JOURNAL of the ADELAIDE BOTANIC GARDENS

AN OPEN ACCESS JOURNAL FOR AUSTRALIAN SYSTEMATIC BOTANY

flora.sa.gov.au/jabg

Published by the
STATE HERBARIUM OF SOUTH AUSTRALIA
on behalf of the
BOARD OF THE BOTANIC GARDENS AND STATE HERBARIUM

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State Herbarium of South Australia
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Government of South Australia
Department of Environment, Water and Natural Resources

Board *of the* Botanic Gardens *and* State Herbarium

J. Adelaide Bot. Gard. 7(2): 145-157 (1985)

THE SPREAD OF NATIVE AUSTRALIAN PLANTS AS WEEDS IN SOUTH AUSTRALIA AND IN OTHER MEDITERRANEAN REGIONS

P.M. Kloot

S.A. Department of Agriculture, G.P.O. Box 1671, Adelaide, South Australia, 5001

Abstract

The native vegetation of South Australia is ill-adapted to survive disturbance such as that imposed by agriculture. Yet 10 species unintentionally introduced and 16 species deliberately introduced from other parts of Australia are established to a greater or lesser extent in South Australia. Furthermore, 15 species native to South Australia have survived the disturbance caused by agriculture and in some cases have become minor weeds.

Apart from the intentionally introduced species which are mainly woody ornamentals, the other groups consist entirely of plants having herbaceous habits. Of the 50 Australian native plants established successfully in areas overseas with a Mediterranean climate similar to that of South Australia, the majority are woody ornamentals. The reasons for this are discussed in the paper.

Introduction

The native flora of Australia is ill-adapted to withstand most of the changes wrought by cultivation, fertilizing, grazing by ruminants and rodents and competition provided by alien plants. Consequently, native plants are not a prominent part of the weed flora, in marked contrast to the importance of native plants as weeds of agriculture in North America (Reed and Hughes, 1970) and South Africa (Wells *et al.*, 1982).

In this paper plants native to Australia which have become established in South Australia, or persisting after land clearing to become regarded as adapted to present farming patterns, are compared with the Australian species which are now established in some other regions of the world enjoying a Mediterranean climate similar to that of South Australia.

The degradation of native vegetation

The inability of many native Australian plants to tolerate the levels of soil phosphate produced by the application of superphosphate has been discussed by many authors (e.g. Specht, 1963) and will not be re-examined here. The severe grazing effects of ruminants on native grasses have been ascribed to their elevated growing points which are eaten or trampled. In contrast the growing point of species adapted for grazing are at or below the ground surface, beneath the level at which animals normally graze (Moore, 1957). Whilst the native grasses survive the browsing of the native Australian marsupials, they are vulnerable to the grazing of rodents and ruminants, particularly rabbits and sheep, and there are many records of the disappearance of native grasses following European settlement of the grasslands of southern Australia (e.g. Tiver and Crocker, 1951; Moore, 1957).

The effects of cultivation *per se* have not been documented to any extent, but Moore (1957) presented data obtained from native pasture near Goulburn, N.S.W., showing that cultivation of the native perennial grasslands resulted in the elimination of the native species and their replacement by aliens. He also commented that the area is likely to regenerate if the disturbance is removed before erosion occurs. In practice this would mean virtually no disturbance beyond the initial clearing.

Analyses of lists of native and introduced species in various plant associations in South Australia reveal that the native vegetation is predominantly perennial, but the successful

Table 1: A comparison of the proportions of annuals and perennials in the native and introduced flora of various land systems in South Australia (Figures in brackets are percentages of the total number of species).

