Drummondita wilsonii, *Philotheca langei* and *P. basistyla* (Rutaceae), new species from south-west Western Australia

F.H. Mollemans

76-6228 Plumeria Road, Kailua-Kona, Hawaii, 96740 USA
[Current address: PO Box 734, Victoria Park, Western Australia 6100]

Abstract

Mollemans, F.H. *Drummondita wilsonii*, *Philotheca langei* and *P. basistyla* (Rutaceae), new species from south-west Western Australia. Nuytsia 9(1): 95-109 (1993). One new species of *Drummondita* and two new species of *Philotheca* are described. All three taxa are apparently rare, each restricted to limited geographic areas. *Drummondita wilsonii* is similar to *D. ericoides*, but has unequal calyx segments in common with *D. miniata*. *Philotheca langei* and *P. basistyla* both have affinities with *Eriostemon falcatus* which is currently presumed extinct. Similarities between *D. wilsonii*, *D. ericoides* and *D. miniata*, pollination mechanisms and flower colour variation in *Drummondita*, distribution and flowering time of the *D. ericoides* group (which includes *D. miniata* and *D. wilsonii*) and the evolutionary history of the *Drummondita ericoides* group, *D. hassellii* group and *D. calida* are discussed.

Introduction

During 1990, three new species were collected, two of which were initially considered to be ecotypic variants of *Eriostemon falcatus* P.G. Wilson, a taxon which is currently presumed extinct. The third, an opportunistic collection of a "pink" flowered *Drummondita 'hassellii'* pointed out by my wife Nellie as being unusual, was made, while searching for a rare *Banksia* in an area north of known occurrences.

Detailed examination of all three taxa found that one of the species of *Eriostemon* was monadelphous, making it referable to *Philotheca*. The other *Eriostemon*, belonging to sect. *Nigrostipulae* (P.G. Wilson 1970), is also referred here to *Philotheca* in keeping with the intention of Armstrong in Wilson (1992) to transfer all species of *Eriostemon* sect. *Nigrostipulae* to that genus. The *Drummondita* was found to be morphologically similar to *D. ericoides* and *D. miniata*.

Additional collections were subsequently made by the author and the following descriptions are based on this material.

Taxonomy

Drummondita Harvey

Drummondita wilsonii F.H. Mollemans, sp. nov. (Figures 1 & 4)

Distinguitur folia aggregatus secus ramulo et flores color; calycis segmenta inaequalia et glaber; statura non robustus. Morphologia similitudo *Drummondita ericoides* et *D. miniata*.

Typus: W.A. Wheatbelt (eastern), Parker Range South, East of Skeleton Rocks (precise locality withheld), alt. 450 m., 15th June 1990, *F.H. Mollemans* 2761 (holo: PERTH; iso: BISH). (Figure 1)

Shrubs 40 cm to 1 m tall, erect, branching, ericoid. *Leaves* green, crowded, linear-clavate, semi-terete, channelled above, 2-6 mm long and 0.6-1 mm wide, with scattered glands, a large, black apical gland, and a petiole to 0.5 mm. *Flowers* 1-3, tubular to 1.5 cm long, terminal. *Calyx segments* unequal, oblong, 4-5 mm long, 2-2.5 mm wide, with scattered glands; green with reddish margins, glabrous outside, minute marginal hairs, inside glabrous. *Petals* oblong-ovate, 12 mm long, 3 mm wide, with scattered glands; reddish fading to green at base, glabrous inside and outside. *Stamens* pink, densely hairy in upper one-third. *Ovary* obtuse. *Seed* 3.5 mm long, dark brown-black.

Other specimens examined. WESTERN AUSTRALIA: W.A. Wheatbelt (eastern), Parker Range South, East of Skeleton Rocks, alt. 450 m., frequency fairly common, 14th July 1990, *F.H. & M.P. Mollemans* 3143, 3144, 3155, 3157, 3158, 3159 (PERTH); W.A. Wheatbelt, Parker Range South, alt. 450 m., frequency (locally) fairly common - 5 seen, 18th October 1990, *F.H. & M.P. Mollemans* 3717 (PERTH).

Distribution. Endemic to the boundary zone of the Avon and Coolgardie Botanical Districts of Western Australia, with one known area of occurrence on a low range located 75 km south-south-east of Southern Cross, Yilgarn Shire, on vacant crown land.

Habitat. Found in (*Eucalyptus* spp.) mallee to 4 m over *Hakea -Melaleuca -Grevillea* scrub to 1.5-3 m and heath to 1.2-1.5 m on part of the east-north-east facing slope of Parker Range South. Geology is quartzitic (silicified sandstone) as boulder, cobble, pebble and gravel outcrop, bordered up-slope (to west) by outcropping volcanics and down-slope (to east) by aeolian sands, with erosional gullies to the north and south. Soils are pale yellow to yellow olive-brown sands of a skeletal nature with gravel, pebbles and ± cobbles of quartzose and ferruginous rock fragments and minimal organic matter. *D. wilsonii* does not occur on the volcanics and is replaced down-slope by *Drummondita hassellii* on the aeolian sands.

Flowering period. Observed for June to July, but probably commenced May as flowering well underway in mid-June, and extends to at least August as the species was fruiting in October.

