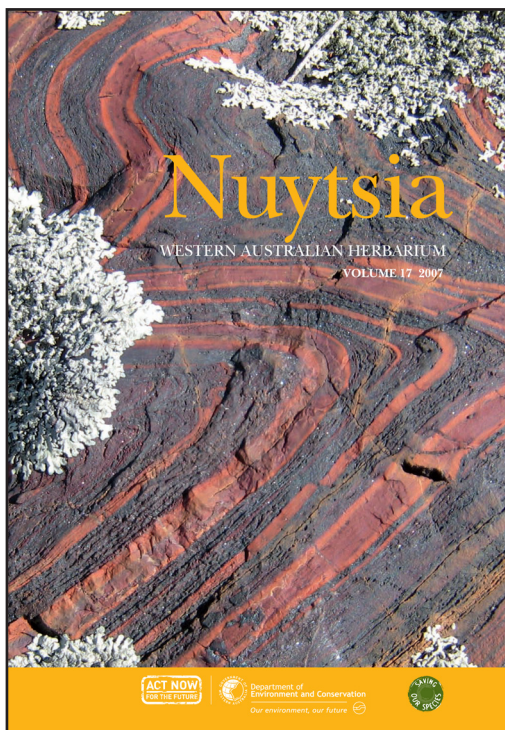


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A review of the sectional classification of *Dicrastylis* (Lamiaceae: Chloantheae) and four new arid zone species from Western Australia

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## A review of the sectional classification of *Dicrastylis* (Lamiaceae: Chloantheae) and four new arid zone species from Western Australia

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### Abstract

Rye, B.L. A review of the sectional classification of *Dicrastylis* (Lamiaceae: Chloantheae) and four new arid zone species from Western Australia. *Nuytsia* 17: 289–324 (2007). A new delimitation is proposed for three of the sections (*Pyramidatae* Munir, *Spicatae* Munir and *Verticillatae* Munir) of the genus *Dicrastylis* Drumm. ex Harv. Keys are given to the five sections of the genus and to the 15 Western Australian species of sections *Pyramidatae* and *Spicatae*. Four new species from the arid and semi-arid zones of Western Australia are described as *Dicrastylis cundeeleensis* Rye, *D. kumarinensis* Rye, *D. mitchellii* Rye and *D. subterminalis* Rye. *Dicrastylis petermannensis* Munir is reduced to a synonym of *D. gilesii* F.Muell., *D. microphyllum* Munir to a synonym of *D. flexuosa* (W.R.Price) C.A.Gardner, and *D. georgei* Munir is tentatively treated as a synonym of *D. cordifolia* Munir. None of the previously published subspecies, varieties and forms for any members of the genus is recognised formally here. However, further study of several species complexes occurring in the arid zone is needed as they are extremely variable and taxonomically difficult.

### Introduction

*Dicrastylis* Drumm. ex Harv. is an endemic Australian genus of more than 30 species. The genus was divided by Munir (1978) into five sections that were distinguished primarily by inflorescence and corolla characters. Recent revisions have dealt with two sections that are restricted to the south-west of Western Australia—sect. *Dicrastylis* (Rye & Trudgen 1998) and sect. *Corymbosae* Munir (Rye 2005)—with the latter section redefined to include two species previously placed in *Mallophora* Endl. The other three sections are examined here, and four new species of *Dicrastylis* from the arid and semi-arid zones of Western Australia are described.

Molecular studies of members of the Lamiaceae tribe Chloantheae (Olmstead *et al.* 1999; Streiber 2004) have indicated that *Dicrastylis s. lat.* (i.e. with the inclusion of *Mallophora*) is a monophyletic genus. The question now for such studies is whether or not the five sections currently recognised within *Dicrastylis* are natural. Streiber's molecular work (2004, pers. comm.), sampling 11 species of *Dicrastylis s. lat.*, has been the first to include sufficient species to give some indications of how the genus should be subdivided. It was already clear that there were a few problems with the original delimitation of some of the sections or with the placement of some of the species within them. For example, the arid zone species *Dicrastylis nicholasii* F.Muell. clearly did not belong in sect. *Corymbosae* where it was originally placed and so was excluded by Rye (2005).

A new circumscription of sections *Pyramidatae*, *Spicatae* and *Verticillatae* is proposed here, and the 15 Western Australian members of these sections are reviewed. The redefined sections are easier to recognise than they were previously, but whether this simplification of their morphological parameters will be supported by more extensive molecular studies remains to be seen.

## Methods

Descriptions are based entirely on dried herbarium material. Dendritic hairs are described here as peltate if the branched upper part of the axis forms a horizontal structure as illustrated in Rye & Trudgen (1998: Figure 1D) or as erect if the branched part of the axis continues upwards, remaining more or less perpendicular to the surface (Rye & Trudgen 1998: Figure 1C). Leaf measurements were taken from the largest leaves on each specimen. Photographs were taken to illustrate the corolla lobe characters used in the keys using a Nikon Digital Camera Head (DS-5M) mounted on a dissecting microscope and controlled by a DS Camera Control Unit (DS-L1).

Holotypes of all of the new taxa have been lodged at PERTH. Specimens cited from previously named species are selected, where possible, mainly from among the recently collected specimens not seen by Munir (1978).

The biogeographic regions and the abbreviations used for them are based on Version 5.1 of the interim biogeographic regionalisation for Australia (IBRA) categories as modified on FloraBase (Thackway & Cresswell 1995; Western Australian Herbarium 1998–; Environment Australia 2000). The distribution maps were compiled using DIVA-GIS freeware Version 5.2.0.2 and are based on PERTH specimen data.

For most of the species, especially those with far inland distributions, flowering probably occurs opportunistically throughout the year. Those species occurring near the borders of the South-West Botanical Province may have more regular flowering times.

Conservation status has only been included for taxa that are currently regarded as Priority Taxa according to the guidelines explained in Atkins (2006). All other taxa are known from at least 15 localities, usually including nature reserves of various kinds, and do not appear to be at risk at present. For species with conservation priority, precise locality data have been withheld.

## Sectional classification

The five sections originally delimited by Munir (1978) are all maintained here and are still distinguished primarily by inflorescence and corolla characters. However, a redefinition of three of them and transfer of species between them is proposed below. One significant change has been the reduction of sect. *Verticillatae* to a single eastern Australian species. For the two sections that occur primarily in the western and central Australian arid zone, sect. *Pyramidatae* and sect. *Spicatae*, the new defining character is whether the corolla lobes have thickening of the margin or veins (Figure 1A, B, D) or not (Figure 1C, E). Sometimes this character is not obvious in all of the flowers of a particular specimen so it is best to examine several flower clusters when keying *Dicrasyllis* specimens.

Two sections that are restricted to the south-west of Western Australia, sect. *Dicrasyllis* and sect.

*Corymbosae*, appear from their morphology and molecular data to be very closely related. The most consistent difference between them, as they are currently defined, is in the lengths of the corolla lobes relative to the corolla tube, with sect. *Dicrastyliis* also tending to have larger looser inflorescences. Streiber's data (2004, pers. comm.), based on a sample of less than a third of the species in the two sections, suggest the possibility that these sections should either be combined or redefined, but a more complete sampling of the taxa is needed to test this.

### Key to sections of *Dicrastyliis*

1. Cymes 3-flowered. Corolla strongly zygomorphic with abaxial lobe far larger (c. 5 times larger in area) than the other lobes. Occurring in the south-east of SA and western NSW ..... sect. **Verticillatae**
- 1: Cymes not regularly 3-flowered, all or most with 5 to numerous flowers. Corolla actinomorphic or somewhat zygomorphic, with the abaxial lobe equalling to distinctly exceeding the other lobes. Occurring mainly in western and central Australia and southern Qld
  2. Corolla lobes with a crenate glabrous margin, which has thickened ridges corresponding with the veins (Figure 1B, D) or a thickened rim (Figure 1A) ..... sect. **Spicatae**
  - 2: Corolla lobes with a smooth (Figure 1E) or somewhat crinkled (Figure 1B) but not thickened margin, sometimes hairy right to the margin, the veins often deeply coloured but fine, not thickened
  3. Inflorescence with head-like cymes arranged in a panicle, more or less pyramidal or spike-like (or spike-like with basal branches), usually with discrete 7-flowered cymes. Corolla white or coloured; hairs often coloured. Widespread in the arid zone, extending slightly into adjacent areas including one species (*D. capitellata*) in saline habitats in the South-West Botanical Province ..... sect. **Pyramidatae**
  - 3: Inflorescence loosely to densely corymbose, sometimes head-like, with cymes or combined cymes commonly more than 7-flowered. Corolla white (including hairs). Endemic to the south-west of WA, not extending far into the arid zone, not in saline habitats
  4. Cymes condensed into dense head-like or spike-like clusters, which are usually further arranged in a corymb. Corolla lobes distinctly shorter than the corolla tube ..... sect. **Corymbosae**
  - 4: Cymes usually in a loosely corymbose arrangement, sometimes more condensed but the individual cymes usually obvious. Corolla lobes about as long as or longer than the corolla tube ..... sect. **Dicrastyliis**

### Species groups within the sections

Groups of species considered to have the greatest affinities to one another are shown below under their sections. Within the two largest groups of species, there are also some pairs of very closely related species, such as *Dicrastyliis flexuosa* and *D. nicholasii*. Molecular data (Streiber 2004 and unpub.), taken from a sample of six of the species listed below, indicate a close relationship between *D. flexuosa* s. lat. and *D. lewellinii* (F.Muell.) F.Muell., and also a close relationship between the other three species sampled, *D. cordifolia* s. lat., *D. exsuccosa* and *D. gilesii*. The last species sampled, *D. cundeeleensis*, did not associate closely with either of those two groups.



Figure 1. Photographs showing corolla lobe characters. A—Atypical variant of *Dicrastylis beveridgei* flower and pedicel, from *S. van Leeuwen* 2937 (PERTH 06810950); B—*Dicrastylis cundeeleensis* whole flower with pedicel largely hidden, from holotype (PERTH 06755607); C—*Dicrastylis kumarinensis* flower with two corolla lobes removed, from holotype (PERTH 01869175); D—*Dicrastylis mitchellii* fruit and pedicel, from holotype (PERTH 03668525); E—*Dicrastylis subterminalis* upper half of flower, from holotype (PERTH 05696771). Scale bars are 1 mm long.

### 1. Section Pyramidatae

*Dicrastylis brunnea* Munir

*Dicrastylis capitellata* Munir, *D. flexuosa* (W.R.Price) C.A.Gardner, *D. lewellinii* (F.Muell.) F.Muell. and *D. nicholasii* F.Muell.

*Dicrastylis cordifolia* Munir, *D. exsuccosa* (F.Muell.) Druce, *D. gilesii* F.Muell. and *D. kumarinensis* Rye

*Dicrastylis subterminalis* Rye

### 2. Section Spicatae

*Dicrastylis beveridgei* F.Muell. and *D. costelloi* F.M.Bailey

*Dicrastylis cundeeleensis* Rye and *D. doranii* F.Muell.

*Dicrastylis mitchellii* Rye and *D. sessilifolia* Munir

### 3. Section Verticillatae

*Dicrastylis verticillata* J.M.Black

**Dicrastylis** sect. **Pyramidatae** Munir, *Brunonia* 1: 525 (1978). Type: *Dicrastylis exsuccosa* (F. Muell.) Druce.

*Leaves* mostly opposite and decussate or (in *D. lewellinii*) mostly in whorls of three. *Cymes* head-like, commonly 7-flowered, subsessile or on peduncles much shorter than the leaves, usually borne in distant axils, either forming an interrupted spike, which may be one-sided, or a more pyramidal inflorescence with the basal branches prominently pedunculate. *Calyx lobes* 4–7, usually 4 or 5, shorter than to greatly exceeding the tube. *Corolla* pale mauve or pink to deep violet-blue or white inside, often with a coloured indumentum outside; lobes smooth or crinkled on the margin but not crenate, veins thin.

*Size and distribution.* Currently 10 species, as listed above, but there are some difficult species complexes in this section which need further study. Possibly, additional species or infraspecific taxa should be recognised in three particularly variable groups, the *D. cordifolia* complex, *D. exsuccosa* complex and *D. gilesii* complex.

Sect. *Pyramidatae* is the most widespread of the sections, occurring in Western Australia, Northern Territory, South Australia, Queensland and New South Wales. It is concentrated in Western Australia, where it extends from the far south of the Northern Botanical Province to near the central west coast and almost reaches the south coast. It is predominantly an arid zone group but one species, *Dicrastylis capitellata*, occurs in the south-eastern part of the South-West Botanical Province, close to its border with the Southwestern Interzone. As *D. capitellata* has an unusual habitat, being apparently the only member of the genus to be associated with salt lakes, it is probably in an environment with comparable water stress to that of species occurring in lower rainfall zones.

*Notes.* Previously this section was based on an inflorescence character, that of having cymes arranged in a more or less pyramidal panicle, and consisted of *Dicrastylis brunnea*, *D. doranii*, *D. exsuccosa*, *D. gilesii* (including its synonym *D. petermannensis*) and *D. sessilifolia*. Inflorescence shape is, however, commonly inconsistent within species. Munir (1978: 525, 529) must have realised that his inclusion of *Dicrastylis doranii* in this section was unnatural, because he considered *D. doranii* to be most closely related to two species he had placed in sect. *Spicatae*, *D. beveridgei* and *D. costelloi*, one of which is the type species of sect. *Spicatae*. He also suggested that his *D. beveridgei* subsp. *revoluta* might be a hybrid between *D. doranii* and *D. costelloi*. Like *D. doranii*, *D. sessilifolia* differs from the other taxa placed in sect. *Pyramidatae* in having thickenings associated with the veins or on the margin of the corolla lobes; both species appear not to belong in the section.

The transfer made here of *D. doranii* and *D. sessilifolia* from sect. *Pyramidatae* to sect. *Spicatae* is more than balanced by the incorporation of four species from other sections, and two of the newly named species also belong here. Consequently, sect. *Pyramidatae* is now twice as large as it was initially.

**Dicrastylis** sect. **Spicatae** Munir, *Brunonia* 1: 508 (1978). Type: *Dicrastylis beveridgei* F. Muell.

*Leaves* in whorls of three or more, or opposite and decussate. *Cymes* head-like, commonly 7-flowered, subsessile or distinctly pedunculate, arranged in spike-like or pyramidal inflorescences. *Flowers* 5-merous. *Calyx lobes* about as long as to distinctly longer than the tube. *Corolla* white, with white indumentum; lobes shorter than the corolla tube; margin crenate, glabrous, with thickened veins.