No. of Associations listed		No. of Species	No. of Perennials & Geophytes	No. of Annuals
"Sclerophyll" land systems				
8	Native	336	324 (96.4)	12 (3.6)
	Introduced	35	17 (48.6)	18 (51.4)
"Mallee" land systems				
13	Native	414	389 (94.0)	25 (6.0)
	Introduced	40	9 (22.5)	31 (77.5)
Arid Lands				
15	Native	227	180 (79.3)	47 (20.7)
	Introduced	5	0 (0.0)	5 (100)
"Savannah" land systems				
7	Native	258	223 (86.5)	35 (13.5)
	Introduced	147	53 (37.4)	92 (62.6)

— Summarised from the appendices to Specht (1972).

aliens are mainly annual (Table 1). The former are not adapted to cycles of cultivation whilst the latter are. Thus the response of each native vegetation association as a whole to the disturbance of cultivation is to disintegrate, leaving remnants along fencelines, roadsides and in other uncultivated areas.

Annual species which might have the potential to survive have still to cope with the environmental hazards of grazing, trampling, fertilizer applications and unsuitable seedbeds apart from any inherent biological factors such as low seed production or seed dormancy.

Native species spreading or persisting in South Australia

In spite of the difficulties, a number of Australian native species have become established in the heavily modified environment of the South Australian settled areas. The native species involved fall into three groups: unintentionally distributed, deliberately planted and locally persistent species.

1. Unintentionally distributed species

This group of 10 species includes those first to be established. These plants travelled mostly by stock movements, although as noted, other means were involved in one or two cases.

(*Adenostemma viscosum* Forst.

A native of sub-tropical Australia which was collected near the Murray mouth by Mueller in 1849 (Bentham, 1867), but never since. This was probably a short-lived infestation associated with coastal shipping (Kloot, 1983), and is only mentioned here because of Bentham's reference to it.)

Brachiaria notochthona (Domin) Stapf

Originally native to the interior of Australia, small populations are now established on Yorke Peninsula, at Roseworthy, Gawler and in some suburbs of Adelaide. It was recorded by

Tate (1890) as *Panicum helopus* only for the interior and north-west pastoral areas, and collected in southern areas only after 1960. It is probably associated with sheep movements as it was noted as a wool-adventive in Central Europe (Probst, 1949).

Chloris truncata R. Br.

It was originally native to the interior, but is now widely established throughout South Australia. It is common in the Adelaide area, but it was rare there in 1909 when Black (1909) noted it as only known from near the Grange railway line. Tate (1890) had recorded it from the far north and north-west of the State and I suggest that it was moved by sheep. It is also a common wool-adventive in Central Europe (Probst, 1949).

Cyperus brevifolius (Rottb.) Hassk.

This species is native to persistently wet areas in eastern Australia. It is a major lawn weed there and is found from time to time in lawns in the Adelaide area (Kloot, 1979).

Cyperus rotundus L.

The original range of this widespread tropical species extends to northern Australia. It was distributed by mistake for *C. esculentus*, and was also brought to South Australia as a contaminant of soil around nursery stock imported from New South Wales (Kloot, 1979). It is now well established in the metropolitan area of Adelaide.

Cyperus sanguinolentus Vahl

A native to swampy areas of eastern Australia and possibly introduced to South Australia in association with cattle movements (Kloot, 1979). A number of patches have persisted for many years on the Fleurieu Peninsula.

Euphorbia tannensis Sprengel ssp. *eremophila* (Cunn.) Hassall

Originally it was found in the northern parts of the State but now it is occasionally collected from near Adelaide area where short-lived populations consisting of a dozen or fewer plants are established from propagules brought from the north.

Sclerolaena birchii (F. Muell.) Domin

Although originally found in restricted areas of New South Wales and Queensland it is now spread widely in those States on land degraded by over-grazing. In spite of a policy of eradication when found, reports of its presence are increasing from the upper and mid-north of South Australia where it has been introduced adhering to sheeps' fleeces from the eastern States.

Solanum capsiciforme (Domin) Baylis

The original range of this plant extended eastward from Western Australia to Eyre and Yorke Peninsulas and Kangaroo Island. Since 1967 however, this species has been collected increasingly from sites east of St Vincent Gulf including a patch about 15 kilometres east of the River Murray on the road to Waikerie. Stock transport has been implicated in this spread. (D.E. Symon, pers. comm.).

