VOLUME 11
NUMBER 1
1996

NUYTSIA

WESTERN AUSTRALIAN HERBARIUM

DEPARTMENT OF
CONSERVATION AND
LAND MANAGEMENT

NUYTSIA

VOLUME 11 NUMBER 1 1996

Western Australian Herbarium
Department of Conservation and Land Management
Western Australia

NUYTSIA

Published by the Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983.

All papers should be submitted to Dr Barbara Rye, Editor, Nuytsia.
Email: Barbarar@herb.calm.wa.gov.au

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Department of Conservation and Land Management, Western Australia

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Western Australian Herbarium,
Department of Conservation and Land Management,
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Cover

Nuytsia floribunda (Labill.) R. Br. ex Fenzl (Loranthaceae) - the Western Australian Christmas Tree is one of the few arborescent mistletoes in the world. This endemic tree is a semi-parasite common in sandy soil from the Murchison River to Israelite Bay. The journal is named after the plant, which in turn commemorates Pieter Nuijts, an ambassador of the Dutch East India Company, who in 1627 accompanied the "Gulde Zeepard" on one of the first explorations along the south coast of Australia.

Cover design by Sue Marais

Photograph A.S. George

James Drummond's newspaper accounts of his collecting activities, in particular his 4th Collection and *Hakea victoria* (Proteaceae)

R.M. Barker

State Herbarium of South Australia, Botanic Gardens, North Terrace, Adelaide, South Australia 5000

Abstract

R.M. Barker. James Drummond's newspaper accounts of his collecting activities, in particular his 4th Collection and *Hakea victoria* (Proteaceae). Nuytsia 11(1): 1-9 (1996). At least three plants, *Hakea victoria*, *Gastrolobium leakeanum* and *Verticordia grandis*, all recognized and published by James Drummond, were first published in Perth newspapers, not in journals edited by William Hooker as has been assumed. This is possibly so for other plants attributed to Drummond in Hooker's journals. The full newspaper account of the expedition on which Drummond made his 4th Collection is reproduced here since Hooker only communicated an abridged version of Drummond's original letter.

Introduction

James Drummond appears to have been a prolific contributor to the two Perth newspapers, *The Inquirer* and *The Perth Gazette*. According to Erickson (1969), even by 1842, "Drummond's long screeds on Botany already occupied many columns of *The Inquirer* and during 1843 he wrote "letters for *The Inquirer* on the *Botany of Western Australia*", which apparently appeared in that paper throughout 1842-43. One letter to *The Inquirer*, which was not printed was Drummond's June 1843 letter on the black Kangaroo Paw in which he provided a formal description of "*Anigozanthus Molloyiae*" which he wished to name in honour of the late Mrs Georgiana Molloy. Nor was this letter reproduced by Hooker, even though it resides in the Drummond letters at Kew (Erickson *l.c.*) and so this botanical tribute to Mrs Molloy was never published.

It was apparently Drummond's custom to submit his letters to the Western Australian newspapers before they were sent to Hooker in England and consequently some, if not all, of the Drummond letters published by Hooker were preceded by newspaper articles. An example is a letter sent to the businessman and probable Drummond sponsor, Mr George Leake. This was published in *The Inquirer* on 6 December 1848 and later reproduced in full by Hooker. A series of 5 weekly articles for *The Perth Gazette* during 1852, published under the title "the Botany of the North-western district of Western Australia" was also based on Drummond's letters and they were later reproduced by Hooker (see Table 1). These relate to Drummond's 6th Collection.

Although these communications were full of botanical information and comments on novelties, Drummond only rarely proposed names for the new taxa he recognized (see Barker & Barker 1990,

Table VI for some of these), but where he did, the account in Hooker's journals may well be predated by a newspaper account.

Drummond letters known to have been prepublished in Western Australian newspapers

During his time as the Australian Botanical Liaison Officer in Kew in 1992, Dr Philip Short of the National Herbarium of Victoria found evidence suggesting that the first publication of *Hakea victoria* by James Drummond was probably not, as has always been thought, in an English journal produced by William Hooker in 1848, but was almost certainly within the Western Australian newspaper *The Inquirer,* probably in 1847. Since the author is part of a project to revise the genus *Hakea,* along with L. Haegi and W.R. Barker of the same institution, this was drawn to our attention.

This prompted the current investigation, and so a copy of the complete text of the James Drummond letter printed in *The Inquirer* in 1847 was obtained from the Battye Library in Perth. A very much abridged part of it appeared in Botanical Magazine 74 Companion pp. 1-3 (Drummond 1848) as "Notice of Mr. Drummond's discovery of three remarkable plants in South-West Australia".

This latter publication has always been cited as containing the protologue for *Hakea victoria* but *The Inquirer* article clearly predates it (Principle III, International Rules of Botanical Nomenclature, Greuter *et al.* 1994). Names published in a non-scientific newspaper before January 1, 1953 are effectively and validly published (Art. 29, International Code of Botanical Nomenclature). As a consequence other names which appear in this same article are also validly published (provided they are accompanied by an adequate description) and should be considered by botanists revising the groups concerned (e.g. *Kingia Cygnorum, Anigozanthus Cheyneii, Banksia Hookeri, Lambertia Hakeoides*); most appear to be synonyms of earlier names.

Because it was obvious from references given in Erickson (1969) that other letters written by Drummond had also found their way to the newspapers in Perth, copies of Drummond articles in *The Inquirer* of 6th December 1848 and in *The Perth Gazette* over 5 weeks from 16th April to 14th May 1852, were also requested from the Battye Library. These articles were found to correspond to accounts reproduced in Hooker's journals as shown in Table 1. Unlike the original case, these articles were not abridged but reproduced by Hooker in full.

However, because of the earlier publication of the newspaper accounts, two species, *Gastrolobium leakeanum* and *Verticordia grandis*, previously thought to have been published originally in Hooker's Journal of Botany and Kew Gardens Miscellany (Vol. 1, p. 247 in 1849 and Vol. 5, p. 119 in 1853, respectively; see Barker & Barker 1990), should now be cited as follows:

Gastrolobium leakeanum J. Drumm., *The Inquirer*, without page number (6 December 1848)
Verticordia grandis J. Drumm., *The Perth Gazette*, without page number (23 April 1852)

The list of Drummond letters published in newspapers, and their subsequent publication by Hooker, given in Table 1, should not be considered to be exhaustive. Other Drummond letters with botanical names were published by Hooker (Barker & Barker *l.c.*) and these too may be predated by newspaper articles.

Table 1. Newspaper reproductions of Drummond's letters with their corresponding (later) articles reproduced by Hooker.

Newspaper article	Hooker's journal
The Inquirer, 7 April 1847	Not published
The Inquirer, 14 April 1847	Bot. Mag. 74, Companion pp. 1-3 (1848)
The Inquirer, 6 December 1848	Hooker's J. Bot. Kew Gard. Misc. 1: 247-251 (1849)
The Perth Gazette, 16 April 1852	Hooker's J. Bot. Kew Gard. Misc. 5: 115-118 (1853)
The Perth Gazette, 23 April 1852	Hooker's J. Bot. Kew Gard. Misc. 5: 118-122 (1853)
The Perth Gazette, 30 April 1852	Hooker's J. Bot. Kew Gard. Misc. 5: 139-143 (1853)
The Perth Gazette, 7 May 1852	Hooker's J. Bot. Kew Gard. Misc. 5: 143-145 (1853)
The Perth Gazette, 14 May 1852	Hooker's J. Bot. Kew Gard. Misc. 5: 178-183 (1853)

Hakea victoria J. Drumm.

The place and date of publication of the original subject of this enquiry, *Hakea victoria* Drumm., having been established as *The Inquirer* dated 14 April 1847, two other matters concerning this species should be discussed here.

Spelling

There has been some confusion over the spelling of the specific epithet. It was frequently cited as "*victoriae*", probably firstly by Meisner (1852) and then by Bentham (1870), followed by Western Australian botanists in the earlier part of this century, e.g. Gardner 1930, Beard 1965. The spelling "*victorae*" by Erickson (1969) is presumably an orthographic error, since her account also contains the spelling "*victoriae*". The spelling is clearly "*victoria*" in the original article as well as in the Hooker reproduction and in other accounts of the species from the Hooker stable, e.g. Bot. Mag. 4528.

Collections

Drummond states in the article that he collected 16 bract-bearing tops of *Hakea victoria* i.e. as was his normal practice, enough for his 14 subscribers, one for Hooker and one to retain. They presumably survived the difficult trip on the horse's back described below and in any case Drummond carried one specimen, 14 feet high, in his hand all the way to Cape Riche. However, only a specimen in MEL (a single leaf and fruit) and a fragment in Meisner's herbarium in NY still survive. Just what happened to the copious collection is unknown. *H. victoria* was not flowering at the time of collection but did contain fruits and the collection may have all been used as a seed source. Support for this theory is given by the fact that a leaf from a cultivated specimen in K is mounted with the NY material. The specimens did reach England since Hooker noted at the end of the article he reproduced that "Noble specimens of the three plants here noticed have reached our hands and bear testimony to the correctness of Mr. Drummond's remarks. The *Banksia* is probably the little known *B. solandri* Br., the others are quite new."

Drummond's account of his 4th Collection

Since the original text is not easily accessible and is probably of interest to naturalists in general it has been reproduced in full here with those parts published by Hooker in bold face. Excerpts of parts of *The Inquirer* article were reproduced by Erickson (1969) in her account of the life of James Drummond, but most botanical references were missing. There are also comments on the botany of a number of groups of plants, on geology and on the itinerary followed. It is, however, only a very succinct account considering that Drummond collected 16 sets of 400 species in this the 4th Collection and that it lasted at least from November 1846, when James Drummond and George Maxwell departed Gingin, to late March 1847 when they returned to Perth (Erickson 1969).

The Inquirer 7th April 1847

Mr Drummond's Journal. - As we anticipated, Mr Drummond, with his usual courtesy and anxiety to diffuse information, has directed that the letter which he is about to transmit to Sir W.J.Hooker should, on its way, be placed in the hands of *The Inquirer*, if desired. We need hardly say that we gladly availed ourselves of the offer, and we make no apology for publishing, entire a document so full of interest to the lovers of science, and so well calculated to maintain the high character of Mr Drummond:

Dear Sir, - I wrote to you about two months since to say that I had set out on a journey to the south, wishing to extend my observations on the botany of this colony from its farthest north to its farthest south settlements. I visited Gingin, a farm of Mr. W.L.Brockman, situated on a fine and ever-running stream of the purest water, a tributary of the Moore River. On the road to it I found an interesting species of *Genetyllus** [*Darwinia*], with very small heath-like leaves, but large heads of drooping flowers surrounded by ciliated bracts - an earnest of more important discoveries since made in this fine genus of *Myrtaceae*. I also found in that same locality an interesting plant belonging to *Sirophulinae* [probably *Scrophulinae*], and a very distinct and showy species of *Grevillea*, with linear leaves and scarlet flowers, growing 12 or 15 feet high. On reaching the brook on which Mr Brockman's farm is situated, I was delighted to find it in many places almost filled with a remarkable fern [?*Adiantum*] - a rare order in this part of New Holland; it resembles a good deal *Aspidium Felix Mas*, but it is a larger plant, bearing fructification on the margins of the fronds; the stems creep mostly on the dead wood which is covered with the water of the brook. Mr Brockman's farm consists mostly of remarkable hills of secondary limestone, covered to the depth of several feet with a rich black soil; barley produces heavy crops on this soil, but for several years the wheat has suffered apparently from the ravages of a fungus. A *malvaceous* plant, new to me was abundantly in flower. These limestone hills abut on the common ironstone formation of the Darling Range. Crossing the ironstone hills in a south-west direction from Gingin, I found the tops of several covered with a magnificent *Conospermum*, with linear leaves, about 18 inches long, and bearing large corymbs of snow-white inflorescences (the true flowers are small and black.) This would be a most desirable plant to cultivate in England, but no seeds were formed on it at this time. After leaving the York district, we travelled mostly by the King George's Sound road, until we got from it a distinct view of the Toolbrunup hills [Stirling Ranges], when we made straight for one of the highest and most conspicuous mountains [Donnelly Peak], which lies to the N.W. of the one marked "Mongerup" in Arrowsmith's map of Western Australia. For about 15 miles we passed over very barren country, but we found a good passage to the east of a remarkable saddle-backed hill, and by digging in a sort of a watercourse we found abundance of excellent water, which no doubt is a permanent spring. By following a kangaroo or native path from this spring, it soon led us into a grassy valley, in which we travelled about 4 miles, when we reached the N.W. end of the highest hill which appears from the K.G.'s Sound road to the north of the Gordon River. Here we found no water; but by following a branch of the same valley until we came directly S.W. of the highest point of the hill, we found plenty of water within 2 feet of the surface. *(To be continued.)*

**Genetyllus* is presumably a misspelling of *Genetyllis*, a genus of Myrtaceae published by de Candolle. The name is invalid.

The Inquirer 14th April 1847

Mr Drummond's Journal [Continued]

We this week conclude Mr Drummond's interesting account of his botanical researches, which we earnestly recommend to the attentive perusal of our readers, and especially of those who are lovers of science: -

Here we spent Christmas Day, and from that circumstance I named the place Christmas Valley; good grass is abundant in many parts of this valley. The principal part of these hills is the old red sandstone formation, containing no trace of organic remains, but passing in many places into micaceous schist of very inferior quality for building purposes. a large portion of the surface of this hill is covered with detached fragments of fine grained sandstone, but just under the highest part on the S.W. side, the strata appear in their natural horizontal position. The botany of the sandstone formation is exceedingly interesting; here we have *Banksia Grandis, Banksia Coccinea*, and a new glaucous entire-leaved species nearly allied to *B. Quercifolia, Isopogon Loudonii,* with a clear trunk 5 or 6 inches in diameter, and a fine *Petrophila* with leaves like banksia. I have only seen on this hill a fine new *Dryandra* of the *Spenora* group, *Huniclidium Baxterii (Hakea Baxterii,* the true plant); and here we have the head-quarters of *Kingia Australis*, with its silvery leaves, apparently a distinct species from our Swan River *Kingia,* which grows much larger, with its leaves more resembling a *Zanthorreae[sic];* I name the Swan River form *K. Cygnorum.* Here in all probability, many of these plants flourished when their first known habitat, near K.G.'s Sound was many feet under the waters of the ocean. In Christmas Valley I found a beautiful little *Helichrysum,* with crimson bracts, varying to rose-colour inside, but perhaps only a variety of *H. Macranthum.* This nameless hill, which I ascended several times, produced several new plants and seeds of other orders. We next visited Mongerup, distant only about 4 miles, but twice that distance by the circuit we had to take to reach its base. We encamped N.W. from the highest part of the hill: I soon found water in a spring near our baggage, and my assistant, Maxwell, found water in a native well about a mile up the watercourse we were on. As Mongerup appeared to be but little higher than the hill which we had so particularly examined I intended to pay it but a passing visit, and to have gone on to others more distant; and my principal object was to examine the strata, which appeared to have a remarkable inclination from the horizon. If we suppose one and one hundred to represent the perpendicular, fifty will represent the horizon, but the strata on Mongerup appear at an angle of 85; their inclination on this hill is towards the S.W. The afternoon was very warm, and I suffered much from the heat in ascending a bare part of the hill. On returning I drank freely of the water from the spring near our baggage; in a short time it acted but very gently as an emetic; I thought it might have been fatigue and excessive heat which caused some degree of illness which I felt. I took some salts, and finding myself but little disposed to travel the next day, I sent Maxwell with our collections, which were cumbersome, to Neurabup [on the Kalgan River to the east of the Porongerup Range], to have them conveyed by a settler residing there to King Georges Sound. This day I examined the peaked hill which forms so remarkable an object from the K.G's Sound road, near Mount Barrow; the hill is close to Mongerup. The rocks are micaceous slate, and the vegetation very different from Mongerup. This day I had taken no unusual exercise, but on drinking freely from the water from my well, which looked uncommonly clear and tempting, it acted again as an emetic, but otherwise disturbing the system so little, that as soon as it ceased operating I put my plants in order and went out again in the afternoon. As Maxwell must necessarily be two days absent, **I determined to have another view of the top of Mongerup. I hid our supply of flour and pork as well as I could, in case of a visit from the natives: I had now to bring water from the native well. Starting at 5 o'clock, I reached the highest summit of the hill by 11. I ascended by the N.E. angle, and at about the height of 2,000 feet I found first making its appearance a splendid *Banksia*, with leaves more than 9 inches long and about 5 wide, irregularly jagged and sinnated [*sic*] like an English oak [*Banksia solandri* R.Br.]. To this splendid plant I have given the specific name of *Hookeri*. From the remains of the flowers they appear to have been scarlet. I had scarcely time to make myself acquainted with this fine *Banksia*, when I found another exceedingly interesting and beautiful plant, a species of *Genetyllus [Darwinia],* growing to the size, and having a considerable resemblance in habit and foliage to *Beaufortia Decussata*, but having the inflorescence inclosed by beautiful bracts, white, variegated with crimson veins; these bracts are as elegantly formed as the petals of the finest tulip, and they are almost as large, hanging in a bell-shaped form from the ends of the slender branches [*Darwinia macrostegia*]. I thought I could never gather enough of this charming plant, and I procured abundance of perfect seeds. As one is obliged to use their hands as well, and almost as often, as their feet, in ascending or descending these very steep hills, I had gone very lightly equipped, I was therefore obliged to make use of my shirt and**

neckhandkerchief (making the shirt into a bag), to bring down a supply of *Banksia* cones. Securing the load so as not to impede the use of my hands. I reached our sleeping place at 3 o'clock, much fatigued with my load, but highly gratified, having this day found at least two plants which will continue to be admired while a taste for the beauties of nature remains to the human race.

When passing from Mongerup to Toolbrunup, we encamped under Talyuberlup, where I found several new and interesting plants; but here we could find no water. Among the plants was a very remarkable *Banksia,* with drooping globular flowers of an orange colour, variegated with crimson. The cones are round, and as large as a 14lb cannon shot. The plant grows about four feet high, with linear leaves with rigid spine-like teeth. This day I gathered for the first time the plant I suppose to be the *Dryandra Nervosa* of Mr. Brown, three *Hakeas* I had not seen before, but two of them are described by Mr. Brown. After searching until 5 o'clock, we made the Calgan River, and reached it about 8 o'clock. On the way I gathered for the first time a splendid *Anigozanthus,* with blood red flowers [almost certainly *A. rufus* Labill.]. From this place we found it common in the sandy valleys all the way to Cape Riche. I have named it, in compliment to my kind friends, Mr. and Mrs. Cheyne, *Anigozanthus Cheyneii.* We spent a day on the Calgan *[sic]*, and I was unsuccessful in my botanical researches. On the top of an ironstone hill, near our bivouac, I found a fine pinnate leaved scarlet *Grevillea* which I had not seen before, and a very distinct *Aplragmous Dryandra*, with glabrous buds and bracts surrounding the flowers. On leaving the Calgan we made straight for Toolbrunup, the hill marked in Arrowsmith's map as 3,000 feet high. In this day's journey I gathered for the first time the largest coned *Banksia* which I have ever seen, a shrub about four feet high, and much resembling in everything but the fructification, the orange and crimson globe flowered species. I call this plant the *Kangaroo Banksia* from the resemblance its bleached tomentose grey looking cones bear to the small species of kangaroo. We encamped near a small wood of gum trees, the only ones to be seen. On the left bank of the brook, about 3 miles northwest from the highest top of the Toolbrunup hills, these trees form an excellent landmark, and we found plenty of water and middling good feed for our horses in their vicinity. The highest point of Toolbrunup is of the old red sandstone formation, and it has the strata so regularly horizontal that they look from below like a fortification built by man. the mountain is so very steep that the highest point is only accessible by following up the southwest angle. The top of the mountain produces my *Banksia Hookeri*, and another new *Genetyllus* [*Darwinia*], with scarlet *fuschia* [sic] like bracts, but the plant is very rare. I also found a new *Lambertia,* with short lanceolate acuminate but scarcely pungent leaves. I call the species *Lambertia Hakeoides*; it probably belongs to the 7-flowered group, but it is widely different from any described species. I found a curious *umbelliferous* plant, and a rose-coloured *Stylidium*, with glaucous leaves, which were new to me, on this remarkable hill. Although the strata are regular and horizontal on the highest peak of this, on the next below they lie at all possible angles, a large mass of the very summit of this second peak being perfectly perpendicular, yet the disorganizing cause appears to have acted only on the surface; the micaceas [*sic*] schist which forms the nucleus where it is exposed by the action of a current of water, appears to be horizontal. From Toolbrunup to Congineerup, distant about 20 miles to the east by south, we found an easy passage, and we encamped under the highest part of this immense mass of hills. They are of little interest to the botanist; they are micaceous slate, containing a large proportion of mica, which, by its decomposition, forms a rich soil. In several places on the side of these hills I observed a fine cruciate [?*Xanthosia* sp.], with multifid *cardamine* like leaves, and small white flowers. I call the species *C. Gigantea*; from its taste and smell, I consider it an excellent substitute for all sorts of cress. Although these mountains, for their size, produced little of interest, the sandy country close to their base and extending about half way to Cape Riche, produced another very distinct *Dryandra* of the aphragmous group: this plant has broader and much shorter lobes to its pinnated leaves than *Nervosa.* Meisner, in his observations of *D. Nervosae* in the "Plantae Preissiana", seems to think that the distinctions in the aphragmous group are not much to be depended on, but in reality there are no more distinct species of the genus or plants of the order to which they belong, or any that are easier seen to be distinct, whether in or out of flower, than the aphragmous *Dryandras.*

To Cape Riche we had a hard day's work; the distance is about 25 miles, and we had found no water on the road. The promontory of Cape Riche will, in time to come, be a spot celebrated in the botany of Western Australia. Here the German botanist, Mr. L. Preiss, in a visit to the farm of the worthy proprietor (himself at the time resident at K.G.'s Sound), found many of his rarest plants: the *Collium Conkoberup*, now better known as the Mount Melville by Mr Cheyne's people, produced him the *Mealytus Preissiana*, the *Eucalyptus Pleurocarpa*, the *E. Cornuta*, and several other interesting species. One of the greatest ornaments of Cape Riche is *Kennedea Nigricans*; this beautiful climber is abundant, and it is as useful as ornamental: it answers for basket making, for tying, and all similar purposes for which willows are useful.

After experiencing the greatest kindness and hospitality from Mr. and Mrs. Cheyne for ten days, and having our supplies of several sorts recruited, which had been exhausted by so long a journey, we set out for Doubtful Island Bay. About a mile to the east of Mr. Cheyne's residence I gathered *Banksia Caleyii* for the first time, and along with it a most distinct and curious species of *Eucalyptus*, with foliage resembling *Eucalyptus Preissii*, but with square buds and seedvessels. At the time of flowering, the buds are about an inch and a half long, with sides 3/4 of an inch wide; at this time the whole is a beautiful crimson, like a ripe pomegranate; the flowers are rose colour; after flowering, the seedvessel regains its green colour, and ultimately turns brown when ripe. I send specimens and seeds of this very curious plant, which clearly shows that but little dependence can be placed on the opposite or alternate character of the leaves as a sectional division of the great genus *Eucalyptus*, as they are seen to be truly opposite or widely alternate on the same branch. It is true all the species enumerated by Schaur [*sic*] in the "Plantae Preissiana", and several others not described as opposite leaved, are always of that character, but the very same spot, namely, the *Collium Conkoberup* (Cape Riche promontory), so often quoted by Mr. Preiss, produces 3 other species that, when they grow luxuriantly, are always opposite leaved and flowered, although in old and weak specimens they are alternate; one little species has the leaves not only opposite, but stem-clasping, and in that state it bears opposite clusters of flowers. The same thing, as to foliage, may often be seen in the young shoots of the common red-gum.

In our first day's journey to the east of Cape Riche, I found a little prickly furze, like *Comesperma*, with bright blue flowers, but on my return to Cape Riche missed the spot where it grew. We slept on the right bank of the estuary of the Salt River [Pallinup River] by some springs of fresh water among the tea-trees, close to the salt water, which any traveller may easily find about a mile and a half back from the sea-beach. The next day, continuing our journey to the east, we found but few interesting plants; and we slept on the bank of a large fresh-water lake, about 2 miles in diameter. We found grass near the east end among some gum-trees. A little to the north of this sleeping-place I observed the buff and crimson nodding flowered *Banksia* in great luxuriance; the plants were only about 6 feet high, but I measured several which were full 30 feet in circumference, and crowded with old flowers and loaded with their ponderous seedvessels. The next day, travelling to the east, I found in the bed of some fresh-water lakes, which were only recently dried up, a species of *Polygonum*, very distinct from the species which grows near Mr. Brockman's, but perhaps not distinct from some European species. We slept by a lake of fine fresh water, full of the jointed rush, but with bad grass for our horses. Next day I found but a few interesting plants. We slept by the side of a small lake of fresh water about a mile to the west of the estuary, which falls into Bremmer [*sic*] Bay. Here we had abundance of grass for our horses. There is also good grass and water on the right bank of the estuary, which falls into Bremmer Bay about a mile back from the sea beach. After passing along the beach of this bay for about 2 miles, we crossed over some sand-hills to the banks of a deep lake of fresh water about a mile long; there was abundance of grass in several places on its banks. In about 10 miles to the west we came to an estuary of very salt water [?Gordon Inlet], with good grass on its banks, and a small well of fresh water, which barely supplied ourselves and our horses with this necessary of life. This was our furthest bivouac to the east: **West Mount Barren was distant about 4** [Hooker says 10 in his version] **miles. Just before I reached this sleeping place, and afterwards in greater abundance between it and Mount Barren, I found a most extraordinary plant, a species of *Hakea* growing 12 or 14 feet high; the true leaves of the plant are 7 or 8 inches long, jagged and sinuated as in *Hakea undulata*; but by far the most conspicuous part of the foliage of this superb plant are its bracts; these make their appearance with the flower buds. when the plant is 3 or 4 years old, they are borne in regular whorls, each circle or whorl being from 7 to 9 inches in height, [and] formed of 5 rows, which have each 5 bracts; the lowest bracts of the whorl are the broadest; they vary from 4 to 5 inches; the whole breadth across in full-grown middle-sized specimens being about 10 inches, and they regularly decrease in size to the uppermost bracts, which are only about 4 inches across from outside to outside; each whirl is a year's growth of the plant after it bears the first flowers. The variegation of these bracts is so extraordinary, that I almost fear to attempt a description. The first year they are yellowish white in all the centre of the bracts, and the same colour appears in the veins and in the teeth, which grow on the margin; the second year, what was white the first year has changed to a rich golden yellow; the third year what was yellow the second changes to a rich orange; and the fourth year the colour of the centre of the same bracts, their veins and marginal teeth, is changed to a blood red. The green, which has a remarkably light and luminous appearance the first year, varies annually to deeper and darker shades, and the fourth year, when the centre of the bracts has acquired a blood-red colour, the green of the same series is of the richest hue; the whirls below change to darker and duller shades, until they ultimately fade into the dull and withered leaves of other climes. The flowers I have not seen; the stem**

and buds of the upper series, which are the only ones unopened, are white and velvetty [*sic*]; the other series contain seedvessels mostly with perfect seeds. To this most splendid vegetable production which I have ever seen, in a wild or cultivated state, I have given the name of our gracious Queen, *Hakea Victoria*. It will soon be in cultivation in every garden of note in Europe, and in many other countries.

I found another *Hakea,* with acicular leaves and large pear-shaped seedvessels, between the before-mentioned estuary and Mount Barren. On Mount Barren I found a fine *Adenanthos*, with eliptic [*sic*] leaves - a remarkable nodding yellow-flowered *Banksia,* with leaves and a habit so like *B. Caleyii,* that it can only be distinguished by the cones and flowers [*Banksia lemanniana,* pers.comm. A. George], which are widely different. I found on this mountain two very distinct *Dryandras,* allied to *Armata*, which were quite new to me. *Dryandra armata* of Brown, as I understand the species, occurs here in three very distinct forms; the common form I sent home in my first collection: it is common on the outer series of the Darling Range in the Swan District, and it grows about King George's Sound. The variety I call *D. Armata* Gracilis (*D. armata* var. *ignicida*, pers.comm. A.George] I first met with near York, and I saw it in several places among the Toolbrunup hills; but the form of *D. Armata,* which is by far the most common from the Toolbrunup hills to the Cape Riche, and from Cape Riche to Doubtful Island Bay, is a strong upright-growing plant with a single stem at the root; this I call the *D. Armata Stricta.* It is possible that these three forms may pass into each other by intermediate plants, but both the Mount Barren species, which I call *D. Macrocarpa* and *D. Ferox*, are very distinct species. The *Dryandra gracilis* of Brown [*D. tenuifolia*?, pers. comm. A.George], common about Mount Barren, is very different from the Beaufort River plant [*D. tenuifolia* var. *reptans,* pers.comm A.George], referred to it by Meisner in the "Plantae Preissiana". *Dryandra Preissii* of the same writer, long ago noticed in the Journal of Botany, is closely allied to *Dryandra Nivea* of Brown, and is no more a *Diplophragma* than several other species placed in a different section of the genus in the "Plantae Preissiana". Mount Barren produces a curious *Aphyllus (Jacksonia)* in large upright bushes; a remarkable larch-like *Calothamnus,* but the flowers were past; a verticillate-leaved *Acacia* [*A. cedroides* pers.comm. A.George] and several other curious plants which I had not before seen. The principal rocks composing this hill are what I call lamellar quartz - that is, quartz which breaks up in a slate-like form, but the pieces are usually much thicker than slate; it occurs in the Toodyay district, and is the same rock which Captain Whitfield has used for flooring his house. There is also a good deal of a flint-like form of quartz, which breaks with a conchoidal fracture. The strata on Mount Barren are but a few degrees from the perpendicular, and their inclination is towards the north-west. **I thought it incumbent of me to send *Hakea Victoria* in some form to my subscribers, and in this plant pressure is altogether out of the question, as the bracts break before they will bend in any direction. I tied up 16 of the bract-bearing tops in two bundles, tying them together with the creeping shoots of the black creeper *Kennedea Nigricans,* and slung them one at each side of my old grey pony Cabbine; the load, although not very heavy, was a most awkward one to get through the bushes, and he never since I got him carried anything so unwillingly. One specimen, 14 feet high, I carried in my hand all the way to Cape Riche, but notwithstanding all the care I took, the brilliant colours in the bracts of this extraordinary plant were much faded before I could get them to King George's Sound.**

We returned from Doubtful Island Bay to Cape Riche nearly by the same route we went. Near the outlet of the Salt River estuary I found the calcarious [*sic*] sand-hills covered in many places with a prostrate *Petrophila*, which must be a showy plant when in flower, as the ground appeared as if paved with its seedvessels. On our return to Mr. Cheyne's we packed up all our collections, and through his kindness in forwarding them by his schooner, we found them in K. G.'s Sound almost as soon as we got there ourselves. On the way, I examined Mount Many-peak, the native "Gilberup"; I found on it several plants which I had not seen before: the most interesting of them to cultivators is a *Stylidium,* with leaves more resembling *Saxifraga Cotyledon* than any species I before saw of its own genus; the flower-stalks are thick, but short (from 7 to 9 inches in height), and a third part of the height is covered with a dense thyrse of large rose-coloured flowers. The plant has a single whirl of bracts near the flowers. This one of the most beautiful species of this interesting genus grows abundantly on the mass of granite rocks which forms the highest point of Mount Many-peak; the rocks which form Mount Many-peak are coarse-grained granite.

Printed and Published by Edmund Stirling, at the office of *The Inquirer*, in St. George's Terrace, Perth.

Acknowledgements

Dr Philip Short of the National Herbarium of Victoria is thanked for initially drawing my attention to the publication of *Hakea victoria* in *The Inquirer*. The Battye Library in Perth provided copies of all of the relevant articles as well as advice concerning copyright and their generosity in doing so is much appreciated.

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Notes on miscellaneous mimosoid legumes (Leguminosae: Mimosoideae), mostly Australian

R.S. Cowan

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Cowan, R.S. Notes on miscellaneous mimosoid legumes (Leguminosae: Mimosoideae), mostly Australian. Nuytsia 11 (1): 11-19 (1996). Lectotypes have been selected for ten taxa of mimosoid legumes treated for the "Flora of Australia": *Albizia canescens* Benth., *Albizia plurijuga* Domin, *Albizia retusa* Benth., *Archidendron hendersonii* (F. Muell.) I. Nielsen, *Archidendron muellerianum* (Maiden & R. Baker) I. Nielsen, *Archidendropsis thozetiana* (F. Muell.) I. Nielsen, *Neptunia gracilis* Benth., *Neptunia gracilis* var. *villosula* Benth., *Neptunia major* (Benth.) Windler and *Neptunia monosperma* F. Muell. ex. Benth. Discussions are included concerning the typification of *Mimosa distachya* Vent., *Pararchidendron pruinosum* (Benth.) I. Nielsen and *Paraserianthes toona* (Bailey) I. Nielsen. In addition, a note is presented concerning the typification of *Mimosa pigra* L.; the disposition of the name *Albizzia amoenissima* F. Muell. is discussed; and a new species, *Archidendron kanisii,* is described.

Introduction

In the course of preparing the account of the Mimosoideae (excluding *Acacia*) for the "Flora of Australia", it appeared advisable to stabilize the binomials of a number of the taxa by selecting lectotypes for the names. The approach used has been that described by Maslin and Cowan (1994): in simplest terms, lectotypification, as we have applied it to *Acacia* taxa, often involves the choice of a single specimen on a designated sheet to serve as the nomenclatural basis for a name, rather than designation of an entire collection or sheet which may have been made, deliberately or inadvertently, from more than a single plant. In the following account, the taxa lectotypified are arranged alphabetically, followed by notes on two taxa and a new species.

Lectotypifications and notes on types

Albizia canescens Benth., Fl. Austral. 2: 423 (1864).

Lectotype (here selected): Fitzroy and Bowen Rivers, [Queensland], *[E.M.] Bowman* (K); *isolecto:* MEL 594743. *Paralectotypes:* (1) Burdekin River, [Queensland], *F. M[ueller]* (K); (2) Rockhampton,

[Queensland], *[A.] Thozet* (K, MEL 594741, 594744, 594745, 594749; MEL 594747, 594748 = probable paralectotypes); (3) Rockhampton, [Queensland], *[J.] Dallachy* (MEL 594742; K and MEL 594746 = probable paralectotypes).

Because Bentham listed four collections (and in the absence of collection numbers others may have been involved), selection of a lectotype is necessary, even though all the material seen represents this species. The sheet chosen was annotated by the author in his hand with the published name; the isolectotype was also seen by him. The lectotype sheet bears two branchlets and a label with only "Queensland Bowman, Dallachy" in Bentham's hand; the upper right-hand specimen (the lectotype) is interpreted as being from the Bowman collection because it matches perfectly the isolectotype at MEL, which has a label with all the collection data given in the protologue but was not annotated by Bentham. The other branchlet on the left is interpreted as being part of the Dallachy collection cited. Some of the paralectotype specimens are listed as probable because of incomplete data on them. For example, the Thozet collection at K bears no collection number, but what is probably the same collection at MEL has 265 as the collection number; MEL also has several additional specimens that are probably parts of the same collection. Similarly, the Dallachy paralectotype from Rockhampton has the date 12 Febr 1862 on the MEL sheet but lacks a date on the K sheet.

Albizia plurijuga Domin, Biblioth. Bot. 3: 274 (1921).

Lectotype (here selected): Queensland, in den Savannenwaldern bei Calcifar (im Chillagoe-Distrikte), February 1910, *K. Domin* 5416 (PR). *Paralectotypes:* same location and date, *K. Domin* 5415, 5417 (PR).

Examination of the original material, kindly made available by the herbarium of the National Museum in Prague, leaves no doubt that this name is synonymous with *A. canescens*. Since three collections were involved, the most complete and representative one is selected as the lectotype of the name.

Albizia retusa Benth., London J. Bot. 3: 90 (1844).

Lectotype (here selected): Prov. Albay, Luzon, Philippine Is., 1841, *H. Cuming* 1223 (K); *isolecto:* (K). *Paralectotype:* Prov. Batangas, Luzon, Philippine Is., 1841, *H. Cuming* 1593 (K).

Bentham in the protologue cited two collections and, although they represent the same taxon, lectotypification of the name is prudent, given the state of knowledge of the flora in the type region. Bentham annotated both collections at K with the published name and both are flowering; the lectotype is selected from the more complete collection with at least one duplicate sheet (at K). This is the same material referred to as the holotype by I. Nielsen (1985: 30).

The type material differs from most Australian specimens in having more pairs of pinnae, appressed-puberulous, oblong leaflets, as well as puberulous inflorescence axes and flowers. Unfortunately, there is altogether too little Australian material to make a decision, but future research may well require recognition of it as distinct from the rest of the subspecies.

Archidendron hendersonii (F. Muell.) Nielsen, Nord. J. Bot. 2: 481 (1982). - *Pithecellobium hendersonii* F. Muell., Fragm. 5:191 (1866).

Lectotype (here selected): Ballina, Richmond R. Heads, [New South Wales], *J.A. Henderson* (MEL 79815). *Paralectotype*: Ballina, [New South Wales], *C. Moore* (MEL 79816).

Mueller in the protologue cited two collections from the same locality. The sheet collected by the person for whom the species is named and which is annotated by the author of the specific epithet is selected as lectotype of the name.

Archidendron muellerianum (Maiden & R. Baker) Nielsen, Nord. J. Bot. 2: 485 (1982). - *Albizia muelleriana* Maiden & R. Baker, Proc. Linn. Soc. New South Wales, ser. 2, 10: 585, pl. 52 (1896).

Lectotype (here selected): Marshall Fall, Alstonville, [New South Wales], Dec. 1892, *W. B[aeuerlen]* (*lecto:* NSW 147408); *isolecto*: (MEL 583109). *Paralectotypes:* (1) [Tintenbar], Richmond River, [New South Wales], 20 Nov. 1895, *W. B[aeuerlen]* (MEL 583107 & MEL 583108); (2) Mullumbimby, Brunswick River, [New South Wales], *W. Baeuerlen* (NSW, *n.v.*).

In describing the species as an *Albizia*, the authors list three collections by W. Baeuerlen from three different localities. They imply, perhaps, that the collection from which the lectotype is selected is the more important by listing it first. Consequently the specimen annotated by the authors from the first-named collection is chosen as lectotype, even though all three collections represent what is presently regarded as the same taxon.

Archidendropsis thozetiana (F. Muell.) Nielsen, Adansonia 5: 326 (1983). - *Acacia thozetiana* F. Muell., Fragm. 4: 9 (1863). - *Albizia thozetiana* (F. Muell.) F. Muell. ex Benth., Fl. Austral. 2: 422 (1864).

Lectotype (here selected): Fort Cooper, [Queensland], *A. T[hozet]* (MEL 595338). *Paralectotypes:* Thozet's Creek, *J. Dallachy* (MEL 595339, 595340, 595342 and 595377); MEL 595341 also bears J. Dallachy specimens from the same locality but the label in the collector's hand gives the collection number as 408 and the date 9 March 1863.

Choice of a lectotype is necessary because Mueller cited several collections in the protologue of *Acacia thozetiana* and these were also cited by Bentham in making the transfer of the species to *Albizia*; most of these have been seen and they all represent the same taxon. The lectotype sheet cited does not bear Bentham's determination, but that he did study it is indicated by the "B" on the reverse of the upper left-hand corner of the label. It is the only specimen seen from Fort Cooper.

Neptunia gracilis Benth., J. Bot. (Hooker) 4: 355 (1842).

Lectotype (here selected): sub-tropical New Holland, 6 December 1846, *T.L. Mitchell* 442 (K-Herb. Bentham). *Paralectotypes:* (1) Camp 29, sub-tropical New Holland, 6 October 1846, *T.L. Mitchell* 599 (K); (2) interior of New Holland, T.L. Mitchell Exped., 1838 (K); (3) Nov. Holl., *[F.] Bauer* (K)

In the protologue, Bentham cited four collections; all are represented at Herb. Kew and all represent the same taxon. A lectotype is chosen to fix the application of the name. Windler (1966) only called attention to the fact that Bentham had not designated a type.

Neptunia gracilis Benth. var. **villosula** Benth., Fl. Austral. 2: 300 (1864).

Lectotype (here selected): Sturts Creek, [Western Australia/Northern Territory border], *F. Mueller* (K-Herb. Hooker, lower right-hand specimen); *isolecto:* MEL 596306. *Paralectotypes:* (1) Gulf of Carpentaria, [Queensland], *[W.] Landsborough* (MEL 596307); (2) between Darling [River] and Coopers Ck, [New South Wales], *Neilson* (MEL 596308).

A lectotype is chosen to fix the varietal name, even though it is a synonym, to one of the collections referred to by Bentham in his protologue; all represent the typical form of *N. gracilis* and all were seen by the author of the name. While recognizing the synonomy involved, Windler (1966) failed to name a type of any sort.

Neptunia major (Benth.) Windler, Austral. J. Bot. 14: 408 (1966). - *N. gracilis* Benth. var. *major* Benth., Fl. Austral. 2: 300 (1864).

Lectotype (here selected): Rockhampton, [Queensland], *[J.] Dallachy* (K). *Paralectotypes:* (1) Burdekin Expedition, [Queensland] (MEL 596305); (2) Bay of Inlets, Queensland, 1770, *J. Banks & D. Solander* (BM *n.v.*, BRI 392178). The last-named collection is *N. gracilis* Benth. var. *gracilis.*

Bentham cited three collectors and collection sites in the protologue and in view of the fine division of taxa in the genus it is worth lectotypifying the name. The Banks and Solander collection might serve this purpose but it appears to be *Neptunia gracilis* f. *gracilis*; there is no basal gland on the petiole and it is impossible to know the habit of the plant from which the collection was taken. Both the other collections represent the species but only the Dallachy specimen at K is annotated by the author of the name, although he also saw the Burdekin Expedition one. Windler (1966) only listed the collections seen by Bentham.

Neptunia monosperma F. Muell. ex Benth., Fl. Austral. 2: 300 (1864).

Lectotype (here selected): Gulf of Carpentaria, [?Queensland/Northern Territory], *[W.] Landsborough* (K, left-hand specimen); *isolecto:* (MEL 596310). *Paralectotypes:* (1) upper Victoria R., [Northern Territory], Dec 1855, *F. Mueller* (K, MEL 596309); (2) Albert River, [Queensland], *[D.] Henne* (MEL 596311).

In the protologue, Bentham lists three collectors and collection sites, but the Victoria River material collected by F. Mueller which Windler (1966) cites as "Type" in Mueller's herbarium represents three taxa: *N. monosperma, N. dimorphantha* and *N. gracilis* f. *glandulosa.* On the K sheet, specimens of the same three taxa are mixed, the two specimens on the left being *N. monosperma,* the centre one *N. dimorphantha* and the right-hand one *N. gracilis* f. *glandulosa.* That Bentham recognized the mixture is indicated by two slips in his hand on the sheet at MEL, one bearing the annotation "*N. monosperma*", the other "*N. gracilis* var. *villosula*", a synonym of *N. gracilis.* Consequently, although it would appear on the surface that Windler inadvertently had chosen a lectotype by naming the first of the three collections cited by Bentham, most of the material does not accord completely with the protologue. Moreover, Windler in his revision did not deliberately choose lectotypes but simply repeated the collection(s) cited in the protologue, and on this evidence alone, one might argue that he did not express a choice. It should also be noted that the herb. K specimen of Mueller gives only "Victoria River" and the MEL sheet of what is presumably the same collection has "Upper Victoria River/ Dec 1855", the locality as cited by Bentham.

The W. Lansborough specimen at Herb. K is chosen as lectotype of the name because it bears the publishing author's annotation in his own hand. The lectotype and the paralectotypes may have been collected in the Northern Territory but since so much more of the Gulf coastline is in Queensland, they are shown as Queensland/Northern Territory collections.

Mimosa distachya Vent., Descr. Pl. Nouv. Jard. J.M. Cels 5: 20 (1800), non Cav. (1795). *Type:* western coast of Australia at 34° latitude, probably near Esperance or in the islands off the coast at Esperance, [1792-1793], *F. Lahaie* (Voyage of La Recherche and L'Esperance), (presumably P but *n.v.*)

There is no evidence easily available that confirms the type of *Mimosa distachya* as having been collected by F. Lahaie, but in the Collectors' Index (1973), the inference under that name is that the collection came from the expedition cited above, even though Ventenat, the author of the binomial, spelled the collector's name "Lahaye" from whom he says he obtained the material. Neither version of the spelling of the collector's name appears in Marchant (1982) and it is likely that the specimen was collected by either Riche or one of the other botanists on the expedition. That it was collected in the Esperance area is highly likely, since it is the only place within the original range of the species in which the expedition landed a party ashore.

Paraserianthes toona (Bailey) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, ser. 4, vol. 5. Adansonia No. 3: 327; Adansonia No. 4: 356-357 (1983). - *Albizia toona* Bailey, Syn. Queensland Fl., Suppl.: 18 (1886). *Type:* Bowen, [Queensland, *F.M. Bailey*]; (*lecto:* BRI 025020, *fide* I. Nielsen, *loc. cit.* p. 357).

While the choice of the lectotype by Nielsen is very probably correct, it is based on the assumption that it is a Bailey collection because his manuscript description of the species is mounted on the sheet. In view of the many examples of mixed materials on herbarium sheets, one may retain a small doubt about the choice.

Pararchidendron pruinosum (Benth.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, ser. 4, vol. 5. Adansonia No. 3: 327 (1983). - *Pithecellobium pruinosum* Benth., London J. Bot. 3: 211 (1844).

Lectotype (here amended): Brisbane River, New South Wales, Oct. 1827, *A. Cunningham* 102 (K-Herb. Cunningham, left-hand fruiting); *?isolecto:* K-Herb. Cunningham. *Paralectotypes:* Brisbane River, Sept. 1824, *A. Cunningham* 70 (K-Herb. Cunningham; probably also represented in Herb. Bentham and Herb. Hooker but collection number on those sheets lacking).

Nielsen (1984) lectotypified this species on the basis of "*A. Cunningham* 102/1824, N.S. Wales, Brisbane River (K)", without discussion; the situation is a bit more complex and merits clarification.

There are three sheets at K, all bearing branchlets of this species and a few notes on each of the three sheets follows.

(1) The sheet from Cunningham's herbarium, presented by Robert Heward in 1862, has a single label in his hand showing 102/1827 and two of the three branchlets on the sheet have tied-on field tags, the left hand (fruiting) one with the notation "seed sent to Kew Feb. 1829/102/spn showing flowers"; the right hand (fruiting) specimen bears a tag with "1828/102"; and, finally, the Cunningham sheet has a central specimen (flowering) with a tag giving "70/Sept 1824". This sheet is not annotated by

Bentham, but that the material was probably used in drawing up the protologue validating the base name is suggested by the fact that he describes pods and the material in both his own and Hooker's herbarium lacks mature fruits.

(2) The Herb. Bentham sheet bears two specimens (neither with a collection number), one in flower at the top with a printed label, giving the type locality and with Bentham's annotation on it; the other specimen is in very young fruit and was collected by Bidwill and its label bears Bentham's annotation as well.

(3) The Herb. Hooker sheet has two specimens which may have been taken from the same tree: the left-hand specimen has mature leaves but is sterile; the right-hand specimen appears to be a duplicate of the flowering material on the Herb. Cunningham and Herb. Benth. sheets. The flowering branchlet bears a label in Cunningham's hand giving the type locality of Brisbane River but no collection number.

Even though the Cunningham Herbarium sheet is not annotated by Bentham, it is the only one with collection numbers and must therefore be the sheet which Nielsen identified as bearing the lectotype; however, he also did not annotate the sheet. Since there are at least two, possibly three, collections represented on the sheet, one of the specimens should be selected as the lectotype of the name. In view of Nielsen's having nominated *Cunningham* 102 as the lectotype, one of the two specimens tagged 102, both fruiting, must be chosen; the most representative of these, the specimen on the left side of the sheet, is chosen for this role. The date of collection must be changed to October 1827, the date given on the main label for the sheet.

Notes on two mimosoid taxa

Albizia amoenissima F. Muell., Fragmenta 8: 165 (1874). *Type:* extreme northeastern New South Wales, *W. Guilfoyle* (MEL 594731).

The specimen cited, the only material I have found in any of the major Australian herbaria, bears the annotation in (?) Mueller's hand: "Northern-Eastern boundary of N.S.W." and on the line below, in the place where the collector of Mueller's specimens is customarily indicated, is inscribed what appears to be a "G". This, I assume, refers to W.R. Guilfoyle, who is cited as the collector in the protologue. The material on the sheet consists of a leaf in two parts, the axes of an inflorescence and, in the packet attached, one complete flower that had been dissected (by Mueller?) and several buds, as well as numerous leaflets. The pinnae, in the limited sample available, occur in about 22 pairs with alternate leaflets in about 20 pairs. The sessile flowers have a calyx 10 mm long (including the 3 mm long, ovate-deltate lobes); the corolla tube is about 20 mm long with the narrowly lanceolate-triangular, reflexed lobes 8 mm long; and the stamens 40 mm long, the tube exserted about 6 mm beyond the mouth of the corolla. Both calyx and corolla are densely golden-brown tomentulose.

Bailey (1883) included the entity along with other *Albizia* taxa but seven years later in his Queensland Flora (1900), he synonymized it under *Pithecellobium moniliferum* (DC.) Benth. Kostermans (1954) followed suit but treated it as a synonym of *Cathormion umbellatum* (Vahl) Kostermans, a disposition accepted by Nielsen (1992) under subspecies *moniliforme* (DC.) Brummitt. It seems obvious that neither Bailey, Kostermans nor Nielsen saw the type, for the material represents a wholly different taxon from *Cathormion.*

While I have not been able to identify the specimen with any species of the genus *Serianthes*, its character states are surely those of the genus, which is not known to occur in Australia. There appear to be at least three possible scenarios to account for the apparent occurrence of the taxon in north-eastern New South Wales: (1) the specimen was grown from seed obtained by Guilfoyle in the course of his visit aboard the *Challenger* expedition in 1868 to several Pacific island groups north-east of Australia; (2) the specimen was collected during the course of his trip on the *Challenger* expedition and sent to Mueller after the Guilfoyle family had taken up a large parcel of land in the Tweed Heads area of New South Wales; and (3) the specimen represents a species which once occurred in New South Wales but has since perhaps become extinct.

The first explanation, that the specimen came from a tree grown at the Tweed Heads property from seed collected on one of the islands visited in 1868, appears unlikely, since only five years had elapsed between his return from the trip and publication of the binomial by Mueller and it is improbable that growth from seed to flower could occur in such a short time.

The second alternative, that Guilfoyle obtained the specimen either during the 1868 *Challenger* expedition or in connection with the nursery business carried on by the family, also seems unlikely. Assuming that the specimen was sent to Mueller from the Tweed Heads property, he might well have concluded, in his great enthusiasm for novelties, that the plant was growing at Tweed Heads and described it as such. The problem with this explanation is that the itinerary of the *Challenger* did not include many areas rich in *Serianthes* species; it included Pago Pago in American Samoa, Vavau, Fiji, the New Hebrides and New Caledonia. The genus is known commonly from New Caledonia but also occurs in Fiji. Consequently, accepting this explanation, one should attempt to identify the specimen with a New Caledonian or Fijian species. The nearest species in Nielsen (1983) is *S. sachetae* Fosberg but the match is not very satisfactory, for *S. sachetae* has fewer pairs of pinnae and more or less sericeous leaflets and somewhat pedicellate, smaller flowers. It occurs in the Noumea area of New Caledonia where the *Challenger* is known to have stayed briefly.

Finally, one must consider the possibility that the single specimen was taken from a tree growing wild in the forests of north-eastern New South Wales and that the species has become extinct as a consequence of the deforestation of that area. If one accepts this scenario, it follows that a new combination of the species epithet with *Serianthes* would be required. This hypothetical explanation is attractive, but to create a name for something that no longer exists, and perhaps never did exist in Australia, is an unnecessary addition to the list of non-functional binomials. The identity of *Albizia amoenissima* cannot be established with available information and will necessarily have to await rediscovery of the plant or further evidence to solve the mystery.

Mimosa pigra L., Cent. Pl. 1: 13 (1755).

If the Rules were strictly applied, this species would have to be referred to as *M. pellita* Humboldt & Bonpland ex Willd., as Barneby (1989: 139) has so cogently argued. However, rather than adhere to the stabilizing effect of following priority and the type method in the International Code of Botanical Nomenclature, past errors have been rendered artificially correct by the choice of a weedy specimen from Mozambique by Verdcourt (1989) as the type of *M. pigra nom. cons.*, a native of tropical South America!! Name changes are unfortunate but not so disastrous as the proponents of retrograde, generalized, contrived schemes to achieve nomenclatural stability would have us believe.

