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RESEARCH NOTES

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INSTRUCTIONS TO AUTHORS

1. Papers dealing with the flora and vegetation of Western Australia will be considered for publication.

2. Style should follow that of a recent issue. All *illustrations*, including drawings, maps, graphs, and photographs, should follow a single, numbered sequence in each paper. They should be submitted in their final size for printing (maximum dimensions 15 cm x 24 cm including space for caption). *References* should quote titles of periodicals in full. Authors should suggest a *short title* for page headings.

3. Papers will be reviewed by an editorial committee. Contributions should be addressed to The Editor, Research Notes, Western Australian Herbarium, Department of Agriculture, George Street, South Perth, Western Australia 6151.

4. VOUCHER SPECIMENS: It is suggested that botanical names central to the objective of the paper be supported by specimens deposited in a recognized herbarium and that the institution be cited in the paper. It is desirable to quote, in the paper, numbers identifying specimens whose determination is uncertain. An explanatory note on the subject is available from the Editor.

5. Very short papers, presenting information such as new records of species in the State, or especially interesting observations of plants will be considered for publication in a section called "Short Notes". Intending authors should examine a recent issue for general format, or contact the Editor.

6. Responsibility for the accuracy of all information in papers, and any opinions contained therein, rests solely with the authors.

WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES

No. 5, 1981: 1 - 4

A LARGE REMNANT OF YELLOW-SAND KWONGAN NEAR BROOKTON, WESTERN AUSTRALIA

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ABSTRACT

The occurrence of a large patch of uncleared Banksia-Xylomelum *vegetation on yellow sandy soil is reported. Such vegetation has been largely cleared for agriculture. About 100 species of native plants have been recorded for the area. The desirability to ensure the perpetuity of this parcel of land in its uncleared condition is noted.*

Large blocks of uncleared land are scarce in the central and western wheat belt areas of Western Australia. Those that do remain are of especial and increasing value because they represent, to the post-pioneer generations, a little of what the landscape was like when the first agricultural settlers came to make their living. Some of these uncleared blocks are held by public Authorities for the specific purpose of flora and fauna conservation, but there are also some very valuable ones that are privately owned. Some in the latter category have been spared clearing because the owner appreciated the rich wildflower displays provided by the native bush, and he resisted the temptation to clear everything. Now he has a resource of considerable value to the heritage of both his family and his country.

One such block of uncleared, privately-owned land was discovered during the course of mapping the vegetation for the Corrigin area. It lies about 17 km NE of Brookton, (near 32°14'S lat. and 117°05'E long.). Initially, from aerial photographs, the area appeared to be a shrubland. As areas of such vegetation are not common in this part of the wheatbelt, we set out to examine it on the ground. We found it to be owned by Messrs. C.W. & K.I. Blechynden, who gave us permission to view the area. The block is entirely surrounded by cleared paddocks. On most sides it has good fences, but in some places there are either old or no fences, such that sheep can enter. It appears that sheep penetrate very little into the reserve, but other grazing and browsing animals (kangaroos and rabbits) were evident throughout the area.

The vegetation turned out to be a *Xylomelum angustifolium-Banksia attenuata/prionotes* low woodland with a thicket understorey made up of many genera and species, primarily of the families Proteaceae, Myrtaceae, Leguminosae, and Epacridaceae. We recorded 98 species of plants from the area (Table 1). The site was of about 200 ha. and lay at the top of a broad, low hill. It appeared to have a thick deposit of yellow sand, probably of

aeolian origin, blown over a lateritic base. The latter was exposed in two small areas on the eastern side and was dominated by a somewhat different suite of plants species including e.g. *Beaufortia bracteosa*, *Melaleuca seriata*, *Xanthorrhoea reflexa*.

The *Banksia-Xylomelum* vegetation is characteristic of many yellow sand plains. It once occurred widely as far north as Kalbarri National Park. The Brookton area is near its southern limits. The patch of vegetation described here is about the last remaining uncleared portion of kwongan (sandplain; Beard 1976) lying along the course of the Avon River for 40 km to the south east. The block represents a very small proportion of the yellow-sandplain vegetation that was scattered through this area.

There are two reserves, about 50 km to the north east - the Badjaling Nature Reserve (no. 23758 of 288 ha.) and the South Badjaling Nature Reserve (no. 12333 of 41 ha.). Both have been included in the Western Australian Museum's Biological Survey of the Western Australian Wheatbelt (Muir *et al.* unpublished). These surveys have shown the reserves to include *Banksia-Xylomelum* vegetation on yellow sand in their highest parts together with other kwongan down slope and salt vegetation on flats. On Reserve 23758, loc. 1.6 appears in the reports to be very similar in composition to that on the Blechynden farm. Reserve 12333 does not appear to contain anything closely similar although there is one sample with *Banksia attenuata* dominant plus *Eremaea pauciflora* and *Leptospermum erubescens*. Even in Reserve 23758 the *Banksia-Xylomelum* vegetation is of relatively limited occurrence, whereas on the Blechynden-Haily parcel it occupies virtually the whole 200 ha. Such a large area of one vegetation type has a very good chance of being self sustaining and therefore is of great value.

In view of the small number of preserved examples of the *Banksia-Xylomelum* vegetation in the wheatbelt, it would be of great value to the tangible heritage of the post-pioneer generations if the Blechynden parcel could be reserved in perpetuity.

REFERENCES

Beard, J.S. 1976. An indigenous term for the Western Australian sandplain and its vegetation. *Journal Royal Society Western Australia 59:* 55-57.

Muir, B.G., Chapman, A., Dell, J. & Kitchener, D.J. Biological Survey of the Western Australian Wheatbelt. Records of the Western Australian Museum, Supplement (unpublished).

Table 1. Plant species recorded during a survey of the Blechynden-Haily Block. Species marked with an asterisk (*) are represented by voucher specimens in the Western Australian Herbarium PERTH).

Acacia lasiocarpa Benth. var. *bracteolata* B.R. Maslin
**Acacia sessilispica* Maiden & Blakely
**Acacia spinosissima* Benth.
**Acacia lasiocalyx* C. Andrews
Actinostrobus arenarius C.A. Gardner
**Adenanthos flavidiflorus* F. Muell.
Alexgeorgea sp.
Amphipogon turbinatus R.Br.

Andersonia brevifolia Sond.
Angianthus pusillus Benth.
Anigozanthus humilis Lindl.
Astroloma ? pallidum (RH 790175)
Baeckea crispiflora F. Muell.
Baeckea ? preissiana (Schau.) Domin
Banksia attenuata R.Br.
Banksia menziesii R.Br.
Banksia prionotes Lindl.
Beaufortia bracteosa Diels
Borya nitida Labill.
? Brachyloma (RH 790174)
Calothamnus quadrifidus R.Br.
Calytrix angulata Lindl.
Calytrix brachyphylla Turcz.
Calytrix strigosa A. Cunn.
Cassytha sp.
Casuarina huegeliana Miq.
Casuarina humilis Otto & Dietr.
Casuarina microstachya Miq.
Caustis dioica R.Br.
Chorizema aciculare (DC.) C.A. Gardner
Conospermum stoechadis Endl.
Conostylis teretifolia J.W. Green
Drosera leucoblasta Benth.
Dryandra armata R.Br.
Dryandra fraseri R.Br.
Dryandra nivea R.Br.
Dryandra sessilis (R.Br.) Druce
Dryandra sp. (RH 790144)
Eremaea pauciflora (Endl.) Druce
Gastrolobium hookeri Meisn.
Gompholobium tomentosum Labill.
Grevillea acrobotrya Meisn.
Grevillea didymobotrya (Endl.) Meisn.
Grevillea eriostachya Lindl.
Hakea lissocarpha R.Br.
Hakea prostrata R.Br.
Hakea trifurcata (Sm.) R.Br.
Hakea sp. aff. *falcata* (RH 790136)
Harperia lateriflora W.V. Fitzg.
Hemiandra pungens R.Br.
Hibbertia huegelii (Endl.) F. Muell.
Hibbertia sp. (RH 790165)
Hypochoeris glabra L.
Isotropis drummondii Meisn.
Jacksonia aphylla (Turcz.) Druce
Laxmannia grandiflora Lindl.
Laxmannia sessilis Lindl.
Lepidobolus preissianus Nees.
Leptospermum erubescens Schau.
Leptospermum spinescens Endl.
Leucopogon sp. (RH 790171)
Levenhookia dubia Sond.
Lhotzkya violacea Lindl.
Loxocarya fasciculata (R.Br.) Benth.
Lyginia barbata R.Br.
Lysinema ciliatum R.Br.

Melaleuca seriata Lindl.
Melaleuca sp. ? *urceolaris* F. Muell. ex Benth.
Mesomelaena stygia (R.Br.) Nees
Muehlenbeckia adpressa (Labill.) Meisn.
**Neurachne alopecuroides* R.Br.
Nuytsia floribunda (Labill.) R.Br.
**Opercularia vaginata* Labill.
Pentaschistes airoides (Nees) Stapf.
Petrophile ericifolia R.Br.
**Petrophile media* R.Br.
**Petrophile squamata* R.Br.
**Pimelea floribunda* Meisn.
**Pimelea suaveolens* (Endl.) Meisn.
Schoenus curvifolius (R.Br.) Benth.
Schoenus globifer Nees
**Schoenus hexandrus* F. Muell. ex R. Tate
**Stackhousia pubescens* A. Rich.
Stipa sp.
Stirlingia latifolia (R.Br.) Steud.
**Stylidium bulbiferum* Benth.
**Stylidium piliferum* R.Br.
**Stylidium repens* R.Br.
Stylidium sp.
Synaphea petiolaris R.Br.
Ursinia anthemoides (L.) Gaertn.
**Verticorida acerosa* Lindl.
**Verticordia brownii* (Desf.) DC.
**Verticordia ? chrysantha* Endl.
**Verticordia insignis* Endl.
**Verticordia picta* Endl.
Xanthorrhoea reflexa Herbert
Xylomelum angustifolium Kippist & Meisn.

WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES

No. 5, 1981: 5-18

VEGETATION MAPS OF FOUR LARGE ISLANDS NEAR ALBANY, WESTERN AUSTRALIA

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ABSTRACT

Vegetation maps and commentary are provided for the four largest islands (Bald, Eclipse, Breaksea, Michaelmas) near Albany, Western Australia. The units mapped were recognized by a mixture of structural and floristic criteria. The number of units mapped ranged from four (Eclipse I.) to nine (Breaksea I.). Vegetation structure and floristics of each island are discussed briefly in the context of exposure to salt-bearing winds, geology, and nesting seabirds.

It is argued that description of the vegetation of large islands of the South-western and southern coastlines of Australia has important scientific value. These islands provide a baseline which could aid understanding of the long term effects of Aboriginal firing on the vegetation of the mainland coast.

INTRODUCTION

Bald, Eclipse, Breaksea and Michaelmas Islands, although only four of the 300 islands near the southern coastline of Western Australia, are amongst the largest. They differ markedly in vegetation because of differences in area, maximum elevation, distance from the mainland and degree of exposure and orientation to the swell (coming from the southwest).

The purpose of this paper is to provide vegetation maps with detailed commentaries for the four islands. Short descriptions of the vegetation present on smaller islands near Albany are supplied, and brief comparisons are made between the vegetation present on islands and on peninsulas and headlands on the adjacent mainland. This is a companion paper to Abbott (in press b), which deals with plant species richness of islands and coastal mainland sites near Albany, analysed mathematically.

Vegetation maps for the four large islands were constructed from extensive reconnaissance on the ground and interpretation of large-scale

aerial photographs (1:4400 to 1:15840). As in Abbott and Watson (1978) and Abbott and Black (1978) the communities mapped represent a combination of structural and floristic units.

MAPS AND COMMENTARY

1. Eclipse Island

35°11'S, 117°53'E. Area 104 ha; maximum elevation 109 m (north of centre); isolation, 6.1 km from mainland at Cave Point; orientation of long axis, east/west; degree of exposure to swell, high; visited 4-15 April 1975; rock type, granite-gneiss; number of plant species recorded, 51; usage by seabirds, four hole-nesting and one surface-nesting species breed on the island (Fullagar 1978). Recorded human disturbance: Sealers frequented the island when the settlement at King George Sound was founded in 1826 (Lockyer 1827). A lighthouse was established and manned by three families from 1926 but was automated in 1975. A fire in 1968 burnt a small portion of the NW part of the island. Rabbits are present.

The most extensive plant communities are designated *Carpobrotus* and *Zantedeschia* in Fig. 1. The *Carpobrotus* one, however, actually conceals a more diverse community. Although *Carpobrotus virescens* is nearly everywhere the dominant element, in some places other species become locally codominant and change the structure from herbland to open-heath. On the eastern hill (elevation 44 m), *Andersonia sprengelioides*, *Verticordia plumosa*, *Boronia alata* and *Dodonaea ceratocarpa* are codominant. Soils here are so poorly developed that the eastern hill is the only place on the island

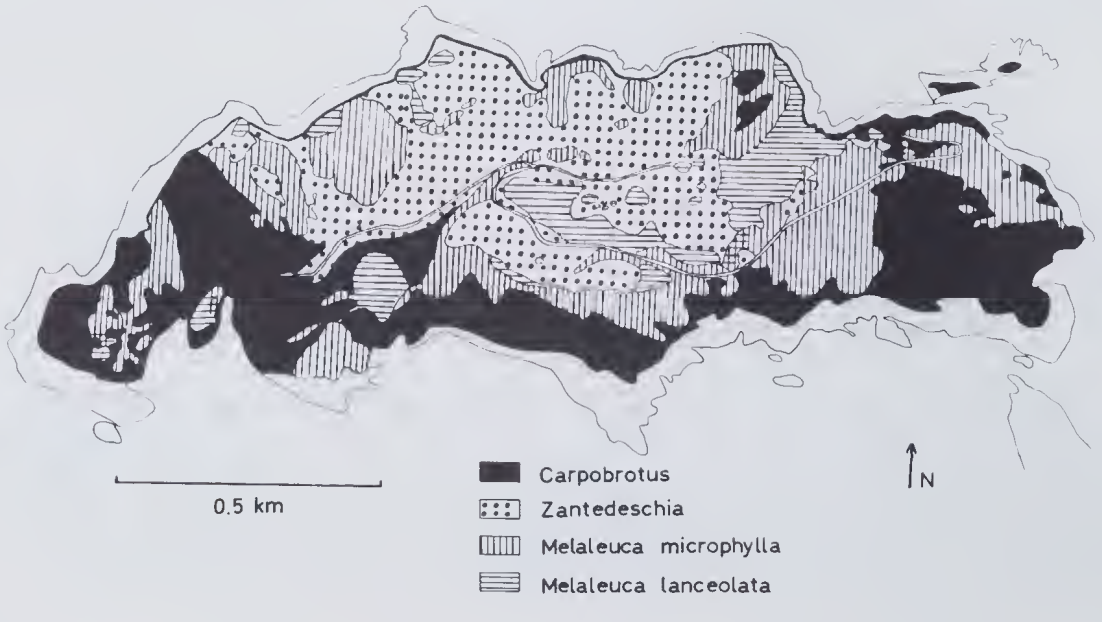

Fig. 1. Vegetation map of Eclipse Island.

lacking nesting seabirds. Nearer the coast *Calocephalus brownii, Senecio lautus, Poa poiformis, Lepidosperma gladiatum, Scirpus nodosus* and *Sporobolus virginicus* are prominent members of the *Carpobrotus* unit as mapped. With increasing distance from the sea *Boronia alata, Leucopogon revolutus, Stylidium adnatum, Verticordia plumosa, Thryptomene saxicola, Chorilaena quercifolia, Andersonia sprengelioides* and *Hibbertia cuneiformis* become more conspicuous and generally increase from 1 m to 2 m in height.

On the other hand the *Zantedeschia* community is virtually monospecific, and is best developed on the more sheltered (northern) slopes of the island. It consists of the Arum Lily *Zantedeschia aethiopica,* evidently an escape from a lighthouse keeper's garden since 1926. As it dies off in summer, much bare soil is then exposed and probably washed from the island. *Zantedeschia* grows to 1 m and clearly excludes many native species, probably those constituting the open-heath of the *Carpobrotus* community.

The remaining two communities mapped are the tallest on the island, and consist of nearly pure stands of one or other of two *Melaleuca* species. Maximum heights reached are 6 m (*M. microphylla*) and 12 m (*M. lanceolata*). The tallest *M. lanceolata* trees are restricted to the most sheltered valley on the island, running NE from the summit into the sea. There is a sparse ground cover of *Z. aethiopica*, otherwise most is bare earth. Where openings occur, occasional bushes of *Leucopogon revolutus, Pimelea clavata, Hibbertia cuneiformis, Chorilaena quercifolia* and *Thryptomene saxicola* (this last only around exposed sheets of rock) occur. In contrast to Breaksea and Michaelmas Islands, *Agonis flexuosa* and *Rhagodia radiata* are so scarce on the island as to make no contribution to the physiognomy of the vegetation. The NE peninsula is a herbland dominated by *Carpobrotus virescens* and *Disphyma clavellatum* with scattered low bushes (0.5 m high) of *Leucopogon revolutus*.

2. Breaksea Island

35°04'S, 118°03'E. Area 102 ha; maximum elevation 102 m (east of of centre); isolation, 5.1 km from mainland at Bald Head; orientation of long axis, east/west; degree of exposure to swell, high; visited 23 August-1 September 1975; rock type, granite-gneiss with extensive aeolianite veneer; number of plant species recorded, 61; usage by seabirds, three hole-nesting and one surface-nesting species breed on the island (Abbott 1978). Recorded human disturbance: Sealers worked the island in the 1820s and a lighthouse was manned by three families from 1858 to 1926.

The vegetation units on this island have been mapped (Fig. 2) more intensively than on Eclipse Island. Over twice as many units are recognized. The dominant unit is *Rhagodia radiata,* of height 1.0-1.5 m, forming a closed-heath over much of the lee slopes of the island but only on aeolianite. Associated perennial species are *Hibbertia cuneiformis, Thryptomene saxicola, Poa poiformis, Lepidosperma gladiatum, Pimelea clavata* and *Leucopogon revoluta*. Many annuals are also present and include *Parietaria debilis, Senecio lautus, Anagallis arvensis* and *Urtica urens*. The exposed side of the island is mainly bare rock, both gneissic and aeolianite. During gales all of the southern side becomes drenched with salt spray. Consequently, its vegetated parts consist of open-herbland of *Calandrinia calyptrata* and associated species *Sarcocornia blackiana, Maireana oppositifolia, Samolus repens* and *Sporobolus virginicus,* and tussock grassland (1 m high) of *Poa poiformis* with *Calocephalus brownii, S. repens, M. oppositifolia, S. virginicus* and *Apium prostratum*.

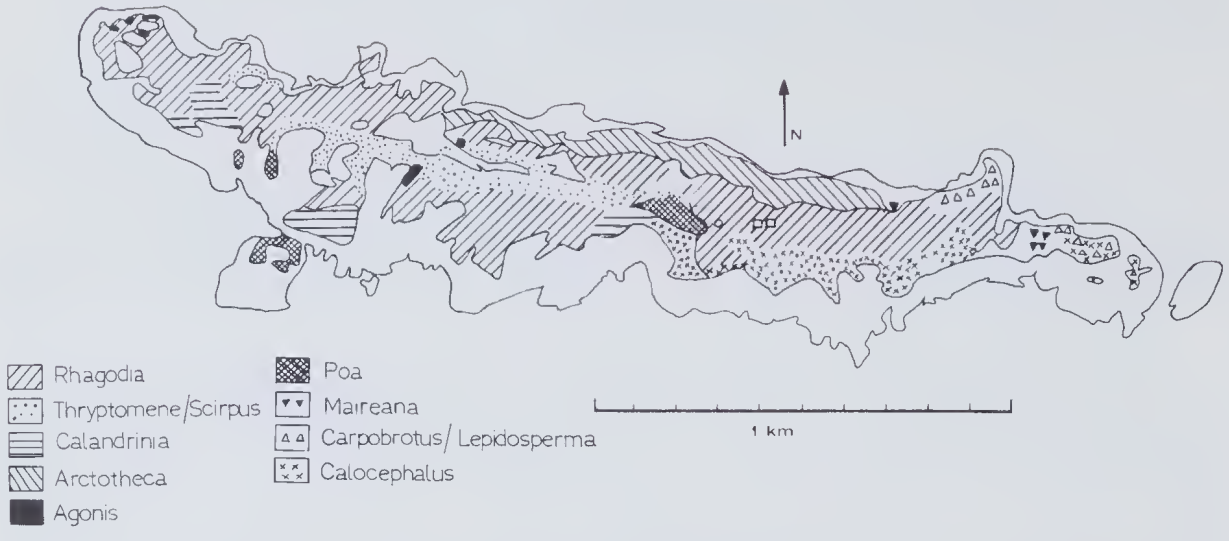

Fig. 2. Vegetation map of Breaksea Island.

On the backbone of the island, largely gneissic, and elsewhere on the island wherever gneisses are exposed is present an open-heath comprising *Thryptomene saxicola, Cheilanthes tenuifolia, Leucopogon revolutus* and *Scirpus nodosus*. *T. saxicola* and *L. revolutus* do not occur east of the houses. *Agonis flexuosa* is represented by a tiny grove of bushes and trees (1-5 m) at two places on the island. A large area dominated by Capeweed *Arctotheca calendula* is present north of the lighthouse buildings; this is of vigorous growth with plants having large leaves and reaching 0.5 m in height. Although *Zantedeschia aethiopica* is present, only a few plants were found about the lighthouse buildings. I do not know why this species has not spread as widely as it has on Eclipse Island, but the garden escape *Cotyledon orbiculata* has a wide range about the buildings. All vegetation units on Breaksea Island are burrowed by nesting seabirds (Abbott 1978).

3. Michaelmas Island

35°03'S, 118°02'E. Area 90 ha; maximum elevation 152 m (at east end); isolation, 2.2 km from mainland at Herald Point and 1.4 km north of Breaksea Island; orientation of long axis, east/west; degree of exposure to swell, low (sheltered by Breaksea Island and Flinders Peninsula); visited 4 September-14 September 1975; rock type, granite-gneiss with aeolianite capping on northern slopes only; number of plant species recorded, 78; usage by seabirds, two hole-nesting species breed (Abbott 1978). Recorded human disturbance: A severe fire was lit on the island in 1826 by sealers (Lockyer 1827).

Seven units were recognized (Fig. 3). A mixture of closed-herbland and open-heath, called '*Carpobrotus* complex' in Fig. 3, occurs on the northern slopes; it is extraordinarily rich in codominant species, including *Carpobrotus virescens, Threlkeldia diffusa, Tetragonia amplexicoma, Olearia*

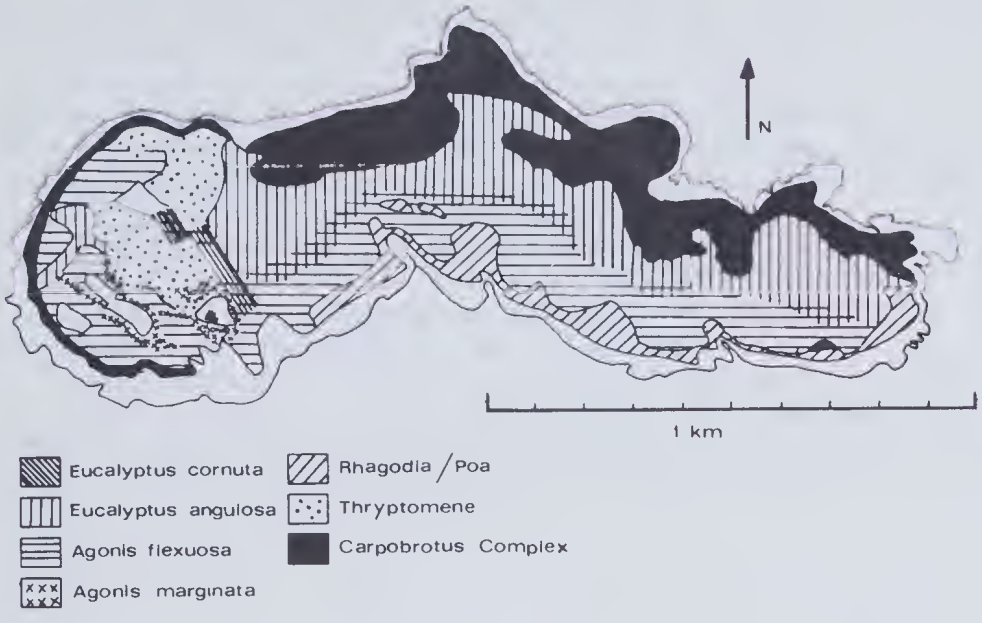

Fig. 3. Vegetation map of Michaelmas Island.

axillaris, *Rhagodia radiata*, *Calandrinia calyptrata*, *Westringia dampieri*, *Maireana oppositifolia* and *Samolus repens*. Where aeolianite cliffs are present the vegetation is sparser (open-heath), with *O. axillaris*, *Acacia littorea*, *A. cyclops* and *W. dampieri* more predominant. On the backbone of the island there is closed-forest of *Eucalyptus angulosa*, with trees to 12 m high. Within this forest little understorey is present and there is deep leaf litter and very few herbs. The chief species comprising the understorey are *Hibbertia cuneiformis* (to 1.1 m), *Leucopogon parviflorus* (to 3 m), *Boronia alata* (over 3 m), *Agonis flexuosa* (over 3 m), *Albizia lophantha* (over 6 m), *Pimelia clavata* and *Chorilaena quercifolia* (over 3 m), *Clematis pubescens* and *Stylidium adnatum*. Between the western dome and the remainder of the island there is a small valley, 30-60 m wide, dominated by *Eucalyptus cornuta* (height to 12 m). *Thryptomene saxicola* and *Agonis marginata* occur around the extensive exposures of gneisses on the western dome. On the thin soil over this rock are to be found moss mats with *Cheilanthes tenuifolia*, *Thryptomene saxicola*, *Andersonia sprengelioides*, *Hakea suaveolens* and *H. oleifolia*.

Agonis flexuosa forms extensive open-heath on the south side of the island and the western sides of the dome. Much of this *Agonis* appears senescent. *Rhagodia radiata* closed-heath and *Poa poiformis* closed-tussock grassland patchily occur on the lower slopes of the south side of the island. Many small annuals, including *Senecio lautus*, *Apium prostratum*, *Crassula macrantha* and *Parietaria debilis*, as well as the perennial sedges *Lepidosperma gladiatum* and *Scirpus nodosus* are found here. This was the only vegetation unit on the island in which burrow-nesting seabirds were found (Abbott 1978b). Areas of slumping on the southern slopes have been colonized by *Calandrinia calyptrata*, *Parietaria debilis*, *Carex preissii*, etc. to form an open-herbland.

4. Bald Island

34°55'S, 118°26'E. Area 717 ha (making the island the third largest island of the southern coast of Western Australia); maximum elevation 311 m (near SE end); isolation 1.2 km from mainland at Channel Point; orientation of long axis, northwest/southwest; degree of exposure to swell, high; visited 14-25 May 1976; rock type, granite-gneiss with eroded aeolianite capping on the northwest corner; number of plant species recorded, 104; usage by seabirds, three species (all hole-nesting) are present (Abbott in press a). Recorded human disturbance: Bald Island was leased for agistment in the early part of this century.

Seven units were mapped (Fig. 4). Storr (1965) published a vegetation map of the parts of the island traversed by him; the SE part of the island left blank on this map is mapped for the first time. Four units account for most of the vegetative cover of Bald Island. *Melaleuca lanceolata*, present only on aeolianite, forms an open-forest to 12 m high. Breaks in this forest are dominated by several

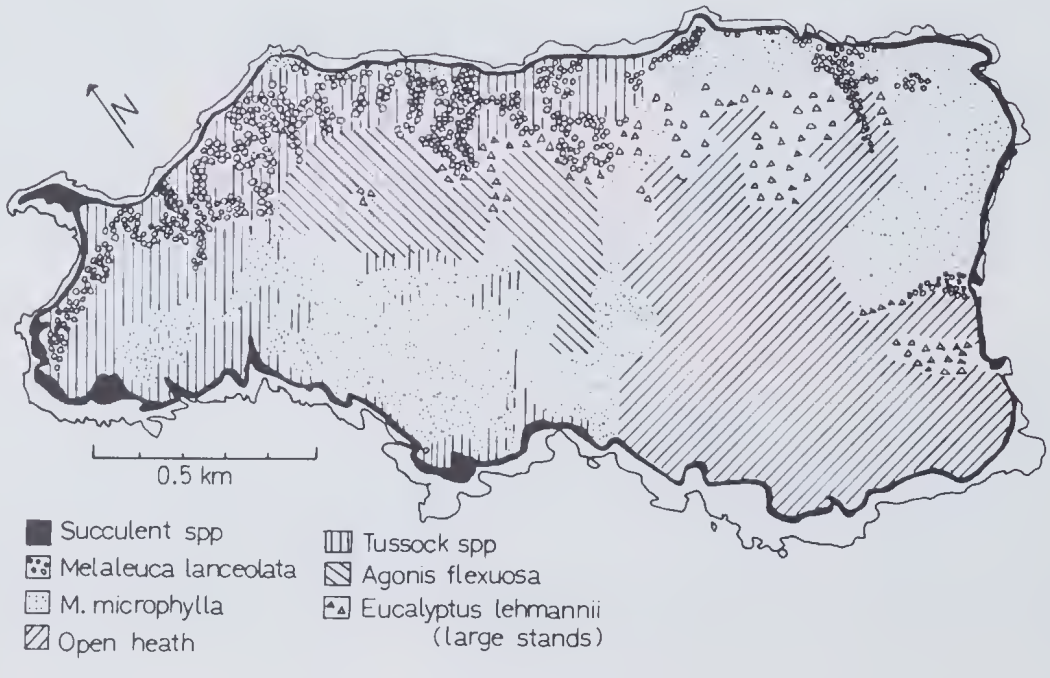

Fig. 4. Vegetation map of Bald Island

species of bushes, namely *Phebalium rude*, *Myoporum tetrandrum*, *Templetonia retusa* and *Thomasia solanacea*, several species of shrubs, namely *Rhagodia radiata*, *Spyridium globulosum* and *Pimelea clavata*, and various species of ground covers including *Poa poiformis*, *Parietaria debilis*, *Stylidium adnatum* and *Senecio lautus*.

Agonis flexuosa occurs virtually as a pure stand on the sheltered upper slopes of the island. This low closed-forest has a deep leaf litter; *Poa poiformis* is the main, albeit sparse, ground cover. Where there are breaks resulting from exposures of bare gneisses a lithic vegetational complex is present. The main species are *Thryptomene saxicola*, *Danthonia caespitosa*, *Scirpus nodosus*, *Lepidosperma angustatum*, *Hibbertia cuneiformis* and *Phyllanthus calycinus*. The exposed slopes of the island are occupied by a closed-scrub (3-5 m high) dominated by *Melaleuca microphylla* and a most unusual open-heath/open-scrub. Species associated with *M. microphylla* include *Thryptomene saxicola* (to 1 m), *Lepidosperma drummondii*, *L. angustatum*, and *Darwinia vestita* (to 1.1 m) with *Andersonia sprengelioides*, *Dodonaea ceratocarpa*, *Athrixia nivea*, *Platysace compressa*, *Danthonia caespitosa*, *Eutaxia obovata*, *Chorilaena quercifolia* and *Agonis marginata* typically around granite boulders. The open-heath/open-scrub (1-5 m high) is floristically similar, though still very depauperate, to heath on mainland sites studied. It is also the only vegetation unit on the island lacking nesting seabirds. It is difficult to single out any one species as dominant because the heath is a mosaic of patches each dominated by one of about 15 species. These include *Andersonia sprengelioides*, *Acacia leioderma*, *Agonis linearifolia*, *A. marginata*, *Banksia praemorsa* (to 2 m), *Boronia albiflora*, *Danthonia caespitosa*, *Eucalyptus lehmannii*, *Gastrolobium bilobum*, *Hakea elliptica*, *H. suaveolens*, *Lepidosperma angustatum*, *Leucopogon revolutus*, *Melaleuca diosmifolia* and *M. microphylla*.

Smaller vegetation units on Bald Island are the zone of succulent species, closed tussock-grassland and *Eucalyptus lehmannii* closed-forest. The zone of succulent, halophytic species occurs on the perimeter of the island and on the northern peninsula. Dominant species on gneisses are *Disphyma clavellatum*, *Carpobrotus virescens*, *Sarcocornia blackiana*, *Maireana oppositifolia*, *Apium prostratum*, *Sporobolus virginicus* and *Calocephalus brownii* whereas on aeolianite *D. clavellatum* and *Atriplex paludosa* are dominant. Closed tussock-grassland is chiefly made up of three species: The grass *Poa poiformis* and the sedges *Scirpus nodosus* and *Lepidosperma gladiatum*, although bushes of *Pimelea clavata*, *Hibbertia cuneiformis*, *Phyllanthus calycinus*, *Rhagodia radiata*, *Solanum symonii* and *Spyridium globulosum* are widely scattered throughout. This unit occurs as breaks throughout the *Melaleuca microphylla* unit as well as along the backbone and in the NW corner of the island. The remaining unit, *Eucalyptus lehmanii* closed-forest, is not as extensive as indicated by Storr (1965). Instead, it forms patchy stands mainly in the eastern portion of the island. Another important difference between Storr's map and mine is that the *Melaleuca microphylla* and the open heath units recognized here were not distinguished by Storr.

VEGETATION OF SMALLER ISLANDS, AND PENINSULAS AND HEADLANDS OF MAINLAND

The vegetation of the other islands and of the mainland sites was not mapped because of their structural uniformity, and in the case of the mainland sites because of their extraordinary floristic richness, making it

impossible for me to detect dominant species. Instead very brief descriptions will be given.

Only 11 of the remaining islands landed on were vegetated. Details of their area and elevation are included in Abbott (in press b). Flat Rock had only about 1 m^2 of *Lepidium foliosum* present. Coffin Island is a moderately-sized (28 ha) island, fully exposed to the SW swell, and consequently with uniform vegetative cover. It is dominated by *Rhagodia radiata* (1-2 m), with *Carpobrotus virescens* and *Sporobolus virginicus* common near the edges. A few bushes of *Anthocercis viscosa* (2 m) and *Stypandra grandiflora* (0.5 m) occur on sheltered parts but they make little contribution to the physiognomy of the vegetation.

The rest of the islands are small (10 ha or less) and sheltered. Vegetative cover on the smallest, Seal Island, an unnamed islet adjacent to Mistaken Island, Green Island and Gull Rock, is scanty and of a very different floristic composition from the other islands or the mainland. *Lavatera arborea, L. plebeia, Carpobrotus virescens, Ehrharta longiflora, Avena barbata* and *Phytolacca octandra* are variously codominant, and other weeds are also present.

Mistaken Island is covered with *Agonis flexuosa* trees (5 m) on its sheltered (northern) side but elsewhere *Anthocercis viscosa* (to 4 m), *Lhotskya ericoides* (to 2 m), *Ehrharta longiflora* (to 1.5 m), *Leucopogon revoluts, Pimelea clavata, Acacia cyclops* and *Cheilanthes tenuifolia* are codominant. A few large Yate (*Eucalyptus cornuta*) trees (6 m) are present on the summit.

The predominant vegetation unit recognized on the exposed mainland sites is open-heath. *Scaevola nitida, Pimelea ferruginea* and *Acacia littorea* are very common where aeolianite occurs. On soils derived from gneissic/granitic rocks *Darwinia diosmoides* and *Melaleuca microphylla* are widespread. Small areas of bushes (up to 3 m high) are present on most sites, but forest occurs only on Flinders Peninsula where a small patch of *Agonis flexuosa* is present.

Nearly all of the sheltered mainland sites studied are devoid of aeolianite. *Darwinia diosmoides, Agonis marginata, Eucalyptus calophylla, Agonis flexuosa* and *Andersonia sprengelioides* are conspicuous and widespread. The commonest vegetation unit is closed-heath. Closed-scrub is present on the two largest sites (Point Possession and Vancouver Peninsula), but only the Vancouver Peninsula possesses *Eucalyptus*-dominated open-forest (as Jarrah/Marri).

THE SCIENTIFIC VALUE OF VEGETATION MAPS OF ISLANDS OF SOUTH-WESTERN AND SOUTHERN AUSTRALIA

Vegetation maps of islands like those presented in this paper have two uses. The first is obvious; maps of the current vegetation will provide a baseline. As the population of Western Australia expands over the next 100 years (and beyond) it is to be expected that pressure will be put on the authorities to make the islands available for recreation. Ideally we should have had vegetation maps produced soon after settlement, but as none were produced we have to accept that maps produced now will be the yardstick with which future changes will be compared.

The second use of island vegetation maps concerns the impact of Aboriginal man on the Western Australian landscape. It is widely known that many of the islands of South-western Australia, South Australia and Bass Strait have acted as 'museums' for mammal species that are now extinct or endangered on the Australian mainland (Ride 1970). It is, however, less appreciated that these islands are important because they were inaccessible to Aborigines. Aborigines from about Onslow to Adelaide either lacked watercraft (Davidson 1935) or did not visit islands (Abbott 1980) Elsewhere islands were frequently visited. The islands of South-western Australia and southern Australia therefore suffered no fires, other than those started by lightning, for 5,000 - 10,000 years depending on when they were isolated by the rise in sea level. In contrast the mainland was repeatedly burnt by Aborigines (Hallam 1975).

The accurate description of the vegetation of islands along the coastline of South-western Australia and southern Australia needs to be completed because the islands and mainland form a natural 'experiment' - the islands are the 'controls' for the long-term firing 'treatment' of the mainland coast.

It needs to be stated that there are probably no islands of South-western Australia or southern Australia that have not been disturbed in some way by European man. In most cases we have no idea how severe the impact of the earliest Europeans (sealers, whalers, castaways) was. The very largest islands have been used for agriculture and grazing by sheep, goats or rabbits (Saint Peter, Flinders, Waldegrave, Thistle, Wedge, several of the Sir Joseph Banks Islands, Boston, and Kangaroo Islands in South Australia; King and Flinders Islands in Bass Strait). Smaller ones have been used for agistment (Woody, Gull, Charley, Sandy Hook, and Bald Islands in Western Australia). Those islands with long-established lighthouses on them (South Island of the South Neptune Group in South Australia, Breaksea I., Eclipse I., and Goose, Deal, and Swan Islands in Bass Strait) have suffered some alterations to vegetation through clearing, limited grazing, and the introduction of alien plants. However, the larger islands adjacent to the southern coast of Western Australia have certainly suffered less disturbance than those of South Australia and Bass Strait.

ACKNOWLEDGEMENTS

My visits to the islands near Albany were financed by the Australian Research Grants Committee and the Zoology Department of the University of Western Australia. The staff of the Western Australian Herbarum, in particular Dr. Neville Marchant, kindly identified plant species.

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APPENDIX

Distribution of plant species on the islands near Albany

Note (1): Several records for Bald Island result from collections made by N.G. Marchant or G.M. Storr. Such species that were not found by me are indicated below by either (Marchant) or (Storr).

(2): * denotes alien plant species.

Acacia alata R.Br., Mimosaceae: Bald
A. cyclops A. Cunn. ex G. Don, Mimosaceae: Mistaken, Michaelmas
A. leioderma B.R. Maslin, Mimosaceae: Bald
A. littorea B.R. Maslin, Mimosaceae: Michaelmas
Actinobole uliginosum (A. Gray) Eichler, Mimosaceae: Gull Rk, Bald
Agonis flexuosa (Spreng.) Schau., Myrtaceae: Eclipse, Seal, Mistaken, Michaelmas, Breaksea, Bald
A. linearifolia (DC.) Schau., Myrtaceae: Bald
A. marginata (Labill.) Schau., Myrtaceae: Michaelmas, Bald
Agrostis avenacea Gmel., Poaceae: Seal, Breaksea, Bald
**Aira cupaniana* Guss., Poaceae: Coffin, Bald
Albizia lophantha (Willd.) Benth., Mimosaceae: Michaelmas
**Anagallis arvensis* L., Primulaceae: Eclipse, islet next to Mistaken, Mistaken, Green, Michaelmas, Breaksea, Bald
Anarthria prolifera R.Br., Restionaceae: Bald
Andersonia sprengelioides R.Br., Epacridaceae: Eclipse, Michaelmas, Bald
Anthocercis viscosa R.Br., Solanaceae: Mistaken, Gull Rk, Coffin
Apium prostratum Labill., Apiaceae: Eclipse, islet next to Mistaken, Mistaken, Michaelmas, Breaksea, Coffin, Bald
**Arctotheca calendula* (L.) M. Levyns, Asteraceae: Green, Gull Rk, Breaksea
**A. populifolia* (Berg.) T. Norl., Asteraceae: Gull Rk
Asplenium adiantoides (L.) Lam., Aspleniaceae: Michaelmas, Bald
Athrixia nivea (Steetz) T. Norl., Asteraceae: Bald
Atriplex paludosa R.Br., Chenopodiaceae: Green, Bald

A. patula L., Chenopodiaceae: Mistaken, Coffin
**Avena barbata* Brot., Poaceae: Seal, Gull Rk, Michaelmas
Banksia praemorsa Andrews, Proteaceae: Bald
Boronia alata Sm., Rutaceae: Eclipse, islet next to Mistaken, Mistaken, Michaelmas, Breaksea, Bald
B. albiflora (R.Br.) Benth., Rutaceae: Bald
**Briza maxima* L., Poaceae: Mistaken, Coffin
**B. minor* L., Poaceae: Mistaken
Bromus arenarius Labill., Poaceae: islet next to Mistaken, Michaelmas
**B. diandrus* Roth., Poaceae: Seal, Coffin
Bulbinopsis semibarbata (R.Br.) Borzi, Liliaceae: islet next to Mistaken, Mistaken
Cakile maritima Scop., Brassicaceae: Green
Caladenia ? flava R.Br., Orchidaceae: Bald
C. latifolia R.Br., Orchidaceae: Mistaken, Michaelmas, Breaksea
Calandrinia calyptrata Hook.f., Portulacaceae: Seal, Mistaken, Gull Rk, Michaelmas, Breaksea, Coffin
Callitris preissii Miq., Cupressaceae: Bald
Calocephalus brownii (Cass.) F. Muell., Asteraceae: Eclipse, Michaelmas, Breaksea, Bald
Carduus tenuiflorus Curt., Asteraceae: Eclipse, Michaelmas, Breaksea, Bald
Carex preissii Nees, Cyperaceae: Eclipse, islet next to Mistaken, Mistaken, Michaelmas, Breaksea, Bald
Carpobrotus virescens (Haw.) Schwantes, Aizoaceae: Eclipse, Seal, islet next to Mistaken, Mistaken, Gull Rk, Michaelmas, Breaksea, Coffin, Bald
Casuarina huegeliana Miq., Casuarinaceae: Eclipse
Centaurium minus Gars., Gentianaceae: Eclipse, Mistaken, Bald (Storr)
Centrolepis polygyna (R.Br.) Hieron, Centrolepidaceae: Mistaken, Bald
C. strigosa (R.Br.) Roem. & Schultz, Centrolepidaceae: Eclipse, islet next to Mistaken, Mistaken, Coffin, Bald
**Cerastium glomeratum* Thuill., Caryophyllaceae: islet next to Mistaken, Mistaken, Michaelmas, Breaksea
Cheilanthes tenuifolia (Burm.f.) Sw., Adiantaceae: Eclipse, Mistaken, Michaelmas, Breaksea, Bald
Chemaescilla corymbosa (R.Br.) F. Muell., Liliaceae: Michaelmas, Bald
**Chenopodium murale* L., Chenopodiaceae: Green, Gull Rock
Chorilaena quercifolia Endl., Rutaceae: Eclipse, Michaelmas, Bald
**Cirsium vulgare* (Savi) Ten., Asteraceae: Eclipse
Clematis pubescens Hueg., Ranunculaceae: Michaelmas, Breaksea, Bald
Cotula australis (Less.) Hook., Asteraceae: Seal, islet net to Mistaken, Mistaken, Green
C. coronopifolia L., Asteraceae: Mistaken, Gull Rk
**Cotyledon orbiculata* L., Crassulaceae: Breaksea
Crassula macrantha (Hook.f.) Diels, Crassulaceae: Seal, islet next to Mistaken, Mistaken, Michaelmas, Breaksea, Coffin
Dampiera cuneata R.Br., Goodeniaceae: Bald
Danthonia caespitosa Gaud., Poaceae: Michaelmas, Bald
Darwinia vestita (Endl.) Benth., Myrtaceae: Bald
Daucus glochidiatus (Labill.) Fisch. et al., Apiaceae: Michaelmas, Bald
Dianella revoluta R.Br., Liliaceae: Eclipse, Mistaken, Michaelmas, Breaksea, Coffin, Bald
Dichondra repens R. & G. Forst., Convolvulaceae: ? Seal, Mistaken, ? Gull Rk, Michaelmas, Breaksea, Bald
Disphyma clavellatum (Haw.) Chinnock, Aizoaceae: Eclipse, Michaelmas, Breaksea, Bald
Dodonaea ceratocarpa Endl., Sapindaceae: Eclipse, Bald
Drosera pallida Lindl., Droseraceae: Mistaken, Michaelmas
**Ehrharta longiflora* Sm., Poaceae: Eclipse, Seal, islet next to Mistaken, Mistaken, Green, Gull Rk, Michaelmas, Breaksea, Coffin

Enchylaena tomentosa R.Br., Chenopodiaceae: Bald (Storr)
**Erodium cicutarium* (L.) L'Herit., ex Ait., Geraniaceae: Eclipse, Seal
Eucalyptus angulosa Schau., Myrtaceae: Michaelmas
E. cornuta Labill., Myrtaceae: Mistaken, Michaelmas
E. lehmanii (Schau.) Benth., Myrtaceae: Bald
**Euphorbia paralias* L., Euphorbiaceae: islet next to Mistaken, Mistaken, Breaksea, Bald
**E. peplus* L., Euphorbiaceae: Bald
Eutaxia obovata (Labill.) C.A. Gardn., Fabaceae: Michaelmas, Bald
Exocarpos sparteus R.Br., Santalaceae: Mistaken
**Fumaria muralis* Sond. ex Koch., Papaveraceae: Breaksea
Gahnia trifida Labill., Cyperaceae: Bald
Galium sp., Rubiaceae: Michaelmas, Bald
Gastrolobium bilobum R.Br., Fabaceae: Mistaken, Bald
**Geranium molle* L., Geraniaceae: islet next to Mistaken, Mistaken, Gull Rk, Michaelmas, Bald
**Gladiolus vittatus* Homen, Iridaceae: Mistaken
Gnaphalium candidissimum Lam., Asteraceae: islet next to Mistaken, Mistaken
G. gymnocephalum DC., Asteraceae: Coffin
G. indutum Hook.f., Asteraceae: Breaksea
G. luteoalbum L., Asteraceae: Michaelmas
G. ? sphaericum Willd., Asteraceae: islet next to Mistaken
Hakea elliptica (Sm.) R.Br., Proteaceae: Bald
H. oleifolia (Sm.) R.Br., Proteaceae: Michaelmas
H. suaveolens R.Br., Proteaceae: Michaelmas, Bald
Haloragodendron racemosum (Labill.) Orchard, Haloragaceae: Bald
Hardenbergia comptoniana Benth., Fabaceae: Michaelmas
Hibbertia cuneiformis (Labill.) Gilg., Dilleniaceae: Eclipse, Seal, islet next to Mistaken, Mistaken, Green, Michaelmas, Breaksea, Coffin, Bald
**Hordeum leporinum* Link, Poaceae: Eclipse, Seal, Gull Rk
Hydrocotyle diantha DC., Apiaceae: islet next to Mistaken, Mistaken, Michaelmas, Breaksea, Bald
Hymenolobus procumbens (L.) Nutt., Brassicaceae: Michaelmas, Bald
**Hypochoeris glabra* L., Asteraceae: islet next to Mistaken, Mistaken, Michaelmas, Breaksea, Coffin, Bald
**Inula graveolens* (L.) Desf., Asteraceae: Eclipse
Juncus bufonius L., Juncaceae: Green
J. kraussii Hochst., Juncaceae: Green
J. pallidus, Juncaceae: Eclipse, Bald (Storr)
Lasiopetalum indutum Steud., Sterculiaceae: Bald (Marchant)
**Lavatera arborea* L., Malvaceae: Seal, Green, Gull Rk
L. plebeia Sims, Malvaceae: Seal, Green, Gull Rk, ? Coffin (sp. uncertain)
Lepidium foliosum Desv., Brassicaceae: Seal, Flat Rk, Gull Rk, Coffin
L. hyssopifolia Desv., Brassicaceae: Bald
Lepidosperma angustatum R.Br., Cyperaceae: Bald
L. drummondii Benth., Cyperaceae: Bald
L. gladiatum Labill., Cyperaceae: Eclipse, islet next to Mistaken, Mistaken Michaelmas, Breaksea, Bald
Leucopogon parviflorus (Andr.) Lindl., Epacridaceae: Michaelmas
L. revolutus R.Br., Epacridaceae: Eclipse, Mistaken, Michaelmas, Breaksea, Coffin, Bald
Lhotzkya ericoides Schau., Myrtaceae: Mistaken
Lobelia alata Labill., Lobeliaceae: Eclipse, Seal, islet next to Mistaken, Gull Rk, Michaelmas, Coffin, Bald
**Lolium rigidum* Gaud. var. *rottbollioides* Boiss., Poaceae: Green
**Lotus subbiflorus* Lag., Poaceae: Fabaceae: Mistaken, Gull Rk
Lyperanthus nigricans R.Br., Orchidaceae: Mistaken, Bald
Maireana oppositifolia (F. Muell.) P.G. Wilson, Chenopodiaceae: Eclipse, Michaelmas, Breaksea, Bald

Malva parviflora L., Malvaceae: Gull Rk
Medicago polymorpha L., Fabaceae: Mistaken, Green, Breaksea
Melaleuca diosmifolia Andrews, Myrtaceae: Bald
M. lanceolata Otto, Myrtaceae: Eclipse, Bald
M. microphylla Sm., Myrtaceae: Eclipse, Bald
Millotia tenuifolia Cass., Asteraceae: Michaelmas
Myoporum oppositifolium R.Br., Myoporaceae: Michaelmas, Breaksea
M. tetrandrum (Labill.) Domin., Myoporaceae: Bald
Olearia axillaris (DC.) Benth., Asteraceae: islet next to Mistaken, Michaelmas, Breaksea, Bald
Oxalis corniculata L., Oxalidaceae: Eclipse, Mistaken, Michaelmas, Breaksea, Bald
O. pescaprae L., Oxalidaceae: islet next to Mistaken
Oxylobium ellipticum (Labill.) R.Br., Fabaceae: Mistaken, Coffin
Parentucellia viscosa (L.) Caruel., Scrophulariaceae: Mistaken
Parietaria debilis Forst.f., Urticaceae: Michaelmas, Breaksea, Coffin, Bald
Pelargonium australe Willd., Geraniaceae: Michaelmas, Breaksea, Coffin, Bald
Phebalium rude Bartl., Rutaceae: Bald
Phyllanthus calycinus Labill., Euphorbiaceae: Bald
Phytolacca octandra L., Phytolaccaceae: Green
Pimelea clavata Labill., Thymeliaceae: Eclipse, Mistaken, Breaksea, Bald
Platysace compressa (Labill.) Norman, Apiaceae: Bald
Poa annua L., Poaceae: Seal, Mistaken, Green, Gull Rk, Breaksea
P. poiformis (Labill.) Druce, Poaceae: Eclipse, Seal, islet next to Mistaken, Mistaken, Michaelmas, Breaksea, Coffin, Bald
Polycarpon tetraphyllum (L.) L., Caryophyllaceae: Seal, islet next to Mistaken, Mistaken, Green, Gull Rk
Polypogon maritimus Willd., Poaceae: Eclipse
Pterostylis nana R.Br., Orchidaceae: Michaelmas
Quinetia urvillei Cass., Asteraceae: Mistaken, Michaelmas
Raphanus raphanistrum L., Brassicaceae: Green
Rhagodia crassifolia R.Br., Chenopodiaceae: Eclipse
R. radiata Nees, Chenopodiaceae: Eclipse, islet next to Mistaken, Mistaken, Michaelmas, Breaksea, Coffin, Bald
Romulea rosea (L.) Eckl., Iridaceae: Mistaken
Rumex brownii Campd., Polygonaceae: islet next to Mistaken, Mistaken, Green, Breaksea
Sagina apetala L., Caryophyllaceae: Eclipse, Michaelmas, Breaksea, Coffin
Samolus repens (Forst.) Pers., Primulaceae: Eclipse, Mistaken, Michaelmas, Breaksea, Bald
Sarcocornia blackiana (Ulbr.) A.J. Scott, Chenopodiaceae: Green, Michaelmas, Breaksea, Bald
Scirpus cernuus Vahl., Cyperaceae: Mistaken, Michaelmas, Breaksea
S. nodosus Rottb., Cyperaceae: Eclipse, islet next to Mistaken, Mistaken, Gull Rk, Michaelmas, Breaksea, Coffin, Bald
Senecio lautus Forst.f. ex Willd., Asteraceae: Eclipse, Seal, islet next to Mistaken, Michaelmas, Breaksea, Coffin, Bald
S. ramosissimus DC., Asteraceae: Bald
Sida hookerana Miq., Malvaceae: Bald (Marchant)
Sisymbrium orientale L., Brassicaceae: Green
Solanum nigrum L., Solanaceae: Eclipse, Green, Gull Rk, Michaelmas
S. symonii Eichler, Solanaceae: Mistaken, Green, Gull Rk, Michaelmas, Breaksea, Bald
Sollya heterophylla Lindl., Pittosporaceae: Michaelmas, Bald (Storr)
Sonchus oleraceus L., Asteraceae: Eclipse, Seal, islet next to Mistaken, Mistaken, Green, Gull Rk, Michaelmas, Breaksea, Coffin, Bald
Spergularia rubra (L.) J. & C. Presl., Caryophyllaceae: Bald
Sporobolus virginicus (L.) Kunth., Poaceae: Eclipse, Mistaken, Green, Michaelmas, Breaksea, Coffin, Bald

Spyridium globulosum (Labill.) Benth., Rhamnaceae: Michaelmas
S. spadiceum (Fenzl) Benth., Rhamnaceae: Bald
Stackhousia pubescens A. Rich., Stackhousiaceae: Bald
**Stellaria media* (L.) Vill., Caryophyllaceae: Eclipse, Mistaken, Green, Gull Rk, Breaksea
Stipa flavescens Labill., Poaceae: Seal, Bald
Stylidium adnatum R.Br., Stylidiaceae: Eclipse, Mistaken, Michaelmas, Breaksea, Bald
S. fasciculatum R.Br., Stylidiaceae: Mistaken
S. glaucum Labill., Stylidiaceae: Bald
Stypandra grandiflora Lindl., Liliaceae: Coffin
Sueda australis (R.Br.) Moq., Chenopodiaceae: Green
Templetonia retusa (Vent.) R.Br., Fabaceae: Bald
Tetragonia amplexicoma (Miq.) Hook., Aizoaceae: Eclipse, Breaksea, Bald
T. tetragonoides (Pall.) Kuntze, Aizoaceae: islet next to Mistaken, Mistaken, Green
Thomasia discolor Steud., Sterculiaceae: Bald
T. solanacea J. Gay, Sterculiaceae: Bald
Threlkeldia diffusa R.Br., Chenopodiaceae: Eclipse, Michaelmas, Breaksea, Bald
Thryptomene saxicola (A. Cunn.) Schau., Myrtaceae: Eclipse, Michaelmas, Breaksea, Bald
Thysanotus patersonii R.Br., Liliaceae: Bald
**Trachyandra divaricata* (Jacq.) Kunth., Liliaceae: Michaelmas
Trachymene pilosa Sm., Apiaceae: Michaelmas
Triglochin centrocarpa Hook., Juncaginaceae: Michaelmas, Breaksea
**Triticum vulgare* L., Poaceae: Eclipse
**Tropaeolum majus* L., Tropaeolaceae: Green
Trymalium spathulatum (Labill.) Ostf., Rhamnaceae: Bald
**Urtica urens* L., Urticaceae: Eclipse, Green, Michaelmas, Breaksea, Bald
Verticordia plumosa (Desf.) Druce, Myrtaceae: Eclipse
Vittadinia sp., Asteraceae: Bald
**Vulpia myuros* (L.) Gmel., Poaceae: Michaelmas, Breaksea
Waitzia citrina (Benth.) Steetz, Asteraceae: Bald (Marchant)
Westringia dampieri R.Br., Lamianceae: Michaelmas, Bald
Zantedeschia aethiopica (L.) Spreng., Araceae: Eclipse, Green, Breaksea
Sp. indet., Amaryllidaceae: Breaksea

WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES

No. 5, 1981: 19-28

A FLOWERING CALENDAR FOR KARRAGULLEN, A NORTHERN JARRAH FOREST LOCALITY

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ABSTRACT

A 1.2 ha area of Jarrah forest, which was burnt over part of its area in March 1978, was monitored for flowering of plants between February 1978 and April 1979. One hundred and two species flowered during this period with a peak period occurring in October. Specific flower colours, which may be related to the type of pollinating agent, did not seem to be associated with season.

