Diplolaena (Rutaceae), new taxa and nomenclatural notes

Paul G. Wilson[1], J.A. Armstrong[2], and E.A. Griffin[3]

[1] Western Australian Herbarium, Department of Conservation and Land Management, PO Box 104, Como, Western Australia 6152
[2]CITES Secretariat, 15 chemin des Anemones, Geneva, Switzerland
[3]Agriculture Western Australia, Baron-Hay Court, South Perth, Western Australia 6151

Abstract

Paul G. Wilson, J.A. Armstrong and E.A. Griffin. *Diplolaena* (Rutaceae), new taxa and nomenclatural notes. Nuytsia 12(1): 107-118 (1998). In preparation for an account of *Diplolaena* in "Flora of Australia" nomenclatural and taxonomic notes are presented. Seven new species are described: *D. cinerea* Paul G. Wilson, *D. eneabbensis, D. geraldtonensis, D. graniticola, D. leemaniana, D. mollis* and *D. obovata*. One new combination is made: *D. velutina* (Paul G. Wilson) Paul G. Wilson. A key to species is provided.

Introduction

A treatment of *Diplolaena* (Rutaceae) has been prepared for Volume 26 of the "Flora of Australia" and this paper is a precursor to it. The genus is endemic to south-west Western Australia. It has long been a problem to taxonomists, partly because of the lack of suitable characters for use in discriminating the taxa and partly because of the apparent merging of one species into another. A further difficulty lies in the uncertain application of some of the names that have been applied to the species.

Bentham (1863) recognized four species and one variety in *Diplolaena* but he observed that when better known the species might be found to "run too much into one another to be otherwise separated than as marked varieties". In making this observation he may have been influenced by Ferdinand Mueller who had annotated material he had sent to Bentham as varieties of *D. dampieri*. Some years later Mueller (1875) still recognized only *D. dampieri* in the genus and indicated that he was not able to discriminate the other species that had been distinguished by Bentham.

The conclusions reached by Mueller were supported by Diels & Pritzel (1904). However, Ostenfeld (1921) recognized the taxa listed by Bentham, but gave them a somewhat different circumscription; he also described an additional species, *D. andrewsii*.

Over the past seventy years, and particularly over the past twenty, there has been much additional collecting of *Diplolaena* material which has made possible a reassessment of its taxonomy. It is now apparent that 15 species can be recognized. Of these, five are fairly clearly demarcated, i.e. *D. andrewsii, D. angustifolia, D. dampieri, D. grandiflora,* and *D. obovata*. The remaining ten species exhibit

considerable variability. This variability, it would appear, is largely due to introgression between neighbouring species. Such introgression often characterizes bird-pollinated genera, with *Diplolaena* being one of the most spectacular examples of the syndrome in Rutaceae (Armstrong 1979, 1987).

As noted above, a difficulty encountered when classifying the *Diplolaena* taxa is the lack of clearly definable characters with which to discriminate them. The characters that are most useful are found in the leaves - their shape, size, texture, and indumentum - but not all of these characters are easy to define. Ostenfeld (1921) provided a key that relied heavily on hair type and abundance; however, as is apparent from his citation of specimens, Ostenfeld had what can now be seen to be a confused understanding of some taxa. The shape and indumentum of the outer involucral bracts is also useful in discriminating the taxa, but these characters are variable, even on involucres from the same plant, while the hairs themselves may be lost with age.

New taxa and taxonomic notes

Diplolaena R. Br. in Flinders, Voy. Terra Austr. 2: 546 (1814).

Type: Diplolaena dampiera Desf., lectotype here chosen.

Lectotypification. Robert Brown (1814), who described the genus *Diplolaena*, stated that he based his description on specimens gathered at Shark Bay on the expeditions of William Dampier and of Baudin. Dampier visited Shark Bay in 1699 and Baudin in 1801.

From an examination of photographs of the material present in herb. BM and herb. OXF it is apparent that Brown studied specimens from Geographe Bay collected by J.B.L.T. Leschenault de la Tour, a botanist on the Baudin expedition, as well as specimens from Shark Bay collected by Leschenault and Dampier. Evidently Leschenault confused his collecting localities and assigned his Geographe Bay collections of *Diplolaena* to Shark Bay (see also Desfontaine (1817) and Ostenfeld (1921)).

Brown's description was brief and informal: "I have ascertained that what appears to be calyx and corolla in this singular plant, are in fact a double Involucrum containing many decandrous flowers, whose Stamina and Pistilla exactly agree with those of the order, but of which the proper floral envelopes are reduced to a few irregularly placed scales". No species name was applied by Brown but it would appear that he assumed the material that he studied to be conspecific.