Affinities. Drummondita wilsonii is morphologically similar to both *D. ericoides* and *D. miniata*. Each has similar flowers and leaves with a large terminal gland. *D. wilsonii* differs from *D. ericoides* in the 1-3 terminal flowers and unequal calyx segments, characters which it shares with *Drummondita miniata*. *D. ericoides* differs from both species in possessing leaves with apical glands which are sometimes pointed. *D. miniata* has the largest flowers with woolly tomentose calyces and the largest leaves, which are more openly arranged and crowded towards branch apices. *D. ericoides* has a similar

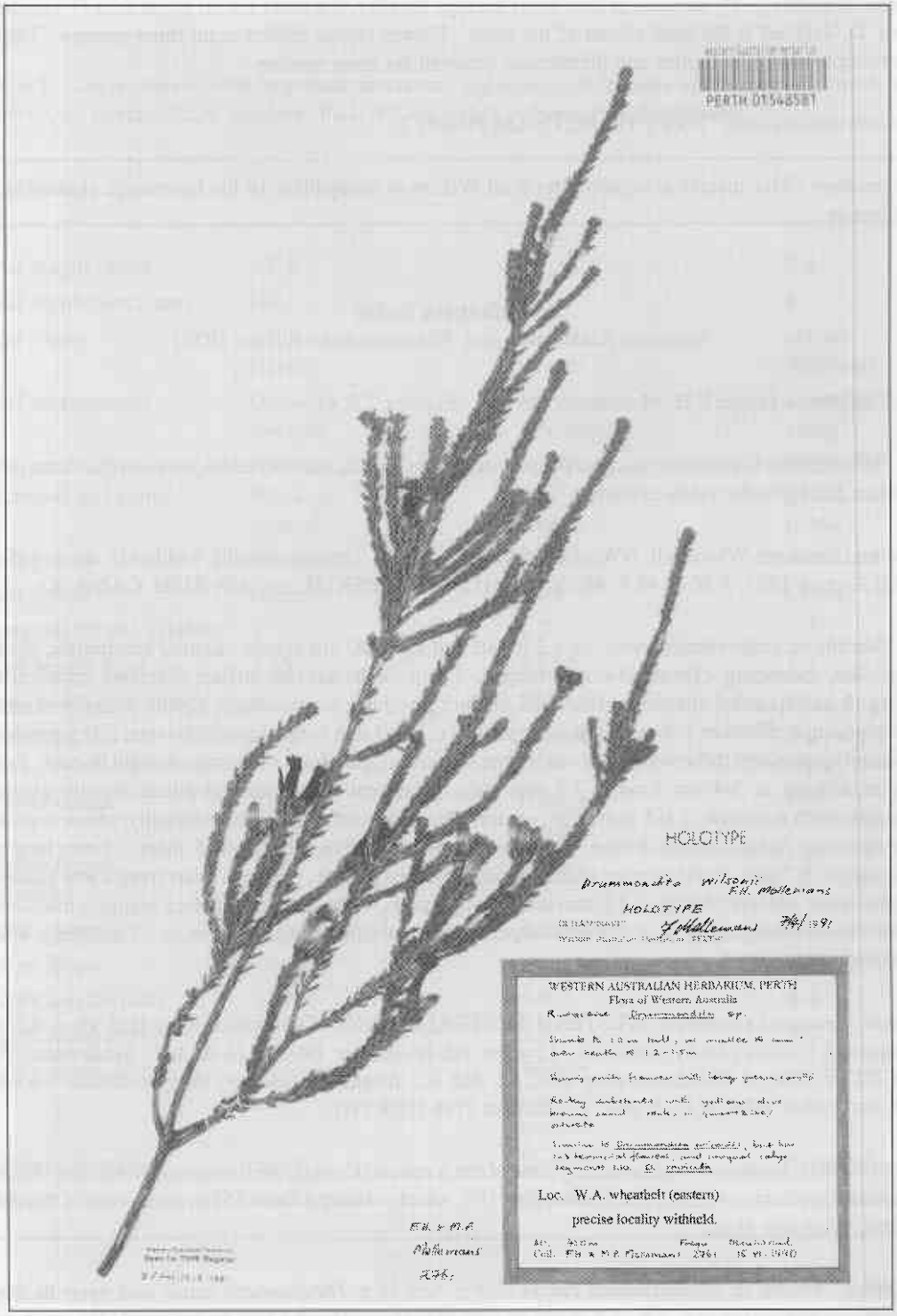

Figure 1. *Drummondita wilsonii* F.H. Mollemans - Holotype (*F.H. & M.P. Mollemans* 2761)

leaf arrangement to that of *D. miniata*, while *D. wilsonii* has leaves which are densely crowded along entire branchlets. *D. miniata*, at least from the type locality, is a more robust shrub than *D. ericoides*, and *D. wilsonii* is the least robust of the three. Flower colour differs in all three species. Table 1 summarises the similarities and differences between the three species.

Conservation status. Poorly known, CALM Priority 1.

Etymology. The species is named after Paul Wilson in recognition of his taxonomic studies of the Rutaceae.

Philotheca Rudge

(includes *Eriostemon* sect. *Nigrostipulae* - Wilson 1970)

1. Philotheca langei F.H. Mollemans, sp. nov. (Figures 2 & 4)

Distinguitur *Eriostemon falcatus* per parvus, ovatus sepala; parvus petalis; stamina filamenta paene glabra; folia glandis valde exsertis.

Typus: Northern Wheatbelt, NW of Chiddarcooping Hill (precise locality withheld), alt. c. 465 m., 25th August 1991, *F.H. & M.P. Mollemans* 4127 (holo: PERTH; iso: AD, BISH, CANB, K).