INTRODUCTION

An investigation into the ecology of an ant community in the Jarrah forest near Karragullen, W.A. has just been completed (Majer, unpublished data). Amongst the important influences on the ant community are seasonal environmental factors, fire history and food availability.

The seasonality of flowering was investigated in the area since many ants utilise nectar produced by flowers (Wilson, 1971), and also seeds comprise a major component of the diet of certain species of ants (Berg, 1975). The major aspects of the ant study will be reported elsewhere although the data on flowering are presented here since they provide a record of the plants present in the area, some information on species of plants which flower soon after fire and also because they are of general interest to apiarists and investigators of pollination or general forest and plant ecology. The data may also provide an interesting comparison with simultaneous investigations performed in *Banksia* woodland at Jandakot (Milewski and Davidge, 1980) and at Cannington (Bell and Stephens, 1979), both near Perth, Western Australia.

SITE DESCRIPTION AND METHODS

The 2.4 ha study area was situated near Karragullen in the Forests Department Victoria Block (32°04'S, 116°07'E; Grid AZ65 on Forests Department Mundaring 80 map). The vegetation consisted of tall closed sclerophyllous forest dominated by *Eucalyptus marginata* (Jarrah) and an admixture of *Eucalyptus calophylla* (Marri). There was a dense shrub understorey with a scattered lower tree storey (*Banksia* spp. and *Persoonia longifolia* R.Br.). The soil

was a lateritic, well drained gravel and the climate was typically Mediterranean with cool, wet, winters and hot, dry summers. The site was previously prescription burnt in the spring of 1975 and the forest was generally healthy although Jarrah die-back, caused by *Phytophthora cinnamomi* Rands, had affected vegetation in nearby low-lying areas. The study area occupied gently sloping ground adjacent to Munday Brook (Fig. 1). Two 20 x 25 m plots were selected for mapping of vegetation and ant nests (Fig. 1). Monthly monitoring of ant activity, and ant food source, was then initiated in February 1978. One plot (burn plot), and a surrounding buffer zone, were prescription burnt with a 150-200 kW/m fire on 29 March 1978. This fire removed all green vegetation from the area. Monthly monitoring was then continued until April 1979 in order or observe the effects of fire on the ants and their food sources.

Flowering was recorded by traversing the entire 2.4 ha study area at approximately fourteen-day intervals. Representative specimens were collected from burnt and unburnt areas and preserved. The predominant colour, or colours, of the corolla, calyx, floral bracts, inflorescence or capitulum was noted for each species. In the case of grasses and sedges where flower colour was not obvious, no record of colour was made. Those species flowering in the burnt area were also noted although the method of recording did not state if flowering was confined to the burnt area.

Voucher specimens of species collected during this study are lodged in the herbarium of the Western Australian Institute of Technology Biology Department.

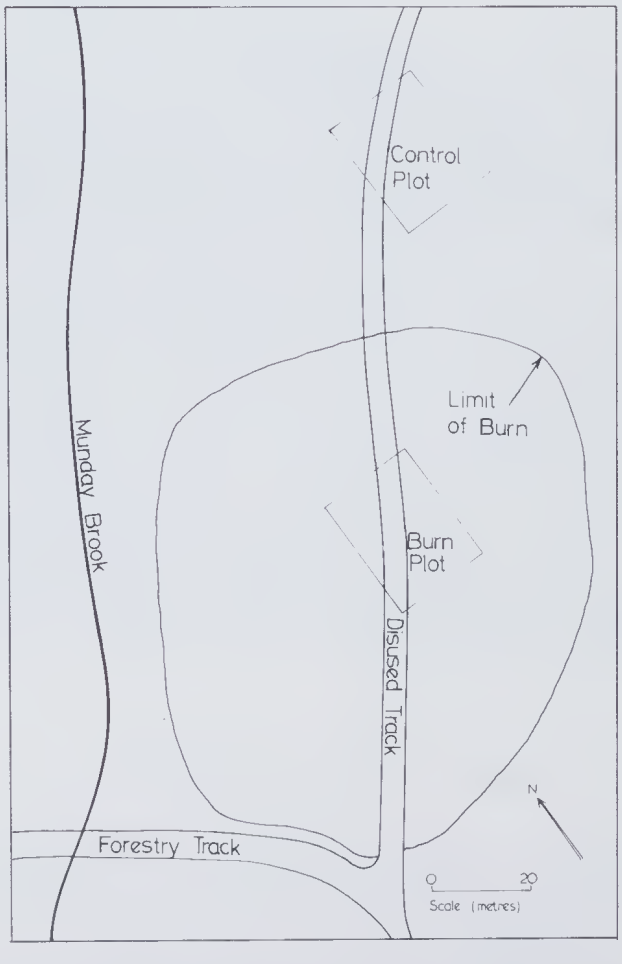

Fig. 1. Map of the 2.4 ha Karragullen study area (delimited by outer box), showing the ant study plots and limit of the March 1978 prescription burn.

Monthly means and totals for meteorological data were taken from the Forests Department Mundaring Weir station which is 14 km north of the study area.

RESULTS

One hundred and two species were observed flowering in the area (Table 1). These belong to 30 families, giving an average of 3.4 species per family. Five species, *Macrozamia riedlei* (Gaud.) C.A. Gardner, Cycadaceae; *Mesomelaena* sp. nov., Cyperaceae; *Leptocarpus scariosus* R.Br., Restionaceae; *Patersonia rudis* Endl., Iridaceae, and *Persoonia longifolia*, Proteaceae were also present in the area but were not observed in flower.

The monthly meteorological summary and total species in flower at each observation period is shown in Figure 2. The majority of the species flowered in spring with the main flush of flowering occurring in late October, a time of decreasing rainfall and rising temperatures. Other species had flowering time coincident with the hotter, drier months of the year. Only one species, *Adenanthos barbigerus* Lindl. flowered continuously throughout the year.

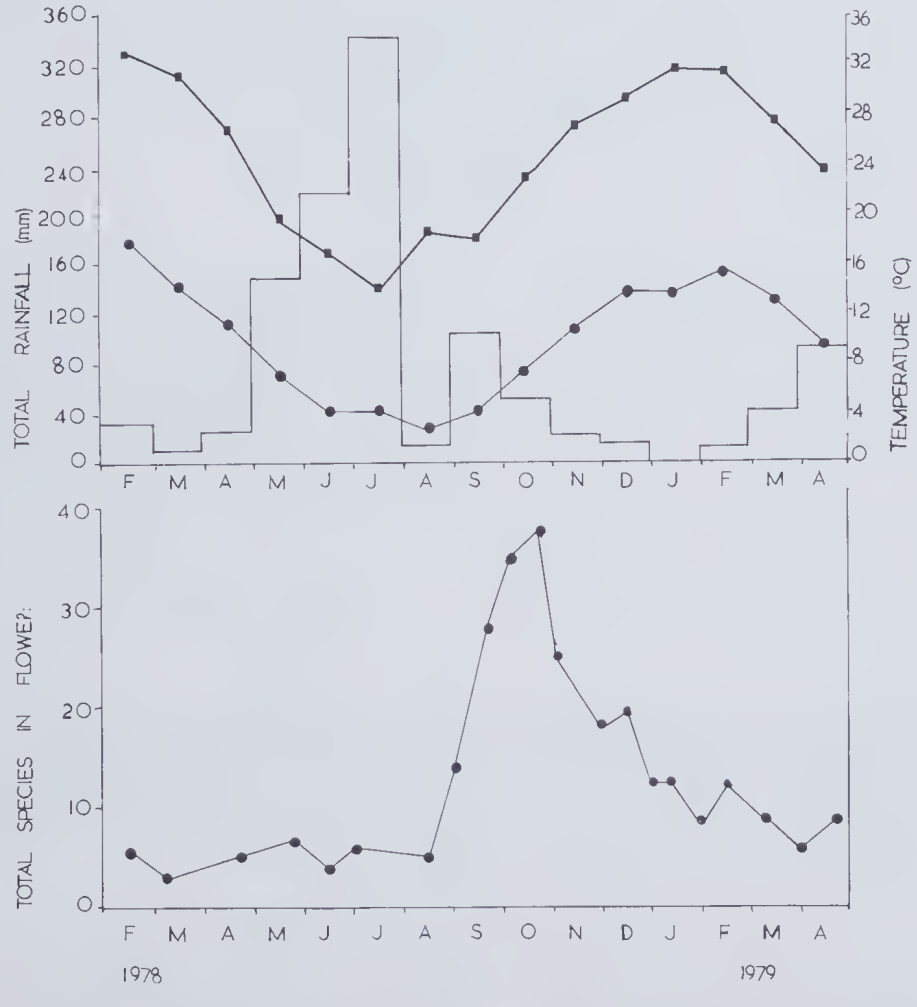

Fig. 2. Monthly rainfall (histogram), mean monthly maximum temperature (■—■), and minimum temperature (●—●) for the Forests Department Mundaring Weir recording station. The lower graph shows the total species in flower at each recording time.

Forty of the 102 species flowered in the burnt area within one year of the fire. Many of these were herbaceous species, some of which were annuals. It is noteworthy that 33 per cent of the dicotyledonous species flowered in the burnt area while 56 per cent of the monocotyledonous species produced flowers here.

In order to see if there was any trend in flower colouration, which in turn may be associated with pollinating agent (Morcombe, 1968), the total number of species in each broad flower colour class was summed for each season (Table 2). The expected number of plants flowering in each class was then calculated for each season using the actual number of species flowering and the overall proportion of species in each flower colour class. It was not possible to statistically analyse the trends in flower colour in view of the low expected frequencies in certain cells of the Table. However, visual inspection of data suggests that there is no relationship between flower colour and season.

DISCUSSION

The number of species flowering in this area is high compared with that reported elsewhere by other workers (e.g. 75 over 2 years for *Banksia* woodland in Western Australia (Milewski and Davidge, 1980) and 85 over an unspecified period in heath vegetation at Cheltenham, Victoria (Patton, 1933). Specht and Rayson (1957) noted 102 species of plants in flower over a 3 year observation period at Dark Island Heath, South Australia while Groves and Specht (1965) reported 117 species flowering over 4 years in heath vegetation on Wilson's Promontory, Victoria. These studies were not confined to small plots and are hence not directly comparable with the present study.

The abundance of flowering at Karragullen may be partly attributed to the recent burn. Although the method of data gathering did not show which species flowered exclusively in the burnt area, field observations suggested that the flowering of many species was confined to this area. Families which had several representatives flowering in the burnt area included Asteraceae, Apiaceae, Cyperaceae, Goodeniaceae, Liliaceae, Lobeliaceae, Orchidaceae and Stylidiaceae. Some of the annual herbaceous species may have arisen from seeds whose germination was stimulated by the fire or from the successful establishment of immigrant propagules. The abundance of monocotyledonous species following the fire may be associated with the fact that their growing point occurs at the base of the plant, the region least likely to be affected by the fire.

The October flowering peak corresponds closely with that observed by Milewski and Davidge (1980), Patton (1933) and Groves and Specht (1965) although the peak occurred one month later in the South Australian heath study (Specht and Rayson, 1957). It would be unwise to correlate flowering with climatic variables using such sparse data although some of the implications of this peak are briefly discussed here.

The attraction of insects and birds to flowers is generally part of a mutual relationship, with the plant being pollinated at the expense of pollen or nectar consumed by the animal. Spring is a period of high primary productivity and therefore abundance and activity of insects associated with plants. Late spring sees an abundance of winged insects, (Majer, unpublished data) making this an ideal time for flowers to be pollinated by insects. It is likely that spring flowering is partly an adaptation for

ensuring success of pollination. Most spring flowering plants set seed in late spring or early summer. Seed production therefore coincides with the period of maximum activity of seed taking ants, such as *Melophorus* sp. 1 (Australian National Insect Collection species code) and *Rhytidoponera inornata* (Crawley), in the northern Jarrah forest (Majer, unpublished data). Berg (1975) suggests that plants with seeds bearing ant attractive appendages, termed elaiosomes, may derive benefit from ants by having their seeds dispersed and buried by ants which feed on this seed-associated structure. The close timing between ant activity and seed production may therefore be an additional facet of this mutually beneficial relationship.

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Table 1. Flowering times (+) of the 102 species of plants observed in flower at the Karragullen study site. For ease of data presentation, the observation dates have been adjusted to the middle and end of each month. Species are arranged by sequence of flowering. Flower colour and incidence of flowering in the burn plot are also given.

+ Family abbreviations: Amarantaceae, Apiaceae, Asteraceae, Cyperaceae, Dilleniaceae, Droseraceae, Epacridaceae, Euphorbiaceae, Goodeniaceae, Haemodoraceae, Iridaceae, Lamiaceae, Lauraceae, Leguminosae, Liliaceae, Lobeliaceae, Myrtaceae, Olacaceae, Orchidaceae, Pittosporaceae, Poaceae, Polygalaceae, Proteaceae, Rhamnaceae, Rubiaceae Rutaceae, Santalaceae, Stylidiaceae, Thymeliaceae, Tremandraceae

* Species recorded as flowering in the burnt area produced flowers at some time during the 15 month post-fire observation period. The Table does not specify the actual time of flowering in the burnt area since control and burnt area records are amalgamated.

° Flower colour code: B, blue; Br, brown; G, green; O, orange; P, pink, purple or mauve; R, red; W, white or cream; Y, yellow

Species	Family+	Flowering* in burnt area	Flower° colour	1978 F	M	A	M	J	J	A	S	O	N	D	1979 J	F	M	A
Platysace compressa (Labill.) Norman	Ap	+	W	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.
Ptilotus manglesii (Lindl.) F. Muell.	Am	-	P	+	+	+	+	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.
Pentapeltis peltigera (Hook.) Bunge	Ap	+	W	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.
Comesperma virgatum Labill.	Pol	+	P	+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	.
Adenanthos barbigerus Lindl.	Pr	+	R	+	.	.	+	.	.	+	+	.	.	+	+	+	+	+	+	+	+	+	.
Lobelia gibbosa Labill.	Lo	+	B	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
Styphelia tenuiflora Lindl.	Ep	+	W	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	+	+	.
Olearia paucidentata (Steetz) F. Muell.	As	-	W	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	+	.
Eriochilus dilatatus Lindl.	Or	-	W	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Astroloma ciliatum (Lindl.) Druce	Ep	-	R	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lepidosperma leptostachyum Benth.	Cy	+	-	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.
Drosera erythrorrhiza Lindl.	Dr.	-	W	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leucopogon oxycedrus Sond.	Ep	+	W	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.
Hibbertia hypericoides (DC.) Benth.	Di	-	Y	.	.	.	.	.	+	+	+	+	+	+	+	+	.	.	.	.	.	.	.

Species	Family[+]	Flowering* in burnt area	Flower[o] colour	1978 F	M	A	M	J	J	A	S	O	N	D	1979 J	F	M	A
Hovea chorizemifolia (Sweet) DC.	Le	-	P	..	..	..	..	.+	.+	+.	..	..	..	..	..	..	..	..
Olax berthamiana Miq.	Ol	-	Y	..	..	..	..	.+	..	..	..	..	..	..	..	..	..	..
Hakea lissocarpha R.Br.	Pr	-	W	..	..	..	..	..	.+	++	+.	..	..	..	..	..	..	..
Trymalium ledifolium Fenzl	Rh	-	W	..	..	..	..	..	.+	++	+.	..	..	..	..	..	..	..
Bossiaea aquifolium Benth.	Le	-	O/Y	..	..	..	..	..	..	++	..	..	..	..	..	..	..	..
Hovea trisperma Benth.	Le	-	P	..	..	..	..	..	..	++	++	..	..	..	..	..	..	..
Dryandra nivea (Labill.) R.Br.	Pr	-	Br	..	..	..	..	..	..	++	+.	..	..	..	..	..	..	..
Hibbertia montana Steud.	Di	-	Y	..	..	..	..	..	..	++	++	++	..	..	..	..	..	..
Acacia alata R.Br.	Le	-	Y	..	..	..	..	..	..	++	+.	..	..	..	..	..	..	..
Chaemaescilla spiralis (Endl.) F. Muell.	Li	+	B	..	..	..	..	..	..	++	..	..	..	..	..	..	..	..
Caladenia deformis R.Br.	Or	+	B	..	..	..	..	..	..	+.	..	..	..	..	..	..	..	..
Craspedia sp.	As	+	Y	..	..	..	..	..	..	++	++	..	..	..	..	..	..	..
Eriochilis scaber Lindl.	Or	-	P	..	..	..	..	..	..	+.	..	..	..	..	..	..	..	..
Daviesia pectinata Lindl.	Le	-	O/R	..	..	..	..	..	..	.+	+.	..	..	..	..	..	..	..
Acacia varia Maslin	Le	-	W	..	..	..	..	..	..	.+	+.	..	..	..	..	..	..	..
Leucopogon capitellatus DC.	Ep	-	W	..	..	..	..	..	..	.+	+.	..	..	..	..	..	..	..
Burchardia umbellata R.Br.	Li	-	W	..	..	..	..	..	..	.+	++	+.	..	..	..	..	..	..
Caladenia sericea Lindl.	Or	+	B	..	..	..	..	..	..	.+	..	..	..	..	..	..	..	..
Lomandra endlicheri (F. Muell.) Ewart	Li	+	W	..	..	..	..	..	..	.+	++	..	..	..	..	..	..	..
Pimelea suaveolens (Endl.) Meisn.	Th	-	Y	..	..	..	..	..	..	.+	++	+.	..	..	..	..	..	..
Pterostylis recurva Benth.	Or	-	G/W	..	..	..	..	..	..	.+	..	..	..	..	..	..	..	..
Grevillea synapheae R.Br.	Pr	-	W/Y	..	..	..	..	..	..	.+	++	+.	..	..	..	..	..	..
Leptomeria cunninghamii Miq.	Sa	-	Y/Br	..	..	..	..	..	..	.+	++	..	..	..	..	..	..	..
Kennedia coccinea Vent.	Le	-	R	..	..	..	..	..	..	.+	++	+.	..	..	..	..	..	..
Agonis linearifolia (DC.) Schauer	My	-	W	..	..	..	..	..	..	.+	..	.+	..	.+	+.	.+	..	..
Hypocalymma angustifolium Endl.	My	-	W	..	..	..	..	..	..	.+	++	+.	.+	..	..	..	..	..
Tetrariopsis octandra (Nees) C.B. Clarke	Cy	+	-	..	..	..	..	..	..	.+	++	+.	..	..	..	..	..	..
Caladenia longiclavata Coleman	Or	+	Y/R	..	..	..	..	..	..	.+	..	..	..	..	..	..	..	..
Acacia pulchella R.Br.	Le	-	Y	..	..	..	..	..	..	..	++	+.	..	..	..	..	..	..
Dampiera linearis R.Br.	Go	+	B	..	..	..	..	..	..	..	++	++	.+	++	..	..	..	..
Eriostemon spicatus A. Rich	Rut	-	P	..	..	..	..	..	..	..	++	++	..	..	..	..	..	..
Hakea amplexicaulis R.Br.	Pr	-	W	..	..	..	..	..	..	..	++	++	..	..	..	..	..	..

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Species	Family[+]	Flowering* in burnt area	Flower[o] colour	1978 F	M	A	M	J	J	A	S	O	N	D	1979 J	F	M	A
Hakea trifurcata (Sm.) R.Br.	Pr	-	W	..	..	..	..	..	..	..	+.	..	..	..	..	..	..	..
Dampiera alata Lindl.	Go	-	B	..	..	..	..	..	..	..	+.	..	..	..	..	..	..	..
Caladenia flava R.Br.	Or	+	Y/R	..	..	..	..	..	..	..	++	+.	..	..	..	..	..	..
Burchardia multiflora Lindl.	Li	-	W	..	..	..	..	..	..	..	++	..	..	..	..	..	..	..
Phyllanthus calycinus Labill.	Eu	+	W	..	..	..	..	..	..	..	++	+.	..	..	..	..	..	..
Stylidium sp. indet.	St	-	W	..	..	..	..	..	..	..	++	..	..	..	..	..	..	..
Astroloma pallidum R.Br.	Ep	-	W	..	..	..	..	..	..	..	+.	..	..	..	..	..	..	..
Opercularia hispidula Endl.	Rub	-	G	..	..	..	..	..	..	..	+.	..	..	..	..	..	..	..
Bossiaea ornata (Lindl.) Benth.	Le	-	R/Y	..	..	..	..	..	..	..	++	+.	..	..	..	..	..	..
Leucopogon verticillatus R.Br.	Ep	-	W	..	..	..	..	..	..	..	+.	+.	..	..	..	..	..	..
Stylidium junceum R.Br.	St	+	P	..	..	..	..	..	..	..	++	+.	..	..	..	..	..	..
Tetratheca hirsuta Lindl.	Tr	-	P	..	..	..	..	..	..	..	.+	++	..	..	..	..	..	..
Synaphea aff. *petiolaris* R.Br.	Pr	-	Y	..	..	..	..	..	..	..	.+	+.	..	..	..	..	..	..
Elythranthera brunonis (Endl.) A.S. George	Or	-	P	..	..	..	..	..	..	..	.+	..	..	..	..	..	..	..
Helipterum cotula (Benth.) DC.	As	+	W/Y	..	..	..	..	..	..	..	.+	++	..	..	..	..	..	..
Stylidium schoenoides DC.	St	-	Y/R	..	..	..	..	..	..	..	.+	+.	..	..	..	..	..	..
Drosera pallida Lindl.	Dr	+	W	..	..	..	..	..	..	..	.+	+.	..	..	..	..	..	..
Lechnaultia biloba Lindl.	Go	+	B	..	..	..	..	..	..	..	.+	++	..	..	..	..	..	..
Hibbertia amplexicaulis Steud.	Di	-	Y	..	..	..	..	..	..	..	.+	+.	..	.+	+.	..	..	..
Opercularia sp. indet.	Rub	-	G	..	..	..	..	..	..	..	.+	..	..	..	..	..	..	..
Conostylis setosa Lindl.	Ha	+	W/P	..	..	..	..	..	..	..	..	++	.+	..	..	..	..	..
Patersonia juncea Lindl.	Ir	+	P	..	..	..	..	..	.	..	..	++	..	..	..	..	..	..
Scaevola striata R.Br.	Go	+	B	..	..	..	..	..	..	..	..	++	.+	..	..	..	..	..
Pimelea spectabilis (Fisch. & Mey.) Lindl.	Th	-	W	..	..	..	..	..	..	..	..	++	..	..	..	..	..	..
Conostylis setigera R.Br.	Ha	-	Y	..	..	..	..	..	..	..	..	+.	..	..	..	..	..	..
Thelymitra crinita Lindl.	Or	-	B	..	..	..	..	..	..	..	..	+.	..	..	..	..	..	..
Sphaerolobium medium R.Br.	Le	-	Y	..	..	..	..	..	..	..	..	++	.+	+.	..	..	..	..
Comesperma volubile Labill.	Pol	-	B	..	..	..	..	..	..	..	..	++	..	..	..	..	..	..
Lobelia rhombifolia De Vriese	Lo	+	B	..	..	..	..	..	..	..	..	++	..	+.	..	..	..	..
Stylidium calcaratum R.Br.	St	+	W	..	..	..	..	..	..	..	..	++	..	..	..	..	..	..
Mirbelia dilatata R.Br.	Le	-	P	..	..	..	..	..	..	..	..	++	.+	++	+.	..	..	..

Species	Family[+]	Flowering* in burnt area	Flower[o] colour	1978 F	M	A	M	J	J	A	S	O	N	D	1979 J	F	M	A
Levenhookia dubia Sond.	St	+	W	..	..	..	..	..	..	..	..	++	..	..	..	..	..	..
Banksia grandis Willd.	Pr	-	Y	..	..	..	..	..	..	..	..	.+	.+	+.	..	..	..	..
Isotoma hypocrateriformis (R.Br.) Druce	Lo	+	P	..	..	..	..	..	..	..	..	.+	.+	+.	..	..	..	..
Agrostocrinum scabrum (R.Br.) Bail.	Li	+	B	..	..	..	..	..	..	..	..	.+	.+	..	..	..	..	..
Xanthorrhoea gracilis Endl.	Li	+	W	..	..	..	..	..	..	..	..	.+	..	+.	..	..	..	..
Trachymene pilosa Sm.	Ap	-	W	..	..	..	..	..	..	..	..	.+	..	..	..	..	..	..
Xanthorrhoea preissii Endl.	Li	+	W	..	..	..	..	..	..	..	..	..	.+	+.	..	..	..	..
Tetrarrhena laevis R.Br.	Poa	-	-	..	..	..	..	..	..	..	..	.+	.+	..	..	..	..	..
Chorizema aciculare (DC.) C.A. Gardner	Le	+	Y/O	..	..	..	..	..	..	..	..	..	.+	+.	..	..	..	..
Hemigenia pritzelii S. Moore	Lam	-	W	..	..	..	..	..	..	..	..	..	.+	+.	..	..	..	..
Gompholobium polymorphum R.Br.	Le	-	O/R	..	..	..	..	..	..	..	..	..	.+	++	..	..	..	..
Tricoryne elatior R.Br.	Li	-	Y	..	..	..	..	..	..	..	..	..	.+	+.	+.	..	..	..
Levenhookia stipitata F. Muell.	St	+	P	..	..	..	..	..	..	..	..	..	.+	+.	..	..	..	..
Eucalyptus marginata Donn ex Sm.	My	-	W	..	..	..	..	..	..	..	..	..	..	++	..	..	..	..
Cassytha glabella R.Br.	Lau	-	W	..	..	..	..	..	..	..	..	..	..	++	+.	..	..	..
Sollya heterophylla Lindl.	Pi	-	B	..	..	..	..	..	..	..	..	..	..	+.	..	..	..	..
Xanthosia atkinsoniana F. Muell.	Ap	+	W	..	..	..	..	..	..	..	..	..	..	++	++	..	+.	..
Comesperma calymega Labill.	Pol	-	B	..	..	..	..	..	..	..	..	..	..	+.	..	..	..	..
Acacia barbinervis Benth.	Le	+	Y	..	..	..	..	..	..	..	..	..	..	.+	++	+.	..	..
Baeckea camphorosmae Endl.	My	+	P	..	..	..	..	..	..	..	..	..	..	.+	++	+.	++	..
Billardiera variifolia Turcz.	Pi	+	B	..	..	..	..	..	..	..	..	..	..	..	++	+.	+.	..
Cyathochaete clandestina (R.Br.) Benth.	Cy	+	-	..	..	..	..	..	..	..	..	..	..	..	++	+.	..	..
Eucalyptus calophylla R.Br. x Lindl.	My	-	W	..	..	..	..	..	..	..	..	..	..	..	..	+.	+.	..
Banksia littoralis R.Br.	Pr	-	Y	..	..	..	..	..	..	..	..	..	..	..	..	+.	+.	..
Lomandra preissii (Endl.) Ewart	Li	-	Y	..	..	..	..	..	..	..	..	..	..	..	..	..	.+	..

Table 2. Number of species, classified by predominant flower colour, flowering in each of the four seasons. The column and row totals are not equal because some plants flower in more than one season. The numbers in brackets are the expected contribution that each colour class should make to the seasons flowering total assuming that there are no trends in flower colour.

	White	Yellow	Pink/ Purple	Blue	Red	Green	Orange	Brown	No predominant colour	Total species in flower
Autumn	9 (6.8)	2 (3.5)	4 (2.3)	1 (2.6)	2 (1.2)	(0.5)	(0.1)	(0.1)	(0.7)	18
Winter	3 (6.4)	6 (3.3)	3 (2.1)	2 (2.5)	1 (1.1)	(0.5)	(0.1)	1 (0.1)	1 (0.7)	17
Spring	28 (29.5)	19 (15.1)	9 (9.8)	10 (11.4)	5 (5.3)	2 (2.2)	1 (0.8)	1 (0.8)	3 (3.0)	78
Summer	10 (12.9)	7 (6.6)	8 (4.3)	6 (5.0)	3 (2.3)	(1.0)	(0.3)	(0.3)	(1.3)	34
Total species in colour class	39	20	13	15	7	2	1	1	4	

WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES

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THE PHYSICAL ENVIRONMENT, FLORISTICS AND PHENOLOGY OF A *BANKSIA* WOODLAND NEAR PERTH, WESTERN AUSTRALIA

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ABSTRACT

The physical environment and floristic composition of 10 ha of mature, undisturbed Banksia *woodland on deep, leached sand are described. The study area covered part of a siliceous dune under a mediterranean climate on the southern outskirts of Perth, Western Australia. The 6 m high tree stratum consisted mainly of* Banksia attenuata *(Proteaceae). The 1 m high shrub stratum comprised 90 perennial species in 25 families. Slight variations in the composition of both strata were found among four study sites in association with small differences in substrate. The period of maximum flowering was October, although a few species flowered in winter or in summer. The times of appearance of an additional 25 species of annuals and herbs, apparent only in winter and spring, are recorded.*

INTRODUCTION

This paper presents data on the physical environment, floristics and phenology of an area of *Banksia* woodland at Jandakot Airport (32°05'S, 115° 53'E) on the southern outskirts of the Perth metropolitan area, Western Australia. The main aim of the study was to provide environmental and floristic data as a counterpart of an intensive study on the reptile, frog and bird communities of this area (Davidge 1979a, 1979b, Milewski unpublished). These data also provide a detailed description of an Australian mediterranean area. It is intended that this description will permit future comparisons of plant and animal communities in Australia with those of other continents with a similar mediterranean climate.

DATA COLLECTION

An area was needed which was large enough to include all plant and animal members of a natural community but which, at the same time, included only one such community. A study area of 10 ha was chosen on the basis of the apparent gross homogeneity of the environment and vegetation, the maturity of the vegetation and a minimum of man-made disturbance or invasion by weedy

annuals. Figure 1 is an aerial view of the area and figure 2 illustrates the vegetation.

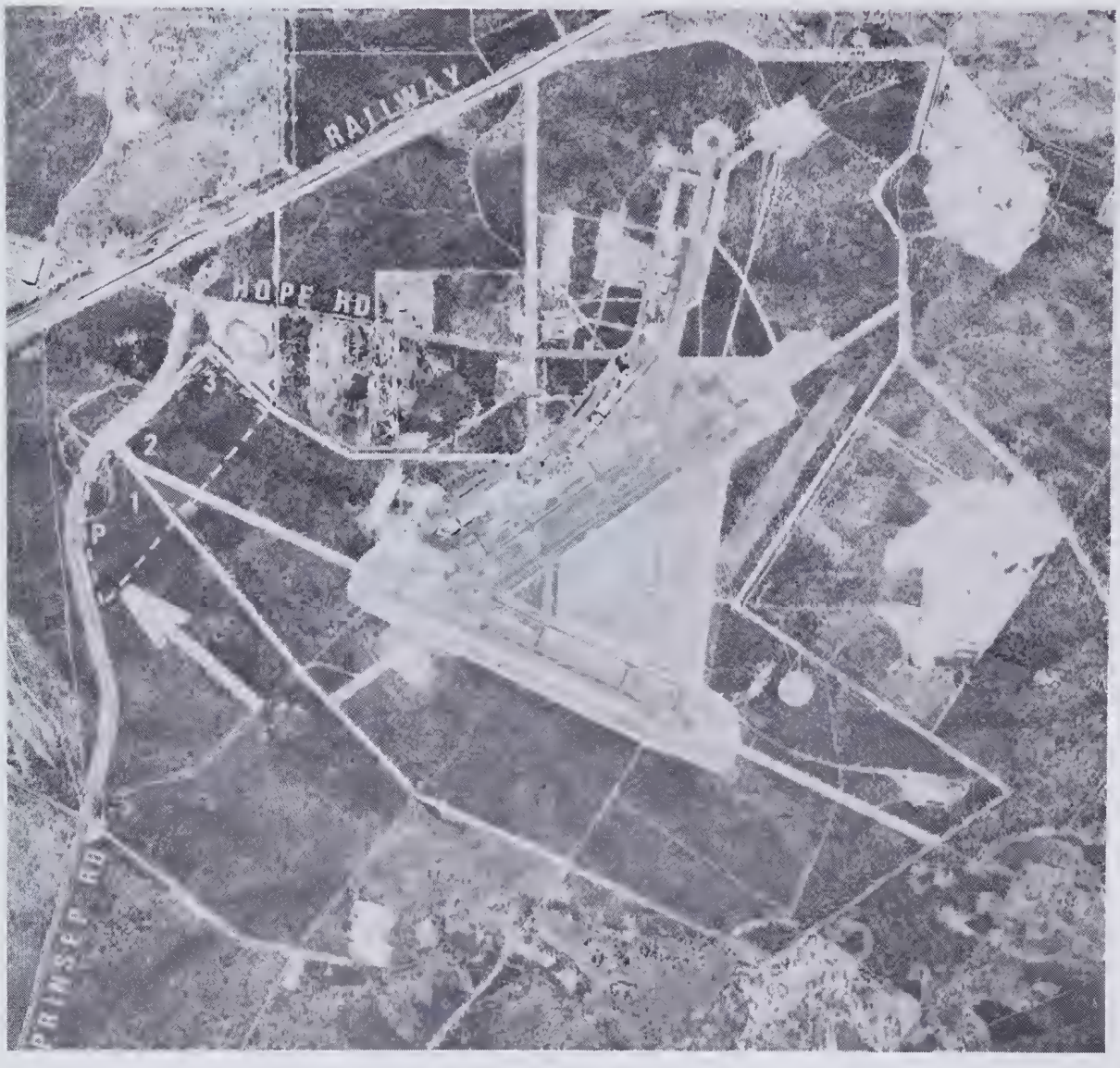

Fig. 1. Aerial view of Jandakot Airport, showing location of study area (arrowed).

Fifty two sample plots, 2 x 1 m, were placed within a primary study site of 1 ha (corresponding to the site used by Davidge 1979a, and R_1 of Davidge 1979b), using an 8 x 8 m grid. The first pair of numbers from a table of random numbers gave the co-ordinate of a point on the grid. Two more pairs of numbers gave the direction and distance to walk from this point to the first plot. The process was repeated to locate the other plots. The area assessed in this way was 100 m^2 of 1% or the total area of the site.

All shrub species (perennials lower than 3 m), present as living plants in each plot, were recorded between February and May 1978. The foliage projective cover of each species was estimated for each half of each plot. Mean foliage projective cover was then calculated for all species in the primary site. The site was examined thoroughly for species undetected by

Fig. 2. General view of the vegetation in the study area, showing the upper stratum of low trees of *Banksia* spp. (*B. menziesii* left foreground, *B. attenuata* background).

the sampling method (only three were discovered in this manner), and their foliage projective cover over the whole primary site was estimated. The cover of trees was measured from colour and infra-red aerial photographs of the site. The proportion of cover contributed by each tree species was then estimated in the field. The primary site was revisited from the end of August to mid-November to estimate the cover of species of annuals and herbs which lose their foliage seasonally.

The cover of each perennial plant species in three 0.5 ha secondary study sites (1, 2 and 3, corresponding to R_2, R_3 and M_2 respectively of Davidge 1979b) in other parts of the study area was estimated relative to that in the primary study site in order to assess floristic variation within the area.

Soil profiles were obtained when the soil was moist by augering to 1.5 m in all sites and to 4.5 m in the primary site. The exposed soil was described in the field by manual texture assessment and comparison of colours with standard charts.

Species were identified at the Western Australian Herbarium by one of us (AVM) or by herbarium staff. Voucher specimens and photographs were lodged as a permanent record at the School of Environmental and Life Sciences, Murdoch University.

PHYSICAL ENVIRONMENT

The monthly distribution of average annual precipitation and average maximum and minimum temperatures for the study area are given in Table 1. The climate is mediterranean with 57% of the average annual precipitation of 860 mm falling in winter (June-Aug.). This corresponds to various alternative climate types such as Thornthwaite's (1948) sub-humid, warm, great-moisture-deficiency-in-summer (CB's) climate, Köppen's (1936) transition between a warm climate with long hot summer (Csa) and a warm climate with long temperate summer (Csb), and the UNESCO-FAO (1963) Attenuated Thermomediterranean climate.

Winds are usually gentle and temperatures rarely reach freezing point, possibly as seldom as once per year. The mean minimum for the coldest month of the average year is about 9°C, while the difference between mean winter and mean summer temperatures is only about 10°C (Bureau of Meteorology 1966). Annual rainfall is very variable, ranging from 500 mm to more than 1,300 mm. A warm to hot dry season is usual for 7 months of the year (Table 1). In October, precipitation and evapotranspiration are equal (Speck 1952). In the following weeks precipitation decreases rapidly and increasing temperatures raise the evapotranspiration. Although plants initially may draw on water stored in the soil, the upper layers of soil reach wilting point by early December and continue to dry out until the soil water is replenished in May (Speck 1952).

Table 1. The monthly distribution of average annual precipitation and average maximum and minimum temperatures for the study area, after Bureau of Meteorology (1966). Monthly precipitation values were obtained by multiplying the values for Fremantle by a factor (1.1) derived from the total annual precipitation for Fremantle and the isohyet which includes Jandakot (864 mm).

Month	Average precipitation (mm)	Temperature (°C)			
		Average max.	Absolute max.	Average min.	Absolute min.
January	8.0	29.4	43.9	17.5	9.2
February	10.8	29.7	44.4	17.7	8.7
March	19.1	27.7	41.3	16.4	7.7
April	46.7	24.5	37.6	14.0	4.0
May	127.8	20.6	32.4	11.6	1.7
June	186.1	18.1	27.6	8.8	1.6
July	173.0	17.1	24.6	8.8	1.2
August	134.0	17.8	27.8	9.0	1.9
September	77.1	19.3	33.3	10.0	2.6
October	47.8	21.0	37.2	11.3	4.4
November	19.6	24.5	40.3	13.7	5.5
December	13.6	27.2	42.2	15.9	8.6
Year	863.6	23.1	44.4	12.9	1.2

The area lies between the Bassendean and Spearwood Dune Systems (McArthur & Bettenay 1960), in a gently undulating Pleistocene landscape of well-drained, deep, coarse, siliceous, podsolized, white over yellow sand on the Swan Coastal Plain (Tables 2a & b). The altitude is 49-52 m above mean sea level. The average depth of the water table, which is virtually flat here, is 24-28 m below ground surface (water table maps held by the Metropolitan Water Board).

The study area covers part of a single dune and the substrate varies slightly in different sites as regards altitude, slope angle, the presence of a partly organic surface layer and the depth below the surface at which yellow sand and its associated band of soft concretions occurs. In some places the upper, white sand is 4 m deep, while in one site (R_3) the finer yellow sand reaches the surface (Table 2a & b).

The deep sandy soil falls within the Jandakot series (iron-humus podzols) of the Bassendean Association (Bettenay *et al.* 1960), but corresponds to Speck's (1952) Karrakatta Sands, perhaps transitional to his Muchea Sands (part of his Bassendean Association). Speck described both of these as having a pH of 5.7-6.6 near the surface and 7.0-7.9 at depth. These soils have excellent infiltration and drainage and are very leached. They comprise 85% coarse sand, 11% fine sand and 1% clay and silt (Speck 1952). Other details are: $CaCO_3$ = 0.5-1.3% near the surface, decreasing to less than 0.2% at depth; organic carbon = 3.4-3.7% near the surface, decreasing to 1.2-1.8% at depth; P_2O_5 = 0.001% near the surface; K_2O = 0.005%; and N = 0.005% (Speck 1952).

FLORISTIC COMPOSITION

a. General description

The vegetation, in colloquial terms, is "low woodland" (tree height 5-6 m, canopy cover 20%) over "heath" (height 0.5-1.0 m, canopy cover 60%). The tree stratum in the primary study site consists mainly of *Banksia attenuata* (Proteaceae), although five other species are present. *Eucalyptus marginata* (Jarrah) and *Casuarina fraserana* are represented by only two or three trees in this site. The shrub stratum comprises 80 perennial species in 25 families, of which *Beaufortia elegans* (Myrtaceae) and *Leucopogon kingianus* (Epacridaceae) are particularly prominent. Most species occur with low cover values, of less than 2% (Tables 3 & 4).

The 0.5 ha sites differ slightly from the primary site in the composition of both the tree and shrub strata. The same species are generally present but have different cover values (Table 3). In one site (M_3) *C. fraserana* occurs as several large trees; in this and another site (R_2) *E. marginata* is more common than in the primary site. The shrubs *B. elegans* and *L. kingianus* have lower cover in the secondary sites than in the primary site, their place being taken by e.g. *Leucopogon conostephioides*, *Eremaea pauciflora*, *Casuarina humilis*, *Stirlingia latifolia* and *Hibbertia hypericoides*. Several species, e.g. *Mesomelaena stygia*, *Daviesia nudiflora* and *Hibbertia racemosa*, are restricted to one site (R_2), apparently associated with patches where yellow sand reaches ground surface. In addition, secondary site M_3 has a relatively high cover (total 20%) of perennial monocotyledons, mainly *Patersonia* (Iridaceae), *Phlebocarya* (Haemodoraceae), *Lyginia* (Restionaceae) and *Amphipogon* (Poaceae) (Table 3).

Table 2a. Colour of soil to 1.5 m depth in the study area, according to the Munsell colour chart. a to e refer to auger holes dug in different parts of the same site.

	Primary site				
Depth (m)	a	b	c	d	e
0-0.1	10YR 5/2	10YR 6/2	10YR 5.5/2.5	10YR 3/2	10YR 4/3
0.1-0.2	7.5YR 4.5/1.5	10YR 6.5/2	7.5YR 6/2		10YR 6/2.5
0.2-0.3	7.5YR 4.5/2	10YR 6.5/2.5	10YR 6.5/2.5	7.5YR 4.5/2	7.5YR 5.5/2
0.3-0.4		7.5YR 6.5/2	10YR 6.5/2	7.5YR/2.5	10YR 5.5/2.5
0.4-0.5	7.5YR 4.5/2		7.5YR 7/2	7.5YR 5.5/2	7.5YR 5.5/3
0.5-0.6	7.5YR 5/2	10YR 7/2		7.5YR 6.5/2	
0.6-0.7	7.5YR 5.5/2			10YR 6.5/2	10YR 6/3
0.7-0.8	7.5YR 5.5/2	10YR 7.5/2	10YR 7.5/2		
0.9-1.0	10YR 7/2	10YR 8/2	10YR 8/2		10YR 6.5/3
1.0-1.1				10YR 7.5/2	
1.1-1.2	10YR 7.5/2	10YR 7.5/2.5	10YR 8/1.5		
1.2-1.3		10YR 8/2	10YR 8.5/1.5		2.5Y 7.5/3
1.3-1.4	10YR 7.5/2	10YR 8.5/2			10YR 7.5/3
1.4-1.5	10YR 7.5/2		10YR 8.5/1.5	10YR 8/2	2.5Y 7.5/3

	Secondary sites			
	Site 1			
Depth (m)	a	b	Site 2	Site 3
0-0.1	10YR 5/2	10YR 4/1.5	10YR 4.5/2	10YR 3.5/2
0.1-0.2	10YR 3.5/1.5	10YR 3.5/1.5	10YR 4.5/2	10YR 3/1.5

Table 2a (cont.)

Depth (m)	Site 1 a	Site 1 b	Site 2	Site 3
0.2-0.3	10YR 3.5/1.5	10YR 3.5/1	10YR 6/2.5	10YR 3.5/1.5
0.3-0.4	10YR 4/1.5	10YR 3.5/1.5	10YR 6.5/2.5	10YR 4/1.5
0.4-0.5	7.5YR 4.5/2	10YR 4/1.5	10YR 6.5/3	10YR 4.5/1.5
0.5-0.6			10YR 6/3.5	7.5YR 4.5/1.5
0.6-0.7	7.5YR 4.5/2	10YR 5/1.5	10YR 6/3	10YR 5.5/1.5
0.7-0.8	7.5YR 4.5/2	7.5YR 5/1.5	2.5Y 6/3	10YR 6/2
0.8-0.9	7.5YR 5/2		2.5Y 7/3.5	10YR 7/2
0.9-1.0	7.5YR 5/2	10YR 5.5/1.5	2.5Y 7.5/4	10YR 7.5/2
1.0-1.1	7.5YR 5.5/1.5	7.5YR 5.5/1.5	2.5Y 7/5	10YR 7.5/2
1.1-1.2	7.5YR 5.5/1.5		2.5Y 7/5	10YR 7.5/2
1.2-1.3	7.5YR 6/1.5	10YR 6/1.5		10YR 7.5/2
1.3-1.4	7.5YR 6/1.5	7.5YR 6/1.5	2.5Y 7.5/5.5	10YR 8/2
1.4-1.5	7.5YR 7/1.5	10YR 6.5/2	2.5Y 7/6.5	10YR 8/2

Table 2b. Description of soil profile in the primary study site, on the basis of field examination of four auger holes to 4.5 m depth.

Profile zone	Munsell Colour	Texture	Depth from surface (m)
1.	Light brownish-grey to very dark greyish-brown, darkest near surface owing to organic matter	Sand, tending to loamy sand near the surface where the coarse grains are bound by humus and fine roots	0 to 0.2
2.	Light brownish-grey becoming gradually paler with depth (to white)	Coarse sand	0.2 to between 0.6 and 4.2
3.	Grading yellower, to pale brown or brownish-yellow	Sand	variable, depending on depth of zone 2, e.g. 0.6 to 3.2, 1.6 to 2.3 or 4.2 to 4.5
4.	Grades darker and richer, to brownish-yellow with darker mottles (strong brown)	Coarse sand or sand with up to 20% by volume of concretions (up to small gravel size) of coarse cemented sand, generally breakable between finger and thumb	variable, depending on depth of zones 2 & 3, e.g. 2.3 to 2.8, 3.3 to 3.8, or not reached by 4.5
5.	Loses the mottles and grades paler, to yellow (similar to but slightly brighter than in zone 3)	Coarse sand or sand	remainder of profile, continuing beyond 4.5

Table 3. Average foliage projective cover of perennial plant species, in order of decreasing cover, in the primary study site (1 ha of *Banksia* woodland). + = cover of less than 0.1%. Also given are the plant species found in three 0.5 ha secondary study sites (1, 2 and 3 corresponding to sites R_2, R_3 and M_2 respectively of Davidge 1979b). For these sites, foliage projective cover was only estimated and is given for those species which either (i) have cover greater than 2% in at least one site, or (ii) are absent from at least one site; the presence of other species is denoted by an asterisk. The tree stratum was defined as all plants taller than 3 m. Total foliage projective cover in the primary site was estimated to be 60-65% from aerial photographs and field assessment.

Species	Primary site	Secondary sites		
		1	2	3
TREE STRATUM				
1. *Banksia attenuata* R.Br.	6.9	6.0	6.0	4.5
2. *Banksia menziesii* R.Br.	2.9	2.5	4.0	4.5
3. *Eucalyptus todtiana* F. Muell.	1.2	1.5	0.5	0.5
4. *Nuytsia floribunda* (Labill.) R.Br.	0.5	0.5	0.8	0.6
5. *Eucalyptus marginata* Sm.	0.1	0.5	1.5	1.5
6. *Casuarina fraserana* Miq.	+	-	-	2.0
7. *Banksia ilicifolia* R.Br.	-	-	+	+
SHRUB STRATUM				
8. *Beaufortia elegans* Schau.	10.8	6.0	2.5	0.6
9. *Leucopogon conostephioides* DC.	6.8	7.0	5.5	7.5
10. *Leucopogon kingianus* (F. Muell.) C.A. Gardn.	4.6	2.0	+	+
11. *Hibbertia hypericoides* (DC.) Benth.	2.7	3.0	6.8	5.5
12. *Stirlingia latifolia* (R.Br.) Steud.	2.5	3.0	4.0	2.5
13. *Eremaea pauciflora* (Endl.) Druce	2.0	4.0	7.5	3.0
14. *Scholtzia involucrata* Endl.	1.8	2.0	5.2	3.5
15. *Hibbertia subvaginata* (Steud.) F. Muell.	1.7	1.8	2.3	1.3
16. *Melaleuca thymoides* Labill.	1.3	1.5	1.5	4.5
17. *Lyginia barbata* R.Br.	1.1	1.0	0.8	2.5
18. *Acacia pulchella* R.Br.	0.8	-	-	-
19. *Conostephium pendulum* Benth.	0.8	1.0	1.5	2.4
20. *Dasypogon bromeliaefolius* R.Br.	0.8	1.0	1.5	2.4
21. *Calytrix flavescens* A. Cunn.	0.7	0.8	2.0	3.5
22. *Eremaea* sp. aff. *fimbriata* Lindl.	0.6	-	-	-
23. *Petrophile linearis* R.Br.	0.5	-	-	-
24. *Daviesia juncea* Sm.	0.4	-	-	-
25. *Bossiaea eriocarpa* Benth.	0.3	-	-	-
26. *Hemiandra pungens* R.Br.	0.3	-	-	-
27. *Lomandra caespitosa* (Benth.) Ewart	0.3	-	-	-
28. *Loxocarya flexuosa* (R.Br.) Benth.	0.3	-	-	-

Table 3 (cont.)

Species	Primary site	Secondary sites 1	2	3
29. *Phlebocarya ciliata* R.Br.	0.3	0.3	0.3	1.5
30. *Schoenus curvifolius* (R.Br.) Benth.	0.3	-	-	-
31. *Stylidium repens* R.Br.	0.3	-	-	-
32. *Cassytha* sp. indet.	0.2	-	-	-
33. *Casuarina humilis* Otto et Dietr.	0.2	4.0	5.0	4.5
34. *Conostylis aculeata* R.Br.	0.2	-	-	-
35. *Gompholobium tomentosum* Labill.	0.2	-	-	-
36. *Hypocalymma robustum* Endl.	0.2	-	-	-
37. *Hypolaena exsulca* R.Br.	0.2	-	-	-
38. *Jacksonia furcellata* (Bonpl.) DC.	0.2	-	-	-
39. *Laxmannia ramosa* Lindl.	0.2	-	-	-
40. *Leucopogon strictus* Benth.	0.2	-	-	-
41. *Lomandra endlicheri* (F. Muell.) Ewart	0.2	-	-	-
42. *Macrozamia riedlei* (Gaud.) C.A. Gardn.	0.2	-	-	-
43. *Phlebocarya filifolia* (F. Muell.) Benth.	0.2	-	-	-
44. *Restio* sp. indet.	0.2	-	-	-
45. *Schoenus brevisetis* Benth.	0.2	-	-	-
46. *Stylidium brunonianum* Benth.	0.2	-	-	-
47. *Acacia stenoptera* Benth.	0.1	-	-	-
48. *Amphipogon turbinatus* R.Br.	0.1	0.2	0.3	0.3
49. *Calytrix fraseri* A. Cunn.	0.1	-	-	-
50. *Eriostemon spicatus* A. Rich.	0.1	-	-	-
51. *Hibbertia aurea* Steud.	0.1	-	-	-
52. *Hibbertia huegelii* (Endl.) F. Muell.	0.1	-	-	-
53. *Hibbertia pachyrrhiza* Steud.	0.1	+	-	+
54. *Hovea trisperma* Benth.	0.1	-	-	-
55. *Laxmannia squarrosa* Lindl.	0.1	-	-	-
56. *Lechenaultia floribunda* R.Br.	0.1	-	-	-
57. *Lepidosperma angustatum* R.Br.	0.1	-	-	-
58. *Lysinema ciliatum* R.Br.	0.1	-	-	-
59. *Melaleuca seriata* Lindl.	0.1	0.1	0.6	1.3
60. *Oxylobium capitatum* Benth.	0.1	-	-	-
61. *Patersonia occidentalis* R.Br.	0.1	0.3	1.0	1.6
62. *Platysace compressa* (Labill.) Norman	0.1	+	-	-
63. *Xanthosia huegelii* (Benth.) Steud.	0.1	-	-	-
64. *Acacia huegelii* Benth.	+	-	-	-
65. *Arnocrinum preissii* Lehm.	+	-	-	-
66. *Calectasia cyanea* R.Br.	+	-	-	-
67. *Conostylis aurea* Lindl.	+	-	-	-
68. *Conostylis juncea* Endl.	+	-	+	-
69. *Conostylis setigera* R.Br.	+	-	-	-
70. *Dampiera linearis* R.Br.	+	-	-	-

Table 3 (cont.)

Species	Primary site	Secondary site 1	2	3
71. *Drosera paleacea* DC.	+	-	-	-
72. *Hensmania turbinata* (Endl.) W.V. Fitzg.	+	-	-	-
73. *Leptomeria empetriformis* Miq.	+	-	-	-
74. *Leucopogon pulchellus* Sond. or *L. polymorphus* Sond.	+	-	+	-
75. *Leucopogon racemulosus* DC.	+	-	-	-
76. *Lomandra preissii* (Endl.) Ewart				
77. *Melaleuca scabra* R.Br.	+	-	-	-
78. *Persoonia saccata* R.Br.	+	+	-	0.7
79. *Pithocarpa pulchella* Lindl.	+	-	-	-
80. Poaceae sp. indet. 1	+	-	-	-
81. Poaceae sp. indet. 2	+	-	-	-
82. *Scaevola paludosa* R.Br.	+	-	-	-
83. *Stylidium junceum* R.Br.	+	-	+	-
84. *Stylidium piliferum* R.Br.	+	-	-	-
85. *Stylidium schoenoides* DC.	+	-	+	-
86. *Thysanotus triandrus* (Labill.) R.Br.	+	-	-	-
87. *Tricoryne elatior* R.Br.	+	-	+	-
88. *Burtonia conferta* DC.	-	-	*	-
89. Cyperaceae sp. indet.	-	-	+	0.3
90. *Daviesia nudiflora* Meisn.	-	-	0.5	-
91. *Hibbertia racemosa* (Endl.) Gilg.	-	+	0.5	+
92. *Mesomelaena stygia* (R.Br.) Nees	-	-	+	-
93. *Pimelea sulphurea* Meisn.	-	-	*	-
94. *Regelia inops* Schau.	-	-	-	*
95. *Schoenus* sp. indet.	-	-	+	-
96. *Synaphea spinulosa* (Burm.f.) Merrill	-	-	*	*
97. *Xanthorrhoea preissii* Endl.	-	-	*	*

Table 4. Estimated relative perennial cover for all plant families occurring in the study area, in order of decreasing cover. Numbers in parentheses refer to species as listed in Table 3. Total foliage projective cover was obtained by adding cover values of species; no account was taken of overlap between canopies in the calculation.

Family	Total foliage projective cover (%)
Myrtaceae (3,5,8,13,14,16,21,22,36,49,59,77,94)	19.0
Proteaceae (1,2,7,12,23,78,96)	15.0
Epacridaceae (9,10,19,40,58,74,75)	12.6
Dilleniaceae (11,15,51,52,53,91)	4.7
Restionaceae (17,28,37,44)	1.6
Fabaceae (24,25,35,38,54,60,88,90)	1.3
Xanthorrhoeaceae (20,27,41,66,76,97)	1.3
Casuarinaceae (6,33)	1.1
Mimosaceae (18,47,64)	0.9
Haemodoraceae (29,34,43,67,68,69)	0.8
Loranthaceae (4)	0.7
Cyperaceae (30,45,57,89,92,95)	0.6
Stylidiaceae (31,46,83,84,85)	0.6
Lamiaceae (26)	0.4
Liliaceae (39,55,65,72,86,87)	0.4
Poaceae (48,80,81)	0.2
Apiaceae (62,63)	0.1
Goodeniaceae (56,70,82)	0.1
Iridaceae (61)	0.1
Lauraceae (32)	0.1
Rutaceae (50)	0.1
Zamiaceae (42)	0.1
Asteraceae (79)	+
Droseraceae (71)	+
Santalaceae (73)	+
Thymelaeaceae (93)	+

A species present in the study area but absent from all study sites is *Adenanthos cygnorum*, which occurs as a stand of tall shrubs between secondary sites M_3 and R_2.

The vegetation of the study area does not correspond precisely to any previously described community, although it has been described in a general sense by Diels (1906), Seddon (1972) and Heddle, Loneragan and Havel (1979, "Bassendean - central and south" vegetation complex) and corresponds to Speck's (1952) "Banksia, Casuarina, Eucalyptus Association", and Beard's (1979) Bassendean System: southern or Perth section. The vegetation differs slightly from that north of Perth, e.g. type F of Havel (1976), in lacking e.g. *Jacksonia floribunda* and members of the genera *Boronia*, *Astroloma* and *Conospermum*. The *Banksia* woodland described by Bell *et al.* (1979) occurs on weakly leached sand associated with limestone outcrops and differs in the composition of the shrub stratum.