New species

Archidendron kanisii R.S. Cowan, *sp. nov.*

Arbor parva vel frutex 3 m altus partibus omnibus glabris. Folia bipinnata pinnis unijugatis; petioli teretes 1.5-2.5 cm longi, nectario elongato, apicale, anguste oblongo, depresso 2.5-3.8 mm longo ferenti; pinnarum axes 4-6 cm longi, nectario circulare ad ovale apicale ferenti; foliola 1 1/2-jugata, petiolulis 3-5 mm longis, laminis ellipticis ad anguste ellipticis oblongo-ellipticis, cuneatis et aequilateralibus basaliter, apice producto sed obtuso, 8.5-16.5 cm longis et 2.5-4 cm latis. Inflorescentiae axillares composito-umbellatae, circa 22 cm longae, pedunculis gracilibus 2.5-4.2 cm longis, inter se 5-10 floribus ferentibus. Flores cremei pentameri; calyx tubularis 4 mm longus, lobis triangularibus 0.1 mm longis; corolla peranguste infundibularis 11.5 mm longa, lobis lanceolatis 2.5 mm longis inclusis. Stamina numerosa circa 15 mm longa, ad basem in tubo circa 6 mm longo conjunctia. Gynoecium solitarium stipitatum anguste oblongum. Legumina et semina non vidi.

Typus: branch of Cooper Creek, Cook District, Queensland, 10 December 1986, *G. Sankowsky* 573 & *N. Sankowsky* (*holo:* BRI; *iso:* BRI).

Small *tree* or *shrub* 3 m tall, completely glabrous in all parts. *Branchlets* terete with several, low, longitudinal ribs, tan-brown. *Leaves* bipinnate with unijugate pinnae; petiole terete, 1.5-2.5 cm long with apical, elongate, narrowly oblong, depressed nectary 2.5-3.8 mm long; axis of pinnae 4-6 cm long with circular to oval, apical nectary; leaflets 1 1/2-jugate (basal leaflet solitary), the petiolules 3-5 mm long, the lamina elliptic to narrowly elliptic and oblong-elliptic, cuneate and equilateral at base, acuminate with blunt tip apically, 8.5-16.5 cm long, 2.5-4 cm wide; nervature more or less raised on both upper and lower surfaces, the tertiary nerves coarsely reticulate. *Inflorescences* axillary, compound-umbellate, *c.* 22 cm long; peduncles slender, 2.5-4.2 cm long, bearing 5-10 flowers each; bracteoles lanceolate, acute, *c.* 0.75 mm long, ciliolate. *Flowers* cream-coloured, 5-merous; calyx tubular, *c.* 4 mm long with triangular lobes *c.* 0.1 mm long; corolla very narrowly funnel-form, 11.5 mm long including lanceolate lobes *c.* 2.5 mm long. *Stamens* numerous, *c.* 15 mm long, united in a basal tube *c.* 6 mm long. *Gynoecium* solitary, stipitate, narrowly oblong, *c.* 2.5 mm long. *Pods* and seeds not seen.

Specimens examined. Only two specimens of the type collection have been seen.

Distribution. Known only from the type locality about 60 km south of Cooktown, Queensland in rainforest.

Etymology. Andries [Andrew] Kanis was preparing text for the "Flora of Australia" on the mimosoid legumes at the time of his sudden death in 1986. Consequently, it seems altogether fitting to name this new species in his memory and to recognize his contributions. I have used some of his materials and notes in the preparation of the manuscript of the subfamily, minus *Acacia,* for the Flora and naming the species for him is meant as a personal acknowledgement of his posthumous assistance.

Affinity. The new species is closely related to *A. muellerianum* but differs in a number of character states: *A. muellerianum* has a small, circular extrafloral nectary at the apex of the petiole, generally smaller leaflets, much shorter, more or less appressed puberulous flowers and inflorescences.

Acknowledgement

Support for the study from which these notes arose is gratefully acknowledged; a contract awarded by the Australian Biological Resources Study to the Western Australian Herbarium made the research possible.

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Notes on *Banksia* L.f. (Proteaceae)

A.S. George

'Four Gables', 18 Barclay Road, Kardinya, Western Australia 6163

Abstract

George, A.S. Notes on *Banksia* L.f. (Proteaceae). Nuytsia 11 (1): 21-24 (1996). *Banksia integrifolia* subsp. *aquilonia* is raised to specific rank, and *B. conferta* var. *penicillata*, *B. ericifolia* var. *macrantha* and *B. meisneri* var. *ascendens* to subspecific rank. *Banksia paludosa* subsp. *astrolux* is described as new. Lectotypes are chosen for *Banksia* sect. *Oncostylis* and *B. laricina*. *Banksia oblongifolia* subsp. *minor*, *B. occidentalis* subsp. *formosa* and *B. seminuda* subsp. *remanens* are not accepted.

Introduction

In preparation for a treatment of *Banksia* in the "Flora of Australia", a new subspecies is described, one taxon treated at varietal rank in my revision (George 1981) is raised to specific rank, and three taxa are accorded subspecific status in line with the concepts accepted in recent revisions of *Verticordia* (George 1991), *Synaphea* (George 1995) and *Dryandra* (George 1996). Two lectotypifications are made. Reasons are given for not accepting three infraspecific taxa published recently by other authors.

Lectotypifications

Banksia sect. **Oncostylis** Benth., Fl. Austral. 5: 542, 544 (1870)

Type: *B. ericifolia* L.f., (*lecto*, here chosen).

Discussion. Bentham included 13 species in the section. All are still placed there, but given the range of morphology of leaves, conflorescence and fruit it is appropriate to select a lectotype. The protologue diagnosis gives no lead to selection, hence *B. ericifolia* is chosen as the earliest-described of the included species.

Banksia laricina C. Gardner, J. Roy. Soc. Western Australia 47: 57 (1964).

Type: Beermullah, Western Australia, July 1958, *C.A. Gardner* 12840 (*lecto:* PERTH 01135708, here chosen; *isolecto:* PERTH 01135724); Moore River, Western Australia, July 1958, *C.A. Gardner s.n.* (*syn:* PERTH 01092898).

Discussion. At PERTH there are two sheets of *Gardner* 12840, one labelled 'Type Specimen' and with a label typed by him with the details in Latin as was often his practice, the second a duplicate from the material bequeathed to the Benedictine Community at New Norcia with a photocopy of the above typed label but no annotation as a Type. There is also a sheet of 'Moore River, July 1958, *C.A. Gardner s.n.*', with his hand-written label (also in Latin) but no annotation as a type. All are flowering specimens. The sheet with the 'Type Specimen' label is selected as lectotype.

New taxa and changes of status

Banksia aquilonia (A.S. George) A.S. George, *stat. nov.*

Banksia integrifolia var. *aquilonia* A.S. George, Nuytsia 3: 283 (1981); *B. integrifolia* subsp. *aquilonia* (A.S. George) Thiele, Austral. Syst. Bot. 7: 406 (1994). *Type*: Witts Lookout No. 1, Crystal Creek National Park, S of Ingham, Queensland, 12 April 1975, *A.S. George* 12973 (*holo*: BRI; *iso*: CANB, NSW, PERTH 04326067).

Discussion. This taxon was altered to subspecific rank by Thiele & Ladiges (1994), but I now consider it specifically distinct from *B. integrifolia.* Its leaf arrangement - spirally arranged but crowded - is readily recognizable through all growth stages from the first seedling leaves. Whorled leaves characterize all the plants that comprise *B. integrifolia. B. aquilonia* also has a unique row of short, stiff brown hairs each side of the midrib on the abaxial leaf surface, and its follicles typically are slightly larger than those of *B. integrifolia.*

Banksia conferta subsp. **penicillata** (A.S. George) A.S. George, *stat. nov.*

Banksia conferta var. *penicillata* A.S. George, Nuytsia 3: 289 (1981). *Type:* N of Clarence on the Newnes Tunnel Road, New South Wales, 6 April 1975, *R. Coveny* 3537 (*holo:* NSW; *iso:* PERTH 01579967).

Discussion. This also creates the autonym *B. conferta* A.S. George subsp. *conferta.* The subspecies are distinguished as follows: subsp. *conferta* has tessellated bark, entire adult leaves, pubescent involucral bracts and pubescent apices to the common bracts; subsp. *penicillata* has ± smooth bark, serrate leaves, villous involucral bracts and penicillate common bracts.

Banksia ericifolia subsp. **macrantha** (A.S. George) A.S. George, *stat. nov.*

Banksia ericifolia var. *macrantha* A.S. George, Nuytsia 3: 400 (1981). *Type: c.* 3 km NW of Byron Bay on road to 'Coast to Coast' Motel, New South Wales, 28 April 1975, *A.S. George* 13011 (*holo:* NSW; *iso:* CANB, PERTH 01580000, 01580019).

Discussion. This also creates the autonym *B. ericifolia* L.f. subsp. *ericifolia.*

Banksia meisneri subsp. **ascendens** (A.S. George) A.S. George, *stat. nov.*

Banksia meisneri var. *ascendens* A.S. George, Nuytsia 3: 448 (1981). *Type:* S of Tutunup (east of Busselton), Western Australia, 26 June 1973, *A.S. George* 11659 (*holo:* PERTH 01591142; *iso:* CANB, K, NSW, PERTH 01591150).

Discussion. This also creates the autonym *B. meisneri* Lehmann subsp. *meisneri*. The subspecies are distinguished on leaves and pistil length, subsp. *meisneri* having reflexed leaves 3-7 mm long and pistils 18-21 mm long, and subsp. *ascendens* ascending or spreading leaves 8-15 mm long and pistils 24-26 mm long.

Banksia oblongifolia Cav.

Discussion. Conran & Clifford (1987) published the combination *B. oblongifolia* subsp. *minor* (Maiden & Camfield) Conran & Cifford but their research covered mainly populations of *B. oblongifolia* in south-eastern Queensland. When the variation over the total range of the species is examined, it becomes clear that there is no morphological discontinuity at which a practical infraspecific distinction can be made.

When I published my revision of *Banksia* (George 1981), I had only photographs of the types of names published by Cavanilles (1800). Recently I had the opportunity to study the specimens themselves. The inflorescence on the lectotype sheet of *B. oblongifolia* (see Conran & Clifford 1987: 183) is from *B. marginata* Cav. and should be excluded from the type material of *B. oblongifolia*. This does not affect the current application of the name *oblongifolia*.

Banksia occidentalis R. Br.

Discussion. Hopper (1989) published *B. occidentalis* subsp. *formosa* Hopper, which he distinguished from typical *B. occidentalis* by its smaller stature, usually shorter, broader leaves and more floriferous habit. Each of these characters is variable to the extent that there is no clear disjunction within the species. At the type locality (Black Point), there is a transition from low plants with short, broad leaves at the seaward edge of the population to taller, narrow-leaved plants inland. The subspecies is not accepted here. Low or coarse-leaved coastal variants occur in a number of other Western Australian species but are not formally named. Examples may be seen in *Banksia* (e.g. *B. grandis* Willd., *B. media* R. Br.), in other Proteaceae (notably *Hakea prostrata* R. Br.) and other families, e.g. *Templetonia retusa* (Vent.) R. Br. (Fabaceae) and *Exocarpus sparteus* R. Br. (Santalaceae).

Banksia paludosa R. Br. subsp. **astrolux** A.S. George, *subsp. nov.*

Ab *Banksia paludosa* typica habitu non-lignotubero differt.

Typus: near Hilltop, north of Mittagong, New South Wales, 29 June 1990, *A.S. George* 16930 (*holo:* NSW; *iso:* BRI, K, MEL, NSW, PERTH).

Other collection examined. NEW SOUTH WALES: *c.* 17 km N of Mittagong, *B. Walters s.n.* (NSW).

Distribution. Restricted to several small populations north of Hilltop, New South Wales.

Habitat. Grows in sandy loam over sandstone in eucalypt forest.

Flowering period. May-August.

Etymology. Named from the Latin *aster* - a star, and *lux* - light, in reference to the locality which is at the beginning of an old track known as Starlight's Trail. Starlight was the name given to a bushranger of the area last Century.

Discussion. This has a habit similar to that of *B. conferta* subsp. *penicillata* A.S. George, i.e. non-lignotuberous, tall, and openly branched, but the flowers are quite like those of *B. paludosa* in being short and openly spaced in the conflorescence. The open spacing of the flowers in the conflorescence is characteristic of *B. paludosa* and occurs in no other species of ser. *Salicinae*. There is also no difference from typical *B. paludosa* in leaf and fruit morphology. It is geographically disjunct from typical *B. paludosa*, the nearest population of the latter being *c.* 30 km away.

Banksia seminuda (A.S. George) Rye

Discussion. Hopper (1989) described *B. seminuda* subsp. *remanens* Hopper, distinguishing it from typical *B. seminuda* by its shorter stature, more floriferous habit and usually shorter, less serrate leaves. Within the species, each of these characters is variable to the extent that there is no clear disjunction into infraspecific taxa, and the subspecies is not accepted here.

Acknowledgements

I am grateful to Kevin Thiele for providing a copy of his Ph.D. thesis (The University of Melbourne) and for a copy of the manuscript of his paper with Pauline Ladiges now (April 1996) submitted to "Australian Systematic Botany". I also thank the staff of the herbarium at the Real Jardín Botánico, Madrid, Spain, for their assistance in studying the material of *Banksia* in the Cavanilles collection during my recent visit.

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Reappraisal of *Scaevola oldfieldii* (Goodeniaceae) and recognition of a new species *S. kallophylla* from south-west Western Australia

G.J. Howell

School of Botany, University of Melbourne, Parkville, Victoria 3052

Abstract

G.J. Howell. Reappraisal of *Scaevola oldfieldii* (Goodeniaceae) and recognition of a new species *S. kallophylla* from south-west Western Australia. Nuytsia 11 (1): 25-31 (1996). Recent collection and cultivation of the two rare taxa included in *Scaevola oldfieldii sens. lat.*, showed that they are distinct species; *S. oldfieldii* F. Muell., a glabrous-leaved shrub to 2.3 m found on rocky slopes between the Murchison River and Geraldton; and *S. kallophylla* G.J. Howell *sp. nov.*, a pubescent, leafier shrub to 0.8 m on the sandy coastal plain between the Murchison and Greenough Rivers. The taxonomy is discussed and an additional couplet, amending the *Scaevola* L. key in the "Flora of Australia", is given to accommodate the new species. Both species are illustrated.

Introduction

Since last century taxonomists have been aware that two taxa were included in *Scaevola oldfieldii* but have chosen not to elevate them above varietal level (Mueller 1860; Diels & Pritzel 1905). Unfortunately, neither of these variants was extensively collected and when Carolin began his monograph for the "Flora of Australia" project (see Carolin 1990), the types had either been destroyed or were unassigned and the species was listed as extinct (Briggs & Leigh 1988).

Expeditions, conducted by myself and the Royal Botanic Gardens, to the Irwin Botanical District of Western Australia in 1991 and 1992, located two variants of *S. oldfieldii.* Cuttings of both variants were propagated at the Royal Botanic Gardens, South Yarra, and have retained their appearance after four years in cultivation. Subsequent examination of the herbarium and living specimens showed that the currently accepted concept of *S. oldfieldii* encompasses two species.

Taxonomic treatment

Mueller's (1860) original description of *Scaevola oldfieldii* mentions two varieties: *leiophylla* (leaves smooth) and *sericophylla* (leaves with silky hairs), but the remark did not constitute a formal description. Diels & Pritzel (1905) described a hairy variant as *S. oldfieldii* var. *tomentosa* E. Pritzel but the holotype has since been destroyed (Carolin 1990). Apparent similarity, rarity, infrequent

collection and the lack of provenance, soil and community information on older herbarium specimens led Carolin (1990) to synonymize this variety.

Carolin (1990) nominated a glabrous specimen (MEL 1521413) as the lectotype of *S. oldfieldii*. The lectotype and isolectotype (MEL 588152), originally from Mueller's herbarium, are glabrous plants from the Murchison River. Two other glabrous specimens from Mueller's herbarium (MEL 1521412, 1521413) have the varietal epithet '*leiophylla*' annotated on their original labels.

Herbarium specimens of the smooth and hairy variants appear remarkably similar and the taxa are more easily distinguished in the living state by the growth habit, flowers, leaf base and indumentum. The present study indicates that the two taxa separate on significant morphological differences and habitat preference and thus each warrants specific designation.

The hairy variant described here as *S. kallophylla* G.J. Howell *sp. nov.* may be synonymous with *S. oldfieldii* var. *tomentosa* but this cannot be tested in the absence of its type material. In any case the epithet, '*tomentosa*' cannot be used as *S. tomentosa* Gaudich. is a validly described and distinct species (Chapman 1991, Carolin 1992).

A major difficulty in using the keys to *Scaevola* species is their reliance on fruit characters. Since fruits of *S. kallophylla* have not been seen by the author, it was assumed that they are similar to those of *S. oldfieldii*. The *Scaevola* species key in the "Flora of Australia" (Carolin 1992) should be altered to read from couplet 14 in Group 3:

14 Flowers mostly in lateral spikes shorter than the leaves or solitary in the axils

14a Shrub to 2.3 m; stem glabrous; leaves petiolate without dense silky hairs in the axils; bracteoles > 3/4 length of corolla; flowers 11-21 mm long ..... **S. oldfieldii**

14a: Shrub to 0.8 m; stem with a fine indumentum; leaves sessile with dense silky hairs in the axils; bracteoles < 1/2 length of corolla; flowers 16-36 mm long ..... **S. kallophylla**

14: Flowers in terminal spikes mostly longer than the leaves

Scaevola oldfieldii F. Muell., Fragm. 2: 19 (1860) - *Lobelia oldfieldii* (F. Muell.) Kuntze, Revis. Gen. Pl. 2: 378 (1891). *Type:* Murchison River, [Western Australia], *A. Oldfield* (*lecto:* MEL 1521413; *isolecto:* MEL 1521412, MEL 588153). (Figure 1)

Shrub to 2.3 m high, older plants with the leaves frequently restricted to the branch tips. *Stems* glabrous. *Leaves* glabrous, acuminate, entire or distantly and sharply dentate, lanceolate to oblanceolate with the base attenuate-petiolate, 75.7-92.3 x 12.1-19.7 mm, axils with few or no hairs, veins camptodromous. *Flowers* sessile, white, streaked with maroon along veins, 11-21 mm long, 10-15 mm wide, borne in leaf axils singly or crowded onto short spikes *c.* 30 mm long rarely to 80 mm. *Bracteoles* > 3/4 length of corolla, pugioniform. *Corolla wings* frequently plicate or incompletely developed to 2.2 mm across, margin ragged. *Floral trichomes* - in corolla throat plumose; on style simple, pilose. *Indusium* 1.4-2.1 mm wide. *Ovary* doliform-turbinate, naked, 1-locular with two ovules. *Fruit* doliform-obovate 3.2 x 1.4 mm, rugulose (tuberculate according to Carolin 1992).

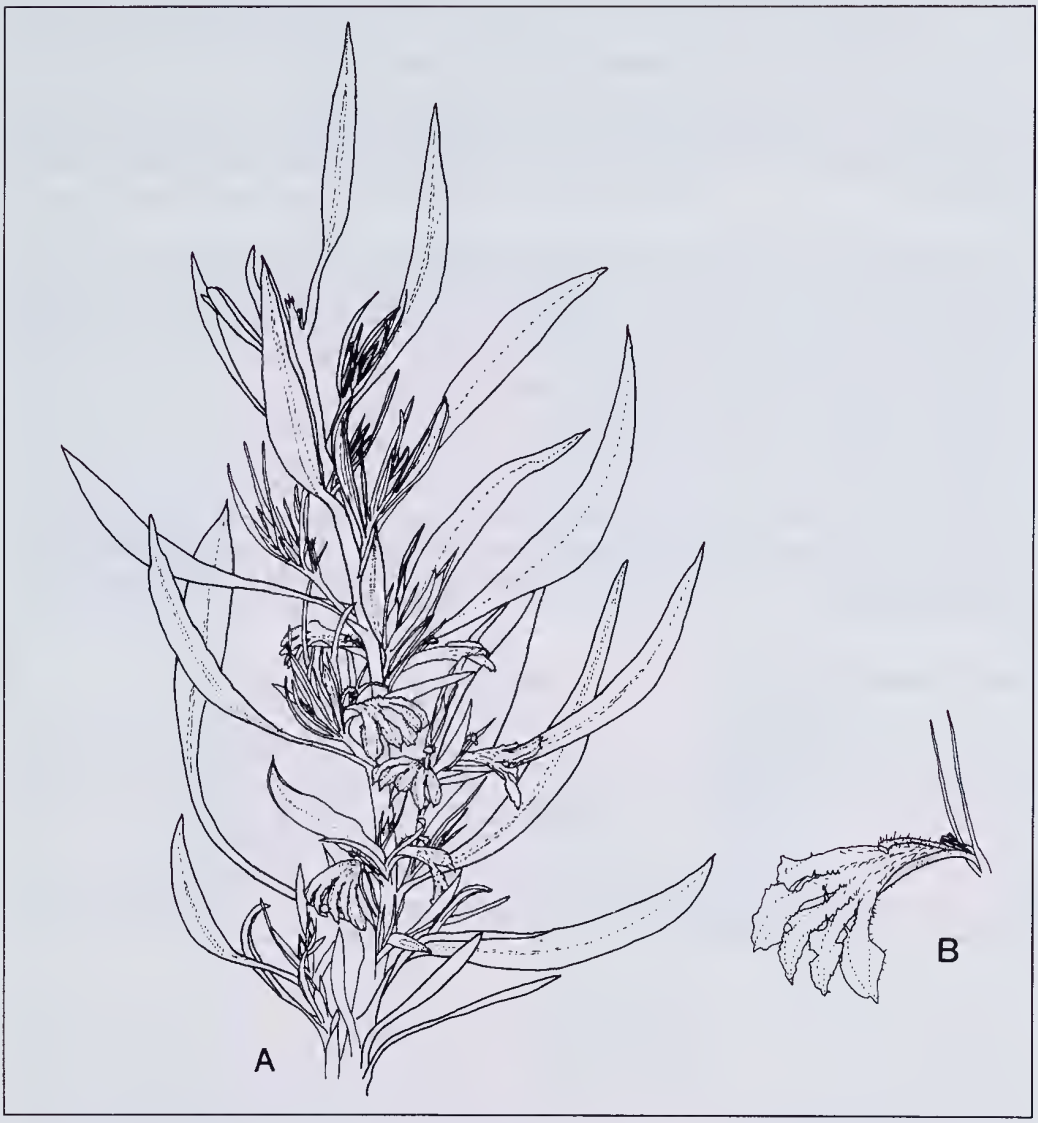

Figure 1. *Scaevola oldfieldii* A - flowering branch (x 0.7), B - flower (x1.3). Based on photographs taken of the 'Z-Bend' population (Kalbarri National Park, September 1991).

Other specimens examined. WESTERN AUSTRALIA: 12 miles [19.3 km] N of Northampton on North West Coastal Highway, 2 Sep. 1970, *A.S. George* 10731 (PERTH); Clay flats Hutt River, 11 Nov. 1972, *B.M.S. Hussey* (PERTH); 28°56'S, 115°09'E, 4.8 km W of Casuarina, 5 Dec. 1976, *R.J. Hnatiuk* 760336a (PERTH); 15.7 km W along fire track towards 'Z-bend' from eastern boundary to E side of Murchison River, Kalbarri National Park, 27°38'10"S, 114°30'10"E, Sep. 1991 *W.P.A. Worboyce* 671 (MEL); 27.6 km S of Northampton grain silo complex along North West Coastal Highway = 14.8 km N of Nabawa turn-off on edge of Geraldton, Sep. 1991, *W.P.A. Worboyce* 798 (MEL); West end of fire break to back of 'Z-bend', upper slopes of Murchison River, Kalbarri National Park, 28 Sep. 1991, *D.R. & B. Bellairs* 1452A (PERTH).

Distribution. From the Murchison River, south to Geraldton, Western Australia.

Habitat. Rocky slopes in mixed shrubland growing on shallow sandy soils.

Flowering period. In the field flowering occurs from August to December but this is apparently water-limited as the species continues to flower into April when grown under shade-house conditions in Melbourne.

Conservation status. Conserved within Kalbarri National Park but outside the park the species is vulnerable due to its small, patchy distribution. Briggs and Leigh (1988) gave this species a conservation code of 2X, but 3RC is considered to be more appropriate. A single genotype (*W.P.A. Worbyce* 671) has been propagated at the Royal Botanic Gardens, South Yarra (MRBG941568). CALM Conservation Codes for Western Australian Flora: Priority 3.

Etymology. Named in honour of A. Oldfield.

Affinities. Similar to *S. kallophylla*, especially as a herbarium specimen, but can be distinguished by its glabrous stems and petiolate leaves. Strongly resembles some erect variants of *S. repens* but is much taller. Hybrid progeny were created using *S. oldfieldii* pollen and a *S. repens* female parent (Howell unpublished data).

Scaevola kallophylla G.J. Howell, *sp. nov.* (Figure 2)

A *Scaevola oldfieldii* differt foliis sessilibus, oblanceolatus, fere mucronatis, breviter pubescentibus at cum pilis longis sericeis confertis in axillis; habitat non nisi inter flumina Murchison et Greenough, in campis maritimus arenosis neque in clivis rupestribus.

Typus: 27°46'S, 114°08'E, Kalbarri Airport turn-off, 3 km from Red Bluff on coastal road to Port Gregory, Kalbarri National Park, Western Australia, 31 October 1992, *G.J. Howell* 158 (*holo:* MEL 2028791; *iso:* MELU, PERTH).

Shrub to 0.8 m high, with terminal foliage appearing particularly dense due to the shorter internodes at the branch tips. *Stems* hairy, pubescent when young . *Leaves* almost hoary due to minute moniliform hairs (not easily discerned in herbarium specimens), almost mucronate, entire, though basal leaves may be remotely dentate, oblanceolate to obovate, 70.9-117.0 x 14.3-25.1 mm, sessile, with silky hairs in the axils sometimes extending onto the leaf-base, veins camptodromous. *Flowers* sessile, white, streaked with maroon along veins, 16-36 mm long, 20-35 mm wide, borne singly in leaf axils or on spicate lateral branches to 120 mm. *Bracteoles* < 1/2 length of corolla, lanceolate, 10-18 x 1.9-4.6 mm. *Corolla wings* flat, entire, 2.3-4.4 mm wide. *Floral trichomes* - in corolla throat simple; on style simple, villous. *Indusium* 2.4-3.1 mm wide. *Ovary* fusiform, naked, 1-locular with two ovules. *Fruit* not seen.

Other specimens examined. WESTERN AUSTRALIA: Champion Bay, 1877, F. Mueller? (MEL 15211416); Greenough River, Nov. 1877, unknown collector (MEL 1521414); Greenough River, Nov. 1877, unknown collector (MEL 1521415); 31 Aug. 1960, *Burns* 1029 (PERTH); 27°46'S, 114°08'E, Kalbarri Airport turn-off, 3 km from Red Bluff on coastal road to Port Gregory, Kalbarri National Park, 31 Oct. 1992, *G.J. Howell* 160 (MEL); 27°48'53"S, 114°08'19"E, 10 km south of Red Bluff, 25 May 1994, *R.J. Cranfield* 9230 (PERTH); 27°48'53"S, 114°08'19"E, south of Red Bluff,

Kalbarri National Park, 25 May 1994, *R.J. Cranfield* 9231 (PERTH); 27°51'53"S, 114°09'02"E, south-west edge of Kalbarri National Park, 29 Dec. 1994, *R.J. Cranfield* 9404 (PERTH).

Distribution. Coastal plain between the Murchison and Greenough Rivers, Western Australia.

Habitat. Coastal heath communities growing on light sandy soils. Vigorous recruitment noted amongst post-fire regenerating *Banksia* or *Acacia* shrubland/heath.

Flowering period. In the field flowering occurs from August to December but this is apparently water-limited as the species continues to flower into March when grown under shade-house conditions in Melbourne.

Conservation status. Conserved within Kalbarri National Park. Large numbers of plants were sighted on the coastal road to Port Gregory for *c.* 20 km south of the Kalbarri Airport. Briggs & Leigh (1988) do not distinguish between this species and *S. oldfieldii*, which is given the code 2X, however, a designation of 3RCa is considered to be more suitable. Two genotypes have been propagated at the Royal Botanic Gardens, South Yarra (*G.J.Howell* 158 = MRBG 941568, *G.J.Howell* 160 = MRBG 941563). CALM Conservation Codes for Western Australian Flora: Priority 4.

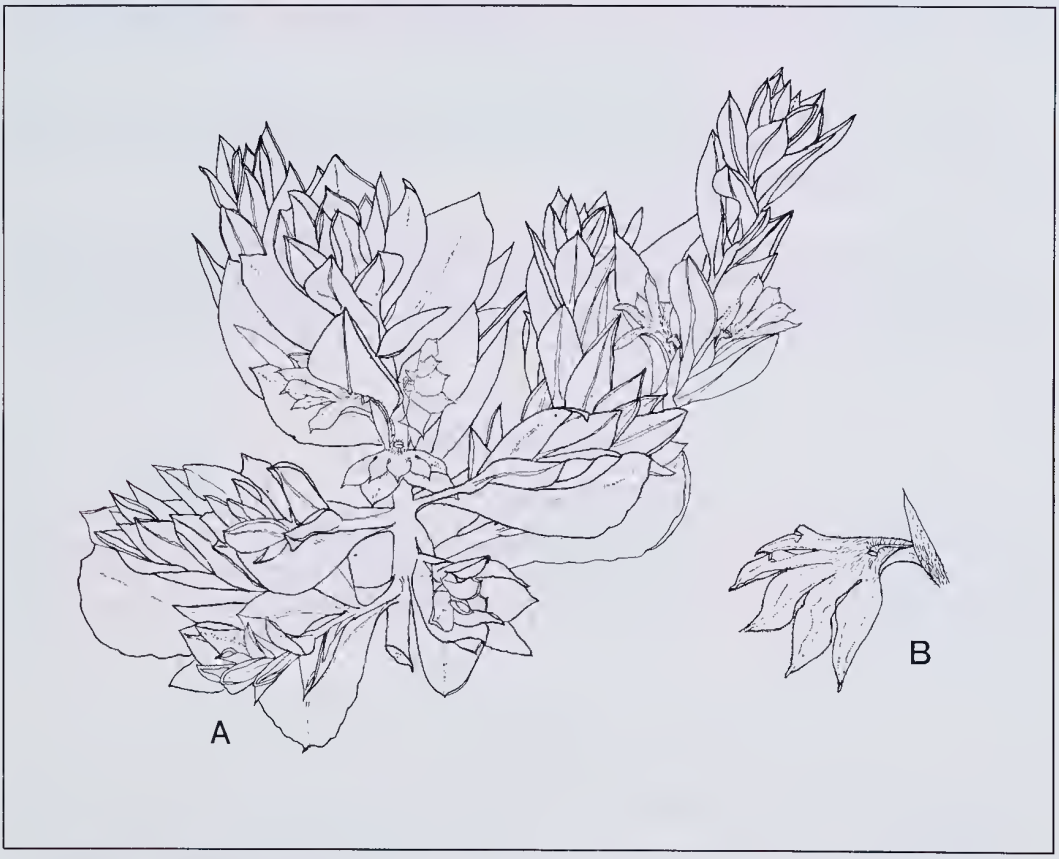

Figure 2. *Scaevola kallophylla* A - flowering branch (x 0.4), B - flower (x 0.8). Based on photographs taken of the 'Kalbarri Airport' population (Kalbarri National Park, October 1992).

Etymology. The specific epithet is derived from the Greek *kallos* - beautiful, and *phyllon* - leaf, alluding to its attractive foliage which resembles that of some *Callistemon* species.

Affinities. Similar to *S. oldfieldii,* especially as a herbarium specimen, but can be distinguished by the indumentum; the broader, sessile leaves and the longer inflorescences. Slight resemblance to *S. porocarya* but is more robust, the flowers are never in weak terminal spikes and are white rather than blue.

Discussion

In general the leaves of *Scaevola kallophylla* are much wider than those of *S. oldfieldii,* however, as a distinguishing feature the use of leaf size and shape alone may be misleading due to the gradation of vegetative leaves into the floral bracts in *S. kallophylla.* Fresh leaves of *S. kallophylla* can be easily distinguished by the presence of moniliform hairs but floral characters should also be considered when attempting to differentiate these species.

Scaevola kallophylla is probably a member of sect. *Xerocarpa* but confirmation can not be made in the absence of fruit. Little nectar was observed in *S. kallophylla* flowers either in the field or on plants grown in the glass house. An unidentified winged, Hymenopteran was observed to persistently enter flowers on plants at the Kalbarri Airport turn-off.

Scaevola kallophylla is an attractive plant which may have horticultural value though, unlike *S. oldfieldii*, it becomes decumbent when kept in pots for too long. In the glasshouse it is susceptible to attack by white fly and mealy bug.

The northern sand-plains of the Irwin Botanical District, in Western Australia, rank amongst the most floristically diverse regions in Australia, especially for *Scaevola* species (Carolin 1992). While such diversity may detract from the report of a new *Scaevola* in the region, the continued discovery of new species exemplifies the importance of this region to Australia's uncharted biodiversity.

Acknowledgements

I thank the Maud Gibson Trust of Victoria for the provision of the Maud Gibson Scholarship that made this work possible, Marco Duretto for reading this manuscript and George Scott for translating and writing the Latin diagnoses. I also gratefully acknowledge the help of the staff of the Royal Botanic Gardens (South Yarra and Cranbourne) for their cooperation and help collecting and propagating the material cited in this study.

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Grevillea maccutcheonii (Proteaceae), a new rare *Grevillea* from Western Australia

G.J. Keighery[1] and R.J. Cranfield[2]

[1] Western Australian Wildlife Research Centre, Department of Conservation and Land Management, PO Box 51, Wanneroo, Western Australia 6065
[2] Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Keighery, G.J. & Cranfield, R.J. *Grevillea maccutcheonii* (Proteaceae), a new rare *Grevillea* from Western Australia. Nuytsia 11(1): 33-36 (1996). A new species in the Proteaceae, *Grevillea maccutcheonii* Keighery & Cranfield, is described and illustrated. The species is critically endangered, being known from only 27 plants in the wild.

Introduction

During surveys for endangered flora on the Scott Coastal Plain (Keighery & Robinson 1992), and subsequently for a floristic classification of the Swan Coastal Plain (Gibson *et al* 1994), it became apparent that at least 12 unnamed taxa were endemic to shallow winter-wet red clay flats over ironstone found on both the Swan and Scott Coastal Plains. Three of these taxa have since been described as *Grevillea elongata* (Olde & Marriott 1994), *Brachysema minor* and *B. papilio* (Crisp 1995). Taxa still awaiting description include two species of *Darwinia* and a new *Chamelaucium* (being described by one of us (GJK) together with N.G. Marchant of the Western Australian Herbarium), a new *Loxocarya* (being described by B.G. Briggs and L.A.S. Johnson of the National Herbarium, Sydney), a new *Actinotus*, and new subspecies of *Calothamnus quadrifidus*, *C. lateralis* and *Grevillea manglesioides*.

This geomorphic unit has been largely cleared for grazing, and most taxa are reduced to remnant populations along road verges, or on the edges of State Forest Blocks. Six species, including the new *Grevillea* described here, are already under, or are proposed for, legal protection as Declared Rare Flora.

Taxonomy

Grevillea maccutcheonii Keighery & Cranfield, *sp. nov.*

Grevilleae manglesioides et *Grevilleae ripicolae* affinis, a qua imprimis differt ramulo glabro, foliis glabris, foliis amplexicaulibus, panduriformibus, duri, apicem pungentiem et floribus majoribus.

Typus: South-east of Busselton [precise locality withheld for conservation reasons], Western Australia, 6 November 1993, *G.J. Keighery* 13786 (*holo:* PERTH 04110390; *iso:* AD, CANB, K, MEL, NSW).

Erect, spreading densely branched, domed *shrub* to 2 m high and 2 m wide, not lignotuberous or suckering. *Branchlets* terete, glabrous, reddish green, young growth red. *Immature leaves* entire or with a single apical lobe. *Mature leaves* sessile, pandurate, 12-33 mm long (mean 19), 6-22 mm wide (mean 11), with a central sinus, base stem-clasping, amplexicaule, rigid, glabrous, with a distinct white margin, margin flat, 3-lobed, one lobe apical, the others shortly below on either side, each lobe terminating in a black pungent point *c.* 1 mm long, shiny green above, dull green below, mid vien prominent when dry on both surfaces. *Inflorescence* terminal, racemose, 26-42-flowered, ?lower flowers more widely spaced than upper flowers; peduncle glabrous, 10-12 mm long; rachis glabrous, markedly decurved, usually simple, rarely two-branched; unit inflorescence 2-4 cm long, loosely hemispherical and secund to subsecund, acropetal. *Inflorescence bract* leaf-like, narrowly cordate. *Floral bracts* ovate, *c.* 1 mm long, 1 mm wide, margin hairy, caducous when buds are small. *Pedicels* 2-3 mm long, glabrous, green, torus oblique. *Flowers* reddish green, acroscopic. *Perianth* 6-8 mm long, narrowly ovate-oblong below the curve, *c.* 3 mm wide, green, glabrous outside, inside margins of tepals with a line of hairs and bearded in the throat above the ovary. *Nectary* prominent, yellow, broadly lunate. *Pistil* 20-24 mm long, glabrous; stipe 2-3 mm long; ovary obliquely ovoid, 1-2 mm long, green; style red; pollen presenter at 90 degrees, almost round, green; stigma almost central. *Fruits* brown, narrowly and obliquely ovoid, 13-16 mm long, 5-6 mm wide, surface smooth, pericarp uniform and *c.* 0.5 mm thick. *Seeds* narrowly oblong, 7-8 mm long, 2-3 mm wide, outer face markedly convex, margin revolute, inner face channelled, eliasome lacking. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: Tutunup area, *G.S. McCutcheon* 2694 & 2718 (PERTH).

Distribution. Known only from a small area near the base of the Whicher Range, south-east of Busselton, Western Australia.

Habitat. Occurs on perched wetlands called the Abba Wet Ironstone Flats, on shallow red sandy clay soils over ironstone. Associated species are a tall shrubland of *Viminaria juncea*, *Dryandra* sp., *Calothamnus quadrifidus*, *Hakea* aff. *varia* over low shrubs and sedges (Gibson *et al.* 1994). This unit is on the interface between the Swan Coastal Plain and the Whicher Scarp.

Phenology. Recorded in flower between May and December, peak flowering July to November. The flowers were probed by Brown, White Cheeked and New Holland Honeyeaters in November 1993. Mature fruits were found in April and May.

Conservation status. This species is Declared Rare Flora under the Western Australian Wildlife Protection Act. The species is considered as critically endangered, being known from a few plants on one road verge, and is the subject of a separate recovery plan.

Etymology. The epithet honours Grahame McCutcheon (born 21 September 1930, formerly an ecologist in the Environmental Protection Division of CALM), who has considerably aided the knowledge and conservation of the flora of the Busselton to Augusta area. It is fitting that this attractive and rare species confined to the area he knows so well will bear his name. The specific epithet is spelt "*maccutcheonii*" according to the International Code of Botanical Nomenclature of 1994, Recommendation 60C.4(a).

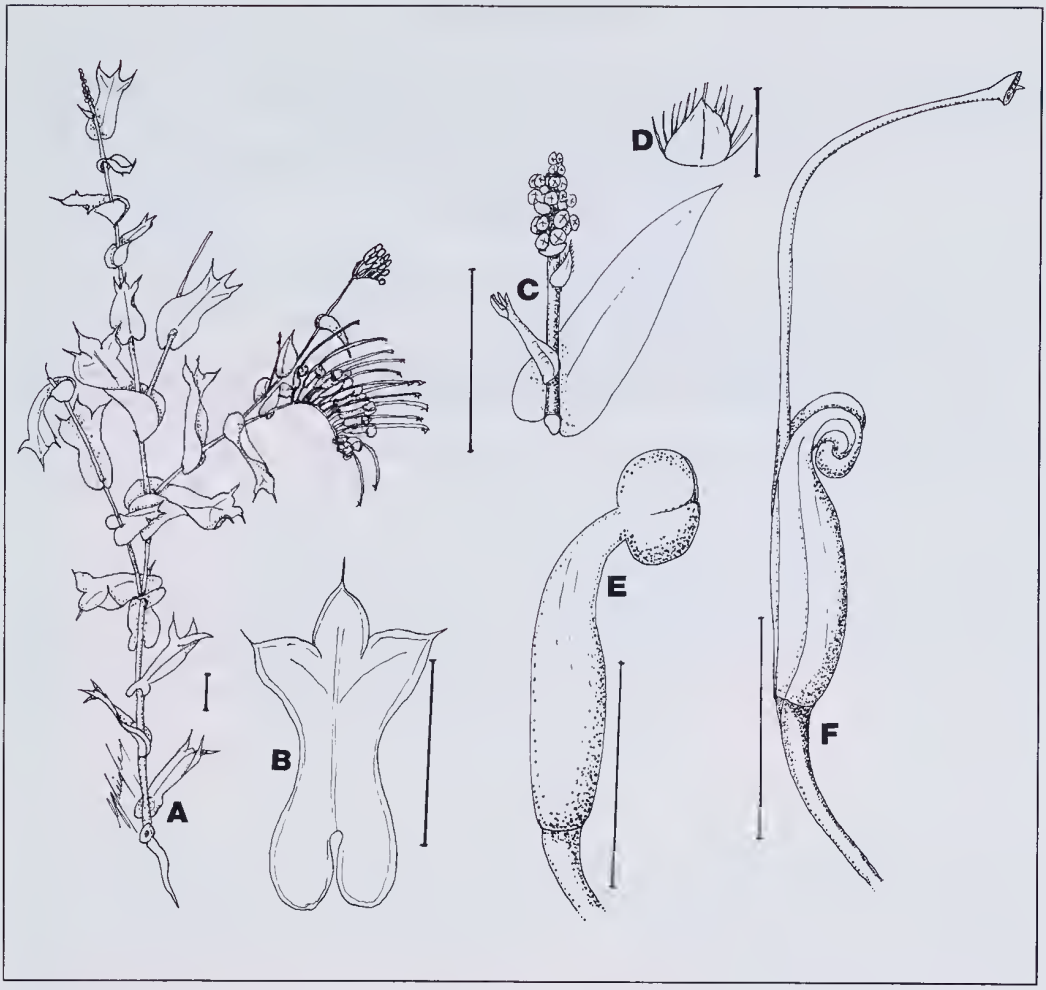

Figure 1. *Grevillea maccutcheonii* A - flowering stem, B - mature leaf, C - inflorescence at early bud stage, D - bract, E - bud, F - mature flower. Scale bar A, B, C, E & F = 10 mm, D = 1 mm. All from *Keighery* 13786.

Discussion. This species is related to *Grevillea manglesioides* Meisn., a species confined to the Busselton to Augusta area (Olde & Marriott 1995). *Grevillea manglesioides* occurs in the same area on the same geomorphic unit, but is parapatric with *G. maccutcheonii.*

The new species differs from *G. manglesioides* and the two other related taxa of this complex (*G. diversifolia* Meisn. and *G. papillosa* (D.J. McGillivray) P.M. Olde & N.R. Marriott) in having panduriform, rigid stem-clasping leaves and larger flowers (pistil 20-24 mm long *vs* 6-11 mm in all other members of the species complex). A less significant character distinguishing *G. maccutcheonii*, is that all ages of vegetative and floral organs are glabrous, with the exception of the margins of the floral bracts.

The new species could also be related to *Grevillea ripicola* A.S. George, but this has leaves that are sessile, narrow, divaricately pinnatipartite, once or twice divided into curved linear pungent lobes and with the upper surface silky hairy when young.

Acknowledgements

The authors are grateful to Grahame McCutcheon for bringing this species to our attention, and for surveying the population, and to Paul Wilson for the Latin diagnosis.

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A taxonomic revision of *Macarthuria* (Molluginaceae) in Western Australia

B.J. Lepschi

Western Australian Herbarium, Department of Conservation and Land Management, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Lepschi, B.J. A taxonomic revision of *Macarthuria* (Molluginaceae) in Western Australia. Nuytsia 11 (1): 37-54 (1996). The genus *Macarthuria* (Molluginaceae) in Western Australia is revised, and six species are recognized. A key and distribution maps are provided, along with illustrations of selected species. *Macarthuria keigheryi* Lepschi and *M. vertex* Lepschi are described as new, and the name *Macarthuria australis* Hügel ex Endl. is neotypified.

Introduction

The endemic Australian genus *Macarthuria* Hügel ex Endl. consists of approximately ten species, five of which are endemic to the south-west of Western Australia, with the remainder occurring in northern and eastern Australia. Of the species indigenous to Western Australia, two are unnamed, and four (including one of the undescribed taxa) are regarded as rare or threatened. This paper provides formal names for the undescribed taxa and reviews the taxonomy of all species known to occur in Western Australia.

Three named species (*M. complanata* E.M. Ross, *M. ephedroides* C.T. White and *M. neocambrica* F. Muell.) and two unnamed species (one of which is newly described here as *M. vertex* Lepschi) occur in eastern and northern Australia. The taxa endemic to eastern Australia are not treated further in this paper, other than in regard to their relationships to Western Australian species.

Macarthuria has variously been included in Aizoaceae (e.g. Mabberley 1987, Stanley & Ross 1983), Molluginaceae (e.g. Beadle *et al.* 1982, Eckardt 1964) or subfamily Molluginoideae within Aizoaceae (e.g. Jacobs & Highett 1990, Prakash 1967). Recent studies on the Aizoaceae *s.l.* (e.g. Bittrich 1988, Endress & Bittrich 1993) have favoured recognition of Molluginaceae, and this is followed here. Research on generic relationships within Molluginaceae has been summarized by Endress & Bittrich (1993) who suggest the Afro-Asian genus *Limeum* L. as the closest relative of *Macarthuria*.

Taxonomic history

Macarthuria was described by S.L. Endlicher in 1837 (Endlicher 1837) to accommodate a single species, *M. australis*, the type of the genus. Steudel (1845), working with material collected by L. Preiss, described *M. foliosa* (synonymous with *M. australis*), with *M. apetala* added by Harvey (1855) and *M. neocambrica* by Mueller (1865). Mueller was apparently also aware of an additional taxon to which he applied the manuscript name *M. apetala* var. *rigidor*, but it was not until 1982 that this plant was formally described as *M. intricata* (Keighery 1982). Three other species have been recognized in recent times, *viz: M. ephedroides* (White 1946), *M. georgeana* (Keighery 1983) and *M. complanata* (Ross 1984).

Materials and methods

This study is based on examination of herbarium collections from BRI, CANB (including CBG), DNA and PERTH, with selected material from K, KPBG, LD, MEL and TCD. All measurements were made from dried specimens, reconstituted in the case of reproductive organs. Terminology for indumentum follows Hewson (1988).

Notes on morphology

Shape and size of leaves varies greatly depending on the stage of growth of the plant. Seedlings, plants regenerating from the rootstock following fire or other disturbance and plants producing new growth at the beginning of the growing season all have larger leaves at the base of the plant (occasionally in a false rosette), and on new stems. These basal leaves are often withered at anthesis and are gradually lost, with the plant producing reduced leaves further up the stems. Basal leaves have been seen in all species treated in this study, except *M. georgeana* and *M. intricata*, and are included in the descriptions. Such leaves have also been seen in the eastern Australian species *M. complanata*, *M. neocambrica* and an unnamed taxon from northern Queensland, but in *M. neocambrica* the basal leaves are usually persistent (in a false rosette), as are the variously developed cauline leaves.

Seedling plants of *M. apetala* (at least the 'southern variant' of this species) and *M. vertex* may flower and fruit when quite young, and with their basal leaves still present are superficially similar to the predominantly herbaceous *M. neocambrica* (see above). The more usual case for these species would appear to be a period of active vegetative growth, followed by flowering and fruiting once the plant is established.

For this study filament lengths are measured from the base of the point of divergence from the staminal ring to the filament apex.

Taxonomic treatment

Macarthuria Hügel ex Endl.

Endlicher (1837: 11). *Type: Macarthuria australis* Hügel ex Endl.

Perennial *herbs, subshrubs* or *shrubs* to 1.5(2) m tall, glabrous or rarely hairy. *Stems* rigid, terete, rarely intricate, flattened or winged. *Leaves* mostly cauline, rarely also basal, alternate, becoming progressively reduced further up the stem, occasionally all reduced to scales. *Inflorescence* cymose, sometimes open and dichotomous, 1-many-flowered, inserted laterally or terminally on the branches, flowers pedicellate. *Sepals* 5, free, in two whorls. *Petals* 5, white to cream, free, or absent. *Stamens* 8, inserted on a staminal ring. *Ovary* 3-locular, with 1-3 ovules per locule. *Style* branches 3, stigma at apex of each. *Fruit* a loculicidal capsule. *Seeds* ± reniform to almost ellipsoid, dark, seed coat often sculpted, arillate.

Distribution. Ten or more species endemic to Australia, of which five are endemic to south-western Western Australia, the remainder occurring from the Kimberley region eastwards to the Northern Territory and Queensland, and south to northern New South Wales.

Etymology. After Sir William Macarthur, 1800-1882, horticulturalist and agriculturalist (Baines 1981).

Key to species of *Macarthuria* in Western Australia

Note: the inner whorl of sepals could be misinterpreted as petals; flowers with petals have ten perianth parts (five sepals, five petals), apetalous flowers only five perianth parts (five sepals). Care should also be taken when examining over-mature flowers and young fruits, as the petals may have been shed.

1 Flowers 1-6 in cymes at the apex of the ultimate inflorescence branchlets (rarely some borne laterally as well). Kimberley region of Western Australia and monsoonal Northern Territory ..... **M. vertex**

1: Flowers 1-many in generally ± condensed cymes borne laterally and occasionally terminally as well, on the main stems (if flowers consistently 1 or 2, then always lateral). South-western Western Australia 2

2 Plant hairy ..... **M. keigheryi**

2: Plant glabrous (very rarely some small papillae may occur in *M. apetala*) 3

3 Petals always present, conspicuous, 2-4 mm long 4

4 Stems distinctly verrucose, rusty brown or glaucous; all leaves reduced to appressed, triangular scales; cymes consistently 1- or 2-flowered, ovary with 1 ovule per locule ..... **M. georgeana**

4: Stems smooth, green; leaves variously developed, but never all reduced to appressed triangular scales; cymes 1-many-flowered, ovary with 2-3 ovules per locule ..... **M. australis**

3: Petals generally absent (occasionally produced in *M. apetala*); when present, inconspicuous, 0.7-1.8 mm long 5

5 Intricately branched shrub; all leaves reduced to appressed triangular scales. Shark Bay to Kalbarri ..... **M. intricata**

5: Erect, little-branched subshrub, not intricate; leaves often small, but never all reduced to appressed triangular scales. Eneabba to Esperance ..... **M. apetala**

1. Macarthuria apetala Harv. (Harvey 1855: 55). *Type:* W[estern] Australia, *J. Drummond s.n.* (*holo*: TCD (photo BRI, PERTH)).

Erect *subshrub* to 30 cm tall, glabrous or rarely with some poorly developed papillae on vegetative parts. *Stems* terete, wiry or more or less stout, greenish to red-brown, often glaucous when dried. *Leaves* present mainly towards the base of the stems and on young growth, becoming progressively reduced further up the stems, sessile to obscurely petiolate; lamina narrowly to linear-obovate, or narrowly elliptic to linear, 1.2-30 mm long, 0.3-3 mm broad; base very narrowly cuneate to attenuate; apex acute to narrowly acute or very shortly acuminate. *Inflorescence* of 1-20 flowers in generally somewhat condensed cymes, inserted laterally (or rarely terminally) on the stems. *Bracts* broadly triangular to triangular, 0.5-1.5 mm long, herbaceous with a narrow scarious margin, brown. *Pedicels* 1-3 mm long. *Sepals* elliptic to broadly elliptic, 1.3-2.3 mm long, herbaceous (inner 2 less strongly so), with a narrow scarious margin. *Petals* usually absent; if present, narrowly to very narrowly obovate to very narrowly elliptic or (rarely) obovate, 0.7-1.8 mm long, base attenuate, not clawed. *Staminal ring* about half as long as ovary; free filaments 0.3-1.2 mm long; anthers 0.3-0.5 mm long. *Ovary* 1-1.3 mm long, with 1 ovule per locule; style branches 0.2-0.5 mm long. *Fruit* ovoid to more or less globular, 1.5-3 mm long. *Seeds* black, tuberculate to pusticulate, shining, broadly comma-shaped, 1.2-1.7 mm long; aril large.

Distribution. Largely subcoastal, occurring in scattered populations from Eneabba southwards to Northcliffe and east as far as Esperance, Western Australia. (Figure 1)

Conservation status. Previously listed as Priority 2 under CALM Conservation Codes for Western Australian Flora. Following this review, this taxon has been removed from the Priority Flora listing as it is more widespread than previously thought, with a number of populations occurring on protected lands. For definitions of conservation codes used by the Department of Conservation and Land Management, see the end of this issue.

Typification. Harvey (1855) did not cite any type material in the protologue of his new species. However, at TCD (the herbarium at which Harvey was curator (Ducker 1988, Stafleu & Cowan 1979)), there is a Drummond specimen comprising an entire, fertile plant, possibly labelled in Harvey's hand (S.C. Ducker pers. comm.) which accords well with the original description of *M. apetala*. This specimen is treated here as the holotype of this name.

