Short Note: A Rare Dwarf Mutant of Eucalyptus gunnii

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Summary

A rare, dwarf mutant of *Eucalyptus gunnii* is described. The mutant is extremely slow growing and has short internodes, small coriaceous leaves which are V-shaped in transverse section and a distinctive divaricating branching pattern. It is natural and has only been observed at low frequency (c. 8%) in one open-pollinated family.

Key words: Dwarf mutant, *Eucalyptus gunnii*.

Introduction

Forest tree populations tend to have high genetic loads of deleterious recessive genes; their expression when homozygous being one of the main causes of inbreeding depression (Ledig, 1986). Such lethal genes are believed to be often expressed in the embryonic stage resulting in reduced seed set following self-pollination (e.g. Griffin and Lindgren, 1985; Namkoong and Bisher, 1987). However, a wide range of abnormalities are also observed in nurseries (e.g. Franklin, 1969) or under cultivation which are potentially lethal and virtually non-existent in aged plantations and natural populations. Nevertheless, such mutants may be useful as genetic markers (e.g. Krug and Alves, 1949; Eldridge, 1976) as well as having other scientific or ornamental value.

The occurrence of such non-adaptive or poorly viable variants in the genus *Eucalyptus* has been noted Krug and Alves, 1949; Pryor and Johnson, 1971; Venkatesh and Sharma, 1974; Eldridge, 1976). A range of potentially deleterious abnormalities have been described from progenies of *E. grandis* (Hodgson, 1976), *E. camaldulensis* and *E. tereticornis* (Venkatesh and Sharma, 1974) and the present article reports a new dwarf-type mutant of *E. gunnii*. This mutant (*Figure 1*) is extremely rare and, despite examination of over 500 open-pollinated families from range wide collections of *E. gunnii* (e.g. Potts and Reid, 1985b), has only been found in a single family (collected from Pensford on the Central Plateau of Tasmania — see Potts and Reid, 1985a). Approximately 8% of the seedlings grown from the family were dwarf mutants and only one plant has been successfully cultivated.

Comparison with normal phenotypes

The mutant mainly differs from the wild-type in being extremely slow growing (achieving a height of only 1.4 m in 11 years), having markedly reduced internode lengths (*Table 1*) and small coriaceous leaves (*Table 1*) folded such that they are V-shaped in cross section (*Figure 1b*). It has little apical dominance and a distinctive, divaricating branching pattern (*Figure 1a*). The latter arises as the shoot apices usually die at the end of each growing season and numerous tiny branches arise, from which 2 to 5 branches may develop the following season. The intensity of waxy glaucousness on the young shoots and leaves of the mutant is greater than normal for the Pensford population, resulting in the mutant having a pronounced bluis-white appearance. The mutant has remained both