Solanum cinereum R. Br.

This species is established in the western Flinders Ranges around Melrose from where it is spreading southwards (Symon, 1976). It was probably introduced in contaminated fodder or attached to stock from New South Wales where it is a minor weed.

Zaleya galericulata (Melville) H. Eichler

Early records (e.g. Tate, 1890) suggest that this species was originally found in the northern parts of the State, but stock movements have introduced it to Eyre Peninsula, the northern cereal areas and the Mallee. In these areas it has been frequently reported by land holders from their properties in recent years.

2. Intentionally established species

These 16 plants were introduced as ornamentals from other parts of Australia, escaped and became naturalised in higher rainfall areas, i.e. receiving more than 400 mm per annum. Although some were early introductions to horticulture, they took longer to become established beyond cultivation than the species in the previous category; in fact most had a lapse of about a century. The upsurge in the cultivation of native Australian plants during the last 30 years could lead to the naturalisation of more such species in the future.

Acacia baileyana F. Muell.

Although native to a very small area of New South Wales, near Cootamundra and Wagga, it was named by Mueller from a specimen taken from an ornamental tree growing in Bowen Park, Brisbane (Mueller, 1888). Another specimen at MEL! from the Paramatta River collected by Woolls in 1887 must have also been collected from a planted tree.

Prior to Mueller recognising and describing *A. baileyana* as a new species, it had been confused with the Queensland species *A. polybotrya*. My conclusion is that *A. baileyana* must have been collected from the wild and cultivated in various places, prior to Mueller's publication. Locally, a specimen collected by Brummitt from near Clare in 1895 (MEL!) was annotated "Possibly strayed from an old garden", which implies that it had been cultivated earlier. It must have been grown under an incorrect name, probably that of another bipinnate-leaved species e.g. *A. decurrens* or *A. dealbata*, both of which had been introduced earlier. There is no record of any attempt to grow *A. polybotrya* in South Australia. *A. baileyana* is now successfully established in the Mt Lofty Ranges, from where it was collected first as an escape in 1943. It is possibly more widespread although a record from Lochiel in mallee clearings seems doubtful. Natural hybrids with both *A. dealbata* and *A. decurrens* are known from the Mt Lofty Ranges.

Acacia cyclops Cunn. ex Don

This species is native to southern coastal areas of Western Australia and the far west coast of South Australia. It was introduced to British horticulture as early as 1824 (Loudon, 1830), but no record of it in South Australian horticulture earlier than that of Schomburgk (1871) was found. It is occasionally found on Yorke Peninsula, on the adjacent northern Adelaide Plains and on Kangaroo Island.

Acacia dealbata Link

The original range of this species was from central New South Wales south to Victoria, but it has been widely planted throughout Australia as an ornamental. It was introduced to the Adelaide Botanic Gardens by 1859 (Francis, 1859), having previously been in cultivation in England since 1823 (Loudon, 1830). It is now found widely in the Adelaide Hills around Stirling and also near Coonawarra in the south-east. A natural hybrid with *A. baileyana* has also been collected (AD!).

Acacia decurrens (Wendl.) Willd.

This ornamental was a comparatively late introduction from the eastern States (Schomburgk, 1871). It has escaped to a minor extent in the southern Mt Lofty Ranges and near Mt Gambier. A natural hybrid with *A. baileyana* has also been collected.

Acacia mearnsii De Wild.

This species is native to the eastern States and its range extends westward to the south-east of South Australia. As it was first described from cultivation in East Africa in 1925 it must have been first grown under the incorrect names of *A. decurrens* or *A. mollissima* (Whibley, 1980). Therefore it is uncertain as to when this species was introduced into cultivation. It has become sparsely established in the southern Mt Lofty Ranges and on Lower Eyre Peninsula.

Acacia paradoxa DC.