At herb. K, MEL and PERTH there are other Drummond collections (both numbered and unnumbered) of *M. apetala*, but none appear to be annotated by Harvey. It is not possible to ascertain with any certainty whether any of these specimens represent duplicates of the holotype and therefore they are not accorded type status. The collections in question are: (1) Swan River, *J. Drummond* 677 (K, four sheets (one ex herb. Benthamianum, three ex herb. Hookerianum); (2) W.A., *J. Drummond* 677 (MEL 723999); (3) Swan River, *J. Drummond* 10 (K (ex herb. Hookerianum)); (4) W. Austr., *J. Drummond s.n.* (MEL 1058091, 1058092, 1058093 (ex herb. O.W. Sonder)); (5) West. Austr., *J. Drummond s.n.* (PERTH 01298259 (ex MEL)).

Notes. The combination of (usually) apetalous flowers, tuberculate to pusticulate seeds, sub-shrubby habit with erect, little-branched stems and overall glabrous nature serve to distinguish this species from all other taxa in Western Australia. The eastern Australian species *M. complanata* and *M. ephedroides* (in part) are also apetalous, but are distinct in their flattened to winged stems and inflorescence structure.

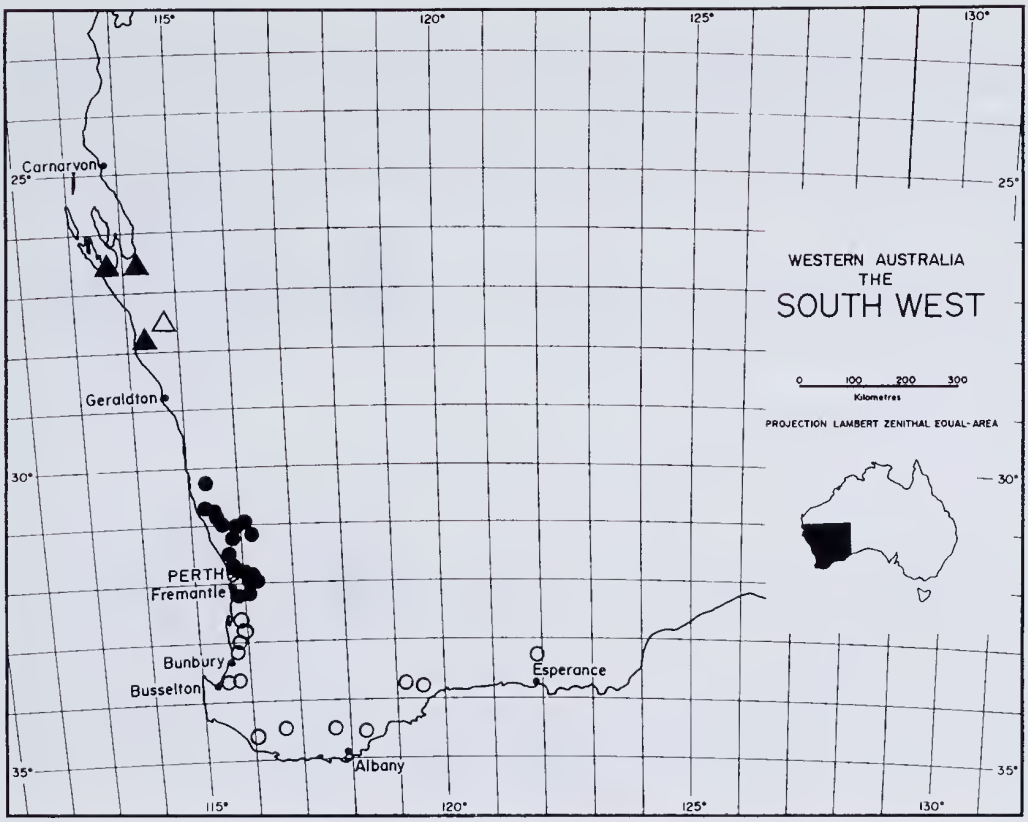

Figure 1. Distribution of *Macarthuria apetala* Variant 1 (typical variant) (●), *M. apetala* Variant 2 (southern variant) (○), *M. georgeana* (△) and *M. intricata* (▲).

Despite its name, this species sometimes produces petals. Petals were seen in some of the collections examined (e.g. *George* 3153, 15030, *Griffin* 8529, *Newbey* 11787, *Spjut* 7396), spread throughout the range of the species, and there is no correlation with other morphological characters and the presence of petals.

The name *Macarthuria apetala* Harv. has long been misapplied to *M. vertex*, a species with petal-bearing flowers from northern Australia (e.g. Chippendale 1971, Lazarides, *et al.* 1988, Specht & Mountford 1958).

M. apetala regenerates strongly from the rootstock following fire or mechanical disturbance, with recruitment of seedlings apparently also occurring after fire (G.J. Keighery, C.D. Turley pers. comm.).

A flowering collection (*D.M. Rose* 411) from Dryandra National Park, north-west of Narrogin, may belong here. It most closely resembles this species but differs in the presence of numerous, moderately well-developed papillae on the vegetative parts and also on the outer whorl of sepals (approaching those found in some individuals of *M. vertex*). Such processes are occasionally seen in other collections of *M. apetala* (such as *Keighery* 2652), but are generally less well developed and are restricted to the vegetative parts. *Rose* 411 may simply represent a variant of *M. apetala*, but the locality is outside the known range of this species.

Variation. Two variants are evident in *M. apetala*, with populations occurring south of Keysbrook (*c.* 17 km south of Mundijong) having consistently larger fruit and seeds than plants from northern populations. The inflorescences of plants from southern areas also tend to be somewhat more congested and fewer-flowered, and the seed coat is often pusticulate rather than tuberculate. However, there is some break-down in the quantitative characters, and the degree of separation between the variants on the dimensions of fruit and seed alone is not considered sufficient to warrant formal taxonomic recognition.

On present collections the two variants are separated by approximately 30 km, but further collecting will almost certainly extend the distributions of one or both variants into the intervening country between Keysbrook and Forrestdale.

Variant 1 (typical variant).

Fruit 1.5-2 mm long. *Seeds* tuberculate, 1.2-1.4 mm long. (Figure 2A-E)

Selected specimens examined. WESTERN AUSTRALIA: Anketell Road, Forrestdale, 16 Jan. 1980, *R.J. Cranfield s.n.* (CANB, PERTH); 1 mile [*c.* 1.6 km] S of Regans Ford, 20 Nov. 1961, *A.S. George* 3153 (PERTH); Strathmore Road Reserve (no. 26248), S of Badgingarra, 5 Nov. 1975, *A.S. George s.n.* (PERTH); Mogumber West road, E of Brand Highway, W of Mogumber, 17 Dec. 1992, *E.A. Griffin* 8529 (PERTH); Dennis De Jong Reserve, Jandakot, 21 Feb. 1992, *G.J. Keighery* 12722 (PERTH); 8 km W along Cadda Road from Brand Highway, 8 Oct. 1991, *S.J. Patrick* 882 (PERTH); Maida Vale, near Perth, 24 Oct. 1962, *M.E. Phillips s.n.* (CBG); *c.* 23 km W of Gingin, 30 Nov. 1974, *R. Pullen* 9745 (CANB); Miling-Roundhill, 18 Mar. 1964, *R.D. Royce* 8125 (CANB, PERTH); 4 km S of Jurien Bay, 12 Sep. 1973, *P.G. Wilson* 11559 (PERTH).

Distribution. Occurs in scattered populations from Eneabba south to Forrestdale (on the southern edge of Perth). Generally subcoastal in distribution, but extending to the coast in some sites, and inland as far as Mogumber and Miling.

Habitat. Recorded from heath and low *Eucalyptus* woodland with a heath understorey on grey or white sands, often in burnt sites or other disturbed areas.

Phenology. Flowering September to April, fruiting November to March.

Variant 2 (southern variant).

Fruit 2-3 mm long. *Seeds* pusticulate to tuberculate, 1.4-1.7 mm long. (Figure 2F-G)

Selected specimens examined. WESTERN AUSTRALIA: N end of Lake Muir, 2 Nov. 1977, *A.S. George* 15030 (PERTH); Capel Nature Reserve, 8 Nov. 1992, *B.J. Keighery & N. Gibson* 769 (CANB, K, PERTH); *c.* 5 km SW of Mondurup, unnamed hill, SW edge Stirling Ranges, 22 Nov. 1979, *G.J. Keighery* 2652 (KPBG); Capel Nature Reserve, 19 Dec. 1991, *G.J. Keighery s.n.* (CANB, PERTH); Adjacent Yarloop rubbish tip, *c.* 1.5 km ESE of Yarloop Railway Station, 17 July 1995, *B.J. Lepschi & T.R. Lally* 1919 (PERTH); 7 km NNE of Woolbernup Hill, Fitzgerald River National Park, 21 Nov. 1985, *K.R. Newbey* 11067 (PERTH); 24 km N of Cape Riche, 21 Oct. 1987, *K.R. Newbey* 11787 (PERTH); Bluman's Farm, Gibson, 20 May 1995, *C.D. Turley* 1/595b (CANB, MEL, NSW, PERTH); Summertime Track, *c.* 13 km SSW of Northcliffe, 19 Feb. 1989, *G. Wardell-Johnson* 38

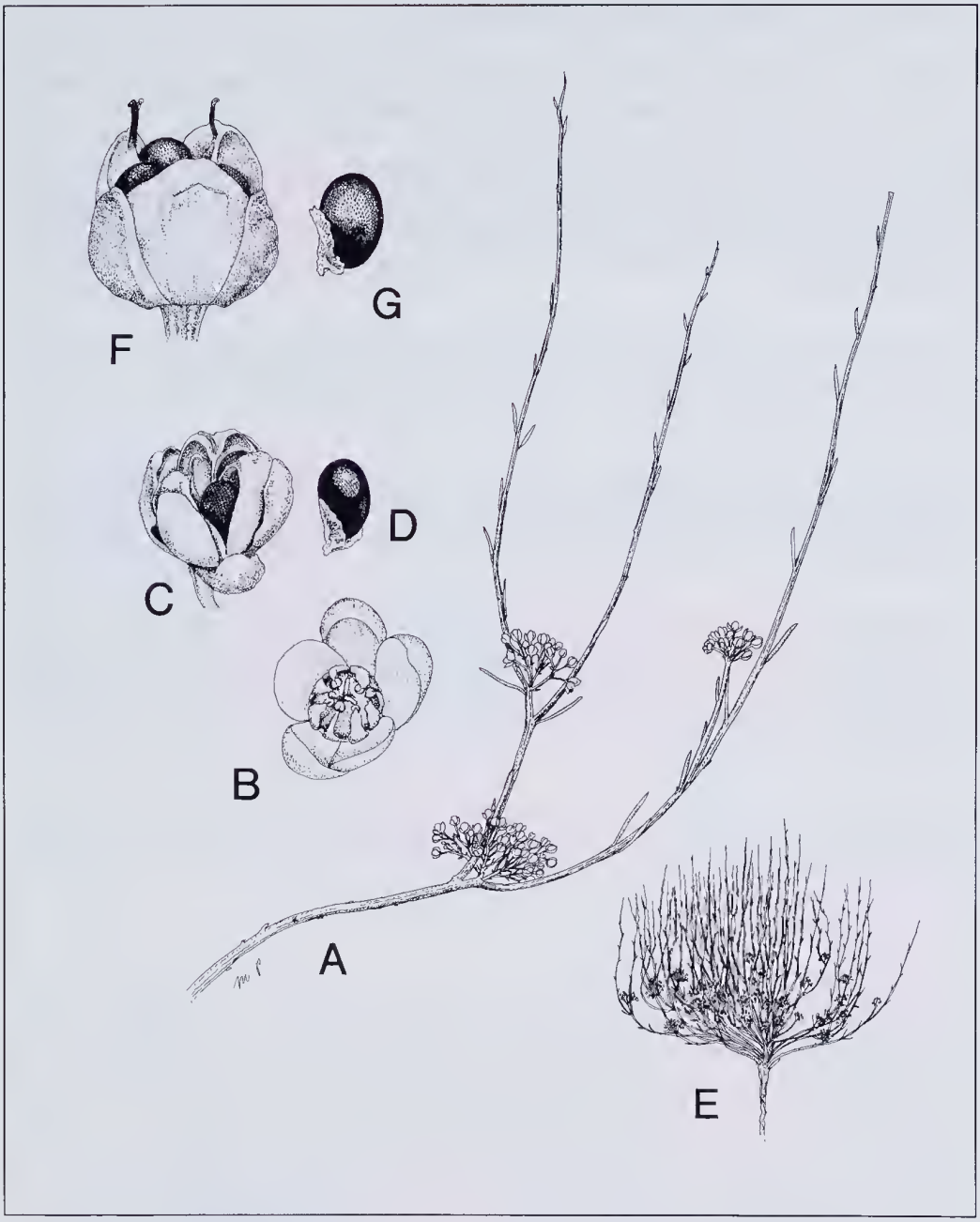

Figure 2A-E. *Macarthuria apetala* Variant 1 (typical variant) A - flowering branchlet (x1), B - flower (x7.5), C - fruit (x9), D - seed (x9), E - habit (x0.25); F, G. *M. apetala* Variant 2 (southern variant) F - fruit (x9), G - seed (x9). Drawn from *A.S. George* 3153 (A-E) and *G.J. Keighery s.n.* (PERTH 03415139) (F, G).

(PERTH); Fitzgerald River Reserve, along rabbit proof fence, *c.* 20 miles [*c.* 32 km] SE of Jerramungup, 7 Oct. 1970, *P.G. Wilson* 10179 (PERTH).

Distribution. Distributed in widely scattered populations from the Keysbrook area, south to Northcliffe and eastwards to Gibson (*c.* 25 km north of Esperance).

Habitat. Recorded from tall dense-shrubland and open *Banksia* and *Eucalyptus* woodland communities, occasionally in areas that had been burnt (up to four years previously), or subject to disturbance. Soils range from deep sand to peaty sand, sand over quartzite, loamy sand over sandy-clay and "gravel". Frequently occurs in or around winter-wet seasonal swamps, as noted by Blackwell & Cala Landscape Consultants (1983).

Phenology. Flowering and fruiting recorded in February, May and July, but mostly during September-December. Plants of *Turley* 1/595a & b were from a site burnt in November 1993 which did not receive rain until autumn of 1995.

Notes. Variant 2 has previously been referred to as *Macarthuria* sp. Harvey (M.E. Trudgen & A. Tingay *s.n.*) *in herb.* at PERTH and on various lists of priority taxa (e.g. Hopper *et al.* 1992), as *Macarthuria* sp. unnamed in Blackwell & Cala (1983), and as *Macarthuria* aff. *australis* in Gibson *et al.* (1994).

2. Macarthuria australis Hügel ex Endl. (Endlicher 1837: 11): *Type citation*: "King George's Sound, [Western Australia], *Hügel". Type:* Bushland opposite Department of Agriculture site, Baron Hay Court, Kensington, Perth, Western Australia, 31°59' S, 115°53' E, 31 August 1995, *B.J. Lepschi & M.H. Brims* 1943 (*neo,* here nominated: PERTH 04232631; *isoneo:* A, AD, B, BRI, CANB, E, G, K, L, MEL, NSW, P, US, W).

Macarthuria foliosa L. Preiss ex Steud. (Steudel 1845: 230). *Type:* Bull's Creek, Perth [= Bull Creek, near the Canning River, Perth, Western Australia, *fide* Marchant 1990], November 1841, *L. Preiss* 1672 (LD (photo PERTH), MEL 1058090 (ex herb. J. Steetz)).

Illustration. Marchant *et al.* (1987: 104).

Erect *subshrub* to 60 cm tall, all parts glabrous. *Stems* terete, dull green. *Leaves* present mainly towards the base of the stems and on young growth, becoming progressively reduced further up the stems, sessile to obscurely petiolate; lamina obovate (in basal leaves only), narrowly to linear-obovate, or very narrowly elliptic to linear-elliptic or linear, 2-28(55) mm long, 0.3-3.5(16) mm broad; base narrowly cuneate to attenuate; apex narrowly acute or (rarely) shortly acuminate or rounded. *Inflorescence* of 1-15(30) flowers, in somewhat condensed or less often diffuse cymes, inserted laterally (or rarely terminally) on the stems; flowers fragrant. *Bracts* ovate to narrowly ovate or subulate, often acuminate, 1-2.5 mm long, herbaceous with a narrow scarious margin, greenish. *Pedicels* 1.8-6 mm long. *Sepals* ovate to broadly ovate or rarely elliptic, 3-5 mm long, herbaceous (inner 2 less strongly so), with a narrow scarious margin. *Petals* elliptic to (rarely) very narrowly elliptic or ovate to broadly ovate, 3.5-4 mm long, base attenuate or rarely truncate, distinctly clawed. *Staminal ring* about one-third to half as long as ovary; free filaments 1.8-2 mm long; anthers 0.5-0.7 mm long. *Ovary* 1.6-2 mm long, with 2 or 3 ovules per locule; style branches 1.7-2.5 mm long. *Fruit* ovoid to more or less globular, 3.8-4.1 mm long. *Seeds* dark brown to almost black, faintly reticulate-areolate so as to appear almost smooth, shining, very broadly comma-shaped, 1.4-1.5 mm long; aril large.

Selected specimens examined. WESTERN AUSTRALIA: 2 km NW of Darlington, 4 Aug. 1979, *P. Armstrong* 50 (PERTH); 4.5 miles [*c.* 7 km] from Gingin towards Bindoon, 28 Sep. 1968, *E.M. Canning* 3565 (CBG, NSW); Water Catchment Reserve, Greenough River, 55 km W of Mullewa, 20 Oct. 1983, *S.J. Forbes* 1712 (BRI, CANB, MEL); Murchison House Stn, 10 miles [*c.* 16 km] NE of mouth of Murchison R., Aug. 1967, *C.H. Gittins* 1622 (NSW, PERTH); 11.5 km E of Jurien, 26 Sep. 1976, *R.W. Johnson* 3249 (BRI, K, MO, PERTH); 15.5 km ENE of Kalbarri on road to The Loop, Kalbarri National Park, 1 Aug. 1995, *T.R. Lally* 611 (CANB, PERTH); Junction of Midland Road and Helena Valley Road, 15 km WNW of Mundaring Weir, 3 Sep. 1995, *B.J. Lepschi* 1955 (CANB, K, L, PERTH, US); ± 47 mile peg on Dale Highway [= *c.* 17 km W of Dale], 30 Aug. 1963, *K. Newbey* 867 (PERTH); 20 km S of Regans Ford at Moore River (along Brand Hwy), 26 Sep. 1989, *B. Nordeustam & A. Anderberg* 11 (PERTH, S).

Distribution. Occurs from Murchison House Station (immediately north of Kalbarri), south to Red Lake Reserve (north-west of Harvey), Western Australia; from near the coast in the west, inland to Yandanooka, Eradu, Moora and the Dale River (south-west of Beverley). (Figure 3)

Habitat. Recorded from a variety of sandy soils (white to brown sands, including beach dunes, in the south, and yellow to red or black sands in the north), either deep sand, or sand over laterite or limestone. Once recorded from loam (*Newbey* 867) at its south-eastern limit, and once on laterite (*Armstrong* 50). Vegetation communities range from *Eucalyptus* and/or *Banksia* woodlands with a heathy understorey in southern areas, to sandplain heath for northern localities.

Phenology. Flowering May to February (but mainly August to September), and fruiting October to February.

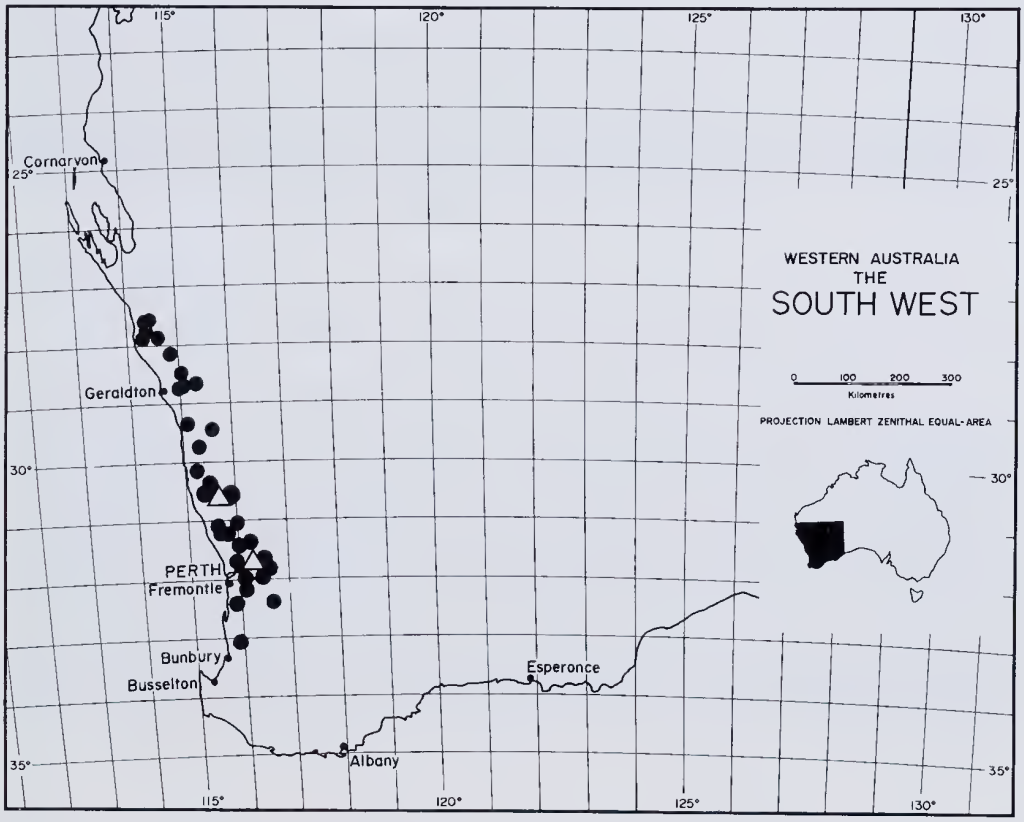

Figure 3. Distribution of *Macarthuria australis* (●) and *M. keigheryi* (△).

Conservation status. Not considered to be at risk. Widespread and common over a considerable range, with populations in a number of conservation reserves.

Typification. No type material of *Macarthuria australis* has been located at herb. W, where Hügel's herbarium is held (Stafleu & Cowan 1979), and it is believed to have been destroyed during the Second World War (E. Vitek *pers. comm.*). Searches for type material at other herbaria (e.g. B, BR, CGE, HBG, K, LE, M, MEL, P and WRSL) where duplicates may exist have also been unsuccessful. A neotype is therefore nominated for *M. australis*. It agrees well with the protologue, except that stamens are consistently eight rather than ten, the staminal ring is white to cream (both in dried and live material) as opposed to pink, and the ovary is strictly 3-locular rather than 3- or 4-locular; this is also consistent for all other material of this species examined by the present author. Endlicher appears to have misinterpreted these characters, or perhaps based his observations on teratological material, as was suggested by Steetz (1848) and Harvey (1855).

Notes. *M. australis* is easily distinguished from all other taxa in Western Australia in having two or three ovules per locule. However in *M. vertex* an additional one or two ovules are sometimes produced, but at least one locule in any given flower has a single ovule, a situation not found in *M. australis*. *M. australis* superficially resembles *M. georgeana* and *M. keigheryi*, but can be distinguished from these taxa (apart from ovule number) by a number of vegetative and floral characters (see under relevant species).

Note that in the key to *Macarthuria* in Marchant *et al.* (1987) the characters on ovule numbers have been inadvertently transposed; *M. australis* has two or three ovules per locule (as per description and illustration), while *M. apetala* has only one.

Variation. The inflorescence in *M. australis* is typically more or less condensed, but in some collections it is more open and diffuse; this is particularly prevalent in material from north of the Murchison River (e.g. *Craven* 7064, *Hnatiuk* 760506), but is also seen in plants from elsewhere within the species range (e.g. *Alford* 11). This is not correlated with any other morphological characters, and would appear to be (at least partly) ontogenetic. Collections exhibiting this inflorescence form are mostly from plants in active growth, and is possibly a response to recent rain.

3. Macarthuria georgeana Keighery (Keighery 1983: 387). *Type*: 24 miles [*c.* 39 km] north of Murchison River on North Western Coastal Highway, Western Australia, 6 November 1966, *A.S. George* 7887 (*holo*: PERTH 01560301; *iso:* CANB 351839, PERTH 03634876)

Erect *subshrub* to 40 cm high, glabrous. *Stems* terete, finely verrucose, rusty-brown or glaucous (when dried), apices acute. *Leaves* reduced to scales, scattered, triangular, 0.7-2 mm long, 0.5-1.5 mm broad, acute. *Inflorescence* of 1 or 2 flowers, in contracted cymes inserted laterally on the stems. *Bracts* numerous, broadly ovate to (rarely) subcircular, 0.5-1.3 mm long, herbaceous, dark brown (inner ones paler). *Pedicels* 2-3 mm long. *Sepals* elliptic to ovate, 3-4 mm long; herbaceous with a very narrow scarious margin (both outer and inner sepals similar in form). *Petals* ovate to broadly ovate or elliptic, 2-3 mm long, shortly clawed. *Staminal ring* about as long as ovary; free filaments 0.5-1.2 mm long; anthers 0.4-0.5 mm long. *Ovary* 1.8-2.2 mm long, with one ovule per locule; style branches 0.5-0.7 mm long. *Fruit* more or less globular, 3-3.5 mm long. *Seeds* dark brown to almost black, apparently smooth, shining, very broadly comma-shaped (almost ellipsoid), 1.7 mm long; aril large. (Figure 4A-D)

Other specimens examined. WESTERN AUSTRALIA: Sandplain 30 miles [*c.* 48 km] N of Ajana, 28 Aug. 1931, *W.E. Blackall* 595 (PERTH); Sandhills north of Murchison River, 30 Aug. 1930, *C.A. Gardner* 2580 (PERTH); 22 miles [*c.* 35 km] N of Galena, Aug. 1967, *C.H. Gittins* 1587 (BRI, NSW, PERTH); 96 km N of Northampton, 6 Aug. 1976, *R.J. Hnatiuk* 760456 (PERTH).

Distribution. Currently only known from the north-eastern portion of Eurardy Station, *c.* 95 km north of Northampton, adjacent to the North West Coastal Highway, Western Australia. (Figure 1)

Habitat. Occurs in scrub heath and mallee scrub communities on deep yellow sand, the 'Eurardy System' of Beard (1976a).

Phenology. Flowering August to September, with all known collections having been made during this period. *Gittins* 1587 has a few mature fruits also, but is predominantly flowering; it is likely that the main fruiting period occurs later in the season, probably October to February.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority 1. *M. georgeana* is not known to occur in any reserves, and there are no recent measures of abundance. It has also not been collected for nearly 20 years, although this may not be an indication of actual rarity. Surveys are required to ascertain whether it occurs in nearby areas of similar habitat, especially Kalbarri National Park.

Notes. M. georgeana is distinct in its finely verrucose, often rusty stems, and few-flowered inflorescences with large petal-bearing flowers.

Descriptions of the fruit and seed of *M. georgeana* are based on the few available fruits on *Gittins* 1587.

4. Macarthuria intricata Keighery (Keighery 1982: 5). *Type*: Hamelin to Tamala [= *c.* 6.5 km W of junction of road to Denham and road to Tamala Station], Western Australia, 10 October 1973, *J.S. Beard* 6789 (*holo:* PERTH 01560328; *iso:* CANB *n.v.*, NSW 369259, PERTH 03634884)

Illustration. Keighery (1982: 5).

Intricately branched *shrub* 0.5-1 m tall, glabrous. *Stems* terete, green, often more or less spinescent. *Leaves* reduced to scales, scattered, triangular to rounded triangular, 0.7-1 mm long, 0.5-0.8 mm broad, acute. *Inflorescence* of 2-6 flowers, in cymes inserted terminally or laterally on the stems. *Bracts* rounded-triangular to broadly rounded-triangular or angular-ovate, 0.5-0.7 mm long, herbaceous, dark brown (inner ones paler). *Pedicels* 1-2 mm long. *Sepals* broadly elliptic to subcircular or broadly ovate, 1.8-2 mm long; the outer 3 sepals herbaceous (inner 2 less strongly so), with a very narrow scarious margin. *Petals* absent. *Staminal ring* about half as long as the ovary; filaments 0.5-1 mm long; anthers 0.4-0.5 mm long. *Ovary* 1.2-1.5 mm long, with one ovule per locule; style branches 0.6-0.7 mm long. *Fruit* ovoid to more or less globular, 2.5-3 mm long. *Seed* dark brown to almost black, tuberculate, shining, 1.5-1.6 mm long, aril large.

Other specimens examined. WESTERN AUSTRALIA: West of Coburn Station, 8 Apr. 1975, *J.S. Beard* 7394 (PERTH); Red Bluff, Kalbarri, 11 Nov. 1980, *Bellairs* 2345 (PERTH); On boundary of Golf Club and Kalflora, outskirts of Kalbarri, 18 Mar. 1995, *D.R. Bellairs* 1097 (CANB, PERTH);

1.5 miles [*c.* 2 km] from turnoff from Denham road on Tamala Station road, 16 Mar. 1968, *S.G.M. Carr* 380 (PERTH); Nanga Station, 15 Nov. 1982, *R.J. Cranfield* 2589 (PERTH); 5.7 miles [*c.* 9 km] [along] Tamala road [to Tamala Station from Denham road], 9 Dec. 1974, *H. Demarz* 5526 (PERTH); Shark Bay: entrance to Tamala and Hamelin Stations, 21 July 1988, *P. Morat* 8274 (P, PERTH); Tamala road, on Nanga Station, Shark Bay, 26 Aug. 1973, *E.C. Nelson* ANU 17322 (CANB, PERTH); Murchison River, *s. dat.*, *Oldfield s.n.* (BRI AQ 277518, MEL); *c.* 25 km NW of Tamala Station Homestead, 18 Sep. 1989, *M.E. Trudgen* 7162 (CANB, PERTH); Tamala, 12 Aug. 1976, *E. Wittwer* 1806 (PERTH).

Distribution. Occurs on Nanga and possibly Coburn Stations, in the southern Shark Bay region, Western Australia. Also occurs in the Kalbarri-Red Bluff area, *c.* 120 km south of the species' main range. (Figure 1)

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority 3. While some populations are within the Shark Bay World Heritage Area, this has no conservation status, and at least one population at Kalbarri has been destroyed as a result of clearing activities (D.R. & B. Bellairs, pers. comm.). Further surveys are urgently required to assess the possible occurrence of *M. intricata* in any reserves, in particular Kalbarri National Park.

Habitat. In the Shark Bay area *M. intricata* occurs in low open shrubland, the 'Tamala System' of Beard (1976b), on red sand over limestone. Once recorded from red sandy clay (*Cranfield* 2589). At Kalbarri and Red Bluff, *M. intricata* has been collected from scrub vegetation on black sand over limestone (*Bellairs* 2345) and shrubland on grey sand over sandstone (*Bellairs* 1097).

Phenology. Flowering recorded July-April, fruiting November-March.

Notes. This species is easily distinguished by its intricate branching with the leaves reduced to appressed, triangular scales (this leaf character also occurs in *M. georgeana*, but the latter differs in a number of other characters). It is also the only member of the genus which could be considered a true shrub.

The label on *Trudgen* 7162 states "[flowers] visited by a small butterfly".

5. Macarthuria keigheryi Lepschi, *sp. nov.*

Sp. nov. *M. apetalae* Harv. affinis a qua planta pubescenti, floribus majoribus, petala plerumque ferentibus, testa laevi differt.

Type: *c.* 30 km W of Dandaragan [precise locality withheld for conservation reasons], Western Australia, 15 December 1989, *B.J. Keighery* 743B (*holo:* PERTH 04176782; *iso:* CANB, K, PERTH 01298283, US).

Erect *subshrub* to 40 cm tall. *Stems* terete, green, ageing yellowish-green in life; all vegetative parts and outer whorl of sepals hairy with more or less coarse, short, spreading, simple hairs (i.e. hirsute). *Leaves* sessile to obscurely petiolate, present mainly towards the base of the stems and on young growth, becoming progressively reduced further up the stems; lamina obovate to very narrowly obovate or narrowly to very narrowly elliptic, 2.7-11.5 mm long, 0.7-3.5 mm broad; base

cuneate to narrowly cuneate; apex shortly acuminate to narrowly acute. *Inflorescence* of 1-25(30) flowers in somewhat condensed cymes, becoming more diffuse in fruit, inserted terminally (or laterally), on the stems. *Bracts* rounded-triangular to triangular or subulate, 1.2-4 mm long, herbaceous with a narrow scarious margin, the herbaceous portion hirsute, greenish. *Pedicels* 2.5-6 mm long. *Sepals* ovate to narrowly ovate, 2-3.5 mm long, herbaceous (inner 2 scarious, glabrous) with a scarious margin, the herbaceous portion hirsute, green, ageing golden-yellow in life. *Petals* usually present (though sometimes absent), very narrowly obovate to narrowly elliptic, 2-2.5 mm long, occasionally obscurely clawed. *Staminal ring* about one-third to half as long as the ovary; free filaments 0.9-1.5 mm long; anthers 0.4-0.5 mm long. *Ovary* 1.8-2 mm long, with one ovule per locule; style branches 0.7-0.8 mm long, stigma at apex. *Fruit* ovoid to more or less globular, 2.5-3 mm long. *Seeds* dark brown to almost black, faintly reticulate-areolate so as to appear almost smooth, shining, broadly comma-shaped, 1.3-1.4 mm long; aril large. (Figure 4E-H)

Other specimens examined. WESTERN AUSTRALIA: Kewdale, 7 Sep. 1976, *R.J. Coveny* 8180 (NSW, PERTH); Type locality, 6 Nov. 1988, *B.J. Keighery* 517B, (MEL, PERTH); Type locality, 21 Oct. 1990, *B.J. Keighery* 1990/13 (PERTH); Type locality, 11 Sep. 1991, *S.J. Patrick* 795 (PERTH); Dundas road, Forrestfield, 28 Feb. 1996, *B.J. Keighery* 2109A, B, C (PERTH).

Distribution. Known only from the type locality, *c.* 30 km west of Dandaragan, and from the Kewdale-Forrestfield area, in the eastern part of Perth, Western Australia. (Figure 3)

Habitat. Recorded from open *Banksia* woodland (generally *B. attenuata* and *B. menziesii* dominant) with a heathy understorey and often with some scattered eucalypts, on white or grey sand. Plants at the Forrestfield site were frequently associated with areas where *Kingia australis* occurred.

Phenology. Flowers recorded September-December and February-March, fruits recorded December and February-March.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority 1. This species is known from only two populations (Dandaragan and Forrestfield), neither of which is on protected land; the third population at Kewdale has not been relocated since its initial discovery in 1981.

Etymology. This species is named after Greg Keighery, in recognition of his contributions to Australian botany. He was also the first to recognize this taxon as distinct.

Notes. This taxon has been previously known as *Macarthuria* sp. Mullering (B.J. Keighery 517), *Macarthuria* sp. aff. *georgeana* (B.J. Keighery 517), or *Macarthuria* sp. aff. *georgeana* (B.J. Banyard 517) ('Banyard' is in error and should read 'Keighery') in herb. PERTH and in lists of priority flora (e.g. Hopper *et al.* 1992).

M. keigheryi is the only member of the genus in which the vegetative parts and outer sepals are always hairy. *M. vertex* is sometimes hairy, but *M. keigheryi* is easily distinguished from hairy forms of *M. vertex* by its inflorescence structure, more robust stems, virtually smooth seeds, geography and ecological preference. *M. keigheryi* is probably allied to *M. apetala*, from which it differs in the presence of indumentum, predominantly terminal inflorescences, larger flowers (generally with petals) and smooth seeds.

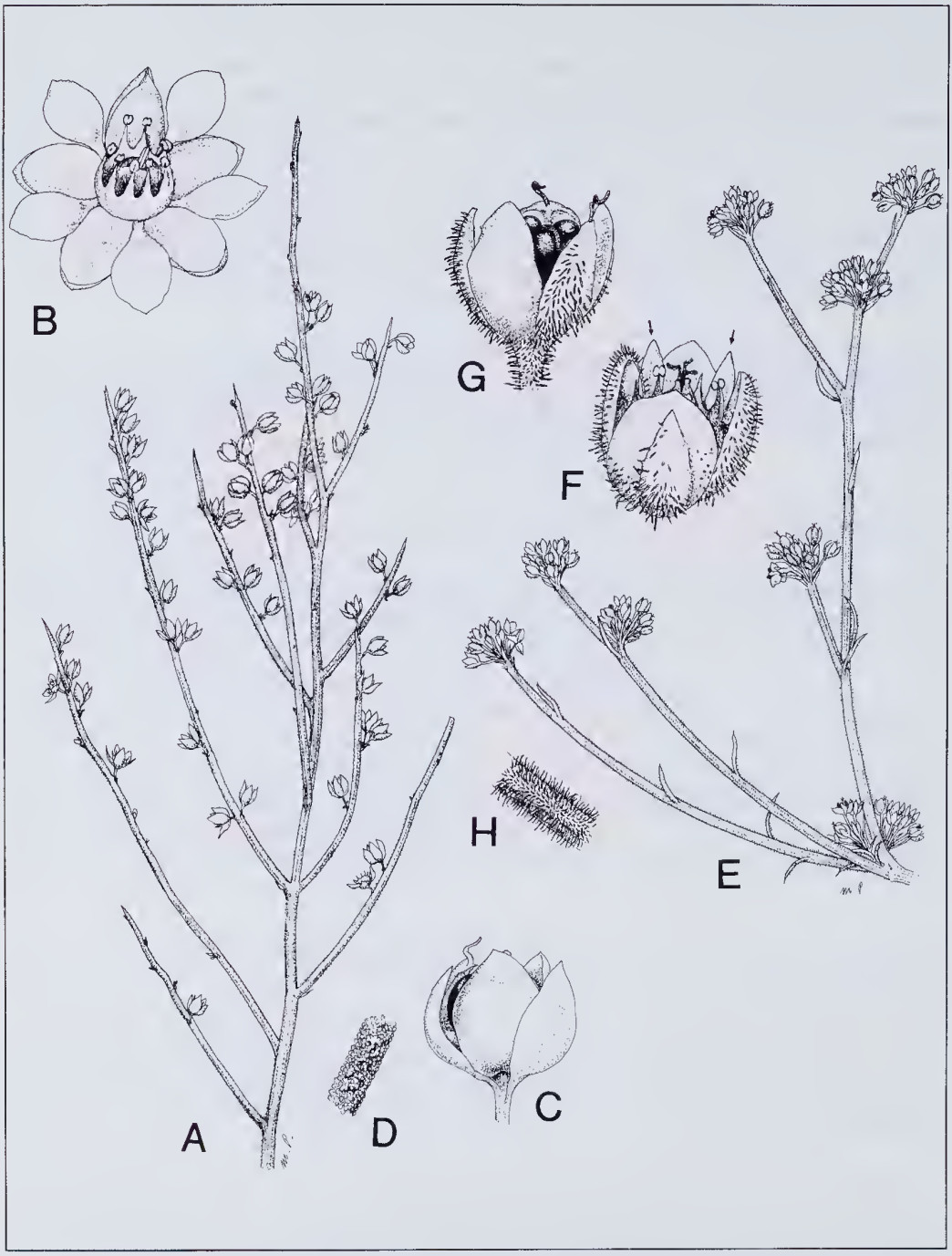

Figure 4A-D. *Macarthuria georgeana* A - flowering branchlet (x1), B - flower (x4.5), C - fruit (x6), D - detail of branchlet surface (x3.5); E-H. *M. keigheryi* E - flowering branchlet (x1), F - flower (3 petals removed; 2 remaining petals arrowed) (x6), G - fruit (x6), H - detail of branchlet surface (x3.5). Drawn from *C.A. Gardner* 2580 (A, B, D), *C.H. Gittins* 1587 (C) and *B.J. Keighery* 743B (E-H).

Plants from the type locality were described as being common to abundant along a fire break during 1988-1990, but uncommon in adjacent woodland. At the same site in 1991, only one plant was found (*Patrick* 795), suggesting that, along with some other *Macarthuria* species, *M. keigheryi* is a disturbance opportunist. This species may also respond favourably to fire, as the Forrestfield site was burnt during 1994/1995.

6. Macarthuria vertex Lepschi, *sp. nov.*

Macarthuria apetala auct. non Harv. (Harvey 1855: 55).

Sp. nov. *M. ephedroide* C.T. White affinis a qua planta plerumque pubescenti, caulibus teretibus et floribus semper petala ferentibus differt.

Type: *c.* 4 miles north-east of Mudginbarry Homestead, Northern Territory, 7 July 1972, *M. Lazarides* 7565 (*holo:* CANB 250669 (photo PERTH); *iso:* BRI AQ 177395; B, DNA, K, L, NSW, US all *n.v.*).

Illustration. Wheeler *et al.* (1992: 140) (as '*Macarthuria* sp. A').

Erect to spreading, or rarely prostrate *subshrub* or *shrub* 0.7(2) m tall, glabrous, or the vegetative parts and outer whorl of sepals hairy with coarse, short, spreading, simple hairs (i.e. scabrous to less often hirsute), and/or blunt, short papillae. *Stems* terete, slender, green to yellowish, often glaucous or greyish when dried. *Leaves* present mainly towards the base of the stems and on young growth, becoming progressively reduced further up the stems, sessile to obscurely petiolate; lamina narrowly to linear-obovate, very narrowly to linear-ovate or subulate, or very narrowly elliptic to linear, 2-81 mm long, 0.3-7 mm broad; base very narrowly cuneate to attenuate; apex acute to narrowly acute or rarely very shortly acuminate. *Inflorescence* of 1-6 flowers in contracted cymes at the apex of the ultimate inflorescence branchlets (rarely some borne laterally as well). *Bracts* narrowly to very narrowly triangular, or rarely very narrowly ovate or subulate, 0.5-2 mm long, herbaceous, brown. *Pedicels* 0.5- 6.5 mm long. *Sepals* ovate to (rarely) broadly or narrowly ovate, ovate-elliptic or elliptic, 1.5-4.2 mm long, herbaceous (inner 2 weakly herbaceous to scarious, rarely with some small papillae in hairy plants), occasionally with a narrow scarious margin. *Petals* elliptic to very narrowly elliptic, 1.5-3 mm long, base attenuate, generally obscurely clawed. *Staminal ring* about half as long as the ovary; free filaments 0.5-1.1 mm long; anthers 0.3-0.7 mm long. *Ovary* usually with I ovule per locule (3 in total; occasionally an additional 1 or 2 ovules may be present (4 or 5 in total), but these generally do not develop further), 1-2.7 mm long, style branches 0.4-0.6 mm long, stigma at apex. *Fruit* ovoid to ellipsoid or more or less globular, 2-3.5 mm long. *Seeds* black, tuberculate, shining, broadly comma-shaped, 1.3-1.7 mm long; aril large. Mostly only 1-3 seeds per fruit are produced but rarely 4 or even 5 may be present.

Selected specimens examined: WESTERN AUSTRALIA: Manning Gorge, 275 km SW of Wyndham, 9 June 1976, *A.C. Beauglehole* 52580 (PERTH); Near Solea Falls, Drysdale River National Park, 12 Aug. 1975, *A.S. George* 13767 (PERTH); 4 km N of Kalumburu, 24 June 1978, *A.S. George* 15197 (BRI, CANB, MEL, PERTH); Adjacent to King George River above Falls, 7 June 1992, *K.F. Kenneally* 11269 (DNA, PERTH); S side of Walcott Inlet & about 1 km W of the mouth of the Isdell River, 25 Mar. 1995, *A.A. Mitchell* 3540 (CANB, PERTH).
NORTHERN TERRITORY: Mt Brockman, 13 km S of Jabiru East, 8 June 1980, *L.A. Craven* 6497 (CANB); Top of Jim Jim Falls, 30 Jan. 1981, *C.R. Dunlop* 5683 (DNA, MEL, NSW); *c.* 26 miles [*c.* 42 km] E of Oenpelli Mission, 17 Feb. 1973, *M. Lazarides* 7755 (BRI, CANB, DNA); Koongarra, 30 May 1978, *B.L. Rice* 2663 (CANB); Tributary of 17 mile Creek NE of Katherine, 21 Mar. 1965, *I.B. Wilson* 397 (CANB, DNA, K, L, NSW, US).

Distribution. Disjunct in northern Australia. In Western Australia recorded from the Kimberley Region at Drysdale River National Park, Kalumburu, King George River, Walcott Inlet and Manning Gorge, north-east of Fitzroy Crossing. In the Northern Territory it occurs from north-north-west of Oenpelli, south to Katherine Gorge National Park and east as far as the Mann and Cadell Rivers. (Figure 5)

Habitat. Recorded from sand over sandstone or deep sand, frequently associated with sandstone outcrops, escarpments and other rocky sites. Often growing in rock crevices or amongst boulders, less frequently in alluvial sands along watercourses and floodouts. Vegetation communities include low open *Eucalyptus* woodland or (rarely) forest, open shrubland, and sparse shrubs, herbs and grasses on rocky sites. Also recorded as a component of post-fire regeneration (*Forster* 6116).

Phenology. Flowering and fruiting recorded all months of the year.

Conservation status. Apparently common at least in the Northern Territory; the few records from Western Australia probably reflect poor collecting rather than rarity. Occurs in a number or conservation reserves, including national parks, within its range.

Etymology. Named from the Latin *vertex* (height, elevation, peak), in reference to the species' inflorescence structure, where the cymes are inserted at the apices of the uppermost branchlets of the inflorescence. The epithet is used here deliberately as a noun in apposition.

Notes. This is *Macarthuria* sp. A of Wheeler *et al.* (1992). Also referred to as *Macarthuria* sp. A Kimberley Flora (*A.S. George* 13767) *in herb.* at PERTH.

M. vertex can be distinguished from all other taxa in Western Australia by its inflorescence structure, in which the few-flowered cymes are borne predominantly at the apices of the ultimate inflorescence branchlets. It is the only *Macarthuria* species in Western Australia which occurs outside the South-west Botanical Province. *M. vertex* is probably most closely related to *M. ephedroides*, a species from central Queensland, with which it shares similar inflorescence structure and floral and seed characters, but can be distinguished by the frequent presence of indumentum, terete rather than

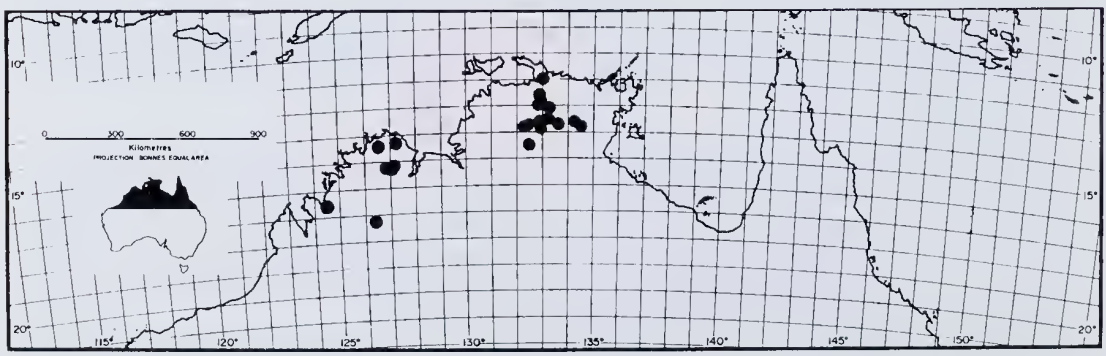

Figure 5. Distribution of *Macarthuria vertex*.

flattened stems and generally more floriferous cymes with consistently petal-bearing flowers. In the protologue of his new species, White (1946) describes *M. ephedroides* as having apetalous flowers, and this has been followed in other publications (e.g. Stanley & Ross 1983). However, from examination of further herbarium collections (e.g. *Speck* 1926) it is apparent that flowers with petals are occasionally produced; a photograph of a plant of *M. ephedroides* with petal-bearing flowers is also in Pearson & Pearson (undated).

M. neocambrica, an eastern Australian species, is also similar to *M. vertex*. It differs in being a generally smaller, consistently glabrous perennial herb (or subshrub), with large, well-developed basal leaves usually present at anthesis (though sometimes withered, especially in sub-shrubby plants) and usually persisting into the fruiting stage, often with some large cauline leaves also. Also, the inflorescence is frequently dichotomously branched, with the flowers solitary at nodes within the inflorescence as well as in few-flowered cymes at the apex of the ultimate inflorescence branchlets. An inflorescence structure approaching that of *M. neocambrica* is sometimes found in flowering/fruiting seedlings of *M. vertex* (e.g. some plants of *Craven* 2297 and *Lazarides* 7797); however, other plants from the same collections have inflorescences typical of *M. vertex*. No such variation has been observed in mature plants of *M. vertex*.

Further study is required to assess the status and affinities of a probable undescribed taxon of *Macarthuria* from northern Queensland (e.g. *Clarkson* 5447, *Clarkson & Neldner* 8648, *Forster et al.* 10583; all BRI) which appears to be allied to the *M. ephedroides* - *M. neocambrica* - *M. vertex* group.

Variation. *M. vertex* is variable with regard to the presence or absence of indumentum, with hairy and glabrous individuals occurring throughout the species range; however, there seem to be no other morphological characters which correlate with the presence or absence of indumentum, nor any apparent geographic separation or ecological differences, and these variants have not been afforded any taxonomic status. There is also gradation from glabrous plants (such as the type) through to plants with some short papillae on the vegetative parts (e.g. *Forster* 6116, *Fox* 2552) to hairy plants (e.g. *Must* 1058, *Rice* 2663). Both variants may be present in the same area (e.g. Nabarlek), but it is not known whether they occur in mixed populations. Papillate collections of *M. apetala*, a normally glabrous taxon, have also been recorded.

Plants of *Russell-Smith* 814 are recorded as being up to 2 m tall; this is quite exceptional, as the height stated on most other collections rarely exceeds 1 m.

Acknowledgements

John Beard, Don and Barbara Bellairs, Marion Blackwell, Neil Gibson, Roger Hearn, Greg and Bronwen Keighery, Coral Turley and Malcolm Trudgen collected materials on my behalf or provided me with additional information regarding their collections. Bruce Maslin and Paul Wilson assisted with Latin and nomenclatural matters. Margaret Pieroni prepared the illustrations, and Sophie Ducker examined handwriting samples and provided information on W.H. Harvey. The curators of B, BR, BRI, CANB, CGE, DNA, HBG, K, KPBG, LD, M, MEL, NSW, P, TCD and WRSL facilitated loans of specimens or searches for type materials. To all, my grateful thanks.

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New species in *Drosera* section *Lasiocephala* (Droseraceae) from tropical northern Australia

Allen Lowrie

6 Glenn Place, Duncraig, Western Australia 6023

Abstract

Lowrie, A. New species in *Drosera* section *Lasiocephala* (Droseraceae) from tropical northern Australia. Nuytsia 11 (1): 55-69 (1996). Five new *Drosera* species, *D. brevicornis* Lowrie, *D. broomensis* Lowrie, *D. caduca* Lowrie, *D. darwinensis* Lowrie and *D. derbyensis* Lowrie, are described and illustrated. *D. fulva* Planchon is recognized as a valid species and is described in detail as well as illustrated. All these taxa are from tropical northern Australia and belong in *Drosera* sect. *Lasiocephala*. A key is provided to all species in sect. *Lasiocephala*.

Introduction

Five new *Drosera* species are described, three from the Kimberley region of Western Australia and two from the Northern Territory, and a further species from the Northern Territory is reinstated. All belong in subgen. *Drosera*, sect. *Lasiocephala* Planchon (Marchant & George 1982). Since Marchant & George's treatment, five additional species belonging to the section have been named (Kondo 1984; Lowrie 1994, 1996). Thirteen species are now listed in this section. They are *D. brevicornis* Lowrie, *D. broomensis* Lowrie, *D. caduca* Lowrie, *D. darwinensis* Lowrie, *D. derbyensis* Lowrie, *D. dilatato-petiolaris* Kondo, *D. falconeri* Kondo & Tsang, *D. fulva* Planchon, *D. kenneallyi* Lowrie, *D. lanata* Kondo, *D. ordensis* Lowrie, *D. petiolaris* R. Br. (also recorded in Papua New Guinea by Conn 1980), and one species in New Caledonia, *D. caledonica* Vieill.