A

B

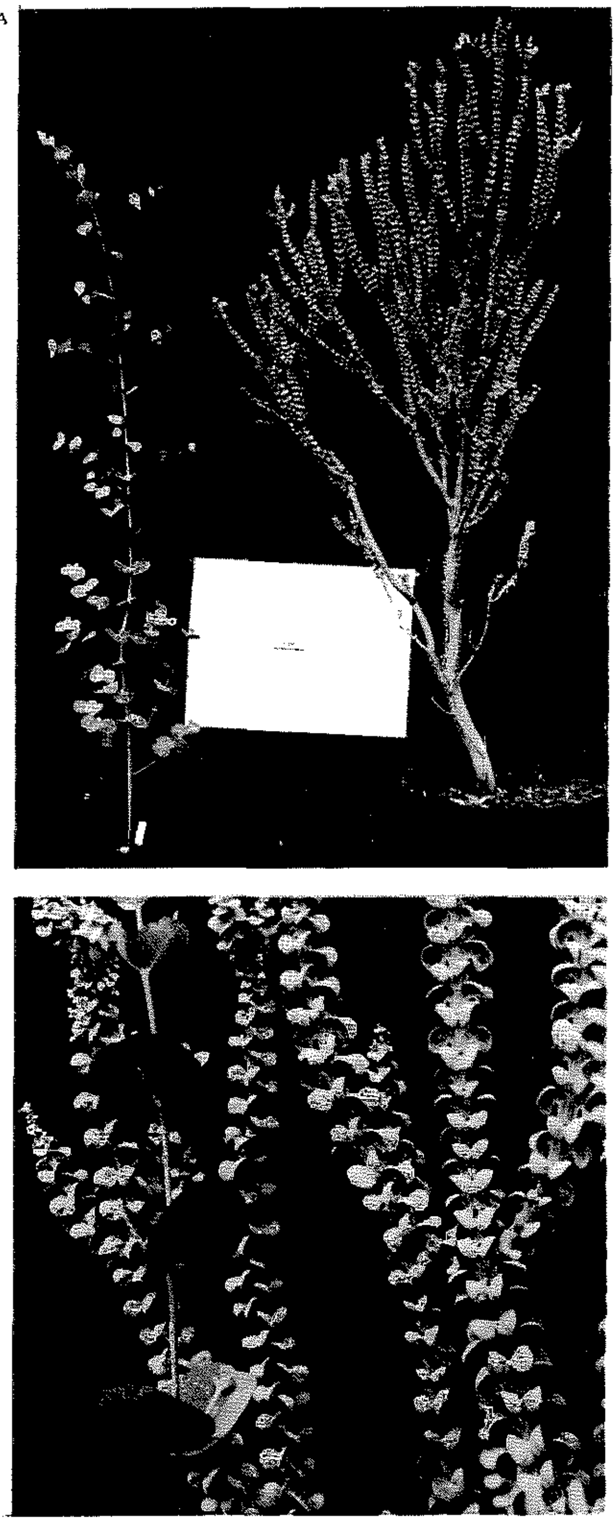

Figure 1. — Typical wild-type seedling of *E. gunnii* after six months growth (left) and the dwarf mutant after 10 years growth (right) (scale in A = 5 cm).

Table 1. — Mean (range) seedling leaf dimensions and internode length (mm) for four populations of *E. gunnii* and measurements from the dwarf mutant. Population locations are given in Potts and Reid (1985a) and growing conditions and characters are detailed in Potts and Reid (1985b).

	Lamina			Internode
Population	Length	Width	Thickness	Length
Liawenee 1150m (n=82)	15.8 (8.8-25.7)	19.3 (9.5-30.7)	0.45 (0.35-0.56)	13 (7-29)
Shannon Lagoon 1050m (n=58)	16.3 (10.9-27.1)	20.7 (12.4-30.4)	0.41 (0.30-0.49)	17 (10-30)
Pensford 960m (n=67)	19.6 (11.3-29.0)	21.5 (13.2-32.9)	0.39 (0.30-0.46)	19 (10-42)
Snug Plains 600m (n=63)	20.7 (13.3-33.0)	23.3 (11.0-37.0)	0.37 (0.32-0.44)	19 (10-36)
Mutant (Pensford)	**5.0**	**12.3**	**0.51**	7

vegatatively and reproductively immature and neither grafting onto wild-type root stocks (grafts died after producing a small amount of new growth) nor the application of GA3 on leaves (10 migrograms in 10 microlitres of ethanol) has altered the phenotype.

Phenotypically, the mutant lies outside the range of variation normally encountered in the Pensford population (*Table 1*). However, there is a trend for characteristics such as growth rate, internode length and lamina size to decrease and lamina thickness to increase with increasing altitude in *E. gunnii* (Potts and Reid, 1985b) and the mutant falls within the range of variation found at high altitudes for internode length, lamina width and lamina thickness (e. g. Liawenee — *Table 1*). Nevertheless, the mutant is clearly distinct from these high altitude variants as it is much slower growing and its leaves are shorter (*Table 1*) and distinctively folded.

Discussion

Hodgson (1976) describes fifteen types of abnormality among *E. grandis* progeny; ten of which were classed as detrimental, and for eight of these the abnormality did not develop until near or after planting. The *E. gunnii* mutant has some similarities to Hodgson's (1976) Type 4 abnormality — "all leaves crowded and small, often quarter normal length or less and with a deep red colour". However, the red colouration is absent from the *E. gunnii* mutant which strongly suggests that the two dwarf mutants are genetically different. The *E. gunnii* mutant probably results from single recessive mutation which is consistent with the expression of this phenotype in c. 8% of the open-pollinated progeny. With an outcrossing rate of about 70% in *Eucalyptus* (Moran and Bell, 1983), a single, rare recessive gene may be expected to be expressed in 7.5% (0.25 × 30%) of open-pollinated progeny from a female heterozygote. However, the possibility that the mutant phenotype is a consequence of a chromosomal abnormality (e.g. Schmitt, 1969) cannot be discounted. Nevertheless, dramatic phenotypic differences resulting from the plieotropic effect of a single gene mutation on several morphometric characteristics are relatively common and, in many of the ways in which it deviates from the wild-type (e.g. internode length and leaf size, thickness and folding and posible GA insensitivity), the dwarf mutant of *E. gunnii* is similar to the recessive GA insensitive "erectoides" mutant described in *Pisum* (e.g. Reid, 1986).

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