

# A revision of *Davidsonia* (Cunoniaceae)

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## Abstract

Harden, G.J.<sup>1</sup> and Williams, J.B.<sup>2</sup> (<sup>1</sup>National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, NSW 2000, Australia; <sup>2</sup>Botany Division, University of New England, Armidale, NSW 2351, Australia). A revision of *Davidsonia* (Cunoniaceae). *Telopea* 8(4): 413–428. The genus *Davidsonia* (Cunoniaceae) is revised on the basis of available herbarium collections, field studies over its geographic range, fresh and preserved materials and previous accounts. Formerly considered a monotypic genus, *Davidsonia* is found to comprise three species; *D. pruriens* F. Muell., the type species, from north-eastern Queensland; ***D. jerseyana*** (F. Muell. ex F.M. Bailey) G. Harden & J.B. Williams, a known variety from north-eastern New South Wales here elevated to specific rank; and ***D. johnsonii*** J.B. Williams & G. Harden, a well-known but hitherto undescribed species from north-eastern New South Wales and south-east Queensland. Each species is fully described and illustrated, and the lectotypification of *D. pruriens* is clarified.

## Introduction

When describing the genus *Davidsonia* in 1867, Ferdinand von Mueller referred it to the family Saxifragaceae. Later, when the Cunoniaceae were separated from that family, *Davidsonia* was traditionally placed in the Cunoniaceae, though Engler (1930) urged its exclusion because of the stiff hairs, alternate leaves, short stamens and exalbuminous seeds. Bange (1952) segregated *Davidsonia* from the Cunoniaceae into its own family, the Davidsoniaceae, and this has generally been regarded as a unigeneric family endemic to eastern Australia. The characters emphasised by Bange (op. cit.) when he described the family Davidsoniaceae were its spirally arranged leaves, non-endospermic seeds and epitropous ovules. Cunoniaceae sens. strict. usually has apotropous ovules but epitropous ovules have also been recorded in *Spiraeanthemum* in that family (Dickison 1980). Airy Shaw (1973), Dahlgren (1980), Takhtajan (1980), Cronquist (1981), and Mabberley (1997) have maintained Davidsoniaceae as a separate family, closely related to the Cunoniaceae. However, Hutchinson (1973) retained the genus in the Cunoniaceae without comment, while Ingle and Dadswell (1956) and Dickinson (1980) argued that the genus should remain in the Cunoniaceae on the evidence of its wood anatomy. Carpological evidence (Doweld 1998) supports the segregation of the Davidsoniaceae from the Cunoniaceae; however, the evidence also emphasises the families' close affinities. Recent research using DNA sequencing supports the inclusion of *Davidsonia* in the Cunoniaceae (Bradford pers. comm. 1997, 1999; Angiosperm Phylogeny Group 1998).

The genus *Davidsonia* was described in 1867 by Mueller with one species, *D. pruriens*. The southern populations of *D. pruriens* were described as a distinct variety, var. *jerseyana*, by Bailey in 1900. The brief description of var. *jerseyana* was that it was 'smaller in all its parts'. The type variety is restricted to north-eastern Queensland, and the variety *jerseyana* confined to north-eastern New South Wales, though erroneously listed by Bange (1952) as also occurring in southern Queensland. These two taxa are markedly allopatric and differ consistently in inflorescence size and position, anther shape and size, pyrene morphology and size, and leaflet venation.

It is considered appropriate that variety *jerseyana* should be given specific rank. This follows the evolutionary species concept as outlined by Wiley (1978, 1981), in which morphologically different allopatric lineages should be given specific rank. A third taxon occurring in New South Wales and southern Queensland is very distinct from the above two taxa in several characters and is here described as a new species.

Three collections of *Davidsonia* (at NSW) made in 1926, 1939 and 1944 from north-eastern New South Wales were segregated by L.A.S. Johnson in June 1949 and labelled 'clearly a new species'. We concur with this view and the species is here described as *Davidsonia johnsonii* J.B. Williams & G. Harden. *D. johnsonii* is largely sympatric with *D. jerseyana* (Fig. 4) but no intermediates are known. It differs from the specimens of *D. pruriens* var. *jerseyana* in several characters including growth habit, leaf size, form and pubescence, and fruit shape and size, and also differs in its reproductive method in that no seeds are known to be formed. This species was not apparently collected between 1944 and 1977 when it was rediscovered by Graham Watson growing on his property at Huonbrook near Mullumbimby, and drawn to the attention of the authors in 1978. However, a specimen had been collected by A.G. Floyd and H.C. Hayes in 1958 at The Pocket and deposited at the Coffs Harbour Forestry Herbarium (CFSHB) and Floyd and Hayes (1961) stated that 'a possible new species at Mooball near Murwillumbah is quite glabrous'. Since that time collections have been made from 18 localities in north-eastern New South Wales and three in south-eastern Queensland. The taxon was informally described or listed as a new species in the following publications (Williams 1979, Williams & Harden 1979, Williams et al. 1984, Floyd 1981, 1989 and Harden 1990), with the descriptions of the flowers and fruit in Floyd (op. cit.) based on information provided by one of the authors (J.B.W.).

In recent years some specific studies at the University of New England have involved examination of the *Davidsonia* taxa in New South Wales. They have concentrated on their conservation and development (Watson 1987) and the pollination of *Davidsonia pruriens* var. *jerseyana* (Elliott 1991). Also, various surveys have been undertaken of both these taxa in New South Wales to establish the distribution and size of the populations as part of the ongoing documentation and management of species that are considered to be rare or threatened (Briggs and Leigh 1988, 1996) or listed in the schedules of the New South Wales *Threatened Species Conservation Act, 1995*. These studies and surveys have either been prepared as thesis requirements for post-graduate courses and have not been published, or have been prepared as internal reports for the National Parks and Wildlife Service of New South Wales (Quinn et al. 1996). One of the authors (J.B.W.) has been involved in each of these studies and surveys.

Fresh material from plants growing at the Royal Botanic Gardens Sydney was used for the illustrations. These were supplemented with preserved mature fruits of *D. jerseyana* from Mooball.

#### ***Davidsonia* F. Muell.**

Mueller (1867: 4); Bailey (1900: 537); Bange (1952: 294); Harden (1990: 523).

Type species: *Davidsonia pruriens* F. Muell.

Small trees to 20 m high, usually in rainforest, either with one or a few sparingly branched stems or a dense-foliaged much-branched canopy; leaves often tufted towards the end of stems. *Indumentum* either prominent and persistent on all or most parts, or inconspicuous or absent on mature parts. *Seedling leaves* simple, serrate; first pair of seedling leaves opposite, narrow-elliptic; following seedling leaves

alternate, pinnate with an increasing number of pinnae (3–7), rachis becoming winged. *Adult leaves* alternate, imparipinnate, petiolate; rachis winged with the wing or wing-like segments dentate; stipules paired, amplexicaul, semi-circular; pinnae sessile or shortly stalked, narrow-obovate to narrow-ovate in general outline; terminal pinna usually the largest, with pinnae pairs progressively smaller towards base of leaf; petiolulate or sessile; stipellae usually present at base of pinnae. *Inflorescences* cauliflorous, ramiflorous or subterminal and borne amongst the leaves, paniculate and open or congested and spike-like. *Flowers* bisexual, 4- or 5-merous; sepals 4 or 5, petaloid, pink or red, connate in the basal half, valvate in bud; petals absent; stamens usually 8 or 10, exerted beyond the sepals, alternating with an equal number of nectaries; carpels 2 or rarely 3, ovary bilocular or rarely trilocular, ovules 5–7 in each loculus, styles 2 or rarely 3; ovules anatropous; in one species (*D. johnsonii*) the flowers are often sterile, with styles reduced or absent and anthers without pollen. *Fruit* a drupe, mesocarp fleshy; pyrenes 2 or rarely 3, compressed, pyrene wall cartilaginous to semi-woody; body of pyrene with soft fibres extending radially from margins, dorsally keeled and terminally crested; seed solitary or absent, glossy dark reddish brown to black, strongly compressed, plano-convex, glabrous, broad-ovate to circular, apex obtuse with a prominent short point at radicle end; endosperm absent.

