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Drummondita billyacatting (Rutaceae), a new, range-restricted species from Western Australia

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Abstract

Shelton, L.R.J. & Thiele, K.R. *Drummondita billyacatting* (Rutaceae), a new, range-restricted species from Western Australia. *Nuytsia* 33: 19–27 (2022). The new species *Drummondita billyacatting* L.R.J.Shelton & K.R.Thiele is described for a taxon previously phrase-named as *D.* sp. Trayning (A.M. George 97), which is narrowly endemic to Billyacatting Hill in the Western Australian wheatbelt. The new species is morphologically readily separable from the widespread *D. hassellii* (F.Muell.) Paul G.Wilson and the morphologically rather similar *D. longifolia* (Paul G.Wilson) Paul G.Wilson. A key is provided to all species of *Drummondita* Harv. (Rutaceae).

Introduction

Drummondita Harv. (Rutaceae) is a small genus of shrubs, mostly endemic to the wheatbelt and adjacent semi-arid regions of south-western Western Australia. Exceptions are *D. calida* (F.Muell.) Paul G.Wilson, which occurs on southern Cape York Peninsula in Queensland, and *D. borealis* Duretto, which occurs in the Top End of the Northern Territory (Duretto, 2018). Of the Western Australian species, *D. hassellii* (F.Muell.) Paul G.Wilson is geographically and ecologically widespread in the eastern wheatbelt, while most of the remainder are more restricted. Four Western Australian species (*D. ericoides* Harv., *D. longifolia* (Paul G.Wilson) Paul G.Wilson, *D. rubriviridis* R.A.Meissn. and *D. wilsonii* Mollemans) are endemic to single peaks or range systems (Mollemans 1993; Wilson 1998; Stack *et al.* 2004; Meissner & Markey 2007).

Wilson (1971) reinstated *Drummondita* as distinct from *Philotheca* Rudge, within which it had been subsumed by Mueller (1869). Bayly (2001) supported the monophyly of *Drummondita* but not of *Philotheca* (Bayly *et al.* 2013).

This paper provides a morphometric analysis of the Western Australian phrase-named species *Drummondita* sp. Trayning (A.M. George 97) in comparison with *D. hassellii* and *D. longifolia*, and describes it as new. *Drummondita longifolia* is a former variety of the widespread *D. hassellii* (Wilson 1998), with Wilson (2013) commenting on similarity between *D.* sp. Trayning and *D. longifolia*.

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Methods

Seventy specimens (51 specimens from the Western Australian Herbarium and 19 field collections) were assessed and measured for this analysis. The herbarium specimens included 39 *D. hassellii*, six *D. longifolia*, three *D.* sp. Trayning and three specimens undetermined at species rank, filed as *Drummondita sp*. A population sample of 19 flowering shoots of *D.* sp. Trayning was collected from Billyacatting Hill to augment the limited available herbarium material. These were pressed and dried to ensure that their measurements would be comparable with herbarium specimens.

Only herbarium specimens with more than three available flowers were measured (because measurement of some floral characters required dissection after rehydration). Three visually average leaves and one flower were measured from each specimen. Leaves were measured dry, while flowers were rehydrated via submergence in a beaker of boiling water with a drop of dish soap for one minute. Leaf measurements were averaged. Characters measured are given in Table 1.

Table 1. Characters measured and assessed. Characters marked with an asterisk were removed from the analysis due to auto-correlations with flower length.