Shrubs or *undershrubs*, erect, to 1.2 m tall and up to 60 cm across. *Leaves* exstipulate, shortly petiolate, ascending, clavate, 4-6 mm long, c. 1 mm thick; adaxial surface flattened, canaliculate; margins and rounded abaxial surface with distinct glandular verrucosities, glands strongly exserted; apex pointed. *Flowers* 1-3, terminal, on a pedicel c. 2.5-3 mm long. *Sepals* obovate, c. 0.5 mm long; minutely pubescent, otherwise glabrous; centre thickened, glandular verrucose; margin flaccid. *Petals* white, elliptic, c. 3-4 mm long, 2-2.2 mm wide, pubescent inside, margin pilose, mostly glabrous outside, with a narrow, c. 0.5 mm wide, central glandular-verrucose band externally which is pink at the apex and fades to white at base. *Staminal filaments* 10, free, alternately 5 short c. 3 mm long and 5 longer c. 3.5 mm, terete at apex to marginally flattened at base, glabrous apart from a few scattered apical hairs; *anthers* oblong, c. 1.0 mm long, orange-pink, white-apiculate, pollen orange-pink. *Ovary* glabrous, of acute, narrowly pyramidal carpels. *Style* glabrous. *Seed* reniform, c. 1.8 mm long, black, minutely reticulate-foveate.

Other specimens examined. WESTERN AUSTRALIA: NNE of Chiddarcooping Hill, alt. c. 427 m., frequency (locally) fairly common - 12 seen, 7th November 1990, *F.H. & M.P. Mollemans* 3776 (PERTH); NW of Chiddarcooping Hill, alt. 465 m., frequency (locally) fairly common - 6 seen, 8th November 1990, *F.H. & M.P. Mollemans* 3796 (PERTH).

Distribution. Endemic to the boundary zone of the Avon and Coolgardie Botanical Districts of Western Australia, occurring north of Chiddarcooping Hill, which is located about 45 km north-west of Southern Cross, Westonia Shire.

Habitat. Found in *Allocasuarina campestris* ± *Acacia* ± *Thryptomene* scrub and open to dense shrubland vegetation to c. 1.8 - 2.8 m tall on pale orange sand over a similar coloured clay crust, near flat granite or amongst granite boulders.

Table 1. Comparison of some important taxonomic and ecological features of *Drummondita ericoides* Harvey, *D. miniata* (C.A. Gardner) P.G. Wilson and *D. wilsonii* F.H. Mollemans.

Character	*D. ericoides*	*D. miniata*	*D. wilsonii*
Leaf length (mm)	4.5-8.5	8.5-16	2-6
Leaf width max (mm)	0.9	1-1.5	1
Leaf shape	± falcate slender	± falcate slender	clavate thickened
Leaf arrangement	Crowded towards apices	Crowded at branch apices	Crowded along entire stem
Terminal leaf gland	Black, ± pointed	Red, round	Black, round
Leaf glands	Scattered	Scattered	Abundant
Leaf colour	Green	Grey	Green
Terminal flower number	1	1-3	1-3
Petal length (cm)	1.35	1.85-2	1.2
Petal width max (mm)	6	5.5	3
Branching	Erect	Divaricate	Very rigid erect
Flower colour	Yellow	Orange-cinnibar	Red
Flower length (ex style)	1.6	2.5-3.1	1.5
Plant stature	Semi-robust	Robust	Slender
Calyx shape	Obovate	Obovate	Oblong
Calyx length (mm)	3	5-6	4-5
Calyx width (mm)	3	3.5	2-2.5
Calyx pubescence	Glabrous	Woolly tomentose outside	Glabrous
Calyx segments	Equal	Unequal	Unequal
Habitat	Rocky peak	Granite	Sandstone