Although this is apparently native to the Mt Lofty Ranges, Adelaide Plains, Yorke and Eyre Peninsula and elsewhere (Whibley, 1980) as well as Kangaroo Island, it is the latter form which is relevant. This is a particularly thorny form, originally absent from the mainland. It was grown in the old Botanic Gardens in 1841 as "Kangaroo Island Acacia" (CSO, 1842). It had been appreciated early as a hedge plant (McEwin, 1843) and was in widespread use by 1850 (Yelland, 1970). Annotations on early herbarium specimens (e.g. AD 96871034) also refer to its use as a hedge. Bentham (1864) noted it as "an old inmate of gardens". It is likely that some of the locations mapped by Whibley (1980) for this species are actually records of escapes of the hedge form which are known from the southern Mt Lofty Ranges and occasionally elsewhere.

Acacia saligna (Labill.) Wendl.

A popular ornamental introduced early from Western Australia (Francis, 1859) which persists as scattered patches and single plants near Cleve, in the Adelaide area and in the south-east of South Australia.

Albizia lophantha (Willd.) Benth.

This was a very early introduction to South Australia from Western Australia for a two-year old specimen (Anon., 1841) was flowering in the old Botanic Gardens in 1841 (Bailey, 1841), and Mueller annotated a specimen from Adelaide in 1848 (MEL!) "Frequent in gardens". It is now found in the southern Mt Lofty Ranges, the Pt Lincoln area, the lower south-east and in the Investigator Archipelago off Eyre Peninsula. It has been suggested that this last location is a natural extension of its original Western Australian distribution (D.E. Symon, pers. comm.).

Ammobium alatum R. Br.

This native of central New South Wales had been introduced to English gardens by 1822 (Loudon, 1830) and to South Australia by 1859 (Francis, 1859). It is still grown in gardens. It was collected from a roadside at Bridgewater and consequently included in the alien flora (Black, 1909). Black's assessment was incorrect as it has never been recorded since and is only mentioned here because Black included it.)

Eucalyptus cladocalyx F. Muell.

Originally confined to three restricted areas of gravelly ironstones on Kangaroo Island, Eyre Peninsula and in the Flinders Ranges, this tree species has been very widely planted as an ornamental and for shelter-belts. From these plantings it has become sparingly naturalised in different parts of South Australia.

Hakea laurina R. Br.

An early introduction from Western Australia (Francis, 1859 as *H. eucalyptoides*) which has escaped from ornamental plantings at American River, Stonyfell, Victor Harbor and Belair.

Kennedya nigricans Lindley

This ornamental climber had been introduced by 1859 from Western Australia (Francis, 1859). It is naturalised in places in the southern Mt Lofty Ranges.

Leptospermum laevigatum (Gaertn.) F. Muell.

This shrub is native to coastal areas of New South Wales, Victoria and Tasmania. It was introduced before 1871 (Schomburgk, 1871) as an ornamental. It was also highly regarded as a sandbinder (Mueller, 1885) and may have been introduced for that purpose. It had escaped in the Victor Harbor area by 1926 (AD97137291!). It is still confined to pockets in the Victor Harbor and Port Elliot area and to small patches along the Adelaide coast between Grange and Outer Harbour. It has been found to be a vigorous invader of disturbed coastal areas in Victoria (Burrell, 1981), and may spread locally in the future.

Pittosporum undulatum Vent.

This shrub was an earlier introduction from New South Wales (Francis, 1859) and recommended as a hedge plant (Heyne, 1877). It is naturalised in the Stirling area of the southern Mt Lofty Ranges. Victorian experience suggests that this tree can compete vigorously with natural scrub (Gleadow and Ashton, 1981).

Solanum aviculare Forst. f.

A native of eastern Australia which was probably cultivated as an ornamental for its showy flowers and fruit. (D.E. Symon, pers. comm.). Locally naturalised on Eyre Peninsula.