The pyrenes lie separately in the fleshy mesocarp and have sometimes been misinterpreted as seeds (e.g. Bailey 1898, Elliott & Jones 1984).

Three types of trichomes are present: (1) glandular trichomes, multicellular and multiseriate, capitate, red-tipped, often terminating teeth on bracts, rachis wings, margins of stipules and pinnae; (2) bristly trichomes (surfaces hirsute, only in *D. pruriens* and *D. jerseyana*) fawn to yellowish or pinkish on young growth, irritant, often on leaves, stems, rachises, outer surface of sepals and on fruit; (3) short soft hairs (surfaces softly pubescent) as on the inner surface of sepals (and outer surface in *D. johnsonii*).

### Key to the species

- 1 Leaflets, rachis, branchlets, inflorescence axes and outer surface of sepals hirsute, at least when young, with long irritant bristly hairs (usually moderately to strongly persistent); most adult leaves more than 35 cm long; pinnae (7–)9–19, the three largest pinnae (terminal and subterminal) 20–40 cm long; margins of pinnae secondarily serrate; inflorescences cauliflorous or ramiflorous, usually borne on the main trunks or sometimes among the leaves; styles 2 or rarely 3, conspicuous, curved, exceeding the stamens; fruit pyriform to obovoid or ellipsoid, with length greater than or equal to its diameter.
  - 2 Inflorescences open, paniculate, usually more than 30 cm long; anthers oblong at anthesis, 1.8–3.0 mm long; pyrenes (when fertile, i.e. containing a seed) 2.0–2.7 cm long, 2.5–2.9 cm wide with a prominent dorsal crest 3.0–6.0 mm long; adult leaves usually 60–120 cm long, rachis scarcely winged; upper lateral pinnae mostly lanceolate to oblong, with 15–27 pairs of secondary veins .....  
 .....  
 ..... **1. *Davidsonia pruriens***
  - 2\* Inflorescences condensed, racemose or spike-like, mostly less than 25 cm long; anthers ellipsoid at anthesis, 1.1–1.7 mm long; pyrenes (when fertile) 2.0–2.2 cm long, 1.6–1.7 cm wide, with an inconspicuous crest 2.0–2.3 mm long; adult leaves usually 35–60 cm long, rachis usually prominently winged; upper lateral pinnae mostly oblanceolate, with 11–17 pairs of secondary veins. ....  
 ..... **2. *Davidsonia jerseyana***

1\* All parts more or less glabrous, sometimes pubescent when young but glabrescent, hairs not irritant; leaves mostly less than 35 cm long; pinnae 5–9, the three largest pinnae (terminal and subterminal) usually 10–20 cm long; margins of pinnae dentate but not secondarily serrate; inflorescences subterminal on branchlets, borne amongst the leaves; styles reduced or absent, if present 2 or 3, shorter than or scarcely exceeding the stamens; fruit depressed-globose, with length less than diameter. .... **3. *Davidsonia johnsonii***

### 1. *Davidsonia pruriens* F. Muell.

Mueller (1867: 4, t. XLVI); Bailey (1900: 538); Bange (1952: 294–296).

[*Davidsonia pungens* was listed in *Gardeners' Chronicle* in 1876, p.603, but without the author's name. This was given as a north Australian plant and from the description is referred to this species.]

Type citation: 'In silvis irriguis ad sinum Rockingham's Bay. Dallachy'

Lectotype: designated by Bange (1952: 296) as Murray's River, Rockingham Bay: *Dallachy*, 12 Aug 1866, a MEL collection with flowers and fruit. As there are nine sheets at MEL in type folders we propose that MEL 106575 be the lectotype, thus restricting lectotypification to a single specimen, in line with the recent addition to Article 9 of the Code. This specimen was annotated by Bange, it consists of portion of a leaf and fruit and it has a copy of the original notes of Dallachy with the date 12<sup>th</sup> August 1866. See full discussion after species description.

Illustrations: Mueller (1867: t. XLVI), Bailey (1898: t. XXXVII), Bange (1952: 295), Cronquist (1981: 549).

Small slender rainforest tree to 18 m high; bark brown to dark grey, becoming flaky. *Indumentum* prominent on all parts, young growth pinkish, hairs long, irritant; red gland-tipped trichomes terminating teeth on margins of stipules and stipellae. *Seedling leaves* at first simple, margins dentate; becoming more or less lobed at base and pinnate after 12 months growth; hirsute and with some reddish glandular hairs present on stipules. *Adult leaves* (30–)60–120(–150) cm long; petiole 10–30 cm long; 15–30 mm diam., margins dentate; stipellae 5–8 mm long, narrow-lanceolate to lanceolate, sometimes divided and 2-lobed from base, margins dentate, withering and appearing spinose on older leaves; rachis slightly winged adaxially, wing continuous or as separated segments, 1–3 mm wide, segments usually absent from petiole; pinnae (7–)9–19; terminal pinna obovate and tapering into petiolule, lateral pinnae lanceolate to oblong or to oblong-ovate or oblong-obovate with basal pair of pinnae broad-ovate to ovate; apex acute to shortly acuminate; base rounded and ± equal in upper lateral pinnae, unequal in basal pinnae; margins secondarily serrate, each tooth with a hair-like point; upper surface dark green and slightly glossy, sparsely hirsute, lower surface fawn-hirsute; secondary veins 15–27 pairs, prominent on both surfaces; largest pinnae (terminal and subterminal) (12–)18–35(–46) cm long, (6–)8–12(–16) cm wide; petiolules 0–5 mm long, up to 40 mm long on terminal pinnae. *Inflorescences* mostly cauliflorous or ramiflorous, rarely borne amongst the leaves, pendent, 12–80 cm long; peduncle (3–)10–18(–30) cm long; number of lateral spikes 2–24, 2–20 cm long; pedicels 1–5 mm long; bracts amplexicaul, c. 5 mm long; bracteoles sessile, 3–5 mm long. *Flowers* 4- or 5-merous; sepals 5.0–8.0 mm long, recurved, basally connate, dark pink, outer surface hirsute, inner surface pubescent, persistent in fruit; stamens 4.5–7.0 mm long, filaments 3.5–4.6 mm long, anthers oblong, 2.0–3.0 mm long, yellow; ovary 2.3–3.0 mm long, hirsute; styles 2 (or 3), divided almost to base, 5.0–8.0 mm long, glabrous. *Fruit* obovoid or ellipsoid, laterally compressed, 38–55 mm long, 32–53 mm wide,

35–46 mm deep; blue-black, glaucous, indumentum sparse at maturity (hairs visible with hand-lens); mesocarp dark red; pyrenes usually 2, strongly laterally compressed, 3.0–6.0 mm long, fimbriate with radiating soft fibres attached to the pyrene body; pyrene body 1.5–2.3 cm long, 1.5–2.1 cm wide, crest 5.0–10.0 mm long; seed ovate to broad-ovate, 1.7–1.8 cm long, 1.2–1.4 cm wide, 3–4 mm deep. (Fig. 1).

**Habitat and distribution:** widespread in tropical rainforest in north-eastern Queensland, chiefly from Cardwell area to Cooktown and inland to near Atherton (Fig. 2). It grows from near sea level to altitudes of over 1000 m. Bange (1952) erroneously cited this taxon as occurring in New South Wales. This taxon has been collected in Fiji (Batiki, Naduruloulou) in 1949 by B. Parham (Parham 1972: 125) where it was cultivated at the Agricultural Experimental Garden (Bange 1952).

