for the seedlings material in the nursery phase. Consequently, the selection that we are going to practice in the next step, with plants resulting from grafting, will be directed towards fixing the characters used as parameters in first selection.

The Duncan's test analysis helped the section of the progenies ortets. Only 11% of the ortets were selected (Table 4). Ortets number 55, 50, 51 and 52 (*H. camargoana* x Fx 4098) had the highest yield. Since one of the parents used was *H. camargoana*, which is not a good latex producer, this

indicates that it does not exist influence of maternal effect on the combination, as often occurs. In addition to the fact that these progenies show high yield, they also show higher diameter, bark thickness and number of vessels rings. Progeny number 05 (PFB 5 x *H. camargoana*) showed the highest degree of susceptibility to *M. ulei*. On the other hand, progenies 33, (*H. camargoana* x PFB 5) 50 and 51 showed the lowest incidence of the pathogen. Townsend Junior (1961) observed that high clone producers are in general highly susceptible to *Microcyclus ulei*. With exception to the progeny number 33, the other two were originated from the same combination: *H. camargoana* x Fx 4098. It is supposed that both yield and *M. ulei* resistance, from the combination *H. camargoana* x Fx 4098, should produce progenies with superior characteristics. Therefore it is recommended to test the material along the time, as a consequence of the development of new pathogen race.

#### CONCLUSIONS

1. Yield by microtapping was shown to be correlated with total height, stem diameter, bark thickness, number of latex vessels rings, density of latex vessels per mm<sup>2</sup> per ring and leaf thickness. As a consequence, since there were significant correlations among yield and leaf thickness and yield and density of latex vessels, it is advisable to study more these characters trying to improve the technique for collecting data.

2. Some families resulting from the crosses with *H. camargoana* showed hybrid vigor when com-

TABLE 4. Selected ortets based in Duncan's test results related to yield (by microtapping), diameter, bark thickness, number of latex vessels rings and incidence of *M. ulei*, at the 0.05 level of significance. Manaus, AM, 1980.

Number of the progeny	Ancestrals	Microtapping Y/t/t (mg)	Diameter (cm)	Bark thickness (mm)	Nº latex vessels rings	Incidence of <i>M. ulei</i>
38	<i>H. camargoana</i> x IAN 873	3.85	3.32	1.00	1.22	1.58
51	<i>H. camargoana</i> x Fx 4098	9.57	3.19	1.20	2.12	1.22
55	<i>H. camargoana</i> x Fx 4098	12.80	3.16	1.10	1.87	1.58
50	<i>H. camargoana</i> x Fx 4098	10.68	3.11	1.20	1.87	1.22
52	<i>H. camargoana</i> x Fx 4098	8.16	3.02	1.10	2.34	1.58
33	<i>H. camargoana</i> x PFB 5	9.80	2.50	1.00	1.22	1.22
05	PFB 5 x <i>H. camargoana</i>	1.35	2.21	1.10	2.12	1.87

pared with native seedlings used as source of pathogen inoculation at the same environmental conditions. Based on this fact, it seems to be early to predict if the selected ortets are going to show dwarfness later on.

3. Morphological characteristics of the progenies indicate that apomixis, self fertilization and accidental outcrossing do not occur when the pollination is conducted. However, every progeny should be examined for traits of the male parent for contamination by outcrossing or self-fertilization are always possible.

4. Ortets number 38, 51, 55, 50, 52, 33 and 5 were selected based on yield (microtapping), bark thickness, diameter and number of latex vessels rings. Correlations of the above characters with yield and the Duncan's test at the 0.05 level of significance supported this selection.

5. Preliminary tests showed that ortets 33, 50 and 51 revealed higher yield and lower incidence of *M. ulei*. Experience has shown that high latex yield clones are in general very susceptible to this fungus. It is supposed that the combination *H. camargoana* x Fx 4098 should produce progenies with these superior characteristics. Therefore, it is advisable to test them in different environments, over a period of time, because of the evidence of development of new races of fungus.

ACKNOWLEDGEMENT

The authors are grateful to Mr. Afonso C.C. Valois and Miss M. Amazonilde Neves, Head of the Scientific Division and Researcher of the National Rubber and Oil Palm Research Centre - CNPSD -, respectively, for their valuable comments and suggestions. Acknowledgements are also due to Mr. Antonio Pessoa Rebello and Mr. Raimundo S. Freire, for their laboratory and field work, respectively.

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