*Size and distribution.* This section currently consists of six species and is primarily Eremaean in distribution. It extends from the far south of the Northern Botanical Province south to, but barely penetrating, the Southwestern Interzone of Western Australia, and inland to southern Northern Territory and northern South Australia.

*Notes.* Sect. *Spicatae* shows a similar range of inflorescences to sect. *Pyramidatae* and is distinguished primarily by its distinctive corolla lobes. Munir (1978) described the corolla lobes of the taxa included here as crenate. The apex of the corolla lobes is broad and rounded, with thickened veins and/or margin, the surface undulating to give the crenate appearance. The distal thickened part of the corolla lobes tends to be almost circular and the basal unthickened part tends to be narrowed slightly or distinctly pinched in so that the distal crenate part seems to form a lamina. This is evident from a comparison of Figure 1 parts A, B and D with the non-crenate corolla lobes illustrated in parts C and E, which have broad-based corolla lobes with thin, darkly coloured veins and no thickening.

The shape of flower clusters when the terminal flower opens is possibly also distinctive in sect. *Spicatae*. Including their attached indumentum and unopened basal flowers, the clusters are predominantly broadly ovoid or bulging in the lower half. Individual flowers (see Figure 1B) also tend to be of this shape.

Previously, three species were included here, *Dicrastylis beveridgei*, *D. costelloi* and *D. lewellinii*. In order to redefine the section to consist of all the species that have crenate corolla lobes, *D. lewellinii* was removed to sect. *Pyramidatae* while two species formerly placed in sect. *Pyramidatae* were added. Two new species belonging to sect. *Spicatae* are named, bringing the total number of species now placed in the section to double the original number.

**Dicrastylis** sect. **Verticillatae** Munir, *Brunonia* 1: 447 (1978). *Type:* *Dicrastylis verticillata* J.M.Black.

*Leaves* mostly in whorls of three. *Cymes* 3-flowered, arranged in verticillate clusters each of 3 cymes in an interrupted spike-like arrangement along each branch. *Calyx lobes* 5, much longer than the tube. *Corolla* white; lobes 5, the abaxial lobe far larger (*c.* 5 times larger in area) than the other lobes and as long as or shorter than the corolla tube, the other lobes shorter than the tube; lobes smooth on the margin, veins thin.

*Size and distribution.* A monotypic section extending from south-eastern South Australia to the far north of New South Wales. *Dicrastylis verticillata* has apparently not been recorded in Victoria although it occurs very close to the border of the north-west corner of that State. Sect. *Verticillata* is geographically separated from all other sections of the genus except in the far north of its range where it probably overlaps slightly with the range of *Dicrastylis lewellinii*.

*Notes.* Originally three species were included in this section, *D. cordifolia* (including its synonym *D. georgei*), *D. flexuosa* (including its synonym *D. microphylla*) and the type species *D. verticillata*. The type species is unique in two respects, in having uniformly 3-flowered cymes and in its strongly zygomorphic flowers. The affinities of this very distinctive species are unclear and it is therefore now placed on its own in sect. *Verticillatae*. The species most likely to be confused with it, at least in non-flowering material, is probably *Dicrastylis lewellinii* as the two species are similar in the arrangement and shape of their leaves, but *D. lewellinii* is readily distinguished by its one-sided inflorescence.



**Key to Western Australian members of *Dicrasyllis* sections *Pyramidatae* and *Spicatae***

1. Leaves more or less linear, mostly 1–2 mm wide, with revolute margins more or less meeting below at midrib or revealing very little of the undersurface. Inflorescence atypical either in being subterminal below a leafy apex or in being somewhat one-sided
  2. Inflorescence long, terminal, somewhat one-sided; cymes many, those in upper part of inflorescence sessile or subsessile. Calyx lobes densely dendritic-hairy outside. Corolla lobes 4 or 5, densely hairy outside except on margin (Mt Holland area to Mt Heywood area) ..... **D. capitellata**
  - 2: Inflorescence short, subterminal below a leafy apex, sometimes one-sided; cymes few, long-pedunculate. Calyx lobes with scattered dendritic hairs outside. Corolla lobes 5, more or less glabrous (far inland WA)..... **D. subterminalis**
- 1: Leaves very narrowly ovate to narrowly obovate to almost circular or cordate, usually 2–30 mm wide; margins flat or recurved, usually widely separated. Inflorescence terminal, raceme-like, spike-like or pyramidal, not one-sided, the branches or cymes paired or whorled at each level
  3. Corolla lobes with a crenate glabrous margin, which has thickened ridges corresponding with the veins (Figure 1B, D) or a thickened rim (Figure 1A) or both
    4. Calyx lobes more than twice as long as the calyx tube
      5. Flower heads with bases of individual flowers hidden by the dense white indumentum. Calyx lobes densely hairy, not obvious below the hairs (Montague Range to Lake Carnegie)..... **D. sessilifolia**
      - 5: Flower heads with bases of individual flowers visible. Calyx lobes sparsely to moderately hairy, obvious (Turee Creek to Killara Station) ..... **D. mitchellii**
    - 4: Calyx lobes about as long as the calyx tube or up to twice as long
      6. Inflorescence resembling a simple or compound spike with few or no long basal peduncles. Bracts narrowly ovate or rarely ovate. Corolla lobes usually with margin thickened into a rim (Figure 1A) but not obviously thickened along the veins. Occurring in central Australia, more commonly in NT & SA than WA
        7. Calyx indumentum bright yellow, rarely with some reddish hairs present (Little Sandy Desert to far inland WA, south-western NT and north-eastern to central SA)..... **D. beveridgei**
        - 7: Calyx indumentum white, off-white or violet (near Neale Junction, WA, to central and southern NT and northern SA) ..... **D. costelloi**
  - 6: Inflorescence pyramidal or with multiple long basal peduncles. Bracts ovate. Corolla lobes usually with the rim not thickened or with the thickened veins below more obvious than the rim (Figure 1B, D). Occurring in WA and far west of NT
    8. Inflorescences 12–35(65) mm long, all or mostly broader than long; axes with yellowish or red-tinged peltate-dendritic hairs, i.e. hairs with the branched summit flat (see Rye & Trudgen 1998: Figure 1D) (Cundeelee area to Plumridge Lakes) ..... **D. cundeeleensis**
    - 8: Inflorescences usually much longer than wide, up to 170 mm long; axes with white or cream, usually erect dendritic hairs (see Rye & Trudgen 1998: Figure 1C) (southern Kimberley Region to far north of Nullarbor Plain and to western NT)..... **D. doranii**
- 3: Corolla lobes with a smooth (Figure 1E) or somewhat crinkled (Figure 1C) but not thickened margin, sometimes hairy right to the margin, the veins often deeply coloured but fine, not thickened

9. Leaves sessile. Flowers with medium to deep violet-blue corolla and white hairs not obscuring the green calyx
10. Leaves and cymes opposite and decussate. Peduncles mostly less than 2 mm long, rarely peduncles of lowest axils up to 8 mm long (Wiluna to Zanthus) ..... **D. flexuosa**
- 10: Leaves partially opposite and partially whorled; cymes often whorled or solitary. Peduncles of lowest axils 15–35 mm long. (Queen Victoria Spring to Kanandah Station)..... **D. nicholasii**
- 9: Leaves with a petiole 1.5–20 mm long. Flowers white or pale blue to mauve inside corolla, often appearing pale to deep pink or yellow outside because of the presence of coloured hairs
11. Plants with cordate, broadly ovate or ± ovate leaves and pink to deep purple indumentum on the flowers. (Edgar Ranges to Exmouth Gulf to Carnarvon Range to Canning Stock Route) ..... **D. cordifolia**
- 11: Plants either with narrowly ovate to long narrow leaves or, if leaves ovate to circular then flowers with yellow indumentum outside
12. Calyx indumentum white or pale yellow or purplish; lobes almost linear to narrowly ovate
13. Leaves green with yellow-brown and red-brown indumentum; petiole 1.5–5 mm long; blade 17–45 × 5–13 mm. Occurring mainly on red sandplains and other sandy habitats. (Kumarina Station to Barrow Range to Cundeelee) ..... **D. brunnea**
- 13: Leaves grey-green on flowering stems, sometimes becoming green with age; petiole 4–13 mm long; blade 35–85 × 12–32 mm. Occurring in rocky habitats on the central Australian ranges. (Rawlinson Range area, also NT & SA)..... **D. gilesii**
- 12: Calyx indumentum usually medium to bright yellow, sometimes also purplish; lobes ± ovate or broadly ovate
14. Leaves very narrowly ovate to almost linear-elliptic, 50–70 × 6–11 mm. Corolla lobes broadly triangular to very broadly ovate, margin very crinkled, with prominent glands outside. (Newman to Collier Range to Lake Disappointment) ..... **D. kumarinensis**
- 14: Leaves very narrowly ovate to almost circular, 40–90 × 11–23 mm. Corolla lobes ovate to triangular, margin smooth, outer surface without obvious glands. (Sturt Creek to near Cosmo Newbery, also NT & SA) ..... **D. exsuccosa**

### Western Australian species recognised

**Dicrastyliis beveridgei** F.Muell., *Fragm.* 8: 50 (1873). *Type*: between Mt Udor and Giles Range, Northern Territory, *E. Giles s.n.* (MEL 40805 *n.v.*).

*Dicrastyliis beveridgei* var. *lanata* Munir, *Brunonia* 1: 523–524 (1978). *Type*: 37 miles [60 km] east-south-east of Coffin Hill, South Australia, 20 October 1960, *N. Forde* 1512 (*holo*: CANB *n.v.*; *iso*: DNA (previously numbered NT 25114)).

*Dicrasytlis beveridgei* subsp. *revoluta* Munir, *Brunonia* 1: 524–525 (1978). *Type*: 25 miles [40 km] north of Sandy Blight/Docker River road junction, Western Australia, 23 September 1969, J.R. Maconochie 825 (*holo*: AD *n.v.*; *iso*: NT 25114, PERTH 01602608).

Description as given in Munir (1978: 521).

*Selected specimens examined*. WESTERNAUSTRALIA: 131 km by road SSE of Giles Meteorological Station Wingellina road, Great Victoria Desert, 20 Sep. 1978, A.C. Beauglehole 60363 & E.G. Errey (PERTH); Little Sandy Desert, 22.3 km SE of Burranbar Pool on Savory Creek, 42.9 km E of Weelarrana Homestead, 28.1 km NE of Cooma Well, 56.6 km N of Yanneri Lake, 18 Oct. 1996, S. van Leeuwen 2937 (PERTH).

*Distribution and habitat*. In Western Australia *Dicrasytlis beveridgei* extends from Walter James Range south to near Mt Fanny (east of Blackstone Range), recorded in red sand with spinifex, with an isolated record from the Little Sandy Desert on a red sand dune in a very open low woodland of *Corymbia* over *Aluta maisonneuvei* and *Grevillea* scrub: CR, LSD. The species is mainly distributed in Northern Territory and South Australia.

*Phenology*. Flowering probably occurs opportunistically through all or most of the year.

*Affinities*. Munir (1978: 517) apparently separated *Dicrasytlis beveridgei* and *D. costelloi* solely on the colour of their indumentum. Use of a single character difference to separate two species is of concern, especially when it is a relatively minor character, and this raises the possibility that only the first-named species, *D. beveridgei*, should be recognised. In *D. beveridgei*, the inflorescence has golden yellow hairs on the calyces and axes, and sometimes also some reddish hairs. On its axes the large hairs are fairly erect – this and their bright yellow colour distinguish *D. beveridgei* from *D. costelloi*, which (apart from *D. costelloi* var. *eriantha*) has the hairs more peltate-dendritic.

Both species occur mainly in Northern Territory and South Australia but *Dicrasytlis beveridgei* is largely separated geographically from *D. costelloi*, being displaced to the south-west but with an area of overlap on its eastern side. Both species show a north-south trend in morphology (see notes under *D. costelloi*) but in *D. beveridgei* this trend is displaced southwards, with most specimens from Northern Territory having narrow leaves and small flowers with a short indumentum while most of the South Australian specimens have broader leaves and larger flowers with a longer, more spreading indumentum. Interestingly, two quite distinct groups, the *D. cordifolia* complex and the *D. exsuccosa* complex, show a similar north-south trend in indumentum.

*Notes*. Subspecies and varieties are not recognised here but the status of all variants within the *Dicrasytlis beveridgei* complex needs further assessment. The typical variety appears to be small-flowered, with the indumentum on the calyx not spreading. Var. *lanata* appears to have larger flowers, partly because the indumentum on the calyx is longer and spreading, and there is also a longer indumentum on the axes. As these two main variants greatly overlap in range and seem to intergrade completely in morphology, they are not maintained as formal entities here.

Western Australian specimens of *Dicrasytlis beveridgei* are mainly housed at AD and were not seen for this study. Those lodged at PERTH that have been collected from near Walter James Range south to near Wingelline Hills, have broad leaves and large flowers with a long spreading indumentum. They therefore match the variant Munir named var. *lanata*.

Typical *D. beveridgei* possibly does not occur in Western Australia. However, there may be either a new variant of *D. beveridgei*, or a closely related new species, in the Little Sandy Desert. A specimen collected there in 1996 (*S. van Leeuwen* 2937) does not match any of the material currently housed at PERTH as it has less densely hairy flowers in dense inflorescences that are mostly narrowly pyramidal. One of its flowers is shown in Figure 1A. Further collections are needed of this taxon.

**Dicrastylis brunnea** Munir, *Brunonia* 1: 546–549 (1978). *Dicrastylis brunnea* var. *brunnea* (established by Munir *loc. cit.*). *Type*: Anketell, east of Mount Magnet, Western Australia, 13 September 1968, *A.M. Ashby* 2619 (*holo*: AD *n.v.*; *iso*: PERTH 01602616).

*Dicrastylis brunnea* var. *pedunculata* Munir, *Brunonia* 1: 549–551 (1978). *Type*: 12 miles [19 km] north-east of Millrose, Western Australia, 8 September 1958, *N.H. Speck* 1385 (*holo*: AD *n.v.*; *iso*: CANB *n.v.*, NSW *n.v.*, PERTH 01602624).

*Illustrations*. Munir (1978) p. 548, Figure 26; p. 550, Figure 27.

Description as given in Munir (1978: 546–547) except for the following characters. *Shrub* 0.3–1.5 m high, usually spreading and often wider than high. *Leaves* with a petiole 1.5–5 mm long; lamina narrowly obovate to ovate, often tapering at base to petiole, 17–44 × 5–13 mm. *Corolla* white, sometimes with purplish hairs.