Code	Character	State	Type
1	Ciliate hairs on stems	(0) Absent; (1) sparse (mostly glabrous, with few hairs on some young branchlets); (2) frequent (mostly evenly distributed across all branches)	Multistate
2	Leaf length	Measured (in mm) from base of petiole to tip of leaf mucro	Continuous
3	Leaf width	Measured (in mm) across leaf blade at widest point	Continuous
4	Petiole length	Measured (in mm) from point of connection with stem to thickening or angling of leaf blade	Continuous
5	Orientation of leaf apex	(0) Straight; (1) inclined	Binary
6	Leaf papilla size	(0) Small (<0.8 mm^2); (1) medium (approximately 0.8 mm^2); (2) large (>0.8 mm^2)	Multistate
7	Leaf shape	(0) Obovate; (1) linear	Binary
8	Leaf base	(0) Cuneate; (1) obtuse	Binary
9	Cilia hairs on leaf margins	(0) Absent; (1) sparse (mostly glabrous with occasional hairs); (2) frequent (mostly evenly distributed along margin)	Multistate
10	Leaf mucro length	Measured (in mm) from translucent section of leaf apex to tip	Continuous
11	Leaf mucro pubescence	(0) Absent; (1) present	Binary
12	Leaf mucro curvature	(0) Curved; (1) not curved	Binary
13	Flower length	Measured (in mm) from base of receptacle to tip of exerted stigma	Continuous
14	Flower width	Measured (in mm) across perianth at widest point	Continuous
15	Sepal length	Measured (in mm) from insertion of sepals on the receptacle, to apex	Continuous
16	Sepal width	Measured (in mm) across sepals at widest point	Continuous
17	Ciliate hairs on sepal margins	(0) Absent; (1) sparse (mostly glabrous with occasional hairs); (2) frequent (mostly evenly distributed along margin)	Multistate

Code	Character	State	Type
18	Petal length*	Measured (in mm) from base to apex	Continuous
19	Petal width	Measured (in mm) across widest point	Continuous
20	Ciliate hairs on petal margins	(0) Absent; (1) sparse (mostly glabrous with occasional hairs); (2) frequent (mostly evenly distributed along margin)	Multistate
21	Stamen filament length*	Measured (in mm) from insertion of filament to base of anther	Continuous
22	Anther length	Measured (in mm) from apex of filament to apex of anther	Continuous
23	Anther width	Measured (in mm) across widest point	Continuous
24	Style length*	Measured (in mm) from point of connection with ovary to base of stigma	Continuous
25	Ciliate hairs on style	(0) Absent; (1) present	Multistate
26	Stigma length	Measured (in mm) from the point at which the stigma widens	Continuous
27	Stigma width	Measured (in mm) across widest diameter	Continuous

Data were analysed using Primer 6.1 (Clarke & Gorley 2006). Auto-correlations between characters were assessed using Draftsman's plots, and logically related characters with correlations >0.8 were reduced to a single character. A resemblance matrix using all remaining characters was constructed using the Gower metric (Gower 1971). Samples were ordinated using non-metric Multi-Dimensional Scaling (nMDS) with 25 restarts and Kruskal fit scheme 1, and classified using the agglomerative unweighted pair group method with arithmetic mean (UPGMA). A similarity percentages breakdown (SIMPER) procedure (Clarke & Gorley 2006) was undertaken with square root transformed data to determine which variables contributed most to the dissimilarity between samples.

Results

Three characters (petal length, staminal filament length and style length) were removed from the dataset because they were highly correlated with flower length. Both the UPGMA classification and two-dimensional nMDS ordination (stress=0.13) showed clear morphological separation between *Drummondita* sp. Trayning, *D. hassellii* and *D. longifolia* (Figure 1). *Drummondita* sp. Trayning and *D. longifolia* are morphologically close, clustering at 80% similarity. The field-collected samples from Billyacatting Hill clearly clustered with the herbarium samples of *D.* sp. Trayning, adding substantial variation within that cluster. The herbarium specimens determined as *D.* sp. were clearly assignable to *D. hassellii*. A wide range of characters were correlated with the separation of the three taxa along the main axis of the ordination (Figure 1). Leaf characters contributed most to the separation of *D. hassellii* from *D.* sp. Trayning and *D. longifolia* in the classification (Table 2), while leaf length and flower size contributed most to the separation of *D.* sp. Trayning from *D. longifolia* (Table 3).

