

A taxonomic revision of *Pithocarpa* (Asteraceae: Gnaphalieae)

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Abstract

B.J. Lepschi. A taxonomic revision of *Pithocarpa* (Asteraceae: Gnaphalieae). *Nuytsia* 13(1) : 61–74 (1999). The endemic Australian genus *Pithocarpa* Lindl. is revised, and three taxa are recognized: *P. corymbulosa* Lindl., *P. pulchella* Lindl. var. *pulchella* and *P. pulchella* var. *melanostigma* (P. Lewis & Summerh.) Lepschi. A key is provided, and all taxa are illustrated and their distributions mapped.

Introduction

Pithocarpa Lindl. (Asteraceae) is an endemic Australian genus of two species of perennial herbs or subshrubs, confined to the south-west of Western Australia. The latest taxonomic revision of the genus is that of Lewis & Summerhayes (1951), which was based on limited herbarium material. Since that time, many more collections of *Pithocarpa* have been gathered, and these have eroded the distinctiveness of the taxa described by Lewis & Summerhayes. Examination of herbarium collections at PERTH has also indicated further problems with regard to the application of some names in the genus. A taxonomic revision of *Pithocarpa* is therefore considered appropriate.

Taxonomic history and generic delimitation

Pithocarpa was erected by Lindley (1839), who recognized two species, *P. corymbulosa* and *P. pulchella*. Steetz (1845) recognized two species: *P. corymbulosa* (misapplied to *P. pulchella*) and a new taxon, *P. major* Steetz, considered by later authors (e.g. Lewis & Summerhayes 1951) to be conspecific with *P. pulchella*. Bentham (1867) adopted a broad circumscription of *Pithocarpa*, recognizing only one taxon to which he applied the name *P. corymbulosa*. This concept was followed by subsequent authors (e.g. Hoffmann 1890, Mueller 1893, Gardner 1931), until Lewis & Summerhayes (1951) provided a critical assessment of the genus. They recognized four species: *P. corymbulosa*, *P. pulchella*, and two new taxa, *P. achilleoides* and *P. melanostigma* (both segregated from *P. pulchella*). However, Lander (1987) and Wheeler (in prep.), have expressed doubt as to the validity of both of the new species described by Lewis & Summerhayes.

The generic delimitation of *Pithocarpa* has been largely stable, with most authors accepting it as a separate taxon. However, Mueller (1893) suggested reducing *Pithocarpa* to sectional rank within *Humea* Sm., and Heine (1967) relegated *Pithocarpa* to synonymy under *Calomeria* Vent. Neither of these approaches have been adopted by other workers.

Generic relationships

The generic relationships of *Pithocarpa* are not clear, and earlier authors appear to have placed undue significance on the lack of a pappus in the genus, a feature which is now considered to have evolved independently in a number of genera in the Asteraceae (Anderberg 1991). Lindley (1839) suggested a relationship between *Pithocarpa* and the genus *Humea* Sm., presumably because of the lack of a pappus in both taxa. The type of *Humea* is now considered to be synonymous with the monotypic *Calomeria*, a genus with which *Pithocarpa* would not appear to have any close relationship (Anderberg 1991). The lack of a pappus was also considered to be of significance by Hemsley (1905), who suggested that *Pithocarpa* may be related to *Thiseltonia* Hemsl., although recent work (Anderberg 1991, Wilson 1992a) points to *Hyalosperma* Steetz or *Acomis* F. Muell. as the closest relatives of *Thiseltonia*.

Anderberg (1991) included *Pithocarpa* in his study of the phylogeny of the Gnaphalieae, and suggested that it was probably closest to taxa within the broadly defined 'Lawrencella complex' (generic limits of the taxa within this group have since been redefined by Wilson (1992b–e)). These findings were supported by a preliminary phylogenetic analysis of *Pithocarpa* and a selection of six of its putative relatives (inferred from Anderberg's work) undertaken by Lepschi (1997). In that analysis, *Pithocarpa* appears as sister to *Argentipallium niveum* (Steetz) Paul G. Wilson, included by Anderberg (1991) in the 'Lawrencella complex' [as *Helichrysum obtusifolium* F. Muell. ex Sond.]. However, as this analysis dealt with only a selection of the possible relatives of *Pithocarpa*, the 'true' sister taxon to this genus may have been excluded.

Materials and methods

This study is based on examination of herbarium collections from AD, CANB, MEL, NSW and PERTH, as well as selected material from CGE (photographs) and K, along with observations made on live plants of all recognized taxa. All measurements were made from herbarium material (reconstituted where necessary). Conservation codes used are those adopted by the Department of Conservation and Land Management (see the end of this issue for definitions of conservation codes).

Taxonomic treatment

Pithocarpa Lindl., Edwards's Bot. Reg. Appendix vols 1–23: xxiii (1839). Type: *P. pulchella* Lindl., lectotype, *fide* Lewis & Summerhayes (1951).

Perennial herbs or subshrubs, vegetative parts covered with whitish, cobwebbed indumentum. *Leaves* alternate, sessile, entire, usually withered by anthesis; clustered towards the base of the main (reproductive) stems and becoming progressively more distant and smaller up the stems, grading into the outer involucre bracts; also densely clustered on very short, lateral vegetative seasonal growth units. *Capitula* either solitary or in open to more or less compact corymbs, inserted terminally on the

