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EARLY RECORDS OF ALIEN PLANTS NATURALISED IN SOUTH AUSTRALIA

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Abstract

A search of collections and early literature revealed that 101 species of alien plants were naturalised in South Australia by 1855. Another thirteen alien species were erroneously recorded as naturalised and native taxa were mistakenly identified as alien species in a further seven instances. All of the species are presented in an annotated list, including citations of relevant specimens. Observations by various botanists on alien plants in that period are reviewed. Of the established species, 90 originated in Europe, and 55 are known to have been introduced on purpose.

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Introduction

An earlier paper (Kloot, 1980) critically reviewed the first publication specifically devoted to the naturalised plants of South Australia (Schomburgk, 1879). The literary material relating to this subject prior to Schomburgk's pamphlet is extremely scanty and may be divided into two classes according to its reliability. The first is the material published by botanists. The literary references in this case are largely supported by specimens although, unfortunately, there has been some loss due to the misplacement of material and the unsatisfactory curation of various collections in the past. Material of the second class is both fragmentary and scattered and consists of the passing comments of agriculturalists, gardeners and others on naturalised plants, generally weeds. There is great variability in the reliability of these references, and one requires a knowledge of the commentator and the names, colloquial and botanical, that were used at different times and in different places.

In this paper, publications by the more reliable botanists are reviewed in chronological order and the other references that have been located in contemporary publications are considered in relation to them.

Plant Introduction and Naturalisation

Although it has not always been done in the past (e.g. Ewart and Tovey, 1909; Piggin, 1977) it is essential to make the distinction between introduction and the later process of naturalisation. The former may be accidental or intentional. Where plants were introduced on purpose there were a number of motives, some of which, with hindsight may seem strange. Pasture, crop and culinary plants were obvious choices for introduction but there were also ornamentals, hedge plants, medicinals, fibre plants, vermifuges and "novelties", a number of which subsequently escaped from cultivation. Regardless of their manner of introduction, naturalised species are those which, having been introduced, maintain themselves indefinitely (or at least through several generations) in the wild or in man-made habitats without feeding or cultivation (Wace, 1978).

In the case of aggressive plants, the ruderals or weedy species, the period between introduction and naturalisation may be as little as one growing season but with slower growing woody trees and shrubs there may be over 100 years between the documented introduction of a species and its naturalisation. Furthermore the majority of plants that have been introduced have not escaped to become naturalised although it may be allowed that many could do so in the future.

The respective documentation of each of the two processes is quite different. Introduction is supported by nurserymen's lists, botanic garden catalogues and other records provided by the earliest introducers often proclaiming the virtues of their introductions for whatever purposes they deemed them fit. However, naturalisation was not recorded except as an afterthought to the writings of botanists who concentrated on the native flora or to the passing comments of people affected one way or another, usually adversely, by the introduced plants.

Furthermore, apparent records of naturalisation must be supported by other evidence that the plants were truly naturalised at that time. Here annotations to herbarium sheets are invaluable as are comments published by independent observers. A single or a few specimens can be misleading and examples will be given later where species were wrongly considered to be naturalised on such a basis.

The First Collectors

The first botanical collections made in South Australia were those assembled by Robert Brown in 1802. Prior to the voyage of Matthew Flinders, in which Brown participated, there was no known European contact with South Australia although Wace (in press) concludes from a passage in Flinders' logbook that there could have been sealers off the South Australian coast at that time. As would be expected, Brown's collections do not contain any alien plants but are mentioned here because of an error associated with one of the specimens.

Bentham (1868) cites a specimen of *Heliotropium europaeum* L. collected by Brown at the top of Spencers Gulf. As this species is recognised by all authorities as being introduced to Australia from Europe, this early collection is clearly anomalous. Black (1909) considered it to be another species, *H. eichwaldii* Steud., but more recently D.E. Symon (pers. comm.) has advised me that the specimen is very poor and its identity is uncertain; it is possibly a species of a native genus.

The next botanical collections from South Australia were those made by and for Governor George Grey in the early 1840s, and were lodged in his wife's name (Mrs. Eliza Lucy Grey) at the British Museum (Natural History) (Lanjouw and Stafleu, 1957). Some sheets of *Lythrum salicaria* L. were found in Melbourne (MEL!). One is dated

27 December 1843 and annotated "Flats at the other side of the river going to Burra" whilst the other dated December 1843 is labelled "Plants growing in the watercourses north Para river". The flats were where the main road crossed the North Para River at Gawler. This ford was at the edge of a property "Clonlea" owned by John Reid whose daughter later wrote about the early days. Amongst other things she wrote ". . . . and I collected and dried all the flowers (new) we could find to give to Captain Grey who was making a botanical collection" (Mahoney, 1928). To Elizabeth Sarah Mahoney (nee Reid) *Lythrum* must have been a "new" plant but as the Reids came from Northern Ireland where this plant is less common (Perring and Walters, 1976) perhaps they did not recognise a fellow immigrant. On the other hand karyotypic differences are known to exist between Australian and European forms of the species, the former being diploid ($2n = 30$) and the latter tetraploid (Curtis, 1963; Webb, 1968). If it is an alien plant that arrived after European contact its presence at Gawler could be explained by the movement of propagules on sheep travelling north from Adelaide. The collection site, being well watered flats, would have been a convenient site to break the journey northwards. However, it is more likely to be a typical semi-aquatic plant that is moved about on birds' feet (Ridley, 1930) and although it originated in the northern hemisphere its appearance in South Australia may have preceded the advent of Europeans. It may be relevant that Brown (1814) recorded it as "native to both Terra Australis and Europe" which implies that it must have been well established when he collected it. Also Schlechtendal (1847) recognised the specimens collected by H.H. Behr near Tanunda as an Australian form *L. salicaria* f. *tomentosum* which differed from the European taxon, a distinction that could reflect differences in ploidy. A future examination of the material at BM may reveal other specimens and hopefully there may be one or more species of less doubtful provenance.

The German Collectors

In 1844 a period of intense collecting around Adelaide and the settled areas began. As most of the botanists involved were German the group as a whole has been so labelled. W. Hillebrand and W. Blandowski collected in the Adelaide area. Behr was active in the Barossa Valley and C. Wilhelmi collected near Port Lincoln. E.G. Sealy and H. Heuzenroeder were active on Kangaroo Island and F.J.H. Mueller ranged more widely. These workers traversed well-established areas and they collected alien as well as native plants. There were other explorations such as those of Charles Sturt to the interior from 1844 to 1846 but these did not record introduced plants. This period of activity ended within 10 years when all of the botanists listed left South Australia for various reasons or ceased collecting. Apart from the botany undertaken during the major expeditions into the interior of Australia there was little activity in South Australia until the late 1870s.

The collections assembled by the botanists enumerated above, apart from Behr's first collection, found their way to George Bentham at Kew, England either through his main collaborator Mueller at Melbourne, or through a parcel of South Australian material sent in 1864 by George Francis, the first Director of the Adelaide Botanic Gardens, to Sir William Hooker, the Director of the Kew Gardens. The Mueller material was returned to Melbourne and remains there but the material sent from Adelaide, although returned, has since disappeared.

The material gathered by these collectors will be discussed below, but before this, the writings of two of them on alien plants in South Australia will be examined.

H.H. Behr

Dr. Hermann H. Behr made two trips to South Australia from 12 September 1844 to

9 October 1845 and from 6 November 1848 to some time in 1849 (Kraehenbuehl, 1981). In 1847 he published an article in *Linnaea* (Behr, 1847) on the flora of South Australia. This was translated by Richard Kippist of the Linnean Society and published four years later (Behr, 1851). After describing the native flora he concluded with the following paragraph:

"The Australian flora has been but little enriched by any European plant except cultivated ones. We find indeed here many that are identical with European plants but the native home of most of them is a very critical (kitzlicher) point while the Australian burgher right (Burgherrecht) of others is beyond all doubt. As might naturally be expected my researches upon this point have not led to any certain results. The following plants appear however to me to be unquestionable immigrants viz. *Lolium temulentum*, *Centaurea cyanus* (rare), *Capsella bursa*."

It should be noted that Behr's article referred to his observations during his first visit to South Australia. The collection from this visit is now in Halle but enquiries there did not succeed in locating the particular species cited. However, from other sources, the following information has been assembled.

Lolium temulentum

This name was used indiscriminately for annual forms of *Lolium* found in crops, a generalisation that goes back to Linnaeus (1753). It is an obligate crop weed (Zohary, 1962) introduced with contaminated grain. Possibly it grew only in crops for which the seed had been imported as *L. temulentum* L. is very rare in South Australia. Available evidence (Kloot, unpubl. data) suggests that *L. rigidum* would probably have been more important particularly in crops grown from locally produced seed. Therefore, many agronomic references and botanical records of *L. temulentum* actually refer to *L. rigidum* or even other *Lolium* spp. The results of investigations in this matter will be presented elsewhere.

Centaurea cyanus

This species, cornflower, has never been recorded as naturalised in South Australia. Two possible explanations are suggested. Firstly, this species was a common contaminant of grain in Europe (Loudon, 1835). It may have been imported in grain from there and grown in the subsequent crops but failed to set seed and persist under local conditions. Alternatively, as Behr wrote the article after he left South Australia he may have remembered incorrectly the blue-flowered *Cichorium intybus* L. as *Centaurea cyanus* L. which is similarly-coloured. *C. intybus* was a very early introduction having been sown by the first settlers (Capper, 1838) and known to have persisted from the first plantings (Anon., 1878).

Capsella bursa

This is *C. bursa-pastoris* L., shepherd's purse, a weedy species that is widespread throughout the world. It originated in Eurasia, but its introduction to South Australia is unknown. It was collected by Mueller in 1848 around Adelaide (MEL!). Behr's reference was supported by a specimen which Schlechtendal verified and was included in his enumeration of South Australian plants collected by Behr (Schlechtendal, 1847). Unfortunately the specimen itself could not be found (K. Werner, pers. comm.). Schlechtendal noted that *C. bursa-pastoris* was found in cultivated places, waste places and abandoned sheep camps. In England, it was noted as a crop weed and hence a potential seed contaminant (Loudon, 1835).

In a paper many years later Behr (1891), whilst discussing the provenance of a species of the California flora which was being debated at that time, made passing reference to two species whose "sudden invasion" of South Australia he had seen. Because of the short periods that he was in South Australia, I suggest that the "sudden invasion" did not occur during either of his visits but rather in the years between his visits i.e. from 1845 to 1848. The two species were *Silybum marianum* L., variegated thistle, in the past more usually known as milk thistle, and *Cotula coronopifolia* L., batchelors' buttons.

Silybum marianum

According to Schomburgk (1879) this was said to have been introduced as a garden plant in 1846. This supports the suggestion made earlier that it was introduced between 1845 and 1848, but no other evidence has been found for Schomburgk's quite definite assertion as to the date. There are no collections by Mueller, and Bentham (1867) does not record it for South Australia. Yet by 1851 it had spread to such an extent that it was included specifically in the Thistle Act of that year.