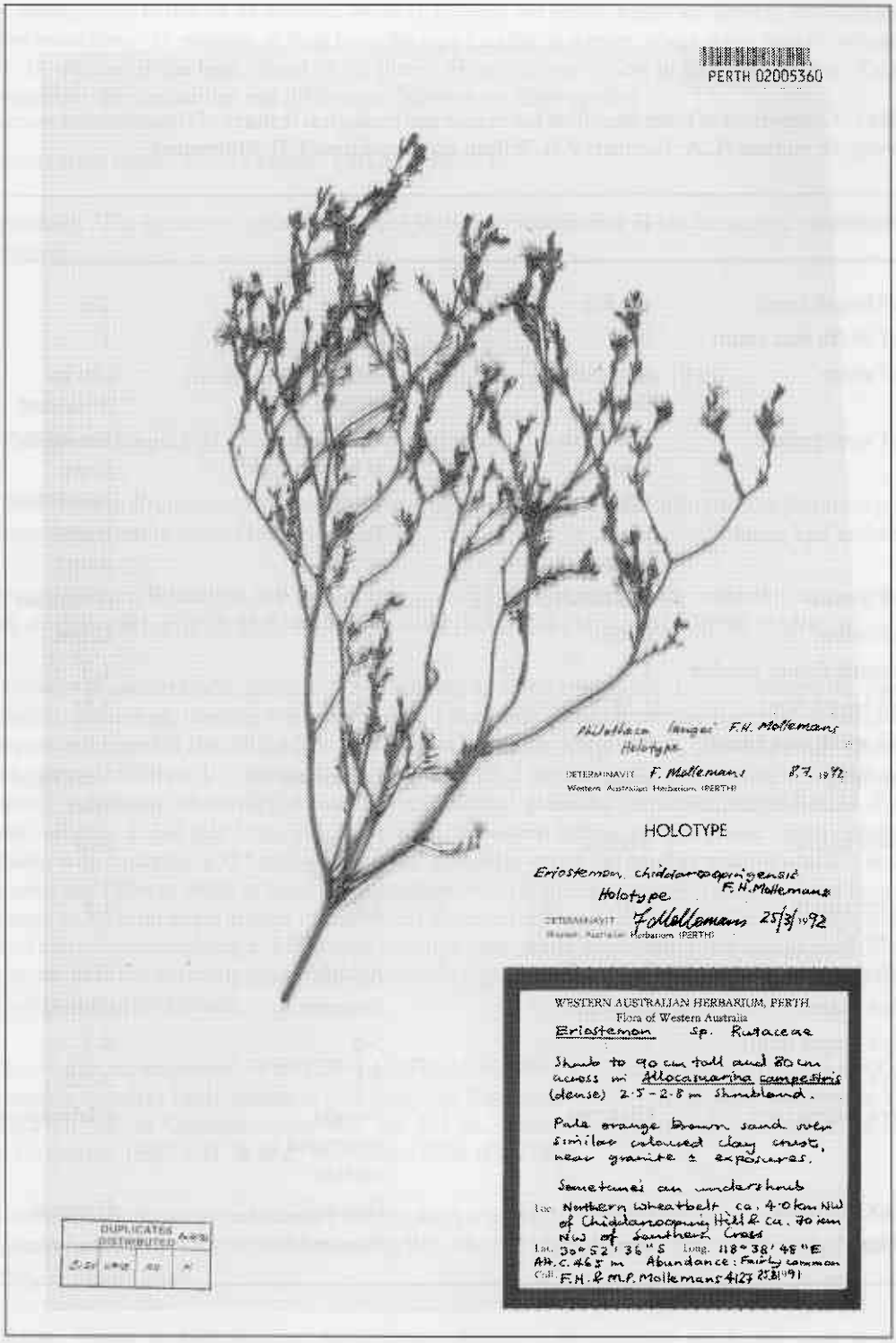

Figure 2. *Philotheca langei* F.H. Mollemans - Holotype (*F.H. & M.P. Mollemans* 4127)

Flowering period. August-October.

Fruiting period. November.

Affinities. Philotheca langei is morphologically similar to *E. falcatus,* each possessing abundant glands on branchlets, similarly shaped leaves and white-apiculate anthers, in common. *Philotheca langei* differs from *E. falcatus* in the smaller, ovate sepals, the smaller petals, the nearly glabrous staminal filaments and the strongly exserted leaf glands. The virtual absence (apart from the few at the apex) of hairs on the staminal filaments of *Philotheca langei* are an important distinguishing character. The petals of *Philotheca langei* are unusual in lacking a stalk (out-growth at the base of the petal) by which it is attached; *P. basistyla,* for example, possesses such a stalk. Table 2 summarises the important taxonomic and ecological features of *Philotheca langei* F.H. Mollemans, *E. falcatus* P. G. Wilson and *Philotheca basistyla* F.H. Mollemans.

The present taxon is referable to *Eriostemon* sect. *Nigrostipulae* (Wilson 1970), but all species in that section are being transferred to *Philotheca* (e.g. Wilson 1992). The species described here is therefore being placed in *Philotheca* in anticipation of the general transfer of other species in sect. *Nigrostipulae* to that genus.

Conservation status. Poorly known, CALM Priority 1.

Etymology. The species is named in honour of Dr Robert T. (Bob) Lange for his untiring efforts in rangelands ecology and palaeobotany in Australia, a mentor of some of Australia's leading botanists and my Honours supervisor at the University of Adelaide in 1981.

2. Philotheca basistyla F.H. Mollemans, sp. nov. (Figures 3 & 4)

Distinguitur *Eriostemon falcatus* per glandulosa-verrucosa absens ramulis; stamina filamenta connatus ille basalis dimidium ad formatus tubus, superus liber filum teretia, dense pilosus; folia longa; multo parvus sepala; parvus petalis; stylus (ubi immaturus) basalis expansus (pyriformis) supra punctum exaffixus cum ovarium et contractus versus ad angustus supra stylus, decrescens ut stylus maturus.

Typus: Trayning District, SSE of Trayning, 180 km east of Perth, (precise locality withheld), alt. 290 m., 25th August 1991, *F.H. & M.P. Mollemans* 4126 (holo: PERTH; iso: BISH).

Much-branched, spreading *shrubs* or *undershrubs*, to 1 m tall and up to 80 cm across. *Leaves* exstipulate, shortly petiolate; lamina slender-clavate, ascending, c. 7-14 mm long, up to c. 1-1.5 mm thick (when fresh), adaxial surface grooved in the lower half, abaxial surface with distinct glandular verrucosities but glands not strongly exserted, apex rounded. *Flowers* solitary, terminal, on a peduncle c. 0.5-1.5 mm long. *Sepals* triangular, c. 0.5-1 mm long; margin flaccid, minutely pubescent otherwise glabrous; centre thickened, glandular-verrucose. *Petals* white, elliptic c. 6(6.5) mm long, petiolate, glabrous outside, pubescent within, hairs longer centrally, an outer c. 1 mm broad thickened midrib, glandular-verrucose, pink at the apex fading to white at the base. *Staminal filaments* 10, alternately 5 c. 3 mm long and 5 c. 3.5 mm, fused in the basal half to form a tube, upper free filaments terete, densely pilose; *anthers* peltate, oblong, c. 0.5 mm long, pollen white. *Ovary* glabrous, obtuse carpels form a depressed cavity which contains the expanded style base. *Style* (when immature) basally expanded

Table 2. Comparison of some important taxonomic and ecological features of *Philotheca langei* F.H. Mollemans, *E. falcatus* P.G. Wilson and *Philotheca basistyla* F.H. Mollemans.