branches, homogamous. *Involucre* obconic, cup-shaped or broadly campanulate. *Involucral bracts* in numerous whorls, continuously variable from the outer bracts to the inner bracts, herbaceous or scarious to chartaceous; outer bracts without lamina, inner bracts with coloured, radiating lamina; stereome undivided, *c.* one- to two-thirds the length of the bract, very narrowly to narrowly winged, hairy with whitish, cobwebbed indumentum as well as some multicellular hairs on the inner bracts; lamina of all bracts glabrous. *Involucral receptacle* convex, glabrous, epaleate. *Florets* actinomorphic, all hermaphrodite; corolla tube cylindrical proximally but becoming slightly flared towards the apex, yellow to greenish-yellow, distal portion flushed purplish; some scattered, multicellular, vesicular hairs to *c.* 0.1 mm long on the abaxial surface (mostly in the proximal part of the tube), glabrous adaxially; corolla lobes 5, triangular to rounded triangular, spreading or slightly recurved to reflexed, venation not extending to lobe apices; abaxial surface with a dense covering of multicellular, vesicular hairs to *c.* 0.1 mm long, adaxial surface glabrous. *Anthers* ecalcarate, caudate, connate along the locules; anther tails delicate and membranaceous, slender, slightly shorter to slightly longer than the narrowly oblong filament collar; filament collar slightly narrower than or as wide as the filament, endothelial cells polarized; anther appendage oblong-elliptic to oblong, slightly narrower or as wide as locules, unpigmented or with purplish pigment in central portion, 0.2 mm long, one-cell thick, shallowly concave abaxially; constituent cells narrowly oblong (those on the margins and at the apex shorter and more or less quadrate), without thickened walls. *Style* swollen at the base, becoming abruptly linear above, branches spreading to recurved, stigmatic surfaces marginal (adaxial), not medially confluent, venation continuous to style apex; style apex rounded-truncate, 0.05–0.1 mm long, slightly broader than stigmatic branches, with short, obtuse sweeping hairs. *Cypselas* more or less cylindrical, glabrous or with non-myxogenic duplex hairs; carpodium annular, *c.* 0.15 mm diameter; pericarp thinly coriaceous, smooth, glabrous, colourless, cells with thickened walls; vascular strands two, diametrically opposed, running the entire length of the seed, laterally placed with reference to cotyledons; testa free from pericarp, thinly coriaceous, reddish-brown, crystals present or absent, vascular strand running *c.* two-thirds the length of the cypselas or reaching (but not passing over) the apex, laterally placed with reference to the cotyledons; cotyledons flattened-planoconvex to planoconvex; pappus absent.

A genus of two species endemic to south-western Western Australia.

Etymology. From the Greek *pithos*, a wine jar, and *carpos*, a fruit, in reference to the shape of the cypselas (Sharr 1996).

Notes. *Pithocarpa* species are perennial. Previous authors (e.g. Steetz 1845, Lewis & Summerhayes 1951, Lander 1987), however, have consistently treated all taxa as annuals, although this is clearly a misinterpretation, probably a result of the unusual phenology exhibited by the genus.

Key to species and varieties

- 1 Involucral bracts without dark pigment; capitula in more or less compact, well-defined corymbs of 2–11 capitula, rarely solitary on lateral branches within the flowering region; ovary and cypselas glabrous. Darling Range east of Perth ***P. corymbulosa***
1. At least some involucral bracts marked with dark reddish-maroon on the abaxial surface; capitula in open, loose corymbs of 2–6 capitula, as well as solitary on lateral branches within the flowering region; ovary and cypselas with antrorse, clavate duplex hairs. Widespread in south-western Western Australia 2

- 2 Style branches yellowish-brown to brown (in life), drying brown ... **P. pulchella** var. **pulchella**
 2. Style branches black or very dark brownish-black, both in life
 and when dried **P. pulchella** var. **melanostigma**

1. *Pithocarpa corymbulosa* Lindl., Edwards's Bot. Reg. Appendix vols 1–23: xxiii (1839). – *Humea corymbulosa* (Lindl.) F. Muell., Victorian Nat. 9: 144 (1893). – *Calomeria corymbulosa* (Lindl.) Heine, Adansonia ser. 2: 7 (1967). *Type*: Swan River, Western Australia, *Toward s.n.* (*holo*: CGE, *n.v.* (photo seen at PERTH)).

Illustration. Blackall & Grieve (1975: 849).

Perennial *herb* or *subshrub* 0.7–1 m tall; *stems* erect, basal portions becoming woody and glabrescent with age, densely covered with a whitish, cobwebbed indumentum comprised of appressed to spreading flexuose hairs to 2.5 mm long. *Leaves* densely covered with a whitish, cobwebbed indumentum on the abaxial surface, somewhat sparser adaxially; lamina entire, narrowly elliptic or narrowly obovate-elliptic to very narrowly obovate, or very-narrowly ovate to linear-ovate, very narrowly elliptic to linear-elliptic or subulate for smallest leaves, 2.5–26.5 mm long, 0.25–6.5 mm wide; base weakly amplexicaul, apex acuminate, margins weakly recurved. *Synflorescence* of terminal, more or less compact to open corymbs of 2–11 capitula (these sometimes loosely aggregated to form a larger corymbose panicle), inserted terminally on the branches, or capitula rarely solitary on lateral branches within the flowering region; lateral capitula within a corymb frequently lacking developed florets. *Involucre* narrowly ellipsoid to more or less cylindrical when young, narrowly obconic to cup-shaped or broadly campanulate (due to spreading laminae of the inner bracts) at anthesis, turbinate to cylindrical with a slight medial constriction in fruit; 4.5–6 mm long, 2–3.5 mm wide at anthesis. *Involucral bracts* 30–45; stereome with a whitish, cobwebbed indumentum (dense on the outer bracts, less so on the inner bracts which also bear some multicellular hairs to *c.* 0.1 mm long); outermost bracts 2–3 mm long, 0.4–0.65 mm wide, claw narrowly oblong, lamina narrowly ovate to narrowly ovate-elliptic, scarious to chartaceous, translucent to straw-coloured when dry; median bracts similar to innermost bracts but to 6 mm long and 1.3 mm wide, with an elliptic to narrowly elliptic lamina; innermost bracts 4.2–4.8 mm long, 0.6–1 mm wide, claw narrowly oblong to narrowly cuneate, lamina narrowly elliptic to oblong-elliptic, chartaceous, white in life and when dry (although bract apices in very young buds may be flushed pink). *Involucral receptacle* 0.9–1.2 mm diameter. *Florets* 12–21. *Corolla tube* 2–2.6 mm long, 0.3–0.4 mm wide at the base, 0.4–0.5 mm wide in the throat; cells of the adaxial epidermis quadrate to oblong at very base of tube, becoming narrowly to linear-oblong above this; walls more or less straight to slightly undulate for cells in proximal *c.* one-half of tube, distinctly sinuous in cells of the distal portion. *Corolla lobes* 0.2–0.4 mm long, 0.15–0.3 mm wide; cells of the adaxial epidermis rounded-oblong to strongly rounded-quadrate (particularly at apex), walls undulate to more or less straight (sometimes distinctly sinuous at very base of lobes). *Stamens* exserted 0.1–0.35 mm beyond the corolla mouth, attached 0.35–0.5 mm up from the corolla tube base; filaments 0.6–0.8 mm long, filament collar 0.2–0.25 mm long; anther thecae 0.8–1.1 mm long, 0.15–0.25 mm wide, anther tails *c.* 0.1–0.15 mm long, anther appendage unpigmented. *Style* 1.5–1.8 mm long, yellowish-brown to brown (in life), drying brown, stigmatic branches (and sometimes distal portion of style) occasionally darker; stigmatic branches 0.6–0.7 mm long. *Cypselas* 1–1.2 mm long, 0.4–0.45 mm wide when mature, glabrous; cells of pericarp narrowly oblong, walls straight; cells of testa generally more or less quadrate to oblong (sometimes narrowly so, often rounded), walls undulate to more or less straight, scattered flat crystals also present, vascular strand running *c.* three-quarters the length of the cypselas, not passing over the apex; pappus absent. (Figure 1A–F)