Cotula coronopifolia

This very early introduction to Australia was collected by R. Brown at Port Jackson, N.S.W., between 1802 and 1804—MEL! (Britten, 1906). It was collected widely by Mueller around Adelaide and found in wet areas throughout the State in later years (MEL!). Its widespread distribution in this State and Australia generally led Bentham (1867) to conclude that it was native. But Mueller (1868) unequivocally considered it to be an early and successful introduction from South Africa. Later authors (e.g. Robertson, 1957; Willis, 1972) have persisted in the error of regarding it as a native. No other evidence for the date of introduction has been found.

F.J.H. Mueller

Dr. Ferdinand Mueller lived in South Australia from 15 December 1847 to late 1852 (Gemmell, 1975; Churchill *et al.*, 1978). Two papers which refer to introduced plants in South Australia were located. There are other references to introduced plants in general, some of which are mentioned in the present paper. Mueller's greatest contribution to the subject is his collection which will be discussed below.

In the first paper (Mueller, 1850) which appeared as a letter in an Adelaide newspaper, he mentioned *inter alia* that *Gnaphalium album* (sic) had been introduced from Europe and by then was growing almost everywhere. He also noted that Cruciferae and Compositae in the neighbourhood of Adelaide had so changed the appearance of the land that apart from the eucalypts, the vegetation appeared more European than Australian.

Gnaphalium luteo-album

Mueller used the name *G. album* in error. Bentham (1867) cited widespread locations from all parts of Australia. The species is very variable and its provenance is uncertain. Drury (1970) noted that the section of the genus to which this species belongs, is centred in the Indo-Malay region, from where it has spread widely and it is possible that distinct European and Australian forms exist. European forms may have been introduced to Australia after settlement but most authors regard it as being native to Australia. One exception was Schomburgk (1875) who listed it as one of the more troublesome weeds of the State at that time, and in the context implied that it was introduced. Mueller's statement, whilst unequivocal, may be only partly correct. It may have been present before settlement, but the disturbance of the native vegetation

presented it with much larger areas suitable for its success than had been previously available.

Regarding the Cruciferae and Compositae, Bentham (1863) recorded nine species of the former as being present in South Australia whilst fifteen species of Compositae were recorded by Bentham (1867). However, one was a misidentification, and there were at least two others not recorded by Bentham or collected by Mueller in South Australia. These were *Cirsium vulgare* and *Silybum marianum* which were the targets of the Thistle Act of 1851. Apart from these two thistles all other species alluded to here are represented by specimens at MEL!

The second paper (Mueller, 1853) is a translation by Richard Kippist of an article written in German. This concerned the native flora but in two places referred to naturalised plants. Firstly (p. 67), he wrote ". . . nearly 100 species are already to be added [to the native flora], which, having migrated, partly from Europe, partly from the Cape, have become naturalised here, beyond the possibility of extirpation". It will be shown later, mostly from Mueller's collections, that there were 101 species naturalised at that time in South Australia.

His second passage is "How powerfully the transforming influence of the imported vegetation acts upon the original flora may be readily observed in the neighbourhood of Adelaide, where the Australian grass, now growing only in scattered tufts, has made way for a thick turf of *Poa annua*, *Briza*, *Koeleria* etc." The passage concludes with Mueller predicting that the spreading of "nomadic grasses" in the interior would probably bring great benefits to the interior of Australia just as the country where grain was grown had already been improved by the increase in rainfall that it caused. This was an expression of the erroneous belief that "rain follows the plough" which had such disastrous results for the marginal agricultural areas of South Australia (Meinig, 1962).

Mueller, apart from mentioning the deterioration of the native flora with the spread of settlement, lists three grasses, for which the following details have been gathered.

Poa annua

This species, *Poa annua* L., winter grass, was collected by Mueller in May 1848 (MEL!) and one of his sheets has the annotation that it was frequent around Adelaide. Slightly earlier McEwin (1847) had also noted it as common in South Australia. Bentham (1878) wrote that it was regarded as abundant in South Australia but no specimens were cited. It was an early introduction to Australia having been collected by Brown at Port Jackson between 1802 and 1804 (Britten, 1906). Formerly, it was recognised as being a useful fodder grass in England providing early feed (Sinclair, 1815; Loudon, 1835), and could well have been introduced for that purpose.

Briza

Two species, *B. maxima* L., quaking grass, and *B. minor* L. shivery grass, were present in South Australia in the 1840s. The former was a popular ornamental grass (Bentham, 1878; Anon., 1879) which was introduced to South Australia before 1843 (McEwin, 1843) and it could have escaped into suitable habitats quite early. Mueller collected it at Echunga in spring, 1848 and there is another collection, possibly also by Mueller from the Torrens River in November 1849 (MEL!). Towards the turn of the century it had become well-established quite widely in moist places in the Adelaide Hills. The second species was also regarded as an ornamental in Britain (Loudon, 1830), but apart from its being grown in the Botanic Gardens I could not locate any other evidence of its horticultural use at that time in this country. By Mueller's time it was widespread in the settled areas of South Australia, and was collected by him, Blandowski and

possibly others from the Adelaide area, the Adelaide Hills, the Barossa Valley and Mount Gambier (MEL!). McEwin (1847) mentioned that he had seen a species of *Briza* in the Colony, but that it was quite rare.

Koeleria

K. phleoides (Vill.) Pers. was collected by Mueller around Adelaide (MEL!). It is a weedy grass and was probably introduced accidentally. It spread rapidly, and had reached Fowlers Bay by 1880 (MEL!). Now it is widespread throughout the State. No earlier record has been located.

The "*Flora Australiensis*" (including a complete list of species)

This monumental work was produced by George Bentham working at Kew in England between 1863 and 1878. This period is somewhat later than that of the German collectors, and it may be assumed that there would have been a considerable change in the introduced flora in the intervening period. However, for the reasons stated earlier, the *Flora Australiensis* understandably reflects the alien flora of South Australia during the period to Mueller's departure in 1851 rather than that contemporaneous with its publication. Therefore, it is appropriate to consider its array of alien plants in South Australia at this point. It should be pointed out that some species collected by Mueller were omitted from the *Flora* for one reason or another and in a few cases there is external evidence that suggests certain plants were naturalised but neither Mueller nor the other collectors gathered them and consequently they were not mentioned by Bentham.

In the following listing, all plants now considered to be alien to South Australia are included, regardless of Bentham's opinion as to their status. For completeness, the list contains all species considered to be present but those not recorded for South Australia by Bentham are discussed here later. Such names are preceded by an asterisk. Native plants which Bentham erroneously regarded as identical to overseas species and that were included in the *Flora* under that "alien" name are also noted. The species are listed in their order in the *Flora*. Where Bentham's name is not currently accepted, the present name is shown in brackets. Volume and page references, statements and quotations preceded by F.A. and enclosed in brackets are respectively cited, paraphrased or reproduced verbatim from the *Flora*. Many annotations by Mueller and others are in Latin and occasionally German. These have been translated. In a number of cases, Mueller noted the month but not the year. Such dates have been given as - ii.?. Most South Australian localities mentioned are shown in Figure 1. Hake's place is a misspelling of Hack's place, being the property of J.B. Hack at Echunga.

RANUNCULACEAE

Ranunculus aquatilis L. (*R. trichophyllus* Chaix)

(F.A. Volume I, page 10. Native. "Near Adelaide, on the Lower Murray river, etc., Behr, F. Mueller".)

Mt Barker Ck, *Mueller*, ix.1848; R. Murray, nr Wellington, *Mueller*, x.1848; Kaiserstuhl, *Mueller*, i.1849; Holdfast Bay, *Mueller*, s.d.—MEL!

The introduction of this species to South Australia from Eurasia is uncertain.

PAPAVERACEAE (FUMARIACEAE)

Fumaria officinalis L.

(F.A. I, 63. "one, at least, of the numerous forms of the European *Fumaria officinalis*

CRUCIFERAE

Nasturtium officinale R. Br. (*Rorippa nasturtium-aquaticum* (L.) Hayek)

(F.A. I, 65. "... in a few streamlets in Victoria and South Australia; but everywhere its importation from Europe could be traced".)

R. Torrens, *Mueller*, 1849; Crystal Brook, *Mueller*, xi.1851—MEL!

Introduced as a vegetable (watercress) by Mrs M. Davenport and planted at Macclesfield by 1844 when it was washed out by a flood into the Onkaparinga River from where it spread naturally or was introduced to other watercourses (Bailey, 1879; Baldwin, 1967).

Nasturtium palustre DC. (*Rorippa islandica* (Oeder) Borbas, syn. *Rorippa palustris* (L.) Besser).

(F.A. I, 65. Native. "Torrens river, near Adelaide, *F. Mueller*".)

R. Murray, *Mueller*, i. ?; R. Torrens at North Adelaide, *Mueller*, 23.i.1848; St. Vincent's Gulf, *s.l.*, *s.d.*—MEL!

Of uncertain introduction but possibly confused with the previous species.

Cardamine hirsuta L.

(F.A. I, 70. Native. "As far as the Flinders Ranges, *F. Mueller*".)

In the MEL collection there are ten specimens that were collected by Mueller and named by him *C. debilis* Banks, which Bentham cites as a synonym of *C. hirsuta*. However, they all are endemic species and have been determined as such by Dr. H.J. Hewson (pers. comm).

Alyssum linifolium Steph. ex Willd.

(F.A. I, 71. "... may possibly have been introduced from southern Europe, but it appears to be too abundant in arid desert situations to be omitted from the Flora". "Near Crystal Brook and about Spencer's Gulf, *F. Mueller*".)

Wellington on R. Murray, *Mueller*, 5.x.1848; betw. Strathalbyn and Wellington, *Mueller*, x.1848—MEL!

No specimens that could be related to Bentham's citation were found. Of unknown but early introduction.

Sisymbrium officinale L.

(F.A. I, 72. "... so well established as a roadside weed that it cannot be omitted from the Flora". "Abundant on roadsides and waste places about Adelaide, *F. Mueller and others*".)

Light River, *Mueller*, xii.?.; in waste places and roadsides about Adelaide, *Mueller*, xi.1848—MEL!

According to Schomburgk (1879) it came from Tasmania, but as it is a common plant in Europe (Fitter, 1978) it could have come direct. It was cultivated for oil in England (Loudon, 1835), and may have been introduced for that purpose.

Capsella procumbens (L.) Fries. (*Hymenolobus procumbens* (L.) Nutt. ex Schinz & Thell.)

(F.A. I, 81. Widespread plant through the Mediterranean and adjacent areas, native to Australia. "Near St. Vincent's Gulf and Lake Alexandrina, *F. Mueller*; Guichen Bay, *H. Edwards*".)