Solanum laciniatum Ait.

A native of eastern Australia with a wide range which extends as far west as the Mt Lofty Ranges in South Australia. It has become established in the south-western extremity of Eyre Peninsula where it has spread from an abandoned homestead garden near Mt Dutton (C.R. Alcock, pers. comm.).

Sollya heterophylla Lindley

This Western Australian shrub was introduced to South Australia before 1859 (Francis, 1859) and is now firmly established near Stirling and Crafers in the southern Mt Lofty Ranges.

3. Locally persistent species

These 15 species or groups of species are native to the areas where they have successfully adapted to disturbed environments. In the cereal areas of South Australia a few native plants have managed to persist for long periods. In situations subject to disturbance but not cultivation, e.g. grazing, more native species are likely to be found, usually as diminishing relics of the original flora confined to scrub remnants, roadsides and similar pockets. Occasionally augmented populations may be favoured at least temporarily by the prevailing environmental conditions, e.g. *Danthonia* favoured by grazing and low soil phosphate levels (Tiver and Crocker, 1951; Moore, 1957), but such populations disappear with cultivation. Some annuals and short-lived perennials are able to persist even through such disturbance and these are noted below.

Some native plants have become prominent in recent years. Prior to their reappearance they had been rare in farming land but more common in the partially disturbed environments described above. It is suggested that they have become prominent for two reasons. Firstly, with a trend to longer rotations and minimum tillage practices, there is less soil disturbance

which favours these native species. Secondly, it is suggested that the consistent use of herbicides (for over 30 years) has diminished the population of aliens and allowed these native species, which tolerate the herbicides that have been used, to build up their populations in the absence of competition from aliens.

Acacia longifolia (Andr.) Willd.

This shrub is native to coastal areas of south-eastern Australia. The variety *sophorae* F. Muell. is particularly well adapted to colonising unstable coastal dune systems. In recent years, it has become a nuisance in the south-east of South Australia where it invades disturbed soil on roadsides and farmland, necessitating chemical control.

Acaena anserinifolia (Forst. & Forst. f.) Druce

This perennial is native to southern Australia including the higher rainfall areas of South Australia (Tate, 1890) but it appears to have been spread by sheep into lower rainfall areas and through its range it has become more abundant.

Calotis erinacea Steetz

This perennial species is reported as occurring in large patches in cereal-growing land around Kimba on Eyre Peninsula. Chemical control is being used (J.A. Dickinson, pers. comm.).

Diplachne fusca (L.) Beauv.

A perennial grass native to northern Australia and extending as far south as the Murray River, where in recent years it has been reported as a weed of orchards near Renmark.

Erodium cygnorum Nees

This annual is occasionally found in annual pastures but, like its introduced cogeners, rarely if ever in crops.

Euphorbia drummondii Boiss.

An annual, poisonous plant frequently found in dryland pastures, but rarely in crops.

Haloragis spp.

These perennials are now reappearing in cropping land in northern Yorke Peninsula.

Oxalis spp.

Short-lived perennials which were previously included in *O. corniculata* L. The specific identity remains doubtful as the taxonomy of this group in Australia is still unsatisfactory. Commonly found in pasture, particularly in the second year or later. *Oxalis* had been noted by Behr (1847) as appearing in pastures as early as 1844-45.

Pimelia spp.

Although some records of these perennial species undoubtedly refer to relic populations surviving in rough grazing land, there are a number of confirmed records where *Pimelia* spp. carried in sheep's fleece have been reintroduced to irregularly-cropped land in the mid-north of South Australia. In some cases the infestations have grown to paddock size and interfere with cropping.

Rumex brownii Campd.

This native dock is a short-lived perennial which is widespread in pastures on Kangaroo Island, southern Eyre Peninsula and parts of the Lower North. It is sufficiently serious as to require control measures. Seedlings may compete with young crops.

Salsola kali L.