Selected specimens examined. WESTERN AUSTRALIA: c. 200 m downstream from Lesmurdie Falls, Lesmurdie Falls National Park, Forrestfield, Perth, 10 Feb. 1996, B.J. Lepschi & T.R. Lally 2494 (AD, BRI, CANB, HO, K, L, MEL, NSW, P, PERTH, US); same locality, 30 Sep. 1996, B.J. Lepschi, J.L. Morris & P.K. Murer 3072 (CANB, MEL, PERTH); 0.8 km N of Old York Rd on Throssel Rd, just inside John Forrest National Park, E edge of Perth, 14 Apr. 1996, B.J. Lepschi & T.R. Lally 2570 (AD, BRI, CANB, K, MEL, PERTH, US); same locality, 15 Sep. 1996, B.J. Lepschi & T.R. Lally 2994 (CANB, PERTH); same locality, 12 Jan. 1997, B.J. Lepschi & T.R. Lally 3335 (PERTH); Reserve C8120, Coulston Rd, Boya, 28 Jan. 1986, P. Sawyer 134 (PERTH); Helena Valley, Feb. 1978, J. Seabrook 543 (CANB, PERTH); Lesmurdie Falls, Perth, 19 Jan. 1947, J. Souster 623 (NSW, [K n.v.]).

Distribution. Occupies a very restricted range between John Forrest National Park and Lesmurdie Falls National Park in the Darling Range on the eastern edge of Perth, Western Australia. It is possible that this species is under-recorded due to its summer flowering time, and the fact that plants are very difficult to locate when not in flower. Consequently, its range may extend beyond the distribution stated above. (Figure 2A)

Habitat. Grows in gravelly or sandy loam close to granite outcrops. Recorded from *Corymbia calophylla* (Lindl.) K.D. Hill & L.A.S. Johnson woodland with a shrubby understorey (Lepschi & Lally 2494), open shrubland with scattered trees of *C. calophylla* (Lepschi & Lally 2570), and 'wandoo' (possibly *Eucalyptus accedens* W. Fitzg. or *E. wandoo* Blakely) woodland (Seabrook 543).

Phenology. Production of new shoots begins by at least September, with advanced flower buds produced by late December. Flowers recorded between January and April, though the main flowering period appears to be January–March, with leaves withered by the onset of flowering. Fruits have been recorded in March and April.

Chromosome number. $n = 13$ recorded by Lepschi & Keighery (1999).

Conservation status. CALM Conservation Codes for the Western Australian Flora: Priority Two. *Pithocarpa corymbulosa* occupies a very small range, on the edge of an expanding city in an area under pressure from urban development. Two populations occur in National Parks, but both these abut urban areas and are subject to considerable human activity. The Lesmurdie Falls population is being encroached upon by invading *Watsonia meriana* (L.) Mill. var. *bulbillifera* (L. Bolus) D.A. Cooke that is extending upslope from a nearby creekline.

Notes. Bentham (1867) adopted a broad concept of *P. corymbulosa*, including within it *P. pulchella*, and although Lewis & Summerhayes (1951) showed conclusively that the two species were distinct, the name *P. corymbulosa* has been persistently misapplied to *P. pulchella* (e.g. Marshall undated, Gibson *et al.* 1994).

2. ***Pithocarpa pulchella*** Lindl., Edwards's Bot. Reg. Appendix vols 1–23: xxiii (1839). *Type:* Swan River, Western Australia, *Drummond s.n.* (*holo:* CGE, *n.v.* (photo seen at PERTH)).

Pithocarpa major Steetz, in Lehm., Pl. Preiss. 1: 446 (1845). *Type:* In muddy gravel in woodland on the plain beyond the village of Guildford, Western Australia, 9 August 1839, L. Preiss *s.n.* (*syn:* MEL 238727).

[*Pithocarpa corymbulosa auct. non* Lindl., Edward's Bot. Reg. App. vols 1–23: xxiii (1839).]