Wellington, *Mueller*, 5.x.1848; Hill R., *Mueller*, x.1851; Pt Adelaide, *Mueller*,

viii. 1852; Guichen Bay, *s.l.*, viii.1860—MEL!)

Of uncertain introduction.

Capsella bursa-pastoris Moench.

(F.A. I, 82. “. . . has now established itself in cultivated places in several of the Australian colonies”.)

About Adelaide, *Mueller*, viii.1848—MEL!

See page 96.

Senebiera didyma Pers. (*Coronopus didymus* (L.) Sm.)

(F.A. I, 83. “. . . perhaps indigenous to N. Australia, and now established in the neighbourhood of towns in almost all the colonies”.)

In valleys of Mt. Lofty Ra. and about Adelaide, *Mueller*, ii.1848; betw. Pt. Adelaide and Hahndorf, *Blandowski*, 1850—MEL!

This is a common weed of southern Europe but its introduction to Australia is uncertain.

Lepidium ruderales L. (incl. *L. hyssopifolium* Desv. and native spp.)

(F.A. I, 86. Native. “Abundant in many localities, especially about salt marshes and in waste places, *F. Mueller and others*”.)

Bentham used *L. ruderales* in error for a number of species including *L. hyssopifolium*. The latter was considered to be native but recently has been judged to be a South African species (Carolin and Hewson, 1981) possibly conspecific with *L. africanum* DC. (Ryves, 1977).

CARYOPHYLLEAE (CARYOPHYLLACEAE)

Gypsophila tubulosa Boiss.

(F.A. I, 155). In error for the native *G. australis* (Schldl.) A. Gray (See Eichler, 1965).

Silene gallica L.

(F.A. I, 155. “. . . introduced into Australia.” “. . . established in several Australian colonies . . .”.)

Bugle Ra., *Mueller*, xi.1848; nr Mt Lofty, *Mueller*, 23.xii.1848; nr the small freshwater lagoon at the Three Wells R., *Waterhouse*, s.d.—MEL!

Waterhouse's specimen would have been collected about the middle 'fifties. Three Wells River was a former name for the Cygnet River, Kangaroo Island. A collection by Tepper s.d. at AD! is annotated “Introduced by the first settlers about 1840”. Probably introduced as a grain contaminant.

Lychnis githago Lam. (*Agrostemma githago* L.)

(F.A. I, 156. “. . . has been introduced with European corn into some of the Australian colonies . . .”.)

Bugle Range, *Mueller*, 22.xii.1848—in oat and barley crops—MEL!

This is the only Australian specimen at MEL and has been included in the reference collection. It is ill-adapted for South Australia and was not collected again until 1967 when E.H. Ising made a collection at Crafers where it had escaped from a garden onto a roadside (AD96750578!). It was a common grain contaminant in England (Loudon, 1835) and thus was introduced here, but it failed to persist under local conditions. It was reintroduced later as a garden plant and is found occasionally in the highest rainfall areas of the Mt. Lofty Ranges.

Cerastium vulgatum L. (*C. glomeratum* Thuill.)

(F.A. I, 156 “. . . perhaps introduced only.” “In good soils, *Behr*”.)

Bethany, *Mueller*, ii.1848; betw. Mt Barker and R. Murray, *Mueller*, x.1848; Twofold Bay, *Mueller*, s.d.; main road betw. Pt Adelaide and Hahndorf, *Blandowski*, 22.ix.1849; Clare village, *s.l.*, 1857—MEL!

A common ruderal probably introduced accidentally very early. Collected by *Behr* in 1844-45 from fertile soils. No specific localities are cited (*Schlechtendal*, 1847). Noted as one of the most troublesome weeds by *McEwin* (1847).

Stellaria glauca With. (*S. palustris* Retz.)

(F.A. I, 158 “. . . truly indigenous, but identical with a European species”. “Extending to St. Vincent’s Gulf, *F. Mueller*”.)

Mt. Lofty Ra., *Mueller*, 10.i.1848 (2 specimens); Murray R., *Mueller*, 1851—MEL!

Another common ruderal probably introduced accidentally, very early.

Stellaria media (L.) Vill.

(F.A. I, 159 “. . . a common weed in cultivated places, especially gardens, as well as in waste places, almost all over the globe, and as such is found in most of the Australian colonies . . .”.)

Third Ck, *Mueller*, 3.ii.1848—MEL!

As *Bentham* noted, it is a common weed of gardens and also of crops (*Loudon*, 1835) and was probably introduced inadvertently.

Arenaria serpyllifolia L. (*A. leptocladus* (Rchb.) Guss.)

(F.A. I, 159 “. . . now almost naturalised in several of the Australian colonies”.)

Clare village, *s.l.*, 7.xi.1857—MEL!

This is a freely seeding annual found in cultivation, particularly in gardens and would have been introduced by the first settlers.

Sagina procumbens L.

(F.A. I, 160. Native. “St. Vincent’s Gulf, lofty ranges, etc. *F. Mueller*”.)

Mt Lofty Ra., *Mueller*, xi.?.; Adelaide, *Mueller*, 21.xi.1848—MEL! Another common ruderal, readily moved as a result of human activities.

Spergula arvensis L.

(F.A. I, 161 “. . . now dispersed over various parts of the world as a cornfield weed, and introduced as such into the Australian colonies . . .”.)

Macclesfield, *Mueller*, ix.1848—MEL!

The specimen was probably found in a crop having been introduced in contaminated seed, although it was also sown as a fodder plant in wheat stubbles in England (*Loudon*, 1835). It is not, and never seems to have been, common in South Australia.

Spergularia rubra (L.) J. & C. Presl. (includes *S. media* (L.) Presl.)

(F.A. I, 161. Native “Near Adelaide, St. Vincent’s Gulf, etc. *F. Mueller*”.)

Klemzig, *Mueller*, 1848; St Vincent’s Gulf, *Mueller*, 7.ii.1848; Murray plains, Murray R., *Mueller*, ii.1848 (2 specimens); Lake Victoria, *Mueller*, 28.iv.1848—MEL!

Other material originally identified as *S. rubra* has since been determined as *S. media*, viz:-

LeFevre Penin., *Mueller*, 16.xii.1847; Lake Alexandrina, *Mueller*, iv.1848; nr Georgetown, *Mueller*, xi.1850; Brighton, *Mueller*, xi.1852—MEL!

The reference to Lake Victoria is probably an error for Lake Alexandrina where Mueller did collect in April 1848. The specimen from Brighton could be Brighton, Victoria, as it is not certain when he actually left Adelaide for Melbourne (Churchill *et al.*, 1978).

Both these species are ruderals commonly found around gardens and waste places in Europe and could have been introduced accidentally by early settlers. But being inhabitants of sub-marshy areas, their introduction could have also been associated with the movement of birds between similar environments. The species was listed by Schlechtendal (1847) under a synonym *S. rupestris* Cambess. as having been collected by Behr in 1844-45 in seasonally flooded grassland at Bethany.

Polycarpon tetraphyllum (L.) L.

(F.A. I, 163. Native. "Near Adelaide, *Herb. Mueller*".)

Valley nr Mt Lofty, *Mueller*, 28.x.1847; Adelaide, *Mueller*, 1848—MEL!

This freely-seeding annual is also commonly found in gardens and would have been yet another inadvertent introduction.

PORTULACEAE (PORTULACACEAE)

Portulaca oleracea L.

(F.A. I, 169. Native. "Elizabeth Creek, in the interior, *Babbage's Expedition*".)

The reference here is undoubtedly to a native taxon found in the interior of Australia. The weedy species or form which is identical to overseas material was not collected in South Australia until 1885 and this could have come from escaped horticultural material (Kloot, 1980).

Calandrinia caulescens H.B. & K. (*C. menziesii* (Hook.) Torr. & Gray)

(F.A. I, 175. ". . . a common Peruvian weed has established itself in waste places about Adelaide and other parts of S. Australia".)

Grain crops Hake's (Hack's) place, *Mueller*, 22.ix.1848; Mt Burr, *s.l.*, x.1848; Parkland nr Adelaide, *Mueller*, *s.d.*—MEL!

A sheet at MEL has been annotated by Mueller "This I have never published for altho' widely spread it may prove not indigenous." From this it may be concluded that it must have been well spread amongst the native vegetation, although native *Calandrinia* spp. could have been included, as well. However, both Mueller and Bentham seem to agree that this species is introduced. Contrary to Bentham's comment, it is a North American species. Closely related species were grown in England as ornamentals (Loudon, 1830) so this species may have been introduced for this purpose. Certainly one species was available commercially from Sydney in 1843 (Anon., 1843) and as there were commercial links between Sydney and Adelaide nurserymen (Bailey, 1845), this could be further evidence.

MALVACEAE

Malva parviflora L.

(F.A. I, 186. "Four common European species [of *Malva*] have become naturalised as weeds in some of the colonies"—no localities given.)

Waste plains in Adelaide, *Mueller*, 28.xii.1847; St Vincent's Gulf, *Mueller*, *s.d.* (c. 1850)—MEL!

Probably a garden escape (Schomburgk, 1879).

Malva verticillata L.

(F.A. I, 186.)

As for the previous species.

It was possibly grown in gardens in South Australia at the time but Bentham's identifications are incorrect, the material was actually *M. parviflora* (Barker, 1977).

ZYGOPHYLLEAE (ZYGOPHYLLACEAE)

Tribulus terrestris L.

(F.A. I, 288 "N. of Lake Torrens, *McDouall Stuart's Expedition*".)

Finke R, *s.l.*, s.d.; N. of Fowler's Bay, *s.l.*, s.d.—MEL!

The cited specimens are densely hairy native forms commonly found in the interior and adjacent settled areas. The form found in the South, particularly in the Adelaide area, is an introduced form identical to overseas material that was collected only much later. The earliest collection of this form is a specimen in Black's herbarium (AD) collected at Mile End on 25.ii.1924. The material cited by Bentham is a native taxon of uncertain status.

Nitraria schoberi L.

(F.A. I, 291).

In error for the endemic species, *N. billardieri* DC. (Noble and Whalley, 1978).

GERANIACEAE

Geranium dissectum L.

(F.A. I, 296.)

In error for a number of endemic species (Carolin, 1964). However, *G. dissectum* did become naturalised much later (Symon, 1964).

Erodium moschatum (L.) L'Her. ex Ait.

(F.A. I, 297. "Has established itself as a weed in some parts of Victoria, S. Australia and W. Australia".)

North Adelaide, *Mueller*, 9.vii.1848—MEL!

Of unknown introduction but, possibly introduced on the fleeces and coats of domestic animals.

Erodium cicutarium (L.) L'Her. ex Ait.

(F.A. I, 298. "A very common weed in Europe and temperate Asia, and found in many other parts of the world, in many cases introduced, as in several or perhaps all of the Australian localities, but too widely spread now to be omitted from the Flora, even if it be not really indigenous".)