Eastwards from the Karrakatta/Bassendean transition, "as the Muchea (Bassendean) sands become more typical the Jarrah trees become fewer, are reduced to stunted trees and finally are absent altogether" (Speck 1952). It is as part of this "Jarrah-Banksia ecotone" Speck 1952) that the study area can best be described, transitional as it is between stands with a canopy of *E. marginata* and *Casuarina fraserana* over smaller trees of *Banksia*, and those containing only *Banksia* and *E. todtiana* (Speck 1952, Beard 1967, Seddon 1972). The shrub stratum appears to represent a similar transition from yellow to white sand, as shown by the rare local occurrence of yellow sand species such as *Mesomelaena stygia* (Havel 1976).

b. Homogeneity

The primary study site (1 ha) appears to represent a single plant community, as shown by a species-area curve (Fig. 3). The very small variations in floristic composition here may be attributed to the chance occurrence of locally rare species in certain parts of the site (Table 3).

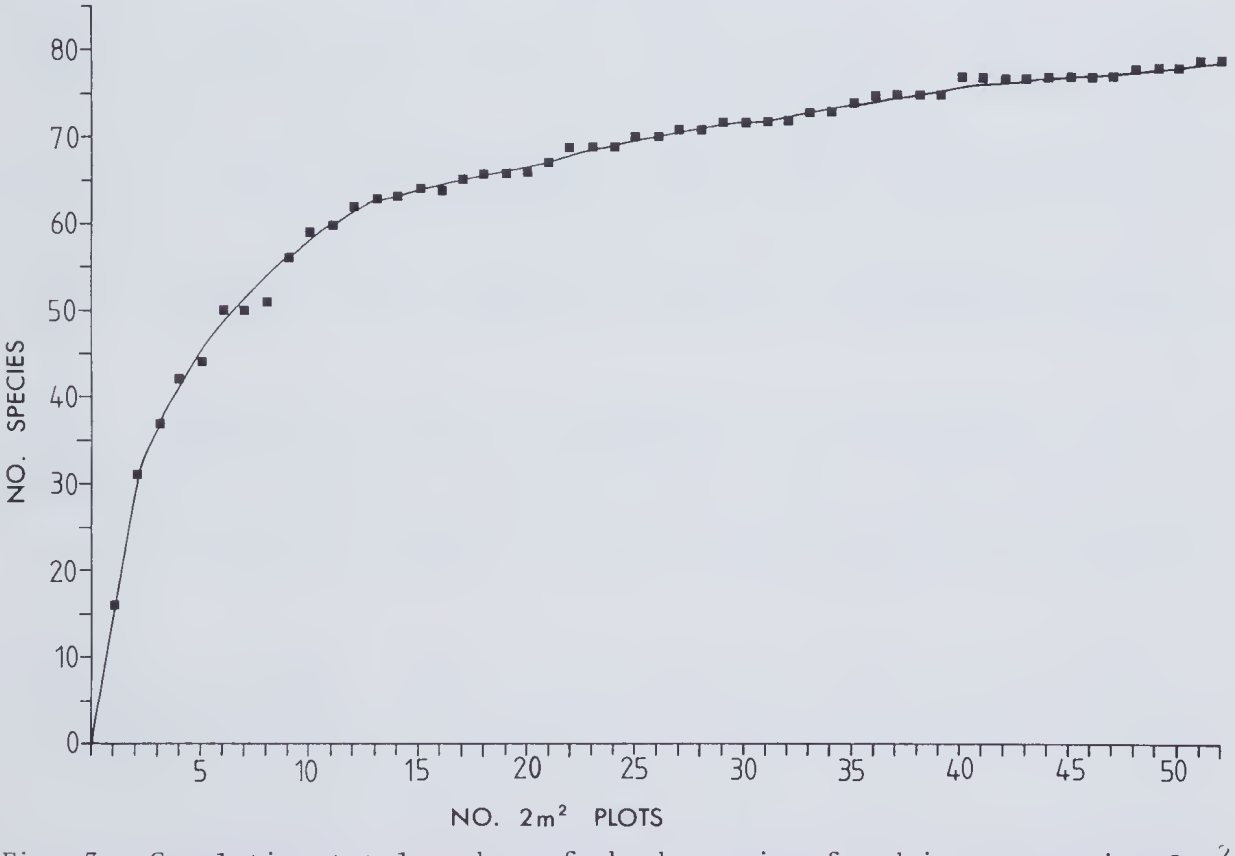

Fig. 3. Cumulative total number of shrub species found in consecutive 2 m^2 sample plots in the 1 ha primary site. Note that the sample plots were not adjacent, but scattered through the site.

Over the entire area, as represented by the secondary sites, floristic composition varies slightly from place to place in association with substrate differences. In view of the large area studied, this variation is relatively small, being found mainly in the cover of species rather than in their presence or absence. Such variation seems unavoidable in view of the requirement of an area large enough to achieve a minimally acceptable sample

for studies of vegetation structure and the animal community as well as for the floristic study.

PHENOLOGY

Table 5 gives 1 year's observations on the flowering and fruiting times of 81 perennial plant species found in the study area. These data were collected from March 1978 to February 1979, an unusually dry year. The previous summer (1977-78) was extremely hot and dry and the rains arrived about a month later than usual (Met. Bureau records). Thus the phenological data presented do not refer to an average year. For instance, in the following year many plants were observed flowering in the study area at least a month earlier than recorded in 1978. However, the data do allow some generalizations to be made.

The period of maximum flowering, i.e. when the most species are in full bloom, is October. However, some species flower at the cold time of year and others, such as the physiognomically dominant *Banksia attenuata* and *Beaufortia elegans*, flower in summer. "For a time the epacrids dominate the whole, the climax of their display being often reached in May" (Diels 1906). *Banksia menziesii*, *Lyginia barbata* and *Calytrix fraseri* are examples of species having protracted flowering seasons including part of summer, although no species was recorded flowering throughout the year. The legumes (Fabaceae and Mimosaceae) are of special interest as a source of seeds for ants, birds and rodents (Majer 1978, Braithwaite & Gullan 1978). The pods of legumes in the study area (e.g. species of *Bossiaea*, *Gompholobium*, *Jacksonia* and *Oxylobium*) reach maturity, dehisce and release seed on to the ground mainly in summer (Dec.-Feb.), various species following each other in turn.

Table 6 gives the times of appearance of species with annual foliage, totalling 25 additional species not listed in Table 3. Several of these species have recently been introduced to Australia. Both indigenous and introduced annuals (mainly Poaceae and Asteraceae) and other herbs (mainly Orchidaceae and Haemodoraceae) are apparent only in winter and spring and wither by December.

The phenology of plants in the study area may be largely explained by rainfall, temperature and photoperiod (Speck 1952). There are two times of year when these factors might retard plant growth. In winter, minimum temperatures and photoperiod are reached, while in summer lack of moisture is the limiting factor. This divides the year into two periods favourable to plant growth. The shorter of these starts in late April or May with the first rains, and the longer period includes October. Possibly species flowering during the long summer drought are able to do so because of deep root systems which penetrate to the underground water (Speck 1952). However, the physiological adaptations which allow the tiny, shallow-rooted perennial herb, *Stylidium repens*, to flower in summer remain a puzzle.

The only other studies in Australia of plant phenology in areas of similar climatic and edaphic conditions are those of Patton (1933), Specht and Rayson (1957) and Groves and Specht (1965). The October peak of flowering in the study area agrees with that found by Patton (1933) and Groves and Specht (1965) for heath in coastal Victoria, but is a month earlier than that observed by Specht and Rayson (1957) for heath in eastern South Australia. Fewest species flower in April and May in the Victorian heath, agreeing with

Table 5. Flowering and fruiting times of plant species at Jandakot in alphabetical order. 1 = in bud, 2 = in initial flower, 3 = in full bloom, 4 = in waning flower, 5 = in green fruit, 6 = categories 1 and 5 simultaneously, * = record incomplete. Each month was divided into three equal and consecutive periods, denoted a, b and c.

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
Species	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc
Acacia huegelii					11	112	345					
Acacia pulchella		111	233	445	555	555	5					
Acacia stenoptera	333	344	445	55							112	222
Adenanthos cygnorum					1	122	233	344	444	555		
Amphipogon turbinatus				12	345	5						
Arnocrinum preissii					12	345						
Banksia attenuata					1	222	333	333	444	455		
Banksia ilicifolia					*3*							11
Banksia menziesii	444	444	445	555	5				122	222	333	
Beaufortia elegans						122	233	334	444	55		
Bossiaea eriocarpa			12	334	455	5						
Calectasia cyanea	222	233	344	444	445						1	111
Calytrix flavescens						111	112	233	444	55		
Calytrix fraseri					1	122	222	333	333	333	444	455
Cassytha sp. indet.						12	233	45				
Casuarina humilis		12	223	333	444	445	555					
Conostephium pendulum	233	333	334	445	5				111	111	112	222
Conostylis aculeata			1	122	333	445	5					
Conostylis aurea				122	333	444	55					
Conostylis juncea				12	345							
Conostylis setigera				122	333	445	5					
Dampiera linearis			1	112	233	444	55					
Dasypogon bromeliaefolius					11	233	455					
Daviesia juncea	222	333	444	555	55							
Daviesia nudiflora	12*											
Eremaea sp. aff. *E. fimbriata*				12	234	455	5					

Table 5 (cont.)

Species	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc
Eremaea pauciflora				1	123	344	555					
Eriostemon spicatus		111	223	333	445	55						
Eucalyptus marginata					111	122	334	5*		*16	66	666
Eucalyptus todtiana					666	666	*			6		
Gompholobium tomentosum					123	334	444	555	5			
Hemiandra pungens				12	333	445	5					
Hensmania turbinata			1	234	55							
Hibbertia huegelii			1	222	334	555						
Hibbertia hypericoides		2	333	333	334	444	555					
Hibbertia pachyrrhiza			1	223	344	55						
Hibbertia subvaginata		1	122	333	444	55						
Hibbertia aurea			12	333	455	5						
Hovea trisperma	233	344	555	555	55							12
Hypocalymma robustum		1	112	233	344	555	5					
Hypolaena exsulca					123	445						
Jacksonia furcellata					1	111	123	333	344	444	555	
Laxmannia ramosa	444	555	5							1	122	333
Laxmannia squarrosa				1	233	445	5					
Lepidosperma augustatum					*5*						*2*	
Leptomeria empetriformis				1	234	55						
Lechenaultia biloba					1	233	455					
Leucopogon conostephioides	333	344	455	555	55					1	122	223
Leucopogon kingianus		1	111	223	334	445	555					
Leucopogon pulchellus polymorphus		1	233	345	5							
Leucopogon racemulosus	445	555	55								12	333
Leucopogon strictus	333	444	455	5							12	233
Lomandra caespitosa			122	334	55							
Lomandra endlicheri	334	5										12
Loxocarya flexuosa				1	123	455						

Table 5 (cont.)

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Arpil	May
	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc
Lyginia barbata			33	344	444	444	444	444	444	445	5	
Lysinema ciliatum		12	233	333	444	455	555					
Melaleuca scabra						122	334	45				
Melaleuca seriata					111	233	344	55				
Melaleuca thymoides				111	233	344	55					
Mesomelaena stygia										*	333	445
Nuytsia floribunda						112	233	444	455			
Oxylobium capitatum	11	223	344	555	555							
Patersonia occidentalis				1	233	445	55					
Persoonia saccata						1	123	344	455	555	55	
Petrophile linearis				11	123	345	5					
Phlebocarya ciliata				112	233	445	5					
Phlebocarya filifolia					123	334	55					
Pithocarpa pulchella										1	234	5
Regelia inops					111	233	455	5				
Restio sp. indet.	333	344	444	55						1	122	223
Scaevola paludosa					123	345						
Schoenus curvifolius		12	233	345	55							
Scholtzia involucrata							112	333	334	455	5	
Stirlingia latifolia		1	111	233	455	55						
Stylidium brunonianum				111	233	445	5					
*Stylidium junceum**				1	234	5						
*Stylidium piliferum**				112	234	5						
Stylidium repens						12	222	333	334	444	444	455
Thysanotus triandrus					11	233	45					
*Xanthosia huegelii**			1	112	233	445	5					

* foliage largely withers after November

Table 6. Phenology of annuals and herbs bearing foliage only in winter and spring and wilting by December. The maximum cover of each species was less than 0.1% of the study area. * indicates perennial species.

Family and species	Time of peak flowering
APIACEAE	
Trachymene pilosa Sm.	late Sept.
ASTERACEAE	
Hypochoeris sp. indet. (introduced)	late Sept.
Millotia tenuifolia Cass.	early Oct.
Podotheca chrysantha Benth.	early-mid Oct.
Podolepis spp. indet.	early-mid Oct.
Ursinia anthemoides (L.) Gaertn. (introduced)	early Oct.
CENTROLEPIDACEAE	
Centrolepis drummondii (Nees) Hieron	mid Sept.
CRASSULACEAE	
Crassula sp. indet.	---------
CYPERACEAE	
Scirpus sp. indet.	mid Sept.
DROSERACEAE	
**Drosera erythrorhiza* Lindl.	---------
**Drosera menziesii* R.Br. ex DC.	Sept.
HAEMODORACEAE	
**Anigozanthos humilis* Lindl.	early Oct.
**Anigozanthos manglesii* D. Don	early Oct.
IRIDACEAE	
**Gladiolus caryophyllaceus* (Burm.f.) Poir. (introduced)	early Oct.
LILIACEAE	
**Burchardia umbellata* R.Br.	early Oct.
**Sowerbaea laxiflora* Lindl.	early Oct.
ORCHIDACEAE	
**Caladenia flava* R.Br.	early Oct.
**Caladenia discoidea* Lindl.	early Oct.
**Pterostylis recurva* ? Benth.	early Sept.
**Pterostylis vittata* Lindl.	early Sept.
**Thelymitra campanulata* Lindl.	mid Oct.
POACEAE	
Aira caryophyllea L. (introduced)	early Oct.
Briza maxima L. (introduced)	early Oct.
Stipa sp. indet.	mid Oct.
Poaceae, sp. indet.	Sept.-Oct.

the present study. In Victoria, where there is a more even distribution of rainfall through the year than in the study area, a slightly higher proportion (33% compared with 14%) of perennial species flower in summer, including several which flower throughout the year (Patton 1933, Groves & Specht 1965). However, Myrtaceae flower mainly in spring in Victoria (Groves & Specht 1965), although those in the study area (e.g. species of *Melaleuca*, *Calytrix* and *Scholtzia*) reach their peak in summer. These genera have also been found flowering in summer elsewhere on the Swan Coastal Plain (Diels 1906).

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HISTORICAL AND RECENT OBSERVATIONS OF THE FLORA OF GARDEN ISLAND, WESTERN AUSTRALIA

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ABSTRACT

We provide a checklist of 188 species collected since 1829 on Garden Island, an island of 1100 ha near Perth, Western Australia. Early observations of the island (1801-1833) emphasised the impenetrability of the vegetation, which conforms well with the vegetation found at present. This is in noted contrast with nearby Rottnest Island, parts of which have been altered considerably since 1829. The flora (native species only) of Garden Island has a 0.71 similarity with that of Rottnest Island.

INTRODUCTION

Garden Island, originally called Meeandip by the Aborigines (Lyon 1833: p. 64) and Ile Buache by the French (Péron, 1807) is 45 km south-west of Perth and southward of Rottnest and Carnac Islands. It is 9.5 km from north to south and only 2 km across at its widest point. The total area is approximately 1100 hectares compared with approximately 1900 ha of Rottnest Island (including 200 ha of salt lakes). The nearest part of the mainland is Point John on Cape Peron which is 2 km from the south-eastern point of Garden Island. The intervening water as well as that between Garden and Carnac Islands is less than 5 m deep. These islands have probably been separated from the mainland for 6,000-7,000 years (Main 1961). Since 1973 Garden Island has been connected to the mainland by a causeway to facilitate access to the naval base, HMAS Stirling.

A ridge-like line of sandy hills runs the entire length of the western part of the island. The sheltered eastern side is gently undulating with extensive flat areas facing Cockburn Sound and the mainland. Most of the surface soil consists of recently formed dunes of calcareous sand. Areas of calcareous dune rock (aeolianite) commonly occur in the western and southern littoral zones.

Climatically the area is Mediterranean with hot, dry summers and cool,

wet winters. The rainfall at Rockingham on the mainland 3 km east of the southern part of Garden Island averages 836 mm per annum (Bureau of Meteorology (1975). Between 1st April and 30th September, 87% of the rainfall of Rockingham is received. The wettest months, May-August provide 73% of the total annual average rainfall. Temperatures on the island are usually mild, even in summer, and sea breezes and strong winds are commonly experienced. Winter storms with gale-force north-west and south-west winds are frequent and salt spray may fall over the entire island.

The island is almost completely vegetated; there are only a few bare-sand areas caused by blowouts. The most widespread plant cover is dense scrub of *Acacia rostellifera*. Forest-like stands of Rottnest Island Pine, *Callitris preissii* occur in the north of the island along with the only other tree species present, *Melaleuca lanceolata*. Garden Island does not have extensive steppe-like plains characteristic of the western parts of Rottnest Island.

Garden Island, like other islands adjacent to south-western Australia, was not inhabited by Aborigines and so was not subject to frequent firing (Seddon 1972: p. 212). Fires could only have been caused by lightning strikes.

HISTORY OF BOTANICAL INVESTIGATIONS

The French Corvette *Le Naturaliste* visited Garden Island in June 1801, and it was recorded that:

> "The interior is completely wooded; the trees on the whole are high and there are shrubs of a very attractive appearance..." (Péron 1807: p. 190; our translation).

In March 1827 Charles Fraser visited Garden Island during the James Stirling expedition to examine the Swan River area.

> "The island of Buache is composed principally of low ridges of light sandy loam, traversing the island from north to south, and terminating on the south with high cliffs or banks of sand, the loftiest parts of which are thickly covered with Cypress, (*Calytris*) {*Callitris preissii*; our interpretation} and the surface towards the sea is considerably interrupted by limestone rocks. The soil, though light, appears to me, from the immense thickets of a species of *Solanum* {*Solanum symonii*} which it produces, and which attains a height of ten feet, to be capable of producing any description of light garden crop." (Fraser 1830: p. 233).

The valley-like depressions and northern part of the island were described as:

> "covered with gigantic *Solana* {*Solanum symonii*} and a beautiful species of *Brunonia* {*Trachymene caerulea*}."

> "The north side of the island is in many places covered with extensive thickets of arborescent *Metrosideros* {*Melaleuca lanceolata*} ..."

In 1829 C.H. Fremantle noted:

> "...the found there {on Garden Island} some dry kind of grass and a species of Rushes, the Island barren." (27th April).
>
> "...fire wood was found on Garden Island in great abundance, the island being covered with a small kind of pine {*Callitris*} and fit for no other use." (28th April).
>
> "...went on shore and tried to walk over the Island, but from the thickness of the trees and undergrowth it was impossible to move...The Island is covered with a small kind of Pine wood {*Callitris*} and appears to have been burnt all over, as there is a quantity of young wood coming up." (28th April).
>
> "I determined to return by walking across the Island, and altho the distance does not exceed 3/4 of a mile it occupied us at least an hour, the wood being so thick with quantities of trees burnt and blown down." (7th May).
>
> "On the Island there are a great many small trees which work up well, the wood is excessively hard, a Species of Pine, having the appearance of Cedar, {*Callitris*} and a good deal of Fir: {probably *Melaleuca lanceolata*} it does not run large, and what does is of little value as the inside about the heart is completely decayed." (19th May) (Cottesloe 1928: pp. 32, 34, 43, 51).

The first European settlement of the western coast of Western Australia was established at Garden Island in June 1829. Gardens were established with great difficulty and with little success until efforts were abandoned in late 1830 (Seddon 1972: p. 214). After the settlement of Fremantle and Perth in 1829 three more observations on the indigenous vegetation of Garden Island were made by visiting naturalists. On the 12th November 1829 Thomas Braidwood Wilson noted:

> "Arriving nearly at the southern extremity of the island, we landed, intending to penetrate across it; but from the thickly interwoven underwood, our progress being painful and slow, the attempt was abandoned." (Wilson 1835: p. 218).

Later, in November and December 1833 Karl von Huegel visited the island and observed in his diary:

> "The island forms unbroken hills through which it is never easy to penetrate; overgrown with thick stands tightly intertwined with *Clematis* {*Clematis microphylla*} and a species of *Viscum* {probably *Cassytha glabella*} it is often the work of an hour to cover a few hundred feet." (Napier 1975: p. 61 and personal communication).

Ludwig Preiss collected on the offshore islands including Garden Island in November and December 1839 but there is no published account of the vegetation, only records of the species collected some of which were cited by Bentham (1863-1878) in "Flora Australiensis" and by Lehmann (1844-48) in "Plantae Preissianae".

In December 1919 the Royal Society in W.A. held an excursion to Garden Island. This was reported on by W.B. Alexander (1921). Describing the view

from Mt. Haycock, a high hill near the northern end of the island, the report stated:

> "The whole interior of this part of the island was seen to be thickly covered with cypress pines *Callitris* interlaced with various creepers forming a dense matted jungle. Nearer the coast, on the slopes of the hills, thickets of wattles *Acacia cyclops* with occasional tea trees *Melaleuca* occur, and in places there are open tracts covered mainly with grasses." (Alexander 1921: p. 55).

Thirty species of flowering plants were recorded.

Because Garden Island is long and narrow and accessible along its eastern side the early European visitors were able to view most of the island from close proximity and their published accounts thus provide a reliable baseline for comparison with recent observations. This is in contrast to nearby Rottnest Island, for which early accounts of its vegetation give conflicting views. This is largely due to the lack of suitable boat landing sites on the latter island. Most early observations on the vegetation of Rottnest were made from landings on the southern and eastern parts of the island at Porpoise Bay and the well-wooded Thomson Bay area (Marchant 1977).

T.B. Wilson (1835 pp. 198-202) gave the following account of a walk to the centre of Rottnest when he visited that island on the 25th and 26th October 1829, a month before he visited Garden Island. Wilson makes no mention of any difficulty in travelling from Porpoise Bay to Salmon Bay and to the centre of the island. He wrote:

> "The hummocks are sand hills, many of which are entirely destitute of any kind of herbage {probably the sand blow-out from Barnett Gully}, in the valleys are some stunted trees and shrubs, and a very little grass. It appeared astonishing to us that Vlaming could speak in raptures of this island which we found so miserably barren." (Wilson 1835: p. 202).

This important early account was overlooked by Storr (1963), Ferguson and O'Connor (1977) and Marchant (1977). The accounts by the Dutch as well as those of the French and the English probably only refer to the eastern part of Rottnest.

RECENT BOTANICAL STUDIES

Floristic comparisons of Rottnest, Carnac and Garden Island were presented by W. McArthur (1957). Fire regeneration studies were made by A.M. Baird (1958) and in 1974 a detailed, unpublished report on the island, including observations on the vegetation and a vegetation map, was prepared by J.M. Miles for the Garden Island Working Group (Department of Conservation and the Environment). W.M. McArthur has prepared detailed soil and vegetation maps of the island for publication in 1981.

We commenced preparing a species list for Garden Island in 1978. Additional information on recent collections of the vascular plants of Garden Island was collected from both the literature and collections at the W.A. Herbarium (PERTH) and at the Herbarium, University of W.A. (UWA) (see

Appendix). This included the following plant collections in addition to those of L. Preiss, W.B. Alexander and W.M. McArthur previously mentioned:- A.M. Baird (published 1958), G.M. Storr 1958-60, R.M. Humphries 1969, J.P. Kelsall 1960, T.E.H. Aplin 1960, T.B. Humphries 1969, I. Abbott 1975, I. Abbott, R. Cranfield and N. Marchant 1978-79 and W.M. McArthur 1978-79.

PLANT SPECIES RICHNESS OF GARDEN ISLAND COMPARED WITH ADJACENT LARGE ISLANDS

Garden Island, although 600 ha less in area than Rottnest Island (excluding the salt lakes), has only two native plant species fewer than Rottnest (Table 1).

TABLE 1

Numbers of native and alien plant species present on Garden, Rottnest and Carnac Islands.

Island	Area	Plant species	
	ha	No. native species*	No. alien species**
Garden	1100	103	71
Rottnest	1700	105†	71†
Carnac	16	44***	53***

* excluding native species introduced by man to the islands
** excluding species in plantations
† based on Storr (1962) with additions supplied by him (Storr ms.) and one addition and several corrections supplied by us
*** based on Abbott (1980a)

Such similarity in species richness is surprising because Rottnest has greater habitat variety than Garden Island. The most striking difference is that salt lakes and associated vegetation are present on Rottnest but absent from Garden Island. Rottnest, however, is more distant from the mainland than is Garden Island. We would expect this factor would tend to reduce plant species richness of Rottnest.

Some of the native plant species present on Rottnest in 1829, the start of European settlement of the adjacent mainland, may have since become extinct. For example Preiss made a small collection of about 50 native species on Rottnest in 1839; six of these were not listed by McArthur (1957) or Storr (1962) and may therefore be extinct on Rottnest. It is likely that three of these species (*Lepidium pseudoruderale*, *Sida hookeriana* and *Gnaphalium japonicum*) represent misidentifications of species still present on Rottnest or adjacent stacks. Between 1839 and 1955 the vegetation of the eastern sector of Rottnest was altered considerably through frequent fires, clearing, and a massive increase in numbers of quokkas (wallabies) about 1930 (Storr 1963). None of these gross changes occurred on Garden Island.

FLORISTIC COMPARISONS BETWEEN GARDEN, ROTTNEST AND CARNAC ISLANDS

A comparison of the numbers of native plant species occurring on these islands is given in Table 2.

TABLE 2

Analysis of similarities between the floras (native species only) of Garden, Rottnest and Carnac Islands

Species occurring on	No. species
Rottnest only	27
Garden only	23
Carnac only	1
all three islands	34
Rottnest and Garden	40
Garden and Carnac	5
Rottnest and Carnac	4

This table shows that most species are found in one of four categories: on Rottnest only, or Garden Island only, on Rottnest and Garden but not Carnac, or on all three islands. Coefficients of similarity for the native species, based on Sorensen's formula, are: 0.71 (Rottnest and Garden Island), 0.53 (Garden and Carnac Islands), and 0.51 (Rottnest and Carnac Islands). This shows that the native plant floras of Garden and Rottnest Islands are more alike than either is to the smaller Carnac Island.

Reference to our checklist and Storr (1962) will enable the species in the seven categories to be readily identified. Of most interest here are the 23 native species found on Garden Island but not on Rottnest or Carnac. Eight of these were recorded only by McArthur in 1952 and island populations may now be extinct. Eleven other species, particularly *Crassula* species 1 & 2, *Cassytha glabella*, *Acacia cochlearis*, *A. saligna*, *Melaleuca huegelii*, *Hardenbergia comptoniana*, *Exocarpos sparteus*, *Leptomeria preissiana*, *Lasiopetalum oppositifolium* and *Waitzia citrina*, are either locally common or widespread over the island. We are unable to explain their restriction to Garden Island. Actually the occurrence of 27 species on Rottnest but not on Garden or Carnac and of another 23 on Garden Island but not on Rottnest or Carnac, parallels well-known faunistic differences, also not yet convincingly explained. Such differences include the occurrence of different species of wallabies, snakes and passerine landbirds on the two islands (Abbott 1980b).

Concerning the 40 species of native plants common to Garden and Rottnest, the simplest explanation for their absence from Carnac Island is that a 16 ha island is too small to permit their survival. However, this cannot be the full explanation as sixteen of these species occur on Penguin Island (area 12 ha) and some stacks close to Rottnest, and another eight species are found on islands elsewhere along the western coast that are very close to the mainland. It seems likely, therefore, that Carnac Island is too far from Garden and Rottnest Islands for successful dispersal of the missing species to occur.

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APPENDIX: LIST OF PLANT SPECIES

Abbreviations

CR	Species also present on Carnac or Rottnest Islands respectively
A	I. Abbott 1975
ACM	I. Abbot, R. Cranfield & N. Marchant 1978-79
Alex	W.B. Alexander 1921 (publication)
Aplin	T.E.H. Aplin
B	A.M. Baird 1958 (publication)
H	R.B. Humphries 1969
K	J.P. Kelsall 1960
McA	W.M. McArthur 1957 (publication)
McA 1978	W.M. McArthur 1978
Preiss 1839	L. Preiss in Lehmann (1844-8)
Storr	G.M. Storr 1958-60 (ms)
{}	indicate records which are unsupported by voucher specimens and which we believe represent identification errors for species found by other collectors.
+	Native W.A. species introduced by man to Garden Island
*	Alien species.

TAXON	ISLAND	DATA SOURCE
GYMNOSPERMAE		
ARAUCARIACEAE		
* *Araucaria heterophylla* (Salisb.) Franco		ACM
CUPRESSACEAE		
Callitris preissii Miq. (previously known as *C. robusta* (R.Br.) Mirb.)	R	McA, B, A, ACM
ANGIOSPERMAE		
MONOCOTYLEDONAE		
ARACEAE		
* *Zantedeschia aethiopica* (L.) Spreng.	CR	A, ACM
CYPERACEAE		
Carex preissii Nees	CR	Storr, B, McA, A, ACM
Lepidosperma angustatum R.Br.	R	A, ACM
Lepidosperma gladiatum Labill.	CR	McA, B, A, ACM
{*L. squamatum* Labill.}		McA
Scirpus nodosus Rottb.	CR	McA, B, A, ACM
S. marginatus Thunb. (previously known as *S. antarcticus* L.)	CR	McA, A, ACM

TAXON	ISLAND	DATA SOURCE
HAEMODORACEAE		
Conostylis candicans Endl.	R	Alex, McA, A, ACM
IRIDACEAE		
* *Homeria miniata* (Andr.) Sweet	R	Storr, ACM
* *Watsonia* sp.		ACM
JUNCACEAE		
Juncus pallidus R.Br.	R	ACM
JUNCAGINACEAE		
Triglochin trichophora Nees ex Endl.	CR	ACM
LILIACEAE		
* *Allium* sp.		ACM
* *Asparagus asparagoides* (L.) W.F. Wight		McA, A, ACM
* *Asphodelus fistulosus* L.	R	McA, A, ACM
Dianella revoluta R.Br.		McA
Thysanotus patersonii R.Br.	R	McA
* *Trachyandra divaricata* (N.J. Jacq.) Kunth (previously known as *Anthericum divaricatum* Jacq.)	CR	McA, A, ACM
MUSACEAE		
* *Musa* sp.		A
ORCHIDACEAE		
Acianthus reniformis (R.Br.) Schlechter	R	A, ACM
Caladenia ? latifolia R.Br.	R	A, ACM
Eriochilus caber Lindl. (previously known as *E. tenuis* Lindl.)		McA
POACEAE		
* *Aira cupaniana* Guss.	R	ACM
* *Avena barbata* Link.	CR	A, ACM
* {*A. fatua* L.}		McA
* *Bambusa* sp.		ACM
Bromus arenarius Labill.	CR	ACM
* *B. diandrus* Roth (previously known as *B. gussonii* Parl.)	CR	McA, A, ACM
* *B. rubens* L.	R	McA 1978, ACM
* *Catapodium rigidum* (L.) C.E. Hubbard ex Dony	CR	A, ACM
* *Cynodon dactylon* (L.) Pers.	R	Storr, A, ACM
* *Ehrharta longiflora* Sm.	CR	ACM
* *Hordeum leporinum* Link	CR	ACM
* *H. vulgare* L.		A
* *Lagurus ovatus* L.	CR	A, McA 1978, ACM
* *Lolium* sp.	CR	ACM
* *Parapholis incurva* (L.) C.E. Hubbard	CR	A
* *Poa annua* L.	CR	McA, ACM
P. poiformis (Labill.) Druce (previously known as *P. caespitosa* Forst.)	CR	McA, A, ACM
* *Polypogon monspeliensis* (L.) Desf.	R	A, McA 1978, ACM
Spinifex hirsutus Labill.	R	Alex, McA, A, ACM
S. longifolius R.Br.	CR	McA, A, ACM
Sporobolus virginicus (L.) Kunth	R	A, ACM
* *Stenotaphrum secundatum* (Walt.) Kuntze	R	A, ACM
Stipa flavescens Labill. (previously known as *S. variabilis* Hughes)	CR	McA, B, A
Vulpia myuros (L.) C.C. Gmel.	CR	A, ACM

	TAXON	ISLAND	DATA SOURCE
	TYPHACEAE		
	{*Typha angustifolia* L.}		McA
*	*T. orientalis* Presl.		McA 1978
	XANTHORRHOEACEAE		
	Acanthocarpus preissii Lehm.	CR	McA, B, A, ACM
	DICOTYLEDONAE		
	AIZOACEAE		
	{*Carpobrotus aequilaterus* N.E. Br.}		Alex, McA, B
	C. virescens (Haw.) Schwantes	CR	A, ACM
	Tetragonia amplexicoma (Miq.) Hook.f.	CR	McA, A, McA 1978, ACM
	T. decumbens Miller (previously known as *T. zeyheri* Fenzl. ex Harv. et Sond.)	CR	McA, McA 1978, A, ACM
	APIACEAE		
	Apium prostratum Labill. ex Vent.	CR	Storr, A, ACM
	Daucus glochidiatus (Labill.) Fisch. et al.	CR	A, ACM
	Hydrocotyle hispidula Bunge	R	ACM
	H. tetragonocarpa Bunge	R	Storr (?sp.), A, ACM
	Trachymene caerulea (Reichb.) Grah. (previously known as *Didiscus coeruleus* DC.)	R.	Preiss, Alex, McA, B A, ACM
	{*T. cyanopetala* (F. Muell.) Benth.}		B
	T. pilosa Sm. (previously known as *Didiscus pilosus* Benth.)	R	McA, A, ACM
	APOCYNACEAE		
	Alyxia buxifolia R.Br.	R	Preiss, McA, A, ACM
*	*Nerium oleander* L.		ACM
	ASTERACEAE		
*	{*Actites megalocarpa* (Hook.f.) N.S. Lander} (previously known as *Sonchus asper* Hill)		McA
	Angianthus cunninghamii (DC.) Benth.		McA
	A. humifusus (Labill.) Benth.		McA
*	*Arctotheca calendula* (L.) Levyns (previously known as *Cryptostemma calendulaceum* (L.) R.Br.)	CR	McA, A, ACM
*	*A. populifolia* (Berg.) T. Norl. (previously known as *A. nivea* (Less.) Leeuwin)	R	McA, A
	Athrixia pulverulenta (Lindl.) Druce		Alex, McA
	Calocephalus brownii (Cass.) F. Muell.	CR	McA, A, ACM
*	*Carduus pycnocephalus* L.	CR	Storr, A, ACM
*	*Conyza bonariensis* (L.) Cronquist (previously known as *Erigeron crispens* Ponnet)	R	McA
**	*Dittrichia graveolens* (L.) W. Greuter	R	ACM
*	*Hypochoeris glabra* L.	CR	McA, A, ACM
	Olearia axillaris (DC.) F. Muell. ex Benth.	CR	McA, B, A, ACM
*	*Osteospermum clandestinum* (Less.) Norl. (previously known as *Tripteris clandestina* Less.)		McA
	Senecio lautus Forst.f. ex Willd.	CR	Alex, McA, B, A, ACM
*	*Sonchus oleraceus* L.	CR	Alex, McA, A, ACM
	Waitzia citrina (Benth.) Steetz		A, ACM

TAXON	ISLAND	DATA SOURCE
BASELLACEAE		
* *? Bousingaultia baselloides* Meirs		ACM
BORAGINACEAE		
Myosotis australis R.Br.	R	W.V. Fitzg, McA, ACM
BRASSICACEAE		
* *Cakile maritima* Scop.	R	Alex, McA, A, ACM
Hymenolobus procumbens (L.) Nutt ex Shinz et Thell.	CR	A, ACM
Lepidium foliosum Desv.	C	K, Storr
* *Nasturtium officinale* R.Br.		ACM
* *Sisymbrium orientale* L.	CR	ACM
CARYOPHYLLACEAE		
* *Cerastium glomeratum* Thuill.	CR	A, ACM
* *Petrorhagia prolifera* (L.) P.W. Ball et Heywood		McA 1978, ACM
* *Polycarpon tetraphyllum* (L.) L.	CR	ACM
* *Sagina apetala* Arduino	CR	A, ACM
* *Silene* sp.		ACM
* *Stellaria media* (L.) Vill.	CR	A, ACM
CHENOPODIACEAE		
Atriplex cinerea Poir.	R	ACM
A. isatidea Moq.	R	McA, A, ACM
* *Chenopodium murale* L.	CR	McA
Enchylaena tomentosa R.Br.	CR	McA
Rhagodia baccata (Labill.) Moq.	CR	Alex, McA, A, ACM
R. radiata Nees		A, ACM
Salsola kali L.	C	McA, A, ACM
Sarcocornia blackiana (Ulbr.) A.J. Scott (previously known as *Salicornia blackiana* Ulbr.)	R	McA, Aplin, A, ACM
{*Suaeda maritima* (L.) Dumont} (presumably in error for *Threlkeldia diffusa* which was not listed by McArthur)		McA
Threlkeldia diffusa R.Br.	CR	Storr, A, ACM
CONVOLVULACEAE		
* *Convolvulus* sp.		ACM
Dichondra repens Forst. et Forst.f.	R	Storr, ACM
Wilsonia backhousei Hook.f.		McA
CRASSULACEAE		
Crassula colorata (Nees) Ostenfeld	CR	A, ACM
C. glomerata Berg.	C	A, ACM
C. pedicellosa (F. Muell.) Ostenfeld	C	A, ACM
C. sp. 1		ACM
C. sp. 2		ACM
EPACRIDACEAE		
Acrotriche cordata (Labill.) R.Br. (previously known as *A. ovalifolia* R.Br.)	R	McA, A, ACM
Leucopogon insularis A. Cunn. ex DC.	R	A, ACM
L. parviflorus (Andr.) Lindl. (previously known as *L. richei* (Labill.) R.Br.)	R	McA, B, K, A, ACM
{*L. racemulosus* DC.}		McA
EUPHORBIACEAE		
Beyeria viscosa (Labill.) Miq.	R	B, H, ACM
{*Euphorbia drummondii* Boiss.}		McA
* *E. peplus* L.	CR	A, ACM

TAXON	ISLAND	DATA SOURCE
EUPHORBIACEAE Cont.		
Phyllanthus calycinus Labill.	R	Alex, McA, B, A, ACM
Poranthera microphylla Brongn.	R	B, ACM
* *Ricinus communis* L.	R	McA, A, ACM
FRANKENIACEAE		
Frankenia pauciflora DC.	CR	McA, A, ACM
FUMARIACEAE		
* *Fumaria muralis* Sond. ex Koch		A, ACM
GENTIANACEAE		
* *Centaurium erythraea* Rafn. (previously known as *Erythraea centaurium* Pers.)	R	Alex, McA, A, ACM
GERANIACEAE		
* *Erodium cicutarium* (L.) L'Hér. ex Ait.	CR	McA, ACM
* *Geranium molle* L.	CR	A, ACM
G. pilosum Forst.		McA
Pelargonium capitatum (L.) L'Hér. ex Ait. (previously known as *P. australe* Willd.)	CR	Alex, McA, B, A, ACM
GOODENIACEAE		
Scaevola crassifolia Labill.	CR	Alex, McA, B, A, ACM
GYROSTEMONACEAE		
Tersonia brevipes Moq.		Alex
LAMIACEAE		
Westringia dampieri R.Br. (previously known as *W. rigida* R.Br.)	R	Alex, McA, A, ACM
LAURACEAE		
Cassytha glabella R.Br.		McA, A, ACM
LEGUMINOSAE		
Acacia cochlearis (Labill.) H. Wendl.		A, ACM
A. cyclops A. Cunn. ex G. Don	CR	Alex, McA, A, ACM
{*A. heteroclita* Meisn.} (presumably in error for *Acacia cochlearis* which was not listed by McArthur)		McA
A. rostellifera Benth.	CR	McA, B, A, ACM
A. saligna (Labill.) H. Wendl. (previously known as *A. cyanophylla* Lindl.)		McA, A, ACM
Hardenbergia comptoniana (Andr.) Benth.		McA, A
* *Medicago polymorpha* L. (Syn. *M. denticulata* Willd.)	CR	Storr, ACM
* *Melitotus indica* (L.) All.	CR	Storr, A, ACM
* *Trifolium scabrum* L.	C	McA 1978
LOBELIACEAE		
Lobelia tenuior R.Br.		McA, A
LORANTHACEAE		
Amyema miraculosum (Miq.) Tiegh. (previously known as *Loranthus miraculosus* (Miq.) Tiegh. var. *melaleucae*)		McA, McA 1978
MALVACEAE		
* *Lavatera arborea* L.	C	McA 1978
L. plebeia Sims	C	A
MELIACEAE		
* *Melia azederach* L.		ACM
MYOPORACEAE		
Eremophila glabra (R.Br.) Ostenfeld (previously known as *E. brownii* F. Muell.)	R	Alex, McA, B, A, ACM

TAXON	ISLAND	DATA SOURCE
MYOPORACEAE Cont.		
Myoporum adscendens R.Br. (previously known as *M. insulare* (R.Br.)	R	McA, A
MYRTACEAE		
+ *Agonis flexuosa* (Spreng) Schau.		A, ACM
+ *Eucalyptus gomphocephala* DC.		ACM
Melaleuca huegelii Endl.		McA, B, A, ACM
M. lanceolata Otto (previously known as *M. pubescens* Schau.)	R	McA, B, A, ACM
ONAGRACEAE		
Epilobium billardierianum Ser. (previously known as *E. glabellum* Forst.)		McA
OROBANCHACEAE		
Orobanche australiana F. Muell.	R	McA, ACM
OXALIDACEAE		
Oxalis corniculatus L.	R	ACM
* *O. pes-caprae* L.		ACM
PAPAVERACEAE		
* *Argemone mexicana* L.		A, ACM
PITTOSPORACEAE		
Pittosporum phylliraeoides DC.	R	McA, A, ACM
POLYGALACEAE		
Comesperma confertum Labill.		McA
C. integerrimum Endl.	CR	Preiss, McA, A, ACM
POLYGONACEAE		
* *Emex australis* Steinh.		McA, ACM
PORTULACACEAE		
Calandrinia ? brevipedata F. Muell.		A, ACM
PRIMULACEAE		
* *Anagallis arvensis* L.	CR	McA, A, ACM
Samolus repens (Forst.) Pers.	R	Preiss, McA, A, ACM
PUNICACEAE		
* *Punica granatum* L.		McA
RANUNCULACEAE		
Clematis microphylla DC.	CR	McA, B, ACM
RHAMNACEAE		
Spyridium globulosum (Labill.) Benth.	CR	McA, B, A, ACM
ROSACEAE		
* *Crataegus* sp.		ACM
RUBIACEAE		
* *Galium murale* (L.) All.	CR	Storr, A, ACM
* *Sherardia arvensis* L.		ACM
RUTACEAE		
Boronia alata Sm.	R	McA, B, A, ACM
Diplolaena dampieri Desf.	R	McA, A, ACM
SANTALACEAE		
{*Exocarpos aphyllus* R.Br.}		McA
E. sparteus R.Br.		A, ACM
Leptomeria preissiana (Miq.) DC.		Preiss, Alex, McA, A, AC, M
SAPINDACEAE		
Dodonaea aptera Miq.	R	Preiss, A, ACM
SCROPHULARIACEAE		
* *Dischisma arenarium* E. Mey. (previously known as *D. capitatum* (Thunb.) Chois.)	CR	McA, A, ACM
* *Parentucellia* sp.		ACM

TAXON	ISLAND	DATA SOURCE
SOLANACEAE		
* *Nicotiana glauca* Grah.	R	Storr, ACM
* *Solanum nigrum* L.	C	Alex, McA, A, ACM
S. symonii Eichler (previously known as *S. simile* F. Muell.)	CR	McA, B, A, ACM
STERCULIACEAE		
Guichenotia ledifolia J. Gay	R	McA, B, A, ACM
Lasiopetalum oppositifolium F. Muell. (previously known as *L. angustifolium* W.V. Fitzg.)		McA, K, A
Thomasia cognata Steud.	R	Alex, McA, B, A, ACM
{*T. triphylla* (Labill.) J. Gay}		Huegel in Preiss
URTICACEAE		
Parietaria debilis Forst.f.	CR	McA, A, ACM
* *Urtica urens* L.	CR	Storr, ACM
VALERIANACEAE		
* *Centranthus ruber* (L.) DC.		McA 1978
VITACEAE		
* *Vitis vinifera* L.		McA 1978
ZYGOPHYLLACEAE		
Nitraria billardieri DC. (previously known as *N. schoberi* L.)	CR	McA, A, ACM
Zygophyllum apiculatum		
UNIDENTIFIED (omitted from Tables 1 & 2)		
SCROPHULARIACEAE		
?Limosella		
ASTERACEAE		
Two species		

WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES

No. 5, 1981: 63-69

VEGETATION AND FLORA OF ROES ROCK, FITZGERALD RIVER NATIONAL PARK, WESTERN AUSTRALIA

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ABSTRACT

The vegetation and flora of Roes Rock, a small mesa of spongolite, are described. The three vegetation types present are well represented in the Fitzgerald River National Park. Fifty nine plant species were recorded and two were important records: Prasophyllum nigricans *has rarely been recorded in the general area, and* Leucopogon *sp. (KRN6781) has only been collected once before.*

INTRODUCTION

Roes Rock is situated about 400 m west of the Fitzgerald River (33°58' S. lat., 119°23' E. long.) near the Fitzgerald River National Park's northern boundary. Although vegetation of the general area has been described and mapped (Beard, 1972; Newbey, 1979; Aplin *et al.*, in preparation), an account of this small mesa's vegetation and flora has not been published. This survey was carried out on April 27, 1980.

Access to Roes Rock is from a four-wheel drive track which is impassable after heavy rains.

The mesa was named after the first Surveyor-General of Western Australia, J.S. Roe, who passed by in 1848 (Roe, 1852).

GEOLOGY AND GEOMORPHOLOGY

The mesa is a remnant of Pallinup Siltstone, up to 60 m thick, overlying granite of the Albany-Fraser Block, which is probably Archaean in age (Cockbain and van de Graaf, 1973). Pallinup Siltstone, the upper member of the Plantagenet Group (Cockbain, 1968), was laid down about 40-43 million years ago, during the Eocene marine transgression. Following the marine regression, the Fitzgerald River quickly cut through the relatively soft spongolite formed mainly from clays and sponge spicules. Backcutting outwards from the river occurred at a much slower rate and resulted in a flat-bottomed gorge flanked by cliffs and steep rubble slopes.

Roes Rock was formed by backcutting from the Fitzgerald River, and a small tributary, Tooartup Creek. The mesa stands about 50 m above the gorge

bottom. The level summit is 100-120 m long in an east-west direction, and mainly 30-40 m wide. Apart from the southern slope, the upper 10-15 m is vertical cliff. Cliff faces are flat, and although formed of horizontally-bedded sediments, they are not differentially weathered as frequently occurs on other cliffs along the gorge. The upper two-thirds of the southern slope has an incline of 40^{o}-50^{o} with small pockets of soil in the weathered bedrock. Some areas of bedrock have a hardened surface layer. Small cavities (10-30 cm high and 30-100 cm deep) have been formed below this layer by bedrock weathering. The lower third of this slope, and below the cliffs, has a general incline of 20^{o}-25^{o}, decreasing to 7^{o} at the base. This latter angle was used to define the perimeter of the Rock. Colluvial soils have accumulated on this slope.

CLIMATE

Situated 26 km from the sea, Roes Rock experiences a Marine Mediterranean climate (Papadakis, 1975), with warm to hot dry summers, and cool damp winters. As the nearest weather recording station is Jerramungup (rainfall only), 40 km away, climatic data have been estimated from maps and data (Australian Bureau of Meteorology, 1962). Average annual rainfall is 475 mm with the main rainy period from May till September, and extremes of 225 mm and 625 mm. Average maximum temperature for the hottest month (January) is about 27^{o}C, and the coldest month (July) about 17^{o}C. Estimated extremes of temperature varied from 44^{o}C to -3^{o}C. The growing period is approximately 6.5 months.

SOIL

The soils are derived from the underlying, relatively soft spongolite, and have been discussed by Newbey (1979). A single sample was collected from the summit of Roes Rock. The soils on the slopes are very similar to the sample.

Soil colour was recorded from a moist sample using Fujihira Soil Colour Charts. All percentages are from visual estimates. Texture classification and terminology follows Northcote (1971). pH was calculated using Inoculo CSIRO Soil pH Test Kit.

Depth 5-21 cm Brown (7.5YR4.5/4) sandy loam; humus content very low; roots fine, numerous; very friable; 3-10% fine sand; 20-30% subrounded spongolite 6-20 mm across; not calcareous; pH 6½; lower boundary wavy to irregular; weathering zone very narrow, or absent.

In some areas, more sand was present in the profile. This was related to the bedrock, and was visually estimated at up to 20% fine and 5% coarse sand.

The flat summit had 5% of bedrock exposed, and 3-5% covered with stone 2-10 cm long. Litter was restricted to a few small patches, under denser stands of large shrubs, and isolated small trees. Consisting mainly of terete and broad leaves, the litter was only 1 cm thick. The water regime was variable, being related to soil thickness and the run-off from small exposures of bedrock.

Soil was absent from the vertical cliffs, but a similar soil to that of the summit was present on the upper slope in pockets up to 21 cm deep. Exposures of bedrock covered 80%, and stone 5-35 cm across covered 15%. A broad-leaf litter, 2 cm thick, was only recorded under a single stunted tree.

On the lower slopes, the soil consisted mainly of colluvium from the upper slopes and cliffs. A small proportion was derived from *in situ* weathering. Soil depth varied from 15 cm to 35 cm with a general increase downslope. Soil moisture is supplemented by run-off from the upper slope and cliffs. During heavy falls of rain, the summit could also provide some run-off. The soil was darkened, possibly due to an increased but still low humus content. Bedrock only covered 5%, and stone 2-10 cm long, also covered 5%. Broad-leaf litter, 1-2 cm thick is almost continuous under large patches of *Eucalyptus* species, and has 40% cover.

VEGETATION

The three types of vegetation present are described in Appendix I. On the summit, height and density of vegetation generally increases with increasing soil depth. Although the soil is shallow (5-12 cm), the underlying spongolite is soft and can be penetrated by the roots of most species (Newbey, unpublished data). This contributes to the survival of deeply rooting species as the shallow soil would dry out during some summers when two to four months may elapse between effective falls of rain. Exposures of bedrock provide some run-off from small falls of rain, but these exposures are less than 10 m across. Soil-binding species e.g. *Gahnia ancistrophylla, Lepidosperma drummondii* are quite common in places.

On the upper slope, vegetation is very scattered, and generally stunted to a moderate degree. Soils are shallow with similar rates of drying-out to the summit soils. However, run-off would be greater from moderate to high intensity falls of rain as the 40^{o}-50^{o} slope is not suited to rapid infiltration. The occurrence of vegetation on a slope of this steepness is unusual as 23^{o}-27^{o} appears to be the steepest slopes growing vegetation in other spongolite areas (Newbey, unpublished data). Soil-binding species are absent.

The lower slope, with a deeper soil and a higher moisture content, supports a much denser and taller vegetation. Its patchiness may be related to soil depth. The high density of the upper stratum strongly restricts the number of smaller plants present.

Beard (1972) and Aplin *et al.* (in preparation) have mapped the vegetation of the general area but their scale of 1:250,000 is too coarse to define the vegetation of Roes Rock.

All vegetation types on Roes Rock are well represented in the Fitzgerald River National Park. Vegetation on the summit and upper slope is Spongolite Complex, and on the lower slope is *Eucalyptus astringens* Low open-forest (Newbey, 1979).

FLORA

Fifty-six species, including one introduced, were recorded and are listed in Appendix II. Three additional species recorded by Alex George, are

also listed. A spring visit may record a few annuals but dead plant material of this life form was not seen.

With two exceptions, the plants recorded are commonly found in similar spongolite situations. *Prasophyllum nigricans* is an inconspicuous and infrequently recorded species. *Leucopogon* sp. (KRN6781) has only been recorded once before, also in the Fitzgerald River National Park (KRN3559).

ACKNOWLEDGEMENT

My thanks to Alex George, W.A. Herbarium, for use of his plant records of Roes Rock.

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APPENDIX I

Vegetation Types

The classification follows that of Muir (1977) and figures in brackets are visual estimates of percentage canopy cover. + = less than 0.1%. CC = canopy cover. * = introduced species.

Vegetation types are listed under their position on Roes Rock: (a) summit, (b) upper slope, and (c) lower slope.

(a) Summit
Key Description: Open Scrub/Open Low Scrub A/Dwarf Scrub D/Very Open Low Grass/Very Open Low Sedges.
Stratum 1: Trees 4-5 m, CC = .2%
Eucalyptus astringens (.2), *Casuarina huegeliana* (+).
Stratum 2: Shrubs 2-3 m, CC = 2%
Callitris preissii ssp. *verrucosa* (.5), *Santalum acuminatum* (.5), *Acacia* sp. (KRN2472)(.2), *Hakea laurina* (+).
Stratum 3: Shrubs 1.6-2 m, CC = 1.5%
Melaleuca pentagona (1), *Banksia laevigata* ssp. *laevigata* (.5), *Persoonia teretifolia* (+), *Sollya heterophylla* (+).
Stratum 4: Shrubs 1.1-1.5 m, CC = 1%
Casuarina campestris ssp. *campestris* (1), *Oxylobium parviflorum* (+).
Stratum 5: Shrubs 0.6-1.0 m, CC = 2%
Calothamnus villosus (1), *Leucopogon rubicundus* (.2), *Calothamnus gibbosus* (+), *Hovea acanthoclada* (+), *Melaleuca cuneata* (+), *Phebalium rude* ssp. *amblycarpum* (+).
Stratum 6a: Shrubs 0.0-0.5 m, CC = 10%
Baeckea tetragona (6), *Leucopogon* sp. (KRN6781)(2), *Acacia* sp. (KRN1295)(+), *Acrotriche plurilocularis* (+), *Carpobrotus rossii* (+), *Cryptandra glabriflora* (+), *Goodenia scapigera* (+), *Verticordia oxylepis* (+).
b: Bunch grasses less than 0.5 m, CC = 3%
Stipa variabilis *Amphipogon turbinatus*
c: Sedges less than 0.5 m, CC - 2.5%
Gahnia ancistrophylla (2),*Lepidosperma striatum* (.2), *Dianella revoluta* (+), *L. drummondii* (+), *Lomandra micrantha* (+).
d: Herbs, CC = +%
Prasophyllum nigricans (+).

(b) Upper Slope
Key Description: Very Open Shrub Mallee/Open Dwarf Scrub D.
Stratum 1: Shrub mallee 3-4 m, CC = 2%
Eucalyptus gardneri (2).
Stratum 2: Shrubs 1.6-2.0 m, CC = 1%
Hakea laurina (1).
Stratum 3: Shrubs 1.1-1.5 m, CC = 1%
Callitris preissii ssp. *verrucosa* (.5).
Stratum 4: Shrubs 0.6-1.0 m, CC = 1.5%
Hakea ilicifolia (1), *Daviesia acanthoclona* (.5), *Oxylobium parviflorum* (+).
Stratum 5a: Shrubs 0.0-0.5 m, CC = 5%
Acrotriche plurilocularis (5), *Goodenia scapigera* (+).
b: Herbs, CC = +%
**Aira caryophyllea* (+), *Pterostylis vittata* (+).

(c) Lower Slope
Key Description: Low Forest A/Very Open Shrub Mallee/Open Scrub/Open Low Scrub A/Very Open Low Sedges.
Stratum 1: Trees 5-7 m, CC = 60%
Eucalyptus gardneri (40), *E. platypus* (20).
Stratum 2: Shrub mallees 3-5 m, CC = 5%
E. transcontinentalis (5).
Stratum 3: Shrubs more than 2 m, CC = 3%
Melaleuca sp. (KRN2764)(2), *Acacia* sp. (KRN2472), *Cassytha melantha* (+).

Stratum 4: Shrubs 1.6-2.0 m, CC = 1%
Melaleuca pentagona (.5), *Dodonaea amblyophylla* (+), *Sollya heterophylla* (+).
Stratum 5: Shrubs 1.1-1.5 m, CC = 2.3%
Daviesia acanthoclona (2), *Acacia* sp. (KRN1298), *Beyeria lechenaultii* (+), *Nematolepis phebalioides* (+).
Stratum 6: Shrubs 0.6-1.0 m, CC = +%
Hakea commutata (+), *Hovea acanthoclada* (+).
Stratum 7a: Shrubs 0.0-0.5 m, CC = 0.3%
Helichrysum lepidophyllum (.2), *Acrotriche ramiflora* (+), *Lasiopetalum compactum* (+), *Microcybe multiflora* (+), *Olearia muelleri* (+).
b: Bunch grasses less than 0.5 m, CC = 0.1%
Neurachne alopecuroides (+), *Stipa elegantissima* (+).
c: Sedges less than 0.5 m, CC = 3.5%
Lepidosperma brunonianum (3), *L. drummondii* (.5), *Dianella revoluta* (+).

