

Notes concerning the classification of species included in *Calocephalus* R.Br. s.lat. and *Gnephosis* Cass. s.lat. (Asteraceae: Gnaphalieae), with descriptions of new genera and species

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Abstract

Descriptions and keys to 40 species here included in, or which have often been considered to have affinities with the broadly-delimited genera *Calocephalus* R.Br. and *Gnephosis* Cass., are provided. Five new species are referred to *Calocephalus*, i.e. *C. badmanii* P.S.Short, *C. beardii* P.S.Short, *C. birchii* P.S.Short, *C. glabratus* P.S.Short, *C. pilbarensis* P.S.Short, and one to *Gnephosis*, i.e. *G. newbeyi* P.S.Short. The new genus *Balladonia* P.S.Short is described and the new combinations made for *B. aervoides* (F.Muell.) P.S.Short and *B. multiceps* (J.H.Willis) P.S.Short, species previously placed in *Calocephalus* and *Chthonocephalus* Steetz, respectively. The genus *Notisia* P.S.Short is described, the only species, *N. intonsa* (S.Moore) P.S.Short being transferred from *Gnephosis*. Lectotype specimens are designated for the names of 14 species and two varieties.

Keywords: Asteraceae, Gnaphalieae, *Balladonia*, *Blennospora*, *Calocephalus*, *Gilruthia*, *Gnephosis*, *Leucophyta*, *Notisia*, review, taxonomy, lectotypifications, pollen:ovule ratios, Australia.

Introduction

George Bentham (1867a), in his treatment of the gnaphalioid genera of Australian Compositae (essentially his tribes “Gnaphalieae” and “Eugnaphalieae”) in *Flora Australiensis*, recognised 34 genera. Excluding several orthographic variants and nomenclatural synonyms he listed 77 generic synonyms. The previous year, in a letter dated 22 July 1866 and sent to Ferdinand Mueller, Bentham had indicated his progress with his treatment of the family for the *Flora* and noted that

So far as I have gone, I have been able (pretty well to my own satisfaction, although very likely not to that of others) very much to reduce the small genera.

Cited in Daly 1927, p. 158

Mueller was to subsequently accept many of the genera recognised by Bentham. However, he noted, for example, that of the many names — often coined by Nicolai Turczaninow (1851) and Asa Gray (1851a, b, 1852) — reduced to synonymy under *Angianthus* Wendl., *Gnephosis* and *Myriocephalus* Benth by Bentham, “some were readily to be restituted” (Mueller 1882, pp. 82, 83). That Mueller found Bentham’s work unacceptable is unsurprising given the following statements concerning generic limits in *Flora Australiensis*:

The limits to be assigned to the group are very uncertain, as it is connected with so many others by almost insensible gradations [...] We are obliged [...] to make arbitrary demarcations, in order not to unite the whole tribe into one

unmanageable genus. Those here adopted are the best that suggest themselves [...] although it must be admitted that in some instances they are not altogether satisfactory.

Bentham 1867a, p. 612, regarding the limits of Helichrysum in Australia

It is very near to *Gnephosis*, differing chiefly in the pappus. The general receptacle is also more broken up or slightly branched, the partial heads are distinct and having more florets connect the genus through *Cephalopterum* and *Gnaphalodes* with *Helipterum*.

Bentham 1867a, p. 573, regarding Calocephalus

It is closely allied to *Angianthus*, but the general involucre and receptacle are less developed than in that genus and the partial involucre much more so, consisting of much more numerous bracts and not flattened.

Bentham 1867a, p. 569, discussing Gnephosis

However, non-specialist taxonomists found it convenient to simply follow Bentham’s concepts and pragmatically placed new species in these genera without, surely, giving much thought to their relationships. The work of earlier taxonomists such as Gray and Turczaninow were presumably overlooked or simply ignored, with Bentham’s opinions holding sway for more than a century.

As part of a study of the genus *Angianthus* (sensu Bentham) in the late 1970s, I familiarised myself with many other compound-headed species of Australian Gnaphalieae and, to a lesser extent, Australian species which at that time were still, following Bentham (1867a), included in *Helipterum* DC. and *Helichrysum*

Mill. As with Mueller, I came to the conclusion that Bentham's generic concepts left much to be desired. I have noted this to be the case for *Calocephalus* and *Gnephosis* in several publications (e.g. Short 1981a, b, c, 1986a), reinstating *Blennospora* A.Gray (Short 1987a) and subsequently *Trichanthodium* Sond. & F.Muell. ex Sond. (Short 1990a) and began (Short 1986b) to again use the name *Leucophyta brownii* Cass. for the species known for many years as *Calocephalus brownii* (Cass.) F.Muell. Anderberg (1991), in his world-wide review of the taxonomy and phylogeny of the tribe Gnaphalieae, accepted many of the smaller genera which I had reinstated from *Angianthus* s.lat. as well as recognising *Blennospora* and *Leucophyta*. He also recorded *Calocephalus* sensu Bentham as being "probably polyphyletic" and recognised that *Calocephalus angianthoides* is referable to *Gnephosis* s.str. (as defined by Short 1987b) but suggested that it would probably be paraphyletic without inclusion of monotypic *Hyalochlamys* A.Gray. Anderberg (1991) also tentatively referred those species excluded from *Gnephosis* s.str. to the genus *Leptotriche* Turcz. He made no combinations to formally accommodate them in that genus and, with the exclusion of those I have removed to *Trichanthodium* (Short 1990a) and the tentative addition here of *G. setifera* P.S.Short (Short 1990c), they constitute what I treat here as species of *Gnephosis* s.lat.

Following his morphology-based, cladistic analysis of the tribe Gnaphalieae, Anderberg (1991), placed the majority of Australian genera in the endemic subtribe Angianthinae, with most others in the subtribe Cassiniinae. The subjects of this paper, *Calocephalus* s.lat. and *Gnephosis* s.lat. were included in the Angianthinae.

Subsequent to Anderberg (1991), Bayer et al. (2002) used a molecular approach to examine phylogenetic relationships in the Australian Gnaphalieae using non-coding chloroplast DNA sequences (the *trnL* intron and *trnL/trnF* intergenic spacer), the maturase encoding plastid enzyme *matK*, and the external transcribed spacer (ETS) of nuclear DNA. For their analyses, 69 of the 87 genera then recognised were sampled, but this equated to just 77 species out of a total of 475–500 species. The results indicated that the subtribes Angianthinae and Cassiniinae as circumscribed by Anderberg (1991) are not monophyletic. Furthermore, results generally support the recognition of many of the smaller genera which have been described or reinstated in recent years in papers by, for example, myself (e.g. Short 1983, 1986c, 1987a, 1989b, 1990a) and Wilson (e.g. 1989a, b, 1992a, b, c). Bayer et al. (2002) also indicated that some genera need to be more closely investigated. It also shed little light on the relationships of the many species that have at some stage been attributed to *Calocephalus* s.lat. and *Gnephosis* s.lat., only eight (*Blennospora drummondii*, *Calocephalus knappii*, *C. multiflorus*, *Gnephosis arachnoidea*, *G. intonsa*, *Leucophyta brownii*, *Trichanthodium exilis* and *T.*

skirrophorum) out of the 40 species treated here, being included in their study. In neither case were species of what I treat as *Gnephosis* s.str. and *Calocephalus* s.str. included in the analyses. On the other hand, the results support my earlier beliefs (e.g. Short 1986a) that a number of genera should be segregated from both *Calocephalus* s.lat. and *Gnephosis* s.lat. Thus, of the four species of *Calocephalus* s.lat. included in analyses, it was no surprise to see *Leucophyta* and *C. knappii* in different clades while *Blennospora drummondii* and *C. multiflora* are in yet another clade. In regard to the four species of *Gnephosis* s.lat. used in the analyses, placement of the morphologically very different *Gnephosis arachnoidea* and *G. intonsa* in different clades is similarly unsurprising. However, the placement of *Trichanthodium exilis* and *T. skirrophorum* in clades distantly removed from each other was totally unexpected. Ward et al. (2009) presented similar results in regard to Australasian Gnaphalieae members, using many of the same species as Bayer et al., but in their results both species of *Trichanthodium* are in the one clade.

A comparison of the generic concepts of Gray (1851a, b, 1852) and Turczaninow (1851), who often independently based their descriptions on duplicate collections gathered by James Drummond, with the treatment of the same taxa by Bentham (1867a) and more recent workers, principally myself and Paul Wilson, is presented in Table 1. In view of his comments that many earlier names "were readily to be restituted" one feels that Mueller (1882) would mostly approve of a reversal to the recognition of at least some of the smaller genera. However, far more work pertaining to the circumscription and status of most Australian gnaphalioid genera, particularly using molecular sequencing combined with morphological studies (e.g. as in Weber & Schmidt-Lebuhn 2015), needs to be carried out before there can be consensus on these matters. It is for this reason that, despite having been critical of past workers in simply adopting Bentham's generic concepts, I too largely adopt here what I consider to be broad, non-monophyletic concepts of *Calocephalus* and *Gnephosis*. However, I do erect two new genera, *Balladonia* and *Notisia*, and maintain several which I have previously reinstated.

I have been aware of some of the new species for 30 years or more and, although they may have phrase-names, I believe it important that they be formally named and their various features described.

I here provide descriptions of 40 species. Most are detailed, being of species which are either first-described here or of species which I have not previously covered. However, I tend to provide abridged, but updated, accounts for species which I have previously revised. Thus, under *Gnephosis* s.str., *G. angianthoides* is described in detail but *G. cassiniana* (Short 1990c) and those previously included in *Chrysocoryne* (Short 1983) have shorter accounts, as do species covered in

revisions of *Blennospora* (Short 1987a) and *Trichanthodium* (Short 1990a).

Materials and methods

Morphology and anatomy

During general studies of the fruit anatomy of Australian Gnaphalieae (Short et al. 1989) observations on the presence or absence of sclerenchyma in the pericarp of fruit of a few species of *Calocephalus* s.lat. and *Gnephosis* s.lat. were made. These, along with a record of the voucher specimen for the single fruit examined, are incorporated in the descriptions.

The number of vascular bundles in the pericarp, the presence and shape of crystals in the fruit wall or testa, and cell structure in fruit and corollas and corolla venation, were mostly observed from florets preserved in 70% ethanol. Sometimes, dried material was rehydrated for c. 24 hours before being stored for a similar time in 70% ethanol. All material was mounted on a microscope slide in a few drops of Lactic Acid L.R. (88% assay). Within, at most, a couple of days, florets were suitably “cleared” and could be examined to ascertain the distribution of vascular tissue, etc. The florets examined were usually from the same voucher specimens cited for the determination of pollen:ovule ratios. I have recorded whether the cell walls of the corolla lobes and tube are straight or undulating, but given the sample-size — usually about ten but occasionally only several florets and these sometimes from the one plant — and the fact that some florets have been rehydrated, it may be that these records are not always a true reflection of their structure.

Flowering times of individual species are gleaned from label data accompanying herbarium specimens.

Pollen:ovule ratios were usually determined from spirit collections specifically gathered for this purpose, with determinations made from 5–15 individual capitula (each from a different plant and randomly collected) from one or more populations. When no spirit material was available, determinations — often from just a single floret — were made from florets removed from a dried specimen. In such cases capitula were soaked in water and a drop of detergent for 24 hours and then transferred to 70% alcohol for about the same length of time before dissection. In all cases dealt with in this paper the pollen:ovule ratio is equivalent to the number of pollen grains per floret. This is because, with the exception of heterogamous *Notisia intonsa*, plants have only bisexual florets while in *N. intonsa* the ratio of male to female florets is 1:1.

Terminology

The terminology used in descriptions often follows that of Roque et al. (2009) but I continue to use some terms which I have previously used in other publications on the taxonomy of compound-headed Gnaphalieae (e.g. Short 1983). Thus, I refer to compound heads rather than glomerules, a term which I consider unnecessary jargon

for a well-defined cluster of capitula; to the bracts which surround a capitulum as capitular bracts, not involucre bracts, as this ensures there can be no confusion of these bracts with those that may form an involucre at the base of compound heads (e.g. Short 1983); the descriptive term “receptacular bracts” rather than paleae; and to capitulum-subtending bracts — a term applied by Bentham (1867a) to a usually singular bract occurring on the adaxial side of a capitulum.

Very often, in the species examined here, there is a fairly gradual morphological change from leaf to bracts of the general involucre (leaf-like to probably more than c. 50% hyaline but with green midrib or stereome), to (when present) capitular-subtending bracts (also often c. 50% or more hyaline), to capitular bracts in which the midrib makes up a small part of the entire bract and may almost be obsolete.

Thus, capitulum-subtending bracts and capitular bracts of the species referred to in this review broadly consist of two parts, an often somewhat vegetative midrib *plus* a hyaline lamina which completely surrounds the midrib and extends above it. Depending on the species, these bracts may generally taper or dilate towards the apex but, excluding hairs or hair-like processes on the margins, the upper (or terminal) part of the lamina, i.e. that part extending above the midrib, is in many species not differentiated from the lower part of the lamina, or at most there may be a slight constriction at about the level of the midrib. However, in some species, the constriction may be prominent and, if so, the delineated terminal lamina is also often differently coloured, may be wider or narrower than the lower part of the bract, and may be reflexed. On such occasions, I have opted to follow Bentham (1867a) and other taxonomists who have described gnaphalioid taxa (e.g. Wilson 1992b), in adopting the term “claw” to refer to the lower part of the bract, while referring to the upper modified part as a “terminal lamina”. At least within the Australian gnaphalioid taxa, I am aware that the terms “claw” and (simply) “lamina” are more usually applied to bracts in which the claw is purely vegetative, a hyaline or scarious lamina being only apically developed; hence my deliberate use here of “terminal lamina” (rather than simply “lamina”) to distinguish it from the marginal, hyaline lamina of the claw. I also note that, as in some taxa described here, the claw may be wider than the terminal lamina, which is at variance to the normal botanical interpretation of a claw, e.g. as “a narrow, stalk-like basal portion of a petal, sepal or bract” as defined in McCusker (1999, p. 591).

The margins of hyaline bracts are commonly entire, or mostly so, throughout the bract but, in some cases, they are not, instead appearing to be ciliate and I have described them in this manner. However, I note that rather than being distinct hairs as implied by this terminology, they may be better described as having “hair-like processes” which appear to be formed by the splitting of the thin margins. This is particularly apparent, for

example, in the capitular bracts of *Gnephosis trifida* which have long hair-like processes extending from the upper margins, these particular bracts being illustrated in Short (1983, figs 9c, 10i, under the name *Chrysocoryne trifida*).

In regards to the sex of a floret I believe the terms bisexual, female, male, and neuter (although the latter does not apply to florets of species dealt with in this paper) should be used. The term “perfect” is frequently used for describing bisexual florets, e.g. Roque et al. (2009), but to the uninitiated it is a term which does not immediately convey the sex of the floret. I also have a preference for the term cypsela, not achene, for the fruit of most Asteraceae. Jeffrey (2006) considered the name cypsela to be superfluous but, as noted by various workers (e.g. Marzinek et al. 2008 and references therein), the fruit of the daisy is not homologous with the achene of other families. Indeed, Roque et al. (2009) effectively acknowledged this, but decided that it is preferable to use the more widespread term, achene.

Pappus structure is highly variable and in some species, whether one should describe a pappus element as a broad-based bristle or a highly lacinate scale or, for that matter, as bristle-like or scale-like, is a moot point. I have described them as I saw them at the time of description and acknowledge that others may perceive them differently. However, in describing features such as the number and length of pappus elements I believe I have adequately described the salient features required for identification.

Accurate determinations of floret number and size cannot be easily obtained from herbarium specimens without destroying capitula. However, for many species it was possible to obtain such determinations from spirit collections expressly collected for this purpose, as well as for the determination of pollen:ovule ratios and the study of anthers and styles. This often means that such information has been obtained from 5–15 individuals from a population and then supplemented by counts and measurements from herbarium specimens, thus expanding the likelihood that the range of variation of characters is accounted for. However, when few specimens — be they spirit or dried collections — were available I have used the abbreviation “c.” in descriptions. Throughout this review Stearn (1983) has been a major source of terminology, as has been the terms for shapes as used by the Systematics Association Committee for Descriptive Terminology (1962), the latter simplified in a most useful table in Radford et al. (1974).

Text notes

Authors of plant names

Names of authors and their abbreviations follow Brummitt & Powell (1992). Thus, reference is made to the Russian taxonomist, Nicolai Turczaninow, the spelling also used by Stafleu & Cowan (1976–1988) but not by Marchant (1990) in his most useful paper.

Herbarium abbreviations, type specimens and typification

Herbarium abbreviations follow Thiers (continuously updated).

If collection dates and specimen numbers are absent from specimen data, as they frequently are from early collections — including type specimens — this is not indicated by “s.dat.” and “s.n.”.

When citing details of type specimens I usually give the specimen citation as provided in the protologue and this is often followed by updated citation of details of the appropriate specimen(s). This is because, particularly in regard to early publications, there may be discrepancies between collection data provided in the protologue and that on the label of otherwise undoubted type specimen, the identity of which may be clarified from other information provided on the sheet and/or in the protologue, or through knowledge of the working habits of authors and the deposition of a collector’s specimens. There are also times when the number of duplicates and/or their allocation to herbaria have, for various reasons, been altered subsequent to publication, e.g. as to some species of *Gnephosis* described by me (Short 1983, as *Chrysocoryne*).

In this paper, and in most others I’ve published on the taxonomy of the tribe Gnaphalieae, I have dealt with species named by Asa Gray (1851a, b, 1852) and Nicolai Turczaninow (1851), most of which were based on specimens collected by James Drummond. I here give an account of the locality and numbering of the specimens examined by Gray in those papers.

Gray noted that he compiled his descriptions of species published in volume 9 of *Hooker’s Icones Plantarum* and volumes 3 and 4 of *Hook. J. Bot. & Kew Gard. Misc.* as a result of Drummond’s specimens being “placed in my hands by Sir William Hooker, for examination” (Gray 1851a, p. 97). The preceding comment was made in the first part of the paper “Characters of some gnaphalioid Compositae of the Division Angiantheæ” in *Hook. J. Bot. & Kew Gard. Misc.* in April 1851, at a time when Gray was in Europe. Indeed, he and his wife had departed American shores on 11 June 1850 and did not return from Europe until 4 September 1851. In some previous publications (e.g. Short 1985, 1987a) I have referred to the specimens as having been forwarded to Gray by Hooker, implying that Gray examined them at Harvard University, Cambridge. However, there is no indication in “Letters of Asa Gray” (Gray 1894, compiled by his wife) that he had worked on the Drummond specimens before departing for Europe in 1850. Indeed, I have little doubt that he at least commenced compiling descriptions while in Europe, a scenario consistent with Mrs Gray recording that her husband “was able to get to Kew the last of December [1850], and spent the winter in hard work in Sir William Hooker’s herbarium, which was then in his house at West Park.” (Gray 1894, p. 377). The fact that some species described by Gray were also

illustrated by Walter Hood Fitch, who was employed by William Hooker and the regular artist for *Hooker's Icones Plantarum*, is also consistent with this scenario. However, the fact that the last instalment of “Characters ...” was not published until September 1852 suggests that some of the work may have been carried out on Gray’s return to Cambridge.

The aforementioned information suggests that syntype specimens should be at K and GH and this is the case, with the principal specimens undoubtedly at K and normally chosen by me as the lectotype specimen of each of the Gray’s names. They are stamped as “Herbarium Hookerianum 1867”, sheets are named in Gray’s hand, and there are illustrations on some sheets — not just published ones, but also unpublished sketches which were marked as “Ic. Pl. tab. ined.” in the “Characters ...” paper but were never actually published. That the K specimens should be considered the principal types is relected in the fact that syntypes of all species named by Gray are not in GH, and those present are comparatively poor, even fragmentary, compared to the specimens in K. For example, the only material in GH of the species of *Gnaphalodes* A.Gray consist of fragmentary material held in an envelope, on which Gray wrote “Gnaphalodes n. gen. Debris examined of the 2 species. Swan R. Drummond.” (Short 1985).

During the 1850/51 trip Gray visited other botanists in Europe, not just Hooker. Visits included a two-month-long spell with George Bentham at his residence in Herefordshire — albeit predominantly working on plants of the United States Exploring Expedition — while much of April was spent in Paris, “where he worked busily through the mornings at the Jardin des Plantes” (Gray 1894, p. 381). After returning from Paris he again spent time at Kew, perhaps some time in the herbarium of the British Museum, i.e. in the herbarium now known as BM, as well as meeting again with Bentham before departing for home. The Kew herbarium today houses Bentham’s set of Drummond’s collections — these stamped as “Herbarium Benthamianum 1854” — but, almost invariably, they lack any indication that they were seen by Gray when compiling the “Characters ...” paper. (I haven’t thoroughly checked all relevant specimens, but that of *Myriocephalus nudus* A.Gray has the pencilled name on the sheet (K 000899267) in what I believe is in Gray’s hand.) I have not made an extensive search for specimens at BM, but of the few which I have seen, e.g. of *Gnaphalodes condensatum* A.Gray and *Blennospora drummondii* A.Gray (Short 1987a), there was nothing on the sheets to indicate that they had been examined by Gray. However, there are some relevant Drummond collections in P which are annotated by Gray, as for example, syntype specimens of the aforementioned *G. condensatum* (P 00715970) and *B. drummondii* (P 00715973), described respectively in August 1852 and June 1851. Gray never dated his annotations but if he saw the specimens in April 1851 then, those annotated can, at

least potentially, be considered to be syntypes; however, whether they were actually used to write descriptions is debatable, particularly in regard to species described in June but only seen in April. In any case, there can be no argument against the K specimens being considered as the principal types, either being considered as the holotype or chosen as the lectotype specimen of a name. However, this can be problematic due to Gray never citing Drummond’s specimen numbers for any of the species he described in the “Characters ...” paper (Table 1), this despite many of them being numbered. This is in marked contrast to Turczaninow who gave the specimen number and, usually, the series to which it belonged (Table 1). Various taxonomists have commented on Drummond’s collections, see for example Barker (2005) and George (2009) and references therein, but in regard to the lack of numbers I allow Bentham to explain:

Of the important and extensive West Australian collections of MR. JAMES DRUMMOND I have had for examination complete sets of excellent specimens in the Kew herbaria, and in the majority of instances I have seen them in different sets so as to check the one with the other. I have thus been enabled to identify nearly the whole of the species published by TURCZANINOW in the ‘Bulletin de la Société Impériale des Naturalistes de Moscou.’ As these collections are very generally distributed, I have quoted the numbers attached to the specimens where I could do it with any certainty. Unfortunately there is much confusion in some of these numbers, Mr. Drummond having recommenced a fresh series with each of the five collections he sent over, besides one or two supplementary sets. The first collection, of which many were published by Lindley and others, were not originally numbered, but numbers were afterwards added in a few additional sets sent home. *In the Hookerian herbarium, owing to the belief at the time that these numbers were not certain enough for quotation, they were often not preserved; in most instances where they are kept there is no indication of which series they belong to, and in other herbaria I have often found them referred to a wrong series* [my emphasis]. These numbers cannot therefore be relied on absolutely for identification without checking them by descriptions.

Bentham 1863, p. 10 of preface

Thus, on searching K for syntypes specimens examined by Gray, one may be confronted with only unnumbered specimens (e.g. as in *Nematopus effusus*), only numbered specimens, or both numbered and unnumbered specimens, for any given name coined by him. Apparent duplicates of such specimens are also to be seen in an array of other herbaria in addition to BM, GH, K and P. These include E, KW (including Turczaninow’s holotypes, which are also isotypes or likely to be isotypes of Gray’s names), MEL (from Drummond’s original herbarium, plus other purchased duplicates), NSW, PERTH, and TCD. I also note that duplicates of gnaphalioid species, other than those acquired from Hooker by Gray, are also in GH, these having come through the purchase of F.W. Klatt’s herbarium of Compositae in 1898. In cases where there are both unnumbered and numbered Drummond specimens of the same taxon and all appearing to have been part of a single gathering, it seems highly likely that, where

all apparent duplicates have the same number, they and the unnumbered ones are all part of the same gathering. However, in such cases, having selected a numbered specimen as a lectotype, both here and in various other papers, I have referred to the likely, but unnumbered, duplicates as “possible” or “probable” isolectotypes; the reverse is the case if the lectotype is an unnumbered specimen.

I examined a number of type specimens from European and North American herbaria prior to their specimens receiving herbarium sheet numbers. With the advent of the JSTOR Plant Science web site (plants.jstor.org) and individual herbarium web sites for E, G, GH, K, NY, P and W, I have been able to add sheet numbers for some of these, this being done up to 12 April 2016. For all other cited specimens it should be assumed that I have seen them unless otherwise indicated by “n.v.”. It should be noted that, in not having institutional access, I have not corrected occasional errors or misinterpretations pertaining to specimen on these websites.

Publication dates

As previously noted (Short 1983, 1995a), in 1851 and 1852 the botanists Asa Gray and Nicolai Turczaninow independently described a suite of new genera and species of Australian Gnaphalieae frequently based on duplicates, or possible duplicates, of specimens collected by James Drummond in Western Australia.

Turczaninow’s descriptions appeared, under the heading “Synanthereae. Quaedam hucusque indescrptae”, in two parts in *Bull. Soc. Imp. Naturalistes Moscou*. The volume and dates, as summarised in Marchant (1990) and Short (1995a) are: Vol. 24 (part 1, number 1), pp. 166–214 (27 March 1851) and Vol. 24 (part 2, number 3), pp. 59–95 (Aug.–Oct. 1851). For discussion of the problems with the determination of publication dates for this journal see Marchant (1990).

The publication dates of Gray’s article entitled “Characters of some Gnaphalioid Compositae of the division Angiantheae” appeared in five parts of *Hooker’s J. Bot. & Kew Gard. Misc.*, the volume and dates of publication gleaned from Stafleu & Cowan (1976–1988) being Vol. 3, pp. 97–102 (April 1851), Vol. 3, pp. 147–153 (May 1851), Vol. 3, pp. 172–178 (June 1851), Vol. 4, pp. 225–232 (Aug. 1852) and Vol. 4, pp. 266–276 (Sep. 1852).

Gray also described several of his species, *Dimorpholepis australis*, *Diotosperma drummondii* and *Scyphocoronis viscosa*, in plates 854–856 of volume 9 of *Hooker’s Icon. Pl.* as well as in *Hooker’s J. Bot. & Kew Gard. Misc.* Stafleu & Cowan (1976–1988) recorded that plates 801–888 were published April–December 1851; Turczaninow published his respective names for these species in August–October 1851. As previously noted (Short 1995a), having examined correspondence between Asa Gray and William Hooker and checked records of publication in *Gardeners Chronicle*, I concluded that it is possible plates 854–856 were not published until late in 1851; Paul Wilson (1992b, citing

Charles Jeffrey) independently stated that plate 856 “appeared between September and November 1851 or possibly later”; this information suggests that Turczaninow’s names have priority over those published by Gray in plates 854–856 of *Hooker’s Icon. Pl.* and is accepted here.

As Bentham (1867a), in volume three of *Flora Australiensis*, dealt with the 24 names coined by each of the aforementioned authors, he too would have assessed the priority of the respective names. He was, perhaps, privy to better documentation of the publication dates of the aforementioned journals and, to assess the likelihood that the dates — or at least the order — of publication as accepted here are correct, I have compared his choice of epithets with those used here (Table 1). For all but six species, the epithet chosen by Bentham is in accord with that accepted here. Of the six exceptions, four were published in *Hooker’s J. Bot. & Kew Gard. Misc.*:

Asteridea multiceps Gray (Sep. 1852): clearly a later name than *Trichostegia asteroides* Turcz. (Aug.–Oct. 1851) and a simple mistake by Bentham as he used Turczaninow’s names for two other pairs of species (*Conanthonium drummondii* A.Gray/*Argyroglottis turbinata* Turcz. and *Acroclinium phyllocephalum* A.Gray/*Helipterum fuscescens* Turcz.) with the same dates of publication.

Antheidosorus gracilis A.Gray (June 1851): treated by Bentham as being earlier than *Gilberta tenuifolia* Turcz. (March 1851) and perhaps reflecting the fact that the generic name *Antheidosorus* was published in April 1851, albeit still a few weeks later than the date accepted here for the publication of Turczaninow’s name.

Cephalosorus phyllocephalus A.Gray (May 1851): treated as being earlier than *Piptostemma carpesioides* Turcz. (March 1851).

Chrysocoryne myosuroides A.Gray (May 1851): treated as being earlier than *Chrysocoryne uniflora* Turcz. (March 1851).

In regard to the acceptance by Bentham of the names *Cephalosorus phyllocephalus* over *Piptostemma carpesioides* and *Chrysocoryne myosuroides* over *Chrysocoryne uniflora* there is another pair of species with these same dates of publication, *Nematopus effusus* A.Gray (May 1851) and *Gnephosis arachnoidea* Turcz. (March 1851). However, in this case, Bentham inconsistently gave Turczaninow’s name priority.

The remaining two exceptions (of the six) were first published in *Hooker’s Icon. Pl.* and Bentham was inconsistent in his choice, giving priority to Gray’s *Dimorpholepis australis* (pl. 856) and *Scyphocoronis viscosa* (pl. 854) but not to *Diotosperma drummondii* (pl. 855) — the middle plate — for which he adopted the name *Ceratogyne obionoides* Turcz.

The general agreement in Bentham’s choice of epithet, and the inconsistencies in choice where they differ, support the order of publication used here.

Turczaninow’s article, “Synanthereae. Quaedam hucusque indescrptae”, was published as a reprint and

pagination differs to that in *Bull. Soc. Imp. Naturalistes Moscou* (Stafleu & Cowan 1976–1988). I only have copies of a few relevant pages and make no further reference to the reprint in this paper.

Order of species' descriptions

Individual accounts of species included in both *Calocephalus* s.lat. and *Gnephosis* s.lat. are ordered alphabetically by name. It helps in finding an account but is also a reflection of the fact that both groups are ill-defined and surely not monophyletic. In contrast, species I place in *Blennospora*, *Calocephalus* s.str. and *Gnephosis* s.str. are ordered by possible relationship, these mostly previously discussed in earlier papers, i.e. for *Blennospora* in Short (1987a), for *Gnephosis* s.str. mostly in Short (1983, under the name *Chrysocoryne*), and for *Trichanthodium* in Short (1990a).

Distribution

I give a brief summation of the distribution of each taxon, but do not provide maps. For distribution I suggest accessing Australia's Virtual Herbarium (chah.gov.au/avh/). Providing specimens are correctly identified maps displayed there should be more up-to-date than anything I can provide as, although my field work substantially added to the number of specimens of some species used to complete this review, I have seen few additional specimens to those I collected or received on loan more than 20 years ago.

Pollen:ovule ratios

Cruden (1977) showed that pollen:ovule ratios are a conservative indicator of breeding systems in flowering plants. That this is the case, has been documented for many species of Australian Asteraceae, e.g. Lawrence (1985), and Short (1981a, 1983, 1985, 1986c, 1987a, b, 1989a, b, 1990a, b, c, 1995a, b, 2000, 2014). While Cruden (1977) and Lawrence (1985) assessed whether the species they examined were self-compatible or self-incompatible, I have usually not had such information. However, the differences in P:O ratios are commonly correlated with an array of morphological differences which are well known to be indicative of differences in breeding systems. For example, in *Millotia*, a genus of 16 species (Short 1995a, b), the ten species deemed to be outcrossers have 5 conspicuous corolla lobes more than 0.35 mm long; style apices which are conspicuously dilated and/or have prominent sweeping hairs; 5 stamens conspicuously exerted at anthesis; anthers with microsporangia c. 0.4–1.1 mm long; and c. 1,100–3,300 pollen grains per floret. The six species deemed to be predominantly selfing inbreeders usually have 3 corolla lobes (or, if 5, then comparatively inconspicuous and less than 0.35 mm long); style apices which are comparatively inconspicuous; stamens which are not conspicuously exerted at anthesis; anthers with microsporangia c. 0.2–0.6 mm long; and c. 60–600 pollen grains per floret. Species of *Millotia*, as are most other species of Australian gnaphalioid taxa for which

I have published P:O ratios have only bisexual florets, which mean that P:O ratios are equivalent to the number of pollen grains per floret. I am aware that more than 30 native genera of Australian Asteraceae — all containing predominantly or only herbaceous, annual species — contain one or more species with low P:O values and associated morphological features which are indicative of a high degree of self-pollination. Just a few species treated here have pollen:ovule ratios of several hundred, including *Notisia intonsa* and the newly-described *Gnephosis newbeyi*.

Specimens examined

Three to five representative specimens are usually cited for each State in which a species occurs. For species, particularly new species, for which there are fewer than about ten collections, I usually cite all specimens examined.

Key to genera (p. 161)

Bayer et al. (2006) presented a key to all genera of the Gnaphalieae. As an aid to their identification, species which are, or have been commonly included in *Calocephalus* and *Gnephosis* by Bentham (1867a) and subsequent workers, are keyed out here, the exceptions being *Calocephalus chrysanthus* Schldl. (now in *Pycnosorus* Benth.), and both *C. globosus* M.B.Scott & Hutch. and *C. gnaphalioides* Hook. in T.Mitch. which were transferred to *Rhodanthe* Lindley by Wilson (1992b). For publication details of these three species see "Excluded Names" (p. 213).

Descriptions, sometimes abbreviated if previously treated in a revision, are usually provided in the taxonomy section. However, three — *Lemooria burkittii* (Benth.) P.S.Short [syn: *Gnephosis burkittii* Benth.; *Angianthus burkittii* (Benth.) J.M.Black]; *Myriocephalus pygmaeus* (A.Gray) P.S.Short [syn: *Gnephosis pygmaea* (A.Gray) Benth.]; and *Stuartina muelleri* Sond. [syn: *Gnephosis rotundifolia* Diels] — are only treated in the following key, but the additional notes in parentheses should enable identification. If not, then appropriate publications dealing with these taxa are included under "Excluded Names" (p. 213).

Table 1. New names applied by Gray and Turczaninow to species whose names were based on specimens (mostly duplicates) collected by James Drummond, compared with names used by Bentham (1863) and those currently accepted. Arranged alphabetically by current names.

Current name	A. Gray	N. Turczaninow	G. Bentham
<i>Actinobole condensatum</i> (A.Gray) P.S.Short, Muellera 4: 413 (1981).	<i>Gnaphalodes condensatum</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 228 (Aug. 1852). Type: "Swan River, <i>Drummond</i> ." Single specimen, Herb.	n/a	<i>Gnaphalodes condensatum</i> A.Gray; Benth., Fl. Austral. 3: 578 (1867).
<i>Actinobole uliginosum</i> (A.Gray) H.Eichler, Taxon 12: 295 (1963).	<i>Gnaphalodes uliginosum</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 228 (Aug. 1852). Type: "Swan River, <i>Drummond</i> ."	n/a	<i>Gnaphalodes uliginosum</i> A.Gray; Benth., Fl. Austral. 3: 578 (1867).
<i>Angianthus pygmaeus</i> (A.Gray) Benth.; P.S.Short, Muellera 5: 175 (1983).	<i>Skirrhophorus pygmaeus</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 148 (May 1851). Type: "South-western Australia, <i>Drummond</i> ."	<i>Skirrhophorus mucronulatus</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 72 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V. n. 59</i> ."	<i>Angianthus pygmaeus</i> (A.Gray) Benth., Fl. Austral. 3: 567 (1867).
<i>Argentipallium tephrodes</i> (Turcz.) Paul G.Wilson, Nuytsia 8: 460 (1992).	n/a	<i>Ozothamnus tephrodes</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 73 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V. n. 385</i> ."	<i>Helichrysum obtusifolium</i> var. <i>tephrodes</i> (Turcz.) Benth., Fl. Austral. 3: 619.
^M <i>Argyroglossis turbinata</i> Turcz.; N.T.Burb., Austral. J. Bot. 6: 233 (1958).	*<i>Conanthonium drummondii</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 273 (Sept. 1852). Type: "South-west Australia, <i>Drummond</i> , 1850."	<i>Argyroglossis turbinata</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 84, t. 1 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. coll. V. n. 63</i> ."	<i>Helichrysum argyroglossis</i> Benth., Fl. Austral. 3: 626 (1867), nom. illeg.
<i>Asteridea asteroides</i> (Turcz.) Kroner, Mitt. Bot. Staatssamml. München 16: 135 (1980).	<i>Asteridea multiceps</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 274 (Sept. 1852). Type: "South-west Australia, <i>Drummond</i> ."	*<i>Trichostegia asteroides</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 81 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. coll. V. n. 66</i> ."	<i>Athrixia multiceps</i> (A.Gray) Benth., Fl. Austral. 3: 599 (1867).
<i>Asteridea gracilis</i> A.Gray; Kroner, Mitt. Bot. Staatssamml. München 16: 136 (1980).	<i>Asteridea gracilis</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 274 (Sept. 1852). Type: "Swan River, <i>Drummond</i> ."	n/a	<i>Athrixia gracilis</i> (A.Gray) Benth., Fl. Austral. 3: 600 (1867).
<i>Asteridea nivea</i> (Steetz) Kroner; Mitt. Bot. Staatssamml. München 16: 138 (1980).	<i>Asteridea stricta</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 275 (Sept. 1852). Type: "Swan River, <i>Drummond</i> ."	n/a	<i>Athrixia stricta</i> (A.Gray) Benth., Fl. Austral. 3: 600 (1867).
<i>Blennospora drummondii</i> A.Gray; P.S.Short, Muellera 6: 355 (1987).	<i>Blennospora drummondii</i> A.Gray, Hook. J. Bot. Kew Gard. Misc. 3: 173 (June 1851). "Swan River, <i>Drummond</i> ."	n/a	<i>Calocephalus drummondii</i> (A.Gray) Benth., Fl. Austral. 3: 574 (1867).
† <i>Calocephalus multiflorus</i> (Turcz.) Benth.	*<i>Achrysum glomeratum</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 229 (Aug. 1852). Type: "Swan River, <i>Drummond</i> ."	<i>Pachysurus multiflorus</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 192 (27 March 1851). Type: "Nova Hollandia. <i>Drum. coll. III. n. 117</i> ."	<i>Calocephalus multiflorus</i> (Turcz.) Benth., Fl. Austral. 3: 576 (1867).
^M <i>Cephalipterum drummondii</i> A.Gray; Paul G.Wilson, Nuytsia 8: 418 (1992).	*<i>Cephalipterum drummondii</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 271 (Sept. 1852). Type: "Variat α , appendicibus radiantibus involucri lacteis; et β , flavidis in sicco subæruginosus. Swan River, <i>Drummond</i> ."	n/a	<i>Cephalipterum drummondii</i> A.Gray; Benth., Fl. Austral. 3: 577 (1867).
^M <i>Cephalosorus carpesioides</i> (Turcz.) P.S.Short, Muellera 5: 183 (1983).	*<i>Cephalosorus phyllocephalus</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 152 (May 1851). Type: "Swan River, <i>Drummond</i> , 1846, 1848." "Ic. Pl. tab. ined."	*<i>Piptostemma carpesioides</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 192 (27 March 1851). Type: Nova Hollandia. <i>Drum. coll. IV. n. 200</i> ."	<i>Angianthus phyllocephalus</i> (A.Gray) Benth., Fl. Austral. 3: 565 (1867).

Current Name	A. Gray	N. Turczaninow	G. Bentham
^M <i>Ceratogyne obionoides</i> Turcz.	*Diotosperma drummondii A.Gray, Hooker's Icon. Pl. 9: t. 855 (late 1851; see Short 1995); Hooker's J. Bot. & Kew Gard. Misc. 4: 276 (Sept. 1852). Type: "South-western Australia, <i>Drummond</i> ." (Given as such in both publications.)	*Ceratogyne obionoides Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 69, t. 1 (Aug.– Oct. 1851). Type: "Nova Hollandia. <i>Drum.</i> <i>coll. V. n. 56</i> ."	<i>Ceratogyne obionoides</i> Turcz.; Benth., Fl. Austral. 3: 555 (1867).
<i>Chrysocephalum semipapposum</i> subsp. <i>occidentale</i> (Benth.) Paul G.Wilson, Nuytsia 27: 71 (2016).	n/a	<i>Chrysocephalum canescens</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 196 (27 March 1851). Type: "Nova Hollandia <i>occidentalis. Gilb. coll. n. 285</i> ."	<i>Helichrysum apiculatum</i> var. <i>occidentalis</i> Benth., Fl. Austral. 3: 625 (1867).
<i>Chrysocephalum semipapposum</i> subsp. <i>occidentale</i> (Benth.) Paul G.Wilson, Nuytsia 27: 71 (2016).	n/a	<i>Chrysocephalum glabratum</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 197 (27 March 1851). Type: "Nova Hollandia. <i>Drum.</i> <i>III. n. 115</i> ."	<i>Helichrysum apiculatum</i> var. <i>occidentalis</i> Benth., Fl. Austral. 3: 625 (1867).
<i>Chthonocephalus pseudevax</i> Steetz; P.S.Short, Muelleria 7: 232 (1990).	<i>Chthonocephalus drummondii</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 178 (June 1851). Type: "Swan River, <i>Drummond</i> ."	n/a	<i>Chthonocephalus pseudevax</i> Steetz; Benth., Fl. Austral. 3: 582 (1867)
^D <i>Dithyrostegia amplexicaulis</i> A.Gray	*Dithyrostegia amplexicaulis A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 100 (April 1851). Type: "South-western Australia, <i>Drummond</i> , 1850." "Ic. Pl. tab. ined."	*Gamozygis flexuosa Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 76, t. 1 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V.</i> <i>n. 57</i> ."	<i>Angianthus amplexicaulis</i> (A.Gray) Benth., Fl. Austral. 3: 568 (1867).
^M <i>Epitriche demissus</i> (A.Gray) P.S.Short, Muelleria 5: 181 (1983).	<i>Skirrhophorus demissus</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 149 (May 1851). Type: "South-western Australia, <i>Drummond</i> ." "Ic. Pl. tab. ined."	*Epitriche cuspidata Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 75 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V.</i> <i>n. 58</i> ."	<i>Angianthus demissus</i> (A.Gray) Benth., Fl. Austral. 3: 567 (1863).
<i>Erymophyllum ramosum</i> (A.Gray) Paul G.Wilson, Nuytsia 7(1): 108 (1989).	<i>Pteropogon ramosus</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 270 (Sept. 1852). (In sect. Helipteroides A.Gray). Type: "Swan River, <i>Drummond</i> ."	n/a	<i>Helipterum tenellum</i> auct. non Turcz.; Benth., Fl. Austral. 3: 646 (1867).
<i>Erymophyllum tenellum</i> (Turcz.) Paul G.Wilson, Nuytsia 7(1): 114 (1989).	<i>Pteropogon gracilis</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 269 (Sept. 1852). (In sect. Helipteroides A.Gray). Type: "Swan River, <i>Drummond</i> ."	<i>Helipterum tenellum</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 198 (27 March 1851). Type: "Nova Hollandia <i>occidentalis. Gilb. n. 272</i> ."	<i>Helipterum gracile</i> (A.Gray) Benth., Fl. Austral. 3: 646 (1867).
^M <i>Gilberta tenuifolia</i> Turcz.; Paul. G.Wilson, Nuytsia 8: 419 (1992).	*Anthediosorus gracilis A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 174 (June 1851). Type: "Swan River. <i>Drummond</i> ." "Ic. Pl. tab. ined."	*Gilberta tenuifolia Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 193 (27 March 1851). Type: "Gilbert <i>coll. n. 277</i> ."	<i>Myriocephalus gracilis</i> (A.Gray) Benth., Fl. Austral. 3: 559 (1867).
<i>Gnaphalium indutum</i> Hook.f. subsp. <i>indutum</i> ; Paul G.Wilson, Nuytsia 18: 292 (2008).	n/a	<i>Gnaphalium sericeum</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 83 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V.</i> <i>n. 392</i> ."	<i>Gnaphalium indutum</i> Hook.f.; Benth., Fl. Austral. 3: 655 (1867).
† <i>Gneposis arachnoidea</i> Turcz.	*Nematopus effusus A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 150 (May 1851). Type: "Swan River, <i>Drummond</i> ."	<i>Gneposis arachnoidea</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 189 (27 March 1851). Type: "Nova Hollandia. <i>Drum.</i> <i>coll. III. n. 120</i> ."	<i>Gneposis arachnoidea</i> Turcz.; Benth., Fl. Austral. 3: 571 (1867).