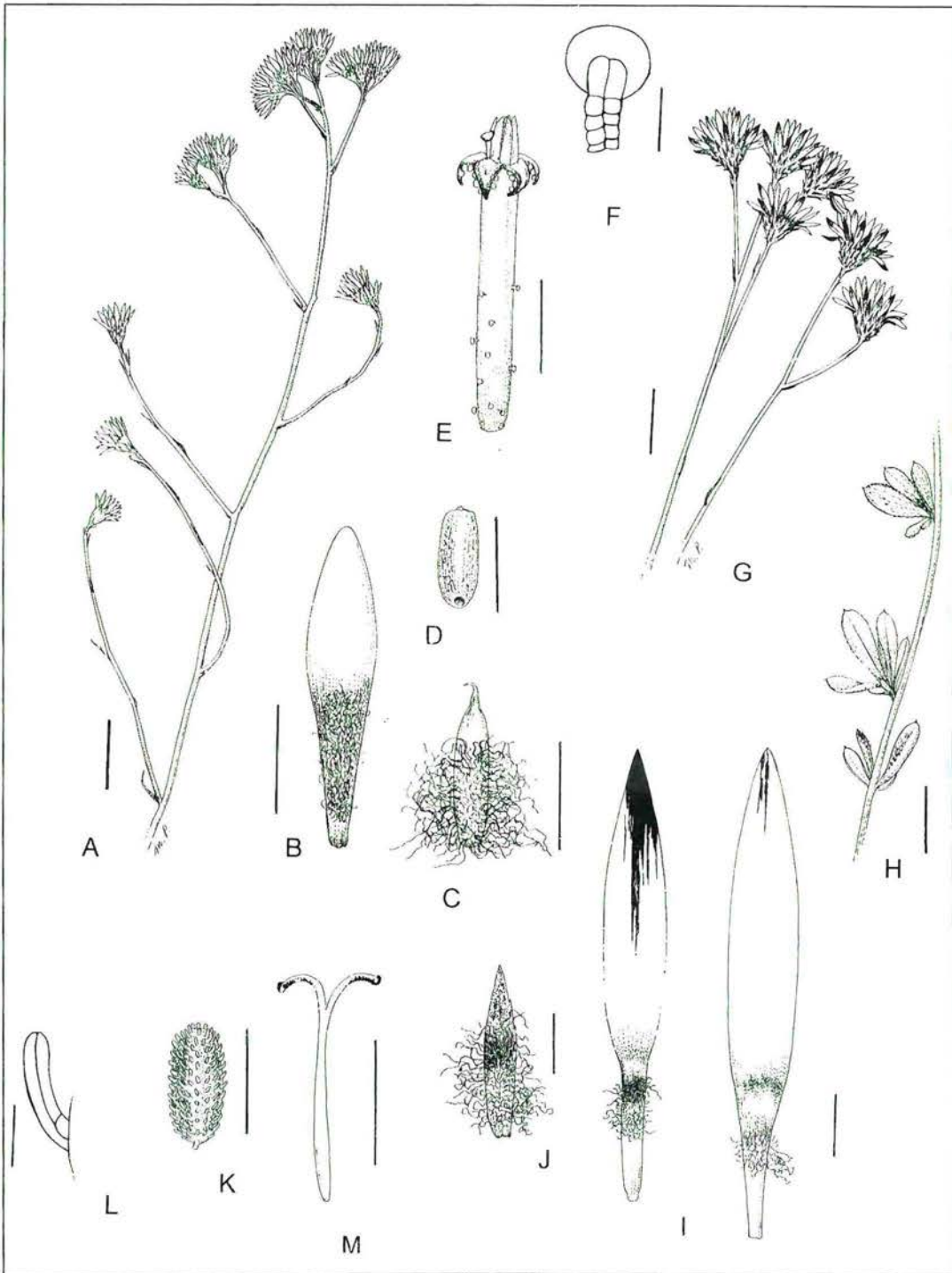


Figure 1. A-F. *Pithocarpa corymbulosa*. A - flowering branchlet, B - median involucre bract, C - outer involucre bract, D - cypsela, E - floret, F - vesicular hair from corolla tube; G-L. *P. pulchella* var. *pulchella*. G - flowering branchlet, H - branchlet with vegetative seasonal growth units, I - median involucre bracts, J - outer involucre bract, K - cypsela, L - cypsela duplex hair; M. *P. pulchella* var. *melanostigma* - style. Drawn from Seabrook 543 (A), Lepschi & Lally 2570 (B-F), GNT 191 (G), Alford 361 (H), Lepschi & Lally 2602 (I, J), Lepschi & Lally 2561 (K, L), Grieve s.n., PERTH 00828033 (M). Scale bars: 10 mm (A, G, H), 1mm (B-E, I-K), 0.05 mm (F, L). All drawn by M. Pieroni, except F and L (drawn by the author).

Illustrations. Blackall & Grieve (1975: 849); Lander (1987: 696); Marshall (undated: 200) [as *P. corymbulosa*].