Table 2. Characters contributing to the separation of *D. hassellii* from *D.* sp. Trayning and *D. longifolia.*

Code	Character	Contribution (%)	Cumulative contribution (%)
2	Leaf length	12.93	12.93
9	Cilia hairs on leaf margins	10.04	22.97
5	Orientation of leaf apex	9.25	32.22
11	Leaf mucro pubescence	7.11	39.33

Code	Character	Contribution (%)	Cumulative contribution (%)
12	Leaf mucro curvature	6.58	45.91
1	Ciliate hairs on stems	6.32	52.23

Table 3. Characters contributing to the separation of *D.* sp. Trayning and *D. longifolia.*

Code	Character	Contribution (%)	Cumulative contribution (%)
2	Leaf length	15.19	15.19
13	Flower length	9.87	25.06
16	Sepal width	9.38	34.44
12	Leaf mucro curvature	8.75	43.19
15	Sepal length	8.45	51.64

Some morphological variation is evident within the widespread *D. hassellii*, with four groups discernible at the 80% similarity level in the nMDS classification (Figure 1), one comprising the single specimen PERTH 00960683 (*J. Dodd* 225) from the eastern end of Lake Deborah West, one comprising the two specimens PERTH 00958034 and PERTH 06015298 (*N.N. Donner* 4592 and *S. Donaldson* & *G. Flowers* SD 1353 respectively) from near Merredin and west of Bullfinch, one comprising the three specimens PERTH 08420009, PERTH 05399378 and PERTH 00958077 (*G. Brockman* GGB 2485, *J. Buegge* E 26 and *C.A. Gardner* 2763 respectively) from south of Forrestania, between Bruce Rock and Cramphorne, and near Campion, and the last comprising all remaining samples. None of these groups is geographically, ecologically or morphologically consistent. The analysis recovered no discernible pattern within *D. hassellii* that would indicate that it should be split into further taxa.

Discussion

The morphometric analysis indicated that *Drummondita* sp. Trayning is distinct from, and morphologically intermediate between, *D. hassellii* and *D. longifolia*, with both analyses placing it closer to the latter than the former. *Drummondita longifolia* is endemic on Peak Charles, while *D.* sp. Trayning is endemic on Billyacatting Hill; the distance between these is *c.* 360 km, with *D. hassellii* common and widespread in the areas between.

In addition to the characters measured for the analysis, *Drummondita* sp. Trayning has a distinctive bark, leaf colour, and pattern of scars on the stems (see key and Taxonomy section below). These characters were not included in the morphometric analysis as they are difficult to quantify, but they remain useful for delineating *D*. sp. Trayning. Given its distinctiveness and ready separation from both *D. hassellii* and *D. longifolia*, we recognise *D.* sp. Trayning as a distinct species, described here as *D. billyacatting* L.R.J.Shelton & K.R.Thiele.

The formal recognition of *D. billyacatting* adds a further species in the genus that is endemic to a single hill, outcrop or range. A well-resolved and species-complete phylogeny and biogeographic analysis of *Drummondita* is currently lacking. The genus may be an example of progressive speciation of narrowly endemic specialised taxa from a widespread and ecologically rather generalised taxon (*D. hassellii*). The relationships between the two northern Australian species, *D. calida* and *D. borealis*, and the Western Australian species may provide useful insights into the biogeographic history of Australia.