Current name	A. Gray	N. Turczaninow	G. Bentham
† <i>Gnephosis brevifolia</i> (A.Gray) Benth.	<i>Crossolepis brevifolia</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 175 (June 1851). Type: "S.W. Australia, <i>Drummond</i> , 1850."	<i>Myriocephalus cotuloides</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 73 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V.</i> <i>n. 61.</i> "	<i>Gnephosis brevifolia</i> (A.Gray) Benth., Fl. Austral. 3: 572 (1867).
† <i>Gnephosis brevifolia</i> (A.Gray) Benth.	<i>Crossolepis eriocephala</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 176 (June 1851). Type: "South-western W. Australia, <i>Drummond</i> , 1850."	<i>Myriocephalus villosissimus</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 74 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V.</i> <i>n. 62.</i> "	<i>Gnephosis eriocephala</i> (A.Gray) Benth., Fl. Austral. 3: 573 (1867).
<i>Gnephosis drummondii</i> (A.Gray) P.S.Short, <i>Muelleria</i> 6: 317 (1987)	<i>Chrysocoryne drummondii</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 152 (May 1851). Type: "Swan River, <i>Drummond</i> , 1845."	n/a	<i>Angianthus tenellus</i> (F.Muell.) Benth., Fl. Austral. 3: 564 (1867).
<i>Gnephosis uniflora</i> (Turcz.) P.S.Short, <i>Muelleria</i> 6: 318 (1987).	<i>Chrysocoryne myosuroides</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 152 (May 1851). Type: "Swan River, <i>Drummond</i> . 1845."	<i>Chrysocoryne uniflora</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 188 (27 March 1851). Type: "Nova Hollandia. <i>Drum.</i> <i>coll. III. n. 116.</i> "	<i>Angianthus myosuroides</i> (A.Gray) Benth., Fl. Austral. 3: 563 (1867).
^M <i>Hyalochlamys globifera</i> A.Gray; P.S.Short, <i>Muelleria</i> 5: 203 (1985).	<i>Hyalochlamys globifera</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 101 (April 1851). Type: "Swan River, <i>Drummond</i> ." "Ic. Pl. tab. ined."	n/a	<i>Angianthus globifer</i> (A.Gray) Benth., Fl. Austral. 3: 567 (1867).
<i>Hyalosperma demissum</i> (A.Gray) Paul G.Wilson, <i>Nuytsia</i> 7: 85 (1989).	<i>Pteropogon demissus</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 269 (Sept. 1852). (In sect. <i>Pteropogonopsis</i> A.Gray). "Swan River, <i>Drummond</i> ."	n/a	<i>Helipterum exiguum</i> F.Muell.; Benth., Fl. Austral. 3: 649 (1867).
<i>Hyalosperma pusillum</i> (Turcz.) Paul G.Wilson, <i>Nuytsia</i> 7: 97 (1989).	n/a	<i>Helipterum pusillum</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 77 (Aug.–Oct. 1851). Type: "Cum præcedente <i>Drum.</i> <i>V. n. 384.</i> " [The preceding was <i>H. fuscescens</i> from Nova Hollandia.]	<i>Helipterum cotula</i> (Benth.) DC.; Benth., Fl. Austral. 3: 644 (1867).
<i>Leiocarpa semicalva</i> (F.Muell.) Paul G.Wilson subsp. <i>semicalva</i> ; Paul G.Wilson, <i>Nuytsia</i> 13: 602 (2001).	n/a	<i>Helichrysum ambiguum</i> , Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 195 (27 March 1851), nom. illeg. Type: "Nova Hollandia. <i>Drum.</i> <i>III. n. 121. et IV. n. 220.</i> "	<i>Leptorhynchus ambiguus</i> (Turcz.) Benth., Fl. Austral. 3: 609 (1867).
<i>Millotia major</i> (Turcz.) P.S.Short, <i>Muelleria</i> 7: 246 (1990).	* <i>Scyphocoronis viscosa</i> A.Gray, Hooker's Icon. Pl. 9: t. 854 (late 1851), Hooker's J. Bot. & Kew Gard. Misc. 4: 225 (Aug. 1852).	<i>Toxanthes major</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 64 (Aug.–Oct. 1851) ("Toxanthus"). Type: "Nova Hollandia. <i>Drum.</i> <i>coll. V. n. 53.</i> "	<i>Scyphocoronis viscosa</i> A.Gray; Benth., Fl. Austral. 3: 592 (1867).
<i>Millotia perpusilla</i> (Turcz.) P.S.Short, <i>Muelleria</i> 7: 246 (1990).	* <i>Anthocerastes drummondii</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc.4: 226 (Aug. 1852). Type: "Swan River, <i>Drummond</i> ."	* <i>Toxanthes perpusilla</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 177 (27 March 1851). Type: "Nova Hollandia. <i>Drum.</i> <i>coll. IV. n. 203.</i> "	<i>Toxanthes perpusillus</i> Turcz.; Benth., Fl. austral 3: (1867).
<i>Myriocephalus helichrysoides</i> A.Gray; P.S. Short, <i>Austral.</i> <i>Syst. Bot.</i> 13: 734 (2000).	<i>Myriocephalus helichrysoides</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 175 (June 1851). Type: "Swan River, <i>Drummond</i> ."	n/a	<i>Myriocephalus helichrysoides</i> A.Gray; Benth., Fl. Austral. 3: 559 (1867).
<i>Myriocephalus nudus</i> A.Gray; P.S.Short, <i>Austral. Syst. Bot.</i> 13: 734 (2000).	<i>Myriocephalus nudus</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 174 (June 1851). Type: "Swan River, <i>Drummond</i> ."	n/a	<i>Myriocephalus nudus</i> A.Gray; Benth., Fl. Austral. 3: 558 (1867).

Current Name	A. Gray	N. Turczaninow	G. Bentham
<i>Myriocephalus pygmaeus</i> (A.Gray) P.S.Short in W.R.Elliot & D.L.Jones, Encyc. Austral. Pl. 6: 471 (1993) (as "pygmaea").	<i>Crossolepis pygmaea</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 177 (June 1851). Type: "South-western Australia, Drummond."	* <i>Leptotriche perpusilla</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 73 (Aug.–Oct. 1851). Type: "Nova Hollandia. Drum. coll. V. n. 60."	<i>Gneposis pygmaea</i> (A.Gray) Benth., Fl. Austral. 3: 572 (1867).
<i>Panaetia lessonii</i> Cass., Ann. Sci. Nat. 17: 417 (1829). Cytological (Watanabe et al. 1999) and morphological (e.g. Short et al. 1989) differences plus molecular analyses (Konishi et al. 2000) support reinstatement of <i>Panaetia</i> Cass.	n/a	<i>Podolepis gilbertii</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 195 (27 March 1851). Type: "Nova Hollandia occidentalis. Gilbert coll. n. 269 et 282."	<i>Podolepis lessonii</i> (Cass.) Benth., Fl. Austral. 3: 606 (1867).
<i>Podolepis aristata</i> subsp. <i>auriculata</i> (DC.) Jeanes, Muelleria 33: 41 (2015).	n/a	<i>Podolepis pallida</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 78 (Aug.–Oct. 1851). Type: "Nova Hollandia. Drum. coll. V. n. 387."	<i>Podolepis pallida</i> Turcz.; Benth., Fl. Austral. 3: 605 (1867).
<i>Podotheca gnaphalioides</i> Grah., Bot. Mag. t. 3920 (1842); P.S. Short, Muelleria 7: 48 (1989).	<i>Podotheca pygmaea</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 227 (Aug. 1852). Type: "Swan River, Drummond."	n/a	<i>Podotheca gnaphalioides</i> Grah.; Benth., Fl. Austral. 3: 601 (1867).
<i>Rhodanthe</i> (sect. <i>Achyroclinoideis</i>) <i>corymbosa</i> (A.Gray) Paul G.Wilson, Nuytsia 8: 401 (1992).	<i>Pteropogon corymbosus</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 268 (Sept. 1852). (In sect. <i>Achyroclinoideis</i> A.Gray). Type: "Swan River, Drummond.—Darling Range, South-west Australia, Collie."	n/a	<i>Helipterum corymbosum</i> (A.Gray) Benth., Fl. Austral. 3: 649 (1867).
<i>Rhodanthe</i> (sect. <i>Achyroclinoideis</i>) <i>laevis</i> (A.Gray), Paul G.Wilson, Nuytsia 8: 402 (1992).	<i>Pteropogon laevis</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 402 (Sept. 1852). (In sect. <i>Achyroclinoideis</i> A.Gray). Type: "Swan River, Drummond, 1843."	n/a	<i>Helipterum laeve</i> (A.Gray) Benth., Fl. Austral. 3: 649 (1867).
<i>Rhodanthe</i> (sect. <i>Achyroclinoideis</i>) <i>polycephala</i> (A.Gray) Paul G.Wilson, Nuytsia 8: 404 (1992).	<i>Pteropogon polycephalus</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 268 (Sept. 1852). (In sect. <i>Achyroclinoideis</i> A.Gray). Type: "Swan River, Drummond."	n/a	<i>Helipterum polycephalum</i> (A.Gray) Benth., Fl. Austral. 3: 649 (1867).
<i>Rhodanthe</i> (sect. <i>Citrinae</i>) <i>citrina</i> (Benth.) Paul G.Wilson, Nuytsia 8: 407 (1992).	n/a	<i>Waitzia dasycarpa</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 77 (Aug.–Oct. 1851). Type: "Nova Hollandia. Drum. V. n. 65."	<i>Waitzia steetziana</i> Lehm.; Benth., Fl. Austral. 3: 636 (1867).
<i>Rhodanthe</i> (sect. <i>Helipteridium</i>) <i>heterantha</i> (Turcz.) Paul G. Wilson, Nuytsia 8: 412 (1992).	<i>Helipterum discoideum</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 231 (Aug. 1852). (In sect. <i>Helipteridium</i> A.Gray). Type: "Variat α , involucre pallido; β , involucre sanguineo. Swan River (β , Swan River to King George's Sound), Drummond."	<i>Helipterum heteranthum</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 198 (27 March 1851). Type: "Nova Hollandia. Drum. IV. n. 214."	<i>Helipterum heteranthum</i> Turcz.; Benth., Fl. Austral. 3: 642 (1867).
<i>Rhodanthe</i> (sect. <i>Leiochrysum</i>) <i>chlorocephala</i> (Turcz.) Paul G.Wilson, Nuytsia 8: 386 (1992). [Gray's var. β belongs to subsp. <i>chlorocephala</i> , var. α to subsp. <i>rosea</i> (Hook.) Paul G.Wilson.]	* <i>Acroclinium multicaule</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 271 (Sept. 1852), as to var. β . Type: "Variat α , radiis involucri lacteis; β , radiis involucri flavescens et subæruginosus. Swan River, Drummond."	<i>Schoenia chlorocephala</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 193 (27 March 1851). Type: "Nova Hollandia. Drum. IV. n. 199."	<i>Helipterum chlorocephalum</i> (Turcz.) Benth., Fl. Austral. 3: 641 (1867).

Current name	A. Gray	N. Turczaninow	G. Bentham
<i>Rhodanthe</i> (sect. <i>Leiochrysum</i>) <i>fuscescens</i> (Turcz.) Paul G. Wilson, Nuytsia 8: 394 (1992).	* <i>Acroclinium phyllocephalum</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 271 (Sept. 1852). Type: "South-west Australia, Drummond (received in 1850)."	<i>Helipterum fuscescens</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 80 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V. n. 64.</i> "	<i>Podotheca fuscescens</i> (Turcz.) Benth., Fl. Austral. 3: 602 (1867).
<i>Rhodanthe</i> (sect. <i>Leiochrysum</i>) <i>pygmaea</i> (DC.) Paul G. Wilson, Nuytsia 8: 398 (1992).	<i>Pteropogon drummondii</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 267 (Sept. 1852). (In sect. <i>Facelioides</i> A.Gray). Type: "Swan River, and interior of South-west Australia, Drummond, 1849."	n/a	<i>Helipterum pygmaeum</i> var. <i>occidentale</i> Benth., Fl. Austral. 3: 647 (1867).
<i>Rhodanthe</i> (sect. <i>Leiochrysum</i>) <i>rubella</i> (A.Gray) Paul G. Wilson, Nuytsia 8: 398 (1992).	* <i>Acroclinium rubellum</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 271 (Sept. 1852). Type: "Between Swan River and King George Sound, Drummond."	n/a	<i>Helipterum rubellum</i> (A.Gray) Benth., Fl. Austral. 3: 641 (1867).
<i>Schoenia</i> (<i>Xanthochrysum</i> subgroup) <i>filifolia</i> (Turcz.) Paul G. Wilson, Nuytsia 8: 373 (1992).	<i>Helipterum tenellum</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 231 (Aug. 1852), nom. illeg. non Turcz. (1851). (In sect. <i>Geniosperma</i> A.Gray). Type: "Swan River, Drummond."	* <i>Xanthochrysum filifolium</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 199, t. 4 (27 March 1851). Type: "Nova Hollandia. <i>Drum. III. n. 119.</i> "	<i>Helichrysum filifolium</i> (Turcz.) F.Muell., <i>Fragm.</i> 3: 134 (1863); Benth., Fl. Austral. 3: 617 (1867).
<i>Siloxerus multiflorus</i> Nees; P.S.Short, <i>Austral. Syst. Bot. Soc. Newslett.</i> 78: 6–7 (1994).	* <i>Actinopappus drummondii</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 226 (Aug. 1852). Type: "Swan River, Drummond."	n/a	<i>Rutidosus pumilo</i> Benth., Fl. Austral. 3: 595 (1867).
<i>Siloxerus pygmaeus</i> (A.Gray) P.S.Short, <i>Muelleria</i> 4: 413 (1981).	* <i>Chamaesphaerion pygmaeum</i> A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 177 (June 1851). Type: "South-western Australia, Drummond." "Ic. Pl. tab. ined."	* <i>Gyrostephium rhizocephalum</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 77 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V. n. 55.</i> "	<i>Chthonocephalus pygmaeus</i> (A.Gray) Benth., Fl. Austral. 3: 582 (1867).
^M <i>Triptilodiscus pygmaeus</i> Turcz.	* <i>Dimorpholepis australis</i> A.Gray, Hooker's Icon. Pl. 9: t. 856 (Sept.–Nov. 1851, or later, see Wilson 1992b, Short 1995); Hooker's J. Bot. & Kew Gard. Misc. 4: 227 (Aug. 1852). Type: "South-western Australia, Drummond. Also in the interior of Eastern Australia, at Bathurst Plains, Fraser; and Nangers, Captain McArthur."	* <i>Triptilodiscus pygmaeus</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 66 (Aug.–Oct. 1851). Type: "Nova Hollandia, <i>Drum. coll. V. n. 54.</i> "	<i>Helipterum dimorpholepis</i> Benth., Fl. Austral. 3: 650 (1867), nom. illeg.
<i>Waitzia acuminata</i> Steetz var. <i>acuminata</i> ; Paul G. Wilson, Nuytsia 8: 469 (1992).	n/a	<i>Waitzia discolor</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 194 (27 March 1851). Type: "Nova Hollandia. <i>Drum. coll. IV. n. 198.</i> "	<i>Waitzia corymbosa</i> J.C.Wendl.; Benth., Fl. Austral. 3: 635 (1867).
<i>Waitzia suaveolens</i> (Benth.) Druce var. <i>suaveolens</i> ; Paul G. Wilson, Nuytsia 8: 473 (1992).	n/a	<i>Waitzia odontolepis</i> Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 77 (Aug.–Oct. 1851). Type: "Nova Hollandia. <i>Drum. V. n. 382.</i> "	<i>Waitzia nivea</i> (Lindl.) Benth., Fl. Austral. 3: 636 (1867).

Underlined names being those used by Bentham and at variance with Gray's and/or Turczaninow's generic names.

* Indicates that the generic name as well as the specific epithet was new to science.

† Indicates that, although accepted here, the author believes that the species is likely to be ultimately placed in another genus.

Generic names in **bold italic** in both the 'A. Gray' and 'N. Turczaninow' columns indicate that it was a new name proposed by that author. In the 'Current name' column it indicates which of those names, if any, is currently accepted.

A superscript **M** or **D** in the 'Current names' column indicates that the genus is monotypic (**M**) or ditypic (**D**).



Fig. 1. **A** *Blennospora drummondii*, granite outcrop, Salmon Gum to Peak Charles road, W.A. (*P.S. Short* 2733); **B** *B. phlegmatocarpa*, near Hines Hill, W.A. (*P.S. Short* 4447 *et al.*). **C–E** *Calocephalus* s.lat.: **C** *C. knappii*, Yannarie River crossing, North West Coastal Hwy, W.A. (*P.S. Short* 4306); **D** *C. multiflorus*, c. 31 km N of Mt Magnet, W.A. (*P.S. Short* 4212); **E** *C. platycephalus*, Finke River gorge between Palm Valley and Hermannsburg, N.T. (*P.S. Short* 3140). **F** *Trichanthodium skirrophorum*, 36 km W of Mundrabilla, W.A. (*P.S. Short* 3906). — Photos: **A** B.A. Fuhrer; **B–F** P.S. Short.



Fig. 2. A–C *Gnephosis* s.str.: A *G. cassiniana*, c. 10 km W of Pindar, W.A. (P.S. Short 2881 et al.); B *G. tridens* (tall narrow plant) & *G. multiflora*, salt lake adjacent to Wave Rock, W.A. (P.S. Short 4530 & 4531 et al.); C *G. trifida*, 5 km S of Morowa, W.A. (P.S. Short 2971 et al.). D *Gnephosis* s.lat.: *G. setifera*, c. 7 km S of Bunjil (P.S. Short 2955 et al.). E *Lemooria burkittii*, 26 km S of Leonora, W.A. (P.S. Short 4390). F *Myriocephalus pygmaeus*, c. 31 km N of Mt Magnet, W.A. (P.S. Short 4215). — Photos: A, C, D B.A. Fuhrer; B, E, F P.S. Short.

Key to genera which have been or are included in *Calocephalus* s.lat. and *Gnephosis* s.lat. (see notes on p. 153)

1. Florets with a pappus of bristle or bristle-like elements
 2. Capitula solitary or few in terminal clusters, capitular bracts generally visible in all capitula *Gilruthia* (p. 187)
 - 2: Capitula in compound heads, with perhaps the exception of outer capitula the capitular bracts substantially hidden
 3. Coastal shrub with at least the upper leaves small and appressed, branches and leaves with a dense white to silvery tomentum, compound heads generally somewhat whitish in appearance except for the yellowish exposed florets (at least eastern Australian specimens commonly intricately branched and cushion-like; southern mainland Australia and Tas.) *Leucophyta* (p. 207)
 - 3: Non-coastal shrub, annual or perennial herbs or if shrub-like not with short, appressed upper leaves
 4. Leaves mostly opposite (perennial herbs; cypselas base stipe-like, lacking an annular carpopodium) *Calocephalus* s.str. (p. 166)
 - 4: Leaves only or mostly alternate (2 or 4 lowermost leaves may be paired); cypselas base with or lacking an annular carpopodium
 5. Receptacular bracts present, forming a central column of c. 5 bracts *Balladonia* (p. 162)
 - 5: Receptacular bracts absent
 6. Cypselas not enveloped in a layer of mucilaginous cells, rarely appearing glabrous, scattered to dense, and often myxogenic, hairs usually present; annual or perennial herbs *Calocephalus* s.lat. (p. 169)
 - 6: Cypselas enveloped in a layer of myxogenic cells (appearing glabrous); annual herbs
 7. Florets 1–3; capitular bracts lacking a distinctly demarcated terminal lamina (W.A., S.A., Vic.) *Blennospora* (p. 164)
 - 7: Florets c. 8–16; capitular bracts with a distinct claw and terminal lamina (W.A.) *Calocephalus* s.lat. (p.p., *C. multiflorus* only) (p. 180)
 - 1: Florets lacking a pappus or the pappus cup-like, or if with bristles or bristle-like elements then either a single bristle present (as in *Myriocephalus pygmaeus*, syn. *Gnephosis pygmaea*) or plants glabrous with flexuose stems (*G. acicularis*) or branches and leaves with scale-like hairs or/and each capitulum with a single capitulum-subtending bract, which is morphologically manifestly different from the upper leaves and the capitular bracts (forms of *G. tenuissima*)
 8. Capitula loosely crowded towards the end of major axes but remaining distinct and not forming a compound head (the outer involucre bracts of all capitula readily visible); capitula heterogamous, florets female and male (W.A.) *Notisia* (p. 210)
 - 8: Capitula not distinct, forming a compound head (the outer involucre bracts of inner capitula substantially hidden and not visible without dissection of the compound head); capitula usually homogamous (florets all bisexual), only heterogamous in *Stuartina*
 9. Capitular bracts with the inner 2 or 3 with rigid, recurved apices [annual herb with prostrate or weakly erect branches 3–30 cm long; leaves spatulate; capitula heterogamous, with outer filiform florets and bisexual disc florets] (W.A., S.A., Qld, N.S.W., A.C.T., Vic.) *Stuartina muelleri* (syn.: *Gnephosis rotundifolia*)
 - 9: Capitular bracts not with rigid recurved apices; capitula homogamous
 10. Branches and leaves beset with stiff, erect bristles (south-western W.A., probably confined to Monger Drainage System) *Gnephosis* s.lat. (p.p., *G. setifera* only) (p. 207)
 - 10: Branches and leaves glabrous or variably hairy but lacking bristles
 11. Plants usually with scale-like glandular hairs on major axes and leaves, if absent (*G. cassiniana*) or seemingly so then each capitulum subtended by a single broad bract, the bract manifestly different in morphology from the capitular bracts; compound heads in some species narrowly oblong to cylindrical *Gnephosis* s.str. (p. 189)
 - 11: Plants lacking scale-like glandular hairs on major axes and leaves; capitulum-subtending bract absent or if 1 or more present then not manifestly differing from outer capitular bracts; compound heads never cylindrical
 12. Cypselas narrowly ellipsoid or narrowly cylindrical, with scattered, non-myxogenic, straight twin hairs and an annular carpopodium; pappus a single bristle or rarely absent [plants consisting of a single compound head and appearing stemless or with prostrate to ascending major axes; leaves linear or subterete; compound heads with a well-developed involucre; florets (1) 2–4 (6) per capitulum; corolla 3- or 4-lobed] (W.A.) *Myriocephalus pygmaeus* (syn. *Gnephosis pygmaea*)
 - 12: Cypselas and pappus (if present) not as above
 13. Branches prostrate, wiry, reddish and each terminating in a compound head with a general involucre of 12–18 densely lanate bracts, these bracts basally with wing-like, hyaline margins; florets 1 or 2; pappus of 8–12 subplumose bristles about ½ the length of the corolla tube (semi-arid and arid regions of W.A., S.A., Qld, N.S.W., Vic.) *Lemooria burkittii* (syn.: *Gnephosis burkittii*)
 - 13: Not with the above combination of characters
 14. Capitula at least 2-flowered *Gnephosis* s.lat. (p. 195)
 - 14: Capitula 1-flowered
 15. Cypselas with a layer of myxogenic cells covering the entire surface, lacking hairs (W.A., N.T., S.A., Qld, N.S.W., Vic.) *Trichanthodium* (p. 211)
 - 15: Cypselas with eglandular hairs *Gnephosis* s.lat. (p. 195)

Taxonomy

Balladonia P.S.Short, *gen. nov.*

Type: *B. aervooides* (F.Muell.) P.S.Short

Annual *herbs*, each major branch terminating in 1–several compound heads, all branches with long, septate hairs, the lower part of the hairs flat and c. 0.1 mm wide, the upper half flagellate. *Leaves* alternate, the lower ones always or often with petiole-like bases (and manifestly so in *B. aervooides*) but the uppermost commonly lacking them, lamina entire, with an indumentum of septate hairs resembling those of the major axes. *Compound heads* with or without a conspicuous involucre of leaf-like bracts. *Capitula* 5–40 per compound head, homogamous. *Capitular bracts* in 2 rows, not differentiated into a distinct claw and terminal lamina; some outer bracts may be foliaceous with narrow hyaline margins (*B. aervooides*), otherwise bracts essentially hyaline except for the midrib; outer bracts with long, intertwined hairs mainly extending from the margins; inner bracts glabrous or sparsely hairy. *Receptacular bracts* present, the c. 5 bracts are joined at least at the base and form a central column, with 5 florets peripheral to the column, and one in the centre of the column, the bracts each with a dense vestiture of long, intertwined hairs at the apex. *Florets* 6, bisexual, yellowish. *Corolla* 5-lobed; lobes with slightly thickened margins and (perhaps not in all lobes) densely papillate on c. the lower 1/3 of the inner surface; inner epidermal cells of lobes with straight to undulate walls, cells of the tube tending to be longer or much longer and their walls straight to undulate; vascular strands in the tube 5, each not extending to a sinus between two lobes. *Stamens* 5; anthers not or barely caudate; apical appendages somewhat triangular; filament collar more or less straight in outline or gradually and slightly dilating along its length towards the base. *Style* with 2 distinct vascular traces from the base, a small nectary present at the base, apices penicillate. *Cypselas* monomorphic, obovoid or somewhat subtriquetrous, papillate, the papillae being subglobose, myxogenic twin hairs, a dense aggregation of large, somewhat rectangular crystals at and about the apex visible in cleared fruit; pericarp with 2 vascular bundles; carpopodium annular, whitish. *Pappus* of scale-like, white bristles joined at the base and c. 1/2 the length of the corolla tube, each bristle with long, intertwined marginal hairs. *Chromosome numbers*: unknown.

Distribution. A ditypic genus, with both species endemic to Western Australia.

Etymology. The name is derived from the locality, Balladonia Homestead, from which the type of *B. multiceps* was collected.

Notes. As previously indicated (Short 1990b) *Calocephalus aervooides* and *Chthonocephalus multiceps* J.H. Willis should be referred to a separate genus. The most distinctive, and unique, feature is the united column of

receptacular bracts at the centre of the receptacle. Five florets are arranged peripherally, another is located in the centre of the column.

At least the lowermost leaves of both species are described here as having petiole-like bases rather than being petiolate, the midrib always having at least a narrow wing and dilating near the base. Thus, I consider them to be sessile, as is usual in the tribe.

Key to species of *Balladonia*

1. Major axes ascending to erect; compound heads usually several together in an elongate spike, subtending leaf-like bracts absent or only 1 or 2 present **1. *B. aervooides***
- 1: Major axes prostrate; compound heads surrounded by 5 or 6 leaf-like bracts **2. *B. multiceps***

1. *Balladonia aervooides* (F.Muell.) P.S.Short, *comb. nov.*

Pachysurus aervooides F.Muell., Fragm. 3: 154 (1863) (basionym). — *Calocephalus aervooides* (F.Muell.) Benth., Fl. Austral. 3: 576 (1867) (“*aervooides*”); Grieve & Blackall, How Know W. Austral. Wildfl. 823 (1975) (“*aervooides*”). — *Leucophyta aervooides* (F.Muell.) Kuntze, Revis. Gen. Pl. 1: 352 (1891) (“*aeruooides*”). — **Type citation:** “Ad portum Gregorii. A. Oldfield.” **Lectotype (here designated):** Port Gregory, A. Oldfield (MEL 543268). **Isotype:** PERTH. **Probable isotype:** K 000901839. (See notes below).

Annual *herb*, major branches ascending to erect, 4–36 cm long and terminating in 1–several compound heads. *Leaves* with often petiole-like bases but the uppermost often sessile, crisped, lamina of the smaller ones often elliptic or ovate, of the largest irregularly ovate or rhomboid, total leaf 3.5–60 mm long, 1.4–40 mm wide, indumentum sparse to dense. *Compound heads* very broadly to depressed ovoid, 4–7 mm long, 5–7 mm diam., often 2–5 loosely arranged in a spike; general involucre absent or sometimes with 1 or 2 (?several) leaf-like bracts at the base, usually much shorter than the compound heads. *Capitula* c. 7–10. *Capitular bracts* with the outer ones oblanceolate, 1.7–2 mm long, 0.4–0.6 mm wide, mainly foliaceous but with narrow hyaline margins, or mainly hyaline, always with long, intertwined hairs mainly extending from the margins; inner bracts obovate, 2.4–2.7 mm long, 1.1–1.4 mm wide, mainly hyaline, glabrous or sparsely hairy. *Corolla* with the lobes with slightly thickened margins and (perhaps not in all lobes) densely papillate on c. the lower 1/3 of the inner surface; tube 1.25–1.9 mm long; inner epidermal cells of lobes with straight to undulate walls, cells of the tube tending to be longer and their walls straight to undulate; vascular tissue not extending to the base of the lobes. *Stamens* 5; anthers c. 0.9 mm long, microsporangia c. 0.65–0.7 mm long, apical appendages somewhat triangular, c. 0.19–0.25 mm long, tail absent; filament collar c. 0.1 mm long, gradually dilating along its length towards the base. *Cypselas* obovoid, 0.8–1 mm long, 0.5–0.6 mm diam., body dark brown, minutely papillate; carpopodium 0.06–0.1 mm long. *Pappus* of c. 12 scale-like bristles.

Distribution. Apart from the type collection, gathered in the vicinity of Port Gregory, the species is not known from the mainland. Other collections have been gathered from Dorre Island and islands that comprise Houtman Abrolhos.

Habitat. Collectors' notes record little, if any, information on the habitat of this species but it has been noted as growing in calcareous sand or sandy loam.

Phenology & reproductive biology. Recorded flowering from about mid-August to early October.

A pollen:ovule ratio of 3,380 was determined for a single floret removed from *A.S. Weston 10463*, from Dorre Island.

Typification. The MEL type specimen of *Pachysurus aervoides* is a sheet containing two elements, one being a large part of a plant with the main root attached, the other a smallish branch which, as indicated by scarring near the base, was removed from the larger element. The sheet also has three labels, one in ink with "Pt. Gregory/W.A./Oldf.", another in pencil with "416/Moist places near Yanginooka (South)", while the third is a blue "Botanical Museum of Melbourne" label giving the name of the species but no locality; all three labels are mounted in a line along the right-hand side of the sheet. A sheet at K also contains two elements and again there is reference to both Yanginooka (South) and Port Gregory, while on the original MEL label accompanying the fragmentary PERTH collection the locality is merely recorded as Pt Gregory. I have no doubt that all elements are of syntype material seen by Mueller when naming *Pachysurus aervoides* and that all are of the one taxon. I am also of the opinion that they are likely to be from the one gathering, with Yanginooka (South) being the actual locality from which the specimen was collected but, as it was nearby and a location with which readers were likely to be familiar, the place name Port Gregory was cited in the protologue. I am inclined to this view because similar discrepancies between label data and the locality cited in publication are not unusual in the case of names published by Mueller. However, although I believe the two elements on the MEL specimen are from the one plant there must be some doubt, however minor, that the K specimen is from the same gathering. I have therefore chosen the MEL specimen as the lectotype of the name *P. aervoides*, regard the PERTH specimen as an isolectotype, and consider the K specimen to be a probable isolectotype.

Notes. Outer capitula in some compound heads may have a poorly developed column of receptacular bracts and fewer than six florets.

There is considerable variation in habit and leaf size in this species, e.g. the lectotype specimen and those gathered from Dorre Island are much more robust than those from the Houtman Abrolhos. Habitat notes are generally lacking from labels but I suspect that

environmental factors, such as the degree of exposure to wind, account for most of the variation.

Anthers in this species appear to lack tails whereas in *B. multiceps* they are present, albeit very fine and quite short (c. 0.15 mm long). However, with only several florets examined for both species this observation may prove unreliable.

Additional specimens examined.

WESTERN AUSTRALIA: East Wallabi Is., 3 Oct. 1987, *J.J. Alford 657* (PERTH); West Wallabi Is., Sep. 1959, *M. Gilham Herb. 2935* (PERTH); North Is., Houtmans Abrolhos, Sep. 1959, *M. Gilham* (PERTH); North Is., Houtman Abrolhos, *M. Gilham Herb. 2186* (PERTH); White Beach, Dorre Island, 6 Oct. 1975, *K.F. Kenneally 4612* (PERTH); West Wallabi Is., Sep. 1959, *G.M. Storr Herb. 3529* (PERTH); East Wallabi Is., 8 Oct. 1969, *G.M. Storr Herb. 3587* (PERTH); White Beach, Dorre Is., 13 Aug. 1977, *A.S. Weston 10463* (PERTH).

2. *Balladonia multiceps* (J.H. Willis) P.S. Short, *comb. nov.*

Chthonocephalus multiceps J.H. Willis, Proc. Roy. Soc. Queensl. 62: 105, pl. 7, figs 25–33 (1952), basionym. — **Type citation:** "... Balladonia Homestead, 128 miles east of Norseman, on sandy soil against large granite slabs, with ephemeral *Helipterum* spp., etc., 31st August, 1947, *J.H. Willis*, Grimwade Expedition. (HOLOTYPE in MEL, PARATYPE in PERTH, CLASTOTYPE in BRI)." **Holotype:** MEL 542225. **Isotypes:** BRI AQ0332363, NSW 587970, ?PERTH (see note below).

Annual *herb* with prostrate major branches to c. 15 cm long and terminating in 1 or 2 compound heads. *Leaves* with the lower ones often shortly petiolate, the upper ones sessile, all entire, spatulate or oblanceolate, 10–32 mm long, 3–9 mm wide, indumentum sparse to dense. *Compound heads* broadly to broadly depressed ovoid, 4.5–7.5 mm long, 5.5–9 mm diam., usually terminal on well-developed axes but usually one almost sessile and immediately above the root; general involucre of c. 5 or 6 leaf-like bracts c. 2/3 to twice the length of the heads. *Capitula* c. 5–40. *Capitular bracts* mainly hyaline except for a prominent, opaque midrib extending for c. 2/3 the length; outer bracts c. 6, oblanceolate, 2.2–2.7 mm long, 0.4–0.8 mm wide, with long intertwined hairs mainly extending from the margins; inner bracts c. 6, obovate, 2.2–2.5 mm long, 1–1.2 mm wide, glabrous or sparsely hairy. *Corolla* with the lobes with slightly thick margins and (perhaps not in all lobes) densely papillate on c. the lower 1/3 of the inner surface; tube 1.25–1.9 mm long; inner epidermal cells of lobes with straight to undulate walls, cells of the tube much longer and with undulate walls; vascular tissue not or barely extending to the base of the lobes. *Stamens* 5; anthers 0.8–0.88 mm long, microsporangia 0.67–0.7 mm long, apical appendages somewhat triangular, 0.17–0.21 mm long, tail c. 0.15 mm long; filament collar 0.15–0.2 mm long, more or less straight in outline or gradually and slightly dilating along its length towards the base. *Cypselas* obovoid and sometimes somewhat subtriquetrous (but if so, perhaps infertile), 0.8–0.9 mm long, c. 0.3–0.4 mm diam., body darkish grey or greyish purple,

densely papillose; carpopodium 0.06–0.08 mm long, c. 5 or 6 cells high. *Pappus* of c. 9 or 10 scale-like bristles.

Distribution. Western Australia, from Balladonia to Cape Arid.

Habitat. I have not seen this species in the field. The few collectors' notes regarding its habitat indicate an association with granite, i.e. "*Eucalyptus occidentalis* woodland, edges granitic sheet, surface calcareous loam, subsurface granite" and "granitic loamy sand".

Phenology & reproductive biology. Recorded flowering in September/October.

A pollen:ovule ratio of 2,418 was determined for a single floret removed from *P.G. Wilson 2880*, from c. 100 km S of Balladonia.

Typification. In his original description Willis indicated that there is a "paratype" in PERTH and a "clastotype in BRI". I have no record of having seen the former specimen but may have done when revising *Chthonocephalus* (Short 1990b). Note that from the protologue it is apparent that specimens referred to as being a clastotype and a paratype are from the same gathering as the holotype specimen and are therefore the equivalent of isotypes. Taxonomists such as Willis (e.g. 1952) and Davis (1948) adopted a different terminology to that in current use, following, for example, Davis & Lee (1944) and references therein. For them, once the holotype was selected a paratype would be another plant from the original gathering; a clastotype was probably a piece removed from the holotype specimen.

Note. Willis (*J.H. Willis*: CANB 136758, MEL 85303, PERTH) recorded that the plant has "pleasantly fragrant flower heads — spicy-aromatic with caramel ("burnt sugar") overtones".

Additional specimens examined.

WESTERN AUSTRALIA: Junana Rock, Cape Arid N.P., 28 Oct. 1989, *G.J. Keighery 11889* (PERTH); 21 km ESE of Boingaring Rocks, 11 Sep. 1980, *K. Newbey 7287* (PERTH); Balladonia, 6 Sep. 1963, *J.H. Willis* (CANB 136758, MEL 85303, PERTH); c. 100 km S of Balladonia, 10 Sep. 1964, *P.G. Wilson 2880* (AD).

Blennospora A.Gray

Hook. J. Bot. & Kew Gard. Misc. 3: 98, 172 (1851); P.S. Short, *Muelleria* 6: 349–358 (1987); A. Anderb., *Opera Bot.* 104: 130 (1991); P.S. Short in N.G. Walsh & Entwisle, *Fl. Victoria* 4: 809 (1999); Keighery, *Nuytsia* 15: 33–36 (2002); R.J. Bayer et al. in Kadereit & C. Jeffrey (eds), *Fam. Gen. Vasc. Pl.* 8: 258 (2006). — **Type:** *B. drummondii* A.Gray

[*Calocephalus* auct. non. R.Br. (1817): Benth., *Fl. Austral.* 3: 573 (1867); various State floras.]

Annual *herbs*, cottony. *Leaves* with at least the lowest pair(s) opposite, the upper and often most alternate but at least in *B. doliiformis* probably all opposite, all leaves sessile, entire, erect, mucronate, cottony, uppermost often with hyaline apices. *Compound heads* with a general involucre, the bracts leaf-like or

hyaline except for the midrib and somewhat flat or curved, *not* forming a claw with a distinct terminal lamina; general receptacle with shortly pedunculate capitula scattered along a single hairy axis. *Capitula* (2) 5–30 per compound head. *Capitular bracts* in 2 or 3 somewhat distinct rows, mostly hyaline except for an opaque midrib extending most of its length and not forming a manifestly, morphologically distinct claw and terminal lamina; mid to upper margins shortly ciliate or with long hairs; bracts commonly united by tangled long hairs. *Florets* 1–3, bisexual; corolla tubular, (4) 5-lobed, tube yellow, lobes yellow or purplish black. *Style branches* truncate, with short sweeping hairs. *Stamens* (4) 5; anthers with a sterile, narrowly triangular apical appendage; microsporangia tailed, endothelial tissue polarized; filament collar straight in outline and composed of uniform cells, basally not thicker than the filament. *Cypselas* monomorphic, obovoid, brown; pericarp with mucilaginous cells covering the surface, vascular bundles 2; carpopodium annular. *Pappus* of multiseriate, unequal, flexible, irregularly long-ciliate bristles joined at the base, longest elements about the length of the corolla tube. *Chromosome number:* $2n = 22$.

Distribution. Southern mainland Australia, with all three species in W.A. and only *B. drummondii* extending to the eastern States.

Reproductive biology. High pollen:ovule ratios, and showy, strong-smelling florets suggest that *B. phlegmatocarpa* has a high degree of cross-pollination while the low pollen:ovule ratios and less showy, not obviously scented florets of *B. doliiformis* and *B. drummondii* are indicative of them having high levels of self-pollination and being self-compatible.

Etymology. From the Greek *blennos* (mucilage or slime) and *spora* (seed), in reference to the single-seeded fruit with a pericarp composed of a layer of cells which become mucilaginous on wetting. With the transfer of *Calocephalus phlegmatocarpus* to *Blennospora*, both the generic name and the specific epithet of the resulting binomial have the same meaning, the epithet derived from the Greek prefix *phlegmato-*, meaning mucus, while *carpos* is the Greek word for fruit.

Notes. Short (1987a) recognised two species, *B. drummondii* and *B. phlegmatocarpa*, with Keighery (2002) subsequently describing a new species, *B. doliiformis*, of which the earliest herbarium specimen was apparently collected in November 1987.

Key to the species of *Blennospora*

1. Corolla lobes purplish black (W.A., S.A., Vic.) **3. *B. drummondii***
- 1: Corolla lobes yellow (but may dry brown) (W.A. only)
 2. Compound heads barrel-shaped; flowers not obviously aromatic; leaves probably opposite throughout **2. *B. doliiformis***
 - 2: Compound heads ellipsoid to broadly ellipsoid or ovoid to broadly ovoid; flowers manifestly aromatic; leaves variably opposite or alternate . . . **1. *B. phlegmatocarpa***

1. *Blennospora phlegmatocarpa* (Diels) P.S.Short

Muelleria 4: 413 (1981); P.S.Short, Muelleria 6: 354 (1987, fig. 2.). — *Calocephalus phlegmatocarpus* Diels, Bot. Jarb. 35: 614, fig. 69 o–u (1905). — **Type citation:** “Hab. in distr. Avon pr. Wyola in lutosus gregaria flor. m. Oct. (D. 5020).” **Lectotype:** Wyola, W.A., 24 Oct. 1901, L. Diels 5020 (MEL 543205) (Short 1987a, p. 354). **Probable isolectotype:** East of York, L. Diels (PERTH 04370678).

Calocephalus stowardii S.Moore, J. Linn. Soc., Bot. 45: 182 (1920). — **Type citation:** “Cowcowing; Stoward, 485.” **Lectotype:** Cowcowing, W.A., 1916, F. Stoward 485 (BM 000810544) (Short 1987a, p. 355).

Ascending to erect *herb* to 10 cm tall. *Leaves* opposite to alternate, semi-terete to terete or linear to narrowly oblanceolate, often somewhat succulent, erect, 5–27 mm long, 0.5–1.5 mm wide, mucronate, cottony, the uppermost ones with hyaline apices and merging in appearance with the bracts of the general involucre. *Compound head* ellipsoid to broadly ellipsoid or ovoid to broadly ovoid, 6–10 mm long, 4.5–10 mm diam.; general involucral bracts leaf-like or somewhat resembling the capitular bracts. *Capitula* c. 5–20 per compound head. *Outer capitular bracts* obovate to oblanceolate or elliptic, 1.7–3.2 mm long, 0.4–1.7 mm wide, flat to conduplicate, outer surface often with long hairs at or about the apex of the midrib, bracts united by long hairs along the mid and upper hyaline margins. *Inner capitular bracts* elliptic or ovate, 2.3–2.8 mm long, 1–1.5 mm wide, flat to conduplicate, outer surface with long hairs at or about the apex of the midrib, margins entire or with long hairs which usually unite the bracts. *Florets* 1–3 per capitulum; corolla tube 5-lobed, lobes yellow. *Stamens* 5; anthers 0.9–1.33 mm long. *Cypselas* 0.9–1.1 mm long. *Pappus bristles* 6–10. *Chromosome number:* $2n = 22$. **Fig. 1B.**

Distribution. Common in south-western Western Australia.

Habitat. Mostly found on saline, often sandy soils on the margins of salt lakes and commonly associated with *Atriplex*, *Disphyma* and *Tecticornia*. A few collections have been made from apparently non-saline soils in *Eucalyptus* woodland.

Phenology and reproductive biology. Flowering & fruiting from about September to December.

Compound heads are showy and have a strong aroma, and pollen:ovule ratios ranging from 2,525 to 6,119 have been recorded (Short 1981a, b, 1987a).

Cytology. Short (1981b, 1987a) recorded $2n = 22$ for a population (*P.S. Short 633*) on the southern margins of Lake Brown, W.A.

Notes. When flowering, plants have a strong, almost putrid, odour. It is a feature evident in herbarium specimens at least 30 years old, not just fresh specimens, and readily distinguishes this species from its congeners.

Selected specimens examined.

WESTERN AUSTRALIA: W side of Lake Gounter, 10 Nov. 1978, R.J. Chinnock 4339 (AD, MEL); Mortlock River flats, 22 Oct. 1945, C.A. Gardner (PERTH 494879); Kevills Lake, 11 Nov. 1983, L. Haegi 2639 (MEL); salt flats at Hines Hill, 21 Sep. 1977, P.S. Short 619 (AD); S margins of Lake Brown, 22 Sep. 1977, P.S. Short 633 (AD); S edge of Lake Varley, 11 Sep. 1982, P.S. Short 1694 (MEL).

2. *Blennospora doliiformis* Keighery

Nuytsia 15: 33 (2002). — **Type citation:** “Ruabon Nature Reserve, 33°39'S, 115°30'E, Western Australia, 3 November 1993, G.J. Keighery 12931 (*holo.*: PERTH 00363369).”

Erect *herb* to 15 cm tall; stem usually simple with 1 or 2 branches at upper nodes; cottony but becoming glabrous. *Leaves* opposite (perhaps with the exception of the uppermost 1 or 2 leaves), erect, semi-terete to terete, linear, often soft and somewhat succulent, erect, 5–15 mm long, 0.5–0.8 mm wide, mucronate, cottony, the uppermost leaves never overtopping flowering compound heads (rarely one almost level). *Compound heads* barrel-shaped, flat at summit, 6–9 mm long, 4–6 mm diam.; general involucral bracts with 1–several somewhat leaf-like but mostly pale brown, hyaline except for the midrib, at least part of their margins commonly with long hairs. *Outer capitular bracts* hyaline, somewhat elliptic to narrowly elliptic, 2–3.5 mm long, 0.5–1.1 mm wide, almost flat to conduplicate, outer surface with long hairs at or about the apex of the midrib, bracts united by long hairs along the upper margins; inner bracts elliptic or obovate, 3.8–4.5 mm long, 1.6–2.2 mm wide, outer surface with long hairs at or about the apex of the midrib, with long hairs on the upper margins. *Florets* (1) 2 (3?) per capitulum; corolla tube 4- or 5-lobed, golden yellow (drying brown). *Stamens* 5; anthers 0.49–0.75 mm long; microsporangia 0.3–0.5 mm long; terminal appendage 0.21–0.28 mm long. *Cypselas* obovoid, 1.35–1.6 mm long, 0.8–1.0 mm diam., dark brown. *Pappus bristles* 5–8. *Chromosome number:* unknown.

Distribution. South-western Western Australia; Gingin to Busselton on the Swan Coastal Plain and on the Scott Coastal Plain.

Habitat. Found on clay soils under *Melaleuca cuticularis* low woodland, in *Melaleuca uncinata*/*M. viminea* shrubland, *Banksia (Dryandra) squarrosa* shrubland, and in lateritic heath.

Phenology and reproductive biology. Flowers in October–November, mature fruit c. December to March.

Compound heads are not particularly showy, lack any recorded aroma, and have 4- or 5-lobed florets. Florets sometimes have only four anthers and anthers have microsporangia only 0.3–0.5 mm long. Pollen:ovule ratios determined for seven individual florets (taken from two compound heads) of G.J. Keighery 2433, collected from near Capel, W.A., ranged from just 272 to 480 ($\bar{x} = 363.1$; s.d. = 68.77; s.e. = 28.076).

Notes. Probably most likely to be confused with *B. drummondii*, the visible corolla lobes drying brown and in general appearance the plants reminiscent in habit of that species, and some W.A. specimens determined as *B. drummondii* prior to 2002 being *B. doliiformis*. The presence of probably totally opposite leaves, the flat-topped, barrel-shaped compound heads, and the yellow florets readily distinguish it from that species.

Selected specimens examined.

WESTERN AUSTRALIA: Fish Road Nature Res., 14 Oct. 1992, B.J. Keighery & N. Gibson 010 (PERTH); Austin Bay Nature Res., 29 Oct. 1993, B.J. Keighery & N. Gibson 021 (PERTH); Lake Muckinburra Res., 27 Oct. 1993, B.J. Keighery & N. Gibson 026 (PERTH); c. 5 km E of Ludlow, 5 March 2001, G.J. Keighery 16076 (PERTH); Scott N.P., 34° 17'S, 115° 15'E, 1 Nov. 1990, C.J. Robinson 300 (PERTH).