Perennial *herb* or *subshrub* (0.1) 0.2–0.8 m tall; *stems* erect, basal portions becoming woody and glabrescent with age, covered with a dense, or (less often) moderately dense, whitish, cobwebbed indumentum comprised of appressed to spreading, flexuose hairs to 2.5 mm long. *Leaves* densely covered with a whitish, cobwebbed indumentum on the abaxial surface, somewhat sparser adaxially; lamina entire, narrowly obovate to linear-obovate or narrowly elliptic to linear elliptic, narrowly oblong, narrowly ovate, linear-ovate, linear or subulate for smallest leaves, 2–40 mm long, 0.3–5.5 mm wide; base weakly amplexicaul, apex acute to acuminate, margins weakly recurved. *Synflorescence* of terminal, open, loose corymbs of 2–5 (6) capitula, as well as solitary, terminal capitula on lateral branches within the flowering region. *Involucre* ellipsoid to narrowly ellipsoid when young, cup-shaped to obconic (occasionally broadly so), or broadly campanulate (due to spreading laminae of the inner bracts) at anthesis and in fruit; 3–6.5 mm long, 2.1–5 (8.5) mm wide at anthesis. *Involucral bracts* 28–115 (160), stereome sparsely to densely hairy with a whitish, cobwebbed indumentum (most dense on the outer bracts, less so on the inner bracts which may occasionally be almost glabrous), inner bracts also bearing some multicellular hairs to *c.* 0.1 mm long; outermost bracts 1.2–3 mm long, 0.2–0.7 mm wide, narrowly triangular to narrowly ovate or narrowly oblong to (rarely) narrowly oblong-elliptic or narrowly oblong-obovate, sometimes spreading to recurved, herbaceous, often with a narrow, more or less translucent, scarious margin, pale brown to brown when dry, frequently tipped dark reddish-brown or maroon; median bracts similar to innermost bracts but to 9.7 mm long and 2.2 mm wide; claw narrowly cuneate, lamina broadly elliptic to narrowly elliptic, obovate-elliptic or narrowly obovate, chartaceous, white, variously tipped or streaked (longitudinally) with dark reddish-maroon on the abaxial surface (rarely the entire bract may be reddish or this colouration may be largely absent), this often fading and/or drying to pale or dark brown on preserved specimens; innermost bracts 3.8–7.9 mm long, 0.7–1.9 mm wide, claw narrowly cuneate or narrowly oblong to very-narrowly oblong or linear; lamina elliptic to narrowly elliptic, elliptic-obovate, narrowly obovate, ovate-elliptic, ovate or broadly ovate, chartaceous, generally white, rarely tipped or streaked (longitudinally) with dark reddish-maroon on the abaxial surface. *Involucral receptacle* (0.7) 1.2–2.5 (4) mm diameter. *Florets* (12) 20–70 (118). *Corolla tube* 1.4–2.7 mm long, 0.2–0.45 mm wide at the base, 0.4–0.7 mm wide in the throat; cells of the adaxial epidermis quadrate to oblong in proximal *c.* two-thirds of tube, narrowly to linear-oblong above this; walls straight to (rarely) slightly undulate for cells in proximal *c.* two-thirds of tube, distinctly sinuous in cells of the distal portion. *Corolla lobes* 0.2–0.4 mm long, 0.2–0.3 mm wide; cells of the adaxial epidermis oblong to narrowly-oblong (sometimes rounded-oblong), those at the apex strongly rounded-quadrate; walls distinctly sinuous for cells in the basal *c.* one-third of the lobes, undulate to more or less straight for cells in the distal portion. *Stamens* exerted 0.15–0.4 mm beyond the corolla mouth, attached 0.3–0.7 mm up from the corolla tube base; filaments 0.5–0.8 mm long, filament collar 0.2–0.3 mm long; anther thecae 0.7–1 mm long, 0.15–0.25 mm wide; anther tails *c.* 0.1–0.25 mm long, anther appendage unpigmented or with purplish pigment in central portion. *Style* 1.3–2.5 mm long, yellowish-brown to black (in life), drying brown to black; stigmatic branches 0.45–0.8 mm long. *Cypsela* 0.8–1.3 mm long, 0.3–0.6 mm wide when mature, more or less densely covered with antrorse, clavate duplex hairs to *c.* 0.1 mm long; cells of pericarp more or less quadrate to oblong or narrowly oblong (often rounded), walls more or less straight to undulate; cells of testa generally more or less quadrate to oblong (sometimes narrowly so, often rounded), walls undulate to more or less straight, flat crystals apparently absent, vascular strand running *c.* two-thirds the length of the cypsela or extending to the apex (but not passing over it); pappus absent. (Figure 1G–M).

Distribution. Occurs from Eneabba southwards to Augusta, Albany and Cape Riche. Extends inland as far as approximately Mogumber, Clackline and the southern edge of the Stirling Range. Bentham's (1867) record of this species [as *P. corymbulosa*] from the 'Mt Barren Range' (i.e. the Barrens in