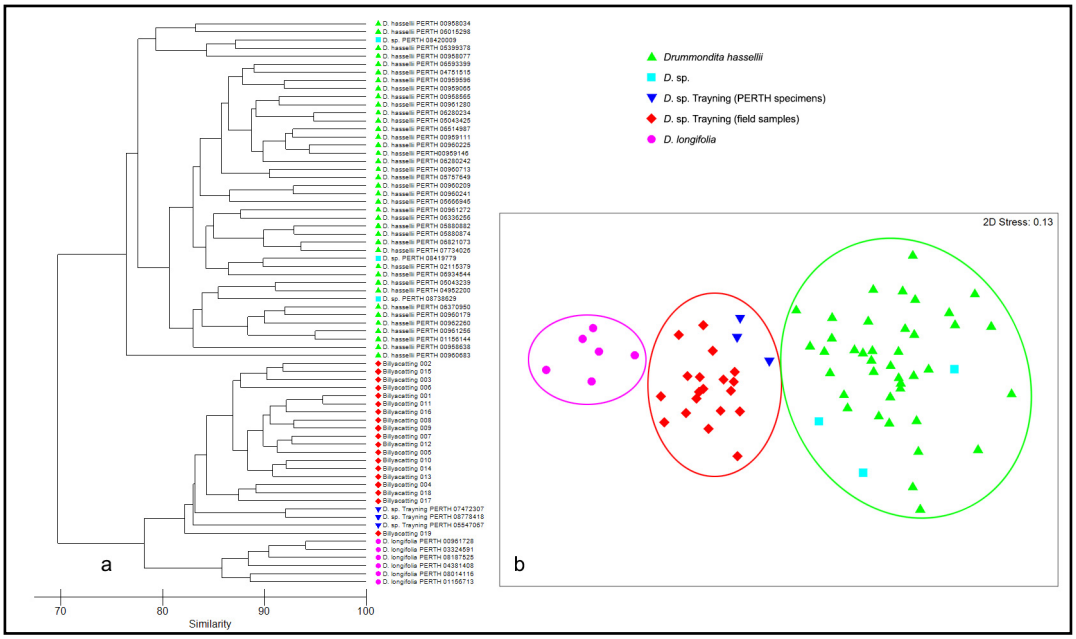

Figure 1. UPGMA classification (left) and nMDS ordination (right) of samples of *Drummondita hassellii* (▲), *D.* sp. Trayning (PERTH specimens ▼; field samples ◆), *D. longifolia* (●) and three undetermined specimens at PERTH (*D.* sp.) (■).

Key to species of *Drummondita*

(Modified from Wilson 2013)

1. Fully developed leaves > 14 mm long (rarely down to 8.5 mm), acuminate or the apex rounded with a short mucro.

2. Flowers pedicellate ..... **D. borealis**

2: Flowers sessile.

3. Sepals 4.5–6 mm long ..... **D. billyacatting**

3: Sepals: 6–9 mm long.

4. Branchlets with sparse translucent cilia, without dark stipular excrescences; Western Australia. ..... **D. longifolia**

4: Branchlets with or without translucent cilia, with dark stipular excrescences; Queensland..... **D. calida**

1: Fully developed leaves < 12 mm long or if longer then with a rounded apex lacking a mucro (Western Australia)

5. Leaves 10–15 mm long with rounded apex; sepals minutely tomentose ..... **D. miniata**

5: Leaves to 12 mm long; sepals glabrous or ciliate (rarely hispidulous in *D. hassellii*)

6. Branchlets initially appressed-puberulous; sepals glandular-verrucose.

7. Leaves ascending ..... **D. ericoides**

7: Leaves spreading..... **D. rubriviridis**

6: Branchlets glabrous or sparsely puberulous; sepals not or scarcely glandular-verrucose.

8. Flowers in terminal clusters of 1–3, shortly pedicellate ..... **D. wilsonii**

8: Flowers solitary, sessile or shortly pedicellate.

9. Leaves sessile; sepals with raised fleshy ridge in centre ..... **D. microphylla**

9: Leaves with a short (c. 0.4 mm) erect petiole; sepals various.

10. Leaves 3–12 mm long, apiculate ..... **D. hassellii**

10: Leaves 2–3.2 (–3.6) mm long, minutely apiculate ..... **D. fulva**

Taxonomy

Drummondita billyacatting L.R.J.Shelton & K.R.Thiele, *sp. nov.*

Type: Billyacatting Hill, NE of Kununoppin, Western Australia [precise locality withheld for conservation reasons], 2 September 1976, *A.M. George* 97 (*holo*: PERTH 05547067).