**Phenology:** chiefly flowers February to July, but recorded most months; with fruit ripe mostly March to June, but recorded throughout the year.

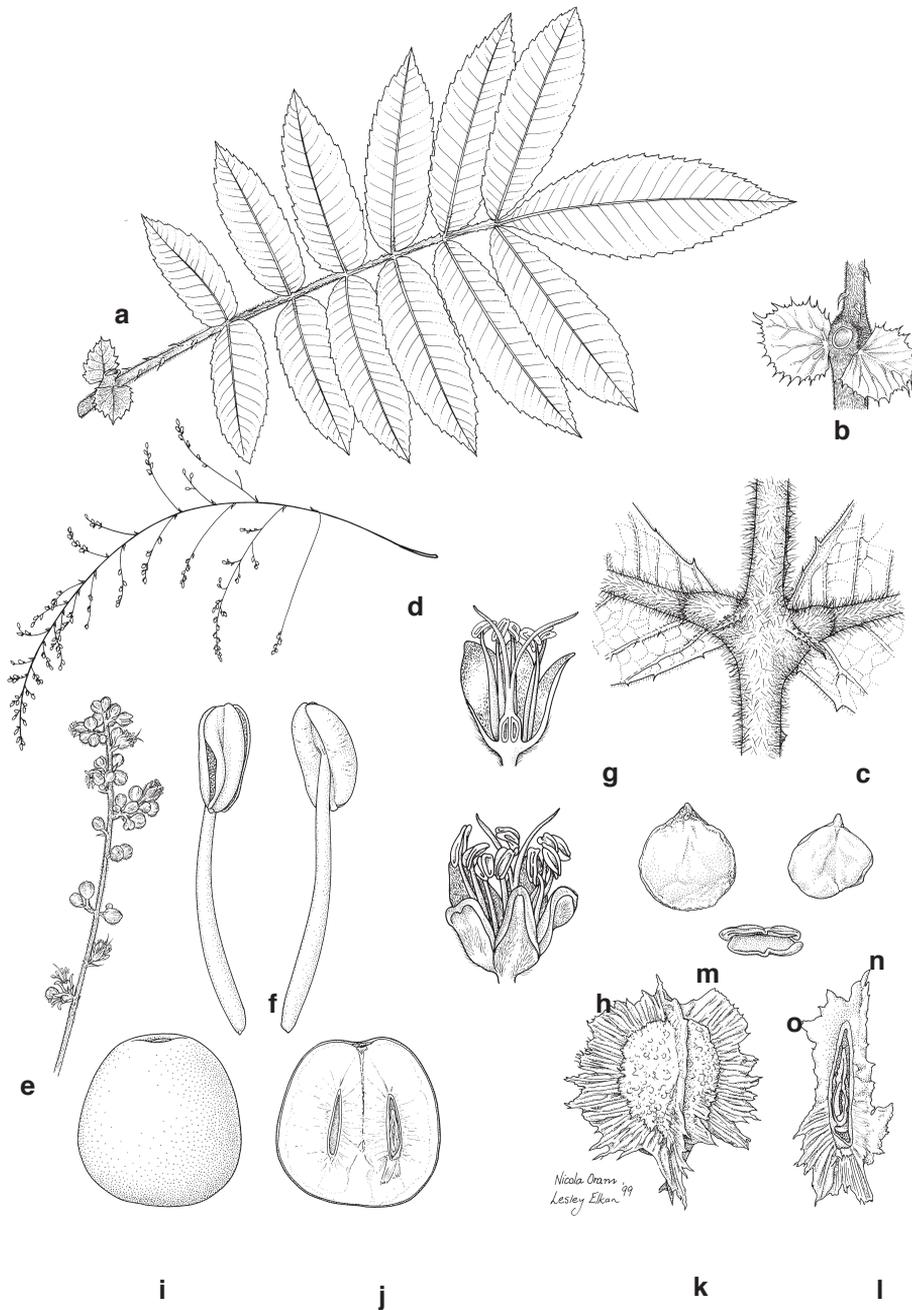
**Conservation status:** due to its widespread distribution it is not considered to be under threat; it is known to occur in a number of conservation areas, e.g. Lake Eacham National Park, Bellenden Ker National Park (now part of Wooroonooran National Park).

**Discussion:** this species is widely cultivated as an ornamental tree and for its edible fruits. As early as the 19th century (Bailey 1895, 1898) this species was recommended for cultivation because of its edible fruits.

**Discussion of lectotype:** the lectotype was designated by Bange (1952: 296) as Murray's River, Rockingham Bay: *Dallachy*, 12 Aug 1866, a MEL collection with flowers and fruit. There is no specimen at MEL that matches the original citation of Mueller; however, there are nine sheets at MEL in type folders collected by Dallachy at Rockingham Bay in 1866. Of these nine sheets only one has been annotated by Bange (MEL 106575); this sheet has the upper portion of a leaf and fruit with a National Herbarium of Victoria label, annotated 'Fragment of Type' with notes of Dallachy's copied from MEL 106543. This sheet also has the following note: 'Dallachy made more than one collection of this species, as these five sheets of types housed here include flowers, fruits & foliage all with similar labels'. This label was not an original label and the notes appear to have been copied in recent years (perhaps before the specimen was seen by Bange in 1952). It also has a small label by Mueller with the name *Davidsonia pruriens*.

The specimen (MEL 106543) which has the original of the notes on the habit of the plant by Dallachy, including the date of 12 August 1866, also has a Phytologic Museum of Melbourne label in Mueller's hand with '*Davidsonia pruriens* Ferd. von Mueller, Murray's River at Rockinghams Bay, Dall.'; the sheet has more recently been labelled 'Sheet 1 of 2'; this specimen is of the lower part of a leaf. Sheet 2 of 2 (MEL 106542) has the upper part of a leaf and a Botanical Museum of Melbourne label in Mueller's hand.

It is apparent that the specimens that were cited by Bange in 1952 have since been remounted and possibly rearranged so that the specimen designated as the lectotype (flowers and fruit) can no longer be identified as the one nominated by Bange. MEL 106546 is the only specimen that has an inflorescence and fruit and a label '*Davidsonia pruriens*' in Mueller's writing and a later National Herbarium of Victoria label with the species name, locality as 'Rockingham Bay, Q'land', collector as J. Dallachy and date as '?1866'. We choose not to nominate this specimen as the lectotype; instead we choose to restrict the lectotypification to a single specimen, MEL 106575. This is in accordance



**Fig. 1.** *D. pruriens*. **a**, adult leaf ( $\times 0.1$ ); **b**, stipules ( $\times 0.5$ ); **c**, rachis, pinnae bases, stipellae ( $\times 1.5$ ); **d**, inflorescence, diagrammatic ( $\times 0.1$ ); **e**, part inflorescence ( $\times 0.5$ ); **f**, stamens ( $\times 8$ ); **g**, flower in L.S. ( $\times 3$ ); **h**, flower ( $\times 3$ ); **i**, drupe ( $\times 0.5$ ); **j**, drupe in L.S. ( $\times 0.5$ ); **k**, pyrene ( $\times 1$ ); **l**, pyrene in L.S. ( $\times 1$ ); **m**, seed ( $\times 1$ ); **n**, embryo ( $\times 1$ ); **o**, embryo showing 2 cotyledons ( $\times 1$ ).

with the proposed amendment to Article 9 of the Code (Brummit 1998) which was approved, in a slightly modified form, by the XVI International Botanical Congress. This specimen was annotated by Bange, it consists of portion of a leaf and fruit and it has a copy of the original notes of Dallachy with the date 12<sup>th</sup> August 1866.

**Common names:** names used for this taxon include Davidsonian Plum by Bailey (1898), Ooray by the Tully River aborigines (Bailey 1900), Davidson's Plum (Mabberley 1997).