Taxonomy

Key to section *Lasiocephala*

1 Leaf lamina narrowly obovate; inflorescence (including scape) covered with short glandular hairs ..... **D. caledonica**

1 Leaf lamina orbicular, suborbicular, reniform or transversely broadly elliptic to very broadly ovate; inflorescence (including scape) glabrous or covered with non-glandular, woolly hairs 2

2 Only juvenile leaves with insect-trapping lamina ..... **D. caduca**
2 All leaves with insect-trapping lamina 3
3 Leaves at anthesis densely covered with appressed hairs; petiole hidden by the dense hairy covering 4
3 Leaves at anthesis sparsely covered with appressed hairs; petiole visible through the hairy covering 6
4 Petiole oblanceolate, 2-4 mm wide ..... **D. ordensis**
4 Petiole linear or very narrowly oblanceolate, < 2 mm wide 5
5 Petiole linear, covered with dendritic hairs ..... **D. lanata**
5 Petiole very narrowly oblanceolate, covered with non-dendritic hairs ..... **D. derbyensis**
6 Lamina reniform, 15-20 mm wide ..... **D. falconeri**
6 Lamina orbicular, suborbicular or transversely broadly elliptic to very broadly ovate, 2.5-7 mm wide 7
7 Lamina transversely broadly elliptic to very broadly ovate, 5.5-7 mm wide leaves appressed to the soil surface ..... **D. kenneallyi**
7 Lamina orbicular or suborbicular, 2.5-3.5 mm wide; leaves of the rosette more or less horizontal to the soil surface or erect to semi-erect 8
8 Leaves of the rosette more or less horizontal to the soil surface 9
8 Leaves of the rosette erect to semi-erect 10
9 Inflorescence (including scape) 5-15 cm long ..... **D. darwinensis**
9 Inflorescence (including scape) 30-40 cm long ..... **D. brevicornis**
10 Petiole oblanceolate 11
10 Petiole linear 12
11 Inflorescence (including scape) up to 18 cm long; pedicels 3-7 mm long ..... **D. dilatato-petiolaris**
11 Inflorescence (including scape) up to 45 cm long; pedicels 1-2 mm long ..... **D. fulva**
12 Inflorescence (including scape) glabrous ..... **D. broomensis**
12 Inflorescence (including scape) covered with woolly hairs ..... **D. petiolaris**

Drosera brevicornis A. Lowrie, *sp. nov.* (Figure 1)

D. fulvo Planchon affine a quo filamento staminis extenso, ultra et supra antheris curvato projecturum cornuatam formanti differt.

Typus: Whistle Duck Dreaming, Kakadu National Park, Northern Territory, Australia, 11 April 1990, *A. Lowrie* 56 (*holo:* PERTH 04223624; *iso:* CANB, DNA, MEL).

A fibrous-rooted *herb* with perennial stock and a solitary leafy rosette. *Leaves* in a flat basal rosette close to the soil; petiole oblanceolate in outline, 0.5-0.8 mm wide near base, 1.5-3 mm wide near the apex, narrowed to 0.9-2 mm at the base of the lamina, commonly 15-20 mm long at flowering, adaxial surface slightly hairy, abaxial surface densely covered with white dendritic hairs. *Lamina* orbicular, 4-5 mm diam., adaxial surface with insect-catching glands positioned around the margins and smaller glands within, abaxial surface densely covered with white dendritic hairs. *Inflorescences* 1 to 4 per

basal rosette, 30-40 cm long (including scape), forming a 25- or more-flowered raceme, densely covered with long woolly dendritic hairs; pedicels 2-3 mm long, pendulous in fruit. *Sepals* obovate, apex slightly crenate, 5-6 mm long, 2.5-3 mm wide, abaxial surface densely covered with white woolly dendritic hairs. *Petals* pink or sometimes white, obovate, with strong midvein, *c.* 10 mm long, *c.* 7 mm wide. *Stamens* *c.* 4.5 mm long, the apex of each filament extended and curved beyond the anthers to form a distinctive horn-like projection. *Ovary* obovoid, *c.* 1.5 mm long, *c.* 1.7 mm diam. at anthesis, carpels 3, broadly bilobed. *Styles* 3, *c.* 2 mm long (including stigmas), each divided into many branching segments in the upper portion with each segment terminating in a clavate stigma.

Selected specimens examined. NORTHERN TERRITORY: Sweers Island, Gulf of Carpentaria, no date, stamped Herbarium Hookerianum 1867, *Bynoe s.n.* Herb. Oldfield (K); On Cox Peninsula Road, heading to Mandorah, 3.2 km from East Charlotte River, 1 May 1995, *A. Lowrie* 1136 (DNA, PERTH); 2.2 miles [3.5 km] SE of Adelaide River, 18 Mar. 1961, *G. Chippendale* 7719 (PERTH); 39 miles [62.4 km] S of Darwin, 19 Mar. 1961, *G. Chippendale* 7788 (PERTH); 5 miles [8 km] W of Stuart Highway, Mandorah Road, 11 Jan. 1971, *J. Must* 660 (PERTH).

Distribution. On the mainland *Drosera brevicornis* is distributed from Palmerston to Batchelor south of Darwin and eastwards towards Kakadu National Park in the Northern Territory.

Habitat. Drosera brevicornis grows on gravel slopes in hilly areas or in shallow depressions in flat country in the slower moving water-shed zones where sand and loam particles can accumulate amongst the gravel pebbles.

Flowering period. March-April.

Conservation status. Drosera brevicornis is a common species in the Northern Territory and is currently not under threat.

Etymology. Drosera brevicornis is named from the Latin *brevi* - short and *cornis* - horned, in reference to the horn-like filament projection above the anthers at the apex of the stamens. (Figure 1G)

Affinities. Its closest relative is *D. fulva*, from which it is distinguished by having a flat basal rosette of leaves, larger pendulous fruit and stamen filaments extended into a curved horn-like projection above the anthers.

Drosera broomensis A. Lowrie, *sp. nov.* (Figure 2)

D. petiolari R. Br. affine sed inflorescentia (scapo incluso) glabra differt.

Typus: Lake Campion, north east of Broome, Western Australia, 21 April 1995, *A. Lowrie* 1089 (*holo:* PERTH 04223675; *iso:* CANB, DNA, MEL).

A fibrous-rooted *herb* with perennial stock and a solitary leafy rosette. *Leaves* erect to semi-erect on a short stock above the soil; petiole linear, lenticulate in section, 0.5-1 mm wide, narrowed and terete at the base of the lamina, commonly 35-40 mm long, adaxial and abaxial surface sparsely covered with white simple hairs at anthesis, later (at the beginning of the dry season) both surfaces densely covered with white simple hairs. *Lamina* suborbicular, 3-3.5 mm wide, 2-2.5 mm wide,

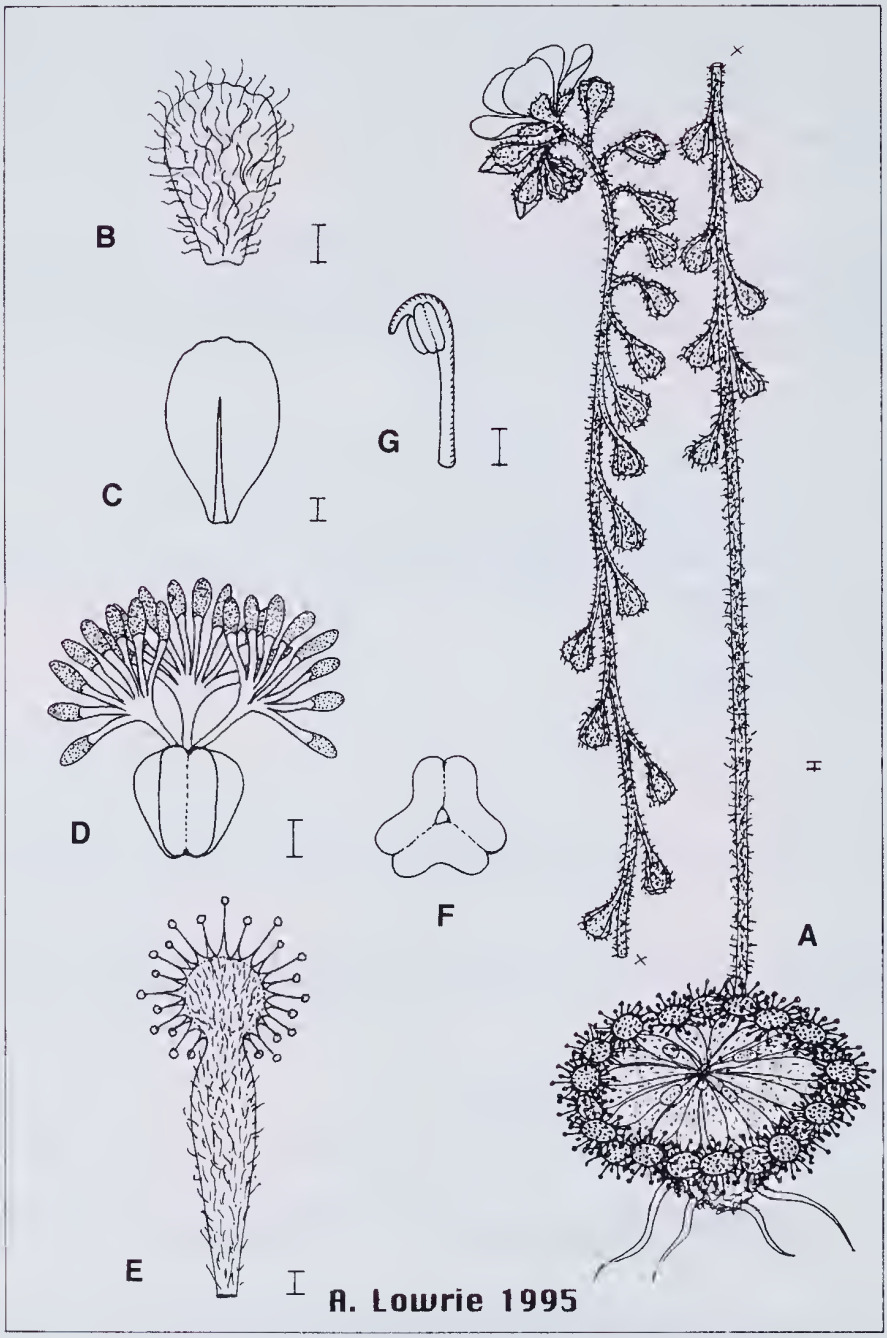

Figure 1. *Drosera brevicornis* A - habit, B - sepal, C - petal, D - gynoecium, E - leaf, F - 3-capellate ovary, base view, G - stamen. Scale bars = 1 mm.

adaxial surface with insect-catching glands positioned around the margins of the lamina and smaller glands within, abaxial surface sparsely covered with white simple hairs. *Inflorescences* 1 to 4 per basal rosette, 15-30 cm long (including scape), forming a 50- or more-flowered raceme, glabrous; pedicels 2-4 mm long, semi-erect in fruit. *Sepals* narrowly ovate, *c.* 3 mm long, *c.* 1.4 mm wide, abaxial surface glabrous. *Petals* white, obovate, with strong mid-vein, *c.* 5.5 mm long, *c.* 3.5 mm wide. *Stamens* *c.* 2.5 mm long. *Ovary* obovoid, *c.* 1 mm long, *c.* 1.4 mm diam. at anthesis, carpels 3, broadly bilobed. *Styles* 3, *c.* 0.8 mm long (including stigmas), each divided into many branching segments in the upper portion with each segment terminating in a dilated irregularly shaped stigma.

Selected specimens examined. WESTERN AUSTRALIA: Roebuck Bay, February 1891, *Tepper* 146 (PERTH); 5 km N of Point Coulomb, N of Broome, 17 Apr. 1977, *K.F. Kenneally* 5896 (PERTH); 4 km S of Cape Bertholet, N of Broome, 19 Apr. 1977, *K.F. Kenneally* 6022 (PERTH); Martin's Well, 7 km S of Lombadina Mission, N of Broome, 16° 34' S, 122° 52' E, 24 Apr. 1977, *K.F. Kenneally* 6142 (PERTH); McLarty Hills, Great Sandy Desert, 19° 30' S, 123° 30' E, 7 Aug. 1977, *A.S. George s.n.* (PERTH); Water Bore Gully, near bore #8, Koolan Island, 16° 09' S, 123° 45' E, 11 Mar. 1984, *L. Vernon s.n.* (PERTH).

Distribution and habitat. Drosera broomensis grows in sandy soils north and north east of Broome, Western Australia.

Flowering period. February-March.

Conservation status. Drosera broomensis is a common species north and north east of Broome, Western Australia and is currently not under threat.

Etymology. The epithet, *broomensis* refers to the Broome region in the Kimberley, Western Australia where this species occurs.

Affinities. This species is distinguished from its closest relative, *Drosera petiolaris,* by its completely glabrous scape and inflorescence.

Notes. I was familiar with *D. broomensis* from herbarium specimens housed in the Western Australian Herbarium well before I had the opportunity to study this species in the field at Lake Campion north east of Broome in 1995.

Drosera caduca A. Lowrie, *sp. nov.* (Figure 3)

D. dilatato-petiolari Kondo affine sed foliis adultis 6-24 cm longis, lamina per insecto-ilaqueantem carenti differt.

Typus: On the road from Beverley Springs to Pantijan, 15 km N of the Charnley River crossing (74 km N of Beverley Springs) in the Edkins Range, Kimberley, Western Australia, 16° 03' S, 125° 23' E, January 1995, *R. & M. Barrett s.n.* (*holo:* PERTH 04223640; *iso:* CANB, DNA, MEL).

A fibrous-rooted *herb* with perennial stock giving rise to one or many leafy rosettes. *Juvenile leaves* erect and semi-erect within the basal rosette; petiole oblanceolate in outline, 0.5-1 mm wide near base, 3-6 mm wide near the apex, narrowed to 1.5-2 mm at the base of the lamina, commonly 15-30 mm long when bearing juvenile inflorescences, adaxial surface glabrous, abaxial surface very

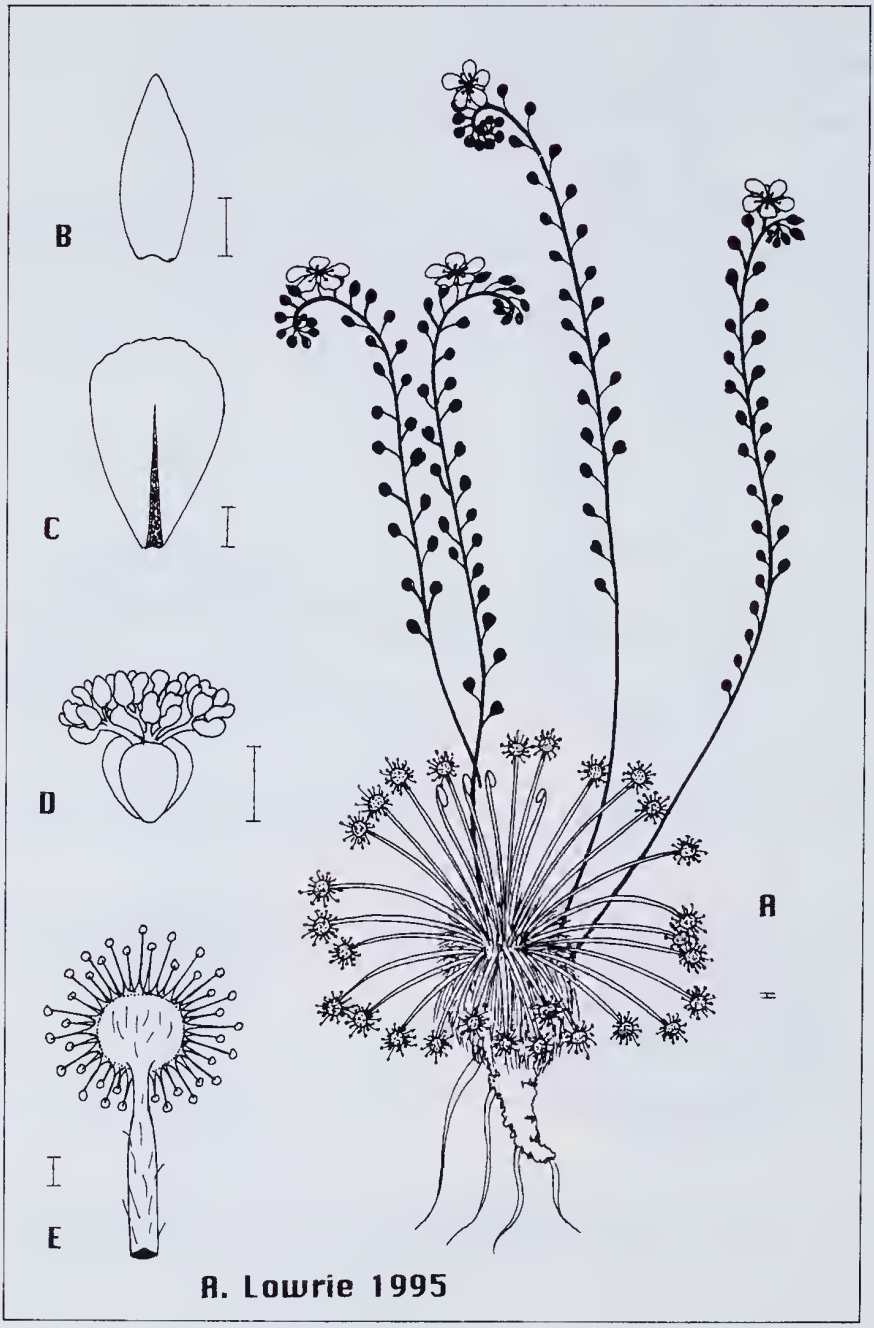

Figure 2. *Drosera broomensis* A - habit, B - sepal, C - petal, D - gynoecium, E - leaf. Scale bars = 1 mm.

sparsely covered with white simple hairs. *Lamina* orbicular, 3-4 mm diam., adaxial surface with insect-catching glands positioned around the margins of the lamina and smaller glands within, abaxial surface glabrous or with a few white simple hairs. *Adult leaves* without insect-trapping glands, V-shaped in section, widely linear in the upper portion, 4-6 mm wide, apex cuspidate, tapering to become very narrowly linear in the lower parts, 0.5-1 mm wide, erect and semi-erect within the basal rosette, commonly 6-24 cm long at anthesis, adaxial surface glabrous, abaxial surface very sparsely covered with white simple hairs. *Inflorescences* 1 or 2 per basal rosette, 30-45 cm long (including scape), forming a 25-45-flowered raceme, scape sparsely covered with woolly simple hairs, raceme with similar indumentum but denser; pedicels 3-4 mm long, semi-erect in fruit. *Sepals* elliptic, apex erose, *c.* 3 mm long, *c.* 1.3 mm wide, abaxial surface apex and upper margins glabrous, remainder covered with white simple hairs. *Petals* white, oblong, with strong mid-vein, *c.* 6.5 mm long, *c.* 3.6 mm wide. *Stamens c.* 3 mm long; ovary obovoid, *c.* 1 mm long, *c.* 0.8 mm diam. at anthesis, carpels 3, broadly bilobed. *Styles* 3, *c.* 1.5 mm long (including stigmas), each divided into many branching segments in the upper portion with each segment terminating in a clavate stigma.

Selected specimens examined. WESTERN AUSTRALIA: Augustus Island, central-northern part of Island, 15°20'S, 124° 33'E, 27 May 1993, *L.A. Craven, J.D. McStewart & C.L. Brubaker* 9205 (DNA).

Distribution. Drosera caduca is distributed throughout the Edkins Range to the southern regions of the Prince Regent River Reserve and also occurs on Augustus Island, Western Australia.

Habitat. On the mainland *Drosera caduca* grows mainly on creek margins in silty white sand soils. Recorded on Augustus Island growing on edge of basin on lower slopes of sandstone ridge with *Eucalyptus miniata* - bloodwood woodland with spinifex on stony brownish sandy soil.

Flowering period. December-July.

Conservation status. On the mainland, *Drosera caduca* is locally abundant at scattered locations over a known north-south distance of 30 km and an east-west distance of 15 km and is not under threat. The size of the Augustus Island population is not known.

Etymology. Drosera caduca is named from the Latin *caducus* - dropping off early, in reference to the insect traps being present only on the first few juvenile leaves but lacking on all subsequent and fully adult leaves.

Affinities. Drosera caduca is distinguished from all other species within the *Drosera petiolaris* complex by its extremely long trapless adult leaves at the time of anthesis.

Drosera darwinensis A. Lowrie, *sp. nov.* (Figure 4)

D. brevicornis Lowrie affine sed inflorescentia (scapo incluso) 5-15 cm longa differt.

Typus: 0.9 km south of Temple Avenue, Palmerston, Northern Territory, Australia, 8 April 1990, *A. Lowrie* 49 (*holo:* PERTH 04223659; *iso:* CANB, DNA, MEL).

A fibrous-rooted *herb* with perennial stock and a solitary leafy rosette. *Leaves* in a flat basal rosette close to the soil; petiole oblanceolate in outline, 0.7-1 mm wide near base, 1.5-3 mm wide near the

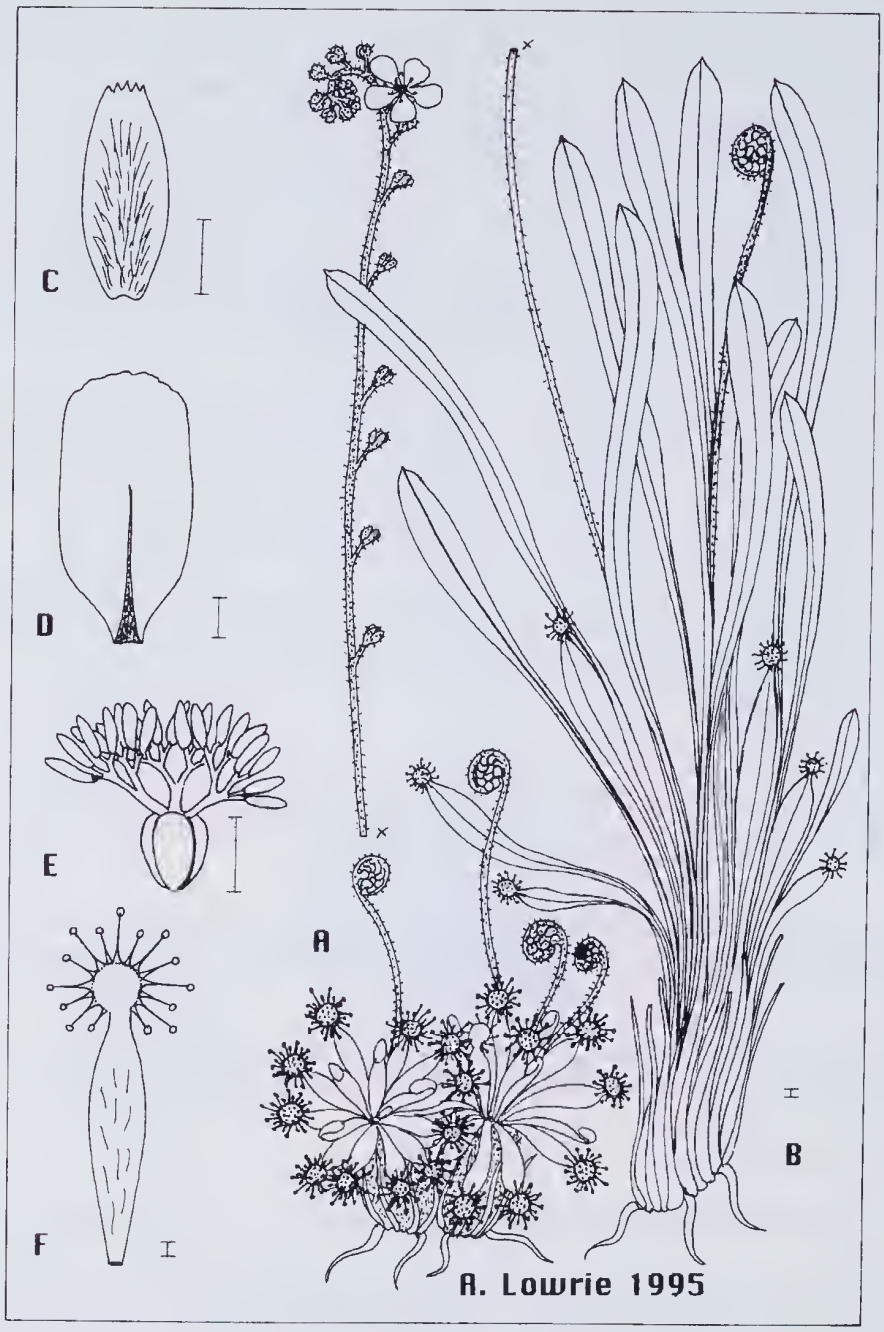

Figure 3. *Drosera caduca* A - habit of juvenile plant, B - habit of adult plant, C - sepal, D - petal, E - gynoecium, F - leaf. Scale bars = 1 mm.

apex, narrowed to 1-1.5 mm at the base of the lamina, commonly 8-10 mm long at flowering, adaxial and abaxial surface covered with mostly white simple hairs, some hairs bearing a few short spurs. *Lamina* orbicular, 3-3.5 mm diam., adaxial surface with insect-catching glands positioned around the margins of the lamina and smaller glands within, abaxial surface covered with white simple hairs. *Inflorescences* 1 or 2 per basal rosette, 5-15 cm long (including scape), forming a 12-24-flowered raceme, densely covered with woolly dendritic hairs; pedicels 0.7-1.5 mm long, pendulous in fruit. *Sepals* ovate, apex erose, 2.5-3 mm long, 1.3-1.8 mm wide, abaxial surface densely covered with white woolly dendritic hairs. *Petals* pink or white, obovate, with a strong mid-vein, *c.* 5 mm long, *c.* 3 mm wide. *Stamens* *c.* 2.5 mm long. *Ovary* obovoid, *c.* 1 mm long, *c.* 0.9 mm diam. at anthesis, carpels 3, broadly bilobed. *Styles* 3, *c.* 1.5 mm long (including stigmas), each divided into many branching segments in the upper portion with each segment terminating in a clavate stigma.

Selected specimens examined. NORTHERN TERRITORY: Chungwah Avenue, Palmerston, 16 Dec. 1990, *P. Simmons* 4 (DNA, PERTH); E of Berry Springs, 12°41'02"S, 131°01'06"E, 10 Dec. 1994, *D.E. Murfet* 2138 (DNA, PERTH).

Distribution. Drosera darwinensis is distributed from Palmerston to Berry Springs south of Darwin and eastwards to Humpty Doo in the Northern Territory.

Habitat. Drosera darwinensis grows in clayey-sand with laterite overlay.

Flowering period. December-April.

Conservation status. Drosera darwinensis is a common species in the Northern Territory and is currently not under threat.

Etymology. The epithet, *darwinensis* refers to the Darwin region in the Northern Territory where this species occurs.

Affinities. This species belongs to the *Drosera petiolaris* complex and its closest relative is *D. brevicornis*. It is distinguished from *D. brevicornis* by having an inflorescence (including scape) 5-15 cm long.

Drosera derbyensis A. Lowrie, *sp. nov.* (Figure 5)

D. lanata Kondo affine sed foliis pilis non-dendriticis dense obtectis differt.

Typus: Silent Grove camping area, Kimberley, Western Australia, 5 June 1995, *A. Lowrie* 1182, (*holo:* PERTH 04223667; *iso:* DNA, MEL).

A fibrous-rooted *herb* with perennial stock giving rise to one or more (mostly solitary) leafy rosettes. *Leaves* erect and semi-erect on a short stock above to the soil; petiole very narrowly oblanceolate in outline, 0.8-1 mm wide near base, 1.3-1.7 (mostly 1.5) mm wide near the apex, narrowed to 0.5-0.7 mm at the base of the lamina, commonly 35-45 mm long at flowering, lenticulate in section, adaxial and abaxial surface densely covered with white woolly non-dendritic hairs. *Lamina* orbicular, 2-3 mm diam., adaxial surface with insect-catching glands positioned around the margins

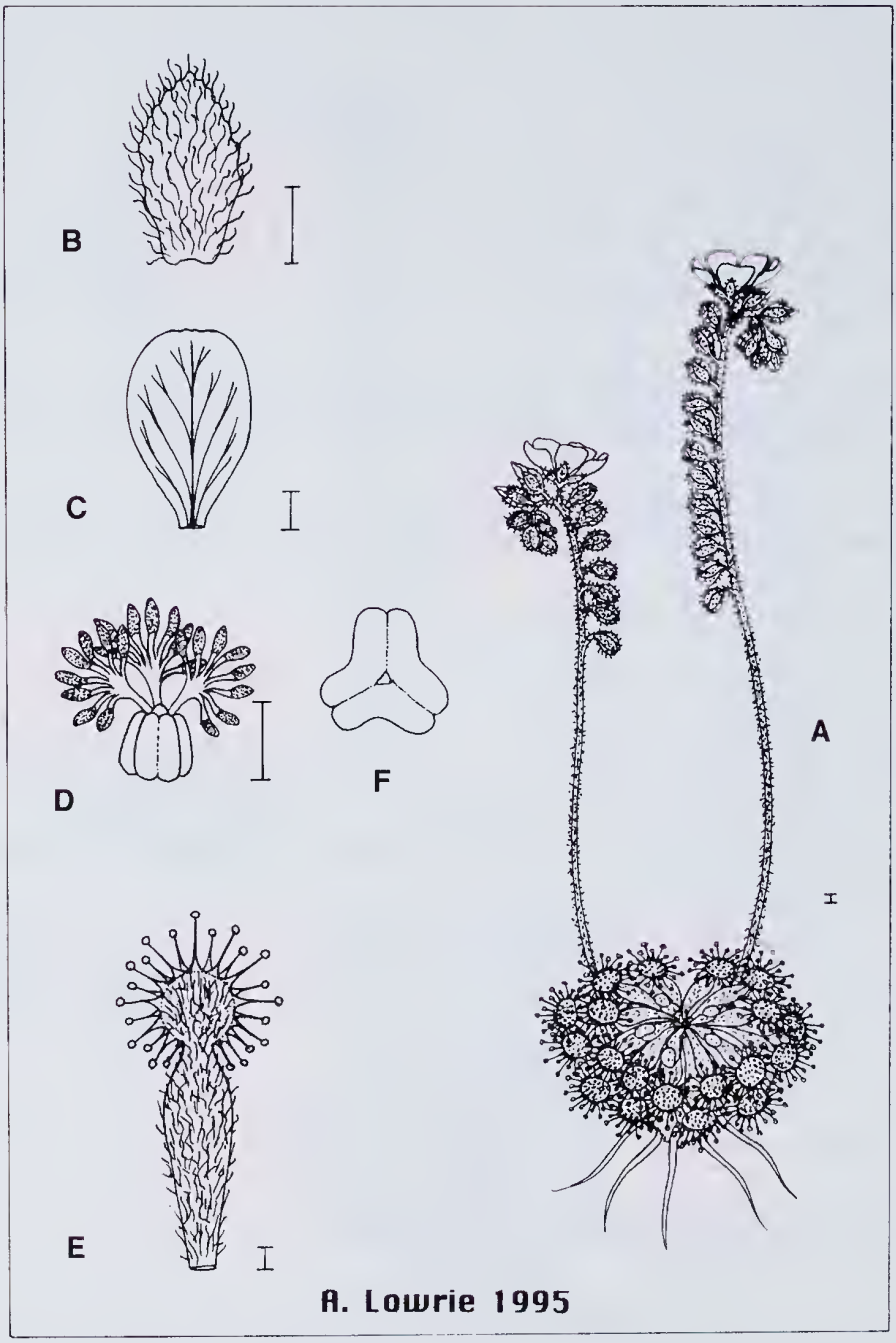

Figure 4. *Drosera darwinensis* A - habit, B - sepal, C - petal, D - gynoecium, E - leaf, F - 3-capellate ovary, base view. Scale bars = 1 mm.

of the lamina and smaller glands within, abaxial surface densely covered with white woolly non-dendritic hairs. *Inflorescences* 1 to 4 per basal rosette, 25-35 cm long (including scape), forming a 30-50-flowered raceme, pedicels 1.5-3 mm long, semi-erect in fruit, scape glabrous in the lower portion, the remainder of scape and raceme densely covered with white woolly non-dendritic hairs. *Sepals* obovate, apex slightly crenate, 1.7-2 mm long, 1-1.2 mm wide, abaxial surface densely covered with white woolly non-dendritic hairs. *Petals* white, oblong, with strong mid-vein, *c.* 4 mm long, *c.* 2 mm wide. *Stamens c.* 1.5 mm long. *Ovary* obovoid, *c.* 1 mm long, *c.* 1 mm diam. at anthesis, carpels 3, broadly bilobed. *Styles* 3, *c.* 1 mm long (including stigmas), each divided into many branching segments with each segment terminating in a dilated stigma.

Selected specimens examined. WESTERN AUSTRALIA: Boab Prison Tree, 0.6 km from Derby, 29 Mar. 1988, *A. Lowrie* 1 (PERTH); On Gibb River Road, 119 km NE of the junction with road to Derby, 17°25'09"S, 124°43'00"E, 4 June 1995, *A. Lowrie* 1161 (DNA, PERTH); 8 miles [12.8 km] E of Derby, 2 Feb. 1971, *K.M. Allen* 614 (PERTH).

Distribution. Drosera derbyensis is distributed from Derby to Beverley Springs in the Kimberley, Western Australia.

Habitat. Drosera derbyensis grows in white sand on the aprons of rock outcrops and in beige sandy soils in floodway areas.

Flowering period. March-June.

Conservation status. Drosera derbyensis is a locally common species over its growing range in the Kimberley and is currently not under threat.

Etymology. The epithet, *derbyensis* refers to the Derby region in the Kimberley, Western Australia where this species occurs.

Affinities. This species belongs to the *Drosera petiolaris* complex and its closest relative is *D. lanata.* It is distinguished from *D. lanata* by having leaves covered with non-dendritic hairs.

Notes. I first discovered *Drosera derbyensis* growing by the Boab Prison Tree near Derby in 1988. *D. derbyensis* has narrow leaves densely covered with white woolly hairs similar to *D. lanata* Kondo. The dense hairy leaf covering of *D. derbyensis* and *D. lanata* is an adaptation also employed by *D. ordensis* Lowrie to retain moisture and provide insulation against desiccation during the dry season.

Drosera fulva Planchon, Ann. Sci. Nat. (Paris) Ser. 3, 9: 289 (1848). (Figure 6)

Typus: Port Essington, Northern Territory, *Armstrong s.n.* (K).

A fibrous-rooted *herb* with perennial stock giving rise to one or more (mostly solitary) leafy rosettes. *Leaves* in a compact basal rosette of semi-erect and prostrate leaves; petiole oblanceolate in outline, 0.6-1.2 mm wide near base, 2-3 mm wide near the apex, narrowed to 0.8-1 mm at the base of the lamina, commonly 25-30 mm long at flowering, adaxial surface glabrous, abaxial surface sparsely covered with appressed white dendritic hairs, later (at the beginning of the dry season) both surfaces are covered with many appressed white dendritic hairs. *Lamina* orbicular, 2-3 mm diam.,

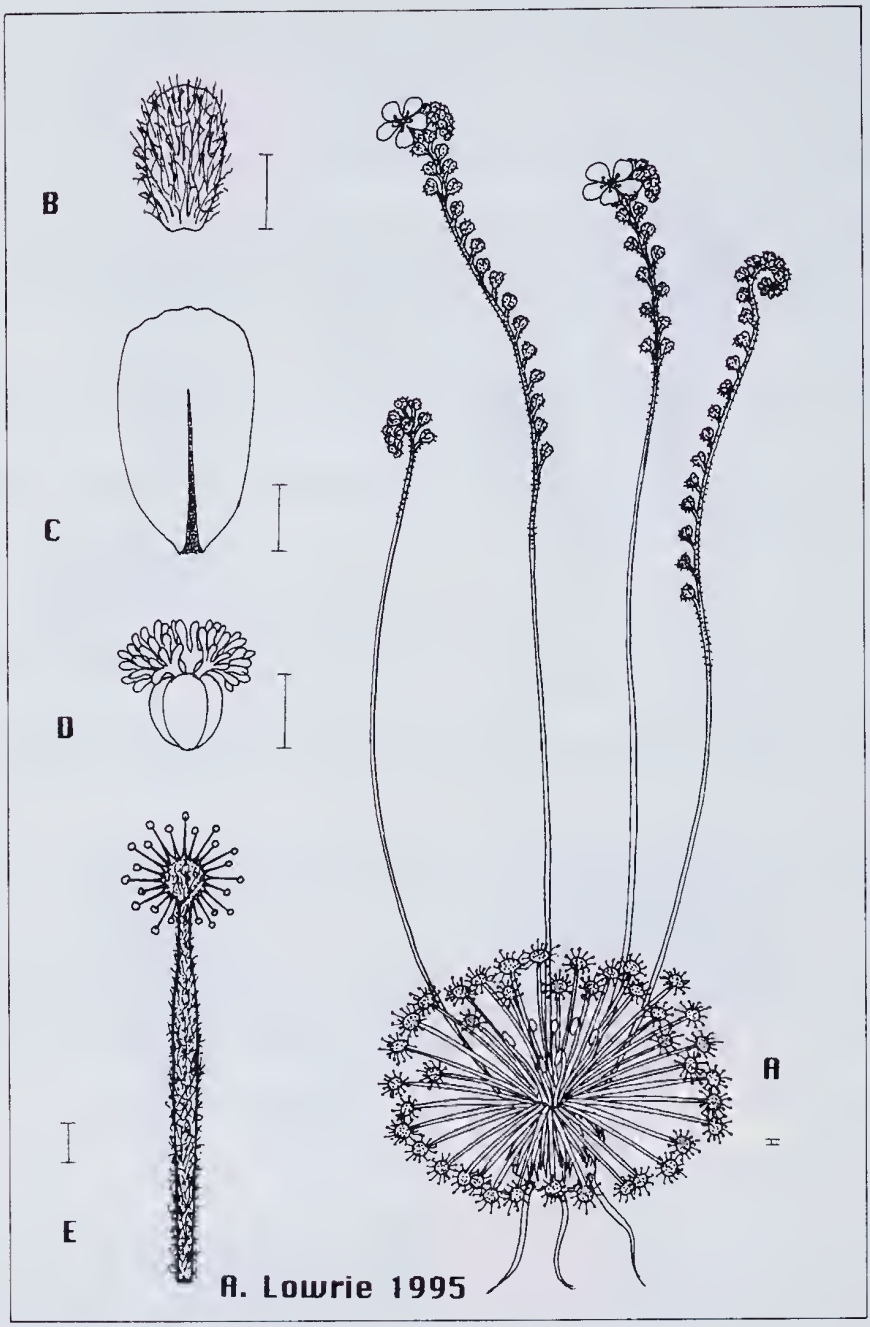

Figure 5. *Drosera derbyensis* A - habit, B - sepal, C - petal, D - gynoecium, E - leaf. Scale bars = 1 mm.

adaxial surface with insect-catching glands positioned around the margins of the lamina and smaller glands within, abaxial surface sparsely covered with appressed white dendritic hairs, later covered with many appressed white dendritic hairs. *Inflorescences* 1 or 2 per basal rosette, 25-45 cm long (including scape), forming a 50- or more-flowered raceme, densely covered with short dendritic hairs; pedicels 1-2 mm long, pendulous in fruit. *Sepals* obovate, apex erose, 3-3.5 mm long, 1.5-1.8 mm wide, abaxial surface densely covered with white dendritic hair. *Petals* white sometimes pink, obovate, with strong mid-vein, apex erose, 6.5-9 mm long, 4-6.5 mm wide. *Stamens c.* 3 mm long, the apex of each filament shortly pointed beyond the anthers. *Ovary* obovoid, 0.8-1 mm long, 1.2-1.5 mm diam. at anthesis, carpels 3, broadly bilobed. *Styles* 3, *c.* 2 mm long (including stigmas), each forked then divided into many branching segments, each segment terminating in a slightly dilated and papillose stigma.

Selected specimens examined. NORTHERN TERRITORY: Paddy Road, off Bridge Mary Road, Koolpinyah, 28 Apr. 1995, *A. Lowrie* 1127 (DNA, PERTH); Near Noonamah, 12°36'09"S, 131°09' 09"E, 10 Dec. 1994, *D.E. Murfet* 2139 (DNA, PERTH); Stuart Highway, 24 miles [38.4 km] S of Darwin, 6 Apr. 1965, *A.S. George* 6526 (PERTH); Noonamah pumping station, 7 Jan. 1991, *P. Simmons* 15 (DNA, PERTH).

Distribution. Drosera fulva extends from Koolpinyah to Noonamah south east of Darwin in the Northern Territory, with a single collection from Port Essington. It is expected *D. fulva* will also be found at many suitable habitats on the Cobourg Peninsula.

Habitat. Drosera fulva grows in sandy soils on damp flats, seepage areas and ephemeral wet depressions just above the wet season flood levels.

Flowering period. February-May.

Conservation status. Drosera fulva is a common species south east of Darwin and is currently not under threat.

Affinities. Closely related to *D. brevicornis* and *D. dilatato-petiolaris*. It is distinguished from *D. brevicornis* by having a basal rosette of semi-erect and prostrate leaves, smaller pendulous fruit and stamen filaments shortly pointed above the anthers. It is distinguished from *D. dilatato-petiolaris* by having an inflorescence (including the scape) 25-45 cm long, pedicels 1-2 mm long and pendulous fruit.

Notes. The type sheet of *D. fulva* consists of two separate collections. Each collection consists of two mounted specimens for each gathering. The two specimens (each bearing individual scapes) on the left side of the sheet are *D. fulva* Planchon, collected from Port Essington (when it was the settlement of Victoria, 1838-1849) by John W. Armstrong, botanist, appointed gardener to the settlement and botanical collector for the Royal Gardens at Kew.

The two specimens (each bearing two scapes) on the right side of the sheet are from Herbarium Oldfield and were collected from Sweers Island in the Gulf of Carpentaria by Benjamin Bynoe a ship's surgeon and naturalist in July 1841. Although these specimens lack complete floral details, they are, in all other respects morphologically similar to the new species *D. brevicornis.*

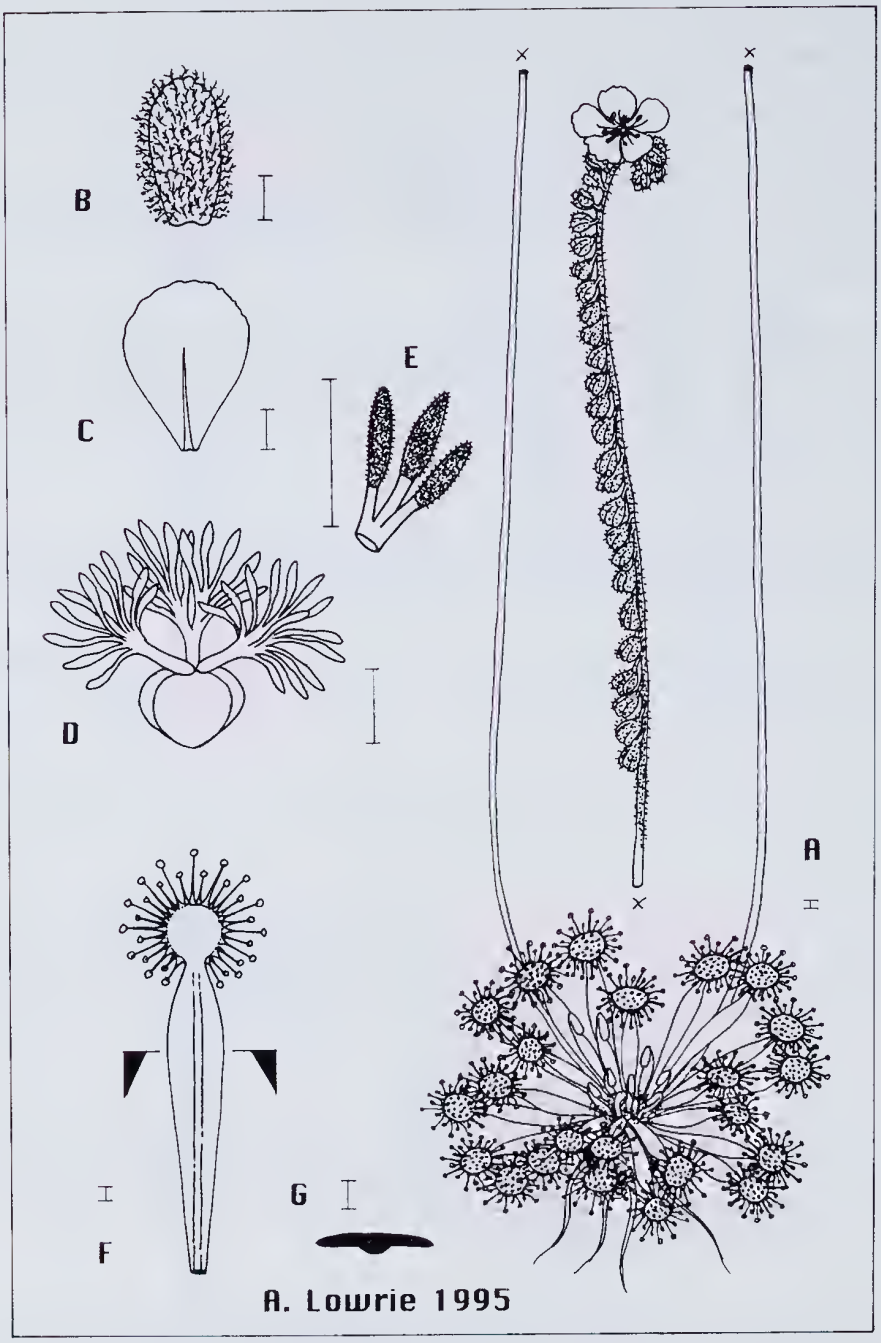

Figure 6. *Drosera fulva* A - habit, B - sepal, C - petal, D - gynoecium, E - stigmas, F - leaf, G - section of petiole. Scale bars = 1 mm.

Acknowledgements

I wish to thank Paul Simmons, Denzel Murfet, Sue Geisen, Russell Barrett and Matthew Barrett for obtaining selected material of various taxa within the *Drosera petiolaris* complex; the leaders of the 1993, 1994 and 1995 *LANDSCOPE* Expeditions for the opportunity to collect material of the *D. petiolaris* complex in remote regions of the Kimberley; the Royal Botanical Gardens at Kew, England who kindly loaned the type sheet of *D. fulva*; Paul Wilson for his assistance with the Latin diagnosis; Barbara Rye for her comments, and the staff at the Western Australian Herbarium.

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Anthocercis sylvicola (Solanaceae), a rare new species from the tingle forests of Walpole, south-western Australia

T.D. Macfarlane[1] and G. Wardell-Johnson[2]

[1]Western Australian Herbarium, C/- Manjimup Research Centre, Department of Conservation and Land Management, Brain Street, Manjimup, Western Australia 6258
[2]Wildlife Research Centre, Department of Conservation and Land Management, PO Box 51, Wanneroo, Western Australia 6065. Present address: Botany Dept, University of Namibia, 340 Mandume Ndemufayo, Pionnerspark, Windhoek, Namibia

Abstract

Macfarlane, T.D. and Wardell-Johnson G. *Anthocercis sylvicola* (Solanaceae), a rare new species from the tingle forests of Walpole, south-western Australia. Nuytsia 11 (1): 71-78 (1996). The rare new locally endemic species *Anthocercis sylvicola* T.D. Macfarlane & Wardell-Johnson is described and illustrated photographically. *Anthocercis sylvicola* is most closely related to *A. genistoides* Miers and *A. anisantha* Endl., but differing most obviously in the smaller green and purple flowers. It is the only member of the genus confined to tall open-forest. Although restricted, its distribution shows a marked discontinuity, a common situation for conservative, relictual high-rainfall taxa in the area. The species is of conservation interest owing to the small area of distribution and small number of plants and populations known. It is listed among conservation priority taxa for Western Australia. A revised key to the spinescent species of *Anthocercis* is presented.

Introduction

During recent studies of plant communities in the south coast area of south western Australia (Wardell-Johnson 1994), a species of *Anthocercis* was found in a vegetation survey quadrat located near Mt Clare, west-south-west of Walpole. Further field work over 3 700 km^2 of the 'Tingle Mosaic' (*sensu* Wardell-Johnson 1994) has shown it to be rare. Earlier collections were found to exist, collected in the 1960s, but they appear not to have been studied by Haegi (1981) and Purdie *et al.* (1982). As the species differs from described species, it is newly described here. The conservation and biogeographical implications of the discovery are also discussed.

New species description

Anthocercis sylvicola T.D. Macfarlane & Wardell-Johnson, *sp. nov.* (Figure 1)

Frutex spinescens foliosus. Ramuli foliaque pubescentia, pilis pro parte maxima simplicibus. Inflorescentia cymarum parvarum composita vel floribus solitariis, sine ramificatione aperta. Flores virides et purpurei; corollae tubus solide purpureus; corollae lobi caespitibus pilorum apicalium ornati.

Typus: Mt Clare, WSW of Walpole, Western Australia, 20 November 1995, *T.D. Macfarlane* 2543, *A.R. Annels & R.W. Hearn* (*holo:* PERTH 04125320; *iso:* AD, BRI, CANB, K, MEL, MO, NSW, PERTH (2 sheets)).

Spinescent *shrub*, partly pubescent with glandular and non-glandular hairs. *Stems* up to 2.5 m tall and 1.5 cm diam., erect or often fallen to an inclined or horizontal position with erect branches, hirsute when young with simple, multicellular, rather weak hairs, glabrous when old. *Spines* initially one per leaf axil, simple or occasionally branched, 8-14 mm long, subsequently often with a second spine growing out adjacent to the first and diverging from it. *Leaves* primary and secondary, blade 7-11 mm long, 2-4.5 mm wide, more or less flat, soft, relatively thin, obovate, sparsely hairy; simple hairs short, rather stiff, curved retrorsely or occasionally erect or antrorse; glandular hairs short-stalked or subsessile; margins entire; apex acute; petiole 1-1.5 mm long; primary leaves alternate and solitary at each node, caducous; secondary leaves one per node, slightly smaller than the primary one and lateral to the spine, present early on the shoot, further secondary leaves often arising at older nodes and forming a cluster from a bud lateral to the spine at or after the formation of a cyme or branch. *Inflorescence* of terminal or subterminal cymes of up to 5 flowers, or flowers apparently solitary, axillary, often extending for a considerable distance from the shoot apex, usually rather sparse. *Bracts* 2 or 3, *c.* 0.5 mm long. *Pedicels* 2.5-3.5 mm long, articulate near the base, glabrous except for sparse minute glands. *Flowers* horizontal or slightly pendulous, protogynous, with a faint unpleasant odour. *Calyx* green, *c.* 3 mm long, externally glabrous, internally hairy, especially near the apex, hairs short, simple; lobes 5. *Corolla* 7-8.5 mm long; tube glabrous, externally dark purple where exposed, green where covered by the calyx tube, internally purple with or without green longitudinal striations on the sides, except for the lower sides (within the calyx) and floor where it is green and translucent, the rim with regular swellings separated by broad grooves or the swellings so pronounced and numerous as to form a corona; lobes 3.2-4 mm long, triangular, spreading at base, the remainder spreading to erect or somewhat incurved, the margins incurved in the upper part, both surfaces green, sometimes with a fine purple midline, externally glabrous, internally hairy with dense, stalked glandular hairs except just below the apex where there is a small dense tuft of short, simple hairs. *Nectary* annular, well developed, *c.* 0.7 mm tall, thick, surrounding base of ovary. *Fertile stamens* 4, *c.* 2 mm long, 2 slightly longer than the other 2, at first strongly recurved and located in lower part of tube whilst the stigma is apparently receptive, subsequently straightening and lengthening, not reaching the stigma; filaments inserted on tube *c.* 1.5 mm above base, upper part more or less linear, green, often with a dull purple stripe on each side, lower part swollen, longitudinally grooved on inner surface, outer surface with a row of stiff, spreading, simple, white hairs near base. *Staminode* located between the longer stamens, well developed and almost as long as the stamens to less than half as long, with or without an anther vestige, occasionally absent, size and presence varying on individual plants. *Style* with capitate stigma situated at or slightly below mouth of corolla tube. *Ovary* 2-locular, with a total of 18-26 ovules. *Mature capsules* and *seeds* not seen.

Other specimens examined. WESTERN AUSTRALIA: Mt Clare, 21 June 1989, *A.R. Annels* 766 (PERTH); Mt Clare, 23 Aug. 1989, *A.R. Annels* 782 (PERTH); Granite Peak area, campsite off Mitchell Road, 15 Sep. 1994, *A.R. Annels* 4432 & *R. Hearn* (PERTH); Frankland National Park, SE of Granite Peak, *c.* 300 m along track N from Mitchell Road, 22 Sep. 1994, *T.D. Macfarlane* 2219, *A.R. Annels & R. Hearn* (BRI, MEL, NSW, PERTH); Mt Clare, WSW of Walpole, 22 Sep. 1994, *T.D. Macfarlane* 2223, *A.R. Annels & R. Hearn* (PERTH); Deep River, upstream of Tinglewood Lodge, WSW of Walpole, 22 Sep. 1994, *T.D. Macfarlane* 2224, *A.R. Annels & R. Hearn* (Manjimup, PERTH); Warbrook [probably an incorrect locality, see below], Sep. 1965, *R.D. Royce* 8315 (PERTH); Walpole-Nornalup National Park near Mt Clare, 9 Oct. 1993, *G. Wardell-Johnson* 4020 (PERTH); Walpole-Nornalup National Park, Mount Claire [Clare], 14 Oct. 1991, *J.R. Wheeler* 2703 (PERTH); near Deep River, *c.* 6 km W of Walpole, 2 Oct. 1967, *P.G. Wilson* 6312 (PERTH).

Figure 1. *Anthocercis sylvicola* A - terminal cluster of flowers (x6), B - shoot with bud and young aborting fruit (x4.3). Photographs by G. Wardell-Johnson, at type locality, 17 November 1993.