3. *Blennospora drummondii* A.Gray

Hook. J. Bot. & Kew Gard. Misc. 3: 173 (1851); P.S.Short, *Muelleria* 6: 355 (1987). — *Calocephalus drummondii* (A.Gray) Benth., Fl. Austral. 3: 574 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 821 (1975); P.S.Short in N.G.Walsh & Entwisle, Fl. Victoria 4: 809, fig. 162c (1999); Corrick & Fuhrer, Wildfl. Victoria, pl. 38 (2000). — *Leucophyta drummondii* (A.Gray) Kuntze, Revis. Gen. Pl. 1: 352 (1891). — **Type citation:** “Swan River, Drummond.” **Lectotype:** Swan River, *J. Drummond* (K 000901825) (Short 1987a, p. 356). **Probable isolectotypes:** *J. Drummond* 359 (BM 000810545; G 00222878; GH (A 00004250, ex BM); MEL 543273; P 00715973, annotated as *nov. gen.* by Gray, no specific epithet; P 00715972, ex BM). **Remaining syntypes & isosyntypes:** *J. Drummond* 68 (E 00385951, K 000901824).

Ascending to erect *herb* to 10 cm tall. *Leaves* mostly alternate, semi-terete to terete or linear to narrowly oblanceolate, often slightly succulent, erect, 5–25 mm long, 0.5–1 mm wide, mucronate, cottony, the uppermost usually overtopping the compound head. *Compound head* ellipsoid to broadly ellipsoid or ovoid to broadly ovoid, 6–12 mm long, 4–13 mm diam.; general involucre bracts somewhat resembling the capitular bracts, mainly hyaline except for the opaque midrib, glabrous to densely hairy on the outersurface. *Capitula* 2–30 per compound head. *Outer capitular bracts* obovate to spatulate, sometimes almost elliptic, 1.7–3.5 mm long, 0.7–1.5 mm wide, flat to conduplicate, outer surface usually with long hairs at or about the apex of the midrib and the bracts united by the hairs, the upper hyaline margins variably ciliate. *Inner capitular bracts* elliptic or ovate to lanceolate, 1.8–4 mm long, 1.7–3.5 mm wide, conduplicate, outer surface with long hairs at or about the apex of the midrib and the bracts free or united by the hairs, upper margins entire or ciliate. *Florets* 1–3 per capitulum; corolla tube 4- or 5-lobed, lobes purplish black. *Stamens* 4 or 5; anthers 0.45–0.75 mm long. *Cypselas* 1.1–1.4 mm long. *Pappus bristles* 7 or 8. *Chromosome number:* $2n = 22$. **Fig. 1A.**

Distribution. Widespread in south-western Western Australia, southern South Australia and western Victoria.

Habitat. Grows in an array of habitats, including in *Eucalyptus* woodland, in mossy swards over granite and in loam over limestone in mallee-eucalypt associations. It is seemingly less tolerant to salt than *B. phlegmaticarpa* but has been found growing on the upper margins of the samphire zone of some salt lakes.

Phenology and reproductive biology. Flowering from about late August, fruiting about November.

The non-showy inflorescence and its lack of a strong aroma, and pollen:ovule ratios ranging from 64 to 339 (Short 1981a, b, 1987a) indicate that it, as also speculated with *B. doliiformis*, commonly self-pollinates and is likely self compatible.

Cytology. Short (1981a, b, 1987a) recorded $2n = 22$ for populations from near Dalwallinu, W.A. (*P.S. Short* 595) and Port Julia, S.A. (*P.S. Short* 719).

Notes. The inconspicuous, purplish black corolla lobes readily distinguish this species from its congeners.

Selected specimens examined.

WESTERN AUSTRALIA: Purnta Rock, 26 Sep. 1977, *P.S. Short* 683 (AD); c. 9.4 km from the Great Northern Hwy along road to Perenjori, 2 Sep. 1982, *P.S. Short* 1628 (MEL); W edge of Lake King, 11 Sep. 1982, *P.S. Short* 1680 (MEL); 65 km SW of Sandstone, 26 Aug. 1970, *P.G. Wilson* 8889 (PERTH).

SOUTH AUSTRALIA: 6 km SW of Port Julia, 17 Dec. 1977, *P.S. Short* 719 (AD).

VICTORIA: c. 24 km SW of Nhill, 4 Oct. 1980, *P.S. Short* 1219 & *M.G. Corrick* (MEL).

Calocephalus R.Br. s.str.

Trans. Linn. Soc. London 12: 106 (25 Feb. 1818; as preprint before Sep. 1817); R.Br., J. Phys. Chim. Hist. Nat. Arts 86: 409 (1818); R.Br., Verm. Bot. Schr. 2: 545 (1826); DC., Prodr. 6: 151 (1838); P.S.Short, *Muelleria* 6: 349–358 (1987). — **Lectotype:** *C. citreus* Less. (Anderberg 1991, p. 131).

Perennial *herbs*, major axes ascending to erect, hairy, at least the upper part of each axis somewhat angular, each major axis commonly branching. *Leaves* entire, sessile, entirely or predominantly opposite and the uppermost ones sometimes alternate, tomentose, the midrib and often two lateral veins prominent, uppermost leaves may have a small hyaline appendage at the apex. *Compound heads* spheroidal to broadly ellipsoid or oblong or broadly depressed ovoid to ovoid; general involucre absent; general receptacle cylindrical to narrowly oblong, consisting of a single, hairy major axis with the capitula scattered more or less evenly along its entire length. *Capitula* 20–300. *Capitular bracts* 8–16, flat to conduplicate, arranged in c. 3 whorls with the outer bracts the smallest, obovate to oblanceolate or somewhat elliptic, mainly hyaline and tending to form a morphologically distinct claw and terminal lamina, although the terminal lamina may be more distinguished by being yellow or white and opaque rather than colourless and transparent; claw glabrous or with long hairs extending from the hyaline margins and/or near the apex of the midrib; midrib opaque, brown to green,

extending c. $\frac{1}{2}$ – $\frac{1}{3}$ the total length of the bract. *Florets* 2 or 3. *Corolla* 5-lobed; lobes with slightly thick margins, much of the inner surface papillate (only glabrous near the apex) with papillae extending along the vascular strands in the tube; inner epidermal cells of lobes and tube with straight or almost straight margins, cells of the lobe smaller; vascular strands seemingly extending to the base of the lobes but obscured by papillae. *Style* with 2 distinct vascular traces from the base, nectary present, branches truncate, apices papillate. *Stamens* 5; anthers caudate, each with a somewhat widely deltate to triangular apical appendage; filament collar more or less straight in outline. *Cypselas* monomorphic, subobconic, brown, epidermis with globose myxogenic twin-hairs which lack basal cells; pericarp lacking sclerenchyma (*C. citreus*, P.S. Short 855; *C. lacteus*, A. Opie 29); vascular bundles in pericarp 2; carpodium absent, the abscission area not differentiated from the pedicel. *Pappus* of 4–11 multiseriate bristles which are plumose in the upper part and united at the base into a small ring. *Chromosome number*: $n = 28$.

Distribution. South-eastern Australia, below an arc extending from south-eastern Queensland to southern Eyre Peninsula in South Australia and including Tasmania.

Etymology. From the Greek *kalos* (beautiful) and *kephale* (head), in reference to the appearance of the compound head.

Notes. As indicated above, this genus was first described by Robert Brown (1817) in a paper titled “Observations on the natural family of plants called Compositae ...”. This same paper was translated into French by Cassini, with additional notes by both Brown and Cassini, and the original was also included by Nees von Esenbeck in a five-volume collection of Brown’s publications, i.e. *Robert Brown’s Vermischte botanische Schriften*. I have not seen the latter publication, details of which are provided by Stafleu & Cowan (1976–1988), and it is this publication to which Lessing referred in his treatment of both *Calocephalus* and *Leucophyta*.

Fruit of both species are illustrated in Short (1987a, fig. 2), being compared with that of *Blennospora phlegmatocarpa*.

Key to species of *Calocephalus* s.str.

1. Capitular bracts yellow; leaves mostly wider in lower half 1. *C. citreus*
 1: Capitular bracts white; leaves mostly wider in upper half 2. *C. lacteus*

1. *Calocephalus citreus* Less.

Syn. Gen. Compos. 271 (1832); Brongn. in Duperrey, Voy. Monde, pl. 60, fig. A (?1832–1834), n.v., as cited in DC.; DC., Prodr. 6: 151 (1838); Sond., Linnaea 25: 491 (1853); Benth., Fl. Austral. 3: 575 (1867); F.M. Bailey, Queensl. Fl. 850 (1900); C. Moore & Betche, Handb. Fl. New South Wales 289 (1893); J.M. Black, Fl. S. Austral. 1st ed. 648 (1929), 2nd ed. 928 (1957); W.M. Curtis, Stud. Fl. Tasman. 346 (1963); N.T. Burb. & M. Gray, Fl. A.C.T. 389, fig. 389 (1970); J.H. Willis, Handb. Pl. Victoria 2: 732 (1973); P.S. Short in Jessop & Toelken, Fl. S. Austral. 3:

1502 (1986); Stanley in Stanley & Ross, Fl. S.E. Queensl. 2: 546 (1986); P.S. Short, Muelleria 6: 351, fig. 3a (1987); E.A. Brown in G.J. Harden, Fl. New South Wales 3: 259 (1992); P.S. Short in N.G. Walsh & Entwisle, Fl. Victoria 4: 811, fig. 162d (1999). — *Calocephalus lessingii* F. Muell., Key Vict. Pl. 1: 332 (1888), nom. illeg. — *Leucophyta citrea* (Less.) Kuntze, Revis. Gen. Pl. 352 (1891), nom. illeg., non *L. citrea* Sond. (1853). — *Calocephalus lessingii* F. Muell. f. *citreus* (Less.) F. Muell. ex Maiden & Betche, Census N.S.W. Pl. 200 (1916). — *Leucophyta lessingii* (F. Muell.) F. Muell., Victorian Naturalist 9: 187 (1893), nom. illeg. — **Type citation**: “Herbae Novae Hollandiae.” **Syntypes**: ?CW, see notes below for possible syntypes or isosyntypes.

Perennial *herb*; major branches erect, c. 15–60 cm long, extending from basal nodes, often developing minor shoots; major and minor branches somewhat rounded to angular, hairy. *Leaves* lanceolate or sub-linear, 10–110 mm long, 1–2 mm wide, tomentose, often sheathing at the base, the midrib and often two lateral veins prominent. *Compound heads* spheroidal to broadly ellipsoid or oblong or broadly depressed ovoid to ovoid, 4–20 mm long, 5–9 mm diam. *Capitula* c. 30–300 per compound head. *Capitular bracts* 8–11, more or less obovate to oblanceolate or somewhat elliptic, sometimes abruptly attenuated in c. the lower $\frac{1}{3}$, mainly colourless and hyaline but the terminal lamina yellow, and with an opaque brown or green midrib which extends c. $\frac{1}{2}$ – $\frac{1}{3}$ the length of the bract, glabrous or with long hairs extending from near the apex of the midrib, all bracts flat to conduplicate, 1.9–3.4 mm long, 0.5–0.9 mm wide, arranged in 2 or 3 rows with the outermost bracts the smallest. *Corolla* tube 1.5–2 mm long. *Style* branches c. 0.5 mm long. *Stamens* with anthers c. 1–1.1 mm long; microsporangia c. 0.8–0.85 mm long; apical appendages triangular, c. 0.2–0.27 mm long. *Cypselas* subobconic, 0.7–0.85 mm long, c. 0.5 mm diam. *Pappus* of 4–9 bristles. *Chromosome number*: $n = 28$.

Distribution. Occurs in south-eastern Australia, below an arc extending from south-eastern Queensland to southern Eyre Peninsula and including Tasmania.

Habitat. Grows in loam and clayey soils in woodlands, grasslands and herb fields. Collectors’ notes include: “*Eucalyptus leucoxylo*n association”, “Peppermint Gum woodland. Brown loam”, “Amongst grasses and weeds on roadside ... basalt”, and “Common in low-lying, open area dominated by *Craspedia globosa* [*Pycnosorus globosus*] and mixed grasses.”

Phenology & reproductive biology. Flowering occurs from about September to March.

A pollen:ovule ratio of 2,862 was determined for a single floret from M.G. Corrick (MEL 1575899), a specimen from the vicinity of Skipton, Victoria.

Schaumann et al. (1987) noted that seed sowed in autumn germinated in 6 to 14 days; no provenance was stated.

Cytology. Watanabe et al. (1999) recorded $n = 28$ for a population (P.S. Short 4573) at Derrimut Grasslands

above the northern edge of Andersons Swamp near Melbourne; one or two quadrivalents were sometimes present.

Typification. I have not seen any specimens annotated by Lessing, the principal locality of his herbarium and types apparently being CW (Stafleu & Cowan 1976–1988), and he gave no indication as to what he examined when describing this species. As Lessing made reference to Brown's earlier publication it seems highly likely that he had one or more of Brown's specimens before him when describing and naming them. However, as others had also collected this species prior to Lessing's publication, it cannot be assumed that this scenario is correct. For example, I have seen specimens in P collected by Brown and some attributed to the voyage of d'Urville, the latter presumably collected during his expedition of 1826–1829. Of these various specimens I noted a sheet (P 00716004, ex herb. Drake) labelled as "Calocephalus (aureus) ... Compositae p. 106". The label was almost certainly not in Brown's hand but, on the same label and in a different hand, it has "Communicavit R. Brown". Another P sheet (P 00716005) was annotated as having been received from K in 1884 and labelled, possibly in Brown's hand, as "Calocephalus citreus Less. V. Diemen's Land". I also saw three further sheets in P (P 00716001, P 00716002, P 00716003), these being received from E in 1890 and simply noted as being from Brown's *Iter Australiense* 1802–05. Identically labelled specimens are in E and NY (NY 00163019). I tentatively labelled all five of the aforementioned P specimens as "possible syntypes or isosyntypes" of the name *C. citreus*. Of the two sheets of this species in P which are attributed to the voyage of d'Urville the locality given for both is Port Jackson, both have reference to the numbers "83 & 253", and one sheet is labelled as "ex herb. Schultz-Bip." (P 03312994), the other as "ex herb. Roussel" (P 03312995). I labelled neither of these collections as possible syntypes or isosyntypes but they are within the time-frame for Lessing to have seen collections from that voyage. I also note that, of the two specimens of this species cited by Candolle (1838) and held at G-DC — as per no. 1037 of the microfiche of the *Candolle Prodromus Herbarium, Genève* — one is attributed to "Port Jackson/ M. D'Urville 1826". The other specimen cited by Candolle was collected by Allan Cunningham in May 1817 from the Lachlan River; it may reflect the quality of the reproduction but I am not totally convinced that it is of this species.

Assuming that Lessing viewed a specimen, or specimens, collected by Brown the following held at, or on loan to, MEL in June 1991 and gathered from Tasmania may be isotypes or isosyntypes of specimens examined by Lessing: Derwent River between Risdon Cove & Frederick Hentry [sic] Bay [original label with "Van Diemanens Land" (Stearn 1962)] (CANB 279089); V. Diemen's Land (BRI 224115); Van Diemens Land (MEL 85014); no locality but with Bennett 2142 label (MEL 85010).

All of the above specimens attributed to Brown and d'Urville and referred to above are of the same taxon. Despite the uncertainty as to the type status of these specimens adequate referencing and clear descriptions by Lessing (1832) and others such as Candolle (1838) and Bentham (1867a), as well as references by both Candolle and Bentham to the illustration in the *Atlas of Duperrey's Voyage autour du monde*, give no reason to doubt that the name *Calocephalus citreus* is correctly applied.

Notes. The name *Calocephalus lessingii* is a nomenclatural synonym and was coined by Mueller (1888) as a result of his belief that *C. citreus* and *C. lacteus* are conspecific.

Selected specimens examined.

SOUTH AUSTRALIA: Bool Lagoon, 29 Dec. 1961, *D. Hunt 615* (AD); Belair, 4 Dec. 1937, *E.H. Ising* (AD 97649918); Tarnma, 4 Feb. 1969, *D.N. Kraehenbuehl 2523* (AD).

QUEENSLAND: between Wallangarra and Bald Mtn, 16 Jan. 1933, *S.T. Blake 4498* (BRI).

NEW SOUTH WALES: about 4 miles north of Armidale, 9 Jan. 1944, *G.L. Davis* (NSW 138941); 8 miles S of Goulburn, 22 Jan. 1968, *I. Beeton* (CBG 022565); Ginninderra to Gundaroo road, 18 Feb. 1976, *J.M. Taylor 139* (CBG).

AUSTRALIAN CAPITAL TERRITORY: Canberra, 14 Jan. 1950, *E. Gauba* (CBG 015418).

VICTORIA: E of Skipton on Glenelg Hwy, Nov. 1968, *M.G. Corrick* (MEL 1575899); Werribee, 7 Jan. 1893, *A. Morrison* (BRI 086219, CANB 133548).

TASMANIA: Derwent River between Risdon Cove and Frederick Hentry [sic] Bay, 1804, *R. Brown* (CANB 279089); Bridgewater, 5 Mar. 1945, *W.M. Curtis* (MEL 621562).

2. *Calocephalus lacteus* Less.

Syn. Gen. Compos. 271 (1832); Brongn. in Duperrey, *Voy. Monde*, pl. 60, fig. B (?1832–1834), n.v., as cited in DC., *Prodr.* 6: 151 (1838); Schldl., *Linnaea* 20: 591 (1847); Hook.f., *Fl. Tasman.* 1: 196 (1860); Benth., *Fl. Austral.* 3: 575 (1867); J.M.Black, *Fl. S. Austral.* 1st ed. 648 (1929), 2nd ed. 928 (1957); W.M.Curtis, *Stud. Fl. Tasman.* 345 (1963); J.H.Willis, *Handb. Pl. Victoria* 2: 732 (1973); P.S.Short in Jessop & Toelken, *Fl. S. Austral.* 3: 1503 (1986); P.S.Short, *Muelleria* 6: 351, fig. 3c–e (1987); P.S.Short in N.G.Walsh & Entwisle, *Fl. Victoria* 4: 811, fig. 162e (1999). — *Calocephalus lessingii* F.Muell., *Key Vict. Pl.* 1: 332 (1888), nom. illeg. — *Leucophyta lactea* (Less.) Kuntze, *Revis. Gen. Pl.* 352 (1891). — *Leucophyta lessingii* (F.Muell.) F.Muell., *Victorian Naturalist* 9: 187 (1893), nom. illeg.; *Bot. Centralbl.* 54: 221 (1893). — *Calocephalus lessingii* F.Muell. f. *lacteus* (Less.) Maiden & Betche, *Census N.S.W. Pl.* 200 (1916). — **Type citation:** "Herbae Novae Hollandiae." **Syntypes:** ?CW, none seen. See note below.

Perennial *herb*, major branches ascending, 5–70 cm long, hairy, mainly rounded but the upper part of each branch somewhat angular, each major branch commonly branching. *Leaves* usually obovate to oblanceolate, sometimes narrowly elliptic or linear, 10–50 mm long, 1–4.5 mm wide, tomentose, often sheathing at the base, rounded at the apex, the midrib and often two lateral veins prominent, uppermost leaves often with a

small hyaline appendage at the apex. *Compound heads* spheroidal to broadly ellipsoid or oblong or ovoid, 6–15 mm long, 6–9 mm wide. *Capitula* 20–200. *Capitular bracts* 9–16, obovate to oblanceolate, mainly colourless and hyaline but the terminal lamina white and opaque, with an opaque brown to green midrib which extends c. ½ the length of the bract, glabrous or with long hairs extending from the hyaline margins and near the apex of the midrib, all bracts flat to conduplicate, 1.5–3.3 mm long, 0.6–1.2 mm wide, arranged in c. 3 whorls with the outer bracts the smallest. *Corolla* tube 1.1–2 mm long. *Style* branches c. 0.6–0.75 mm long. *Stamens* with anthers c. 0.9–1 mm long; microsporangia c. 0.72–0.77 mm long; apical appendages widely deltate to triangular, c. 0.2–0.25 mm long. *Cypselas* subobconic, 1–1.1 mm long, c. 0.4 mm diam. *Pappus* of 6–11 bristles. *Chromosome number*: unknown.

Distribution. Occurs in the southern Mt Lofty Ranges and south-eastern South Australia, much of southern Victoria, the south-eastern corner of New South Wales, and Tasmania.

There is a record of this species for Western Australia, it being a specimen attributed to James Drummond (*J. Drummond* 3: 118) and one widely distributed in herbaria, e.g. E, MEL, NSW & P. During his third collecting expedition Drummond travelled from Toodyay to Albany and east to Cape Riche and, given that *C. lacteus* is known from near-coastal habitats in eastern Australia, it is not inconceivable that he did collect it. However, unless it was extremely rare, a lack of subsequent collections from W.A. strongly suggests that *J. Drummond* 118 comes from elsewhere and, as he didn't venture outside that State, was not collected by Drummond. In the absence of subsequent specimens I believe it should not be recorded for W.A.

Habitat. Collectors' notes include: "Coastal cliffs. Associated species include *Stipa teretifolia* [*Austrostipa stipoides*], *Poa poiformis*, *Calocephalus* [*Leucophyta*] *brownii*, *Carpobrotus rossii*, *Lobelia alata* [*L. anceps*], *Apium prostratum*.", "amongst grasses and weeds on roadside. Hard caked soil. Basalt.", "Organic clay loam to 4 cm over light clay ... Continuous grassland, cleared. Associated with *Phalaris tuberosa*, *Plantago varia*, *Poa* sp., *Plantago lanceolata*, *Cirsium vulgare*, *Juncus* sp.", "among *Typha angustifolia* in shallow moist depression in quarry", "Under *Eucalyptus ovata* at edge of grassy flat" and "partially cleared dry sclerophyll ... on bare ground".

Phenology & reproductive biology. Flowering mainly occurs from about November to March.

A single floret from *A. Brown* 168 (MEL), collected from the vicinity of Forest Lagoon, Tasmania, contained 3,314 pollen grains.

Typification. As with *C. citreus* it seems likely that Lessing examined a specimen or specimens collected by Robert Brown from Tasmania. If so, CANB 279090,

K 000901833, MEL 543203, MEL 543204, NSW 139006 and P 00715999 are presumably syntypes or isosyntypes of the name *C. lacteus*. Both MEL 543204 and P 00715999 are annotated, possibly in Brown's hand, as "*Calocephalus lacteus* Less." As with *C. citreus*, there may be other specimens which were examined by Lessing, such as a gathering from Western Port Bay attributed to d'Urville and cited by Candolle (1838). However, again as with *C. citreus*, there seems no reason to believe, whatever proves to be authentic type material, that there is any problem with the current application of the name *C. lacteus*.

Notes. The name *Calocephalus lessingii* is an illegitimate name and a nomenclatural synonym, being coined by Mueller (1888) as a result of his belief that *C. citreus* and *C. lacteus* are conspecific.

Selected specimens examined.

SOUTH AUSTRALIA: Onkaparinga River at Grünthal [= Verdun], 1 Mar. 1884, *Anon.* (AD 97622638, ex herb. R. Tate); Bool Lagoon, 29 Dec. 1961, *D. Hunt* 614 (AD).

NEW SOUTH WALES: Northern shores of Baragoot Lake, May 1995, *J. Miles* (NSW 392139, number as per plantnet.rbg Syd.nsw.gov.au, accessed August 2012).

VICTORIA: 6.5 km from Newhaven, coastal cliffs, 4 Feb. 1984, *D.E. Albrecht* 182 (MEL); Cape Woolamai, Phillip Is., 8 Sep. 1981, *A. Opie & S. van Berkel* 29 (MEL); Hawkesdale, Jan. 1903, *H.B. Williamson* (NSW 139012).

TASMANIA: Verwood Rd, Forest Lagoon, 27 Jan. 1981, *A. Brown* 168 (BRI, HO, MEL); between Steppes and Interlaken, 28 Jan. 1949, *N.T. Burbidge* 3431 (AD, CANB); River Jordan, Jan. 1900, *F.A. Rodway* (NSW 139008).

Calocephalus R.Br. s.lat.

Calocephalus s.lat.: Benth., Fl. Austral. 3: 573 (1867) p.p., excluding *Blennospora*, *Leucophyta*, *C. citreus* & *C. lacteus*; O.Hoffm. in Engler & Prantl, Nat. Pflanzenfam. IV(5): 194 (1890) p.p., excluding *Blennospora*, *Leucophyta*, *C. citreus* & *C. lacteus*; P.S.Short in Jessop, Fl. Centr. Austral. 391 (1981); P.S.Short in Jessop & Toelken, Fl. S. Austral. 3: 1501 (1986), p.p., excluding *Leucophyta*, *C. citreus* & *C. lacteus*; A.Anderb., Opera Bot. 104: 128 (1991) p.p., excluding *C. citreus* and *C. lacteus*; R.J.Bayer et al. in Kadereit & C.Jeffrey, Fam. Gen. Vasc. Pl. 8: 270 (2006) p.p., excluding *C. citreus* & *C. lacteus*.

Achrysum A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 228 (Aug. 1852). — **Type**: *A. glomeratum* A.Gray

Notes. I believe it likely that all species included here will at some stage be removed from *Calocephalus* and referred to other genera, some new and perhaps with the name *Achrysum* reinstated. However, in the meantime I accept them all as members of *Calocephalus*.

Calocephalus birchii, *C. glabratus*, *C. multiflorus* and *C. pilbarensis* have morphological attributes which suggest that each is well-removed from all others included here but there are some species which share a number of features suggesting a close relationship. Thus, *C. beardii* and *C. knappii* are generally similar in gross morphology and are anatomically united in that the base of the corolla lobes are papillose. Similarly, *C. badmanii* and *C. platycephalus* share many features

Key to species included in *Calocephalus* s.lat.

- 1. Robust herb or subshrub, branches and leaves almost glabrous except for occasional long, septate eglandular hairs, but compound heads with a manifestly woolly/cottony general involucre of bracts, each of the inner bracts with a white lamina (south-western Qld) **5. *C. glabratus***
- 1: Herb or subshrub but at least lacking the general involucre as above
 - 2. Perennial, robust subshrub with linear leaves 15–65 mm long, 0.5–1 mm wide, branches and leaves with a dense, whitish grey, cottony indumentum contrasting with dark yellow compound heads which are ovoid or ellipsoid, 10–20 mm long; outer capitular bracts subcartilaginous and compound heads difficult to pull apart (central Qld) **3. *C. birchii***
 - 2: Perennial or annual plants unlike the above, never with subcartilaginous bracts
 - 3. Cypselas lacking an annular carpodium, the abscission area not differentiated from the pedicel (annual herbs, capitular bracts with yellow or white terminal laminae; cypselas beset with small, glistening globose, myxogenic hairs; eastern mainland Australia: S.A., Qld, N.S.W., Vic.) **10. *C. sonderi***
 - 3: Cypselas with an annular carpodium
 - 4. Cypselas enveloped in a layer of myxogenic cells (appearing glabrous); annual herbs **7. *C. multiflorus***
 - 4: Cypselas not enveloped in a layer of mucilaginous cells, rarely appearing glabrous, scattered to dense (and often myxogenic) hairs usually present; annual or perennial herbs
 - 5. Cypselas sericeous, i.e. enveloped with long, straight hairs (W.A.) **8. *C. pilbarensis***
 - 5: Cypselas never enveloped in long, straight hairs but usually with scattered globose twin-hairs
 - 6. Base of corolla lobes papillose; inner epidermal cells of the corolla throat with undulate margins
 - 7. Pappus of 6 or 7 bristles which are plumose throughout their length and have a terminal tuft; leaves, with the exception of the uppermost ones, glabrous or only with short glandular hairs (W.A.) **2. *C. beardii***
 - 7: Pappus of 3–6 lax, plumose bristles; leaves mostly with a conspicuous cottony indumentum (W.A., N.T., S.A., Qld) **6. *C. knappii***
 - 6: Base of corolla lobes not papillose; inner epidermal cells of the corolla throat with straight margins
 - 8. Branches mostly glabrous or only with scattered hairs, if at all dense then only beneath the compound heads (weakish herbs; bracts subtending the compound heads absent; capitular bracts each with a 0.6–1.1 mm long, reflexed, yellow or rarely white terminal lamina; W.A.) ... **4. *C. francisii***
 - 8: Branches mostly with a dense cottony or silky indumentum
 - 9. Branches rigid, erect usually with a dense cover of long, silky, white, appressed hairs, sometimes somewhat cottony; pappus of 11–16 sub-flexuose bristles (mound springs, S.A., ?Qld) **1. *C. badmanii***
 - 9: Branches ascending to erect, usually not rigid, with a sparse to dense cottony indumentum; pappus of 6–11 flexuose bristles (W.A., N.T., S.A., Qld, N.S.W.) **9. *C. platycephalus***

in common and *C. francisii* — which is otherwise distinctive — may not be far removed from them, all three species lacking basally papillose corolla lobes.

1. *Calocephalus badmanii* P.S.Short, sp. nov.

Type: South Australia. 67 km S of William Creek, South Australia, 1 Nov. 1989, *B. Nordenstam & A. Anderberg* 975 (holotype: MEL 1591937; isotypes: AD n.v., E 00433318, MO 797777, NSW n.v., NY 00004656, PERTH n.v., S (two sheets, S-G-114 & S09-35337).

[*Calocephalus platycephalus* auct. non (F.Muell.) Benth.; P.S.Short in Jessop & Toelken, *Fl. S. Austral.* 3: 1504, fig. 681B (1986), p.p.; P.S.Short in Jessop, *Fl. Centr. Austral.* 392 (1981), p.p.]

[*Calocephalus ditrichii* auctt. non F.Muell.; J.M.Black, *Trans. & Proc. Roy. Soc. South Austral.* 42: 57, fig. 8 (1918), *Fl. S. Austral.* 1st ed. 648, pl. 54 (1929), 2nd ed. 929, fig. 1231 (1957).]

Subshrub, c. 30–60 cm tall, major branches somewhat rigid, mainly erect, usually with a dense cover of long, silky, white, appressed hairs, sometimes somewhat cottony. *Leaves* alternate, sessile, entire, more or less linear or lanceolate, the upper part usually recurved, 4–15 mm long, 0.5–1.5 mm wide, with silky, white appressed hairs or somewhat cottony, uppermost leaves often with a small hyaline apex. *Compound heads* somewhat globular or obloid, c. 4–14 mm long,

4–14 mm diam.; bracts subtending compound heads generally resembling the outer capitular bracts but the midrib more prominent, the entire surface of the midrib cottony; *general receptacle* branched, sparsely cottony. *Capitula* c. 20–40 per compound head. *Capitular bracts* in more or less 2 rows. *Outer bracts* c. 8–10, hyaline except for a midrib extending c. the length of the claw, all bracts united by long intertwined hairs at the apex of the midrib; claw narrowly elliptic or oblanceolate to obovate, 2.2–2.8 mm long, 0.7–1.2 mm wide; terminal lamina very widely depressed to depressed ovate, 0.5–0.9 mm long, 0.7–0.95 mm wide, more or less distinguished by a constriction above the midrib, yellow. *Inner bracts* c. 7–9, hyaline, midrib indistinct, extending c. 4/5 the length of the bract, all bracts elliptic or obovate, 3.2–3.5 mm long, 1–1.2 mm wide, glabrous, apex pale yellow, a terminal lamina not differentiated or if so then smaller than in the outer bracts. *Partial receptacle* conical, glabrous. *Florets* 8–28, bisexual. *Corolla* tubular, 5-lobed; lobes with thick margins and apparently lacking papillae on inner surface; tube 2–3 mm long; inner epidermal cells of lobes and throat with straight walls, the cells not in distinct rows; vascular strands not extending the length of the tube. *Style* with 2 distinct vascular traces from the base, nectary annular,



Northern Territory Herbarium (DNA)
 HOLOTYPE of
Calocephalus badmanii P.S.Short
 Determinavit P.S.Short Mar. 2012

0 5
centimetres



MEL 1591937

MEL1591937

FLORA OF AUSTRALIA

Calocephalus

South Australia: 67 km S of William Creek, on the Oodnadatta track. Just N of Dillinna Creek
 Stony slopes with very saline, white soil.

Virgate, divaricately branched suffrutescent perennial, 3-6 dm. Foliage silver-grey. Capitula clusters depressed globose, somewhat asymmetric. Fls yellow.

1. XI. 1989
 Leg. B. Nordenstam & A. Anderberg No. 975

29°22'S 136°46'E

(P.S.)

96050

NATIONAL HERBARIUM OF
 VICTORIA (MEL), AUSTRALIA

Fig. 3. Holotype of *Calocephalus badmanii* (MEL). — B. Nordenstam & A. Anderberg 975.



NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

Fig. 4. Holotype of *Calocephalus beardii* (MEL). — P.S. Short 4238.

branches truncate, 0.54–0.8 mm long, apices papillate. *Stamens* 5; anthers c. 1 mm long, prominently caudate, each with a subtriangular (somewhat straight-sided in the lower half) apical appendage c. 0.2–0.25 mm long; filament collar c. 0.3 mm long, more or less straight in outline but gradually dilating towards the base. *Cypselas* 0.7–0.8 mm long, c. 0.4 mm diam., brown, with globose (?myxogenic) twin hairs which seemingly lack basal cells; vascular bundles in pericarp 2; carpodium annular. *Pappus* of 11–16, sub-flexuose bristles about the length of the corolla, joined at the base, bristles long-plumose throughout their length, with a pale yellow terminal tuft. *Chromosome number*: unknown. **Fig. 3.**

Distribution. Apparently restricted to north-eastern South Australia between latitudes c. 29° and 30°S and longitudes c. 136° and 140°E.

Habitat. Locality notes accompanying specimens indicate that *C. badmanii* is restricted to mound spring areas, referring to the plants growing in saline soils in the vicinity of the springs but also growing in the surrounding, dry, limestone mounds. Collectors' notes include: "on rocky outcrop in yellow gravelly sand", "sandy slightly saline area, occasionally flooded", "mound springs (margins) in travertine limestone with yellow sand", "on floodplain in yellow saline sand", and "in more or less saline, sandy flat".

Phenology & reproductive biology. Flowering collections having been gathered from July to February, with most (five) collected in July.

A pollen:ovule ratio of 3,258 was determined for a single floret removed from *F.J. Badman 3004*, a specimen from Finnis Springs Station.

Etymology. The name honours the collector and ecologist, Frank Badman (1943–2015) (Barker et al. 2016).

Notes. Distinguished from *C. platycephalus* by its habit and the number of pappus bristles (11–16 per floret compared with 6–11 in *C. platycephalus*). The long-plumose teeth of the pappus bristles also tend to be more spreading in *C. badmanii* than in *C. platycephalus*.

Black (1918) applied the name *Calocephalus dittrichii* F.Muell. to this species following advice from A.J. Ewart that Gill's specimen from Coward Springs agreed well with the type specimen in MEL.

Additional specimens examined.

SOUTH AUSTRALIA: Hamilton Hill, *Anon. 26* (AD 9782 3007); Hill at Smith Springs 80 km W of Marree, 3 July 1989, *F.J. Badman 2958* (AD); Sulphuric Springs, Finnis Springs Stn, 9 July 1989, *F.J. Badman 3004* (AD); Old Finnis Springs, 9 July 1989, *F.J. Badman 3011* (AD); Horse Springs, Stuart Ck Stn, 12 July 1989, *F.J. Badman 3088* (AD); 5 km SE of Beresford, 22 Jan. 1989, *R. Bates 17185* (MEL); at 12 Springs, Moolawatana Stn, 29 Aug. 1972, *B. Copley 3823*; Gosse Springs, 11 July 1983, *T.J. Fatchen 609* (AD); Coward Springs Mound, 19 Nov. 1891, *W. Gill* (AD 97632046, ex herb. Black; MEL 85028); Near Catt's Springs on Murnpeowie, Sep. 1898, *M. Koch 2027* (AD ex herb. J.M. Black, BRI, MEL, NSW); Near Petermorra Springs, 31 Feb.

1984, *N. McLaren 42* (AD); Hamilton Hill, 19 Oct. 1983, *M. Nobbs 1214* (AD); William Ck, 19 Sep. 1984, *M. Nobbs 1298* (AD); Finnis Springs, 13 Dec. 1926, *F.D. Warren ?10* (AD 97649466; AD 97632045, ex herb. Black; AD 97632046, ex herb. Black); 10 km W of Curdimurka, 3 Oct. 1978, *J.Z. Weber 5777* (AD).

2. *Calocephalus beardii* P.S.Short, *sp. nov.*

Type: Western Australia. 4.5 km S of turn-off to Neds Ck and Wiluna along Great Northern Highway (25°26'35"S, 119°17'01"E), 26 Aug. 1995, *P.S. Short 4238* (holotype: MEL 2027650; isotypes: AD, K, PERTH).

Calocephalus aff. *knappii* (F.Muell.) Ewart & Jean White; P.S.Short in Jessop, Fl. Centr. Austral. 391 (1981).

Calocephalus sp. Pilbara-Desert (*M.E. Trudgen 11454*) WA Herbarium, as per florabase.dec.wa.gov.au/ [pre March 2012], and www.anbg.gov.au/cgi-bin/apclist [accessed 7 Mar. 2012].

Annual *herb*, major branches 4.5–20 cm long, ascending to erect, mainly with shortly stalked glandular hairs, but often cottony below the compound heads. *Leaves* alternate, sessile, entire, lanceolate or linear, 4.5–32 mm long, 0.5–2.5 mm wide, the margins and midvein on the lower surface often thickened, the apex often bulbous, glabrous or with shortly stalked glandular hairs, usually the uppermost leaves cottony. *Compound heads* elliptic to spheroidal or broadly to very broadly ovoid, 7–23 mm long, 7–11 mm diam.; bracts subtending compound heads absent but the lowest capitula subtended by a single, mainly foliaceous, densely hairy bract; *general receptacle* branched, densely cottony, each secondary peduncle terminating in c. 2–4 capitula. *Capitula* c. 15–100 per compound head, each capitulum or secondary group apparently subtended by a densely cottony bract, the lower capitulum-subtending bracts mainly foliaceous, the upper resembling the outer capitulum bracts. *Capitular bracts* in 2 rows. *Outer bracts* c. 6, 2.9–3.9 mm long, 0.8–1.1 mm wide, hyaline except for a green midrib extending for c. the length of the claw, all bracts united by long intertwined hairs which invest the upper part of the midrib; claw somewhat elliptic or oblong, 2.4–2.7 mm long, 0.8–1 mm wide, hyaline margins entire; terminal lamina more or less lanceolate, c. 0.6–0.7 mm long, c. 0.25–0.3 mm wide, pale yellow. *Inner bracts* c. 8, 2.5–3.5 mm long, 0.9–1.5 mm wide, all bracts united by intertwined hairs at the apex of the midrib, the hairs shorter than in the outer bracts; claw ovate, 2.1–2.8 mm long, 0.9–1.5 mm wide, hyaline margins entire; terminal lamina ovate to very widely ovate, 0.3–0.7 mm long, c. 0.3 mm wide, flat to concave, barely reflexed, pale yellow. *Partial receptacle* conical, glabrous. *Florets* 8–39, bisexual. *Corolla* tubular, 5-lobed; lobes with slightly thick margins, inner surface papillate at the base; tube 1.9–2.2 mm long; inner epidermal cells of lobes and throat with more or less straight walls, tending to be slightly undulate in the throat, the cells not in distinct rows; vascular tissue not extending to the base of the sinus. *Style* with 2 distinct vascular traces from the base, nectary small, branches truncate, c. 0.55–0.8 mm long, apices papillate. *Stamens*

5; anthers c. 0.8–0.94 mm long, caudate; microsporangia c. 0.62–0.8 mm long; apical appendage triangular, c. 0.13–0.23 mm long; filament collar more or less straight in outline but slightly dilated towards the base. *Cypselas* (mature) not seen, seemingly glabrous and probably enveloped with myxogenic hairs; vascular bundles in pericarp 2; carpodium annular. *Pappus* of 6 or 7 bristles c. the length of the corolla, joined at the base, bristles more or less evenly plumose throughout their length but with pale yellow terminal tufts. *Chromosome number*: unknown. **Fig. 4.**

Distribution. A common species in north-western and central Western Australia, between latitudes c. 20° and 28° S, and west of longitude 126° E.

Habitat. A species occupying a variety of arid habitats, with collectors' notes including "growing on ironstone laterite with scattered *Eremophila*", "in red clay loam among mulga", "gibber plain, ironstone", "stony red sand slope", "on flats with *Aristida*", and "along river on sandy soil".

Phenology & reproductive biology. Herbarium specimens have been collected as early as June and August but few if any have florets which have reached anthesis, full-flowering specimens usually being collected from mid-August to November, with most specimens gathered in September.

Pollen:ovule ratios from a single floret taken from each of five individual plants of *P.S. Short* 4238, the type specimen, ranged from 1,627 to 2,578 (\bar{x} = 2,157; s.d. = 360.491; s.e. = 180.246).

Etymology. The epithet honours Dr John Beard (1916–2011) who published a number of botanical works — in particular vegetation maps — which I found most useful when I commenced botanizing in Western Australia in the late 70s. He also wrote the book *Plant Life of Western Australia* (Beard 1990) which, when I delve into it, brings back pleasant memories of field trips.

Notes. Many specimens of *C. beardii* have been previously referred to either *C. francisii* or *C. knappii*. It is readily distinguished from *C. francisii* which has capitular bracts with much larger terminal lamina and glabrous, often somewhat succulent leaves. There is overlap in the distribution of both species but *C. francisii* is usually found to the south-west of the range of *C. beardii*. The basal part of the corolla lobes of *C. francisii* are also non-papillate; they are papillate in *C. beardii*, a feature also shared with *C. knappii*, the species to which it appears most closely affiliated.

As noted in the key, *C. knappii* and *C. beardii* differ in leaf indumentum and pappus morphology. They also differ in the partial receptacle, which in *C. knappii* has minute pedicels but is smooth in *C. beardii*, and in the capitular bracts, which in *C. beardii* lack hairs on the margins but in *C. knappii* have long marginal hairs.

Calocephalus beardii has been found growing with *C. knappii* (H. Toelken 6353 & 6354) and *C. multiflorus* (R.J. Chinnock 4706 & 4707).

Selected specimens examined.

WESTERN AUSTRALIA: 3 miles S of Meekatharra, 26 Oct. 1965, *J.V. Blockley* 127 (KPBG); 32.9 km NW of Minga Bore, 17 Sep. 1979, *R.J. Chinnock* 4706 (AD); 21 km NW of Ashburton Downs on the Kooline road, 9 Sep. 1986, *R.J. Chinnock* 7055 (AD); 90 miles E of Meekatharra, 16 Oct. 1945, *C.A. Gardner* 7881 (PERTH); Belele Stn, 20 Nov. 1965, *D.W. Goodall* 3439 (PERTH); 16 miles S of Nullagine, Sep. 1971, *R. Mirrington* 710922 (PERTH).

3. *Calocephalus birchii* P.S.Short, sp. nov.

Type: Queensland. Sumana, N. of Aramac, 22°17'58"S, 145°21'34"E, calcareous dunes, 20 July 2006, *R.J. Fensham* 5544 (holotype: BRI AQ616220).

Calocephalus sp. Aramac (*R.J. Fensham* 5270).

Perennial *subshrub*; major branches ascending to erect, to c. 40 cm long, surfaces mostly obscured by a dense, whitish grey, cottony indumentum, the upper part of flowering branches almost leafless for c. 1/3–1/2 their length. *Leaves* alternate, sessile, spreading, entire, linear, (5–) 15–65 mm long, 0.5–1 mm wide, margins inrolled, with a dense cottony indumentum often obscuring all but the blunt mucro. *Compound heads* ovoid or ellipsoid, 10–20 mm long, 10–14 mm diam.; bracts subtending compound heads absent; *general receptacle* a glabrous, elongate major axis with very short secondary branches culminating in small groups of capitula, individual capitula directly attached to major axis also present. *Capitula* c. 20–100 or more per compound head. *Capitular bracts* c. 7–9 in c. 2 or 3 rows, the outer most slightly shorter than the inner; all bracts obovate–oblanceolate, c. 2.3–3.5 mm long, 0.7–1 mm wide, flat to slightly conduplicate and each with a distinct claw and terminal lamina; claw mostly herbaceous, brownish, particularly the outer ones stiff and subcartilaginous, the margins sometimes in the lower half of the claw very narrowly hyaline; terminal lamina not to distinctly dilated above the claw and somewhat ovate, c. 0.5 mm long, semi-transparent, very pale yellow or whitish, distinguished from the claw by a constriction above the midrib; all bracts usually with long hairs extending from the hyaline outer surface of the bracts in the vicinity of the claw/margin interface. *Partial receptacle* ill-defined, glabrous. *Florets* 2, bisexual. *Corolla* tubular, 5-lobed; tube 1.6–1.9 mm long; lobes 0.25–0.44 mm long, with thickish margins, inner surface papillate except for the uppermost part of the tip, the papillae extending slightly down along the vascular traces; inner epidermal cells of throat with straight walls; vascular tissue extending to about the base of the sinus, sometimes being slightly above it or slightly below. *Style* with 2 distinct vascular traces, the distance they extend into the branches obscured by uncleared substance, branches c. 0.6–mm long, apices somewhat truncate but not manifestly so and long-papillate. *Stamens* 5; anthers 1–1.3 mm long, caudate,



Fig. 5. Holotype of *Calocephalus birchii* (BRI). — R.J. Fensham 5544.

QUEENSLAND HERBARIUM (BRI)
 Flora of Queensland Warrego
Calocephalus sp. (Eulo M.E.Ballingall MEB2590)
 Coll. E. Addicott CL4 4 APR 1997
 28°37'S 144°46'E Alt. m.
 Depth m.
 Currawinya Lakes NP, veg site N84, eastern side of
 Hoodis Range towards northern boundary (AMG Z55
 254406E 6822003N).
 Grassy swale between mound springs.
 Rare taxon.

