TAXONOMY OF THE *ACACIA ANEURA* COMPLEX

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ABSTRACT

Most of the native species of Acacia known as "mulga" have been placed under the species A. aneura *F. Muell. ex Benth. although other species have also been confused with it. The "species" is characterised by a flat winged, leaf-like pod associated with narrow, obscurely veined phyllodes. It is recognised that it is not a simple homogeneous species. After studying herbarium material from Queensland three variants have been tentatively distinguished—"broad", "long-narrow" and "short-narrow". The taxonomic problems in this group may be impossible to solve by study of herbarium material alone and it is proposed that a major project is needed throughout the range of mulga to correlate morphological, ecological and cytological characters of plants within this complex.*

In the eastern part of its range four species are sometimes confused with A. aneura— A. catenulata *C. T. White*, A. brachystachya *Benth.*, A. ramulosa *W. V. Fitzg., and* A. clivicola *Pedley. A key to these species and notes on their identification, range and relationships are provided. Polyploidy in* A. aneura *is reported. The complex pattern of variation in growth form and phyllode dimensions of* A. aneura *is possibly due to the retreat of the species to refugia during arid periods at the end of the Tertiary, followed by a recent expansion of its range.*

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Considering the economic importance of mulga and its obvious variability little work has been done on its systematics. Despite its range and its number of species the genus *Acacia* as a whole has also been neglected. The name mulga has been applied to several species but I shall confine my discussion to the eastern Australian species, *A. aneura* F. Muell. ex Benth., *A. catenulata* C. T. White, *A. brachystachya* Benth., *A. ramulosa* W. V. Fitzg. and *A. clivicola* Pedley. The difficulties in the taxonomy of the *A. aneura* complex lie not in the species confused with mulga but rather in the taxon known as *A. aneura* itself. This has been recognized as being heterogeneous and almost certainly consists of several taxa. Preece (1971) recognised that because of the variability it was dangerous for ecologists to apply results too far beyond the populations studied. All members of the complex are woody plants with narrow, greyish, finely striate phyllodes, with flowers in rather short and slender spikes. The similarity of vegetative characters of different species is probably because all are adapted in a similar way to the aridity of the environment. Species similarly adapted are *A. microsperma* Pedley, *A. cyperophylla* F. Muell., *A. calcicola* Forde & Ising, and other species mentioned by Preece, but these are rarely confused with mulga at least by taxonomists.

Identification of the different species is difficult and is probably easier for a worker in the field who can use such characters as habit of growth, and colour and orientation of foliage, than it is for herbarium botanists who must rely on characters such as indumentum of branchlets and phyllodes, nervature of phyllodes and subtle differences of the calyx. The fruits of the species are characteristic and important in identification. A key to the identification to species in the complex is given in the appendix to this paper. Study of the group of species from dried material is hampered by the paucity of specimens, especially those with both flowers and fruits, and by the lack of notes on herbarium labels on size and habit of the plant and on the habitat.

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Nomenclature has become involved in some cases because of the poor specimens on which names have been based. Unfortunately a name cannot be rejected because it is based on scrappy material.

Acacia aneura. Mulga.

Presumably all workers involved with mulga or mulga lands can recognise mulga, though this is not true of all landholders in the mulga region. In the field the species can often be recognised by its obliquely ascending branches but herbarium specimens are often difficult to identify. The only reliable diagnostic character is the flat winged pod. At present all specimens with such pods are identified as *A. aneura*, but botanists have recognised that it is far from being a single homogeneous species. Burbidge (1960) stated: "*Acacia aneura* itself shows a great deal of variability in growth habit and in phyllode dimensions but minor forms not only re-occur in many localities but re-occur in association with one another. There is little evidence that the forms can be subdivided into geographic races though it may be possible to recognise a series of ecotypes." Hall, Specht and Eardley (1964) suggested that there may be two ecotypes associated with summer and winter rainfall regions. Everist (1949) distinguished two varieties—a narrow-leaved one which he noted chiefly west of longitude 144 and towards the north limit of mulga in Queensland, and the commoner broad-leaved variety which seemed identical with *A. aneura* var. *latifolia* J. M. Black.

The variation shown by herbarium specimens is difficult to analyse in the absence of notes on habit and size of plants but after studying herbarium material from Queensland I have tentatively distinguished three variants—"broad", "long-narrow" and "short-narrow". These depend mainly on dimensions of the phyllodes but there seems to be some correlation with characters of the flowers and fruits. My two "narrow" variants correspond to the narrow-leaved variety of Everist and more or less confirm his observations. There is therefore a suggestion that there are geographic races. In the Warrego district where all three variants occur there is some indication of ecological segregation, the narrow-phylloded plants occurring on run-off areas on upper slopes.