Murray R., *Mueller*, s.d. (c. 1850); nr Spencer's Gulf, *Mueller*, s.d. (c. 1850)—MEL!

Evidently introduced very early and spread widely, probably by being attached to the fleece and coats of domestic animals.

GERANIACEAE (OXALIDACEAE)

**Oxalis pes-caprae* L. See page 124.

LEGUMINOSAE

Medicago denticulata Willd. (*M. polymorpha* var. *vulgaris* (Benth.) Shinners).

(F.A. II, 186. "Waste places, Queensland, N.S. Wales, Victoria and S. Australia".)

R. Torrens, before Lofty Ra., *Mueller*, 28.xii.1848; Pt Lincoln, *Wilhelmi*, s.d.—MEL!

Probably introduced inadvertently in sheep's fleeces by the earliest settlers. The basis for Bentham citing "waste places" is not known. McEwin (1847) noted that a *Medicago* was common in some situations at that time.

Medicago sativa L.

(F.A. II, 186. "Rocky pastures, Victoria and South Australia".)

North Adelaide, *Mueller*, 6.ii.1848—MEL!

It was recorded as growing in the Old Botanic Gardens in 1841 (Bailey, 1841), but Stevenson (1839a) was able to give instructions as to the correct time to sow it, which implies that he had already had local experience with the plant. The significance of Bentham's "rocky pastures" is not known.

Melilotus parviflora Desf. (*M. indica* (L.) All.)

(F.A. II, 186. "In South Australia".)

Crystal Brook, *Mueller*, x.?.; Holdfast Bay, *Mueller*, ii.?, frequent—MEL!

Originally identified as *M. officinalis* by *Mueller*. Probably introduced as a fodder plant (Schomburgk, 1879), being confused with *M. officinalis* which was both a useful fodder in some parts of England (Sinclair, 1815) and a contaminant of harvested wheat (Loudon, 1835).

Trifolium agrarium L. (*T. campestre* Schreb.)

(F.A. II, 186. "In South Australia".)

No specimen was located. It was noted as growing at Beaudesert in 1858 (Anon., 1858). This location is unknown but the context indicates that it was in South Australia. The earliest collection located was a specimen collected by Tepper at Clarendon in 1881 (MEL!). That specimen is annotated "wild in fields, roadsides etc". This species was commonly grown in British pastures (Loudon, 1835).

Trifolium repens L.

(F.A. II, 186. "In South Australia".)

Chain of Ponds, *Mueller*, s.d. (c. 1849)—MEL!

According to an early report (Anon., 1859), this plant was introduced in two ways. It was sown by the earliest settlers at Glenelg (Holdfast Bay), as noted also by Capper (1838), and it was introduced in contaminated wheat from Van Diemen's Land.

Lotus corniculatus L.

(F.A. II, 188. Native species. "Near Bethanie, *F. Mueller*".)

The cited specimen was not located at MEL. The citation may have been based on the record of Schlechtendal (1847) of a specimen *L. corniculatus* var. *vulgaris* collected by Behr in 1844-45 in dried out creekbeds near Bethany. The status of this species is problematical as there seem to be both native and introduced forms (Burbidge and Gray, 1970). Also Eichler (1965) noted that there could be confusion between this species and *L. pendunculatus* Cav. If the determination was correct it is likely that the specimen came from cultivation, as that species is not established in that area even today, being too dry during summer.

Lotus tetragonolobus L.

(F.A. II, 188. “. . . a native of Southern Europe, has been introduced as a weed of cultivation in the Bugle Range, S. Australia, *F. Mueller*”.)

Bugle Ra., *Mueller*, ix.1850, sub-spontaneous—MEL!

No specimen from S.A. is known from AD or ADW and it was not recorded by Black (1948). *Mueller*'s specimen may have been from a garden, although it had been recommended as a potential fodder in England, having already been used for this purpose in the south of France (Loudon, 1835).

Vicia sativa L. var. *segetalis* Ser. (*V. sativa* L.)

(F.A. II, 241. “Naturalized, especially about Adelaide in South Australia”.)

On plains betw. Adelaide and Gawler, *Mueller*, ix.?.; South Australia, *s.l.*, *s.d.*—MEL!

Introduced early and grown as a fodder (Anon., 1843a). Whilst *V. sativa* var. *segetalis* is a synonym of *V. angustifolia* L. the cited specimens are, in fact, *V. sativa*.

Vicia hirsuta (L.) S.F. Gray

(F.A. II, 241. “. . . naturalized, especially about Adelaide in South Australia”.)

Bugle Ra., *Mueller*, Spring 1850, spontaneous in cornfields—MEL!

Confined even now to pockets of the Adelaide Hills. Of uncertain introduction.

ROSACEAE

Rosa rubiginosa L.

(F.A. II, 432. “. . . is said to have established itself, apparently wild, in South Australia”.)

Torrens R., nr Chain of Ponds, *Mueller*, iii.?—MEL!

This plant was introduced as an ornamental before 1839 (Stevenson, 1839). Five specimens were growing in the old Botanic Gardens at the end of 1841 (CSO, 1842). It appeared in nurserymen's catalogues e.g. McEwin, 1843; Bailey, 1845. No other evidence was found to support Bentham's statement as to its establishment as apparently wild at that time. The first references to it being weedy were much later (e.g. Anon., 1892; Anon., 1894).

Alchemilla arvensis Scop. (*Aphanes arvensis* L.)

(F.A. II, 432. “. . . in some, if not all, the Australian stations, very probably introduced from Europe”. “Mountain pastures, Rivoli Bay, *F. Mueller*”.)

A specimen—Kaiserstuhl, *Mueller*, ix.1848, MEL! has been determined by Rothmaler as a native species *A. australiana* Rothm. No specimen was found from Rivoli Bay. Black's (1909) citation of “near Gawler and Beachport” was presumably based on Bentham's locations. There are no specimens in the Black herbarium at AD although there are Tate and Tepper collections from as early as 1879 (AD!). However, if Rothmaler's taxonomic subdivision is not accepted, and the local material is considered identical to that in Europe, I have no explanation for its introduction other than as a contaminant of pasture seed.

HALORAGACEAE (CERATOPHYLLACEAE)

Ceratophyllum demersum L.

(F.A. II, 491. Native. “Murray River, *F. Mueller*”.)

Murray R. S.A., *Mueller*, ii.?.; Murray R., *Mueller*, iv.?—MEL!

The second specimen may not have been from South Australia, although in April 1848 Mueller did collect along the lower Murray River and lakes.

An aquatic plant originating in the Old World that was most unlikely to have been intentionally introduced. It probably arrived attached to water birds. Its arrival could well have pre-dated European contact.

LYTHRARIEAE (LYTHRACEAE)

Lythrum hyssopifolium L.

(F.A. III, 299. Native. "St. Vincent's Gulf, etc. *F. Mueller* and others".)

There are no specimens at MEL that could have been cited as above. However, there are two separate folders of *L. hyssopifolium* which contain slips noting that the specimens were received back from Bentham with their annotations missing. It is possible that these two specimens were those cited by Bentham. Of uncertain introduction, but unlikely to have been introduced intentionally.

ONAGRARIEAE (ONAGRACEAE)

Oenothera biennis L. (*O. stricta* Ledeb. ex Link)

(F.A. III, 302. "A plant of N. American origin, long cultivated in gardens in Europe and other countries, and readily establishing itself in waste places on river banks, etc, and now said to be naturalized in many parts of N.S. Wales, Victoria and S. Australia".)

Betw. Mt. Lofty and the city, *Mueller*, 25.xii.1847; R. Torrens bed at Klemzig, *s.l.*, 27.ii.?.; Enfield, *s.l.*, ix.?—MEL!

Probably a garden escape. *O. biennis* is the common evening primrose and it is suggested that *O. stricta* was introduced in error.

CUCURBITACEAE

Cucumis myriocarpus Naud.

(F.A. III, 318. "... is in F. Mueller's collection from the banks of the Torrens river in S. Australia, as an introduced plant".)

R. Torrens, *Mueller*, iii.1847—MEL!

This was cultivated in England under the name *C. prophetarum* Jacq. for the striped fruit which was regarded as a curiosity (Loudon, 1830). It seems likely that the species was an escape from cultivation.

FICOIDEAE (AIZOACEAE)

Mesembryanthemum aequilaterale Haw. (*Carpobrotus aequilaterus* (Haw.) N.E. Brown)

(F.A. III, 324. Native, also found on the coasts of Chile and California. "Murray river, Holdfast Bay, Salt plains on the W. side of Flinders Range, *F. Mueller*".)

The South Australian material at MEL was not located but older material from other states originally determined as *M. aequilaterale*, has been determined by S.T. Blake as *C. edulis* and *C. virescens*. Blake (1969) does not record any specimens of *C. aequilaterus* from South Australia.

Mesembryanthemum crystallinum L.

(F.A. III, 325. Native. "A common seacoast plant in S. Africa, found also on the

coasts of the Canary Islands, southern Europe, and California". "Holdfast Bay and Port Adelaide, *F. Mueller*".)

Holdfast Bay, *Mueller*, s.d.; betw. Holdfast Bay and Port Adelaide, *Mueller*, s.d.—MEL!

This was an ornamental (Loudon, 1830) which was available commercially in South Australia (e.g. Hackett, 1876). It was even recommended as a substitute for spinach (Heyne, 1871). No early record of its horticultural use was located but nevertheless its role as such may be assumed. There were no other records of it being established in South Australia until 1879 (Anon., 1879) so perhaps *Mueller*'s specimens were from cultivation.

UMBELLIFERAE

Petroselinum sativum Hoffm. (*P. crispum* (Mill.) Nyman ex Hort. Kew)

(F.A. III, 336. "About Adelaide".)

At the Torrens, upstream from North Adelaide, *Mueller*, 23.i.1848—MEL!

Introduced very early and grown in vegetable gardens (Stevenson, 1839). This is only found as an occasional escape here and there (Black, 1952) and it does not seem to persist. From *Mueller*'s location, his specimen could also have been a plant from cultivation.

Sium latifolium L.

(F.A. III, 336. "Cape Wilson and Lofty Range, *F. Mueller*".)

Mt. Lofty Ra., in creeks, *Mueller*, ii.1847—MEL!

Cape Wilson refers to a specimen collected at Wilson's Promontory, Victoria, in 1853. This is a difficult species which has caused much confusion (e.g. Black, 1909, 1926, 1952), as it is not certain whether this taxon is identical to the European *S. latifolium* or whether it is a native taxon.

Pastinaca sativa L.

(F.A. III, 336. "Near Adelaide, *F. Mueller*".)

Torrens R., *Mueller*, xi.1849—MEL!