*Selected specimens examined*. WESTERN AUSTRALIA: 4 km W of Walling Rock Homestead, 16 Sep. 1988, *R.J. Cranfield* 7503 (PERTH); 93 km N of Leonora towards Leinster, 8 Oct. 1985, *C.I. Stacey* 791 (PERTH).

*Distribution and habitat*. A Western Australian endemic, extending from Kumarina Station south-east to Cundeelee Mission: COO, GAS, GVD, MUR. Occurs in sandy soils, the sand usually red but sometimes yellow, apparently mainly on sandplains but occasionally in rocky soil, with one record from the base of a breakaway. Recorded with spinifex and sometimes with scattered eucalypts.

A Helms specimen is doubtfully recorded as being from near Barrow Range but there is a note attached stating that the original label was lost. This specimen was probably collected closer to Cundeelee where Helms collected many specimens on the same expedition.

*Phenology*. Flowers recorded from July to October.

*Affinities*. The affinities of *Dicrastylis brunnea* are uncertain but it comes out next to *D. gilesii* in sect. *Pyramidatae* in the key to species given above. Apart from the characters given in the key, *D. brunnea* differs from *D. gilesii* in its leaves usually being more obtuse and in its calyx lobes tending to be narrower and more prominently dotted inside with sessile glands.

Since this species appears to be capable of hybridising with *D. cundeeleensis* (see notes under that species), the possibility that its affinities lie outside sect. *Pyramidatae* needs to be investigated.

*Notes*. In the Wiluna area, some specimens of *Dicrastylis brunnea* have the lower flower clusters or branches on longer peduncles than specimens in other areas. This variant has been named as *D. brunnea* var. *pedunculata* but it appears to intergrade with the typical variant and does not seem to be worth recognising formally. In view of the large degree of inflorescence variability in other species

(see discussion under *D. gilesii* and *D. flexuosa*), this variation does not appear to be significant.

***Dicrasyllis capitellata*** Munir, *J. Adelaide Bot. Gard.* 14: 89–91 (1991). *Type*: north-north-east of Mt Heywood, Western Australia [precise locality withheld for conservation purposes], 1 December 1990, *W.R. Archer* 112904 (*holo*: AD *n.v.*, illustration seen; *iso*: AD, BRI, CANB, DNA, S, K, MEL, NSW [previous duplicates *n.v.*], PERTH 02504839).

*Illustration*. Munir (1991), Figure 2.

Description as in Munir (1991: 89–90) except for the following characters. *Shrub* 0.2–0.35 m high, up to 0.4 m wide, erect or spreading at base, with the flowering branches tending to spread horizontally. *Leaves* opposite and decussate but often crowded, sessile or with a petiole up to 0.5 mm long; lamina linear or long-linear, 10–25 × 1–2 mm, of uniform width or slightly broader above the middle. *Inflorescence* resembling a 1-sided spike of dense clusters (cymes) with the upward orientation of the clusters brought about by a curving of some of the peduncles; clusters solitary or sometimes paired, usually 7-flowered, depressed globular, 5–7(8) mm diam., with imbricate basal bracts persistent for a while after the fruits drop. *Bracts* usually 7 (one bract subtending each flower), ovate or broadly ovate, with dendritic and simple hairs outside and on the margins, glabrous inside. *Calyx* 2–3 mm long, glabrous inside. *Corolla* reportedly pale mauve or bluish, *c.* 4 mm long.

*Selected specimens examined*. WESTERN AUSTRALIA: [localities withheld] 22 Aug. 1995, *G. Barrett s.n.* (PERTH); 20 May 1993, *G.F. Craig* 2768 & *B. Haberley* (PERTH); 9 Apr. 1997, *R.J. Cranfield* 11269 (PERTH).

*Distribution and habitat*. Endemic to Western Australia, extending from near the wildlife sanctuary north of Mt Holland south-east to near Mt Heywood (east of Grass Patch): MAL. The species occurs in low-lying ground with open mallee woodlands, on white sandy clay on slightly raised ground close to salt lakes.

*Phenology*. Flowers apparently from November to March. Fruits recorded in early April.

*Conservation status*. Department of Environment and Conservation (DEC) Conservation Codes for Western Australian Flora: Priority One (Atkins 2006). Reported to be locally abundant at two sites.

*Affinities*. This species may be closest to the eastern Australian species *Dicrasyllis lewellinii* as the two species have similar leaves and inflorescences, but *D. capitellata* is readily distinguished by its leaves being glabrous and green on the upper surface and by its shorter flowers.

*Notes*. The original description given by Munir (1991) was based just on the type collection. A new description is given above because several new collections have significantly increased the range of variation known for this species. Unfortunately the new collections have only the remains of old inflorescences without any attached flowers or fruits so characters such as the frequency of 4-merous floral whorls cannot be examined. The type collection often has different numbers of calyx and corolla lobes on the same flowers.

**Dicrastylis cordifolia** Munir, *Brunonia* 1: 461–464 (1978). *Type*: about 200 miles [320 km] south-south-west of Broome, Western Australia, 4 August 1962, *H.A. Johnson s.n.* (*holo*: NT *n.v.*; *iso*: K *n.v.*, NSW *n.v.*, PERTH 01602632).

*Dicrastylis cordifolia* var. *barnettii* Munir, *Brunonia* 1: 464 (1978). *Type*: Carnarvon, Western Australia [probably collected north of Carnarvon, 1936–1938], *G.B. Barnett s.n.* (*holo*: PERTH 01602640).

*Dicrastylis cordifolia* var. *purpurea* Munir, *Brunonia* 1: 464–465 (1978). *Type*: between Oakover River and Canning Stock Route, Western Australia, 1954, *J.N. Casey s.n.* (*holo*: PERTH 01603043).

*Dicrastylis georgei* Munir, *Brunonia* 1: 457–461 (1978). *Type*: south of Roy Hill, Western Australia, 23 August 1960, *A.S. George* 1007 (*holo*: PERTH 01603116).

*Dicrastylis georgei* var. *cuneata* Munir, *Brunonia* 1: 459–461 (1978). *Type*: 22 miles [35 km] from Roy Hill on Wittenoom road, Western Australia, 7 August 1970, *R. Carolin* 7717 (*holo*: SYD *n.v.*, illustration seen).

Description as given in Munir (1978: 457–462) except for the following characters. *Shrub* usually broader than tall, 0.2–0.7(1) m high, up to 2.5 m wide. *Leaves* cordate or more or less ovate, petiole 4–10(15) mm long. *Inflorescence* sometimes reddish or purplish in bud. *Flowers* 3.5–5 mm long. *Calyx* densely hairy outside with a mixture of large dendritic hairs 0.7–3 mm long and minute hairs; lobes with minute simple glandular hairs inside, occasionally also with some long non-glandular dendritic hairs present. *Corolla* white or pale blue inside, often appearing pink or purple outside because of its hairs, the coloured hairs sometimes covering the outer surface or combined with white hairs, but sometimes only white hairs present.

*Distribution.* The *Dicrastylis cordifolia* complex, i.e. *D. cordifolia* s. lat., extends from Edgar Ranges south-west to Exmouth Gulf, south to Carnarvon Range and south-east to Canning Stock Route, and has a significant disjunction in its distribution to where it occurs in the western part of the Pilbara south of Onslow: CAR, DL, GAS, GSD, LSD, PIL.

*Phenology.* Flowering probably occurs opportunistically.

*Affinities.* This species is related to *Dicrastylis exsuccosa* and *D. gilesii* but can usually be distinguished by its cordate or almost cordate leaves. It occurs mainly in the Pilbara region and is geographically separated from most other species of *Dicrastylis* but shows some overlap in range with *D. exsuccosa* and *D. kumarinensis*, differing from both those species in having pink to deep purple indumentum on the flowers rather than a bright yellow indumentum. *Dicrastylis gilesii* is well separated geographically from *D. cordifolia* and has longer, usually more greyish leaves.

*Notes.* The distinction between *Dicrastylis cordifolia* and *Dicrastylis georgei* was originally based on a combination of leaf shape and size, inflorescence shape and calyx hair length, as given in the couplet numbered 7 of the key in Munir (1978: 444). Each species was also divided into two or three varieties, based again on leaf morphology, and in some cases also based on hair colour and calyx hair length or inflorescence form. The complexity of this classification reflects the extreme variability of the complex, but identification of specimens to the level of species or variety is difficult as there appears to be continuous variation between each of the characters being used to distinguish these taxa. Many specimens key out to different taxa depending upon which of the characters is given pre-eminence in identifying them.

The type specimen of *Dicrastyliis cordifolia* var. *purpurea* seems somewhat intermediate between *D. cordifolia* var. *cordifolia* and *Dicrastyliis georgei*. Its leaf shape is ovate rather than cordate and it has a longer, denser, finer indumentum on the calyx than in var. *cordifolia*. Its young shoots and peduncles are more purplish than those on the type of var. *cordifolia*, but this character difference is not consistent and the lack of obvious colour on the type of var. *cordifolia* may be due to its advanced fruiting stage. Recent collections certainly indicate that these two varieties intergrade and that var. *purpurea* also intergrades with *D. georgei*.

The presence of different hair colour variants within species of *Dicrastyliis* is very common. *Dicrastyliis georgei* is similar to *D. cordifolia* in having a mixture of very noticeably purple-haired specimens and apparently completely white-haired specimens, with a range of intermediate specimens showing different frequencies of purple hairs. This variation frequently occurs within populations and even on the same plants there may be colour differences between branchlets. Another practical problem in distinguishing purple-haired specimens is that the colour is often difficult to assess on old specimens that may have faded and also on specimens in advanced fruit. There seems no justification for formally recognising the colour variants of any of these taxa unless they show a definite geographic separation, which is certainly not the case here.

As a result of these problems in separating the taxa, only one species, *Dicrastyliis cordifolia*, is recognised here, but variants from different areas, including one that is completely geographically separated, are described briefly below. Not surprisingly, there is a general trend for specimens to appear less lush, with smaller leaves, flowers and calyx hairs, as they extend into more arid areas. Specimens from the western or north-western part of the range show a greater tendency to have cordate leaves than the south-eastern ones. Combining these two tendencies, the type specimen of *D. cordifolia* from the western desert area has small cordate leaves and small flowers with short calyx hairs, whereas the type specimen of *D. georgei* from near Roy Hill in the Pilbara has large leaves that are mostly broadly ovate and large flowers with long calyx hairs. Differences in inflorescence structure between these two type specimens are not so marked, the main difference being that *D. cordifolia* has more branches, with the lower branches tending to be more widely spreading.

The three main geographic variants listed below are not treated formally as no practical method of separating them reliably on morphological characters could be found. No clear geographic boundary exists between the two main areas of distribution but the third region is geographically isolated by a disjunction of more than 200 km.

#### **a. northern specimens**

*Illustration.* Munir (1978) p. 462, Figure 5; reproduced in Rye (1992) p. 799, Figure 244A.

*Leaf blades* cordate to broadly ovate, 10–30 × 8–17 mm. *Calyx* with coarse or fine dendritic hairs outside; longest hairs 0.7–1.3 mm long.

*Selected specimens examined.* WESTERN AUSTRALIA: Nifty Mine site, 26 Oct. 1997, *N.D. Burrows* MTR 39 (PERTH); Well 45, Canning Stock Route, 950 km NE of Wiluna, 9 July 1991, *G.C. Cornwall* 497 (PERTH); 12 km SE of Tanguin Hill, c. 130 km SE of Shay Gap, 13 July 1984, *K.R. Newbey* 10458 (PERTH).

*Distribution and habitat.* Occurring in the far south of the Northern Botanical Province and in the

northern part of the Eremaean Botanical Province of Western Australia: DL, GSD, LSD, PIL. Extends from the Edgar Ranges south to Mt Divide Station (upper Oakover River) and from near Cape Keraudren (beyond southern end of Eighty Mile Beach) east to Well 45 on the Canning Stock Route. The type specimen was recorded from “near stony outcrops amongst firmer sandy loamy soil” and there are some other records from high or low stony sites but most habitat records are from between red sand dunes.

*Notes.* Munir examined only about half the specimens now known from this area and treated most of them as *Dicrastylis cordifolia* var. *cordifolia*. On *G.C. Cornwall* 497 the collection notes record “minute blue or white flowers, red hairy buds” while several other specimens give the corolla colour as white.

### **b. south-eastern specimens**

*Illustrations.* Munir (1978) p. 458, Figure 4, p. 460, Figure 4a.

*Leafblades* narrowly to broadly ovate or cordate, 10–40(55) × 7–30 mm. *Calyx* with fine dendritic hairs outside; longest hairs 1–3 mm long.

*Selected specimens examined.* WESTERNAUSTRALIA: 2.5 km S of Mt Methwin at base of Carnarvon Range, Little Sandy Desert, 28 Aug. 1998, *B. & B. Backhouse, D. Edinger, G. Marsh, B. & R. Johnson* BEMJ 114 (PERTH); 14.3 km from Jigalong Community on a bearing of 205 degrees and c. 200 km E of Newman, 21 June 1996, *A.A. Mitchell* PRP1173 (PERTH); Mt Windell Rd corridor, 5.9 km NE of Mt Windell, 15.5 km ESE of Karijini National Park Headquarters, 2 Aug. 1991, *S. van Leeuwen* 901 (PERTH).

*Distribution and habitat.* Occurring in the northern part of the Eremaean Botanical Province of Western Australia: CAR, GAS, GSD, LSD, PIL. Extends from Turee Creek (Karijini National Park area) east to the Rudall River area and south-east to Carnarvon Range. Occurs commonly on red sand in low-lying sites with spinifex, sometimes recorded with *Acacia*.

*Notes.* Most of the material from this region was treated by Munir (1978) as *Dicrastylis georgei* and divided into two varieties, var. *georgei* and var. *cuneata*. These two varieties appear to completely intergrade. The species as defined by Munir (1978) showed great variation of leaf shape, with the kind of leaf base that defines var. *cuneata* often coexisting with the ‘typical’ leaf base on a single specimen and both leaf types occurring throughout the range of the taxon. Some specimens also have cordate leaves although less frequently than in the other regions listed above and below. Particularly atypical in its overall leaf shape is *P.K. Latz* 17790, which has narrowly ovate-elliptic leaves.

A variant with particularly large leaves, up to 55 mm long, occurs in the Karijini National Park area. A variant occurring in the far south-east of the range of the complex, in the Little Sandy Desert, has rather small flowers with long fine hairs. This is possibly a distinct variant but other variants also occur in the same general area.

### **c. western specimens**

*Leafblades* cordate, ovate or broadly ovate, 22–30 × 22–25 mm. *Calyx* with fine dendritic hairs outside; longest hairs 1.2–2.5 mm long.