De Lacy and Vincent (personal communication) have reported both diploid and tetraploid races of mulga, and part of the variation is probably due to the occurrence of polyploids. The voucher specimen for the diploid was collected at "Boatman" south-east of Charleville and represents the broad-phylloded variant. The tetraploid for which there is no voucher represents a narrow-phylloded variant from Cheepie. This is the only report of polyploidy in phyllodineous species of *Acacia*, with the exception of *A. koa* A. Gray from Hawaii (Atchison, 1948) and *A. heterophylla* (Lam.) Willd (Vassal, 1969) both of which are tetraploid.

The type specimen of *A. aneura* which is figured by Everist came from near Lake Torrens. It is from a narrow-leaved plant not at all like the mulga around Charleville and there would be an obvious gain in information to other workers if the Charleville plant had some distinguishing name. Formal taxonomic treatment of the variation that occurs in mulga may not be possible however, but if work on mulga is to be made more meaningful then an attempt should be made to analyse the variation and, if possible, to define the variants. Field studies such as those of Ross (1968) in South Africa would have to be correlated with ecological and cytological work. This would be a major project if it were to be carried out throughout the range of mulga.

Species closely allied to Acacia aneura

Acacia catenulata. Bendee.

This was described in 1944, but had been previously recognised as distinct by many landholders though many had failed to distinguish its consistently from mulga. Careful workers such as Blake (1938) and Francis (1925) both failed to recognise it.

It can usually be distinguished from *A. aneura* by its characteristically fluted trunk. There are also subtle differences in the indumentum of the branchlets and phyllodes, but its constricted pods provide the only certain means of identifying the plant. Usually however few pods develop.

The ranges of bendee and mulga overlap only in the eastern part of mulga's range and the two species occupy dissimilar habitats, so that nowadays they are usually not confused. *A. catenulata* extends from south-central Queensland (western Darling Downs to Grey Range) to the Dividing Range north of Jericho in central Queensland. It occurs on shallow soils on rocks affected by deep weathering. There is usually a high proportion of rock outcrop but where soils are deeper with no outcrops, mulga and bendee may occur together, for example south-west of Surat and between Morven and Mitchell.

Acacia clivicola. Bastard mulga.

This is not particularly closely related to any of the other species discussed. It is distinguished from all the others by its united calyx lobes and by its pods having obviously obliquely transverse seeds. Its nearest relatives are *A. aprepta* Pedley which is confined to a small area in the Maranoa and western Darling Downs districts where it is sometimes known as Miles mulga, and *A. kempeana* F. Muell. from Central Australia, both of which have similar calyxes. It is a rounded shrub usually less than 4 m tall with obliquely ascending branches. It ranges widely in south-western Queensland but seems to be confined to shallow soil overlying weathered rock. It often forms dense stands on upper slopes above mulga. It is rather variable in foliage characters but its phyllodes are usually broadest above the middle.

Acacia ramulosa. Horse mulga.

There has been some confusion between this species and *A. cibaria.* Maiden (1917) discussed the problem and after noting that the type specimens represented *A. brachystachya, A. ramulosa* and *A.* sp. suggested the name *A. ramulosa* be dropped. Under the present International Code of Botanical Nomenclature it is not possible to drop a name without good reason. Maiden has however presented evidence for selecting Beckler's specimen ("between the Darling River and Barcoo") as lectotype of *A. cibaria* which must therefore be regarded as a synonym of *A. brachystachya.* This was done by Black (1917) though Gardner (1930) listed *A. ramulosa, A. brachystachya* and *A. cibaria.*

A. ramulosa has not been collected in Queensland often and I have little information about its usual habitat. It ranges widely from south-western Queensland, through the northern part of South Australia to Western Australia. There is a disconcerting range of variation in the thickness of phyllodes and pods in herbarium specimens and the species may prove as complex as *A. aneura.* Its nearest relative is *A. brachystachya.*

Acacia brachystachya. Turpentine mulga.

There are also some complications in the nomenclature of this species. They reveal that the confusion regarding the identity of the species of the mulga complex began almost as soon as *A. aneura* was first formally described. About nine years after it was first described, Bentham (1864) again described *A. aneura,* adding to it a description of *A. aneura* var (?) *stenocarpa,* citing one specimen (in fruit) from the Barrier Range. This description is followed immediately by Bentham's original description of *A. brachystachya,* based on a single flowering specimen from Mutanie Ranges. Both specimens were collected by Beckler on the Victoria Expedition from localities east of Broken Hill, no more than 80 miles apart; and both represent *A. brachystachya.* Bentham's failure to match fruiting and flowering specimens correctly is not uncommon and has confused the taxonomy of Australian *Acacia.* Mueller further complicated the matter by including the type of *A. aneura* var. *stenocarpa* among the types of

A. cibaria. The holotype of *A. brachystachya* is a small specimen bearing immature flowers but there can be no doubt of the correct application of the name.