The label on this specimen is of an unusual design which may indicate that the collection was of peculiar origin, e.g. a garden specimen. This species was also introduced as a vegetable very early (Stevenson, 1839) and it rarely escapes. Specimens have been collected four times this century from Millicent and once from the Hindmarsh Valley (AD!). One sheet at Adelaide (AD97618271) was annotated by Black thus: "I have never seen this plant wild. 12/3/17. Yes, at Millicent. 5/12/17". This plant is but adventive, persisting for short periods after cultivation.

Coriandrum sativum L.

(F.A. III, 336. "Near Adelaide".)

Nr Bethanien, *Mueller*, s.d.; gardens around Adelaide, *Mueller*, xii.1851—MEL!

The second specimen is very poor and may be misidentified. The species has never been collected outside gardens and, in my opinion was, and is, merely a garden herb. It is not part of the naturalised flora.

Daucus carota L.

(F.A. III, 337. ". . . more or less established in waste places near settlements in Victoria and South Australia".)

Third Ck, *Mueller*, i.?. Tanunda Ck, *Mueller*, iii.1852—MEL!

The carrot was an early introduction to vegetable gardens (Stevenson, 1839) and is now found wild occasionally in the south-east of this State. *Mueller's* specimens were likely to have been from or near market gardens. However, it was sown in England in pastures (Loudon, 1835).

RUBIACEAE

Galium aparine L. (*G. tenerum* Schleicher ex Grud.)

(F.A. III, 447. ". . . probably introduced". "Mount Gambier, *F. Mueller*".)

Towards R. Murray, *Mueller*, 6.x.1848; Mt Gambier, Limestone Caves, *Mueller*, i.1857—MEL!

The first specimen was also seen by Bentham but its location was omitted. A weed of cultivation probably accidentally introduced.

DIPSACEAE (DIPSACACEAE)

**Scabiosa maritima* L. (*S. atropurpurea* L.) See page 122.

COMPOSITAE

Centaurea melitensis L.

(F.A. III, 458. "A native of the Mediterranean region . . . very abundant in various parts of Queensland, N.S. Wales, Victoria, Tasmania, and S. Australia".)

On plains (parklands?) of city of Adelaide, *Mueller*, iv.?.; urban Adelaide, *Mueller*, xi.1848; on road betw. Port Adelaide and Hahndorf, *Blandowski*, 1850—MEL!

Whilst this species was recorded as an ornamental in Britain (Loudon, 1830), no local evidence for this use was found. According to Schomburgk (1879) it was introduced about 1844 but no evidence supporting this contention was located.

Centaurea solstitialis L.

(F.A. III, 458. "S. Australia, *Herb. F. Mueller*".)

Around urban Adelaide, *Mueller*, xi.1848—MEL!

The specimen upon which Bentham's citation was based was misidentified; in fact, it was *C. melitensis*. *C. solstitialis* was not definitely recorded in South Australia until 1892 (MEL!).

Carthamus tinctorius L.

(F.A. III, 458. "Near Adelaide, in the neighbourhood of gardens".)

Big Gumtree Ck, *Mueller*, x.1851 (2 specimens)—MEL!

The location is not known. It must have been a local name of no official standing. This plant would have been introduced intentionally as a dye plant, known at that time as bastard saffron (Loudon, 1835), although no very early local records could be located. However, even now it is not a naturalised plant, persisting for only a short period after cultivation.

Onopordon acanthium L.

(F.A. III, 458. "Victoria and South Australia".)

South Australia, *Mueller*, 1848; By creek, *s.l.* (*Mueller?*) 3.ii.1848—MEL!

This has always been a rare plant in South Australia (e.g. annotation to AD97642230)

and has been confused in the past with *Cirsium vulgare* and *Silybum marianum* which have both been called "Scotch" thistles at various times. It has also been confused with *O. acaulon* (AD!). However, the cited specimens appear to me to be yet another thistle which I do not recognise.

**Onopordon acaulon* L. See page 123.

**Cirsium vulgare* (Savi) Ten. See page 123.

**Silybum marianum* (L.) Gaertn. See page 97.

Cynara cardunculus L. var. *scolymus* (L.) Benth. (*C. scolymus* L.)
(F.A. III, 459. "Near Adelaide".)

On road to Mt. Lofty, *Mueller*, xii.1847—MEL!

Both *C. cardunculus* and *C. scolymus* were very early introductions (Stevenson, 1839, 1839a). The latter has never become established outside cultivation. *C. cardunculus*, however, established itself (Anon., 1881) and went on to become a major weed particularly of the Adelaide Plains, the mid-North and adjacent areas. In the older literature the names *C. scolymus* and *C. cardunculus* were often interchanged erroneously (e.g. Schomburgk, 1879).

Adenostemma viscosum Forst.

(F.A. III, 462. "Entrance to the Murray river, *Wilhelmi*. Probably introduced".)

Towards the entrance, Murray R., *Wilhelmi*, 1849; Murray, *Mueller*, s.d.—MEL!

Apparently a casual introduction from eastern Australia or some other subtropical location that failed to persist. It has never been collected from South Australia since.

Erigeron linifolius Willd. (*Conyza bonariensis* (L.) Cronq.)

(F.A. III, 495. Common tropical weed. "Near Adelaide, and other places about St. Vincent's Gulf, *Behr*, *F. Mueller*, and others".)

St Vincent's Gulf, *Behr*, 1848; R. Torrens, *Mueller*, 18.i.1848; R. Torrens, nr Nth. Adelaide, s.l., 23.i.1848; Tanunda, *Mueller*, 1.iii.1848; around Adelaide, *Mueller*, vii.1848; Gleeville, Mt Lofty Ra., *Mueller*, v.1849; St Vincent's Gulf, *Mueller*, 1851—MEL!

"Gleeville" was the property of Sir Samuel Davenport at Beaumont in the foothills of the Mt. Lofty Ranges. Bentham noted that some specimens may belong to *E. albidus* (syn. *C. albidus*). A very common weed found around settlements and probably introduced accidentally and very early.

Anthemis cotula L.

(F.A. III, 547. "N.S. Wales, S. Australia and W. Australia".)

Around urban Adelaide in waste places, *Mueller*, xi.1848—MEL!

The next specimen that was located was from Clarendon in 1881 (MEL!). It is not a common plant even now although in recent times it has been found more frequently in lawns. Attention has already been drawn to the possibility that this is really *A. arvensis* L. (Robertson, 1957; Kloot, 1980). The synonym *Maruta cotula* was used erroneously by Schomburgk for *Dittrichia graveolens* (L.) W. Greuter (Kloot, 1980).

Cotula coronopifolia L.

(F.A. III, 549. Native. "Near Adelaide and Lofty Range, *F. Mueller*; Kangaroo Island, *Waterhouse*".)

R. Torrens towards Lofty, *Mueller*, 27.xii.1847; Kensington, *Mueller*, 28.i.1848; urban Adelaide, *Mueller*, 28.i.1848—MEL!

Waterhouse's specimen was not located. This species has been discussed above on page 97.

Cryptostemma calendulacea R. Br. (*Arctotheca calendula* (L.) Levyns)

(F.A. III, 675. "... may have been introduced into Australia from the Cape". "Very common on roadsides about Adelaide, *F. Mueller*".)

Frequent in places about Adelaide, *Mueller*, 1848; Gawlertown, *Mueller*, ix.1848; betw. Pt Adelaide and Hahndorf, *Blandowski*, 22.ix.1849; Adelaide, *Blandowski*, 1850—MEL!

According to A. Molineux (1879) this plant first appeared on the banks of the Torrens, 300 yd (approx. 270m) above the first dam in 1841. Bailey (1879) also recalled that it had been introduced into Adelaide in 1840 or 1841 and soon had covered the whole of the Adelaide Plains.

According to another report two years later (Anon., 1882) it had been introduced about 38 years earlier from the Cape as a fodder plant. By 1862 (Anon., 1862) it was recorded as a common plant in the parklands of Adelaide.

Calendula officinalis L.

(F.A. III, 675. "... introduced about Adelaide, *Herb. F. Mueller*".)

Torrens R. nr Adelaide, *Mueller*, i.1848; Holdfast Bay, *Mueller*, 30.i.1848; s.l., *Mueller*, s.d. det. by Sonder in 1851—MEL!

The third specimen would have been collected by Mueller in South Australia but the locality is not known. The species was introduced as an ornamental and was being grown in the old Botanic Gardens in 1841 (Bailey, 1841). A garden escape.

Calendula arvensis L.

(F.A. III, 675. "A single specimen from Adelaide in Mueller's herbarium.")

Urban Adelaide, *Mueller*, vii.1848—MEL!

Another garden escape which is now much more widespread in South Australia than the previous species.

Hypochoeris glabra L.

(F.A. III, 677. Native. "Common, *F. Mueller* and others".)

Nr R. Torrens, *Mueller*, 28.xii.1847; nr city of Adelaide, *Mueller*, 28.xii.1847; Adelaide, *Mueller*, 20.vii.1848; betw. Pt Adelaide and Hahndorf, *Blandowski*, 22.ix.1849—MEL!

A common weedy plant, probably introduced accidentally.

Picris hieracioides L.

(F.A. III, 678. "... may be introduced". "Port Lincoln, *R. Brown, Wilhelmi*; Murray river to St. Vincent's Gulf, *F. Mueller* and others; Kangaroo Island, *Waterhouse*".)

According to Dr. H.W. Lack (pers. comm.) the material cited by Bentham is referable to *P. squarrosa* Steetz, or possibly a new taxon, both of which are endemic.

Sonchus oleraceus L. (includes *S. asper* (L.) Hill)

(F.A. III, 679. Introduced. "Mount Gambier, Bugle Range, Torrens river, etc., *F. Mueller*; towards Spencer's Gulf, *Waterhouse*".)

Adelaide, frequent, *Mueller*, 5.iii.1848; Gawler R. nr. Benthania, *Mueller*, iii.1848; Gleeville, *Mueller*, 1849; Bugle Ra., *Mueller*, iv.1850; Tanunda, *Mueller*, s.d.; towards Spencer's Gulf, *Warburton*, s.d.—MEL!

This was a very common weed that was introduced early. McEwin (1847) noted it as one of the most troublesome weeds, which grew in "incredible quantities" on newly broken ground, and grew tall and rank if allowed.

Two specimens of *S. asper* as follows:

Gawler, *Mueller*, s.d.; Mt Gambier, *s.l.*, s.d.—MEL!

In *Sonchus* there are native taxa which are difficult to separate from introduced material (see Eichler, 1965; Willis, 1972).

Cichorium intybus L.

(F.A. III, 680. "S. Australia, *F. Mueller*".)

Gawler R. and Tanunda, *Mueller*, iii.1848—MEL!

Sown by the first settlers as a fodder species (Capper, 1838) and grown in gardens as a substitute for coffee (Stevenson, 1839). An escape from cultivation, highly palatable to stock and only becoming a problem on roadsides and other ungrazed places. Also see *Centaurea cyanus* on page 96.

PRIMULACEAE

Anagallis arvensis L.