A photograph has been examined of the *Diplolaena* collection in herb. OXF that was gathered by W. Dampier at Shark Bay; it is of *D. grandiflora*. Photographs of three sheets of *Diplolaena* in herb. BM which contain material collected on the Baudin expedition have also been examined; all these sheets were presumably examined by Brown. They are as follows:

Sheet 1. This contains material collected on the Baudin expedition and material collected on an expedition under the command of Capt. King. There are neither locality details nor dates. All the specimens on this sheet are of *D. grandiflora* Desf.

Sheet 2. This sheet has a description of the plant attached to it and the locality data "cote ouest de la Nlle hollande iles de dorres Baie des chiens Marins 1801". Both the note and the description are apparently in Leschenault's handwriting. The sheet has been annotated "Diplolaena grandiflora

Desfont. in Mem. Mus. 3. p. 449. t. 19. Sharks Bay. M. Lechenault". The specimens on the sheet are all of *D. grandiflora* and are presumably isotypes of that name.

Sheet 3. This sheet has in Leschenault's handwriting the locality data "cote ouest de la Nlle hollande iles de dorres Baie des chiens marins 1801". It has been annotated "Diplolaena dampieri Desfont. Mem. Mus. 3. t. 20 exclud. syn. Dampieri quod ad praecedentem pertinet / Sharks bay. M. Leschenault". The note presumably refers to the comment by Desfontaines that the plant is the same as that mentioned by Dampier in "Terres Australes, vol.v, page 141, tab. 3, fig. 3, edit. francaise" which, of course, it is not. The three specimens on this sheet have been correctly identified and are presumably isotypes of *D. dampieri* Desf. Since this coastal species is only found on the south-west coast of Western Australia as far north as Perth it was presumably collected by Leschenault at Geographe Bay (the only south-west locality visited).

In order to be consistent with the typification given in recent literature we are lectotypifying the name *Diplolaena* on the lower right hand specimen of Sheet 3. The name of the lectotype of the genus therefore becomes *D. dampieri* which is the name indicated (prematurely) as type in Farr *et al.* (1979), in Chapman (1991), and in Greuter *et al.* (1993). This is in spite of the fact that the greater part of the material examined by Brown was of *D. grandiflora*. Since the two species are undoubtedly congeneric the choice of either species as lectotype makes no difference to the application of the name *Diplolaena*.

Key to species

1 Leaves linear to narrowly oblong, 2-6 cm long; margin recurved to revolute; inner involucral bracts 15-20 mm long (Wanneroo to Eneabba) ..... **D. angustifolia**

1: Leaves variously shaped but not linear, 1-6 cm long; margin if recurved then inner involucral bracts less than 12 mm long

2 Leaves elliptic to broadly elliptic, glabrous above when mature, densely tomentose below with a close pale indumentum, somewhat leathery

3 Outer involucral bracts broadly ovate, inner bracts ± equal to stamens (Geraldton to North West Cape) ..... **D. grandiflora**

3: Outer involucral bracts triangular to narrowly triangular, inner bracts much shorter than stamens

4 Leaves with a dense indumentum of minute stellate hairs; involucral bracts with a grey indumentum (Cape Leeuwin to Fremantle) ..... **D. dampieri**

4: Leaves with a dense indumentum of well-defined stellate hairs; involucral bracts with a rusty indumentum (Hutt River to Dongara) ..... **D. geraldtonensis**

2: Leaves variously shaped, pubescent above or if glabrous then not densely tomentose below, papery to leathery

5 Leaves sparsely stellate-pubescent above and below

6 Inner involucral bracts glabrous; leaves broadly cordate [1.5-4 cm long] (Darling Range near Perth) ..... **D. andrewsii**

6: Inner involucral bracts pubescent; leaves rounded to cuneate at base

7 Leaves obovate to broadly obovate, *c.* 1 cm long; involucral bracts rusty-pubescent (Green Head to Lancelin) ..... **D. obovata**

7: Leaves oblong-elliptic, mostly over 3 cm long, very thin, involucral bracts grey-pubescent (Darling Range) ..... **D. drummondii**

5: Leaves moderately to densely stellate-pubescent below, sparsely to densely so above

8 Leaves narrowly oblong-cuneate, 3-5 mm wide, often conduplicate; margin flat or slightly recurved (Coorow to Kondinin) ..... **D. velutina**

8: Leaves oblong to broadly elliptic, broadly obovate or circular, flat or rarely slightly conduplicate; margin not recurved

9 Leaves broadly elliptic to broadly obovate, to 2 cm long, firm, very densely tomentose above and below (Shark Bay to Kalbarri) ..... **D. mollis**

9: Leaves variously shaped, sparsely to moderately densely pubescent above

10 Leaves sparsely to moderately densely pubescent below

11 Leaves broadly oblong-elliptic, mostly 2-6 cm long, thin (Darling Range) ..... **D. drummondii**

11: Leaves elliptic to broadly elliptic, to 2 cm long, herbaceous

12 Leaf-indumentum loose, hairs *c.* 0.7 mm diam.; outer involucral bracts rusty (Walpole to Esperance) ..... **D. microcephala**