*Selected specimens examined.* WESTERN AUSTRALIA: S of Yanrey Station, turnoff North West Coastal Highway, 26 June 1975, *A.M. Ashby* 5175 (PERTH); 4 km S of Barradale Roadhouse, off the Yanrey turnoff, 10 Aug. 1990, *S. Barker s.n.* (PERTH); 16 miles [26 km] NE of Giralia Homestead, S of Exmouth, 4 Aug. 1967, *A.S. George* 9169 (PERTH); 40 km W of Nyang Homestead, 15 Nov. 1977, *A.A. Mitchell* 512 (PERTH); 30 km E of Onslow, 17 Apr. 1978, *A.A. Mitchell* 544 (PERTH); Giralia Homestead, 3 May 1978, *A.A. Mitchell* 560 (PERTH).

*Distribution and habitat.* Extending about 125 km from near Onslow south-west to Giralia Station and south to near Barradale Roadhouse, in the western part of the Pilbara region in the Eremaean Botanical Province of Western Australia: CAR, PIL. The habitat is commonly recorded as red sand in low-lying sites with spinifex, sometimes with *Acacia*.

*Notes.* Munir (1978) chose one of the specimens from this region to be the type of *Dicrastyliis cordifolia* var. *barnettii*. The type of var. *barnettii* was probably collected in the period from 1936 to 1938. The locality for this and many other collections of other plant species made by Barnett are only given vaguely as 'Carnarvon'. This *Dicrastyliis* specimen was presumably collected north of Carnarvon, in the area south of Onslow where several specimens matching it occur. Munir did not examine any of the other specimens listed above except *A.S. George* 9169, a specimen he cited under typical of *D. georgei*, but he did cite one additional specimen, *A.S. George* 10818, under var. *barnettii*. *A.S. George* 10818 was from a different area, however, coming from the upper Rudall River in the south-eastern area of the *D. cordifolia* complex.

The western specimens are geographically separated from all other material of the complex and have a much smaller geographic range than the northern and south-eastern specimens. Despite this restricted distribution, they vary in leaf shape, inflorescence structure and calyx indumentum between the typical features of *D. cordifolia* and the typical features of *D. georgei*, although they are consistent in having moderately large leaves and flowers.

***Dicrastyliis costelloi*** F.M. Bailey, *Queensland Dept. Agric. Stock Bot. Bull.* 4: 14 (1891). *Type:* near Lake Nash on the border between Queensland and Northern Territory, *M. Costello s.n. (holo: BRI n.v.)*.

*Dicrastyliis costelloi* var. *globulifera* Munir, *Brunonia* 1: 519 (1978). *Type:* Macumba Station, South Australia, 3 September 1931, *E.H. Ising s.n. (holo: AD 966050523 n.v.)*.

*Dicrastyliis costelloi* var. *violacea* Munir, *Brunonia* 1: 519–520 (1978). *Type:* 61 km east of Dalhousie Springs, South Australia, 2 August 1963, *T.R.N. Lothian* 1722 (*holo: AD n.v.; iso: DNA (ex AD, previously numbered NT65309)*).

*Dicrastyliis doranii* var. *eriantha* F. Muell., *Trans. Proc. Roy. Soc. SA* 8: 13 (1886), *p.p.* *Dicrastyliis costelloi* var. *eriantha* (F. Muell.) Munir, *Brunonia* 1: 517 (1978). *Type:* central Australia [Northern Territory?], 1883, *C. Winnecke s.n. (lecto: MEL 40817, fide Munir 1978: 517)*.

*Illustration.* Munir (1978) p. 515, Figure 21.

Description as given in Munir (1978: 514).

*Selected specimens examined.* WESTERN AUSTRALIA: 52 miles [84 km] E of Neale Junction, Great Victoria Desert, 11 Oct. 1966, *A.S. George* 8446 (PERTH). NORTHERN TERRITORY: at junction of

roads, Alice Springs via Granite Downs, Hamilton Homestead and Mt Sarah, 10 Sep. 1986, J.Z. Weber 9448 (PERTH).

*Distribution and habitat.* Occurs in Northern Territory and South Australia in deep red sand on sand dunes with spinifex, one record with *Plectrachne* and *Grevillea*. Also recorded from east of Neale Junction (Western Australian part of Great Victoria Desert near the South Australian border), but this specimen is atypical: GVD.

*Phenology.* Flowering probably occurs opportunistically.

*Affinities.* See notes under its close relative *Dicrastylis beveridgei*.

*Notes.* The large disjunction in the range of this species between the single known collection from Western Australia and the main central Australian distribution in Northern Territory and South Australia is accompanied by morphological differences. The isolated Western Australian specimen appears to show greatest similarity in morphology to the Simpson Desert specimens in the south-east.

Central Australian specimens from Northern Territory and South Australia have the inflorescence white or purplish, spike-like or with basal peduncles bearing clusters of flowers or spikes of flowers. Like most other widespread taxa of *Dicrastylis* in the arid zone, *D. costelloi* is extremely variable. In the northern part of its range, in about 20–22 degrees latitude in Northern Territory, including the type locality from near the border with Queensland, *Dicrastylis costelloi* has narrow leaves and small flowers with the indumentum close to the surface rather than spreading, or perhaps the flowers just appear to be small because of their close indumentum. In the south-east in the Simpson Desert area, the leaves and flowers tend to be larger with a longer or more spreading indumentum on the flowers so that they appear more fluffy; this variant has been named var. *eriantha*. There is no clear geographic or morphological separation of variants with the different indumentum lengths.

Specimens with an obvious purple indumentum on the flowers and stems (often also with purple stems), which have been named var. *violacea*, occur widely and appear to completely intergrade via specimens having just a few purple hairs to specimens without any purple indumentum. Var. *globulifera* (n.v.) is known from only one collection and described as being intermediate between var. *costelloi* and var. *violacea*.

The single Western Australian specimen is unusual in having the basal peduncles up to 11 mm long, flowers larger than on any from Northern Territory and South Australia (although those on *R. Millinton* 19 Oct. 1968 (DNA 70238) from the Andado area of the Simpson Desert are almost as large), and an off-white indumentum that is more yellowish or pale ferruginous than normal but not bright yellow as in *D. beveridgei*. The Western Australian specimen matches var. *eriantha* in having large flowers and densely hairy axes to the inflorescence, but differs from all the named varieties in having only solitary flowers on the long basal peduncles of the inflorescence, and in having the indumentum more like that of *D. doranii* than usual. Var. *eriantha* shows the greatest similarity to *D. doranii* and needs further study.

***Dicrastylis cundeeleensis*** Rye, *sp. nov.*

*Dicrastyli doranii* F.Muell. affinis, sed inflorescentia pyramidalis plus compacta et indumento plus peltato differt.

*Typus*: south-east from Queen Victoria Springs, Western Australia [precise locality withheld for conservation purposes], 29 October 2001, *N. Streiber* 67, *P.C. Jobson & S. Anders* (*holo*: PERTH 06755607; *iso*: CANB *n.v.*, NSW *n.v.*, SYD *n.v.*).

*Dicrastylis* sp. Cundeelee (D.J. Pearson 101), in G. Paczkowska & A.R. Chapman, *West. Austral. Fl.: Descr. Cat.* p. 212 (2000).

*Shrub* 0.2–0.5 m high, with peltate-dendritic hairs less than 0.5 mm long forming a dense white to yellow or rarely reddish indumentum on the young stems and axes and peduncles of the inflorescence. *Leaves* opposite and decussate, sessile or subsessile, usually narrowly elliptic or narrowly obovate, rarely obovate, 10–22 × 2.5–5 mm, light green or sometimes bluish or yellowish, densely and closely covered by peltate-dendritic hairs; hairs up to 0.3 mm long. *Inflorescence* 12–50(65) mm long, nearly always broader than long, white to medium yellow or rarely partially reddish, each branchlet terminated by a short broad cymose arrangement of flowers, which is depressed-ovoid in outline to shortly pyramidal, the lowest branches or terminal part of inflorescence often with 7-flowered cymes (consisting of two lateral branches each with a dense group of 3 more or less sessile flowers and the short terminal branch 1-flowered) but often with variations in the numbers of flowers from 3 to 7 on each lateral branch within the cyme. *Flowers* 5-merous. *Calyx* 2–3 mm long, divided for more than half its length into 5 lobes but the divisions hidden by a very dense indumentum outside, glabrous inside, the indumentum of pale to mid yellow dendritic hairs, the lower hairs up to 1.7 mm long, the uppermost hairs much shorter; lobes almost ovate but shape hidden from outside by the very dense indumentum, 1.3–2 mm long. *Corolla* white, glabrous outside on basal half and appressed-dendritic-hairy and with yellowish sessile glands in upper half, densely bearded inside the throat, sometimes with a few scattered hairs extending a short distance above the throat, glabrous below throat; tube 1.7–2.5 mm long; lobes 1–1.5 mm long, the broadly rounded distal margin thickened and crenate and the veins at apex thickened, the crenate part often depressed ovate, the basal unthickened part often narrowed somewhat. *Stamens* distinctly exerted; filament 1.3–1.5 mm long, white; anther 0.4–0.5 mm long, much darker-coloured than the filament. *Style* prominently exerted; entire part *c.* 1.7 mm long at maturity, base densely covered by dendritic hairs up to 0.5 mm long, with the dendritic hairs becoming fewer and then absent just below the branches; branches recurved, shorter than entire part of style, glabrous. *Fruit* obovoid when young, not seen at maturity. (Figures 1B, 2)

*Other specimens examined*. WESTERNAUSTRALIA: [localities withheld] 23 Jan. 1969, *E.M. Bennett* 2902 (PERTH); 20 Oct. 1995, *D.J. Edinger* 1054 (PERTH); Apr. 2005, *J. Law* 3 (MEL, PERTH); 1975, *N.G. Marchant* 75/318 (AD, PERTH); 26 Nov. 1986, *D.J. Pearson* 101 (PERTH); 15 Mar. 1993, *S.G. Pearson* 1 (PERTH); 29 Oct. 2001, *N. Streiber* 68, *P.C. Jobson & S. Anders* (PERTH); 14 Sep. 1979, *J. Taylor* 484, *M.D. Crisp & R. Jackson* (PERTH).

*Distribution and habitat*. Endemic to Western Australia, extending from near Ponton Creek east to the Plumridge Lakes area, with several collections from within a nature reserve: COO, GAS, GVD (Figure 3). Two records are from yellow sandplain, and two others from red or reddish yellow sand in open mallee vegetation with *Triodia*.

*Phenology*. Flowers mainly recorded from October to December, also one record from April.

*Conservation status*. Recently listed as Priority Three under DEC Conservation Codes for Western Australian Flora. At least eight localities are known for this taxon, most of them on two large conservation reserves, the known distribution extending over 300 km.

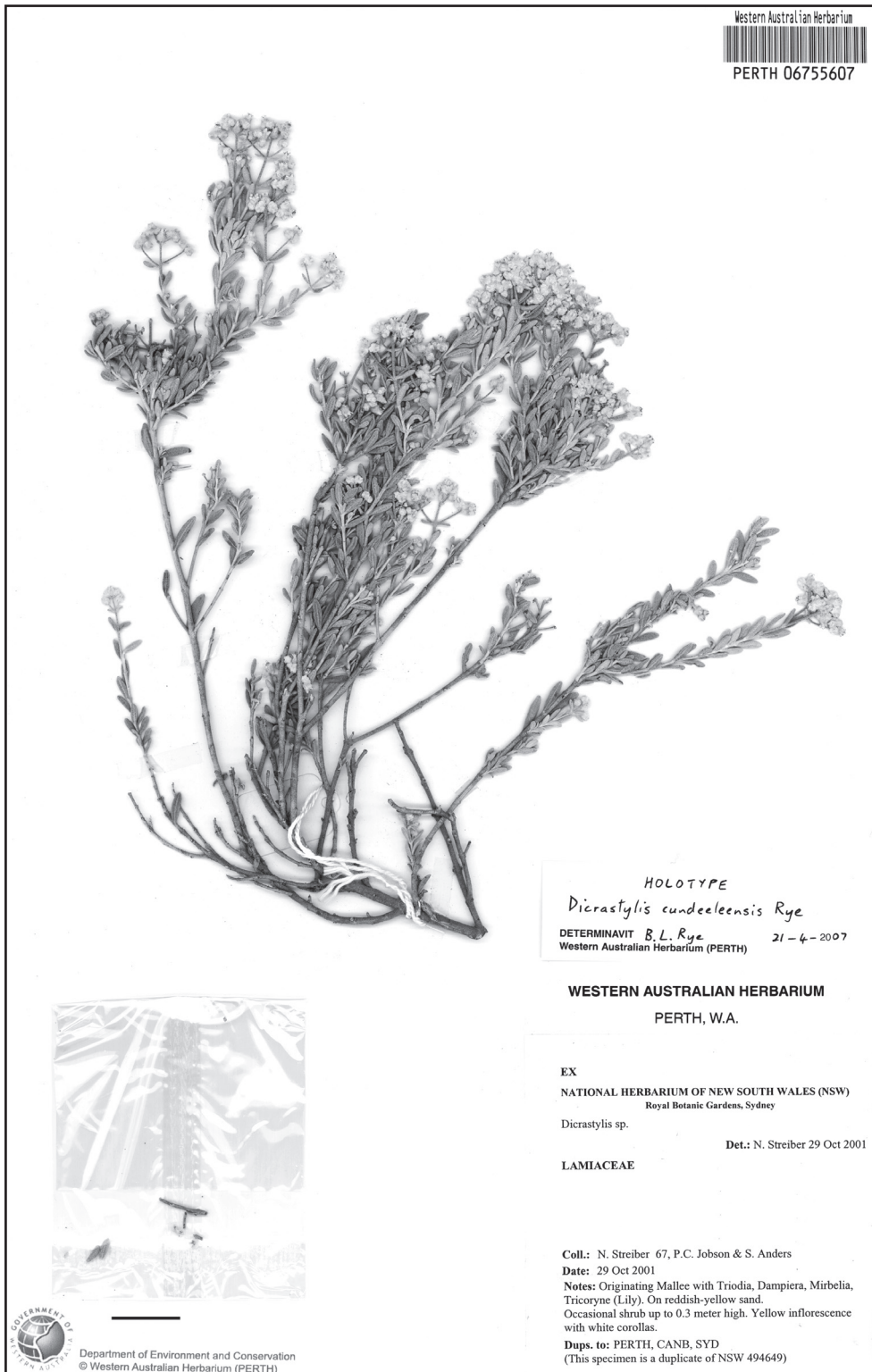


Figure 2. Holotype of *Dicrastylis cundeleeensis* (PERTH 06755607). Scale bar = 20 mm.