**Selected specimens (from c. 36 examined):** Queensland: Cook: Endeavour River, *Persieh s.n.*, 1884 (MEL 106561); Bloomfield River, Barnard *s.n.* (MEL 106570); Daintree River, *Pentzke s.n.*, 1882 (MEL 106557); near Lake Barrine, 10 miles [16 km] E. of Atherton, *Melville 3683, Pont & Stephens*, 9 Apr 1953 (NSW, BRI, K, MEL); Lake Eacham, Atherton Tableland, 17°17'S, 145°37'E, *Williams s.n.*, 29 Oct. 1987 (NE 61704); Copper Lode Falls Dam Site, on Freshwater Creek, approx. 6 miles [9.5 km] S of Cairns, *Gittins 2139*, 22 Aug 1970 (BRI); Mt Bellenden-Ker, *Mueller s.n.*, 1893 (NSW 104896, MEL); State Forest Reserve 185, Danbulla, *Doggrell s.n.*, 28 Sept 1929 (BRI 333062, L). North Kennedy: Tully, margin of Mitchell Park by stream, *Clemens s.n.*, Dec 1949 (BRI 134733)

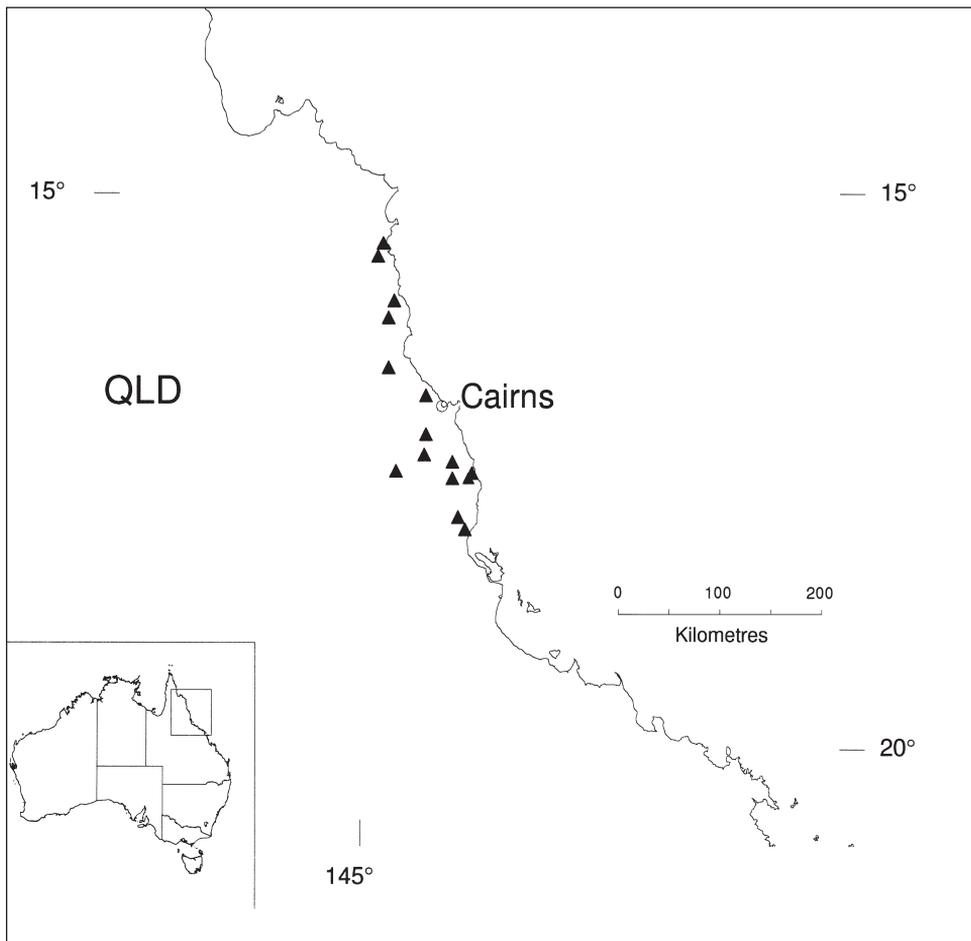


Fig. 2. Distribution of *D. pruriens* (▲).

**2. *Davidsonia jerseyana* (F. Muell. ex F.M. Bailey) G. Harden & J.B. Williams, comb. et stat. nov.**

*Davidsonia pruriens* F. Muell. var. *jerseyana* F. Muell. ex F.M. Bailey, *Queensland Flora* 2: 538; Bange (1952: 296).

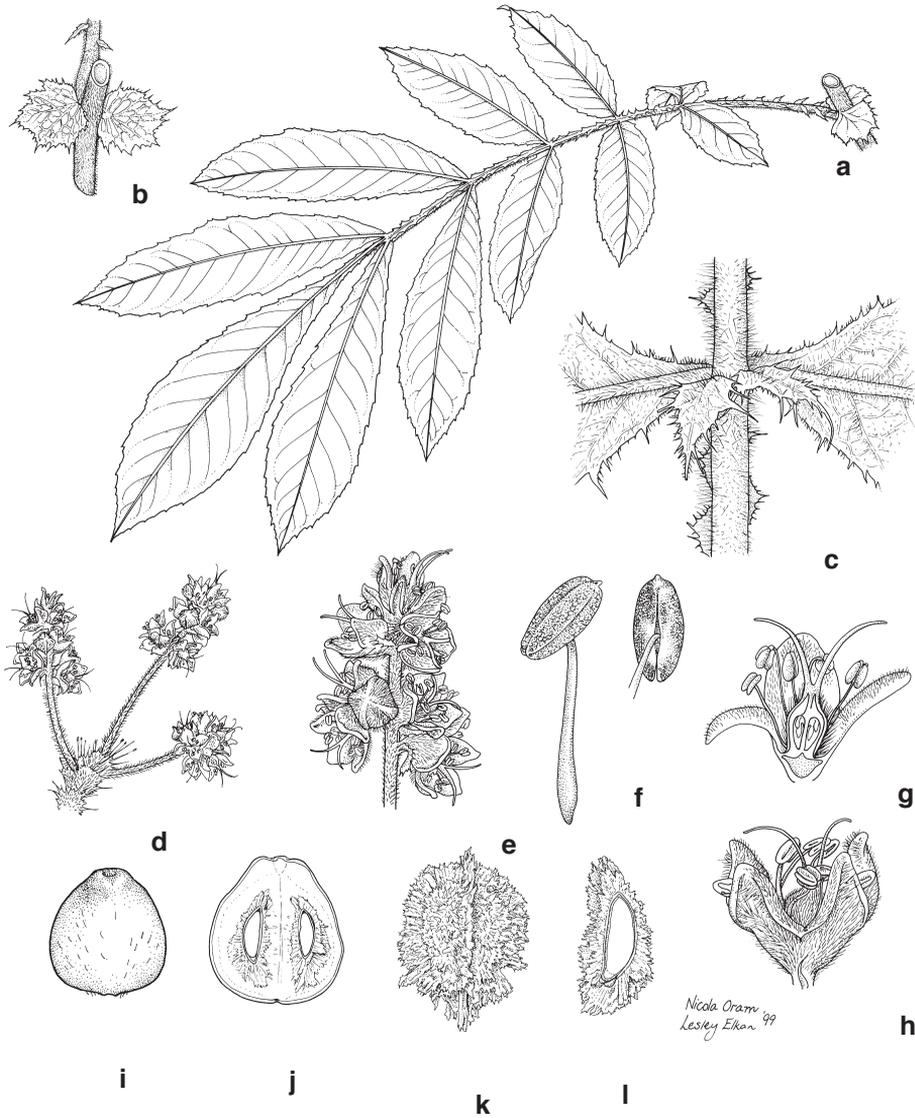
Type citation: 'Towards Tweed River'

Lectotype (Bange 1952: 296): New South Wales: North Coast: Richmond River; *Baerleren s.n.*, Oct 1892 (BRI 11134).