This annual seems to be a native form which detailed taxonomic investigations might establish as a separate taxon from the Eurasian species of the same name. It is found in marginal pasture land but is less common in the crop phase of the rotation.

Solanum esuriale Lindley

The southern portion of the range of this perennial extends into agricultural areas of Victoria and South Australia where it is widespread, thriving in pastures, particularly if irrigated, orchards and on roadsides.

Stipa spp.

Speargrasses have been found to invade poor pastures towards the margins of the South Australian cereal areas and beyond. Their unpalatability, particularly as they set seed, ensures that they are rejected by grazing stock and are able to spread more or less unimpeded. The species involved are perennials.

Vittadinia spp.

Spreading from roadsides into adjoining farmland in the Lower-North where, as short-lived perennials they take advantage of longer pasture phases in the crop-pasture rotation.

Zygophyllum spp.

An annual occasionally found in pastures but not in crops in marginal farming land east of the Mt Lofty Ranges.

The establishment of Australian plants overseas

It is both relevant and illuminating to extend this survey to include the naturalization of native Australian plants in other regions of the world having a Mediterranean climate similar to that of the settled areas of South Australia. Information from floras of the Mediterranean basin, South Africa and California is presented in Appendix I. There is a clear distinction between the deliberately planted ornamentals and the other species which have been noted as wool adventives in Europe (Probst, 1949; Clapham, *et al.* 1962). However in spite of the large shipments of wool from Australia to Europe, it cannot be concluded that this was the actual means of introduction which led to the present infestations of the various species. For example both *Acaena anserinifolia* and *Alternanthera nodiflora* were grown in British gardens (Loudon, 1830) and this, or perhaps some other way, could have been the source from which present populations have developed. Similarly although Munz and Keck (1959) indicate that *Atriplex muelleria* and *A. semibaccata* were introduced as fodder plants, Probst's (1949) records of the same species as wool aliens in Central Europe suggest another potential means of entry. Admittedly this would be less likely in the case of California as the amount of wool imported there from Australia is negligible.

The importation to South Africa and California of *Atriplex* spp. as potential fodder plants resulted from the lively programmes of plant exchanges, particularly of potentially valuable species, that flourished in the second half of the last century and the first decades of this.

In South Australia, each of the 10 unintentionally introduced species and each of the 16 locally persistent species has a herbaceous habit. This is consistent with their movement being mainly by sheep in the first case and of their finding a niche in agricultural systems in the latter. With the intentionally planted species however, only two (excluding *Ammobium alatum*) are herbaceous, the remainder being woody ornamentals.

However, of the 50 species (Appendix I) that are successfully established in Mediterranean areas overseas, only 14 are herbaceous, the other 36 being woody ornamentals which were

deliberately planted. This is not surprising when the various categories of plants that are succeeding in disturbed conditions in South Australia are compared with those succeeding overseas. There is little scope for the first group as there is no movement of live sheep from Australia to the areas under consideration. The third category of locally persisting plants is obviously irrelevent. This only leaves the group of intentionally introduced plants and this class both in South Australia and overseas consists predominantly of woody ornamentals. Up to 8 of the herbaceous plants were deliberately planted, so the importance of deliberate introduction is even greater. From these data we see that the overwhelming majority of Australian plants successfully established overseas are cultivated ornamentals, mostly woody.

By contrast the proportion of the aliens naturalised in Australia that are herbaceous in habit is much larger. In a checklist of naturalised alien plants of South Australia (Kloot, in prep.) a preliminary count revealed that about 780 of the 900 species listed are herbaceous.

Contaminated pasture seed imported to Australia is a potent source of herbaceous aliens from Europe. This particularly applied to last century when so many were introduced, but the threat still continues today. However there is no reciprocal movement of herbaceous native species for the recently developed export of Australian pasture seed to the Mediterranean basin, California and elsewhere, is based on certified seeds of high purity which are unlikely to contain Australian native plant seeds. The relatively few impurities are likely to be of species alien to Australia, that are able to survive under the conditions in which pasture seed crops are grown.