12: Leaf-indumentum loose or dense, hairs *c.* 0.3 mm diam.; outer bracts fawn or rarely rusty (Darling Range to Collie) ..... **D. graniticola**

10: Leaves densely pubescent below

13 Outer and inner involucral bracts with rusty red indumentum

14 Outer bracts very narrowly triangular; leaves glabrous and bright green above, somewhat leathery (Mingenew to Dandaragan) ..... **D. ferruginea**

14: Outer bracts ovate; leaves soft, sparsely pubescent and dull green above, papery (Eneabba area) ..... **D. eneabbensis**

13: Outer and inner bracts green or with grey to pale red indumentum

15 Leaves almost glabrous above, oblong-elliptic, flat, somewhat leathery (Hutt River to Dongara) ..... **D. geraldtonensis**

15: Leaves pubescent above, narrowly oblong to elliptic, broadly ovate, or broadly elliptic, papery

16 Outer bracts narrowly triangular to triangular; leaves narrowly oblong to oblong or elliptic, mostly 10-20 mm long, flat or folded, firm

17 Leaf-indumentum loose, hairs *c.* 0.7 mm diam.; outer involucral bracts rusty (Walpole to Esperance) ..... **D. microcephala**

17: Leaf-indumentum loose or moderately dense, hairs *c.* 0.3 mm diam.; outer involucral bracts fawn or rarely rusty (Darling Range to Collie) ..... **D. graniticola**

16: Outer bracts ovate to broadly ovate; leaves broadly ovate to broadly elliptic or circular, mostly 20-30 mm long, flat, soft, sparsely to moderately densely pubescent above

18 Leaves elliptic, with sessile stellate hairs above; outer bracts ovate, acute to acuminate, grey-pubescent (Mt Peron to Dandaragan) ..... **D. cinerea**

18: Leaves broadly ovate to circular, with stipitate stellate hairs above; outer bracts broadly ovate, obtuse, fawn-pubescent (Greenough to Jurien Bay) ..... **D. leemaniana**

Diplolaena angustifolia Hook., Bot. Mag. 70: sub tab. 4059 (1843). *Type:* Swan River Colony, Western Australia, *J. Drummond* 1st coll. no. 14 (*holo:* K).

Diplolaena salicifolia Bartl. in Endl., Pl. Preiss. 1: 173 (1844). *Type citation:* In calcareo-arenosis ad fluvium Cygnorum prope Freemantle, Woodman's point et in insula Rotenest 15. Aug. 1839. Herb. Preiss. No. 2020. *Type:* Western Australia, 15 August 1839, *L. Preiss* 2020 (*lecto:* LD; *isolecto:* GOET, MEL 232709, 232706, 232708 *p.p.*, 232707 *p.p.*, TCD [*L. Preiss* 528]), lectotype here chosen.

Diplolaena salicifolia var. *revoluta* Bartl., *loc. cit. Type: L. Preiss* 2020 (*lecto:* LD, *isolecto:* GOET, MEL 232709, 232706, 232708 *p.p.*, 232707 *p.p.*; TCD [*L. Preiss* 528], see note below), lectotype here chosen.

Typification. As indicated above, *Preiss* 2020 consists of specimens from three localities. The material was evidently mixed when Bartling studied it for he was not able to indicate from which of the localities the two varieties that he recognized came. Seven sheets of no. 2020 have been examined, four in MEL, one in GOET, one in LD, and one in TCD (as no. 528). The specimens consist of two taxa, one of which corresponds to the description of var. *revoluta* and is close to typical *D. angustifolia,* the other corresponds to the description of var. *cuneata* and is close to typical *D. dampieri, q.v.* However, material representing each of the varietal names appears to show some introgression between *D. angustifolia* and *D. dampieri.*

The name *D. salicifolia* var. *revoluta* is not illegitimate, even though it is lectotypified on the specimen that is also the lectotype of *D. salicifolia*, since at the time of publication no holotype of either name was indicated (see article 52.1 of the "International Code of Botanical Nomenclature", Greuter *et al.* 1994).

Diplolaena dampieri is recorded by recent collections from Rottnest Island, and from Woodman Point (10 km south of Fremantle) southwards to Cape Leeuwin whereas *Diplolaena angustifolia* is now known from about 20 km north of Fremantle north to Eneabba. It would appear probable that both species once grew near Fremantle (see note below) and that they there introgressed; it is also likely that the specimens represented in *Preiss* 2020 were collected from this variable population. However, recent collections from Woodman Point and Rottnest Island show no suggestion of such introgression.

It is interesting to note that James Drummond, in a letter to W.J. Hooker dated 14 October 1839, records that he and Preiss visited Rottnest Island shortly after the 3 August 1839. Here they observed what appears from his description to have been a species of *Diplolaena*, and which, according to Drummond, they also found "on the coast of the mainland". No Drummond collection that corresponds to any of the Preiss 2020 specimens has been found.