(F.A. IV, 270. Introduced. ". . . more or less established in N.S. Wales, Victoria, Tasmania, S. Australia, and W. Australia".)

On road to Mt Lofty Ra., *Mueller*, xi.1848; blue form-Hake's (Hack's) place, *Mueller*, xi.1848; Kangaroo Is., *Waterhouse*, s.d.; Hake's (Hack's) place, *Mueller*, xii.1848; Other specimens annotated "in crops" and "half wild at St. Vincent's Gulf"—MEL!

An early garden plant (Anon., 1859) but no contemporary records were located.

GENTIANEAE (GENTIANACEAE)

Erythraea australis R. Br. (*Centaureum minus* Gars. & *C. spicatum* (L.) Fritsch.)

(F.A. IV, 371. Native plant almost identical to the European *E. spicata*. "South coast, *R. Brown*; round St. Vincent's Gulf and Torrens river, *F. Mueller*; Spencer's Gulf, *Warburton*".)

C. minus Gars.

Gawler Town, *Mueller*, xi.1848; St Vincent's Gulf, *Mueller*, s.d.—MEL!

C. spicatum (L.) Fritsch.

St Vincent's Gulf, *Mueller*, s.d.; towards Spencer's Gulf, *Warburton*, s.d.—MEL!

The status of the genus in Australia is obscure particularly as *C. spicatum* is very widespread, although of Eurasian origin, and may have been present in southern Australia before European settlement. *C. minus* under the name *Erythraea centaurium* was a highly regarded medicinal plant. One sheet at MEL! is annotated "A most valuable medicine".

BORAGINEAE (BORAGINACEAE)

Borago officinalis L.

(F.A. IV, 384. "About Adelaide in S. Australia".)

About Adelaide, *Mueller*, xi.1849; Pt Adelaide, *Blandowski*, 1850—MEL!

These two specimens are identical and are annotated in *Mueller's* writing "*Borago* sp. nov." and later "*Halgania* sp. nov." Thus, although *Borago officinalis* was an early introduction to South Australia as a herb grown in gardens, *Bentham's* citation is based on the misidentification of a native *Halgania*. *B. officinalis* has never been recorded as a garden escape in this State.

Anchusa officinalis L.

(F.A. IV, 385. "S. Australia".)

St Vincent's Gulf, *s.l.*, *s.d.* det. by *Mueller*—MEL!

A later hand has annotated the sheet indicating that it could be *A. capensis* Thunb. *A. officinalis* is otherwise not known from South Australia. *A. capensis* is known as a garden escape (Black 1912). It was available to the Australian trade at least as early as 1843 (Anon., 1843) and was being sold in Adelaide in 1845 (Bailey, 1845).

Lithospermum arvense L. (*Buglossoides arvensis* (L.) Johnston).

(F.A. IV, 385. "Established in several localities in Queensland, Victoria, Tasmania and S. Australia . . .")

Clare village, *Mueller*, xi.1851—MEL!

Although no contemporary records were located, this species was noted as being common in neglected suburban gardens around Adelaide (Anon., 1875) from which I infer that it had been grown there earlier. It is possible that *Mueller's* specimen came from a garden.

Heliotropium curassavicum L.(F.A. IV, 393. Native. "Murray river, *F. Mueller*".)

Lagoons nr R. Murray, *Stuart*, ii.1848; fields nr R. Murray at Moorundie, *Mueller*, 1849; R. Murray, *Mueller*, i.1850; shady beds, R. Murray, rare, *Mueller*, ii.1851—MEL!

Apparently a native of the Americas (Brummitt, 1972) but of unknown introduction to South Australia. Its arrival may have preceded European contact although it should be noted that it was not collected by *Brown*.

Heliotropium europaeum L.(F.A. IV, 394. Native. "Head of Spencer's Gulf; *R. Brown*; in the interior, *McDouall Stuart*".)

These specimens were not seen but *Bentham* notes that *Brown's* specimens had a different aspect. This species was discussed on page 94.

CONVOLVULACEAE

**Convolvulus sepium* L. (*Calystegia sepium* (L.) R. Br.) See page 122.

SOLANEAE (SOLANACEAE)

Solanum nigrum L.(F.A. IV, 446. "probably in some of the Australian localities, introduced with cultivation." "Lofty Range, *F. Mueller*; Kangaroo Island, *Waterhouse*".)

Third Ck, *Mueller*, 10.i.1848; gullies in Mt Lofty Ra., *Mueller*, xi.?—MEL!

The first collection was mixed and consisted of *S. nigrum* and *S. opacum* A. Braun & Bouche. The name *S. nigrum* was used for a number of species, both native and introduced (Symon, 1981a) but the true *S. nigrum* is a native of Eurasia (Symon, *op. cit.*). Of uncertain introduction, probably as a garden weed.

Physalis peruviana L.

(F.A. IV, 466. Introduced. "Near Adelaide, *Blandowsky*".)

Betw. Pt Adelaide and Hahndorf, on roadside, *Blandowski*, 22.ix.1849 (MEL 91267!); Sturt R., *s.l.*, xi.1849—MEL!

Symon (1981) has drawn attention to Bentham's citation for Sturt River in N. Australia being an error for the second specimen listed here. Introduced as a minor cultivated crop plant under the name of *P. edulis* and *P. frutescens* and growing in the old Botanic Garden in 1841 (Bailey, 1841; CSO, 1842).

A minor garden escape, it was noted as growing very freely and fruiting at Second Valley in 1850 (Yelland, 1970).

Datura tatula L. (*D. stramonium* L.)

(F.A. IV, 469. "An introduced weed".)

R. Torrens, nr North Adelaide, *Mueller*, 23.i.1848, MEL501745!; St Vincent's Gulf, *Mueller*, *s.d.*, MEL501744!

A very early introduction. Bailey (1906) recalled children in Adelaide as early as 1839 eating of the plant and becoming ill. It is likely that this species was deliberately introduced by nurserymen, for Loudon (1830) indicated that it was cultivated in England at that time. Other species of *Datura* now naturalised in Australia are still grown in Europe as ornamentals (Moore, 1972). *Brugmansia fastuosa*, a synonym of *Datura metel* was recorded in early South Australian nurserymen's catalogues (McEwin, 1843; Bailey, 1845).

Nicotiana glauca Grah.

(F.A. IV, 469. "Escape from gardens".)

R. Torrens, sub-spontaneous, *Mueller*, xii.?—MEL!

This plant was introduced to Adelaide from Melbourne about 1847 by Mr. F.M. Dutton and one box was given to Bailey's Hackney Nurseries (Anon., 1894).

SCROPHULARINEAE (SCROPHULARIACEAE)

Verbascum blattaria L. (*V. thapsus* L.)

(F.A. IV, 473. Introduced. "N.S. Wales, Victoria and S. Australia".)

Brownhill Ck, *Mueller*, viii.?—MEL!

This specimen was identified as *V. blattaria* β *virgatum*. It was seen by Bentham but he recorded *V. virgatum* from Victoria only. Many species of the genus *Verbascum*, including those mentioned here, were grown in Britain as ornamentals (Loudon, 1830) but no local evidence was found.

Veronica peregrina L.

(F.A. IV, 511. Introduced. "Rocky River, *F. Mueller*", erroneously placed in Victoria.)

Rocky R., *Mueller*, x.1851—MEL!

Of unknown introduction.

VERBENACEAE

Verbena officinalis L.

(F.A. V, 36. Perhaps introduced into some localities. "Near Adelaide, *Blandowski*; towards Spencer's Gulf, *Warburton*".)

Third Ck, *Mueller*, 10.i.1848; betw. Pt Adelaide and Hahndorf, *Blandowski*, 22.ix.1849; towards Spencer's Gulf, *Warburton*, s.d.—MEL!

A native of Eurasia (Munir, 1981) previously considered native to Australia by all authorities. This species did have medicinal uses (Howes, 1974) which would have been a reason for its introduction. However, as Bentham notes the species was common on roadsides and waste places it could have been accidentally introduced. It is possible that its arrival in Australia preceded European settlement, and was an extension of its vast range in Eurasia where it is found as far south as the tropics. Recorded as growing on the banks of the River Torrens in 1837 (Backhouse, 1843), and collected by Behr in 1844-45 in rocky, damp places at Tanunda (Schlechtendal, 1847).

LABIATAE

Marrubium vulgare L.

(F.A. V, 73. "A roadside weed of European or Asiatic origin . . . and gathered by various collectors in N.S. Wales, Victoria and S. Australia".)

At Hake's (Hack's) place, *Mueller*, xii.1848 nr Spencer Gulf, *Mueller*, s.d.—MEL!

This species was used extensively for medicines and confectionery in the past (Bailey, 1943) and was being recommended to be grown more widely in South Australia for its medicinal properties as late as 1885 (Schomburgk, 1885). Yet it had been noted as densely overgrowing large spaces on the hills and in the dales of Bullaparinga (near Second Valley) as early as 1850 (Yelland, 1970). It was spread by catching in sheeps' fleeces.

Nepeta cataria L.

(F.A. V, 73. ". . . occurs in the neighbourhood of Adelaide".)

St Vincent's Gulf, *Mueller*, iii.1851—MEL!

A very rare plant that has been collected only twice in South Australia since *Mueller*'s collection (AD!). *Mueller*'s specimen may have been associated with a garden.

Rosmarinus officinalis L.

(F.A. V, 73. ". . . has been introduced into Hope Valley, Victoria, *F. Mueller*".)

Hope Valley, *Mueller*, viii.1848—MEL!

Bentham's citation is incorrect, the specimen being from South Australia. Introduced early (Stevenson, 1839) as a herb plant and used also for hedges. Not truly naturalised even now as it only occasionally persists or spreads slightly from cultivated plants. Probably *Mueller*'s collection was of such a plant.

Mentha viridis L. (*M. spicata* L. emend. Huds.)

(F.A. V, 82. Introduced. "Borders of streams, Mount Lofty Range, *F. Mueller*".)

Mt Lofty Ra., *Mueller*, i.1848; borders of streams, Mt Lofty Ra., *Mueller*, i.1848—MEL!

A garden escape introduced to South Australia by 1843 (McEwin, 1843).

Prunella vulgaris L.

(F.A. V, 87. Native to Australia as well as northern temperate regions etc. "Torrens river, *F. Mueller*; Rapide Bay, *Malpas*".)

Nr Pt Adelaide and Rapide Bay, *Blandowski*, 1850—MEL!

Bentham's citation may be based on a misreading of the extant specimen or there may have been others that are now missing. This plant was used as a medicinal and ornamental in the past (Bailey, 1943) although no local evidence for these uses was found.

PLANTAGINEAE (PLANTAGINACEAE)

Plantago coronopus L.

(F.A. V, 138. "... probably introduced into Australia". Holdfast Bay, *F. Mueller*".)

Holdfast Bay, *Mueller*, xii.1851—MEL!