QUEENSLAND HERBARIUM (BRI)
 Brisbane Australia
 AQ 654298

Northern Territory Herbarium (DNA)
 HOLOTYPE of
Calocephalus glabratus P.S.Short
 Determinavit P.Short Apr. 2012

Det. M.B.Thomas JUN 1997 Compositae
 Dups.
 *May be cited as computerised collection number AQ 654298
 (Archival Paper)

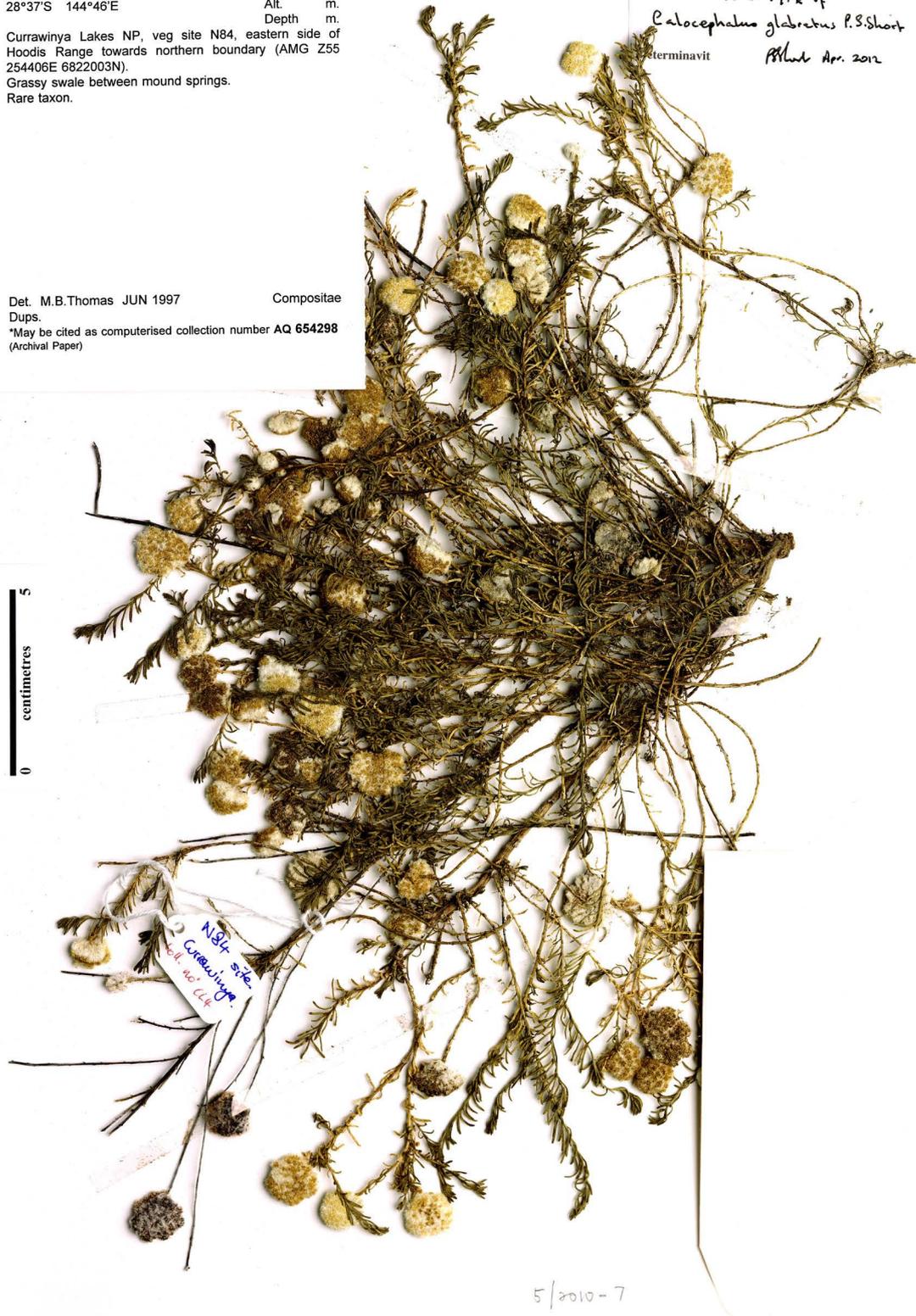


Fig. 6. Holotype of *Calocephalus glabratus* (BRI). — E. Addicott CL4.

microsporangia 0.8–0.9 mm long; apical appendages triangular, 0.18–0.23 mm long; filament collar more or less straight in outline. *Cypselas* obovoid, 1.3–1.4 mm long, 0.7–0.8 mm diam., brown, the epidermis with numerous globose, shiny, perhaps slightly stalked papillae (glands); pericarp with 2 vascular bundles; carpodium apparently absent, the fruit on a short stipe. *Pappus* of highly-divided, scale-like, white or (at least in part) pale yellowish elements joined at the base and often about the length of the corolla tube but somewhat variable in length (including within a single floret), the individual elements manifestly dividing into long, tangling processes (“hairs”). *Chromosome number*: unknown. **Fig. 5.**

Distribution. Endemic to central Queensland, with all specimens from the Mitchell Pastoral District.

Habitat. Collectors’ notes include “saline areas around areas of groundwater discharge”, “calcareous dunes”, “salty scalded areas” and “inland sand dune ... open shrubland of *Calocephalus*, *Myoporum* and *Sclerolaena*”.

Phenology. Flowering specimens have been collected for most months from April to December.

Etymology. I have been aware of the existence of this species for many years but, until recently, had mostly poor or inadequate material on which to base a description. The epithet honours Charles Weldon de Burgh Birch, who in 1873 collected the first specimen known to me. For a brief biography of Birch see George (2009) and references therein. Among other things, Birch (1872) encouraged those who resided in the Queensland bush to contribute to our knowledge of Australian plants by sending specimens to Ferdinand Mueller in MEL.

Notes. Dried compound heads, due to the subcartilaginous nature and strong attachment of the outer capitular bracts to the general receptacle, are difficult to dissect, even after soaking in hot water and detergent for 24 hours; this alone is a feature which sets it apart from other species included here in a broadly-defined *Calocephalus*.

I have opted to refer to the stiff and subcartilaginous bracts as part of an outer whorl of the involucre of each capitulum although it may be that they are better interpreted as capitulum-subtending bracts.

At first observation the pappus appeared to consist of long-plumose bristles, but closer examination suggests that the individual elements making up the pappus are better described as highly divided scales, there being no distinct central axis as observed in bristles.

Additional specimens examined.

QUEENSLAND: Bowen Downs, 1873, [*C.W.*] Birch (MEL 84976); Geera, Dec. 1935, *S.T. Blake 10387* (CANB n.v., BRI, K n.v., MO n.v., US n.v., SP n.v., AAU n.v., CHR n.v.); Albion Vale, Oct. 1989, *R. Cheffins 388* (BRI 449698); Coreena, N. of Barcaldine, 10 Oct. 2005, *R.J. Fensham 5270* (BRI AQ610552); Edgbaston, 16 Apr. 2007, *R.J. Fensham 5696*

(BRI AQ753413); Lake Huffer, 30 Nov. 1997, *E.J. Thompson MUT25 & D.J. Baumgartner* (BRI AQ573046).

4. *Calocephalus francisii* (F.Muell.) Benth.

Fl. Austral. 3: 576 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 822 (1975). — *Pachysurus francisii* F.Muell., Fragm. 3: 155 (1863). — *Leucophyta francisii* (F.Muell.) Kuntze, Revis. Gen. Pl. 1: 352 (1891). — **Type citation:** “Ad flumen Murchison River et sinum Champion Bay. A. Oldfield.” **Lectotype (here designated):** Murchison River, *A.F. Oldfield* (MEL 543274). **Isolectotypes:** K 000901845, NSW 139000. **Remaining syntype:** Champion Bay, *Anon.* (MEL 543275, presumed here to have been gathered by Oldfield).

Annual herb; major branches decumbent to erect, c. 1–14 cm long, mainly glabrous but hairy towards the compound heads; stem often simple in the smaller plants, 1–6.5 cm high, but usually forming major branches at near-basal and upper nodes. *Leaves* alternate, sessile, entire, sublinear or narrowly elliptic or lanceolate, 5–25 mm long, 0.5–3 mm wide, often semi-succulent, glabrous. *Compound heads* usually present (depauperate plants sometimes with a single capitulum), narrowly ellipsoid to globose or narrowly oblong or ovoid, 5–27 mm long, 4–10 mm diam.; bracts subtending compound heads absent; *general receptacle* with distinct peduncles which are 1–2 mm long and either simple or branched, the entire receptacle loosely enveloped in long hairs. *Capitula* 15–60 per compound head. *Capitular bracts* in 2 or 3 rows, all mainly hyaline, yellow or white and differentiated into a distinct claw and terminal lamina, the claw with a variably distinct, opaque, green midrib. *Outer bracts* 4 or 5 in a single row, usually with smaller and less reflexed terminal laminae than those of the inner bracts; claw somewhat elliptic or obovate, 1.4–1.8 mm long, 0.8–0.9 mm wide, with long hairs on the middle and upper margins; terminal lamina widely to very widely ovate, concave, 0.6–1 mm long, 0.6–1 mm wide. *Inner bracts* 5–9 in 1 or 2 rows, with terminal laminae reflexed c. 90° to the claw; claw widely elliptic to circular or obovate to very widely obovate, 1.7–2.2 mm long, 1.5–2.2 mm wide, usually with long hairs on the upper margins; terminal lamina transversely elliptic or depressed ovate, somewhat concave, 0.8–1.1 mm long, 1.5–1.6 mm wide. *Receptacle* conical. *Florets* 8–20, bisexual. *Corolla* 5-lobed; lobes with slightly thick margins, inner surface lacking papillae at the base, tube 1.6–2.3 mm long; inner epidermal cells of lobes and tube similar, their margins more or less straight (not undulate); vascular tissue not extending to the base of the lobes. *Style* with 2 distinct vascular traces from the base, nectary small, branches truncate, c. 0.5 mm long, apices papillate (some cells long-papillate). *Stamens* 5; anthers 0.66–0.75 mm long, caudate; microsporangia 0.44–0.51 mm long; apical appendages narrowly triangular, 0.21–0.24 mm long; filament collar more or less straight in outline. *Cypselas* obovoid, 0.4–0.5 mm long, 0.28–0.32 mm diam., pale brown or pinkish-brown, glabrous or with globose twin-hairs which

may have basal cells; pericarp lacking sclerenchyma (P.S. Short 2080); vascular bundles in pericarp 2; carpopodium annular. *Pappus* of 4–6 plumose bristles c. the length of the floret and united at the base in a small ring. *Chromosome number*: $n = c. 14$.

Distribution. Restricted to Western Australia between c. 23° and 30° S and west of c. 122° E.

Habitat. A common component of coastal heath, this species is also widespread in open scrub or woodland of the interior and in favourable seasons is common in herb fields that develop on sand-dunes. Less commonly occurs amongst samphire, *Atriplex* and *Frankenia* shrubs on the edge of saline depressions.

Phenology & reproductive biology. Flowering specimens have been mainly collected from about mid-August to mid-October.

The showy inflorescence alone suggests that this species must commonly cross-pollinate. This is supported by the pollen:ovule ratios determined for 15 individuals of *P.S. Short 396*, collected c. 100 km N of the Murchison River Bridge along the North West Coastal Highway. Values ranged from 1,119 to 2,870 ($\bar{x} = 1,636$; s.d. = 499; s.e. = 129).

Cytology. Turner (1970) determined $n = c. 14$ for a population (*B.L. Turner 5372*) collected about 150 miles north of Mullewa.

Notes. A somewhat polymorphic species in regard to the shape and degree of hairiness of the capitular bracts and the colour of the terminal lamina. Collections from the Shark Bay region, e.g. *S.D. Hopper 1371* & *A.S. George 11403*, have inner capitular bracts with an obovate claw, compared to the more common widely elliptic to circular or widely to very widely obovate claw found in specimens such as *P.S. Short 587*. Furthermore, in *S.D. Hopper 1371* & *A.S. George 11403* the margins of the claw of the inner capitular bracts lack or have very few hairs. The bulk of the inland specimens have much more hairy margins and there is a general gradation to fewer hairs toward the coast, with differences in the degree of hairiness tending to be associated with change in the shape of the claw. The specimen *A.S. George 11403*, from Dirk Hartog Island, is also an unusual collection in that the terminal lamina of the bracts is white, this being particularly obvious in the elements which comprise the PERTH specimen, and less so on elements of the duplicate specimen at AD where a hint of yellow is evident.

It may be due to age but the globose twin-hairs on the fruit do not appear to be myxogenic. I have soaked fruit which were several years old in water for three days without a mucilaginous layer forming on the surface.

As cited by Bentham (1867a), James Drummond collected this species, his collection being *Drummond 161*. It is represented in E (E 00433317, erroneously as a 'type'), Harvard (GH 00004568, erroneously as a 'type') and MEL (MEL 85059). It also appears that a

duplicate is held at Geneva (G 00222879), but it is erroneously labelled as *Calocephalus angianthoides* and attributed to Preiss.

Selected specimens examined.

WESTERN AUSTRALIA: 1 km E of Kalbarri, 26 Sep. 1976, *R.J. Chinnock 3185* (AD); Dirk Hartog Is., 2 Sep. 1972, *A.S. George 11403* (AD, PERTH); 25 km SW of Cooloomia Hmsd, 18 Sep. 1979, *S.D. Hopper 1371* (PERTH); "The Boats", c. 27 km from Laverton along road to Leonora, 20 Aug. 1982, *P.S. Short 1527* (MEL, PERTH); 16 km W of Gascoyne Junction, 20 Aug. 1986, *P.S. Short 2518* (AD, MEL, PERTH).

5. *Calocephalus glabratus* P.S.Short, sp. nov.

Type: Queensland. Currawinya Lakes N.P., eastern side of Hoodis Range, 28°37'S, 144°46'E, grassy swale between mound springs, 4 Apr. 1997, *E. Addicott CL4* (holotype: BRI AQ654298).

Calocephalus sp. Eulo (*M.E. Ballingall MEB2590*), Queensland Checklist sensu A.E. Holland (2010), www.anbg.gov.au/cgi-bin/apclist [accessed 7 Mar. 2012].

Subshrub or robust herb; major branches somewhat rigid, prostrate to ascending, to c. 40 cm long, glabrous or with a few scattered, long, septate hairs. *Leaves* alternate, sessile, entire, somewhat linear or lanceolate, the upper part sometimes recurved, 4–16 mm long, 0.5–1.3 mm wide, glabrous or with a few scattered long, septate hairs. *Compound heads* globular or obloid, c. 5–10 mm long, 5–15 mm diam.; bracts subtending compound heads numerous, in several rows, the outermost bracts leaf-like but with hyaline margins, the mid to inner bracts with a white lamina, all bracts densely cottony; *general receptacle* branched, densely cottony. *Capitula* to c. 20 per compound head. *Capitular bracts* in 2 rows. *Outer bracts* c. 5, spatulate, 2.9–3.7 mm long, c. 0.8–1.1 mm wide, the lower margins not or narrowly hyaline, upper margins hyaline and developing into a hyaline, sometimes pale white lamina, the midrib extending c. 4/5 the length of the bract, numerous long intertwined hairs at the apex of the midrib. *Inner bracts* c. 4, hyaline, midrib indistinct, extending c. 4/5 the length of the bract, obovate to oblanceolate, 2.4–3.2 mm long, 0.8–1.1 mm wide, glabrous or with long hairs near the apex of the midrib and along the hyaline margins, a terminal lamina not, or barely, differentiated. *Partial receptacle* conical, glabrous. *Florets* 4–7, bisexual. *Corolla* 5-lobed; lobes with thick margins and apparently lacking papillae on inner surface; tube 2–2.4 mm long; inner epidermal cells of lobes and throat with straight walls, the cells not in distinct rows; vascular tissue extending to the base of the lobes. *Style* with 2 distinct vascular traces from the base, nectary present, branches truncate, c. 0.8 mm long, apices papillate. *Stamens* 5; anthers c. 1–1.2 mm long, caudate; microsporangia c. 0.9 mm long; apical appendages subtriangular, c. 0.25 mm long; filament collar more or less straight in outline but dilated towards the base. *Cypselas* c. 1 mm long, c. 0.5 mm diam., brown, glabrous or with scattered, probably myxogenic, twin hairs with basal cells; carpopodium annular. *Pappus* of 7–14, sub-flexuose, white bristles

about the length of the corolla, joined at the base, bristles long-plumose throughout their length, with a terminal tuft. *Chromosome number*: unknown. **Fig. 6.**

Distribution. Restricted to the Eulo–Thargomindah area of south-western Queensland.

Habitat. Locality notes accompanying *M.E. Ballingall 2590* record that the specimen was collected from along a drainage flat where plants were growing “in reddish-brown loam with stony pavement” amongst “herbland chenopods and other Asteraceae”; for *M. Wilson* (BRI AQ533064) it was noted that plants were growing on the “crest of [the] mound spring on the edge of the mud”; while plants at Basin Bore in Currawinya N.P. (*P.I. Forster 20461*) were very common in “Grassland on claypan with scattered clumps of *Myoporum*”.

Phenology & reproductive biology. Flowering specimens have been collected from March to September.

A pollen:ovule ratio of 4,952 was obtained from a single floret of *M.E. Ballingall 2590*, collected from Granite Springs Station.

Etymology. The specific epithet refers to the stems and leaves being almost devoid of hairs.

Notes. This species, presumably because of the well-developed general involucre, has previously been referred to *Myriocephalus appendiculatus* Benth. following a determination by J.H. Willis of *S.T. Blake 11715* (MEL), or as an unnamed species of *Myriocephalus*. However, it is readily distinguished from *Myriocephalus* s.str. by its plumose pappus bristles and fruit morphology, etc.

Additional specimens examined.

QUEENSLAND: On Granite Springs Stn c. 22 km S of Eulo–Thargomindah road, 4 Sep. 1990, *M.E. Ballingall 2590* (BRI AQ501143, MEL1588568); Eulo, at edge of mud springs, 22 June 1936, *S.T. Blake 11713* (BRI, MEL); Currawinya N.P., Basin Bore, 19 Mar. 1997, *P.I. Forster 20461* (BRI AQ 604061, DNA, MEL n.v., NSW n.v.); Currawinya N.P. on the eastern drainage of Hoods Range, 12 Aug. 2004, *S. Peck lot458* (BRI AQ612511); Currawinya N.P. on the eastern drainage of Hoods Range, 12 Aug. 2004, *S. Peck lot459* (BRI AQ612510); Yowah Ck, SSE of Yowah Mound Spring on track leading to Twelve Mile Waterhole, 20 Mar. 1997, *M. Wilson* (BRI AQ533064).

6. *Calocephalus knappii* (F.Muell.) Ewart & Jean White

Proc. Roy. Soc. Victoria 22: 319, pl. 58, figs 1, 2 & 9 (1910); Chippendale, Trans. Roy. Soc. S. Austral. 82: 337 (1959); P.S.Short in Jessop, Fl. Centr. Austral. 392 (1981); P.S.Short in Jessop & Toelken, Fl. S. Austral. 3: 1502 (1986). — *Eriochlamys knappii* F.Muell., Australas. Chem. Druggist 6: 4 (May 1883). — **Type citation**: “In the vicinity of the Finke River; Rev. H. Kempe.” **Lectotype (here designated)**: Finke River, 1882, *F.A.H. Kempe 503* (MEL 543276 & MEL 543277, see below). **Isolectotype**: NSW 139002. **Remaining syntypes, isosyntypes & possible isolectotypes**: Finke River, Dec. 1879, *F.A.H. Kempe* (MEL 543280, NSW 139001); Finke River,

1880, *F.A.H. Kempe* (MEL 543279); Finke River, 1882, *F.A.H. Kempe* (MEL 543278); Finke River, 1882, *F.A.H. Kempe 516* (MEL 543281); Finke River, *F.A.H. Kempe* (K 000901837, but perhaps collected July 1883); Finke River, Central Aust., *F.A.H. Kempe* (K 000901838, received at K 4/1888); Finke River, *F.A.H. Kempe* (AD 97632031, ex herb. J.M.Black, fragments only, presumably obtained from MEL).

Annual *herb*; major branches decumbent to erect, 3–30 cm long; stem simple in the smaller plants but usually forming major branches at basal and/or upper nodes, all branches cottony, the long, septate hairs with broad, flat bases, also short, glandular hairs present. *Leaves* alternate, entire, ovate to lanceolate, or elliptic or linear, 5–32 mm long, 2.5–6 mm wide, spreading to adpressed, subglabrous to densely hairy, with long, septate hairs with broad, flat bases, also with scattered, glandular hairs. *Compound heads* broadly ovoid to ovoid or globular or somewhat oblong, 6–16 mm long, 6–11 mm diam.; bracts subtending compound heads more or less absent; *general receptacle* branched, cottony, each secondary peduncle terminating in c. 3–5 capitula. *Capitula* 20–70 per compound head, each one usually subtended by a bract which resembles the outer capitular bracts. *Capitular bracts* in two rows. *Outer bracts* 6–9, narrowly oblanceolate, 2–3.5 mm long, 0.2–0.7 mm wide, predominantly (rarely entirely) green, but with a hyaline apex and sometimes narrow hyaline margins, always with long hairs extending from the margins. *Inner bracts* 7 or 8, lanceolate, 1.8–3.2 mm long, 0.4–1 mm wide, entirely hyaline or sometimes with a very small opaque base, usually with long hairs extending from the margins. *Partial receptacle* somewhat conical, with minute but distinct pedicels, glabrous. *Florets* 10–18, bisexual. *Corolla* campanulate, 5-lobed; lobes with thick margins, inner surface variably papillate (?sometimes absent) at the base; tube 1.6–2.4 mm long; inner epidermal cells of lobes with more or less straight walls, those of the tube undulate, cells not in distinct rows; vascular tissue not extending to the base of the lobes. *Style* with 2 distinct vascular traces from the base, nectary small, branches truncate, c. 0.6–0.7 mm long, apices papillate. *Stamens* 5; anthers c. 0.71–0.92 mm long, caudate; microsporangia 0.53–0.72 mm long; apical appendages triangular, c. 0.17–0.23 mm long; filament collar mostly more or less straight in outline but dilated towards the base. *Cypselas* obovoid, 0.45–0.5 mm long, c. 0.3 mm diam., brown, seemingly glabrous but the epidermis with inconspicuous, globose twin-celled papillae; pericarp with a layer of sclerenchyma (*D.W. Goodall 3440*); vascular bundles in pericarp 2, lateral; carpodium absent, the abscission area not differentiated from the pedicel. *Pappus* of 3–6 lax, plumose bristles c. as long as the corolla tube, also some smaller bristles often present, all bristles scarcely united at the base. *Chromosome number*: $n = 14$. **Fig. 1C.**

Distribution. Widespread, occurring in south-western Queensland, central Australia and much of Western Aus-

tralia but avoiding the sandy deserts, i.e. Great Sandy, Gibson and Simpson Deserts.

Habitat. It grows in a number of different arid zone plant communities. Collectors' notes include: "In ... red sand with *Triodia*", "Reddish sandy loam, *Acacia* dominant", "*Acacia* over spinifex", "Sandy loam with surface gravel. Mulga scrub.", "Open ground of mulga flat. Red loam with buckshot gravel, small quartz & ironstone pebbles on surface", "Red loam over limestone" and "Open floodplain; compact sandy loam".

Phenology & reproductive biology. Most flowering specimens of *C. knappii* have been collected from about late July to mid-October but specimens have been collected in all months except January, April and December.

Pollen:ovule ratios determined for five florets from *P.S. Short 4306*, collected at the Yannarie River crossing along the North West Coastal Highway, W.A., ranged from 2,036 to 2,872 (\bar{x} = 2,351; s.d. = 321; s.e. = 161).

Cytology. Watanabe et al. (1999) recorded $n = 14$ from a population (*P.S. Short 4413*) at a crossing of Beasley Creek along the road linking Laverton and Bandya, W.A.

Lectotypification. The lectotype specimen, *F.A.H. Kempe 503*, which is designated here was collected in 1882 and, as was regular practice at that time in MEL, the elements of which it is composed would have been unmounted and retained in a single folder. In later years when it was mounted the individual elements were distributed over two sheets. Each sheet was stamped with a different accession number but the fact that they formed part of the same collection was recorded, the sheet numbered MEL 543276 labelled as being "Sheet 1 of 2", while MEL 543277 was labelled as "Sheet 2 of 2". Both sheets are therefore regarded as constituting a single specimen, which is in accord with Article 8.3, Ex. 4 of the *Code* (McNeill et al. 2012).

Notes. Readily distinguished from other species by the viscous nature of the florets, an absence of distinct coloured terminal laminae in the inner capitular bracts, and the usually long-ciliate margins of the capitular bracts.

Selected specimens examined.

WESTERN AUSTRALIA: 38 miles S of Neale Junction, 12 Oct. 1966, *A.S. George 8459* (KPBG, PERTH); 1.4 km from Towera Hmsd turnoff on Towera–Lyndon Hmsd road, 25 Aug. 1977, *P.S. Short 479* (AD); c. 8 km S of Sullivan Ck on Leonora–Agnew road, 10 Oct. 1983, *P.S. Short 2012* (AD, MEL, PERTH).

NORTHERN TERRITORY: 15 miles SW of White Quartz Hill Hmsd, 14 Aug. 1959, *G.M. Chippendale* (AD 9675003, BRI, NT 6527–to DNA, NSW); 6 km E of Jessie Gap, 10 Aug. 1988, *P.S. Short 3143* (MEL); 26 miles NW of Haasts Bluff, 7 Sep. 1956, *R.E. Winkworth 1419* (CANB, NT).

SOUTH AUSTRALIA: Mt Harriet road, 45 km S of Musgrave Park Stn, 28 Oct. 1966, *J.Z. Weber 138* (AD).

QUEENSLAND: 23 miles N of Thargomindah, 28 Sep. 1968, *L.D. Williams 114* (BRI).

7. *Calocephalus multiflorus* (Turcz.) Benth.

Fl. Austral. 3: 576 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 822 (1975). — *Pachysurus multiflorus* Turcz., Bull. Soc. Imp. Naturalistes Moscou 24 (1): 192 (27 March 1851), basionym. — *Leucophyta multiflora* (Turcz.) Kuntze, Revis. Gen. Pl. 1: 352 (1891). — **Type citation:** "Nova Hollandia. *Drum. coll. III. n. 117.*"

Syntypes: *J. Drummond 3:117* (KW 001001489, see note below; MEL 543201, ex herb Steetz, annotated by Turcz.); P 00715997, ex herb. Schultz-Bip., annotated by Turcz.). **Isosyntypes:** E; GH 00010847, ex herb. Klatt; K 000901842, ex herb. Benth 1854; K 000901840 p.p. (see notes); MEL 543202; NSW; P 00715996, ex BM, received 1914; PERTH, ex K, ex TCD, 2 sheets; PERTH (ex MEL).

Possible isosyntypes: *J. Drummond* (MEL 85125).

Achrysum glomeratum A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 4: 229 (Aug. 1852). — **Type citation:** "Swan River, *Drummond.*" **Syntypes & isosyntypes:** *J. Drummond 3: 117* (E; K 000901842, ex herb. Benth. 1854; K 000901840 p.p., ex herb. Hook. 1867; GH 00010847, ex herb. Klatt; KW 001001489, see notes below; MEL 543201, ex herb. Steetz; MEL 543202, number '18' crossed out; NSW; P 00715996, ex BM, received 1914; P 00715997, ex herb. Schultz-Bip.; PERTH, ex K, ex TCD, 2 sheets; PERTH, ex MEL); *J. Drummond 5: 389* (G 00222877; K 000901841, ex herb. Benth 1854; K 000901840, p.p., ex herb. Hook. 1867; PERTH, ex K, ex TCD; KW 001001488; KW 001001490, see note below). **Possible isosyntypes:** *J. Drummond* (MEL 85125). *J. Drummond 5: 388* (P 03312998, ex BM, received Apr. 1923).

Annual *herb*, stem and major branches 5–16 cm long, ascending to erect, with a sparse to dense cottony indumentum, the long, septate hairs with broad, flat bases. *Leaves* alternate, sessile, entire, narrowly elliptic, lanceolate, or oblanceolate, 4–23 mm long, 0.6–5.5 mm wide, cottony, with the long, septate hairs with broad, flat bases, also with scattered, yellow, glandular hairs, leaves sweetly aromatic, most leaves slightly mucronate, the uppermost usually with a small hyaline tip. *Compound heads* very broadly to depressed ovoid, c. 4–18 mm long, 5–18 mm diam.; bracts subtending compound heads absent but each of the lower capitula subtended by a single, mainly foliaceous bract; *general receptacle* branched, sparsely cottony, each secondary peduncle terminating in 2–10 capitula. *Capitula* c. 10–180 per compound head, each one usually subtended by a bract, the lower capitulum-subtending bracts mainly foliaceous, the upper hyaline except for a midrib extending for most of the length, often densely hairy. *Capitular bracts* in 2 rows. *Outer bracts* c. 6, usually hyaline except for a midrib extending for c. the length of the claw or sometimes the midrib with only narrow hyaline margins, all bracts united by long intertwined hairs which often invest much of the midrib; claw somewhat elliptic, 1.2–1.5 mm long, 0.7–0.9 mm wide, upper margins with long hairs; terminal lamina widely depressed to depressed ovate, 0.3–0.35 mm long, 0.4–0.5 mm wide, more or less distinguished by a constriction above the midrib, pale yellow. *Inner bracts* 7 or 8, entirely hyaline or sometimes with an indistinct

midrib extending to c. $\frac{1}{3}$ the length of the claw, all bracts united by long, dense, intertwined hairs at the base of the terminal lamina; claw elliptic or obovate, 1.4–1.8 mm long, 0.5–1.1 mm wide, upper margins with long hairs; terminal lamina circular or transversely elliptic, 0.2–0.4 mm long, 0.3–0.6 mm wide, somewhat concave, usually reflexed, yellow. *Receptacle* more or less conical, glabrous. *Florets* 8–16, bisexual. *Corolla* 5-lobed; lobes with slightly thickened margins, lacking papillae on inner surface or slightly papillate on some lobes; tube 0.8–1 mm long; inner epidermal cells of lobes and throat with more or less straight walls, the cells not in distinct rows; vascular tissue not, or barely, extending to the base of the lobes. *Stamens* 5; anthers c. 0.6–0.8 mm long, caudate; microsporangia 0.45–0.63 mm long; apical appendages narrowly triangular, c. 0.15–0.2 mm long; filament collar more or less gradually dilating towards the base. *Style* with 2 distinct vascular traces from the base, nectary ?absent or barely developed, branches truncate, 0.27–0.32 mm long, apices papillate. *Cypselas* obovoid, c. 0.4 mm long, 0.25 mm diam., brown, glabrous, enveloped by myxogenic hairs; pericarp lacking sclerenchyma (*P.S. Short* 2189); vascular bundles in pericarp 2; carpodium annular. *Pappus* of 5 or 6 bristles about the length of the corolla, united at the base, bristles irregularly long-plumose in their upper $\frac{1}{2}$ or throughout their length. *Chromosome number*: unknown. **Fig. 1D.**

Distribution. Restricted to Western Australia between latitudes 23°S and c. 32° S and west of c. 123° E.

Habitat. This species is common in arid shrubland communities but has also been collected from more temperate regions. The few collectors' notes include: "Open *Acacia*–*Cassia* [*Senna*] scrub. Sandy loam covered with ironstone gravel", "*Acacia*, mallee *Eucalyptus* scrub. Sand or very sandy loam", "Open woodland of *Melaleuca* & *Acacia* with *Triodia*. Light brown sandy loam soil", "with *Casuarina* & *Hakea* in roadside gravel pit" and "Sand with ironstone gravel. *Acacia*, *Eremophila* shrubland".

Phenology & reproductive biology. Flowering specimens have been collected from late August to early November, with those collected in late October and November often with mature or near-mature fruit.

Pollen:ovule ratios ranging from 1,954 to 2,620 (\bar{x} = 2139; s.d. = 267; s.e. = 134) were determined for five capitula from *P.S. Short* 4331, collected c. 11 km south of Booloogooro Homestead.

Typification. Turczaninow's herbarium in KW contains two sheets of this species. One sheet, KW 001001490, consists of a single element of *J. Drummond* 389, while the other sheet contains a number of elements attributed to both *J. Drummond* 117 and *J. Drummond* 389, elements purported to be of *J. Drummond* 117 having the herbarium number KW 001001489, those purported to be of 389 having the number KW 001001488. As

Turczaninow made no mention of it in his publication, the specimens of *J. Drummond* 389 have no type status in regard to the name *Pachysurus multiflorus*, and with Turczaninow's personal herbarium in KW it would normally be considered to house the holotype specimen, i.e. those elements of *J. Drummond* 117 which comprise the specimen now labelled as KW 001001489. However, unless a piece of paper appearing to be part of an original label and attached to an element in the right hand bottom corner of the sheet is numbered on the reverse, there is nothing to indicate which of the attached 14 elements actually belong to Drummond's numbers 117 and 389. Thus, I have merely indicated that KW houses a syntype specimen. The two further syntypes, i.e. MEL 543201 and P 00715997 (ex herb. Schultz-Bip.), both contain labels in Turczaninow's hand and, as noted in Short & Sinkora (1988), the former specimen was probably obtained by Joachim Steetz in 1852. There is no evidence on the sheets, or in publication, that Turczaninow saw additional specimens of *Drummond* 117 in K, MEL, P and PERTH and these are accordingly regarded as isosyntypes.

Gray did not refer to a numbered Drummond specimen in the protologue pertaining to the name *Achrysum glomeratum* but at K there is a single sheet (K 000901840, stamped Herbarium Hookerianum 1867) on which is pencilled "*Achrysum glomeratum*, n. gen" in what I believe to be Gray's hand. Numerous individuals are attached to the sheet and — as with specimens in KW — it consists of elements purported to be of *J. Drummond* 117 and *J. Drummond* 389 but with no clear indication as to which elements belong to the respective numbers. There are also *J. Drummond* 389 specimens in both G and PERTH. With the exception of K 000901840 no other possible syntype or isosyntype specimens of *Achrysum glomeratum* listed above are annotated by Gray.

A specimen at P (P 03312998) labelled as *J. Drummond* 388 and coming from the fifth collection is not annotated by Gray and does not contain an original Drummond label. I listed it above as a possible isosyntype of the name *Achrysum glomeratum* on the assumption that it should be labelled as *J. Drummond* 389.

Selected specimens examined.

WESTERN AUSTRALIA: 12 km SW of Paynes Find, 13 Nov. 1983, *L. Haegi* 2656 (AD, MEL, PERTH); Merredin, 6 Nov. 1923, *M. Koch* 2937 (NSW); Pindar, Oct. 1909, *J.H. Maiden* (CANB 246317, NSW 128037); 36 km from Laverton along road to Bandy Stn, 21 Aug. 1982, *P.S. Short* 1532 (MEL); 20 km S of Booloogooro Hmsd, 13 Oct. 1983, *P.S. Short* 2051 (AD, CANB, MEL, PERTH).

8. *Calocephalus pilbarensis* P.S. Short, *sp. nov.*

Type: Western Australia. c. 2 km S. of Fortescue River crossing along Marble Bar road, 22° 34' 28" S, 119° 57' 18" E, in open *Eucalyptus* woodland on floodplain, 28 Aug. 1995, *P.S. Short* 4261 (holotype: MEL 2027673; isotypes: AD, BRI, CANB, K, NSW, PERTH, S).

Calocephalus sp. Wittenoom (*A.S. George 1082*) WA Herbarium, as per both florabase.dec.wa.gov.au/search/current/16525 and www.anbg.gov.au/cgi-bin/aplist [both accessed 7 Mar. 2012].

Annual herb; major branches axes ascending to erect, to c. 45 cm long, with a sparse to dense cottony indumentum, stalked glandular hairs often present, when devoid of cottony hairs the axes yellowish, greyish when densely cottony. Leaves alternate, basal and cauline, descending in size towards the compound heads, mostly lanceolate to linear-lanceolate or somewhat linear-ob lanceolate, 10–60 mm long, 0.1–0.8 mm wide, apically with a blunt mucron, dark green to grey due to sparse to dense indumentum of cottony, white, eglandular hairs as on stems. Compound heads spheroid to broadly ellipsoid or very broadly ovoid, 9–15 mm long, 11–18 mm diam.; general involucre absent but scattered, leaf-like, somewhat linear or oblanceolate and sparsely to densely cottony bracts visible at and about the base of immature compound heads and amongst the capitula, such bracts inconspicuous in mature compound heads; general receptacle short, somewhat oblong, unbranched and the capitula sessile. Leaf-like, capitulum-subtending bracts linear or narrowly oblanceolate as per those around the base of the compound head. Capitula c. 35–45 per compound head (37 capitula from single compound head 14 mm long, 15 mm diam.). Capitular bracts c. 16–21 in about 3 rows, all bracts with a distinct claw and terminal lamina, mostly hyaline except for a pale yellow-green midrib extending c. the length of the claw, the terminal lamina well-formed, c. 1.4–1.9 mm long, 1.2–1.9 mm wide, concave, distinctly delimited and the inner ones reflexed to c. 90° but as with the hyaline margins almost colourless and therefore inconspicuous; outermost bracts c. 5 or 6, differing from the mid- and inner bracts by being shorter, having narrower midribs, and in being somewhat woolly, having longer and more numerous intertwined hairs which extend from c. the upper ½ of both the midrib and hyaline margins of the claw; mid- and innermost bracts c. 3.8–5.5 mm long, 1.2–1.9 mm wide; bracts in both rows united by long, white, intertwined hairs extending from the apex of the midrib and the hyaline margins at the claw/lamina interface. Florets 8–12, bisexual. Corolla 5-lobed; lobes with their inner surfaces minutely papillate throughout; tube 2.6–3.1 mm long; inner epidermal cells of throat mostly with straight walls but some cells with somewhat undulating margins; vascular tissue extending to c. ¼ the length of the lobe. Style with 2 distinct vascular traces from the base, nectary small (c. 0.15 mm long), branches truncate, c. 0.7–0.75 mm long, apices long-papillate. Stamens 5; anthers 1.45–1.52 mm long, microsporangia 1.1–1.18 mm long, shortly caudate, each with a subtriangular terminal appendage 0.3–0.37 mm long, the appendage with a definite central thickening extending its length; filament collar almost straight in outline, only slightly and gradually expanding to the base. Cypselas somewhat compressed obovoid, 1.2–2 mm long, 0.45–

1 mm wide, densely sericeous, except at the base the white, straight, appressed, eglandular hairs obscuring the surface of the fruit, the upper hairs exceeding the fruit body by c. 0.3–0.7 mm; carpopodium appears to be absent. Pappus of 9–13 weakish, white bristles c. the length of the corolla tube, joined at the base, bristles subplumose at the base but the hairs grading to very long plumose and becoming tangled towards the apex. Chromosome number: unknown. Fig. 7.

Distribution. Common in north-west W.A., including the Pilbara, with most records between c. 22° and 25° S, and west of 121° E.

I believe the specimen *W.D. Campbell* (PERTH), collected in 1902, is probably erroneously labelled as being collected from Cue, a locality which would represent a fairly major disjunction from its otherwise known distribution. As Cue lies on the Great Northern Highway I would also have expected it to have been collected from that region on other occasions.

Habitat. A species of very open eucalypt woodland, *Acacia* shrubland, and tussock-grass plains, it grows in red loam or clay-loam soil. In good seasons it is prolific and a dominant component of the landscape (e.g. see florabase.dec.wa.gov.au/browse/photo/16525).

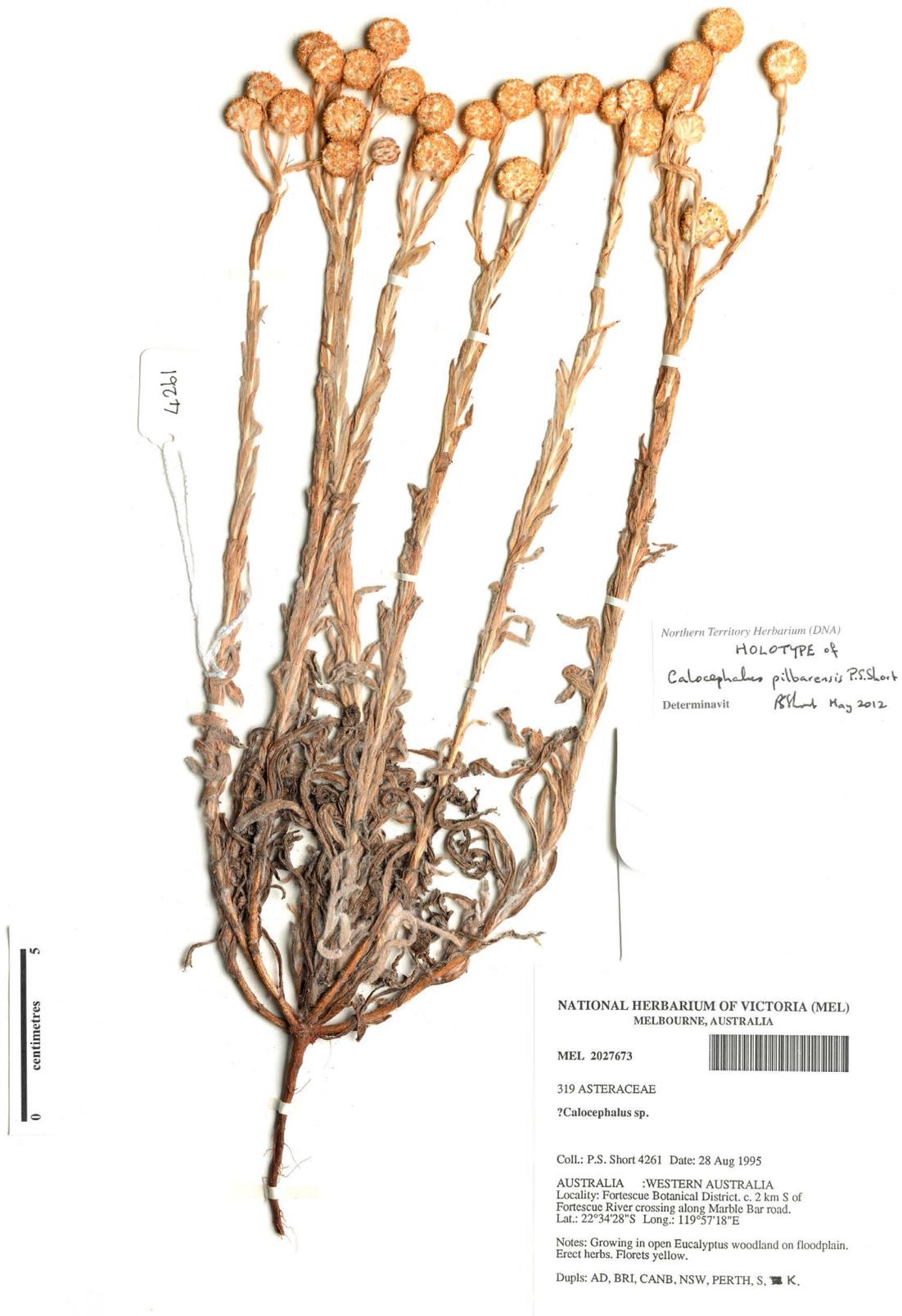
Phenology & reproductive biology. Mostly collected in August but, assuming specimens referred to as *Calocephalus* sp. Wittenoom (*A.S. George 1082*) are correctly identified, data seen at both the Australian Virtual Herbarium and the Florabase websites [accessed 20 June 2015] indicate that they have been gathered from May to October.

All florets, by virtue of having separating style arms and developed stigmatic surfaces, and each with at least an immature ovary, appear to be bisexual but it was noticeable in 11 capitula sampled from *P.S. Short 4261* that there was always a substantial number of florets in which cypselas never developed, the ratio of florets with developed:undeveloped cypselas being 3:5, 4:7, 4:7, 4:7, 4:8, 4:8, 5:6, 5:6, 5:7, 5:7 and 6:5. Low fruit set was also evident in other specimens.

On the assumption that all florets are bisexual a pollen:ovule ratio of 7,790 pollen grains was determined from a single floret of the type specimen, *P.S. Short 4261*. It is a very high value compared to many other members of the Australian Gnaphalieae for which I have recorded pollen:ovule ratios, one that not only suggests that cross-pollination is common but also suggests self-incompatibility; the latter suggestion would explain the low fruit set, albeit that environmental factors — particularly a lack of rain — may curtail fruit development.

Etymology. In reference to the distribution of the species in and around the Pilbara region.

Notes. I have referred in the above description to small leaf-like, capitulum-subtending bracts within the compound heads. However, without destroying numerous compound heads I could not determine their



4261

Northern Territory Herbarium (DNA)
HOLOTYPE of
Calocephalus pilbarensis P.S.Short
Determinavit R.S. May 2012

0 centimetres 5

NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA

MEL 2027673



319 ASTERACEAE
?Calocephalus sp.

Coll.: P.S. Short 4261 Date: 28 Aug 1995

AUSTRALIA :WESTERN AUSTRALIA
Locality: Fortescue Botanical District. c. 2 km S of
Fortescue River crossing along Marble Bar road.
Lat.: 22°34'28"S Long.: 119°57'18"E

Notes: Growing in open Eucalyptus woodland on floodplain.
Erect herbs. Florets yellow.

Dupls: AD, BRI, CANB, NSW, PERTH, S, K.

NATIONAL HERBARIUM OF
VICTORIA (MEL), AUSTRALIA

Fig. 7. Holotype of *Calocephalus pilbarensis* (MEL), — P.S. Short 4261.

arrangement with certainty nor establish that one (or perhaps more) even consistently subtends every capitulum.

This species is clearly differentiated from all other species included within *Calocephalus* s.lat. by its sericeous cypselas.

At least superficially this species appears to be related to *Pycnosorus* Benth., revised by Everett & Doust (1992), both taxa having compound heads, sessile capitula, well-developed plumose pappus bristles and sericeous cypselas. It differs from *Pycnosorus* in its lack of receptacular bracts and in having white, not yellow, pappus bristles and almost colourless, not yellow, capitular bracts.

Selected specimens examined.

WESTERN AUSTRALIA: Balfour Downs, 8 Aug. 1966, J.S. Beard 4472 (KPBG, PERTH); Hamersley Stn, 28 Aug. 1970, J.S. Beard 6132 (KPBG n.v., NSW, PERTH); about 15 km SW of Balfour Downs Hmsd on track to Jigalong, 31 Aug. 1995, A.A. Mitchell PRP540 (MEL, PERTH n.v.); 45 km from Tom Price along Marandoo Development road, 30 Aug. 1995, P.S. Short 4282 (AD, MEL, NSW, PERTH); Mt Augustus Stn, 23 Aug. 1973, E. Wittwer 1118 (PERTH).

9. *Calocephalus platycephalus* (F.Muell.) Benth.