Illustrations: Bange (1952: 295); Williams & Harden (1979:15); Harden (1990: 523).

Slender small trees to 6(–10) m high, unbranched or few-branched or with several stems from the base, each bearing a terminal tuft of leaves; bark brown, corky and somewhat scaly. *Indumentum* persistent on most parts, dense on young fruit and shoots, hairs erect, pale brown, irritant; glandular hairs present on margins of stipules. *Seedling leaves* at first simple, margins dentate and becoming lobed at base, becoming pinnate after 12 months growth, hirsute, with some reddish glandular hairs present on stipules. *Adult leaves* (25–)35–80(–120) cm long; petiole 5–20 cm long; rachis prominently winged adaxially, wing continuous or as separated segments, (1–)3–4 (–5) mm wide, becoming more separated on lower rachis as stipella-like outgrowths, similarly on petiole, margins irregularly dentate, teeth ± spinose; pinnae (7–)11–17 (–19); stipules, 10–30 mm diam., margins dentate; terminal pinna obovate to oblong-obovate to elliptic, lateral pinnae mostly oblanceolate to oblong-oblanceolate, with basal pinnae ± elliptic, apex acute to acuminate, base tapered and ± equal in upper pinnae, unequal in lower pinnae, upper surface dark green and dull, sparsely hirsute, lower surface dull and ± hirsute; margins secondarily serrate, each tooth with a hair-like point; secondary veins 11–17 pairs, prominently raised on both surfaces; terminal and subterminal pinnae largest, (6–)20–30(–40) cm long, lower pinnae (3–)6–10(–15.5) cm wide; petiolules 1–3 mm long; stipellae present at base of most pinnae, lanceolate, 3–11 mm long, 3–5 mm wide, lower stipellae often 3-lobed, margins glandular-toothed. *Inflorescences* usually cauliflorous, mostly lateral on main stems, pendent, compressed panicles, often appearing as tight clusters; 4–10(–30) cm long, peduncle 3–6 cm long, pedicels 1–3 mm long; bracts amplexicaul, 5.0–7.0 mm long, bracteoles sessile 3.0–4.0 mm long. *Flowers* 4- or 5-merous; sepals 4–6 mm long, basally connate, dark pink to red, outer surface bristly-hirsute, inner surface pubescent, recurved, persistent in fruit; stamens 10, 4.5–6.5 mm long; filaments 4.1–5.5 mm long, anthers ellipsoid, 1.1–1.7 mm long, yellow; ovary 1.5–2.6 mm long, styles usually 2, divided to base, 4.4–5.6 mm long, glabrous; stigmas minutely capitate. *Fruit* pyriform to obovoid, laterally compressed, 33–45 mm long, 31–37 mm wide, 27–35 mm deep, blue to black, glaucous; young fruits hirsute, mature fruits sparsely hirsute with golden-brown to fawn hairs 1.0–2.0 mm long; mesocarp dark red; pyrenes usually 2, strongly laterally compressed, fimbriate with soft fibres 1.0–2.0 mm long, attached to the pyrene body; pyrene body 1.4–1.8 cm long, 0.9–1.5 cm wide, crest 2.1–2.3 mm long; seed 1.1–1.2 cm long, 0.8–0.9 cm wide, 2.5–3.0 mm deep. (Fig. 3).

**Habitat and distribution:** usually grows in subtropical and riverine rainforest, in moderately high rainfall from 1100 to over 2000 mm, at altitudes less than 300 m above sea level. Mostly on red and yellow podsolic soils of clay texture, over fine-grained metasediments, greywacke, slate, phyllite or quartzite, also on alluvial deposits. Confined to north-eastern New South Wales; chiefly from the Brunswick and Tweed Rivers catchments, from Mullumbimby north to Urliup, Upper Crystal Creek and Settlement Road (Fig. 4).



**Fig. 3.** *D. jerseyana*. **a**, adult leaf ( $\times 0.2$ ); **b**, stipules ( $\times 0.5$ ); **c**, rachis, pinnae bases, stipellae ( $\times 1.5$ ); **d**, inflorescence ( $\times 0.5$ ); **e**, part inflorescence ( $\times 1$ ); **f**, stamens ( $\times 8$ ); **g**, flower in L.S. ( $\times 3$ ); **h**, flower ( $\times 3$ ); **i**, drupe ( $\times 0.5$ ); **j**, drupe in L.S. ( $\times 0.5$ ); **k**, pyrene ( $\times 1$ ); **l**, pyrene in L.S. ( $\times 1$ ).

**Phenology:** flowers recorded chiefly from October to January; fruit ripe mostly December to February.

**Conservation status:** listed in New South Wales as an endangered species on Schedule 1 of the *Threatened Species Conservation Act, 1995*; 2ECi on the ROTAP List (Briggs & Leigh 1996). *D. jerseyana* is only known to occur in one gazetted reserve, Brunswick Heads Nature Reserve. The largest known population of this taxon is just to the west of the Brunswick Heads Nature Reserve (Watson 1987). Many of the smaller populations are on the verges of minor roads; several are represented by isolated trees, and therefore may not be viable in the longer term.

**Discussion of type:** there is no description of this taxon by Mueller; but, 'in an unpublished, and apparently (Ross, pers. comm.) now no longer extant manuscript, he named this new form *D. jerseyana*' (Watson 1987 p. 4). However, Hoogland in 1978 examined MEL specimens 'Taken from a folder marked *Geissois jervoisiana* F. Muell. ms.' which he determined as *Davidsonia pruriens*. The specimens annotated by