The specimen cited above from Trinity College, Dublin (TCD) has what is presumably an original Preiss label with a Preiss "field" collecting number 528 (see Lander 1988); it bears the following information:

Frutex 5-pedalis superbus floribus nutantibus. In calcareis umbrosis ad colliculum secundum fluvium Cygnorum haud longe ab oppido "Freemantle", prope "Woodman'spoint" nec non in Insula "Rottennest". Floret Aug. 15.39.

This information is different to the version cited by Bartling and explains the apparent intermediate nature of the type material, since the Swan River locality ("secundum fluvium Cygnorum") is intermediate between the present distributions of the two species, *D. dampieri* and *D. angustifolia.*

Diplolaena salicifolia is lectotypified so that it corresponds to *D. angustifolia* in the broad sense, for this is the manner in which the name was synonymized by both Bentham (1863) and Ostenfeld (1921); *Diplolaena salicifolia* var. *revoluta* is lectotypified so that it becomes a nomenclatural synonym of var. *salicifolia* while *Diplolaena salicifolia* var. *cuneata* is lectotypified so that it becomes a synonym of *D. dampieri*, *q.v.*, in the broad sense.

Diplolaena cinerea Paul G. Wilson, *sp. nov.*

Frutex ad 1.2 m altus. Folia elliptica, applanata, 2 - 3 cm longa, molliuscula, apice rotundato, basi late cuneata, supra sparse vel modice pubescentia, infra modice pubescentia vel velutina. Involucrum 2 cm diam.; bracteae exteriores ovatae acutae *c.* 10 mm longae griseo velutinae; bracteae interiores anguste ovatae bracteas exteriores aequantes vel paulo superantes. Stamina *c.* 15 mm longa, pallide aurantia.

Typus: Lesueur National Park, Western Australia, 12 September 1993, *W. Evans* 711 (*holo:* PERTH 04085981; *iso:* CANB, K, NSW).

Shrub to 1.2 m high. *Leaves* elliptic, flat, mostly 20-30 mm long, rounded at apex, broadly cuneate at base, soft, sparsely to moderately densely pubescent above with small sessile stellate hairs, moderately densely soft-pubescent to velvety below. *Flower heads c.* 2 cm diam.; outer bracts ovate, acute, *c.* 10 mm long, with a yellowish grey-velvety indumentum; inner bracts narrowly ovate, equal to or shortly exceeding outer bracts, pale grey-tomentose. *Petals* linear, membranous, woolly-ciliate, otherwise almost glabrous. *Stamens c.* 15 mm long, pale orange; anthers *c.* 1.5 mm long, pink.

Specimens examined. WESTERN AUSTRALIA: 40 km SSW of Eneabba, *R. Coveny* 3085 (NSW, PERTH); E from Mt Peron, *C.A. Gardner* 9437 (PERTH); 8 km N of Mt Lesueur, *E.A. Griffin* 2221 (PERTH); Cataby Road, W of Dandaragan, Western Australia, 12 Sept. 1988, *E.A. Griffin* 5069A (PERTH).

Distribution. Found near the west coast of Western Australia between Mt Peron and Dandaragan.

Habitat. On lateritic breakaways, in loamy soils, or in sand over sandstone.

Etymology. The epithet *cinerea* refers to the grey colour of the involucral bracts.

Notes. This species typically has a yellowish grey velutinous indumentum on the involucral bracts. The indumentum, and the softly puberulous leaves, help to distinguish it from *D. ferruginea* which grows in the same general area, but normally in different habitats.

Diplolaena dampieri Desf., Mem. Mus. Hist. Nat. 3: 452 t. 20 (1817). *Type:* "La terre d'Endracht" [i.e. Shark Bay area but probably actually Geographe Bay], Western Australia, 1801, *J. Leschenault* (*iso:* BM).

Diplolaena salicifolia var. *cuneata* Bartl. in Endl., Pl. Preiss. 1: 173 (1844). *Type:* (*lecto:* MEL 232707 right-hand specimen; *isolecto:* MEL 232708 *p.p.*), lectotype here chosen, see comment under *D. angustifolia*.

Notes. Leschenault, who was a naturalist on Baudin's expedition, collected in 1801 at Geographe Bay and Shark Bay. The type specimen of *D. dampieri* matches material collected in recent years from Geographe Bay but does not match any material of *Diplolaena* from Shark Bay. It is therefore evident that the locality data were incorrectly recorded.

Diplolaena drummondii (Benth.) Ostenf., Biol. Meddel. Kongel. Danske Vidensk. Selsk. 3/2: 80 (1921). - *D. microcephala* var. *drummondii* Benth., Fl. Austral. 1: 358 (1863). *Type citation:* Swan River, *Drummond*, 1843, n. 91; Phillips river, *Maxwell*. *Type: J. Drummond* 91 (*lecto:* K; *isolecto:* MEL 709185), lectotype here chosen.

