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MORPHOLOGICAL VARIATION IN EUCALYPTUS L'Herit.,

SERIES : DUMOSAE

by

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## ABSTRACT

Series Dumosae comprised the following 15 species from southern and western Australia prior to this study: Eucalyptus anceps, E. calcareana, E. clelandii, E. conglobata, E. cyanophylla, E. dongarraensis, E. dumosa, E. fraseri, E. georgei, E. kondininensis, E. lesouefii, E. pileata, E. sheathiana, E. striaticalyx, E. woodwardii. The series is noted for its high morphological variability with intergradation between many taxa often making identifications difficult. A survey of morphological characters revealed a lack of discrete differences in seed morphology, wood anatomy, leaf anatomy and leaf architecture, and indicated that differences between taxa result mainly from continuous variation in form rather than presence or absence of characters. Leaf surface texture and colour were examined by measuring height of cuticular sculpturing with epifluorescence microscopy and the contribution of glaucousness to leaf reflectance with a spectrophotometer.

A preliminary study was made on sessile-fruited forms using 202 specimens scored for six characters. A Canonical Variates Analysis (CVA) based on geographical groupings of South Australian specimens resulted in a new interpretation of E. conglobata and E. anceps as generally distinct entities in this state, both morphologically and geographically. However, classification of Western Australian specimens by the same CVA revealed much intergradation indicating that their current taxonomic status is unacceptable.

A set of 27 characters, mainly continuous metrics describing fruit, leaf and bud morphology, was chosen for analysis of all taxa and scored for 499 individuals. Two main numerical methods were used to objectively describe and analyse variation. Intergradation between groups was studied using CVA, and multivariate distance relationships between groups were determined using a multistate distance metric and Discriminant-distances between group centroids derived from CVA.

Existing taxa (including the undescribed "E. pterocarpa") were represented by 16 groups of 4 to 11 individuals collected from as near as possible to the type localities. Classification of unassigned individuals by CVA demonstrated much intergradation between taxa and geographical interspersions contrary to accepted distributional limits. Problems with existing species concepts were highlighted in a separate analysis on a subset of specimens derived from the South-eastern Region of South Australia. This CVA detected four species with strong intergradation within a single population.

In other analyses potential new taxonomic groups were tested. The recognition of several geographical groupings of South Australian large-fruited forms with affinities to E. cyanophylla was not supported. Distance relationships were examined between 31 populations of four or more individuals and most were found to be more distinctive than the most similar pair of groups representing existing species (E. calcareana and E. pileata). The five most distinctive groups were included with the 16 groups representing typical forms of existing species for further investigation of gradation and geographical relationships using CVA. A taxonomic system was derived on the basis of multivariate distance relationships, intergradation, and relative contributions of characters to group discrimination which is of practical importance for identification

by keys. Disparities between these three factors necessitated a subjective approach in deriving a new taxonomy from the evidence documented. Variation for each of the existing taxa is discussed in relation to evidence from the numerical analyses. A proposed taxonomic revision of the Dumosae is presented with a key to all taxa. Five taxa without substantial intergradation using the complete character set are recognized at the specific level. These are E. dumosa, E. kondininensis, E. lesouefii, E. woodwardii and a new taxon E. pterocarpa. Within E. dumosa five subspecies are recognized: ssp. dumosa, ssp. clelandii, ssp. conglobata, ssp. fraseri and ssp. georgei.

Cross-pollination trials, cases involving barriers to gene exchange within Dumosae, and evidence of inter-series and inter-section hybrids are described. The possible evolutionary and biogeographical development of series Dumosae is discussed. There is evidence that the widespread and taxonomically difficult E. dumosa complex arose from ancestors of the more distinctive tree forms in Western Australia, and underwent adaptive radiation and eastward migration relatively recently in conjunction with the development of sand dune systems in the mid-Pleistocene.