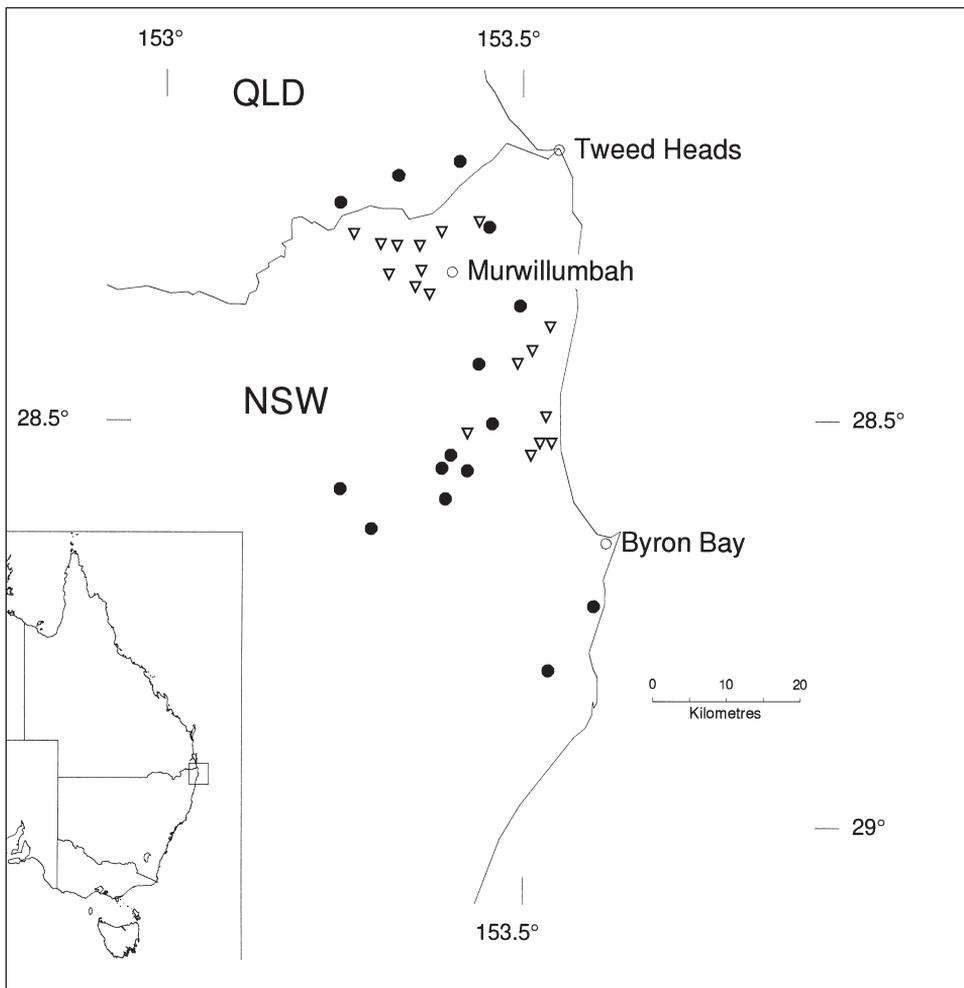


Fig. 4. Distribution of *D. jerseyana* (▽) and *D. johnsonii* (●).

Hoogland were *Baeuerlen 864* (MEL 106568 and MEL 106569) and *Barnard s.n.* (MEL 106570 and MEL 106571). The former specimens have since been re-determined as *D. jerseyana* and the latter confirmed as *D. pruriens*. MEL 106568 has attached a draft description of the specimen in Mueller's hand, but, there is no annotation of the name on either the note or on the sheets by Mueller.

The first reference to this new taxon was in Bailey (1895), '*D. jerseyana*, F. v. M., found on the southern border of Queensland and in the adjoining scrub lands of New South Wales'. Bailey (1900) listed var. *jerseyana* (with *D. jerseyana* F. v. M. as a synonym) as a variety, validating the name with the brief note that it is smaller in all parts than the type variety. It was not till 1909 that Bailey (p. 169) gave his own name as author of the variety, when he listed under *Davidsonia*, var. *jerseyana* Bail. = *D. jerseyana* F. v. M.

As no holotype existed, Bange (1952) proposed the specimen collected by Baeuerlen in October 1892 (BRI 11134) at Richmond River (New South Wales) as the lectotype for the variety 'because it is probably the specimen F. v. Muell. and Bailey have seen, the more so as the specimen is a good one'. Bange made no mention of the specimens collected in the same month in 1892 by Baeuerlen (No. 864) at Murwillumbah (MEL, NSW) as those at MEL were under the genus *Geissois* and he did not examine NSW material. It could be argued that the locality (Richmond River) of the designated lectotype does not fit Bailey's published habitat description of 'Towards Tweed River'. However, Bailey gave that vague description in *The Queensland Flora* (1900) from a Queensland perspective and we do not consider it sufficient reason to overturn Bange's lectotypification. This taxon is not known to occur in Queensland, even though it has been found very close to the border with that State; Bange (op. cit.) erroneously cited a specimen collected at Chillingham (*Dixon s.n.*, BRI 101933) for Queensland.

**Common name:** the common name widely used for this taxon is Davidson's Plum (Williams et al. 1984; Floyd 1989; Harden 1990).

**Selected specimens (from 14 examined):** New South Wales: North Coast: Chillingham Road, 13 km NW of Murwillumbah, *Foreman & Woodland s.n.*, 22 Oct 1977 (NE 35399); Chillingham, Tweed River, *Dixon s.n.*, Oct 1933 (BRI 333069); Murwillumbah, *Baeuerlen 864*, Oct 1892 (NSW, MEL); Tweed River, *Fawcett s.n.*, 1883 (MEL 106559); 5 km NE of Mullumbimby, *Elliott s.n.*, 18 Aug 1991 (NE 55496); 1 km E of Mooball, *Williams & Harden s.n.*, 17 Nov 1979 (NE 61638, NSW, BRI, CANB); 1 km east of Mooball, beside Burringbar Creek, *Williams s.n.*, Nov 1980 (NSW 389178, MEL, NE); Brunswick River, *White s.n.*, Nov 1885 (MEL 106549); Brunswick River Bridge, *Floyd & Hayes s.n.*, 21 Jan 1958 (CFSHB).

### 3. *Davidsonia johnsonii* J.B. Williams & G. Harden, **sp. nov.**

Ab aliis speciebus combinatione characterum sequentium distinguitur: planta in omnes partes plus minusve glabra; folia minora pinnis paucioribus; inflorescentiae terminales vel subterminales in ramulis frondosis; fructus depresso globosus; indumentum calycis breviter molliterque pubescens; pili irritantes omnino deficientes.

Type: New South Wales: North Coast: Huonbrook, Wilsons Creek Road, west of Mullumbimby, *J.B. Williams & G.J. Harden s.n.*, 17 Nov 1979 (holo NSW 427612; iso AD, BRI, CANB, HO, K, MEL, NE)

[*Davidsonia* species in Williams & Harden (1979: 15); Williams et al. (1984: 30)]

[*Davidsonia* species A in Harden (1990: 523)]

[*Davidsonia* sp. A Mullumbimby-Currimbin [sic] Ck (A.G. Floyd 1595) in *Threatened Species Conservation Act, 1995*]

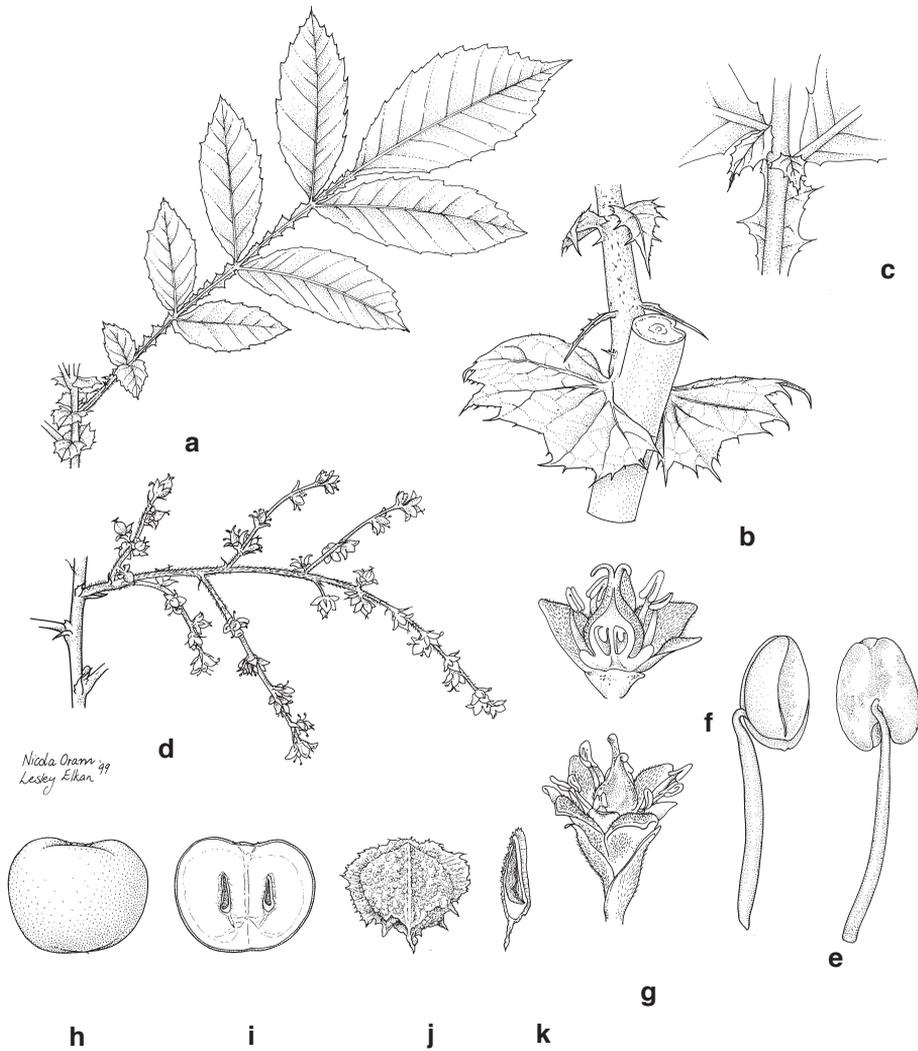
Illustrations: Williams & Harden (1979: 15); Harden (1990: 523).