APPENDIX II

Flora List

The occurrence of each species within a vegetation type is listed as percentage of canopy cover (CC); + = less than 0.1%. * = introduced species. ** additional species recorded by A. George.

Vegetation types are (a) summit, (b) upper, and (c) lower slope.

Species	Vegetation Types (a)	(b)	(c)
Acacia sp. (KRN2472)	.2		1
Acacia sp. (KRN1298)			.2
Acacia sp. (KRN1295)	1		
Acrotriche pluriloculars Jackes	+	5	
Acrotriche ramiflora R.Br.			+
**Aira caryophyllea* L.		+	
Amphipogon turbinatus R.Br.	1		
Baeckea tetragona F. Muell.	6		
Banksia laevigata Meisn. ssp. *laevigata*	.5		
Beyeria lechenaultii (DC.) Baill.			+
***Borya nitida* Labill.	+		+
Callitris preissii Miq. ssp. *verrucosa* (A. Cunn. ex Endl.) J. Garden	.5	.5	
Calothamnus gibbosus Benth.	+		
Calothamnus villosus R.Br.	1		
Carpobrotus rossii (Haw.) Schwantes	+		
Casuarina campestris Diels ssp. *campestris*	1		
Casuarina huegeliana Miq.	+		
Cryptandra glabriflora C.A. Gardner	+		
Cassytha melantha R.Br.			+
Daviesia acanthoclona F. Muell.		.5	2
Dianella revoluta R.Br.	+		+
Dodonaea amblyphylla Diels	.2		

Species	Vegetation Types (a)	(b)	(c)
**_Eriochilus dilatatus_ Lindl.	+		
Eucalyptus astringens Maiden	.2		
Eucalyptus gardneri Maiden		2	40
Eucalyptus platypus Hook.			20
Eucalyptus transcontinentalis Maiden			5
Gahnia ancistrophylla Benth.	2		
Goodenia scapigera R.Br.	+	+	
Hakea commutata F. Muell.			+
Hakea ilicifolia R.Br.		1	
Hakea laurina R.Br.	+	1	
Helichrysum lepidophyllum (Steetz.) Benth.			.2
Hovea acanthoclada (Turcz.) F. Muell.	+		+
Lasiopetalum compactum S. Paust			+
Lepidosperma brunonianum Nees			3
Lepidosperma drummondii Benth.	+		.5
Lepidosperma striatum R.Br.	.2		
Leucopogon rubicundus (F. Muell.) Benth.	.2		
Leucopogon sp. (KRN6781)	2		
Lomandra micrantha (Lindl.) Ewart	+		
Melaleuca cuneata Turcz.	+		
Melaleuca pentagona Labill.	1		.5
Melaleuca sp. (KRN2764)			2
Microcybe multiflora Turcz.			+
Nematolepis phebalioides Turcz.			+
Neurachne alopecuroides R.Br.			+
Olearia muelleri (Sond.) Benth.			+
Oxylobium parviflorum Benth.	+	+	
Persoonia teretifolia R.Br.	+		
Phebalium rude Bartl. ssp. _amblyocarpum_ (F. Muell.) P.G. Wilson	+		
Prasophyllum nigricans R.Br.	+		
**_Pterostylis nana_ R.Br.	+		
Pterostylis vittata Lindl.		+	
Santalum acuminatum (R.Br.) DC.	.5		
Sollya heterophylla Lindl.	+		
Stipa elegantissima Labill.			+
Stipa variabilis Hughes	2		
Verticordia oxylepis Turcz.	+		

WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES

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NOTES ON THE BIOLOGY OF *PILOSTYLES* (RAFFLESIACEAE) IN WESTERN AUSTRALIA

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ABSTRACT

Pilostyles hamiltonii *is widely distributed throughout the south-west of Western Australia. This taxon has been recorded parasitizing the genera* Daviesia *(10 spp.),* Jacksonia *(2 spp.),* Oxylobium *(2 spp.) and* Gastrolobium *(1 sp.).* Pilostyles *is dioecious on* Daviesia *but monoecious on the other three host genera. Flowers break through the bark of all host species in summer (January) and probably are wasp pollinated. Fruits of the parasite remain on the plant for up to 8 months. It is suggested that speciation of* Pilostyles *may have occurred in Western Australia and that taxonomy of the group warrants further attention.*

INTRODUCTION

Pilostyles (Rafflesiaceae) is a small-flowered genus of stem parasites with a restricted range of host plants in the Mimosoideae, Caesalpinoideae and Papilionoideae. The genus is widespread, occurring in Iran, East Africa, Western Australia and the Americas where it can be found from California through the tropics to Chile (Kuijt, 1969). The single Australian species, *P. hamiltonii*, was described by Gardner (1948) from material collected near Mundaring Weir, some 30 km from Perth. The only other published information on this species are some notes by Smith (1951) and a brief report by Kenneally and Pirkopf (1979).

METHODS

During 1975-1979, field surveys were undertaken throughout south-western Australia to determine the distribution of *Pilostyles*. Infected plants could be recognized from some distance due to the darker appearance of the host plants. As well, infected plants, especially *Daviesia*, often had delayed and greatly reduced flowering. Wherever *Pilostyles* was found, records were made of host species and habitat, distribution of parasite on host and type of sexual expression in the parasite. If sufficient plants

were present, the sex ratio was determined. Incidental observations were also made on the general biology of the parasite. Voucher specimens are deposited in the Western Australian Herbarium (PERTH).

One site was selected for more detailed study (Fig. *). This was in *Eucalyptus marginata* (Jarrah) forest near Kalamunda, in the Darling Range, approximately 20 km east of Perth. Within this area, on an open, northerly facing slope, an area of understorey dominated by *Daviesia angulata* was divided into 1470 metre-square quadrats. Each square metre was scored for the number of individuals of *Daviesia* present. Where *Pilostyles* was found, its sex was determined, and the species of host plant was noted. This site was visited at least once per month for 15 months, so that observations could be made on the life cycle of *Pilostyles*. An adjacent area which had been burnt in the spring prior to the period when detailed observations began was used to note the effect of fire on *Pilostyles*.

RESULTS

Host Species

The type collection of *Pilostyles hamiltonii* includes two host species, *Daviesia pectinata* and *D. angulata*. (This species has been confused with *D. polyphylla* by many workers - Personal communication, Dr. M.D. Crisp, Herbarium, Canberra Botanic Gardens.) Smith (1951) extended the list of known hosts to four with the addition of *D. incrassata* and *D. rhombifolia*. The current range of host species is detailed in Table 1. All host species belong to the Papilionoideae Tribe Podalyrieae. Most species (10) belong to the genus *Daviesia*, with two species each of *Jacksonia* and *Oxylobium* and one species of *Gastrolobium* being parasitised by *Pilostyles*.

Table 1. Host genera and species infected by *Pilostyles* in Western Australia. The flowering time of the parasite (Jan. - April) varies little with host species even though the hosts' flowering months vary considerably.

Host genus	Host species	Host flowering months
Daviesia	*angulata* Benth. ex Lindl.	May
	colletioides Meisn.	July-August
	incrassata Sm.	Aug.-Nov.
	nudiflora Meisn.	June-Sept.
	pectinata Lindl.	June-Nov.
	pedunculata Benth. ex Lindl.	Aug.-Dec.
	polyphylla Benth. ex Lindl.	Aug.-Nov.
	preissii Meisn.	Dec.-Feb.
	quadrilatera Benth.	June-Sept.
	rhombifolia Meisn.	July-Aug.
Jacksonia	*floribunda* Endl.	Nov.-March
	spinosa (Labill.) R.Br.	Sept.-March
Oxylobium	*atropurpurea* Turcz.	Sept.-Nov.
	linearifolium (Don) Domin	Aug.-Dec.
Gastrolobium	*velutinum*	Aug.-Feb.

Distribution

Except for an outlier at Peak Eleanora, (host: *Oxylobium linearifolium*) *Pilostyles* is confined to south-west Western Australia (Fig. 1).

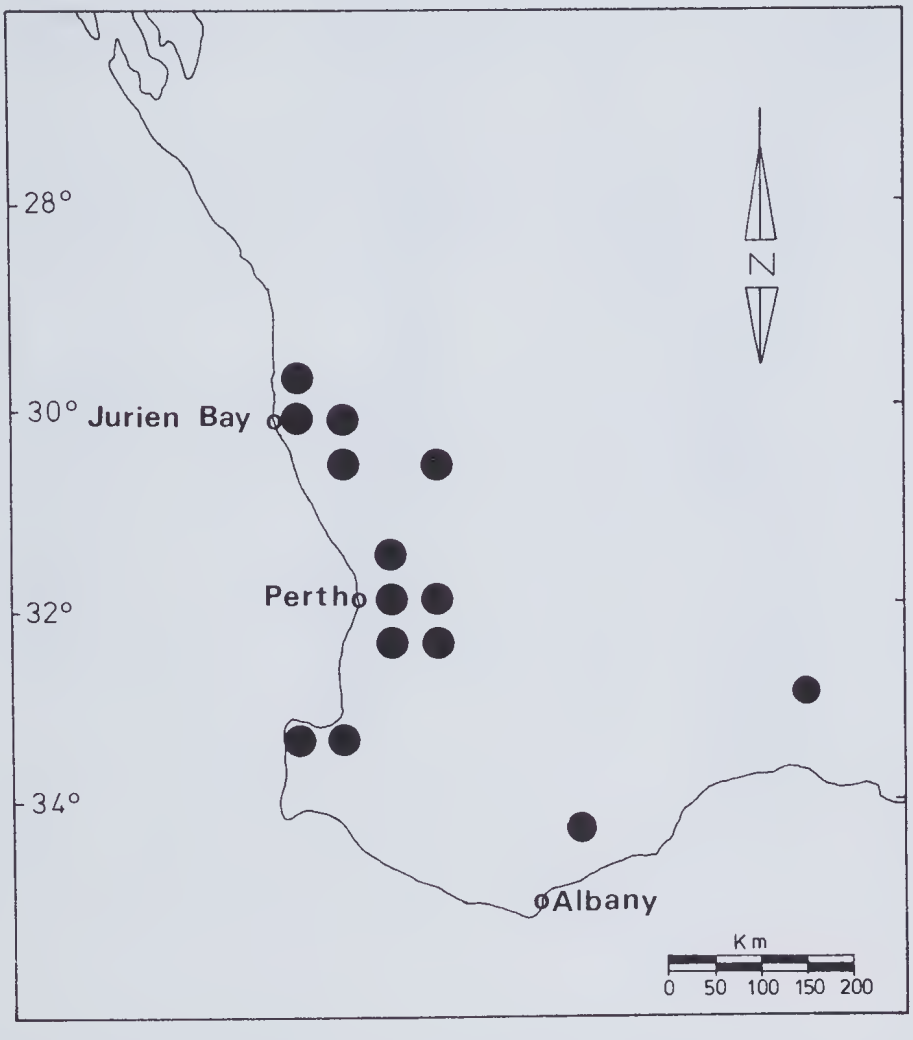

Fig. 1. Distribution of *Pilostyles hamiltonii* in Western Australia. Each dot shows the presence of the species in a 50 km square, based on the Australian Map Grid (50 km).

The parasite occurs as far north as Eneabba, is widespread throughout the Darling Range and occurs in the Stirling Range. It is expected that future discoveries will extend this range particularly along the south coast from Albany to Esperance. The range of habitats for *Pilostyles* includes the low heath vegetation of the Northern Sandplains, the understorey of the *Eucalyptus wandoo* and *E. marginata* forests, and the dense Myrtaceae, Proteaceae and Leguminosae scrub on the slopes of Bluff Knoll, in the Stirling Ranges. The parasite is apparently absent from the sandy soils of the Swan Coastal Plain near Perth even though two of the host species commonly occur. Elsewhere, probably with the exception of the *D. angulata* and *D. polyphylla* host group, only a small part of the hosts' range is occupied by the parasite. For example, *Jacksonia floribunda* is widely distributed through the Irwin and Darling botanical districts but parasitised plants have only been found in the Irwin district. Six of the 14 known host

species are infected on the sandplains or lateritic slopes of the Irwin district between the Moore River and Eneabba. Although species of *Daviesia* occur in the Stirling Range, no parasitized plants have been found there.

Some of the *Daviesia* hosts, particularly *D. angulata*, occupy disturbed sites, and plants bearing *Pilostyles* can often be found in old gravel pits, beneath powerlines and along forest tracks. Most of the *Daviesia* hosts have large underground root-stocks from which regeneration occurs after disturbance.

It is interesting to note that the only *Daviesia* plants found infected with *Pilostyles* grew on highly leached and lateritic soils characteristic of large areas within the *Eucalyptus marginata* forest and dissected duricrust plateaux north of Perth near Jurien Bay. By contrast the two infected species of *Jacksonia* grew in deep, white Pleistocene sand north of Perth.

Flower Distribution on Hosts

Like other species in the genus, *Pilostyles hamiltoni* is a stem parasite and flowers were only rarely observed on leaves in some *Daviesia* species. In all host species the most recent flowers of the parasite are borne on woody stems usually one growth season old but occasionally older. Consequently there is a progression up the plant from the remnants of past season's flowers and fruits, indicated by the scale-like bracts and ruptured bark, through the current year's growth into the younger stems where development of next year's flowers is occurring within the bark of the host. Some of these features are evident in Figs. 2-7.

The flowers of *Pilostyles* are unisexual. *Pilostyles* on *Daviesia* is almost always dioecious whereas *Pilostyles* on *Jacksonia*, *Oxylobium* and *Gastrolobium* is monoecious. Examples are given as Table 2. Hence, the stems of *Daviesia* hosts usually bear arrays of flowers which are either all male or all female (Figs. 3 and 4). In the other three genera (e.g. Fig. 7) the male flowers occur interspersed with female flowers on all branches. Though only 68 plants of these genera were recorded infected with *Pilostyles* this pattern was consistent, suggesting that most plants were infected only once. The male flowers are usually less obvious because they are short-lived and may abscise before the stigmatic surface of the female flowers hardens following pollination. Also, the male flowers are usually outnumbered two to three times by female flowers on these plants.

In the field, as previously mentioned, hosts may be sympatric. For example, in the Darling Range, *D. angulata*, *D. preissii* and *D. pectinata* grow together, each bearing dioecious parasites. Likewise, *Oxylobium* and *Gastrolobium*, with monoecious parasites, are sympatric in the Stirling Range. However, in the Irwin district where sand overlies laterite, mixed populations occur, with dioecious *Pilostyles* on *D. polyphylla* and *D. quadrilatera* together with the monoecious condition of the parasite on *Jacksonia*.

Occasionally male and female flowers were encourntered on the same *Daviesia* host (e.g. *D. angulata* - Table 2). Out of a total of 112 plants scored in a gravel pit near Kalamunda, six were monoecious. Unlike the flower distribution of *Pilostyles* on the other host genera, male and female flowers were not mixed at random. Two conditions were found. Firstly, half of the stems of the host arising from the rootstock bore seasonal arrays of male *Pilostyles* flowers whereas the other stems bore female flowers. As all stems were of the same age, this suggests that the host was infected

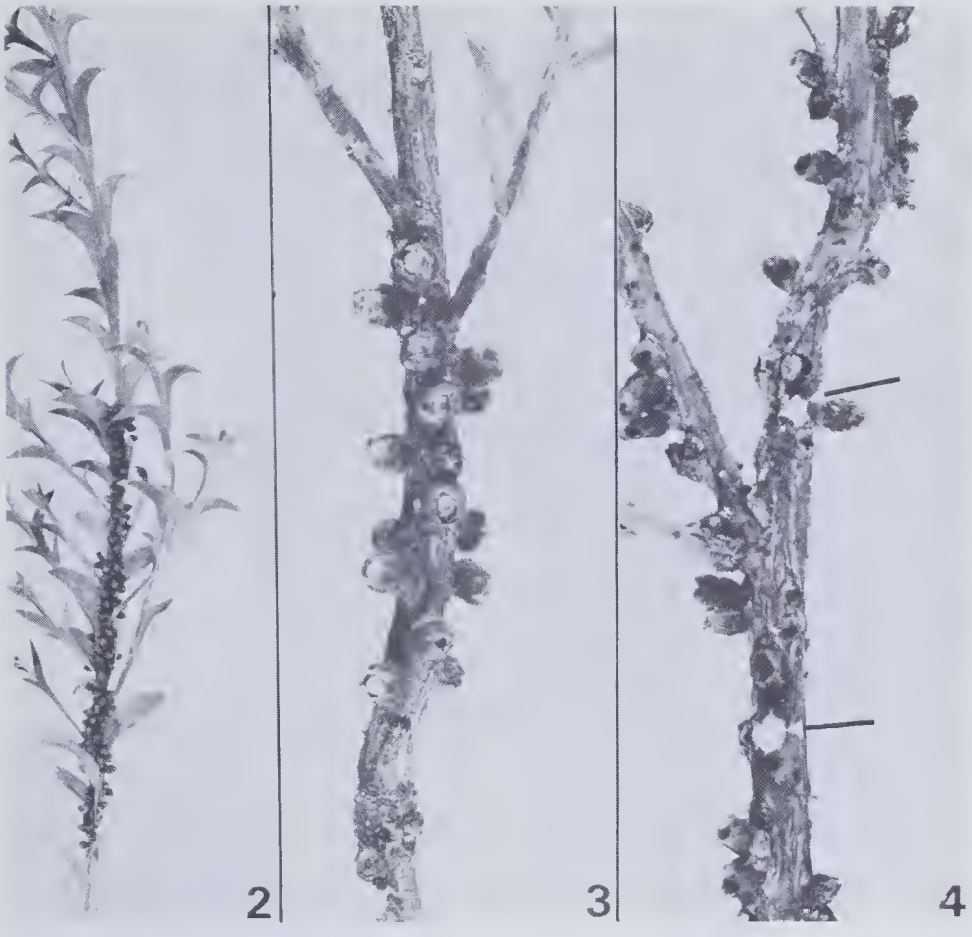

Fig. 2. Shoot of *Daviesia pectinata* infected with *Pilostyles* showing female flowers (x 0.3). Figs. 3 and 4. Stems of *Daviesia angulata* infected with *Pilostyles*; (3) with receptive female flowers, (4) with male flowers showing two (arrowed) at anthesis (x 1.5).

Table 2. Distribution of the unisexual flowers of *Pilostyles*. The number of host plants counted bearing male and/or female flowers of *Pilostyles* is shown.

Host	Locality	Number of host plants bearing		
		male parasite flowers	female parasite flowers	both male and female flowers
Daviesia angulata	Kalamunda (forest plot)	38	38	0
Daviesia angulata	Kalamunda (gravel pit)	51	55	6
Daviesia pectinata	Kalamunda	6	3	0
Jacksonia floribunda	Cataby-Eneabba	0	0	31
Oxylobium atropurpurea	Stirling Range	0	0	23
Gastrolobium velutinum	Stirling Range	0	0	14

Fig. 5. Heavy infestation of *Pilostyles* (female) on *Daviesia angulata*.
Figs. 6 and 7. Infected stems of *Jacksonia floribunda*; (6) general view of small shoot, (7) details of flowers of *Pilostyles* (x 1.5) pushing through the thick bark. Young fruits (F) and dehydrated male flowers (M) are indicated.
Fig. 8. Overcut jarrah forest near Kalamunda showing understorey with infected *Daviesia* plants (arrowed) where data for Table 4 was obtained.

twice simultaneously by *Pilostyles*. Secondly, most of the branches of the host were colonized by a *Pilostyles* plant producing flowers of one sex. However, several younger branches arising from the root stock bore parasite flowers of the opposite sex. Possibly a second invasion by *Pilostyles* had occurred in a fairly mature host.

Darling Range Study Site

(a) Distributions within site

Daviesia was a prominent component of the understorey (Fig. 8). The plot contained 650 individuals of *D. angulata* and 70 of *D. pectinata*. *Pilostyles* was found infecting 76 (12%) of *D. angulata* bushes, and 9 (13%) of *D. pectinata*. Of the 76 of *D. angulata*, exactly half (38) were infected with male *Pilostyles*, and half with female.

Each metre quadrat contained from zero to four individuals of *D. angulata* (Table 3). The plants were shown to occur in clumps rather than randomly, with respect to the metre square plots, by comparing the observed distribution with that expected from a Poisson distribution. The departure from the latter was highly significant ($\chi^2 = 40.17$, d.f. = 3, $p < 0.001$).

It was expected that the distribution of *Pilostyles* would be clumped both around female individuals and within host groups. However, the highest percentage of parasitization (Table 3) occurred in quadrats containing only one individual of *D. angulata*, whilst all quadrats which contained either three or four individuals of *Daviesia* contained no *Pilostyles*.

(b) Response to fire

Following the fire, both species of *Daviesia* had regenerated from extensive rootstocks. In some of these, *Pilostyles* was evident in one and a half year old shoots, suggesting that *Pilostyles* had survived the fire within the root-stock and grew up within the regenerating *Daviesia* stems. Rapid reappearance of *Pilostyles* in stems regenerating after fire was also observed in other host species in the northern sandplains.

(c) Life Cycle

During December, swellings appear on the woody stems of the previous year's growth of the host. These swellings enlarge until flower buds emerge in January. Flower initiation and emergence in the parasite are apparently unrelated to flower initiation in the host (Table 1). Male and female flowers emerge concurrently, the buds opening towards the end of February.

Table 3. Occurrence of *Pilostyles* on *Daviesia angulata* near Kalamunda. For details see text.

Number of host plants in each quadrat	0	1	2	3	4
Number of quadrats	998	326	117	26	3
Number of plants parasitized		62	14	0	0
% plants parasitized		19.6	5.9	0	0

However, male flowers which are short-lived are only present until early April, while many young female flowers can still be found in late April. Both male and female flowers of *Pilostyles* on *Daviesia* are burgundy in colour. This contrasts with the orange flowers of *Pilostyles* found on *Jacksonia* and the orange-red flowers of *Pilostyles* on *Oxylobium* and *Gastrolobium*.

The most probable pollen vector is a small, unidentified, native wasp, which has been observed visiting flowers of both male and female plants of *Pilostyles*. For example, during a one-and-half hour period in a population near Kalamunda, wasps were observed visiting male flowers on two host plants (over 14 separate visits to flowers), and female flowers on five host plants (over 13 separate visits to flowers).

When visiting the flowers, the wasps land in the middle of the flower, on top of the central column. The insects then probe between the column and the perianth in search of nectar. Both male and female flowers have nectaries near the point of attachment of the perianth. Foraging at the nectaries necessitates that the same part of the insect touches either the anthers or stigmatic surface. The morphology of the wasps is such as to facilitate pollen transport, and the observed behaviour should lead to pollen transfer from male to female plants. It is therefore suggested that these wasps are the pollinators of *Pilostyles*.

From about May onward, the female flowers enlarge as fruit and seed maturation proceeds, until fruit-fall occurs in October-November. Each female flower contains about seventy ovules when on *Daviesia angulata* and *Jacksonia floribunda*, but over 100 when on *Oxylobium atropurpurea* or *Gastrolobium velutinum* (Table 4). Fruits are rarely found on the ground beneath female plants, but it is not known how dispersal is effected, or how parasitisation occurs.

Table 4. Ovule counts for *Pilostyles* on four hosts.

Host	Number and range of ovules/ovary (n = 5)
Daviesia angulata	69 (60-77)
Jacksonia floribunda	73 (65-84)
Oxylobium atropurpurea	122 (87-138)
Gastrolobium velutinum	102 (59-143)

DISCUSSION

Pilostyles hamiltonii is more widespread, and has a greater host range than was previously thought, yet its distribution in Western Australia remains an enigma. There are several disjunctions, even though some of the intervening areas have an abundance of some of the known host species. There appear to be considerable differences between some of these disjunct occurrences, as reflected in flower colour, host preferences and sexual expression. These differences may well deserve taxonomic recognition.

It is also unclear why *Pilostyles* should parasitise such a small proportion of the species in each genus which is utilized as a host, even though it is known to infect four different genera in Western Australia. Less than a fifth of the Western Australian species of *Daviesia* are known hosts of *Pilostyles*, and *Jacksonia*, *Oxylobium* and *Gastrolobium* each contain 20-40 species, yet only five species from these three genera are known hosts. Uninfected species are frequently found occurring sympatrically with infected ones. Considering the morphology and distribution as well, the most likely explanation is that three taxa of *Pilostyles* occur in Western Australia - one on *Daviesia*, one on *Jacksonia*, and one on *Oxylobium* and *Gastrolobium*. *Pilostyles* on *Oxylobium* and *Gastrolobium* is of restricted, disjunct occurrence on a relatively old land surface and hence may represent a relict distribution. *Pilostyles* on *Jacksonia* being marginal to the larger distributional area wherein *Daviesia* is a host, may be of recent origin. If such is the case, then the observed relationship between host range and parasite range is in accord with the distributional pattern. Clearly much more needs to be known, particularly concerning host/parasite relationships and control of sexual expression in the parasite and floral morphology of *Pilostyles*, before the evolutionary history of *Pilostyles* in Western Australia can be elucidated.

Further aspects of the biology of *Pilostyles* which require further investigation are the processes of seed dispersal and infection of a new host.

The scarcity of fruits on the ground beneath female plants suggests either that they are eaten, or that an effective dispersal mechanism exists, but nothing is known beyond this. Ants are likely dispersal agents, and have been reported dispersing seeds of several species in the jarrah forest (Majer 1978). Storage of seeds by ants might provide the germinating seed with an easy pathway to the host tissues via the root system. Although Kuijt (1969) claims that *Pilostyles* infects only stems, and not roots, our evidence suggests that root-stocks may be infected.

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WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES
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THE DISTRIBUTION OF BORAGINACEAE IN WESTERN AUSTRALIA IN RELATION TO THE BIOLOGICAL CONTROL OF *ECHIUM PLANTAGINEUM* L.

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ABSTRACT

Distribution maps based on 1° lat. x 1.5° long. grid are given for the 55 described species of native and introduced Boraginaceae in Western Australia. The species are also listed for each of the 181 grid cells covering the State. Nine of the species are introduced, including Echium plantagineum *L. which is the subject of biological control by insects. Native species of Boraginaceae could provide alternative host plants and a mechanism for the spread of insects between western and eastern Australia.*

INTRODUCTION

The pasture weed, *Echium plantagineum* L. (Paterson's Curse, also known as Salvation Jane) is the subject of biological control by insects. All the four species of insect that are intended for release are possibly not specific to members of the genus *Echium* but thought to be restricted to a small group of the Boraginaceae (Kirk and Wapshere 1979; Wapshere and Kirk 1977). Consequently it is desirable to know whether possible alternative host plants in the same family of plants (Boraginaceae) occur in Western Australia.

There has been little research on the native Boraginaceae of Western Australia. The names used in this paper are based on present taxonomic knowledge of the family except in *Halgania* where one of us (KFK) has carried out a preliminary taxonomic investigation. Several undescribed taxa require naming and only one distribution map, for *Heliotropium undulatum* Vahl., has been published (Rye *et al.* 1980). Piggin (1977) gives a distribution map of *Echium plantagineum* for Australia. The intention of this paper is to list those described species of Boraginaceae occurring in Western Australia and to give their distribution based on herbarium specimens. This information is considered in relation to the known distribution of *Echium plantagineum* and the biological control of this weed.

METHODS

The methods used to map the Boraginaceae follow those of Hnatiuk and Maslin (1980a and b). Species distributions have been recorded using a 1^{o} latitude by 1.5^{o} longitude grid system based on the 1:250,000 topographical survey maps produced by the Division of National Mapping, Canberra. The numbering of each grid cell follows that of Brook (1977). We used 181 grid cells. Figure 1 of Hnatiuk and Maslin (1980a) gives the grid cell numbers. To their 179 grid cells we have added two, Houtman Abrolhos (grid cell number 223) and the islets of the Ashmore Reef, Timor Sea (no grid cell number allocated).

The 55 species mapped are arranged alphabetically and the occurrence in a grid cell is indicated by a "quadrangle". The number of occurrences in each grid are summed to provide the maps of all species, native species only and introduced species only per grid cell (Figure 1). The grid cells with their lists of species are arranged in ascending numerical order of map number beginning with Ashmore Reef. Introduced species are indicated on both the maps and list by an asterisk. The specimens upon which the maps are based are annotated as voucher specimens and housed in the Western Australian Herbarium (PERTH).

RESULTS

The species found in Western Australia are listed in Table 1. Also indicated are those that are introduced and/or overlap with the distribution of *E. plantagineum*. There is a total of 55 species from 18 genera of which nine species are introduced. There are 11 genera containing only native species and six genera containing only introduced species with one genus, *Heliotropium*, represented by both native and introduced species. The largest genus is *Heliotropium* with 20 species, followed by *Halgania* with 16 species. Twenty three species overlap the distribution of *E. plantagineum*. Six of these are introduced. Figure 1A gives the total species number per grid cell while Figure 1B lists the native species per grid cell and Figure 1C the introduced species per grid cell. Figure 1D gives the corresponding grid cell numbers. More native species are found in the northern half of Western Australia when compared with the southern half while the introduced species occur in the south west. Species of Boraginaceae are found more or less throughout Western Australia, the greatest number being 11 species for grid cell numbers 110, 117 and 255. The greatest total of introduced species per grid cell is five and this occurs in the Perth grid cell. In Table 2 the species are listed for each grid cell number and following Figure 1 the distribution of each species is presented alphabetically.

DISCUSSION

Table 1 indicates those species of native Boraginaceae that overlap the distribution of *E. plantagineum*. Some native species may become alternative hosts for introduced biological control agents particularly as one of the insects, the *Echium* leaf miner, *Dialectica scalariella* (Zeller), attacks genera of Boraginaceae other than *Echium* (Wapshere and Kirk 1977). The other genera attacked by this insect include *Anchusa, Borago, Cynoglossum, Heliotropium, Myosotis* and *Symphytum*. All six genera are present in Western Australia and three, *Cynoglossum, Heliotropium* and *Myosotis* contain native

Table 1. Species of Boraginaceae recorded from Western Australia.

Species	Introduced (I)	Overlapping *Echium* (E)
Amsinckia calycina (Moris) Chater	I	E
Amsinckia lycopsoides (Lehm.) Lehm.	I	-
Anchusa capensis Thunb.	1	E
Borago officinalis L.	1	E
Buglossoides arvensis (L.) I.M. Johnston	I	E
Coldenia procumbens L.	-	-
Cordia subcordata Lam.	-	-
Cynoglossum australe R.Br.	-	-
Echium plantagineum L.	1	-
Ehretia saligna R.Br.	-	-
Ehretia urceolata W.V. Fitzg.	-	-
Halgania andromedifolia Behr & F. Muell.	-	E
Halgania argyrophylla Diels	-	-
Halgania bebrana Oldfield & F. Muell.	-	E
Halgania corymbosa Lindl.	-	E
Halgania cyanea Lindl.	-	E
Halgania erecta Ewart & Rees	-	-
Halgania glabra J.M. Black	-	-
Halgania gustafsenii F. Muell.	-	-
Halgania lavandulacea Endl.	-	E
Halgania littoralis Gaud.	-	E
Halgania preissiana Lehm.	-	E
Halgania rigida S. Moore	-	E
Halgania sericiflora Benth.	-	E
Halgania solanacea F. Muell.	-	-
Halgania tomentosa (R. Helms) Ewart & J. White	-	E
Halgania viscosa S. Moore	-	E
Heliotropium asperrimum R.Br.	-	-
Heliotropium bacciferum Forsk.	-	-
Heliotropium bracteatum R.Br.	-	-
Heliotropium conocarpum F. Muell. ex Benth.	-	-
Heliotropium crispatum F. Muell. ex Benth.	-	-
Heliotropium cunninghamii Benth.	-	-
Heliotropium curassavicum L.	-	E
Heliotropium diversifolium F. Muell. ex Benth.	-	-
Heliotropium epacrideum F. Muell. ex Benth.	-	-
Heliotropium europaeum L.	1	E
Heliotropium flaviflorum W.V. Fitzg.	-	-
Heliotropium heteranthum (F. Muell.) Ewart & O.B. Davies	-	-
Heliotropium ovalifolium Forsk.	-	-
Heliotropium paniculatum R.Br.	-	-
Heliotropium pleiopterum F. Muell.	-	-
Heliotropium strigosum Willd.	-	-
Heliotropium supinum L.	I	-
Heliotropium tenuifolium R.Br.	-	-
Heliotropium undulatum Vahl.	-	E
Heliotropium ventricosum R.Br.	-	-
Messerschmidia argentea (L.f.) I.M. Johnston	-	-
Myosotis australis R.Br.	-	E
Omphalolappula concava (F. Muell.) Brand	-	E

Table 1 (cont.)

Species	Introduced (I)	Overlapping *Echium* (E)
Plagiobothrys australasicus (DC.) I.M. Johnston	-	-
Symphytum officinale L.	I	E
Tournefortia mollis F. Muell.	-	-
Trichodesma zeylanicum (Burm.f.) R.Br. var. *latisepalum* F. Muell.	-	-
Trichodesma zeylanicum (Burm.f.) R.Br. var. *zeylanicum*	-	E

species. A similar situation exists for the *Echium* borer, *Phytoecia coerulescens* (Kirk and Wapshere 1979). Thus it could be possible for insects to spread, via native species, to the eastern half of Australia or vice versa. The native species are mostly perennial shrubs as opposed to the introduced annual species. The presence of these native shrubs could provide alternative food for insects during summer when most plants of *E. plantagineum* die.

Some native species of Boraginaceae occur on both nearshore (Abrolhos Islands) and offshore islands (Ashmore Reef) where they may constitute, as in the latter example, an important component of the island flora (e.g. *Messerschmidia argentea*). The effect of insect damage on populations of these plants is unknown.

The maps, being based on herbarium specimens, suggest a lack of collecting of species of Boraginaceae, e.g. *Cynoglossum australe*. Taxonomic uncertainty about species is also suggested by the maps, e.g. *Halgania glabra*. The greatest abundance of species is associated with towns or major roads while grid cells where no species occur suggests a lack of collecting in these remote areas. An interesting area for the centre of Australia is grid cell 186, centred on the Rawlinson Range. Here the greater species abundance compared with surrounding areas probably reflects the presence of the Giles Weather Station, the Rawlinson Ranges and the major central Australian road for the area. The number of species given for this area is possibly a better indication of the actual numbers near the border of Western Australia than the numbers given in Figure 1.

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Table 2. Lists of species occurring in 1^{o} x 1.5^{o} grid cells. (* indicates introduced species).

NO GRID CELL NUMBER ASHMORE REEF
Messerschmidia argentea

GRID CELL 102 LONDONDERRY
Heliotropium flaviflorum
Heliotropium paniculatum
Trichodesma zeylanicum
var. *latisepalum*

GRID CELL 103 BROWSE ISLAND
No species recorded

GRID CELL 104 MONTAGUE SOUND
Heliotropium strigosum

GRID CELL 105 DRYSDALE
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 106 MEDUSA BANKS
No species recorded

GRID CELL 107 CAMDEN SOUND
Heliotropium paniculatum
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 108 PRINCE REGENT
Ehretia saligna
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 109 ASHTON
No species recorded

GRID CELL 110 CAMBRIDGE GULF
Coldenia procumbens
Cordia subcordata
Ehretia saligna
Heliotropium conocarpum
Heliotropium paniculatum
Heliotropium strigosum
Heliotropium tenuifolium
Heliotropium ventricosum
Tournefortia mollis

GRID CELL 110 (cont.)
Trichodesma zeylanicum var. *latisepalum*
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 111 PENDER
No species recorded

GRID CELL 112 YAMPI
No species recorded

GRID CELL 113 CHARNLEY
Heliotropium conocarpum
Heliotropium ventricosum
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 114 MT. ELIZABETH
Heliotropium ovalifolium
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 115 LISSADELL
Heliotropium paniculatum
Heliotropium tenuifolium

GRID CELL 116 BROOME
Ehretia saligna
Heliotropium paniculatum

GRID CELL 117 DERBY
Ehretia saligna
Ehretia urceolata
Heliotropium bacciferum
Heliotropium cunninghamii
Heliotropium diversifolium
Heliotropium paniculatum
Heliotropium strigosum
Heliotropium tenuifolium
Heliotropium ventricosum
Trichodesma zeylanicum var. *latisepalum*
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 118 LENNARD RIVER
Ehretia saligna
Heliotropium ovalifolium
Heliotropium paniculatum

GRID CELL 118 (cont.)
Heliotropium tenuifolium
Trichodesma zeylanicum var. *latisepalum*

GRID CELL 119 LANSDOWNE
Heliotropium paniculatum
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 120 DIXON RANGE
Heliotropium conocarpum
Trichodesma zeylanicum var. *latisepalum*
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 121 LAGRANGE
Halgania glabra
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 122 MT. ANDERSON
Halgania solanacea
Heliotropium ovalifolium
Heliotropium paniculatum
Heliotropium tenuifolium
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 123 NOONKANBAH
Halgania solanacea
Heliotropium conocarpum
Heliotropium paniculatum
Heliotropium tenuifolium
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 124 MT. RAMSAY
Halgania solanacea
Heliotropium epacrideum
Heliotropium flaviflorum
Heliotropium paniculatum
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 125 GORDON DOWNS
Halgania solanacea
Heliotropium conocarpum
Heliotropium curassavicum
Heliotropium tenuifolium

GRID CELL 125 (cont.)
Trichodesma zeylanicum var. *latisepalum*
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 126 BEDOUT ISLAND
Heliotropium tenuifolium

GRID CELL 127 MANDORA
Halgania solanacea
Heliotropium ovalifolium
Heliotropium paniculatum
Heliotropium tenuifolium
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 128 MUNRO
No species recorded

GRID CELL 129 MCLARTY HILLS
Halgania solanacea
Heliotropium paniculatum
Heliotropium tenuifolium

GRID CELL 130 CROSSLAND
No species recorded

GRID CELL 131 MT. BANNERMAN
Heliotropium tenuifolium

GRID CELL 132 BILLILUNA
Halgania solanacea
Heliotropium diversifolium

GRID CELL 133 BARROW ISLAND
Heliotropium ovalifolium
Heliotropium undulatum
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 134 DAMPIER
Heliotropium ovalifolium
Heliotropium paniculatum
Heliotropium tenuifolium
Heliotropium undulatum
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 135 ROEBOURNE
Ehretia saligna
Heliotropium crispatum
Heliotropium curassavicum
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 136 PORT HEDLAND
Ehretia saligna
Heliotropium crispatum
Heliotropium curassavicum
Heliotropium heteranthum
Heliotropium ovalifolium
Heliotropium paniculatum
Heliotropium tenuifolium
Heliotropium undulatum
Trichodesma zeylanicum var. *zeylanicum*

GRID CELL 137 YARRIE
Halgania solanacea
Heliotropium asperrimum
Heliotropium epacrideum
Heliotropium ovalifolium
Heliotropium paniculatum
Heliotropium undulatum

GRID CELL 138 ANKETELL
Halgania solanacea
Heliotropium epacrideum

GRID CELL 139 JOANNA SPRING
Halgania solanacea

GRID CELL 140 DUMMER
No species recorded

GRID CELL 141 CORNISH
Heliotropium ovalifolium
Heliotropium tenuifolium

GRID CELL 142 LUCAS
Halgania solanacea
Heliotropium epacrideum
Heliotropium paniculatum

GRID CELL 144 ONSLOW
Cordia subcordata
Ehretia saligna
Halgania cyanea

GRID CELL I44 (cont.)
Heliotropium crispatum
Heliotropium curassavicum
Heliotropium tenuifolium
Heliotropium undulatum
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 145 YARRALOOLA
Cordia subcordata
Heliotropium curassavicum

GRID CELL I46 PYRAMID
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 147 MARBLE BAR
Heliotropium crispatum
Heliotropium ovalifolium
Heliotropium paniculatum
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 148 NULLAGINE
Heliotropium cunninghamii
Heliotropium flaviflorum
Heliotropium ovalifolium
Heliotropium tenuifolium
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 149 PATERSON RANGE
No species recorded

GRID CELL I50 SAHARA
No species recorded

GRID CELL 151 PERCIVAL
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 152 HELENA
No species recorded

GRID CELL 153 STANSMORE
No species recorded

GRID CELL I54 NINGALOO
No species recorded

GRID CELL I55 YANREY
Halgania viscosa
Heliotropium crispatum
Heliotropium ovalifolium
Heliotropium undulatum

GRID CELL I56 WYLOO
Heliotropium heteranthum

GRID CELL 157 MT. BRUCE
Heliotropium cunninghamii
Heliotropium ovalifolium
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL I58 ROY HILL
Heliotropium undulatum
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL I59 BALFOUR DOWNS
Halgania solanacea
Heliotropium ovalifolium

GRID CELL 160 RUDALL
Halgania solanacea
Heliotropium ovalifolium
Heliotropium paniculatum
Heliotropium strigosum
Heliotropium tenuifolium

GRID CELL 161 TABLETOP
Heliotropium epacrideum

GRID CELL 162 URAL
No species recorded

GRID CELL I63 WILSON
No species recorded

GRID CELL 164 WEBB
Halgania solanacea

GRID CELL 165 MINILYA
Heliotropium undulatum

GRID CELL 166 WINNING POOL
Halgania viscosa

GRID CELL 167 EDMUND
Heliotropium crispatum
Heliotropium cunninghamii
Heliotropium curassavicum
Heliotropium heteranthum
Heliotropium undulatum

GRID CELL 168 TUREE CREEK
No species recorded

GRID CELL 169 NEWMAN
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 170 ROBERTSON
Halgania solanacea
Heliotropium ovalifolium

GRID CELL 171 GUNANYA
No species recorded

GRID CELL 172 RUNTON
Heliotropium bacciferum

GRID CELL 173 MORRIS
No species recorded

GRID CELL 174 RYAN
No species recorded

GRID CELL 175 MACDONALD
Heliotropium epacrideum

GRID CELL 176 QUOBBA
Heliotropium curassavicum
Heliotropium undulatum

GRID CELL 177 KENNEDY RANGE
Halgania sericiflora
Heliotropium curassavicum
Heliotropium undulatum
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 178 MT. PHILLIPS
Heliotropium conocarpum
Heliotropium heteranthum

GRID CELL 178 (cont.)
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 179 MT. EGERTON
Halgania gustafsenii

GRID CELL 180 COLLIER
Halgania glabra
Halgania gustafsenii
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 181 BULLEN
No species recorded

GRID CELL 182 TRAINOR
No species recorded

GRID CELL 183 MADLEY
No species recorded

GRID CELL 184 WARRI
No species recorded

GRID CELL 185 COBB
No species recorded

GRID CELL 186 RAWLINSON
Halgania glabra
Halgania gustafsenii
Halgania solanacea
Heliotropium epacrideum
Heliotropium ovalifolium
Heliotropium paniculatum
Heliotropium pleiopterum
Heliotropium tenuifolium

GRID CELL 187 SHARK BAY
Halgania littoralis
Heliotropium undulatum

GRID CELL 188 WOORAMEL
Heliotropium undulatum
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 189 GLENBURGH
Halgania glabra

GRID CELL 190 ROBINSON RANGE
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 191 PEAK HILL
Heliotropium heteranthum

GRID CELL 192 NABBERU
No species recorded

GRID CELL 193 STANLEY
No species recorded

GRID CELL 194 HERBERT
Halgania glabra
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 195 BROWNE
Halgania solanacea
Heliotropium heteranthum

GRID CELL 196 BENTLEY
Halgania glabra
Halgania solanacea

GRID CELL 197 SCOTT
Halgania erecta
Omphalolappula concava
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 201 EDEL
Halgania littoralis
Halgania viscosa

GRID CELL 202 YARINGA
No species recorded

GRID CELL 203 BYRO
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 204 BELELE
Halgania glabra
Heliotropium heteranthum
Heliotropium ovalifolium
Plagiobothrys australasicus
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 205 GLENGARRY
Halgania cyanea
Halgania gustafsenii
Heliotropium ovalifolium

GRID CELL 206 WILUNA
Halgania cyanea
Heliotropium curassavicum
Heliotropium heteranthum
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 207 KINGSTON
Heliotropium heteranthum

GRID CELL 208 ROBERT
No species recorded

GRID CELL 209 YOWALGA
Halgania gustafsenii
Halgania solanacea

GRID CELL 210 TALBOT
Halgania glabra
Halgania solanacea
Heliotropium ovalifolium
Omphalolappula concava

GRID CELL 211 COOPER
Cynoglossum australe
Heliotropium asperrimum
Heliotropium paniculatum
Omphalolappula concava

GRID CELL 213 AJANA
**Echium plantagineum*
Halgania argyrophylla
Halgania bebrana
Halgania preissiana
Halgania sericiflora

GRID CELL 214 MURGOO
Heliotropium curassavicum
Plagiobothrys australasicus

GRID CELL 215 CUE
Halgania preissiana
Heliotropium undulatum
Omphalolappula concava

GRID CELL 216 SANDSTONE
Halgania cyanea
Halgania viscosa

GRID CELL 217 SIR SAMUEL
Halgania preissiana
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 218 DUKETON
Halgania cyanea

GRID CELL 219 THROSSELL
No species recorded

GRID CELL 220 WESTWOOD
No species recorded

GRID CELL 221 LENNIS
No species recorded

GRID CELL 222 WAIGEN
No species recorded

GRID CELL 223 HOUTMAN ABROLHOS
Cynoglossum australe

GRID CELL 224 GERALDTON
**Buglossoides arvensis*
Halgania argyrophylla
Halgania bebrana
Halgania preissiana
Halgania sericiflora
Heliotropium curassavicum
Heliotropium undulatum
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 225 YALGOO
Halgania argyrophylla
Halgania preissiana
Halgania sericiflora
Halgania solanacea
Heliotropium curassavicum
Omphalolappula concava

GRID CELL 226 KIRKALOCKA
No species recorded

GRID CELL 227 YOUANMI
Halgania viscosa

GRID CELL 228 LEONORA
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 229 LAVERTON
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 230 RASON
No species recorded

GRID CELL 231 NEALE
No species recorded

GRID CELL 232 VERNON
No species recorded

GRID CELL 233 WANNA
No species recorded

GRID CELL 234 DONGARA
**Echium plantagineum*
Halgania preissiana
Heliotropium undulatum

GRID CELL 235 PERENJORI
Halgania cyanea
Halgania preissiana
Halgania solanacea
Omphalolappula concava

GRID CELL 236 NINGHAN
Halgania solanacea

GRID CELL 237 BARLEE
No species recorded

GRID CELL 238 MENZIES
Halgania cyanea
Plagiobothrys australasicus

GRID CELL 239 EDJUDINA
No species recorded

GRID CELL 240 MINIGWAL
No species recorded

GRID CELL 241 PLUMRIDGE
No species recorded

GRID CELL 242 JUBILEE
No species recorded

GRID CELL 243 MASON
No species recorded

GRID CELL 244 HILL RIVER
No species recorded

GRID CELL 245 MOORA
**Echium plantagineum*
Halgania lavandulacea
Halgania littoralis
Halgania preissiana

GRID CELL 246 BENCUBBIN
Halgania cyanea
Halgania lavandulacea
Halgania preissiana
Halgania viscosa
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 247 JACKSON
No species recorded

GRID CELL 248 KALGOORLIE
**Buglossoides arvensis*
**Echium plantagineum*
Halgania andromedifolia
Halgania cyanea

GRID CELL 248 (cont.)
Halgania rigida
Halgania viscosa
Omphalolappula concava
Trichodesma zeylanicum
var. *zeylanicum*

GRID CELL 249 KURNALPI
Halgania cyanea
Halgania rigida
Heliotropium asperrimum
**Heliotropium europaeum*
**Heliotropium supinum*

GRID CELL 250 CUNDEELEE
Halgania cyanea

GRID CELL 251 SEEMORE
Halgania viscosa
Omphalolappula concava

GRID CELL 252 LOONGANA
No species recorded

GRID CELL 253 FORREST
Omphalolappula concava

GRID CELL 255 PERTH
**Amsinckia calycina*
**Buglossoides arvensis*
**Echium plantagineum*
Halgania andromedifolia
Halgania corymbosa
Halgania lavandulacea
Halgania preissiana
Heliotropium curassavicum
**Heliotropium europaeum*
Myosotis australis
**Symphytum officinale*

GRID CELL 256 KELLERBERRIN
**Amsinckia lycopsoides*
**Buglossoides arvensis*
Halgania andromedifolia
Halgania cyanea
Halgania lavandulacea
Halgania preissiana
Halgania rigida

GRID CELL 257 SOUTHERN CROSS
*Echium plantagineum
Halgania andromedifolia
Halgania cyanea
Halgania lavandulacea
Halgania preissiana
Halgania tomentosa
Halgania viscosa
*Heliotropium europaeum

GRID CELL 258 BOORABBIN
Halgania andromedifolia
Halgania cyanea
Halgania lavandulacea
Halgania viscosa

GRID CELL 259 WIDGIEMOOLTHA
Halgania cyanea
Halgania preissiana
Halgania rigida

GRID CELL 260 ZANTHUS
No species recorded

GRID CELL 261 NARETHA
Omphalolappula concava

GRID CELL 262 MADURA
Halgania andromedifolia

GRID CELL 263 EUCLA
Omphalolappula concava

GRID CELL 264 PINJARRA
*Anchusa capensis
*Buglossoides arvensis
*Echium plantagineum
Halgania preissiana
Myosotis australis

GRID CELL 265 CORRIGIN
*Buglossoides arvensis
Halgania lavandulacea
Halgania preissiana
Heliotropium curassavicum

GRID CELL 266 HYDEN
Halgania andromedifolia
Halgania lavandulacea

GRID CELL 266 (cont.)
Halgania preissiana
Halgania tomentosa
Halgania viscosa

GRID CELL 267 LAKE JOHNSTON
Halgania andromedifolia
Halgania lavandulacea
Halgania preissiana

GRID CELL 268 NORSEMAN
Halgania andromedifolia
Halgania cyanea
Halgania preissiana
Halgania rigida

GRID CELL 269 BALLADONIA
No species recorded

GRID CELL 270 CULVER
Halgania andromedifolia

GRID CELL 271 BURNABBIE
Halgania andromedifolia

GRID CELL 272 NOONAERA
No species recorded

GRID CELL 273 BUSSELTON
*Buglossoides arvensis
*Echium plantagineum
Myosotis australis

GRID CELL 274 COLLIE
*Borago officinalis

GRID CELL 275 DUMBLEYUNG
*Buglossoides arvensis
*Echium plantagineum
Halgania cyanea
Halgania lavandulacea
Halgania preissiana
*Heliotropium europaeum

GRID CELL 276 NEWDEGATE
*Echium plantagineum
Halgania andromedifolia
Halgania preissiana

GRID CELL 277 RAVENSTHORPE
Halgania andromedifolia
Halgania preissiana
Heliotropium asperrimum

GRID CELL 278 ESPERANCE
Halgania andromedifolia
Halgania preissiana

GRID CELL 279 MALCOLM
Halgania andromedifolia
Halgania preissiana

GRID CELL 280 AUGUSTA
No species recorded

GRID CELL 281 PEMBERTON
No species recorded

GRID CELL 282 MOUNT BARKER
**Borago officinalis*
**Echium plantagineum*
**Heliotropium europaeum*

GRID CELL 283 BREMER BAY
**Anchusa capensis*
Halgania andromedifolia

GRID CELL 284 MONDRAIN ISLAND
No species recorded

GRID CELL 285 CAPE ARID
No species recorded

GRID CELL 286 IRWIN INLET
No species recorded

GRID CELL 287 ALBANY
**Borago officinalis*

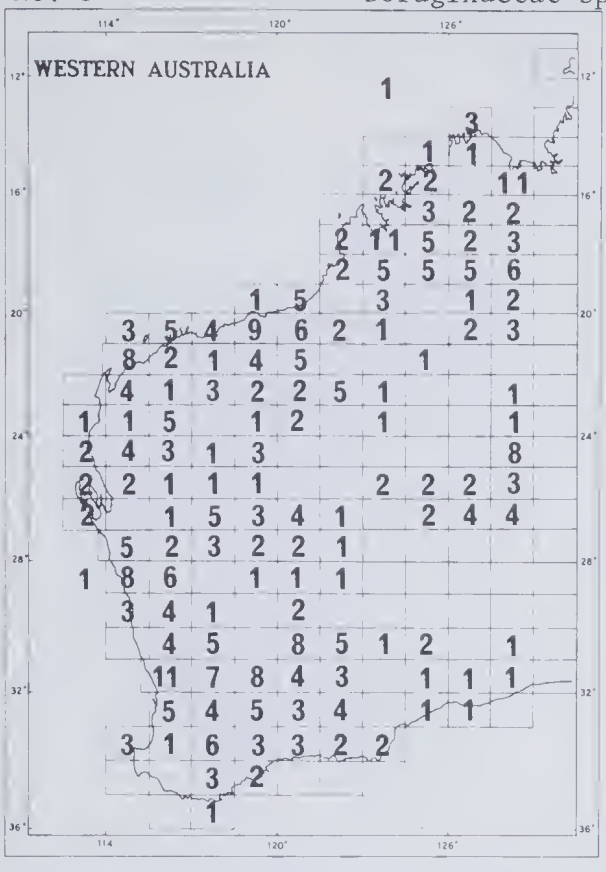


Figure 1A. Total species of Boraginaceae

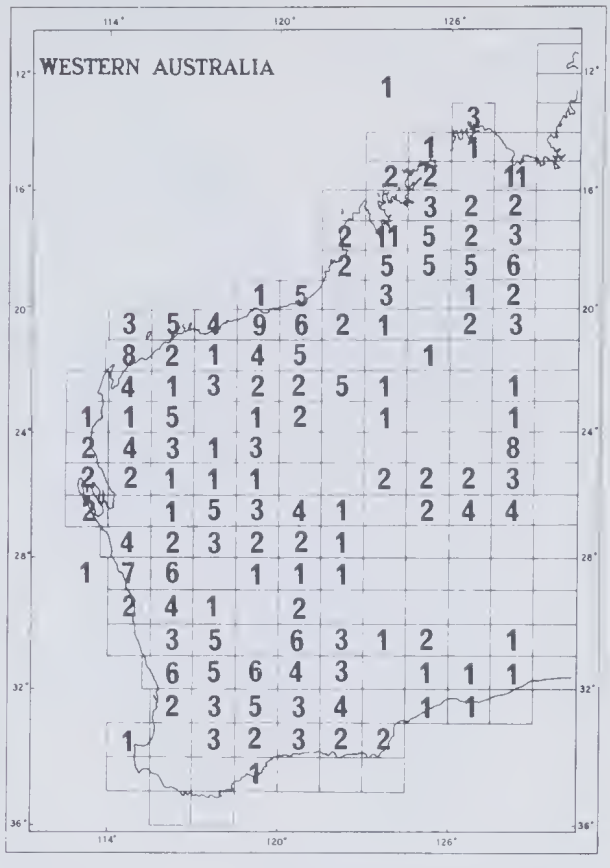


Figure 1B. Total native species of Boraginaceae

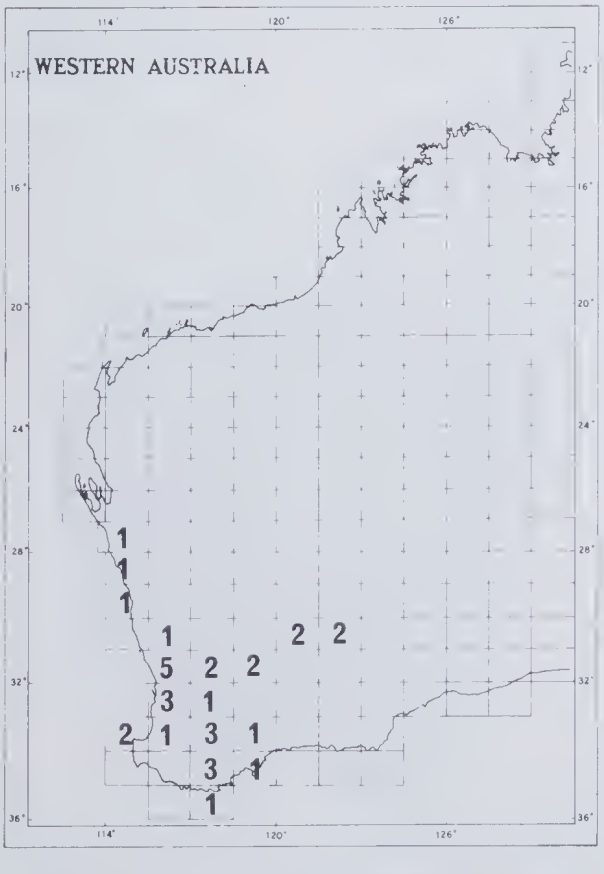


Figure 1C. Total introduced species of Boraginaceae

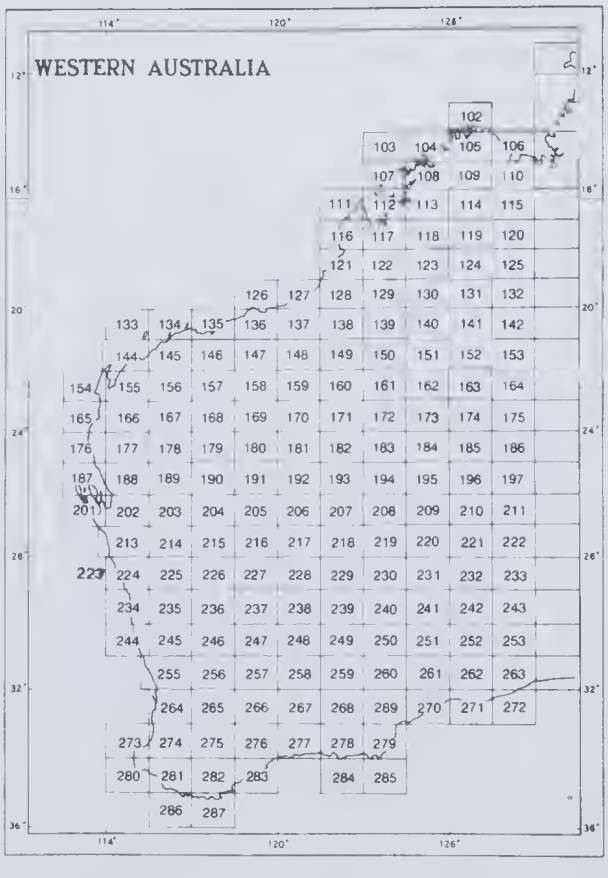
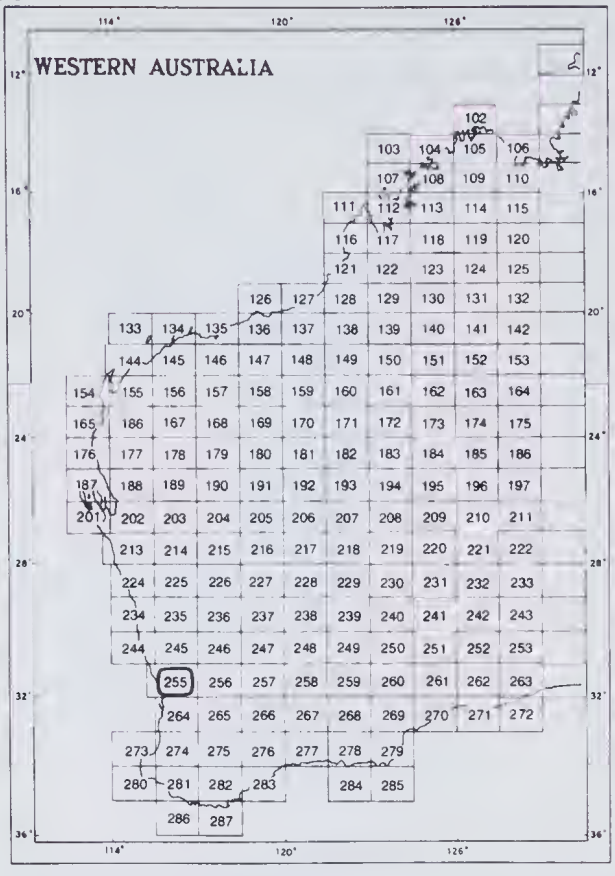
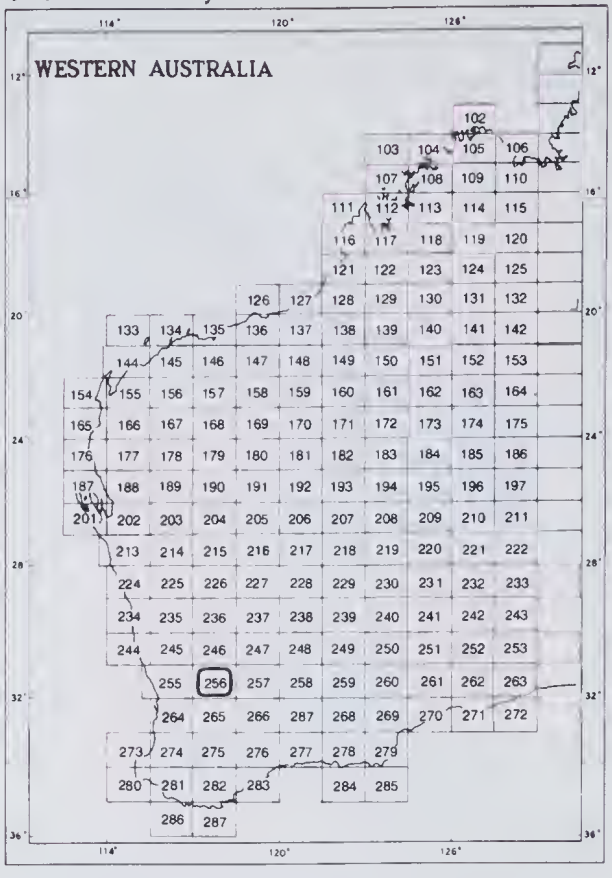