Distribution. In a genus notable for restricted species, this species is the most geographically restricted, with a range area of 0.03 km^2, and geographic extent of 12 km^2 *sensu* Mace *et al.* (1992). It occurs in two populations within 1.5 km of one another near Mt Clare on the south coast (the Mt Clare and Deep River populations, approximately 34° 59' S, 116° 43' E), and another 30 km to the north near Granite Peak (34° 43' S, 116° 42' E).

Habitat. The three populations are all in tall open forest, with *Eucalyptus jacksonii* (Red Tingle), *E. guilfoylei* (Yellow Tingle) and *E. diversicolor* (Karri) dominant at Mt Clare (basal area 39 $m^2 ha^{-1}$) and the Deep River, and *E. diversicolor* dominant at Granite Peak. Each of these populations is in brown, gravelly, freely drained clay-loam soils in moisture-gaining sites, proximal to water-shedding areas of granite outcrop.

Each of the sites is species-poor, for example, there are 16 vascular plant species in the 400 m^2 quadrat at the Mt Clare site. *Hovea elliptica, Clematis pubescens, Trymalium floribundum, Pteridium esculentum, Opercularia volubilis, Acacia pentadenia, Tremandra stelligera,* and *Chorizema retrorsum* are dominant understorey species common to the three sites. In addition, *Callistachys lanceolata* and *Acacia divergens* are dominants at the Granite Peak site, and *Acacia urophylla* and *Hibbertia cuneiformis* at the Mt Clare site.

Because the substrate is more moist than surrounding areas, the three populations occur in areas naturally protected from frequent fire. However, it is inevitable that they are burnt occasionally, e.g. both populations in the vicinity of Mt Clare burnt in the high intensity fire of 1951 and probably in 1937 as well. Although the Mt Clare area was burnt by a prescribed fire in early Summer 1979, the immediate area of the *Anthocercis* population did not burn. Similarly, the immediate area of the Granite Peak population did not burn in the prescribed fire of Spring 1989. Two of the three populations (Granite Peak and Deep River) occur adjacent to areas of machine disturbance (gravel scrapes).

Habit and fire response. The response to fire of this species is not known, and fertile fruits have not been seen despite repeated visits. The habit of the plant is unusual. In the long-unburnt area, at Mt Clare, it grows as a semi-erect shrub, with branches bending over and trailing along the ground. It then resumes the semi-erect shrub habit. No evidence has, however, been found of rooting from trailing branches. Nevertheless, there is some difficulty in deciding what constitutes an individual plant.

Flowering and fruiting periods. Flowering September - February. Fruiting season unknown, although immature, aborted fruit collected in December and February.

Conservation status. Anthocercis sylvicola occurs in populations of varying size, ranging from a few score at Deep River to thousands at Mt Clare (although the difficulty of deciding what constitutes an individual plant should be noted). The species has been assigned the conservation code Priority 2 (Hearn 1994: see end of this issue for details of the codes). It has previously been assigned the phrase name "*Anthocercis* sp. Walpole (*P.G. Wilson* 6312)" pending its formal description. The species appears to be genuinely rare, given that there has been much informed botanical survey work in the region. However, all three localities are within national parks, and do not face immediate threat other than from fire.

Etymology. The epithet, *sylvicola* (dweller in forests) is from the Latin *sylva* - forest or wood, and *cola* - dweller, in reference to the habitat of the species.

Notes. The specimen listed above as *Royce* 8315 is labelled "Warbrook, W.A. Shrub 1.2 m high, in moist black swampy sand, Sept. 1965, *R.D. Royce* 8315." We believe that it was misnumbered and as a consequence has also been mislabelled. Our reasons are as follows. (1) The species is otherwise known only from the vicinity of Walpole, *c.* 360 km south of Warbrook, which is near Perth. (2) The habitat given for the other plants collected at Warbrook concurrently with *Royce* 8315 is very different from the known Walpole sites for the *Anthocercis*. (3) A search of the specimen database WAHERB, which was nearly complete for the PERTH collections, revealed that for Royce collections made from near Walpole, there was a series collected in September-October 1963 from which specimen 8115 was missing. This number differs from 8315 by only one digit, which would be an easily made error. Royce's field notebook contains the entry "8115 5/10/63 Myrt." [i.e. Myrtaceae], and two numbers earlier: "swampy heath. W. Nornalup." [i.e. west of Nornalup]. There is a strong temptation to assume that 8115 was the *Anthocercis*, which subsequently was given the wrong label information as a result of an erroneous number tag. Problems with this interpretation are the reference to Myrtaceae, which is an unlikely attribution for this spiny *Anthocercis*; and the habitat, given under 8113 and differing from the known sites for the *Anthocercis*. However, this habitat may very well not apply to 8114 and 8115. Thus, in view of points 1-3 above, we suspect that the *Anthocercis* could really be the missing 8115. The fate of the real 8315, if any, is unknown.

Key to the spinescent species of *Anthocercis* (modified from Purdie *et al.* 1982)

1. Branches and leaves conspicuously pubescent
   2. Flowers white to cream; spines pubescent; corolla lobes glabrous at apex ..... **A. anisantha**
   2. Flowers green and purple; spines usually glabrous; corolla lobes with hair tufts at apex ..... **A. sylvicola**
1. Branches and leaves glabrous or sparsely pubescent
   3. Inflorescence usually branched; pedicels glandular-pubescent; most leaves at least 3 mm wide ..... **A. intricata**
   3. Inflorescence not branched; pedicels glabrous or sparsely pubescent most leaves 0.5-2.5 mm wide
      4. Corolla lobes with minute hairs at apex ..... **A. genistoides**
      4. Corolla lobes glabrous ..... **A. anisantha**

General discussion

The new species conforms well to the current circumscription of *Anthocercis* (Purdie *et al.* 1982), but the flower colour is distinctive. The green is evidently darker than the "pale yellow-green" of *A. gracilis* (Purdie *et al.* 1982), and the purple, whilst present as markings in other species, in *A. sylvicola* occurs as solid colour all over the exposed corolla tube.

Anthocercis sylvicola is most closely related to *A. anisantha* Endl. and *A. genistoides* Miers, sharing with them a densely spiny habit, small leaves occurring initially singly or in twos and on older branches in small clusters, but deciduous, flowers in sessile cymose clusters or solitary terminally or away from the shoot apex, occurring lateral to spine bases, and an inland distribution. The other spinescent species, *A. intricata* F. Muell., has sparse spines, larger leaves, though arranged as in the preceding species, flowers in pedunculate cymose inflorescences with open branching, and a coastal distribution.

A. genistoides differs from *A. sylvicola* in having larger flowers with a whitish corolla, leaves usually grooved or channelled on the upper surface instead of flat or slightly folded along the midline, fully rather than incompletely deciduous leaves, axes glabrous and minutely papillose, instead of hispid, and in being usually leafless in the warmer months of the year instead of always at least sparsely, usually densely, leafy. *A. anisantha* differs in having usually larger flowers with a whitish corolla, leaves and stems very densely glandular-hairy (except for the non-glandular-hairy or glabrous subspecies *collina* Haegi from the Northern Eyre Peninsula, South Australia) instead of non-glandular, in being more sparsely hispid, with hairs usually absent from spines and exterior of calyx, and sparse on leaves, and in having fully deciduous leaves.

This group of spiny species, plus *A. gracilis* Benth., tend to shed their leaves and generate new ones from buds lateral to the spines, with the clusters of new leaves often growing out as new shoots. Thus they are, in effect, deciduous plants, partially so in *A. sylvicola* and *A. anisantha* in that there is apparently no leafless period, fully so in *A. genistoides* and *A. gracilis*, in which the plants are leafless during the warmer, drier part of the year.

The habit of this species is unusual, particularly in areas long unburnt, and is suggestive of a clonal growth habit. All populations have been regularly examined for viable seed over several months of the flowering, and post-flowering season. Although a few post-anthesis non-viable capsules were collected, no viable seed has been noted and the capsules are apparently shed before full development has occurred. It is possible that the species seeds episodically in unusual conditions and that, like many other species in the genus, it has long-lived soil-stored seed. If that were the case the species might well become more abundant following fire. However, no seedlings were observed following a moderate intensity fire in the autumn of 1994 in an area adjacent to the Mt Clare population. The long flowering period and moderate abundance of flowers suggests that the pollinator may have become rare or extinct. The flowers produce a faint scent, and insects have been observed visiting the flowers (S. Watkins pers. comm.). One of us (TDM) found blowflies (Diptera: Calliphoridae) to be the predominant visitors during one short observation period at Granite Peak.

The habitat of this species is not unusual in the Walpole area and similar sites exist in Karri/Tingle forest as islands of habitat throughout the Tingle Mosaic. Other sites identified as occurring in the same community type (10 of 446 quadrats in the survey area among which 44 community types were identified) occurred in Soho, Crossing (Mt Frankland National Park), and Ordnance Forest Blocks. Nevertheless, only one quadrat included this species. A total of 89 quadrats were located within tall open-forest, chiefly of Red Tingle, Yellow Tingle or Karri. It is possible that further populations of this species await discovery, particularly in the Soho hills, although the dense vegetation and poor access of the area would make survey difficult.

The discovery of a species of *Anthocercis* confined to tall open-forest of the High Rainfall Zone (*sensu* Hopper 1992) is of significance. Its two closest relatives, also in the south-west, are species of the Transitional Rainfall Zone. Although *A. gracilis*, another local endemic, is also a forest species of the High Rainfall Zone, it occurs in the more seasonal environment of the Darling Scarp. *Anthocercis sylvicola* is the first species found in the forest of the least seasonal, high-rainfall area of the State.

Distribution patterns and chemistry demonstrate that both the genus *Anthocercis* and tribe Anthocercideae are conservative and relictual. Based on the occurrence of both tropane and nicotinic alkaloides, and the range of trichome hair types found in the tribe Anthocercideae, Haegi (1986, 1992) argues that this tribe represents stock that has long undergone independent evolution. Symon (1992)

argues that the tribe represents an ancient lineage separated since the time Australia broke from Gondwanaland, based on diverse speciation patterns and the scattered distribution of the respective genera across Australia.

The environments of the Walpole area have been described as having micro-habitats that are the most akin of any in the south-west, to those existing at the time of Gondwana (Main & Main 1991, Wardell-Johnson & Horwitz in press). Hope & Kirkpatrick (1989), however, warn against labelling existing species or environments as Gondwanic as no extant community can be regarded as reflecting conditions as they were in the early Paleocene more than 50 million years BP. Nevertheless, the general area (Warren Botanical Subdistrict) has been shown to be the most important centre of endemism for conservative high rainfall taxa in the State (Hopper *et al.* 1992).

The Walpole area in particular is known for many conservative taxa of disjunct distribution in areas of granite outcrop (e.g. three *Eucalyptus* species, *Chamelaucium forestii* and *Chamelaucium* sp. undescribed) or swampy terrain (e.g. *Eucalyptus ficifolia* and *Reedia spathacea*). The occurrence of populations of this species near areas of high relief is notable. For example, Mt Clare (190 m) and Granite Peak (360 m) are the highest points in the landscape in their respective areas. The continuing discovery of new, possibly relictual, high-rainfall taxa with disjunct distributions supports notions of recurring climatic changes and periodic isolation of hilltops during marine transgressions (Roberts *et al.* in press, Wardell-Johnson & Horwitz in review) as isolating mechanisms for populations over a long period.

It is possible that this species represents an early lineage in the genus *Anthocercis*. The unusual habit, the possibility of containing chemicals of major pharmaceutical significance (given the frequency of secondary compounds occurring in the Solanaceae), and the possible relictual nature of this species, make it worthy of more detailed taxonomic and ecological investigation. Phytochemical and electrophoretic studies may be especially revealing.

Acknowledgements

We thank the following for assistance with aspects of the work: Tony Annels and Roger Hearn for helping with field observations and collections, including the discovery of the Granite Peak population, S. Watkin for field observations, C. Vellios and I. Wheeler for field assistance during the vegetation surveys which led to the relocation of the new species, the Director of the Western Australian Herbarium (PERTH) for access to the collections and specimen database, and Paul Wilson for translating the Latin description.

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A taxonomic review of the genera *Lachnostachys*, *Newcastelia* and *Physopsis* (Chloanthaceae) in Western Australia

B.L. Rye

Western Australian Herbarium, Department of Conservation and Land Management,
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Rye, B.L. A taxonomic review of the genera *Lachnostachys*, *Newcastelia* and *Physopsis* (Chloanthaceae) in Western Australia. Nuytsia 11(1): 79-107 (1996). Three species are transferred from *Newcastelia* to *Physopsis*, bringing the total number of species in the latter genus to five. Keys are provided for the genera of tribe Physopsideae and the species belonging to *Lachnostachys*, *Newcastelia* and *Physopsis*. Information on the Western Australian members of each of these three genera, including distribution, habitat, flowering time and conservation status, is also given, and the new species *Newcastelia roseoazurea* Rye is described.

Introduction

A recent survey of Western Australian plants of conservation priority in the family Chloanthaceae revealed problems with the delimitation of the genus *Physopsis* and also the infraspecific entities included in *Lachnostachys* and *Newcastelia*. A few species traditionally included in *Newcastelia* were found to match *Physopsis* in all characters except their usually 5-merous flowers, yet differed in several characters from other members (including the type) of *Newcastelia*. Only two species, both with consistently 4-merous flowers, had been included in *Physopsis* and both appeared to be more closely related to at least one of the 5-merous '*Newcastelia*' species than to one another. This paper addresses these anomalies by transferring three species from *Newcastelia* to *Physopsis*.

Physopsis, *Lachnostachys* and *Newcastelia* are closely related genera belonging to tribe Physopsideae, the first two endemic to south-western Australia and the last extending from Western Australia east to Queensland. The history of all members of the tribe is presented in detail in Munir (1978). Munir's taxonomic revision also provides detailed descriptions and illustrations of all the species except for one new *Newcastelia* species, which is described and illustrated in this paper. The information given here for the previously described taxa is restricted mainly to new data relating to the altered generic limits and to areas not covered in the revision, such as habitat, flowering time and conservation status. New distribution maps are also provided, incorporating the data from recent collections and disregarding some localities from old collections that appear to be vague or otherwise misleading.

Materials and methods

Apart from a few specimens borrowed from DNA and type specimens seen at MEL, all material examined in this study is housed at PERTH. A few recently collected specimens are cited to supplement the specimens cited previously by Munir (1978); all of them are represented at PERTH and many of them have duplicates at other herbaria.

For simplicity, the term 'spike' is used throughout for the spike-like inflorescences found in the three genera, but is not strictly correct as the cymes and flowers are subsessile or shortly stalked rather than sessile. The botanical provinces cited for Western Australia follow Beard (1980). Each symbol used on the geographical distributions indicates the presence of the species in an area measuring 0.25 degree latitude by 0.25 degree longitude. Conservation codes are those adopted by the Western Australian Department of Conservation and Land Management for its Gazetted Rare and Priority Flora List; they are defined at the end of this Nuytsia issue.

Taxonomic treatment

Table 1 compares the geographical distributions and morphological characteristics of the five genera currently recognized in tribe Physopsideae. It should be noted that generic and infrageneric boundaries in the *Dicrastylis-Mallophora* group need further investigation, but that is beyond the scope of this paper.

Key to genera of tribe Physopsideae

1. Style with dendritic hairs on basal part, the hairs 0.3-0.7 mm long; upper part of style divided into 2 branches or distinctly 2-lobed (in *Mallophora rugosifolia* Munir, the lobes are sometimes only *c.* 0.2 mm long). Calyx tube much to slightly shorter than, or rarely equalling, the calyx lobes
   2. Flowers all or mostly 5-merous or (in *Dicrastylis archeri* Munir and *D. capitellata* Munir) with the calyx mostly 5-lobed but corolla lobes and stamens mostly 4. Style hairy on more than half of the undivided portion and sometimes on the branches as well; branches usually about as long as undivided portion but sometimes almost reaching base of style or as little as 1/4 length of style ..... **Dicrastylis**
   2. Flowers all or mostly 4-merous. Style hairy only on the basal half of the undivided portion; branches or lobes short, less than 1/3 the length of the style ..... **Mallophora**
1. Style glabrous throughout or with simple or 2-branched hairs on basal half, the hairs up to 0.3 mm long; apex notched or 2-lobed. Calyx tube greatly to slightly exceeding, or rarely equalling, the calyx lobes
   3. Upper leaf surface slightly to distinctly rugose, becoming glabrous. Corolla yellow or white; lobes 4 or 5, broadly obtuse, either with prominent reticulate veins or thickened and with no veins visible ..... **Physopsis**

3. Upper leaf surface shallowly to deeply bullate, densely covered in dendritic hairs or becoming glabrous on the summits of the bullae but with hairs retained between the bullae. Corolla purple, blue or white; lobes either (4)5-8 or very reduced, if fully developed then either narrrow throughout or with a narrow apical protrusion, thin-textured, with the midvein obvious and usually also a couple of lateral veins clearly visible on each side
   4. Corolla with (4)5-8 lobes alternating with the stamens; lobes either narrow throughout or narrowed into an apical protrusion. Ovary 4-celled or with cells becoming fewer by abortion at maturity, with 1 ovule per cell ..... **Newcastelia**
   4. Corolla lacking lobes or with very reduced short broad lobes, with (4)5-10(12) stamens arising at summit of floral tube and appearing to form a continuation of it. Ovary 2-celled at maturity, with 2 ovules per cell ..... **Lachnostachys**

Lachnostachys Hook.

Hooker (1841: tt. 414, 415). *Type: Lachnostachys ferruginea* Hook.

Small or medium-sized *shrubs*, erect or spreading. *Young stems* terete or (if leaves decurrent) appearing 4-ridged and 4-angled, with a very dense indumentum of non-glandular dendritic hairs. *Leaves* opposite-decussate, sessile, sometimes decurrent, entire; lower surface with a dense persistent indumentum of non-glandular dendritic hairs; upper surface shallowly to deeply bullate, covered with non-glandular dendritic hairs, which often hide the bullae, the hairs sometimes shed from the bullae summits but persistent between the bullae. *Inflorescence* of reduced, almost sessile cymes arranged in solitary or multiple spikes terminating leafy branchlets; spikes dense in bud, remaining dense (except in *Lachnostachys eriobotrya*, which usually has short internodes between adjacent pairs of cymes at maturity); cymes usually 3-flowered, in opposite-decussate pairs. *Flowers* (4)5-10(12)-merous, with equal numbers of calyx lobes, corolla lobes (if present) and stamens. *Calyx* densely dendritic-hairy outside, glabrous inside; lobes shorter than tube. *Corolla* mauve to deep purple, glabrous outside; lobes absent or very reduced, when present equal, much shorter than corolla tube and stamens, depressed-ovate or shallowly triangular, acute to almost truncate, glabrous, thin-textured, with the midvein prominent and usually a few lateral veins clearly visible. *Stamens* inserted at the summit of floral tube, alternating with the corolla lobes (when present) and appearing to form a continuation of the tube, long-exserted, glabrous; filament slender with an expanded base. *Ovary* becoming 2-celled at maturity, with 2 ovules in each cell. *Style* greatly exserted, glabrous or with non-glandular simple or deeply 2-branched hairs on basal half, sometimes also with dendritic hairs at the extreme base; apex notched. *Fruit* dry, indehiscent, 1- or rarely 2-seeded, enclosed in the persistent calyx.

A genus of six species endemic in south-western Australia, occurring primarily on sandy soils, often associated with laterite, in the South-west Botanical Province and South-western Interzone and extending slightly into the Eremaean Botanical Province. (Figure 1)

Lachnostachys is distinguished from its closest relative, *Newcastelia*, by its very reduced to absent corolla lobes and its 2-celled mature ovary; indeed these two characters are unique in tribe Physopsidae. Several additional characters distinguish *Lachnostachys* from other genera in the tribe, as indicated in the key and Table 1.

Table 1. Comparison of the geographical distribution and morphological characteristics of the five genera of tribe Physopsideae.

	Mallophora	*Dicrastylis*	*Physopsis*	*Newcastelia*	*Lachnostachys*
Distribution					
main area	south-west	south-west & arid zone	south-west	arid zone	south-west
Leaves					
upper surface	bullate	rugose to bullate	smooth to rugose	bullate	bullate
glandular dendritic hairs	absent	usually absent	usually present	absent	absent
Flowers					
no. of parts	4(5)	4,5(6)	4,5	(4)5-8	(4)5-10(12)
Calyx					
tube length	< lobes	≤ lobes	> lobes	≥ lobes	> lobes
Corolla					
colour	white	white or coloured	yellow or white	purple, blue or white	purple
lobes	obvious	obvious	obvious	obvious	absent or inconspicuous
lobes apex	obtuse	obtuse or subacute	broadly obtuse	attenuate to caudate	acute to truncate
lobes midvein*	not prominent	rarely prominent	not prominent	prominent	prominent
Style					
exsertion	exserted	exserted	included	included or exserted	exserted
indumentum	dendritic	dendritic	absent or simple	absent	absent, simple or 2-branched
apex	distinctly lobed or branched	branched	distinctly lobed	notched or slightly lobed	notched
Mature ovary					
ovules/cell	1	1	1	1	2

* The midvein is termed 'prominent' when it is more obvious or extending much further than the lateral veins and 'not prominent' when there is a prominent reticulate pattern of both types of veins or when the veins are not visible.

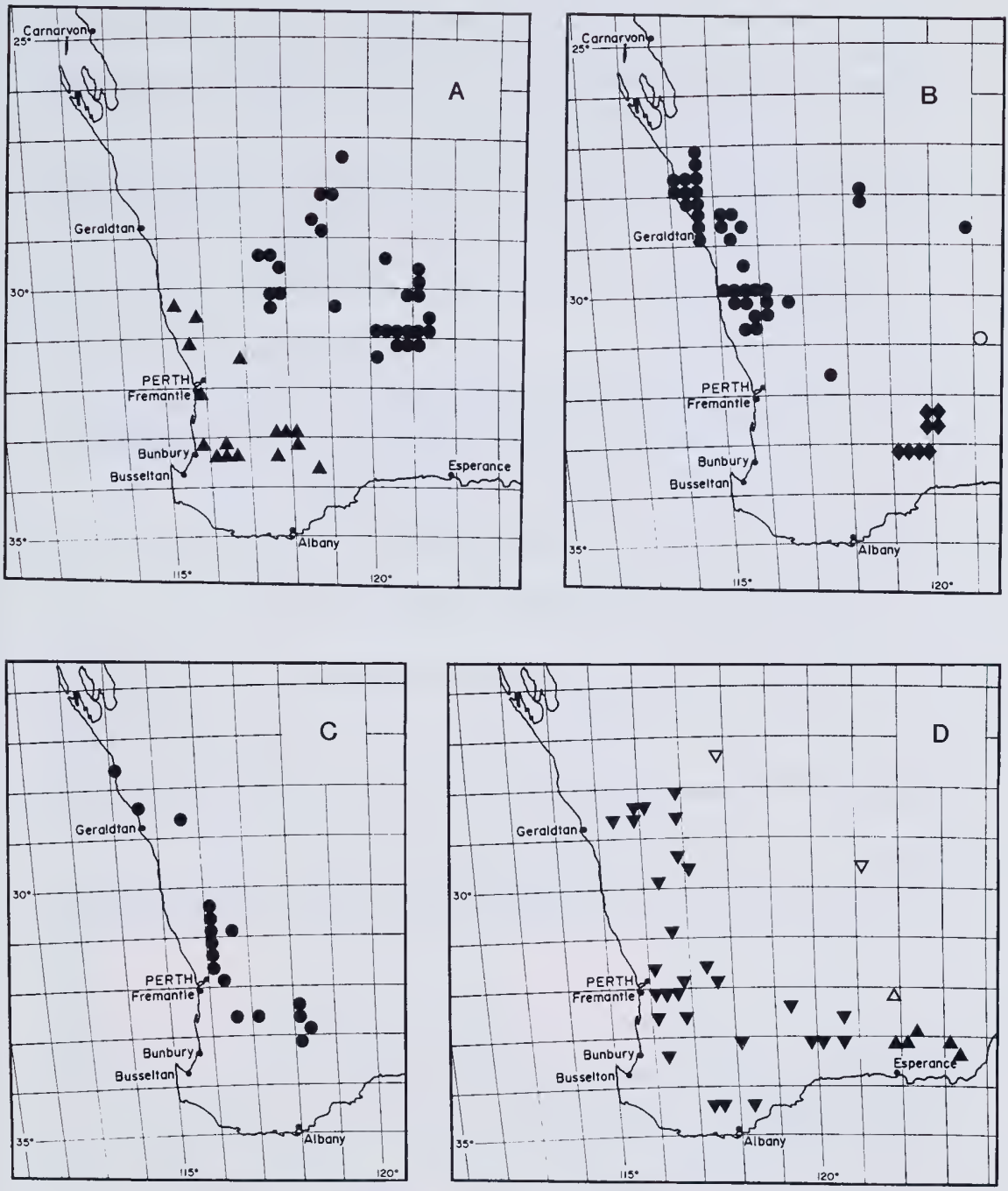

Figure 1. Geographical distribution of *Lachnostachys* species. A - *L. albicans* ▲ and *L. coolgardiensis* ● ; B - *L. bracteosa* ◆ and *L. eriobotrya* ● ; C - *L. ferruginea*; D - *L. verbascifolia* var. *paniculata* ▲ and *L. verbascifolia* var. *verbascifolia* ▼. Open symbols are used to indicate doubtful records, all of which date from before 1910.

Key to *Lachnostachys* species

1. Leaves narrowly ovate to almost circular, not decurrent (the stems terete)
   2. Leaves usually acute; upper surface shallowly bullate. Inside of corolla tube glabrous. Ovary hairy but not glandular ..... **L. albicans**
   2. Leaves usually obtuse; upper surface deeply bullate. Inside of corolla tube with dendritic hairs. Ovary both hairy and glandular
      3. Bracts ovate or broadly ovate, with a purple or brown indumentum. Flowers (6)7-10-merous; corolla tube hairy inside almost to the summit ..... **L. ferruginea**
      3. Bracts narrowly ovate or ovate, with a white or off-white indumentum. Flowers (4)5-7(8)-merous; corolla tube usually glabrous at summit inside (although glabrous portion may be overlaid with hairs that are inserted lower in the tube) ..... **L. verbascifolia**
1. Leaves linear and/or decurrent (the stems 4-ridged or appearing 4-angled)
   4. Leaves narrowly oblong to ovate; upper surface densely hairy. Flowers 5- or 6-merous, with dendritic hairs inside corolla tube. Style glabrous. Occurring in the Sandstone-Paynes Find-Coolgardie area ..... **L. coolgardiensis**
   4. Leaves linear; upper surface becoming glabrous on the tuberculate or rugose summits of the bullae. Flowers 7-12-merous, with simple or 2-branched hairs inside corolla tube. Style hairy near base. Occurring from Murchison River south-east to Lake King
      5. Flower spikes several to many in an opposite-decussate arrangement terminating each branchlet, often becoming interrupted. Inside of corolla glabrous except near base ..... **L. eriobotrya**
      5. Flowers spikes solitary (each on a separate leafy branchlet), dense. Inside of corolla hairy throughout ..... **L. bracteosa**

Lachnostachys albicans Hook. (Hooker 1841: t. 414). *Type:* Swan River Colony [Western Australia], 1839, *J. Drummond s.n.* (*holo:* K *n.v.*).

Illustrations. Diels & Pritzel (1904: Figure 57A,B); Munir (1978: Figure 48).

Description. Munir (1978: 646-650). Additional characters: leaves with simple glandular hairs mixed with longer non-glandular dendritic hairs; corolla lobes shallowly triangular or depressed ovate, 0.3-0.6 mm long.

Selected specimens examined. WESTERN AUSTRALIA: 28 km W of Lake Grace, Tarin Rock Reserve, 2 Oct. 1984, *J.M. Brown* 306; Frazer Rd, Banjup, 18 Sep. 1979, *R. Carey*; Badgingarra National Park, 8 km W along Cadda Rd off Brand Highway, 8 Oct. 1985, *M. Carter* 407; 2 km W of Muja, Collie region, 9 Oct. 1981, *G.J. Keighery* 4083; 5 km E of Tincurrin, 26 Oct. 1982, *K.H. Rechinger* 59106.

Distribution. Extends from Badgingarra south to Collie and south-east to Tarin Rock, in the South-west Botanical Province of Western Australia.

Habitat. Occurs in sandy soils, commonly over laterite, in *Eucalyptus marginata* forest on the eastern side of the Darling Range and associated hills, or in shrublands in other areas.

Flowering period. Mainly August-October, also recorded March and May-June.

Conservation status. Not considered to be at risk.

Notes. This species always has distinct, although very reduced, corolla lobes, which are generally more obvious than in other *Lachnostachys* species.

Lachnostachys bracteosa C.A. Gardner (Gardner 1964: 47). *Type:* West of Lake King, Western Australia, 25 October 1961, *C.A. Gardner* 13636 (*lecto:* PERTH 01607340, *fide* Munir (1978: 669); *isolecto:* CANB, K, MEL, PERTH 01607308).

Illustration. Munir (1978: Figure 52).

Description. Munir (1978: 669-672).

Selected specimens examined. WESTERN AUSTRALIA: 10 km N of Lake Cronin, 13 Sep. 1981, *K.R. Newbey* 8795; Intersection of Tarco Rd with the Lake King to Newdegate Road, 7 Sep. 1986, *P.S. Short* 2755, *M. Amerena & F.A. Fuhrer.*

Distribution. Extends from near Hyden east to north of Lake Cronin and south-east to Lake King, in the South-west Botanical Province of Western Australia.

Habitat. Occurs in sandy soils, often on laterite or with lateritic gravel, recorded in shrublands.

Flowering period. September-December.

Conservation status. Not considered to be at risk at present.

Lachnostachys coolgardiensis S. Moore (Moore 1903: 100). *Type:* Coolgardie district, [Western Australia], 1900, *L.C. Webster* (NSW 106693 *n.v.*, illustration seen).

Lachnostachys brevispicata E. Pritzel (Diels & Pritzel 1904: 511). - *L. coolgardiensis* f. *brevispicata* (E. Pritzel) Munir (Munir 1978: 654-655). *Type:* Menzies, Western Australia, October 1901, *E. Pritzel* 1018 (*lecto:* PERTH 01607359, *fide* Munir (1978: 654)).

Illustrations. Diels & Pritzel (1904: Figure 57F-H); Munir (1978: Figure 49).

Description. Munir (1978: 650-655).

Selected specimens examined. WESTERN AUSTRALIA: 500 m [0.5 km] N of Gnarlbine Rocks, 28 Sep. 1992, *G. Barrett*; 104 km N of Kalgoorlie, *c.* 26 km S of Menzies, 3 Sep. 1985, *B.J. Conn* 1924; Walling Rock Station, 12 Sep. 1988, *R.J. Cranfield* 7371; 28 km E of Jaurdi Homestead, 17 Sep. 1981, *K.R. Newbey* 8820; 5.5 km S of Paynes Find, 10 July 1980, *C.I. Stacey* 643.

Distribution. Occurs in southern Western Australia, extending from Gidgee Station (north of Sandstone, in the Eremaean Botanical Province) south-west to Cleary (just inside the South-west Botanical Province), south to Boorabbin National Park and south-east to Boulder (in the South-western Interzone).

Habitat. Occurs in sandy soils of red, yellow or other colours, on sandplains, dunes or rarely on lateritic rises, in spinifex grasslands or in shrublands, sometimes in open woodlands.

Flowering period. June-October.

Conservation status. Not considered to be at risk.

Notes. Previously two forms of *Lachnostachys coolgardiensis* were recognised, f. *brevispicata* having broader leaves and larger spikes than f. *coolgardiensis* (Munir 1979: 645). As in many other species, there is a tendency for leaf size and inflorescence size to be correlated, but both characters show continuous variation with no clearcut division into forms. Such characters might also be expected to vary greatly within populations and individuals partly as a result of rainfall fluctuations from year to year, which can be extreme in arid environments.

Lachnostachys eriobotrya (F. Muell.) Druce (Druce 1917: 630). - *Walcottia eriobotrya* F. Muell. (Mueller 1859: 241-242). - *Lachnostachys walcottii* F. Muell. (Mueller 1861: 140). *Type:* Murchison River, Western Australia, *P. Walcott* (*lecto:* MEL 41166, *fide* Munir (1978: 673)).

Lachnostachys rodwayana W. Fitzg. (Fitzgerald 1904: 29). *Type:* Arrino, Western Australia, September 1903, *W.V. Fitzgerald* (PERTH 01607367).

Pycnolachne ledifolia Turcz. (Turczaninow 1863: 214-215). *Type:* Swan River [Western Australia], *J. Drummond* coll. 7, n. 220 (*holo:* KW *n.v.*, photograph PERTH 04134559).

Illustrations. Diels & Pritzel (1904: Figure 57C-E); Munir (1978: Figure 53).

Description. Munir (1978: 672-679). Additional characters: leaves often decurrent; corolla lobes absent or depressed ovate and up to 0.6 mm long; stamens 7-12, most commonly 8-10.

Selected specimens examined. WESTERN AUSTRALIA: 10 km S of Eneabba along Brand Highway, 24 Jan. 1979, *B. Barnsley* 893; Marr Rd, Watheroo National Park, 11 Oct. 1985, *M. Carter* 456; 13.2 km W of Coomberdale, on Coomberdale West Rd, 17 Oct. 1993, *B. Conn* 3857 & *M.E. Tozer*; Port Gregory road, 14.6 km NW of Northampton, 27 Sep. 1985, *N. Hoyle* 473; Eurady Station, 26 Sep. 1988, *P. Roberts* 907.

Distribution. Occurs mainly in the South-west Botanical Province of Western Australia, extending from north of Eurady Station (near Murchison River) south-east to near Moora, with an isolated record from Kellerberrin. There are also a few records from inland areas, including Mount Magnet and Sturt Meadows Station, in the Eremaean Botanical Province.

Habitat. Occurs in sandy soils, often over laterite, in low to tall shrublands or woodlands, sometimes dominated by *Banksia* or *Eucalyptus* species.

Flowering period. August-November.

Conservation status. Not considered to be at risk.

Notes. Flower size is extremely variable, with large-flowered specimens (having up to 12 stamens) more common north of Geraldton and small-flowered specimens (sometimes with as few as 7 stamens) more common south of Geraldton. Also, nearly all the specimens from north of Geraldton have decurrent leaves but this character is much less frequent south of Geraldton. Some specimens have distinct small corolla lobes up to 0.6 mm long.

Lachnostachys ferruginea Hook. (Hooker 1841: t. 415). *Type:* Swan River Colony [Western Australia], *J. Drummond* 14 (*holo*: K *n.v.*, illustration seen).

Lachnostachys ferruginea f. *acutifolia* Munir (Munir 1978: 659-660). *Type:* Kulin, Western Australia, September 1946, *A.M. Ashby* 16 (*holo:* AD *n.v.*; *iso:* PERTH 01292986).

Lachnostachys ferruginea f. *obtusifolia* Munir (Munir 1978: 663). *Type:* 100 miles [161 km] north of Perth, between New Norcia and Moora, Western Australia, 15 September 1958, *H. & E. Walter* 719 (*holo:* B *n.v.*)

Lachnostachys ferruginea f. *reticulata* Munir (Munir 1978: 659). *Type:* Tarin Rock, Western Australia, 26 October 1946, *A.M. Ashby* 1279 (*holo:* AD *n.v.*).

Illustration. Munir (1978: Figure 50).

Description. Munir (1978: 655-663).

Selected specimens examined. WESTERN AUSTRALIA: Tarin Rock Reserve, 1 Sep. 1990, *D.E. Albrecht* 4127 *& B.A. Fuhrer*; Near Avon Valley National Park, 28 Oct. 1985, *C. Barrow*; 3.5 km at 227 degrees from New Norcia, 31 Oct. 1990, *E.A. Griffin* 5927; *c.* 17 km by road N of Neendaling, 17 Aug. 1979, *L. Haegi* 1819; E edge of the Wongan Hills, *c.* 15 km N of township of Wongan Hills, 31 Aug. 1980, *K.F. Kenneally* 7465.

Distribution. Extends from Kalbarri National Park south-east to Lake Grace, in the South-west Botanical Province of Western Australia.

Habitat. Occurs in sandy or clayey soils, commonly over laterite or with lateritic gravel, in shrublands, often dominated by *Eucalyptus*, *Allocasuarina* or *Dryandra* species.

Flowering period. August-November.

Conservation status. Two of the forms of *Lachnostachys ferruginea*, namely f. *obtusifolia* and f. *reticulata,* were included on the Gazetted Rare and Priority Flora List, but have now been removed because they are no longer considered to be sufficiently distinct to warrant recognition. The species as a whole is not considered to be at risk.

Notes. In addition to the forms listed above as synonyms of *Lachnostachys ferruginea*, the varietal name var. *paniculata*, which was originally described under the closely related species *L. verbascifolia*, was transferred to this species by Munir (1978). More recently, Munir has redetermined several specimens of this taxon (e.g. *W. Archer* 2508903) as *L. verbascifolia*, a correction endorsed here. Var. *paniculata* matches *L. ferruginea* in its short calyx indumentum but in all other respects matches *L. verbascifolia*, and it occurs well beyond the known range of *L. ferruginea*. However, a taxon described originally under this varietal name, as var. *paniculata* f. *obtusifolia*, does belong in

L. ferruginea; it is from an area where there have been many collections of *L. ferruginea* but none of *L. verbascifolia*.

Of the forms previously recognized in *Lachnostachys ferruginea*, f. *acutifolia* and f. *reticulata* are separated from f. *ferruginea* by leaf characters, while f. *obtusifolia* is separated by its inflorescence consisting of more spikes. Two of the taxa, f. *obtusifolia* and f. *reticulata*, were named originally from single specimens. Since then, other specimens of both taxa have been collected from the type localities or nearby, as well as intermediate specimens from these or other sites. As *Lachnostachys ferruginea* shows continuous variation in each of the characters used to distinguish the forms, with considerable variation apparently occurring within populations, there appears to be no justification for maintaining these forms as distinct entities.

Lachnostachys verbascifolia is very closely related to *L. ferruginea* and, owing to the great variability of these taxa, particularly the former, key characters that are reliable throughout the range of both species are hard to find. Apart from the differences given in the key, *L. verbascifolia* can generally be distinguished from *L. ferruginea* by its longer leaves with a greater length/width ratio. Although both species have inflorescences varying from one to many spikes terminating each branchlet, *L. verbascifolia* almost invariably has more than one spike per branchlet whereas solitary spikes are fairly common in *L. ferruginea*. Of the two varieties of *L. verbascifolia*, only var. *verbascifolia* overlaps in geographical range with *L. ferruginea*, and this variety is readily distinguished by its longer calyx indumentum with fine antrorse branches on the dendritic hairs.

Lachnostachys verbascifolia F. Muell. (Mueller 1868: 158-159). *Type:* [Western Australia], *J. Drummond* coll. 5, n. 237 (*lecto:* MEL 41202, *fide* Munir (1978: 663)).

Description. Munir (1978: 663-669). Additional characters: flowers (4)5-7(8)-merous; calyx indumentum white or rarely very pale ferruginous.

Distribution. Occurs mainly in the South-west Botanical Province of Western Australia, extending from Pinjar south to Collie and Cranbrook and from there east to near Mt Coombaninya (south of Balladonia) and Mt Ragged. Also extends inland to Noongal Station (near Yalgoo) in the Eremaean Botanical Province, with a few other doubtful inland records.

Habitat. Occurs in sandy soils, rarely associated with laterite, in shrublands or woodlands, sometimes dominated by *Eucalyptus* species.

Flowering period. June-November.

Notes. Specimens from the north (in the Pinjar-Yalgoo-Wongan Hills area) always have a long indumentum on the stems and leaves, whereas those from the south-east (from near Grass Patch eastwards) have a relatively short indumentum, and there is a mixture of short- and long-haired specimens in intermediate areas. The south-eastern variant differs from other variants of the species in its shorter calyx indumentum with more spreading branches on the dendritic hairs; it has been recognized both at the species level, as *Lachnostachys dempsteri*, and at the varietal level, as *L. verbascifolia* var. *paniculata*. Varietal rank is currently accepted.

Most flowers are 5-7-merous, but occasional 8-merous flowers have been observed on a predominantly 7-merous specimen (*A.S. George* 6851) of var. *verbascifolia* and 4-merous flowers are as common as

5-merous flowers on at least one specimen (*W.R. Archer* 2209910) of var. *paniculata*. No 4-merous flowers have been reported in any other members of the genus *Lachnostachys*.

Lachnostachys verbascifolia var. **paniculata** Ewart (Ewart 1907: 58). - *Lachnostachys dempsteri* E. Pritzel (Diels & Pritzel 1904: 512). - *Lachnostachys ferruginea* var. *paniculata* (Ewart) Munir (Munir 1978: 660-663). *Type:* 85 miles [137 km] north-east from Esperance Bay, between Esperance Bay and Fraser Range, [Western Australia], 1884, *A. Dempster* (*lecto*: MEL 41206, *fide* Munir (1978: 660) for var. *paniculata*, here designated for *L. dempsteri*).

Selected specimens examined. WESTERN AUSTRALIA: 23 km NNE of Mt Buraminya, 14 July 1990, *W. Archer* 1407906; S of Crystal Lake, 25 Aug. 1990, *W. Archer* 2508903; 12 km W of Mt Coobaninya, 22 Sep. 1990, *W.R. Archer* 2209910; 27.5 km N of Mt Ridley, 20 Oct. 1990, *W.R. Archer* 2010902.

Distribution. Extends from Grass Patch (north of Esperance) east to near Mt Coombaninya (south of Balladonia) and Mt Ragged (in Cape Arid National Park).

Conservation status. Not considered to be at risk at present. Up to 1994 *Lachnostachys verbascifolia* var. *paniculata* was listed (under the name *L. ferruginea* var. *paniculata*) on the Gazetted Rare and Priority Flora List, but its apparent rarity resulted from having most of the specimens housed under *L. verbascifolia* with the variety not specified. Now that these specimens and those previously misplaced under *L. ferruginea* have been redetermined as *L. verbascifolia* var. *paniculata*, the variety is known from about nine localities, including one in Cape Arid National Park. It may be favoured by fires.

Notes. According to Munir (1978: 662), this taxon usually has 6-9 stamens per flower and rarely has 5 stamens or more than 9 stamens. In this study, stamen number was found to vary from 4 to 7, with the most common number being 5. Perhaps the larger stamen numbers recorded by Munir were from specimens of *Lachnostachys ferruginea* f. *obtusifolia* (see notes under *L. ferruginea*), which do have higher stamen numbers typical of those in *L. ferruginea*, rather than from true *L. verbascifolia* var. *paniculata*.

Ewart (1907) gave *Lachnostachys dempsteri* as a synonym of his new variety *L. verbascifolia* var. *paniculata* and included a type of *L. dempsteri* in his cited collections, evidently intending the two names to be equivalent. It therefore seems appropriate to choose the same lectotype here for *L. dempsteri* as that already nominated by Munir (1978: 660) for var. *paniculata*. The other two specimens cited by Munir are also less suitable choices for the lectoype because one (MEL 41207) lacks label details and the other (MEL 41139) has much less plant material on the sheet and an unreadable date on the label.

Lachnostachys verbascifolia F. Muell. var. **verbascifolia**

Lachnostachys cliftonii F. Muell. (Mueller 1875: 3-4). *Type:* Sources of Arrowsmith River, [Western Australia], *W. Clifton* (MEL 41140, 41186).

Lachnostachys cordifolia S. Moore (Moore 1921: 247). *Type:* Sand Springs, about 15 miles [24 km] south-east of York, Western Australia, *G. Turvey*, Herb. O.H. Sargent 808 (BM *n.v.*).

Illustration. Munir (1978: Figure 51).

Selected specimens examined. WESTERN AUSTRALIA: 42 km NE of Coujinup Hill, 27 km N of Rollands Rd on Carmody Rd, 25 June 1983, *M.A. Burgman* 1505 *& S. McNee*; Noongal Station, 9 Aug. 1993, *S. Dawson* 929; 75 km NE of Ravensthorpe, 4 km W of Dunn Swamp, 21 Sep. 1979, *J. Taylor* 767, *M.D. Crisp & R. Jackson*; E Perenjori, 25 July 1995, *J. Trott.*

Distribution. Extends from Pinjar and Noongal Station (near Yalgoo) south to Collie and Cranbrook and south-east to near the upper Young River.

Conservation status. Widespread and not considered to be at risk.

Notes. Three *O.H. Sargent* specimens from Sand Springs (south-east of York) were examined, one labelled 909a (PERTH 03718247) and the other two unnumbered (PERTH 03717739, 03717992). Although these were collected from the type locality of *Lachnostachys cordifolia*, they appear not to belong to the type collection but to have been collected shortly after the taxon was named, probably in 1924.

Newcastelia F. Muell.

Mueller (1857: 22). *Type: Newcastelia cladotricha* F. Muell.

Small or medium-sized *shrubs*, erect or spreading, with an indumentum of non-glandular dendritic hairs on the stems, leaves and calyces. *Young stems* terete, densely hairy. *Leaves* opposite-decussate or rarely (occasionally in *N. interrupta*) in whorls of 3, sessile or shortly petiolate, entire; lower surface with a dense persistent indumentum of dendritic hairs; upper surface bullate, covered with dendritic hairs, often also with sessile glands or simple glandular hairs but these generally hidden by the longer dendritic hairs. *Inflorescence* of reduced, almost sessile cymes arranged in solitary or multiple spikes or dense heads terminating leafy branchlets; spikes dense in bud, sometimes developing short or long internodes between the adjacent pairs of cymes at maturity; cymes 3-flowered or (in *N. cladotricha*) reduced to a solitary flower, in opposite-decussate pairs. *Flowers* (4)5-8-merous, with equal numbers of calyx lobes, corolla lobes and stamens. *Calyx* densely dendritic-hairy outside, glabrous inside; lobes shorter than or rarely as long as calyx tube. *Corolla* usually pale to deep purple or blue, rarely white, glabrous outside; tube longer than or about as long as the lobes, with a dense long antrorse indumentum inside but often partially glabrous; lobes equal, spreading, very narrowly to broadly ovate, glabrous, either narrow throughout or attenuate to a slender terminal protrusion, thin-textured, with the midvein prominent and commonly a few lateral veins clearly visible, the main lateral veins becoming more or less parallel to the midvein towards the apex; terminal protrusion of each lobe recurved or spreading, the apex obtuse and with a recurved margin. *Stamens* alternating with the corolla lobes, included to greatly exserted, glabrous; filament inserted in upper part of corolla tube or at summit of tube, expanded at the base or slender throughout. *Ovary* 4-celled, with 1 ovule in each cell. *Style* included to greatly exserted, glabrous; apex notched or slightly 2-lobed. *Fruit* dry, indehiscent, 1(2)-seeded, enclosed in the persistent calyx.

A genus of nine species, occurring primarily in arid regions, extending from Eighty Mile Beach in Western Australia east across central Australia (Northern Territory and South Australia) to south-eastern Queensland. In Western Australia, it occurs mainly in the Eremaean Botanical Province, but also occurs in the southern part of the Northern Botanical Province and in the South-western Interzone (Figures 2-4). Two species, *Newcastelia interrupta* Munir and *N. velutina* Munir, are endemic to Queensland; the remaining species all occur in Western Australia, where three of them are endemic.

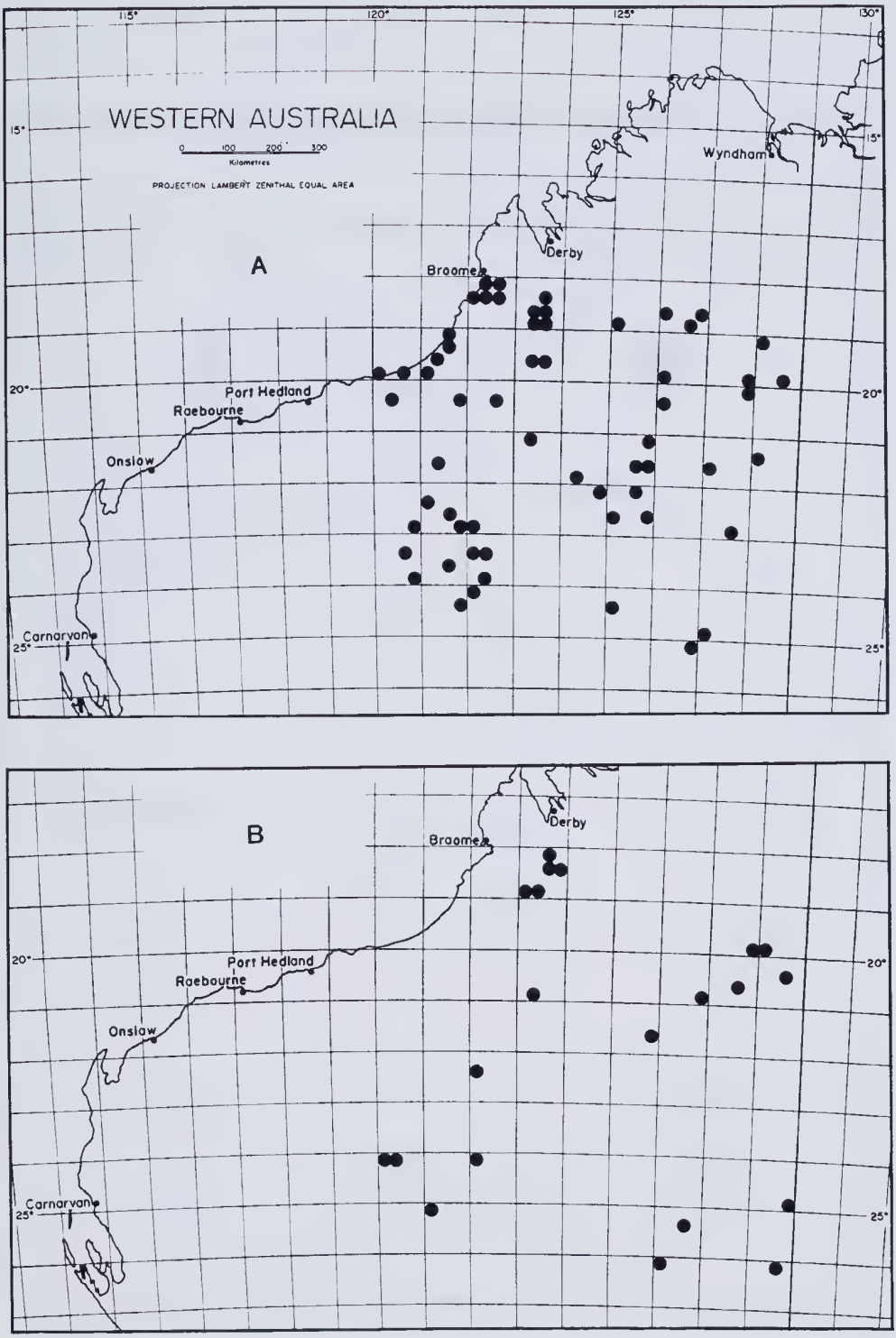

Figure 2. Distribution in Western Australia. A - *Newcastelia cladophora*, B - *Newcastelia spodiotricha*.

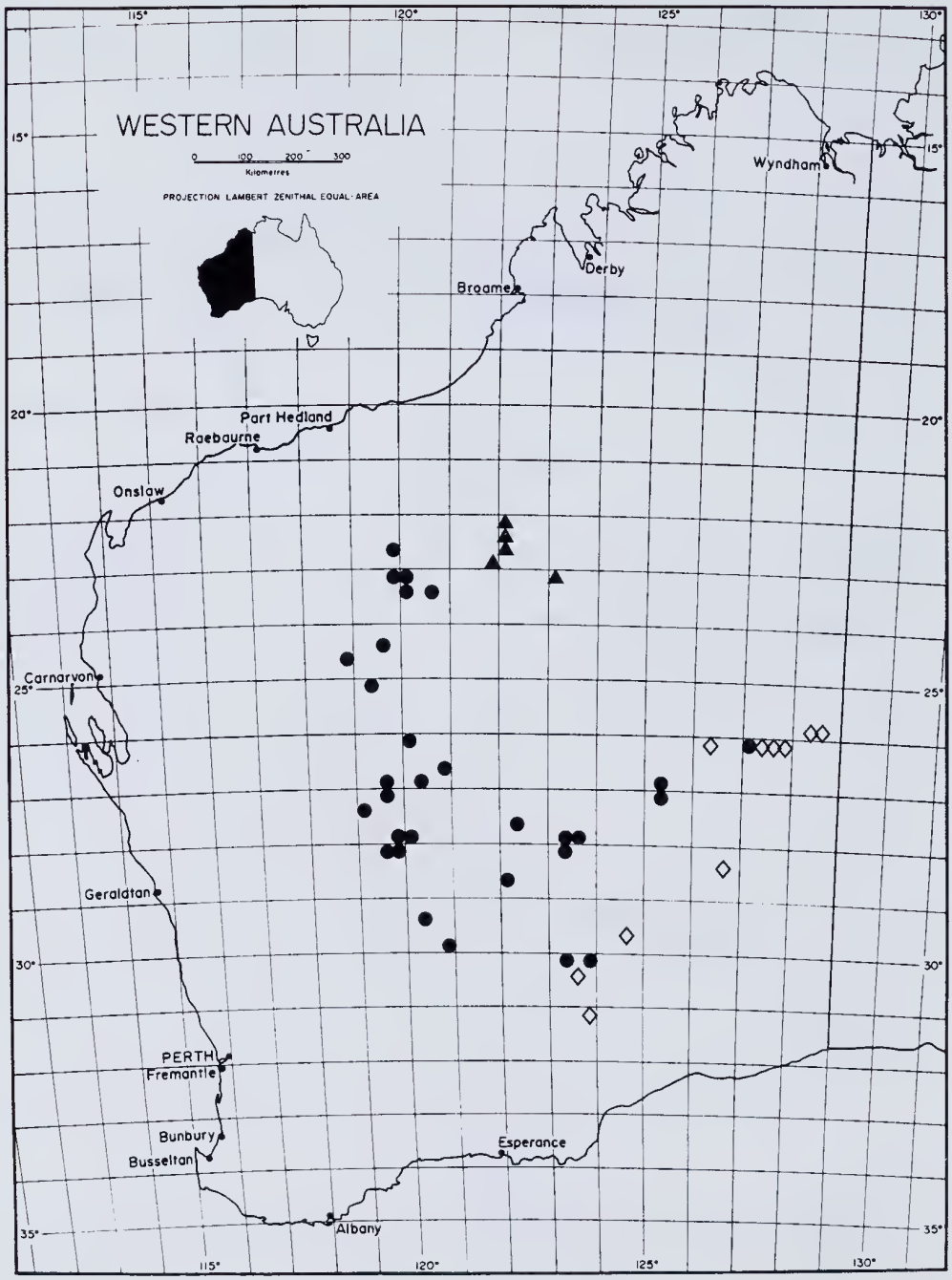

Figure 3. Distribution in Western Australia of *Newcastelia bracteosa* ◇ and full distribution of *Newcastelia hexarrhena* ● and *Newcastelia roseoazurea* ▲ .