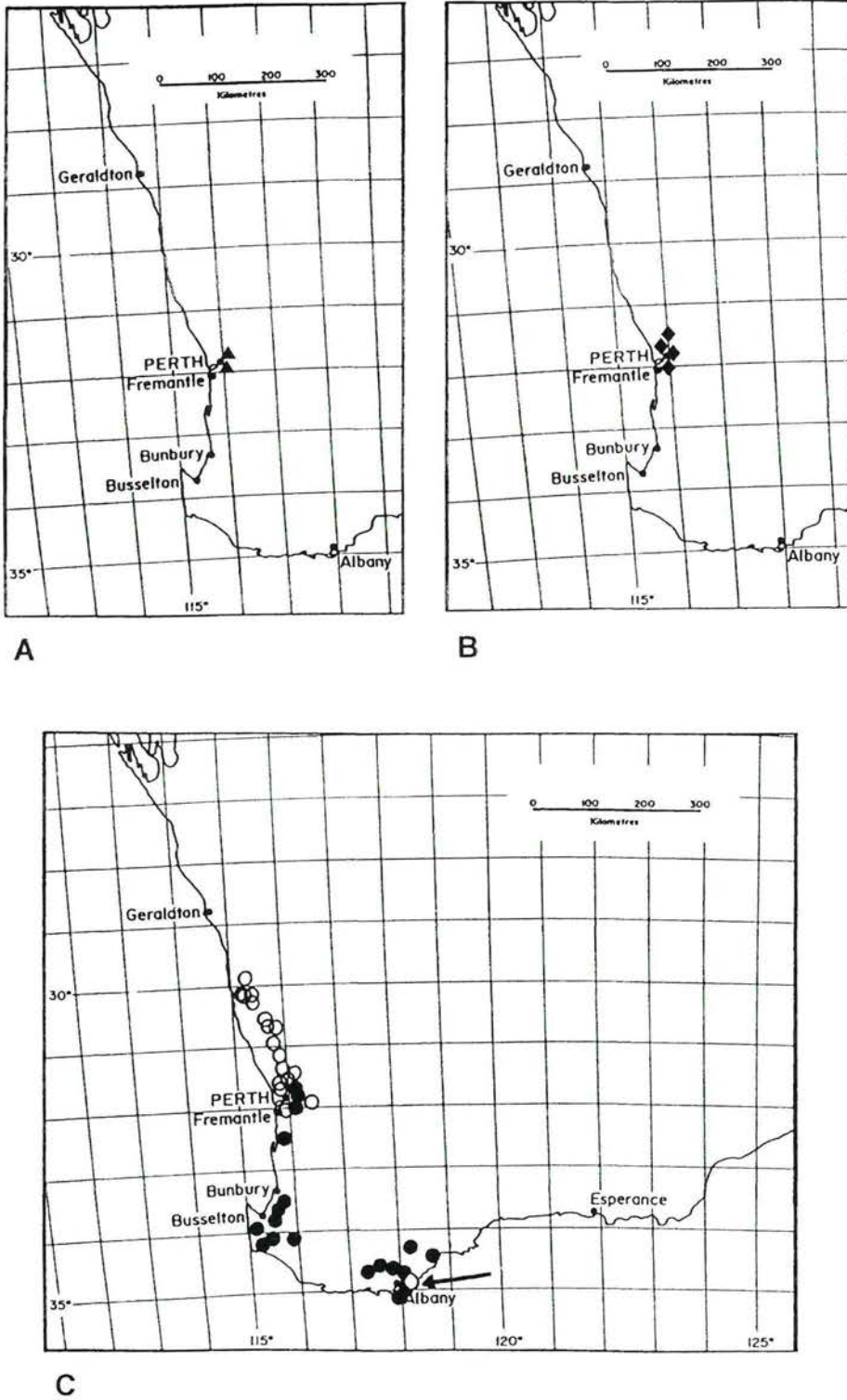


Figure 2. Distribution of *Pithocarpa* species. A – *P. corymbulosa*, B – *P. pulchella* (intermediate plants), C – *Pithocarpa pulchella* var. *pulchella* ○ and *P. pulchella* var. *melanostigma* ●. Outlying collection of var. *pulchella* (Lepschi & Lally 2581) marked with arrow.

Fitzgerald River National Park, between Bremer Bay and Hopetoun) is in error. The locality refers to Mt Barrow, c. 6 km due east of Mount Barker township. (Figure 2B–C).

Infraspecific taxa. *Pithocarpa pulchella* exhibits a significant degree of morphological variation throughout its range, and it was this heterogeneity that led Lewis & Summerhayes (1951) to erect *P. achilleoides* and *P. melanostigma* as segregates from *P. pulchella sens. str.* However, Lewis & Summerhayes's taxonomy was based on a small number of herbarium collections, and this is likely to have disproportionately magnified otherwise minor morphological differences. When a greater range of material is examined, the characters they used to circumscribe their taxa break down.

Lewis & Summerhayes (1951) used six quantitative and six qualitative characters to distinguish *P. achilleoides*, *P. melanostigma* and *P. pulchella*. Data from a morphometric study (Lepschi 1997) indicates that all of the quantitative characters show continuous variation throughout the range of *P. pulchella sens. lat.*, and as such do not allow the recognition of any additional taxa. Of the qualitative characters, most are very subjective and are almost impossible to quantify, while one appears to have been erroneously interpreted (these characters are discussed in more detail under the respective infraspecific taxa). Only one character, colour of the style branches, exhibits any useful variation within *P. pulchella*, although even here there are intermediates between the recognized character states.

In plants from the northern part of the range of *P. pulchella* (i.e. from the Eneabba district to the Perth district), the style-branches are yellowish-brown to brown (in life, becoming brown upon drying), while plants from the southern part of the species range (i.e. from the Perth district to the Albany district), exhibit style-branches which are black or very dark brownish-black (both in life and when dried). Occasional intermediate plants have also been seen (e.g. *Aplin* 462, *Lepschi & Lally* 2565), all but two (these with inadequate locality data) from the Perth region, where the ranges of the two variants overlap. As these entities are well defined (notwithstanding occasional intermediate individuals) and exhibit a clear geographical pattern, taxonomic recognition at varietal rank is considered appropriate. Two further characters (not considered by Lewis & Summerhayes 1951), density of indumentum on the vegetative parts and the involucre bracts, and the width of leaves on vegetative seasonal growth units, show some correlation with style-branch colouration. However, their usefulness as discriminatory characters is limited, as both appear to vary clinally within *P. pulchella* (see Lepschi 1997). Indumentum density is also a subjective character which is difficult to accurately quantify. Accordingly, they are most useful as supplementary characters.

2a. *P. pulchella* Lindl. var. *pulchella*

Pithocarpa achilleoides P. Lewis & Summerh., Kew Bull. 5: 437 (1951). *Type:* Wooroloo, Western Australia, November 1907, *M. Koch* 1895 (*holo:* K; *iso:* NSW 397293), *syn. nov.*

Illustrations. See under species.

Vegetative parts and outer involucre bracts densely to moderately hairy with a whitish, cobwebbed indumentum. *Leaves* on vegetative seasonal growth units 0.8–4 mm wide. *Style branches* yellowish-brown to brown (in life), drying brown. (Figure 1G–L)

Selected specimens. WESTERN AUSTRALIA: Clackline Nature Reserve (W boundary), 15 Mar. 1985, *J. Alford* 1 (PERTH); Boonanarring V.C.L. off Wannamal West Rd, Gingin, 21 Mar. 1986, *J.J. Alford* 507 (PERTH); Wanneroo Pine Plantation, 14 Apr. 1980, *H. Demarz* 8049 (CANB, PERTH); Lesueur