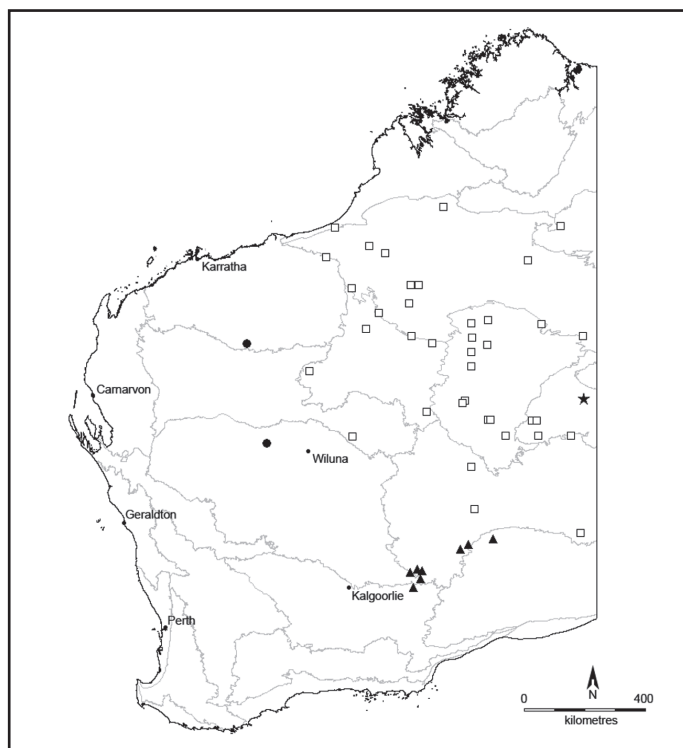


Figure 3. Distribution in Western Australia of *Dicrastyliis cundeeleensis* (▲), *D. doranii* (□), *D. mitchellii* (●) and *D. subterminalis* (★).

*Etymology.* Named after the Cundeelee area where this species occurs.

*Affinities.* *Dicrastyliis cundeeleensis* is very closely related to *D. doranii*, but occurs south-west of the range of *D. doranii* (Figure 3A) and can be distinguished by leaf characters and by its shorter and more spreading inflorescence, which is usually broader than long and tends to be more yellowish or rarely reddish. Its corolla is white but the calyx indumentum is usually pale to medium yellow, the inflorescence usually appearing cream to medium yellow. The inflorescence of *D. doranii* is nearly always much longer than broad. In the typical variant of *D. doranii* the inflorescence is often 100–170 mm long and has some long, erect dendritic hairs on its axes, unlike the uniformly peltate-dendritic indumentum of *D. cundeeleensis*.

In *Dicrastyliis cundeeleensis* the leaves generally appear to be very flat, whereas leaves of *D. doranii* are often distinctly bowed, with the adaxial surface convex and the abaxial surface concave. Actually, the leaf margins of *D. cundeeleensis* are recurved but the flat surface in between is filled with peltate-dendritic hairs such that the whole surface appears to be flat. In *D. doranii*, the margins are more obviously recurved and, as already noted, the whole leaf surface tends to be bowed. The northern variant of *D. doranii*, which has been named *D. carnegiei*, is readily distinguished from *D. cundeeleensis* by the short close indumentum on its leaves which fills the rather shallow depressions on the lower surface and is usually accompanied by numerous small yellowish glands protruding above the hairs. In *D. cundeeleensis*, the leaf hairs are larger and their flat branched summit overlaps to form a more level layer on the lower surface of the leaves, hiding the deep glabrous depressions. These depressions correspond with the bullae on the upper surface and contain glands. They tend to

become visible as the indumentum becomes less dense on aging leaves. Typical *D. doranii* also tends to have the hairs longer than in *D. carnegiei*, although still filling the depressions rather than having glabrous depressions as in *D. cundeeleensis*.

*Notes.* There is no obvious petiole on any of the leaves of *Dicrastylis cundeeleensis* because of the continuation of the indumentum to the base of the leaf, but if a petiole is present below the indumentum it is very short and poorly defined.

One specimen collected from Queen Victoria Spring Nature Reserve (*D.J. Edinger* 1054A) appears to be a hybrid between *Dicrastylis brunnea* and *D. cundeeleensis*, although only the latter parent was simultaneously collected (*D.J. Edinger* 1054). *Dicrastylis brunnea* has commonly been collected in the Cundeelee area in similar habitats to those occupied by *D. cundeeleensis* and so is very likely to come into occasional contact with *D. cundeeleensis*.

In view of the very close affinity of the new taxon to *Dicrastylis doranii*, there is some doubt as to whether it should be treated as a separate species or just as a subspecies of *D. doranii*. Being geographically separated as well as having significant morphological differences, it clearly does need to be recognised formally as a distinct taxon, and the simplest option of treating it as a separate species is taken here.

***Dicrastylis doranii*** F.Muell., *Fragm.* 8: 230 (1874). *Type:* Rawlinson Range, Western Australia, *E. Giles s.n. (holo: MEL 40815 n.v.)*.

*Dicrastylis carnegiei* Hemsl., *Hook. Ic. Pl. ser. 4, 6: t. 2582* (1899). *Type:* c. 22°30'S, 126°E, Western Australia, *H.D. Carnegie s.n. (holo: K n.v.)*.

*Illustration.* Munir (1978) p. 528, Figure 22.

Description as given in Munir (1978: 526–527) except that the leaves are occasionally in whorls of three and the inflorescence is often almost elongated, i.e. much longer than broad, and closer to cylindrical than to pyramidal, or with a spike-like upper part and widely spaced branches below forming a pyramidal base.

*Selected specimens examined.* WESTERN AUSTRALIA: 86 km NE of Warburton Community on road to Giles, 23 Oct. 1989, *B.J. Conn* 3457 & *J.A. Scott* (PERTH); 0.5 km E of Shallow Bore, Lorna Glen Station, 3 Nov. 2002, *D.J. Edinger* 3192 & *G. Marsh* (PERTH); 50 km W of Kiwirrkurra, Gibson Desert, 3 Nov. 1998, *P.K. Latz* 15761 (PERTH). NORTHERN TERRITORY: c. 70 miles [113 km] WNW Mount Singleton, 13 June 1957, *G. Chippendale* 3350 (PERTH).

*Distribution and habitat.* Probably occurs in the far south of the Northern Botanical Province of Western Australia although it was omitted from the “Flora of the Kimberley Region” treatment of the family (Rye 1992), extending from Wallal Downs Station (Kimberley Region) and the far north of the Eremaean Botanical Province south to the northern border of the Nullarbor Plain: CR, DL, GD, GSD, GVD, LSD, NUL, TAN (Figure 3). Also occurs in Northern Territory. Occurs mainly on or between red sand dunes, also recorded in red sand over sandstone or other types of rock, often associated with spinifex.

*Phenology.* Flowering probably occurs opportunistically throughout all or most of the year.

*Affinities.* Closely related to several other species with thickenings on the corolla lobes, differing from its close relative *D. cundeeleensis* as noted under that species. It is distinguished from *D. beveridgei* and *D. costelloi* primarily by its inflorescence being less spike-like and by its corolla lobes having thickening extending down along the veins from the margin rather than just forming a marginal rim. It also tends to have broader flatter leaves (i.e. less revolute) and broader bracts, and it lacks the deep yellow and deep reddish or violet hairs commonly found in the other two species.

*Notes.* This is a very widespread and variable species in need of further study. Its inflorescence is variable in structure, but typically is quite long and with widely spaced lower branches (as illustrated in Munir 1978: Figure 22A) and has either white or cream indumentum.

*Dicrastylis carnegiei* is a small-flowered, short-haired, glandular variant that occurs in the north-western part of the species' range, mainly in the Great Sandy Desert. It possibly should be recognised formally, at least at the subspecific level, but seems to show too much intergradation with typical *D. doranii* to be readily identified at the margins of its distribution in the Gibson Desert. The typical variant of *D. doranii* extends from the Gibson Desert south to the northern margin of the Nullarbor Plain.

***Dicrastylis exsuccosa*** (F.Muell.) Druce, *Bot. Exch. Cl. Brit. Isles* 4: 619 (1917). *Pityrodia exsuccosa* F.Muell., *Fragm.* 1: 60 (1858). *Dicrastylis ochrotricha* F.Muell., *Fragm.* 4: 161 (1864), *nom. illeg.* *Type citation:* in locis petraeis deserti Australiae centralis, e.g. ad rivum Sturt's Creek. *Type:* Sturt Creek, ?Western Australia, 11 March 1856, *F. Mueller s.n.* (*holo:* MEL 40891 *n.v.*, illustration seen; *iso:* K *n.v.*).

*Dicrastylis exsuccosa* f. *albo-lutea* Munir, *Brunonia* 1: 539–540 (1978). *Type:* 75 miles [121 km] south-west of The Granites, Northern Territory, 1 August 1970, *P.K. Latz* 710 (*holo:* AD *n.v.*; *iso:* DNA (previously numbered NT 27718)).

*Dicrastylis exsuccosa* f. *lachnophylla* Munir, *Brunonia* 1: 537–538 (1978). *Type:* near Barrow Range, Western Australia, 25 June 1958, *J.B. Clement s.n.* (*holo:* AD *n.v.*).

*Dicrastylis exsuccosa* subsp. *cinerea* Munir, *Brunonia* 1: 540–542 (1978). *Type:* Carnegie Station, Western Australia, July 1941, *F.M. Bennett* 157 (*holo:* PERTH 01603078).

*Dicrastylis exsuccosa* subsp. *elliptica* Munir, *Brunonia* 1: 542–545 (1978). *Type:* Yelma, 99 miles [159 km] east of Wiluna, Western Australia, 17 August 1958, *N.H. Speck* 1222 (*holo:* CANB *n.v.*, illustration seen; *iso:* NSW *n.v.*, PERTH 01603086).

*Dicrastylis exsuccosa* subsp. *wilsonii* Munir, *Brunonia* 1: 545–546 (1978). *Type:* 10 miles [16 km] south of No. 8 Well on Canning Stock Route, Western Australia, 21 September 1942, *H.M. Wilson* 21 (*holo:* PERTH 01603094).

*Dicrastylis exsuccosa* var. *lanceolata* Munir, *Brunonia* 1: 535–536 (1978). *Type:* 34 miles [55 km] north-north-east of Barrow Creek township, Northern Territory, 24 August 1956, *M. Lazarides* 5826 (*holo:* CANB *n.v.*; *iso:* DNA (ex CANB, previously numbered NT 18081), PERTH 01603051). Also unseen isotypes at AD, BRI, MEL, and US.

*Dicrastylis exsuccosa* var. *tomentosa* Munir, *Brunonia* 1: 536–537 (1978). *Type:* 40 miles [64 km] north-west of Giles, Rawlinson Range, Western Australia, 4 August 1962, *R.H. Kuchel* 286 (*holo:* AD *n.v.*; *iso:* L, UP, both *n.v.*).

*Illustrations.* Munir (1978) p. 532, Figure 23; p. 541, Figure 24; p. 544, Figure 25.

Description as given in Munir (1978: 530–531).

*Distribution.* Extends from Sturt Creek south-west to the Wiluna area and south to Newbery and near Warburton in Western Australia: CR, GAS, GD, GSD, GVD, LSD, MUR, TAN. Also occurs in Northern Territory and South Australia. (Figure 4)

*Phenology.* Flowering probably occurs opportunistically.

*Affinities.* See notes under the newly described close relative *Dicrasyllis kumarinensis*.

*Notes.* The *Dicrasyllis exsuccosa* complex is extremely variable. Munir (1978) recognised many infraspecific entities for *D. exsuccosa* but these are difficult to identify because of their overlapping ranges and the presence of morphological intermediates. In any case, the use of subspecies, varieties and forms within a single species is confusing. Two main variants are listed below, differing in the length of their calyx indumentum and are largely geographically separated, although they show some morphological intergradation where their ranges overlap.

#### **a. short-haired variant**

*Illustration.* Munir (1978) p. 532, Figure 23.

*Leaf blades* narrowly or very narrowly ovate, 40–90 × 11–23 mm, pale to deep yellow-green on under surface at first, becoming less yellowish with age, medium to dark green on upper surface. *Calyx* with scattered to fairly frequent coarse yellow hairs 0.5–1.3 mm long and a distinct, more continuous layer of finer shorter hairs, the calyx lobes clearly visible.

*Selected specimens examined.* WESTERN AUSTRALIA: Bishops Dell, 8 June 1980, *A.A. Burbidge* 174 (PERTH); Gregory Salt Lake, Billiluna Station, 1992, *T. Handasyde* 30 (PERTH). NORTHERN TERRITORY: 1 mile [1.6 km] E of Camel W.H., Tanami Range, 12 Sep. 1971, *C. Dunlop* 2314 (DNA); 128 km W of Stuart Highway on track to Lajamanu, *G. Leach* 1720 (DNA); c. 320 km N of Alice Springs along Stuart Highway, 15 June 1988, *J.Z. Weber* 10180 (DNA).

*Distribution and habitat.* In Western Australia this variant extends from Sturt Creek south to near Babool Rockholes (south-west of Warburton): GSD, TAN. It also occurs in Northern Territory and possibly in northern South Australia. Most records are from red sand between dunes with spinifex but one record is from an alluvial flat and one atypical specimen (with leaves hairier than normal) is from amongst massive sandstone on a plateau above a spring.