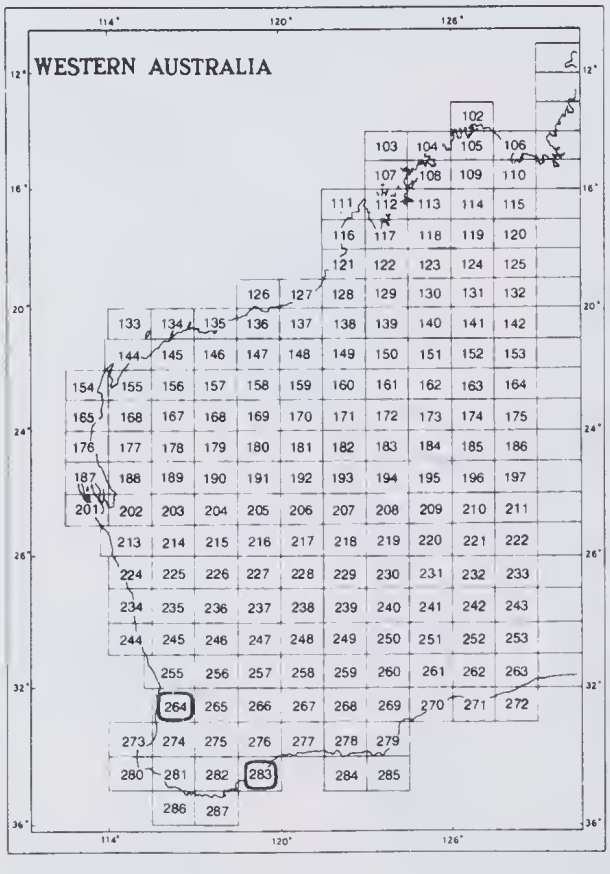
Figure 1D. Guide to grid cell numbers



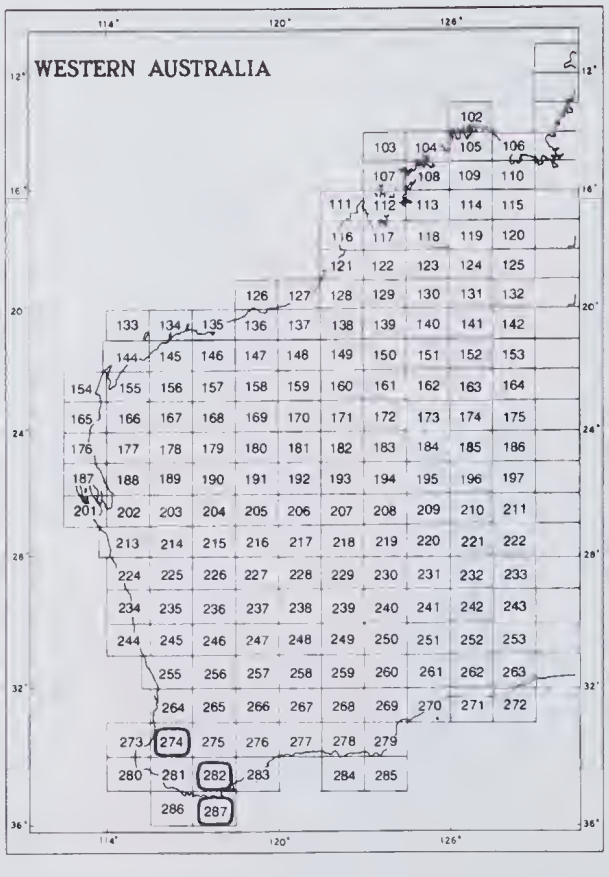
Amsinckia calycina



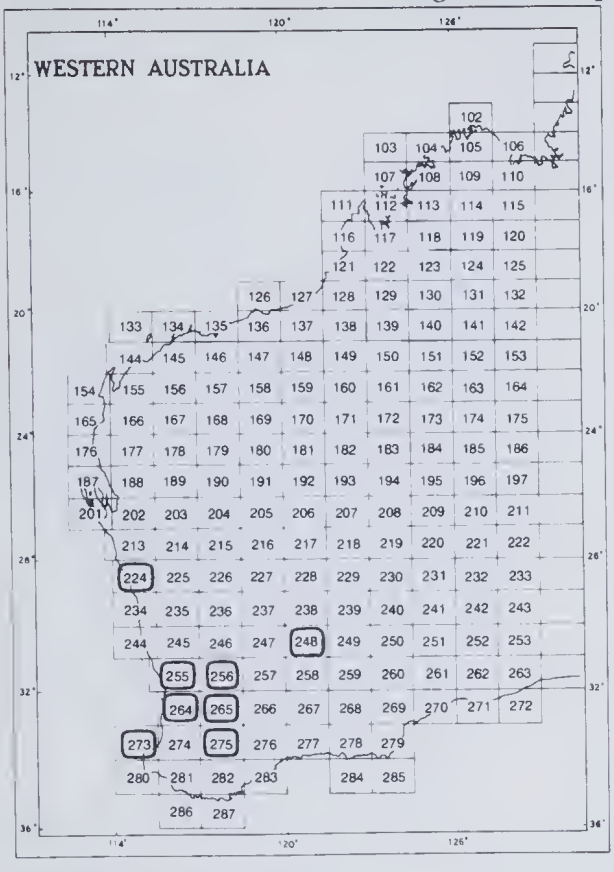
Amsinckia lycopsoides



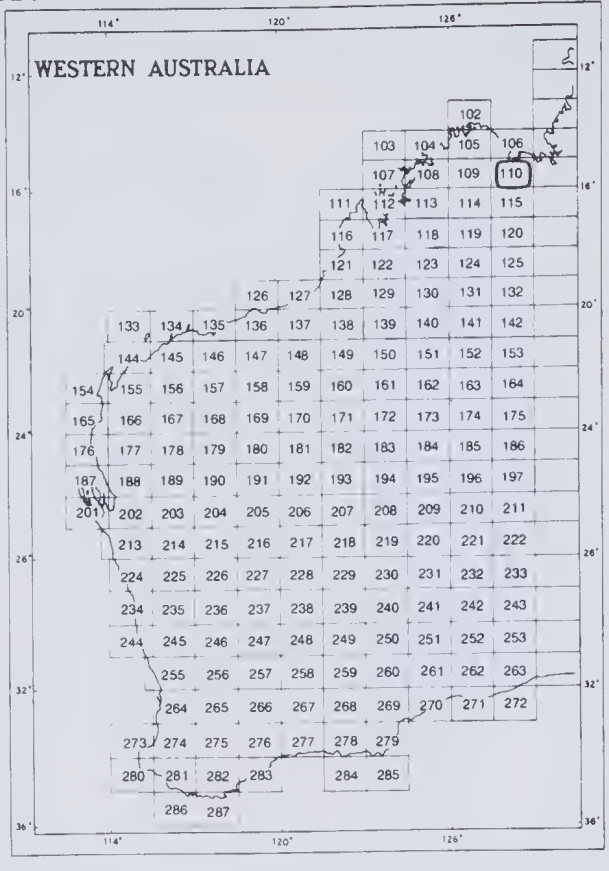
Anchusa capensis



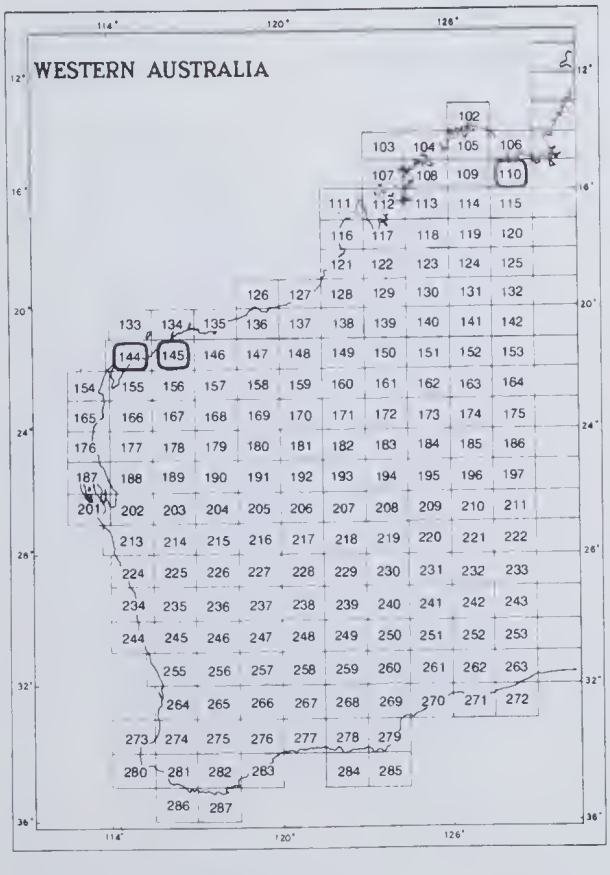
Borago officinalis



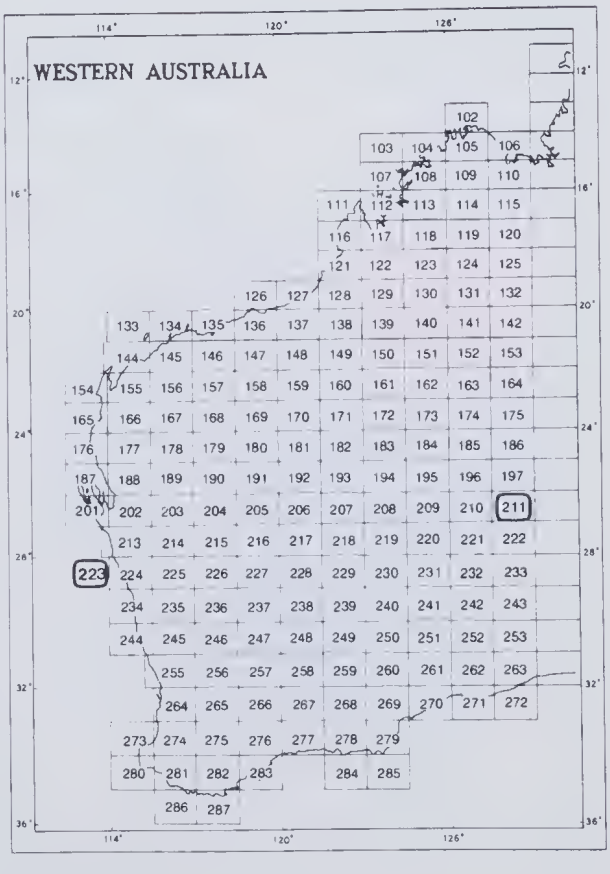
Buglossoides arvensis



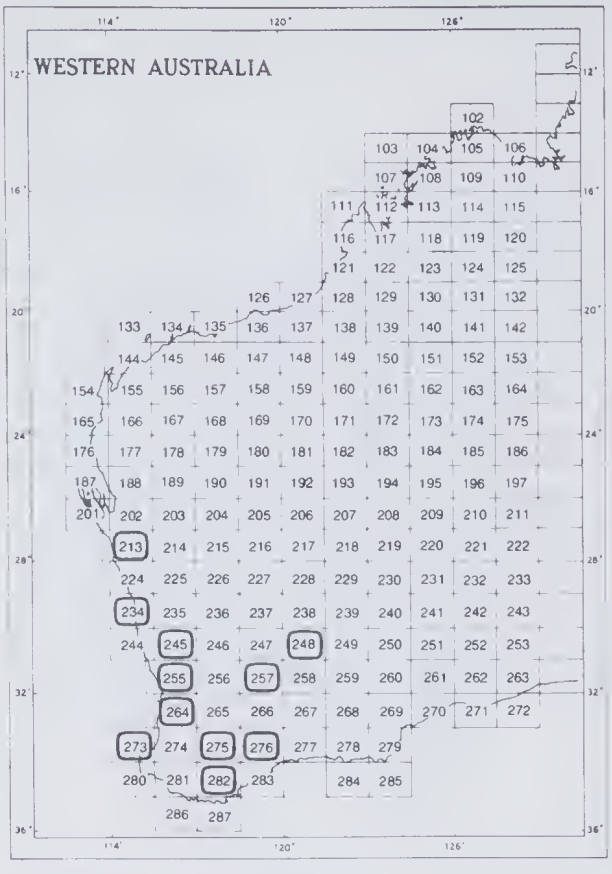
Coldenia procumbens



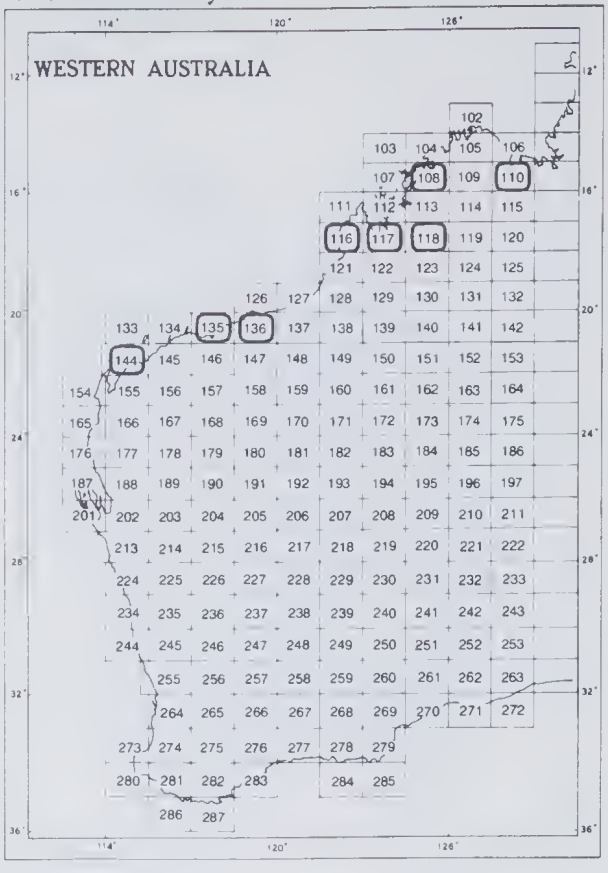
Cordia subcordata



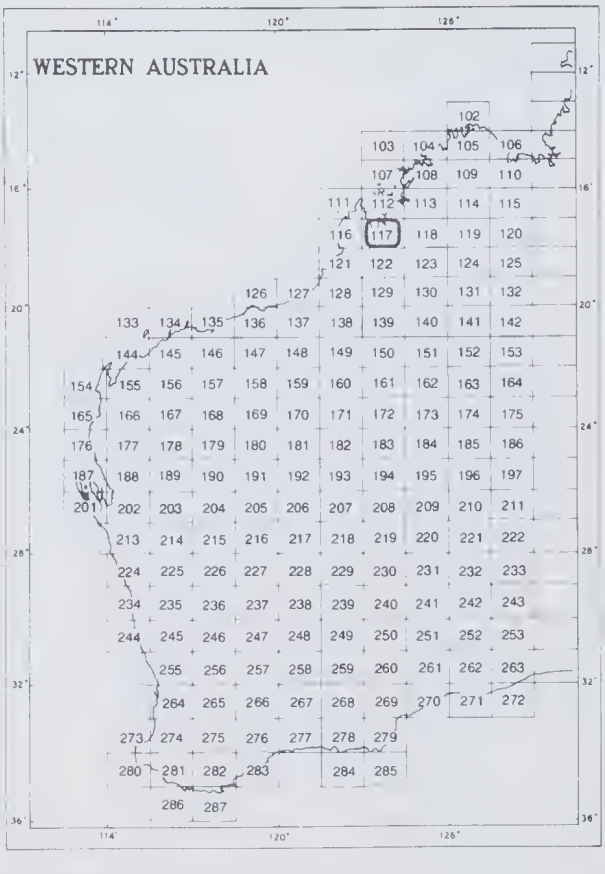
Cynoglossum australe



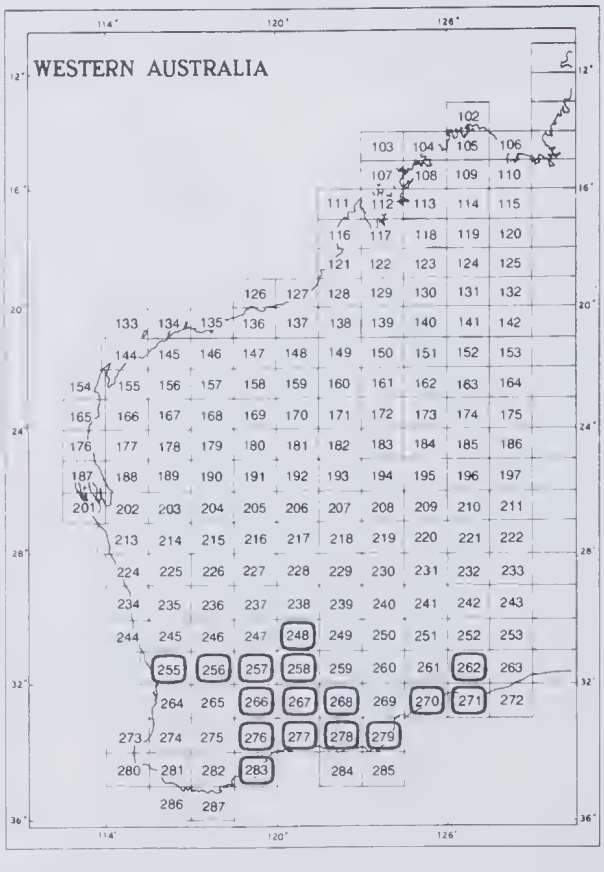
Echium plantagineum



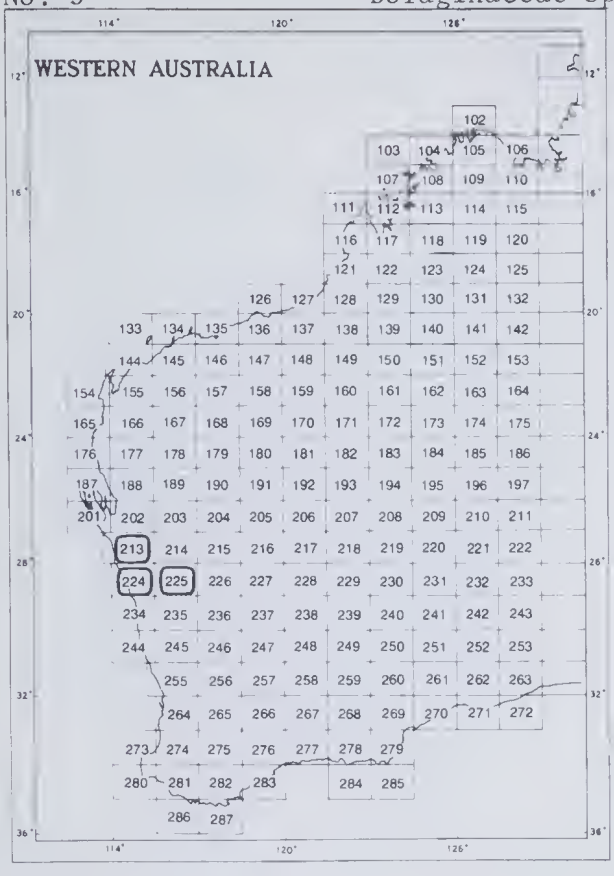
Ehretia saligna



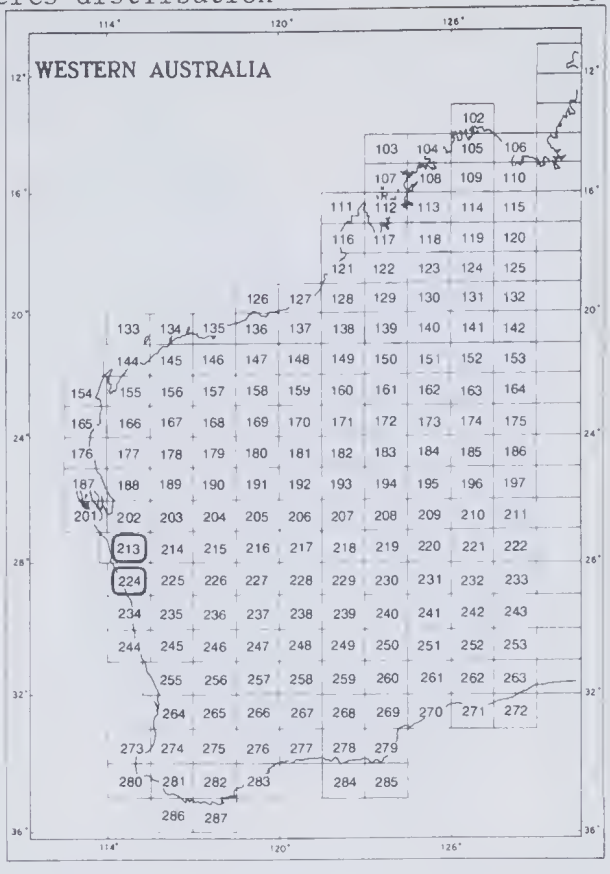
Ehretia urceolata



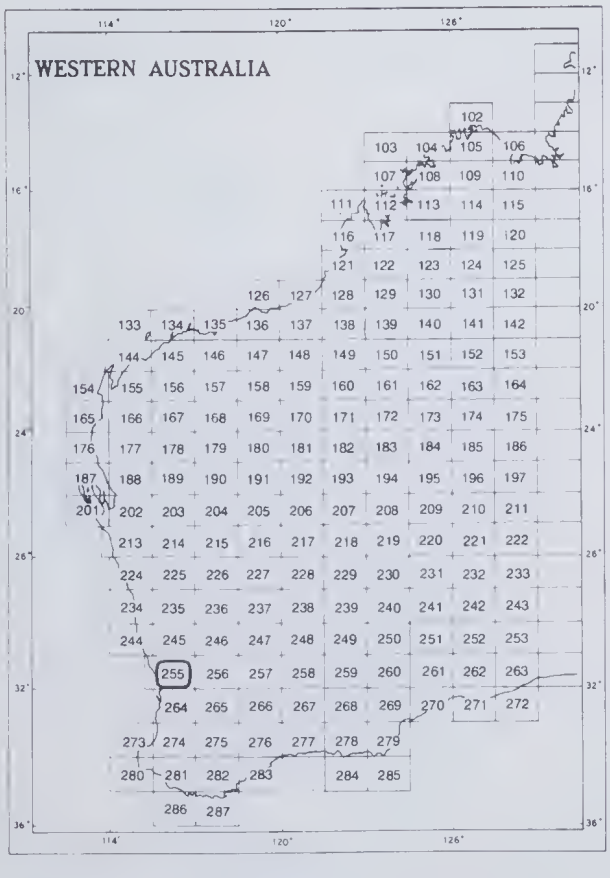
Halgania andromedifolia



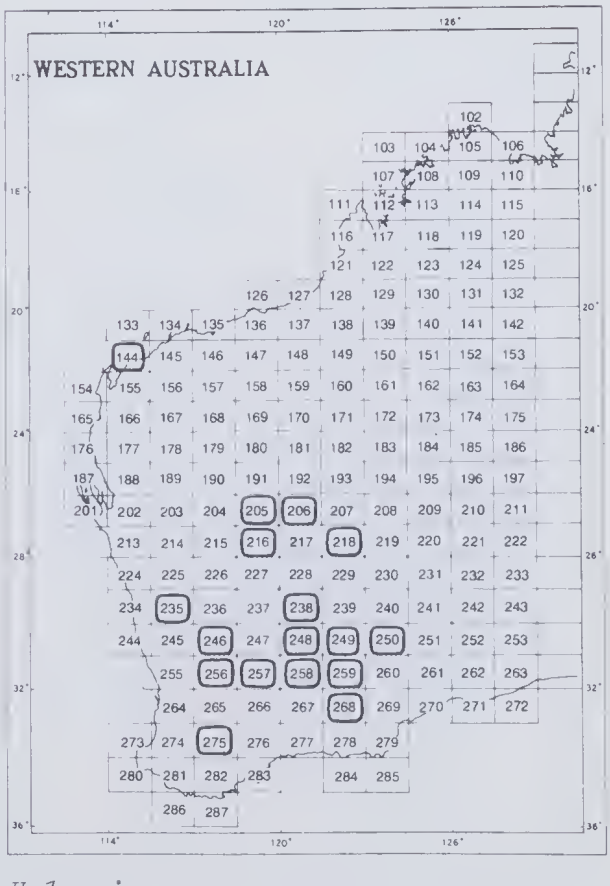
Halgania argyrophylla



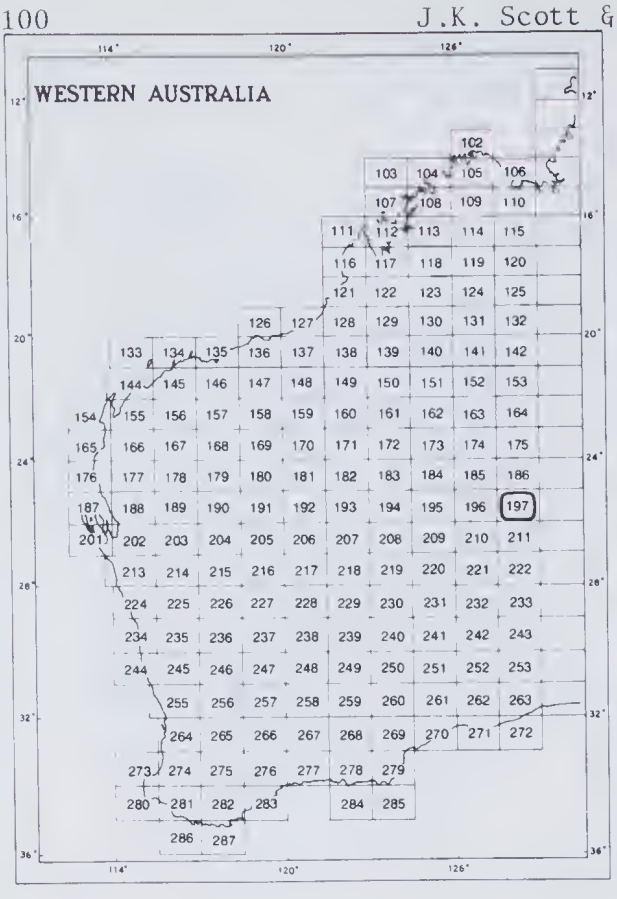
Halgania bebrana



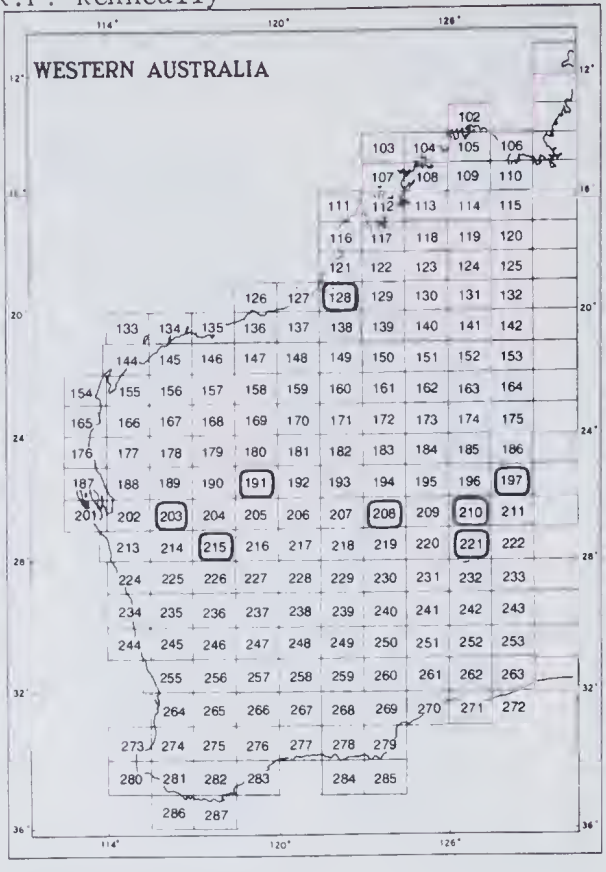
Halgania corymbosa



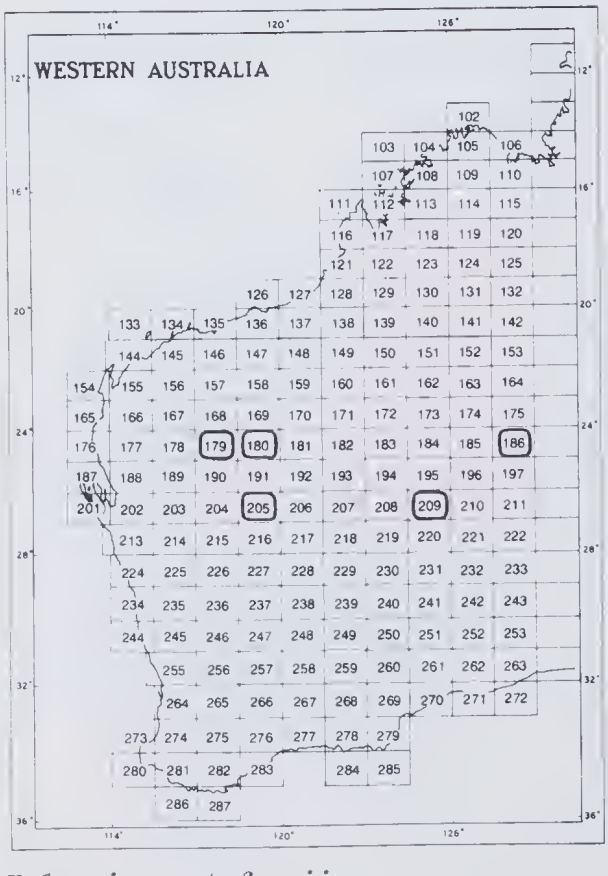
Halgania cyanea



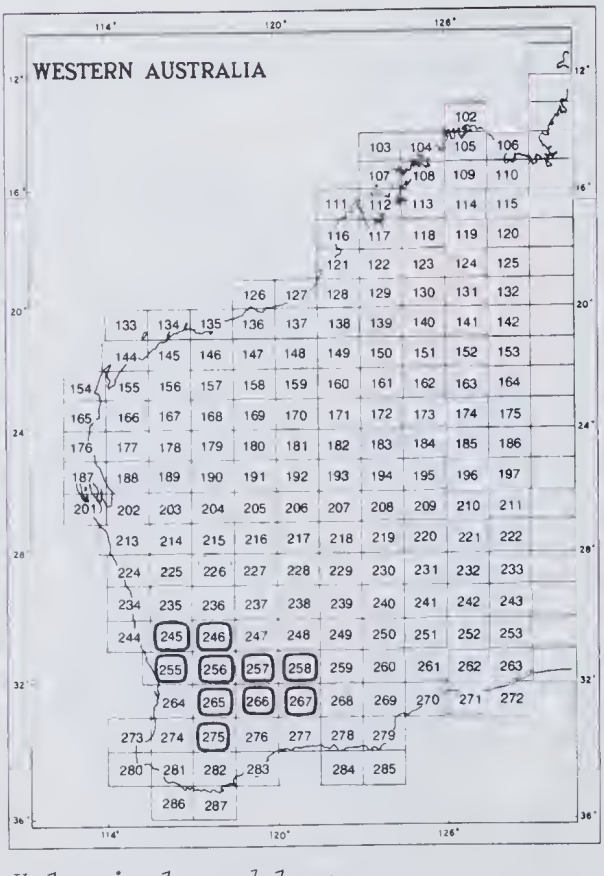
Halgania erecta



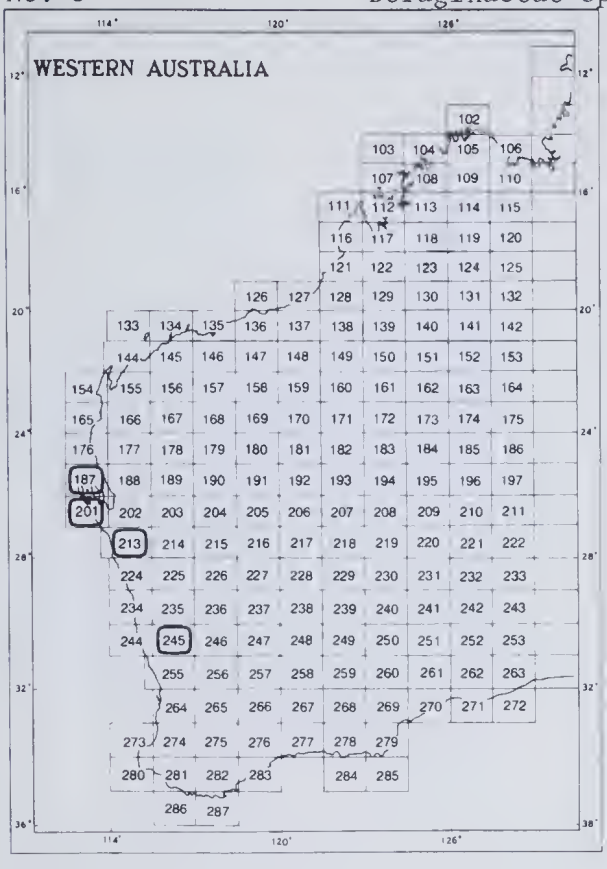
Halgania glabra



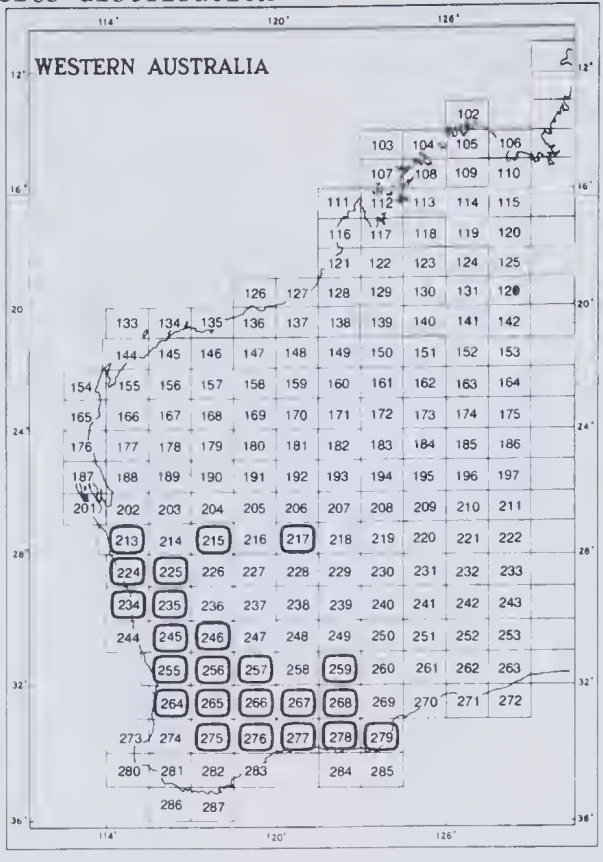
Halgania gustafsenii



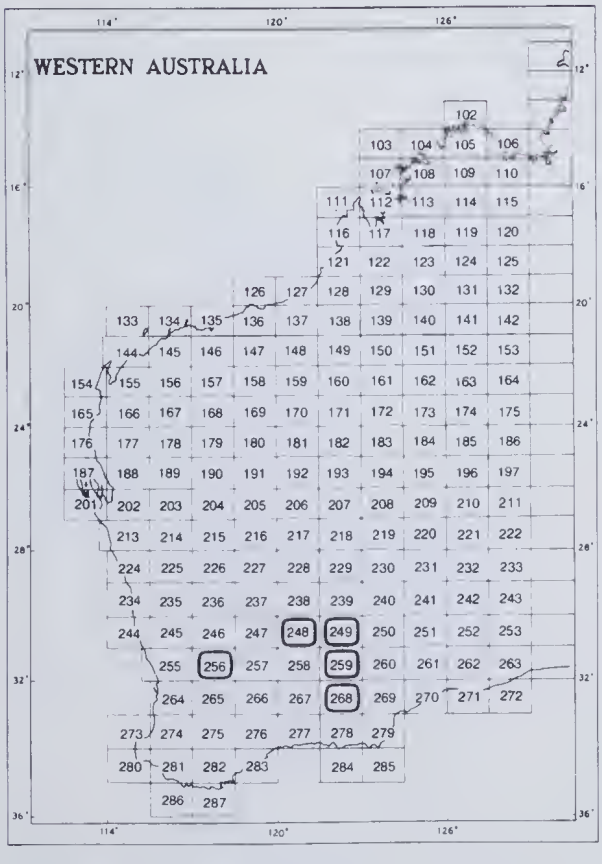
Halgania lavandulacea



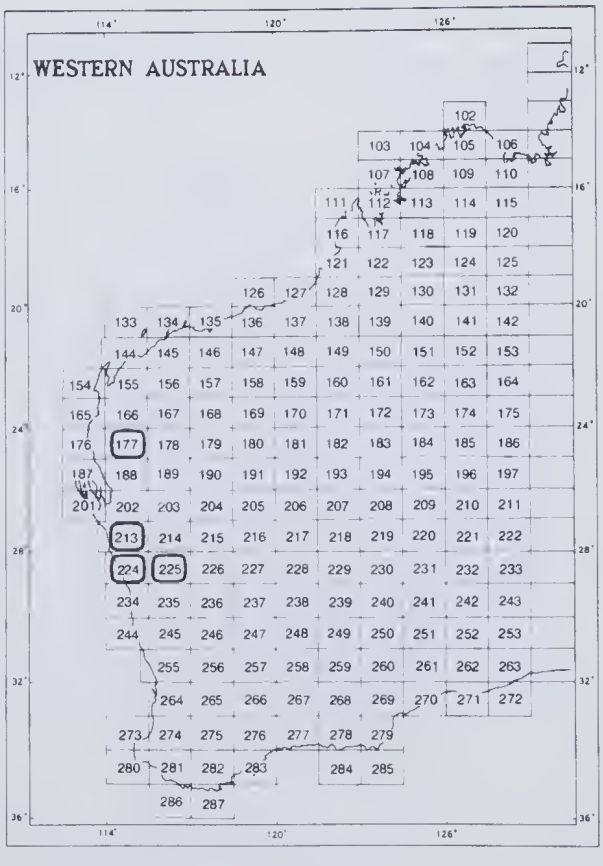
Halgania littoralis



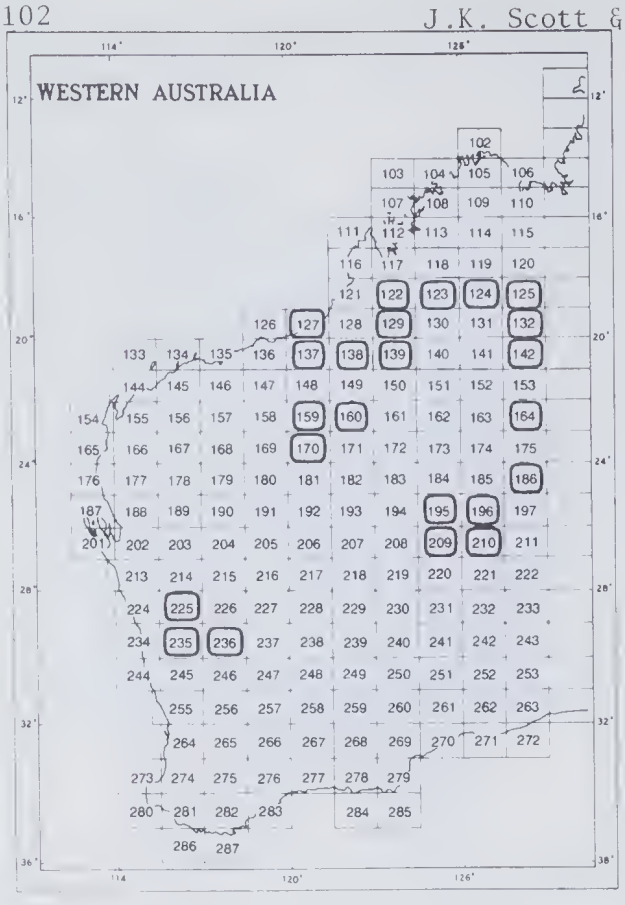
Halgania preissiana



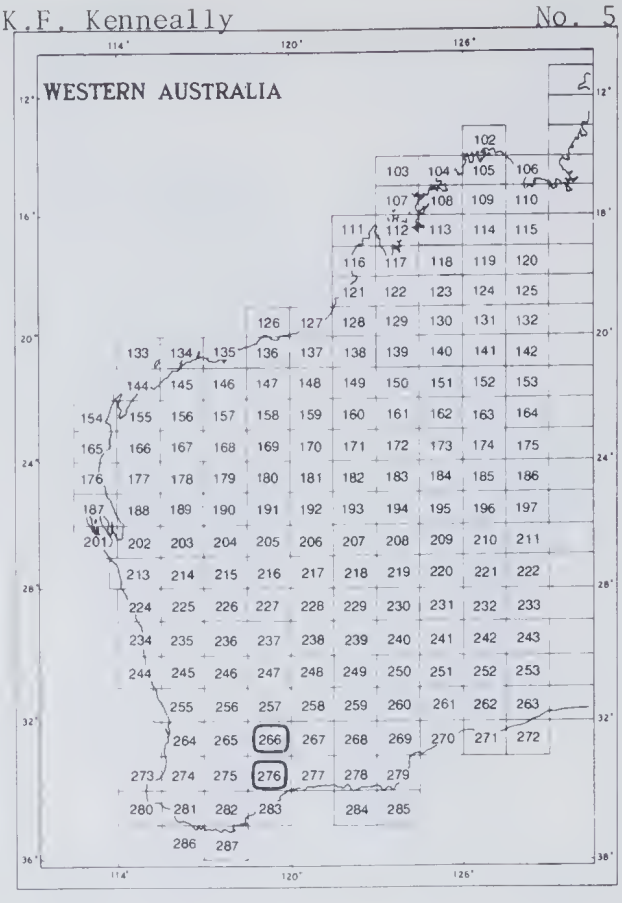
Halgania rigida



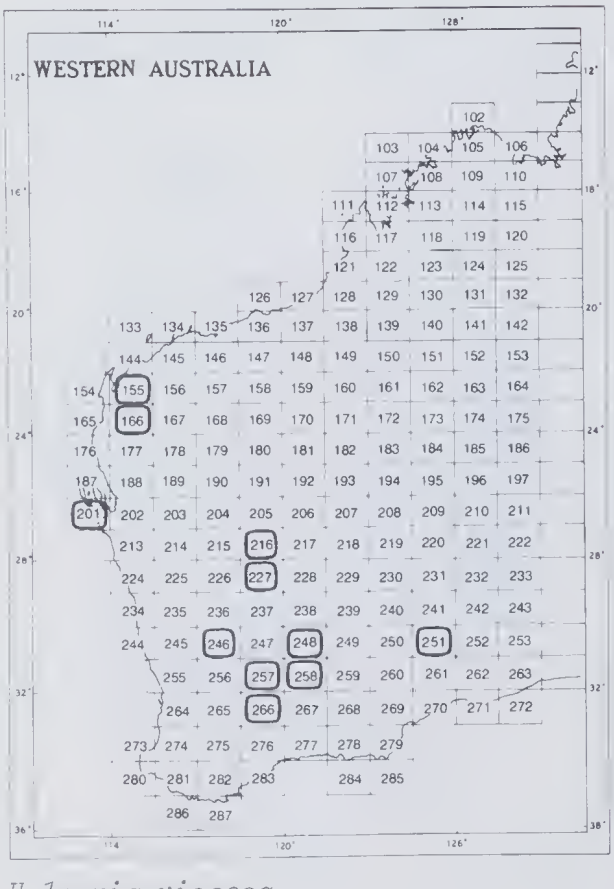
Halgania sericifolia



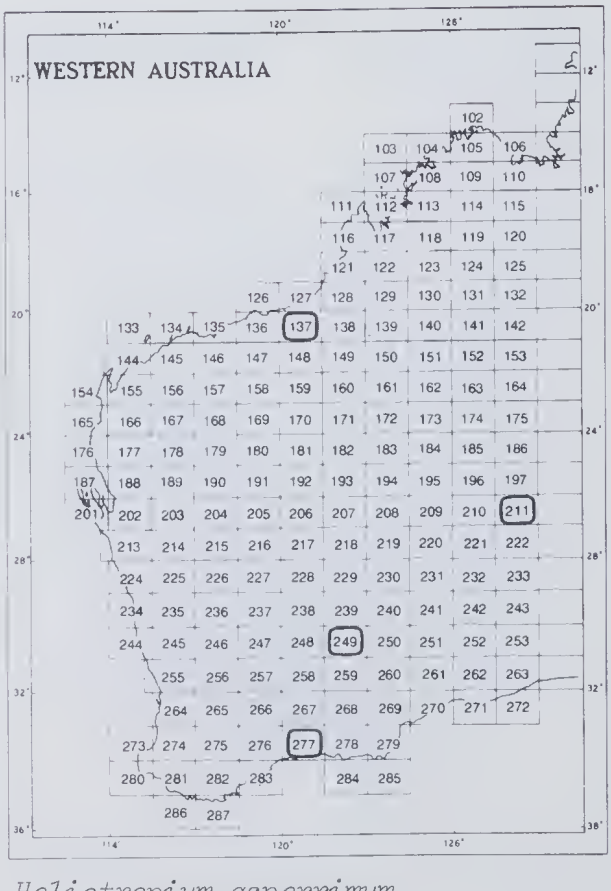
Halgania solanacea



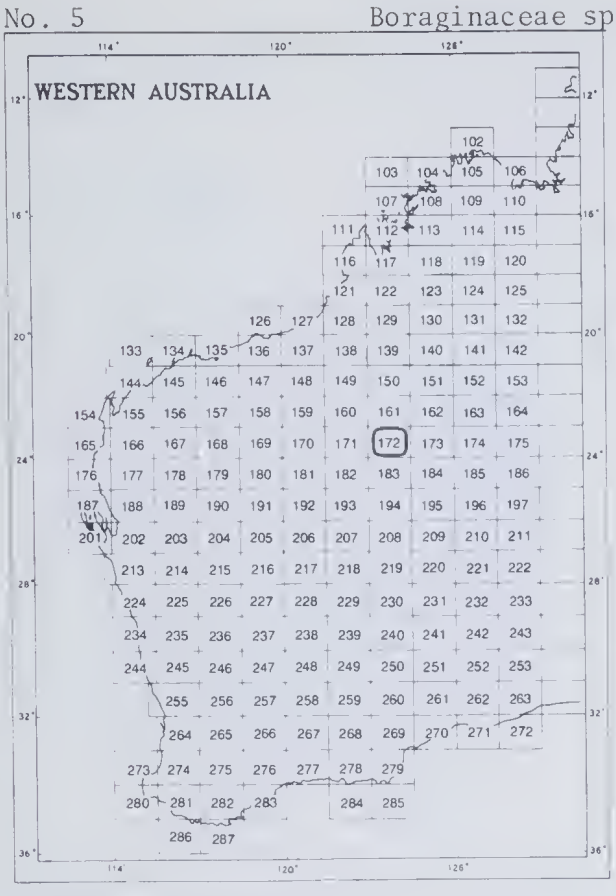
Halgania tomentosa



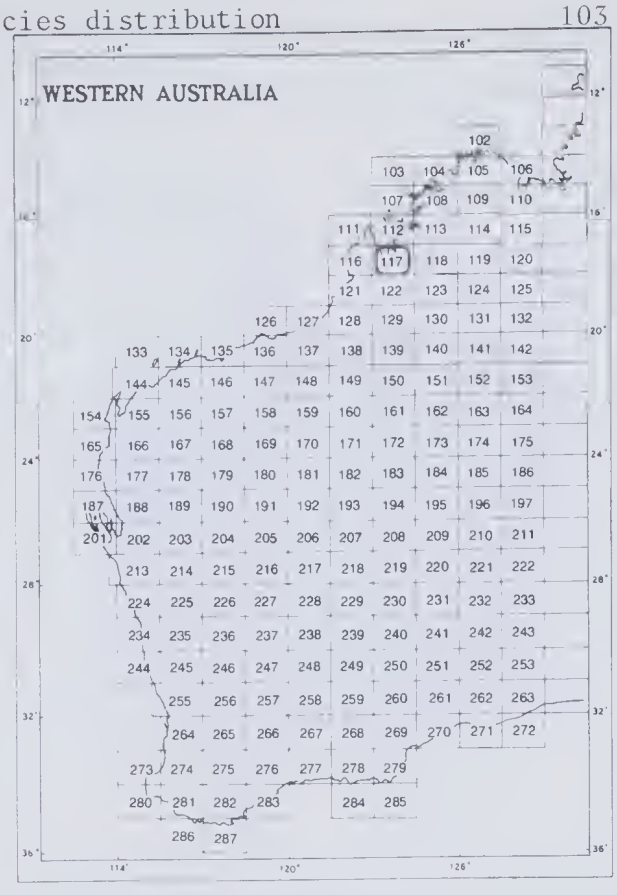
Halgania viscosa



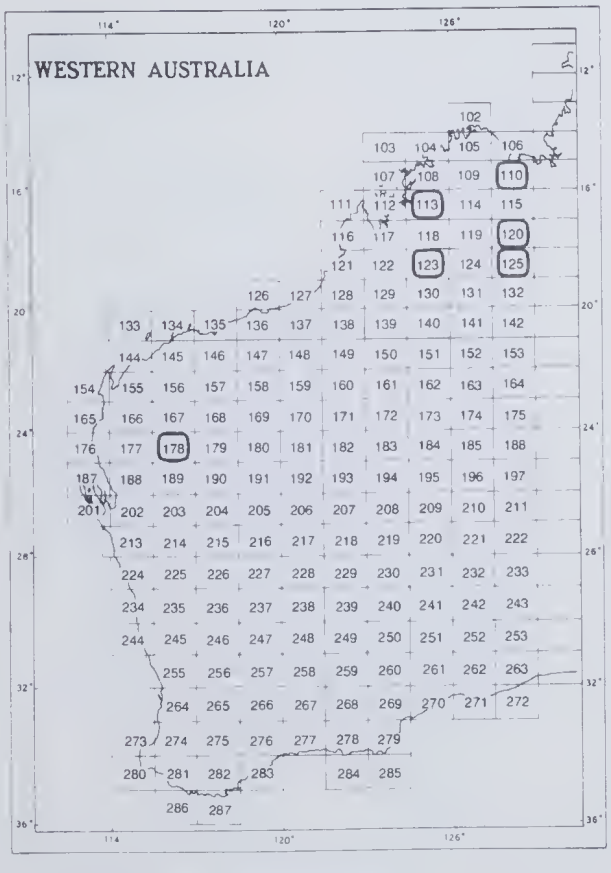
Heliotropium asperrimum



Heliotropium bacciferum



Heliotropium bracteatum



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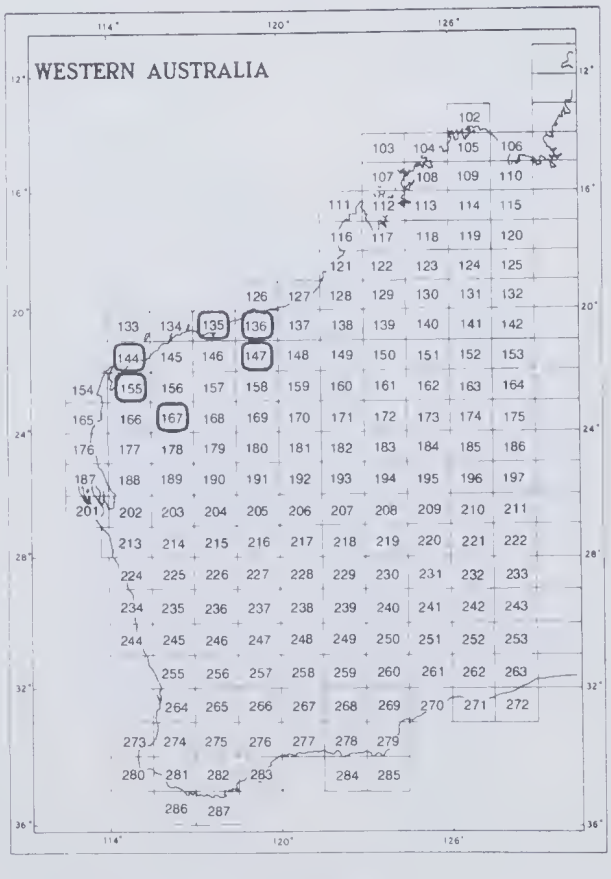