Bushy spreading, suckering small tree 5–10(–18) m high, well-branched and forming a dense leafy crown; freely suckering from the roots; bark fawnish, smooth or becoming finely scaly. *Indumentum* inconspicuous or absent on mature parts; buds, young shoots and leaves pubescent, glabrescent with age; inflorescence axes and perianth shortly and finely pubescent; leaf buds fawn pubescent with non-irritant hairs; stalked red glandular hairs present on young shoots, and terminating teeth on rachis wings, margins of stipules and pinnae. *Seedling leaves* not seen as no viable seeds are known to develop. *Adult leaves* ; (6–)10–33(–47.5) cm long; petiole 2.5–7.0 cm long; rachis prominently winged adaxially, wing mostly continuous on rachis, as separated segments on petiole, wing irregularly dentate, each tooth with a hair-like point; stipules 7–15 mm diam., margins dentate, persistent; pinnae (3–)5–9(–11); terminal pinna mostly obovate to oblanceolate and tapering into petiolule, lateral pinnae narrow-ovate to narrow-obovate to oblong-oblanceolate, basal pinnae ovate to falcate-elliptic; apex acute to slightly acuminate, base  $\pm$  equal in upper pinnae, unequal on lower pinnae, upper surface green and glossy, lower surface dull, and both surfaces glabrous, margins regularly dentate; secondary veins 6–9 pairs, raised on lower surface; largest pinnae (terminal or subterminal) usually (10–)13–17(–25) cm long, (4–)5–7(–8) cm wide; lower pinnae 1.7–9.3 cm long, 0.8–4.5 cm wide; petiolules 0–2 mm long, except for terminal petiolule 10–25 mm long; stipellae usually present at base of pinnae (especially lower pairs), narrow-lanceolate, 3–11(–20) mm long, 1–3 mm wide, margins glandular-toothed. *Inflorescences* borne amongst the leaves, often terminal, elongated panicles, usually 10–20 cm long; peduncle 0.5–5 cm long; pedicels 0–1.0 mm long; bracts 3.0–4.0 mm long; bracteoles sessile, 2.0–3.0 mm long. *Flowers* 4- or 5-merous; sepals 3.1–4.4 mm long, dark pink, both surfaces finely and shortly pubescent; stamens (6–)8–10, 3.5–5 mm long; filaments 4.1–6.0 mm long, anthers ellipsoid to obovoid, 1.4–2.2 mm long, yellow, pollen absent from flowers examined; ovary 1.0–1.7 mm long, pubescent, styles 2 or 3, 2.1–4.5 mm long, often reduced or absent; sometimes ovary vestigial or lacking. *Fruit* depressed-globose, 20–39 mm long, 25–60 mm wide, 28–53 mm deep, reddish purple to purplish black; sprinkled with fine hairs, appearing smooth; mesocarp reddish; pyrenes usually 2 per fruit, sometimes 3, shape variable dependent on number, surface shortly and softly fibrous; pyrene body 0.9–1.2 cm long, 1.0–1.1 cm wide, crest 1.4–1.7 mm long; seeds not known to develop within the pyrenes. (Fig. 5).

**Habitat and distribution:** *Davidsonia johnsonii* usually grows in disturbed subtropical rainforest, or on margins of wet sclerophyll forest and gully rainforest, sometimes in disturbed areas, mostly from 15 to 260 m altitude. Usually on podsolic soils of variable structure, gleyed podsolics or kraznozems on basalt, often over Silurian greywacke, slate or phyllite; over Lismore basalt and its boundary with Nimbin rhyolite; and over Lamington volcanics. Dominant species include *Eucalyptus grandis* and *Lophostemon confertus* in wet sclerophyll forest, and with many species in rainforest including *Hicksbeachia pinnatifolia*, *Diploglottis australis*, *Acacia melanoxylon*, *Castanospora alphanthii*, *Omalanthus populifolius*.

This taxon has a very scattered distribution and is known from a limited number of small populations, north from Tintenbar in New South Wales to near Natural Bridge (Watson 1987) and Upper Tallebudgera (McDonald pers. comm. 2000) and Upper Currumbin valleys in southern Queensland (Fig. 4), a distance of about 120 km and an east-west range of 30 km. Mostly occurs as groups of several mature trees, with many saplings and young plants that have developed from root suckers.

**Phenology:** flowers chiefly October to November; ripe fruit recorded mostly February to April.



**Fig. 5.** *D. johnsonii*. **a**, adult leaf ( $\times 0.3$ ); **b**, stipules ( $\times 1.5$ ); **c**, rachis, pinnae bases, stipellae ( $\times 1.5$ ); **d**, inflorescence ( $\times 0.5$ ); **e**, stamens ( $\times 8$ ); **f**, flower in L.S. ( $\times 3$ ); **g**, flower ( $\times 3$ ); **h**, drupe ( $\times 0.5$ ); **i**, drupe in L.S. ( $\times 0.5$ ); **j**, pyrene ( $\times 1$ ); **k**, pyrene in L.S. ( $\times 1$ ).

**Conservation Status:** listed as '*Davidsonia* sp A Mullumbimby-Currimbin [sic] Ck (A.G. Floyd 1595)' in New South Wales as an endangered species on Schedule 1 of the *Threatened Species Conservation Act, 1995*; 2ECi on the ROTAP list (Briggs & Leigh 1996). This species is only known to occur in one gazetted reserve, Snows Gully Nature Reserve in New South Wales. The largest populations at Huonbrook and Upper Burringbar are on private properties; present owners are actively involved in the conservation and rehabilitation of disturbed rainforest. Threats to the species include general clearing of remnant pockets of rainforest and the likely narrow genetic base in a limited set of small populations.

There are some important questions arising as to the dispersal of the species and its future in the wild. Flowers are formed regularly and prolifically, but as indicated in the species description no pollen has been detected in mature anthers and ovaries are small or lacking, sometimes vestigial and often the styles are reduced or absent. Ovules are usually absent — but in one collection two or three abortive shrivelled ovules were present in each of the two loculi. Fruit are produced abundantly and are well-developed but the pyrenes are always empty and no seed has ever been found. From our own field observations and communications with others that are familiar with field populations (G. Watson, A.G. Floyd, D.L. Jones) the species relies on root suckers for reproduction. This vegetative reproductive process readily enables present stands to propagate, but it does not account for the species distribution in populations scattered over 120 kms. Unless, as suggested by Watson (1987), aboriginal people were involved with the vegetative spread of this species over its geographic range. Or, alternatively is it possible that very rarely fertile seeds are formed, with subsequent dispersal and establishment of seedlings.

**Derivation of name:** named in honour of the late Dr L.A.S. Johnson who during the past 49 years made outstanding contributions to systematic botany, rainforest floristics and to the understanding of the Australian flora while on the staff and as Director, and later as Director Emeritus, of the Royal Botanic Gardens Sydney. Lawrie Johnson annotated specimens of this taxon in 1949, the year after he joined the staff of the Gardens, as 'clearly a new species'.