Apart from the species listed in this paper as being moved by sheep within Australia, Probst (1949) lists 172 endemic Australian herbaceous plants that have been recorded as wool-adventives in Europe. However, as shown in Appendix I only 5 of them are actually naturalised there—*Cotula australis*, *Limosella australis*, *Acaena anserinifolia*, *Alternanthera nodiflora* and *Tetragonia tetragonoides*—and the latter three are known also to have been introduced intentionally for horticultural purposes.

Although there are many Australian plants that can be dispersed effectively, few have become established overseas, even compared with the number that have become established in the similar climatic region of South Australia. Two reasons are suggested.

Firstly, sheep pick up plant propagules when grazing. Whether a live sheep is moved near or far, it is eventually returned to an open paddock and should the propagules fall from the fleece then they fall into an environment somewhat similar to where they originated. On the other hand, if the sheep is shorn or slaughtered only the fleece is moved with its load of plant propagules ("vegetable fault") to a factory and the propagules may never come in contact with the soil. In the past, wool shoddy has been used as a mulch in orchards and the like (Hayward and Druce, 1919) and where seeds have survived the wool-scouring processes they may germinate and become established, at least casually.

Secondly, as discussed at the beginning of this paper, most Australian plants are not well adapted to disturbance and compete poorly with plants that evolved in other parts of the world in disturbed conditions as found in agriculture. Furthermore, the herbaceous plants do not even have the advantage of height as do those woody ornamentals which have succeeded overseas.

It is noticeable that in the area of Mediterranean climate that has been the most degraded for the longest period i.e. the Middle East, very few Australian species have yet become established there according to the Floras and weed lists that have been located. Five chenopods originally introduced to Israel as potential fodders have become sparingly naturalised there on roadsides (Dafni and Heller, 1982). Even without their indigenous burden of predators and parasites, even the most aggressive Australian plants do not have sufficient vigour or the appropriate habit or growth cycle to compete.

The coincidence of names in Appendix I with those listed earlier for South Australia is significant. It suggests that a small number of Australian plants are sufficiently "agressive", or perhaps "weedy", to be able to compete successfully in disturbed ecosystems of similar structure in different parts of Australia, and indeed, in some parts of the world. It would seem worthwhile that quarantine measures should be enforced for those areas presently free of these particular species.

Acknowledgements

I am grateful to Mr D.E. Symon and Mr C.R. Alcock for their constructive comments on the manuscript.

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APPENDIX I

Australian plants naturalised in other Mediterranean areas of the world

Species	Australian distribution	Europe	South Africa	California	Method of Introduction Deliberate*	Possible wool adventive
Acacia cultriformis A. Cunn.	Qld. & N.S.W.	Ref. 3			x	
A. cunninghamii Hook.	Qld. & N.S.W.	3			x	
A. cyclops Cunn. ex Don	W.A. & S.A.	1,3	4		x	
A. dealbata Link	S.E. Aust.	1,2	4		x	
A. decurrens (Wendl.) Willd.	E. Aust.		8	6	x	
A. ligulata Cunn. ex Benth.	Mainland Aust.	3			x	
A. longifolia (Andr.) Willd.	S.E. Aust. coasts	1,2,3	4	6	x	
A. mearnsii De Wild.	E. Aust.	1,2	4		x	
A. melanoxylon R. Br.	E. Aust. high rainfall	1,3	4	6	x	
A. paradoxa DC.	Southern Aust.		4		x	
A. pravissima F. Muell.	N.S.W. & Vic.	3			x	
A. pycnantha Benth.	S.E. Aust.	1,3	4		x	
A. retinodes Schldl.	S.A., Vic. & Tas.	1,2,3		6	x	
A. saligna (Labill.) H. Wendl.	W.A.	1,2,3	4		x	
A. verticillata (L'Her.) Willd.	S.E. Aust.	3			x	
Acaena anserinifolia (Forst. & Forst. f.) Druce	S.E. Aust.	1		7		9,10
Albizia lophantha (Willd.) Benth.	W.A.	3	4	6	x	
Alternanthera nodiflora R. Br.	Mainland Aust.	1				9
Atriplex lindleyi Moq.	Inland Aust.			6	x	
A. muelleri Benth.	Mainland Aust.		4		x	9
A. nummularia Lindl.	Mainland Aust.			6	x	
A. semibaccata R. Br.	Mainland Aust.		4	6	x	9

