themselves. Whether the cells of higher plants have such a capacity is a moot point[11-13].

We thank Dr. E. J. Hewitt for advice.

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Heritability of Heartwood Formation in *Pinus radiata* D. Don

An important change which occurs in the wood of most trees as they grow older is the transformation of sapwood into heartwood. This change is associated with the death of the ray and vertical parenchyma cells, and definite modifications to the anatomy of both softwoods and hardwoods[1]. As a result, heartwood is more difficult to season, is less readily penetrated by preservatives and pulping liquors, and resinous extractives are troublesome.

Schreiner[2] could not find conclusive evidence of the inheritance of heartwood formation, while Harris[3] thought that the genetical constitution, age and ecology of a tree together contribute to the formation of heartwood in the stem. The latter suggested that a 'heartwood forming' tendency is genetically controlled, but that environment also plays an important part.

The most useful investigation of the inheritance of a characteristic should yield a quantitative measure of the intensity of genetic control. Such a measure is provided by a ratio called 'heritability'[4] which considers genetic variability in relation to phenotypic variability. This term is used in either a broad or narrow sense depending on whether the total or only the additive portion of the genetic variability is taken into account.

In an investigation of this kind it is not practical to investigate the variation in the age at which heartwood begins to form in the tree. Therefore the amount of heartwood was used as the basis for calculating estimates of gross heritability from results derived from trees of a clonal plantation.

Thirteen clones from a plantation of *P. radiata*, established in 1939, in the Australian Capital Territory were sampled by selecting the first, middle and last trees of the row comprising the clone. Only vertical trees were chosen. Increment cores were taken from each tree in the north and the south directions at heights of 1·2 m and 4·6 m.

In a mature cross-sectional disk of *P. radiata*, the coloured heartwood adjacent to the pith and the narrow transition zone, which also contains heartwood substances[3], stain a deep orange-brown on the application of a diazotized benzidine stain[5], in contrast to a yellowish stain for the sapwood. This staining technique was used to differentiate the heartwood and transition zone from the sapwood, because the natural colour changes could not be seen clearly in the small samples used.

Because of differences in the pattern of early height growth, sampling at fixed heights in trees produces specimens with differing ring counts. Consequently the growth ring showing the furthest extent of heartwood from the pith could not be used as a comparative measure of heartwood content, and it was decided instead to use the area proportion of heartwood. This was possible because of the poor correlation between specimen ring count and proportion of heartwood in these results. Therefore, the radial extent of the heartwood and the tree radius were recorded for each specimen, so that values for the opposite radii at each height could be averaged and used to express the heartwood area as a proportion of the total cross-sectional area for each sampling height in each tree.

The variation in heartwood content between trees was separated by analysis of variance into within-clones and between-clones components and gross heritability estimated as :

$$\frac{\text{between-clone variance}}{\text{between-clone variance} + \text{within-clone variance}}$$

Estimates of gross heritability for the proportion of heartwood were as follows :

Height (m)	Gross heritability estimate significant at 5% level	*S.E.*
1·2	0·37	0·18
4·6	0·36	0·18

The value of 0·37 is not very large compared with the estimate of 0·73 obtained for average fibre length on clonal material from the same locality by Dadswell *et al.*[6]. Little gain could therefore be expected to result from the use of seed from parents selected for low heartwood content, and even if vegetative propagation methods were used, the gains achieved would be worthwhile only if the absence of heartwood was very critical to the final product.

It should be stressed that the work recorded here is based on results from 13 clones from a single area. However, the lack of heritability estimates for many wood features is keenly felt and there is some justification for publishing preliminary values in the hope that they may be augmented by others to provide better estimates based on pooled results.

I thank the Director-General, Forestry and Timber Bureau, Canberra, for making available the wood specimens, and particularly Messrs. A. G. Brown and J. M. Fielding for arranging for their collection. I also thank Misses J. Down and J. Sibthorpe for carrying out the detailed measurements on which the results of this investigation have been based, and Miss N. Ditchburne, C.S.I.R.O. Division of Mathematical Statistics, for help in the statistical analyses.

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ENTOMOLOGY

Purification of the Fire Ant Trail Substance

The fire ant, *Solenopsis saevissima* (Fr. Smith), utilizes a trail substance as an aid in effective foraging[1]. Workers secrete a substance from the Dufour's gland which is deposited from the sting in the form of minute streaks. These mark a trail from a suitable food source to the nest. Workers are strongly attracted to this substance and follow the trail outward to the food source. The newly recruited workers in turn lay trails to the nest, reinforcing the original trail. The appropriate properties for effective trail substances have been discussed by Bossert and Wilson[2].