Drummondita sp. Trayning (A.M. George 97) Western Australian Herbarium, in *Florabase*, https://florabase.dpaw.wa.gov.au/ [accessed 27 March 2021].

Shrubs to 70 cm high. *Branchlets* erect, cream-coloured when young, verrucose and sparsely puberulous, resinous (particularly in leaf axils of young growth and especially those of leaves subtending flowers). *Leaves* shortly petiolate, alternate, scattered becoming crowded at tips of stems, linear, (8.5–) 14.5–20 mm long, 0.6–1.9 mm wide, papillate with pronounced oil glands, glabrous or sometimes sparsely puberulous near tip or margin; apex with a short, usually curved and often pubescent mucro 0.2–0.8 mm long; base cuneate, stipular excrescences absent. *Bracteoles* absent. *Flowers* 1–3 per branch at apex, sessile, 13–21.2 mm long, *c.* 4–5.5 mm wide. *Sepals* broadly elliptic, 4.5–6 mm long, *c.* 2.5–4.2 mm wide, coriaceous, resinous, yellow and/or green sometimes with red tips, glabrous except for marginal cilia. *Petals* constricted below middle, oblong, *c.* 11.4–14.5 mm long, 2.5–4 mm wide, yellow below, dark red towards apex, with scattered oil glands, glabrous except for marginal cilia (especially prevalent at apex). *Stamens* 5, exceeding the petals, alternating with 5 staminodes; *filaments* united for ¾ of length, with the free portion dark red, *c.* 11.5–19 mm long, pilose-sericeous (densely so towards the apex and with a very dense ring of hairs present just above the line of the ovary on the inside); *anthers* dorsifixed, apiculate, included within filaments, 2.5–4 mm long. *Ovary* of 5 free carpels, subglobose, *c.* 1.3–1.5 mm high, 1.8–2 mm wide, glabrous; *style* slender, *c.* 12–18 mm long, glabrous; *stigma* exerted, *c.* 0.3–0.7 mm long, 0.5–1 mm wide, subglobular-disciform. *Seeds* glossy, dark brown, reniform, with a cream-coloured aril. (Figure 2)

Diagnostic features. Drummondita billyacatting may be distinguished from all other members of the genus by the combination of pale cream-coloured bark, light yellowish-green leaves with translucent mucronate apices, and yellow flowers (the petals sometimes red-tipped).

Other specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 13 Jun. 2006 *W. Johnston* WJ 17 (PERTH); 31 Aug. 2014 *K.R. Thiele* 5087 (PERTH).

Phenology. Flowers in August and September

Distribution and habitat. Known only from Billyacatting Hill, which is *c.* 16 km NE of Kununoppin and 417 m above sea level (Figure 3) (Chapman 1981). Billyacatting Hill Nature Reserve comprises

Figure 2. *Drummondita billyacatting* (left; *K.R. Thiele* 5807) and *D. hassellii* (right; *K.R. Thiele* 4487).