A. brachystachya is closely related to *A. aneura* and even more so to *A. ramulosa*, but can be distinguished from both readily enough by its pods and less readily by its phyllodes. The phyllodes are usually thick and long, and stand stiffly erect and provide a reliable means of identifying the growing plant. Its ecology is puzzling. It grows on low stony hills or on alluvium, often intimately associated with mulga. Its range is a wide one, from south-western Queensland through the central part of South Australia to about Sharks Bay in Western Australia, rather similar to that of *A. ramulosa* but not extending quite as far north.

DISCUSSION

The present pattern of distribution of plants depends not only on environmental conditions applying at present but also on past plant distributions and environmental factors. The present distribution of *Acacia* in Australia should be considered in relation to the vegetation and climate of the Tertiary. Herbert's (1950) lucid summary of this period is taken to be substantially correct, with little alteration required from more recent work.

The climate up to at least the Eocene had been mild and uniform, but from the Miocene onwards it became drier and more seasonal. It is believed that *Acacia* which is a tropical genus has been present in the Australian region since at least the Cretaceous, though it has been definitely identified no earlier than the Miocene (Cookson, 1954). As a response to climatic change in the late Tertiary distinct areas of speciation of *Acacia* developed in the northern, the south-western, and south-eastern parts of the continent separated by arid areas unfavourable to major development of the genus. Though a few species must have been well established in these generally unfavourable areas. The climate became increasingly arid, culminating in a great arid period or periods. It is of little consequence whether this was a single arid period or an alternation of dry and less dry periods. Neither is the exact dating of the arid period of much importance, though the present distribution of *Acacia* and other genera suggests that it was earlier than mid-Recent favoured by Crocker (1959). Galloway (1971) has discussed some of the problems in reconstructing palaeoclimates.

During the arid period much of the vegetation of the central part of Australia was destroyed but it is likely that species already adapted to arid conditions persisted in refugia (Croker and Wood, 1947). With a return to more mesic conditions the arid region was recolonised by the species that had survived within the area and by invasions of species outside the area.

Löve and Löve in a series of papers mostly on Arctic and alpine plants (e.g. 1953) have postulated that polyploids are genetically better suited for survival under adverse conditions than are diploids; and Stebbins (1950) that polyploids are genetically better adapted than diploids to invade new areas recently laid bare. If then mulga were forced by general aridity of the interior into small isolated areas with favourable environmental conditions, a large gene pool would be maintained because of differences in selection pressure from one refugium to another. Polyploids either developed or were preserved in some populations. Colonisation from the refugia with the polyploids possibly having some advantage, would then result in a complex mosaic of different variants, some of which may be eliminated, but many of which may be maintained because of the wide range of the species. Successive cycles of mesic and arid conditions with expansion and contraction of mulga populations would further complicate the pattern of variation.

The isolation of some mulga populations, for example an occurrence near the southern end of Lake Buchanan, possibly indicates a recent contraction of the range of the species. Ranges of other species of *Acacia* show similar disjunctions.

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APPENDIX

Key to *Acacia aneura* and its immediate allies.

Calyx lobes free almost to base; pod flat or terete, when flat not raised over seeds alternately on each side.

Calyx lobes free to base linear but slightly thickened and expanded at apex, 0.5-1.1 mm long; pod flat constricted between the seeds or winged; phyllodes 2-17 (-24) cm × 1-12 mm, 3-90 (-120) times as long as broad.

Pods leaf-like, flat, winged (the wing up to 2 mm broad, sometimes quite rudimentary); phyllodes up to 25 cm long and 120 times as long as broad .. .. *A. aneura*

Pods constricted between seeds, 4-6 mm broad; phyllodes up to 10 cm long, up to 25 times as long as broad .. .. *A. catenulata*

Calyx lobes united at the base so that the calyx can usually be dissected from the flower intact, 0.4-1.0 mm long, linear usually not markedly expanded or thickened at the apex, usually with some hairs throughout their length; phyllodes 8-13 cm × 1.5-3 mm, 25-80 times as long as broad.

Phyllodes often terete, occasionally flat but thick; pod cylindrical, 7-9 cm long, longitudinally nerved .. .. *A. ramulosa*

Phyllodes thick but flat (never terete?); pod rather turgid, thickened (up to $2\frac{1}{2}$ mm thick rather like those of *A. aneura* but without wings turgid), 3-6 cm long .. .. .. *A. brachystachya*

Calyx lobes united for about $\frac{3}{4}$ of their length; pod flat, raised over the seeds alternately on each side, up to 5 cm long, 4-$6\frac{1}{2}$ mm broad, obscurely transversely veined; seeds obliquely transverse; phyllodes (2-)3-5(-7) cm × (0.8-)1-2.2(-3.2) mm, 10-33(-60) times as long as broad .. .. *A. clivicola*