*Notes.* This is the typical variant of the species and also includes the type of the variant that Munir named *Dicrasyllis exsuccosa* var. *lanceolata*. The leaves are generally longer and narrower than in the long-haired variant of *D. exsuccosa*. There are two main short-haired subvariants but these overlap in range and intergrade. One subvariant extends from Southesk Tablelands east into Northern Territory, but also reportedly occurs much further south near Babool Rockholes (*AD n.v.*). Its leaves are often grey-green on the upper surface, with shallow broad bullae and little separation between the bullae (but sometimes more mature leaves resembling the other subvariant are present) and it has relatively short hairs on the peduncles and calyx. A second subvariant extends from Balgo Hills Station south



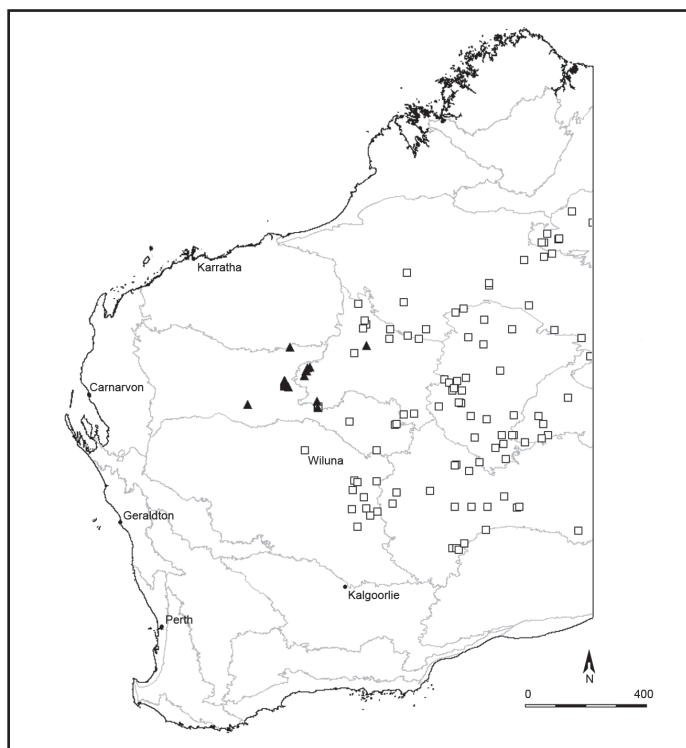


Figure 4. Distribution in Western Australia of *Dicrasyllis exsuccosa* (□) and *D. kumarinensis* (▲).

towards Sir Frederick Range and into Northern Territory. Its leaves are dark green above, with deeper and more widely spaced bullae, and longer hairs on the peduncles and calyx. Some specimens are intermediate in both states, for example one from Wilson Cliffs, Western Australia.

An odd specimen (*K.F. Kenneally* 11971) from the Tanami Desert has pale grey-green leaves like those of *D. gilesii* and occurs on a somewhat similar rocky habitat. However, it has the calyx indumentum and shape of *D. exsuccosa* and is well outside the known range of *D. gilesii*.

#### **b. long-haired variant**

*Illustrations.* Munir (1978) p. 541, Figure 24; p. 544, Figure 25.

*Leaf blades* narrowly ovate to almost circular, usually ovate, (15)20–60 × (7)10–25 mm, often silvery-grey, with deep narrow bullae on upper surface but the bullae sometimes hidden. *Calyx* with a very fine woolly indumentum of yellow or a mixture of yellow and deep pinkish hairs 1.3–3 mm long, tending to obscure the lobes.

*Selected specimens examined.* WESTERN AUSTRALIA: S of Windy Corner, Aug. 1976, *A.M. Ashby* 5420 (DNA); 46 km SSW of Well 42, Canning Stock Route, 3 May 1979, *A.S. George* 15580 (DNA); near Mt Charles, *H.A. Johnson s.n.* (DNA 5096); Little Sandy Desert, 2 May 1979, *A.S. Mitchell s.n.* (DNA, PERTH); Gunbarrel Highway, 25 km SE of Mt Beadell, 4 June 1985, *R. Southgate s.n.* (DNA).

*Distribution and habitat.* In Western Australia it extends from the northern Gibson Desert south to near Cosmo Newbery (NE of Laverton): CR, GAS, GD, GSD, GVD, LSD, MUR. Also occurs in Northern Territory and South Australia. Commonly recorded from red sand dunes or sandy plains, also recorded from sandstone outcrops or other kinds of rocky rises, often associated with spinifex.

*Notes.* This taxon has been known at PERTH as *Dicrastyliis tomentosa* ms but its status is far from clear. It might warrant at least subspecific status as it occurs in a distinct geographic region with little overlap in range with typical *D. exsuccosa* but it is extremely variable and needs further study to determine whether it should be subdivided and additional taxa recognised.

Three subspecies, one variety and two forms have been named by Munir (1978) from among the long-haired specimens. One of these, subsp. *wilsonii*, has been a Priority One taxon (Atkins 2006), as it was known from only two specimens from Mt Moore and near No. 8 Well on the Canning Stock Route. Munir distinguished it from the other variants of *Dicrastyliis exsuccosa* because its calyx was hairy inside and it had broader leaves. However, the broadest leaves known among the long-haired specimens are those of a specimen (*A.S. George* 9099) of subsp. *cinerea* and the calyx lobes of other variants are also sometimes hairy inside.

***Dicrastyliis flexuosa*** (W.R.Price) C.A.Gardner, *J. Roy. Soc. W. Austral.* 27: 191 (1942). *Pityrodia flexuosa* W.R.Price, *Kew Bull.* 1910: 384 (1910). *Type:* Western Australia, 23 June 1908, *W.H. Ince s.n.* (*holo:* K n.v.; *iso:* PERTH 03666204).

*Dicrastyliis microphylla* Munir, *Brunonia* 1: 451–454 (1978). *Type:* Cundelee Mission, north of Zanthus, Western Australia, 21 September 1963, *A.S. George* 5804 (*holo:* PERTH 01603140; *iso:* PERTH 01603167 & 01603159).

*Illustrations.* Munir (1978) p. 453, Figure 2; p. 455, Figure 3.

Description as given in Munir (1978: 454) except for the following characters. *Shrub* 0.3–1(1.5) m high. *Leaves* usually ovate, sometimes narrower, 9–27 × 3–11 mm. *Cymes* usually all subsessile with the peduncle up to 2 mm long, rarely the lower cymes with a peduncle up to 8 mm long.

*Selected specimens examined.* WESTERN AUSTRALIA: 1 km S of Canegrass Swamp, 25 Oct. 1992, *G. Barrett s.n.* (PERTH); Barwidgee Station, 1999, *L. Boladeras* 1 (PERTH); 80.2 km W of Agnew towards Sandstone, 26 Oct. 1996, *R. Schuh & G. Cassis* 96-21 (PERTH); 5 km W of Zanthus, 17 Sep. 1979, *J. Taylor* 566, *M.D. Crisp & R. Jackson* (PERTH); Bandy Station, 23 Nov. 1989, *S. Van Vreesen* 2706 (PERTH).

*Distribution and habitat.* Endemic to Western Australia, extending from near Wiluna south-east to Zanthus: COO, MUR. Occurs in red sandy soil on plains with spinifex, one record from a low shrubland with mallees.

*Phenology.* Flowers from August to November.

*Affinities.* Very closely related to *Dicrastyliis nicholasii* but differing as described under that species.

*Notes.* The typical variant of *Dicrastyliis flexuosa*, with ovate leaves, extends from Wiluna south-east to the Coolgardie area. A southern variant, occurring from the Coolgardie area south to Zanthus, tends to have somewhat narrower leaves with the margins more recurved, the most extreme example being

the type specimen of *D. microphylla*. While the northern specimens have broader leaves on average, there is no clear separation of the two variants in leaf width. When *D. microphylla* was first named, it appeared more distinctive than it does now because no other southern collections had been available to show the complete variation in leaf width over the full distribution of *D. flexuosa*. *Dicrastyliis microphylla* is here reduced to a synonym of *D. flexuosa*.

Specimens from the far south of the species range in the Zanthus region show another unusual character not previously recorded for *Dicrastyliis flexuosa*. Some of them have the lower peduncles lengthened to *c.* 4 mm, or on one specimen (*N.G. Marchant* 75/300) reaching a maximum length of 8 mm. Other specimens from the same region have all of their cymes subsessile as in typical *D. flexuosa*.

***Dicrastyliis gilesii*** F.Muell., *Fragm.* 8: 229–230 (1874). *Type*: between Alberta River and Mt Olga, Northern Territory, *E. Giles s.n.* (*holo*: MEL 40878 *n.v.*; *iso*: B, NSW both *n.v.*).

*Dicrastyliis gilesii* f. *brevipila* Munir, *Brunonia* 1: 565–566 (1978). *Type*: Blackstone Mining Camp, *c.* 360 km south-west of Alice Springs, *c.* 50 km north-east of Cavanagh Range, Western Australia, 11 July 1958, *R. Hill & T.R.N. Lothian* 921 (*holo*: AD *n.v.*; *iso*: K *n.v.*, DNA (ex NT 18079)).

*Dicrastyliis gilesii* f. *densa* Munir, *Brunonia* 1: 560–561 (1978). *Type*: 50 miles [80 km] east of Docker River Settlement, Northern Territory, 26 October 1970, *P.K. Latz* 835 (*holo*: AD *n.v.*; *iso*: DNA (ex NT 28776), PERTH (ex NT 28776) 01603124).

*Dicrastyliis gilesii* f. *irregularis* Munir, *Brunonia* 1: 564–565 (1978). *Type*: Warrabu Gorge on south-west side of Rawlinson Range, *c.* 15 km north-west of Giles, Western Australia, 3 August 1962, *P.G. Wilson* 2405 (*holo*: AD *n.v.*, illustration seen; *iso*: B, E, both *n.v.*).

*Dicrastyliis gilesii* var. *bagotensis* Munir, *Brunonia* 1: 561–566 (1978). *Type*: Bagots Creek, George Gill Range, Northern Territory, 13 August 1957, *G. Chippendale* (*holo*: DNA (ex NT 3616); *iso*: PERTH 03716023).

*Dicrastyliis gilesii* var. *laxa* Munir, *Brunonia* 1: 566–567 (1978). *Type*: 25 miles [40 km] south-west of Napperby Station, Northern Territory, 16 September 1956, *M. Lazarides* 5999 (*holo*: AD *n.v.*; *iso*: DNA (ex NT 47674), PERTH 03716023).

*Dicrastyliis petermannensis* Munir, *Brunonia* 1: 551–553 (1978). *Type*: 1 mile [1.6 km] west of Docker Creek Settlement, Petermann Ranges, Northern Territory, 20 September, *J.R. Maconochie* 800 (*holo*: AD *n.v.*, illustration seen; *iso*: PERTH (ex NT 25089) 01603590).

*Illustrations.* Munir (1978) p. 553, Figure 28; p. 558, Figure 30; p. 562, Figure 31.

Description as given in Munir (1978: 556) except for the following. *Inflorescence* very variable in length and in the arrangement of the cymose clusters but more or less pyramidal overall, very compact to quite loose, (40)60–220 mm long, the arrangement of the cymes on each branch ranging from corymbose or racemose to spike-like, with dendritic hairs 0.4–1.5 mm long forming a very dense creamy to yellow-brown indumentum on the axes and peduncles; cymes commonly 7- to 15-flowered, the flowers densely grouped into a globular head-like cluster 15–22 mm diam.

*Selected specimens examined.* WESTERN AUSTRALIA: Rawlinson Range, E side of the Pass of the Abencerrages, 24 July 1978, *A.S. George* 12144 (PERTH); Purnawara Rockhole, 4 km N of Boundary Peak, Bell Rock Range, 25 June 1989, *D.J. Pearson* 633 (PERTH). NORTHERN TERRITORY: Mt Hastie, 30 Sep. 2001, *D.E. Albrecht* 10052 (NT, PERTH); Waterhouse Ranges, near Orange Creek, 23 Aug. 1988, *M.J. Barritt* 461 (DNA); Mt Olga, Mar. 1967, *W.H. Butler s.n.* (PERTH); Curtin Springs, 27 Apr. 1974, *T.S. Henshall* 109 (DNA); Palm Valley, *P.K. Latz* 4471 (DNA); 1.5 miles [2.4 km] W of Ormiston Gorge, 18 June 1974, *J. Wauchope s.n.* (DNA); Krichauff Range, 5 Aug. 1981, *A.S. Weston* 12579 (DNA, PERTH).

*Distribution and habitat.* In Western Australia this species occurs in the Rawlinson Range area: CR, GSD, GVD. Also occurs in southern Northern Territory and the far north-west of South Australia. Recorded mainly from the rocky higher slopes of the mountain ranges of central Australia, in sand or sandstone. Three specimens record the vegetation as: spinifex; hummock grassland; shrubland with *Ptilotus* and *Dodonaea*.

*Phenology.* Flowering probably occurs opportunistically through all or most of the year.

*Affinities.* Closely related to *Dicrastylis exsuccosa*, which differs in having a bright yellow indumentum on the flowers. Most specimens of *D. gilesii* are also distinguished by their large grey leaves. See also the affinities section under *D. cordifolia*.

*Notes.* Some depauperate specimens, perhaps collected after a long dry spell, have lost most of their leaves, with only the smaller more terminal leaves present, the largest of which are *c.* 20 mm long. The leaves are relatively uniform in flowering specimens in shape, size and colour, all being soft to the touch and pale grey-green because of the dense indumentum, but fruiting or vegetative specimens sometimes have darker greenish leaves with the indumentum largely worn off.

Corolla colour in *Dicrastylis gilesii* is mostly recorded as white or cream but occasionally as purplish, a colour that could refer to the presence of purplish hairs rather than the corolla surface colour. Many specimens have a pink-purple indumentum on the young inflorescences, especially those still in early bud. According to the original description of var. *laxa*, this taxon lacks pink-purple indumentum, but the label on one of the cited specimens (*A.O. Nicholls* 892) records some stems with a reddish-green indumentum and others with an almost white indumentum. Unfortunately, few specimens give any information on indumentum colour.

Although *Dicrastylis gilesii* is very variable in its inflorescence, all of the inflorescence types used to distinguish the named varieties listed as synonyms above, and the synonymous species *D. petermannensis*, seem to completely intergrade. Inflorescences vary from short and compact through to much larger and rather loose, with great variation in inflorescence length occurring within each of the named varieties. Separation of the taxa is based mainly on the density and arrangement of the branches and cymes, with the densest inflorescences tending to occur in f. *densa* and the loosest ones in var. *laxa*, but these seem to represent the extremes of a continuum.

Arrangement of the cymes on each branch varies from being relatively corymbose or racemose to almost spike-like, although the overall inflorescence shape is nearly always pyramidal. The spike-like arrangement, with the cymes subsessile or with peduncles less than 5 mm long, is seen in the type specimen of *D. petermannensis* and to varying degrees in some specimens included in *D. gilesii*. *Dicrastylis petermannensis* was named based on a single collection from Petermann Range, Northern

Territory, but has since been recorded from the far north-west of South Australia. A specimen from Rawlinson Range in Western Australia (*A.S. George* 8816) was placed under *D. gilesii* var. *laxa* in Munir (1978) but apparently bridges the gap between the new species and the original one. It has an inflorescence of a similar size and density to that of *D. petermannensis* but with a somewhat more racemose arrangement of the cymes on each branch.

In its indumentum, leaf and floral characters, *D. petermannensis* appears to be identical to *D. gilesii* and therefore is reduced here to a synonym. It should be noted that many of the floral measurements given for *D. gilesii* in Munir (1978) are about twice the size of those recorded for the species here, whereas the measurements given for *D. petermannensis* are much more in agreement.