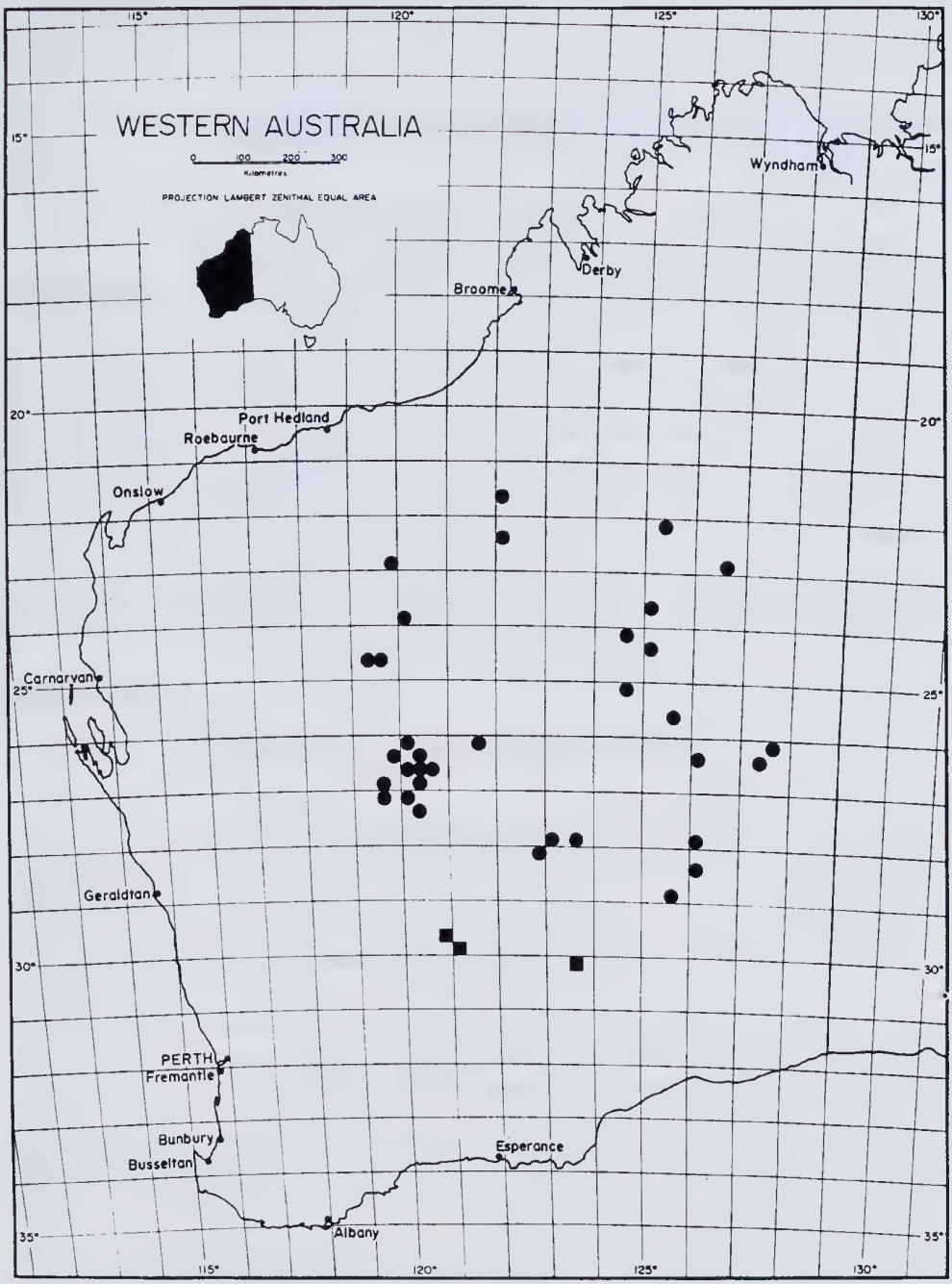

Figure 4. Distribution in Western Australia of *Newcastelia cephalantha* ● and full distribution of *Newcastelia insignis* ■ .

This genus is closely related both to *Lachnostachys* and *Physopsis*, but can be distinguished from the former by the number of ovary cells, from the latter by leaf characters and from both genera by corolla characters. *Newcastelia* species differ from the other genera in that their corolla lobes are either narrower throughout or have a narrow apical protrusion.

Key to *Newcastelia* species

1. Stamens inserted below summit of corolla tube and included or barely exserted; filament scarcely enlarged towards the base. Style included to shortly exserted
   2. Inflorescence with long white or pink to purple hairs giving the flowers a shaggy appearance, each bract subtending 1 flower. Ovary glabrous, with sessile glands on summit. Occurring in Western Australia and Northern Territory ..... **N. cladotricha**
   2. Inflorescence with short white hairs, each bract usually subtending 3 flowers. Ovary hairy on summit, sometimes also with sessile glands. Occurring in Queensland.
      3. Corolla tube hairy inside except at the base. Ovary lacking glands ..... **N. interrupta**
      3. Corolla tube hairy inside in basal half but not distal half. Ovary with sessile glands ..... **N. velutina**
1. Stamens inserted at or just below summit of corolla tube, greatly exserted; filament gradually expanding towards the base. Style greatly exserted.
   4. Flowers usually 5-merous. Ovary densely glandular throughout, glabrous.
      5. Flowers usually in globular to obloid heads, rarely in dense spikes. Calyx indumentum *c.* 2 mm long, with two types of hairs of very different size, the large hairs with long antrorse branches ..... **N. cephalantha**
      5. Flowers in short to long, dense or interrupted spikes. Calyx indumentum 0.5-1 mm long; hairs variable in size but not of two distinct types, with short spreading branches
         6. Leaf undersurface with a continuous dense indumentum. Inflorescence of usually more or less continuous spikes, with a white or off-white indumentum ..... **N. spodiotricha**
         6. Leaf undersurface with hairs concentrated along the veins, the interveinal spaces glabrous. Inflorescence of usually distinctly interrupted spikes, with a pink to red indumentum on the calyces ..... **N. roseoazurea**
   4. Flowers usually 6-8-merous. Ovary either glandular only on the summit or densely hairy at first in upper half (but glabrescent in fruit)
      7. Leaves very narrowly ovate. Flower heads or spikes subglobular to shortly cylindric, with a bright yellow indumentum and white or lilac corollas. Bracts sessile, very narrowly ovate ..... **N. insignis**
      7. Leaves narrowly ovate to narrowly elliptic. Flower spikes cylindric, with a white or off-white indumentum and purple corollas. Bracts very shortly petiolate, ovate or broadly ovate
         8. Corolla lobes rather suddenly narrowed to apical point. Ovary glabrous, with sessile glands on summit ..... **N. bracteosa**
         8. Corolla lobes very gradually attenuate to apical point. Ovary densely hairy at first in upper half but glabrescent in fruit, also with sessile glands ..... **N. hexarrhena**

Newcastelia bracteosa F. Muell. (Mueller 1873: 49-50). *Type:* MacDonnell Ranges, [Northern Territory], 1872, *E. Giles* (*holo:* MEL 40990).

Newcastelia elliptica Munir (Munir 1978: 609-612). *Type:* 50 miles [80 km] west of Ayers Rock, Northern Territory, 18 January 1969, *J.R. Maconochie* 654 (*holo*: AD *n.v.*, illustration seen; *iso:* MEL 40985).

Illustrations. Diels & Pritzel (1904: Figure 56D); Munir (1978: Figures 36, 39); Munir (1986: Figure 550A).

Description. Munir (1978: 596-600, 609-612).

Selected specimens examined. WESTERN AUSTRALIA: Ponton Creek, 20.5 km E of Zanthus, 17 Sep. 1979, *J. Taylor* 557, *M.D. Crisp & R. Jackson*; 21.7 km E of Zanthus, 3 Nov. 1993, *L. Sweedman* 2912.
NORTHERN TERRITORY: *c.* 10 km E of Tarn of Auber, Mereenie oilfield area, 16 Oct. 1984, *P.K. Latz* 10009 (also DNA).

Distribution. In Western Australia, occurs in the Eremaean Botanical Province, extending from the Warburton-Blackstone Range area south-west to Goddard Creek (near Zanthus). Also occurs in Northern Territory and South Australia.

Habitat. Occurs in red sandy soils, on sandplains or associated with (on or between) dunes or sand ridges, in spinifex grasslands, sometimes dominated by shrublands of *Acacia* or *Eucalyptus* species.

Flowering period. August-November.

Conservation status. Widely distributed and not considered to be at risk.

Notes. Although *Newcastelia elliptica* was reduced to a synonym of *N. bracteosa* in 1985 by P.K. Latz (determinavits on DNA specimens) and by Munir (1986), this change was overlooked until recently in Western Australia and *N. elliptica* is given by mistake as an accepted name in the most recent list of Northern Territory plants (Dunlop *et al.* 1995). The two taxa were originally separated primarily on leaf thickness, but Munir (1986: 1188) noted that the difference between the two taxa appeared to be due to "age and seasonal growth".

This species overlaps in range with its closest relative, *Newcastelia hexarrhena*, between the Warburton area and Queen Victoria Springs. One specimen (*A.S. George* 8445) from the area of overlap, collected east of Neale Junction in Great Victoria Desert, is currently identified as *N. bracteosa* because it has a glabrous ovary, but has broad inflorescences like those usually found in *N. hexarrhena.* Some characters cannot be checked on this specimen because it is only in bud. More material is needed from this locality to determine whether both species occur at the site and whether there are intermediates.

Newcastelia cephalantha F. Muell. (Mueller 1875: 4). *Type:* Between Alberta River and Mt Olga, [South Australia], *E. Giles* (*holo:* MEL 41005).

Newcastelia cephalantha var. *oblonga* Munir (Munir 1978: 634-635). *Type:* Hann Range, 70 miles [119 km] north of Alice Springs, Northern Territory, 1 June 1962, *D.J. Nelson* 372 (*holo:* AD *n.v.; iso*: PERTH 01607375).

Newcastelia cephalantha var. *queenslandica* Domin (Domin 1928: 1107). *Type:* Windorah, Queensland, 1910, *W. Rose (holo:* PR 530702 *n.v.*).

Newcastelia cephalantha var. *tephropepla* Munir (Munir 1978: 635-636). *Type:* About 46 km west of Musgrave Park Homestead, along track to Mt Davies, western portion of Musgrave Ranges, South Australia, 6 September 1963, *Hj. Eichler* 17310 (*holo:* AD *n.v.*).

Illustrations. Diels & Pritzel (1904: Figure 56H,J); Munir (1978: Figure 45); Munir (1981: Figure 399); Munir (1986: Figure 550B).

Description. Munir (1978: 629-636).

Selected specimens examined. WESTERN AUSTRALIA: Rudall River region, June 1987, *R.P. Hart* 648; 48 km N of Wiluna on road to Neds Creek, 12 Sep. 1987, *J.W. Green* 5355; Paroo Station, 26 July 1983, *A.A. Mitchell* 1140; 18 km E of Woolnough Range, 30 June 1984, *G.J. Morse* 224; 13 km N of Kumarina Roadhouse, 10 Aug. 1980, *C.I. Stacey* 670.

Distribution. In Western Australia, distributed in the Eremaean Botanical Province, extending from Telfer Mining Centre south to Albion Downs Station (south of Wiluna) and from Kumarina Station east to the border with Northern Territory. Also occurs in Northern Territory, South Australia and Queensland.

Habitat. Occurs in red sandy soils with spinifex grasslands, sometimes dominated by shrubs, commonly *Acacia* species, or by *Eucalyptus* species with a mallee habit.

Flowering period. June-October.

Conservation status. Widely distributed and not considered to be at risk.

Notes. The varieties of *Newcastelia cephalantha* are no longer recognized in Western Australia. The indumentum colours and leaf measurements used to distinguish var. *tephropepla* from the other two varieties are conflicting on some of the PERTH specimens annotated by Munir; for example *A.S. George* 9070 is a large-leaved specimen included under var. *cephalantha* but has white hairs rather than ferruginous ones. Var. *oblonga* was distinguished from var. *cephalantha* by its larger leaves and flower heads but there is considerable overlap in these characters on the annotated specimens of the two varieties, a situation similar to that discussed above for the forms of *Lachnostachys coolgardiensis.*

Newcastelia cladotricha F. Muell. (Mueller 1857: 22). *Type:* Sturt's [Sturt] Creek, towards Mt Mueller, [Western Australia], March 1856, *F. Mueller* (*holo:* MEL 41017).

Illustration. Munir (1978: Figure 41).

Description. Munir (1978: 615-619).

Selected specimens examined. WESTERN AUSTRALIA: Near Canning's Cairn, Canning Stock Route, 27 July 1995, *B. & B. Backhouse* 131; N of Well 15, Canning Stock Route, 22 July 1989, *S. Barker* 36; Gibson Desert, *c.* 130 km W of Giles, 19 June 1987, *H.M. Lee* 235; 5 km E of Thangoo Homestead, 8 July 1992, *A.A. Mitchell* 2597; Great Northern Highway, 11.3 km E of Pinnacle Creek, 31 Aug. 1991, *Peter G. Wilson* 870 *& R. Rowe.*

Distribution. In Western Australia, extends from near Roebuck Bay and Eighty Mile Beach in the south-east of the Northern Botanical Province through the north-eastern part of the Eremaean Botanical Province, south to Rawlinson Range. Also occurs in Northern Territory.

Habitat. Occurs in red sandy soils on sandplains or associated with dunes (usually on the lower slopes or in the hollows between the dunes), usually in spinifex grasslands, often with a shrub layer dominated by *Acacia* species.

Flowering period. Flowers recorded April-October, with a peak in July-August.

Conservation status. Widely distributed and not considered to be at risk.

Notes. This species is the only member of its genus having each cyme reduced to a solitary flower.

Newcastelia hexarrhena F. Muell. (Mueller 1876: 16). *Type:* Between Victoria Spring and Ularing, [Western Australia], *J. Young* (*holo:* MEL 41024).

Illustrations. Munir (1978: Figure 37); Munir (1981: Figure 400).

Description. Munir (1978: 600-603).

Selected specimens examined. WESTERN AUSTRALIA: 10 km E of Duketon on Bandya Station, 7 June 1988, *R.J. Cranfield* 6891; Gravel Pit Junction, 20 km N by track from Ponton Camp, Queen Victoria Spring Nature Reserve, 22 Oct. 1995, *D.J. Edinger* 1131; SW of Adelong Station, 24 Oct. 1989, *G.J. Keighery* 11396; 16 km SW of Tangadee Homestead, 22 Aug. 1984, *T. Houston* 589-1; 15 km SE of Officer Basin, 9 Dec. 1987, *D.J. Pearson* 352.

Distribution. Endemic to the Eremaean Botanical Province of Western Australia, extending from Roy Hill south to Walling Rock Station (west of Menzies) and from near Sandstone east to Mt Eveline (east of Warburton).

Habitat. Through most of its range, the species occurs in red sandy soils with spinifex grasslands, but in the southernmost part it often occurs in yellow sandy soils, occasionally dominated by *Eucalyptus* species with a mallee habit.

Flowering period. August-November.

Conservation status. Not considered to be at risk.

Newcastelia insignis E. Pritzel (Diels & Pritzel 1904: 506). *Type:* Menzies, Western Australia, October 1901, *E. Pritzel* 849 (*lecto:* AD 79221080, *fide* Munir (1978: 626), illustration seen; *isolecto*: PERTH 01607820).

Illustrations. Diels & Pritzel (1904: Figure 56E-G); Munir (1978: Figure 44).

Description. Munir (1978: 626-629). Additional characters: corolla probably varying from pale purple to white, the lobes narrowly obtuse or acute.

Selected specimens examined. WESTERN AUSTRALIA: Doney Lagoon, Adelong Station, 22 Sep. 1988, *R.J. Cranfield* 7590; 2.5 km NE of Comet Vale, 16 Oct. 1987, *G.J. Keighery* 9680; 6.5 km SE of Argus Corner, 26 Nov. 1986, *D.J. Pearson* 109A.

Distribution. Endemic to Western Australia, recorded from the Comet Vale area and from the northern boundary of Queen Victoria Spring Nature Reserve, the two areas about 250 km apart.

Habitat. Occurs in red, or occasionally yellow, sandy soils. Recorded in spinifex grasslands and/or in shrublands, sometimes dominated by *Acacia* or *Eucalyptus* species.

Flowering period. September-November.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority 3. Recorded from about four localities.

Notes. Although the corolla colour is given as "yellow or whitish-yellow" in Munir (1978: 628), there are only two specimens at PERTH with a label indicating corolla colour, and this is recorded as "lilac or white" (*C.A. Gardner* 11104) and "white" (*G.J. Keighery* 9680). The bright yellow hairs on the calyx give the flowers and fruits on the dried specimens a strong yellow appearance overall, but the dried corolla colour is pale to medium brown and there does appear to be a slight purplish tinge on some specimens.

Newcastelia roseoazurea Rye, *sp. nov.*

Newcasteliae spodiotrochae affinis sed indumento folii paginae inferioris minus denso, indumento alabastrorum fusco rosea vel rubro.

Typus: South of Rudall River camp, Western Australia, 12 August 1971, *P.G. Wilson* 10475 (*holo:* PERTH 03771148; *iso:* CANB, MEL, NSW).

Shrubs 0.3-1 m high, often rounded, with an indumentum of patent dendritic hairs on the stems, leaves and parts of the flowers, the many-branched hairs often broader than long. *Stem indumentum* 0.5-0.8 mm long, white or ferruginous on the vegetative stems and pinkish on the inflorescence axes. *Leaves* opposite-decussate, sessile or very shortly petiolate, ovate to very broadly ovate or oblong-elliptic, 8-38 x 4-19 mm, acute or obtuse, with recurved margins, green below the indumentum but often tinted by the white or ferruginous colour of the indumentum, the upper leaf surface usually grey-green throughout or grey-green towards the base and ferruginous towards the apex; lower surface reticulate-veined, with hairs concentrated along the veins and with scattered sessile glands, the veins almost white or yellow to pale ferruginous; upper surface deeply bullate, with several hairs towards the summit of each bulla; hairs 0.2-0.5 mm long on upper surface, slightly longer on lower surface. *Inflorescence* up to 200 mm long, usually comprising a terminal spike and two or more axillary spikes in an opposite-decussate arrangement, rarely (in depauperate specimens) reduced to a single terminal spike typically 25-35 mm long; peduncles up to 50 mm long but usually 5-20 mm; spikes up to

110 mm long, 10-15 mm wide, usually distinctly interrupted at anthesis, with the internodes 5-17 mm long, but with shorter, less obvious internodes in depauperate specimens; cymes 3-flowered. *Bracts* sessile, ovate or broadly ovate, dendritic-hairy outside, glabrous inside, caducous. *Flowers* 5-merous. *Calyx* green below the indumentum but the very dense indumentum resulting in a deep pink to red colour in bud, altering at anthesis to a pale yellow colour at the base and pink in the remainder, the largest hairs 0.5-0.8 mm long and 0.5-1.0 mm wide; tube 1.5-2.7 mm long; lobes ovate or broadly ovate, 1.1-1.5 mm long, acute. *Corolla* blue; tube 2.3-3.5 mm long, with dendritic hairs inserted towards but not reaching the base of tube, the hairs antrorse and 1-2 mm long; lobes ovate or broadly ovate, 2.3-3 mm long, attenuate-caudate at the apex, the apical protrusion 0.5-1.3 mm long and with a recurved obtuse apex. *Stamens* greatly exserted, blue; filament inserted at summit of tube at the junction of two corolla lobes, 2.1-2.6 mm long, 0.2-0.4 mm wide at the extreme base, narrowed to 0.1-0.2 mm halfway between the base and apex; anther 0.6-0.9 mm long at the onset of dehiscence. *Ovary* glabrous, with sessile glands throughout. *Style* greatly exserted, 3.3-4 mm long; apex notched or slightly 2-lobed. *Fruit* not seen at maturity. (Figure 5)

Other specimens examined. WESTERN AUSTRALIA: Rudall River National Park, 4 Aug. 1995, *B. & B. Backhouse* 46, 47; W of Well 23, Canning Stock Route, 2 Aug. 1967, *J.S. Beard* 4932; 1.2 km along the Tallawana track from its intersection with the Canning Stock Route, 15 July 1988, *A.E. DeJong*; N Rudall River National Park, 8 Aug. 1989, *A.E. DeJong*; Rudall River region, Sep. 1986, *R.P. Hart* 132; Kintyre: Rudall River region, Aug. 1988, *R.P. Hart* 841; Rudall River region, 4 Aug. 1995, *R.P. Hart* 977; Yandogooge catchment just N of Rudall River National Park, 4 Aug. 1995, *R.P. Hart* 1013-1015; Rudall River region, Sep. 1987, June 1988 & Aug. 1988, *W.G. Martinick & Associates*.

Distribution. Endemic to the Eremaean Botanical Province of Western Australia, apparently restricted to the Rudall River area, extending from near Moses Chair south to near Wells Range and south-east to Canning Stock Route.

Habitat. Recorded in red sandy soils on silty flats, in spinifex grasslands with a shrub layer.

Flowering period. July-September.

Conservation status. Not considered to be at risk at present. With a known range of just over 150 km, this species is much more restricted than the other Western Australian *Newcastelia* species except for *N. insignis*, which is known from fewer locations but over a greater distance. *N. roseoazurea* has been collected from at least eight sites, including some in a national park, and is reported to be common in the area.

Etymology. From the Latin *roseus* - pink-coloured and *azureus* - blue, referring to the striking combination of these two colours on the flowers, the calyx with bright pink hairs and the corolla blue. Flower colour is variously described as red, yellow, blue or purplish on herbarium specimens, depending partly on the stage of flowering and whether the overall flower colour or only part of the flower is being described.

Notes. Closely related to *Newcastelia spodiotricha*, which differs in its more densely hairy leaf undersurface and white or off-white indumentum on the flower buds. In *N. spodiotricha* the inflorescence is usually more or less continuous, whereas in *N. roseoazurea* the inflorescence is usually distinctly interrupted, and *N. spodiotricha* usually has longer flowers with narrower corolla lobes than *N. roseoazurea*.

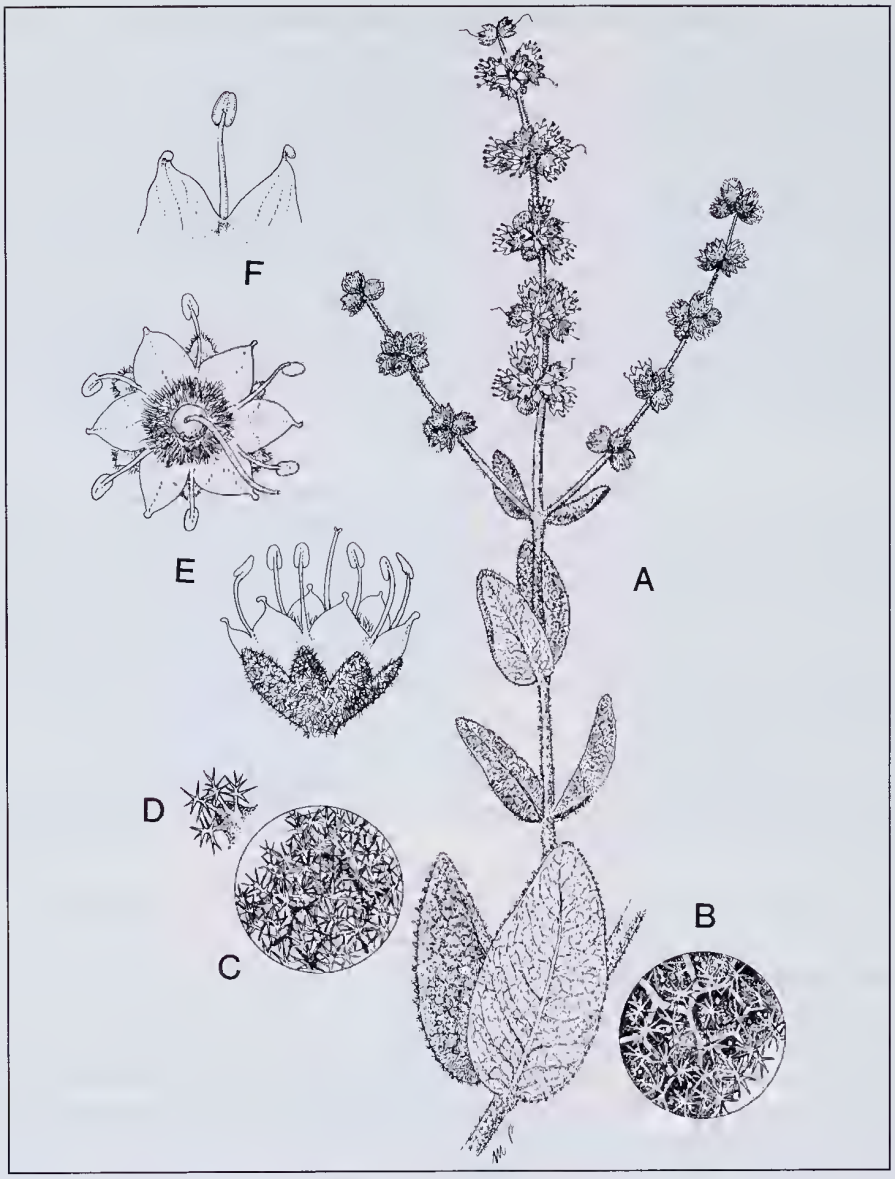

Figure 5. *Newcastelia roseoazurea*. A - flowering stem (x1), B - portion of undersurface of leaf (x9), C - portion of upper surface of leaf (x9), D - enlargement of bullae (side view) from upper surface of leaf (x9), E - top and side views of flower (x4), F - stamen and adjacent corolla lobes (x6). Drawn from *R.P. Hart* 977.

Newcastelia spodiotricha F. Muell. (Mueller 1862: 21-22). *Type:* Between Victoria River and Gulf of Carpentaria, [Northern Territory], *J. McDouall Stuart (holo:* MEL 41041).

Illustrations. Munir (1978: Figure 38); Munir (1981: Figure 401); Munir (1986: Figure 550C).

Description. Munir (1978: 603-609).

Selected specimens examined. WESTERN AUSTRALIA: Track to Red Bluff, S of Moffettah Well, 9 Dec. 1991, *H.N. Foote* 300; Gardner Range, 190 km SE of Halls Creek, 6 July 1995, *K. Coate* 378B;

Rudall River Region, 29 Mar. 1990, *R.P. Hart* 894; *c.* 58 km SSW of No 1 McHugh Bore on Dampier Downs Station, 26 Sep. 1980, *S.D. Hopper* 1729; 5.4 km W of Geegully Creek Crossing towards Frome Rocks, Edgar Ranges, 6 Oct. 1983, *T. Willing* 109.

Distribution. In Western Australia, extends from near Frome Rocks (north of Edgar Ranges in the southern part of the Northern Botanical Province) through the north-eastern part of the Eremaean Botanical Province south to near Muggan Rockholes (south-west of Warburton Range). Also occurs in Northern Territory, South Australia and Queensland.

Habitat. Occurs in red sandy soils, often on dune summits, sometimes on rocky hills. Recorded in spinifex grasslands with a shrub layer.

Flowering period. March-November, especially June-October.

Conservation status. Widely distributed and not considered to be at risk.

Physopsis Turcz.

Turczaninow (1849: 34-35). *Type: Physopsis spicata* Turcz.

Small to tall *shrubs*, with *P. chrysophylla* possibly sometimes a small *tree*, erect or spreading; indumentum of dendritic hairs, with shorter simple hairs often also present. *Young stems* terete, densely hairy. *Leaves* opposite-decussate or in whorls of 3, sessile or very shortly petiolate, entire or slightly toothed; lower surface with a dense persistent indumentum of dendritic hairs; upper surface fairly smooth to distinctly rugose, often ridged but not or scarcely bullate, with glandular dendritic hairs and glandular simple hairs or sessile glands (glands often visible only on very young leaves), sometimes also with non-glandular dendritic hairs, becoming glabrous but sometimes remaining sticky. *Inflorescence* of reduced, almost sessile cymes arranged in solitary or multiple spikes terminating leafy branchlets; spikes dense in bud, sometimes developing short internodes between the pairs or whorls of cymes at maturity; cymes 3-flowered or reduced to a solitary flower, in opposite-decussate pairs or whorled. *Flowers* 4- or 5-merous, with equal numbers of calyx lobes, corolla lobes and stamens. *Calyx* densely dendritic-hairy outside, glabrous inside; lobes slightly to much shorter than tube. *Corolla* yellow or white, glabrous outside, partially to largely glabrous inside but always with a region of simple or rarely 2-branched hairs; tube longer than lobes; lobes equal, spreading, broadly ovate to almost spathulate, broadly obtuse, sometimes hairy and distinctly thickened at the base, the upper portion either thickened or with prominent reticulate veins. *Stamens* inserted within the upper part of floral tube, alternating with the corolla lobes, sessile, subsessile or with a short filament, glabrous; filament slender; anther included or borne at the corolla throat. *Ovary* 4-celled, with 1 ovule in each cell. *Style* included or borne at the corolla throat, glabrous throughout or with simple hairs towards the base, sometimes glandular towards base; apex with 2 distinct spreading lobes. *Fruit* dry, indehiscent, 1(2)-seeded, enclosed in the persistent calyx.

A genus of five species, endemic to the south-west of Western Australia. *Physopsis* occurs primarily in the South-west Botanical Province and South-western Interzone but extends slightly into adjacent areas of the Eremaean Botanical Province (Figure 6).

Physopsis can be distinguished from *Newcastelia* mainly by the leaf and corolla characters used in the generic key, and from *Lachnostachys* by these and several additional characters. All species of *Physopsis* have been observed to have glandular dendritic hairs (as well as simple glandular hairs)

on very young leaves, usually on the upper surface or margin of the lamina, although these may not be present on all specimens. Such hairs are rare in the remainder of the family but do occur in *Dicrastylis incana* Munir (tribe Physopsideae) and *Pityrodia scabra* A.S. George (tribe Chloantheae). Sessile glands and simple glandular hairs are commonly found on very young leaves in other genera but are generally not obvious because of the much larger non-glandular dendritic hairs.

Other characters present in *Physopsis* but uncommon in the remainder of tribe Physopsideae, are the relatively smooth and glabrous upper surface of mature leaves, the very short stamens, the filaments being more reduced in *Physopsis chrysophylla* and *P. spicata* than in any other members of the tribe, and the short style with a distinctly lobed apex.

Key to *Physopsis* species

1. Leaves with a very short petiole 0.5-3 mm long (petiole may only be clearly visible when the leaf is removed from the stem); upper surface of lamina usually fairly flat, the margins often narrowly recurved. Flowers 1 per bract. Stamens sessile or subsessile. Style base with sessile glands or glandular hairs
   2. Leaves with a white indumentum on undersurface. Inflorescence with a white indumentum and yellow corollas. Calyx lobes much shorter than tube. Corolla tube 4-7 mm long; lobes 4, with small simple glandular hairs inside towards the base ..... **P. spicata**
   2. Leaves with a yellow indumentum on undersurface. Inflorescence with both the indumentum and corollas yellow. Calyx lobes slightly shorter than tube. Corolla tube *c.* 2 mm long; lobes (4)5, with long simple non-glandular hairs inside towards base ..... **P. chrysophylla**
1. Leaves sessile, with strongly recurved to revolute margins. Flowers mostly 3 per bract. Stamens with a short filament 0.3-0.5 mm long. Style glabrous, not glandular
   3. Leaves mostly opposite, narrowly ovate to ovate or elliptic. Corolla tube hairy inside towards the base; lobes 4 ..... **P. lachnostachya**
   3. Leaves mostly in whorls of 3, more or less linear. Corolla tube hairy inside throughout; lobes (4)5
      4. Stems, leaves and flowers with a bright yellow indumentum. Calyx indumentum 0.4-0.5 mm long ..... **P. chrysotricha**
      4. Stems, leaves and flowers with a white or off-white indumentum. Calyx indumentum 0.7-1.2 mm long ..... **P. viscida**

Physopsis chrysophylla (C.A. Gardner) Rye, *comb. nov.*

Newcastelia chrysophylla C.A. Gardner (Gardner 1964: 62). *Type:* About 45 km N of Murchison River, Western Australia, 3 January 1959, *C.A. Gardner* 12054 (*lecto:* PERTH 01607804, here designated; *isolecto:* CANB, MEL, PERTH 01607812).

Illustration. Munir (1978: Figure 40).

Description. Munir (1978: 612-615). Additional characters: calyx indumentum 0.5-1 mm long; corolla apparently yellow, the lobes very prominently reticulate-veined.

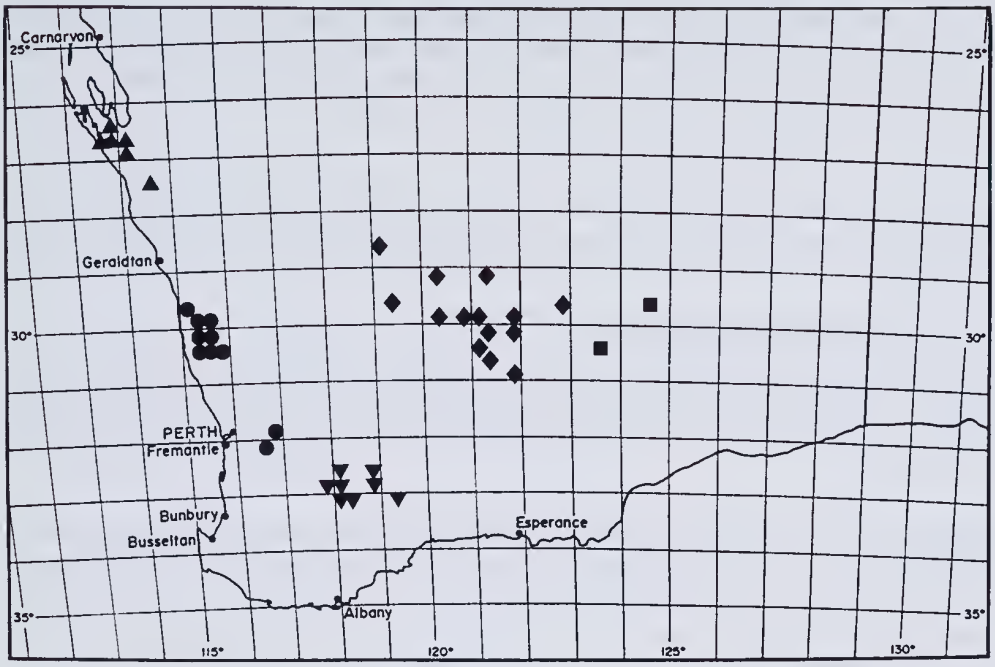

Figure 6. Geographical distribution of *Physopsis* species. *P. chrysophylla* ▲, *P. chrysotricha* ■, *P. lachnostachya* ▼, *P. spicata* ● and *P. viscida* ◆.

Selected specimens examined. WESTERN AUSTRALIA: 6 km W of Denham turnoff towards Tamala Station, 10 Nov. 1982, *R.J. Cranfield* 2534; Cooloomia Nature Reserve, 13 km W of Cooloomia homestead, 19 Sep. 1979, *S.D. Hopper* 1394.

Distribution. Restricted to the far north of the South-west Botanical Province of Western Australia, extending from stations in the Freycinet Estuary-Hamelin Pool area south to Eurardy Station.

Habitat. Occurs in red or yellow sandy soils, one record from sand over limestone, in dense shrublands dominated by species of *Acacia*, *Banksia* or other genera.

Flowering period. October-January.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority 3. The species has been recorded from at least seven localities, including one in a nature reserve.

Notes. There are several herbarium sheets with the type collection number 12054, but none annotated by Gardner as the type. The sheet cited as the holotype by Munir (1978: 612) is here designated the lectotype.

Gardner (1964) stated that this species was related to *Newcastelia* (now *Physopsis*) *chrysotricha*, but did not elaborate on his reasons for this belief, noting only how the two taxa differed. This study confirms the relationship between the two species, although *P. chrysophylla* appears to show greater similarity to *P. spicata* than to *P. chrysotricha*. Apart from the characters used in the key, the

similarities between *P. chrysophylla* and *P. spicata* include their long corolla lobes, which are hairy on the thickened base, and their ovary, which is either hairy throughout or with hairs extending somewhat below the densely glandular summit. The other three *Physopsis* species have glabrous corolla lobes and the ovary with a mixture of hairs and sessile glands only on the summit.

Physopsis chrysotricha (F. Muell.) Rye, *comb. nov.*

Newcastelia chrysotricha F. Muell. (Mueller 1876: 15-16). *Type:* Near Victoria Springs [Queen Victoria Spring, Western Australia], *J. Young* (*lecto:* MEL 41013, *fide* Munir (1978: 636); *isolecto:* MEL 41012).

Illustration. Munir (1978: Figure 46).

Description. Munir (1978: 636-639). Additional characters: calyx indumentum 0.4-0.5 mm long; corolla colour not recorded but almost certain to be either yellow or white, the lobes prominently reticulate-veined.

Distribution. Recorded from the south-east of Great Victoria Desert in the Eremaean Botanical Province and from near Queen Victoria Spring in the South-western Interzone of Western Australia.

Habitat. No habitat details recorded, but the species occurs in a more arid environment than any other members of the genus.

Flowering period. September.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority 1. *Physopsis chrysotricha* has not been collected since 1891, suggesting that it is very rare or extinct. However, the absence of recent collections may be due partly to the remoteness of the area where the taxon has been recorded; a field survey specifically for this species is clearly needed.

Notes. Very closely related to *Physopsis viscida*, which possibly should be regarded as a subspecies of *P. chrysotricha*, but readily distinguished by its bright yellow indumentum. *P. chrysotricha* also appears to have more leafy and more interrupted spikes with a shorter indumentum. However, it is known from only two collections, neither of which is in fruit. More material is needed of this very poorly known taxon to determine whether these character differences are reliable.

Physopsis lachnostachya C.A. Gardner (Gardner 1939: t. 3384). *Type:* Gravelly hills, Kukerin, Western Australia, 9 November 1935, *C.A. Gardner s.n.* (*holo:* PERTH 01607863; probable *iso:* PERTH 01607855).

Illustrations. Gardner (1939: Tablet 3384); Munir (1978: Figure 35).

Description. Munir (1978: 585-688). Additional characters: calyx indumentum 1.2-1.8 mm long; corolla lobes prominently reticulate-veined.

Selected specimens examined. WESTERN AUSTRALIA: Tarin Rock Reserve, 28 km W of Lake Grace, 2 Oct. 1984, *J.M. Brown* 305; 22 km S of Hyden on road to Newdegate, 18 Sep. 1984, *D.B. Foreman* 775; 23 km S of Hyden, 23 Nov. 1985, *D.B. Foreman* 1177; Kananda Farm, Kulin East, 24 Oct. 1994, Kulin Kondinin Herbarium 14.

Distribution. Endemic to the South-west Botanical Province of Western Australia, extending from Kulin south to near Kukerin and east to near Lake King.

Habitat. Commonly occurs in lateritic or gravelly soils, in low to tall shrublands sometimes dominated by *Eucalyptus* species with a mallee habit.

Flowering period. September-January.

Conservation status. Not considered to be at risk at present.

Notes. The sheet cited above as the holotype bears a label, signed by Gardner, identifying it as the type of *Physopsis lachnostachya.* As Munir (1978) did not see this sheet, he cited the other specimen listed above (PERTH 01607855) as the holotype, but the latter sheet lacks Gardner's endorsement and gives a slightly different locality, *viz.* "gravelly rises between Kukerin and Tarin Rock". Despite this difference, the second specimen is probably an isotype, as the description of the plant and the date are identical to those on the holotype.

Considering its small geographical range, *Physopsis lachnostachya* is very variable, especially in leaf size and shape. The leaf lamina varies from very narrowly ovate to ovate or elliptic, and is particularly small and narrow in specimens (e.g. *D.B. Foreman* 775, 1177) occurring in a small area between Hyden and Newdegate. In all areas, the leaves have bright yellow hairs on the undersurface as in *P. chrysophylla*, although the undersurface is largely hidden on some specimens.

Physopsis spicata Turcz. (Turczaninov 1849: 35). *Type:* New Holland [Western Australia], 1846-1847, *J. Drummond* coll. 4, n. 234 (*holo:* KW *n.v.*, photograph PERTH 04134567).

Illustrations. Diels & Pritzel (1904: Figure 55A-C); Gardner (1939: Tablet 3383); Munir (1978: Figure 34).

Description. Munir (1978: 581-585). Additional characters: calyx indumentum 1.5-3 mm long; corolla lobes thick-textured, the veins not visible, with small glandular hairs inside on the thickened base.

Selected specimens examined. WESTERN AUSTRALIA: 5.6 km W of Brand Mudge Rd, Alexander Morrison National Park, 5 Nov. 1992, *R.J. Cranfield & P. Spencer* 8404; Talbot West Rd, 3.7 km by road NW of Luelf Rd, *c.* 15 km SW of York, 30 Oct. 1993, *B.J. Conn* 3943, *M.E. Tozer & F. Ovens*; Watheroo West Rd, NE of Badgingarra, 7 Nov. 1988, *E.A. Griffin* 5478; Eneabba, 16 Dec. 1987, *H. Demarz* 12017; Beekeeper Rd, 19 Apr. 1994, *J.L. Robson* 621.

Distribution. Endemic to the South-west Botanical Province of Western Australia, occurring mainly from Arrowsmith Hill south-east to Watheroo National Park and near Bald Hill (south-east of Badgingarra), also occurring near York.

Habitat. Occurs in sandy soils, sometimes with laterite, recorded in low shrublands.

Flowering period. August-February.

Conservation status. Not considered to be at risk at present.

Notes. This species differs from other members of the genus in its very long calyx and corolla tube, its corolla lobes lacking obvious veins but having glandular hairs at the base, and also in the occurrence of hairs and sessile glands on the base of the style. Its nearest relative appears to be *Physopsis chrysophylla*.

Physopsis viscida (E. Pritzel) Rye, *comb. nov.*

Newcastelia viscida E. Pritzel (Diels & Pritzel 1904: 505). *Type:* Coolgardie goldfields, Western Australia, October 1901, *E. Pritzel* 858 (*lecto:* AD, *fide* Munir (1978: 640), *n.v.*, illustration seen; *isolecto*: PERTH 01607847).

Illustrations. Diels & Pritzel (1904: Figure 56A-C); Munir (1978: Figure 47); Munir (1981: Figure 402).

Description. Munir (1978: 639-643). Additional characters: calyx indumentum 0.7-1.2 mm long; corolla white, the lobes prominently reticulate-veined.

Selected specimens examined. WESTERN AUSTRALIA: *c.* 25 km W of Mulline on Menzies to Diemals road, 17 Sep. 1989, *B.J. Conn* 3161 & *J.A. Scott*; 7 km N of Emu Well, Adelong Station, 22 Sep. 1988, *R.J. Cranfield* 7578; *c.* 6 km NE of Bungalbin Hill, 28 Sep. 1995, *B.J. Lepschi* 2074; Melita Station, 4 Nov. 1988, *H. Pringle* 2210; N of Leonora, Sep. 1994, *T. Read* 7.

Distribution. Recorded mainly from the South-west Interzone, but extending slightly north into the Eremaean Botanical Province of Western Australia. Extends from north of Lake Barlee east to near Elora Soak and south-east to Hampton Hills Station (south of Kalgoorlie).

Habitat. Occurs mainly in red sand or sandy clay, also sometimes in yellow soils, recorded on rocky hillsides, sand dunes and on plains, often with laterite or lateritic gravel, rarely associated with other types of rocks. The vegetation is usually recorded as shrublands or woodlands dominated by *Eucalyptus* or a variety of other genera.

Flowering period. Mainly September-November.

Conservation status. Not considered to be at risk.

Notes. In the protologue, Diels & Pritzel (1904: 505), noted that this species has a similar floral structure to *Newcastelia* (now *Physopsis*) *chrysotricha*, *Newcastelia cladotricha* and *Physopsis spicata*. The first of these is undoubtedly its closest relative (see notes under *P. chrysotricha*), and all three species are similar to *P. viscida* in having short stamens and style. Most *Newcastelia* species and all *Lachnostachys* species have prominently exserted stamens and style.

Discussion

The transfer of three primarily 5-merous species from *Newcastelia* to *Physopsis*, has resulted in a clearer separation of the two genera. Previously, the sole character used to distinguish *Physopsis* and *Newcastelia*, was the number of floral parts. This was, in any case, a somewhat incomplete difference, separating species with consistently 4-merous flowers from those producing mainly 5- but

also some 4-merous flowers. A second difference suggested by the table and accompanying illustration in Munir (1978: 415) is that the style apex tends to be more deeply divided in *Physopsis*. This has become a more reliable difference by the current change to the generic limits, as the three species transferred from *Newcastelia* into *Physopsis* have the style apex distinctly lobed, unlike the usually notched apex of the species remaining in *Newcastelia*.

Most of the species of *Lachnostachys* and *Newcastelia*, especially those with wide geographical ranges, show a great deal of morphological variation. The characters that have been used to distinguish most of the varieties and forms in these species appear to have been chosen partly for historical reasons, either because the variant had already been named at some level or because the herbarium collections at the time of publication of the names had fewer specimens of intermediate morphology. Certainly these characters have no clear geographical significance and, at least in some cases, vary within populations and probably on individual plants. Most of the named infraspecific taxa in *Lachnostachys* and *Newcastelia* are, therefore, no longer recognized.

Acknowledgements

I would like to thank A.A. Munir for his detailed comments on an early draft of this manuscript, which have led to considerable improvements. I am also grateful to Barry Conn and Brendan Lepschi for reviewing the paper and Paul Wilson for advice on nomenclature and the Latin diagnosis. The illustration was drawn by Margaret Pieroni.

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A synopsis of the genera *Pomaderris*, *Siegfriedia*, *Spyridium* and *Trymalium* (Rhamnaceae) in Western Australia

B.L. Rye

Western Australian Herbarium, Department of Conservation and Land Management,
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983

Abstract

Rye, B.L. A synopsis of the genera *Pomaderris*, *Siegfriedia*, *Spyridium* and *Trymalium* (Rhamnaceae) in Western Australia. Nuytsia 11 (1): 109-131 (1996). Keys and distribution maps are given for Western Australian Rhamnaceae in the genera *Pomaderris*, *Siegfriedia*, *Spyridium* and *Trymalium*, together with brief information on each taxon, including its habitat, flowering period, conservation status and synonyms. The new combination *Pomaderris rotundifolia* (F. Muell.) Rye is made, the new taxon *Trymalium myrtillus* subsp. *pungens* is described, and several taxa of conservation significance are illustrated.

Introduction

As noted in earlier papers on Western Australian Rhamnaceae (Rye 1995a, 1995b), the total number of genera to be recognized in this State will depend upon the outcome of studies, still in progress, on the generic limits of the family throughout Australia. Of the south-western Australian taxa, the delimitation of five genera is now clear. One of these is the new genus *Granitites* described in Rye (1996), and the other four genera, *Pomaderris, Siegfriedia, Spyridium* and *Trymalium*, are dealt with here. This publication provides a complete list of the Western Australian members of these genera, with keys, distribution maps and other information to facilitate their identification. All synonyms are listed, including phrase names that were used to identify the taxa prior to the publication of their formal taxonomic names. Conservation priority codes are given for taxa on the Priority Flora List and illustrations provided for four priority taxa for which there are no previous illustrations. An explanation of the conservation codes used by the Department of Conservation and Land Management for Western Australian flora is given at the end of each issue of this journal.

Formal taxonomy

Pomaderris rotundifolia (F. Muell.) Rye, *comb. nov.*

Spyridium rotundifolium F. Muell. (Mueller 1863: 25). - *Cryptandra rotundifolia* (F. Muell.) F. Muell. (Mueller 1883: 61). *Type:* Point Malcolm, [Western Australia], *Maxwell* (MEL 227042).

Conservation status. Included on the 1990 Priority Species List as *Spyridium rotundifolium* but now more populations are known and the species is no longer considered to be at risk.

Notes. Characteristics of *P. rotundifolium* that are typical of the genus *Pomaderris* include the conspicuous annular disc (common among Western Australian species but not among those from other states), long dense indumentum on the ovary summit, deeply divided style (sometimes almost split into 3 distinct styles) and half-inferior schizocarp with a basal valve on each fruitlet. *P. rotundifolium* has more prominent bracts and shorter pedicels than all or nearly all other members of the genus, giving its inflorescence a more head-like appearance. It also has very well developed petals with a hooded lamina enclosing an anther in bud, whereas most *Pomaderris* species either lack petals or have a reduced lamina. Uncertainty over the species' generic placement has resulted from these unusual characteristics and the dearth of fruits, with only one fruiting specimen known, and perhaps also from the admixture of an unrelated *Spyridium* species among the specimens.

Prior to recent work on the family, *Spyridium tricolor* specimens at PERTH were housed, together with those of *P. rotundifolium*, under the name *Spyridium rotundifolium*. Confusion between the two taxa was due to their overlapping geographical ranges and a superficial morphological similarity, both species having broad leaves and large bracts surrounding the flower clusters. A closer examination of the leaves, flowers and fruits revealed many differences, with each species having inflorescence, disc, fruit and aril characters indicative of the genus in which it is now placed.

Trymalium myrtillus subsp. **pungens** Rye, *subsp. nov.*

A *Trymalio myrtillio* subsp. *myrtillio* ramulis spinescentibus, foliis parvioribus differt.

Typus: 34 km south-east of Ongerup, Western Australia, 28 October 1976, *K. Newbey* 5007 (*holo:* PERTH 0332414; *iso:* CANB).

Spinescent branchlets numerous, stout, 3-11 mm long. *Petioles* 0.2-0.5 mm long. *Leaf blades* conduplicate at first, obovate, 2.3-4.0 mm long, approximately 1-1.5 mm wide, rather sparsely hairy on the recurved margins and midvein of undersurface and with a dense white indumentum between the midvein and recurved margins, the hairs simple, antrorse and 0.2-0.3 mm long; upper surface (not including recurved margins) with a sparse indumentum much shorter than that on undersurface, the hairs sometimes 2-branched to stellate. *Flowers* 1.8-2.3 mm in diameter. (Figure 1)

Other specimen examined. WESTERN AUSTRALIA: Near Lake Grace, 30/9/1933, *W.E. Blackall* 3198 (PERTH).

Distribution and habitat. Recorded from near Lake Grace and from south-east of Ongerup, the latter locality an exposed slight ridge with "well drained stoney, crumbly red clayey loam/clay/dolerite dyke".

Flowering period. Flowers recorded September-October and fruits recorded in late October.

Conservation status. Known from only two collections, neither of which appears to be from a conservation reserve. No attempt has been made to survey this taxon, which is now included on the Priority Flora List as a Priority 1 taxon.