National Park, Beekeepers Track, 6 June 1993, *W. Evans* 567 (CANB, PERTH); corner Hammond Rd and Bartram Rd, Jandakot, 23 Mar. 1960, *A.S. George* 671 (PERTH); Nicholson Rd, c. 2.5 miles [c. 4 km] N of Forrestdale, 7 May 1961, *A.S. George* 2350 (PERTH); 7.4 km ENE of Pinjar Rd on Neaves Rd, Melaleuca Park Reserve, 7 km W of Bullsbrook, 31 Mar. 1996, *B.J. Lepschi & T.R. Lally* 2552 (AD, BRI, CANB, PERTH); 3.5 km E of Brand Highway on Mogumber West Rd, c. 36 km SSE of Dandaragan, 7 Apr. 1996, *B.J. Lepschi & T.R. Lally* 2555 (PERTH); c. 21.1 km NW of BP Cataby Roadhouse on Brand Highway towards Badgingarra, 7 Apr. 1996, *B.J. Lepschi & T.R. Lally* 2557 (AD, BRI, CANB, MEL, PERTH); 4.9 km W of Cockleshell Gully Rd turnoff on Coorow-Green Head Rd, c. 11.5 km ENE of Green Head, 7 Apr. 1996, *B.J. Lepschi & T.R. Lally* 2561 (A, AD, B, BRI, CANB, HO, K, L, MEL, MO, NSW, NY, US); same locality, 1 July 1996, *B.J. Lepschi & T.R. Lally* 2692 (AD, CANB, MEL, PERTH); Bakers Junction Nature Reserve, 2.5 km NE of Bakers Junction on road to Jerramungup, 2 May 1996, *B.J. Lepschi & T.R. Lally* 2581 (PERTH); bushland remnant adjacent Kwinana Freeway 'on ramp' at junction with South Street, Leeming, Perth, 26 May 1996, *B.J. Lepschi & T.R. Lally* 2602 (AD, BRI, CANB, HO, PERTH); 7 miles [c. 11.3 km] from Bindoon, 26 Apr. 1957, *H. Lewis* 32 (NSW, [K n.v.]); Darling Range, 1843, *L. Preiss* 27 (MEL).

Distribution. This variety occurs in the northern part of the range of *P. pulchella*, extending from Encabba southwards to Jandakot (on the southern edge of Perth) and inland to near Mogumber and Clackline. An isolated collection (*Lepschi & Lally* 2581) also exists from near Bakers Junction, north-east of Albany.

Pithocarpa pulchella var. *pulchella* overlaps with var. *melanostigma* in the Perth region. In this area var. *melanostigma* occurs predominantly on the Darling Scarp, with var. *pulchella* on the Coastal Plain, although this distribution is not entirely exclusive. To date no examples of actual sympatry have been documented, but *Cranfield* 828 from Wanneroo may represent a mixed population of *P. pulchella* var. *pulchella* and var. *melanostigma*. This collection comprises plants with both brown (MEL sheet) and black to dark brownish-black (CANB, NSW and PERTH sheets) style-branches. (Figure 2C)

Habitat. Grows in deep sand or sand over laterite, limestone or sandstone, often with some gravelly content. Vegetation communities include low heath (often with emergent mallees), banksia woodland, eucalypt woodland (mainly *Corymbia calophylla* and/or *Eucalyptus marginata* Sm.), or mixed banksia-eucalypt woodland, the latter three generally with a shrubby understorey.

Phenology. Populations north of about Mogumber tend to begin flowering and producing new growth approximately two months before more southerly populations of this taxon (i.e. south to Jandakot), although there is overlap in phenology between northern and southern plants. New shoots are produced around late May (for northern populations), and this continues until approximately November (in southern populations). Flowers have been recorded between December and April for northern populations, and between March and June for southern populations. Fruits have been recorded between February and June.

Chromosome number. $n = 13$ recorded by *Lepschi & Keighery* (1999).

Conservation status. Widespread and common, and not considered at risk. *Pithocarpa achilleoides*, here considered synonymous with *P. pulchella* var. *pulchella*, has been regarded as a poorly known species, and was listed by the Department of Conservation and Land Management's unpublished "Declared Rare and Priority Flora List" of 1996.

Typification. At AD, MEL, NSW and PERTH there are other collections labelled as '*M. Koch 1895*' which match the type material of *P. achilleoides*. However, dates do not match that of the type material, and it is therefore uncertain whether any of these collections represent duplicates of the holotype. Accordingly, they have not been afforded any type status. Collections in question are: (1) Wooroloo, Dec. 1907, *M. Koch 1895* (NSW 397296); (2) Wooroloo, Jan. 1908, *M. Koch 1895* (MEL 238723, 238724, PERTH 00535702 and possibly PERTH 00535699) and (3) Wooroloo, Nov. 1908, *M. Koch 1895* (AD 97632398).

Notes. Despite some differences in phenology between the northern populations of this variety and those from further south, there are no correlated morphological differences. Plants from northern populations tend to have a denser indumentum and somewhat broader leaves, but there is overlap and these characters appear to vary clinally throughout the range of *P. pulchella* (see under *Notes* for the species). Accordingly, separate taxonomic status is not considered appropriate.

Pithocarpa achilleoides is here placed in the synonymy of *P. pulchella* var. *pulchella*. Lewis & Summerhayes (1951) defined *P. achilleoides* on the basis of synflorescence structure, capitulum width, involucre bract number, length of the largest (= median) involucre bracts, length of the receptacle, and the number and length of the florets (notably, this circumscription encompassed only plants with yellowish-brown to brown style branches; plants with black to dark brownish-black style branches with otherwise identical capitulum and synflorescence morphology were included in their concept of *P. melanostigma*). As mentioned previously, all the quantitative characters used by Lewis & Summerhayes (1951) to define *P. achilleoides* show continuous variation throughout the range of *P. pulchella sens. lat.*, and as such are of little value in circumscribing taxa. The difference in synflorescence structure cited by Lewis & Summerhayes (1951) for *P. achilleoides* ('small corymbs of 2–5') and *P. pulchella sens. str.* ('mostly solitary.....but sometimes forming small corymbs of up to 4 capitula') also shows considerable overlap.

To judge from the infrequent application of the name *P. achilleoides* to herbarium collections, it would appear that most workers have either been reluctant or unable to recognize this taxon. Lander (1987) also specifically excluded *P. achilleoides* from his treatment of the genus for the "Flora of the Perth Region", even though *P. achilleoides* is supposedly endemic to this area, with the comment that it was probably conspecific with *P. pulchella sens. str.*, a view supported here.

2b. *P. pulchella* var. *melanostigma* (P. Lewis & Summerh.) Lepschi, *comb. et stat. nov.*

Pithocarpa melanostigma P. Lewis & Summerh., Kew Bull. 5: 438 (1951). *Type:* District South West Plantagenet, in scrub on damp hills not far from the sea, Western Australia, January 1901, *E. Pritzel* 243 (*holo:* K; *iso:* AD 97632397, NSW 397306).