Character	*P. langei*	*E. falcatus*	*P. basistyla*
Plant stature/branching	Erect	Short, much-branched	Spreading, much-branched
Leaf length (mm)	4-6	6	7-14
Leaf width (mm)	1	1	1-1.5
Leaf shape	Clavate	Falcate	Slender-clavate
Leaf apex	Pointed	Rounded	Rounded
Stem glands	Abundant	Abundant	Few
Gland exertion	Strongly exserted	Exserted	Exserted
Petal length (mm)	3-4	7	6(6.5)
Petal width (mm)	2-2.2	3	2.5-3
Petal petiole	Absent	(?)	Present
Calyx length	0.5	3	1
Calyx shape	Obovate	Narrowly triangular	Triangular
Calyx apex	Obtuse	Acute	Obtuse
Staminal filament pubescence	A few apical hairs	Scattered hairs	Densely pilose in upper half
Staminal filaments	Free	Free	Fused in lower half as a tube
Anthers	White-apiculate	White-apiculate	Non-apiculate
Habitat	Sand loam, granite	(?) sandplain	Deep sand yellow
	Allocasuarina		*Eucalyptus*, mixed heath

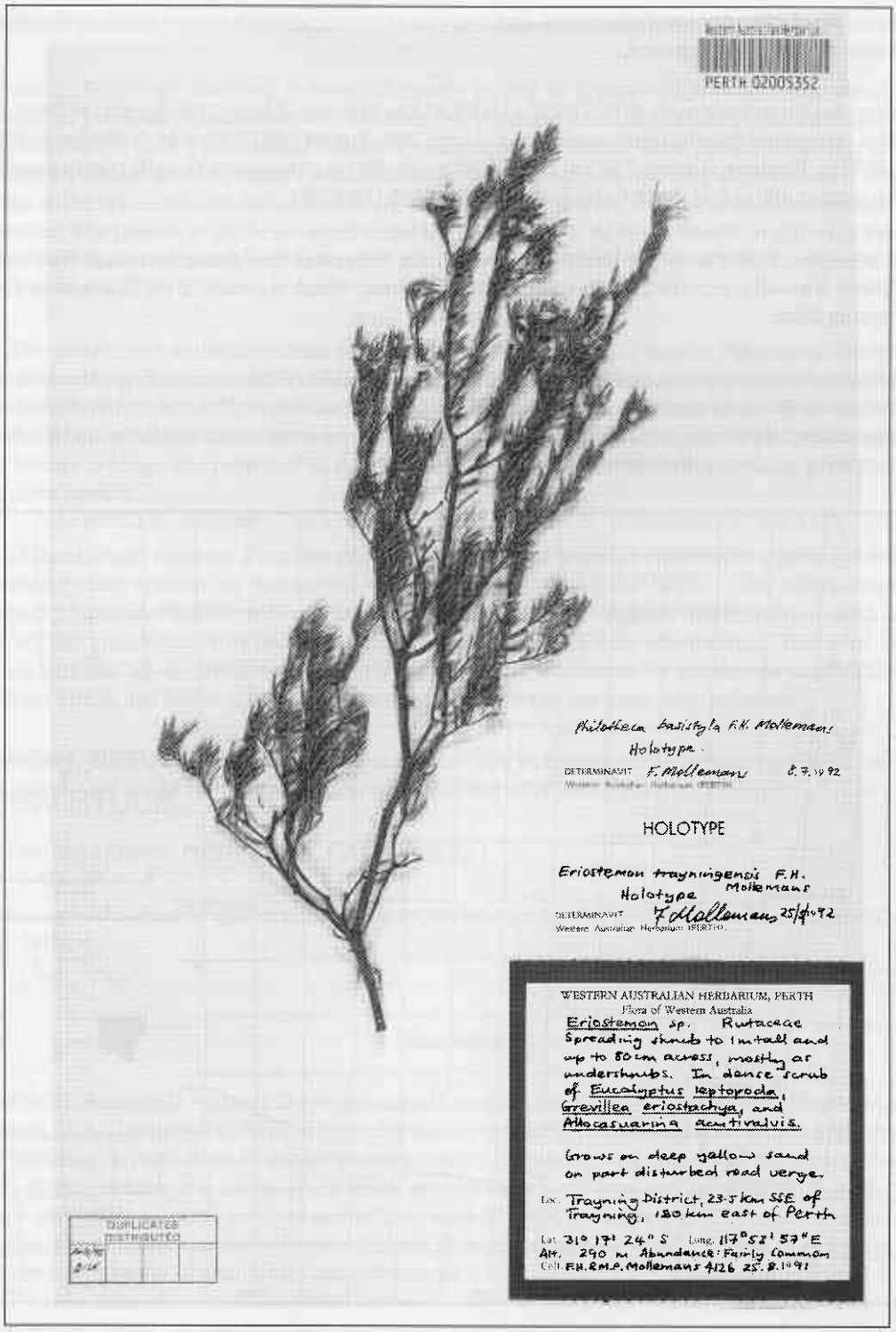

Figure 3. *Philotheca basistyla* F.H. Mollemans - Holotype (*F.H. & M.P. Mollemans* 4126)

(pear-shaped) above point of attachment with ovary and tapering upwards, narrowing as style matures, densely pilose. *Fruit* not seen.