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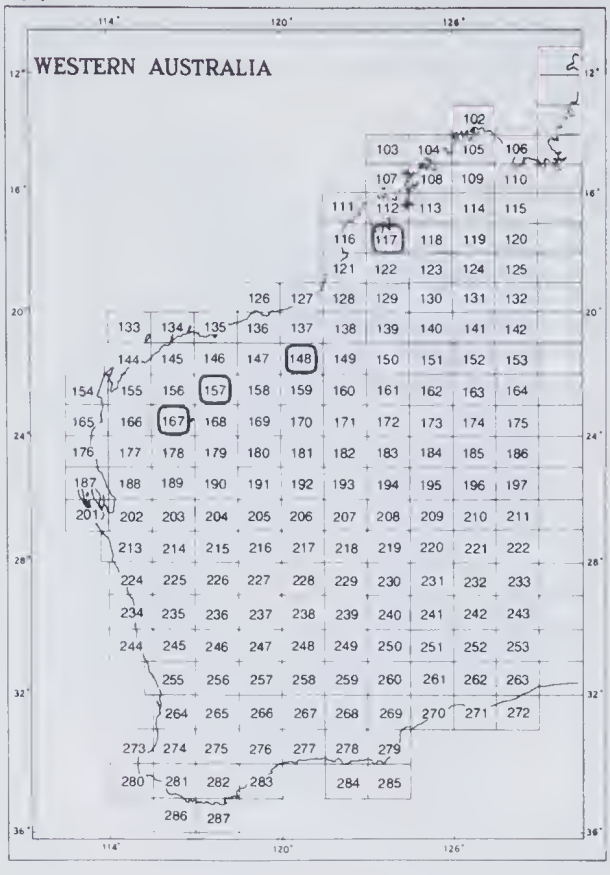

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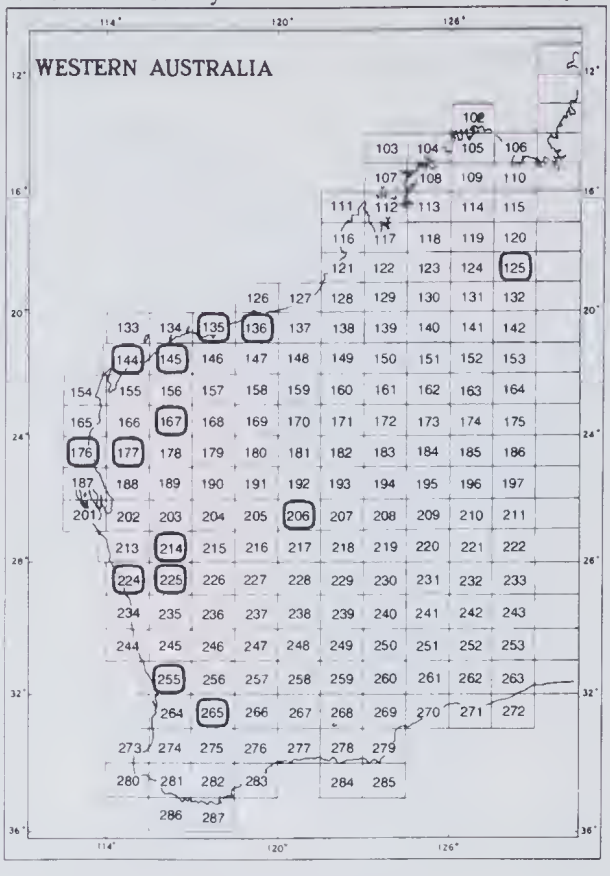

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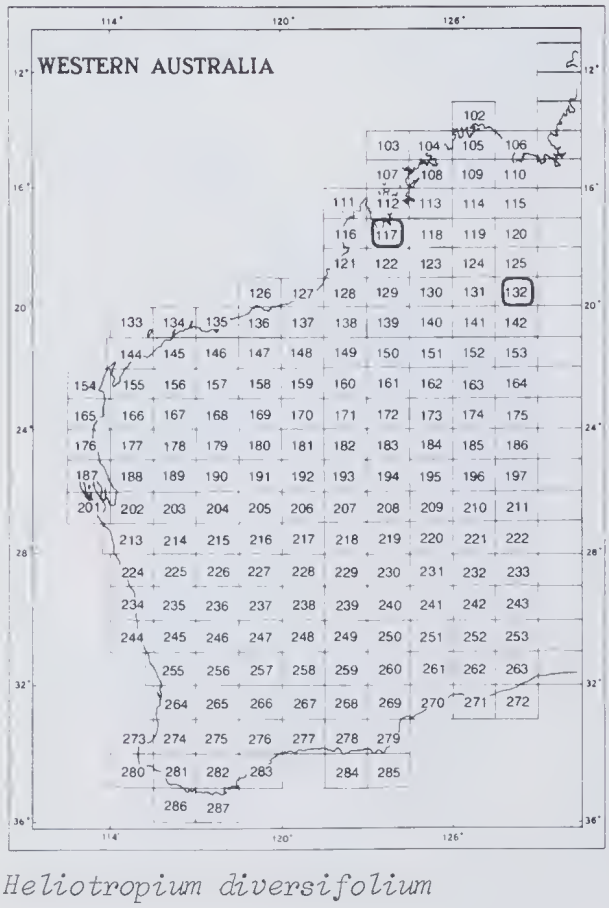

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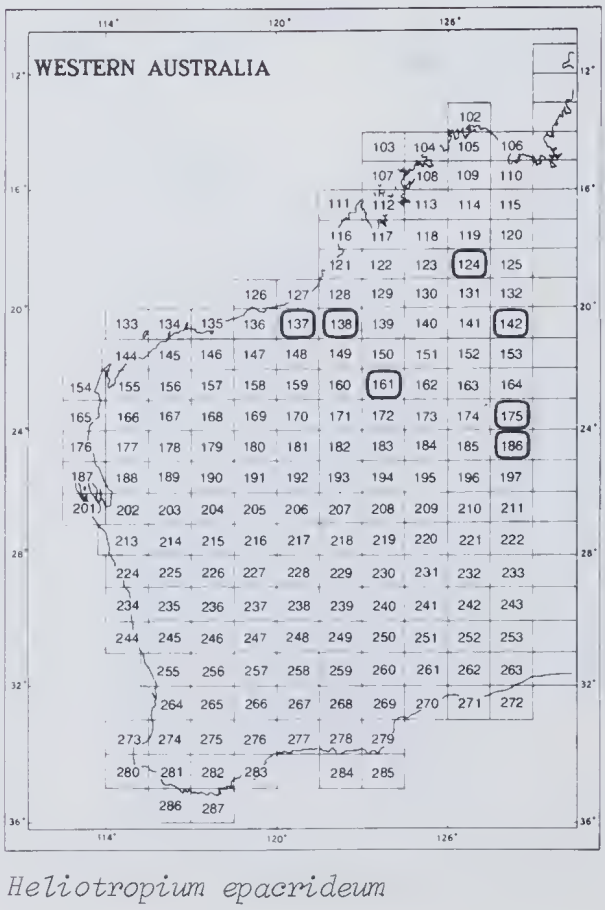

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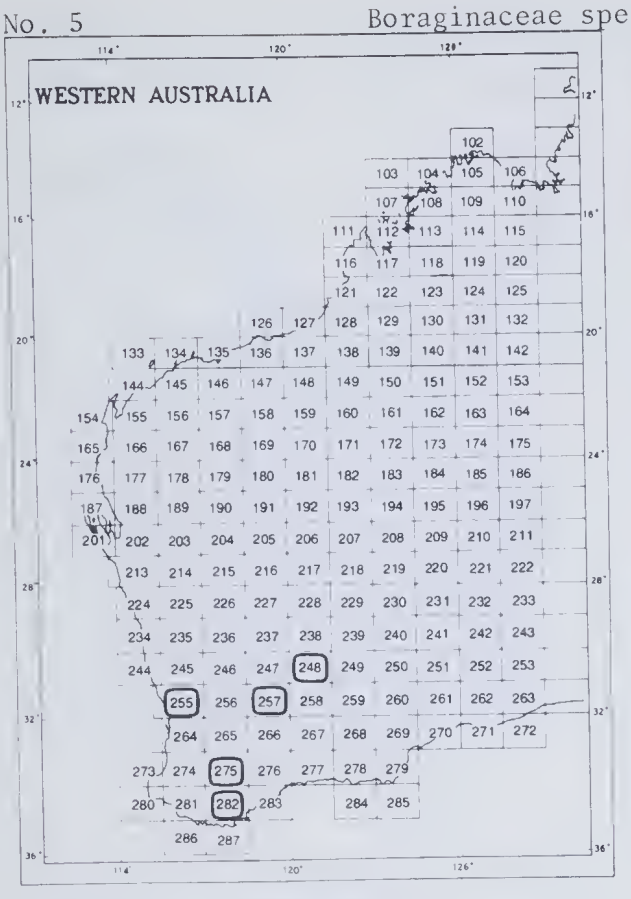
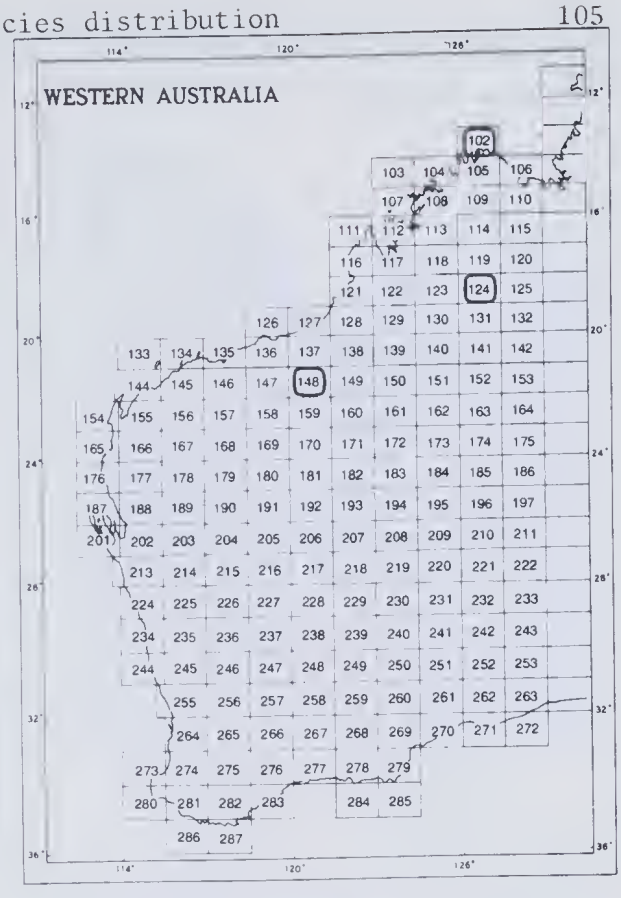


Heliotropium europaeum



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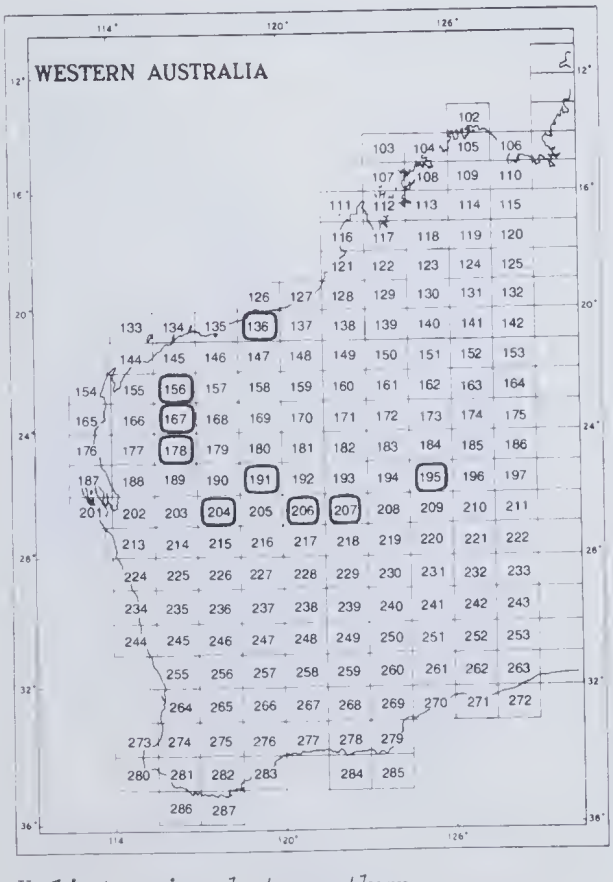

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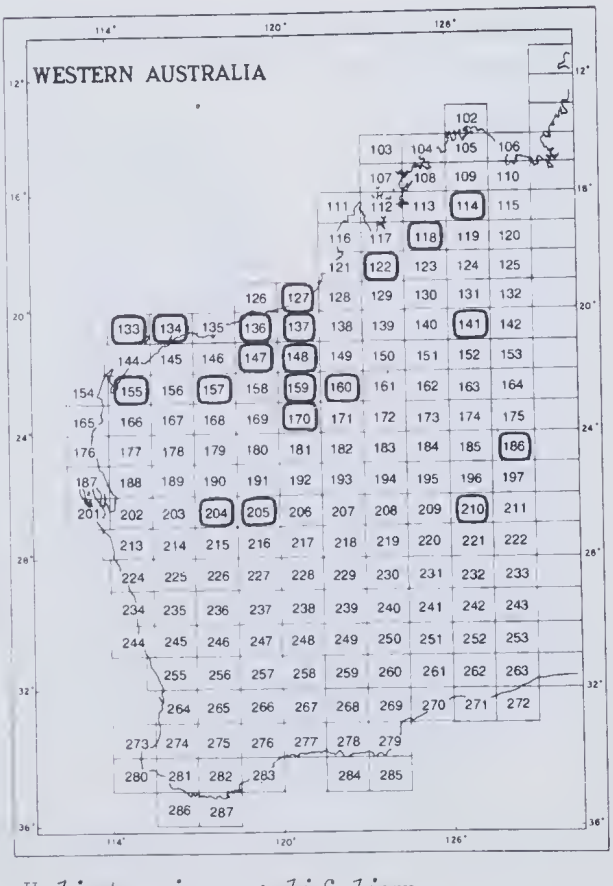

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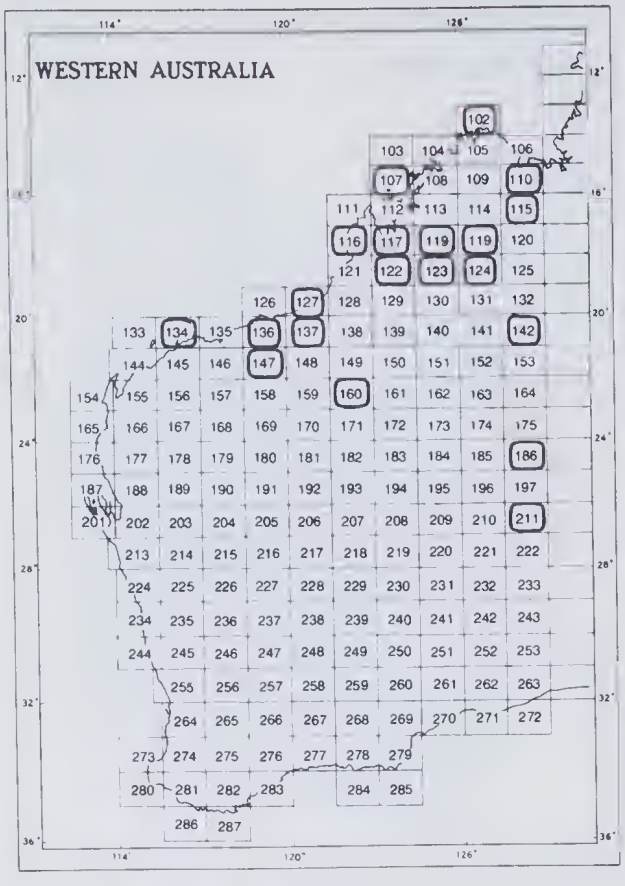

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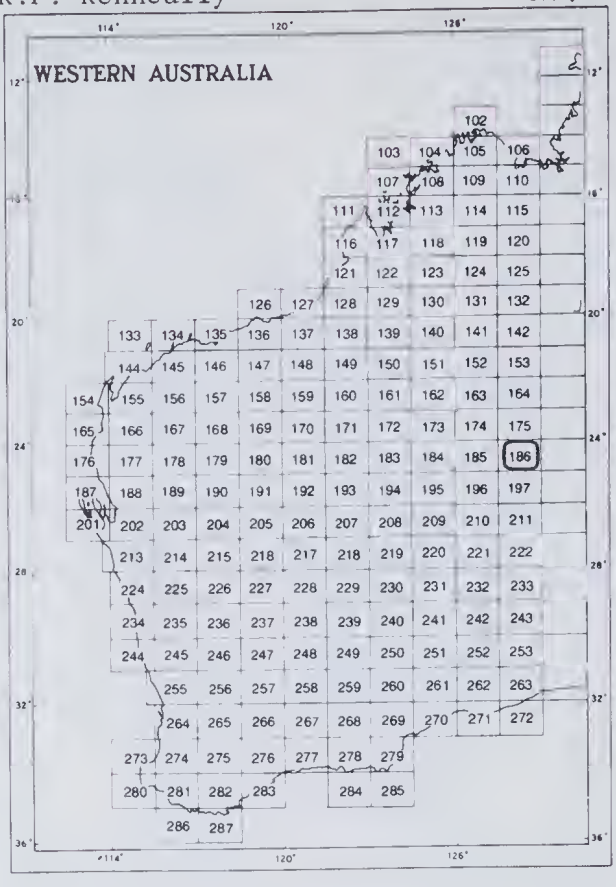

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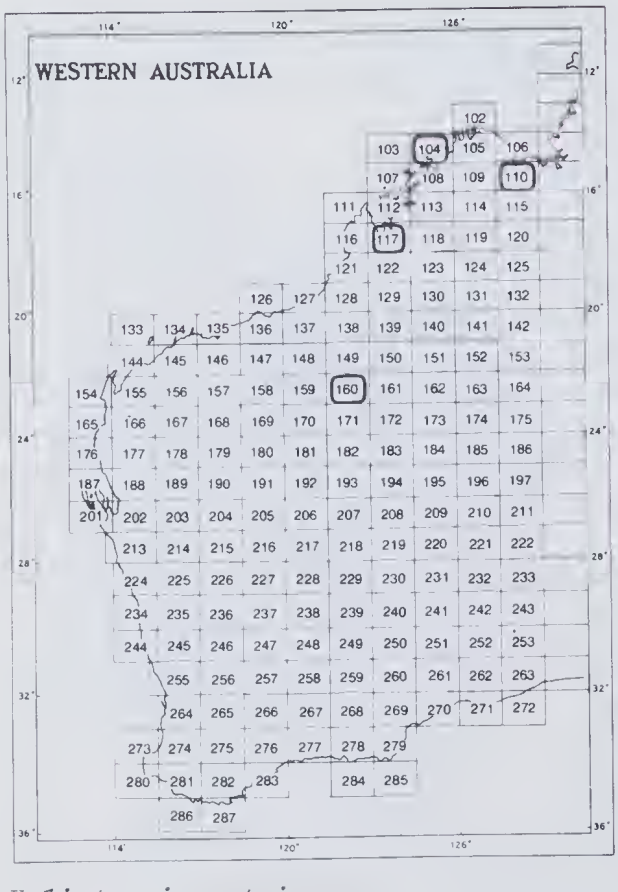

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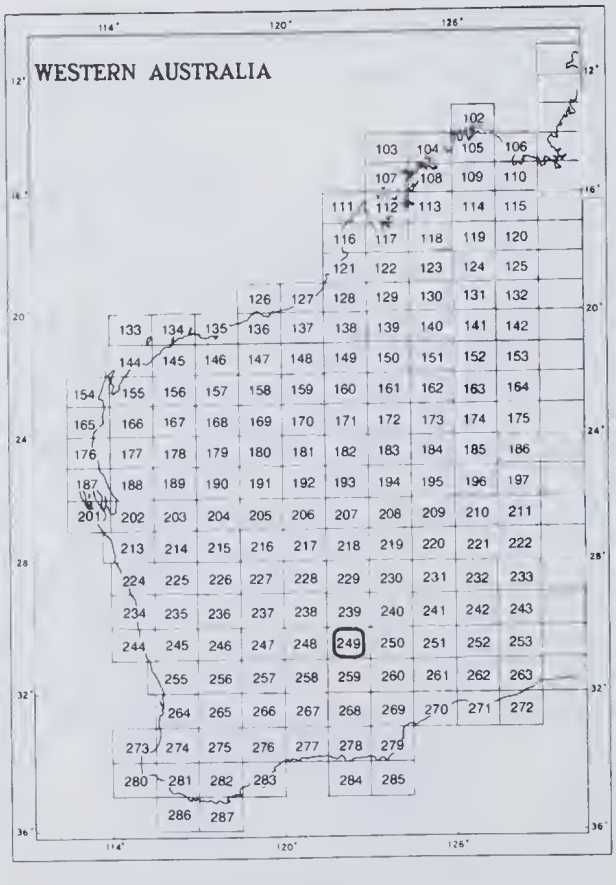
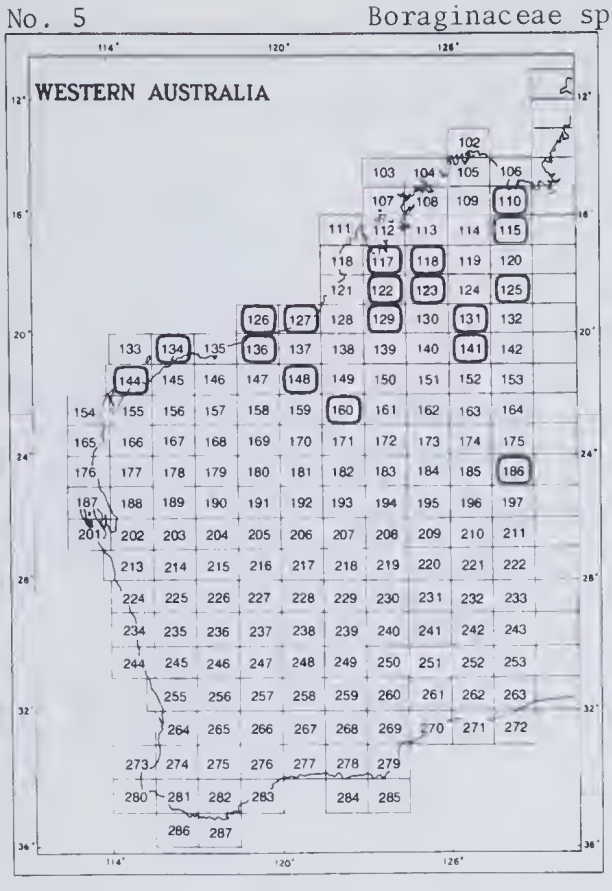
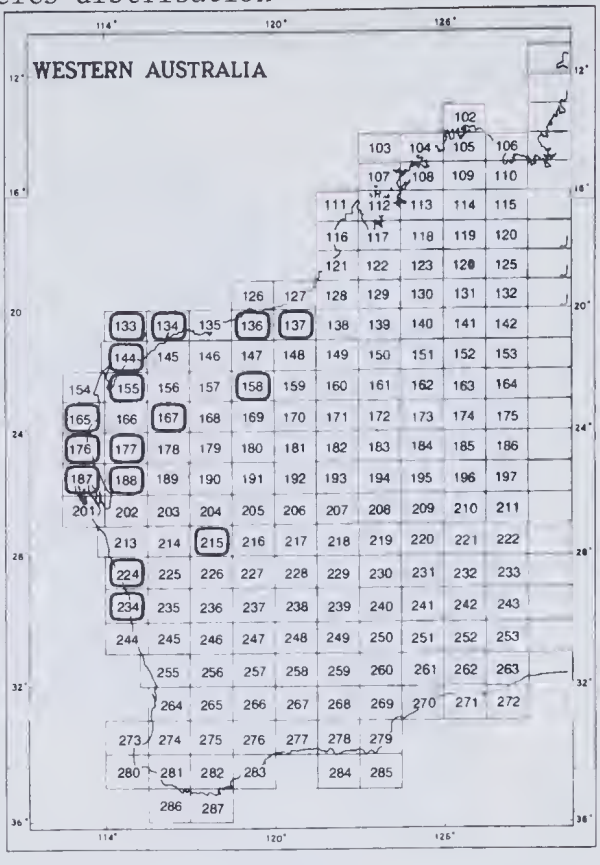


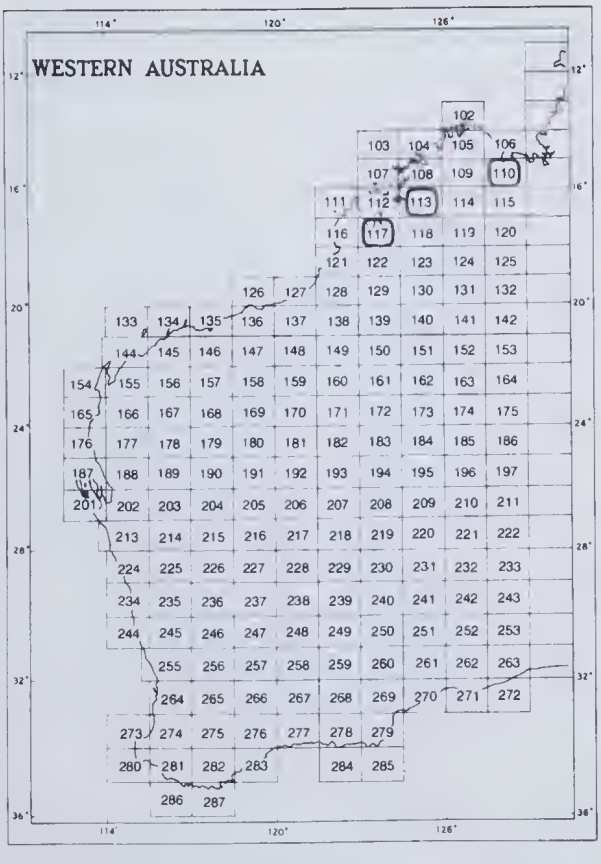
* *Heliotropium supinum*



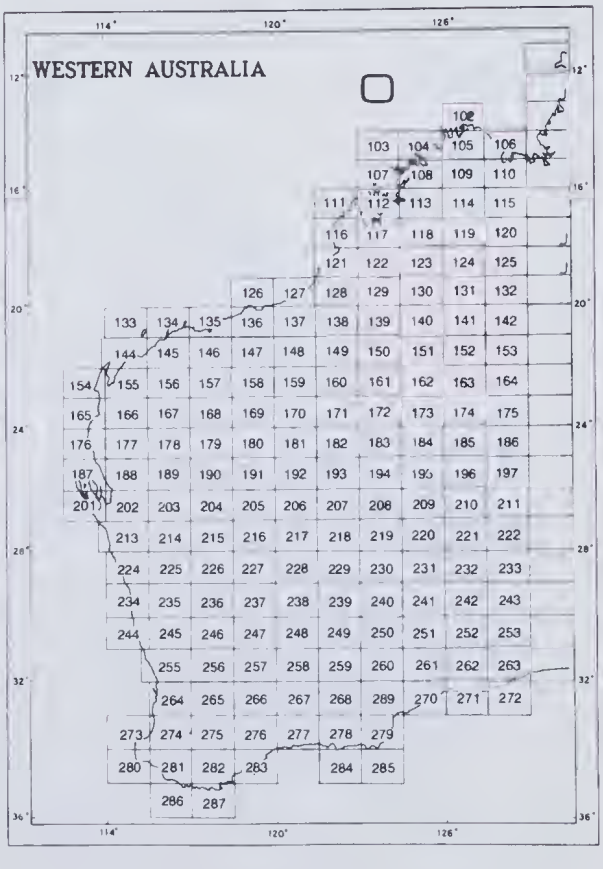
Heliotropium tenuifolium



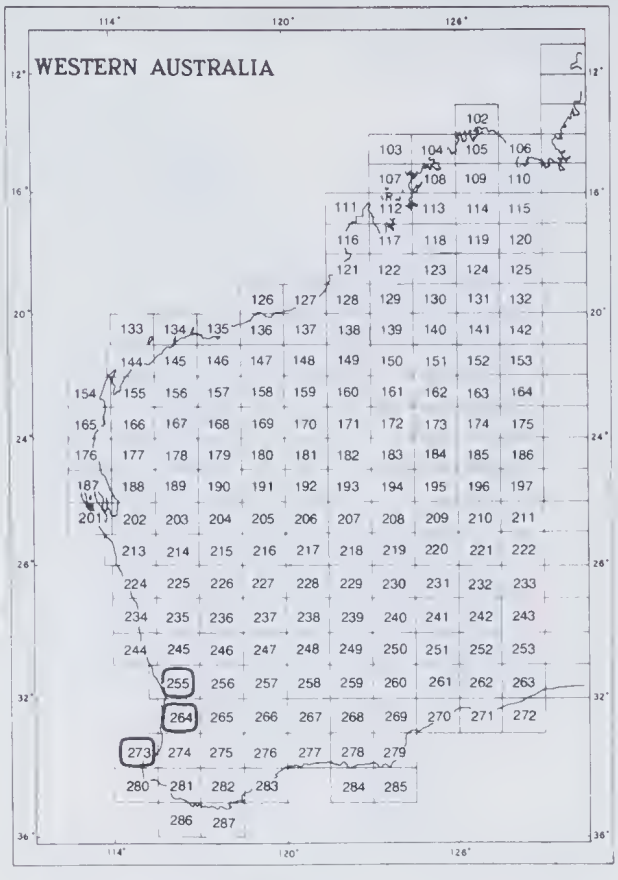
Heliotropium undulatum



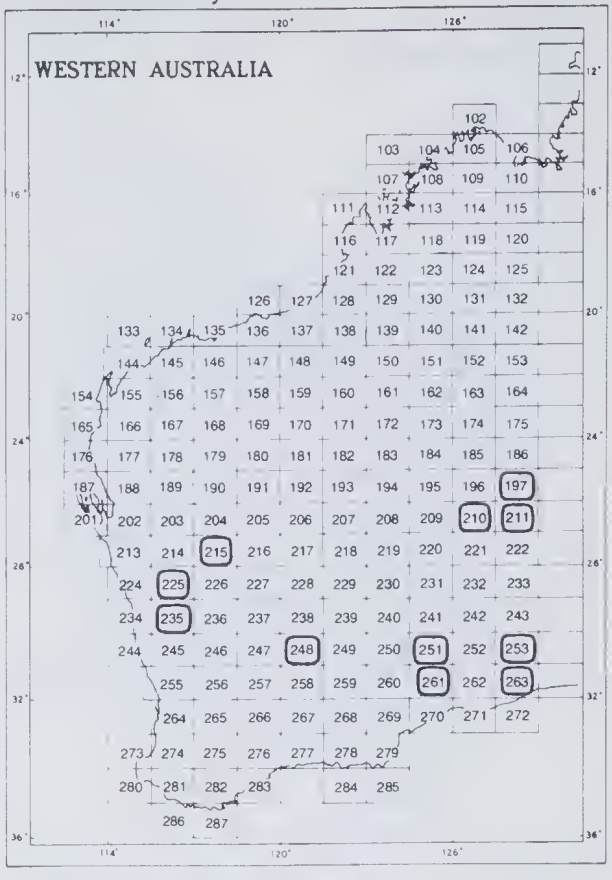
Heliotropium ventricosum



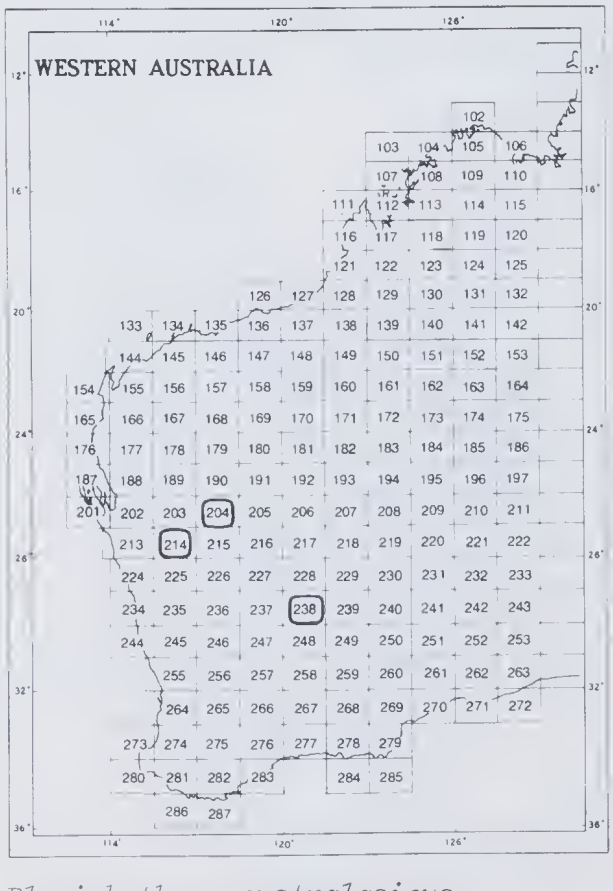
Messerschmidia argentea



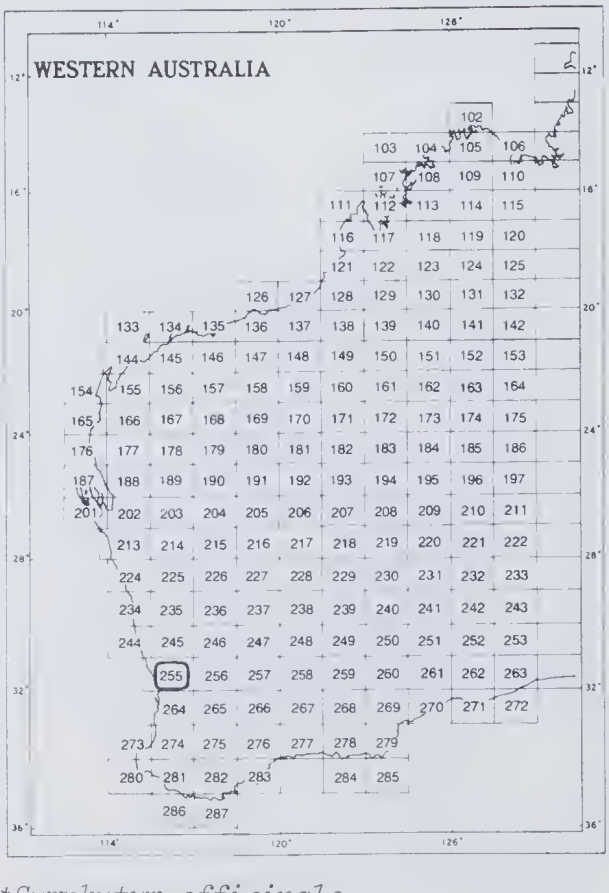
Myosotis australis



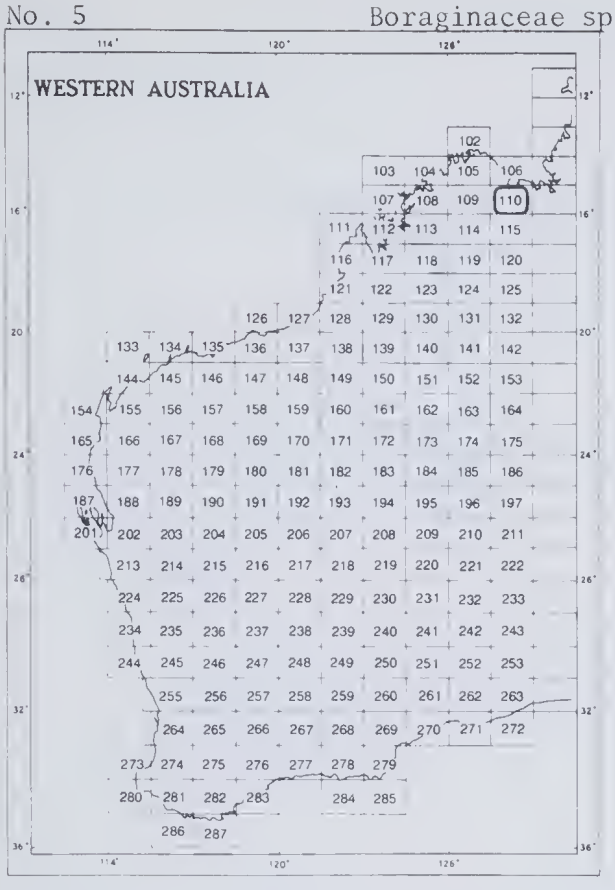
Omphalolappula concava



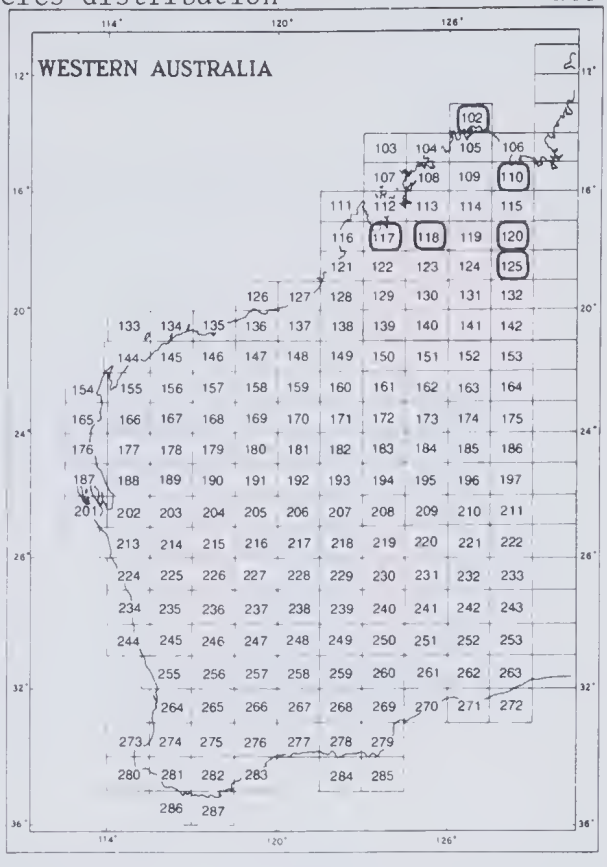
Plagiobothrys australasicus



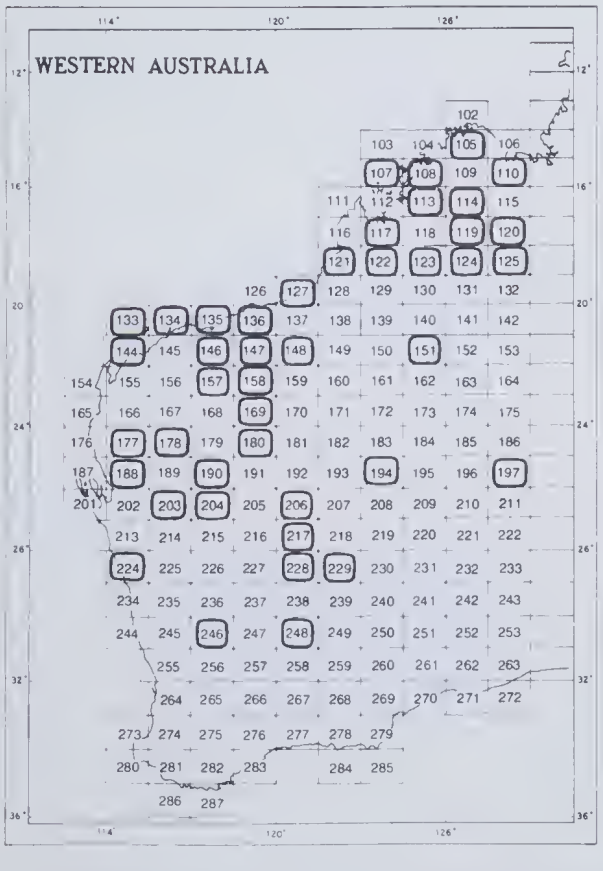
**Symphytum officinale*



Tournefortia mollis



Trichodesma zeylanicum var. *latisepalum*



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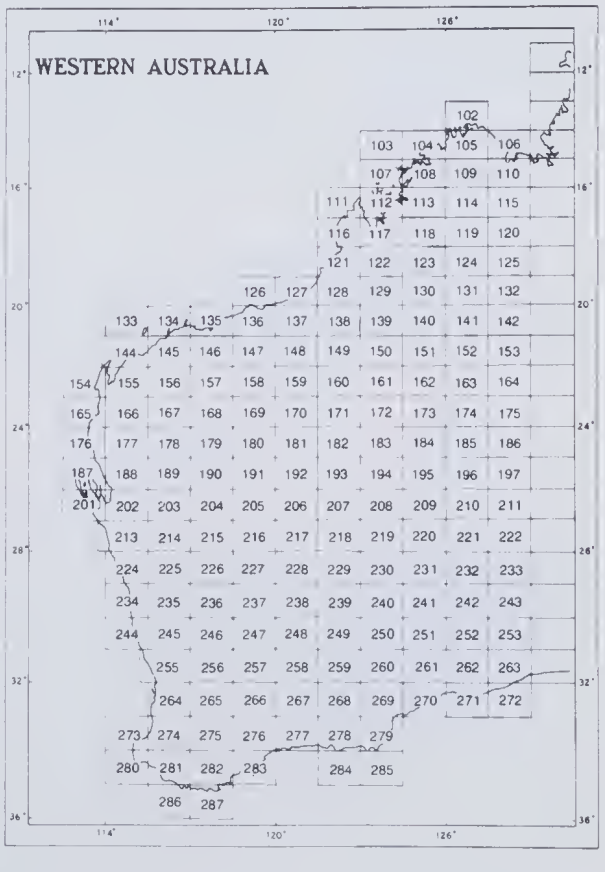

WESTERN AUSTRALIAN HERBARIUM RESEARCH NOTES

No. 5, 1981: 111-134

A CHECKLIST OF THE VASCULAR PLANTS OF THE PERTH REGION, WESTERN AUSTRALIA

By N.G. Marchant and Gillian Perry

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South Perth, W.A. 6151

ABSTRACT

1,460 native and 497 naturalised plant species are listed for the Perth Region which is an area of approximately 10,500 sq. km.

INTRODUCTION

The Perth Region as defined here is an area of approximately 10,500 sq. km and includes metropolitan Perth, the Mandurah-Bunbury area and parts of the Darling Range (Figure 1). The boundary has been drawn so as to exclude the species-rich areas north of the Moore River, the wandoo woodland flora of the eastern part of the Darling Range and the wetter Jarrah forest south west of Dwellingup. The eastern boundary conveniently follows a more or less straight line drawn between some of the highest points of the Darling Range.

The list of native and naturalised alien plants presented here is a preliminary one. Additional information and corrections are invited. The checklist is a precursor to a proposed handbook of the vascular plant flora of the Perth Region.

THE ENVIRONMENT

Most of the Perth Region falls into two distinct geomorphological zones which are separated by a north-south Scarp and the associated Darling Fault. East of the Scarp lies the dissected western margin of the Great Western Plateau, an area of ancient crystalline rocks with an extensive covering of laterite. West of the Scarp is the Swan Coastal Plain, a deep sedimentary basin with superficial deposits of recent origin. A small part of the region, near Gingin, forms the southern portion of the Dandaragan Plateau, an area of exposed Mesozoic sediments. Detailed information on the geology of the region is given by Seddon (1972) and Biggs *et al.* (1980).

The soils of the Great Western Plateau range from sand to heavy clay and the laterites mentioned above. Shallow soil areas over acidic or basic

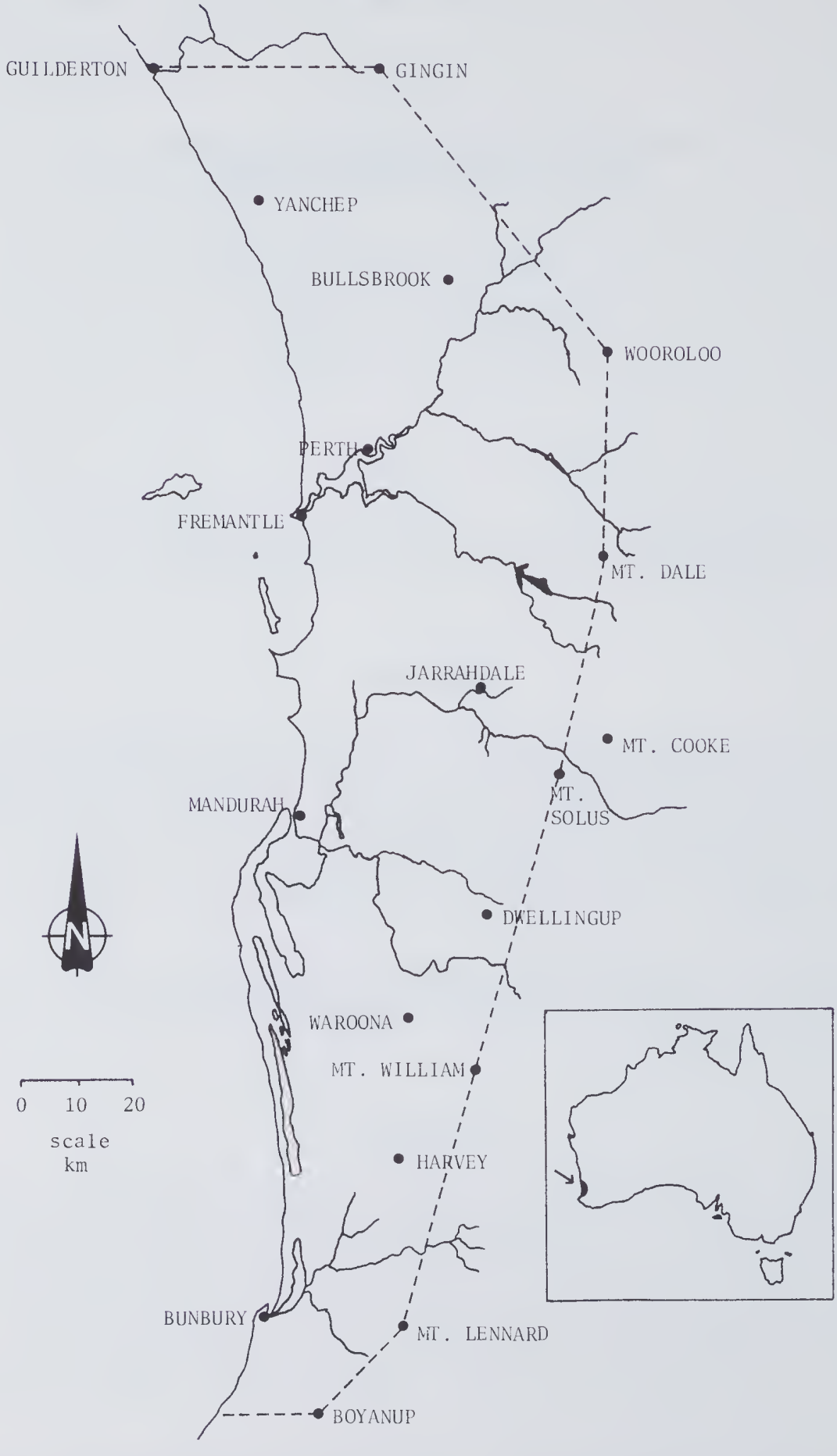

Figure 1. Map showing the boundary of the Perth Region as defined for the proposed flora.

rocks are common, especially near the scarp edge. The soils of the Swan Coastal Plain are mostly yellow, grey or grey-white infertile sands. Surface clay or subsoil clays are commonly encountered near river channels and in the foothills of the Darling Range. Small areas of peat-rich soils occur in wetlands and contribute to the habitat diversity of the Region. Limestone areas with calcareous sands occur along the narrow coastal zone. The landforms and soils of the Darling System have been described by Churchward and McArthur (1980) and the soils of the coastal plain by Bettenay *et al.* (1960).

Climatically the Region is Mediterranean with hot, dry summers and cool, wet winters. Rainfall decreases from south to north and east of the Scarp. The highest rainfall area within the Region is near the Scarp edge, south east of Perth where a small area is delimitated by a 1,400 mm annual isohyet. The driest areas in the region are in the north and north east near Guilderton and south east of Gingin which lie between the 600 and 700 mm per annum isohyets (Map, Heddle *et al.* 1980).

The vegetation of the Perth area has been studied by Heddle *et al.* (1980). The plateau of the Region supports an extensive forest of *Eucalyptus marginata* and *E. calophylla*. A varied shrub layer is always present in uncleared areas; small areas of low shrubland are developed on shallow soils. The sandy soils of the Swan Coastal Plain support extensive, low open woodlands mostly of *Banksia* and *Eucalyptus* with a species-rich shrub layer. Tracts of low shrubland occur in coastal areas over limestone. Heathlands with different species composition are commonly seen in winter-wet depressions where subsoil layers retain moisture during dry periods.

The Perth Region has the greatest concentration of the State's population and urban development. The major land uses of the area are agriculture, forestry, mining and quarrying. These activities have resulted in large tracts of land of the Swan Coastal Plain and the clay-rich soils of the valleys of the Great Western Plateau being cleared or partly cleared. Fortunately some uncleared areas are still extant and the authors consider it is unlikely that many native plant species have been lost to the region since the beginning of European settlement in 1829. On the other hand, clearing and associated land uses have resulted in the establishment of many alien plant species. The proportion of naturalised plant species in the Perth Region is far greater than in Western Australia as a whole (G. Perry, unpublished).

METHODS

The list of species presented here has been compiled from records of the Western Australian Herbarium (PERTH). Further checks were made from published species lists; however, records have not been used unless supported by voucher specimens lodged in the Herbarium.

Many specimens examined were collected in what are now suburbs of Perth, as for example by botanists such as C. Andrews, W.V. Fitzgerald, M. Koch and A. Morrison in the period 1900-1910. Further collections in the city area were made by W.M. Carne, E. Dell and B.T. Goadby in the following two decades. Only recently, for the purpose of the present project, has intensive collecting been resumed.

As far as possible the nomenclature of naturalised aliens has been

checked with the literature up to January 1981. In addition, advice has been obtained from specialists who are currently engaged in revisionary studies but whose findings have not yet been published. Naturalised aliens are here regarded as species not native to the Perth Region but thought to have established themselves. However, there have been few field studies to assess whether or not a species is naturalised or merely adventive.

The following list includes 126 families and 629 genera. The total number of species recorded is 1,957 of which 497 (approximately 25%) are naturalised aliens. Table 1 shows the total number of native and naturalised species in each of the major plant groups.

Table 1. Number of Species in the Perth Region.

	Native	Naturalised	Totals
Ferns and Fern Allies	19	2	21
Gymnosperms	5	0	5
Angiosperms			
Monocotyledons	396	168	564
Dicotyledons	1,040	327	1,367
TOTALS	1,460	497	1,957

ACKNOWLEDGEMENTS

The authors wish to acknowledge the assistance of R. Cranfield, 1. Fetwadjieff, J. Goff and C. Lynch who helped to compile the list. We are also grateful to M. D'Antuono for computer programming.

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LYCOPODIACEAE

LYCOPODIUM SERPENTINUM KUNZE
PHYLLOGLOSSUM DRUMMONDII KUNZE

ISOETACEAE

ISOETES DRUMMONDII A.BRAUN

SELAGINELLACEAE

SELAGINELLA GRACILLIMA (KUNZE)ALSTON

OPHIOGLOSSACEAE

OPHIOGLOSSUM LUSITANICUM L.

SCHIZAEACEAE

SCHIZAEA FISTULOSA LABILL.

CYATHEACEAE

* CYATHEA COOPERI (HOOKER EX F.MUELL.)DOMIN

DENNSTAEDTIACEAE

ASPLENIUM ADIANTOIDES (L.)LAMARCK
CYCLOSORUS GONGYLODES (SCHKUHR)LINK
PLEUROSORUS RUTIFOLIUS (R.BR.)FEE
PTERIDIUM AQUILINUM (L.)KUHN
PTERIS VITTATA L.

LINDSAEACEAE

LINDSAEA LINEARIS SWARTZ

ADIANTACEAE

ADIANTUM AETHIOPICUM L.
ANOGRAMMA LEPTOPHYLLA (L.)LINK
CHEILANTHES DISTANS (R.BR.)METT.
CHEILANTHES TENUIFOLIA (N.L.BURMAN)SWARTZ

MARSILEACEAE

MARSILEA DRUMMONDII A.BRAUN
PILULARIA NOVAE-HOLLANDIAE A.BRAUN

SALVINIACEAE

* SALVINIA MOLESTA D.S.MITCHELL

AZOLLACEAE

AZOLLA FILICULOIDES LAMARCK

ZAMIACEAE

MACROZAMIA RIEDLEI (FISCH.EX GAUD.) C.A.GARDNER

PODOCARPACEAE

PODOCARPUS DROUYNIANA F.MUELL.

CUPRESSACEAE

ACTINOSTROBUS ACUMINATUS PARL.
ACTINOSTROBUS PYRAMIDALIS MIQ.
CALLITRIS PREISSII MIQ.

TYPHACEAE

TYPHA DOMINGENSIS PERS.
* TYPHA ORIENTALIS C.PRESL

RUPPIACEAE

RUPPIA MEGACARPA MASON
RUPPIA POLYCARPA MASON
RUPPIA TUBEROSA J.L.DAVIS & TOMLINSON

POTAMOGETONACEAE

AMPHIBOLIS ANTARCTICA (LABILL.)SONDER & ASCHERS.EX ASCHERS.
AMPHIBOLIS GRIFFITHII (J.M.BLACK) DEN HARTOG
HETEROZOSTERA TASMANICA (MARTENS EX ASCHERS.)DEN HARTOG
LEPILAENA PREISSII (LEHM.)F.MUELL.
POSIDONIA ANGUSTIFOLIA M.L.CAMBRIDGE & J.KUO
POSIDONIA AUSTRALIS J.D.HOOKER
POSIDONIA OSTENFELDII DEN HARTOG
POSIDONIA SINUOSA M.L.CAMBRIDGE & J.KUO
POTAMOGETON DRUMMONDII BENTH.
POTAMOGETON OCHREATUS RAOUL
POTAMOGETON PECTINATUS L.
POTAMOGETON TRICARINATUS F.MUELL.& A.BENN. EX A.BENN.
THALASSODENDRON PACHYRHIZUM DEN HARTOG
ZOSTERA MUCRONATA DEN HARTOG

NAJADACEAE

NAJAS MARINA L.

APONOGETONACEAE

APONOGETON HEXATEPALUS VAN BRUGGEN

JUNCAGINACEAE

TRIGLOCHIN CALCITRAPA HOOKER
TRIGLOCHIN CENTROCARPA HOOKER
TRIGLOCHIN MINUTISSIMA F.MUELL.
TRIGLOCHIN MUCRONATA R.BR.
TRIGLOCHIN MUELLERI BUCHENAU
TRIGLOCHIN PROCERA R.BR.
TRIGLOCHIN STRIATA RUIZ & PAVON
TRIGLOCHIN TRICHOPHORA NEES EX ENDL.

ALISMATACEAE

* ALISMA PLANTAGO-AQUATICA L.

HYDROCHARITACEAE

HALOPHILA OVALIS (R.BR.)J.D.HOOKER
HALOPHILA SPINULOSA (R.BR.)ASCHERS.
HYDRILLA VERTICILLATA (L.F.)ROYLE
OTTELIA OVALIFOLIA (R.BR.)RICH
* VALLISNERIA SPIRALIS L.

POACEAE

AGROSTIS AEMULA R.BR.
AGROSTIS AVENACEA GMEL.
AGROSTIS PLEBEIA R.BR.
* AGROSTIS STOLONIFERA L.
* AIRA CARYOPHYLLEA L.
* AIRA CUPANIANA GUSS.
* ALOPECURUS MYOSUROIDES HUDSON
* AMMOPHILA ARENARIA (L.)LINK
AMPHIBROMUS NEESII STEUD.
AMPHIPOGON AMPHIPOGONOIDES (STEUD.)VICKERY
AMPHIPOGON CARICINUS F.MUELL.
AMPHIPOGON DEBILIS R.BR.
AMPHIPOGON LAGUROIDES R.BR.
AMPHIPOGON STRICTUS R.BR.
AMPHIPOGON TURBINATUS R.BR.
* ANTHOXANTHUM ODORATUM L.
* ARRHENATHERUM BULBOSUM (WILLD.)C.PRESL
* ARUNDO DONAX L.
* AVENA BARBATA LINK
* AVENA FATUA L.
* AVENA SATIVA L.