Illustration. Blackall & Grieve (1975: 849) [*as P. melanostigma*].

Vegetative parts and outer involucre bracts moderately to sparsely hairy with a whitish, cobwebbed indumentum. *Leaves* on vegetative seasonal growth units 0.5–2.5 mm wide. *Style branches* black or very dark brownish-black (from darkly pigmented stigmatic papillae and sweeping hairs), both in life and when dried. (Figure 1M)

Selected specimens examined. WESTERN AUSTRALIA: Greenmount, E of Midland, Apr. 1901, *C. Andrews s.n.* (PERTH); S of Porongurups on Narrikup Road, 21 May 1972, *A.M. Ashby* 4480 (AD,

CANB, PERTH); Albany Commonage, 6 May 1924, *C.A. Gardner* 1649 (PERTH); 41 km W of Rocky Gully on Muir Highway, 8 June 1977, *A.S. George* 14589 (PERTH); King George Sound, May 1899, *B.T. Goadby s.n.* (NSW, PERTH); Toodyay Road, \pm 20 mile peg, *s. dat.*, *B. Grieve s.n.* (PERTH); Kalamunda, 19 km E of Perth, 17 Apr. 1986, *R. & M. Hamilton* 218 (CANB, MEL); top of Mt Barker Hill at scenic lookout, 12 Apr. 1971, *K.F. Kenneally s.n.* (PERTH); junction of Albany Highway and Yellanup Road, c. 15.5 km SSE of Mount Barker, 1 May 1996, *B.J. Lepschi & T.R. Lally* 2576 (PERTH); 2.3 km ESE of Slee Road on Vasse Highway, c. 17.5 km ESE of Busselton, 3 May 1996, *B.J. Lepschi & T.R. Lally* 2588 (A, AD, BRI, CANB, HO, K, L, MEL, NSW, PERTH, US); c. 14 km SSE of Capel on road to Donnybrook, 3 May 1996, *B.J. Lepschi & T.R. Lally* 2591 (AD, BRI, CANB, K, MEL, PERTH, US); Darlington, 23 June 1949, *B. Roark s.n.* (PERTH); Mt Clarence, Albany, Mar. 1911, *J. Staer s.n.* (NSW); near 45 mile peg on Brookton Highway, 23 May 1966, *GNT* 191 (PERTH); 31.5 km NW of Denmark, 27 Apr. 1993, *G.J. Wardell-Johnson* 3339 (PERTH).

Distribution. Disjunctly distributed in the southern part of the range of *P. pulchella*. The apparent gap in the distribution of this taxon may be an artefact of inadequate collecting, but this requires confirmation. Occurs from the Wanneroo–Midland area on the northern edge of Perth, south to Augusta, Albany and Cape Riche, extending inland to the southern edge of the Stirling Range. Overlaps with var. *pulchella* in the Perth area (see under that taxon for details). (Figure 2C)

Habitat. Generally recorded growing in sand (including sand over granite or laterite), sandy-loam or loam (occasionally with some gravel content), but once recorded from clay over ironstone (*Keighery* 13334). Frequently grows in winter-wet sites. Vegetation communities include heath and other shrubland formations, mallee-heath, banksia woodland and eucalypt woodland (mainly *Corymbia calophylla* and/or *Eucalyptus marginata*), the latter two generally with a shrubby understorey.

Phenology. Data on phenology is less complete than that available for var. *pulchella*. New growth is produced from approximately September to November, with flowers recorded between January and July, and fruits between March and July.

Chromosome number. $n = 13$ recorded by Lepschi & Keighery (1999).

Conservation status. Widespread, not regarded as rare or endangered. This taxon [as *P. melanostigma*] was formerly listed on the Department of Conservation and Land Management's list of poorly known flora as a Priority Two taxon (e.g. Hopper *et al.* 1990), but was deleted in 1992 following the location of additional populations (R. Hearn, pers. comm.).

Notes. *Pithocarpa melanostigma* is here reduced to varietal rank within *P. pulchella*. Lewis & Summerhayes (1951) distinguished *P. melanostigma* from *P. achilleoides* (see above) and *P. pulchella sens. str.* on the basis of stem morphology (stems slender, ascending and 'rather flexuous'), branching pattern (plants 'much branched above the base'), involucre bract number, the 'flexuous' nature of the largest (= median) involucre bract margins, and the colouration of the apical portion of the involucre bracts (see below) and the style-branches. Of these characters, only one, style-branch colouration, is useful as a taxonomic discriminator (see under *Infraspecific taxa*, above). The characters of stem morphology, branching pattern and involucre bract margin are all very subjective, and were not found to be taxonomically informative during the course of this study. Examination of plants in the field also suggest that stem morphology and branching pattern are frequently influenced by environmental factors (see Lepschi 1997). Colouration of the apical portion of the involucre bracts appears to have been erroneously interpreted by Lewis & Summerhayes (1951). They describe the involucre bracts of *P. melanostigma* as being 'tipped with very dark brown', as opposed to 'medium to light brown' for

P. pulchella and *P. achilleoides*. Observations on living plants have shown that the involucre bracts of *P. pulchella sens. lat.* are marked to varying degrees with dark reddish-maroon on the abaxial surface. However, this distinctive colouration frequently fades to a light brown colour, probably through bleaching by sunlight, or may become discoloured (to more or less dark brown), possibly as a result of inadequate specimen preparation.

As is the case with all the quantitative characters utilized by Lewis & Summerhayes (1951), involucre bract number (considered diagnostic for *P. melanostigma*) varies continuously throughout the range of *P. pulchella sens. lat.* and as a result is of little use as a taxonomic discriminator.

Apart from a few regional flora treatments (e.g. Blackall & Grieve 1975, Lander 1987), and its inclusion in two studies of Gnaphalieae phylogeny (Anderberg 1991, Puttock 1994), *Pithocarpa* has received little systematic attention in recent years.

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