Fl. Austral. 3: 576 (1867); C.Moore & Betche, Handb. Fl. New South Wales 289 (1893); F.M.Bailey, Queensl. Fl. 851 (1900); Maiden & Betche, Census N.S.W. Pl. 200 (1916); Chippendale, Trans. Roy. Soc. South Australia 82: 337 (1959); P.S.Short in Jessop, Fl. Centr. Austral. 392 (1981); G.M.Cunningham et al., Pl. W. New South Wales 706 (1981); P.S.Short in Jessop & Toelken, Fl. S. Austral. 3: 1504 (1986); E.A.Brown in G.J.Harden, Fl. New South Wales 3: 259 (1992). — *Pachysurus platycephalus* F.Muell., Fragm. 3: 154 (1863). — *Leucophyta platycephala* (F.Muell.) Kuntze, Revis. Gen. Pl. 352 (1891). — **Type citation:** “Ad flumen Darling; Goodwin. Ad montes Barrier Range; Beckler. Ad sinum Spencer’s Gulf; Warburton.” **Lectotype (here designated):** Darling River, [1858/59], [J.] Dallachy & [T.H.] Goodwin (MEL 543210). **Isolectotypes:** K 000901843, MEL 543211, MEL 543213. **Remaining syntypes or possibly isolectotypes:** Darling River, [1858/59], [J.] Dallachy (MEL 543212, NSW 139017); Lake Menindee, River Darling, Nov. 1858, [J.] Dallachy (MEL 85145). **Remaining syntypes:** Towards Spencers Gulf, Warburton (MEL 85146); Vict. Exped. 12 March 1861, [H.] Beckler (MEL 543209 p.p.); Darling River to Barrier Range, Victoria Expedition (K 000901844); Near Cariapundi [Caryapundy], 19 March [1861], [H.] Beckler (MEL 543209 p.p.).

Calocephalus dittrichii F.Muell., S. Sci. Rec. Mag. Nat. Hist. 2 (May 1886) & Bot. Centralbl. 27: 300 (1886, post May); C.Moore & Betche, Handb. Fl. New South Wales 289 (1893); F.M.Bailey, Queensl. Fl. 851 (1900); Stapf, Index Lond. 531 (1929), as “*dietrichii*”. — *Myriocephalus dittrichii* F.Muell., S. Sci. Rec. Mag. Nat. Hist. 2 (May 1886) & Bot. Centralbl. 27: 300 (1886, post May), nom. inval., pro syn. — *Leucophyta dittrichii* (F.Muell.) Kuntze, Revis. Gen. Pl. 352 (1891). — **Type citation:** “Near Charlotte-Waters; Lieutenant Dittrich; collected during Mr. Lindsay’s Expedition.” **Lectotype (here designated):** South of Charlotte Waters, 1885, Lieut. Dittrich 37 (MEL 543272).

[*Calocephalus multiflorus* auct. non (Turcz.) Benth.: J.M.Black, Fl. S. Austral. 1st ed. 648 (1926), 2nd ed. 928 (1957); H.Eichl., Suppl. J.M.Black’s Fl. S. Austral. 327 (1965); R.J.Henderson (ed.), Names & Distrib. Queensl. Pl., Algae & Lichens 26 (2002); P.D.Bostock & A.E.Holland (eds), Census Qld Fl. 24 (2007); P.D.Bostock & A.E.Holland (eds), Census Qld Fl. 19 (2010).]

Annual, or perhaps sometimes longer-lived herb, with ascending to erect branches 8–50 cm long, branches with a sparse to dense cottony indumentum. *Leaves* alternate, sessile, entire, linear or lanceolate, 5–30 mm long, 1–5.5 mm wide, with a sparse to dense cottony indumentum, the uppermost usually with a small hyaline tip. *Compound heads* broadly depressed to depressed ovoid or globular, 6–20 mm long, 8–30 mm diam., tertiary “heads” present in the larger inflorescences; bracts subtending compound heads numerous, in several ill-defined rows, mainly hyaline, somewhat similar to the outer capitular bracts but with the midrib more prominent and the entire outer surface of the midrib cottony. *General receptacle* branched, cottony. *Capitula* 10–160 per compound head. *Capitular bracts* c. 17–22 in about 2 rows. *Outer bracts* hyaline except for a midrib extending c. the length of the claw, bracts more or less glabrous or united by long intertwined hairs at the apex of the midrib, their hyaline margins being entire; claw oblanceolate to obovate, 2.2–3 mm long, 0.6–1.3 mm wide; terminal lamina very widely ovate, 0.5–1.1 mm long, 0.6–0.9 mm wide, often distinguished from the claw by a constriction above the midrib, yellow. *Inner bracts* hyaline except for a midrib extending c. the length of the claw, glabrous; claw elliptic or obovate, 2.7–3.1 mm long, 0.9–1.3 mm wide; terminal lamina very widely ovate to depressed ovate, 0.3–0.7 mm long, 0.5–0.7 mm wide, pale yellow. *Partial receptacle* conical, glabrous. *Florets* 12–22, bisexual. *Corolla* 5-lobed; lobes with thick margins and lacking papillae on inner surface; tube 1.8–2.5 mm long; inner epidermal cells of lobes and throat with straight walls, the cells not in distinct rows; vascular tissue extending to the base of the lobes. *Style* with 2 distinct vascular traces from the base, nectary ?absent or barely developed, branches truncate, c. 0.5–0.6 mm long, apices papillate. *Stamens* 5; anthers c. 0.85–1 mm long, caudate; microsporangia c. 0.71–0.76 mm long; apical appendages subtriangular, c. 0.14–0.2 mm long; filament collar c. 0.3 mm long, more or less straight in outline but slightly dilating towards the base. *Cypselas* obovoid, 0.5–0.62 mm long, 0.25–0.3 mm diam., brown, with globose (?myxogenic) twin-hairs which seemingly have basal cells; vascular bundles in pericarp 2; carpodium annular. *Pappus* of 6–11 flexuose, bristles c. the length of the corolla tube, joined at the base, bristles plumose throughout their length, often with yellowish terminal tufts. *Chromosome number:* $n = 12$. **Fig. 1E.**

Distribution. Common in central Australia (W.A., N.T., S.A., Qld, N.S.W.), but barely extending into W.A. where it only occurs in the Central Ranges biogeographical

region. If correctly labelled, a specimen from Springvale, near Jericho, Qld (*V. Scarth-Johnson 51*) represents a major disjunction in the distribution of the species.

Habitat. *Calocephalus platycephalus* grows in an array of arid-zone habitats, including *Acacia* shrubland on low sand dunes, *Eucalyptus terminalis* open woodland with shrub story dominated by *Senna* spp., with *Triodia pungens* on the margins of salt lakes, on *Atriplex nummularia* flats, and seasonally inundated floodplains with cracking clay.

Cytology. Watanabe et al. (1999) recorded $n = 12$ for a population (*K. Watanabe 670*) in the vicinity of Alice Springs.

Phenology & reproductive biology. The majority of specimens have been collected from about August to October but flowering specimens have been collected in all months.

A pollen:ovule ratio of 2,324 was determined from a single floret of *P.S. Short 3140* which was collected from near Palm Valley in the Finke River Gorge, N.T.

Lectotypification of Pachysurus platycephalus. The Rev. Goodwin assisted the curator of the Melbourne Botanic Gardens, John Dallachy, during the latter's collecting trip in the Darling River–Mt Murchison region of New South Wales in 1858–1859 (Mueller in unpublished monthly reports to the Chief Secretary, housed at MEL). Thus, although Goodwin's name is missing from the labels of MEL 543212, MEL 85145 and NSW 139017, it is possible that these collections are duplicates of the lectotype.

The sheet MEL 543209 contains several branches and an envelope of fragments of this taxon. The material looks as if it may be from the one gathering, but there are four labels indicating that it consists of at least two collections. One label is seemingly in Mueller's hand and is in general accord with the protologue, i.e. "North Barrier Ranges, Dr Beckler", indicating that the sheet contains syntype specimens. Other label data, cited above, indicate that specimens were actually gathered on the 12th and the 19th March 1861, with the latter gathered near Caryapundy.

Bentham (1867a) referred to a specimen "Towards Spencer's Gulf (a fragment only), *F. Mueller*" and from the label annotation there is no doubt that this is the specimen MEL 85146. I believe this same specimen is actually that cited by Mueller as "Ad sinum Spencer's Gulf; Warburton" and it is therefore a syntype of *Pachysurus platycephalus* F.Muell.

Lectotypification and publication of the name Calocephalus dittrichii. Dittrich, as well as collecting the lectotype specimen of *Calocephalus dittrichii* from "near" or "south" of Charlotte Waters, also gathered this taxon from Stevensons Creek (MEL 84475, PERTH) and Finke River (MEL 84474) when on Lindsay's Expedition in 1885/6. I doubt that either of the last two specimens should be considered to be syntypes of

the name *C. dittrichii* as the protologue suggests to me that Mueller was referring only to the one collection, that from Charlotte Waters. The lectotype specimen here chosen is also the only collection annotated as *C. dittrichii* by Mueller. It consists of two plants, both less than c. 15 cm tall, plus some fragments in a separate envelope; the size of these plants is also consistent with the original description in which it was recorded that "the specimens seen about hand-high".

It is believed that volume two of the new series of *The Southern Science Record and Magazine of Natural History* was never issued, although page proofs containing the description of at least some species are believed to have been distributed by Mueller (Chapman 1991, George 2009). I have no record of having seen any copy of a page proof from that journal which refers to the name *Calocephalus dittrichii*. However, that there was a distributed, printed article appears indisputable. In what I take to be a direct copy from the distributed article — the description is enclosed in square brackets — published in *Botanisches Centralblatt* there is reference to the description as being from "Definitions of some new Australian Plants. (From Wing's Southern Science Record. Vol. II. New Ser. May, 1886)"; a lack of cited pagination perhaps supports the belief that they were referring to what Chapman (1991) and George (2009) referred to as "page proofs". The question, in my mind, is whether the distributed material should be regarded as a "page proof", something of questionable validity in regard to publication, or as a "preprint"; the fact that there is direct reference to *The Southern Science Record and Magazine of Natural History* in *Botanisches Centralblatt* suggests the description was considered as a preprint at the time of distribution and that the date of valid publication of the name should be considered to be May 1886. This conclusion is at variance to that presented in APNI (www.cpbr.gov.au/cgi-bin/apni, accessed March 2012) in which it is stated that the name was validly published in *Botanisches Centralblatt*. However, the question is academic, there being no question as to priority of the name in relation to *C. platycephalus*.

That the name *C. dittrichii* is synonymous with the earlier name *C. platycephalus* appears to have been first noted by J.H. Willis in an annotation accompanying the specimen *R.E. Winkworth* (DNA-A19063): "I fail to perceive any difference (except that of age) between TYPE *C. dittrichii* (near Charlotte Waters) and TYPE *C. platycephalus* (F.Muell.) Benth. from Darling R. etc. The latter name should stand and I apply it to this collection. J.H. Willis 27/4/1956 Nat. Herb. Victoria".

As evident in his letter dated 26 Apr. 1968 (accompanying *D.J.E. Whibley 1186*, AD) and sent to Judy Wheeler (at AD) it is also apparent that Jim Willis was instrumental in having the name *C. platycephalus* reinstated after it was reduced by J.M. Black (1929) to synonymy under *C. multiflorus* (Turcz.) Benth. Jim had access to type specimens of both taxa at MEL; as

he noted, "Black could not have critically examined the types, or he would surely never have chosen to lump these species".

Notes. Distinguished from *C. badmanii* by its habit, the latter being a subshrub with somewhat rigid branches, and in having 6–11 pappus bristles per floret compared with 11–16 in *C. badmanii*. The long-plumose teeth of the pappus bristles also tend to be more spreading in *C. badmanii* than *C. platycephalus*.

Selected specimens examined.

WESTERN AUSTRALIA: Rebecca Ck, 24 Oct. 1989, *B.J. Conn* 3460 (MEL, NSW); Warburton Plains, 18 Nov. 1978, *H. Demarz* 7220 (CANB, KPBG, PERTH); Lake Hopkins, 5 Oct. 1966, *A.S. George* 8337 (PERTH).

NORTHERN TERRITORY: 13 miles S of White Quartz Hill Hmsd, 14 Aug. 1959, *G.M. Chippendale* (AD 96750114, BRI 105067, CANB 214565, DNA ex NT 6525, MEL 85137, NSW, PERTH); 79 miles N of Andado Hmsd, 7 Sep. 1959, *G.M. Chippendale* (AD 96750120, BRI 105059, CANB 214553, DNA ex NT 6574, MEL 85136, NSW, PERTH); Irving Ck, 10 March 1964, *D.J. Nelson* 940 (AD, CANB, DNA ex NT, MEL, PERTH).

SOUTH AUSTRALIA: c. 20 km NNW of Quinyambie Hmsd, 31 July 1971, *N.S. Donner* 3626 (AD); Level Post Bay, Lake Eyre, 9 Oct. 1980, *B. Lay* 1218 (AD, MEL); c. 30 km W of Everard Park Hmsd, 16 Sep. 1963, *D.J.E. Whibley* 1186 (AD, MEL).

QUEENSLAND: 39 km W of Coorabulka, 10 Sep. 1978, *R. Purdie* 1345 (BRI); 5 km S of Glengyle Stn, 24 Aug. 1973, *G.W. Trapnell & K.A. Williams* 200 (BRI).

NEW SOUTH WALES: Olive Downs, Dec. 1887, *W.H. Baeuerlen* (BRI 224103); Darling River, *J. Dallachy* (NSW 139017).

10. *Calocephalus sonderi* F.Muell.

Rep. Pl. Babbage's Expedition 13 (1859), nom. nov.; F.Muell., Second Gen. Rep. Veg. Colony [Victoria] 12 (1854), nom. nud.; Benth., Fl. Austral. 3: 575 (1867); J.M.Black, Fl. S. Austral. 1st ed. 648 (1929), 2nd ed. 928 (1957); J.H.Willis, Handb. Pl. Victoria 2: 732 (1973); G.M.Cunningham et al., Pl. W. New South Wales 706 (1981); Jacobs & Pickard, Pl. N.S.W. 73 (1981); P.S. Short in Jessop & Toelken, Fl. S. Austral. 3: 1504 (1986); Stanley in Stanley & E.M.Ross, Fl. S.E. Queensl. 2: 546 (1986); E.A.Brown in G.J.Harden, Fl. New South Wales 3: 259 (1992); P.S.Short in N.G.Walsh & Entwisle, Fl. Victoria 4: 811, fig. 162f (1999). — *Leucophyta citrea* Sond., Linnaea 25: 490 (1853), non *Calocephalus citreus* Less. (1832). — *Leucophyta sonderi* (F.Muell.) Kuntze, Revis. Gen. Pl. 1: 352 (1891). — **Type citation:** "Murray - scrub, Dr. Behr." **Lectotype (here designated):** [?near] Murray-scrub, [*H.H. Behr*], (MEL 84769, ex herb. Sond.). **Isolectotype:** Murray scrub, [*H.H.*] *Behr* (MEL 85007).

Annual herb with ascending to erect major branches c. 6–45 cm long and usually developing minor branches from upper nodes; branches somewhat angular, hairy. Leaves usually alternate, but at least sometimes the lowermost opposite, all leaves commonly oblanceolate, sometimes elliptic to narrowly elliptic or narrowly oblong to linear or lanceolate, 5–63 mm long, 2–5 mm wide, often dilated and sheathing at the base and variably decurrent, midrib distinct in the upper surface,

the uppermost leaves with a hyaline appendage at the apex, all leaves tomentose. *Compound heads* very broadly to broadly ovoid or spheroidal to broadly ellipsoid, 6.5–12 mm long, 6.5–9 mm diam.; general involucre inconspicuous and represented by a few capitular-like bracts; general receptacle cylindrical to narrowly oblong, consisting of a single, hairy major axis with the capitula scattered more or less evenly along its entire length. *Capitula* c. 50–100. *Capitular bracts* 7–10, obovate, ovate or somewhat elliptic, mainly hyaline but the uppermost portion constricted and shades of yellow or white, with an opaque green or brown midrib which extends c. $\frac{2}{3}$ the length of the bract, the entire bract gradually tapered to the base or somewhat abruptly attenuated in the lower $\frac{1}{4}$, all bracts with long hairs extending from near the apex of the midrib but the margins entire, all bracts flat to conduplicate, 1.7–3.5 mm long, 0.5–0.9 mm wide, arranged in 2 rows. *Florets* 1–3, bisexual. *Corolla* 5-lobed; lobes with slightly thick margins and with papillae on inner surface; tube 1.1–2.3 mm long; inner epidermal cells of lobes and throat with straight walls, the cells not in distinct rows, those of the lobes much smaller than the elongate cells of the tube; vascular tissue not or barely extending to the base of the lobes. *Style* with 2 distinct vascular traces from the base, nectary annular, branches truncate, c. 0.26–0.48 mm long, apices papillate. *Stamens* 5; anthers c. 1–1.2 mm long, caudate; microsporangia c. 0.8–1.0 mm long; apical appendages subtriangular, c. 0.15–0.28 mm long; filament collar more or less straight in outline but slightly dilated towards the base. *Cypselas* obconic, 0.6–1 mm long, 0.35–0.4 mm diam., brown, epidermis myxogenic and with globose myxogenic twin hairs which lack (or have very short) basal cells (stalked ?glandular hairs present near the apex of immature fruit); pericarp lacking sclerenchyma (*P.S. Short* 3024); vascular bundles in pericarp 2; carpopodium absent, the abscission area not differentiated from the pedicel. *Pappus* of c. 6–8 long-plumose, bristle-like structures which are basally united into a cup-like structure. *Chromosome number:* unknown.

Distribution. Broadly-confined to south-eastern, mainland Australia, with the species centred in north-eastern Victoria and southern New South Wales and common along much of the southern part of the Murray River drainage basin but with disjunct populations in northern New South Wales, southern Queensland and central-eastern South Australia.

Habitat. Commonly grows on heavy clay and scalded soils in myall, red gum and black box woodlands and also recorded for saltbush and grassland communities which are often inundated. It has also been recorded as a weed of crops (Cunningham et al. 1981), including barley (*R.W.Baker*, NSW149626).

Phenology & reproductive biology. Cunningham et al. (1981) recorded that germination usually occurs in autumn but maximum growth and flowering occurs

when the soil begins to dry out. Specimen data indicates that flowering occurs from about October to March.

Pollen:ovule ratios determined from five individuals of *P.S. Short 2979*, collected near Wentworth, N.S.W., ranged from 5,144 to 5,707 (\bar{x} = 5,400; s.d. = 220; s.e. = 110).

Typification. There are two specimens at MEL which I believe should be considered to come from a single gathering by Dr H.H. Behr and be authentic type material of the name *Leucophyta citrea* Sond. Only one of these is labelled as having been part of Sonder's herbarium and accordingly has been chosen by me as the lectotype specimen; it consists of five elements from one or more plants and a hand-written label which, on the front, records the locality as Murray-scrub and, on the back, has part of a hand-written description headed "*Leucophyta citrea* S." The isolectotype specimen consists of a single element which, in general appearance, strongly matches that of the lectotype specimen, and has a handwritten label indicating that it was collected by Behr from the Murray scrub, that it was seen by Bentham, and gives three (one unpublished) names for the specimen, including *Leucophyta citrea* Sond. and the new name chosen by Mueller, *Calocephalus sonderi*.

Notes. There are some marked disjunctions in the distribution of the species, i.e. Andamooka–Stuart Creek region (e.g. *F.J. Badman 3605 & 3842*) in South Australia, southern Queensland, northeast New South Wales, and north-west New South Wales populations are all somewhat discrete from each other and from the more southerly populations in New South Wales, Victoria and South Australia. There are few, if any features, by which the different populations can be distinguished but specimens from the Narrabri–Kootingal region of New South Wales, e.g. *Baker* (NSW 149626), *J.H. Maiden* (NSW 139021), *P.S. Short 3024*, have white bracts, whereas specimens with yellow bracts as found elsewhere. The *Mulham W902* (NSW) and *Baeuerlen* (NSW 139035) collections from the Tibooburra region of New South Wales and Andamooka–Stuart Creek differ from the more common southern form in that they have generally larger compound heads and involucre bracts and the terminal lamina of the bracts are often more brightly coloured. At least to some extent, size differences may simply reflect favourable growing seasons when they were gathered. In any case, I have opted to refer all specimens to a single, somewhat variable species.

Jacobs & Pickard (1981) referred to a taxon they called "*C. sp. aff. sonderi*". This is the form with white bracts and as noted above, and by Brown (1992), formal recognition of this entity does not seem warranted.

A note accompanying the specimen *G.A. Crawford 110* (NSW), collected in 1950, records that the species grows extensively on the heavy soils of the Wakool Irrigation District, that it appears to have "no fodder value" and that it is locally known as "Poverty weed".

Cunningham et al. (1981, p. 706) noted that young plants may be "sparingly grazed" but "older plants are shunned by stock", perhaps due to its "strong aroma when bruised or damaged".

Selected specimens examined.

SOUTH AUSTRALIA: Paisley Ck, Stuart Creek Stn, 28 Sep. 1989, *F.J. Badman 3842* (AD); 10 miles upstream from Renmark, 30 Nov. 1968, *W.R. Barker 712* (AD).

QUEENSLAND: 20 miles N of Nindigully, 1 Dec. 1958, *L.H. Arnold* (AD 95909102, BRI 013404).

NEW SOUTH WALES: near Deniliquin, 5 April 1952, *E. Gauba* (CBG 015414); 40 km E of Tibooburra, Aug. 1976, *W.E. Mulham W902* (NSW); 7 km from Wentworth along road to Renmark, 28 Oct. 1986, *P.S. Short 2979* (AD, MEL, NSW); 16 km W of Pilliga, 31 Oct. 1986, *P.S. Short 3024* (AD, NSW, MEL).

VICTORIA: Two Mile Swamp Wildlife Res., 27 Dec. 1985, *A.C. Beauglehole 83018* (CANB, MEL); Barmah State Forest, 2 Jan. 1986, *A.C. Beauglehole 83622* (CANB, HO, MEL); Shire of Dimboola, 7 Jan. 1898, *F.M. Reader* (MEL 85005).

Gilruthia Ewart

Proc. Roy. Soc. Victoria 22(1): 14 (1909). — **Type:** *G. osbornii* Ewart & Jean White

Annual herb; major branches prostrate to ascending, cottony, with long septate hairs. Leaves mainly alternate but the lowermost opposite, entire, the uppermost with a small, hyaline apex, all leaves cottony, the long, septate hairs with broad, flat bases. Compound heads absent, capitula solitary or in terminal clusters. Capitula homogamous. Capitular bracts in about 5 rows, differentiated into a distinct claw and terminal lamina; claw mainly hyaline except for a midrib extending c. the length of the claw and bracts united in each row by long, intertwined hairs at the apex of the midrib. Receptacle somewhat conical, lacking receptacular bracts, glabrous. Florets bisexual. Corolla 5-lobed; lobes with thick margins and their inner surfaces papillate at the base; inner epidermal cells of lobes with more or less straight walls, those of the tube undulate, cells not in distinct rows; vascular strands in the tube 5, each extending to a sinus between two lobes. Stamens 5; anthers caudate; apical appendage triangular and thickened centrally and at the apex; filament collar more or less straight in outline but dilated towards the base. Style with 2 distinct vascular traces from the base, nectary annular; branches apically papillate. Cypselas monomorphic, obovoid, enveloped by a whitish-translucent layer of myxogenic cells; pericarp lacking a layer of sclerenchyma; vascular bundles in pericarp 2; carpodium annular. Pappus c. the length of the corolla, tubular for $\frac{1}{4}$ – $\frac{3}{4}$ its length but the upper part divided into irregularly long-plumose bristles. Chromosome number: $n = 13$.

Distribution. Endemic to Western Australia.

Etymology. The generic name and the specific epithet were named for two of Ewart's colleagues at Melbourne University, Professor John Anderson Gilruth (1871–1937) and Professor William A. Osborne (1873–1967).

Notes. A very distinctive taxon and only treated here because of the previous recognition of *Calocephalus skeatsianus* Ewart & Jean White, a synonym of *Gilruthia osbornii*. That the same authors attributed the same taxon to different genera and published the names less than a year apart presumably reflects the fact that the material of *C. skeatsianus* examined by them had generally not reached anthesis.

Grieve & Blackall (1975), recognised *Calocephalus skeatsianus* and noted, at the end of their index to scientific names, that at the time of the completion of the book's manuscript in 1972, representative specimens of *Gilruthia osbornii* at PERTH were unknown to them; material originally identified as this species was housed under *Rhodanthe mardonii* (S.Moore) Paul G.Wilson. Grieve (1982) subsequently added *G. osbornii* to the supplement of Grieve & Blackall (1975). He made no note about the similarity of specimens referred to *C. skeatsianus* and *G. osbornii* and both species were also recognised in Green (1985). However, when recognising monotypic *Gilruthia*, Anderberg (1991) — referring to correspondence from Paul G.Wilson (PERTH) — cited the name *C. skeatsianus* as being a possible synonym of *G. osbornii*. I don't doubt that only one species is involved.

The presence of distinct capitula, not compound heads, is an obvious feature by which to distinguish this taxon from all others which have at some time been placed in *Calocephalus s.lat.*

1. *Gilruthia osbornii* Ewart & Jean White

Proc. Roy. Soc. Victoria 22(1): 14, pl. 7 (Sep. 1909); Grieve, How Know W. Aust. Wildfl. Part IV, Suppl. 75 (1982). — **Type citation:** "Mt. Malcolm (north of Kalgoorlie), West Australia, F. Rodway, 123, Nov., 1906." **Holotype:** Mt. Malcolm, Nov. 1906, *F.A. Rodway 123* (MEL 1592447).

Calocephalus skeatsianus Ewart & Jean White, Proc. Roy. Soc. Victoria 22(2): 317, pl. 57 & 58, figs 5 & 6 (April 1910) (as "*skeatsiana*"); Grieve & Blackall, How Know W. Austral. Wildfl. 822 (1975). — **Type citation:** "Watheroo Rabbit Fence, West Australia. M. Koch. Dec. 1906. No. 1544." **Presumed syntype:** Watheroo Rabbit Fence, Aug. 1906, *M. Koch 1544* (MEL 543284). **Presumed isosyntype:** PERTH and perhaps MEL 543285 p.p. (see notes below).

Annual *herb*; major branches prostrate to ascending, c. 2–23 cm long, with branching at basal and upper nodes, all branches cottony, with long septate hairs. *Leaves* mainly alternate but the lowermost opposite, entire, obovate to oblanceolate or elliptic or linear, 4–16 mm long, 0.5–1.8 mm wide, mucronate, the uppermost with a small, hyaline apex, all leaves cottony, with long, septate hairs with broad, flat bases. *Capitula* solitary or remaining distinct but with 2–4 (8) in a terminal cluster. *Capitular bracts* in about 5 rows; claw widely obovate to obovate or almost obtriangular, 1.7–3.3 mm long, 1.1–1.6 mm wide; terminal lamina depressed to widely depressed ovate or somewhat shallowly deltate, 0.7–0.9 mm long, 1–1.4 mm wide, mainly pale yellow-brown

but may be streaked pink-purple. *Florets* 9–19. *Corolla* lobes with thick margins and their inner surfaces papillate at the base; tube 1.9–2.4 mm long; inner epidermal cells of lobes with more or less straight walls, those of the tube undulate, cells not in distinct rows; vascular tissue extending to the base of the lobes. *Stamens* 5; anthers c. 1.2–1.4 mm long, caudate; microsporangia c. 1–1.1 mm long; apical appendage triangular, c. 0.26–0.33 mm long, thickened centrally and at the apex; filament collar more or less straight in outline but dilated towards the base. *Style* with 2 distinct vascular traces from the base, nectary annular, branches c. 0.6–0.9 mm long, apices papillate. *Cypselas* obovoid, 1–1.2 mm long, 0.7–0.85 mm diam., appearing brown but enveloped by a whitish-translucent layer of myxogenic cells; pericarp lacking a layer of sclerenchyma (voucher information lost); vascular bundles in pericarp 2; carpopodium annular. *Pappus* c. the length of the corolla, tubular for $\frac{1}{4}$ – $\frac{3}{4}$ its length but the upper part divided into 6–11 irregularly long-plumose bristles. *Chromosome number:* $n = 13$.

Distribution. Western Australia, between latitudes 26° and 32°S, and west of longitude 123°E.

Habitat. A herb of semi-arid and arid zone *Acacia*- and *Eucalyptus*-dominated shrublands and woodlands on sand or sandy loam.

Phenology & reproductive biology. Flowering specimens have been collected from August to November. Specimens gathered in August, as with the type specimen of *C. skeatsianus*, are often barely flowering and the capitula are shorter than at anthesis; those collected in November have mature or near-mature fruit.

A pollen:ovule ratio of 4,724 was determined for a single floret from *B. Smith 462* (MEL), collected from Mt Gibson.

Cytology. Watanabe et al. (1999) recorded $n = 13$ for a population (*P.S. Short 4198*) 20 km from Mount Magnet along the road to Sandstone.

Typification. The holotype specimen of *G. osbornii*, MEL 1592447, consists of two plants mounted on the one sheet.

Max Koch used species numbers, not collection numbers, and at MEL there are three specimens of *M. Koch 1544*. Two of these have original collector's labels and have the locality Watheroo Rabbit Fence. Thus, MEL 543284 appears to be annotated in Ewart's, or possibly White's hand, as "*Calocephalus Skeatsiana*" and the word "Type" is pencilled in the top right corner; however, the date of collection is given as "iix. 1906", i.e. as August 1906, not December 1906, as in the protologue. A duplicate of this specimen is held at PERTH. The sheet MEL 543286 appears to be labelled by Ewart or White as "*Calocephalus Skeatsiana* Ewart & White" and has the word "Type" pencilled in the top right corner; however, this specimen is at variance with the protologue, being dated as "iix.1905", i.e. as August 1905, and the note from Koch that "You may find a few better developed flowers among these specimens" also

indicates that it is a separate gathering from that of 1906 and therefore has no type status. (According to my notes made in 1985 there are also two sheets of the Aug. 1905 collection at K, with one not being in a type folder; as of Feb. 2016 there is only one specimen K 000901835 on the Kew Herbarium Catalogue website.) The third sheet at MEL, MEL 543285, comprises several elements of the same taxon, including material in an envelope; a note attached when the specimen was data based states that “This sheet was found unlabelled in association with the two labelled sheets of type material, now mounted as MEL 543254 and MEL 543286.” Photocopies of both the original labels on MEL 543254 and MEL 543286 are also attached to this sheet; it is not possible to tell whether the elements are part of the 1905 or 1906 collections or a mixture of both.

All of the aforementioned specimens have immature capitula and appear to lack florets; some “digging” amongst the most mature capitula may reveal some immature florets. This apparent lack of mature florets is consistent with the illustration of an unopened floret in the original description (pl. 57, fig. 4) and Koch’s note attached to MEL 543286 regarding the possibility of better-developed florets in that specimen.

Label information and that provided in the protologue do not completely match for any of the aforementioned specimens. However, annotations do indicate that all MEL specimens, and presumably the PERTH specimen with the original Melbourne herbarium label, were examined by Ewart and White. Following the protologue those specimens gathered in 1905 do not have type status. On the other hand, I think it likely that the month “iix” of the 1906 specimen was simply misread as December, not August (a date also consistent with the immaturity of the plants), and have therefore listed MEL 543284 as a “presumed” syntype specimen and the duplicate PERTH specimen as a “presumed” isosyntype specimen of the name *Calocephalus skeatsianus*. Perhaps MEL 543285 may also contain some duplicate material.

Key to species of *Gnephosis* s.str.

- 1. Inner capitular bracts with a prominent c. 0.4–0.5 mm long, yellow terminal lamina **1. *G. angianthoides***
- 1: Inner capitular bracts lacking a prominent terminal lamina, or if at all developed then not yellow but the same pale brownish as the marginal lamina
- 2. Plants glabrous; leaves somewhat succulent; pappus absent **2. *G. cassiniana***
- 2: Plants with scale-like hairs; leaves barely ever even slightly succulent; pappus present or absent
- 3. Capitular bracts 2–6 (c. 10); capitula with (2) 3–5 (8) florets
- 4. Pappus absent; capitular bracts with ciliate margins; corolla 3–5-lobed **4. *G. multiflora***
- 4: Pappus present (often a small jagged ring but sometimes with several apically divided bristles); capitular bracts with entire margins; corolla 5-lobed **3. *G. tenuissima***
- 3: Capitular bracts 2; capitula usually with 1 or 2 florets (rarely 3 or 4 in *G. drummondii*)
- 5. Midrib of capitulum-subtending bracts with at least 3 distinct lobes **6. *G. trifida***
- 5: Midrib of capitulum-subtending bracts not divided
- 6. Corollas mainly 5-lobed; anthers usually 5 **5. *G. uniflora***
- 6: Corollas 3- or 4-lobed; anthers 3 or 4
- 7. Compound heads narrowly oblong, c. 1–2.5 cm long; florets (1) 2 or 3 (4) per capitulum (W.A., S.A., Vic.) **7. *G. drummondii***
- 7: Compound heads narrowly oblong to cylindrical, (c. 1) 3–6 cm long (W.A.) **8. *G. tridens***

Selected specimens examined.

WESTERN AUSTRALIA: 12 km SW of Paynes Find, 13 Nov. 1984, *L. Haegi 2655* (AD, MEL, PERTH); 30 km S of Billabong Roadhouse, 17 Oct. 1983, *P.S. Short 2118* (MEL); 31 km from Yalgoo towards Paynes Find, 21 Oct. 1983, *P.S. Short 2162* (MEL, PERTH); 32 km N of Cleary, 12 Nov. 1983, *P.S. Short 2372* (AD, MEL, PERTH); Youangarra Stn, 26 Aug. 1970, *P.G. Wilson 8872a* (PERTH).

***Gnephosis* Cass. s.str.**

Bull. Sci. Soc. Philom. Paris 43 (1820); DC., Prodr. 6: 151 (1838); P.S.Short, Muellera 6: 317–319 (1987); A.Anderb., Opera Bot. 104: 130 (1991) p.p., excluding *G. acicularis*; P.S.Short in N.G.Walsh & Entwisle, Fl. Victoria 4: 808 (1999). — **Type:** *G. tenuissima* Cass.
Chrysocoryne Endl., Bot. Zeitung (Berlin) 1: 457 (1843). — **Type:** *C. drummondii* A. Gray [= *Gnephosis drummondii* (A.Gray) P.S.Short]
Pachysurus Steetz, Pl. Preiss. 1: 441 (1845). — **Type:** *P. angianthoides* Steetz [= *Gnephosis angianthoides* (Steetz) A.Anderb.]
[*Angianthus* auct. non Wendl: Benth., Fl. Austral. 3: 561 (1867), as to *A. myosuroides* (= *G. uniflora*), *A. pusillus* (= *G. tenuissima*) & *A. tenellus* (= *G. drummondii*); also in various State and regional floras which followed Bentham.]

Annual *herbs*, the stem simple and sometimes flexuose in small plants but usually forming major branches at near-basal and upper nodes; a sparse to dense cover of scale-like glandular hairs usually present on branches and leaves, only *Gnephosis cassiniana* glabrous. *Leaves* sessile, entire, alternate, not or slightly succulent (particularly *G. cassiniana*). *Compound heads* narrowly ellipsoid to obloid, obovoid or cylindrical to oblong; general involucre not or barely developed, a few leaf-like bracts with hyaline apices may be present. *Capitula* c. 6–250, usually each subtended by a bract (capitulum-subtending bract) manifestly distinct from the capitular bracts. *Capitular bracts* in 1, 2 or 3 rows, some species (*G. drummondii*, *G. tridens*, *G. trifida*, *G. uniflora*) with only 2 bracts, but as many as c. 13 in other species; sometimes differentiated into a distinct claw and terminal lamina but usually not so, often with

long marginal hairs. *Receptacle* conical, glabrous. *Florets* bisexual, 1–c. 16 (only 1 in *G. tridens* and 1 or 2 in *G. trifida* and *G. uniflora*). *Corolla* tubular, 3-, 4- or 5-lobed. *Stamens* 3, 4 or 5, anthers caudate, with apical appendages. *Cypselas* monomorphic, obovoid, purplish, thin-walled, with scattered globose, myxogenic hairs (papillae); carpodium annular. *Pappus* absent or present (*G. angianthoides* & *G. tenuissima* only), being a small jagged ring or of apically divided bristles or scale-like bristles joined at the base. *Chromosome numbers*: $n = 14$, $c. 13$, 12 , $c. 11$, 6 .

Distribution. Australia, with six of the eight species only in Western Australia. Maps showing the distribution of most species can be seen in Short (1981a, p. 402, fig. 4, as spp. of *Chrysocoryne*). There is a tendency for some species to be restricted to particular drainage systems in south-western Western Australia.

Etymology. The origin of this name is unclear. Possible derivations were noted by Baines (1981).

Cytology. *Gnephosis* s.str. is one of many Australian genera with an apparent base number of $x = 14$ and exhibiting infragenetic dysploidy, an observation which led to the suggestion that $x = 14$ may be the base number for the tribe in Australia (Watanabe et al., 1999).

Note. The relationships of many of the species within *Gnephosis* s.lat. are unclear and the suggestion that *Gnephosis* s.str. comprises the species here placed within it is open to question. However, all species except *G. angianthoides* have a single capitulum-subtending bract that is morphologically distinct from the upper leaves and the capitular bracts, and all except *G. cassiniana* have a sparse to dense indumentum of scale-like glandular hairs. Indeed, the delimitation is not too dissimilar to that suggested by Anderberg (1991) who noted of *G. angianthoides* that, in having “a less reduced capitular [bract] arrangement ... is ... probably the most plesiomorphic taxon of the genus” (Anderberg 1991, p. 130); the same argument allows for the inclusion of *G. cassiniana*. The circumscription here used differs from Anderberg in that I exclude *G. acicularis* and *Hyalochlamys globifera* A.Gray on the basis of bract and cypselas morphology. Contrary to their earlier inclusion (Short 1990c) I here exclude *G. setifera* and *G. brevifolia* from *Gnephosis* s.str. — among other things they differ in lacking capitulum-subtending bracts and scale-like hairs — but in doing so reiterate that further investigations are required to substantiate this view.

The possible relationships of most of the species here referred to *Gnephosis* s.str. were schematically displayed when I treated them as members of *Chrysocoryne* (Short 1983, p. 186, fig. 9). What is now *G. tenuissima* (with multiple bracts and florets) was at the base and I illustrated a progressive loss in bract and floret number, along with change in corolla lobe number and levels of pollen production. There were also some

changes in bract morphology. Using primarily these same characters, and also including *G. angianthoides* and *G. cassiniana*, unpublished cladistic analyses by me supported similar relationships which are reflected in the order of treatment followed here.

1. *Gnephosis angianthoides* (Steetz) A.Anderb.

Opera Bot. 104: 130 (1991). — *Pachysurus angianthoides* Steetz in Lehm., Pl. Preiss. 1: 442 (1845). — *Calocephalus angianthoides* (Steetz) Benth., Fl. Austral. 3: 575 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 821 (1975). — *Leucophyta angianthoides* (Steetz) Kuntze, Revis. Gen. Pl. 1: 352 (1891). — **Type citation**: “In arenosis subumbrosis ad radicem montis Eliza, d. 25. Oct. 1839. Herb. Preiss. No. 44.” **Lectotype (here designated)**: MEL 543264 (ex herb. Steetz). **Isolectotypes**: G-DC (G 00222880), K 000901847 (ex herb. Hook. 1867), LD 1014325, MEL 543265, MEL 543266 (ex herb. Sonder), MEL 543267 (ex herb. Sonder), P 00698994, P 00715988, P 00715959 (ex herb. Schultz-Bip.), S.

Calocephalus priceanus Domin, Vestn. Kral. Ceske Spolecn. Nauk., Tr. Mat.-Prir. 2: 121 (1923). — **Type citation**: “W.A.: coll. W. H. Ince.” **Holotype**: K 000901836.

Annual *herb*, the stem simple and often flexuose in the smaller plants but usually forming major branches at near-basal and upper nodes; major branches 2.5–20 cm long, usually ascending to erect, sometimes decumbent, reddish or purple-brown, with a sparse to dense cover of scale-like glandular hairs and the upper part usually with a cottony indumentum. *Leaves* sessile, entire, elliptic to narrowly elliptic or obovate to oblanceolate, 2.2–19 mm long, 1.1–3.4 mm wide, the basal ones in a rosette, cauline leaves alternate, all leaves often somewhat succulent and with a sparse to dense indumentum of scale-like hairs, the upper leaves sometimes cottony. *Compound heads* narrowly ellipsoid to obloid, 4.5–27 mm long, 5–11 mm diam., general involucre absent but each of the lower capitula subtended by a single, mainly foliaceous bract; *general receptacle* branched, sparsely cottony, each secondary peduncle terminating in 1–4 capitula. *Capitula* 8–280 per compound head, each one usually subtended by a bract, the lower capitulum-subtending bracts mainly foliaceous, the upper hyaline except for a midrib extending for c. $\frac{2}{3}$ the length. *Capitular bracts* in 2 rows. *Outer bracts* c. 6 or 7, mainly hyaline except for a midrib extending for c. $\frac{3}{4}$ – $\frac{4}{5}$ the length of the claw, all bracts united by long intertwined hairs at the apex of the midrib and base of the terminal lamina; claw elliptic or obovate, 1.4–1.7 mm long, 0.8–0.9 mm wide; terminal lamina widely depressed to depressed ovate, 0.3–0.5 mm long, 0.5–0.6 mm wide, more or less distinguished by a constriction above the midrib but otherwise resembling the hyaline margins of the claw. *Inner bracts* c. 5 or 6, entirely hyaline or sometimes with an indistinct midrib extending to c. $\frac{1}{3}$ the length of the claw, all bracts united by long, dense, intertwined hairs at the base of the terminal lamina; claw obovate or elliptic, 1.4–1.7 mm long, 0.7–0.9 mm wide; terminal lamina widely depressed to depressed ovate, 0.4–0.5 mm long, 0.45–0.75 mm wide, somewhat

concave, slightly reflexed, yellow. *Receptacle* conical, glabrous. *Florets* 1–11, bisexual. *Corolla* tubular, 5-lobed; lobes with slightly thick margins, papillate at the base of the lobes; tube 1–1.2 mm long; inner epidermal cells of lobes with more or less straight walls, those of the throat with undulate margins, the cells not in distinct rows; vascular tissue barely extending to the base of the lobes. *Style* with 2 distinct vascular traces from the base, nectary annular, branches truncate, c. 0.28–0.32 mm long, apices papillate. *Stamens* 5; anthers c. 0.55–0.65 mm long, distinctly caudate; microsporangia c. 0.4–0.5 mm long; apical appendages triangular, c. 0.15 mm long; filament collar more or less straight in outline but slightly dilated towards the base. *Cypselas* obovoid, 0.4–0.5 mm long, 0.25–0.3 mm diam., purple, with globose, myxogenic twin hairs which seemingly lack a basal cell; vascular bundles in pericarp 2; carpodium annular. *Pappus* of 3–7 scale-like bristles about the length of the corolla, joined at the base, the upper part of the bristles irregularly long-plumose. *Chromosome number*: $n = 14$.

Distribution. South-western Western Australia, west of 124° E and south of 26° S but excluding the wet-forest areas of the extreme South-west.

There is a collection *R. Bates 4718* (AD) labelled as being collected on 29 October 1984 from Coolanie Valley, Eyre Peninsula, South Australia. However, apparent labelling discrepancies for other specimens Bates collected in that month — as gleaned from AVH together with the fact that he was collecting in W.A. just a couple of days before he apparently collected on Eyre Peninsula, suggest he also gathered this specimen in that State. Perusal of his other collection localities from that time, plus my knowledge of the distribution of this species, suggests the specimen was gathered at Newman Rocks, W.A., a locality at which it is particularly common. Unless other specimens substantiate its presence *G. angianthoides* should not be recorded for S.A.

Habitat. The species tends to grow on the margins of salt lakes or in samphire flats, as indicated by the following collectors' notes: "in sand amongst samphire and *Melaleuca*", "low lying samphire flats with scattered shrubs of *Lycium australe*, *Dodonaea*, *Atriplex spongiosa* ... reddish brown sandy loam", "amongst samphire and *Frankenia*" and "in sandy loam amongst samphire and *Gunniopsis*". It has also been recorded as growing in shallow depressions of granite outcrops and for one specimen it is recorded as growing "in red sandy soil with [*Eucalyptus*] *loxophleba*".

Phenology & reproductive biology. Mostly flowering from about late September to November, with fruiting from about mid-November to December. Several flowering or near-flowering specimens have been gathered in August and one also in May.

Pollen:ovule ratios ranging from 1,700 to 1,823 ($\bar{x} = 1,771$; s.d. = 44; s.e. = 22) were determined from five florets from *P.S. Short 1765*, collected at Newman Rocks.

Cytology. Watanabe et al. (1999) recorded $n = 14$ from a population (*P.S. Short 4071*) about 13 km north of Carnamah along the road to Three Springs, W.A.

Notes. Typically, the inflorescence is a compound head consisting of a dense cluster of capitula, each head terminating a branch. Sometimes the lower capitula are not strongly aggregated with the others and are comparatively poorly developed, having only one or two florets each and with fewer and less-differentiated bracts than normal.

Selected specimens examined.

WESTERN AUSTRALIA: Mongers Lake, 23 Sep. 1980, *H. Demarç 8284* (KPBG); Hammersley Lakes system, 4 Nov. 1983, *L. Haegi 2564* & *P.S. Short* (AD, MEL, PERTH); Newman Rocks, 19 Sep. 1982, *P.S. Short 1765* (MEL); "The Boats", c. 27 km from Laverton along road to Leonora, 9 Oct. 1983, *P.S. Short 2008* (MEL, PERTH); Lake Ninan, 25 Oct. 1983, *P.S. Short 2216* (AD, MEL, PERTH).

2. *Gnephosis cassiniana* P.S.Short

Muelleria 7: 242, fig. 1 (1990). — **Type citation**: "HOLOTYPE: Western Australia, c. 2.5 km S of Binu along Geraldton road ... 20.ix.1983, [*P.S. Short 2134* (MEL 693806). ISOTYPE: AD, CANB, MEL (wet colln), NSW, PERTH." AVH [avh.ala.org.au, accessed 9 July 2015] lists: **Holotype**: MEL 0693806A. **Isotypes**: AD 98930048, CANB 394473, MEL 2164883A (spirit), PERTH 1063154. (NSW not listed).