Appendix I *(Continued)*

Species	Australian distribution	Europe	South Africa	California	Method of Introduction Deliberate*	Possible wool adventive
A. vesicaria Hew. ex Benth.	Mainland Aust.			7	x	
Bromus arenarius Labill.	? Mainland Aust.			6		9
Chenopodium pumilio R. Br.	Mainland Aust.			6		9
Cotula australis (Sieber ex Spreng.) Hook. f.	Southern Aust.	1		6		9
Danthonia pilosa R. Br.	Southern Aust.			6		9
Eucalyptus botryoides Sm.	N.S.W. & Vic. coasts	1			x	
E. camaldulensis Dehnh.	Mainland Aust.	1,2		7	x	
E. globulus Labill.	N.S.W., Vic. & Tas.	1		6	x	
E. gomphocephala DC.	W.A.	1			x	
E. lehmanii Preiss	W.A.		4		x	
E. polyanthemos Schauer	N.S.W. & Vic.			6	x	
E. resinifera Sm.	Qld & N.S.W. coasts	1			x	
E. robusta Sm.	Qld & N.S.W.	1			x	
E. rudis Endl.	W.A.	1			x	
E. tereticornis Sm.	East. Aust.	1		6	x	
E. viminalis Labill.	S.E. Aust.	1			x	
Hakea gibbosa (Sm.) Cav.	Qld & N.S.W.		4		x	
H. salicifolia (Vent.) B.L. Burtt	Qld & N.S.W.	1			x	
H. sericea Schrad. & Wendl.	S.E. Aust.	1	5		x	
H. suaveolens R. Br.	W.A.		4		x	
Helichrysum bracteatum (Vent.) Andr.	Throughout Aust.	1			x	
Leptospermum laevigatum (Gaertn.) F. Muell.	Vic, Tas, & N.S.W. coasts		4		x	
Limosella australis R. Br.	Southern Aust.	1				9
Myoporum insulare R. Br.	Southern Aust.	1	4		x	
M. tenuifolium Forst.	Mainland Aust.	1			x	
Oxalis exilis A. Cunn.	E. Aust.	1			x	
Pittosporum undulatum Vent.	N.S.W.	1			x	
Tetragonia tetragonoides Pallas (O. Kuntze)	E. Aust. coasts	1		6	x	9
Total Number of Species		35	18	19	43	10

* Deliberate introduction—as ornamentals, fodder plants or for tanning, sandbinding or swamp drainage purposes, based on one or more of the references shown.

Note: *Rumex brownii* Campd. is naturalised in Britain (10), although it is not recorded in

the "Flora Europaea" (1). It is native to southern Australia and is a wool alien (9,10). *Myriophyllum verrucosum* Lindl. is also recorded from Britain (10) but not recorded in the "Flora Europaea" (1). It is a plant of very wet areas cf. *Cotula australis, Limosella australis*, but its introduction in Britain is obscure. The record of *Senecio lautus* Sol. (10) is probably the South African species *S. inaequidens* DC. (see Chater & Walters, 1976).

References: 1. Tutin *et al.* (1964-1980)
2. Davis (1965-1982)
3. Meikle (1977)
4. Adamson & Salter (1950)
5. Henderson & Anderson (1966)
6. Munz & Keck (1959)
7. Munz (1968)
8. Whibley (1980)
9. Probst (1949)
10. Clapham, Tutin & Warburg (1962)