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A STUDY OF THE HERITABILITY OF OIL CONTENT IN COTYLEDONS OF *HEVEA* SEEDLINGS

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SUMMARY

Appreciable heritability was discovered in the oil content of Hevea *cotyledons. This oil content was also found to be significantly inversely correlated with height of the seedlings. The inverse relationship with growth suggested a hormonal mechanism and chromatographic analysis revealed an inhibitor as well as a stimulator in the oil.*

Routine studies of the oil content of rubber seeds revealed a very high degree of variability in this parameter. Therefore further studies were initiated in order to estimate the relationship of this parameter to other factors such as growth and latex production : the utilization of a population of eight different crosses obtained by the artificial pollination of *Hevea* cultivars of economic importance also permitted an estimate of the heritability of this factor.

The cotyledons from one month old seedlings were removed, dried, macerated in a high speed macerator, and weighed ; the oil was next extracted in a Goldfisch extractor using ether as the solvent. The oil content was determined in mg per g dry weight of the cotyledons after evaporation of the ether. An index of rubber yield was determined by a new technique developed at the Rubber Research Institute of Ceylon (in the press). This was done by wrapping a thin strip of weighed filter paper around the stem of the young seedling and pricking the stem at four points with a needle through the filter paper. The latex that trickled out was absorbed on the filter paper. The strip of filter paper was removed after ten minutes, dried, and weighed, and the weight of dry rubber determined as an index of latex content of the seedling. This index of latex content and corresponding measurements of height and girth were made one year and four months after the seed was sown.

Crump's formula (Crump, 1946) was utilized in calculating environmental and genetic variances and covariances (Kempthorne, 1957). Heritability was assessed as equal to the genotypic variance divided by phenotypic variance.

TABLE 1

ANALYSIS OF OIL CONTENT, GROWTH AND DRY RUBBER MEASUREMENTS

Parents ♀ + ♂→	No. of progeny	Seed oil content mg/g dry wt	Heights cm	Girths cm	Latex mg/prick	
PB 5/51 × IAN 45-873	11	318·9 – 525·0	127–244	3·9–7·3	4·5 – 36·1	Range
Ch 26 × PB 5/51	19	90·0 – 471·4	133–216	4·5–6·4	5·0 – 20·1	
4008 × PB 5/51	7	213·2 – 274·5	171–241	4·6–7·7	6·2 – 21·9	
RRIC 100 × 1458	4	232·7 – 369·3	155–219	5·1–7·7	14·8 – 33·9	
1458 × PB 5/51	6	228·1 – 427·8	123–172	4·9–7·7	5·8 – 23·9	
4008 × 1458	5	230·2 – 317·1	128–212	4·9–7·7	5·8 – 23·9	
RRIC 100 × 3148	5	163·9 – 291·4	134–203	5·1–7·0	5·2 – 15·3	
1458 × 4008	9	314·0 – 502·6	153–245	5·1–8·9	5·8 – 21·9	
Variance ratio F		8·05***	3·10**	0·92	1·59	Variance
Genetic variance σ_g^2		4951·99	33·9663	zero	3·26	
Environmental variance σ_e^2		5540·59	127·59	0·1483	43·33	
Heritability $\frac{\sigma_g^2}{\sigma_g^2 + \sigma_e^2}$		0·4720	0·2102	zero	0·0700	
Seed oil content			–0·2881*			Correlations r_e
Height				0·7987***		
Girth					0·2722*	

* and ** and *** denote significance at ·05, ·01, and ·001 per cent, respectively.

$$r_e = \frac{e_1 \quad e_2}{\sigma^2_{e_1} \times \sigma^2_{e_2}}$$

From the results of analysis presented in Table 1, it is seen that seed oil content shows the highest heritability among the parameters studied. Measurements of height are also shown to be more important than girth as growth estimates of young plants of *Hevea*.

The inverse relationship shown in Table 1 between seed oil content and height suggested that hormonal mechanism may be active in the oil. 5 λ 1 of the oil was spotted on Whatman No. 1 filter paper and isopropanol - ammonia - water (10 : 1 : 1 v/v) used to develop the chromatograms (Bennet-Clark *et al.*, 1952) to a distance of 30 cm ; after removal of the solvent vapours the chromatograms were divided

into transverse strips which were placed in petri dishes and moistened with distilled water. Ten mustard seeds (soaked overnight) were placed on each paper (replicated six times) and allowed to germinate. The number of germinated seeds were counted after 18 hr and the percentage stimulation or inhibition of germination was calculated from duplicate tests. Stimulation was noted at two zones at R_f .2 and .8; inhibition of germination was noted at R_f .6.

Genetic analysis of F_2 progeny from determinations of the oil content of seeds, without destroying their viability, has been achieved in the case of rape (Downey & Harvey, 1962; Dorrel, 1970) and flax using gas liquid chromatography. The heritability values for characters such as tree height, stem girth, and disease resistance of forest trees have been reviewed by Hyun in 1970 : in comparison, the oil content of *Hevea* seeds would appear to be of sufficient magnitude for a similar adoption of this parameter as a reference in selection.

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