* AXONOPUS COMPRESSUS (SWARTZ)BEAUV.
* BRACHIARIA MUTICA (FORSK.)STAPF
* BRIZA MAXIMA L.
* BRIZA MINOR L.
* BROMUS ALOPECUROS POIR.
  BROMUS ARENARIUS LABILL.
* BROMUS DIANDRUS ROTH
* BROMUS HORDEACEUS L.
* BROMUS MADRITENSIS L.
* BROMUS RUBENS L.
* BROMUS WILLDENOWII KUNTH
* CATAPODIUM RIGIDUM (L.)C.E.HUBBARD EX DONY
* CENCHRUS ECHINATUS L.
* CENCHRUS INCERTUS M.A.CURTIS
* CHLORIS GAYANA KUNTH
  CHLORIS TRUNCATA R.BR.
* COIX LACRYMA-JOBI L.
* CORTADERIA SELLOANA (SCHULTES & J.H.SCHULTES)ASCHERS.& GRAEBN.
* CRYPSIS SCHOENOIDES (L.)LAMARCK
  CYMBOPOGON BOMBYCINUS (R.BR.)DOMIN
* CYNODON DACTYLON (L.)PERS.
* CYNOSURUS ECHINATUS L.
* DACTYLIS GLOMERATA L.
  DANTHONIA ACEROSA VICKERY
  DANTHONIA CAESPITOSA GAUD.
  DANTHONIA OCCIDENTALIS VICKERY
  DANTHONIA PILOSA R.BR.
  DANTHONIA RACEMOSA R.BR.
  DANTHONIA SETACEA R.BR.
  DEYEUXIA QUADRISETA BENTH.
  DICHELACHNE CRINITA (L.F.)J.D.HOOKER
* DIGITARIA DIDACTYLA WILLD.
* DIGITARIA SANGUINALIS (L.)SCOP.
  DIPLOPOGON SETACEUS R.BR.
* ECHINOCHLOA CRUS-GALLI (L.)BEAUV.
* ECHINOCHLOA CRUS-PAVONIS (KUNTH)SCHULTES
* EHRHARTA BREVIFOLIA SCHRAD.
* EHRHARTA CALYCINA SM.
* EHRHARTA LONGIFLORA SM.
* EHRHARTA VILLOSA J.H.SCHULTES EX SCHULTES & J.H.SCHULTES
* ELEUSINE CORACAN (L.)GAERTN.
* ELEUSINE INDICA (L.)GAERTN.
  ERAGROSTIS BROWNII (KUNTH)NEES EX STEUD.
* ERAGROSTIS CURVULA (SCHRAD.)NEES
  ERAGROSTIS ELONGATA (WILLD.)J.F.JACQ.
* ERAGROSTIS MEGASTACHYA (KOELER)LINK
* EUSTACHYS DISTICHOPHYLLA (LAG.)NEES
* FESTUCA RUBRA L.
* GASTRIDIUM PHLEOIDES (NEES & MEYEN) C.E.HUBBARD
* GLYCERIA MAXIMA (HARTM.)O.R.HOLMBERG
* HAINARDIA CYLINDRICA (WILLD.)W.GREUTER
  HEMARTHRIA UNCINATA R.BR.
* HOLCUS LANATUS L.
* HOLCUS SETIGER NEES
* HORDEUM GENICULATUM ALL.
* HORDEUM GLAUCUM STEUD.
* HORDEUM LEPORINUM LINK
* HORDEUM VULGARE L.
* HYPARRHENIA HIRTA (L.)STAPF
* LAGURUS OVATUS L.
* LOLIUM MULTIFLORUM LAMARCK
* LOLIUM PERENNE L.
* LOLIUM RIGIDUM GAUD.
* LOLIUM TEMULENTUM L.
  MICROLAENA STIPOIDES (LABILL.)R.BR.
* MISCANTHUS SINENSIS ANDERSS.
  NEURACHNE ALOPECUROIDEA R.BR.
* ORYZOPSIS MILIACEA (L.)BENTH.& J.D.HOOKER EX ASCHERS.& C.SCHWEINF.
* PANICUM CAPILLARE L.
* PANICUM MAXIMUM JACQ.
* PANICUM MILIACEUM L.
* PARAPHOLIS INCURVA (L.)C.E.HUBBARD
* PASPALUM DILATATUM POIR.
* PASPALUM DISTICHUM L.
* PASPALUM PASPALODES (MICHAUX)LAMS.-SCRIBN.
* PASPALUM URVILLEI STEUD.
* PENNISETUM CLANDESTINUM HOCHST.EX CHIOV.
* PENNISETUM GLAUCUM (L.)R.BR.
* PENNISETUM MACROURUM TRIN.
* PENNISETUM PURPUREUM SCHUMACHER
* PENNISETUM SETACEUM (FORSK.)CHIOV.
* PENNISETUM VILLOSUM R.BR.EX FRESEN.
* PENTASCHISTIS AIROIDES (NEES)STAPF
* PENTASCHISTIS THUNBERGII (KUNTH)STAPF
* PHALARIS ANGUSTA NEES EX TRIN.
* PHALARIS AQUATICA L.
* PHALARIS ARUNDINACEA L.
* PHALARIS CANARIENSIS L.
* PHALARIS MINOR RETZ.
* PHALARIS PARADOXA L.
* PLAGIOCHLOA UNIOLAE (L.F.)ADAMSON & SPRAGUE
* POA ANNUA L.
  POA DRUMMONDIANA NEES
  POA HOMOMALLA NEES
  POA POIFORMIS (LABILL.)DRUCE
  POA PORPHYROCLADOS NEES
* POA PRATENSIS L.
  POA SERPENTUM NEES
* POLYPOGON MARITIMUS WILLD.
* POLYPOGON MONSPELIENSIS (L.)DESF.
  POLYPOGON TENELLUS R.BR.
* PUCCINELLIA CILIATA BOR
* RHYNCHELYTRUM REPENS (WILLD.)C.E.HUBBARD
* SECALE CEREALE L.
* SETARIA GENICULATA (LAMARCK)BEAUV.
* SETARIA ITALICA (L.)BEAUV.
* SETARIA PALMIFOLIA (KOENIG)STAPF
* SETARIA PUMILA (POIR.)ROEMER & SCHULTES
* SETARIA SPHACELATA (SCHUMACHER)STAPF & C.E.HUBBARD
* SETARIA VERTICILLATA (L.)BEAUV.
* SORGHUM BICOLOR (L.)MOENCH
* SORGHUM HALEPENSE (L.)PERS.
* SORGHUM SUDANENSE (PIPER)STAPF
  SPINIFEX HIRSUTUS LABILL.
  SPINIFEX LONGIFOLIUS R.BR.
* SPOROBOLUS AFRICANUS (POIR.)ROBYNS & TOURNAY
  SPOROBOLUS VIRGINICUS (L.)KUNTH
* STENOTAPHRUM SECUNDATUM (WALTER)KUNTZE
  STIPA COMPRESSA R.BR.
  STIPA ELEGANTISSIMA LABILL.
  STIPA FLAVESCENS LABILL.
  STIPA HEMIPOGON BENTH.
  STIPA HIRSUTA HUGHES
  STIPA SEMIBARBATA R.BR.
  TETRARRHENA LAEVIS R.BR.
  THEMEDA AUSTRALIS (R.BR.)STAPF
* TRACHYNIA DISTACHYA (L.)LINK
* TRITICUM AESTIVUM L.
* VULPIA BROMOIDES (L.)S.F.GRAY
* VULPIA MEMBRANACEA (L.)DUMORT.
* VULPIA MYUROS (L.)C.C.GMELIN

CYPERACEAE

BAUMEA ARTHROPHYLLA (NEES)BOECK.
BAUMEA ARTICULATA (R.BR.)S.T.BLAKE
BAUMEA AUSTRALIS (NEES)S.T.BLAKE
BAUMEA JUNCEA (R.BR.)PALLA
BAUMEA LAXA (NEES)BOECK.
BAUMEA VAGINALIS (BENTH.)S.T.BLAKE
CAREX APPRESSA R.BR.
CAREX FASCICULARIS SOLANDER EX BOOTT
CAREX INVERSA R.BR.
CAREX PREISSII NEES
CAREX TERETICAULIS F.MUELL.
CAUSTIS DIOICA R.BR.
CHORIZANDRA CYMBARIA R.BR.
CHORIZANDRA ENODIS NEES
CYATHOCHAETA AVENACEA BENTH.
* CYPERUS BREVIFOLIUS (ROTTB.)HASSK.
* CYPERUS CONGESTUS VAHL
* CYPERUS ERAGROSTIS LAMARCK
  CYPERUS POLYSTACHYOS ROTTB.

* CYPERUS ROTUNDUS L.
* CYPERUS TENELLUS L.F.
* CYPERUS TENUIFLORUS ROTTB.
CYPERUS VAGINATUS R.BR.
ELEOCHARIS ACUTA R.BR.
ELEOCHARIS SPHACELATA R.BR.
EVANDRA PAUCIFLORA R.BR.
GAHNIA DECOMPOSITA BENTH.
GAHNIA TRIFIDA LABILL.
LEPIDOSPERMA ANGUSTATUM R.BR.
LEPIDOSPERMA CANESCENS BOECK.
LEPIDOSPERMA DRUMMONDII BENTH.
LEPIDOSPERMA EFFUSUM BENTH.
LEPIDOSPERMA GLADIATUM LABILL.
LEPIDOSPERMA GRACILE R.BR.
LEPIDOSPERMA LEPTOSTACHYUM BENTH.
LEPIDOSPERMA LONGITUDINALE LABILL.
LEPIDOSPERMA SCABRUM NEES
LEPIDOSPERMA SQUAMATUM LABILL.
LEPIDOSPERMA STRIATUM R.BR.
LEPIDOSPERMA TETRAQUETRUM NEES
LEPIDOSPERMA TUBERCULATUM NEES
MESOMELAENA STYGIA (R.BR.)NEES
MESOMELAENA TETRAGONA (R.BR.)BENTH.
SCHOENUS ANDREWSII W.V.FITZG.
SCHOENUS ASPEROCARPUS F.MUELL.
SCHOENUS BENTHAMII F.MUELL.
SCHOENUS BIFIDUS (NEES)BOECK.
SCHOENUS BREVIFOLIUS R.BR.
SCHOENUS BREVISETIS (R.BR.)BENTH.
SCHOENUS CAESPITITIUS W.V.FITZG.
SCHOENUS CALOSTACHYUS (R.BR.)POIR.
SCHOENUS CLANDESTINUS S.T.BLAKE
SCHOENUS CURVIFOLIUS (R.BR.)BENTH.
SCHOENUS GRAMMATOPHYLLUS F.MUELL.
SCHOENUS GRANDIFLORUS (NEES)F.MUELL.
SCHOENUS LAEVIGATUS W.V.FITZG.
SCHOENUS LANATUS LABILL.
SCHOENUS MINUTULUS F.MUELL.
SCHOENUS NANUS (NEES)BENTH.
SCHOENUS ODONTOCARPUS F.MUELL.
SCHOENUS PEDICELLATUS (R.BR.)BENTH.
SCHOENUS RIGENS S.T.BLAKE
SCHOENUS RODWAYANUS W.V.FITZG.
SCHOENUS SCULPTUS (NEES)BOECK.
SCHOENUS SUBBARBATUS KUEKENTHAL
SCHOENUS SUBBULBOSUS BENTH.
SCHOENUS SUBFASCICULARIS KUEKENTHAL
SCHOENUS UNISPICULATUS F.MUELL.EX BENTH.
SCIRPUS ARTICULATUS L.
SCIRPUS BRUNONIANUS S.T.BLAKE
* SCIRPUS CALDWELLII V.J.COOK
SCIRPUS CERNUUS VAHL
SCIRPUS CONGRUUS (NEES)S.T.BLAKE
SCIRPUS FLUITANS L.
SCIRPUS MARGINATUS THUNB.
SCIRPUS NODOSUS ROTTB.
SCIRPUS OLDFIELDIANUS S.T.BLAKE
* SCIRPUS PROLIFER ROTTB.
SCIRPUS VALIDUS VAHL
TETRARIA AUSTRALIENSIS C.B.CLARKE
TETRARIA CAPILLARIS (F.MUELL.)J.M.BLACK
TETRARIA OCTANDRA (NEES)KUEKENTHAL
TRICOSTULARIA NEESII LEHM.

ARACEAE

* ZANTEDESCHIA AETHIOPICA (L.)SPRENG.

LEMNACEAE

LEMNA DISPERMA HEGELM.
LEMNA GIBBA L.
SPIRODELA PUNCTATA (G.MEYER)THOMPSON

RESTIONACEAE

ALEXGEORGEA ARENICOLA CARLQUIST
ANARTHRIA GRACILIS R.BR.
ANARTHRIA HUMILIS NEES
ANARTHRIA LAEVIS R.BR.
ANARTHRIA PROLIFERA R.BR.
CHAETANTHUS LEPTOCARPOIDES R.BR.
EMPODISMA GRACILLIMUM (F.MUELL.)
L.A.S.JOHNSON & CUTLER
HYPOLAENA EXSULCA R.BR.
HYPOLAENA FASTIGIATA R.BR.
LEPIDOBOLUS PREISSIANUS NEES
LEPTOCARPUS ARISTATUS R.BR.
LEPTOCARPUS CANUS NEES
LEPTOCARPUS COANGUSTATUS NEES
LEPTOCARPUS SCARIOSUS R.BR.
LEPTOCARPUS TENAX (LABILL.)R.BR.
LEPTOCARPUS TENELLUS (NEES)F.MUELL.
LEPYRODIA GLAUCA (NEES)F.MUELL.
LEPYRODIA HELEOCHAROIDES GILG
LEPYRODIA MACRA NEES
LEPYRODIA MUIRII F.MUELL.
LOXOCARYA CINEREA R.BR.
LOXOCARYA FASCICULATA (R.BR.)BENTH.
LOXOCARYA FLEXUOSA (R.BR.)BENTH.
LOXOCARYA PUBESCENS (R.BR.)BENTH.
LYGINIA BARBATA R.BR.
MEEBOLDINA DENMARKICA SUESS.
RESTIO GRACILIOR (F.MUELL.)BENTH.
RESTIO LEPTOCARPOIDES BENTH.
RESTIO MEGALOTHECA F.MUELL.
RESTIO STENOSTACHYUS W.V.FITZG.
RESTIO TREMULUS R.BR.
RESTIO USTULATUS F.MUELL.EX EWART &
SHARMAN

CENTROLEPIDACEAE

APHELIA CYPEROIDES R.BR.
APHELIA DRUMMONDII (HIERON.)BENTH.
APHELIA GRACILIS SONDER
CENTROLEPIS ARISTATA (R.BR.)ROEMER &
SCHULTES
CENTROLEPIS CAESPITOSA D.A.COOKE
CENTROLEPIS DRUMMONDIANA (NEES)D.A.COOKE
CENTROLEPIS GLABRA (F.MUELL.EX SONDER)
HIERON.
CENTROLEPIS INCONSPICUA W.V.FITZG.
CENTROLEPIS MUTICA (R.BR.)HIERON.
CENTROLEPIS PILOSA HIERON.
CENTROLEPIS POLYGYNA (R.BR.)HIERON.

HYDATELLACEAE

TRITHURIA SUBMERSA J.D.HOOKER

COMMELINACEAE

CARTONEMA PHILYDROIDES F.MUELL.

PONTEDERIACEAE

* EICHHORNIA CRASSIPES (MART.)SOLMS

PHILYDRACEAE

PHILYDRELLA PYGMAEA (R.BR.)CARUEL

JUNCACEAE

* JUNCUS ACUTUS L.
* JUNCUS BUFONIUS L.
* JUNCUS CAPITATUS WEIG.
JUNCUS HOLOSCHOENUS R.BR.
JUNCUS KRAUSSII HOCHST.
JUNCUS MICROCEPHALUS KUNTH
JUNCUS PALLIDUS R.BR.
JUNCUS PLANIFOLIUS R.BR.
JUNCUS POLYANTHEMUS BUCHENAU
JUNCUS SUBSECUNDUS N.A.WAKEF.
LUZULA MERIDIONALIS NORDENSK

LILIACEAE

ACANTHOCARPUS PREISSII LEHM.
AGROSTOCRINUM SCABRUM (R.BR.)BAILL.
* ALBUCA CANADENSIS (L.)LEIGHTON
* ALLIUM NEAPOLITANUM CIRILLO
* ALLIUM PORRUM L.
* ALLIUM ROSEUM L.
* ALLIUM TRIQUETRUM L.
ARNOCRINUM PREISSII LEHM.
ARTHROPODIUM CAPILLIPES ENDL.
ARTHROPODIUM PREISSII ENDL.
* ASPARAGUS ASPARAGOIDES (L.)W.F.WIGHT
* ASPARAGUS OFFICINALIS L.
* ASPHODELUS FISTULOSUS L.
* BAEOMETRA UNIFLORA (JACQ.)LEWIS
BORYA NITIDA LABILL.
BULBINE SEMIBARBATA (R.BR.)HAW.
BURCHARDIA MULTIFLORA LINDL.
BURCHARDIA UMBELLATA R.BR.
CAESIA PARVIFLORA R.BR.
CALECTASIA CYANEA R.BR.
CHAMAESCILLA CORYMBOSA (R.BR.)F.MUELL.EX BENTH.
CHAMAESCILLA SPIRALIS (ENDL.)F.MUELL.
CHAMAEXEROS SERRA (ENDL.)BENTH.
CORYNOTHECA MICRANTHA (LINDL.)MACBRIDE
DASYPOGON BROMELIIFOLIUS R.BR.
DIANELLA REVOLUTA R.BR.
DICHOPOGON STRICTUS (R.BR.)BAKER
HENSMANIA TURBINATA (ENDL.)W.V.FITZG.
JOHNSONIA ACAULIS ENDL.
JOHNSONIA LUPULINA R.BR.
JOHNSONIA PUBESCENS LINDL.
KINGIA AUSTRALIS R.BR.
* LACHENALIA REFLEXA THUNB.
LAXMANNIA GRANDIFLORA LINDL.
LAXMANNIA RAMOSA LINDL.
LAXMANNIA SESSILIFLORA DECAISNE
LAXMANNIA SESSILIS LINDL.
LAXMANNIA SQUARROSA LINDL.
LOMANDRA CAESPITOSA (BENTH.)EWART
LOMANDRA ENDLICHERI (F.MUELL.)EWART
LOMANDRA HERMAPHRODITA (C.ANDREWS) C.A.GARDNER
LOMANDRA MICRANTHA (ENDL.)EWART
LOMANDRA PREISSII (ENDL.)EWART
LOMANDRA PURPUREA (ENDL.)EWART
LOMANDRA SERICEA (ENDL.)EWART
LOMANDRA SONDERI (F.MUELL.)EWART
LOMANDRA SUAVEOLENS (ENDL.)EWART
* NOTHOSCORDUM INODORUM (AITON)NICHOLSON
SOWERBAEA LAXIFLORA LINDL.
STYPANDRA GRANDIFLORA LINDL.
STYPANDRA IMBRICATA R.BR.
THYSANOTUS ANCEPS LINDL.
THYSANOTUS ARBUSCULA BAKER
THYSANOTUS ARENARIUS N.H.BRITTAN
THYSANOTUS ASPER LINDL.
THYSANOTUS DICHOTOMUS (LABILL.)R.BR.
THYSANOTUS MULTIFLORUS R.BR.
THYSANOTUS PATERSONII R.BR.
THYSANOTUS SCABER ENDL.
THYSANOTUS SPARTEUS R.BR.
THYSANOTUS TENELLUS ENDL.
THYSANOTUS THYRSOIDEUS BAKER
THYSANOTUS TRIANDRUS (LABILL.)R.BR.
* TRACHYANDRA DIVARICATA (JACQ.)KUNTH
TRICORYNE ELATIOR R.BR.
TRICORYNE HUMILIS ENDL.
WURMBEA DIOICA (R.BR.)F.MUELL.
WURMBEA MONANTHA (ENDL.)MACFARLANE
WURMBEA PYGMAEA (ENDL.)BENTH.
WURMBEA TENELLA (ENDL.)BENTH.
XANTHORRHOEA BREVISTYLA D.A.HERBERT
XANTHORRHOEA BRUNONIS ENDL.
XANTHORRHOEA GRACILIS ENDL.
XANTHORRHOEA PREISSII ENDL.
XANTHORRHOEA REFLEXA D.A.HERBERT

HAEMODORACEAE

ANIGOZANTHOS BICOLOR ENDL.
ANIGOZANTHOS FLAVIDUS REDOUTE & DC.
ANIGOZANTHOS HUMILIS LINDL.
ANIGOZANTHOS MANGLESII D.DON
ANIGOZANTHOS VIRIDIS ENDL.
BLANCOA CANESCENS LINDL.
CONOSTYLIS ACULEATA R.BR.
CONOSTYLIS ANDROSTEMMA (LINDL.)F.MUELL.
CONOSTYLIS AUREA LINDL.
CONOSTYLIS CANDICANS ENDL.
CONOSTYLIS CARICINA LINDL.
CONOSTYLIS FILIFOLIA F.MUELL.
CONOSTYLIS JUNCEA ENDL.
CONOSTYLIS PAUCIFLORA S.D.HOPPER
CONOSTYLIS PSYLLIUM ENDL.
CONOSTYLIS SERRULATA R.BR.
CONOSTYLIS SETIGERA R.BR.
CONOSTYLIS SETOSA LINDL.
CONOSTYLIS STYLIDIOIDES F.MUELL.
CONOSTYLIS VAGINATA ENDL.
HAEMODORUM BREVISEPALUM BENTH.
HAEMODORUM LAXUM R.BR.
HAEMODORUM PANICULATUM LINDL.
HAEMODORUM SIMPLEX LINDL.
HAEMODORUM SIMULANS F.MUELL.
HAEMODORUM SPARSIFLORUM F.MUELL.
HAEMODORUM SPICATUM R.BR.
MACROPIDIA FULIGINOSA (HOOKER)DRUCE
PHLEBOCARYA CILIATA R.BR.
PHLEBOCARYA FILIFOLIA (F.MUELL.)BENTH.
TRIBONANTHES AUSTRALIS ENDL.
TRIBONANTHES BRACHYPETALA LINDL.
TRIBONANTHES LONGIPETALA LINDL.
TRIBONANTHES UNIFLORA LINDL.
TRIBONANTHES VARIABILIS LINDL.

TECOPHILAEACEAE

* CYANELLA CAPENSIS L.

AMARYLLIDACEAE

* NARCISSUS JONQUILLA L.

HYPOXIDACEAE

HYPOXIS GLABELLA R.BR.
HYPOXIS OCCIDENTALIS BENTH.

DIOSCOREACEAE

DIOSCOREA HASTIFOLIA ENDL.

IRIDACEAE

* BABIANA STRICTA (AITON)KER-GAWL.
* CHASMANTHE FLORIBUNDA (SALISB.)N.E.BROWN
* FERRARIA CRISPA BURMAN
* FREESIA REFRACTA (JACQ.)KLATT
* GLADIOLUS ALATUS L.
* GLADIOLUS ANGUSTUS L.
* GLADIOLUS CARYOPHYLLACEUS (N.L.BURMAN) POIR.
* GLADIOLUS UNDULATUS L.
* HESPERANTHA GRAMINIFOLIA SWEET
* HEXAGLOTTIS LEWISIAE GOLDBLATT
* HOMERIA COLLINA (THUNB.)SALISB.
* HOMERIA MINIATA (ANDR.)SWEET
* IXIA MACULATA L.
* IXIA METELERKAMPIAE L.BOLUS
* IXIA PANICULATA DELAROCHE
* IXIA POLYSTACHYA L.
* MORAEA VEGETA L.
ORTHROSANTHUS LAXUS (ENDL.)BENTH.
PATERSONIA BABIANOIDES BENTH.
PATERSONIA JUNCEA LINDL.
PATERSONIA OCCIDENTALIS R.BR.
PATERSONIA PYGMAEA LINDL.
PATERSONIA SERICEA R.BR.EX KER-GAWL.
PATERSONIA UMBROSA ENDL.

* ROMULEA FLAVA (LAMARCK)DE VOS EX GOLDBLATT & BARNARD
* ROMULEA ROSEA (L.)ECKL.
* SISYRINCHIUM MICRANTHUM CAV.
* SPARAXIS GRANDIFLORA (DELAROCHE)KER-GAWL.
* SPARAXIS TRICOLOR (SCHNEEV.)KER-GAWL.
* TRITONIA CROCATA (L.)KER-GAWL.
* TRITONIA LINEATA (SALISB.)KER-GAWL.
* WATSONIA BULBILLIFERA J.W.MATTHEWS & L.BOLUS
* WATSONIA LEOPOLDTII L.BOLUS
* WATSONIA MARGINATA (L.F.)KER-GAWL.
* WATSONIA MERIANA (L.)MILLER
* WATSONIA PYRAMIDATA (ANDR.)KLATT

ORCHIDACEAE

ACIANTHUS RENIFORMIS (R.BR.)SCHLECHTER
ACIANTHUS TENUISSIMUS NICHOLLS & GOADBY
CALADENIA APHYLLA BENTH.
CALADENIA CAIRNSIANA F.MUELL.
CALADENIA DEFORMIS R.BR.
CALADENIA DISCOIDEA LINDL.
CALADENIA FILAMENTOSA R.BR.
CALADENIA FLAVA R.BR.
CALADENIA GEMMATA LINDL.
CALADENIA HIRTA LINDL.
CALADENIA HUEGELII H.REICHENB.
CALADENIA LATIFOLIA R.BR.
CALADENIA LONGICLAVATA E.COLEMAN
CALADENIA MACROSTYLIS FITZG.
CALADENIA MARGINATA LINDL.
CALADENIA MENZIESII R.BR.
CALADENIA NANA ENDL.
CALADENIA PATERSONII R.BR.
CALADENIA RADIATA NICHOLLS
CALADENIA REPTANS LINDL.
CALADENIA SERICEA LINDL.
CALOCHILUS ROBERTSONII BENTH.
CORYBAS DILATATUS (RUPP & NICHOLLS)RUPP & NICHOLLS EX RUPP
CRYPTOSTYLIS OVATA R.BR.
DIURIS EMARGINATA R.BR.
DIURIS LAEVIS FITZG.
DIURIS LAXIFLORA LINDL.
DIURIS LONGIFOLIA R.BR.
DIURIS PURDIEI DIELS
DIURIS SETACEA R.BR.
DRAKAEA ELASTICA LINDL.
DRAKAEA GLYPTODON FITZG.
DRAKAEA JEANENSIS R.S.ROGERS
ELYTHRANTHERA BRUNONIS (ENDL.)GEORGE
ELYTHRANTHERA EMARGINATA (LINDL.)GEORGE
EPIBLEMA GRANDIFLORUM R.BR.
ERIOCHILUS DILATATUS LINDL.
ERIOCHILUS SCABER LINDL.
LEPORELLA FIMBRIATA (LINDL.)GEORGE
LYPERANTHUS NIGRICANS R.BR.
LYPERANTHUS SERRATUS LINDL.
MICROTIS ALBA R.BR.
MICROTIS ATRATA LINDL.
MICROTIS BROWNII H.REICHENB.
MICROTIS ORBICULARIS R.S.ROGERS
MICROTIS UNIFOLIA (G.FORSTER)H.REICHENB.
* MONADENIA MICRANTHA LINDL.
PARACALEANA NIGRITA (LINDL.)BLAXELL
PRASOPHYLLUM BROWNII H.REICHENB.
PRASOPHYLLUM CYPHOCHILUM BENTH.
PRASOPHYLLUM DRUMMONDII H.REICHENB.
PRASOPHYLLUM ELATUM R.BR.
PRASOPHYLLUM FIMBRIA H.REICHENB.
PRASOPHYLLUM GIBBOSUM R.BR.
PRASOPHYLLUM GIGANTEUM LINDL.
PRASOPHYLLUM HIANS H.REICHENB.
PRASOPHYLLUM MACROSTACHYUM R.BR.
PRASOPHYLLUM OVALE LINDL.
PRASOPHYLLUM PARVIFOLIUM LINDL.
PRASOPHYLLUM REGIUM R.S.ROGERS
PTEROSTYLIS ANGUSTA GEORGE
PTEROSTYLIS BARBATA LINDL.
PTEROSTYLIS NANA R.BR.
PTEROSTYLIS RECURVA BENTH.
PTEROSTYLIS ROGERSII E.COLEMAN
PTEROSTYLIS SCABRA LINDL.
PTEROSTYLIS VITTATA LINDL.
SPICULAEA CILIATA LINDL.
THELYMITRA ANTENNIFERA (LINDL.)J.D.HOOKER
THELYMITRA CAMPANULATA LINDL.
THELYMITRA CORNICINA H.REICHENB.
THELYMITRA CRINITA LINDL.
THELYMITRA FLEXUOSA ENDL.
THELYMITRA FUSCOLUTEA R.BR.
THELYMITRA MUCIDA FITZG.
THELYMITRA NUDA R.BR.
THELYMITRA PAUCIFLORA R.BR.
THELYMITRA SPIRALIS (LINDL.)F.MUELL.
THELYMITRA TIGRINA R.BR.
THELYMITRA VARIEGATA (LINDL.)F.MUELL.
THELYMITRA VILLOSA LINDL.

CASUARINACEAE

CASUARINA CAMPESTRIS DIELS
CASUARINA FRASERANA MIQ.
CASUARINA GREVILLEOIDES DIELS
CASUARINA HUEGELIANA MIQ.
CASUARINA HUMILIS OTTO & DIETR.
CASUARINA LEHMANNIANA MIQ.
CASUARINA MICROSTACHYA MIQ.
CASUARINA OBESA MIQ.
CASUARINA THUYOIDES MIQ.

URTICACEAE

PARIETARIA DEBILIS G.FORSTER
* SOLEIROLIA SOLEIROLII (REQ.)DANDY
* URTICA URENS L.

PROTEACEAE

ADENANTHOS BARBIGERUS LINDL.
ADENANTHOS CYGNORUM DIELS
ADENANTHOS DRUMMONDII MEISN.
ADENANTHOS MEISNERI LEHM.
ADENANTHOS OBOVATUS LABILL.
ADENANTHOS TEGES GEORGE
BANKSIA ATTENUATA R.BR.
BANKSIA CANDOLLEANA MEISN.
BANKSIA GRANDIS WILLD.
BANKSIA ILICIFOLIA R.BR.
BANKSIA LITTORALIS R.BR.
BANKSIA MENZIESII R.BR.
BANKSIA PRIONOTES LINDL.
BANKSIA SPHAEROCARPA R.BR.
CONOSPERMUM ACEROSUM LINDL.
CONOSPERMUM AMOENUM MEISN.
CONOSPERMUM CRASSINERVIUM MEISN.
CONOSPERMUM DENSIFLORUM LINDL.
CONOSPERMUM GLUMACEUM LINDL.
CONOSPERMUM HUEGELII R.BR.
CONOSPERMUM INCURVUM LINDL.
CONOSPERMUM POLYCEPHALUM MEISN.
CONOSPERMUM SCAPOSUM BENTH.
CONOSPERMUM STOECHADIS ENDL.
CONOSPERMUM SUAVEOLENTE D.A.HERBERT
CONOSPERMUM TRIPLINERVIUM R.BR.
DRYANDRA ARMATA R.BR.
DRYANDRA BIPINNATIFIDA R.BR.
DRYANDRA CALOPHYLLA R.BR.
DRYANDRA CARDUACEA LINDL.
DRYANDRA CARLINOIDES MEISN.
DRYANDRA CONFERTA BENTH.
DRYANDRA DRUMMONDII MEISN.
DRYANDRA FRASERI R.BR.
DRYANDRA HEWARDIANA MEISN.
DRYANDRA KIPPISTIANA MEISN.
DRYANDRA NIVEA (LABILL.)R.BR.
DRYANDRA NOBILIS LINDL.
DRYANDRA PATENS BENTH.
DRYANDRA POLYCEPHALA BENTH.

DRYANDRA PRAEMORSA MEISN.
DRYANDRA PROTEOIDES LINDL.
DRYANDRA SCLEROPHYLLA MEISN.
DRYANDRA SERRATULOIDES MEISN.
DRYANDRA SESSILIS (KNIGHT)DOMIN
DRYANDRA SHUTTLEWORTHIANA MEISN.
FRANKLANDIA TRIARISTATA BENTH.
GREVILLEA BIPINNATIFIDA R.BR.
GREVILLEA BITERNATA MEISN.
GREVILLEA BREVICUSPIS MEISN.
GREVILLEA CANDOLLEANA MEISN.
GREVILLEA CRITHMIFOLIA R.BR.
GREVILLEA DIVERSIFOLIA MEISN.
GREVILLEA DRUMMONDII MEISN.
GREVILLEA ENDLICHERIANA MEISN.
GREVILLEA GLABRATA (LINDL.)MEISN.
GREVILLEA OBTUSIFOLIA MEISN.
GREVILLEA ORNITHOPODA MEISN.
GREVILLEA PANICULATA MEISN.
GREVILLEA PILULIFERA (LINDL.)DRUCE
GREVILLEA PULCHELLA (R.BR.)MEISN.
GREVILLEA QUERCIFOLIA R.BR.
GREVILLEA SYNAPHEAE R.BR.
GREVILLEA THELEMANNIANA HUEGEL
GREVILLEA VESTITA (ENDL.)MEISN.
GREVILLEA WILSONII A.CUNN.
HAKEA AMPLEXICAULIS R.BR.
HAKEA AURICULATA MEISN.
HAKEA CANDOLLEANA MEISN.
HAKEA CERATOPHYLLA (SM.)R.BR.
HAKEA CONCHIFOLIA HOOKER
HAKEA COSTATA MEISN.
HAKEA CRASSINERVIA MEISN.
HAKEA CRISTATA R.BR.
HAKEA CYCLOCARPA LINDL.
HAKEA ERINACEA MEISN.
HAKEA INCRASSATA R.BR.
HAKEA LASIANTHA R.BR.
HAKEA LISSOCARPHA R.BR.
HAKEA MARGINATA R.BR.
HAKEA MYRTOIDES MEISN.
HAKEA OBLIQUA R.BR.
HAKEA PETIOLARIS MEISN.
HAKEA PROSTRATA R.BR.
HAKEA RUSCIFOLIA LABILL.
HAKEA STENOCARPA R.BR.
HAKEA SULCATA R.BR.
HAKEA TRIFURCATA (SM.)R.BR.
HAKEA UNDULATA R.BR.
HAKEA VARIA R.BR.
ISOPOGON ASPER R.BR.
ISOPOGON DIVERGENS R.BR.
ISOPOGON DRUMMONDII BENTH.
ISOPOGON DUBIUS (R.BR.)DRUCE
ISOPOGON SPHAEROCEPHALUS LINDL.
ISOPOGON TERETIFOLIUS R.BR.
LAMBERTIA MULTIFLORA LINDL.
PERSOONIA ANGUSTIFLORA BENTH.
PERSOONIA COMATA MEISN.
PERSOONIA ELLIPTICA R.BR.
PERSOONIA HAKEIFORMIS MEISN.
PERSOONIA LONGIFOLIA R.BR.
PERSOONIA RUDIS MEISN.
PERSOONIA SACCATA R.BR.
PERSOONIA SULCATA MEISN.
PETROPHILE BILOBA R.BR.
PETROPHILE BREVIFOLIA LINDL.
PETROPHILE CHRYSANTHA MEISN.
PETROPHILE DIVARICATA R.BR.
PETROPHILE LINEARIS R.BR.
PETROPHILE MACROSTACHYA R.BR.
PETROPHILE MEDIA R.BR.
PETROPHILE PLUMOSA MEISN.
PETROPHILE SEMINUDA LINDL.
PETROPHILE SERRURIAE R.BR.
PETROPHILE SQUAMATA R.BR.
PETROPHILE STRIATA R.BR.
STIRLINGIA LATIFOLIA (R.BR.)STEUD.
STIRLINGIA SIMPLEX LINDL.
SYNAPHEA ACUTILOBA MEISN.
SYNAPHEA BRACHYSTACHYA LINDL.
SYNAPHEA FAVOSA R.BR.
SYNAPHEA PETIOLARIS R.BR.
SYNAPHEA PINNATA LINDL.
SYNAPHEA PREISSII MEISN.
SYNAPHEA SPINULOSA (N.L.BURMAN)MERR.
XYLOMELUM OCCIDENTALE R.BR.

SANTALACEAE

EXOCARPOS SPARTEUS R.BR.
LEPTOMERIA AXILLARIS R.BR.
LEPTOMERIA CUNNINGHAMII MIQ.
LEPTOMERIA EMPETRIFORMIS MIQ.
LEPTOMERIA PAUCIFLORA R.BR.
LEPTOMERIA PREISSIANA (MIQ.)A.DC.
LEPTOMERIA SPINOSA (LEHM.)A.DC.
SANTALUM ACUMINATUM (R.BR.)A.DC.

OLACACEAE

OLAX BENTHAMIANA MIQ.

LORANTHACEAE

AMYEMA MIQUELII (LEHM.EX MIQ.)TIEGHEM
AMYEMA PREISSII (MIQ.)TIEGHEM
LYSIANA CASUARINAE (MIQ.)TIEGHEM
NUYTSIA FLORIBUNDA (LABILL.)R.BR.EX FENZL

RAFFLESIACEAE

PILOSTYLES HAMILTONII C.A.GARDNER

POLYGONACEAE

* EMEX AUSTRALIS STEINH.
* FALLOPIA CONVOLVULUS (L.)A.LOVE
MUEHLENBECKIA ADPRESSA (LABILL.)MEISN.
MUEHLENBECKIA POLYBOTRYA MEISN.
* POLYGONUM ATTENUATUM R.BR.
* POLYGONUM AVICULARE L.
* POLYGONUM GLABRUM WILLD.
* POLYGONUM HYDROPIPER L.
* POLYGONUM MINUS HUDSON
* POLYGONUM PLEBEIUM R.BR.
* POLYGONUM PROSTRATUM R.BR.
* RUMEX ACETOSELLA L.
* RUMEX BROWNII CAMPD.
* RUMEX CONGLOMERATUS MURRAY
* RUMEX CRISPUS L.
* RUMEX PULCHER L.
* RUMEX SCUTATUS L.
* RUMEX VESICARIUS L.

CHENOPODIACEAE

ATRIPLEX CINEREA POIR.
* ATRIPLEX HASTATA L.
ATRIPLEX HYPOLEUCA NEES
ATRIPLEX ISATIDEA MOQ.
* ATRIPLEX NITENS SCHKUHR
ATRIPLEX SEMIBACCATA R.BR.
* CHENOPODIUM ALBUM L.
* CHENOPODIUM AMBROSIOIDES L.
* CHENOPODIUM GIGANTEUM D.DON
* CHENOPODIUM GLAUCUM L.
* CHENOPODIUM MACROSPERMUM J.D.HOOKER
* CHENOPODIUM MULTIFIDUM L.
* CHENOPODIUM MURALE L.
CHENOPODIUM PUMILIO R.BR.
DYSPHANIA MYRIOCEPHALA BENTH.
HALOSARCIA HALOCNEMOIDES (NEES)P.G.WILSON
HALOSARCIA INDICA (WILLD.)P.G.WILSON
HALOSARCIA LEPIDOSPERMA P.G.WILSON
HALOSARCIA LEPTOCLADA P.G.WILSON
HALOSARCIA PERGRANULATA (J.M.BLACK)
P.G.WILSON
RHAGODIA BACCATA (LABILL.)MOQ.
SALSOLA KALI L.

SARCOCORNIA BLACKIANA (ULBRICH)A.J.SCOTT
SARCOCORNIA QUINQUEFLORA (UNG.-STERNB.) A.J.SCOTT
SUAEDA AUSTRALIS (R.BR.)MOQ.
THRELKELDIA DIFFUSA R.BR.

AMARANTHACEAE

* ALTERNANTHERA PUNGENS KUNTH
* AMARANTHUS ALBUS L.
* AMARANTHUS HYBRIDUS L.
* AMARANTHUS LIVIDUS L.
* AMARANTHUS VIRIDIS L.
HEMICHROA PENTANDRA R.BR.
PTILOTUS DECLINATUS NEES
PTILOTUS DRUMMONDII (MOQ.)F.MUELL.
PTILOTUS ESQUAMATUS (BENTH.)F.MUELL.
PTILOTUS GAUDICHAUDII (STEUD.)J.M.BLACK
PTILOTUS HUMILIS (NEES)F.MUELL.
PTILOTUS MANGLESII (LINDL.)F.MUELL.
PTILOTUS POLYSTACHYUS (GAUD.)F.MUELL.
PTILOTUS SERICOSTACHYS (NEES)F.MUELL.
PTILOTUS SPATHULATUS (R.BR.)POIR.
PTILOTUS STIRLINGII (LINDL.)F.MUELL.

GYROSTEMONACEAE

GYROSTEMON RAMULOSUS DESF.
TERSONIA BREVIPES MOQ.

PHYTOLACCACEAE

* PHYTOLACCA OCTANDRA L.

AIZOACEAE

* CARPOBROTUS EDULIS (L.)L.BOLUS
CARPOBROTUS VIRESCENS (HAW.)SCHWANTES
* GALENIA SECUNDA (L.F.)SONDER
GLINUS LOTOIDES L.
MACARTHURIA APETALA HARVEY
MACARTHURIA AUSTRALIS HUEGEL EX ENDL.
* MESEMBRYANTHEMUM CRYSTALLINUM L.
TETRAGONIA AMPLEXICOMA (MIQ.)J.D.HOOKER
TETRAGONIA DECUMBENS MILLER
TETRAGONIA EREMAEA OSTENF.

PORTULACACEAE

CALANDRINIA BREVIPEDATA F.MUELL.
CALANDRINIA CALYPTRATA J.D.HOOKER
CALANDRINIA COMPOSITA BENTH.
CALANDRINIA CORRIGIOLOIDES F.MUELL.EX BENTH.
CALANDRINIA CYGNORUM DIELS
CALANDRINIA GRANULIFERA BENTH.
CALANDRINIA LINIFLORA FENZL
CALANDRINIA MENZIESII (HOOKER)TORREY & GRAY
CALANDRINIA POLYPETALA FENZL
MONTIA AUSTRALASICA (J.D.HOOKER)PAX & K.HOFFMANN
* PORTULACA OLERACEA L.

CARYOPHYLLACEAE

* CERASTIUM GLOMERATUM THUILL.
* CORRIGIOLA LITORALIS L.
* MOENCHIA ERECTA (L.)P.G.GAERTN. B.MEYER & SCHERB.
* PETRORHAGIA PROLIFERA (L.)P.W.BALL & V.H.HEYWOOD
* POLYCARPON TETRAPHYLLUM (L.)L.
* SAGINA APETALA ARD.
* SAGINA PROCUMBENS L.
* SILENE GALLICA L.
* SILENE NOCTURNA L.
* SILENE VULGARIS (MOENCH)GARCKE
* SPERGULA ARVENSIS L.
* SPERGULARIA DIANDRA HELDR.& SART.EX HELDR.
* SPERGULARIA RUBRA (L.)J.& C.PRESL
* STELLARIA MEDIA (L.)VILL.

RANUNCULACEAE

CLEMATIS ARISTATA R.BR.EX DC.
CLEMATIS MICROPHYLLA DC.
CLEMATIS PUBESCENS HUEGEL EX ENDL.
RANUNCULUS COLONORUM ENDL.
* RANUNCULUS MURICATUS L.
RANUNCULUS PUMILIO R.BR.EX DC.
RANUNCULUS SESSILIFLORUS R.BR.EX DC.
* RANUNCULUS TRILOBUS DESF.

LAURACEAE

CASSYTHA RACEMOSA NEES

PAPAVERACEAE

* ARGEMONE MEXICANA L.
* PAPAVER RHOEAS L.
* PAPAVER SOMNIFERUM L.
* ROMNEYA COULTERI HARVEY

FUMARIACEAE

* FUMARIA CAPREOLATA L.
* FUMARIA MURALIS SONDER EX KOCH
* FUMARIA OFFICINALIS L.

BRASSICACEAE

* BRASSICA JUNCEA (L.)CZERN.& COSS.
* BRASSICA OXYRRHINA (COSS.)WILLK.
* BRASSICA RAPA L.
* BRASSICA TOURNEFORTII GOUAN
* CAKILE MARITIMA SCOP.
* CAPSELLA BURSA-PASTORIS (L.)MEDIK.
* CORONOPUS DIDYMUS (L.)SM.
* DIPLOTAXIS MURALIS (L.)DC.
* DIPLOTAXIS TENUIFOLIA (L.)DC.
* HELIOPHILA PUSILLA L.F.
* HYMENOLOBUS PROCUMBENS (L.)NUTT.EX SCHINZ & THELL.
* LOBULARIA MARITIMA (L.)DESVAUX
* NASTURTIUM OFFICINALE R.BR.
* RAPHANUS RAPHANISTRUM L.
* RAPHANUS SATIVUS L.
* SISYMBRIUM IRIO L.
* SISYMBRIUM OFFICINALE (L.)SCOP.
* SISYMBRIUM ORIENTALE L.
STENOPETALUM FILIFOLIUM BENTH.
STENOPETALUM ROBUSTUM ENDL.
STENOPETALUM SPHAEROCARPUM F.MUELL.

RESEDACEAE

* RESEDA ALBA L.

DROSERACEAE

DROSERA BULBIGENA MORRISON
DROSERA BULBOSA HOOKER
DROSERA DRUMMONDII LEHM.
DROSERA ERYTHRORHIZA LINDL.
DROSERA GIGANTEA LINDL.
DROSERA GLANDULIGERA LEHM.
DROSERA HETEROPHYLLA LINDL.
DROSERA HUEGELII ENDL.
DROSERA LEUCOBLASTA BENTH.
DROSERA MACRANTHA ENDL.
DROSERA MARCHANTII DE BUHR
DROSERA MENZIESII R.BR.
DROSERA MICROPHYLLA ENDL.
DROSERA OCCIDENTALIS MORRISON
DROSERA PALEACEA DC.
DROSERA PALLIDA LINDL.
DROSERA PLATYSTIGMA LEHM.
DROSERA PULCHELLA LEHM.

DROSERA PYCNOBLASTA DIELS
DROSERA STOLONIFERA ENDL.
DROSERA STRICTICAULIS (DIELS)O.H.SARGENT
DROSERA SUBHIRTELLA PLANCH.
DROSERA ZONARIA PLANCH.

CRASSULACEAE

* CRASSULA ALATA (VIV.)BERGER
CRASSULA COLORATA (NEES)OSTENF.
* CRASSULA DECUMBENS THUNB.
CRASSULA EXSERTA (READER)OSTENF.
CRASSULA GLOMERATA BERGIUS
CRASSULA HELMSII (T.KIRK)COCKAYNE
* CRASSULA NATANS THUNB.
CRASSULA SIEBERANA (SCHULTES & J.H.SCHULTES)DRUCE
* CRASSULA THUNBERGIANA SCHULTES

PITTOSPORACEAE

BILLARDIERA BICOLOR (PUTTERL.)E.M.BENNETT
BILLARDIERA CANDIDA (ENDL.)E.M.BENNETT
BILLARDIERA COERULEO-PUNCTATA (KLOTZSCH) E.M.BENNETT
BILLARDIERA DRUMMONDIANA (PUTTERL.) E.M.BENNETT
BILLARDIERA FLORIBUNDA (PUTTERL.)F.MUELL.
BILLARDIERA PARVIFLORA DC.
BILLARDIERA VARIIFOLIA DC.
CHEIRANTHERA FILIFOLIA TURCZ.
CHEIRANTHERA PREISSIANA PUTTERL.
PITTOSPORUM PHYLLIRAEOIDES DC.
PRONAYA FRASERI (HOOKER)E.M.BENNETT
SOLLYA HETEROPHYLLA LINDL.

BYBLIDACEAE

BYBLIS GIGANTEA LINDL.

ROSACEAE

* APHANES ARVENSIS L.
* ROSA RUBIGINOSA L.
* RUBUS DISCOLOR WEIHE & NEES
* RUBUS SELMERI LINDEB.EX F.ARESCHOUG
* RUBUS ULMIFOLIUS SCHOTT

LEGUMINOSAE SUBFAM.MIMOSOIDEAE

ACACIA ACUMINATA BENTH.
ACACIA ALATA R.BR.
ACACIA ANOMALA C.A.GARDNER EX COURT
ACACIA APHYLLA MASLIN
ACACIA AURONITENS LINDL.
ACACIA BARBINERVIS BENTH.
ACACIA BAXTERI BENTH.
ACACIA BENTHAMII MEISN.
ACACIA CELASTRIFOLIA BENTH.
ACACIA COCHLEARIS (LABILL.)H.L.WENDL.
ACACIA CONGESTA BENTH.
ACACIA CRASSISTIPULA BENTH.
ACACIA CYCLOPS A.CUNN.EX G.DON
ACACIA DENTIFERA BENTH.
ACACIA DIVERGENS BENTH.
ACACIA DREWIANA W.V.FITZG.
ACACIA DRUMMONDII LINDL.
ACACIA EPHEDROIDES BENTH.
ACACIA ERICIFOLIA BENTH.
ACACIA EXTENSA LINDL.
ACACIA GILBERTII MEISN.
* ACACIA HORRIDA (L.)WILLD.
ACACIA HORRIDULA MEISN.
ACACIA HUEGELII BENTH.
ACACIA INCRASSATA HOOKER
ACACIA INCURVA BENTH.
ACACIA INSOLITA E.PRITZEL
ACACIA LASIOCARPA BENTH.
ACACIA LATERITICOLA MASLIN
ACACIA LATIPES BENTH.
ACACIA LITTOREA MASLIN
ACACIA MICROBOTRYA BENTH.
ACACIA MOOREANA W.V.FITZG.
ACACIA NERVOSA DC.
ACACIA OBOVATA BENTH.
ACACIA ONCINOPHYLLA LINDL.
ACACIA PARADOXA DC.
ACACIA PREISSIANA (MEISN.)MASLIN
ACACIA PULCHELLA R.BR.
* ACACIA PYCNANTHA BENTH.
ACACIA RESTIACEA BENTH.
ACACIA RIDLEYANA W.V.FITZG.
ACACIA ROSTELLIFERA BENTH.
ACACIA SALIGNA (LABILL.)H.L.WENDL.
ACACIA SEMITRULLATA MASLIN
ACACIA SPHACELATA BENTH.
ACACIA STENOPTERA BENTH.
ACACIA SUBFLEXUOSA MAIDEN
ACACIA TERETIFOLIA BENTH.
ACACIA TETRAGONOCARPA MEISN.
ACACIA TRUNCATA (N.L.BURMAN)HORT.EX HOFFMANNS.
ACACIA UROPHYLLA BENTH.EX LINDL.
ACACIA VARIA MASLIN
ACACIA WILLDENOWIANA H.L.WENDL.
ACACIA XANTHINA BENTH.
ALBIZIA LOPHANTHA (WILLD.)BENTH.

LEGUMINOSAE SUBFAM.CAESALPINIOIDEAE

LABICHEA LANCEOLATA BENTH.
LABICHEA PUNCTATA BENTH.
* PARKINSONIA ACULEATA L.

LEGUMINOSAE SUBFAM.PAPILIONOIDEAE

AOTUS CORDIFOLIA BENTH.
AOTUS ERICOIDES (VENT.)G.DON
BOSSIAEA AQUIFOLIUM BENTH.
BOSSIAEA ERIOCARPA BENTH.
BOSSIAEA ORNATA (LINDL.)BENTH.
BOSSIAEA PULCHELLA MEISN.
BOSSIAEA RUFA R.BR.
BRACHYSEMA PRAEMORSUM MEISN.
BURTONIA CONFERTA DC.
BURTONIA SCABRA R.BR.
CHORIZEMA ACICULARE (DC.)C.A.GARDNER
CHORIZEMA CORDATUM LINDL.
CHORIZEMA DICKSONII R.A.GRAHAM
CHORIZEMA GLYCINIFOLIUM (SM.)DRUCE
CHORIZEMA ILICIFOLIUM LABILL.
CHORIZEMA RHOMBEUM R.BR.
* CICER ARIETINUM L.
* CYTISUS PROLIFERUS L.F.
DAVIESIA ANGULATA BENTH.
DAVIESIA BRACHYPHYLLA MEISN.
DAVIESIA CORDATA SM.
DAVIESIA COSTATA CHEEL
DAVIESIA DECURRENS MEISN.
DAVIESIA DIVARICATA BENTH.
DAVIESIA HAKEOIDES MEISN.
DAVIESIA HORRIDA PREISS EX LEHM.
DAVIESIA LONGIFOLIA BENTH.
DAVIESIA NUDIFLORA MEISN.
DAVIESIA PEDUNCULATA BENTH.
DAVIESIA POLYPHYLLA BENTH.
DAVIESIA PREISSII MEISN.
DAVIESIA QUADRILATERA BENTH.
DAVIESIA RHOMBIFOLIA MEISN.
DILLWYNIA CINERASCENS R.BR.EX SIMS
DILLWYNIA DILLWYNIOIDES (MEISN.)DRUCE
* DIPOGON LIGNOSUS (L.)VERDC.
EUCHILOPSIS LINEARIS (BENTH.)F.MUELL.
EUTAXIA OBOVATA (LABILL.)C.A.GARDNER
EUTAXIA PARVIFOLIA BENTH.
EUTAXIA VIRGATA BENTH.
GASTROLOBIUM BILOBUM R.BR.
GASTROLOBIUM CALLISTACHYS MEISN.
GASTROLOBIUM CALYCINUM BENTH.
GASTROLOBIUM EPACRIDOIDES MEISN.

GASTROLOBIUM HOOKERI MEISN.
GASTROLOBIUM ILICIFOLIUM MEISN.
GASTROLOBIUM MICROCARPUM MEISN.
GASTROLOBIUM OXYLOBIOIDES BENTH.
GASTROLOBIUM POLYSTACHYUM MEISN.
GASTROLOBIUM PULCHELLUM TURCZ.
GASTROLOBIUM SPATHULATUM BENTH.
GASTROLOBIUM SPINOSUM BENTH.
GASTROLOBIUM VILLOSUM BENTH.
* GENISTA LINIFOLIA L.
GOMPHOLOBIUM ARISTATUM BENTH.
GOMPHOLOBIUM CAPITATUM A.CUNN.
GOMPHOLOBIUM KNIGHTIANUM LINDL.
GOMPHOLOBIUM MARGINATUM R.BR.
GOMPHOLOBIUM OVATUM MEISN.
GOMPHOLOBIUM POLYMORPHUM R.BR.
GOMPHOLOBIUM PREISSII MEISN.
GOMPHOLOBIUM SHUTTLEWORTHII MEISN.
GOMPHOLOBIUM TOMENTOSUM LABILL.
GOMPHOLOBIUM VENUSTUM R.BR.
HARDENBERGIA COMPTONIANA (ANDR.)BENTH.
* HEDYSARUM CORONARIUM L.
HOVEA CHORIZEMIFOLIA (SWEET)DC.
HOVEA PUNGENS BENTH.
HOVEA STRICTA MEISN.
HOVEA TRISPERMA BENTH.
ISOTROPIS CUNEIFOLIA (SM.)BENTH.EX B.D.JACKSON
JACKSONIA ALATA BENTH.
JACKSONIA CAPITATA MEISN.
JACKSONIA DECUMBENS E.PRITZEL
JACKSONIA FLORIBUNDA ENDL.
JACKSONIA FURCELLATA (BONPL.)DC.
JACKSONIA GRACILIS MEISN.
JACKSONIA HAKEOIDES MEISN.
JACKSONIA HORRIDA DC.
JACKSONIA LEHMANNII MEISN.
JACKSONIA MACROCALYX MEISN.
JACKSONIA MOLLISSIMA W.V.FITZG.
JACKSONIA RESTIOIDES MEISN.
JACKSONIA SERICEA BENTH.
JACKSONIA SPINOSA (LABILL.)R.BR.
JACKSONIA STERNBERGIANA HUEGEL
JACKSONIA ULICINA MEISN.
KENNEDIA CARINATA (BENTH.)DOMIN
KENNEDIA COCCINEA VENT.
KENNEDIA PROSTRATA R.BR.
KENNEDIA STIRLINGII LINDL.
* LABLAB PURPUREUS (L.)SWEET
LATROBEA TENELLA (MEISN.)BENTH.
* LESPEDEZA JUNCEA (L.F.)PERS.
* LOTUS ANGUSTISSIMUS L.
* LOTUS SUBBIFLORUS LAG.
* LOTUS ULIGINOSUS SCHKUHR
* LUPINUS ALBUS L.
* LUPINUS AUGUSTIFOLIUS L.
* LUPINUS COSENTINII GUSS.
* LUPINUS LUTEUS L.
* LUPINUS MUTABILIS SWEET
* LUPINUS PILOSUS MURRAY
* MEDICAGO ARABICA (L.)HUDSON
* MEDICAGO INTERTEXTA (L.)MILLER
* MEDICAGO LACINIATA (L.)MILLER
* MEDICAGO LUPULINA L.
* MEDICAGO POLYMORPHA L.
* MEDICAGO SATIVA L.
* MELILOTUS ALBA MEDIK.
* MELILOTUS INDICA (L.)ALL.
* MELILOTUS MESSANENSIS (L.)ALL.
MIRBELIA DILATATA R.BR.
MIRBELIA FLORIBUNDA BENTH.
MIRBELIA RAMULOSA (BENTH.)C.A.GARDNER
MIRBELIA SPINOSA BENTH.
* ORNITHOPUS COMPRESSUS L.
* ORNITHOPUS PINNATUS (MILLER)DRUCE
* ORNITHOPUS SATIVUS BROT.
OXYLOBIUM ACUTUM BENTH.
OXYLOBIUM CAPITATUM BENTH.
OXYLOBIUM CUNEATUM BENTH.
OXYLOBIUM DRUMMONDII MEISN.
OXYLOBIUM LANCEOLATUM (VENT.)DRUCE
OXYLOBIUM LINEARIFOLIUM (G.DON)DOMIN
OXYLOBIUM RETICULATUM MEISN.
PULTENAEA ASPALATHOIDES MEISN.
PULTENAEA ERICIFOLIA BENTH.
PULTENAEA OCHREATA MEISN.
PULTENAEA RETICULATA (SM.)BENTH.
PULTENAEA SKINNERI F.MUELL.
SPHAEROLOBIUM FORNICATUM BENTH.
SPHAEROLOBIUM LINOPHYLLUM (HUEGEL)BENTH.
SPHAEROLOBIUM MACRANTHUM MEISN.
SPHAEROLOBIUM MEDIUM R.BR.
SPHAEROLOBIUM SCABRIUSCULUM MEISN.
SPHAEROLOBIUM VIMINEUM SM.
* SUTHERLANDIA FRUTESCENS (L.)R.BR.
TEMPLETONIA BILOBA (BENTH.)POLHILL
TEMPLETONIA DRUMMONDII BENTH.
TEMPLETONIA RETUSA (VENT.)R.BR.
* TRIFOLIUM ALEXANDRINUM L.
* TRIFOLIUM ANGUSTIFOLIUM L.
* TRIFOLIUM ARVENSE L.
* TRIFOLIUM CAMPESTRE SCHREBER
* TRIFOLIUM CERNUUM BROT.
* TRIFOLIUM CHERLERI L.
* TRIFOLIUM DUBIUM SIBTH.
* TRIFOLIUM FRAGIFERUM L.
* TRIFOLIUM GLOMERATUM L.
* TRIFOLIUM HIRTUM ALL.
* TRIFOLIUM HYBRIDUM L.
* TRIFOLIUM INCARNATUM L.
* TRIFOLIUM LAPPACEUM L.
* TRIFOLIUM LIGUSTICUM BALBIS EX LOISEL.
* TRIFOLIUM ORNITHOPODIOIDES L.
* TRIFOLIUM PRATENSE L.
* TRIFOLIUM REPENS L.
* TRIFOLIUM RESUPINATUM L.
* TRIFOLIUM SCABRUM L.
* TRIFOLIUM SPUMOSUM L.
* TRIFOLIUM STRIATUM L.
* TRIFOLIUM SUBTERRANEUM L.
* TRIFOLIUM TOMENTOSUM L.
* VICIA BENGHALENSIS L.
* VICIA HIRSUTA (L.)S.F.GRAY
* VICIA SATIVA L.
VIMINARIA JUNCEA (SCHRAD.& WENDL.) HOFFMANNS.