Although other species of *Plantago* were sown as pasture plants, *P. coronopus* was not. Probably an accidental introduction.

CHENOPODIACEAE

**Chenopodium murale* L. See page 122.

Atriplex patula L.

(F.A. V, 173. "... probably only of modern introduction in Australia." "Holdfast Bay and Gawler Ranges, *F. Mueller*".)

Gawler R. ("fluvii Gawleri"), *Mueller*, 15.iv.1848—MEL!

The specimen from Holdfast Bay was not located and as shown the reference to Gawler Ranges is an error. This plant is generally associated with seacoasts or swampy areas and is also known as a garden weed. It was probably introduced with ballast dumped in areas suited to the plant, or with garden materials.

POLYGONACEAE

Emex australis Steinh.

(F.A. V, 262. "perhaps introduced from thence" [South Africa]. "Near Adelaide and Holdfast Bay, *F. Mueller*".)

Holdfast Bay, *Mueller*, 30.i.1848; Nth Adelaide, on roadside, *Mueller*, vii.1848—MEL!

There is a persistent story that this plant was introduced, at least, to Western Australia by the first settlers in 1830 as a potential vegetable akin to spinach. This account arose from Turner's (1912) report but I am not aware of the basis of this story.

The most plausible explanation of its introduction to South Australia, is that it came in contaminated hay brought from the Cape Colony by Dr. Nash of Marino for his horses about 1840 (Anon., 1934). If the hay was fed out in the sandy country close to the coast, the *Emex* would have been introduced into a very congenial environment. From there it was carried northward to Holdfast Bay where, according to the same source, it was very thick in the 1850s. At that time Holdfast Bay was the main port from which people, animals and goods were despatched to many places, so the plant would have been spread far and wide.

Rumex crispus L.(F.A. V, 263. Naturalised. "Barker town, *F. Mueller*".)Mount Barker township, adventive, *Mueller*, ii.1850—MEL!

Probably introduced as a contaminant in garden seeds or implements.

Rumex acetosella L. (*R. angiocarpus* Murb.)

(F.A. V, 265. Introduced.)

R. Torrens, rare, *Mueller*, i.1847; about Adelaide, *Mueller*, s.d.—MEL!

Introduced very early as a garden vegetable (Stevenson, 1839a) but evidently it escaped soon afterwards, at least in the Mt Gambier area where it was already a problem by 1862 (Anon., 1862a).

Polygonum aviculare L.(F.A. V, 267. ". . . probably introduced". "Near Adelaide, *F. Mueller*".)Around Adelaide, *Mueller*, 28.xii.1847; on roads, waste places and cultivated land around Adelaide, *Mueller*, 14.i.1848—MEL!The two labels are attached to one specimen which looks somewhat atypical. The taxonomy of this aggregate in Australia has been examined (J. Tideman, pers. comm.) and the name used here is doubtful. *Mueller*'s note of January 1848 implies that it was widespread at that time. Probably introduced accidentally, as it had a bad reputation even earlier (Sinclair, 1815; Loudon, 1835).

EUPHORBIACEAE

**Ricinus communis* L. See page 123.

URTICACEAE

Urtica urens L.

(F.A. VI, 191. "A European weed now common near buildings in various parts of Victoria, Tasmania and S. Australia".)

Wheat Gawler, around buildings and sheds, *Mueller*, viii.1848—MEL!

Wheat Gawler was a mine above Glen Osmond. This weedy species was noted by Schomburgk (1879) as being imported from Tasmania in hay about 1840.

JUNCACEAE

Juncus bufonius L.(F.A. VII, 127. Common in temperate parts of Globe. "St. Vincent's Gulf to Rivoli Bay, and the Murray, *F. Mueller, Behr*".)N. Holland austr., *Mueller*, s.d.; Torrens R., *Mueller*, 28.xi.1847; Rivoli Bay, *Mueller*, 1848—MEL!

The taxonomy of this species is difficult, as it is not certain if only one species is involved. This plant is found widely throughout the world and its presence in Australia may have preceded European settlement.

GRAMINEAE

Panicum miliaceum L.

(F.A. VII, 488. ". . . in South Australia as an escape from cultivation".)

No specimens were located. Black (1909) recorded it as cultivated as fodder and spontaneous in moist places, but he did not have any specimens in his herbarium (AD). Later collections are very scattered and suggest that it may have been associated with discarded bird seed or that it was a contaminant of other crops. It is doubtful whether it is naturalised even now.

Polypogon monspeliensis (L.) Desf.

(F.A. VII, 546. "... perhaps ... an introduced weed". "Holdfast Bay, *F. Mueller*".)
Holdfast Bay, *Mueller*, 1851 (2 specimens)—MEL!

A common weedy grass probably introduced accidentally, but as it is commonly found in wet areas, its movement by water birds must be considered a possibility.

Alopecurus geniculatus L.

(F.A. VII, 555. "... perhaps truly indigenous to Australia and New Zealand." "Spencer's and St. Vincent's Gulfs to the Murray, *F. Mueller*".)

Rocky R., *Mueller*, x.1851 (2 specimens); betw. Crystal Brook and Rocky R., *Mueller*, x.1851; R. Broughton, *Mueller*, x.1851 (2 specimens)—MEL!

A grass that is now more commonly found in the northern areas and less frequently in wetter areas. Of uncertain introduction, but it was recorded as fodder grass of wet areas in England (Sinclair, 1815).

Phalaris minor L.

(F.A. VII, 556. Perhaps introduced. "St. Vincent's Gulf, *Story*".)

Third Ck, *Mueller*, 10.i.1848 (2 specimens); Adelaide, roadsides and fields, *Mueller*, xi.1848—MEL!

According to annotations on sheets at MEL! it appears that some forms may have been introduced intentionally as cultivars, but others are weedy forms. The introductions could have been as misidentified, or as contaminants of *P. canariensis* which was grown widely, being highly regarded as horse fodder (Loudon, 1835).

Phalaris canariensis L.

(F.A. VII, 557. Introduced. "Naturalised on the seashores of Bremerhaven, *F. Mueller*".)

No specimen could be located at MEL, but many specimens collected from other places at other times and originally identified by *Mueller* as *P. canariensis* have since been correctly determined as *P. minor*. Furthermore, the locality is in doubt, as no such place is known in South Australia. Perhaps it was a European specimen. Introduced as a crop for bird seed and horse fodder.

Deschampsia caespitosa (L.) Beauv.

(F.A. VII, 587. Native. "Between Rivoli Bay and Mount Gambier, *F. Mueller*".)

Betw. Rivoli Bay and Mt Gambier, *Mueller*, s.d.—MEL!

A widespread grass, which may have been introduced prior to European settlement. It has never again been collected from *Mueller*'s station. It is now found in the Hindmarsh Valley with a further record from an Adelaide suburb.

Avena fatua L.

(F.A. VII, 588. Introduced weed. "Now established as apparently wild in S. Australia ... (*F. Mueller*)".)

Betw. Torrens and Pt Adelaide, *Blandowski*, 1851; Mt Lofty Ra., Kensington and Glen Osmond, *Mueller*, 30.xi.1851—MEL!

A cereal weed probably introduced with the original seed wheat being a common contaminant of harvested cereals in England (Loudon, 1835). By 1858, it was found on all cultivated land and was the "pre-eminent" weed of South Australia (Anon., 1858). The closely related *A. sterilis* was introduced as an ornamental grass before 1856 (Francis, 1859) but a more precise record could not be located.

Cynodon dactylon (L.) Pers.

(F.A. VII, 609. Native, but Bentham notes that Brown had suggested that it was introduced with cultivation. "St. Vincent's Gulf to the Murray, *F. Mueller* and others.")

City and Pt Adelaide, *Mueller*, 9.iii.1848; Adelaide, growing on roadsides, *Mueller*, iv.1848—MEL!

The status of this species is difficult but I feel that the forms found in the southern parts of the State are introduced. Originally imported as a fodder grass (Francis, 1959a) but heavily promoted as a turf grass (Schomburgk, 1870).

Koeleria phleoides Pers.

(F.A. VII, 639. "... may be introduced." "Adelaide and Torrens River, *F. Mueller*".)

Urban Adelaide, *Mueller*, s.d.; Torrens R., *Mueller*, s.d.—MEL!

See page 99.

Poa annua L.

(F.A. VII, 654. Introduced. Abundant in South Australia and elsewhere.)

Around Adelaide, *Mueller*, v.1848 (2 specimens) MEL!

See page 98.

Glyceria fluitans R. Br.

(F.A. VII, 657.)

In error for the native *G. australis* Hubbard. (See Eichler, 1965).

Briza minor L.

(F.A. VII, 660).

Probably of Mediterranean origin . . . of recent introduction to many parts of Australia." "Around St. Vincent's and Spencer's Gulfs, *F. Mueller*".)

Bethany, *Mueller*, 1848; Adelaide, *Mueller*, 1848; betw. Pt Adelaide and Hahndorf, *Blandowski*, 22.ix.1848; Hahndorf, *Blandowski*, s.d.; betw. Adelaide and Hahndorf, s.l., ix.1849—MEL!

See page 98.

Briza maxima L.

(F.A. VII, 660. Introduced. Established in a few localities in South Australia and elsewhere.)

Echunga, *Mueller*, Spring 1848; Torrens R., *Mueller*, xi.1849—MEL!

See page 98.

Ceratochloa unioides DC. (*Bromus unioides* H.B. & K.)

(F.A. VII, 662. "... Naturalised in a few localities in . . . S. Australia . . .").

Torrens, *Mueller*, 1848; Torrens at Nth Adelaide, *Mueller*, 29.i.1848—MEL!

Introduced a number of times as a fodder plant (Anon., 1859; annotations to specimens collected at Mt Gambier in 1869, MEL!). McEwin (1847) noted that a "brome grass (*Bromus mollis*)" was common. It is not certain which species was intended. Mueller (1873) wrote that he had noted *B. sterilis* and *B. mollis*, as well as other *Bromus* spp., as introduced in 1847. These two names were used last century for *B. diandrus* Roth. and *B. hordeaceus* L. respectively. No specimens or any further literary references of this period were located to support Mueller's observation.

Festuca bromoides L. (*Vulpia bromoides* (L.) S.F. Gray).

(F.A. VII, 663. Native. "Round St. Vincent's Gulf, *F. Mueller*".)

Kensington, Adelaide, *Mueller*, 1848; Kensington, in fields, *Mueller*, xi.1848; Hahndorf, *Blandowski*, 1848; Pt Adelaide, *Blandowski*, 1850; Bethanien, *Herb. Mueller*, s.d.—MEL!

Common weedy species of unknown introduction. Although Bentham included *V. myuros* (L.) Gmel. within his species, all the cited material is in fact *V. bromoides*.

Festuca rigida Mert. & Koch (*Catapodium rigidum*) (L.) Hubbard).