Erect herb to c. 6 cm tall, simple or branched, glabrous. *Leaves* mostly elliptic or ovate but sometimes linear or oblanceolate, 3.5–12 mm long, 0.6–2.4 mm wide, succulent, glabrous. *Compound heads* ellipsoid or obovoid, 3.5–12 mm long, 2.5–8 mm diam. *Capitula* (2) 6–30. *Capitulum-subtending bract* 2.8–3.8 mm long, entire bract leaf-like or with narrow, entire, hyaline margins. *Capitular bracts* 9–12, an outer pair of mostly green bracts surrounding 1 or more inner whorls of mostly hyaline bracts, all bracts with long hairs on the margins. *Florets* 4–16; corolla 5-lobed; lobes with slightly thickened margins, papillate at the base of each lobe; inner epidermal cells of lobes with more or less straight walls, those of the throat with almost straight or slightly undulate margins, the cells not in distinct rows; vascular tissue extending to the base of the lobes. *Anthers* 5, each with c. 300 pollen grains; microsporangia c. 0.58–0.66 mm long; terminal appendage somewhat narrowly triangular but apically obtuse. *Cypselas* obovoid, 0.4–0.5 mm long, pink. *Pappus* absent. *Chromosome number*: unknown. **Fig. 2A**.

Distribution. South-western Western Australia, around the margins of saline depressions near Binu and Pindar and from Mongers Lake.

Phenology & reproductive biology. Flowering is recorded for September (as per specimens examined to 1990).

A pollen:ovule ratio of 1,560 (*Short 1990c*) determined from a single floret from *P.G. Wilson 12298* is suggestive of cross-pollination but also self-compatibility.

Habitat. Only noted as growing with *Tecticornia* spp. in sand.

Selected specimens examined.

WESTERN AUSTRALIA: c. 10 km W of Pindar, 13 Sep. 1986, P.S. Short 2881, M. Amareena & B.A. Fuhrer (AD, MEL, PERTH); c. 0.5 km N of Pindar, 8 Sep. 1995, P.S. Short 4365 (MEL); 6 km S of Warriedar Hmsd near west bank of Mongers Lake, 26 Sep. 1986, P.G. Wilson 12298 (MEL, PERTH).

3. *Gnephosis tenuissima* Cass.

Bull. Sci. Soc. Philom. Paris 43 (1820); P.S.Short in N.G. Walsh & Entwisle, Fl. Victoria 4: 808, fig. 162a (1999). —

Type citation: "... Nouvelle-Hollande ... au port Jackson, à la baie des Chiens-Marins." **Lectotype:** Port Jackson, New Holland, coll. unknown (P 00698997, annotated by Cassini) (Short 1987b, p. 318). **Isolectotype:** P 00698998.

Possible isolectotype or possible remaining syntype: Habitat in novaehollandia (P 00715965, ex herb. A.N. Desvaux); no locality (P00715966, annotated by Cassini).

Remaining syntype: Shark Bay, voyage of Captain Baudin (P 00698996).

Crossolepis pusilla Benth. in Endl. et al., Enum. Pl. Huegel 61 (1837); P.S.Short, Muelleria 5: 189, figs 9 p.p., 10 af (1983). — *Chrysocoryne pusilla* (Benth.) Endl., Bot. Zeitung (Berlin) 1: 458 (1843). — *Chrysocoryne huegelii* A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 151 (1851), nom. illeg. — *Angianthus pusillus* (Benth.) Benth., Fl. Austral. 3: 564 (1867); O.Hoffm. in Engler & Prantl, Nat. Pflanzenfam. IV(5): 194, fig. 98CG (1890). — *Siloxerus pusillus* (Benth.) Kuntze, Revis. Gen. Pl. 367 (1891) (as *Styloncerus*, orthographic variant of *Siloxerus*); *Siloxerus pusillus* (Benth.) Ising, Trans. & Proc. Roy. Soc. South Australia 46: 604 (1922), comb. superfl. — **Type citation:** "Swan River. (Hügel)." **Lectotype:** Swan River, W.A., K.A.A.F. Hügel (W 0047218) (Short 1983, p. 189). **Isolectotype:** K 000901791.

Angianthus pusillus var. *polyanthus* Benth., Fl. Austral. 3: 564 (1867). — **Type citation:** "Murray and Darling desert." **Lectotype:** Murray & Darling desert, Victorian Expedition (K 000901792) (Short 1983, p. 190). **Possible isolectotypes:** near R. Darling, Victorian Expedition, Dr. Beckler (K 000901798); Darling Desert, Anon. (MEL 541203); near Darling R., 28 Oct. 1860, Vict. Exped. (MEL 541204); near R. Darling, V. Exped., Beckler (MEL 84537); sand hills, 29 Sep. 1860, Vict. Exped. (MEL 84538).

Chrysocoryne angianthoides F.Muell., Linnaea 25: 404 (1853). — **Type citation:** "In virgultis deserti pone Cudnaka." **Lectotype:** in den gestrüppen zwischen Cudnaka & Arkaba, Oct. 1851, F. Mueller (MEL 541201) (Short 1983, p. 190). **Isolectotypes:** MEL 541200; MEL 541202. **Probable isolectotypes:** GH 00014319, ex herb. Sond.; MEL 84532, ex herb. Sond.

Gnephosis sp. Pt Quobba (P.G. Wilson 12622) WA Herbarium, as per florabase.dpaw.wa.gov.au/search/current/18438 [accessed 7 May 2015] and biodiversity.org.au/nsl/services/apc-format/display/237273?product=apc [accessed 9 July 2015].

[*Podolepis divaricata* A.Cunn. ex DC., Prodr. 6: 151 (1838), nom. inval., nom. in sched.]

Annual herb usually with ascending to erect branches to 15 cm long, sometimes unbranched, with scale-like glandular hairs. Leaves linear or narrowly elliptic

to elliptic or oblanceolate to obovate, 2–33 mm long, 0.5–4 mm wide, with scale-like hairs. Compound heads narrowly ellipsoid to ellipsoid, oblanceoloid to obovoid or ovoid, 10–22 mm long, 3–7 mm diam. Capitula 20–80. Capitulum-subtending bract 1.2–2.8 mm long; midrib entire. Capitular bracts c. 4–10, in 2 rows, margins entire, not or sometimes with a reasonably well-defined claw and terminal lamina, but if present, the terminal lamina pale brownish as is the lamina of the claw. Florets (1) 3–8; corolla 5-lobed. Anthers 5, each with c. 300–450 pollen grains. Cypselas obovoid, 0.35–0.5 mm long, purplish, papillose. Pappus usually a jagged ring 0.1–0.2 mm high, sometimes with several apically divided bristles extending to c. ½ the length of the corolla. Chromosome number: $n = 6$.

Distribution. Widespread in central and southern mainland Australia (W.A., N.T., Qld, S.A., N.S.W., Vic.).

Habitat. Occurs in an array of mostly semi-arid and arid habitats, e.g. on red sand ridges dominated by *Triodia* and species of *Acacia*, amongst *Tecticornia* on the edge of saline depressions, in sandy loam at the base of granite rocks, and in clay loam in chenopod shrubland.

Phenology & reproductive biology. Typically flowers about August to November following winter rains, but, for example, in the southern N.T. flowering has been recorded in April.

An average pollen:ovule ratio of 1,967 has been determined for this species (Short 1981a, as *Chrysocoryne pusilla*). Data was obtained from 45 individual plants, with 15 from each of three populations, i.e. R.J. Chinnock 4335 and P.S. Short 924 from W.A., and P.S. Short 902 from S.A.

Cytology. Short (1981b, 1983), using the name *Chrysocoryne pusilla*, recorded $n = 6$ for a population (P.S. Short 834) from Hesso, S.A., and $2n = 12$ for a population (P.S. Short 999) about 90 km north of Geraldton, W.A.

Notes. I've previously noted that the locality, Port Jackson, cited for the lectotype specimen is erroneous (Short 1987b) and believe it indisputable that the type was collected at Shark Bay by a member of the Baudin expedition.

As previously noted (Short 1983, as *Chrysocoryne pusilla*) this is a polymorphic taxon exhibiting much variation in habit, the shape of the leaves and compound heads, the structure of the pappus and in the number of bracts and florets per capitulum. I have little doubt that it will be shown to consist of a number of distinctive taxa worthy of recognition, including that first described as *Crossolepis pusilla* Benth.

As noted under the treatment of *G. acicularis*, a specimen P.S. Short 4439 appears to be referable to this species but has unusually well-developed pappus bristles, these being about the length of the corolla tube and highly and long-dissected.

Despite having mislaid my notes concerning the type specimen of *G. tenuissima*, I believe the phrase name

taxon *Gnephosis* sp. Pt Quobba (*P.G. Wilson 12622*) WA Herbarium is *G. tenuissima* s. str. I'm not aware that I have seen a specimen of *P.G. Wilson 12622*, but in May 2015 viewed specimens which have been attributed to that phrase-name taxon at PERTH, i.e., *A.H. Burbidge 4682*, *J. Docherty 95*, *D. Edinger et al. B 7/11*, *D.M. Porter 284* and *G. Byrne 1731*.

Selected specimens examined.

WESTERN AUSTRALIA: Carnamah, 2 Nov. 1906, *A. Morrison* (CANB 209963, BRI 144628, PERTH); 6 km SW of Paynes Find, 24 Oct. 1984, *M.G. Corrick 9329* (MEL); c. 20 km N of Gascoyne Junction, 24 Aug. 1977, *P.S. Short 464* (AD); Overlander Roadhouse to Denham road, 16 Oct. 1983, *P.S. Short 2099* (AD, MEL, PERTH); c. 8 km S of Sullivan Ck on Leonora to Agnew road, 10 Oct. 1983, *P.S. Short 2014* (MEL, PERTH).

NORTHERN TERRITORY: Curtis Springs Stn, 18 Sep. 1974, *P.K. Latz 5690* (DNA); 32 km SE of Newhaven Hmsd, 6 Sep. 2013, *P.K. Latz 28772* & *P. Rilstone* (DNA); 12 miles N of Kulgera Store, 17 Sep. 1968, *A.O. Nicholls 927* (DNA).

SOUTH AUSTRALIA: c. 400 m N of Hesso, 13 Oct. 1979, *P.S. Short 902* (AD).

QUEENSLAND: Naryilco Stn, 3 Oct. 1971, *B.J. Copley 3690* (AD).

NEW SOUTH WALES: 12.8 km N of Lake Wallace Hmsd, 26 Sep. 1971, *N.S. Lander 72* (AD, NSW).

VICTORIA: Kulkyn National Forest, Oct. 1948, *A.C. Beaglehole 1090* (MEL).

4. *Gnephosis multiflora* (P.S.Short) P.S.Short

Muelleria 6: 317 (1987). — *Chrysocoryne multiflora* P.S.Short, Muelleria 5: 192, figs 9 p.p., 10 g–h, 11 (1983). — **Type citation:** "HOLOTYPE ... [*R.J.*] *Chinnock 4411* & [*P.G.*] *Wilson*, Mortlock River just east of Meckering ... 22.xi.1978 (AD 98002346). ISOTYPUS: PERTH." **Holotype:** AD 98002346. **Isotypes:** AD 98126008, MEL 0108109, PERTH 1043951.

Erect herb to c. 4 cm tall, simple or branched, with scale-like glandular hairs. *Leaves* elliptic or oblanceolate to obovate or linear, 3–7 mm long, 1–2 mm wide, densely covered in scale-like hairs. *Compound heads* narrowly oblong to oblong, 5–20 mm long, 2.5–4.5 mm diam. *Capitula* 50–250. *Capitulum-subtending bract* 1.8–2.9 mm long, margins sometimes ciliate; midrib entire. *Capitular bracts* 2–4 (10), majority of capitula with 2 concave bracts with ciliate margins and 1 or 2 inner flat bracts with ciliate upper margins, the cilia 0.1–0.3 mm long. *Florets* (2) 3–5 (6); corolla 3–5-lobed. *Anthers* 3–5, each with c. 16–40 pollen grains. *Cypselas* obovoid, c. 0.4 mm long, purplish, papillose. *Pappus* absent. *Chromosome number:* $2n = c. 24$.

Distribution. South-western Western Australia, possibly confined to the Avon River drainage system.

Habitat. Probably confined to the sandy soil on the margins of saline depressions.

Phenology and reproductive biology. Flowering in about October/November.

An average pollen:ovule ratio of 106 has been determined for this species (Short 1981a, as *Chrysocoryne* sp. A).

Cytology. Short (1981b, 1983), using the name *Chrysocoryne multiflora* recorded $2n = c. 24$ for a population (*P.S. Short 1046*) near Meckering, W.A. **Fig. 2B.**

Selected specimens examined.

WESTERN AUSTRALIA: Western edge of Lake King, 12 Nov. 1978, *R.J. Chinnock 4364* (AD, PERTH); c. 4.6 km E of Meckering, 20 Nov. 1979, *P.S. Short 1046* (AD); salt lake adjacent to Wave Rock, 31 Oct. 1995, *P.S. Short 4531* (MEL).

5. *Gnephosis uniflora* (Turcz.) P.S.Short

Muelleria 6: 318 (1987). — *Chrysocoryne uniflora* Turcz., Bull. Soc. Imp. Naturalistes Moscou 24: 188 (27 March 1851); P.S.Short, Muelleria 5: 198, fig. 9 p.p. (1983). —

Type citation: "Nova Hollandia. Drum coll. III. n.116."

Lectotype (here designated): KW 001001484. **Isolotypes:** BM 000810556; GH 00014320/00014321, ex herb. Klatt; K 000901820; K 000901817, colln dated 1845, ex herb. Benth; KW 001001485; MEL 541599; NSW 685758, P: two sheets; TCD. **Probable isolotypes:** Swan River, *Drummond* (GH 00014322/00014323, K 000901819, MEL 84468, MEL 541598, MEL 541600).

Chrysocoryne myosuroides A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 152 (May 1851). — *Angianthus myosuroides* (A.Gray) Benth., Fl. Austral. 3: 563 (1867); O.Hoffm. in Engler & Prantl, Nat. Pflanzenfam. IV(5): 194, fig. 98B (1890). — *Siloxerus myosuroides* (A.Gray) Kuntze (as *Styloncerus*, orthographic variant of *Siloxerus* and as "myosuroides"). — **Type citation:** "Swan River, *Drummond*, 1845." **Lectotype:** *J. Drummond 116* (K 000901820) (Short 1983, p. 198). **Isolotypes:** Swan River, *Drummond 116* (BM 000810556; GH 00014320/00014321, ex herb. Klatt; K 000901817; KW 001001484, KW 001001485, MEL 541599, NSW 685758, P: two sheets, TCD). **Probable isolotypes:** Swan River, *Drummond* (GH 00014322/00014323, K 000901819, MEL 84468, MEL 541598, MEL 541600).

Erect herb to 8 (14) cm tall, simple or branched, with scale-like glandular hairs. *Leaves* narrowly elliptic to elliptic, oblanceolate to obovate or lanceolate, 2–8 mm long, 0.5–2 mm wide, with a dense cover of scale-like hairs. *Compound heads* cylindrical to narrowly oblong, 15–44 mm long, 1.5–2.5 mm diam. *Capitula* 50–150. *Capitulum-subtending bract* 1.7–2.1 mm long; midrib entire. *Capitular bracts* 2, concave, upper margins variable ciliate, the cilia less than c. 0.1 mm long. *Florets* 1 or 2; corolla 5-lobed. *Anthers* 5, each with c. 250–350 pollen grains. *Cypselas* obovoid, 0.4–0.5 mm long, purplish, papillose. *Pappus* absent. *Chromosome number:* unknown.

Distribution. South-western Western Australia, from Meckering north to about Pindar.

Habitat. Grows in sand or sandy loam in association with *Tecticornia* species and *Melaleuca* on the margins of salt lakes.

Phenology and reproductive biology. Flowering about September to November.

An average pollen:ovule ratio of 1,778 has been determined for this species (Short 1981a, as *Chrysocoryne uniflora*), being based on 15 specimens of *P.S. Short 614A*.

Notes. In Short (1983), having received on loan a single specimen of *J. Drummond* 3:116 from KW, I referred to it as being the holotype specimen of *Chrysocoryne uniflora* (and on the determinavit slip simply referred to it as “Type”). The specimen, consisting of a single element, did not contain an original label but, with Turzaninow’s herbarium (with the exception of his Siberian collection) apparently housed in Kiev (e.g. Marchant 1990), I never questioned the status of the specimen. However, having since viewed JSTOR images for this species it is evident that a further specimen exists in KW, this being KW 001001484. The specimen consists of five elements and an original label, most or all of which I believe is in Turczaninow’s hand, and has the words, in part, “*Chrysocoryne uniflora* m[?]: n. sp. capitulis unifloris”. Undoubtedly, it should be considered to be the principal type and hence my above designation of it as the lectotype specimen of the name *Chrysocoryne uniflora*. The specimen consisting of a single element, now numbered as KW 001001485, is an isolectotype.

Selected specimens examined.

WESTERN AUSTRALIA: c. 3.4 km E. of Meckering in Mortlock River, 20 Sep. 1977, *P.S. Short* 614A (AD); 7.9 km N. of Latham, 15 Nov. 1979, *P.S. Short* 986 (AD, DNA); c. 30.4 km S of Pindar, 15 Nov. 1979, *P.S. Short* 991 (AD); c. 54.5 km from Nugadong along main road to Gunyidi, 19 Nov. 1979, *P.S. Short* 1014 (AD, DNA); c. 2.5 km S. of Binnu, 20 Oct. 1983, *P.S. Short* 2135 (AD, CANB, HO, NSW, PERTH); c. 13 km N of Carnamah, 5 Oct. 1993, *P.S. Short* 4070 (AD, MEL, PERTH, S, TI).

6. *Gnephosis trifida* (P.S.Short) P.S.Short

Muelleria 6: 318 (1987). — *Chrysocoryne trifida* P.S. Short, Muelleria 5: 196, figs 9 p.p., 10k–m, 12 (1983). — **Type citation:** “HOLOTYPE ... [*P.S.*] *Short* 966, 45.1 km N. of Koorda along main road to Mollerin. Salt lake ... 14.xi.1979 ... (AD 98002348). ISOTYPUS: PERTH.” Holotype: AD 98002348. Isotypes: AD 98126013, MEL 0108108, PERTH 1043986.

Erect *herb* to 7 cm tall, simple or branched, with scale-like glandular hairs. *Leaves* oblanceolate or narrowly elliptic to elliptic, 2–8 mm long, 1–2 mm wide, with scale-like hairs. *Compound heads* cylindrical to narrowly oblong, 10–40 mm long, 1–2 mm diam. *Capitula* 30–100. *Capitulum-subtending bract* 1.6–2.2 mm long; midrib with at least 3 distinct lobes. *Capitular bracts* 2, concave, upper margins long-ciliate, the cilia c. 0.5 mm long. *Florets* 1 (2); corolla 5-lobed, lobes with slightly thick margins, seemingly only papillate at the base of 4 lobes; inner epidermal cells of lobes with more or less straight walls, those of the throat with undulate margins, the cells not in distinct rows. *Anthems* 5, each with c. 350–500 pollen grains; microsporangia c. 0.49–0.58 mm long, terminal appendage narrow and somewhat oblong or narrowly triangular but apically obtuse. *Cypselas* obovoid, 0.3–0.4 mm long, purplish, papillose. *Pappus* absent. *Chromosome number:* $n = c. 11$. **Fig. 2C.**

Distribution. South-western Western Australia, from about Perenjori to Lake Barlee.

Habitat. Locally common with *Tecticornia* and other salt-tolerant shrubs on the margins of salt lakes.

Phenology & reproductive biology. Flowering from about late August to mid-November.

An average pollen:ovule ratio of 2,044 was determined for this species (Short 1981a, as *Chrysocoryne* sp. B), being based on 15 individuals of *P.S. Short* 966.

Cytology. Short (1981b, 1983), using the name *Chrysocoryne trifida*, recorded $n = c. 11$ for a population (*P.S. Short* 966) about 45 km north of Koorda, W.A.

Selected specimens examined.

WESTERN AUSTRALIA: 34.5 km N of Perenjori, 15 Nov. 1979, *P.S. Short* 989 (AD); 5 km S of Morawa, 8 Sep. 1995, *P.S. Short* 4369 (MEL, PERTH, TI); near Mollerin, 2 Sep. 1967, *P.G. Wilson* 6083 (PERTH); Lake Barlee, southern margin, 25 Aug. 1970, *P.G. Wilson* 8813 (PERTH).

7. *Gnephosis drummondii* (A.Gray) P.S.Short

Muelleria 6: 317 (1987); P.S.Short in N.G.Walsh & Entwisle, Fl. Victoria 4: 808, fig. 162b (1999). — *Chrysocoryne drummondii* A.Gray, Hooker’s J. Bot. & Kew Gard. Misc. 3: 152 (1851); P.S.Short, Muelleria 5: 193, figs 9 p.p., 10ij (1983). — **Type citation:** “Swan River, *Drummond*.” **Lectotype:** Swan River, W.A., *J. Drummond* 16 (K 000901812) (Short 1983, p. 193). **Possible isolectotypes or remaining syntypes:** *J. Drummond* (K 000901813, MEL 541601); *J. Drummond* 356 (MEL 84756; P, two sheets).

Chrysocoryne tenella F.Muell., Defn. Austral. Pl. 49 (28 June–12 July 1855), preprint from Trans. & Proc. Victorian Inst. Advancem. Sci. 1854–1855: 130 (10 Sep. 1855), reprinted in Hooker’s J. Bot. & Kew Gard. Misc. 8: 149 (1856), see Seberg (1986) for dates of publication. — *Angianthus tenellus* (F.Muell.) Benth., Fl. Austral. 3: 564 (1867). — *Siloxerus tenellus* (F.Muell.) Kuntze, Revis. Gen. Pl. 367 (as *Styloncerus*, orthographic variant of *Siloxerus*); *Siloxerus tenellus* (F.Muell.) Ostenf., Biol. Meddel. Kongel. Danske Vidensk. Selsk. 3: 138 (1921), comb. superfl. — **Type citation:** “In flats subject to inundations by winter rains, between the Long Lake and the Fountain, on Spencer’s Gulf. C. Wilhelmi.” **Lectotype:** between the Fountain and Long Lake, S.A., *C. Wilhelmi* (K 000901814) (Short 1983, p. 193). **Isolectotype:** TCD, P. **Probable isolectotype or syntype:** MEL 541620.

[*Crossolepis pusilla* auct. non Benth.: Hooker’s Ic. Pl. 5: t. 413 (1841).]

[*Chrysocoryne pusilla* auct. non (Benth.) Endl.: Endl., Bot. Zeitung (Berlin) 1: 457 (1843).]

Erect *herb* to 6 cm tall, simple or branched, with scale-like glandular hairs. *Leaves* oblanceolate to obovate or narrowly elliptic to elliptic, 2–11 mm long, 0.4–1 mm wide, usually with a dense cove of scale-like hairs. *Compound heads* narrowly oblong, 5–25 mm long, 2–3.5 mm diam. *Capitula* 40–150. *Capitulum-subtending bract* 1.6–2.3 mm long; midrib entire. *Capitular bracts* 2, concave, upper margins ciliate, the cilia c. 0.1 mm long. *Florets* (1) 2 (4); corolla 3- or 4- (rarely

5-) lobed. *Anthers* 3 or 4 (5), each with 20–60 pollen grains. *Cypselas* obovoid, 0.4–0.5 mm long, purplish, papillose. *Pappus* absent. *Chromosome number*: $n = 12$.

Distribution. South-western Western Australia, southern South Australia and south-western Victoria.

Habitat. Occurs in both coastal and inland situations, growing in sandy soil around saline depressions, on granite outcrops and in open woodland.

Phenology & reproductive biology. Flowering occurs from about September to December.

An average pollen:ovule ratio of 122 was determined for this species (Short 1981a, as *Chrysocoryne drummondii*), a value indicative of self-compatibility and high levels of self-pollination.

Cytology. Watanabe et al. (1999) recorded $n = 12$ from a population (*P.S. Short 4535*) from Lake King, W.A.

Selected specimens examined.

WESTERN AUSTRALIA: c. 16 km from Brookton along road to Beverley, 21 Nov. 1979, *P.S. Short 1049* (AD, DNA); c. 8.6 km W of Lake Grace, 24 Nov. 1979, *P.S. Short 1085* (AD); Hopetoun airstrip, 10 Nov. 1983, *P.S. Short 2351 & L. Haegi* (AD, MEL, PERTH); c. 1 km W of Lucky Bay, 30 Sep. 1970, *P.G. Wilson 10009* (PERTH).

SOUTH AUSTRALIA: c. 25 km NW of Naracoorte, 18 Nov. 1961, *Hunt 414* (AD); c. 15.2 km from Edillillie along road to Pt Lincoln, 26 Sep. 1978, *P.S. Short 807* (AD).

VICTORIA: between Apsley and Boorooopi, 2 Nov. 1971, *M.E. Phillips* (CANB).

8. *Gnephosis tridens* (P.S.Short) P.S.Short

Muelleria 6: 318 (1987). — *Chrysocoryne tridens* P.S. Short, Muelleria 5: 199, figs 9 p.p., 13 (1983). — **Type citation**: “HOLOTYPE ... [*P.S.*] *Short 1041*, c. 3.5 km E of Meckering in Mortlock River flats ... 20.xi.1979 (AD 98002347). ISOTYPUS: CANB, PERTH.” **Holotype**: AD 98002347. **Isotypes**: AD 98121073, CANB 332966, MEL 0108110, PERTH 1043978.

Erect herb to 8 cm tall, simple or branched, with scale-like glandular hairs. *Leaves* linear, elliptic or oblanceolate to obovate, 3–8 mm long, 0.5–1 mm wide, with a dense cover of scale-like hairs. *Compound heads* cylindrical to narrowly oblong, 10–63 mm long, 1.5–2 mm diam. *Capitula* 50–250. *Capitulum-subtending bract* 1.7–2.2 mm long; midrib entire. *Capitular bracts* 2, concave, upper margins variably ciliate, the cilia less than c. 0.1 mm long. *Florets* 1; corolla 3- (4-)lobed. *Anthers* 3 (4), each with 8–28 pollen grains. *Cypselas* obovoid, 0.45–0.55 mm long, purplish, papillose. *Pappus* absent. *Chromosome number*: $n = c. 13$. **Fig. 2B**.

Distribution. South-western Western Australia, ranging from the Lake Moore region south to salt lakes near Cranbrook and c. as far east as Dundas Rocks.

Habitat. Grows in sandy soil and most commonly on the margins of salt lakes but also in shallow depressions associated with granite outcrops.

Phenology and reproductive biology. Flowering from about September to November.

An average pollen:ovule ratio of 49 has been determined for this species (Short 1981a, as *Chrysocoryne* sp. C.). Data was obtained from 45 individual plants, with 15 from each of three populations, i.e. *P.S. Short 605, 614B* and *632*.

Cytology. Short (1981b, 1983), using the name *Chrysocoryne tridens*, recorded $n = c. 13$ for a population (*P.S. Short 675*) in saline flats at Wave Rock, W.A.

Selected specimens examined.

WESTERN AUSTRALIA: c. 3.4 km E. of Meckering in Mortlock River, 20 Sep. 1977, *P.S. Short 614B* (AD); southern edge of Lake Moore, 14 Nov. 1977, *P.S. Short 972* (AD); base of Dundas Rocks, 26 Nov. 1979, *P.S. Short 1113* (AD); c. 15.5 km from Borden along Chester Pass road, 3 Nov. 1983, *P.S. Short 2284 & L. Haegi* (AD, MEL, PERTH); salt lake adjacent to Wave Rock, 31 Oct. 1995, *P.S. Short 4530* (MEL).

Gnephosis Cass. s.lat.

Cyathopappus F.Muell, Fragm. 2(16): 157 (1861). — **Type**: *C. gnephosioides* F.Muell. [= *Gnephosis arachnoidea* Turcz.]

Nematopus A.Gray, Hooker's J. Bot. & Kew Gard. Misc. 3: 150 (May 1851). — **Type**: *N. effusus* A.Gray [= *Gnephosis arachnoidea* Turcz.].

Gnephosis s.lat.: Benth., Fl. Austral. 3: 569 (1867) p.p., excluding *G. burkittii* (= *Lemooria burkittii*), *G. pygmaea* (= *Myriocephalus pygmaeus*), *G. skirrophora* (= *Trichanthodium skirrophorum*), *G. tenuissima* (*Gnephosis* s.str.); O.Hoffm. in Engler & Prantl, Nat. Pflanzenfam. IV(5): 194 (1890) p.p., excluding *Leptotriche* and *Trichanthodium*; P.S.Short in Jessop, Fl. Centr. Austral. 391 (1981); P.S.Short in Jessop & Toelken, Fl. S. Austral. 3: 1519 (1986), p.p., excluding *G. burkittii* (= *Lemooria burkittii*); R.J.Bayer et al. in Kadereit & C.Jeffrey, Fam. Gen. Vasc. Pl. 8: 266 (2006) p.p., at least excluding *Gnephosis* s.str. as defined above.

?*Crossolepis* Less., Syn. Gen. Compos. 270 (1832). — **Type**: *C. linifolia* Less.

?*Hirnellia* Cass., Bull. Sci. Soc. Philom. Paris 57 (1820). — **Type**: *H. cotuloides* Cass.

[*Leptotriche* auct. non Turcz.; A.Anderb., Opera Bot. 104: 128 (1991); R.J.Bayer et al. in Kadereit & C.Jeffrey, Fam. Gen. Vasc. Pl. 8: 270 (2006), see notes below.]

Notes. As with *Calocephalus* s.lat. I believe it likely that the species included here will at some stage be removed from *Gnephosis* and referred to other genera, including some new ones. However, in the meantime I accept them all as members of this genus.

Accounts of species are arranged alphabetically. This is because most may well be distantly related to each other; for the same reason, I have not combined species' descriptions to present a “generic” description. However, some species appear to be very closely related. Thus, morphological features of both *G. gynotricha* and *G. macrocephala* indicate they are closely-related; their most distinctive feature pertains to the arrangement and relative size of the capitular bracts, i.e. the two small outer bracts which surround two inner, subequal bracts, at least the largest of which is much longer than

Key to species of *Gnephosis* s.lat.

- 1. Branches and leaves beset with stiff, erect bristles (south-western W.A., probably confined to Monger Drainage System) 8. *G. setifera*
- 1: Branches and leaves glabrous or variably hairy but lacking bristles
- 2. Capitula 1-flowered
- 3. Cypselas at least apically, and commonly entirely, enveloped in long, entwined, cottony hairs; major branches prostrate to ascending and with a prominent cottony indumentum; leaves densely cottony (arid areas of N.T., S.A., Qld, N.S.W.) 4. *G. eriocarpa*
- 3: Cypselas enveloped in long, straight twin hairs; major branches ascending to erect, mostly sparsely hairy except below the compound heads; leaves glabrous or sparsely hairy (W.A.)
- 4. Leaves straight to somewhat falcate; corolla yellow; pappus possibly absent or a ring to c. 0.2 mm and exceeded by the hairs of the cypsela (W.A., Carnarvon region) 5. *G. gynotricha*
- 4: Leaves commonly curved in their upper part and somewhat sigmoid; corolla orange; pappus a small cup c. 0.26–0.6 mm high and somewhat hidden by the hairs of the cypsela (W.A., commonly margins of salt lakes in northern wheat belt and adjoining areas to the north and north-west, absent from the Carnarvon region) 6. *G. macrocephala*
- 2: Capitula at least 2-flowered
- 5. Capitula with 2 florets (widespread in semi-arid and arid W.A., N.T., S.A., Qld, N.S.W.) 2. *G. arachnoidea*
- 5: Capitula with 4 to c. 36 florets (W.A. only)
- 6. Stem and branches not flexuose, with a cottony indumentum beneath the compound heads 3. *G. brevifolia*
- 6: Stem and branches flexuose, glabrous
- 7. Corolla 5-lobed 1. *G. acicularis*
- 7: Corolla 3-lobed 7. *G. newbeyi*

the outer bracts. Superficially, they closely resemble *Trichanthodium* Sond. & F.Muell. ex Sond., large specimens having a similar habit and there being only a single floret per capitulum. However, they differ from the latter, for example, in having cypselas enveloped in long hairs rather than being covered in a layer of mucilaginous cells. Their fruit morphology suggests a close relationship with *Feldstonia* P.S.Short.

Two other species, *G. acicularis* and *G. newbeyi*, share a number of morphological attributes — including flexuose branches, and bract and fruit morphology — and essentially differ in features indicative of different breeding systems, i.e. large, showy capitular bracts and large 5-lobed corolla in *G. acicularis* compared to smaller, less showy capitular bracts and smaller 3-lobed corollas in *G. newbeyi*. Of all the species here included in *Gnephosis* s.lat., it is perhaps these two which are closest to those included here in *Gnephosis* s.str. Indeed, Anderberg (1991) included *G. acicularis* in *Gnephosis* s.str., a circumscription which is otherwise that accepted here.

I follow Bentham (1867a) in tentatively citing *Crossolepis linifolia* Less. as a possible species of *Gnephosis* s.lat. He (Bentham 1837) had much earlier recorded the problem caused by Lessing’s extremely short description of *Crossolepis*. Just what Lessing’s name applies to didn’t only puzzle Bentham but also Candolle (1838) — who evidently saw no specimen and based his description on Lessing’s original — and Gray. Gray (1851a) when describing *G. brevifolia*, recorded that “This, with the following [*G. eriocarpha* and *G. pygmaea*] evidently congeneric species, I doubtfully refer to Lessing’s genus *Crossolepis*, of which nothing is known beyond the annexed most imperfect character, and that the author places it among his *Craspedieae* ... Here I should likewise refer these plants, although the

glomerule [compound head] and the subtending leaves are so lax ... [but] Having usually as many as ten flowers in each capitulum, a naked receptacle, no pappus, and scarious, fimbriate, involucre scales, they must needs be referred to *Crossolepis* until the plant so imperfectly characterized by Lessing shall be further known.” (Gray 1851a, pp. 175–176). The fact that Bentham, Candolle and Gray all failed to locate an authentic specimen suggests that one may not exist. My search of the JSTOR Plant Science website in August–September 2012 and specific sites such as the HAL virtual herbarium site (www.botanik.uni-halle.de/herbarium/?lang=en) have also been to no avail.

Flann et al. (2010) cited *Hirnellia cotuloides* Cass. as a synonym of *Angianthus tomentosus* Wendl., providing no evidence for this action, but perhaps following Candolle (1838) who indicated that he had seen a dried specimen. However, no such specimen appears to be in G-DC or the general herbarium, as evidenced by the microfiche of G-DC specimens, an electronic search of holdings, and my own requests on two previous visits to G. I also fail to perceive any gross resemblance of *A. tomentosus* and species of *Cotula*. Thus, I follow Bentham (1867a) in tentatively referring it to *Gnephosis* s.lat., albeit that I do not rule out the possibility that *H. cotuloides* may be another species of *Angianthus*.

Anderberg (1991), following my (Short 1987b) change in circumscription of *Gnephosis*, tentatively suggested that the remaining 12 species could be referred to the genus *Leptotriche* Turcz. He made no new combinations to accommodate them and neither did Bayer et al. (2006), who repeated Anderberg’s concepts in recognising *Leptotriche* as a genus of 12 species, overlooking work which had been carried out in the intervening years. Most importantly, *Leptotriche* has been found to be synonymous with *Myriocephalus*

Benth., the sole species now in synonymy under *M. pygmaeus* (A.Gray) P.S.Short (Short 2000). Furthermore, I (Short 1990a) had earlier removed three other species listed by Anderberg — *Gnephosis baracchiana*, *G. exilis* and *G. skirrophora* — to *Trichanthodium* Sond. & F.Muell. ex Sond. The remaining species listed by Anderberg are dealt with in this paper, *G. intonsa* being removed to its own genus, *Notisia*, and remaining names here dealt with under *Gnephosis* s.lat.

1. *Gnephosis acicularis* Benth.

Fl. Austral. 3: 572 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 819 (1975). — **Type citation:** “*Drummond*, 6th Coll. n. 201. Of this I have seen a considerable number of specimens ... but unfortunately too young for a full description.” **Syntypes:** S.W. Australia, “all too young”, 1848, *Drummond* 201 (K 000901802); Sw. riv., “all too young”, *Drummond* (K 000901803); S.W. Australia, *Drummond* 201, 1848 (K 000901804); Swan River, *Drummond* 4: 201, s.dat. (K 000901805); Swan River, *J. Drummond* (MEL 542230, marked as seen by Bentham); Swan River, *J. Drummond* 6: 201 (A 00008373, collection date given as 1854, ex BM; P 00699000, ex BM in 1914). **Possible isosyntypes:** Swan River, *J. Drummond* 4: 201 (MEL 542233, ex herb. Steetz, acquired from Turczaninow in 1851, labelled as “*Drummond*’s 4th colln of 1848”); Swan River, *J. Drummond* 201 (G 00223919, received 1848; MEL 542232; PERTH). Swan River, *J. Drummond* (MEL 542231; P 00698995, donated by W.J. Hooker in 1848).

Annual herb; stem simple or branching from upper nodes, stem and major branches erect, 8–33 cm long, strongly flexuose, glabrous. Leaves alternate, sessile, entire, often subfalcate, linear, 3–47 mm long, 0.1–0.9 mm wide, glabrous, the uppermost leaves usually with a hyaline appendage at the apex. Compound heads depressed ovoid to broadly depressed ovoid or broadly obovoid, 4.2–7 mm high, 4–12 mm diam.; general involucre c. $\frac{1}{2}$ – $\frac{2}{3}$ the length of the head but somewhat inconspicuous, of many, brownish, shiny, mainly hyaline bracts with a brown, opaque midrib; general receptacle an expanded, unbranched or shortly branched axis, glabrous. Capitula c. 6–50 per compound head. Capitulum-subtending bracts 1 to several, resembling capitular bracts and not readily discernible. Capitular bracts 15–20 arranged in c. 3 rows, flat to conduplicate, obovate, 2.5–3.7 mm long, 0.6–1 mm wide, mainly hyaline but with an opaque midrib extending c. $\frac{2}{3}$ the length of the bract, glabrous or sparsely hairy near the apex of the midrib and the outer bracts with long hairs on the margins, the majority of the bract (claw) narrowly hyaline and gradually to abruptly dilating upwards to a small constriction in the upper part which demarcates a somewhat colourless or an extremely pale yellow, erect and slightly concave terminal lamina which is about the width or wider than the claw. Florets 6–14, bisexual. Corolla tubular, 5-lobed; tube 1.3–1.6 mm long, outer surface with a few orange glands, inner cells of throat with manifestly undulate margins; vascular tissue reaching or almost reaching the base of the sinus between the lobes, with 1 (2) additional vascular traces

formed midway between each of the sinus-reaching traces, these falling well short or almost reaching the base of the sinus. Stamens 5; anthers 0.7–0.85 mm long, microsporangia 0.53–0.61 mm long, apical appendages somewhat triangular, 0.17–0.24 mm long; filament collar c. 0.2 mm long, gradually dilating along its length towards the base. Style with 2 distinct vascular traces from the base, branches apically truncate, with short sweeping hairs. Cypselas obovoid, brown, 0.4–0.5 mm long, c. 0.3 mm diam., smooth; pericarp with 2 vascular bundles; elongate crystals (with 2 long sides and 3 much shorter sides at each end) scattered throughout an internal layer (?testa) visible in cleared fruit; carpodium annular, whitish. Pappus a ciliate ring with 3–5 weak, plumose bristles c. the length of the corolla and detaching with it from the cypselas. Chromosome number: $n = 14$.

Distribution. Restricted to Western Australia between latitudes c. 29° and 30° S and longitudes c. 115° and 118° E.

Habitat. Only known from sandy, saline soils on the edge of salt lakes, e.g. for *L. Haegi* 2648 it is recorded that plants grew on a “Sandy rise in samphire flat with other chenopodiaceous shrubs and scattered *Eremophila*”.

Phenology & reproductive biology. Flowering is recorded from late September to about mid-November.

A pollen:ovule ratio of 1,576 was determined for a single floret removed from *P.S. Short* 2182, a specimen from the margins of Mongers Lake.

Cytology. Watanabe et al. (1999) recorded $n = 14$ for a population (*P.S. Short* 4425) near Yellowdine.

Typification. As noted above, Drummond used collection numbers but recommenced a fresh series for each of the sets of collections he sent to Europe. Bentham (1863), among others, recorded that it can be difficult to link specimen numbers with any one set of collections. There is also a frequent problem with Drummond material of the same species in that some specimens are numbered and others aren’t but, from the appearance of the elements, seem likely to be part of an original single gathering. In the case of *G. acicularis* there is a number of sheets containing specimens attributed to Drummond and, as such, may have type status. However, of them, only four specimens apparently seen by Bentham and labelled in accord with the protologue are definite syntypes, these being labelled as part of the 6th Collection, numbered *Drummond* 201, and housed in K. There is an isosynotype in P and probably one in A.

Other Drummond specimens of this species are, in one way or another, not in accord with the protologue, being unnumbered or numbered as *Drummond* 201 but attributed to the 4th, not 6th, collection. For example, in MEL there are four sheets of *G. acicularis* attributed to Drummond. Before mounting, all material now distributed on the sheets was in a common folder and each has a common label noting that this was the case and that “presumably all [are] part of Drummond 4th collection n.

201”; although this may be correct, there are only two sheets with original labels — which simply number them as “201”, the remaining two are unnumbered. Such discrepancies may simply reflect the “confusion in some of these numbers” referred to by Bentham (1863, p. 10*), and on which he later expounded (Bentham 1867b). Indeed, Bentham (1863, p. 10*) recorded finding numbered Drummond specimens “referred to a wrong series”. However, they probably should not be assumed to be isosyntypes of the name *G. acicularis* and I refer to them as having possible type status.

From what is recorded of Drummond’s travels and the known distribution of the species it is possible that *G. acicularis* may have been gathered during expeditions to acquire material for both the 4th and 6th collections. If this did happen, the likelihood of both being independently labelled as 201 is low, supporting the notion that all material of *G. acicularis* collected by Drummond and bearing this number is actually part of the one gathering. Conversely, perhaps Drummond — who maintained a herbarium — having collected this species for the 4th set of specimens, deliberately applied the same number in the 6th set of collections after realising that he had recollected the species.

I also note that there are label discrepancies in dates of collection for *Drummond 201*, be they for the 4th or the 6th collection. Thus, Gray (April 1851a, p. 150) cited *Drummond 201* as being collected in 1848, as did Joachim Steetz who recorded “Collect. N.iv. Anni 1848 No. 201” on MEL 542233, but Erickson (1969) did not record a major set of Drummond’s collections as having been gathered in that year and George (2009) noted that the 4th collection was made in 1844–47. Presumably the date of 1854 recorded for P 00699000 (*Drummond 6: 201*) is the date of receipt of the specimen, the 6th collection being compiled in 1850–51 (George 2009).

Notes. As of 6 July 2012 there is a specimen, *P.S. Short 4439*, on AVH which is referred to this species. It was collected in 1995 prior to my leaving MEL in 1996. I have not seen it since, except for a small, temporary spirit collection gathered for the determination of pollen grain numbers. On examining it I realised that it is not of this species but perhaps referable to, or having affinities with, polymorphic *G. tenuissima* Cass.; the pappus bristles are unusually well-developed, being about the length of the corolla tube and highly and long-dissected.

Cypselas from *L. Haegi 2648*, which was collected in 1983, failed to release mucilage in 2012, after they were soaked in water for three days.

Selected specimens examined.

WESTERN AUSTRALIA: 8 km W of Winchester, 17 Nov. 1975, *Chapman* (PERTH); 93.5 km N of Cleary, 13 Nov. 1983, *L. Haegi 2648* (AD, MEL, PERTH); 54.5 km from Nugadong along road to Bunyidi, 19 Nov. 1979, *P.S. Short 1015* (AD); 21 km N of Wongan Hills, 20 Nov. 1979, *P.S. Short 1032* (AD); Mongers Lake, 23 Oct. 1983, *P.S. Short 2182* (MEL, PERTH).

2. *Gnephosis arachnoidea* Turcz.

Bull. Soc. Imp. Naturalistes Moscou 24(1): 189 (March 1851), basionym; Grieve & Blackall, How Know W. Austral. Wildfl. 818 (1975); P.S.Short in Jessop & Toelken, Fl. S. Austral. 1520 (1986); E.A.Brown in G.J.Harden, Fl. New South Wales 3: 257 (1992). — **Type citation:** “*Drum. coll. III. n. 120.*” **Syntypes:** *J. Drummond 3: 120* (?KW n.v.; P 00699001, ex herb. Schultz-Bip., partly labelled in Turczaninow’s hand; MEL 542188, ex herb. Steetz). **Isosyntypes:** *J. Drummond 120* (GH 00008374, ex herb. Klatt; K 000899487, dated 1845, ex herb. Benth.; MEL 542186; NSW, ex BM, received 1915; P 00715967, ex BM, received 1914; PERTH, ex K, ex TCD; PERTH, ex MEL). **Probable isosyntypes:** *J. Drummond* (K 000899488, ex herb. Hook.; MEL 542187; MEL 542189; MEL 542190, ex herb. Sonder; P 00715955, ex herb. E. Cosson, ex MEL).

Nematopus effusus A.Gray, Hooker’s J. Bot. & Kew Gard. Misc. 3: 150 (May 1851). — **Type citation:** “Swan River, *Drummond.*” **Holotype:** *J. Drummond* (K 000899488, ex herb. Hook., seemingly annotated by Gray). **Isotypes:** *J. Drummond* (MEL 542187; MEL 542189; MEL 542190, ex herb. Sonder; P 00715955, ex herb. E. Cosson, ex MEL). **Probable isotypes:** *J. Drummond 120* (GH: 00008374, ex herb. Klatt; K 000899487, dated 1845, ex herb. Benth., not annotated by Gray; MEL 542186; NSW, ex BM, received 1915; MEL 542188, ex herb. Steetz; P 00715967, ex BM, received 1914; P 00699001, ex herb. Schultz-Bip.; PERTH, ex K, ex TCD; PERTH, ex MEL).

Cephalosorus leptocladus F.Muell., Fragm. 3: 158 (1863). — *Gnephosis leptoclada* (F.Muell.) Benth., Fl. Austral. 3: 571 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 818 (1975). — **Type citation:** “In locis lapidosis flumen Murchison versus. Oldfield.” Type not seen.