GERANIACEAE

* ERODIUM BOTRYS (CAV.)BERTOL.
* ERODIUM CICUTARIUM (L.)L'HERIT.
ERODIUM CYGNORUM NEES
* ERODIUM MOSCHATUM (L.)L'HERIT.
* GERANIUM MOLLE L.
GERANIUM RETRORSUM L'HERIT.EX DC.
GERANIUM SOLANDERI CAROLIN
* PELARGONIUM CAPITATUM (L.)L'HERIT.
PELARGONIUM LITTORALE HUEGEL

OXALIDACEAE

* OXALIS BOWIEI HERBERT
* OXALIS CAPRINA THUNB.
OXALIS CORNICULATA L.
* OXALIS CORYMBOSA DC.
* OXALIS GLABRA THUNB.
* OXALIS LATIFOLIA KUNTH
* OXALIS PES-CAPRAE L.
* OXALIS PURPUREA L.

LINACEAE

LINUM MARGINALE A.CUNN.EX PLANCH.
* LINUM TRIGYNUM L.
* LINUM USITATISSIMUM L.

ZYGOPHYLLACEAE

NITRARIA BILLARDIERI DC.
ZYGOPHYLLUM APICULATUM F.MUELL.

ZYGOPHYLLUM FRUTICULOSUM DC.

RUTACEAE

BORONIA ALATA SM.
BORONIA BUSSELLIANA F.MUELL.
BORONIA CAPITATA BENTH.
BORONIA COERULESCENS F.MUELL.
BORONIA CRENULATA SM.
BORONIA CYMOSA ENDL.
BORONIA DEFOLIATA F.MUELL.
BORONIA DICHOTOMA LINDL.
BORONIA FASTIGIATA BARTL.
BORONIA MOLLOYAE DRUMM.
BORONIA OVATA LINDL.
BORONIA PURDIEANA DIELS
BORONIA RAMOSA (LINDL.)BENTH.
BORONIA SCABRA LINDL.
BORONIA SPATHULATA LINDL.
BORONIA TENUIS (LINDL.)BENTH.
* COLEONEMA ALBUM (THUNB.)BARTL.& H.WENDL.
DIPLOLAENA ANDREWSII OSTENF.
DIPLOLAENA ANGUSTIFOLIA HOOKER
DIPLOLAENA DAMPIERI DESF.
DIPLOLAENA MICROCEPHALA BARTL.
ERIOSTEMON NODIFLORUS LINDL.
ERIOSTEMON SPICATUS A.RICH.
PHEBALIUM ANCEPS DC.
UROCARPUS GRANDIFLORUS (HOOKER)P.G.WILSON
UROCARPUS PALLIDUS (BENTH.)P.G.WILSON

TREMANDRACEAE

PLATYTHECA GALIOIDES STEETZ
TETRATHECA CONFERTIFOLIA STEETZ
TETRATHECA HIRSUTA LINDL.
TETRATHECA NUDA LINDL.
TETRATHECA PILIFERA LINDL.
TETRATHECA SETIGERA ENDL.
TETRATHECA SIMILIS J.THOMPSON
TREMANDRA DIFFUSA R.BR.

POLYGALACEAE

COMESPERMA CALYMEGA LABILL.
COMESPERMA CILIATUM STEETZ
COMESPERMA CONFERTUM LABILL.
COMESPERMA FLAVUM DC.
COMESPERMA INTEGERRIMUM ENDL.
COMESPERMA SCOPARIUM STEETZ
COMESPERMA VIRGATUM LABILL.
COMESPERMA VOLUBILE LABILL.

EUPHORBIACEAE

ADRIANA QUADRIPARTITA (LABILL.)GAUD.
AMPEREA ERICOIDES ADR.JUSS.
BEYERIA CINEREA (MUELL.ARG.)BENTH.
BEYERIA VISCOSA (LABILL.)MIQ.
CALYCOPEPLUS EPHEDROIDES PLANCH.
EUPHORBIA AUSTRALIS BOISS.
* EUPHORBIA DENDROIDES L.
* EUPHORBIA HELIOSCOPIA L.
* EUPHORBIA LATHYRUS L.
* EUPHORBIA MARGINATA PURSH
* EUPHORBIA PEPLUS L.
* EUPHORBIA TERRACINA L.
MONOTAXIS GRANDIFLORA ENDL.
MONOTAXIS OCCIDENTALIS ENDL.
PHYLLANTHUS CALYCINUS LABILL.
PORANTHERA ERICOIDES KLOTZSCH
PORANTHERA HUEGELII KLOTZSCH
PORANTHERA MICROPHYLLA BRONGN.
PSEUDANTHUS VIRGATUS (KLOTZSCH)MUELL.ARG.
RICINOCARPOS GLAUCUS ENDL.
* RICINUS COMMUNIS L.
STACHYSTEMON AXILLARIS GEORGE
STACHYSTEMON VERMICULARIS PLANCH.

CALLITRICHACEAE

* CALLITRICHE STAGNALIS SCOP.

STACKHOUSIACEAE

STACKHOUSIA BRUNONIS BENTH.
STACKHOUSIA HUEGELII ENDL.
STACKHOUSIA PUBESCENS A.RICH.

SAPINDACEAE

DIPLOPELTIS HUEGELII ENDL.
DODONAEA APTERA MIQ.
DODONAEA ATTENUATA A.CUNN.
DODONAEA CERATOCARPA ENDL.
DODONAEA CRYPTANDROIDES DIELS
DODONAEA HACKETTIANA W.V.FITZG.

RHAMNACEAE

CRYPTANDRA ARBUTIFLORA FENZL
CRYPTANDRA GLABRIFLORA BENTH.
CRYPTANDRA HUMILIS (BENTH.)F.MUELL.
CRYPTANDRA MUTILA NEES EX REISS.
CRYPTANDRA PUNGENS STEUD.
CRYPTANDRA TUBULOSA FENZL
SPYRIDIUM GLOBULOSUM (LABILL.)BENTH.
SPYRIDIUM TRIDENTATUM (STEUD.)BENTH.
TRYMALIUM ANGUSTIFOLIUM REISS.
TRYMALIUM LEDIFOLIUM FENZL
TRYMALIUM SPATHULATUM (LABILL.)OSTENF.

MALVACEAE

ALYOGYNE HUEGELII (ENDL.)FRYXELL
* LAVATERA ARBOREA L.
* LAVATERA CRETICA L.
LAVATERA PLEBEIA SIMS
LAWRENCIA SPICATA (HOOKER)BENTH.
* MALVA PARVIFLORA L.
SELENOTHAMNUS SQUAMATUS (NEES)MELVILLE
SIDA HOOKERANA MIQ.

STERCULIACEAE

GUICHENOTIA LEDIFOLIA J.GAY
GUICHENOTIA SAROTES BENTH.
KERAUDRENIA HERMANNIIFOLIA J.GAY
LASIOPETALUM BRACTEATUM (ENDL.)BENTH.
LASIOPETALUM FLORIBUNDUM BENTH.
LASIOPETALUM GLABRATUM S.PAUST
LASIOPETALUM LINEARE S.PAUST
LASIOPETALUM MEMBRANACEUM (STEUD.)BENTH.
LASIOPETALUM OPPOSITIFOLIUM F.MUELL.
RULINGIA CYGNORUM (STEUD.)C.A.GARDNER
THOMASIA COGNATA STEUD.
THOMASIA FOLIOSA J.GAY
THOMASIA FORMOSA S.PAUST
THOMASIA GLUTINOSA LINDL.
THOMASIA GRANDIFLORA LINDL.
THOMASIA MACROCARPA HUEGEL
THOMASIA MONTANA STEUD.
THOMASIA PANICULATA LINDL.
THOMASIA PAUCIFLORA LINDL.
THOMASIA TRIPHYLLA (LABILL.)J.GAY

DILLENIACEAE

HIBBERTIA ACEROSA (R.BR.EX DC.)BENTH.
HIBBERTIA AMPLEXICAULIS STEUD.
HIBBERTIA AUREA STEUD.
HIBBERTIA CRASSIFOLIA (TURCZ.)BENTH.
HIBBERTIA CUNEIFORMIS (LABILL.)SM.
HIBBERTIA ENERVIA (DC.)HOOGL.
HIBBERTIA GLOMEROSA (BENTH.)F.MUELL.
HIBBERTIA GRACILIPES BENTH.
HIBBERTIA HUEGELII (ENDL.)F.MUELL.
HIBBERTIA HYPERICOIDES (DC.)BENTH.
HIBBERTIA LASIOPUS BENTH.
HIBBERTIA LINEATA STEUD.

HIBBERTIA MINIATA C.A.GARDNER
HIBBERTIA MONTANA STEUD.
HIBBERTIA MYLNEI BENTH.
HIBBERTIA NYMPHAEA DIELS
HIBBERTIA PACHYRRHIZA STEUD.
HIBBERTIA PERFOLIATA ENDL.
HIBBERTIA POLYSTACHYA BENTH.
HIBBERTIA QUADRICOLOR DOMIN
HIBBERTIA RACEMOSA (ENDL.)GILG
HIBBERTIA RHADINOPODA F.MUELL.
HIBBERTIA SILVESTRIS DIELS
HIBBERTIA SPICATA F.MUELL.
HIBBERTIA STELLARIS ENDL.
HIBBERTIA SUBVAGINATA (STEUD.)F.MUELL.
HIBBERTIA VAGINATA (BENTH.)F.MUELL.
HIBBERTIA VERRUCOSA (TURCZ.)BENTH.

CLUSIACEAE

HYPERICUM GRAMINEUM G.FORSTER

FRANKENIACEAE

FRANKENIA PAUCIFLORA DC.

VIOLACEAE

HYBANTHUS CALYCINUS (DC.EX GING.)F.MUELL.
HYBANTHUS FLORIBUNDUS (LINDL.)F.MUELL.

CACTACEAE

* OPUNTIA STRICTA (HAW.)HAW.

THYMELAEACEAE

PIMELEA ARGENTEA R.BR.
PIMELEA FERRUGINEA LABILL.
PIMELEA FLORIBUNDA MEISN.
PIMELEA GRACILIFLORA (ENDL.)HOOKER
PIMELEA IMBRICATA R.BR.
PIMELEA LEHMANNIANA MEISN.
PIMELEA PREISSII MEISN.
PIMELEA ROSEA R.BR.
PIMELEA SPECTABILIS (FISCH.& C.A.MEYER) LINDL.
PIMELEA SUAVEOLENS (ENDL.)MEISN.
PIMELEA SULPHUREA MEISN.
PIMELEA SYLVESTRIS R.BR.

LYTHRACEAE

* LYTHRUM HYSSOPIFOLIA L.

MYRTACEAE

AGONIS FLEXUOSA (SPRENG.)SCHAUER
AGONIS GRANDIFLORA BENTH.
AGONIS LINEARIFOLIA (DC.)SCHAUER
ASTARTEA FASCICULARIS (LABILL.)DC.
BAECKEA CAMPHOROSMAE ENDL.
BAECKEA CRISPIFLORA F.MUELL.
BEAUFORTIA ELEGANS SCHAUER
BEAUFORTIA ERIOCEPHALA W.V.FITZG.
BEAUFORTIA MACROSTEMON LINDL.
BEAUFORTIA PURPUREA LINDL.
BEAUFORTIA SQUARROSA SCHAUER
CALLISTEMON PHOENICEUS LINDL.
CALLISTEMON SPECIOSUS (SIMS)DC.
CALOTHAMNUS LATERALIS LINDL.
CALOTHAMNUS QUADRIFIDUS R.BR.
CALOTHAMNUS RUPESTRIS SCHAUER
CALOTHAMNUS SANGUINEUS LABILL.
CALOTHAMNUS TORULOSUS SCHAUER
CALYTRIX ANGULATA LINDL.
CALYTRIX AUREA LINDL.
CALYTRIX BRACHYPHYLLA (TURCZ.)BENTH.
CALYTRIX BREVIFOLIA (MEISN.)BENTH.
CALYTRIX BREVISETA LINDL.
CALYTRIX CRESWELLII (F.MUELL.)DIELS & E.PRITZEL
CALYTRIX DEPRESSA (TURCZ)BENTH.
CALYTRIX EMPETROIDES (SCHAUER)BENTH.
CALYTRIX FLAVESCENS A.CUNN.
CALYTRIX FRASERI A.CUNN.
CALYTRIX GLUTINOSA LINDL.
CALYTRIX SAPPHIRINA LINDL.
CALYTRIX STRIGOSA A.CUNN.
CALYTRIX VARIABILIS LINDL.
CHAMELAUCIUM UNCINATUM SCHAUER
CONOTHAMNUS TRINERVIS LINDL.
DARWINIA ACEROSA W.V.FITZG.
DARWINIA CITRIODORA (ENDL.)BENTH.
DARWINIA NEILDIANA F.MUELL.
DARWINIA PIMELIOIDES CAYZER & F.W.WAKEF.
DARWINIA RHADINOPHYLLA F.MUELL.
DARWINIA THYMOIDES (LINDL.)BENTH.
EREMAEA BEAUFORTIOIDES BENTH.
EREMAEA FIMBRIATA LINDL.
EREMAEA PAUCIFLORA (ENDL.)DRUCE
EREMAEA PURPUREA C.A.GARDNER
EREMAEA VIOLACEA F.MUELL.
EUCALYPTUS ACCEDENS W.V.FITZG.
EUCALYPTUS CALOPHYLLA LINDL.
EUCALYPTUS DECIPIENS ENDL.
EUCALYPTUS DECURVA F.MUELL.
EUCALYPTUS DRUMMONDII BENTH.
EUCALYPTUS FALCATA TURCZ.
EUCALYPTUS FOECUNDA SCHAUER
EUCALYPTUS GOMPHOCEPHALA DC.
EUCALYPTUS HAEMATOXYLON MAIDEN
EUCALYPTUS LAELIAE PODGER & CHIPPENDALE
EUCALYPTUS LANE-POOLEI MAIDEN
EUCALYPTUS LOXOPHLEBA BENTH.
EUCALYPTUS MARGINATA DONN EX SM.
EUCALYPTUS MEGACARPA F.MUELL.
EUCALYPTUS PATENS BENTH.
EUCALYPTUS RUDIS ENDL.
EUCALYPTUS TODTIANA F.MUELL.
EUCALYPTUS WANDOO BLAKELY
HYPOCALYMMA ANGUSTIFOLIUM ENDL.
HYPOCALYMMA CORDIFOLIUM (LEHM.)SCHAUER
HYPOCALYMMA ROBUSTUM ENDL.
HYPOCALYMMA XANTHOPETALUM F.MUELL.
KUNZEA MICRANTHA SCHAUER
KUNZEA RECURVA SCHAUER
KUNZEA VESTITA SCHAUER
LEPTOSPERMUM ELLIPTICUM ENDL.
LEPTOSPERMUM ERUBESCENS SCHAUER
LEPTOSPERMUM FIRMUM (SCHAUER)BENTH.
LEPTOSPERMUM FLORIDUM (SCHAUER)BENTH.
* LEPTOSPERMUM LAEVIGATUM (GAERTN.)F.MUELL.
LEPTOSPERMUM OLIGANDRUM TURCZ.
LEPTOSPERMUM SPINESCENS ENDL.
LHOTSKYA ACUTIFOLIA LINDL.
LHOTSKYA BREVIFOLIA SCHAUER
LHOTSKYA VIOLACEA LINDL.
MELALEUCA ACEROSA SCHAUER
MELALEUCA CARDIOPHYLLA F.MUELL.
MELALEUCA CILIOSA TURCZ.
MELALEUCA CUTICULARIS LABILL.
MELALEUCA HAMULOSA TURCZ.
MELALEUCA HUEGELII ENDL.
MELALEUCA INCANA R.BR.
MELALEUCA LANCEOLATA OTTO
MELALEUCA LATERIFLORA BENTH.
MELALEUCA LATERITIA A.DIETR.
MELALEUCA LEPTOCLADA BENTH.
MELALEUCA LEPTOSPERMOIDES SCHAUER
MELALEUCA MICROPHYLLA SM.
MELALEUCA PARVIFLORA LINDL.
MELALEUCA POLYGALOIDES SCHAUER
MELALEUCA PREISSIANA SCHAUER
MELALEUCA RADULA LINDL.
MELALEUCA RHAPHIOPHYLLA SCHAUER
MELALEUCA SCABRA R.BR.
MELALEUCA SERIATA LINDL.
MELALEUCA TERETIFOLIA ENDL.
MELALEUCA THYMOIDES LABILL.
MELALEUCA TRICHOPHYLLA LINDL.

MELALEUCA UNCINATA R.BR.
MELALEUCA VIMINEA LINDL.
PILEANTHUS PEDUNCULARIS ENDL.
REGELIA CILIATA SCHAUER
REGELIA INOPS SCHAUER
SCHOLTZIA INVOLUCRATA (ENDL.)DRUCE
SCHOLTZIA LAXIFLORA BENTH.
VERTICORDIA ACEROSA LINDL.
VERTICORDIA CHRYSANTHA ENDL.
VERTICORDIA DENSIFLORA LINDL.
VERTICORDIA DRUMMONDII SCHAUER
VERTICORDIA GRANDIFLORA ENDL.
VERTICORDIA HUEGELII ENDL.
VERTICORDIA INSIGNIS ENDL.
VERTICORDIA LINDLEYI SCHAUER
VERTICORDIA NITENS (LINDL.)SCHAUER
VERTICORDIA OVALIFOLIA MEISN.
VERTICORDIA PENNIGERA ENDL.
VERTICORDIA PLUMOSA (DESF.)DRUCE
VERTICORDIA SERRATA (LINDL.)SCHAUER

ONAGRACEAE

* EPILOBIUM TETRAGONUM L.
* OENOTHERA AFFINIS CAMBESS.
* OENOTHERA DRUMMONDII HOOKER
* OENOTHERA ERYTHROSEPALA BORBAS
* OENOTHERA SPECIOSA NUTT.
* OENOTHERA STRIATA LEDEB.EX LINK

HALORAGACEAE

GLISCHROCARYON AUREUM (LINDL.)ORCHARD
GLISCHROCARYON FLAVESCENS (DRUMM.EX HOOKER)ORCHARD
GONOCARPUS BENTHAMII ORCHARD
GONOCARPUS CORDIGER (FENZL)ENDL.EX NEES
GONOCARPUS DIFFUSUS (DIELS)ORCHARD
GONOCARPUS HEXANDRUS (F.MUELL.)ORCHARD
GONOCARPUS INTRICATUS (BENTH.)ORCHARD
GONOCARPUS NODULOSUS NEES
GONOCARPUS PANICULATUS (R.BR.EX BENTH.) ORCHARD
GONOCARPUS PITHYOIDES NEES
GONOCARPUS TRICHOSTACHYUS (BENTH.)ORCHARD
HALORAGIS ACULEOLATA BENTH.
HALORAGIS BROWNII (J.D.HOOKER)SCHINDLER
HALORAGIS TENUIFOLIA BENTH.
* MYRIOPHYLLUM AQUATICUM (VELL.)VERDC.
MYRIOPHYLLUM INTEGRIFOLIUM (J.D.HOOKER) J.D.HOOKER
MYRIOPHYLLUM PROPINQUUM A.CUNN.
MYRIOPHYLLUM TILLAEOIDES DIELS

APIACEAE

ACTINOTUS LEUCOCEPHALUS BENTH.
* AMMI MAJUS L.
APIUM ANNUUM P.S.SHORT
* APIUM GRAVEOLENS L.
APIUM PROSTRATUM LABILL.EX VENT.
CENTELLA CORDIFOLIA (J.D.HOOKER)NANNF.
* CONIUM MACULATUM L.
DAUCUS GLOCHIDIATUS (LABILL.)FISCH. C.A.MEYER & AVE-LALL.
ERYNGIUM PINNATIFIDUM BUNGE
* FOENICULUM VULGARE MILLER
HOMALOSCIADIUM HOMALOCARPUM (F.MUELL.) HJ.EICHLER
HYDROCOTYLE BLEPHAROCARPA F.MUELL.
* HYDROCOTYLE BONARIENSIS LAMARCK
HYDROCOTYLE CALLICARPA BUNGE
HYDROCOTYLE DIANTHA DC.
HYDROCOTYLE LEMNOIDES BENTH.
HYDROCOTYLE PILIFERA TURCZ.
HYDROCOTYLE SCUTELLIFERA BENTH.
HYDROCOTYLE TETRAGONOCARPA BUNGE
HYDROCOTYLE TRACHYCARPA F.MUELL.
PENTAPELTIS PELTIGERA (HOOKER)BUNGE
PENTAPELTIS SILVATICA (DIELS)DOMIN
PLATYSACE CIRROSA BUNGE
PLATYSACE COMPRESSA (LABILL.)NORMAN
PLATYSACE FILIFORMIS (BUNGE)NORMAN
PLATYSACE JUNCEA (BUNGE)NORMAN
PLATYSACE XEROPHILA (E.PRITZEL) L.A.S.JOHNSON
SCHOENOLAENA JUNCEA BUNGE
TRACHYMENE ANISOCARPA (TURCZ.)B.L.BURTT
TRACHYMENE CAERULEA R.A.GRAHAM
TRACHYMENE CYANOPETALA (F.MUELL.)BENTH.
TRACHYMENE PILOSA SM.
XANTHOSIA ATKINSONIANA F.MUELL.
XANTHOSIA CANDIDA BENTH.
XANTHOSIA CILIATA HOOKER
XANTHOSIA FRUCTICULOSA BENTH.
XANTHOSIA HUEGELII (BENTH.)STEUD.
XANTHOSIA PUSILLA BUNGE

EPACRIDACEAE

ACROTRICHE CORDATA (LABILL.)R.BR.
ANDERSONIA ARISTATA LINDL.
ANDERSONIA GRACILIS DC.
ANDERSONIA HETEROPHYLLA SONDER
ANDERSONIA INVOLUCRATA SONDER
ANDERSONIA LATIFLORA F.MUELL.
ANDERSONIA LEHMANNIANA SONDER
ANDERSONIA SPRENGELIOIDES R.BR.
ASTROLOMA CILIATUM (LINDL.)DRUCE
ASTROLOMA COMPACTUM R.BR.
ASTROLOMA DRUMMONDII SONDER
ASTROLOMA MACROCALYX SONDER
ASTROLOMA MICROCALYX SONDER
ASTROLOMA MICRODONTA F.MUELL.EX BENTH.
ASTROLOMA PALLIDUM R.BR.
ASTROLOMA STOMARRHENA SONDER
ASTROLOMA XEROPHYLLUM (DC.)SONDER
BRACHYLOMA PREISSII SONDER
CONOSTEPHIUM MINUS LINDL.
CONOSTEPHIUM PENDULUM BENTH.
CONOSTEPHIUM PREISSII SONDER
LEUCOPOGON AUSTRALIS R.BR.
LEUCOPOGON CAPITELLATUS DC.
LEUCOPOGON CINEREUS E.PRITZEL
LEUCOPOGON CONOSTEPHIOIDES DC.
LEUCOPOGON GLABELLUS R.BR.
LEUCOPOGON GLAUCIFOLIUS W.V.FITZG.
LEUCOPOGON GRACILLIMUS DC.
LEUCOPOGON HIRSUTUS SONDER
LEUCOPOGON INSULARIS A.CUNN.EX DC.
LEUCOPOGON KINGIANUS (F.MUELL.)C.A.GARDNER
LEUCOPOGON OLDFIELDII BENTH.
LEUCOPOGON OLIGANTHUS E.PRITZEL
LEUCOPOGON OXYCEDRUS SONDER
LEUCOPOGON PARVIFLORUS (ANDR.)LINDL.
LEUCOPOGON PENDULUS R.BR.
LEUCOPOGON POLYMORPHUS SONDER
LEUCOPOGON PROPINQUUS R.BR.
LEUCOPOGON PULCHELLUS SONDER
LEUCOPOGON RACEMULOSUS DC.
LEUCOPOGON SPRENGELIOIDES SONDER
LEUCOPOGON SQUARROSUS BENTH.
LEUCOPOGON STRICTUS BENTH.
LEUCOPOGON TENUIS DC.
LEUCOPOGON VERTICILLATUS R.BR.
LYSINEMA CILIATUM R.BR.
LYSINEMA ELEGANS SONDER
NEEDHAMIELLA PUMILIO (R.BR.)L.WATSON
STYPHELIA TENUIFLORA LINDL.

PRIMULACEAE

* ANAGALLIS ARVENSIS L.
SAMOLUS JUNCEUS R.BR.
SAMOLUS REPENS (J.R.FORSTER)PERS.

PLUMBAGINACEAE

* LIMONIUM SINUATUM (L.)MILLER
* LIMONIUM VULGARE MILLER

LOGANIACEAE

* BUDDLEJA MADAGASCARIENSIS LAMARCK
LOGANIA CAMPANULATA R.BR.
LOGANIA SERPYLLIFOLIA R.BR.
LOGANIA SPERMACOCEA F.MUELL.
LOGANIA VAGINALIS (LABILL.)F.MUELL.
MITRASACME PALUSTRIS W.V.FITZG.
MITRASACME PARADOXA R.BR.

GENTIANACEAE

* CENTAURIUM ERYTHRAEA RAFN
* CENTAURIUM SPICATUM (L.)FRITSCH
* CENTAURIUM TENUIFLORUM (HOFFMANNS.& LINK)FRITSCH
* CICENDIA FILIFORMIS (L.)DELARBRE

MENYANTHACEAE

VILLARSIA ALBIFLORA F.MUELL.
VILLARSIA CAPITATA NEES
VILLARSIA LASIOSPERMA F.MUELL.
VILLARSIA LATIFOLIA BENTH.
VILLARSIA VIOLIFOLIA F.MUELL.

APOCYNACEAE

ALYXIA BUXIFOLIA R.BR.
PARSONSIA DIAPHANOPHLEBA F.MUELL.
* VINCA MAJOR L.

ASCLEPIADACEAE

* ARAUJIA HORTORUM FOURN.
* ASCLEPIAS CURASSAVICA L.
* GOMPHOCARPUS FRUTICOSUS (L.)W.T.AITON

CONVOLVULACEAE

* CONVOLVULUS ARVENSIS L.
CONVOLVULUS ERUBESCENS SIMS
* CUSCUTA EPITHYMUM (L.)L.
DICHONDRA REPENS J.R.& G.FORSTER
WILSONIA BACKHOUSEI J.D.HOOKER

HYDROPHYLLACEAE

* PHACELIA TANACETIFOLIA BENTH.

BORAGINACEAE

* ANCHUSA CAPENSIS THUNB.
* BUGLOSSOIDES ARVENSIS (L.)I.M.JOHNSTON
* ECHIUM PLANTAGINEUM L.
HALGANIA CORYMBOSA LINDL.
* HELIOTROPIUM EUROPAEUM L.
MYOSOTIS AUSTRALIS R.BR.
* SYMPHYTUM OFFICINALE L.

VERBENACEAE

* LANTANA CAMARA L.
* PHYLA NODIFLORA (L.)GREENE
* VERBENA RIGIDA SPRENG.

CHLOANTHACEAE

CHLOANTHES COCCINEA BARTL.
DICRASTYLIS MICRANTHA MUNIR
DICRASTYLIS PARVIFOLIA F.MUELL.
LACHNOSTACHYS ALBICANS HOOKER
LACHNOSTACHYS ERIOBOTRYA (F.MUELL.)DRUCE
LACHNOSTACHYS FERRUGINEA HOOKER
LACHNOSTACHYS VERBASCIFOLIA F.MUELL.
MALLOPHORA GLOBIFLORA ENDL.
MALLOPHORA RUGOSIFOLIA MUNIR,
PHYSOPSIS SPICATA TURCZ.
PITYRODIA BARTLINGII (LEHM.)BENTH.
PITYRODIA UNCINATA (TURCZ.)BENTH.

AVICENNIACEAE

AVICENNIA MARINA (FORSK.)VIERH.

LAMIACEAE

HEMIANDRA COCCINEA SARGENT
HEMIANDRA INCANA BARTL.
HEMIANDRA LEIANTHA BENTH.
HEMIANDRA LINEARIS BENTH.
HEMIANDRA PUNGENS R.BR.
HEMIGENIA BARBATA BARTL.
HEMIGENIA CANESCENS (BARTL.)BENTH.
HEMIGENIA INCANA (LINDL.)BENTH.
HEMIGENIA MICROPHYLLA BENTH.
HEMIGENIA PRITZELII S.MOORE
HEMIGENIA SERICEA BENTH.
* LAVANDULA ANGUSTIFOLIA MILLER
* LAVANDULA STOECHAS L.
* LEONOTIS LEONURUS (L.)R.BR.
* MARRUBIUM VULGARE L.
* MENTHA AQUATICA L.
* MENTHA PULEGIUM L.
* MENTHA SPICATA L.
* MENTHA SUAVEOLENS EHRH.
MICROCORYS LONGIFOLIA BENTH.
* SALVIA REFLEXA HORNEM.
* SALVIA VERBENACA L.
* STACHYS ARVENSIS (L.)L.
WESTRINGIA DAMPIERI R.BR.
WESTRINGIA RIGIDA R.BR.

SOLANACEAE

ANTHOCERCIS GRACILIS BENTH.
ANTHOCERCIS LITTOREA LABILL.
* CESTRUM PARQUI L'HERIT.
* DATURA FEROX L.
* DATURA INOXIA MILLER
* DATURA METEL L.
* LYCIUM FEROCISSIMUM MIERS
* NICANDRA PHYSALODES (L.)GAERTN.
* NICOTIANA GLAUCA R.A.GRAHAM
NICOTIANA ROTUNDIFOLIA LINDL.
* PHYSALIS MINIMA L.
* PHYSALIS PHILADELPHICA LAMARCK
* PHYSALIS VISCOSA L.
* SALPICHROA ORIGANIFOLIA (LAMARCK)BAILL.
* SOLANUM AVICULARE G.FORSTER
* SOLANUM ELAEAGNIFOLIUM CAV.
* SOLANUM GIGANTEUM JACQ.
* SOLANUM LACINIATUM AITON
SOLANUM LASIOPHYLLUM DUNAL EX POIR.
* SOLANUM NIGRUM L.
* SOLANUM NODIFLORUM JACQ.
SOLANUM SIMILE F.MUELL.
* SOLANUM SISYMBRIIFOLIUM LAMARCK
* SOLANUM SODOMEUM L.
SOLANUM SYMONII HJ.EICHLER

SCROPHULARIACEAE

* BELLARDIA TRIXAGO (L.)ALL.
* CYMBALARIA MURALIS P.GAERTN. B.MEYER & SCHERB.
* DISCHISMA ARENARIUM E.MEYER
* DISCHISMA CAPITATUM (THUNB.)CHOISY
GLOSSOSTIGMA DRUMMONDII BENTH.
GRATIOLA PERUVIANA L.
* KICKXIA ELATINE (L.)DUMORT.
* KICKXIA SPURIA (L.)DUMORT.
LIMOSELLA AUSTRALIS R.BR.
* MISOPATES ORONTIUM (L.)C.S.RAFIN.
* PARENTUCELLIA LATIFOLIA (L.)CARUEL
* PARENTUCELLIA VISCOSA (L.)CARUEL
* VERBASCUM CRETICUM (MURRAY)CAV.
* VERBASCUM THAPSUS L.
* VERBASCUM VIRGATUM STOKES

* VERONICA ARVENSIS L.
VERONICA CALYCINA R.BR.
* VERONICA PERSICA POIR.

MARTYNIACEAE

* PROBOSCIDEA LOUISIANICA (MILLER)THELL.

OROBANCHACEAE

OROBANCHE AUSTRALIANA F.MUELL.

LENTIBULARIACEAE

POLYPOMPHOLYX MULTIFIDA (R.BR.)F.MUELL.
UTRICULARIA HOOKERI LEHM.
UTRICULARIA MENZIESII R.BR.
UTRICULARIA VIOLACEA R.BR.
UTRICULARIA VOLUBILIS R.BR.

MYOPORACEAE

EREMOPHILA GLABRA (R.BR.)OSTENF.
MYOPORUM ADSCENDENS R.BR.
MYOPORUM CAPRARIOIDES BENTH.
MYOPORUM TETRANDRUM (LABILL.)DOMIN

PLANTAGINACEAE

* PLANTAGO CORONOPUS L.
* PLANTAGO LANCEOLATA L.
* PLANTAGO MAJOR L.

RUBIACEAE

* GALIUM DIVARICATUM LAMARCK
* GALIUM MURALE (L.)ALL.
OPERCULARIA ECHINOCEPHALA BENTH.
OPERCULARIA HISPIDULA ENDL.
OPERCULARIA VAGINATA LABILL.
* SHERARDIA ARVENSIS L.

CAPRIFOLIACEAE

* LONICERA JAPONICA THUNB.

VALERIANACEAE

* CENTRANTHUS MACROSIPHON BOISS.

DIPSACACEAE

* SCABIOSA ATROPURPUREA L.

CUCURBITACEAE

* CITRULLUS LANATUS (THUNB.)MATSUMURA & NAKAI
* CUCUMIS MYRIOCARPUS NAUDIN

CAMPANULACEAE

* WAHLENBERGIA CAPENSIS (L.)A.DC.
WAHLENBERGIA PREISSII DE VRIESE
WAHLENBERGIA SIMPLICICAULIS DE VRIESE
WAHLENBERGIA STRICTA SWEET

LOBELIACEAE

GRAMMATOTHECA BERGIANA (CHAM.)C.PRESL.
ISOTOMA HYPOCRATERIFORMIS (R.BR.)DRUCE
ISOTOMA PUSILLA BENTH.
ISOTOMA SCAPIGERA (R.BR.)G.DON
LOBELIA ALATA LABILL
LOBELIA GIBBOSA LABILL.
LOBELIA HETEROPHYLLA LABILL.
LOBELIA RHOMBIFOLIA DE VRIESE
LOBELIA RHYTIDOSPERMA BENTH.
LOBELIA TENUIOR R.BR.
* MONOPSIS SIMPLEX (L.)E.WIMMER

GOODENIACEAE

ANTHOTIUM HUMILE R.BR.
DAMPIERA ALATA LINDL.
DAMPIERA CARINATA BENTH.
DAMPIERA CORONATA LINDL.
DAMPIERA CUNEATA R.BR.
DAMPIERA HEDERACEA R.BR.
DAMPIERA LAVANDULACEA LINDL.
DAMPIERA LINEARIS R.BR.
DAMPIERA TERES LINDL.
DAMPIERA TRIGONA DE VRIESE
DAMPIERA TRILOBA LINDL.
GOODENIA ARTHROTRICHA F.MUELL.EX BENTH.
GOODENIA CAERULEA R.BR.
GOODENIA CLAYTONIACEA F.MUELL.
GOODENIA CORYNOCARPA F.MUELL.
GOODENIA EATONIANA F.MUELL.
GOODENIA FASCICULATA (BENTH.)CAROLIN
GOODENIA FILIFORMIS R.BR.
GOODENIA MICROPTERA F.MUELL.
GOODENIA PINIFOLIA DE VRIESE
GOODENIA PULCHELLA BENTH.
GOODENIA SCAPIGERA R.BR.
GOODENIA TENELLA R.BR.
LECHENAULTIA BILOBA LINDL.
LECHENAULTIA EXPANSA R.BR.
LECHENAULTIA FLORIBUNDA BENTH.
LECHENAULTIA LINARIOIDES DC.
LECHENAULTIA STENOSEPALA E.PRITZEL
SCAEVOLA CANESCENS BENTH.
SCAEVOLA CRASSIFOLIA LABILL.
SCAEVOLA GLANDULIFERA DC.
SCAEVOLA GLOBULIFERA LABILL.
SCAEVOLA HOLOSERICEA DE VRIESE
SCAEVOLA HUMIFUSA DE VRIESE
SCAEVOLA LANCEOLATA BENTH.
SCAEVOLA LONGIFOLIA DE VRIESE
SCAEVOLA NITIDA R.BR.
SCAEVOLA PALUDOSA R.BR.
SCAEVOLA PHLEBOPETALA F.MUELL.
SCAEVOLA PILOSA BENTH.
SCAEVOLA PLATYPHYLLA LINDL.
SCAEVOLA STRIATA R.BR.
SCAEVOLA THESIOIDES BENTH.
VELLEIA TRINERVIS LABILL.
VERREAUXIA RIENWARDTII (DE VRIESE)BENTH.

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LEVENHOOKIA LEPTANTHA BENTH.
LEVENHOOKIA PREISSII (SONDER)F.MUELL.
LEVENHOOKIA PUSILLA R.BR.
LEVENHOOKIA STIPITATA (SONDER)F.MUELL.
STYLIDIUM ADPRESSUM BENTH.
STYLIDIUM AFFINE SONDER
STYLIDIUM AMOENUM R.BR.
STYLIDIUM BREVISCAPUM R.BR.
STYLIDIUM BRUNONIANUM BENTH.
STYLIDIUM BULBIFERUM BENTH.
STYLIDIUM CALCARATUM R.BR.
STYLIDIUM CANALICULATUM LINDL.
STYLIDIUM CARICIFOLIUM LINDL.
STYLIDIUM CARNOSUM BENTH.
STYLIDIUM CILIATUM LINDL.
STYLIDIUM CRASSIFOLIUM R.BR.
STYLIDIUM CROSSOCEPHALUM F.MUELL.
STYLIDIUM DESPECTUM R.BR.
STYLIDIUM DICHOTOMUM DC.
STYLIDIUM DIUROIDES LINDL.
STYLIDIUM DIVARICATUM SONDER
STYLIDIUM EMARGINATUM SONDER
STYLIDIUM GUTTATUM R.BR.
STYLIDIUM HISPIDUM LINDL.
STYLIDIUM INUNDATUM R.BR.
STYLIDIUM JUNCEUM R.BR.
STYLIDIUM LEPTOCALYX SONDER
STYLIDIUM LEPTOPHYLLUM DC.

STYLIDIUM LINEATUM SONDER
STYLIDIUM LONGITUBUM BENTH.
STYLIDIUM MACROCARPUM (BENTH.)R.ERICKSON & WILLIS
STYLIDIUM MINIATUM MILDBR.
STYLIDIUM NONSCANDENS CARLQUIST
STYLIDIUM OBTUSATUM SONDER
STYLIDIUM PERISCELIANTHUM R.ERICKSON & WILLIS
STYLIDIUM PERPUSILLUM J.D.HDOKER
STYLIDIUM PETIOLARE SONDER
STYLIDIUM PILIFERUM R.BR.
STYLIDIUM PILOSUM LABILL.
STYLIDIUM PREISSII (SONDER)F.MUELL.
STYLIDIUM PUBIGERUM SONDER
STYLIDIUM PULCHELLUM SONDER
STYLIDIUM PYCNOSTACHYUM LINDL.
STYLIDIUM REPENS R.BR.
STYLIDIUM RHYNCHOCARPUM SONDER
STYLIDIUM RIGIDIFOLIUM MILDBR.
STYLIDIUM ROSEO-ALATUM R.ERICKSDN & WILLIS
STYLIDIUM SCABRIDUM LINDL.
STYLIDIUM SCHOENOIDES DC.
STYLIDIUM SQUAMELLOSUM DC.
STYLIDIUM STRIATUM LINDL.
STYLIDIUM UNIFLORUM SONDER
STYLIDIUM UTRICULARIOIDES BENTH.

ASTERACEAE

* ACANTHDSPERMUM HISPIDUM DC.
* AMBRDSIA ARTEMISIIFDLIA L.
* AMBROSIA PSILDSTACHYA DC.
ANGIANTHUS CUNNINGHAMII (DC.)BENTH.
ANGIANTHUS TOMENTOSUS WENDL.
* ARCTOTHECA CALENDULA (L.)LEVYNS
* ARCTOTHECA POPULIFOLIA (BERGIUS)T.NDRLINDH
* ARCTOTIS STOECHADIFOLIA BERGIUS
* ASTER SUBULATUS MICHAUX
ATHRIXIA PULVERULENTA (LINDL.)DRUCE
* BERKHEYA RIGIDA (THUNB.)EWART J.WHITE & REES
BRACHYCOME BELLIDIOIDES STEETZ
BRACHYCOME GLANDULOSA (STEETZ)BENTH.
BRACHYCOME IBERIDIFOLIA BENTH.
BRACHYCOME PUSILLA STEETZ
CALOCEPHALUS BRDWNII (CASS.)F.MUELL.
* CARDUUS PYCNOCEPHALUS L.
* CARDUUS TENUIFLORUS W.CURTIS
* CARTHAMUS LANATUS L.
* CENTAUREA CALCITRAPA L.
* CENTAUREA MELITENSIS L.
* CENTAUREA SOLSTITIALIS L.
* CHONDRILLA JUNCEA L.
* CHRYSANTHEMOIDES MONILIFERA (L.)T.NDRLINDH
* CHRYSANTHEMUM FOENICULACEUM (WILLD.)STEUD.
* CHRYSANTHEMUM FRUTESCENS L.
* CHRYSANTHEMUM SEGETUM L.
* CICHORIUM INTYBUS L.
* CIRSIUM VULGARE (SAVI)TEN.
* CONYZA ALBIDA SPRENG.
* CONYZA BONARIENSIS (L.)CRONQUIST
* COREOPSIS GRANDIFLORA HOGG EX SWEET
COTULA AUSTRALIS (SIEB.EX SPRENG.) J.D.HOOKER
* COTULA BIPINNATA THUNB.
COTULA CORONOPIFOLIA L.
* COTULA TURBINATA L.
CRASPEDIA UNIFLORA G.FORSTER
* CREPIS FOETIDA L.
* CREPIS VESICARIA L.
* DITTRICHIA GRAVEOLENS (L.)W.GREUTER
* GALINSOGA PARVIFLORA CAV.
* GNAPHALIUM CANDIDISSIMUM LAMARCK
* GNAPHALIUM LUTEO-ALBUM L.
* GNAPHALIUM PENSYLVANICUM WILLD.
GNAPHALIUM SPHAERICUM WILLD.
* GNAPHALIUM SPICATUM LAMARCK
* HEDYPNOIS RHAGADIOLOIDES (L.)SCHMIDT
* HELIANTHUS ANNUUS L.
* HELIANTHUS TUBEROSUS L.
HELICHRYSUM APICULATUM (LABILL.)D.DON
HELICHRYSUM BLACKALLII N.T.BURBIDGE
HELICHRYSUM BRACTEATUM (VENT.)ANDR.
HELICHRYSUM CDRDATUM DC.
HELICHRYSUM LEUCOPSIDIUM DC.
HELICHRYSUM LINDLEYI HJ.EICHLER
HELICHRYSUM ROSEUM (LINDL.)DRUCE
HELIPTERUM CORYMBOSUM (A.GRAY)BENTH.
HELIPTERUM COTULA (BENTH.)DC.
HELIPTERUM DEMISSUM (A.GRAY)DRUCE
HELIPTERUM HUMBOLDTIANUM (GAUD.)DC.
HELIPTERUM MANGLESII (LINDL.)BENTH.
HELIPTERUM PYRETHRUM (STEETZ)BENTH.
HELIPTERUM SPICATUM (STEETZ)BENTH.
* HYPOCHOERIS GLABRA L.
* HYPOCHOERIS RADICATA L.
* LACTUCA SALIGNA L.
* LACTUCA SERRIOLA L.
* LACTUCA VIROSA L.
LAGENIFERA HUEGELII BENTH.
* LEDNTODON TARAXACOIDES (VILL.)MERAT
LEPTORHYNCHOS ELONGATUS DC.
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MILLOTIA TENUIFOLIA CASS.
MYRIOCEPHALUS APPENDICULATUS BENTH.
MYRIOCEPHALUS GRACILIS (A.GRAY)BENTH.
MYRIOCEPHALUS HELICHRYSOIDES A.GRAY
MYRIOCEPHALUS RHIZOCEPHALUS (DC.)BENTH.
OLEARIA AXILLARIS (DC.)F.MUELL.EX BENTH.
DLEARIA ELAEOPHILA (DC.)BENTH.
OLEARIA MURICATA (STEETZ)BENTH.
OLEARIA PAUCIDENTATA (STEETZ)BENTH.
OLEARIA RUDIS (BENTH.)F.MUELL.EX BENTH.
OLEARIA STRIGOSA (STEETZ)BENTH.
* OSTEOSPERMUM CLANDESTINUM (LESS.) T.NORLINDH
* PICRIS ECHIOIDES L.
* PICRIS HIERACIOIDES L.
PITHOCARPA CORYMBULOSA LINDL.
PITHOCARPA PULCHELLA LINDL.
PODOLEPIS CANESCENS A.CUNN.EX DC.
PODOLEPIS GRACILIS R.A.GRAHAM
PODOLEPIS LESSONII (CASS.)BENTH.
PODOTHECA ANGUSTIFOLIA LESS.
PODOTHECA CHRYSANTHA (STEETZ)BENTH.
PODOTHECA GNAPHALIOIDES R.A.GRAHAM
QUINETIA URVILLEI CASS.
RUTIDOSIS MULTIFLORA (NEES)B.L.ROBINSDN
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SENECIO HISPIDULUS A.RICH.
SENECIO LACERATUS (F.MUELL.)BELCHER
SENECIO LAUTUS G.FORSTER EX WILLD.
SENECIO LEUCOGLOSSUS F.MUELL.
SENECIO QUADRIDENTATUS LABILL
SENECIO RAMOSISSIMUS DC.
* SENECIO VULGARIS L.
SILOXERUS FILIFOLIUS (BENTH.)OSTENF.
SILOXERUS HUMIFUSUS LABILL.
* SILYBUM MARIANUM (L.)GAERTN.
* SOLIVA PTEROSPERMA (JUSS.)LESS.
* SONCHUS ASPER (L.)HILL
* SONCHUS OLERACEUS L.
* TARAXACUM OFFICINALE WEBER EX WIGGERS
* TOLPIS BARBATA (L.)GAERTN.
* TRAGOPOGON PORRIFOLIUS L.
TRICHOCLINE SPATHULATA (A.CUNN.EX DC.) WILLIS
* UROSPERMUM PICROIDES (L.)SCDP.EX F.W.SCHMIDT
* URSINIA ANTHEMOIDES (L.)POIR.
WAITZIA AUREA (BENTH.)STEETZ
WAITZIA CITRINA (BENTH.)STEETZ
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WAITZIA SUAVEOLENS (BENTH.)DRUCE
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SHORT NOTES

SELLIERA RADICANS CAV. (GOODENIACEAE), A NEW RECORD FOR WESTERN AUSTRALIA

This creeping perennial has been collected near Crusoe Beach, Wilson Inlet, east of Denmark (N.G. Marchant s.n. 4th March 1977, voucher specimen in PERTH). It was found growing on a muddy flat underneath paper-barked *Melaleuca* trees with various sedges and *Lobelia alata*. The habitat is periodically inundated with estuarine water and may receive fresh water from seepages at low tide.

Selliera radicans is native to coastal regions from Kangaroo Island and Eyre Peninsula in South Australia to the Sydney region, the Bass Strait islands and Tasmania. It is also found on the North and South islands of New Zealand as well as Stewart Island and in Chile, South America (Krause 1912).

The only known Western Australian occurrence is near a small fishing-boat anchorage a few kilometers away from any habitation. The area is quite undisturbed and it is not likely that *Selliera* has been introduced by man to the locality. The initial collection was sterile, its identity was confirmed after cultivation and subsequent flowering in Perth

Reference

Krause, K. (1912). Goodeniaceae und Brunoniaceae. *Das Pflanzenreich*, 4.277 (Heft 54): 112-113.

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MATTHIOLA (R.BR. IN) AIT. (BRASSICACEAE) NATURALIZED IN WESTERN AUSTRALIA

Matthiola incana (L.) Ait., the common garden stock, a native of the Mediterranean region, has become naturalized at a number of coastal localities in the Perth metropolitan region. The species has been recorded from Fremantle (GK 2490), Trigg Island (GK 2269) and Yanchep (Demarz 6483), a range of over 80 kilometres.

Generally the species has become established on limestone cliffs covered by sand, and not on open sandy beaches. Plants are robust perennials, purple flowered, persisting for up to seven years and producing copious amounts of seed (they are autogamous and self fertile, Keighery. 1980). Many seedlings are found during winter, but few survive their first summer drought.

Matthiola incana has also been recorded as a naturalized alien in South Australia by Eichler, 1965.

Voucher collections are lodged in PERTH and KPG.

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Eichler, Hj. *Supplement to Black's Flora of South Australia.* Government Printer. Adelaide 1965.
Keighery, G.J. (1980). *Breeding Systems of Introduced Cruciferous Weeds.* Kings Park Unpublished Report. (Available on request).

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PASSIFLORA CAERULEA IN WESTERN AUSTRALIA

Passiflora caerulea L. (Passifloraceae), a Brazilian species, is probably the most widely cultivated ornamental passion flower (Bailey, 1937). The species is a robust woody twining shrub, bearing large blue and white flowers during late spring and summer.

Within Western Australia *Passiflora caerulea* has been commonly cultivated via cuttings, and the species, though rare in modern gardens, can be frequently encountered in abandoned gardens, farms or occasionally road verges. Interestingly several vigorous colonies have been found growing between railroad lines (e.g. Bunbury: GK 2827, Cottesloe: GK 1859a, and Bridgetown: GK 3019; Vouchers in PERTH and KPG). These colonies form tangled shrubs from a spreading rootstock, and benefit from the frequent burning and slashing of these areas. Spread is probably via vegetative sections removed by passing trains, or in soil removed during repair work on the lines.

In all localities *Passiflora caerulea* spreads via vegetative means (rhizomes, rooted stems or fragmentation,) fruit is rarely formed. Material of this species in the Perth metropolitan area is self sterile, non autogamous and lacks a suitable pollinating agent.

At present, *Passiflora caerulea* appears to be in the grey area between a "persisting garden escape" (as noted by Willis, 1972) and a naturalized alien. It should prove an interesting subject to continue monitoring.

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Bailey, L.H. (1937). *The Standard Cyclopedia of Horticulture*, Vol. III, p-z, pp. 2423-3639. The Macmillan Company. New York.
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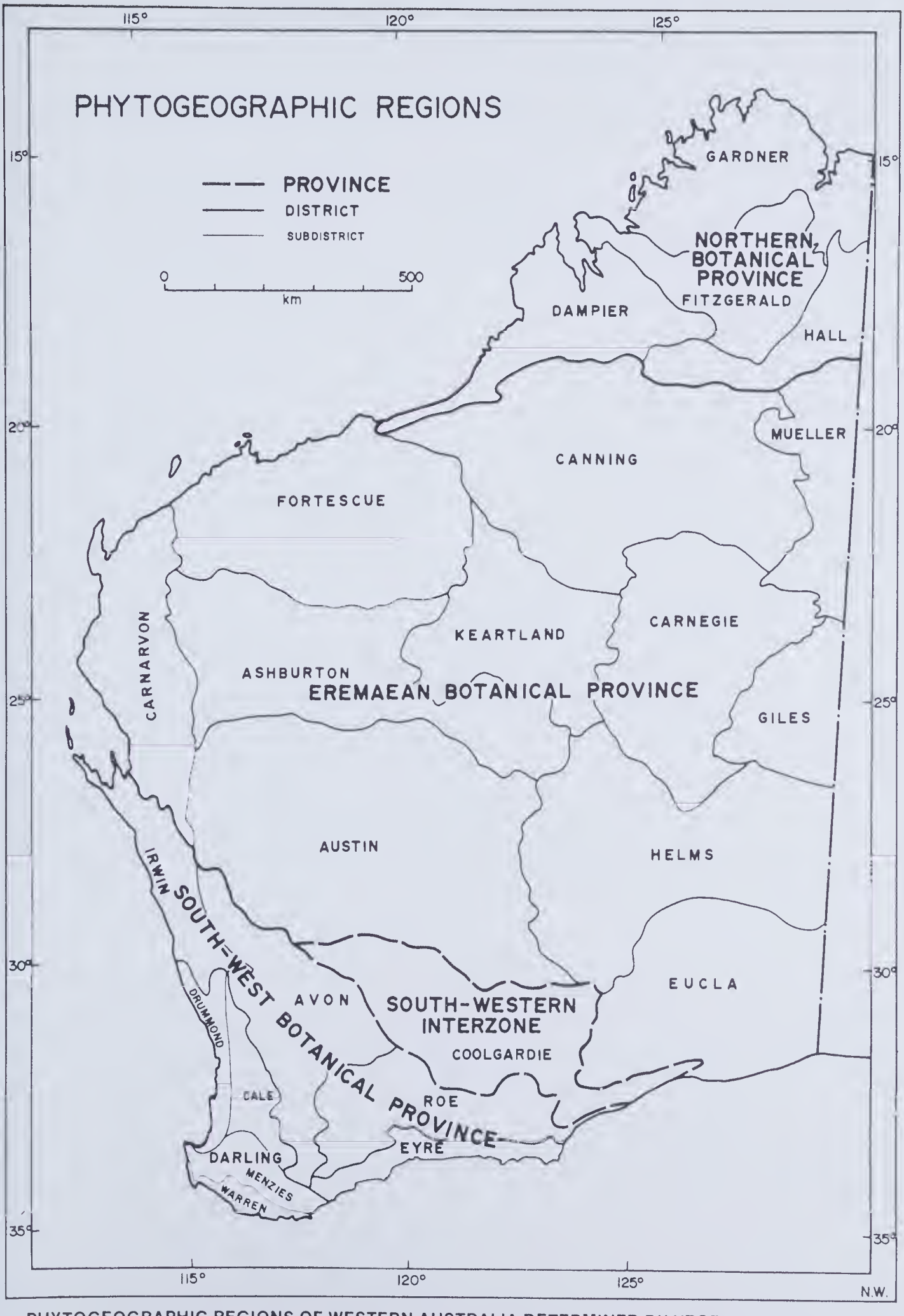

PHYTOGEOGRAPHIC REGIONS OF WESTERN AUSTRALIA DETERMINED BY VEGETATION MAPPING
(from Beard, 1980, Western Australia Herbarium Research Notes No. 3.).