Typification. The *Drummond* collection cited above corresponds to the plant that is found in the Darling Range in the Mundaring area and also near Collie. It grows in association with laterite.

Note. The excluded syntype, *Maxwell s.n.* from Phillips River (MEL 709140) is *D. microcephala, q.v.*

Diplolaena eneabbensis Paul G. Wilson, *sp. nov.*

Frutex ad 0.5 m altus. Folia elliptica, applanata, plerumque 20-25 mm longa, molliuscula, apice rotundato, basi cuneata, supra sparse pubescentia pilis parvis sessilibus, infra modice molliter pubescentia vel velutinosa. Involucrum *c.* 2 cm diam.; bracteae exteriores ovatae acutae, *c.* 13 mm longae, indumento molli-rubiginoso; bracteae interiores anguste ovatae exteriores paulo superantes.

Typus: 1.8 km north of Beekeepers Road, Eneabba, Western Australia, 22 September 1988, *J.J. Alford* 1208 (*holo:* PERTH 1678892; *iso:* CANB).

Shrub to 0.5 m high. *Leaves* elliptic, flat, mostly 20-25 mm long, rounded at apex, broadly cuneate at base, soft, very sparsely pubescent above with small weak sessile stellate hairs, moderately densely soft-pubescent to velvety below. *Flower heads c.* 2 cm diam.; outer bracts ovate, acute, *c.* 13 mm long, 5-6 mm wide in middle, with a soft reddish brown indumentum; inner bracts narrowly ovate, shortly exceeding outer bracts, reddish brown-tomentose. *Petals* linear, membranous, stellate-pubescent, *c.* 6 mm long. *Staminal filaments c.* 20 mm long, pink; anther *c.* 1.3 mm long, pink.

Specimens examined. WESTERN AUSTRALIA: First North Rd E of Eneabba, *B. & B. Backhouse* NS63 (PERTH); 2.5 km S of Greenhead turnoff on Brand Highway, *B. & B. Backhouse* NS74 (PERTH); 7 km ESE of Eneabba, *R.J. Cranfield* 8928 (PERTH).

Distribution. Only known from near Eneabba, south-west Western Australia.

Habitat. Shrubland on sand and gravel over laterite.

Etymology. The epithet is derived from the name of the town near where the species is found.

Notes. This species is intermediate in morphology between *D. ferruginea* and *D. cinerea*, both of which occur in the Eneabba area. It differs from *D. cinerea* most noticeably in having rusty red (not grey) involucral bracts, and from *D. ferruginea* in having broadly ovate (not narrowly triangular) outer bracts.

Diplolaena geraldtonensis Paul G. Wilson, *sp. nov.*

Frutex ad 1.5 m altus. Folia leviter coriacea, oblonga, 2.5-4 cm longa, apice rotundato, base cuneata, supra laevis, sparse vel modice pubescentia, subtus laxe velutina. Involucrum *c.* 1.5 cm diam.; bracteae exteriores trullatae vel anguste triangulares, 10-15 mm longae, cervicolores vel rubiginae; bracteae

interiores ovatae vel anguste oblongae, bracteas exteriores paulo superantes. Stamina *c.* 20 mm longa, pallido rubra.

Typus: 1.5 km north along Buller River Road, West Moresby Range, Western Australia, 22 August 1983, *R.J. Cranfield* 2766 (*holo:* PERTH 00914185).

Shrub to 1.5 m high. *Leaves* somewhat leathery; petiole 3-7 mm long; lamina oblong, mostly 2.5-4 cm long, apex rounded, base cuneate; upper surface smooth, sparsely to moderately densely pubescent with weak stellate hairs; lower surface loosely velvety, the outer hairs larger. *Flower heads* *c.* 15 mm diam.; outer bracts trullate to narrowly triangular, acute, 10-15 mm long, densely tomentose with fawn-coloured (to rusty) unthickened stellate hairs; inner bracts ovate to narrowly oblong, acute to long acuminate, slightly exceeding outer bracts, stellate-pubescent. *Petals* membranous, linear, *c.* 10 mm long, moderately densely stellate-pubescent. *Staminal filaments* *c.* 20 mm long, pale red, pilose in lower half; anther red, *c.* 1.3 mm long.

Specimens examined. WESTERN AUSTRALIA: 1 km S of Geraldton, *J.A. Armstrong* 7013 (PERTH); Burma Rd, *A.M. Ashby* 1511 (PERTH); Yandanooka, 1932, *A.M. Baird* (PERTH); Isseka, *J.V. Blockley* 686 (PERTH); Hutt River, *W.H. Butler* 17 (PERTH); 28 km S of Northampton, *R.J. Cranfield* 4068 (PERTH); Howatharra Hill Reserve, Moresby Range, *D. & N. McFarland* 1060 (PERTH).

Distribution. Occurs in south-western Western Australia near the west coast from Hutt River south to Dongara.

Habitat. In low shrubland in sand on gravel or laterite.

Etymology. This species is named after the town of Geraldton near where the plant is found.