Cyathopappus gnephosioides F.Muell., Fragm. 2: 158 (1861), as “*gnephosoides*”. — *Cephalosorus gnephosoides* F.Muell., loc. cit., nom. illeg., pro syn. (being a name on specimens). — *Gnephosis cyathopappa* Benth., Fl. Austral. 3: 571 (1867); F.M.Bailey, Compr. Cat. Queensland Pl. 268 (1913); J.M.Black, Fl. S. Austral. 1st ed. 646 (1929), nom. illeg. (The specific epithet *gnephosioides* was available, Art. 63). — *Gnephosis gnephosoides* (F.Muell.) Druce, Bot. Exch. Club Soc. Brit. Isles 4: 624 (1917). — *Gnephosis gnephosoides* (F.Muell.) Domin, Mem. Soc. Roy. Sci. Boheme 2: 121 (1923); J.M.Black, Fl. S. Austral. 2nd ed. 926 (1957). — **Type citation:** “Tam in locis depressis, quam in collibus arenosis secundum Darling flumen. Dr. Beckler.” **Lectotype (here designated):** near R. Darling, 1860, *V.E. Exp. Dr. Beckler* (MEL 542185). **Possible isolectotypes or remaining syntypes:** near R. Darling, 31 Oct. 1860, *Vic. Exped.* (K 000899486); dry lake near Menindie [sic], Bambamero [= Lake Pamamaroo], 31 Oct. 1860, *Vict. Exped.* (MEL 542184, seen by Bentham); dry lake near Mennindie [sic], *Vict. Expl. Exped.* (NSW 138928, ex MEL as per attached “Phytologic Museum of Melbourne” label).

Nematopus foliatus Sond., Linnaea 25: 486 (1853). — *Gnephosis arachnoidea* var. *foliata* (Sond.) Benth., Fl. Austral. 3: 572 (1867). — *Gnephosis foliata* (Sond.) H.Eichler, Taxon 12: 295 (1963); Grieve & Blackall, How Know W. Austral. Wildfl. 818 (1975); P.S.Short in Jessop, Fl. Centr. Austral. 389 (1981); G.M.Cunningham et al., Pl. W. New South Wales 710 (1981); S.W.L.Jacobs & J.Pickard (1981), Pl. N.S.W. 78; E.A.Brown in G.J.

Harden, Fl. New South Wales 3: 257 (1992). — **Type citation:** “Cudnaka.” **Lectotype (here designated):** Cudnaka, 1851, *F. Mueller* (MEL 542182, ex herb. Sonder, with note in Mueller’s hand that it was sent to Sonder in 1852, specimen seen by Bentham). **Isolectotype:** Cudnaka, *F. Mueller* (MEL 542183, ex herb. Sonder).

Annual, erect, usually much-branched *herb*, c. 5–30 cm tall, indumentum of cottony hairs prominent in some plants but commonly sparse. *Leaves* lanceolate or linear, 4–34 mm long, 0.5–4 mm wide, the midrib usually prominent on the lower surface, glabrous or with a sparse to dense cottony indumentum, small spherical glandular hairs often present. *Compound heads* depressed-ovoid to broadly depressed-ovoid, 4–10 mm high, 5–12 mm diam.; bracts subtending compound head forming a general involucre which at anthesis are c. $\frac{1}{3}$ – $\frac{1}{2}$ the length of the head, consisting of numerous, leaf-like cottony bracts, the inner-most with yellow, hyaline apices; general receptacle somewhat rounded, with short but distinct minor receptacles, glabrous. *Capitula* c. 50–300; generally held in subgroups of 4 or 5 within the compound head. *Capitular bracts* c. 6–11, in 2 or 3 rows, narrowly oblong, narrowly elliptic or oblanceolate, 1.85–2.5 mm long, 0.4–0.7 mm wide, flat to concave, primarily hyaline but with an opaque midrib extending c. $\frac{1}{2}$ – $\frac{5}{6}$ the length of the bract, externally glabrous or sparsely hairy near the apex of the midrib, glandular hairs sometimes present, the lamina with a small constriction in the upper part, upper part yellow. *Florets* 2, bisexual. *Corolla* distinctly tubular in the basal half, yellow or yellow-orange, 5-lobed; lobes all papillate in their lower part; tube 1.2–1.5 mm long; inner epidermal cells of lobes small, straight-walled and tending to be 4- or 5-angled, the walls thickened, those of the throat much larger, elongate, rectangular and their walls not obviously thickened; vascular tissue extending to the base of the lobes; *Stamens* 5; anthers c. 0.87–1.0 mm long, microsporangia c. 0.62–0.74 mm long, apical appendages subrhombic, c. 0.25 mm long; filament collar c. 0.13–0.17 mm long, gradually dilating along its length towards the base. *Style* with 2 distinct vascular traces from the base, apically truncate, long-papillate. *Cypselas* obovoid, 0.8–1.2 mm long, 0.4–0.7 mm diam., brownish, papillose, the papillae minute and white-translucent, myxogenic; pericarp with 2 vascular bundles; irregularly-shaped crystals scattered throughout an internal layer visible in cleared fruit; carpopodium c. 0.1 mm long, white. *Pappus* cup-like, 0.3–0.55 mm long, c. $\frac{1}{2}$ to the length of the basal tube of the corolla, apically almost entire or slightly jagged, whitish. *Chromosome number:* $n = 12$.

Distribution. Widespread in arid and semiarid regions of Australia (W.A., N.T., S.A., Qld, N.S.W.), from near-coastal W.A. to central N.S.W. and south-western Queensland.

Habitat. Grows in sandy to clay soils, which may also be slightly saline, in an array of arid-zone habitats, in-

cluding chenopod shrubland, open *Acacia*-dominated shrubland, open eucalypt woodland with a dominant understorey of species of *Senna*, and open herb fields.

Phenology & reproductive biology. Flowering mainly occurs in September and October with fruit reaching maturity in October/November. About a third of the herbarium specimens seen were collected in August when the compound heads are conspicuous but few, if any, florets have reached anthesis.

Pollen:ovule ratios, ranging from 3,126 to 4,358 ($\bar{x} = 3,674$; s.d. = 372; s.e. = 96; $n = 15$) were recorded for 15 capitula from *P.S. Short 454*, a collection gathered c. 18 km south of Carnarvon, W.A.; 4,188 pollen grains were counted in a floret from *E.H. Ising* (AD 97412134), a specimen from Evelyn Downs, S.A.

Cytology. Watanabe et al. (1999) recorded $n = 12$ for two W.A. populations, these being from near Mount Magnet (*P.S. Short 4196*) and Leonora (*K. Watanabe 350*).

Type specimen of Nematopus effusus. There is only one syntype specimen of which I am aware, this an unnumbered Drummond collection in K. The only specimen in GH is ex herb. Klatt and was not seen by Gray. Thus, the K collection is regarded as the holotype specimen. Contrary to Gray’s comment that “there is no trace of a pappus”, a cup-like pappus is present in the holotype.

Lectotypification of Nematopus foliatus. I have no record of having seen authentic type material of the name *Nematopus foliatus* in any herbarium other than MEL and have here chosen MEL 542182 as the lectotype specimen, with MEL 542183 being an isolectotype. The specimens are not too dissimilar in appearance and are similarly labelled with Mueller’s unpublished binomial in which he referred the species to *Skirrhophorus*. The cited location of “Cudnaka” was Mueller’s name for Kanyaka (e.g. Grandison 1990).

Lectotypification of Cyathopappus gnephosioides. Both MEL specimens of *Cyathopappus gnephosioides* were undoubtedly examined by Mueller prior to publication and, following Willis (1962), there is no reason to doubt that they, and specimens in K and NSW, were collected by Dr H. Beckler during the Victoria Exploring Expedition, with Beckler based in the Menindee region from 16 October 1860 to 26 January 1861. However, although the specimens are not dissimilar, label data is not identical for these specimens and the information in the protologue, in which it is indicated that the species is found in depressed locations between sandhills along the Darling River, can be interpreted as suggesting that more than one collection of the taxon was made. Therefore, as only MEL 542185 is definitely attributed to Beckler, I have chosen it as the lectotype specimen of the name *Cyathopappus gnephosioides*, with the remaining specimens considered to be possible isolectotypes or remaining syntype specimens. When adopting the illegitimate name *Gnephosis cyathopappa* for this species, in which he cited *Cyathopappus gnephosoides*

in synonymy, Bentham examined MEL 542184 as well as the specimen at K, citing “N.S. Wales. Near Menindie, Darling river [sic], Victorian Expedition.”

Type specimen of Cephalosorus leptocladus. I have not seen any material which can be considered to be a syntype specimen of this name at MEL and nor do I have any record of having seen one at K. Bentham (1867a, p. 571), in *Flora Australiensis* recorded “Stony places, Barrel Well, Murchison [R]iver, Oldfield, a single specimen in Herb. F. Mueller, the inflorescence very rotten. When examined in a better state it may prove to be a variety of *G. cyathopappa*.” It is on the basis of this statement and Mueller’s original description that I regard the name *Cephalosorus leptocladus* to be a taxonomic synonym of *Gnephosis arachnoidea*. The fact that the type specimen was in a poor state when seen by Bentham, and that both it and the label would have been loose in a folder, suggests that it is no longer extant.

Notes. Differences in fruit morphology suggests that this species is distinct from *Gnephosis* s.str. but I have refrained from reinstating the name *Nematopus* A.Gray.

Cypselas from *P.S.Short 2069*, which was collected in 1983, released mucilage from their surface papillae when, in 2012, they were soaked in water for 12 hours.

Selected specimens examined.

WESTERN AUSTRALIA: Belele Stn, 20 Oct. 1965, *D.W. Goodall 3193* (PERTH); 8 km S of Buningonia Well, 19 Nov. 1978, *G.J. Keighery 1965* (CANB, KPBG, PERTH); Rocky Pool, Gascoyne Junction, 15 Oct. 1983, *P.S. Short 2069* (MEL, PERTH).

NORTHERN TERRITORY: 0.5 km W. of Ayers Rock, 30 Sep. 1979, *R.W. Johnson 3376* (BRI, DNA); Tobermorey Stn, Toko Range, 11 Oct. 1995, *P.K. Latz 14628* (DNA, MEL n.v.); 7.5 km SE of Greentree Dam, Hamilton Downs Stn, 18 Oct. 1988, *D.J. Nelson 2688* (DNA).

SOUTH AUSTRALIA: Nilpinna Stn, 10 Oct. 1968, *B. Andrews* (AD 96919216); Watts Bank, Nilpinna Stn, 21 Oct. 1978, *F. Badman 154* (AD, MEL); Coondambo Stn, 25 Oct. 1980, *B. Lay 1217* (AD).

QUEENSLAND: Gilruth Plains, 17 Oct. 1948, *A.J. Callender G815* (CANB).

NEW SOUTH WALES: 113 km W. of Wanaaring on Milparinka road, 7 Nov. 1971, *D.F. Blaxell 610* (NSW); 5 km SW of Brewarrina, 3 Nov. 1978, *J. Thompson 2967* (NSW); 45 km from White Cliffs, 22 Nov. 1978, *A. Tyrell 312* (CBG).

3. *Gnephosis brevifolia* (A.Gray) Benth.

Fl. Austral. 3: 572 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 819 (1975). — *Crossolepis brevifolia* A.Gray, Hooker’s J. Bot. & Kew Gard. Misc. 3: 175 (June 1851). — **Type citation:** “S.W. Australia. *Drummond*, 1850.” **Lectotype (here designated):** *J. Drummond 5: 61* (K 000901808, labelled “*Crossolepis? brevifolia* n. sp.” in Gray’s hand and with pencilled illustrations on sheet, dated 1850, ex herb. Hook.). **Isolectotypes:** *J. Drummond 5: 61* (G 00223918; K 000901809, undated, labelled as “61, suppl. to 5th colln”, ex herb. Benth.; KW; MEL 542235; NSW, ex BM, received 20 Jan. 1915, but labelled as “no. 61 of 5th colln suppl. 1849”; P 00715962, ex BM; PERTH, ex K, ex TCD).

Myriocephalus cotuloides Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 73 (Aug.–Oct. 1851). — **Type citation:** “*Drum. V. n. 61.*” **Holotype:** *J. Drummond 5: 61* (KW). **Isotypes:** *J. Drummond 5: 61* (G 00223918; K 000901808; K 000901809; KW; MEL 542235; NSW, ex BM, received 20 Jan. 1915, labelled as “no. 61 of 5th colln suppl. 1849”; P 00715962, ex BM; PERTH, ex K, ex TCD).

Crossolepis eriocephala A.Gray, Hooker’s J. Bot. & Kew Gard. Misc. 3: 176 (June 1851). — *Gnephosis eriocephala* (A.Gray) Benth., Fl. Austral. 3: 573 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 819 (1975). — **Type citation:** “South-western Australia. *Drummond*, 1850.” **Syntypes:** *J. Drummond 5: 62* (K 000901811, labelled “Swan River, *Drummond 62, suppl. 5th colln*”, ex herb. Benth.; K 000901810, labelled “*Drummond 62*, S.W. Australia, 1850”, with “*Crossolepis? eriocephala* n. sp.” in Gray’s hand, with pencilled illustrations on sheet, ex herb. Hook.). **Iso syntypes:** *J. Drummond 5: 62* (G 00223917; GH 00006315, ex herb. Klatt, as “Ser. 5, suppl. 62”; KW; ?CW n.v.; MEL 542198, ex herb. Steetz; MEL 542199; NSW, ex BM, received 20 Jan. 1915, labelled as “no. 62 of 5th colln suppl. 1849”; P 00715961, ex BM; PERTH, ex K, ex TCD; PERTH, ex MEL).

Myriocephalus villosissimus Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(2): 74 (Aug.–Oct. 1851). — **Type citation:** “*Drum. V. n. 62.*” **Syntypes:** *J. Drummond 5: 62* (KW; MEL 542198, ex herb. Steetz, received by Steetz from Turczaninow in 1852). **Iso syntype or possible syntype:** G 00223917, PERTH (ex MEL, a single element which may have been removed from the Steetz sheet). **Iso syntypes:** GH 00006315, ex herb. Klatt, as “Ser. 5, Suppl. 62”; K 000901810; K 000901811; MEL 542199; NSW, ex BM, received 20 Jan. 1915, labelled “no. 62 of 5th colln suppl. 1849”; P 00715961, ex BM; PERTH, ex K, ex TCD.

Gnephosis sp. Norseman (*K.R. Newbey 8096*) WA Herbarium, as per florabase.dpaw.wa.gov.au/search/current/17721 [accessed 7 May 2015] and biodiversity.org.au/nsl/services/apc-format/display/237272?product=apc [accessed 9 July 2015].

Annual herb; stem rarely simple, usually with major branching from basal and near-basal nodes; major branches mostly ascending to erect, sometimes decumbent, 3–20 cm long, with or without minor branching, brown or reddish brown, mostly glabrous except for scattered, shortly-stalked and somewhat rigid glandular hairs less than c. 0.05 mm long and with a cottony indumentum of eglandular hairs beneath the compound heads. *Leaves* sessile, entire, narrowly elliptic, lanceolate, oblanceolate or linear, 3–18 mm long, 0.3–1.5 mm wide, alternate, scattered, may be very slightly succulent, mostly glabrous except for short glandular hairs as on branches but uppermost leaves with some eglandular, white cottony hairs, apically barely and bluntly mucronate. *Compound heads* usually spheroidal to obovoid or somewhat broadly depressed ovoid or broadly obovoid, c. 4–9 mm long, 4–10 mm diam., usually distinctly solitary on the end of a branch but sometimes the lateral minor axes are short and up to c. 10 compound heads are held in a loose spike-like arrangement (e.g. *P.S. Short 2016* and *B.H. Smith 505*); general involucre barely developed but several

herbaceous outer bracts and capitulum-subtending bracts together making it conspicuous, the bracts sparsely to densely cottony on their outer surface and glabrous on the inner; *general receptacle* branched, scattered and very shortly stalked glandular hairs and sometimes a few cottony hairs present, each branch appearing to terminate in a single capitulum. *Capitula* (3–) 14–c. 30 per compound head, each capitulum appearing to be subtended by a single, outer, mainly foliaceous bract but 1 or 2 smaller foliaceous ones may be present; at least the largest of these oblanceolate or distinctly spatulate and about the length of the capitular bracts and all such bracts tending to be manifestly cottony on the outer surface but glabrous on the inner. *Capitular bracts* c. 8–11, in 2 rows, not differentiated into a distinct claw and terminal lamina and mainly hyaline except for a midrib extending for c. 1/3–4/5 the length of the bract, ovate to somewhat elliptic or sometimes almost oblanceolate, 2.5–3 mm long, 0.5–1.3 mm wide (excluding hairs), margins with very long and often somewhat tangled hairs for part to most of their length, long and tangled hairs also commonly extending from the outer surface of at least the outermost bracts and these often forming a prominent cottony indumentum, inner surfaces glabrous. *Partial receptacle* hemispherical, glabrous, the whitish bases of the pedicels distinctly scattered over the surface. *Florets* (6–) 12–36, bisexual. *Corolla* 5-lobed and mostly only the lobes exceeding the bracts at anthesis; tube c. 1.4–1.8 mm long, outer surface with scattered multicellular glandular hairs and tending to be somewhat sticky, some cottony hairs may also be present; lobes with slightly thickened margins, papillate (but not distinctly so) at the base of 3 or sometimes 4 lobes; inner epidermal cells of lobes elongate, rectangular with slightly undulate walls, those of the throat somewhat similar, the cells not in distinct rows; vascular tissue almost extending to the base of the lobes. *Stamens* 5; anthers c. 0.72–0.82 mm long, prominently caudate; microsporangia c. 0.52–0.63 mm long; apical appendages triangular, c. 0.17–0.21 mm long; filament collar more or less straight in outline but slightly dilated towards the base. *Style* with 2 distinct vascular traces from the base, nectary small, branches truncate, c. 0.5 mm long, apices longish papillate. *Cypselas* obconic, 0.26–0.35 mm long, 0.2–0.28 mm diam., dark pink, pinkish brown or pale brown, glabrous, on wetting a thin mucilaginous layer formed over the fruit; fruit not sectioned but pericarp appearing to be thin; cleared fruit display a crystalline layer extending around the cypselas, this either in the pericarp or the testa, crystals somewhat oblong; vascular bundles in pericarp 2; carpopodium whitish, c. 0.02–0.04 mm long, often falling from the fruit. *Pappus* absent. *Chromosome number*: $n = 12$.

Distribution. Endemic to arid and semi-arid regions of Western Australia, from about the Pilbara region south to about Norseman and Parker Range.

Habitat. Found in an array of arid and semi-arid habitats, including chenopod steppe on slightly saline clay or clay loam with species of *Atriplex* and *Tecticornia*; mixed *Acacia* shrubland on red sandy soil; rocky outcrops with shrubs of *Acacia* and *Eremophila*; and in sand or sandy loam on the upper margins of salt lakes.

Phenology & reproductive biology. Flowering late August to October, with seed set from about late October to November.

Pollen:ovule ratios ranging from 1,803 to 1,998 ($\bar{x} = 1,880$; s.d. = 67; s.e. = 34; $n = 5$) were determined for five florets from *P.S. Short 1567*, collected c. 60 km towards Gascoyne Junction from the North West Coastal Highway.

Cytology. Watanabe et al. (1999) recorded $n = 12$ for a population (*P.S. Short 4243*) near Kumarina, W.A.

Notes. The corolla tube in most specimens lack cottony hairs on their outer surface but a few collections from the more northern part of the range, such as *P.S. Short 1570*, have them; otherwise they appear to sit within *G. brevifolia*.

The number of capitula in a compound head may vary greatly within and between plants of the one population, e.g. from as few as 6 to 30 in *N.H. Speck 1492*, this in turn affecting the shape of the inflorescence.

In May 2015, subsequent to completing the above description and returning loans upon which the description was based, I examined specimens referred in PERTH to the phrase-name taxon *Gnephosis* sp. Norseman (*K.R. Newbey 8096*) WA Herbarium, including *K.R. Newbey 8096*. They fit within my circumscription of *G. brevifolia*, of which I admit to some uncertainty, but suggest that much of the variation between specimens is a reflection of the harshness, or otherwise, of the environment in which they have grown.

Although lacking various features such as the scale-like hairs and large capitulum-subtending bracts of *Gnephosis tenuissima* the closest relationships of this species may well be with it and/or *G. cassiniana*, with the latter — like *G. brevifolia* — also lacking scale-like hairs (Short 1990c). On the other hand, on morphological grounds a close relationship with the species of *Eriochlamys* is evident; as with them, it lacks a pappus, has thin-walled fruit with a basal, annular carpopodium, and a similar arrangement and morphology of capitular bracts. Furthermore, the corolla tube in the species of *Eriochlamys* (Walsh 2007) also have scattered glands and cottony hair, the feature noted above as occurring in some specimens here referred to *G. brevifolia*. I've independently arrived at this conclusion and note that it is consistent with the result of Anderberg's (1991, fig. 13) analyses of morphological and anatomical characters of the Gnaphalieae, in which *Eriochlamys* is in a clade containing *Gnephosis* s.str. (plus *G. acicularis*) and the monotypic *Hyalochlamys*. (Analyses of nuclear and chloroplast sequences by Bayer et al., 2002, showed *Eriochlamys* to be well-removed from *Gnephosis*, but

the species used in their analyses were *G. arachnoidea*, a species perhaps generically distinct from *Gnephosis* s.str., and *G. intonsa*, here placed in monotypic *Notisia*.)

Selected specimens examined.

WESTERN AUSTRALIA: Between Munderoo and Globe Hill, Ashburton River, 29 Sep. 1905, *A. Morrison* (K, probably also PERTH but only dated Sep. 1905); c. 73 km from the North West Coastal Hwy along the Gascoyne Junction road, 26 Aug. 1982, *P.S. Short 1570* (AD, MEL, PERTH); ¼ mile north of Mellenbye on Morawa to Yalgoo road, 26 Oct. 1984, *B.H. Smith 505* (MEL, PERTH); 35.5 miles east of Wiluna, 25 Sep. 1958, *N.H. Speck 1492* (AD, CANB).

4. *Gnephosis eriocarpa* (F.Muell.) Benth.

Fl. Austral. 3: 570 (1867); J.M.Black, Fl. S. Austral. 1st ed. 647 (1929), 2nd ed. 926 (1957); G.M.Cunningham et al., Pl. W. New South Wales 710 (1982); P.S.Short in Jessop, Fl. Centr. Austral. 389 (1981); P.S.Short in Jessop & Toelken, Fl. S. Austral. 3: 1520 (1986); E.A. Brown in G.J.Harden, Fl. New South Wales 3: 257 (1992). — *Skirrhophorus eriocarpus* F.Muell., Fragm. 3: 156 (1863) (“*Skirrhophorus*”). — **Type citation:** “Inter montes Stokes Range et sinum Cooper’s Creek legit dr. Wheeler.” **Holotype:** between Stokes Range & Coopers Creek, [1861.] *Dr [W.F.] Wheeler* (MEL 542234).

Annual herb; major branches c. 5–25 cm long, usually developing branchlets from upper nodes, with a prominent indumentum of fine, cottony, eglandular hairs. *Leaves* alternate, sessile, entire, held erect, elliptic to narrowly elliptic or more or less linear or obovate to lanceolate, 9–45 mm long, 1.5–9 mm wide, densely cottony. *Compound heads* obovoid to spheroid or broadly depressed ovoid to very broadly ovoid, 5–12 mm long, 5.5–13 mm diam.; general involucre conspicuous, c. ⅓–½ the length of the compound heads, consisting of a few leaf-like, woolly outer bracts and a few inner bracts which grade into the capitular bracts; general receptacle a slightly expanded axis. *Capitula* c. 15–80 per compound head, particularly in mature heads several capitula appearing together as slightly discrete groups within the compound head. *Capitular bracts* c. 6–8, obovate, 3–4.2 mm long, 0.65–1.3 mm wide, all bracts mostly flat and with a usually distinct claw and terminal lamina, hyaline except for a yellow-green, opaque midrib extending c. 4/5 or more the length of the claw; claw with wide hyaline margins at least in the upper part but for much of the claw margins not hyaline or very narrowly so and dilating towards the apex of the claw, margins entire but the outer surface with conspicuous cottony, entangling hairs, the hairs mostly about the apex of the claw; lamina ovate to widely ovate, 0.4–1 mm long, 0.3–0.9 mm wide, flat to slightly concave, more narrow to slightly wider than the claw, very pale whitish or pale purple. *Florets* 1, bisexual. *Corolla* 5- or rarely 6-lobed; tube 2.1–2.7 mm long, outer surface glabrous or with globular glands; lobes with slightly thickened margins, with a band c. 0.15–0.2 mm of papillae at the base of all lobes; inner epidermal cells of lobes subrectangular and smaller than the elongate, straight-walled, rectangular cells of the throat; vascular tissue extending or almost

extending to the sinus, large papillae sometimes extending along the upper part of the vascular traces. *Stamens* 5; anthers 1.1–1.35 mm long, very prominently cordate, the tails c. 0.25–0.43 mm long; microsporangia c. 0.8–0.93 mm long; apical appendages triangular, c. 0.3–0.44 mm long; filament collar tending to gradually dilate towards the base. *Style* c. 2.3 mm long, with 2 distinct vascular traces from the base; branches c. 0.75 mm long, truncate, with short sweeping hairs. *Cypselas* obconic, 1.1–2.5 mm long, 0.5–0.6 mm diam., at least apically and usually the entire brown fruit enveloped in long, entwined, eglandular, white, cottony, uniseriate, septate hairs; under high magnification (100×) surface cells of the pericarp noticeably elongate and their pattern of thickening giving an appearance of undulating walls, at low magnification (c. 40×) the surface appearing to have numerous, faint longitudinal streaks; cleared fruit display a crystalline layer extending around the cypselas, this either in the pericarp or the testa, crystals 6- or 8-sided but always with 2 sides much longer than the others; vascular bundles in pericarp 2; basally the fruit with a yellowish, plug-like structure (?a modified pedicel) and lacking a distinctly cellular carpodium. *Pappus* of c. 8–10 scales c. 0.05 mm long with prominently-thickened cell walls, scales terminating in long cottony hairs as on cypselas. *Chromosome number:* unknown.

Distribution. An arid zone species found between latitudes c. 23°S and 32°S and between longitudes c. 132°W and c. 144°W, and thus encompassing much of the southern part of the Northern Territory, northern South Australia, south-western Queensland and north-western New South Wales.

Habitat. A species found in an array of arid-zone habitats, including open shrubland, the base of sand-dunes, and open herb field dominated by other asteraeous herbs and chenopods. Commonly on sand and sandy loam but also noted in heavier clay soils.

Phenology & reproductive biology. Mostly flowering from about late July to late September but with some records as early as May and as late as November.

A pollen:ovule ratio of 4,824 was determined for a single floret from *P.S. Short 3007*, collected between Ti-booburra and Wanaaring, N.S.W.

Typification. Doctor W.F. Wheeler was surgeon on A.W. Howitt’s first relief contingent to search for members of the “Burke & Wills Expedition” and collected specimens representing about 70 species from between Stokes Hill and Coopers Creek in 1861 (e.g. Willis 1962). In regard to this species the only specimen of type status seen by me is that cited above and regarded as the holotype. It is marked as having been seen by Bentham for *Flora Australiensis* and contains an original label in Mueller’s hand indicating that he had entertained the idea of naming it after Wheeler. The specimen is poor, consisting of a single branch with two compound heads

and several leaves, plus a fragment bag containing another immature head and some dissected capitula containing unopened florets.

Notes. I have examined cleared florets with both immature and near-mature cypselas and am somewhat uncertain as to whether the scale-like objects terminating in long, tangled hairs at the corolla/cypselas interface are part of the pericarp, part of the corolla base, or — as adopted here — because of their location should be deemed to be elements comprising a pappus. As the hairs extending from the scale-like objects appear to be of identical structure to those extending from the pericarp it could be that a pappus should be deemed to be absent, as interpreted by Black (1929).

On a note accompanying a specimen, NSW 138914, collected by the naturalist Dr William McGillivray in August 1921 from Lake Callabonna, S.A., it is recorded that the name “Loompa-loompa” is used by aboriginal people for this species and that small birds use it for nest-making.

Selected specimens examined.

NORTHERN TERRITORY: 79 miles SSW of Alice Springs, 2 Sep. 1972, *P.K. Latz 2653* (CANB, MEL, NT); NW Simpson Desert, 30 Sep. 1973, *P.K. Latz 4640* (AD, NT); 1 km north of Henbury Airstrip, Stuart Hwy, 14 Sep. 1978, *J.R. Maconochie 2431* (BRI, MEL, NT).

SOUTH AUSTRALIA: Happy Thought Well, Blanchewater Crossing, Strzelecki Track, 6 Sep. 1971, *B. Copley 3643* (AD); Stuart Range, c. 65 km E of Coober Pedy, 9 Sep. 1966, *N.N. Donner 1758* (AD); c. 10 km W of Curdimurka, 3 Oct. 1978, *J.Z. Weber 5770* (AD).

QUEENSLAND: Pooppel Corner, 24 Sep. 1966, *D.E. Boyland 272A* (BRI, MEL); Currawilla, 11 June 1949, *S.L. Everist 3988* (BRI, CANB); 8 km from Birdsville on new Betoota road, *R.W. Purdie 1137* (BRI).

NEW SOUTH WALES: Tibooburra, 20 Oct. 1949, *E.F. Constable* (NSW10773); Fowlers Gap Stn, 8 km N of Hmsd, 30 Aug. 1973, *G.M. Cunningham & P.L. Milthorpe 1344* (NSW); Byrnedale, Oct. 1971, *W.E. Mulham W512* (NSW).

5. *Gnephosis gynotricha* Diels

Bot. Jahrb. Syst. 35: 613, fig. 69 f–j (1905); Grieve & Blackall, How Know W. Austral. Wildfl. 817 (1975). —

Type citation: “Hab. in distr. Austin litorali pr. Carnarvon in herbosis arenoso-lutosis gregaria flor. m. Aug. (D. 3624).” **Lectotype (here designated):** Carnarvon, Aug. 1901, *L. Diels 3624* (MEL 542201).

Gnephosis sp. Billabong (*B. Nordenstam & A. Anderberg 203*), WA Herbarium, as per florabase.dpaw.wa.gov.au/search/current/14349 [accessed 13 May 2015] and biodiversity.org.au/nsl/services/apc-format/display/237271?product=apc [accessed 9 July 2015].

Annual *herb*; major branches ascending to erect, 2–18 (37) cm long, mostly sparsely hairy and tending only to be prominently so beneath the compound heads, the hairs long, white, fine or slightly coarse and often tangled. *Leaves* linear or narrowly elliptic or somewhat falcate, 5–45 mm long, 0.5–2.5 mm wide, glabrous or sparsely hairy, the hairs as on branches, the uppermost leaves usually with a hyaline appendage at the apex.

Compound heads broadly ellipsoid to ellipsoid or broadly depressed ovoid to ovoid, 4.5–18 mm long, 5–10 mm diam.; general involucre consisting of a few bracts c. 1/5 the length of the heads, inconspicuous, at least in mature heads, the bracts mainly green, opaque but with hyaline margins and apex, sparsely to densely hairy and merging with the capitulum-subtending bracts; receptacle a shortly expanded to cylindrical axis with minor receptacular axes more or less evenly distributed over its surface, glabrous. *Capitula* c. 20–100 per compound head; capitulum-subtending bracts absent or several present, inconspicuous and resembling the outer capitular bracts. *Capitular bracts* 4, in 2 rows. *Outer bracts* 2, concave, of equal size, 1.3–2.2 (2.7) mm long, c. 2/3 the length of the inner bracts, mainly hyaline but with a green, opaque midrib extending most of the length of the bract, glabrous or with a few scattered hairs on the midrib. *Inner bracts* 2, subequal; largest bract 2.6–3.2 mm long, hyaline, midrib not or scarcely developed, concave, and more or less enveloping the floret, glabrous; smaller bract 2.1–2.9 mm long, concave, with a green, opaque midrib extending almost the length of the bract, glabrous or with a few scattered hairs on the midrib. *Florets* 1, tubular, bisexual. *Corolla* 5-lobed; tube 1.5–2 mm long; lobes yellow, triangular and somewhat rigid, with slightly thickened margins, all with a narrow (compared to *G. macrocephala*) papillate band (c. 0.1 mm wide) at the base; tube 1–1.2 mm long; inner epidermal cells of lobes much smaller than those of the throat, the walls tending to be straight and not in distinct rows; vascular tissue extending to the base of the lobes, large papillae may occur along this line of tissue. *Stamens* 5; anthers 1.18–1.31 mm long, shortly caudate; microsporangia 0.79–1.0 mm long; apical appendages somewhat triangular, c. 0.3 mm long; filament collar gradually and slightly dilating towards the base, basally not thicker than the filament. *Style* c. 1.7–2.2 mm long, with 2 distinct vascular traces from the base, nectary annular, branches c. 0.55–0.65 mm long, truncate, apices papillate. *Cypselas* obconical or almost so, 0.85–1.05 mm long, 0.6–0.7 mm diam., pubescent, the long straight twin hairs to c. 0.85 mm long and apically minutely bifid; pericarp lacking a layer of sclerenchyma, with a reticulate venation pattern (*P.S. Short 2031*); carpodium absent. *Pappus* seemingly absent or a ring to c. 0.2 mm high and exceeded by the apical hairs of the cypselas. *Chromosome number:* n = 12.

Distribution. Restricted to Western Australia between latitudes c. 24°S and 26°30'S and west of longitude c. 115°W.

Habitat. Grows in sand or loam in arid shrubland communities. Collectors' notes include: “in sand ... between shrubs of *Hakea*, *Acacia* & chenopods”, “Red-brown loam. Open *Acacia* shrubland”, “Red sand-dune dominated by shrubs of *Acacia*”, “low chenopod (mainly *Atriplex*) shrubland” and “on red sand ridges among low chenopod shrubs”.

Phenology & reproductive biology. Flowering is generally recorded from August to September with fruit set in late September and October.

A pollen:ovule ratio of 6,306 was determined for a single floret from *P.S. Short 4338*, collected c. 32 km S of Carnarvon.

Cytology. Turner (1970) recorded $n = 12$ for a population (*B.L. Turner 5387*) from near Gascoyne Junction.

Typification. Type specimens have not been located at any herbarium other than MEL. The MEL sheet consists of two plants, a packet containing fragments, and an original “Königl. Botanischer Garten und Museum” label, and is here designated as the lectotype specimen of *G. gynotricha*.

Any type material housed in B is believed to have been destroyed (e.g. Orchard 1999). Specimens collected by Diels from Western Australia and now housed in MEL were purchased or donated (e.g. Short 1990d) in the early part of the 20th century.

Notes. A unique feature of this species pertains to the fruit. Unlike *G. macrocephala*, and indeed other gnaphalioid species I have examined (Short et al. 1989), this species displays a reticulate venation pattern in the pericarp.

The pappus of this species is minute and at times seemingly absent. In some specimens there is nothing but an almost flat capping on the apex of the fruit, a capping which could possibly, but I suspect erroneously, be interpreted as part of the fruit wall.

The extent and number of large papillae which may occur on the inner surface of the corolla tube and follow the lines of vascular tissue seems to be extremely variable; in one floret viewed under 100× magnification they were common, in another from the same specimen just a few were mostly clustered in the vicinity of a single sinus between two lobes.

Subsequent to completing the above description, in May 2015, I examined two specimens, *B. Nordenstam & A. Anderberg 203* and *P.G. Wilson 12652* referred in PERTH to the phrase-name taxon *Gnephosis* sp. Billabong (*B. Nordenstam & A. Anderberg 203*) WA Herbarium. The specimens, but particularly the *Wilson* specimen, stand out because of their large size, largest plants being more than 30 cm tall, a feature which perhaps reflects growth conditions, i.e. plenty of water and/or growing in shade. Also slightly disconcerting is the fact that the individual capitula within the compound head do not seem to stand out as individual components as much as they do in most specimens but this may be reflective of their stage of flowering. However, plants of both collections lack a pappus — or it is barely developed — and, although some capitular bracts may be slightly larger than in many other specimens, they otherwise tend to fit within my circumscription of *G. gynotricha*. On my determinavit slips I suggest that both are “probably referable” to this species although, parti-

cularly in regard to the *Wilson* specimen, I have doubts that this is the case.

Selected specimens examined.

WESTERN AUSTRALIA: 39 km by road NNW of Overlander Roadhouse, 2 Sep. 1977, *E.N.S. Jackson 3117* (AD); c. 1 km N of Boologooro Hmsd, 25 Aug. 1982, *P.S. Short 1550* (AD, CANB, MEL, PERTH); c. 50 km SE of Carnarvon, 27 Aug. 1982, *P.S. Short 1571* (AD, CANB, PERTH); c. 14 km SE of Carnarvon, 12 Oct. 1983, *P.S. Short 2031* (MEL, PERTH); 26 miles E of Gascoyne Junction, 22 Aug. 1965, *B.L. Turner 5387* (KPBG, MEL, PERTH).

6. *Gnephosis macrocephala* Turcz.

Bull. Soc. Imp. Naturalistes Moscou 24(1): 190 (March 1851); Benth., Fl. Austral. 3: 570 (1867); Grieve & Blackall, How Know W. Austral. Wildfl. 817 (1975). — **Type citation:** “*Drum. coll. IV. n. 202.*” **Syntypes:** *J. Drummond 4: 202* (?KW n.v., not listed by Marchant 1990; MEL 542197, ex herb. Steetz, with label in Turczaninow’s hand). **Isosyntypes:** *J. Drummond 4: 202* (G 00223916; GH 00008375, ex herb. Klatt; K 000899483, ex herb. Benth.; K 000899484; K 000899485; MEL 542196, seen by Bentham; P 00699002, but as “5th colln 202, 1849”; P 00715963, dated 1848; PERTH. **Probable isosyntypes:** Swan River, *J. Drummond* (GH 00004646; K 000899482; MEL 542195; P 00715960, donated W.J. Hooker 1848).

Cephalosorus gymnocephalus A.Gray, Hooker’s J. Bot. & Kew Gard. Misc. 3: 153 (May 1851). — **Type citation:** “Swan River, *Drummond*, 1848.” **Lectotype (here designated):** Swan River, *Drummond* (K 000899482, annotated as “*Cephalosorus gymnocephalus* n. gen.” by Gray, ex herb. Hook.). **Isolectotypes:** GH 00004646, annotated by Gray; MEL 542195; P 00715960, donated W.J. Hooker 1848. **Probable isolectotypes:** *J. Drummond 4: 202* (G 00223916; GH 00008375, ex herb. Klatt; K 000899483, ex herb. Benth.; K 000899484, ex herb. Hook.; K 000899485, ex herb. Hook.; ?KW n.v., not listed by Marchant (1990); MEL 542196; MEL 542197; P 00699002, but as “5th colln, 202, 1849”; P 00715963, dated 1848; PERTH).

Annual *herb*; major branches ascending to erect, 4–38 cm long, mostly sparsely hairy, the hairs long, white, fine to somewhat coarse and often tangled. *Leaves* linear or lanceolate, somewhat stiff and often curved in the upper half and sometimes the leaf somewhat sigmoid, 5–38 mm long, 0.5–0.8 mm wide, glabrous or sparsely hairy and the hairs as on the branches, the uppermost leaves usually with a hyaline appendage at the apex. *Compound heads* very broadly ovoid to ovoid, sometimes obloid, 5.5–20 mm long, 5.5–14 mm diam.; general involucre consisting of numerous bracts in several rows, c. $\frac{1}{4}$ – $\frac{1}{3}$ the length of the heads, inconspicuous, at least in mature heads, the bracts mainly green, opaque but with hyaline margins and apex, sparsely to densely hairy and merging with the capitulum-subtending bracts; receptacle a shortly expanded to cylindrical axis with minor receptacular axes more or less evenly distributed over its surface, glabrous. *Capitula* 20–c. 200 per compound head; capitulum-subtending bracts absent or several, inconspicuous and resembling the outer capitular bracts. *Capitular bracts* 4, in 2 rows. *Outer bracts* 2, concave,

of equal size, 2.3–3.5 mm long, 3/4–4/5 the length of the largest inner bract, mainly hyaline but with a green, opaque midrib extending most of the length of the bract, glabrous or with a few scattered hairs on the midrib. *Inner bracts* 2, unequal in length; largest bract 3–4.3 mm long, hyaline, midrib not or scarcely developed, concave, and more or less enveloping the floret, glabrous; smaller bract 2.4–3.6 mm long, concave, with a green, opaque midrib extending almost the length of the bract, glabrous or with a few scattered hairs on the midrib. *Florets* 1, tubular, bisexual. *Corolla* dark yellow or yellow-orange, 5-lobed, tube 1.6–2.8 mm long; lobes with thickened margins, 2–4 lobes with a papillate band c. 0.5–0.6 mm wide in the lower c. 1/3 and extending into the throat; inner epidermal cells of lobes and those of the throat somewhat similar in size and with undulating margins; vascular tissue extending to the base of the lobes, occasional large papillae may be present along the tissue line. *Stamens* 5; anthers 1.48–1.6 mm long, shortly caudate; microsporangia 1.1–1.27 mm long; apical appendages subtriangular to ovate, c. 0.3–0.4 mm long; filament collar straight in outline or slightly dilating, basally not thicker than the filament. *Style* c. 2–3 mm long, with 2 distinct vascular traces from the base, branches c. 0.6–0.7 mm long, apically truncate and papillate. *Cypselas* somewhat obconical, 1–1.3 mm long, 0.55–0.7 mm diam., pubescent, the long straight twin hairs apically minutely bifid, the longest hairs c. 0.6–0.8 mm long; pericarp lacking a layer of sclerenchyma (*L. Haegi* 2640), vascular bundles 2; carpopodium absent. *Pappus* a small cup c. 0.26–0.6 mm high, somewhat hidden by the apical hairs of the cypselas. *Chromosome number*: unknown.

Distribution. Restricted to Western Australia between latitudes c. 27°S and 31°S, and W of longitude c. 123°E.

Habitat. Commonly found in somewhat saline soil on the margins of salt lakes. Collectors' notes include: "Low lying samphire flats with scattered shrubs of *Lyrcium australe*, *Dodonaea*, *Atriplex spongiosa* ... reddish-brown sandy loam", "In very sandy loam amongst samphire and *Gunniopsis*" and "[in] travertine gypsum".

Phenology & reproductive biology. Flowering is mostly recorded in October and November.

A pollen:ovule ratio of 6,068 was determined for a single floret from *P.S. Short* 4394, a specimen collected c. 12 km from Leonora along the road to Menzies.

Notes. This species can be difficult to distinguish from *G. gynotricha*, at least in herbarium specimens. However, in good specimens, and in the field, it is readily distinguishable by the often yellow-orange, not yellow, florets, a generally more robust habit, and the leaves which are frequently curved in their upper part. The pappus is also generally larger in this species than in *G. gynotricha*.

Selected specimens examined.

WESTERN AUSTRALIA: Lake Carey, 7 Oct. 1973, *H. Demarz* 4611 (KPBG, PERTH); Lake Austin, 18 Oct. 1980, *H. Demarz* 8343 (KPBG, PERTH); c. 76 km N of Bullfinch, 4 Nov. 1983, *L. Haegi* 2563 (AD, BRI, CANB, CBG, HO, MEL, NSW, PERTH); 7.5 km N of Latham, 13 Nov. 1983, *L. Haegi* 2662 (AD, BRI, CANB, CBG, HO, NSW, MEL, PERTH); c. 7.5 km E of Three Springs, 14 Nov. 1983, *P.S. Short* 2392 (AD, CANB, MEL, NSW, PERTH).

7. *Gnephosis newbeyi* P.S.Short, sp. nov.

Type: Western Australia. Western edge of Lake King, 33° 05'S, 119° 31'E, Growing in sand under *Melaleuca* and amongst samphire, 10 Nov. 1983, *P.S. Short* 2358 & *L. Haegi* (holotype: MEL 1524610; isotypes: AD, PERTH).

Annual *herb*; stem simple or with major branches from upper nodes; branches erect, 3–13 cm long, strongly flexuose, glabrous. *Leaves* alternate, sessile, entire, often subfalcate, linear, 4–15 mm long, 0.1–0.2 mm wide, glabrous, the uppermost leaves usually with a hyaline appendage at the apex. *Compound heads* obloid, depressed ovoid to broadly depressed ovoid or broadly obovoid, 2.5–3.5 mm long, 1.7–4 mm diam.; general involucre c. 1/2–2/3 the length of the head but not inconspicuous, of many, brownish, shiny, mainly hyaline bracts with a brown, opaque midrib; general receptacle an expanded, unbranched or shortly branched axis, glabrous. *Capitula* 3–8 per compound head. *Capitulum subtending bracts* 1, widely obovate, 1.9–2.1 mm long, 1.5–1.8 mm wide, glabrous, usually readily differentiated from the capitular bracts. *Capitular bracts* c. 15, flat to conduplicate, obovate, 1.5–2 mm long, 0.5–1.1 mm wide, arranged in c. 3 rows, mainly hyaline but with an opaque midrib extending c. 1/3–2/3 the length of the bract and generally with a distinct claw and apical lamina, glabrous or with a few minute glandular hairs on the midrib; claw with hyaline margins throughout their length with the margins gradually dilating towards the lamina or in the inner bracts the hyaline margins only in c. the upper half of the claw; lamina somewhat colourless or an extremely pale yellow, erect and slightly concave, about the width or wider than the claw. *Florets* 4–13, tubular, bisexual. *Corolla* 3-lobed; tube c. 0.8 mm long, externally with or without several prominent orange, globular glands and often sticky. *Style* branches truncate, with short sweeping hairs. *Stamens* 3; anthers c. 0.3 mm long. *Cypselas* obovoid, brown, c. 0.45 mm long, c. 0.25 mm diam.; carpopodium annular, whitish. *Pappus* a white ring with usually entire bristle-like elements c. 0.1–0.3 mm long but one or several elements in a ring extending c. 1/2 to about the length of the corolla may be present. *Chromosome number*: unknown. **Fig. 8.**

Distribution. Only known to me from the margins of Lake King and other salt lakes near Pingrup and Peak Charles.

Habitat. Plants comprising both the holotype collection and *K. Newbey* 7843 were growing in saline sandy soil in a *Melaleuca* zone surrounding a salt lake.