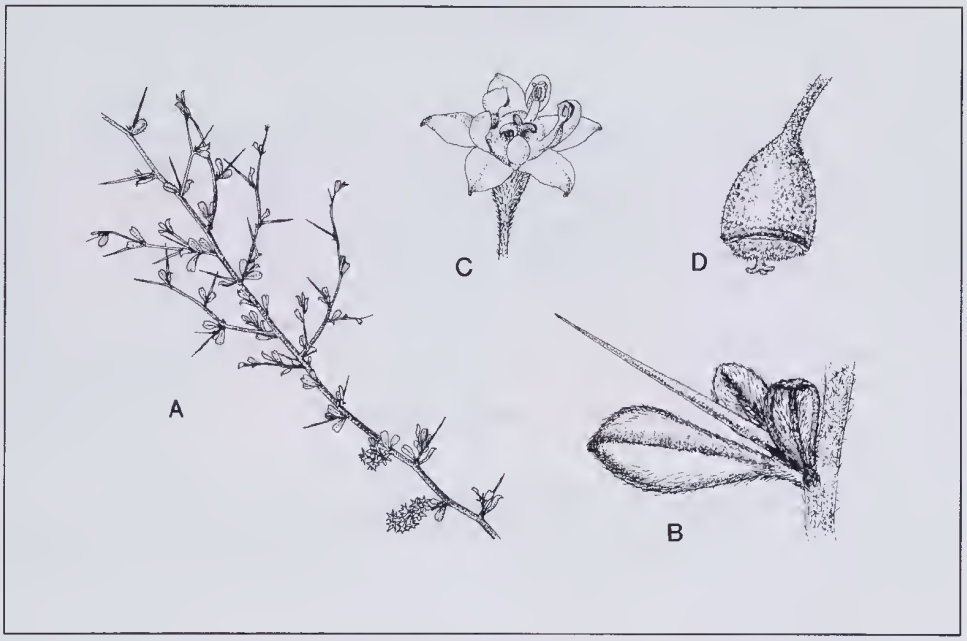

Figure 1. *Trymalium myrtillus* subsp. *pungens* A - habit (x1), B - spinescent branchlet and leaves (x8), C - flower (x12), D - fruit (x8). Drawn from *W.E. Blackall* 3198 (A-C) and *K. Newbey* 5007 (D).

Etymology. From the Latin *pungens* - sharp, piercing, in reference to the spinescent branchlets.

Notes. Since the two known localities for subsp. *pungens* are east of the known range of subsp. *myrtillus*, the two taxa appear to be allopatric. At first sight, the new taxon appears to be a distinct species, as its numerous stout spinescent branchlets give it a very different appearance from the unarmed subsp. *myrtillus*, but there appear to be no other absolute differences. Apart from *T. myrtillus* subsp. *pungens*, the only *Trymalium* species exibiting spinescence is *T. elachophyllum*, which has fewer, finer spinescent branchlets occurring on some but not all specimens. In *T. elachophyllum*, there is considerable overlap in the geographical ranges of spinescent and non-spinescent specimens, and this character probably varies within populations, with no correlating characters to suggest that the spinescent variant should be recognized formally.

Of the two specimens of *T. myrtillus* subsp. *pungens*, one has the smallest leaves known in the species and the other has leaves equalling those of the smallest-leaved specimen of subsp. *myrtillus*. Subsp. *myrtillus* is a much more widespread and variable taxon, with leaf measurements of 4.5-12.5 x 1.5-4 mm compared with 2.5-4.5 x 1-1.5 mm in subsp. *pungens*. These measurements, which include the petiole length, were taken from the largest leaves occurring on each herbarium specimen. Specimens of subsp. *myrtillus* from the more arid parts of its geographical range tend to have larger leaves with the upper surface more hairy than those occurring in the more mesic areas closer to where subsp. *pungens* is found. Subsp. *pungens* also appears to have smaller flowers than the type subspecies but this may be partly due to the fact that the more spiky specimens are less well pressed, perhaps resulting in greater shrinkage of the flowers on drying.

Synopsis and keys

Pomaderris Labill.

A large genus occurring across southern Australia and from north-eastern Queensland south to Tasmania and also in New Zealand, with the greatest numbers of species occurring in New South Wales and Victoria. There are five species known only from Western Australia and two species shared with other regions. The geographical distributions of the seven Western Australian species are given in Figure 2. Some characteristics of the genus are as follows: cymes usually with long conspicuous pedicels and often condensed into an umbel-like cluster, rarely with short pedicels and head-like; petals (in nearly all species) either reduced, with the lamina not enclosing an anther, or absent; disc absent or annular; ovary summit with long erect hairs (in western and most eastern Australian species); schizocarp partially inferior; fruitlets (in nearly all species) crustaceous with a chartaceous to membranous basal valve. Most of these characters are illustrated in Figure 3, for example the basal valve on the fruitlet in Figure 3J.

1. Stigmatic lobes 2. Fruitlets longitudinally dehiscent along the middle of the adaxial surface and halfway down the abaxial surface, without a basal valve ... **P. bilocularis**
1. Stigmatic lobes 3. Fruitlets with a membranous to chartaceous basal valve on the adaxial surface
2. Flowers either shortly pedicellate or lacking petals. Style deeply divided into 3 branches
3. Pedicels short, hidden by bracts. Petals present. Disc conspicuous, annular ..... **P. rotundifolia**
3. Pedicels long, conspicuous. Petals absent. Disc absent ..... **P. paniculosa**
3a. Leaves stellate-hairy on upper surface. Recorded from sand and non-calcareous rocks on the mainland, usually inland ..... subsp. **paniculosa**
3a. Leaves glabrous on upper surface. Recorded from coastal limestone on an island of Recherche Archipelago ..... subsp. **paralia**
2. Flowers long-pedicellate, with petals. Style 3-lobed (lobes shorter than the entire portion of style)
4. Leaves narrowly ovate or ovate, 45-150(200) mm long. Petal limb broad with a truncate base. Disc inconspicuous ..... **P. grandis**
4. Leaves obovate or oblong-elliptic to circular or obcordate, 3-26 mm long. Petal limb either not expanded or tapering to a claw. Disc prominent, annular
5. Petals spathulate with a broad, almost circular limb. Ovary summit with very long hairs surrounded by a region of very short hairs, sometimes also with a distinct outer glabrous border ..... **P. forrestiana**
5. Petals linear to narrowly spathulate. Ovary summit with long hairs surrounded by the glabrous disc, without an area of short hairs
6. Leaves 3-7 mm long. Sepals 1-1.5 mm long at anthesis, *c.* 2 mm long in fruit, persistent. Petals glabrous ..... **P. brevifolia**
6. Leaves 8-26 mm long. Sepals 1.5-2.7 mm long at anthesis, 2-3 mm long in fruit, deciduous. Petals usually hairy outside ..... **P. myrtilloides**

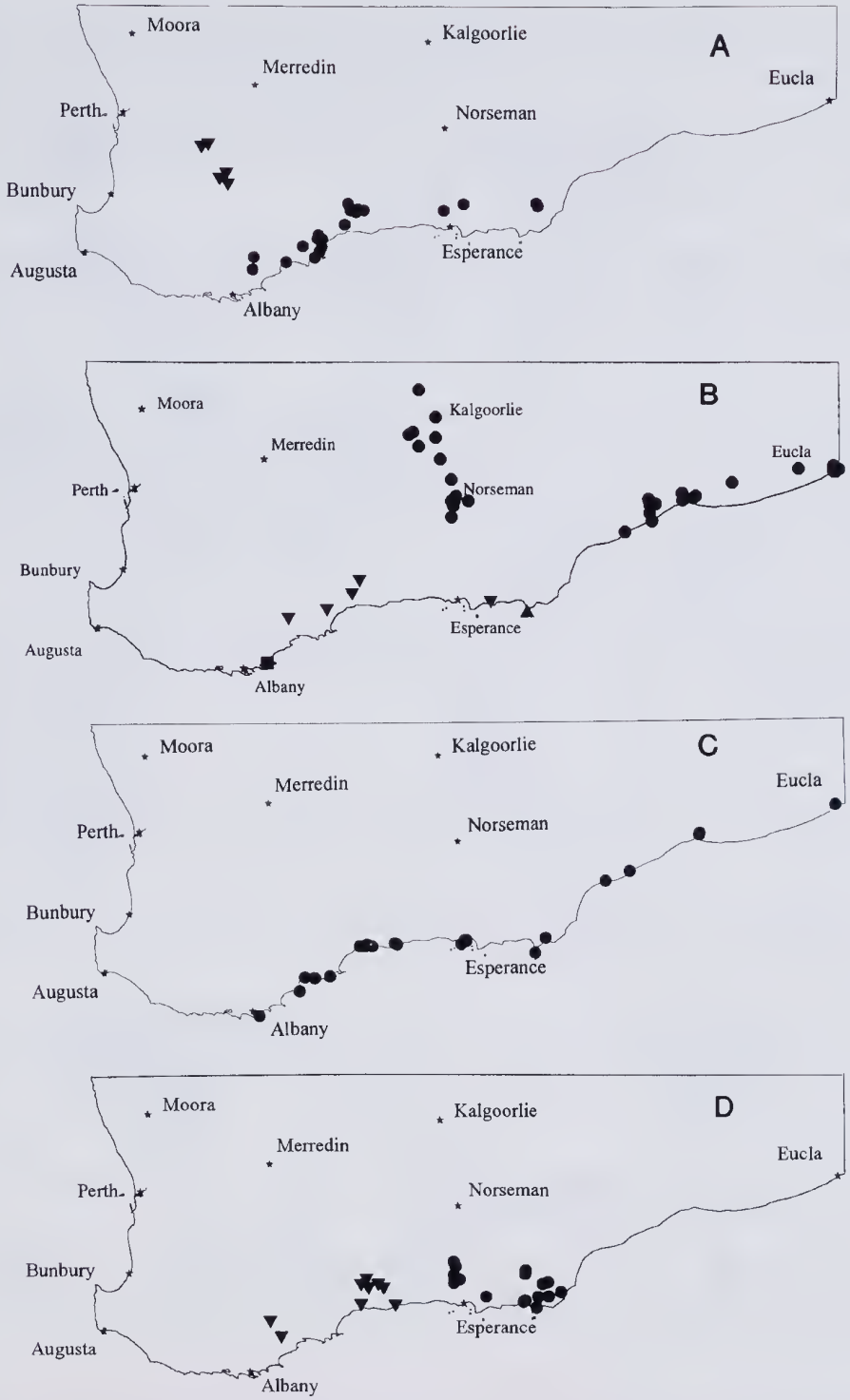

Figure 2. Distribution of *Pomaderris* and *Siegfriedia* species in Western Australia. A - *Pomaderris bilocularis* ▼, *P. brevifolia* ●; B - *P. forrestiana* ●, *P. grandis* ■, *P. paniculosa* subsp. *paniculosa* ▼, *P. paniculosa* subsp. *paralia* ▲; C - *P. myrtilloides*; D - *P. rotundifolia* ●, *Siegfriedia darwinioides* ▼.

Pomaderris bilocularis A.S. George - occurs in lateritic soils, usually in gravelly sand or on lateritic ridges, in woodlands dominated by *Eucalyptus* or *Allocasuarina* species or in heathlands. Extends from Tutanning Reserve south-east to near Dumbleyung, all but one of the known populations occurring on reserves. Flowers: October-April. Fruits: May, August. Shrub 0.4-1 m high. Schizocarp *c.* half inferior. This species is atypical of *Pomaderris* in having a gynoecium of 2 (rather than 3) fused carpels and in lacking a basal valve on the fruitlets, but otherwise has all the typical characteristics of the genus. **Priority 4** (Figure 3A-E)

Pomaderris brevifolia N.G. Walsh - occurs in clay or sandy soils, often on rocky sites, commonly in woodlands dominated by mallee (*Eucalyptus*) species. Extends from Stirling Range east to Cape Arid National Park. Flowers: January-August. Fruits: August-October. Shrub 0.3-1.2(2) m high. Schizocarp *c.* half inferior. (Walsh 1994: Figure 1)

Pomaderris forrestiana F. Muell. - recorded mainly on rocky sites, occurring on limestone along the coast and on a variety of rock substrates inland, from Broad Arrow (north of Kalgoorlie) south to near McPherson Rock (south of Norseman) and along the coast of the Great Australian Bight from Toolinna Cove east to Wilson Bluff on the South Australian border. Also occurs in South Australia. Flowers: May-October. Fruits: August-November. Shrub 0.4-1.5 m high. Schizocarp *c.* half inferior. *Pomaderris mayeri* C.A. Gardner (Canning & Jessop 1986: Figure 428B)

Pomaderris grandis F. Muell. - occurs in rocky gullies on the slopes of Mt Manypeaks, a very restricted endemic. Flowers: July-October. Fruits: October-November. Shrub 1-4.5 m high. Schizocarp *c.* half inferior. This species is abundant after fires (G.J. Keighery pers. comm.). **Priority 4** (Figure 3F-J)

Pomaderris myrtilloides Fenzl - occurs in coastal vegetation, on limestone or in deep sand, extending along the south coast from Albany east to Eucla. Flowers: February-July. Fruits: August-November. Shrub 0.3-1.5(2) m high. Schizocarp *c.* one-third inferior. There are two variants.

typical variant - widespread in the species' range but appears to occur more commonly on limestone than on sand dunes. Leaves glabrous or almost glabrous on the adaxial surface. *Pomaderris myrtilloides* var. *major* Benth., *P. stenopetala* F. Muell.

hairy variant - occurs mainly on sand dunes, recorded at Beaufort Inlet and from Fitzgerald River National Park east to Esperance. Leaves densely hairy on both surfaces. This variant tends to have larger leaves and sepals than the typical variant but these characters overlap too much to be useful in distinguishing them. *Pomaderris* sp. 2 (*G.J. Keighery* 6099)

Pomaderris paniculosa F. Muell. ex Reissek - distributed in southern Australia. Shrub 0.4-1.6 m high. Schizocarp *c.* three-quarters inferior.

subsp. **paniculosa** - recorded in stony soil and in sand, often along watercourses or drainage lines, extending from near Ongerup east to Cape Le Grand. Also occurs in South Australia, Victoria and possibly New South Wales. Flowers: July-October. Fruits: October. (Walsh 1990: Figure 3)

subsp. **paralia** N.G. Walsh - recorded on the limestone cliffs of Middle Island, Recherche Archipelago. Also occurs in South Australia, Victoria and Tasmania. Flowers: November. The name *Pomaderris oraria* F. Muell. has been misapplied to this subspecies. Subsp. *paralia* usually has larger leaves than subsp. *paniculosa*. **Priority 2** (Walsh 1990: Figure 4)

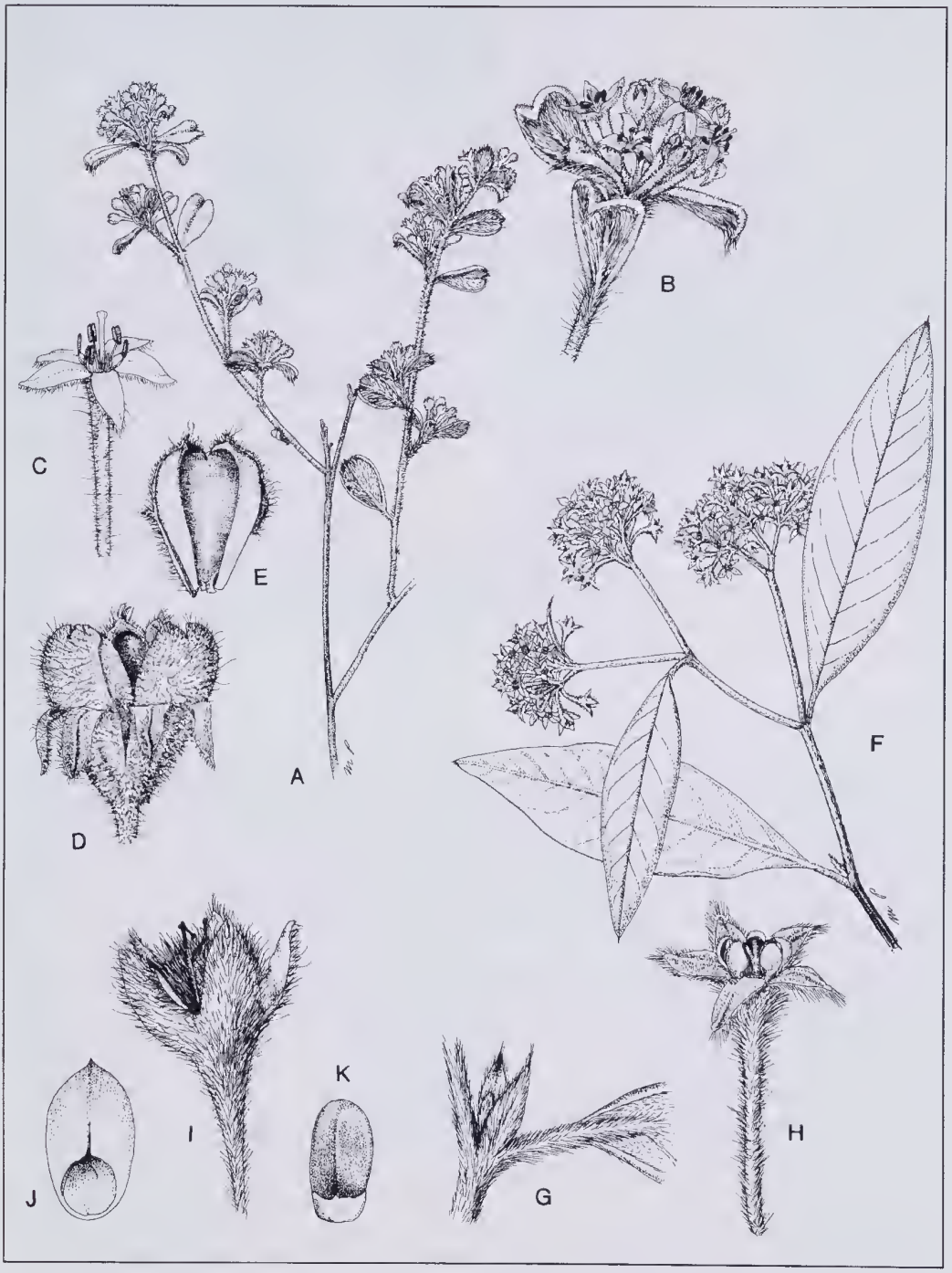

Figure 3. A-E - *Pomaderris bilocularis* A - flowering branch (x1), B - flower cluster (x3), C - flower (x6), D - dehiscing fruit (x8), E - dehisced fruitlet (x8); F-K - *Pomaderris grandis* F - flowering branch (x1), G - stipules (x4), H - young flower (x6), I - dehiscing fruit (x6), J - adaxial view of fruitlet (x7.5), K - seed and aril (x7.5). Drawn from *A.S. George* 29/3/1969 (A-C), *S. Patrick* 394 (D,E), *D. Davidson* 1/10/1986 (F-H) and *G.J. Keighery* 8827 (I-K).

Pomaderris rotundifolia (F. Muell.) Rye - recorded in clayey or limestone soils, often in woodlands dominated by mallee (*Eucalyptus*) species. Extends from Grass Patch and Scadden east to Cape Arid National Park. Flowers: June-September. Fruits: September-October. Shrub 0.2-1.5 m high. Schizocarp *c.* two-thirds inferior. *Cryptandra rotundifolia* (F. Muell.) F. Muell., *Spyridium rotundifolium* F. Muell.

Siegfriedia C.A. Gardner

A monotypic genus endemic to Western Australia. Its distribution is given in Figure 1D. It is distinguished from all other genera of Rhamnaceae in south-western Australia by its opposite-decussate leaves, very prominent involucral bracts enclosing the flowers in a bell-like inflorescence, and long-exserted stamens. These characters are found in a few members of a number of unrelated genera including *Darwinia* (Myrtaceae) and *Pimelea* (Thymelaeaceae), presumably in response to the same selection pressures. Among the Rhamnaceae, *Siegfriedia* appears to be closest to *Pomaderris*, having the same type of fruit with a membranous to chartaceous basal valve on each fruitlet. Some other characters worth noting in *Siegfriedia* are: bracts denticulate; pedicels long; flowers 4-merous; petals absent; style exserted, with a 3-lobed apex; schizocarp about half-inferior, with 3 fruitlets; aril basal, clear-translucent, 3-lobed.

Siegfriedia darwinioides C.A. Gardner - occurs mainly in sandy clay, often with gravel or on rocky sites. Extends from between Ongerup and Stirling Range east to near Starvation Boat Harbour, with most records from the Ravensthorpe area. Flowers: April-August. Fruits: August-November. Shrub 0.3-1 m high. The variation within this species, for example in the inflorescence structure, needs further study. **Priority 3** (Figure 4)

Spyridium Fenzl

A southern Australian genus with the greatest number of species in South Australia, also well represented in Western Australia and extending to Victoria and south-eastern New South Wales, and with a few endemic species in Tasmania. Most of the 15 species in Western Australia are endemic. Characteristics of the Western Australian species are outlined in Rye (1995a: 120) and their geographical distributions are shown in Figures 5 and 6. Some species previously included in the genus *Spyridium* have been transferred to *Stenanthemum* (Rye 1995b) and one to *Pomaderris*.

Western Australian species fall into three groups, referred to here as the *Spyridium cordatum*, *S. globulosum* and *S. oligocephalum* groups. The first group, comprising *S. cordatum*, *S. glaucum*, *S. microcephalum*, *S. minutum*, *S. mucronatum* and *S. tricolor*, has discrete triangular disc lobes and an inflorescence either of very small cymes (usually 2- or 3-flowered) or of small head-like condensed cymes terminating leafy branchlets. The *S. globulosum* group, also containing *S. majoranifolium*, *S. montanum*, *S. riparium*, *S. spadiceum* and *S. villosum*, has discrete emarginate disc lobes that are broadly oblong to transversely elliptic. In this group the inflorescence usually consists of medium- to large-sized cymes with obvious branches each bearing a few flowers or (especially in *S. majoranifolium*) of apparently axillary, condensed cymes resembling heads. The last group, comprising *S. oligocephalum*, *S. polycephalum*, and *S. subochreatum*, is distinguished from both the preceding groups by the stipule characters described in the key and its undulate annular disc. Its inflorescence is of head-like condensed cymes.

One taxon excluded from this account is *Spyridium pauciflorum* (Turcz.) Benth., based on *Cryptandra pauciflora* Turcz. The type collection, probably from the Stirling Range-Albany-Mt

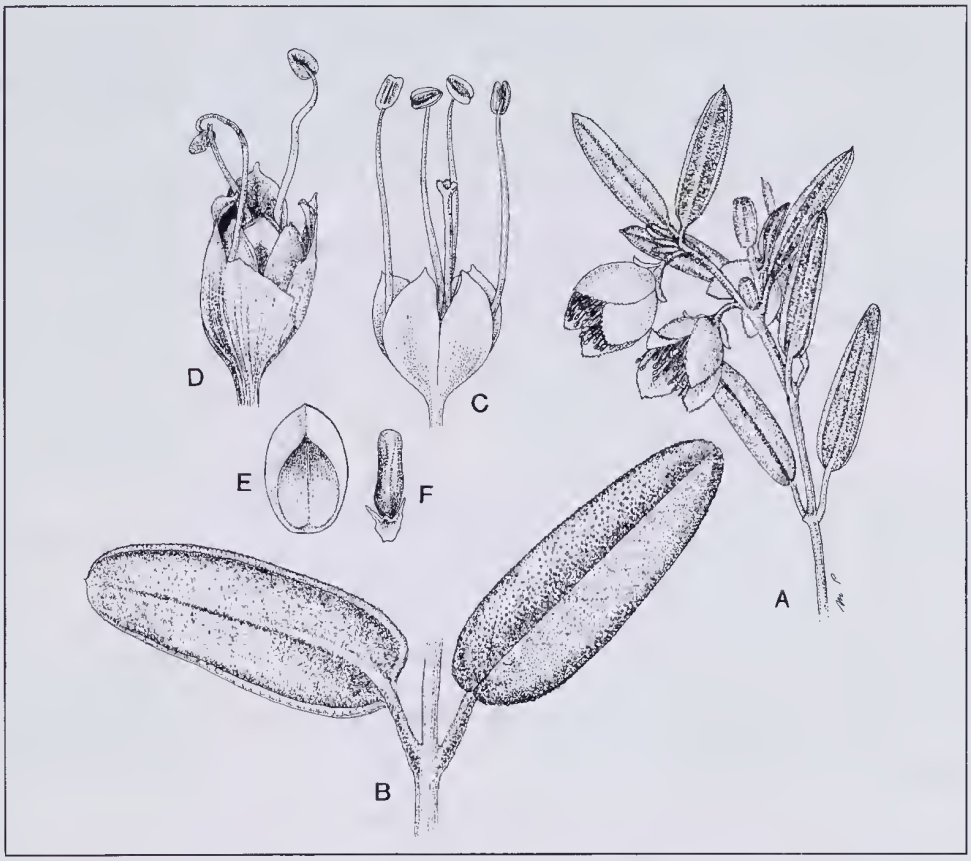

Figure 4. *Siegfriedia darwinioides* A - habit (x 1), B - pair of leaves (x2), C - flower (x6), D - dehiscing fruit surrounded by remnants of the flower (x6), E - abaxial view of fruitlet (x6), F - shrivelled seed with aril (x6). Drawn from *E.M. Bennett* 2315 (A, D-F) and *M.A. Burgman* 1570 *& S. McNee* (B,C).

Barrens area, needs to be examined to determine the status of this taxon. Judging from a photograph of the holotype at KW and from the description given by Bentham (1863: 432), *S. pauciflorum* would belong either in the *S. oligocephalum* species group or the *S. globulosum* species group. However, it differs from the former group in its more discretely lobed disc and its more discolorous and apparently less prominently veined leaves, and differs from the latter group in its more attenuate leaf bases. *Spyridium pauciflorum* appears to have large stipules like those of *S. spadiceum* or the *S. oligocephalum* group.

1. Stipules large and papery, acute or sometimes with a short deciduous point, readily torn, each pair united for some distance but free at the summit. Disc annular, continuing under the stamens to form an undulate or lobed ring above the hairy ovary summit
   2. Flowers very hairy, the largest hairs on sepals 0.7-1.3 mm long. Seeds orange-brown (above a dark base), without obvious darker markings ..... **S. polycephalum**
   2. Flowers with a short to medium-sized indumentum outside, the largest hairs on sepals 0.1-0.5 mm long. Seeds yellow-brown with obvious dark spots or other dark markings

3. Stipules and bracts deep red-brown. Sepal hairs *c.* 0.1 mm long (often *c.* 0.2 mm long in South Australia). Occurring on limestone at Toolinna ..... **S. subochreatum**

3. Stipules and bracts orange-brown (giving the inflorescence a somewhat ferruginous appearance). Sepal hairs 0.3-0.5 mm long. Occurring on non-calcareous rocks from Kalgan River to Fitzgerald River National Park ..... **S. oligocephalum**

1. Stipules small and coriaceous in most species, if large then long-acuminate, fairly resilient but tending to loose point or distal half with age, each pair either very shortly united at base or free throughout. Disc of 5 lobes alternating with the stamens above the hairy ovary summit; lobes either broadly oblong to transversely elliptic and emarginate, or triangular

4. Disc lobes more or less triangular, the apex of the triangle midway between adjacent pairs of stamens

5. Leaves appearing sessile, the short (0.3-0.5 mm) petiole appressed to the stem; blade 1-2.5 mm long, very dorsally thickened, about as thick as broad. (Inflorescence *c.* 2-flowered.) ..... **S. minutum**

5. Leaves with a distinct petiole 0.5-5 mm long; blade 2-80 mm long, broader than thick

6. Floral tube with long erect (antrorse) hairs which are easily detached, becoming glabrous in fruit

7. Leaves almost circular, folded inwards, with incurved or flat margins. Bracts 4-6 mm long ..... **S. tricolor**

7. Leaves linear to broadly ovate or cordate, not folded, with distinctly recurved or revolute margins. Bracts 1.5-3 mm long

8. Leaves cordate or broadly ovate, 2-5 mm long ..... **S. cordatum**

8. Leaves usually linear to oblong, sometimes elliptic or ovate, 4-9 mm long ..... **S. microcephalum**

6. Floral tube with short and/or long spreading hairs, which persist in fruit

9. Leaves 2-4(4.5) x 0.8-1.5 mm, with a glabrous mucro. Bracts 1-2 mm long, ciliate; outer surface glabrous or with minute hairs concentrated along midvein ..... **S. mucronatum**

9a. Leaves 1.4-1.6 mm wide. Flowers usually *c.* 10 per head ..... subsp. **multiflorum**

9a. Leaves 0.6-1.2 mm wide. Flowers usually 3-6 per head

9b. Leaves slightly recurved at apex; mucro 0.1-0.3 mm long. Sepals with hairs 0.2-0.4 mm long. Occurring from Frank Hann National Park east to near Cape Arid National Park ..... subsp. **mucronatum**

9b. Leaves distinctly recurved at apex; mucro up to 0.1 mm long. Sepals with hairs 0.1-0.2 mm long. Occurring from Borden east to Ravensthorpe ..... subsp. **recurvum**

9. Leaves 12-16 x 5-9 mm, with a hairy mucro. Bracts *c.* 3 mm long; outer surface uniformly covered by short appressed hairs ..... **S. glaucum**

4. Disc lobes broadly oblong to transversely elliptic and emarginate

10. Leaves large, usually (20)25-80 x 10-37 mm but sometimes smaller on Abrolhos Islands, subtended by small thick stipules. (Bracts hairy outside over most of surface.)

11. Young stems with short white or off-white hairs; flowers with long or short white hairs. Leaves usually glabrous above. Restricted to the coast ..... **S. globulosum**

11. Young stems and flowers with long ferruginous hairs as well as short white hairs. Leaves hairy on both surfaces. Occurring in Stirling Range .. **S. montanum**

10. Leaves usually small and 4-18(23) x 1.5-11 mm, sometimes large (up to 45 x 15 mm) in *S. spadiceum* but then subtended by large thin stipules

12. Bracts usually hairy throughout or over more than half the surface. Sepals with a combination of short and medium-sized hairs *c.* 0.2 mm long or with short hairs only. (Leaves narrowly oblong to almost circular, 4-18(23) x 2.5-11 mm.) ..... **S. majoranifolium**

12. Bracts largely glabrous but with hairs at base, along midrib and or margins. Sepals with a mixture of large hairs 0.4-0.6 mm long and much shorter hairs

13. Leaves very narrowly or narrowly ovate, 8-17 x 1.5-2.5(3.5) mm, acute, glabrous or subglabrous on upper surface. Occurring along rivers or streams, recorded from Kent River east to Mitchell River ..... **S. riparium**

13. Leaves either linear to elliptic and obtuse or narrowly ovate to ovate and 5-15 mm wide, (12)14-45 mm long, densely minutely hairy on upper surface when young but sometimes becoming subglabrous. Occurring on hills or possibly sometimes on lower ground from Ongerup south to Albany

14. Leaves narrowly ovate or ovate, up to 45 mm long, (5)7-15 mm wide, becoming subglabrous on upper surface. Restricted to granitic hills in Porongurup Range and at Albany ..... **S. spadiceum**

14. Leaves linear to elliptic, up to 22 mm long, 1.5-6 mm wide, densely hairy on upper surface. Recorded in sandy soils, sometimes over sandstone, from Ongerup to Stirling Range..... **S. villosum**

Spyridium cordatum (Turcz.) Benth. - mainly recorded in gravelly or stony to rocky sites, usually in shrublands or woodlands dominated by *Eucalyptus* species with a mallee habit. Extends from west of Lake King east to Mt Ragged, but most records are from the western part of the distribution, with disjunct occurrences at Esperance (one record) and the vicinity of Mt Ragged in Cape Arid National Park (several populations). Flowers: August-December, March-May. Fruits: recorded September-October. Shrub 0.05-0.45 m high. Closely related to *Spyridium microcephalum* and intermediates between the two species, having more or less ovate leaves, occur from near Bremer River east to near Howick Hill. The intermediates are keyed and mapped with typical *S. microcephalum*. Both species are very variable and need further study. A specimen of *S. cordatum* from Frank Hann National Park (*K.R. Newbey* 5512) has more or less sessile leaves like those of another close relative *S. minutum*, but in other characters is typical of *S. cordatum*. *Cryptandra cordata* Turcz.

Spyridium glaucum Rye - recorded in clay, known only from the range of hills north-east of Ravensthorpe. Flowers and fruits: September-November. Shrub 0.5-1 m high. *Spyridium* sp. Ravensthorpe (*E.M. Bennett s.n.*) **Priority 1** (Rye 1995a: Figure 1A-F)

Spyridium globulosum (Labill.) Benth. - occurs in sand close to the coast, usually on sand dunes or on limestone, sometimes dominant in low exposed coastal vegetation, often in woodlands dominated

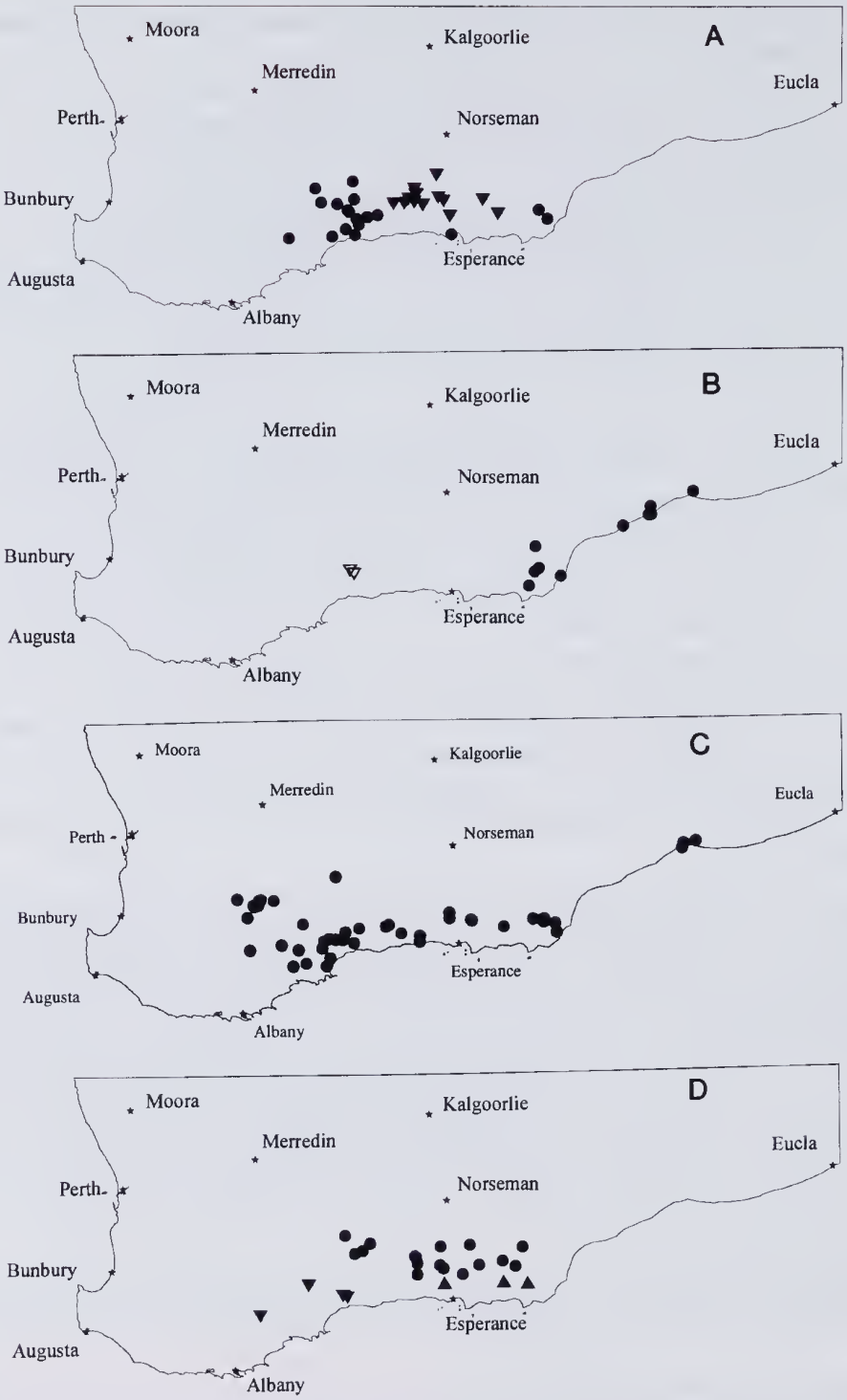

Figure 5. Distribution of the *Spyridium cordatum* group in Western Australia. A - *Spyridium cordatum* ●, *S. minutum* ▼; B - *S. glaucum* ▽, *S. tricolor* ●; C - *S. microcephalum*; D - *S. mucronatum* subsp. *mucronatum* ●, *S. mucronatum* subsp. *multiflorum* ▲, *S. mucronatum* subsp. *recurvum* ▼.

by a variety of species including *Acacia* species, Peppermint (*Agonis flexuosa*) Tuart (*Eucalyptus gomphocephala*) and other *Eucalyptus* species. Extends around the coast from Abrolhos Islands and Geraldton to Israelite Bay, also recorded from Eyre. Although the species occurs close to the South Australian border, there are no records from that State (Canning & Jessup 1986). Flowers and fruits: June-November. Shrub (0.4)0.6-5 m high. Two varieties have been named but are not recognized here because they are merely infra-populational variants. **Basket Flower**

typical variant - throughout the species range. Leaves glabrous and green on the upper surface. *Ceanothus globulosus* Labill., *Cryptandra globulosa* (Labill.) F. Muell., *Pomaderris aemula* Steud., *P. globulosa* (Labill.) G. Don, *P. phyllirifolia* Steud., *P. polyantha* Steud., *P. pyrrophylla* Steud., *Spyridium globulosum* var. *globulosum*, *Trymalium globulosum* (Labill.) Fenzl (Powell 1990: Figure on pp. 198-199).

hairy variant - known only from populations in Perth suburbs along the Swan River estuary, between Peppermint Grove and Kings Park, and on the lower Canning River at Aquinas Bay, occurring in mixed populations with the typical variant. Hairy on both surfaces of the leaves, which are therefore whitish. *Cryptandra albicans* (Steud.) F. Muell., *Pomaderris albicans* Steud., *Spyridium globulosum* var. *albicans* (Steud.) Diels, *Trymalium albicans* (Steud.) Reissek

Spyridium majoranifolium (Fenzl) Rye - occurs mainly on coastal dunes and on a variety of rocky sites, including granite and limestone, in situations varying from exposed coastal heathlands through to relatively sheltered gullies with woodlands dominated by mallee (*Eucalyptus*) species. Extends from Stirling Range and Mutton Bird Island (west of Albany) east to Cape Arid National Park. Flowers: mainly April-September. Fruits: August-November. Shrub 0.1-2 m high. This species is very variable, with three main variants.

typical variant - widespread on the coast and on hills inland. Leaves usually ovate but sometimes oblong-ovate or almost circular, 6-23 x 4-11 mm, hairy on both surfaces. *Pomaderris commixta* Steud., *Spyridium spadiceum* var. *majoranifolium* (Fenzl) Benth., *Trymalium majoranifolium* Fenzl, *T. majoranifolium* var. *velutinum* Reissek

atypical coastal and hills variant - widespread on the coast and on hills inland. Leaves usually oblong-ovate to almost circular, rarely narrowly oblong, 5-18 x 3-10 mm, glabrous on upper surface. *Pomaderris subretusa* Steud., *Spyridium spadiceum* var. (?) *calvescens* (Reissek) Benth., *Trymalium majoranifolium* var. *calvescens* Reissek

plains variant - occurs inland in sandy clay or sand on the plains south of Stirling Range. Leaves narrowly oblong to narrowly oblong-ovate, 7-12 x 2.5-3.5 mm, glabrous on upper surface.

Spyridium microcephalum (Turcz.) Benth. - occurs in sand or clay, sometimes on hills, in the west often in gravelly or granitic soils, in the east often on limestone, commonly in vegetation dominated by mallee (*Eucalyptus*) species. Extends from Dongolocking Reserve east to Eyre. Not recorded from South Australia but specimens there, if they exist, would probably be housed under the name *Spyridium eriocephalum* Fenzl., a species with more prominently pointed leaves and more delicate stipules. Flowers and fruits: mainly March-November. Shrub 0.1-1.5 m high. Closely related to *S. cordatum* but differing in the narrower leaves with recurved margins more or less meeting below and in the usually larger disc, but there are intermediate specimens as described under *S. cordatum*. *Spyridium microcephalum* has two intergrading variants.

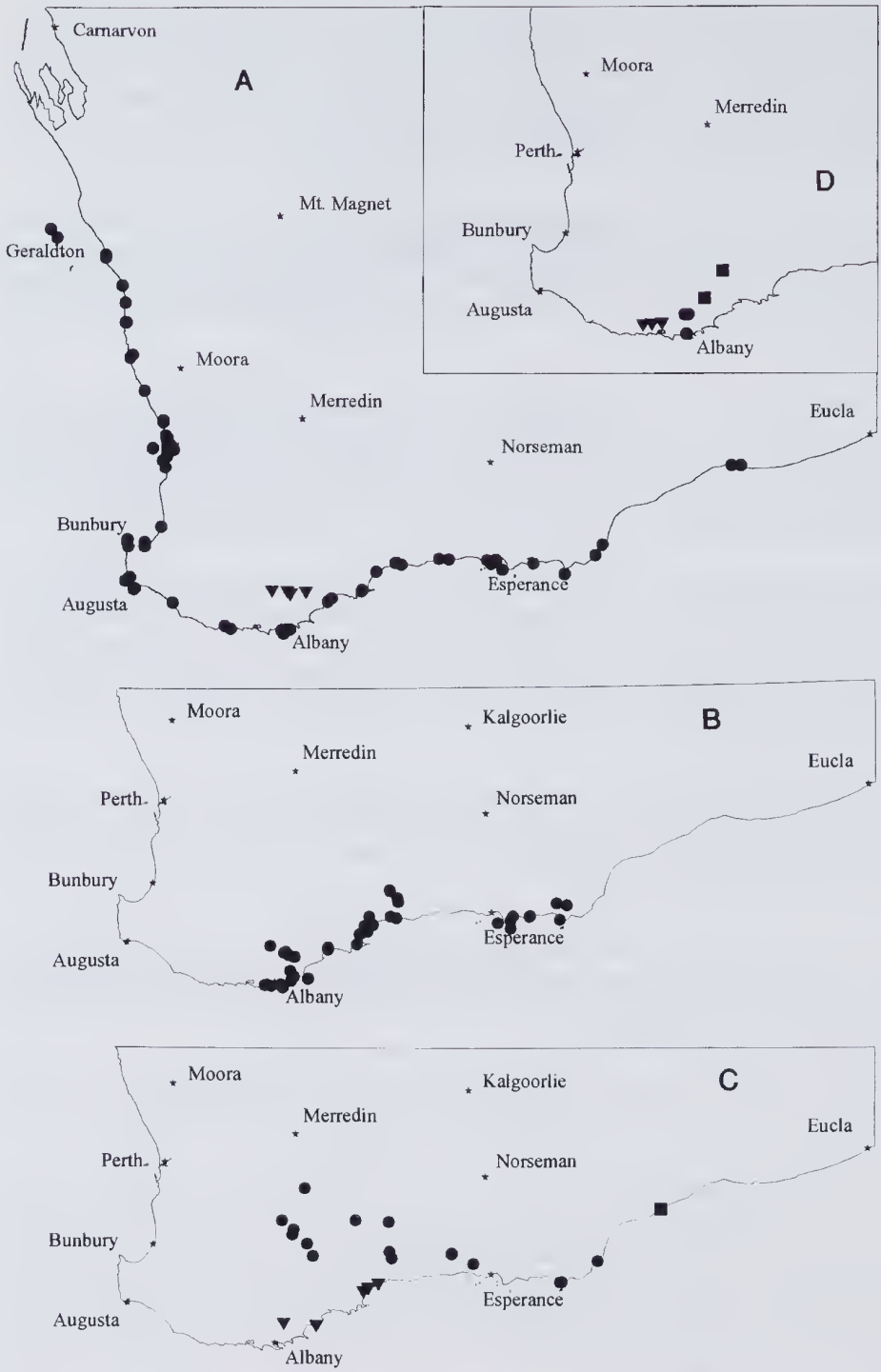

Figure 6. Distribution of the *Spyridium globulosum* and *S. oligocephalum* groups in Western Australia. A - *Spyridium globulosum* ●, *S. montanum* ▼; B - *S. majoranifolium*; C - *S. oligocephalum* ▼, *S. polycephalum* ●, *S. subochreatum* var. *subochreatum* ■; D - *S. riparium* ▼, *S. spadiceum* ●, *S. villosum* ■.

typical variant - extends from Boxwood Hill south to Munglinup. Leaves 1-1.4 mm wide, the margins usually meeting. Sepals with short, often ferruginous, hairs 0.2-0.3 mm long. *Cryptandra microcephala* Turcz., *Spyridium denticuliferum* Diels

hairy variant - extends from Dongolocking Reserve east to Eyre, but rare in the area where the typical variant occurs. Leaves up to 3.3 mm wide but usually less than 3 mm, the margins often separated. Sepals with white hairs up to 0.7 mm long but occasionally only *c.* 0.3 mm long.

Spyridium minutum Rye - occurs on plains, recorded mainly in sandy clay or sand over clay, usually in open shrublands dominated by *Eucalyptus* species with a mallee habit. Extends from near Salmon Gums south to near Gibson and from near the upper Young River east to near Mt Beaumont. Flowers and fruits: March-May, September-November. Shrub 0.1-0.25 m high. Closely related to *Spyridium cordatum* but, in addition to the characters used in the key, it is distinguished by its more persistent indumentum on the fruit. *Spyridium* sp. Mt Beaumont (*K.R. Newbey* 6718) (Rye 1995a: Figure 1G-K)

Spyridium montanum Rye - recorded from sandstone and shale on mountains, often in high gullies, in the central and eastern parts of Stirling Range. Flowers and fruits: April-July, October. Shrub 1-2.5 m high. **Priority 2** (Rye 1995a: Figure 1L-O)

Spyridium mucronatum Rye - occurs on sandy soils or sand with clay, in vegetation dominated by *Eucalyptus* species with a mallee habit, often in the shade beneath the mallees. Distributed in inland areas from Borden east to Cape Arid National Park, the northernmost locality being Frank Hann National Park. Shrub 0.15-0.6 m high. Flowers and fruits: September-March.

subsp. **mucronatum** - extends from Frank Hann National Park east to near Mt Buraminya (north of Cape Arid National Park). *Spyridium* sp. Frank Hann (*K.R. Newbey* 6688) (Rye 1995a: Figure 2A-C)

subsp. **multiflorum** Rye - extends from north of Gibson east to near Mt Ragged in Cape Arid National Park. **Priority 2** (Rye 1995a: Figure 2D,E)

subsp. **recurvum** Rye - occurs from Borden east to the Ravensthorpe area. **Priority 3** (Rye 1995a: Figure 2F-H)

Spyridium oligocephalum (Turcz.) Benth. - occurs in sandy soils, recorded either in heathlands or in shrublands dominated by *Eucalyptus* species with a mallee habit. Extends from near Kalgan River east to Fitzgerald River National Park. Flowers and fruits: March, July-October. Shrub 0.6-1.2 m high. Very closely related to *S. subochreatum* but, in addition to the characters described in the key, appears to differ in its more silvery leaves and less discrete or more elongate markings on the seed. *Spyridium kalganense* Diels, *Trymalium oligocephalum* Turcz. **Priority 3** (Rye 1995a: Figure 2I-N)

Spyridium polycephalum (Turcz.) Rye - occurs mainly in sandy soils, often on rocky hills, recorded in heathlands or shrublands, the latter commonly dominated by mallee (*Eucalyptus*) species. Extends from near Harrismith east to Mt Arid in Cape Arid National Park. Flowers and fruits: April-November. Shrub 0.3-1 m high. *Trymalium polycephalum* Turcz.

Spyridium riparium Rye - occurs along rivers and streams, in sandy or gravelly soil overlying lateritic soil, extending from Kent River east to Mitchell River. Flowers and fruits: July-November. Shrub 1-1.5 m high. **Priority 1** (Rye 1995a: Figure 2O-S)

Spyridium spadiceum (Fenzl) Benth. - occurs on granitic hills in Porongurup Range and at Albany, one record giving the vegetation as a thicket and another as *Eucalyptus megacarpa* woodland. Flowers and fruits: October-February. Shrub 0.5-3 m high, usually with a prominent ferruginous indumentum on the young shoots. *Cryptandra spadicea* (Fenzl) F. Muell., *Pomaderris hirsuta* Steud., *Spyridium spadiceum* var. *spadiceum*, *Trymalium spadiceum* Fenzl, *T. thomasioides* Turcz. **Priority 2** (Rye 1995a: Figure 3A-D)

Spyridium subochreatum (F. Muell.) Reissek var. **subochreatum** - recorded from Toolinna, in limestone habitats with *Banksia* shrublands or *Eucalyptus* species with a mallee habit. Also occurs in South Australia, Victoria and possibly New South Wales. (A second variety, *Spyridium subochreatum* var. *laxiusculum* J.M. Black, distinguished by its less compact inflorescences, is restricted to South Australia.) Flowers and fruits: April-May, October. Fruits recorded October. Shrub 0.1-0.3 m high. The few Western Australian specimens can be readily distinguished from related species by the very short indumentum on the flowers and have large greyish green leaves 10-16 x 2-6 mm. However, if additional western populations are located, the indumentum length and leaf size may prove to overlap more with those of the closely related species *S. oligocephalum* and *S. polycephalum*. Certainly South Australian specimens of *S. subochreatum* are much more variable in leaf size and they occasionally have leaves becoming glabrous above. *Cryptandra subochreata* (F. Muell.) F. Muell., *Pomaderris subochreata* Reissek *nom. illeg.*, *Trymalium behrii* F. Muell. ex Reissek, *T. subochreatum* F. Muell. **Priority 2** (Canning & Jessop 1986: Figure 430D)

Spyridium tricolor W.R. Barker & Rye - occurs in sandy soil with limestone, often in shrublands dominated by mallee (*Eucalyptus*) species. Extends from Cape Arid National Park north-east to near Eyre. Also occurs in South Australia. Flowers: all year. Fruits: recorded July. Shrub 0.3-1.5(3) m high. (Barker & Rye 1993: Figure 1)

Spyridium villosum (Turcz.) Benth. - known from one location in the eastern part of Stirling Range, occurring in sand over sandstone, with an atypical specimen recorded from Ongerup in sandy soil. Flowers: October-November. Shrub 0.1-0.4 m high. Although the atypical specimen (*E.J. Croxford* 6644) has broader leaves and longer hairs on the sepals like *Spyridium spadiceum*, it appears to match *S. villosum* more closely. More collections are needed to determine how distinct the two taxa are. *Cryptandra villosa* Turcz. **Priority 2** (Rye 1995a: Figure 3E-H)

Trymalium Fenzl

A primarily Western Australian genus, comprising 11 species endemic to Western Australia, a single species endemic to South Australia and two endemic to Victoria. Geographical distributions for the Western Australian taxa are given in Figures 7 and 8. Characteristics of the genus as a whole are outlined in Rye (1995a: 131). Most species have an unusual dehiscence of the schizocarp, which splits around the base in an irregular manner to release the fruitlets. Excluded from the genus is the Western Australian species that has been known either as *Trymalium wichurae* Nees ex Reissek or *Cryptandra wichurae* (Nees ex Reissek) C.A. Gardner. This species is atypical of both genera and Kevin Thiele (pers. comm.) intends to circumscribe a new genus incorporating this and an eastern Australian species, both originally described under the genus *Trymalium*.

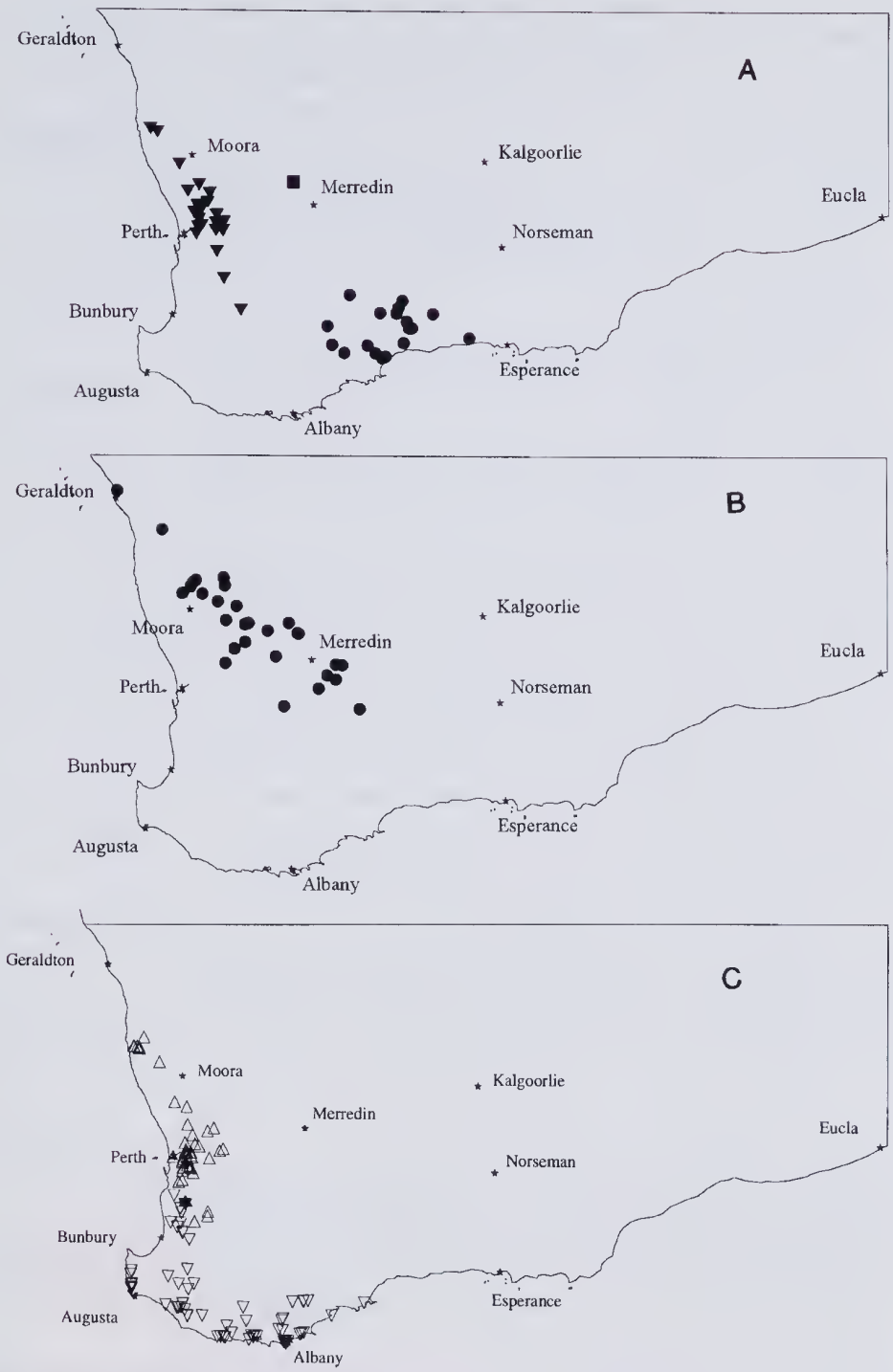

Figure 7. Distribution of *Trymalium* species in Western Australia. A - *Trymalium angustifolium* ▼, *T. densiflorum* ■, *T. elachophyllum* ●; B - *T. daphnifolium*; C - *T. floribundum* subsp. *floribundum* △, *T. floribundum* subsp. *trifidum* ▽, intermediate between the two subspecies of *T. floribundum* ✸.