Notes. A specimen collected *c.* 3 km south-east of Geraldton (*J.A. Armstrong* 7013) is intermediate between *D. geraldtonensis* and *D. grandiflora*; only the latter of these species was growing in the same vicinity.

Diplolaena graniticola Paul G. Wilson, *sp. nov.*

[*D. microcephala auct. non* Bartl. *sensu lectotypico:* Bartl., Pl. Preiss. 1: 173 (1844) *p.p.* as to syntype *L. Preiss* 2018].

Frutex ad 1.5 m altus. Folia chartacea; petiolus *c.* 5 mm longus; lamina applanata, elliptica vel late elliptica, plerumque 15-25 mm longa, apice rotundato, basi cuneata, pagina superiora pilis parvulis sparse pubescentia; pagina inferiora pilis parvulis modice pubescentia. Involucrum *c.* 15 mm diam.; bracteae exteriores anguste triangulares, 10-14 mm longae, virido- vel rubiginoso-pubescentiae. Stamina 20 mm longa, flava vel rubra.

Typus: Boyagin, Western Australia, 8 August 1979, *H. Demarz* 7396 (*holo:* PERTH 00919470).

Shrub to 1.5 m high. *Leaves* papery; petiole *c.* 5 mm long; lamina flat, elliptic to broadly elliptic, mostly 15-25 mm long, apex rounded, base cuneate; upper surface with sparse stellate indumentum of very small unthickened hairs; lower surface with a moderately dense stellate indumentum of small unthickened

hairs. *Flower heads c.* 15 mm diam.; outer bracts narrowly triangular, 10-14 mm long, pubescent with very small green or rusty stellate hairs; inner bracts narrowly triangular, slightly exceeding outer bracts, tomentose. *Petals* membranous, linear, *c.* 6 mm long, sparsely stellate-pubescent. *Staminal filaments* 20 mm long, yellow to red, pilose in lower half; anther red, 1-1.3 mm long.

Selection of specimens examined. WESTERN AUSTRALIA: 15 km SE of Dale, *D.E. Albrecht* 4156 (MEL, PERTH); 2 miles [3.2 km] W of Wagin, *K. Newbey* 1281 (PERTH); Tutanning, 9 Aug. 1966, *S. James* (PERTH).

Distribution. Western Australia, east of Perth in the Darling Range from Mt Observation south to Wagin and Collie.

Habitat. Recorded as predominantly growing on or around granite outcrops.

Etymology. The specific epithet refers to the preferred habitat of this species.

Notes. Diplolaena graniticola grades to the east into *D. velutina* and to the west into *D. drummondii*, while to the south it appears to merge into *D. microcephala*. These four species could be regarded as infraspecific taxa of *D. microcephala*.

Diplolaena leemaniana Paul G. Wilson, *sp. nov.*

Frutex effusus ad 0.7 m altus. Folia late ovata vel late elliptica vel circularis, 20 x 16 mm - 35 x 25 mm, ad apicem et basim rotundata, mollia, supra sparse vel modice pubescentia trichomis stipitatis instructa, subtus molliter pubescentia vel velutina. Involucrum *c.* 2 cm diam.; bracteae exteriores late ovatae, obtusae, *c.* 10 mm longae, indumento cervicolore; bracteae interiores ovatae vel late ovatae, bracteas exteriores aequantes vel paulo superantes. Stamina 15-20 mm longa, pallido rubra.

Typus: South Arrowsmith River, Cliff Head turnoff, Western Australia, 7 September 1969, *A.C. Burns* 117 (*holo:* PERTH 00920002).

Spreading *shrub* to 0.7 m high. *Leaves* somewhat flaccid, broadly ovate or broadly elliptic to circular, flat, mostly 20-35 mm x 16-25 mm, rounded at apex and base, soft, sparsely to moderately densely pubescent above when mature with stipitate stellate hairs, moderately densely soft-pubescent to velvety below. *Flower heads c.* 2 cm diam.; outer bracts broadly ovate, obtuse, *c.* 10 mm long, with a fawn indumentum and a few large rusty brown stellate hairs; inner bracts ovate to broadly ovate, equal to or shortly exceeding outer bracts, grey- to rusty-stellate-tomentose; innermost bracts red, sparsely pubescent. *Petals* linear, membranous, woolly-ciliate, otherwise almost glabrous. *Staminal filaments* 15-20 mm long, pale red; anther *c.* 1.5 mm long, pink.

Selected specimens examined. WESTERN AUSTRALIA: 5 km S along road to Cliff Head from Brand Highway, *D.E. Albrecht* 4187 (PERTH); South Dongara, *N.H. Speck s.n.* (PERTH); 8 km SW of Greenough, *G.J. Keighery* 5172 (PERTH); Jurien Bay to Green Head, *M.E. Phillips* 021820 (PERTH).

Distribution. South-western Western Australia near the west coast between Greenough and Jurien Bay.