Other specimens examined. WESTERN AUSTRALIA: Trayning District, 180 km east of Perth, alt. 290 m., frequency (locally) fairly common - c. 4 seen, 20th August 1990, *F.H. & M. P. Mollemans* 3213 (PERTH); Trayning District, 180 km east of Perth, alt. 290 m., abundance (locally) fairly common, 25th August 1991, *F.H. & M.P. Mollemans* 4124, 4125 (PERTH).

Distribution. Endemic to the boundary region of the Avon and Coolgardie Botanical Districts of Western Australia, occurring south-south-east of Trayning, which is located c. 180 km east of Perth, Trayning Shire.

Habitat. Found in dense scrub of *Eucalyptus leptopoda, Grevillea eriostachya, Allocasuarina acutivalvis, Baeckea muricata, Baeckea floribunda, Hakea coriacea, Melaleuca conothamnoides, Melaleuca* sp., *Daviesia* sp., *Choretrum pritzellii, Phebalium tuberculosum, Pimelea* sp. and *Hibbertia* sp. growing on deep yellow sand.

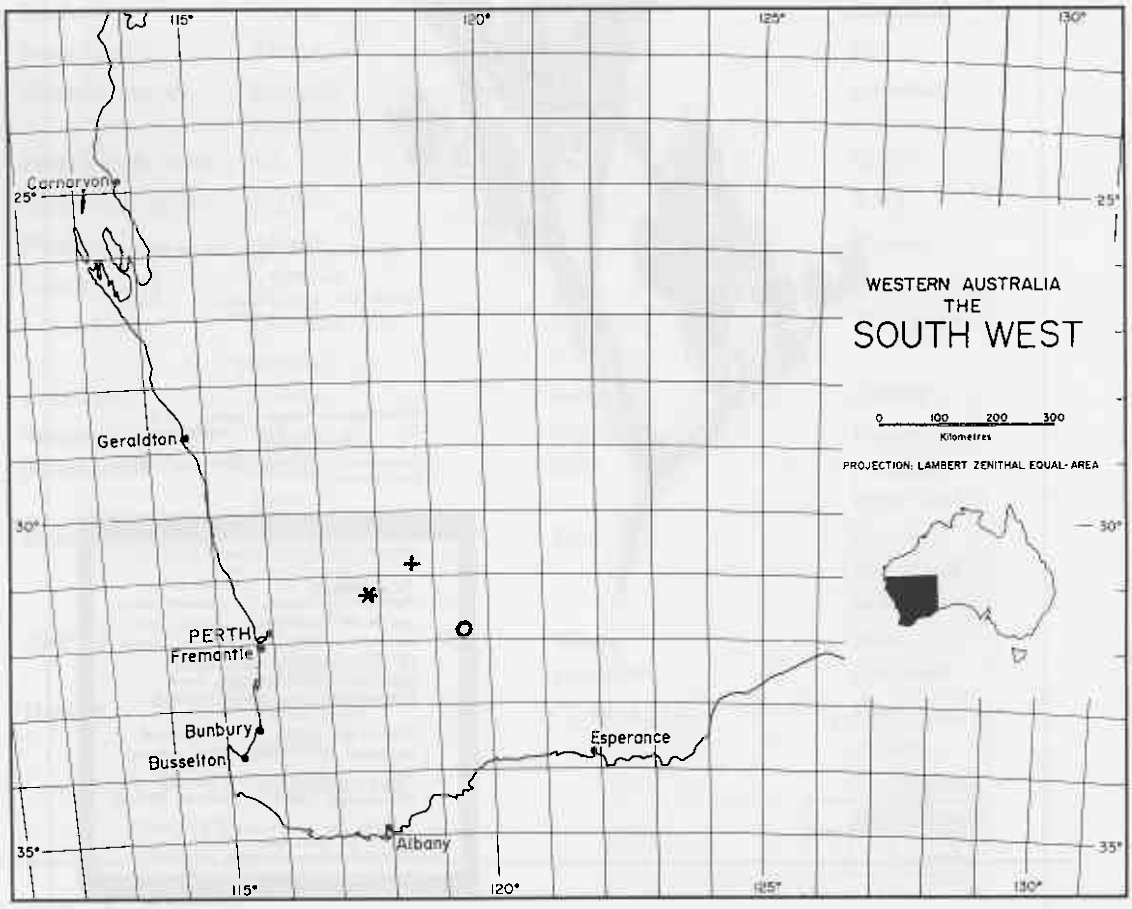

Figure 4. Distribution of *Drummondita wilsonii* F.H. Mollemans (o), *Philotheca langei* F.H. Mollemans (+) and *Philotheca basistyla* F.H. Mollemans (*)

Flowering period. August-October.

Affinities. *Philotheca basistyla* is morphologically similar to *Eriostemon falcatus*. The complete absence of glandular verrucosities on branchlets and the terete staminal filaments which are fused in the lower half to form a tube makes it distinct. Additional differences are in the longer leaves, much smaller sepals and smaller petals. *Philotheca basistyla* also possesses a basally expanded style which grows in the depressed area between the carpels. Such a character is unusual in *Eriostemon*, but the character was present in different specimens (*Mollemans* 3213, 4126) collected in different years. Other important taxonomic and ecological features of *Philotheca basistyla* F.H. Mollemans are summarised in Table 2.