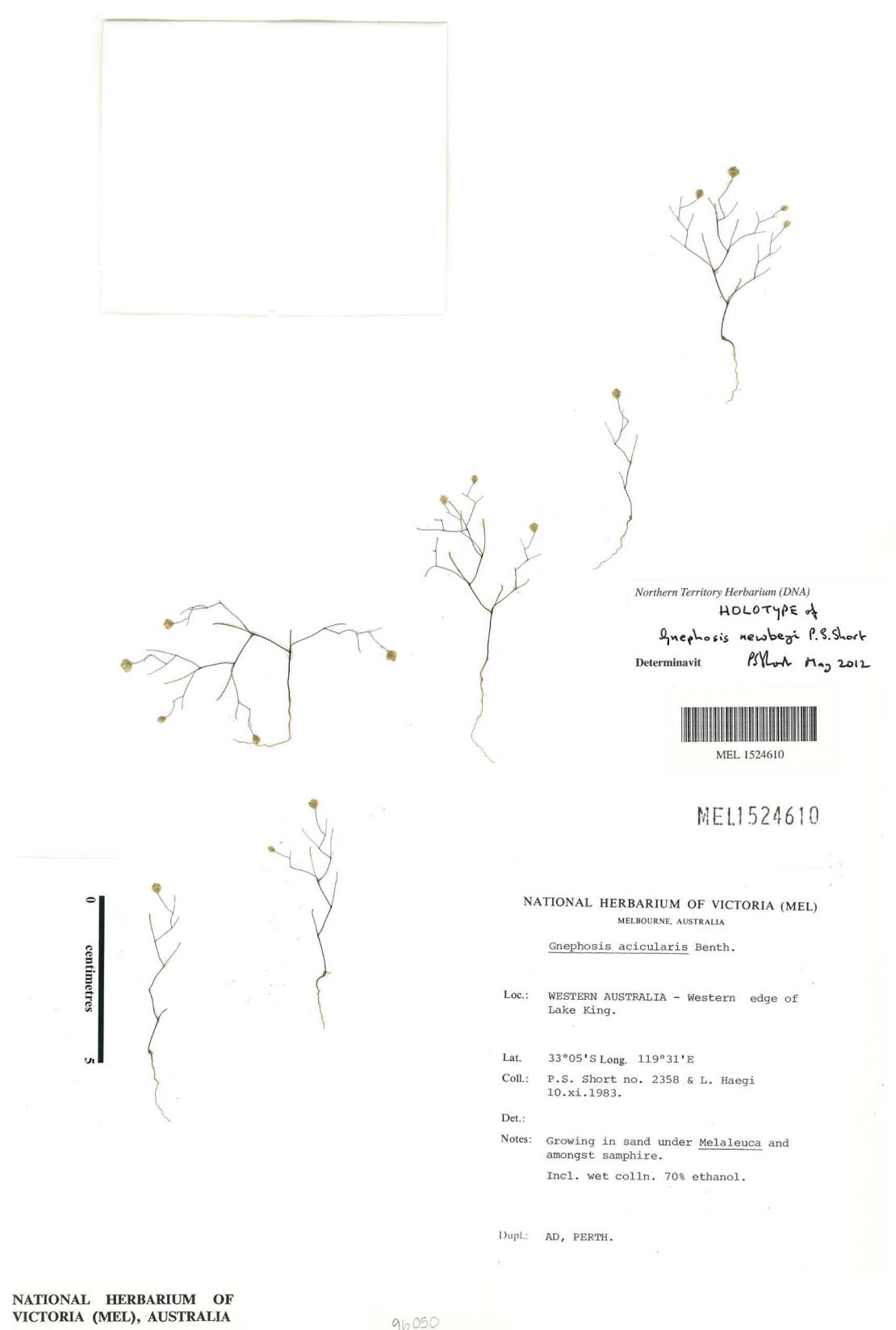


Fig. 8. Holotype of *Gneposis newbeyi* (MEL). — P.S. Short 2358 & L. Haegi.

Phenology & reproductive biology. The only specimens seen were collected in November.

The small capitula, 3-lobed florets with 3 anthers, and small anthers with few pollen grains are indicative of selfing and self-compatibility.

Etymology. The epithet commemorates Ken Newbey (1936–1988), among other things the collector of more than 12,000 plant specimens (Kenneally 1988, Underwood 2011), including the specimen which first drew my attention to the existence of this species.

Notes. The species is readily distinguished from *G. acicularis* by its 3-lobed corolla with three stamens, not 5-lobed corolla with five stamens.

The label associated with the type specimen indicates that there is a spirit collection associated with it; this is not the case.

Additional specimens examined.

WESTERN AUSTRALIA: W edge of Lake King, 12 Nov. 1978, R.J. Chinnock 4363 (AD); 3 km E of Peak Charles, 2 Nov. 1980, K. Newbey 7843 (PERTH); 10 km SW of Pingrup, 23 Nov. 1979, P.S. Short 1072 (AD).

8. *Gnephosis setifera* P.S.Short

Muelleria 7: 244, fig. 2 (1990). — **Type citation:** “Holotypus: Western Australia, c. 7 km S of Bunjil along road to Latham ... 16.ix.1986, [P.S.] Short 2955, [M.] Amerena & [B.A.] Fuhrer (MEL 117004). ISOTYPUS: PERTH.”

Prostrate *herb* with branches to c. 5 cm long or sometimes consisting of a single, sessile compound head in a basal rosette of leaves, branches and leaves with scattered, erect bristles. Leaves oblanceolate or spatulate, 3.5–15 mm long, 1.5–2.6 mm wide. *Compound heads* broadly depressed to depressed ovoid, 3–5 mm high, 5–16 mm diam.; bracts subtending compound head forming a conspicuous involucre of leaf-like bracts; general receptacle branching. *Capitula* 10–45. *Capitulum-subtending bract* absent. *Capitular bracts* in 2 or 3 rows; outer bracts 1–4, leaf-like, with bristles and long-flexuose hairs; inner bracts 8–12, in 1 or 2 rows, mostly hyaline, margins long-ciliate, outer surface sometimes with long-flexuose hairs. *Florets* 5–11; corolla 5-lobed; lobes with slightly thick margins, papillate at the base of each lobe; inner epidermal cells of lobes and throat with straight margins; vascular tissue more or less extending to the base of the lobes. *Cypsela* obovoid, 0.44–0.57 mm long, dark pink; pericarp with 2 vascular bundles; carpopodium absent. *Pappus* absent. *Chromosome number:* unknown. **Fig. 2D.**

Distribution. Endemic to the margins of salt lakes of the northern wheat belt, W.A., possibly being confined to the Monger River drainage system.

Habitat. From sandy, presumably slightly saline, soils. Recorded associates include species of *Atriplex*, *Gunnipopsis* and *Tecticornia*.

Phenology & reproductive biology. Flowering is recorded for September (as per specimens seen to 1990).

A pollen:ovule ratio of 1,664 (Short 1990c) determined from a single floret suggest cross-pollination but also self-compatibility.

Notes. The general vestiture of bristles, prostrate habit, and compound-heads make this one of the most readily identifiable species of Australian gnaphalioid taxa.

Selected specimens examined.

WESTERN AUSTRALIA: On the road from Perenjori to White Wells, 1 km E of Mongers Lake, 19 Sep. 1987, G. Bergqvist (MEL, PERTH, S); 5 km S of Morawa, 8 Sep. 1995, P.S. Short 4371 (MEL, PERTH, TI).

***Leucophyta* R.Br.**

Trans. Linn. Soc. London 12: 106 (25 Feb. 1818; as preprint before Sep. 1817); R.Br., J. Phys. Chim. Hist. Nat. Arts 86: 409 (1818); Cass. in Cuvier, Dict. Sci. Nat. 26: 158 (1823); Less., Syn. Gen. Compos. 271 (1832) (“*Brownei*”); DC., Prodr. 6: 152 (1838); R.Br., Verm. Bot. Schr. 2: 546 (1826); Steetz in Lehm., Pl. Preiss. 1: 442 (1845); A.Anderb., Opera Bot. 104: 125 (1991); P.S.Short in N.G.Walsh & Entwisle, Fl. Victoria 4: 799, fig. 159c (1999); R.J.Bayer et al. in Kadereit & C.Jeffrey, Fam. Gen. Vasc. Pl. 8: 270 (2006). — **Type:** *Leucophyta brownii* Cass.

Shrub, densely branched and cushion-like or somewhat spreading, tomentose. *Leaves* alternate, sessile, entire, tomentose, at least the uppermost usually strongly appressed. *Compound heads* present; general involucre inconspicuous; general receptacle conical, with minor receptacular appendages distributed more or less evenly over its surface, glabrous to sparsely hairy, with glandular hairs. *Capitula* many per compound head. *Capitular bracts* in 2 rows, flat to conduplicate, usually scarious but with an opaque brown to green midrib extending all or most of the length, sometimes the scarious margins absent, never manifestly differentiated into a distinct claw and terminal lamina defined by a constriction, all bracts sparsely to densely hairy at or just below the apex, glandular orange hairs often present on the midrib. *Florets* (1) 2 or 3, tubular, bisexual. *Corolla* 5-lobed; tube with outer surface glabrous; lobes all with thickened margins, c. the lower 2/3 of their inner surface papillate; inner epidermal cells of throat somewhat rectangular and straight-walled; vascular tissue perhaps extending to the sinus, large papillae extending along the upper part of the vascular traces. *Stamens* 5; anthers prominently cordate; apical appendages triangular; filament collar tending to gradually dilate towards the base. *Style* with 2 distinct vascular traces from the base; branches truncate, with short sweeping hairs. *Cypsela* monomorphic, obconic, brown, with scattered multicelled, glandular hairs; pericarp with the outer cells thick-walled, with two vascular bundles; cleared fruit display a crystalline layer extending around the cypsela, this either in the pericarp or the testa, crystals narrowly rectangular or narrowly hexagonal; carpopodium absent. *Pappus* of multiseriate, plumose bristles united at the base, about the length of the corolla tube. *Chromosome number:* $n = 9$.

Distribution. Australia.

Etymology. Derived from the Greek *leucon*, meaning white, and *phyton*, for plant.

Notes. As with *Calocephalus* this genus was first described by Robert Brown (1817) in a paper titled "Observations on the natural family of plants called Compositae ...", a paper subsequently translated into French by Cassini, and to which both Brown and Cassini provided additional notes. The original paper was also included in Nees von Esenbeck's "Robert Brown's Vermischte botanische Schriften", to which Lessing referred in his treatment of both *Calocephalus* and *Leucophyta*.

Leucophyta is differentiated from other compound-headed gnaphalioid tax in Australia by both its shrubby habit and coastal habitat, the only exception being *Angianthus cunninghamii* which is also a coastal, shrubby species but manifestly differs, among other things, in the structure and arrangement of the capitular bracts, in having papillate cypselas, and in lacking a pappus.

1. *Leucophyta brownii* Cass.

in Cuvier, Dict. Sci. Nat. 26: 159 (1823); Less., Syn. Gen. Compos. 271 (1832) ("*Brownei*"); DC., Prodr. 6: 152 (1838); Steetz, Pl. Preiss. 1: 442 (1845); Hook.f., Fl. Tasman. 1: 196 (1860) ("*Brownei*"); P.S.Short in N.G.Walsh & Entwisle, Fl. Victoria 4: 799, fig. 159c (1999). — *Calocephalus brownii* (Cass.) F.Muell., Rep. Pl. Babbage's Expedition 13 (1859); F.Muell., Second Gen. Rep. Veg. Colony [Victoria] 12 (1854), nomen nudum; Benth., Fl. Austral. 3: 575 (1867); J.M.Black, Fl. S. Austral. 1st ed. 648 (1929), 2nd ed. 928, fig. 1230 (1957); W.M.Curtis, Stud. Fl. Tasman. 345 (1963); J.H.Willis, Handb. Pl. Victoria 2: 732 (1973); Grieve & Blackall, How Know W. Austral. Wildfl. 821 (1975); P.S.Short in Jessop & Toelken, Fl. S. Austral. 3: 1502A, fig. 681 (1986). — **Type citation:** "Nous avons fait cette description spécifique, et celle des caractères génériques, sur plusieurs échantillons secs qui se trouvent dans l'herbier de M. de Jussieu. Ces échantillons, recueillis sur la côte occidentale de la Nouvelle-Hollande, près le port du Roi George, et sur la côte australe, près le détroit de Bass, nous ont offert quelques différences ..." [based this specific description and that of the generic characters on several dry specimens which are found in M. de Jussieu's herbarium. These samples gathered from the western coast of New Holland, near Port King George, and on the southern coast, near Bass Strait ...]. **Lectotype (here designated):** dét. de Bass [Bass Strait], *Anon.* (P 00715976). **Remaining syntypes:** Nouv. holl. port du R. georges [King George Sound], (P 00715983); ile King [King Island] (including P 00715982 and, by my notes, perhaps two other sheets in P; S (S-G-3638, ex P). **Possible remaining syntypes:** Nouv. Hollande, Voyage of Baudin, 1801 (P 00715984). See notes below.

Leucophyta brownii var. *candidissima* Steetz in Lehm., Pl. Preiss. 1: 442 (1845); W.R. Elliot & D.L. Jones, Encyc. Austral. Pl. 6: 147 (1993). — **Type citation:** "In clivulis arenosis ad maris litora, haud procul ab oppidulo Freemantle. Exeunte Januario, 1839. Herb. Preiss. No. 31. (Specimina glomeruligera, sed floribus nondum evolutis.) In Nova Hollandia leg. cl. Ferd. Bauer. (V.s. in herbario aulico Vindobonn.)" **Lectotype (here**

designated): J.A.L. Preiss 31 (MEL 543270, ex herb. Steetz). **Isolectotypes:** G 00222881, LD 1052804, MEL 543269, P (3 sheets, one ex herb. Schulz-Bip., one ex herb. Drake, the latter P 00715987).

Leucophyta brownii var. *virescens* Steetz in Lehm., Pl. Preiss. 1: 443 (1845). — **Type citation:** "In colliculis arenosis insulae Rottennest, mense Aug. 1839. Herb. Preiss. No. 32. (Specimina florentia). In Nova Hollandia leg. cl. Ferd. Bauer. (V.s. in herb. aulico Vindobonnensi.) In insula van Dieman leg. cl. Gunn. Herb. Gunn. No. 433." **Lectotype (here designated):** J.A.L. Preiss 32 (MEL 543271, ex herb. Steetz). **Isolectotypes:** S (S-G-3639), P.

Shrub to c. 1 m high, often densely branched and cushion-like but sometimes more open and spreading, branches grey-white, white or somewhat silvery-tomentose. *Leaves* narrowly oblong to linear or narrowly elliptic or ovate to lanceolate, 1.5–14 mm long, c. 0.8–1.2 mm wide, white to grey-white tomentose, at least the uppermost ones usually strongly appressed. *Compound heads* broadly depressed ovoid or spheroidal, 6–16 mm long, 7–15 mm diam.; general involucre inconspicuous, of a few leaf-like bracts. *Capitula* 30–110 per compound head. *Capitular bracts* 9–13, in 2 rows, obovate or elliptic, flat to conduplicate, 1.8–3.75 mm long, 0.8–1.7 mm wide. *Florets* (1) 2 or 3. *Corolla* 5-lobed; tube 1.6–2.1 mm long. *Stamens* 5; anthers 1.06–1.35 mm long, very prominently cordate, the thickish tails c. 0.2–0.35 mm long; microsporangia 0.82–0.97 mm long; apical appendages triangular, c. 0.22–0.29 mm long. *Style* c. 2.3–2.35 mm long; branches c. 0.7 mm long. *Cypselas* obconic, 1.2–1.8 mm long, 0.7–1.2 mm diam., brown, with scattered multi-celled, glandular hairs. *Pappus* of 10–13 bristles. *Chromosome number:* $n = 9$. **Fig. 9.**

Distribution. Coastline of south-western Western Australia, South Australia, Victoria and Tasmania.

Habitat. A coastal plant which occurs on rocky shores, in coastal dunes — where associates may include species such as *Acacia longifolia* (Andrews) Willd., *Apium prostratum* Labill. ex Vent. and *Leucopogon parviflorus* (Andrews) Lindl. — and along the foreshore of many beaches, where it may form a distinct zone, e.g. as at Hardwicke Bay, Yorke Peninsula where I have observed it growing above a zone of *Spinifex sericeus* R.Br.

Phenology & reproductive biology. Typically a summer-flowering species.

A pollen:ovule ratio of 4,594 was determined for a single floret from *P.S. Short 1944*, a specimen gathered from Badger Head, Tasmania.

Elliot & Jones (1993) recorded that seed (provenance not provided) germinates without pre-sowing treatment within 10–30 days and that cuttings readily strike from semi-hardwood growth.

Cytology. Short (1986b) recorded $n = 9$ for a population (*P.S. Short 301*) from near Port Minlacowie, Yorke Peninsula, S.A.



Fig. 9. *Leucophyta brownii*, near Port Minlacowie, S.A. (unvouchered).
— Photo: P.S. Short.

Typification. Unfortunately, there is a number of specimens of *L. brownii* held in P to which I have added incorrect determinavit slips regarding their type status. This, in part, is because of my mistake in regards to what constitutes a type of a genus (Art. 10), but also because of a misreading of the protologue of *L. brownii*. In the former category there are a number of collections gathered by Robert Brown which, contrary to my determinavits, have no type status as, although Brown named the genus the naming of a species was left to Cassini. These are, or at least include, specimens now numbered as P 00715971, P 00715974 and P 00715975, the numbers being absent when I examined specimens in 1991.

In regards to syntype specimens of *L. brownii*, I initially believed the wording in the protologue to have included any specimens collected during the Baudin expedition from the southern coast of Australia. However, the wording (see above) actually excludes specimens from Kangaroo Island (P 00715979, P 00715980, P 00715981, P 00715985, P 00715986) and St Francis Island (P 00715977, P 00715978), both islands being off the coast of South Australia and surely not “near” Bass Strait. With those specimens excluded I have opted to choose a specimen (P 00715976) clearly labelled as coming from Bass Strait as the lectotype specimen. This specimen has a printed label stating “Nouvelle Hollande, Côte méridionale. Voyage aux Terres-Australes. Capitaine Baudin 1801.” while a further label attached to it has the handwritten name “*Leucophyta Brownei* Cass.” and, in the same hand, the locality is given as “détr. de Bass” (i.e. Bass Strait). Although I have some doubts, the annotation “détr. de Bass” appears to be in the hand of Antoine Laurent de Jussieu (1748–1836), which is consistent with the statement in the protologue that the specimens seen by Cassini were in Jussieu’s herbarium. Although no specimens appear to have been annotated by Cassini I have no reason to doubt that the specimen chosen as the lectotype was examined by him. A King George Sound specimen and several from King Island — a principal

stopping point for the Baudin expedition and on the western edge of Bass Strait — are regarded as remaining syntype specimens.

Labels suggesting that the lectotype and some other specimens attributed to the Baudin Expedition were gathered in 1801 are incorrect; they must have been collected from the southern Australian coastline in 1802 and 1803 (e.g. Brosse 1983, Cornell 1974).

Notes. I have no doubt that habit and leaf size in these plants is modified by environmental factors. Sand-laden winds would no doubt efficiently prune shoots and maintain a compact cushion-like habit while plants largely buried in sand may develop comparatively longer branchlets than their wind-exposed neighbours. However, Cassini (1823), Steetz (1845) and Bentham (1867a) all alluded to the variability of this species, with the latter noting that “the Western specimens are generally more vigorous than the others, with longer leaves and larger heads” (Bentham 1867a, p. 574). Elliot & Jones (1982, p. 433) also noted a “more vigorous and less compact form in cultivation [which] originated from near Cape Le Grand, W.A.”. I have only observed the species twice in Western Australia (as represented by P.S. Short 3890 & 3892) and at few localities in the eastern States. However, I concur with the aforementioned authors that the mostly spreading, longer-leaved specimens from Western Australia also have less rigid branches and the entire shrubs tend to sprawl or at least be comparatively open rather than having the cushion-like habit (which is associated with comparatively rigid, intricate branchlets) and generally shorter and more appressed leaves common in specimens from the eastern States. Furthermore, Tony Rodd (in litt. 1987) noted that specimens gathered near Cape Leeuwin (W.A.) and cultivated in Sydney maintain their distinctive habit and leaf-size.

Thus, there are grounds for formally recognising infraspecific taxa, as did Steetz (1845) when recognising var. *candidissima* Steetz and var. *virescens* Steetz, and I have deliberately lectotypified both names with specimens collected from W.A. As the specimens are part of the Steetz herbarium this is not only in accordance with recommendations in the *Code*, but leaves the names free for application should it be deemed useful to formally apply either name to western material, the lectotype specimen of *L. brownii* coming from Bass Strait and being representative of the entity forming a compact shrub and having short and mostly appressed leaves. Having examined the lectotype specimens of both var. *candidissima* and var. *virescens* I also believe that they are representative of the same entity and if one is to be adopted, it should be the name var. *candidissima*, the lectotype of which best represents both the white-silvery appearance and the robust nature of the majority of the W.A. specimens I’ve examined. Elliot & Jones (1993) followed my advice in doing just that.

Although there is considerable evidence to justify the recognition of var. *candidissima* — which at least

extends to the W.A./S.A. border as evidenced by a collection from the Eucla area collected by J.D. Batt in 1887 (MEL84909) — I am not totally convinced that this is warranted. This is partly because I have viewed few specimens from South Australia, not having examined the many specimens in AD, but also because a few specimens do not support the recognition of two taxa (albeit that I believe that the varietal level allows for some morphological intermediates). For example, *R.D. Royce 6166*, a specimen from Wilson Island, Recherche Archipelago has comparatively short leaves and probably a more cushion-like habit than that normally associated with W.A. specimens while, in Victoria, a specimen (NSW 138963), probably collected by Carl Walter in 1892 from Portland, exhibits long stems and spreading, long (but narrow) leaves more in keeping with specimens from W.A. I also note that a specimen *M.E. Phillips 122* (CBG) cultivated from cuttings originally obtained from Venus Bay, Victoria, displays intricate branching at the base but much longer new growth more typical of the W.A. variant; the uppermost leaves on the longest shoot also displays longish somewhat appressed leaves similar to those on the lectotype of the var. *candidissima*. For these reasons I have here opted not to recognise varietal levels within this taxon; others may disagree.

Selected specimens examined.

WESTERN AUSTRALIA: Point Ann, Fitzgerald River Res., 16 Mar. 1972, *A.S. George 11280* (PERTH); Wilson Is., Recherche Archipelago, 1 Feb. 1960, *R.D. Royce 6166* (PERTH).

SOUTH AUSTRALIA: Policeman's Point, Coorong, 26 Dec. 1967, *C.E. Chadwick* (NSW 138989); Nora Creina Settlement, 15 Feb. 1987, *P. Gibbons 659* (AD, MEL); creek mouth, Second Valley, 4 Feb. 1965, *D.E. Symon 3217* (AD, CANB).

VICTORIA: Port Fairy, 21 Jan. 1988, *M.G. Corrick 570* (MEL); The Lakes Coastal Park, Ninety Mile Beach, 3 Jan., 1987, *I. Crawford 580* (E, MEL); Lakes Entrance, 14 Jan. 1984, *J.H. Ross 2792* (AD, MEL).

TASMANIA: Port Dalrymple, [Jan. 1804 (Stearn 1962), *R. Brown* (CANB 279088; K; MEL 543208, labelled as no. 2140 by Bennett and a mixed collection, one element with appressed leaves, the other with longer, non-appressed leaves typical of W.A. collections); Foredures c. 2 km SE of Badger Head, 6 Feb. 1983, *P.S. Short 1944* (MEL); Preservation Is., Ferneaux Group, 28 Jan. 1978, *J.S. Whinray 1971* (MEL).

Notisia P.S.Short, gen. nov.

Type: *N. intonsa* (S.Moore) P.S.Short

Annual *herb*, stem and major branches prostrate to erect, cottony. *Leaves* sessile, entire, obovate to oblanceolate, sometimes distinctly spatulate, cottony. *Capitula* heterogamous, woolly, c. 5 or so loosely grouped together at the end of the major axes and short lateral branches, each capitulum subtended by 1 to several cottony to woolly bract-like leaves. *Involucral bracts* 6 or 7, rigid, densely woolly on the outer surface, predominantly herbaceous, not forming a manifestly distinct claw with a terminal, well-delimited hyaline lamina; each of the 2 outer female florets enclosed by a single strongly conduplicate bract enclosing the

fruit and the lower $\frac{1}{2}$ of the corolla tube, herbaceous except for hyaline apex; the 2 inner male florets together surrounded by 4 or 5 bracts which are fused for c. $\frac{1}{2}$ – $\frac{2}{3}$ their length, the free portion flat or almost so, mainly green and opaque, the apex and sometimes the margins hyaline. *Female florets* 2, lacking pappus; corolla filiform, apically with several elongate, biseriate hairs on the outer surface; style filiform. *Male florets* 2, lacking ovary and pappus; corolla tubular, 5-lobed; lobes small, with thick margins, 1 or 2 biseriate, elongate, hairs often present on their outer surface, their inner surfaces not papillate at their base; cells of the lobes short and thickened, those of the tube long-rectangular and straight-walled; vascular strands in tube 5, each extending to a sinus between two lobes. *Stamens* 5; filament collar almost straight in outline and not thicker than the filament; anthers prominently caudate, apical appendage obtuse. *Style* with 2 distinct vascular traces from the base but not or barely at all divided into distinct branches, apically truncate and papillate. *Cypselas* monomorphic, narrowly ellipsoid, glabrous, pericarp with 2 vascular bundles, carpopodium annular. *Chromosome number*: unknown.

Distribution. Endemic to Western Australia.

Etymology. The name is essentially derived from a rearrangement of the letters comprising the specific epithet; it is not an anagram, being minus one letter and having an additional “i”.

Notes. The structure of the inflorescence is open to interpretation. It perhaps can be considered to be an amalgamation of two capitula, each with a single female floret, surrounding another capitulum with usually two male florets. However, as indicated by the above description, I am inclined to think it is derived from a single heterogamous capitulum in which inner bisexual florets have become functionally male, thus allowing for the fusion of the bracts below the corolla and consequent obliteration of the non-functional gynoeceum. That this is the case is supported by the fact that species of Gnaphalieae with separate female and male capitula are almost unknown in Australia, whereas species with heterogamous capitula with outer female florets and inner florets, which are bisexual or male, are common.

The presence of female and male florets and heterogamous capitula readily distinguish this species from all others currently placed in *Gnephosis* s.lat. and many other genera, including all members of the *Angianthus* group (sensu Anderberg 1991), which have only bisexual florets. Although having small, hyaline apices the capitular bracts are not manifestly divided in to a distinct claw with a constriction between it and a terminal lamina. Various other features, singularly or in combination — such as the absence of a pappus and the morphology of the bracts and cypselas — similarly readily distinguish *Notisia* from other gnaphalioid genera with heterogamous capitula.

1. *Notisia intonsa* (S.Moore) P.S.Short, comb. nov.

Gnephosis intonsa S.Moore, J. Linn. Soc., Bot. 34: 197 (1899), as "*G. intonsus*", basionym; Grieve & Blackall, How Know W. Austral. Wildfl. 819 (1975). — **Type citation:** "Repperi ad Gibraltar mens. Sep." **Holotype:** Gibraltar, Sep. 1895, S. Moore (BM 000810548). **Isotypes:** K 000901816 (photo PERTH), NY 00158206.

Annual herb, stem and major branches prostrate to erect, 2.5–15 cm long, cottony. *Leaves* obovate to oblanceolate, sometimes distinctly spatulate, cottony, 3–13 mm long, 0.7–2.1 mm wide. *Capitula* heterogamous, woolly, loosely grouped together at the end of the major axes and short lateral branches, each capitulum subtended by 1 (–several) leafy, cottony to woolly, bract(s). *Involucral bracts* 6 or 7; bracts surrounding female florets strongly conduplicate and enclosing the fruit and the lower ½ of the corolla tube, 2.8–4 mm long, opaque except for a small hyaline apex; bracts surrounding male florets, 3.4–3.7 mm long (including fused bases), the free portion flat or almost so, mainly green, opaque, the apex and sometimes the margins hyaline. *Female corolla* tube 1.5–1.7 mm long. *Cypselas* narrowly ellipsoid, yellowish brown, glabrous, 1.4–1.7 mm long, 0.33–0.45 mm diam. *Male corolla* tube 1.2–1.6 mm long. *Stamens* 5; anthers 0.55–0.62 mm, excluding prominent wide tails c. 0.23–0.29 mm long; microsporangia 0.38–0.49 mm long, apical appendages 0.12–0.19 mm long; filament collar 0.09–0.26 mm long. *Chromosome number:* unknown.

Distribution. South-western Western Australia between latitudes c. 29° and 32° S and longitudes 119° and 122°E.

Habitat. The only collectors' notes recording the habitat of this species are "Mixed *Eucalyptus* woodland over *Santalum/Erremophila* scrubland on brown stony saline loams" and "gilgai plain; brown cracking clay".

Phenology & reproductive biology. The few specimens I have examined were collected from early September to mid-November.

Pollen:ovule ratios, ranging from 292 to 372 (\bar{x} = 350; s.d. = 29; s.e. = 15; n = 5) were determined from 5 capitula, each from a different plant, of *P.S. Short 4040*, a collection gathered south-east of Marvel Loch.

Typification. Moore (1899), when describing this and other new species from Western Australia, recorded that his first set of specimens had been allocated to BM, the second to Columbia College, New York (incorporated into NY in 1899), and a third set to K. I accordingly regard the specimen of *G. intonsus* at BM as the holotype (with BM at this time being Moore's unofficial place of work) with isotypes in K and NY. From the JSTOR website (accessed Sep. 2012) it is evident from the isotype at NY that Moore had considered placing the species in *Angianthus*, not *Gnephosis*, but with the same epithet. The specimen at K was received in January 1897 and is mounted on the same sheet as *G.H. Thiselton-Dyer 65*; a photograph of the K sheet is held at PERTH.

Additional specimens examined.

WESTERN AUSTRALIA: 1.3 km E Nepean Mine, 25 Sep. 1986, *R.J. Chinnock 7350* (AD, PERTH); 2.5 km NE of Metzke's Find, 9 Sep. 1988, *R. Cranfield 7292* (MEL, PERTH n.v.); Gibraltar, 4 Oct. 1973, *H. Demarz 4562* (PERTH); Gibraltar, 20 Nov. 1973, *H. Demarz 4888* (PERTH); Twenty miles W of Ravensthorpe, 14 Oct. 1955, *E. Gauba W.A.476* (MEL, PERTH n.v.); 14 km SE of Marvel Loch, 21 Sep. 1979, *K. Newbey 6034* (PERTH); c. 14 km SE of Marvel Loch, 24 Sep. 1993, *P.S. Short 4040* (MEL); No. 8 Pumping Stn, Dedari, 24 miles W of Coolgardie, 1903, *G.H. Thiselton-Dyer 65* (K).

***Trichanthodium* Sond. & F.Muell. ex Sond.**

Linnaea 25: 489 (1853); P.S.Short, Muelleria 7: 213–224 (1990); R.J.Bayer et al. in Kadereit & C.Jeffrey, Fam. Gen. Vasc. Pl. 8: 282 (2006). — **Type:** *T. skirrophorum* Sond. & F.Muell. ex Sond.

Annual herbs, branching or simple, glabrous, lanate or tomentose. *Leaves* mainly alternate but lowermost pair(s) opposite, all sessile, entire, usually with a slight mucro, the uppermost with a hyaline apex. *Inflorescence* a compound head; bracts subtending compound heads inconspicuous or the outer ones c. equal to the head; general receptacle flat to convex, glabrous or with long bristles. *Capitula* discoid, homogamous. *Capitular bracts* 1- or 2-seriate, flat to conduplicate, not manifestly differentiated into a distinct claw and terminal lamina, primarily hyaline and yellow in the upper part but at least those of the outer row with an opaque midrib. *Florets* 1 per capitulum, bisexual; corolla tubular, 5-lobed, yellow; style branches truncate; stamens 5, anthers tailed. *Cypselas* monomorphic, obovoid, often somewhat flattened, covered in mucilage-producing cells. *Pappus* an entire truncate cup or a lacinate ring or cup. *Chromosome numbers:* n = 3, 4, ??.

Distribution. An Australian genus with four species; for a distribution map see Short (1990a, Fig. 1).

Cytology. Chromosome number determinations for all four species are recorded in Short (1990a) and Watanabe et al. (1999). Excluding an unsubstantiated report by Turner (1970) of n = 7 for *T. scarlettianum*, for which I determined 2n = 6, then only *T. skirrophorum*, the most widespread species, has n = 4, the others have n = 3.

Etymology. From the Greek *trich-* (hair), *anthos* (flower) and *podion* (foot), in reference to the bristly general receptacle of *T. skirrophorum*.

Key to species of *Trichanthodium*

1. General receptacle with bristles 1. *T. skirrophorum*
- 1: General receptacle glabrous
 2. Leaves tomentose; pappus a truncate cup 2. *T. scarlettianum*
 - 2: Leaves glabrous to lanate; pappus a lacinate ring or cup
 - 3: Anthers 0.9–1.2 mm long, apical appendage protruding from the corolla tube at anthesis (W.A.) 3. *T. exilis*
 - 3: Anthers 0.5–0.8 mm long, apical appendage not manifestly protruding from the corolla tube at anthesis (Vic.) 4. *T. baracchianum*

1. *Trichanthodium skirrophorum* Sond. & F.Muell. ex Sond.

Linnaea 25: 490 (1853); P.S.Short, Muelleria 7: 218 (1990). — *Gnephosis skirrophora* (Sond. & F.Muell. ex Sond.) Benth., Fl. Austral. 3: 570 (1867). — **Type citation:** “Cudnaka.” **Lectotype:** Cudnaka, F.Mueller (MEL 542193) (Short 1990a, p. 218). **Probable isolectotypes:** K 000901884; MEL 542194.

Angianthus codonopappus F.Muell., Fragm. 9: 2 (1875). — *Gnephosis codonopappa* F.Muell. in Giles, Geog. Travels in Cent. Aust. 217 (1875), nomen nudum; F.Muell., Fragm. 9: 2 (1875), pro syn. — **Type citation:** “In vicinia lacus Eyrei; Giles.” **Lectotype:** towards Lake Eyre, 1872, E.Giles (MEL 542191) (Short 1990a, p. 218).

Herb with branches 3–35 cm long, densely lanate. *Leaves* lanceolate or linear, 5–30 mm long, 0.5–1.2 mm wide, tomentose, grey-green. *Compound heads* broadly depressed ovoid to obloid, 4–12 mm long, 5–15 mm diam., subtended by a general involucre of outer leaf-like bracts and inner hyaline bracts, the longest c. 1/3 as long as the head but inconspicuous in mature heads; general receptacle transversely ellipsoid, bristle. *Capitula* 25–200 per compound head. *Capitular bracts* 5 or 6, outer ones densely hairy at apex, inner 1 or 2 conduplicate, midrib indistinct, glabrous or sparsely hairy at apex. *Cypselas* 1–1.3 mm long. *Pappus* cup-like, 0.6–1.2 mm long. *Chromosome number:* $n = 4$. **Fig. 1F.**

Distribution. Widespread across southern and central mainland Australia.

Habitat. Frequently in chenopod shrubland in saline and gypseous soil.

Phenology and reproductive biology. Flowering c. August to October. An average pollen:ovule ratio of 3,728 has been recorded for this species (Short 1990a).

Cytology. Short (1981b), as *Gnephosis skirrophora*, recorded $n = 4$ for a population near Copley, S.A. (*P.S. Short 747*), as had Turner (1970) for populations near Norseman (*B.L. Turner 5563*) and Eucla, both in W.A. Using the name *T. skirrophorum*, Short (1990a) and Watanabe et al. (1999) recorded the same number for three more localities from W.A. (Bulla Bulling, *P.S. Short 1757*; 8 km S of Billabong Roadhouse, *P.S. Short 2834*; Norseman, *K. Watanabe 182*), two more from S.A. (Ceduna, *L. Haegi 2688*; Hawker, *K. Watanabe 202*), and one from Broken Hill, N.S.W. (*K. Watanabe 209*).

Selected specimens examined.

WESTERN AUSTRALIA: 128 miles N of Rawlinna, 12 Oct. 1966, *A.S. George 8468* (PERTH); 8 km S of Billabong Roadhouse, 11 Sep. 1986, *P.S. Short 2834* (AD, MEL, PERTH); c. 3 km from Yalgoo along Paynes Find road, 14 Sep. 1986, *P.S. Short 2908* (MEL, PERTH).

NORTHERN TERRITORY: NW Simpson Desert, 29 Sep. 1973, *P.K. Latz 4394* (AD, DNA).

SOUTH AUSTRALIA: 6.5 km NE of Chilpuddie, 15 Oct. 1967, *H. Eichler 19549* (AD); 15 km W of Leigh Ck, 12 Oct. 1958, *R. Schodde 975* (AD); 10 km W of Blanchetown, 2 Nov. 1971, *D.J.E. Whibley 3755* (AD).

QUEENSLAND: Poeppel Corner, 24 Sep. 1966, *D. Boyland 236A* (BRI, MEL, NSW).

NEW SOUTH WALES: 48 km NE of Broken Hill, 16 Oct. 1921, *E.H. Ising* (AD 96935543).

VICTORIA: 24 km NW of Underbool, 20 Oct. 1983, *J.H. Browne 176* (MEL); 45 km SSW of Mildura, 13 Oct. 1977, *M.D. Crisp 3431* (CANB, MEL).

2. *Trichanthodium scarlettianum* P.S.Short

Muelleria 7: 219 (1990). — **Type citation:** “HOLOTYPE: Western Australia, Goulet Bluff, Peron Peninsula ... 17.x. 1983, [P.S.] Short 2106 (MEL 1523476). Isotypi: AD, CANB, PERTH.”

Herb with branches 3–25 cm long, lanate. *Leaves* linear or lanceolate, 5–30 mm long, 0.5–1.1 mm wide, tomentose. *Compound heads* broadly depressed to depressed ovoid, 4.5–6 mm long, 5–11 mm diam., subtended by a general involucre c. 1/3–1/2 the length of the compound head, inconspicuous in mature heads; general receptacle convex, glabrous. *Capitula* 14–130 per compound head. *Capitular bracts* 4 or 5, outer ones densely hairy at the apex of the midrib, inner ones less hairy and sometimes glabrous. *Cypselas* 1–1.8 mm long. *Pappus* a slightly jagged cup 0.5–1.15 mm long. *Chromosome number:* $n = 3$ and perhaps 7.

Distribution. Restricted to the Shark Bay region (including nearby islands) of Western Australia.

Habitat. Grows in a variety of plant communities, including beach foredunes near Hamelin Pool, red sand over limestone in *Acacia*- and *Ptilotus*-dominated shrubland, and in clay in low chenopod shrubland.

Phenology and reproductive biology. Flowering August to October.

An average pollen:ovule ratio of 6,195 has been recorded for this species (Short 1990a).

Cytology. Turner (1970), as “*Calocephalus skirrophora*” recorded $n = 7$ for this species, but this is at variance with a subsequent determination by Short (1990a) of $2n = 6$ for specimens (*P.S. Short 2097*) collected 40 km west of the Overlander Roadhouse, W.A.

Selected specimens examined.

WESTERN AUSTRALIA: Dirk Hartog Is., 2 Sep. 1972, *A.S. George 11381* (CANB, PERTH); 7 km S of Overlander Roadhouse, 20 Aug. 1977, *P.S. Short 420* (AD); 28 km S of Wooramel Roadhouse, 16 Oct. 1983, *P.S. Short 2092* (MEL).

3. *Trichanthodium exilis* (W.Fitzg.) P.S.Short

Muelleria 7: 221 (1990). — *Gnephosis exilis* W.Fitzg., J. Western Australia Nat. Hist. Soc. 2: 24 (1905). — **Type citation:** “Minginew, September, 1903.– W.V.F.” **Lectotype:** Minginew, Sep. 1903, *W.V. Fitzgerald* (NSW 138835) (Short 1990a, p. 222).

Herb with branches 2–20 cm long, almost glabrous to manifestly lanate. *Leaves* narrowly oblong to linear or oblanceolate, 4–11 mm long, 0.7–1.3 mm wide, sometimes slightly succulent, glabrous or lanate. *Compound heads* broadly depressed to depressed ovoid,

spheroid or obloid, 4–11 mm long, 4.5–11 mm diam., subtended by a general involucre c. $\frac{1}{3}$ – $\frac{1}{2}$ the length of the compound head, inconspicuous in mature heads; general receptacle flat to convex, glabrous. *Capitula* 10–200 per compound head. *Capitular bracts* 5 or 6, outer ones densely hairy at the apex of the midrib, inner ones generally less hairy. *Cypselas* 0.9–1.6 mm long. *Pappus* a jagged ring 0.2–0.65 mm long. *Chromosome number*: $n = 3$.

Distribution. Western Australia, from about Bunjil and Lake Moore north to Lake Austin.

Habitat. Commonly growing in sandy to gypseous soils amongst *Tecticornia* and *Atriplex* around the margins of saline depressions.

Phenology and reproductive biology. Flowering about September.

An average pollen:ovule ratio of 5,135 has been recorded for this species (Short 1990a).

Cytology. Short (1990a) recorded $2n = 6 + 2Bs$ for a population from Mongers Lake (*P.S. Short 563*) and $n = 3$ for a population at Lake Austin (*P.S. Short 2922*).

Selected specimens examined.

WESTERN AUSTRALIA: c. 3 km from Yalgoo, 1 Sep. 1982, *P.S. Short 1609* (AD, BRI, CANB, DNA, MEL, PERTH); Lake Austin, 14 Sep. 1986, *P.S. Short 2922* (AD, CANB, MEL, NSW, PERTH); c. 6 km S of Warriedar Hmsd, 26 Sep. 1986, *P.G. Wilson 12294* (MEL, PERTH).

4. *Trichanthodium baracchianum* (Ewart & Jean White) P.S.Short

Muelleria 7: 222 (1990). — *Gnephosis baracchianum* Ewart & Jean White, Proc. Roy. Soc. Victoria 21: 542, pl. 30 figs 3–8 (1909). — **Type citation**: “Salt swamp near Mission Station, Dimboola. St. Eloy D’Alton.” **Lectotype**: MEL 542236 (Short 1990a, p. 222). **Probable isolectotype**: NSW.

Herb with branches 1–10 cm long, glabrous or lanate. *Leaves* narrowly oblong to linear, elliptic or ovate to lanceolate, 4.5–12 mm long, 0.5–2.2 mm wide, semi-succulent, with a short mucro, usually glabrous but sometimes sparsely lanate. *Compound heads* depressed ovoid, 4–7 mm long, 5–11 mm diam., subtended by a general involucre usually c. $\frac{1}{2}$ as long as the head and inconspicuous in mature heads but sometimes outer leaf-like bracts about the length of the head; general receptacle convex, glabrous. *Capitula* 8–50 per compound head. *Capitular bracts* 4–7, outer ones densely hairy at apex, inner ones sparsely hairy at apex. *Cypselas* 1.3–1.5 mm long. *Pappus* a jagged ring 0.3–0.4 mm long. *Chromosome number*: $n = 3$.

Distribution. A species endemic to western Victoria, found in saline regions in a narrow band from about Jeparit south to Mitre Flora & Fauna Reserve.

Habitat. Halophytic communities on the edge of saline flats.

Phenology and reproductive biology. Flowering October to November.

An average pollen:ovule ratio of 891 has been recorded for this species (Short 1990a). The recorded range was 404–1,526 and I am of the opinion that counts of less than 1,000 may not be the norm, such numbers having been determined from last-formed florets and/or small, somewhat water-stressed plants.

Cytology. Chromosome numbers of $n = 3$ and $2n = 6$ have been reported for this species from specimens collected near Antwerp (Short 1990a, Watanabe et al. 1999).

Selected specimens examined.

VICTORIA: Mitre Flora & Fauna Res., 11 Nov. 1986, *A.C. Beaglehole 86523* (MEL); 3.5 km W of Antwerp, 26 Oct. 1983, *N.H. Scarlett 83/266* (MEL); c. 4 km W of Antwerp, 15 Oct. 1988, *P.S. Short 3338* (MEL).

Excluded names

Calocephalus chrysanthes Schldl.

Linnaea 20: 592 (1847). Type: “Vom Grubenlande bei Bethanien. December.” [Behr].

= *Pycnosorus chrysanthus* (Schldl.) Sond., Linnaea 25: 492 (1853); J.Everett & A.N.Doust, Telopea 5: 39 (1992).

Calocephalus globosus M.B.Scott & Hutch.

Kew Bull. 1916: 36 (1916). Type: “WESTERN AUSTRALIA. Kauring, on the York-Greenhills line, *Stoward 505*.” (holo: K).

= *Rhodanthe spicata* (Steetz) Paul G.Wilson, Nuytsia 8: 413 (1992).

Calocephalus gnaphalioides Hook. in T.Mitch.

J. Exped. Int. Trop. Austral. 378(1849). Type: not cited.

= *Rhodanthe moschata* (Cunn. ex DC.) Paul G. Wilson, Nuytsia 8: 385 (1992).

Gnephosis burkittii Benth.

Fl. Austral. 3: 570 (1867). Type: “S. Australia. Lake Gillies, Burkitt.”

= *Lemooria burkittii* (Benth.) P.S.Short, Muelleria 7: 112 (1989). — Additional synonym: *Angianthus burkittii* (Benth.) J.M. Black, Fl. S. Austral. 4: 645, pl. 53 (1929). **Fig. 2E.**

Gnephosis pygmaea (A.Gray) Benth.

Fl. Austral. 3: 572 (1967).

= *Myriocephalus pygmaeus* (A.Gray) P.S.Short in W.R. Elliot & D.L.Jones, Encyc. Australian Pl. 6: 471 (1993) (as “pygmaea”); P.S. Short, Austral. Syst. Bot. 13: 735 (2000). — Basionym: *Crossolepis pygmaea* A.Gray, Hooker’s J. Bot. & Kew Gard. Misc. 3: 177 (June 1851). Type: “South-western Australia, Drummond.” **Fig. 2F.**

Gnephosis rotundifolia Diels

Bot. Jarb. 35: 614, fig. 69k–n (1905). Type: “Hab. in distr. Stirling pr. locum quem vocant ‘The Pass’ in declivis lapidosis solo lutoso-arenoso flor. M. Oct. (D. 4600).”

= *Stuartina muelleri* Sond., Linnaea 25: 522 (1853); Grieve & Blackall, How Know W. Austral. Wildfl. 853 (1975); H.I.Aston & D.A.Cooke, Muelleria 6(4): 256 (1986), lectotypification; P.S.Short in N.G.Walsh & Entwisle, Fl. Victoria 4: 819 (1999).

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