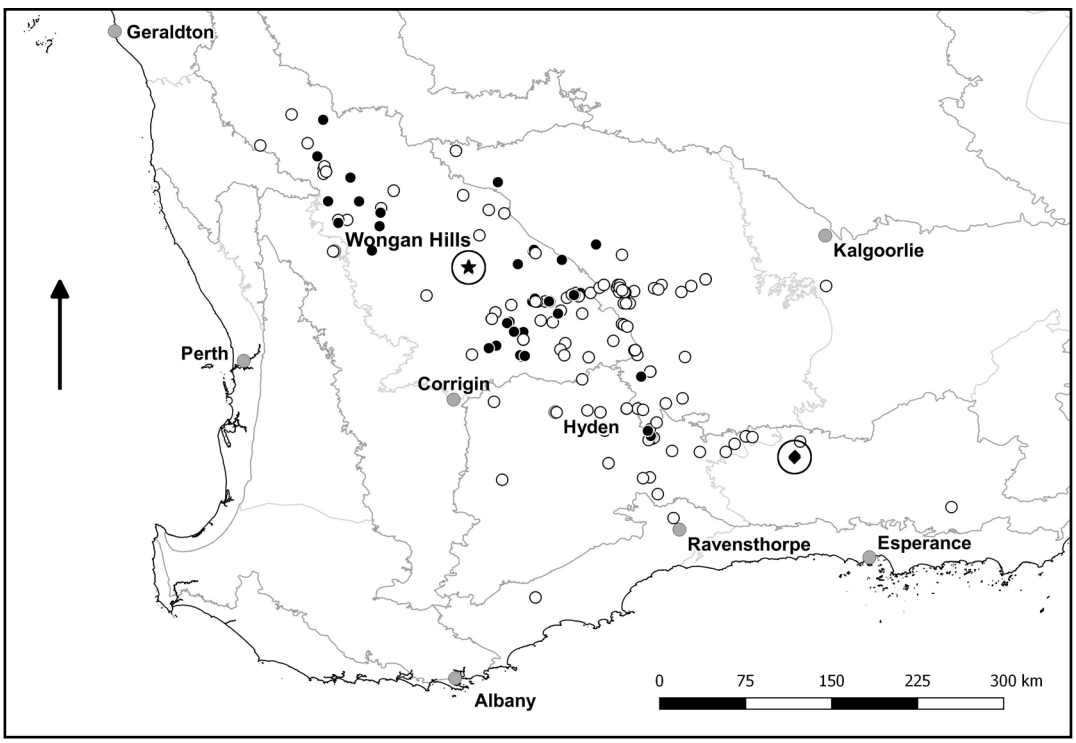

Figure 3. Distribution of *Drummondita billyacatting* (★, circled), *D. longifolia* (◆, circled) and *D. hassellii* (● specimens used in the analysis, ○ other specimens).

2075 ha., with approx. 66% being outcropping granite (Chapman 1981). The vegetation is dominated by species of *Melaleuca*, *Acacia*, *Allocasuarina*, *Eucalyptus*, *Dodonaea*, *Lepidosperma*, *Calothamnus* and *Borya* (Muir 1981). *Drummondita billyacatting* grows in cracks and patches of shallow soil within lithic vegetation complexes below the main peak; given the amount of outcropping granite in the reserve it may be locally more widespread than collections indicate.

Conservation status. Listed as Priority Two under Conservation Codes for Western Australian Flora (Western Australian Herbarium 1998–), as *D.* sp. Trayning (A.M. George 97).

Etymology. The epithet is derived from the name Billyacatting and is used as a noun in apposition. 'Billyacatting' in turn is an indigenous place name in the Noongar language, possibly derived from *bilya* or *beliar* (water or river), *kat* (hill) and *-ing* (place of).

Notes. *Drummondita billyacatting* is most similar to *D. longifolia* (a threatened species known only from Peak Charles), but has smaller flowers and shorter leaves, both intermediate between those of *D. longifolia* and *D. hassellii.* Frequency of mucro curvature is also intermediate with *D. longifolia* (mostly curved mucros) and *D. hassellii* (mostly straight mucros). It differs from *D. hassellii* most noticeably in having pale yellowish green and widely spaced leaves (dark green and crowded in *D. hassellii*), and cream-coloured bark on young branchlets (bark grey to brown in *D. hassellii*). Petals of plants at Billyacatting Hill vary from all-yellow to yellow with red tips of varying length; in all other respects plants with these two flower colours are identical, and the colours are scattered in the population. Red-tipped petals have been observed on young and old flowers and are therefore not the product of senescence.

Acknowledgements

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