The presence of a distinct medial strip on the outside of petals is seen in *Philotheca basistyla*, *Philotheca langei*, and some other species (see Wilson 1970). Examination of the type of *Eriostemon falcatus* (*W.E. Blackall* B.917, October 1931: PERTH) indicates the presence of the same character, but due to the condition of the specimen it is quite obscure and difficult to see. In the smaller petals of *Philotheca langei* this petal medial strip is quite narrow and broadens with increasing petal size in the other species.

Monadelphous stamens are a character which places this taxon in *Philotheca*, a genus which is morphologically similar to *Eriostemon* sect. *Nigrostipulae* (Wilson 1970). The morphological similarity between *Philotheca basistyla* and *Eriostemon falcatus* suggests that they are related, and placing the present taxon in *Philotheca* tends to ignore this apparent relationship. However, it is recognised that all of *Eriostemon* sect. *Nigrostipulae* will eventually be transferred to *Philotheca* (Wilson 1992), and so the situation will be remedied once this has been accomplished.

Comments. Damage by locusts occurred during the 1990 locust plague (J. Armstrong pers. comm.), but plants were found flowering again without apparent ill effect in 1991.

Conservation status. Poorly known, CALM Priority 1.

Etymology. The specific epithet refers to the expanded style base of this taxon, and was suggested by P.G. Wilson.

Discussion

Similarities between D. wilsonii, D. ericoides and D. miniata. Gardner (1928) considered *Drummondita miniata* (C.A. Gardner) P.G. Wilson to be very closely related to *D. ericoides* Harvey, and pointed out the similarity in petal shape to support this suggestion. Shrub size and branching, leaf arrangement, size, shape, vestiture and colour of the apical gland, flower size, sepal size (unequal in *D. miniata*), shape and vestiture, petal vestiture and colour, were all cited by Gardner (1928) as differences. A comparison of *Drummondita wilsonii* with both *D. miniata* and *D. ericoides* (Table 1) also shows a comparable quantity of similarities and differences.

Gardner (1928) selected only one character in common amongst many differences to establish a relationship between *D. ericoides* and *D. miniata*. The three species *D. wilsonii, D. ericoides* and *D. miniata* have similarities in the leaves, petals, some calyx characters and in the preference for substrata which are always rocky in nature (Table 1), but there are clear size differences in particular

in habit, leaf and floral characters. Compared to the other *Drummondita* taxa (*D. hassellii*, *D. hassellii* var. *longifolia* and *D. calida*), all taxa have flowers which exhibit variations in colour and shape of floral parts, but there are significant differences between *D. hassellii*, *D. hassellii* var. *longifolia* and *D. calida* and what may be termed the *Drummondita ericoides* group (*D. ericoides*, *D. miniata* and *D. wilsonii*), in the possession by the latter group of leaves which are similarly shaped, channelled above and which possess the large terminal gland. None of the other taxa have large glands at leaf apices. Several leaf characters may therefore be added to petals (used by Gardner 1928) to further establish the relationship between *D. ericoides* and *D. miniata*, and to add *D. wilsonii*.

Pollination mechanisms and flower colour variation in Drummondita. One of the more striking characters of *D. ericoides*, *D. miniata* and *D. wilsonii* is that of flower colour. The petals of *D. miniata* are orange-cinnibar in colour, *D. ericoides* yellow-white (Gardner 1928) and *D. wilsonii* reddish fading to green at the base. From west to east the flower colour of these species, which are grouped here due to similarities in petals and several leaf characters, grades from yellow (*D. ericoides*) through orange-cinnibar (*D. miniata*) to red (*D. wilsonii*).

Gardner (1928) noted a similar pattern of petal colour variation in the flowers of *D. hassellii* again from yellow through to red, from west to east in its distributional range. This, he suggested limited the value of flower colour as a distinguishing character between *D. miniata* and *D. ericoides*. Colour variation in the flowers of *D. hassellii* is apparently clinal in nature, with populations varying more or less continuously over its range. But this species is quite variable taxonomically and may in time be subdivided into more than one taxon. Parallels are therefore apparent between what may be termed the *D. hassellii* group and the informal *D. ericoides* group (which includes both *D. miniata* and *D. wilsonii*) recognised here.

The species of the *Drummondita ericoides* group have a broader geographic range and more northerly distribution than that of the *D. hassellii* group, but are restricted by habitat requirements to certain geological features (Table 1), of apparently great age. Although exhibiting an identical pattern of flower colour to the *D. hassellii* group, the species of the *D. ericoides* group, rather than forming a cline, apparently occupy different locational foci within a hypothetical cline. What we see nowadays in these three species may be three divergent members of a formerly more widespread, common ancestor.

Flower colour has definite advantages for pollination, and in the *D. ericoides* group the flower colour of a common ancestor appears to have been retained by each species in the group. In the flora of south-west Western Australia the colours seen in this group are amongst the four most common and *Drummondita* is bird pollinated according to Keighery (1982).

Similar colour variation to that present in both the *D. ericoides* group and the *D. hassellii* group is also found in the flowers of *Diplolaena* (Rutaceae) with flowers again varying in colour from west to east from yellow through to red (G.J. Keighery pers. comm., P.G. Wilson pers. comm.). In this instance, however, the colour variation is in the stamens (P.G. Wilson *op. cit.*), which in *Diplolaena* are quite long and prominent. Armstrong (1979) lists birds as pollen vectors in *Diplolaena*.