Habitat. Coastal, in sand over limestone.

Etymology. The specific epithet is derived from the township of Leeman which is near the centre of the distribution of the species.

Notes. This species may be recognized by the broadly elliptic to circular leaves, their somewhat flaccid texture, and their soft indumentum. It may also be distinguished by the stipitate stellate hairs that form the covering to the leaves' upper surface, for the leaves of most species of *Diplolaena* have an indumentum with an inner layer of sessile stellate hairs and an outer layer of larger stipitate hairs, whereas in *D. leemaniana* only stipitate hairs are present.

Diplolaena microcephala Bartl. in Lehmann, Pl. Preiss. 1: 173 (1844). *Type citation:* In littore rupestri arenoso inter frutices densos promontorii Cape Riche 20. Nov. 1840. Herb. Preiss. No. 2019, nec non in montosis glareosis sterilibus districtus Grantham m. Mart. 1841. No. 2018. *Type:* Cape Riche, Western Australia, 20 November 1840, *L. Preiss* 2019 (*lecto:* MEL 709201), lectotype here designated.

[*D. microcephala* var. *drummondii auct. non* Benth. *sensu lectotypico*: Benth., Fl. Austral. 1: 358 (1963) *p.p.*, as to "Phillips river, *Maxwell*" (MEL 709140)].

Distribution. Found from near Walpole east to Esperance near the south coast of Western Australia.

Habitat. This species occurs principally along streams.

Notes. The excluded syntype of *Diplolaena microcephala*, *L. Preiss* 2018, is here referred to *D. graniticola.*

Diplolaena mollis Paul G. Wilson, *sp. nov.*

Frutex ad 2 m altus. Folia late elliptica vel late obovata, 1-2 cm longa, apice rotundato, basi late cuneata, utrinque velutina. Involucrum 15-20 mm diam.; bracteae exteriores ovatae vel anguste ovatae, 6-10 mm longae, dense rubiginoso-velutinae; interiores late ovatae vel anguste oblongae, acutae, longitudine bracteas exteriores aequantes vel paulo superantes. Stamina 15-20 mm longa, rubra.

Typus: 1 km south of Kalbarri, Western Australia, 6 May 1968, *Paul G. Wilson* 6559 (*holo:* PERTH 00922161; *iso:* CANB, K).

Shrub to 2 m high. *Leaves* leathery; petiole 3-6 mm long; lamina flat, broadly elliptic to broadly obovate, mostly 1-2 cm long, apex rounded, base cuneate, both sides with a close but very dense fawn velvety indumentum of small weak stellate hairs. *Flower heads* 15-20 mm diam.; outer bracts ovate, 6-10 mm long, densely velvety with small stellate hairs; inner bracts broadly ovate to narrowly oblong, acute, shortly exceeding outer bracts, densely stellate-hairy; innermost bracts narrowly oblong, thin, almost glabrous. *Petals* linear, *c.* 7 mm long, woolly-stellate to glabrous. *Staminal filaments* 15-20 mm long, pilose towards base, deep red; anther 1-1.4 mm long, red.

Selected specimens examined. WESTERN AUSTRALIA: Eagle Gorge, 6 km S of Red Bluff, *J.A. Armstrong* 7011 (PERTH); 40 km NE of Kalbarri, 20 May 1968, *J. Bannister* (PERTH); Cooloomia Nature Reserve, *S.D. Hopper* 1364 (PERTH); Murchison River, 20 Sep. 1948, *C. Morrison & D.C. Serventy* (PERTH); South Hamelin, Sep. 1953, *N.H. Speck* (PERTH); Dirk Hartog Island, *A.S. George* 11526 (PERTH); 20 miles [32 km] SSE of Tamala Homestead, *A.S. George* 9593 (PERTH).

Distribution. Western Australia, on or near the west coast from Shark Bay south to Kalbarri.

Habitat. Growing in sand over limestone in low shrubland.

Etymology. The specific epithet refers to the soft texture of the leaves.

Notes. Diplolaena mollis may be distinguished from other members of the genus by the shape of the leaves and by the close velvety indumentum which covers both surfaces. It is found in the same area as *D. grandiflora* and the two occasionally hybridize.

Diplolaena obovata Paul G. Wilson, *sp. nov.*

Frutex erectus ad 80 cm altus. Folia chartacea, late ovata, praecipue 6-12 mm longa, apice rotundato, basi cuneata, utrinque sparse stellata. Involucrum *c.* 10 mm diam.; bracteae exteriores late ovatae, *c.* 6 mm longae, rubiginosae; bracteae interiores rubiginosae late ovatae bracteas exteriores paulo superantes. Stamina *c.* 15 mm longa, viridia vel flava.

Typus: Ocean Farm, Lancelin, Western Australia, 10 June 1981, *R.J. Cranfield* 1688 (*holo:* PERTH 922676).