1. Ovary hairy but in most species surrounded (and often hidden at first) by a glabrous disc. Schizocarp hairy above the disc
2. Indumentum of simple hairs, the young stems and upper surface of leaves rather sparsely hairy, the lower surface of leaves densely hairy. Disc densely papillose ..... **T. angustifolium**
2. Indumentum of long simple hairs and short stellate hairs, the young stems and leaves densely hairy throughout or the upper surface of leaves glabrous to sparsely hairy. Disc glabrous or stellate-hairy
3. Stipules usually deciduous, if persistent then not densely arranged. Leaves large, over 10 mm long
4. Inflorescence very hairy; pedicels with many hairs 0.4-0.7 mm long; sepals villous throughout without any small hairs visible, the long terminal hairs extending 1-1.5 mm beyond the apex ..... **T. venustum**
4. Inflorescence not so obviously hairy; pedicels with short hairs alone or also with scattered hairs 0.2-0.4 mm long; sepals almost glabrous or with short hairs, sometimes also with long hairs extending up to 0.6 mm beyond apex
5. Leaves narrowly ovate to more or less circular or (in *T. litorale*) sometimes obovate or broadly so; lower surface with minute hairs or with a mixture of long patent hairs and minute hairs; upper surface usually rather dull, hairy throughout or with rows of hairs on the indented midvein and usually also on the main lateral veins
6. Leaves narrowly to very broadly ovate or more or less circular; upper surface largely glabrous or with scattered long patent simple hairs. Sepals usually either distinctly less densely hairy than floral tube or with short hairs mixed with long hairs which protrude 0.3-0.6 mm from the sepal apex ..... **T. floribundum**

6a. Leaves narrowly ovate or ovate, 12-50(95) mm long, usually obtuse, with scattered long patent hairs on upper surface. Stigmatic lobes 2 in all or most flowers ..... subsp. **floribundum**

6a. Leaves narrowly ovate to almost circular, (20)35-130 mm long, usually acute to attenuate, usually glabrous above except on the main veins, if hairy then usually broadly ovate to circular. Stigmatic lobes 3 in all or most flowers ..... subsp. **trifidum**

6. Leaves ovate-elliptic to obovate or broadly so; upper surface with a dense indumentum of short stellate hairs. Sepals with a similar short indumentum to that of the floral tube ..... **T. litorale**

5. Leaves obovate or narrowly obovate; lower surface with long antrorse hairs; upper surface shiny, either completely glabrous or with a row of hairs on the deeply indented midvein. (Sepals densely hairy, the indumentum similar to that of floral tube.) ..... **T. spatulatum**

3. Stipules persistent in a dense arrangement on the branchlets after leaves shed. Leaves small, less than 10 mm long
7. Inflorescence of condensed head-like cymes; pedicels 0.2-0.3 mm long at anthesis. Disc stellate-hairy ..... **T. densiflorum**
7. Inflorescence of elongate cymes; pedicels 0.5-2 mm long at anthesis. Disc glabrous

8. Leaves linear to narrowly obovate and with revolute margins. Schizocap between half and three-quarters inferior ..... **T. daphnifolium**

8. Leaves narrowly obcordate to obovate and folded inwards. Schizocarp fully or almost fully inferior ..... **T. myrtillus**

8a. Spinescent branchlets absent. Leaves 4.5-12.5 x 1.5-4 mm ..... subsp. **myrtillus**

8a. Spinescent branchlets numerous. Leaves 2.5-4.5 x 1-1.5 mm ..... subsp. **pungens**

1. Ovary glabrous. Schizocarp glabrous above the disc

9. Leaves obcordate, with margins or whole blade incurved or folded inwards. Flowers completely glabrous. Schizocarp ellipsoid or narrowly ellipsoid and narrowed at apex ..... **T. urceolare**

9. Leaves linear to oblong-elliptic, with margins somewhat recurved to revolute. Flowers usually with at least a few hairs on outside of floral tube and/or sepals. Schizocarp obovoid to cup-shaped and broad at apex

10. Leaves 2-5 mm long. Schizocarp *c.* two-thirds inferior, erect or spreading, regularly dehiscent into three equal parts. Fruitlets coriaceous to brittle; inner surface finely reticulate, not ridged ..... **T. elachophyllum**

10. Leaves 8-40 mm long. Schizocarp fully inferior, pendulous, irregularly dehiscent. Fruitlets very hard; inner surface prominently ridged, with large deep lacunae ..... **T. ledifolium**

10a. Plants growing close to the coast on limestone, tending to become multistemmed. (Leaves 18-40 x 1.5-8 mm.) ..... var. **ledifolium**

10a. Plants usually growing on clay or sand, often on granite or laterite but not on limestone, usually or always single-stemmed

10b. Leaves 14-38 x 0.7-2.5 mm, long-linear, with revolute margins meeting or nearly meeting on the undersurface ..... var. **lineare**

10b. Leaves 8-37 x 1-6 mm, usually narrowly obovate to almost elliptic, rarely linear, usually with recurved margins, if with revolute margins then these usually not meeting on the undersurface ..... var. **rosmarinifolium**

Trymalium angustifolium Reissek - occurs mainly in lateritic soils but also recorded near granite, commonly in Jarrah (*Eucalyptus marginata*), Marri (*E. calophylla*) or Wandoo (*E. wandoo*) woodlands, extending from north of Badgingarra south-south-east to Boolarding (near Darkan). Flowers: mainly May-August, also September-October. Fruits: July-September. Shrub 0.1-0.6 (1.2) m high. Schizocarp almost fully inferior, irregularly dehiscent. *Cryptandra angustifolia* (Reissek) F. Muell.

Trymalium daphnifolium Reissek - recorded in clay or sandy soil, in shrublands or woodlands, the latter sometimes dominated by *Allocasuarina* species, *Eucalyptus* species with a mallee habit, York Gum (*E. loxophleba*) or Salmon Gum (*E. salmonophloia*). Extends from Moresby Range south-east to King Rocks (north-east of Hyden). Flowers: June-October. Fruits: recorded September-October. Shrub 0.4-3 m high. Schizocarp over half (but less than two-thirds) inferior, irregularly dehiscent. *Trymalium ledifolium* var. *daphnifolium* (Reissek) Benth.

Trymalium densiflorum Rye - known only from one specimen, collected in red soil near Trayning, in vegetation dominated by a *Eucalyptus* species with a mallee habit. Flowers: August. Shrub *c.* 1 m high. Schizocarp not seen. **Priority 1** (Rye 1995a: Figure 4A-C)

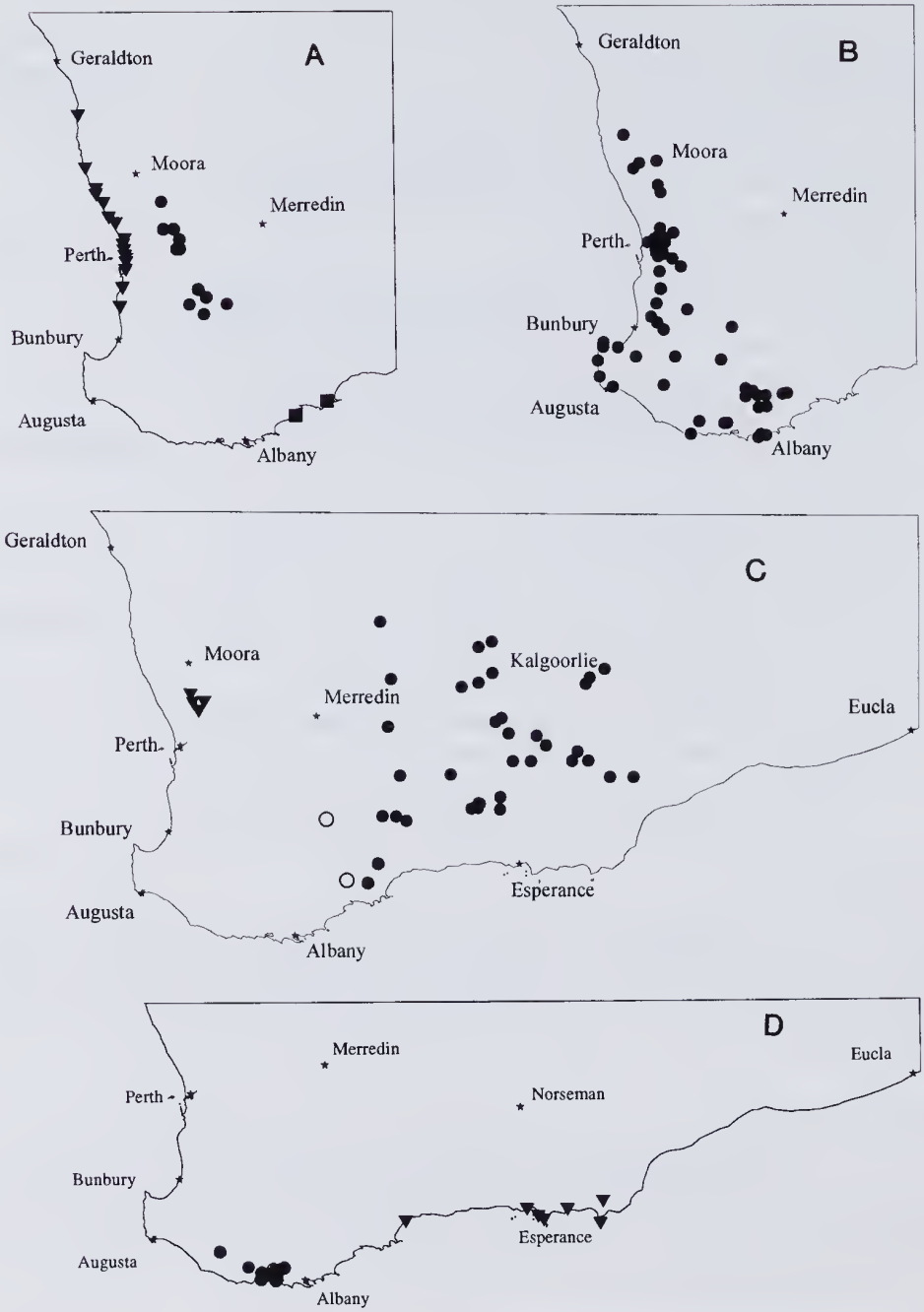

Figure 8. Distribution of *Trymalium* species in Western Australia. A - *T. ledifolium* var. *ledifolium* ▼, *T. ledifolium* var. *lineare* ●, *T. litorale* ■; B - *T. ledifolium* var. *rosmarinifolium*; C - *T. myrtillus* subsp. *myrtillus* ●, *T. myrtillus* subsp. *pungens* ○, *T. urceolare* ▼; D - *T. spatulatum* ▼, *T. venustum* ●.

Trymalium elachophyllum Rye - recorded mainly in clay, sandy clay or gravelly soils, commonly dominated by small *Eucalyptus* species with a mallee habit, extending from Pingrup east to Young River. Flowers: mainly July-September. Fruits: August-October. Shrub 0.3-1.5 m high. Schizocarp *c.* two-thirds inferior, regularly dehiscent. (Rye 1995a: Figure 4D-G)

Trymalium floribundum Steud. - occurs mainly in clay, sandy clay or gravelly soils, often over laterite or other rock substrates, often in gullies or bordering watercourses and swamps, in woodlands or forests, extending from near Mt Lesueur south to Augusta and from there east to Mt Manypeaks. Shrub or tree 1-9 m high. Schizocarp less than half inferior, irregularly dehiscent. Closely related to *Trymalium venustum*, *T. litoralis* and *T. spatulatum*, all of which have been included in this species. A specimen intermediate between the two subspecies (*A.P. Hansen* 4/10/1984) occurs at Dwellingup on the border of their parapatric ranges.

subsp. **floribundum** - extends from near Mt Lesueur south to the Mt Saddleback area (west of Quindanning). Flowers: July-October. Fruits: September-December. Sepals glabrous or with short hairs only. *Trymalium billardierei* var. *calvescens* Reissek, *T. billardierei* var. *hirsutum* Reissek ex Benth. *nom. illeg.*, *T. billardierei* var. *dense-tomentosum* Fenzl, *T. billardierei* var. *tomentoso-hirsutum* Fenzl, *T. billardierei* var. *tomentosum* Reissek, *T. expansum* Steud., *T. ledifolium* var. (?) *obovatum* Benth., *T. odoratissimum* Lindl., *T. spatulatum* var. *tomentosum* (Reissek) Ostenf. (Diels & Pritzel 1905: Figure 44A-D)

subsp. **trifidum** Rye - commonly occurs in *Eucalyptus* forests, often along watercourses, sometimes forming an understorey in Karri (*E. diversicolor*) forest. Extends from Waroona Dam south to Augusta and Mt Manypeaks. Flowers: mainly August-November. Fruits: mainly October-January. Sepals sparsely to densely hairy, often with long hairs, which may extend up to 0.6 mm beyond apex. **Karri Hazel** (Rye 1995a: Figure 4H,I)

Trymalium ledifolium Fenzl - extends from near Illawong (north of Leeman) south to Albany. Flowers: mainly June-October. Fruits: mainly August-December. Shrub 0.3-2.5 m high. Schizocarp inferior, irregularly dehiscent. (Wheeler 1987: Figure 173)

var. **ledifolium** - occurs in coastal shrublands on limestone ridges, hills or outcrops, extending along the west coast from Illawong south to Yalgorup National Park. The name *Trymalium albicans* (a synonym of *Spyridium globulosum*) was misapplied to this taxon by Bentham (1863: 423) and treated as a separate species from the other (atypical) variants of *T. ledifolium.* Var. *ledifolium* appears to differ from the two varieties listed below only in minor characters, tending to be multi- rather than single-stemmed, have broader leaves and possibly more colourful flowers. *Cryptandra floribunda* Steud., *C. ledifolia* (Fenzl) F. Muell.

var. **rosmarinifolium** (Steud.) Benth. - occurs in clay or less commonly in sand, widespread in lateritic and granitic areas, in situations varying from low coastal heathlands to *Eucalyptus* forests. Extends from Coomallo Creek south to the far south-west of Western Australia and south-east to King George Sound. A very variable taxon in need of further study. It usually has shorter, flatter leaves than the other two variants, especially in the region from Yallingup east to Stirling Range. In the Wagin-Boyup Brook-Kojonup area, the leaves are narrow and almost linear, but still flat. In the Darling Range and northwards, it often has longer more elongate leaves with more revolute margins; some of the elongate-leaved specimens in the Darling Range have the leaves hairy on the upper surface and they also tend to have more hairy sepals than all the other variants. Specimens from the southern part of the Darling Range to the extreme south-west tend to have scattered stellate hairs (sometimes

also scattered simple hairs) on the schizocarps, which are glabrous on other specimens. *Cryptandra anomala* Steud., *C. glaucophylla* Steud., *C. westringiifolia* (Steud.) F. Muell., *Pomaderris rosmarinifolia* Steud., *P. westringiifolia* Steud., *Spyridium westringiifolium* (Steud.) Benth., ?*Trymalium ledifolium* var. *platyphyllum* Diels (type not located), *T. rosmarinifolium* (Steud.) Reissek, ?*T. vaccinioides* Suesseng. (type not located), *T. westringiifolium* (Steud.) Reissek

var. **lineare** Rye - mainly recorded in gravelly soils or on lateritic ridges but sometimes associated with granite, in woodlands (usually dominated by *Eucalyptus* species) or in shrublands, extending from near Calingiri south to near Wickepin. (Rye 1995a: Figure 4J,K)

Trymalium litorale (Diels) Domin - known only from Cape Riche and Bremer Bay, recorded on coastal granite. Flowers and young fruits: July-September. Shrub height unknown. Mature schizocarp not seen. A poorly known taxon closely related to *Trymalium venustum*, *T. floribundum* and *T. spatulatum* but readily identified by the whitish, minutely stellate-hairy upper surface on its leaves. *Trymalium billardierei* var. *litorale* Diels **Priority 1** (Rye 1995a: Figure 5A)

Trymalium myrtillus S. Moore - occurs mainly in clay or sandy clay, sometimes associated with granite or other types of rocks, commonly in low to tall shrublands. Extends from Die Hardy Range south to near Bremer Bay and from near Lake Grace east to Balladonia. Flowers: July-October. Fruits: August-November. Shrub 0.5-3 m high. Schizocarp largely to fully inferior, regularly dehiscent.

subsp. **myrtillus** - extends from Die Hardy Range south to near Bremer Bay and south-east to Balladonia. One specimen from Bremer River (*K.R. Newbey* 4359), in the far south-west of the taxon's distribution, is unique in having many of the leaves 3-toothed at the apex. (Diels & Pritzel 1905: Figure 44E-G)

subsp. **pungens** Rye - see earlier description. **Priority 1**

Trymalium spatulatum (Labill.) Ostenf. - occurs on granitic hills and other elevated rocky sites, apparently often in rock crevices. An isolated record from Fitzgerald River National Park, otherwise extending from Esperance east to Mt Baring (Cape Arid National Park) and Middle Island. Flowers: July-September. Fruits: September-October. Shrub 1.2-3 m high. Schizocarp over half to almost two-thirds inferior, irregularly dehiscent. The use of the name *Trymalium spatulatum* is in doubt because it possibly should be regarded as a later homonym of a taxonomic synonym of *Spyridium spathulatum* F. Muell., a species occurring in South Australia and Victoria. *Ceanothus spatulatus* Labill., *Cryptandra billardierei* (Fenzl) F. Muell., *Pomaderris spatulata* (Labill.) G. Don, *Trymalium billardierei* Fenzl *nom. illeg.*

Trymalium urceolare (F. Muell.) Diels - occurs in reddish or brown clayey soils, often with lateritic gravel, usually in woodlands, often dominated by Wandoo (*Eucalyptus wandoo*). Extends from Moora south to the Bindoon area. Flowers: July-September. Fruits: September-November. Shrub *c.* 1 m high. Schizocarp inferior, irregularly dehiscent. *Trymalium billardierei* var. *urceolare* F. Muell. **Priority 2** (Diels & Pritzel 1905: Figure 44H,J; Rye 1995a: Figure 6)

Trymalium venustum Rye - occurs in sandy soil, often on laterite or with lateritic gravel, in Jarrah (*Eucalyptus marginata*) forest, sometimes also with Karri (*Eucalyptus diversicolor*) trees. Extends from north-east of Northcliffe east to Mitchell River and Denmark. Flowers: July-September, also recorded January-February. Young fruits: August. Shrub 1.5-4(6) m high. Mature schizocarp not seen. (Rye 1995a: Figure 5B-D)

Acknowledgements

I would like to thank Amanda Spooner for devoting many hours to generating computer-assisted distribution maps for the taxa and Terena Lally for assisting in bringing the maps up to date. The diagnosis for the new subspecies was translated into Latin by Paul Wilson and the line illustrations were drawn by Margaret Pieroni.

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A new subspecies in *Muehlenbeckia horrida* (Polygonaceae) from Western Australia

Karen L. Wilson

Royal Botanic Gardens, Mrs Macquaries Road, Sydney, New South Wales 2000

Abstract

K.L. Wilson. A new subspecies in *Muehlenbeckia horrida* (Polygonaceae) from Western Australia. Nuytsia 11 (1): 133-138 (1996). The rare, endemic *Muehlenbeckia horrida* subspecies *abdita* K.L. Wilson, *subsp. nov.*, is described. A lectotype is designated for *M. horrida.*

Introduction

Muehlenbeckia horrida H. Gross is a small shrubby species that has previously been considered to be restricted to inland south-eastern Australia. Typically, it grows in silty soil in and beside seasonally dry inland lakes and streams. The most northerly locality is the bank of the Barwon River at Brewarrina in north-western New South Wales; it occurs sporadically farther south to north-western Victoria and in South Australia in the Murray River region and near Andamooka. It is distinctive in the genus in generally having four perianth segments rather than the five segments that are nearly universal in the rest of the species. Rarely a few flowers in an inflorescence of typical *M. horrida* will be found to have five segments.

In the last two decades, several collections have been made of a *Muehlenbeckia* growing in the seasonally wet bed of a (freshwater) lake south-west of Newdegate, Western Australia. Besides examining these collections, I saw the taxon in the field in November 1994. It is generally similar to typical *M. horrida,* and like that taxon is suckering in habit but is apparently somewhat taller at maturity. It further differs from the typical form in having more divaricate and intricate branching, fewer leaves, and usually five perianth segments in the flower. Its stems also lack the minutely warty ornamentation seen on all but the oldest stems in the typical form. It is here described as a new subspecies of *M. horrida,* based on these morphological differences and its geographic segregation.

The opportunity is taken to designate a lectotype for the name *M. horrida,* which was based on three collections from eastern Australia.

Taxonomic treatment

Muehlenbeckia horrida H. Gross, Bot. Jahrb. Syst. 49: 347 (1913). *Type citation:* 'Aust.: *leg. St Eloy d'Alton* n. 4 male; Lake Buloke, June 1892, fl. female *(C. Walter);* Donald Victoria *(sine collectore).* - Herb. Melbourne.' *Type:* Lake Buloke, Victoria, June 1892, *C. Walter;* (*lecto* (here designated): B ex MEL, female).

Depauperate erect to divaricate-intricate *subshrub* 0.3-1.2 m high, suckering to *c.* 2 m diameter. *Older stems* grey-white and glaucous, with age becoming brown with flaky or corky bark; younger stems pale to reddish, often somewhat glaucous, irregularly striate or verrucose; branchlets sometimes terminally spinescent. *Leaves* usually densely crowded on short (*c.* 2 mm long) lateral branchlets, eventually deciduous, semi-succulent, rarely glaucous, simple, sessile; blade linear with abaxial groove, 10-55 mm long, 0.7-1.5 mm wide; base truncate; margins rounded, flat to recurved; apex acute. *Flowers* 3-5 per cluster at stem nodes or on short lateral branchlets. *Perianth* in fruiting stage much thickened, mostly 4-angled, tough and corky when dry. *Stamens* 6-8; anthers 0.8-1.5 mm long. *Nut* trigonous, 2.0-3.0 mm long, dark brown, shining, smooth.

Notes. The lectotype is the only syntype that I found in B, where many of Hugo Gross's types and other specimens are held; it has been determined as *M. horrida* by Gross. In MEL, there is a possible residual syntype (Donald, *Dr Curdie* (male, MEL 79607), but that has not been annotated by Gross. No specimen collected by St Eloy d'Alton that could be considered a possible type has been found in B or MEL.

The two subspecies are distinguished most obviously by the number of perianth segments and the stem surfaces. Perianth segments are four in subsp. *horrida* and five in subsp. *abdita*; rarely five segments will be found in a few flowers on a plant in subsp. *horrida* or similarly four in subsp. *abdita.* The stems of the new subspecies lack the warty protuberances seen on those of the typical subspecies (Figure 1). As seen in close-up, the protuberances are rather more rounded and regular than 'warty' (or 'verrucose') suggests and they have a crater-like central depression, but the term 'warty' ('verrucose') is appropriate for what is visible at low magnification. In addition, the new subspecies has a more divaricate and intricate branching habit, and tends to have few or no leaves by the time of flowering, whereas the typical subspecies is more erect and less divaricately branched and usually has numerous leaves associated with the flowering branches.

Key to subspecies

1 Perianth 4-lobed, rarely 5-lobed in a few flowers on a plant; all but oldest stems with warty surface ..... subsp. **horrida**

1: Perianth 5-lobed, rarely 4-lobed in a few flowers on a plant; all stems lacking warty protuberances ..... subsp. **abdita**

Muehlenbeckia horrida subsp. **horrida**

Plants mostly 0.3-0.6 m high (rarely to 1 m). *Stems* erect, occasionally with short divaricate branchlets near apex; all but the oldest stems minutely warty. *Leaves* numerous (rarely few). *Perianth segments* 4, rarely 5 in a few flowers on a plant. (Figure 1A-D)

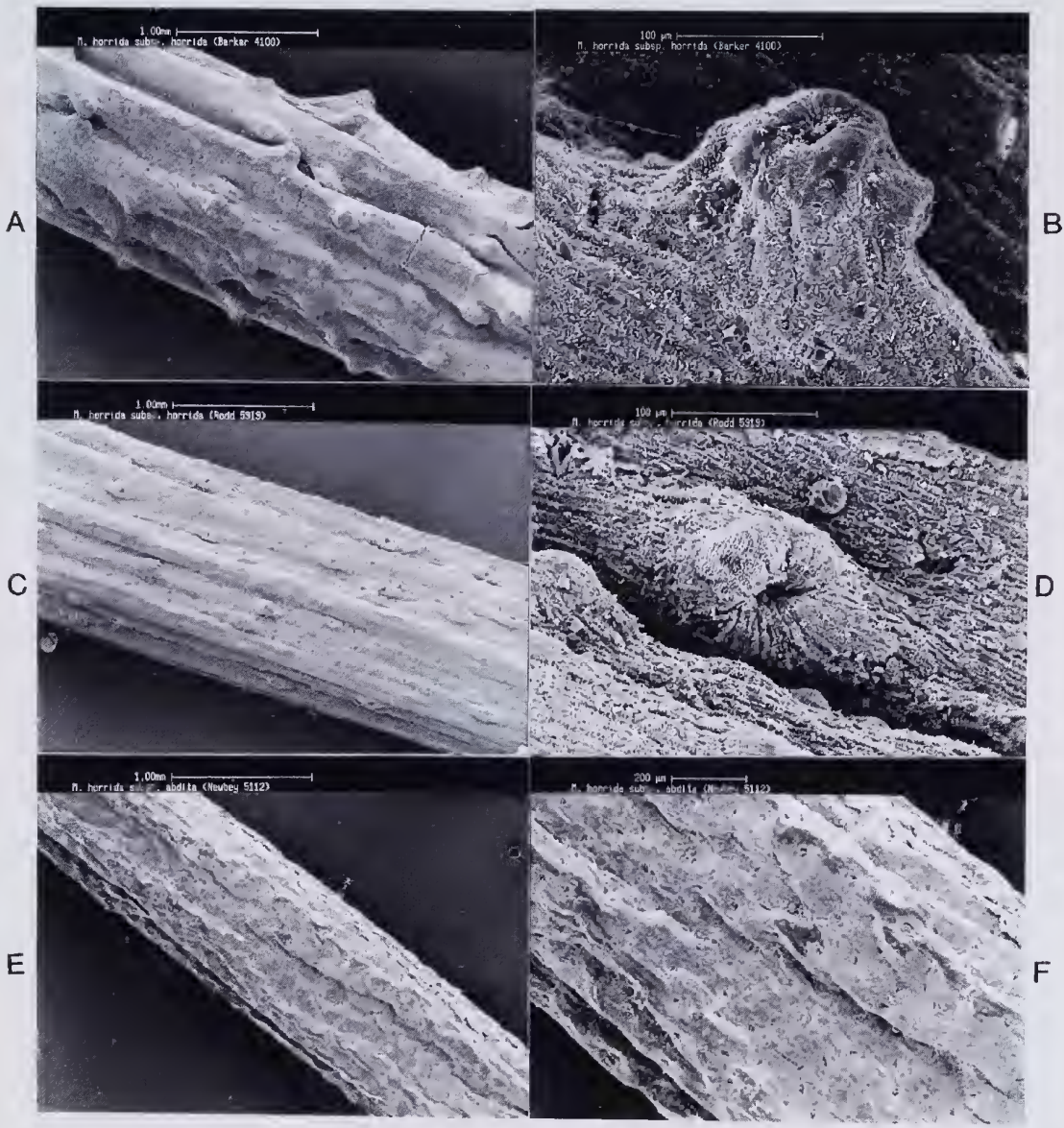

Figure 1. SEM micrographs of dried stem surfaces. A-D *Muehlenbeckia horrida* subsp. *horrida*. A - rather densely and prominently warty surface as seen in some South Australian specimens; B - close-up view of a protuberance; C - less warty surface as seen in most specimens from Victoria and New South Wales; D - close-up view of a protuberance; E, F - *M. horrida* subsp. *abdita*. E - stem without protuberances; F - close-up view of same stem. Material used: *Barker* 4100 (A, B); *Rodd* 5919 (C, D), *Newbey* 5112 (E, F).

Selected specimens examined. NEW SOUTH WALES: Brewarrina, beside Barwon River, 6 Nov. 1986, *K.L. Wilson* 6863, 6864 (male, NSW), 6865 (female, NSW); 35 km N of Barham on road to Moulamein, 7 Nov. 1986, *A. Rodd* 5919 & *J. Gentle* (female, NSW); Barham, 9 Oct. 1947, *D.G. May* (female, NSW 4479).
VICTORIA: Mildura, 3 Sep. 1981, *M.G. Corrick* 7437 (female and male, MEL, AD, NSW); Terrick Terrick Flora Reserve, 5 Sep. 1985, *A.C. Beauglehole* 80055 (male, MEL, NSW).
SOUTH AUSTRALIA: Lake Campbell, Roxby Downs Station, 18 Aug. 1971, *B. Lay* 393 (male, AD); Walkers Flat, *c.* 90 km ENE of Adelaide, *N. Donner* 1010 (immature, AD); east side of River Murray by ferry crossing at Walkers Flat, 21 Aug. 1980, *W.R. Barker & R.M. Barker* 4100 (male, AD, NSW).

Distribution and habitat. Occurs sporadically from Brewarrina in north-western New South Wales to north-western Victoria and South Australia in the Murray River region and near Andamooka. Typically growing in silty soil in and beside dry inland lakes and on banks of streams.

Discussion. Specimens of the typical subspecies from South Australia tend to be more divaricately branched and have more prominently and abundantly warty stems than those from farther east, but they match the latter in number of perianth segments and other characters.

Muehlenbeckia horrida subsp. **abdita** K.L. Wilson, *subsp. nov.*

A subspecie typica perianthio 5-partito (rarissimo 4), caulibus plus minusve intricatis everrucosisque, differt.

Typus: NE of Pingrup [precise locality withheld], Western Australia, 30 August 1978, *K. Newbey* 5112 *p.p.*; (*holo:* NSW, female; *iso:* CANB, K, MEL, PERTH (2 sheets)). The other material in *Newbey* 5112 is male material of the same taxon.

Plants 0.6-1.2 m high. *Main stems* spreading to more or less erect but divaricately to intricately branched; stems not minutely warty. *Perianth segments* 5, rarely 4 in a few flowers on a plant. (Figures 1E,F,2)

Specimens examined. WESTERN AUSTRALIA: NE of Pingrup [precise locality withheld], 10 Feb. 1973, *K. Newbey* 3678 (immature, PERTH); 30 Aug. 1978, *K. Newbey* 5112 (2 sheets, (male & female *(holotype)*, PERTH, K, MEL, NSW); 13 Jan. 1988, *S. Halse* (male, PERTH); 6 Nov. 1994, *K. Wilson* 8793 & *K. Frank* (female, NSW, PERTH).

Distribution and habitat. Known only from the one population in the bed of a freshwater lake south-west of Newdegate. The lake is dry for much of the year but "may be completely covered with water for a few months" according to a note on the type collection. Water has been to about 1 m deep in the lake in past years, and the lake has been used for water-skiing in some winters (A. Coates, pers. comm.).

Etymology. The epithet is taken from the Latin adjective *abditus* - secret, hidden, referring to the isolated occurrence of this taxon, so far from the other populations of the species.

Conservation status. This is a Priority 1 taxon (CALM Conservation Codes for Western Australian Flora). It is only known from the one population in what is becoming a rare habitat: the bed of an inland freshwater lake. The taxon is common on the bed of the lake and I would estimate the population at

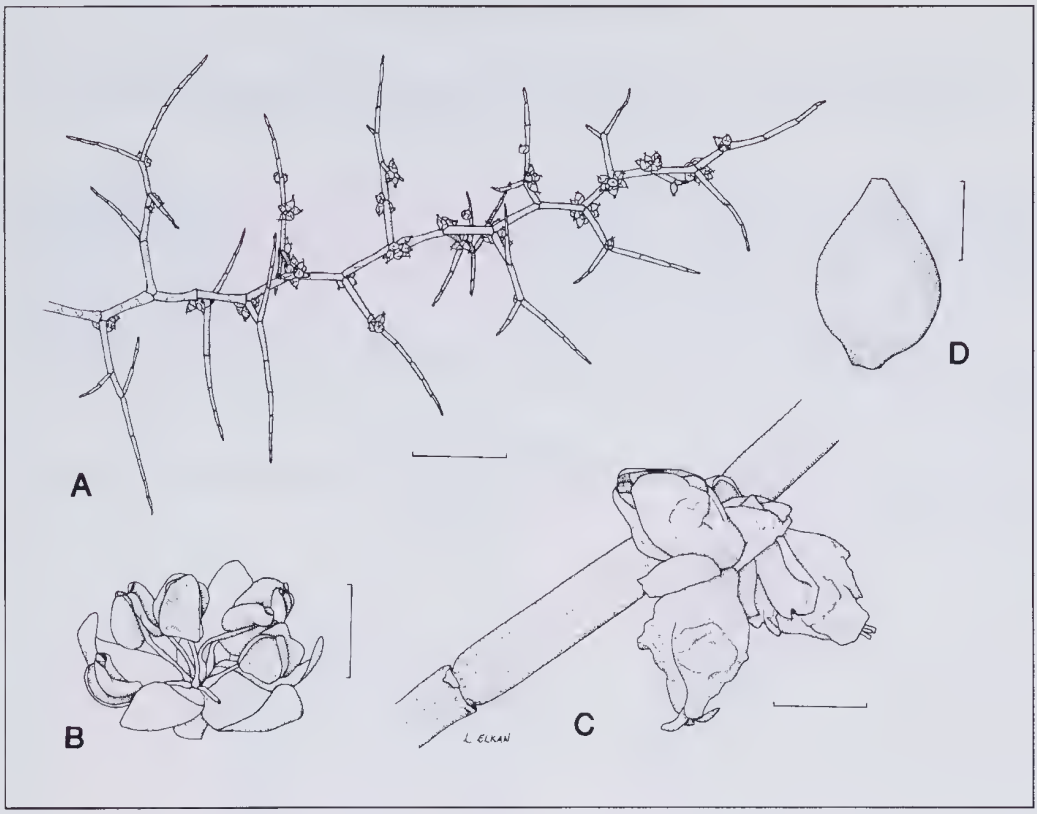

Figure 2. *Muehlenbeckia horrida* subsp. *abdita* A - branch with clusters of flowers at nodes; B - male flower showing dehisced anthers; C - cluster of flowers enclosing immature nuts; D - nut. Scale bars: A = 20 mm; B, C = 2 mm; D = 1 mm. Drawn from male part of *Newbey* 5112 (A, B); female part of *Newbey* 5112 - the holotype (C, D).

more than 100 individuals in November 1994 although the plants were only just starting to re-grow after inundation and were not easy to see. The lake and surrounding shrublands are proclaimed as a water reserve but increased saline drainage from the farmed lands surrounding the reserve represents an increasing hazard for the reserve. Indeed, samphire plants (Chenopodiaceae) were in evidence in the bed of the lake in 1994, suggesting that salinity is already increasing. The taxon is in urgent need of further survey and assessment of its conservation status.

Discussion. Differs from the typical subspecies as outlined above.

Further study of subsp. *abdita* is also needed to understand more about how the plants survive inundation, which occurs intermittently. When the site was visited in November 1994, the surface of the lake bed was nearly completely dry and the plants were shooting from rootstocks, most older above-ground stems being dead. Any plans to alter the water regime, either as to depth or duration, need careful consideration.

Acknowledgements

My thanks go to the curators of the following herbaria who sent material on loan or gave permission for me to study specimens at their institution: AD, B, CANB, K, MEL, PERTH.

I have had useful discussions with Anne Coates and other biologists in Western Australia, also with Bob Makinson, who was originally involved with preparing a treatment of the family Polygonaceae with me here in NSW, partly funded by an Australian Biological Resources Study (ABRS) grant, and subsequently at CBG. Elizabeth Brown made helpful comments on the manuscript.

The type population of *M. horrida* subsp. *abdita* was examined in the course of field study of sedges that was largely funded by another grant to me from ABRS. Kristina Frank is thanked for her help during that fieldwork.

My thanks go also to Leonie Stanberg, who took the SEM micrographs and prepared Figure 1, and to Lesley Elkan, who drew Figure 2.

SHORT COMMUNICATIONS

Succowia balearica (Brassicaceae): a new and potentially serious weed in Western Australia

In 1992 the author collected (voucher *Keighery* 11030) an unknown vigorous twining annual vine superficially similar to *Fumaria capreolata* L. (Fumariaceae), but with yellow flowers and spiny fruits (Figure 1). The plants were growing in *Banksia* woodland below Reabold Hill in Bold Regional Park, 8 km west of Perth. It was subsequently identified as *Succowia balearica* (L.) Medicus, a native of the western Mediterranean. This population on Reabold Hill was then destroyed.

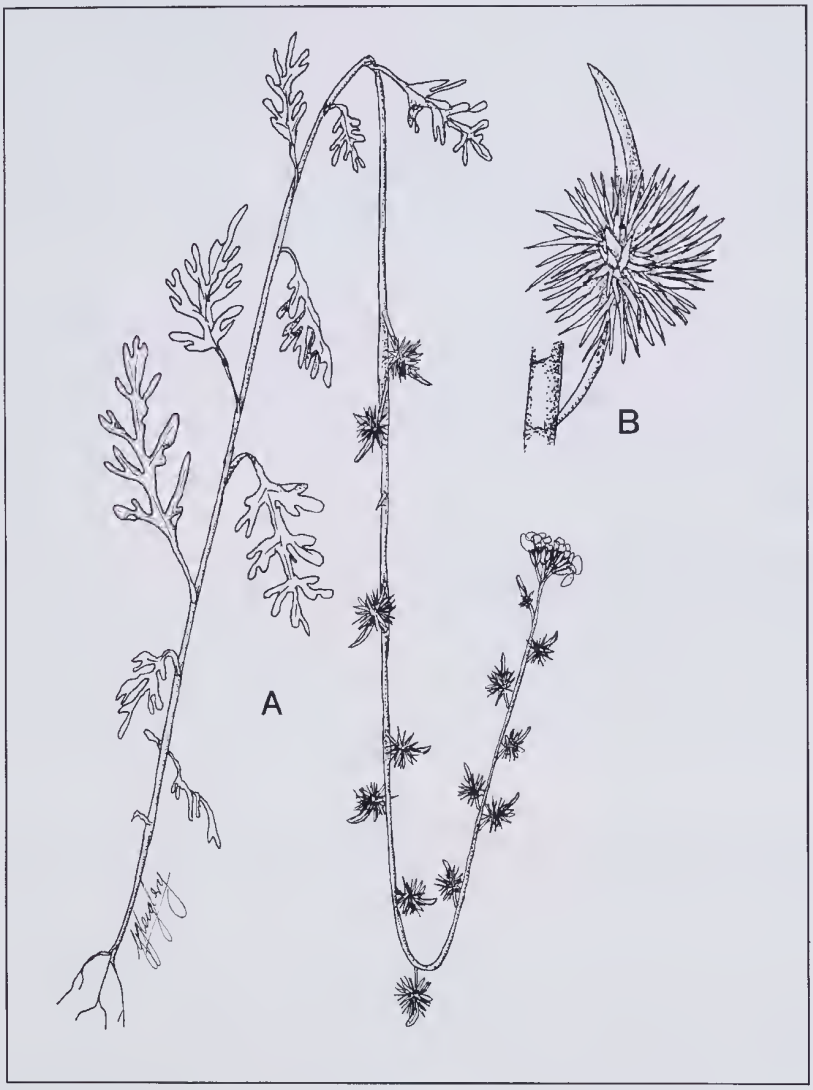

Figure 1. *Succowia balearica* A - habit (x0.5), B - mature fruit (x2). Drawn from *G.J. Keighery* 11030.

In 1993 further plants of this species were located on Mount Eliza (vouchers *Keighery* 12329 and 14367), and the source became clear. Material of this species had been planted in the Mediterranean garden of Kings Park and Botanic Garden. Presumably a visitor had inadvertantly transferred fruits from Kings Park to Reabold Hill, possibly on his clothing.

By 1995 the species was found to be well established on Mount Eliza below the botanic gardens, through the old Swan Brewery site to the edge of the Kennedy Fountain gardens, in *Dryandra sessilis* and *Acacia* shrubland and *Callitris preissii* and Tuart (*Eucalyptus gomphocephala*) woodland.

This species is obviously able to naturalize readily in the Perth area, and be readily transported. It is potentially a serious weed to much of the vegetation of the western side of the Swan Coastal Plain and should be eradicated before further spread occurs. There are no other records of this species as naturalized elsewhere in Western Australia or elsewhere in Australia (Hewson 1982), and it should not be imported again.

Reference

Hewson, H. (1982). *Brassicaceae. In:* "Flora of Australia." Vol. 8. pp. 231-357. (Australian Government Publishing Service: Canberra.)

G.J. Keighery

Western Australian Wildlife Research Centre, Department of Conservation and Land Management, PO Box 51, Wanneroo, Western Australia 6065

Lambertia rariflora subsp. *lutea* (Proteaceae): revised geographical distribution and habitat notes

Lambertia rariflora subsp. *lutea* Hnatiuk is a recently described tall shrub or small tree from the Walpole Region, south western Australia (Hnatiuk 1995). At the time of its original description the taxon was known from only two collections, habitat details were few, and information on abundance and geographical distribution inadequate. Consequently it has been considered to be possibly rare. As part of our work on a Recovery Plan for the rare, endangered and conservation priority flora of the Department of Conservation and Land Management's Southern Forest Region (Hearn *et al.* in prep.), we undertook a field survey of *L. rariflora* subsp. *lutea*. The results are reported here ahead of the Recovery Plan in order to improve the available published information on the species as soon as possible.

This taxon was apparently first collected by A.R. Annels in 1990, although the specimen was lost after its identity had been investigated. Subsequently all occurrences of the taxon found during surveys for earlier regional ecological studies (Wardell-Johnson *et al.* 1995) and for our report on conservation taxa (Hearn *et al.* in prep.) were documented. During this work, we have visited most populations and noted relevant features. Additional information was contributed by other people interested in the flora of the area.

Distribution. Approximately eight collections of *Lambertia rariflora* subsp. *lutea* are known (see below), representing six populations. These populations extend over a range of 25 km, and represent two clusters: (1) Sharpe Forest Block and edge of Mount Frankland National Park, NNW of Walpole, and (2) Nornalup Road area, NE of Walpole. The two specimens cited by Hnatiuk (1995), *Weston* 93.3.6 (representing population 1) and *Weston* 95.4.1 (which is the type specimen of the subspecies, representing population 2), were not available for this study. They are from Sharpe Block. The Sharpe Block populations (populations 1-4) are tightly clustered, whereas the two populations near Nornalup Road (populations 5 and 6) are approximately 9 km apart.

Specimens examined. WESTERN AUSTRALIA (localities simplified): population 3: 19 km N of Walpole, Mt Frankland National Park, 34° 48' S, 116° 43' E, 10 Jan. 1990, *A.R. Annels* 1024 (PERTH, Manjimup); population 6: near Nornalup Road, 1.5 km S of Boronia Rd, 34° 50' S, 116° 59' E, 1 Feb. 1995, *B.G. Hammersley* 1334 (PERTH); population 4: *c.* 3.5 km SE of Granite Peak, 34° 44' S, 116° 44' E, 22 Feb. 1996, *R. Hearn* 5706, 5707, 5708 (PERTH, Manjimup, duplicates to be distributed); population 5: 29 km NE of Walpole, 34° 46' S, 116° 57' E, 4 Mar. 1993, *G. Wardell-Johnson* 3223 (PERTH, Manjimup).

Habitat. Our observations of all the populations are that the plants are most often found on lower slopes or on slopes that are gradual and without any substantial overall relief. Although not occurring very close to watercourses like subsp. *rariflora*, subsp. *lutea* seems to prefer sites with a good water supply.

Most of the populations are on the margins of roads or tracks in disturbed soil or are close to the roads in undisturbed soil. This could be considered as a favourable effect of disturbance on the regeneration of the subspecies, or a preference for gaps in the forest canopy. However, our interpretation is that the most important benefit of these situations is concerned with fire protection (see Fire response below).

Associated vegetation is usually a forest of Jarrah (*Eucalyptus marginata*), sometimes accompanied by Marri (*E. calophylla* = *Corymbia calophylla*) with shrubs such as *Agonis* spp., *Banksia grandis*, *Podocarpus drouynianus* and *Dryandra formosa*. Population 6, however, occurred in heath, including the shrubs *Hakea cygna* and *Pericalymma elliptica*, and trees of *Nuytsia floribunda*.

Fire response. Lambertia rariflora subsp. *lutea* is sensitive to fire, even large plants being readily killed by fires of various intensities. In several populations, the plants are restricted to or most frequent on the edges of roads. We speculate that these situations lead to the plants being either protected from fire by the disturbed soil or experiencing the relatively mild, and therefore often non-fatal, edging fires that are part of the fire management regime. There is currently no information on regeneration after fire.

Conservation status. CALM Conservation Codes for Western Australian Flora: Priority 3. Population sizes for *Lambertia rariflora* subsp. *lutea* ranged from small (with 7 and *c.* 20 plants recorded for populations 4 and 3 respectively) to large (e.g. *c.* 300 plants recorded for population 6). Of the six known populations, two were found in the Mount Frankland National Park, so the occurrence of the species on conservation land has been established.

Conclusion

In describing *Lambertia rariflora* subsp. *lutea* for the first time, Hnatiuk (1995) had seen only two specimens, which had been collected within about one kilometre of each other. The additional collections reported here represent four more populations which extend over 25 km. Although the region north of Walpole has had a relatively low intensity of botanical collecting, there has been sufficient to show that the subspecies genuinely has a restricted range and low abundance. The subspecies is therefore of continuing conservation concern.

Possible threats to *Lambertia rariflora* subsp. *lutea* include intense fires and possibly *Phytophthora* infection, given the known sensitivity of many Proteaceae to the latter. Investigations of the response of the subspecies to these two threat factors are required. It is also desirable to establish *ex situ* material to guard against loss of all wild populations.

Acknowledgements

We thank Carl Beck and Simon Watkin, CALM, Walpole, and Peter Lezaich, then CALM, Manjimup District, for assistance with the field work. Brenda Hammersley searched for populations on our behalf and she and Arthur Weston provided information on the populations seen by them.

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T.D. Macfarlane

Science and Information Division, Department of Conservation and Land Management, Brain Street, Manjimup, Western Australia 6258

R.W. Hearn

Regional Office, Department of Conservation and Land Management, Brain Street, Manjimup, Western Australia 6258

A.R. Annels

Science and Information Division, Department of Conservation and Land Management, Brain Street, Manjimup, Western Australia 6258

CONSERVATION CODES FOR WESTERN AUSTRALIAN FLORA

R: Declared Rare Flora - Extant Taxa (= Threatened Flora = Endangered + Vulnerable)

Taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.

X: Declared Rare Flora - Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Endangered Flora Consultative Committee.

1: Priority One - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.

4: Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Publication date of Nuytsia Volume 10 Number 3: 25 January 1996

Notes for Authors

The aim of *Nuytsia* is to publish original papers on systematic botany with preference given to papers relating to the flora of Western Australia. Descriptions and keys using manuscript or phrase names will not generally be accepted. All papers are refereed and the Editorial Advisory Committee reserves the right to reject papers. Opinions expressed by authors are their own and do not necessarily represent the policies or views of the Department of Conservation and Land Management.

After final acceptance of papers, authors are requested to provide discs readable directly by IBM computer or internet email attachments. Wherever possible, the MS-WORD software should be used. Within a paragraph two spaces are required between sentences; after colons, semicolons, commas and dashes a single space is required. Latin names should be italicized. Original figures should not be lettered but accompanied by copies indicating lettering. Page proofs will be forwarded to authors for checking. Twenty reprints of each paper will be provided free of charge; no additional copies may be ordered.

Style and layout should follow recent numbers of *Nuytsia*, noting particularly the following.

Title. Should include the family name of genera or species treated, but not authorities. New taxa should be named if not numerous. The geographic area of study should be given where appropriate.

Abstract. The paragraph (or paragraphs) should be indented and commence with bibliographic information. New taxa, combinations and names should be listed. The major contents of the paper should be summarized but no additional material given.

Headings. All headings should be in capitals and lower case, major headings being centred and minor ones left-justified.

Keys. May be either indented (e.g. Nuytsia 5: 277) or bracketed (e.g. Nuytsia 5: 84). Indented keys involving more than nine levels of indentation should be avoided.

Species treatments. Use of certain named paragraphs, or sets of paragraphs, for matter following the descriptions is encouraged. The desired sequence and examples of commonly used headings are shown below. Recommended headings which are italicized below, should be left-justified, followed by text on the same line.

(1) Taxon name, synonymy (if any), significant manuscript or phrase names and type details (for previously published taxa).
(2) Latin (for new taxa - indented).
(3) *Typus:* (for new taxa - not indented).
(4) English description (indented).
(5) *Other specimens examined* or *Selected specimens examined* as appropriate.
(6) *Distribution.*
(7) *Habitat.*
(8) *Phenology* or *Flowering period.*
(9) *Conservation status.* (Department of Conservation and Land Management conservation codes for rare and threatened (Declared Rare Flora and Priority Flora) WA taxa are given in each issue).
(10) *Etymology.*
(11) *Typification.*
(12) *Affinities* or *Relationships.*
(13) *Discussion* or *Comments* or *Notes.*

Threatened species. It is the policy of CALM not to publish precise locality data for threatened species. Authors are therefore requested not to cite precise locality data when describing threatened species. Generalized localities should be given accompanied by the statement - [precise locality withheld].

Synonymy. Recent papers should be consulted for examples of an appropriate format for citing synonyms.

Standard abbreviations. Where abbreviations are used, the following standards should be followed.

(1) Author abbreviations - Brummitt, R.K. & Powell, C.E. (1992). Authors of Plant Names. (Royal Botanic Gardens: Kew.)

(2) Book titles in literature citations - Stafleu, F.A. & Cowan, R.S. (1976-83). Taxonomic Literature. Edn 2. (I.A.P.T.: Utrecht) (but with capital initial letters.) - Green, J.W. (1985). Census of the Vascular Plants of Western Australia. Edn 2. Pp. 20-24. (Department of Agriculture: Perth.)

(3) Journal titles in literature citations and reference lists - Lawrence, G.H.M. *et al.* (1968). B-P-H (Botanico-Periodicum-Huntianum). - Green *loc. cit.*

Figures. Numbers should follow a single sequence including maps.

References. Citation of references in the text should be of the form *author's surname (year)* or *(year: page)* with full details given in the Reference section. This format is also recommended to replace the traditional abbreviations for references listed under taxonomic names, for example using Bentham (1878: 234) instead of Benth., Fl. Austral. 7: 234 (1878).

Structure of papers. Authors are encouraged to use the conventional structure of scientific papers when a complete study is being reported (e.g. a revision). A *Methods* section should include the method of drawing up the descriptions from specimens, extent of search for types, and discussion of concepts for choice of taxonomic categories. A *Discussion* section should be considered, which would include some or all of the following: a summary of the findings, emphasizing the most significant; interpretation of the results in the light of other relevant work; statement of new problems which have arisen; advising of aspects which are to be followed up; suggestion of topics which others might usefully pursue; prediction and speculation.

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ISSN 0085-4417
Print Post Approved PP665002/00001