***Dicrastylis kumarinensis* Rye, sp. nov.**

*Dicrastylis exsuccosae* (F.Muell.) Druce affinis sed folius plus elongatis, floris minoribus et lobis corollae latioribus margine crispatis differt.

*Typus*: 20 km north of Kumarina, Western Australia, 3 October 1978, *A.A. Mitchell* 632 (*holo*: PERTH 01869175; *iso*: CANB).

*Dicrastylis* sp. Kumarina (*A.A. Mitchell* 632), in *G. Paczkowska & A.R. Chapman*, *West. Austral. Fl.: Descr. Cat.* p. 212 (2000).

*Shrub* 0.4–0.8 m high, up to *c.* 1 m diam., with a very dense close indumentum of yellow dendritic hairs on the young stems and main inflorescence axes and with a very dense indumentum of spreading yellow dendritic hairs on the pedicels or minor axes. *Leaves* opposite and decussate or rarely in whorls of three, mostly widely antrorse to patent; petiole 3–6 mm long; blade very narrowly ovate to almost linear-elliptic, 60–110 × 7–15 mm; lower surface pale green or yellowish, densely covered by erect dendritic hairs up to 1 mm long; upper surface much darker green, deeply bullate, less densely covered by erect dendritic hairs. *Inflorescence* a narrowly pyramidal to almost cylindrical panicle of cymes, 80–250 mm long; peduncles of lower branches 10–55 mm long; cymes 5- to many-flowered. *Flowers* 5-merous. *Calyx* 4–5 mm long, with minute simple glandular hairs inside except for extreme base, which is glabrous, and with a few long dendritic hairs towards apex, densely covered outside by yellow erect dendritic hairs *c.* 1 mm long; tube 1–2 mm long; lobes broadly ovate, 3–3.5 mm long, gland-dotted inside. *Corolla* white, glabrous outside except for a patch of short dendritic hairs concentrated at the base of each of the lobes, appressed-hairy inside tube and sometimes fairly densely bearded in the throat, all hairs white or a few of them yellow, with yellow sessile glands outside especially on distal part of tube and on the lobes; tube 1.7–2.5 mm long; lobes broadly triangular to very broadly ovate, 1.3–1.7 mm long, with a glabrous crinkled margin. *Stamens* slightly exserted from the throat; filament *c.* 0.7 mm long; anther 0.6–0.7 mm long, dark-coloured. *Style* deeply 2-branched; undivided part 0.5–1.3 mm long, with white dendritic hairs 0.6–1.2 mm long; branches recurved, shorter or longer than the entire part, glabrous. *Fruit* hard-walled, globular, 2.5–3.5 mm long and wide but not seen at full maturity, extreme base with base of calyx adnate, densely covered above by yellow dendritic hairs. (Figures 1C, 5)

*Other specimens examined.* WESTERN AUSTRALIA: Collier Range, 157 km N of Meekatharra, 13 Aug. 1963, *J.S. Beard* 2757 (MEL, PERTH); 150 km S of Mt Newman turnoff, Great Northern Highway, 11 Sep. 1978, *A.C. Beauglehole* 59370 & *E.G. Errey* 3070 (PERTH); 640 mile post, 7.5 mi. [11 km] N of Kumarina, 26 Oct. 1970, *H. Demarz* 2792 (PERTH); SE of Newman on edge of

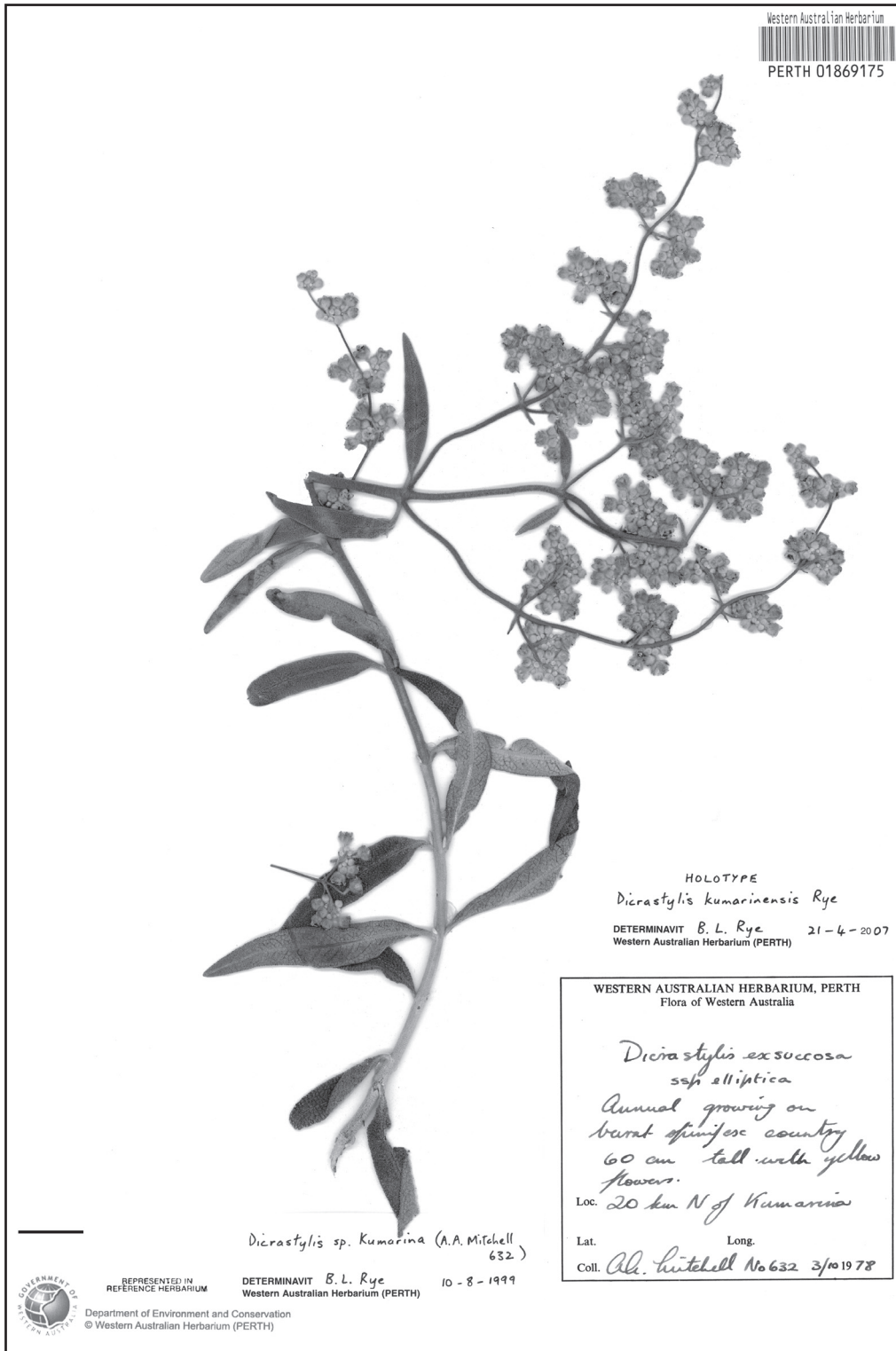


Figure 5. Holotype of *Dicrastylis kumarinensis* (PERTH 01869175). Scale bar = 20 mm.

Great Sandy Desert, 26 Aug. 1988, *D.J. Edinger* 632 (PERTH); 5 km E of Tabimaya Well, Carnarvon Range proposed conservation park, Little Sandy Desert, 23 Aug. 1999, *D.J. Edinger* Nats 10 (PERTH); 2 km SW of Serpents Glen, 5 km W of M6 Hill, Carnarvon Range, Little Sandy Desert, 26 Aug. 1999, *D.J. Edinger* Nats 46 (PERTH); abandoned Rabbit Proof Fence, 20 Oct. 1991, *H.N. Foote* 107 (PERTH); 640 mile peg N of Meekatharra, 15 Oct. 1963, *F. Lullfitz* 2629 (PERTH); c. 15 km N of Kumarina on Great Northern Highway, 27 Aug. 1995, *A.A. Mitchell* 434 (PERTH); 143 km S of Newman, 6 Oct. 1989, *B. Nordenstam & A. Anderberg* 361 (PERTH); between Lake Disappointment and Robertson Range, Aug. 1973, *G.N. Royce s.n.* (PERTH); 26.5 km N of Kumarina Roadhouse, 12 July 1980, *C.I. Stacey* 649 (AD, NSW, NT, PERTH); Little Sandy Desert, 11.4 km SW of Cooma Well, 9.2 km NNE of Moffetah Well, 15 Aug. 1997, *S. van Leeuwen* 3212 (BRI, PERTH); Little Sandy Desert, 5.4 km N of Cooma Well along the old No. 1 Vermin Proof Fence, 30.6 km SE of Old Cundlebar, 14 Aug. 2001, *S. van Leeuwen* 4888 (BRI, PERTH); Great Northern Highway, 15 km N of Kumarina, 1 Aug. 2004, *J.E. Wajon* 1181 (PERTH).

*Distribution and habitat.* Endemic to Western Australia, extending from near Newman south to Collier Range and east to between Robinson Range and Lake Disappointment: GAS, LSD, PIL (Figure 4). Occurs in red sand, on or between sandhills, in shrublands. Associated shrubland species are listed for one collection as *Calytrix*, *Grevillea juncifolia*, *Bonamia* and *Keraudrenia*.

*Phenology.* Flowers August to October.

*Etymology.* Named after the locality of Kumarina where this species has commonly been collected.

*Affinities.* This species has previously been confused with *Dicrastylis exsuccosa* but is easily distinguished by its smaller flowers with broader corolla lobes (broadly ovate rather than ovate) with a distinctly crinkled margin. It also tends to have longer narrower leaves. The two species slightly overlap in range but no intermediates are known.

*Notes.* Although several specimens of this species had been collected by 1975, Munir (1978) did not annotate or cite any of these and so was unaware of the existence of this taxon. One specimen (*H.N. Foote* 107) has the leaves and inflorescence branches of one stem in alternating whorls of three. No other whorled leaves have been observed.

### ***Dicrastylis mitchellii* Rye, *sp. nov.***

*Dicrastylis sessifoliae* Munir affinis sed inflorescentia indumento minus denso et lobis calycis minus dense pubescentibus differt.

*Typus:* Killara Station, Western Australia, October 1981, *A.A. Mitchell* 905 (*holo:* PERTH 03668525; *iso:* PERTH 03668312).

*Dicrastylis* sp. Turee Creek (S. Black s.n. PERTH 06344577), Western Australian Herbarium, in FloraBase, <http://florabase.dec.wa.gov.au> [accessed May 2007].

*Shrub* c. 0.3 m high, with short and long dendritic hairs forming a very dense white indumentum 0.5–1 mm long on the young stems and with sparse or very scattered dendritic hairs 1.3–1.5 mm long on the green to deep reddish axes and peduncles of the inflorescence. *Leaves* mostly in alternating whorls of three, sessile, very narrowly ovate to narrowly elliptic or narrowly ovate, 20–35 × 5–9 mm,

upper surface rugose (shallowly bullate or divided into slightly raised areas), with margins recurved and widely separated, moderately densely dendritic-hairy at first, with many sessile golden glands on undersurface especially; hairs 0.3–0.5 mm long, with a patent stalk and horizontal branched portion, i.e. peltate-dendritic, fine, white. *Inflorescence* a terminal raceme-like or narrowly pyramidal arrangement of cymes, most cymes with a peduncle 10–30 mm long, the basal cymes on a peduncle up to 55 mm long; main axis and branches slender, sometimes deep reddish-purple; cymes 7-flowered and 10–15 mm diam. but sometimes massed with other cymes into a many-flowered cluster up to 20 mm wide. *Flowers* 5-merous. *Calyx* 3.5–4.5 mm long, glabrous inside, sparsely to moderately densely covered outside by long-stalked dendritic hairs up to 2 mm long, also with some sessile glands; lobes narrowly triangular, 2.5–3.5 mm long. *Corolla* apparently white; tube 3–4 mm long, glabrous outside on basal part and appressed dendritic at summit especially below each of the lobes, densely bearded in the throat; lobes 1–1.5 mm long, with appressed white dendritic hairs at base and centre, with an unthickened base usually narrowed below a broadly rounded thickened distal margin; thickened distal part depressed ovate to circular, with thickened veins, crenate. *Stamens* distinctly exerted; anther 0.5–0.6 mm long, dark-coloured. *Style* prominently exerted, deeply 2-branched; undivided part covered by dendritic hairs *c.* 0.5 mm long; branches glabrous. *Fruit* hard-walled, obovoid, *c.* 2.5 × 2 mm, glabrous at base, the summit and sides covered with a white dendritic-hairy indumentum and some sessile glands, 1–3-seeded. *Seeds* *c.* 2.2 × 1 mm, soft, white. (Figures 1D, 6)

*Other specimen examined.* WESTERN AUSTRALIA: [locality withheld] 27 Oct. 2000, *S. Black s.n.* (PERTH).

*Distribution and habitat.* Known from two widely separated collections, one from Turee Creek and the other collection from Killara Station, Western Australia: GAS, PIL. The former collection was from sandplain below a dune and the latter was recorded and on clay soils with *Eremophila*. (Figure 3)

*Phenology.* Flowers and fruits recorded in October.

*Conservation status.* Recently listed as Priority One under DEC Conservation Codes for Western Australian Flora. No precise localities are known for this taxon but additional populations are likely to be located as the two known records were probably made *c.* 300 km apart.

*Etymology.* Named after the first collector of the species, Andrew Mitchell, who has collected plants extensively in north-western Australia. His specimens are used for the types of both this species and *D. kumarinensis*.

*Affinities.* The species keys out with *Dicrastylis sessilifolia* Munir, which differs in having more hairy inflorescences with the bases of individual flowers, including the densely hairy calyx lobes, hidden by a dense white indumentum.

*Notes.* More collections are needed of this poorly known species. A fruit from *S. Black s.n.* (27 Oct. 2000) was used for the fruit measurements given in the description; it contained a single functional seed and also a small aborted seed. Fruits on the holotype were of a similar length but narrower, being *c.* 1.7 mm diam., and contained seeds *c.* 1.5 mm long that may have been immature. The larger measurements given above for the calyx and corolla were taken from the fruits.