(F.A. VII, 664. "Introduced from Europe and now common about Adelaide and Hopkins River, *F. Mueller*; Lake Bonney, *Mrs. Wehl*; Port Lincoln, *S.F. Browne*".)

Urban Adelaide, *Mueller*, 21.xi.1848; St Vincent's Gulf, *Mueller*, 1848; nr Mt Gambier, *Wall (? Wehl)*, s.d.; Pt Lincoln, *Browne*, 1875; Lake Bonney, *Mrs. Wehl*, s.d.—MEL!

The specimens from Lake Bonney and Port Lincoln are from a later period than this paper attempts to cover but have been included for completeness.

A weedy grass of unknown introduction, yet as late as 1874 it was introduced to the Adelaide Botanic Gardens (Schomburgk, 1875).

Lolium perenne L.

(F.A. VII, 666. Now naturalised in several localities in South Australia and elsewhere.)

South Australia, everywhere, *Mueller*, s.d.—MEL!

Presumably Mueller did not bother to collect any further specimens, yet it is likely that there would have been much variation in the forms present, even at that time. From Linnaeus (1753) onward forms found in pastures were assigned to *L. perenne* and those from crops, to *L. temulentum*, yet it is likely that *L. rigidum* and probably *L. multiflorum* would have been present but not recognised (Kloot, unpubl. data).

L. temulentum L. (incl. *L. rigidum* Gaud.)

(F.A. VII, 667. Naturalised in South Australia and elsewhere and apparently more abundant than *L. perenne*.)

Third Ck, *Mueller*, 10.i.1848 (2 specimens, one awned, the other not); on the way to Mt Lofty Ra., *Mueller*, xi.1848 (unawned); Bugle Ra., in grain crops, *Mueller*, 4.xi.1848 (awned)—MEL!

See page 96.

L. temulentum var. *linicola* (Sond.) Benth. (*L. remotum* Schrank.)

(F.A. VII, 667. "Near Adelaide, *Blandowski*".)

St Vincent's Gulf, *Blandowski*, s.d.; Adelaide, ? *Blandowski*, s.d.; nr. Pt Adelaide, *Blandowski*, 1850—MEL!

These specimens are identical. They are difficult being too fine in their features to be *L. temulentum*. They also do not agree with *L. remotum* (syn. *L. linicola*) and I have tentatively identified them as *L. persicum*. Like *L. temulentum* this was probably a contaminant of seed grain but has failed to persist in Australia.

Hordeum murinum L. (*H. glaucum* Steud.)

(F.A. VII, 669. Introduced and now well established in South Australia and elsewhere.)

Around Adelaide, frequent in waste places and on roads, Mueller, xi.1848; Glen Osmond, on roads and around fields, Mueller, xi.1848—MEL!

Although in later years *H. leporinum* Link was erroneously included in *H. murinum* by Australian authors, during the period under review only *H. glaucum* seems to have been present in South Australia. Cocks *et al.* (1976) investigated the early history of this plant and concluded that it was an unintentional introduction from Europe, probably via the Cape Colony, as a contaminant of fodder or adhering to fleece.

Species excluded from the "Flora Australiensis"

Mueller collections

The following species although collected by Mueller were not recorded by Bentham in the *Flora Australiensis* for South Australia.

Papaver rhoeas L.

(F.A. I, 63. Recorded for Victoria but not South Australia.)

Adelaide, rare in cultivated fields, Mueller, xi.1849—MEL!

This specimen was seen by Bentham and as no Victorian specimen was found it is possible that the record for Victoria was an error. A popular ornamental in Britain (Loudon, 1830) but also known as a contaminant of cereal grain (Loudon, 1835). Uncommon even now in South Australia.

Scabiosa maritima L. (*S. atropurpurea* L.)

Entirely omitted from the *Flora Australiensis*.

Mt Lofty Range, spontaneous in places, Mueller, xii.1851—MEL!

This is an escaped garden plant which was introduced by 1843 (McEwin, 1843).

Convolvulus sepium L. (*Calystegia sepium* (L.) R. Br.)

(F.A. IV, 430. Recorded for other States but not for South Australia.)

Settlement of Adelaide, Mueller, i.1848; R. Torrens, Mueller, 23.i.1848—MEL!

The taxonomy of this species is difficult and Eichler (1965) has drawn attention to the different forms found here. It was grown as an ornamental (Loudon, 1830) but no local evidence from this period has been found.

Chenopodium murale L.

(F.A. V, 160. Recorded for Queensland, Victoria and Tasmania.)

Common about urban Adelaide, Mueller, vii.1848; Holdfast Bay, in gardens, Mueller, xii.?—MEL!

A common weed probably introduced accidentally very early. No earlier reference to it was located.

Other records

The following species were not recorded in the *Flora* nor were they known to have been collected by Mueller or the other collectors of that period, but nevertheless are believed to have been naturalised in South Australia.

Cirsium vulgare (Savi) Ten.

According to A. Molineux (1879) he first saw it close to the residence of the Governor of the Adelaide Gaol on the banks of the Torrens in 1841. By 1850, it had the reputation of being "an atrocious thistle, the curse of the Colony" (Yelland, 1970). This was the species erroneously called "Scotch" thistle and one of the species subject to the 1851 Thistle Act.

Onopordon acaulon L.

According to two reports, both unsigned but written by A. Molineux, who was a reliable observer, this species had been introduced as an ornamental by 1844 (Anon., 1891a), and had escaped into the Adelaide parklands by 1845 (Anon., 1897).

Silybum marianum (L.) Gaertn.

The other species for which the 1851 Thistle Act was introduced. This was discussed on page 97.

Ricinus communis L.

Pascoe (1901) recalled that castor oil plants were growing on a rubbish heap on the corner of King William and Currie Streets, Adelaide, during the 1840s. It had been introduced to the old Botanic Garden before 1841 (Bailey, 1841) and was being heavily promoted for its oil production by 1843 (Stevenson, 1843).

G.W. Francis

George Francis, first Director of the Adelaide Botanic Gardens, was a great admirer of Sir William Hooker of Kew. Francis dedicated his first publication to him and some years later engaged in correspondence with Hooker to seek his assistance in developing his Botanic Gardens and the associated botanical museum (Best, 1966). In a letter dated 26 May 1855, Francis (1855) added a postscript on the subject of introduced plants. This is reproduced verbatim from Best (*op. cit.*).

"P.S. Some British plants are certainly native here, as *Poa annua*, *Polygonum aviculare*—*Sonchus oleraceus*—*Hevularia glabra*—*Malva sylvestris* and two or three *Chenopodiums*—others now common but introduced as *Escholtzia californica*, *Medicago lupulina*—*Melilotus leucantha*—*Calendunia grandiflora*—*Oxalis cernua*—*Papaver rheias* . . ."

Francis' observations are not supported by any extant collections. However, *Poa annua*, *Polygonum aviculare* and *Sonchus oleraceus* had been collected by Mueller some years earlier. These species have been discussed already. *Hevularia glabra* (sic) is an error and the species intended is not known. A suggestion that this may be a mistranscription of *Herniaria glabra* seems improbable because this species has never been recorded from South Australia, but Francis may have misidentified one or more of the other Caryophyllaceae that were present at the time. *Malva sylvestris* is not known from South Australia, but *M. parviflora* was collected by Mueller about Adelaide. *Chenopodium murale* was collected by Mueller in South Australia but omitted for South Australia by Bentham (1870), as mentioned earlier. No records from that period of other alien species of *Chenopodium* have been located. *Eschscholtzia californica* has always been a rare plant outside gardens in South Australia. Perhaps another poppy was intended but there is no indication from collections what it might have been.

Medicago lupulina has always been rare and *M. polymorpha* var. *vulgaris* Shinnars, is more likely to have been meant, the latter being common in South Australia and sometimes confused with the former, which was more common in Britain. *Melilotus leucantha* is a synonym for *M. alba* Medik. but the first record that has been located for this plant in South Australia is much later (Anon., 1891), and it has always been rare. *M. indica*, on the other hand was collected by Mueller and was listed above. *Calendunia grandiflora* is probably a mistranscription of *Calendula grandiflora* which is a horticultural name for a cultivar of *C. officinalis*, which was present at that time and collected by Mueller.

Oxalis cernua L. (*O. pes-caprae* L.)

This species was introduced as an ornamental before 1841 (Bailey, 1841), but escaped and became a very serious weed. It was not collected by Mueller which suggests that it may still have been confined to gardens at that stage. Its mention by Francis implies that it had escaped and had become a troublesome weed between 1850 and 1855. No specimens from this period were located.

Conclusion

By 1855, nearly twenty years after the foundation of the Colony, there were 114 alien species recorded as naturalised in South Australia, according to the evidence presented here. This is an over-estimate because it includes *Lychnis githago*, *Lotus tetragonolobus*, *Petroselinum crispum*, *Pastinaca sativa*, *Coriandrum sativum*, *Carthamus tinctorius*, *Onopordon acanthium*, *Adenostemma viscosum*, *Borago officinalis*, *Nepeta cataria*, *Rosmarinus officinalis*, *Panicum miliaceum* and *Phalaris canariensis* which have never really become established. Furthermore, there are other species, whose status during this early stage is not really clear, although in later years they undoubtedly became established e.g. *Mesembryanthemum crystallinum*, *Buglossoides arvensis*.

Of the 101 species that I have taken to be naturalised by 1855, 90 were from Europe, 6 were introduced from South Africa, 2 arrived from North America and 3 were from South America. Nine European and one South African species were not included in the "*Flora Australiensis*". All the extra-European species with the exception of *Cotula coronopifolia*, *Arctotheca calendula* and *Emex australis* probably reached Australia via Europe, having been previously introduced there as ornamentals e.g. *Oxalis pes-caprae*, *Oenothera stricta*.

Of the total, 55 species are either known to have been imported intentionally, or there is a very strong case based on available evidence for deliberate introduction. Others are suspected but no firm evidence yet has been found.

The rate of introduction, or more correctly, naturalisation, may be examined. By 1855, as shown in this paper, 101 species were naturalised. Black (1909) included 368 plants as naturalised in South Australia at that time. At present, the number is about double that of Black's figure (Kloot, unpubl. data). Thus during the periods 1836-1855, 1855-1909 and 1909 to the present, the increase in naturalised species has been about the same, viz. an average of 5-6 species per year, a figure that approximates the equivalent figure for Victoria (Ross, 1976). However, it is somewhat higher than the figure for Queensland (Everist, 1959) which is about 4 per year. The explanation may be that the historical, social and economic links of the settlers of sub-tropical Queensland were originally with temperate regions and the species introduced, either intentionally or accidentally, from such sources are less likely to succeed in such a different ecosystem.

Early records of alien flora in South Australia are probably better than for most other States, because of the fortunate circumstances of a concentrated period of collecting shortly after settlement. Brown's activities at Sydney between 1802 and 1805 may be comparable. Further studies of the development of the South Australian alien flora are in preparation.

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