**Discussion:** a specimen of this taxon collected in 1936 at Nimbin by King (BRI) was cited by Bange (1952) as 'variety dubious'. Specimens deposited at Coffs Harbour Forestry Herbarium (now CFSHB) collected by Floyd and Hayes at The Pocket in 1958 and Watson at Thieles Gate, Huonbrook in 1978 were originally not separated as a new taxon. It was not until Watson brought the plants to the attention of the authors in 1978 that it was further investigated and the differences from the other two taxa were clarified.

**Common names:** Smooth Davidsonia (Williams et al. 1984), Smooth Davidson's Plum (Floyd 1989, Harden 1990), Small-leaved Davidson's Plum (Floyd 1989).

**Selected specimens (from 21 examined):** Queensland: Moreton: Olson's Property, Currumbin Valley, *Jones s.n.*, 10 Jan 1982 (NSW 389182, BRI, CANB, NE).

New South Wales: North Coast: Hogans Scrub, North Tumbulgum, *Floyd 1827*, 8 Dec 1981 (NSW, CFSHB); Whian Whian, *Cheal s.n.*, 6 Sept 1926 (NSW 104890); Mooball, near Murwillumbah, *Flowers s.n.*, 2 May 1944 (NSW 104891); 5.2 km west of Burringbar on property of M. Lickfold, Williams, *Harden & Guymmer s.n.*, 13 Nov 1980 (NSW 389176, A, AD, B, BRI, CANB, CHR, HO, K, L, LE, MO, NE, PE, PRE, RSA, US, W); Burringbar Range, end of track 1.7 km N of Upper Burringbar, 22°25'S 153°27'E, *Davies 1564a & Richardson*, 27 Feb 1990 (CANB, NSW, BRI, MEL); Nimbin, *King s.n.*, 2 Mar 1936 (BRI 333410); Kerle's Property, c. 9 km W of Mullumbimby on Wilsons Creek Road, *Williams s.n.*, 17 Dec 1985 (NE 69307, NSW, BRI, MEL); Thiele's Gate, Huonbrook via Mullumbimby, *Watson s.n.*, 26 Aug 1978 (NE 35678), *Floyd 1595*, 3 Dec 1980 (CHSHB); The Pocket, Billinudgel Rd, *Floyd*

& Hayes *s.n.*, 22 Jan 1958 (CFSHB); Broken Head, 10 km S of Byron Bay, Elliott *s.n.*, 25 Aug 1991 (NE 55495).

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## References

- Airy Shaw, H.K. (1973) *A dictionary of the flowering plants and ferns by J.C. Willis*, ed. 8, revised by H.K. Airy Shaw. (Cambridge University Press: London).
- Angiosperm Phylogeny Group (1998) An ordinal classification for the families of flowering plants. *Ann. Missouri Bot. Gard.* 85: 531–553.
- Anon. (1876) New plants. *Gard. Chron.* 5: 603.
- Bailey, F.M. (1895) Peculiarities of the Queensland flora. *Bot. Bull. Dept. Agric., Queensland* 12: 11–26.
- Bailey, F.M. (1898) Edible fruits indigenous to Queensland. No. 1. Davidsonian Plum. *Queensland Agric. J.* 2: 471.
- Bailey, F.M. (1900) *The Queensland Flora* 2:538.
- Bailey, F.M. (1909) *Comprehensive Catalogue of Queensland Plants both Indigenous and Naturalised*.
- Bange, G.G.J. (1952) A new family of dicotyledons: Davidsoniaceae. *Blumea* 7: 293–296.
- Briggs, J.D. & Leigh, J.H. (1988) *Rare or Threatened Australian plants*. Special Publication No. 14. (Australian National Parks and Wildlife Service: Canberra).
- Briggs, J.D. & Leigh, J.H. (1996) *Rare or threatened Australian plants*, revised edition. (CSIRO: Collingwood).
- Brummit, R.K. (1998) A proposal to allow second-stage lectotypification and neotypification where necessary. *Taxon* 47: 890.
- Cronquist, A.J. (1981) *An Integrated System of Classification of Flowering Plants*. (Columbia University Press: New York)
- Dahlgren, R.M.T. (1980) A revised system of classification of the angiosperms. *Bot. J. Linn. Soc.* 80: 91–124.
- Dickison, W.C. (1980) Comparative wood anatomy and evolution of the Cunoniaceae. *Allertonia* 2: 281–321.
- Doweld, A.B. (1998) The carpology and taxonomic relationships of *Davidsonia* (Davidsoniaceae). *Edinburgh J. Bot.* 55: 13–25.
- Elliott, F. (1991) *Observations on the pollination of Davidsonia pruriens F. Muell. var. jerseyana Bailey*. Unpublished Student report, Botany Department, University of New England, Armidale.
- Elliott, W.R. & Jones, D.L. (1984) *Encyclopaedia of Australian Plants* 3: 199–200. (Lothian Publishing Company: Melbourne).
- Engler, A. & Prantl, K. (1930) *Die Natürlichen Pflanzenfamilien* 18a: 261–262.
- Floyd, A.G. (1981) *New South Wales Rainforest Trees*, Part II, ed. 2. Research Note No. 7 (Forestry Commission of New South Wales: Sydney).
- Floyd, A.G. (1989) *Rainforest Trees of Mainland South-eastern Australia*. (Inkata Press: Melbourne).
- Floyd, A.G. & Hayes, H.C. (1961) *New South Wales Rainforest Trees*, Part II. Research Note No. 7 (Forestry Commission of NSW: Sydney).
- Francis, W.D. (1970) *Australian Rainforest Trees*, ed. 3. (Australian Government Publishing Service: Canberra).

- Harden, G.J. (1990) Davidsoniaceae. P. 523 in Harden, G.J. (ed.), *Flora of New South Wales*, vol.1. (New South Wales University Press: Kensington).
- Hutchinson, J. (1973) *The Families of Flowering Plants*, ed. 3. (Oxford University Press: London).
- Jacobs, S.W.L. & Pickard, J. (1981) *Plants of New South Wales. A Census of the Cycads, Conifers and Angiosperms*. (Royal Botanic Gardens: Sydney).
- Mabberley, D.J. (1997) *The Plant-book. A Portable Dictionary of the Vascular Plants*, ed. 2. (Cambridge University Press: Cambridge).
- Mueller, F.J.H. (1867) *Fragmenta Phytographiae Australiae* 6:4.
- Parham, J.W. (1972) *Plants of the Fiji Islands*. (Government Printer: Suva).
- Quinn, F.C., Williams, J.B., Gross, C.L. & Bruhl, J.J. (1996) *Report on rare and threatened plants of north-eastern New South Wales*. Report prepared for New South Wales National Parks and Wildlife Service and Australian Nature Conservation Agency.
- Stanley, T.D. & Ross, E.M. (1984) *Flora of South-eastern Queensland*, vol. 1. (Queensland Department of Primary Industries: Brisbane).
- Takhtajan, A. (1980) Outline of the classification of flowering plants (Magnoliophyta). *Bot. Rev.* 46: 225–359.
- Watson, G.C. (1987) *A comparative study of the New South Wales members of the family Davidsoniaceae Bange with a view to their conservations and development*. Unpublished Diploma in Natural Resources thesis, University of New England, Armidale.
- Wiley, E.O. (1978) The evolutionary species concept reconsidered. *Syst. Zool.* 27: 17–26.
- Wiley, E.O. (1981) *Phylogenetics: the theory and practice of phylogenetic systematics*. (Wiley: New York).
- Williams, J.B. (1979) *Checklist of the Rainforest Flora of New South Wales*. (University of New England: Armidale).
- Williams, J.B. & Harden, G.J. (1979) *Rainforest Trees and Shrubs*. (University of New England: Armidale).
- Williams, J.B., Harden, G.J. & McDonald, W.J.F. (1984) *Rainforest Trees and Shrubs of New South Wales and Southern Queensland*. (Botany Department, University of New England: Armidale).

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