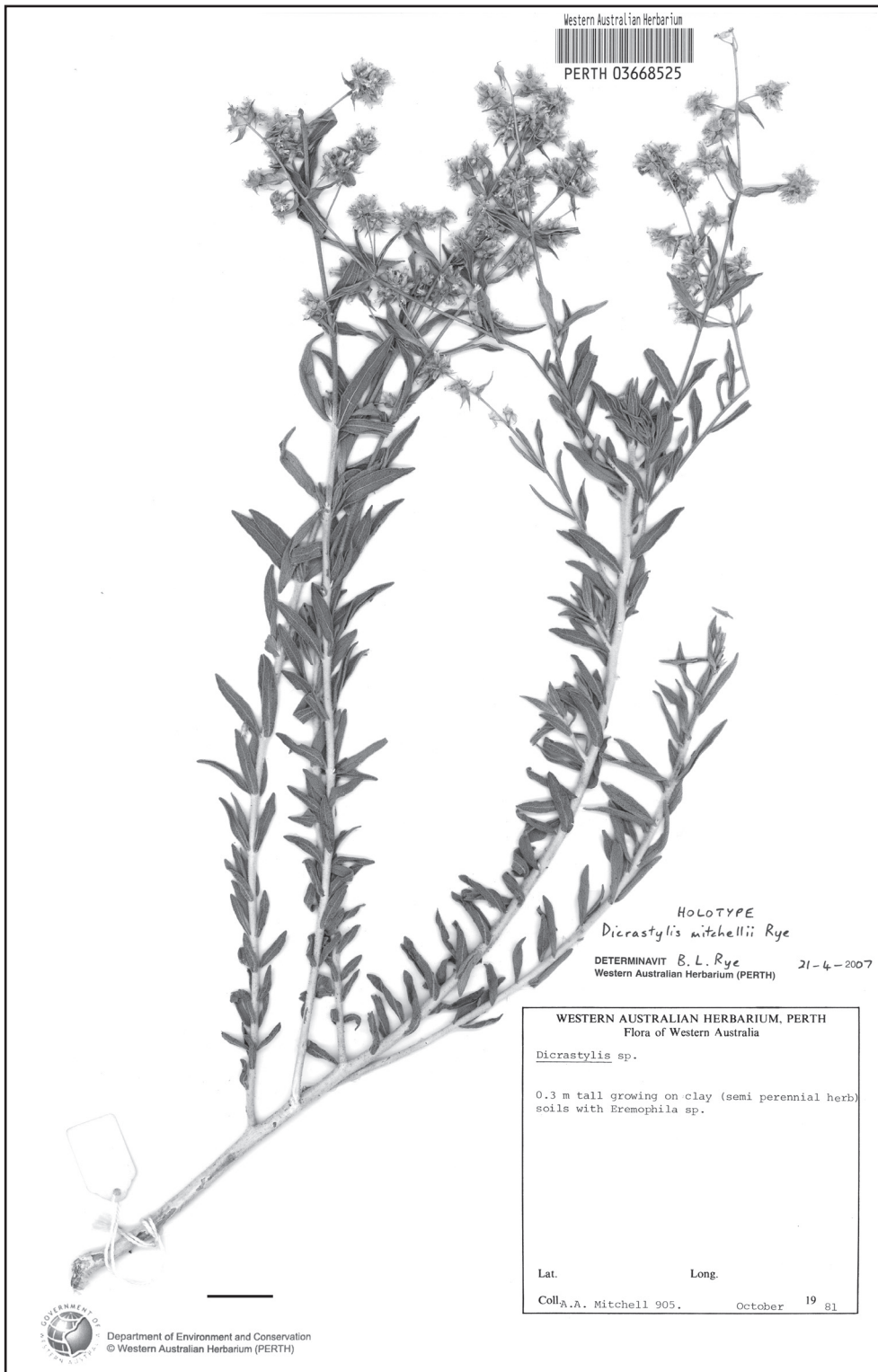


Figure 6. Holotype of *Dicrastylis mitchellii* (PERTH 03668525). Scale bar = 20 mm.

**Dicrastylis nicholasii** F. Muell., *Fragm.* 10: 15 (1876). *Type citation*: ad fontes eremi Victoria Springs. *Type*: Queen Victoria Springs, Western Australia, *J. Young s.n.* (*holo*: MEL 40890 *n.v.*, illustration seen).

*Illustration*. Munir (1978) p. 491, Figure 14.

*Shrub* c. 0.6 m high, with dendritic hairs up to 2 mm long forming a very dense white indumentum on the young stems and less densely arranged on the deep reddish axes and peduncles of the inflorescence. *Leaves* mostly opposite and decussate but some in whorls of three, sessile, narrowly ovate or narrowly elliptic-oblong, 10–18 × 3–6 mm, fairly densely dendritic-hairy at first; hairs with a patent stalk and horizontal branched portion. *Inflorescence* a raceme-like arrangement of long-pedunculate cymes, 70–130 mm long; lower peduncles 15–35 mm long; cymes 7-flowered, the flowers densely grouped into a globular head-like cluster 12–16 mm diam. *Flowers* 5-merous. *Calyx* 5–6 mm long, glabrous inside, densely covered outside by dendritic hairs up to 1.5 mm long; lobes narrowly triangular or very narrowly ovate, 4–5 mm long. *Corolla* probably blue; tube c. 5 mm long, glabrous outside on basal part and dendritic-hairy above especially below each of the lobes, glabrous inside on basal part and densely appressed-hairy above; lobes with a few long simple hairs inside, densely dendritic-hairy outside, the abaxial lobe c. 2.5 mm long and the others c. 1.5 mm long. *Stamens* distinctly exerted; filament 2.5–3 mm long, apparently dark blue; anther 1–1.3 mm long, apparently yellow inside and dark blue outside. *Style* prominently exerted, c. 8 mm long, the entire portion densely covered by dendritic hairs c. 0.5 mm long, with the dendritic hairs becoming fewer and shorter on basal part of each of the branches; branches c. 3 mm long in young flowers. *Fruit* not seen at maturity.

*Specimens examined*. WESTERN AUSTRALIA: [localities withheld] 13 May 2003, *S. Adriano s.n.* (PERTH); 17 Oct. 1986, *G.J. Keighery & J.J. Alford 771* (PERTH); 12 July 2006, *C. Slee 689-001* (PERTH).

*Distribution and habitat*. Extends from near Officer Basin south to near Queen Victoria Springs and Kanandah Station, Western Australia: GVD, NUL. Recorded on a slightly undulating plain, in red sandy loam over calcrete, in a low open mallee woodland.

*Phenology*. Flowers recorded in May, September and October, probably flowering sporadically in response to rain.

*Conservation status*. DEC Conservation Codes for Western Australian Flora: Priority Two (Atkins 2006). Known from three very old collections, two of which were made by Helms on the Elder Expedition of 1891, and three recent collections, with one location assumed to be in a conservation reserve.

*Affinities*. Very closely related to *Dicrastylis flexuosa*, both species having sessile leaves, a violet-blue corolla and long calyx lobes with a sufficiently sparse indumentum for their shape and green colour to be apparent. Other members of sect. *Pyramidatae* have shortly to long-petiolate leaves, a paler corolla and densely hairy calyx lobes. *Dicrastylis flexuosa* can be distinguished from *D. nicholasii* by the regular opposite and decussate arrangement of its cymes, often with very long internodes, up to 65 mm long, between the pairs of cymes. In *D. nicholasii* the long peduncles of the cymes of the lower axils give the inflorescence a more pyramidal structure and internodes are often shorter than the peduncles. While *Dicrastylis nicholasii* often has some of its leaves in whorls of three, *D. flexuosa* has its leaves regularly opposite. The two taxa also differ in distribution, with *D. nicholasii* occurring east of the known range of *D. flexuosa*, although there is so little distance between their known ranges that perhaps when they are better known they might prove to overlap slightly.

The southern variant of *Dicrastylis flexuosa*, which occurs close to the known range of *D. nicholasii*, is similar to *D. nicholasii* in its leaf size and shape, and in sometimes having the lowest flower heads distinctly pedunculate. However, the different arrangements of the cymes and the much longer peduncles in *D. nicholasii* suggest that it should be maintained as a distinct species. Certainly, present indications are that this taxon is distinct at least at the subspecific level.

*Notes.* Previously, *Dicrastylis nicholasii* was known only from three very old collections. A specimen collected in 1986 has increased the range of morphological variation now known for this priority taxon. Contrary to the description given by Munir, this specimen has one corolla lobe distinctly larger than the rest, stamens distinctly exerted and style branches largely glabrous, but these are characters that often differ between or within populations in other species of *Dicrastylis*. Corolla colour was recorded as “possibly white”, suggesting that it was not noted until after the specimen had been dried and the corolla colour had faded. The stamens and style have retained some deep blue colouring. Two other new collections do not have the flower colour recorded.

***Dicrastylis sessilifolia*** Munir, *Brunonia* 1: 552–556 (1978). *Type*: sandplain near Youanmi, Western Australia, 9 October 1939, *G.E. Brockway* 32 (*holo*: PERTH 01603604).

*Illustration.* Munir (1978) p. 555, Figure 29.

Description as given in Munir (1978: 554).

*Selected specimens examined.* WESTERN AUSTRALIA: De La Poer Range Nature Reserve, 18 Oct. 1996, *A. Chapman et al.* DLP 11 (PERTH); 25 km SW of Tandagee Homestead, 22 Aug. 1984, *T. Houston* 590-1 (PERTH); 31.7 km W of Agnew towards Sandstone, 26 Oct. 1996, *R. Schuh & G. Cassis* 96-19 (PERTH); 94 km N of Leonora towards Leinster, 8 Oct. 1985, *C.I. Stacey* 792 (PERTH); 103.7 km N of Rason Lakes road near Helms Lake, 5 Nov. 1993, *L. Sweedman* 2949 (PERTH).

*Distribution and habitat.* Endemic to Western Australia, extending from near Montague Range and Sandstone east to Lake Carnegie: GAS, GD, GVD, MUR. Occurs mainly in red sand on dunes or plains, commonly with spinifex.

*Phenology.* Flowers from August to November.

*Affinities.* See the affinities section under the related species *Dicrastylis mitchellii*. *Dicrastylis sessilifolia* is also closely related to *D. doranii* but differs in its longer calyx lobes.

*Notes.* Unlike all of the other Western Australian taxa listed above, no significant changes are needed for this species in its description or synonymy. However, new specimens, including those cited above, have significantly increased its known geographic range.

***Dicrastylis subterminalis*** Rye, *sp. nov.*

Folia sessilia, plerumque linearia ad marginem revoluta, pagina subta omni vel fere occulta supra sparse pilosa. Inflorescentia ex constans cymis paucis longe pedunculatis capituliformibus infra apicem foliosum positis. Flores 5-meri. Calyx pilis longis dendriticis aureis et glandibus numerosis dispersis ornatus. Corolla alba, lobis plus minusve glabris.

*Typus*: south of Schwerin Mural Crescent, Western Australia, 17 May 2000, D.J. Edinger 2128, B. Backhouse & G. Marsh (*holo*: PERTH 05696771; *iso*: AD, DNA, MEL, GRH).

*Dicrastylis* sp. Central Ranges (D.J. Edinger 2128, B. Backhouse & G. Marsh), Western Australian Herbarium, in FloraBase, <http://florabase.dec.wa.gov.au> [accessed May 2007].

*Shrub* small, height not recorded; young stems with a very dense appressed indumentum of dendritic hairs forming a continuous covering (but becoming less dense close to the flowering axils) and with scattered patent hairs *c.* 0.6 mm long protruding from the main cover, the patent hairs often with simple capitate lateral branches. *Leaves* irregularly arranged but most of them opposite or subopposite and decussate and a few in whorls of three, sessile, 9–15 × 1–2.5 mm, with revolute margins, mostly linear and with the margins more or less meeting below at midrib but a few leaves very narrowly ovate or very narrowly elliptic, their broader shape caused by the margins being partially separated and revealing a little of the sparsely hairy undersurface; undersurface with short dendritic hairs on the midrib and scattered longer patent simple or branched hairs and with numerous sessile glands in the regions on each side of the midvein; upper surface rugose (shallowly bullate or divided into slightly raised areas), green, with scattered long patent simple hairs and minute shortly stalked glandular hairs; longest hairs on upper surface, 0.6–0.8 mm long, multicellular, yellowish, with the apex often slightly swollen into a head or gland. *Inflorescence* of a few long-pedunculate cymes below a leafy apex; peduncles mostly 20–30 mm long; cymes dense, head-like, globular, 10–15 mm diam., commonly 7-flowered, possibly sometimes 5-flowered; basal bracts ovate, *c.* 4 mm long, with recurved ciliate margins. *Flowers* 5-merous. *Calyx* *c.* 4.5 mm long, very deeply divided into 5 lobes, with minute sessile or shortly stalked glands inside mostly near the base, otherwise glabrous inside, covered outside by numerous subsessile minute glands and scattered golden dendritic hairs up to 1.3 mm long; lobes narrowly triangular, *c.* 4 mm long. *Corolla* white, with long simple hairs in the throat; tube *c.* 5 mm long, more or less glabrous outside; lobes broadly ovate-triangular to more oblong-elliptic, *c.* 1.5 mm long. *Stamens* distinctly exerted; anther *c.* 1 mm long, apparently yellow inside and dark blue outside. *Style* exerted, deeply 2-branched, the unbranched part densely covered by dendritic hairs which become fewer and shorter on the branches; branches prominently exerted, with scattered dendritic hairs *c.* 0.4 mm long. *Fruit* not seen. (Figures 1E, 7)

*Selected specimens.* Only known from the type.

*Distribution and habitat.* Recorded from Schwerin Mural Crescent in the far inland of Western Australia: CR (Figure 3). The only known locality is in red sand by a creekline, with *Corymbia eremaea* and spinifex.

*Phenology.* Flowers recorded in May but the flowering time may be very variable if it is dependant on infrequent occurrences of rain.

*Conservation status.* Recently listed as Priority One under DEC Conservation Codes for Western Australian Flora. Known from a single population, where the species was described as being common. The species is known from a very remote area and no attempt has been made to survey it. Areas that should be searched for it include the adjacent Petermann Ranges of Northern Territory

*Etymology.* The epithet *subterminalis* refers to the subterminal position of the cymes on the branchlets.

*Affinities.* This is a very distinctive species with no obvious close relatives. In its inflorescence, *D. subterminalis* seems unique, and it also has more glabrous flowers than any other species. Overall,



Figure 7. Holotype of *Dicrastylis subterminalis* (PERTH 05696771). Scale bar = 20 mm.

it appears to have greatest affinities to the species group comprised of *Dicrastylis capitellata*, *D. flexuosa*, *D. lewellinii* and *D. nicholasii*. Its leaves are similar to those of *D. capitellata* in their shape and in the lack of a dense indumentum on their upper surface, but are more obviously sessile and are less densely hairy on the undersurface.

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