Small erect *shrub* 20-80 cm high. *Leaves* papery; petiole 3-5 mm long; lamina broadly obovate, mostly 6-12 mm long, apex rounded, base cuneate; upper and lower surfaces with a sparsely stellate indumentum of even-sized hairs. *Flower heads c.* 10 mm diam.; outer bracts broadly ovate, *c.* 6 mm long, rusty-pubescent with unthickened stellate hairs; inner bracts broadly ovate, slightly exceeding outer bracts, rusty-stellate-pubescent. *Petals* membranous, linear, *c.* 9 mm long, moderately densely stellate-pubescent. *Staminal filaments c.* 15 mm long, green to yellow, pilose in lower half; anther red, *c.* 0.9 mm long.

Specimens examined. WESTERN AUSTRALIA: 11 km NE of Cervantes, *A.H. Burbidge* 3905 (PERTH); 5 km along Jurien Bay road to Jurien Bay, *H. Demarz* 108 (PERTH); 4 km from Seabird, *E.A. Griffin* 5697 (PERTH); Lancelin, 24 May 1966, *M. Barrow* (PERTH); 4 miles [6.4 km] from Jurien Bay, *J.S. Beard* 7812 (PERTH); Mt Lesueur Reserve, *E.A. Griffin* 4175 (PERTH); Cockleshell Gully flats, *C.A. Gardner* 8417 (PERTH).

Distribution. Occurs in south-west Western Australia from Green Head south to Lancelin about 5 km inland of the west coast.

Habitat. Grows in shallow sand over limestone.

Etymology. The specific epithet refers to the shape of the leaves.

Notes. Diplolaena obovata closely resembles *D. microcephala* (a south coastal species), particularly in the sizes of the leaves and involucres. It differs most markedly in its leaf shape (broadly obovate rather than elliptic) and in its sparse indumentum.

Diplolaena velutina (Paul G. Wilson) Paul G. Wilson, *stat. nov.*

D. microcephala var. *velutina* Paul G. Wilson, Nuytsia 1:198(1971). *Type:* 2 miles [3.2 km] north of Wyalkatchem, Western Australia, 30 June 1959, *T.E.H. Aplin* 509 (*holo:* PERTH 01636146)

Notes. This species occurs in inland south-western Western Australia from near Coorow south-east to near Kondinin. It has generally been recorded as growing on or around granite hills. As is noted above, in the Darling Range area it grades to the west into *D. graniticola,* while towards its northern limit, near Watheroo, it grades into *D. ferruginea* and into *D. cinerea.*

Acknowledgements

Laurie Jessup, while the Australian Botanical Liaison Officer, provided photographs of the *Diplolaena* material at the BM that was studied by Robert Brown. David Mabberley (herb. OXF) provided photographs of the specimens collected by William Dampier in Western Australia. The herbaria GOET, LD, MEL, and TCD generously arranged for the loan of type material. This work was partly funded by a grant from the Australian Biological Resources Study.

References

Armstrong, J.A. (1979). Biotic pollination mechanisms in the Australian flora - a review. New Zealand J. Bot. 17: 467-508.

Armstrong, J.A. (1987). Floral syndromes as generic determinants. Proceedings of the Boden Conference on "The systematic status of large flowering plant genera". Australian Systematic Botany Society Newsletter 53: 54-59.

Bentham, G. (1863). "Flora Australiensis." Vol. 1. (Reeve: London.)

Brown, R. (1814). General remarks, geographical and systematical, on the botany of Terra Australis. *In:* Flinders, M. "Voyage to Terra Australis." Vol. 2, app. III. (London.)

Chapman, A.D. (1991). "Australian Plant Name Index." Vol. 2. Australian Flora and Fauna Series no. 13. (Australian Government Service: Canberra.)

Desfontaines, R.L. (1817). Description du genre *Diplolaena.* Mem. Mus. Hist. Nat. 3: 449-453, t. 19, 20.

Diels, L. & Pritzel, E. (1904-5). Fragmenta phytographiae Australiae occidentalis. Bot. Jahrb. Syst. 35: 55-662.

Farr, E.R., Leussink, J.A. & Stafleu, F.A. (1979). "Index Nominum Genericorum (Plantarum)." (Bohn, Scheltema & Holkema: Utrecht.)

Greuter, W. *et al.* (eds). (1993). "Names in Current Use for Extant Plant Genera." (Koeltz: Königstein.)

Greuter, W. *et al.* (eds). (1994). "International Code of Botanical Nomenclature." (Koeltz: Königstein.)

Lander, N. (1987). Asteraceae specimens collected by Johann August Ludwig Preiss. Kingia 1: 9-19.

Mueller, F. (1875). "Fragmenta Phytographiae Australiae." Vol. 9. pp. 1-216. (Government Printer: Melbourne.)

Ostenfeld, C.E.H. (1921). Contributions to West Australian Botany, III. Biol. Meddel. Kongel. Danske Vidensk. Selsk. 3/2: 1-114.