Drummondita miniata is thought to be bird pollinated as Keighery (pers. comm.) has observed brown honeyeaters visiting the large flowers of this species at the Cue Rifle Range (Cue is the type locality of *D. miniata*). The relatively smaller flowers of *D. ericoides* and *D. wilsonii* (Table 1) would seem to be a factor preventing bird pollination. However, brown honeyeaters, for example, possess a

long slender tongue with a feather-like appendage at the apex (D. Graham pers. comm.), by which they could easily penetrate the narrow tubular flowers of these two species. According to Keighery (1982), such "narrow, tubular flowers are rarely visited by insects ... and can only be utilised by the smaller, slender-billed honeyeaters."

Insects are widespread, and likewise flower colour is an insect attractant, while moth and butterfly pollen vectors are also possible for the genus because some of these possess an extendible proboscis by which they could easily penetrate *Drummondita* flowers. So, although bird pollination is implicated in the reproductive strategy of *Drummondita*, it is still uncertain as to what if any other pollen vectors are involved. Field data on this aspect is required, particularly for *D. ericoides* and *D. wilsonii*, for which no information is available.

Distribution and flowering time of the D. ericoides group. The inland species, *D. miniata*, occupies an area subject to unreliable rainfall. Because of its eremaean (desert) distribution, *D. miniata* may flower opportunistically depending on rainfall, a characteristic of other eremaean species e.g. *Calothamnus* sp. (Hawkeswood and Mollemans *ined.*). *D. ericoides* and *D. wilsonii*, on the other hand, have a more temperate distribution and are unlikely to have developed such a survival mechanism, so are probably unlike *D. miniata* in having flowering times triggered by an environmental stimulus other than rainfall, such as day-length.

The evolutionary history of the Drummondita ericoides group (which includes D. miniata and *D. wilsonii), D. hassellii group and D. calida.* The distribution patterns of the *D. ericoides* group and the *D. hassellii* group, which occur in central and south-west Western Australia, overlap. But *D. calida* is distributed (in the north of the Northern Territory and Queensland) well away from other members of the genus. The presence of elements of the *D. ericoides* group and *D. calida* (which occurs in similar rocky habitats to those which carry the *D. ericoides* group) on geologically old stable features with very little soil development, and their exclusion from adjacent geologically recent aeolian deposits, suggests that they are amongst the oldest members of the genus. The *D. hassellii* group (apart from *D. hassellii* var. *longifolia*), on the other hand, seems to have developed later in association with the widespread development of aeolian deposits during the so-called period of developing aridity since the separation of Australia from Antarctica.

Drummondita hassellii (F. Muell.) Paul G. Wilson var. *longifolia* Paul G. Wilson, which occurs on Peak Charles has habitat preferences similar to those of the *Drummondita ericoides* group and *D. calida*. The presence of this taxon on the geologically stable substrate of Peak Charles, suggests that it is significantly older than the remainder of the *D. hassellii* group.

Drummondita calida (F. Muell.) Paul G. Wilson, occurs on mountainous habitats in the Gilbert's River area of North Queensland (see Wilson 1971) and its distribution also extends to rocky hillsides near Bloomfield Springs in Kakadu National Park, Northern Territory (*Menkhorst* KA 364: PERTH). The presence of *D. calida* on the other side of the continent, suggests that the past distribution of *Drummondita* encompassed a large part of Australia prior to the break-up of Gondwanaland, and the subsequent disintegration of the group resulting from associated climatic deterioration. The possibility may be considered that *D. calida* found its way to northern Australia through long distance dispersal mechanisms, from the apparent stronghold of the genus in southern Western Australia. But, *Drummondita* is ant dispersed according to J. Armstrong (pers. comm.).

On hills such as Parker Range south (habitat of *Drummondita wilsonii*) and White Peak near Geraldton (habitat of *Drummondita ericoides*), the substrate has remained essentially unaltered while

the climate has changed through time. However, on adjacent more recently developed aeolian sandplains and associated deposits both the substrate and the climate has changed.

D. hassellii has developed on the aeolian deposits, and in the Parker Range south area there is a clear segregation between *D. hassellii* and *D. wilsonii*. *D. wilsonii* occurs only on skeletal soils developed on the geologically old rocks, while down-slope it is replaced by *D. hassellii* on sandplains lapping onto and having extensive occurrence adjacent to the range. Even though both *D. wilsonii* and *D. hassellii* occur essentially side by side at the boundary between outcrop with skeletal soils and adjacent sandplains, no evident intermediate forms (hybrids) were observed. There is a clear substrate related line of demarcation between the two species, and this may also reflect a clear genetic segregation.

It is possible that if *D. ericoides*, *D. wilsonii* and *D. miniata* are brought together experimentally they could hybridise, as a relationship (albeit tenuous) has been established between them using several leaf characters coupled with the petal character used by Gardner (1928). But this would not occur in nature due to the vast distances separating the three species. *D. ericoides* occurs near Geraldton, *D. miniata* in the Cue district and *D. wilsonii* occurs south-south-east of Southern Cross; *D. ericoides* is separated from *D. miniata* by a distance of 360 km, while these two species are separated from *D. wilsonii* by distances of 600 and 550 km, respectively.

Heath vegetation is thought to have flourished in Australia for almost 50 million years (Specht *et al.* 1979), and had its beginnings in the pan-Australian rain forest which existed when Australia was part of Gondwanaland. The break-up of Gondwanaland allowed for altered climatic influences, particularly around southern Australia, which was associated with the gradual separation from west to east of Australia and Antarctica. As *Drummondita* exhibits evident divergence, associated with climatic and physiographic changes stemming from continental separation, there are clear indications that it is a genus of great antiquity.

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