

Pomax abunda Ngugi and *P. beanii* Ngugi (Rubiaceae), two new species from Eastern Australia

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Summary

Ngugi, L.B. & Forster, P.I. (2025). *Pomax abunda* Ngugi and *P. beanii* Ngugi (Rubiaceae), two new species from Eastern Australia. *Austrobaileya* **15**: 52–70. This paper examines morphological variation in *Pomax umbellata* (Gaertn.) Sol. ex A.Rich., which occurs mainly in coastal areas of eastern Australia, and reviews other names placed in synonymy with it. Lectotypes are designated for *Pomax hirta* DC., *P. umbellata* var. *mitchelliana* Domin and *P. umbellata* var. *ovatifolia* Domin. *Pomax beanii* Ngugi and *P. abunda* Ngugi, both of which occur in more inland parts of eastern Australia, are described as new species. Notes are provided for all species, detailing their distinctive features, habitat, phenology, and conservation status, along with detailed illustrations, images, distribution maps, and a species identification key for all *Pomax* species.

Key Words: Rubiaceae; *Pomax*; *Pomax abunda*; *Pomax beanii*; *Pomax umbellata*; flora of Australia; flora of Queensland; flora of New South Wales; flora of Victoria; new species; taxonomy; species key; lectotypification

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Introduction

Pomax Sol. ex DC., from the family Rubiaceae, currently comprises three species that are widespread across all states and territories of mainland Australia, excluding Tasmania (Ngugi 2022). It has been classified within the tribe *Anthospermeae* Cham. & Schldl., subtribe *Operculariinae* Benth. based on morphology (Puff 1982). The most recent genomic studies using a combined plastid dataset have inferred that it is sister to *Leptostigma* Arn. (Thureborn *et al.* 2024a,b), although their earlier work based on low copy nuclear genes indicated a closer relationship to *Opercularia* Gaertn. (Thureborn *et al.* 2022). In either case, *Leptostigma*, *Opercularia* and *Pomax* are closely related and form a monophyletic clade with strong statistical support.

Pomax plants are relatively small and inconspicuous in stature, with a single species (usually referred to as *P. umbellata*), or multiple species and varieties recognised in taxonomic accounts of the genus (de

Candolle 1830; Bentham 1867; Bailey 1900; Domin 1929; Ngugi 2022). The genus was originally established to include two species: *Pomax hirta* DC. and *P. glabra* DC. (de Candolle 1830). *Opercularia umbellata* Gaertn. was later transferred to *Pomax* by Richard (1834) as *P. umbellata* (Gaertn.) Sol. ex A.Rich. Subsequently, *P. rupestris* F.Muell. was described by Mueller (1853). Bentham (1867) reduced all these names to synonymy under *P. umbellata*, considering them to be variations of a single entity, a view later supported by Bailey (1900). However, Domin (1929) revisited this species complex and divided *P. umbellata* into six varieties with the description of *P. umbellata* var. *ovatifolia* Domin, *P. umbellata* var. *mitchelliana* Domin, *P. umbellata* var. *hirta* (DC.) Domin, *P. umbellata* var. *glabra* (DC.) Domin, and *P. umbellata* var. *carnosula* Domin. Nevertheless, these varieties were not formally recognised in subsequent flora accounts (Burbidge & Gray 1970; James 1992; Ross 1993; Jeanes 1999; CHAH 2011),

although Hawkeswood (1980) suggested that “at least four entities” might exist. Currently, *Pomax* includes three recognised species: *P. umbellata*, *P. rupestris*, and *P. ammophila* Ngugi (Ngugi 2022; CHAH 2023).

The different species within *Pomax* exhibit considerable floral diversity associated with several reproductive mechanisms, including protogyny, heterostyly, andromonoecy, and cleistogamy. Understanding these mechanisms provides insights into adaptive strategies for successful reproduction and outcrossing in the genus.

One likely explanation for the diverse floral characteristics observed in *Pomax* is the protogynous nature of its flowers, where the pistils emerge before the stamens in bisexual flowers (Fig. 1C & D). This temporal separation of reproductive organ maturity reduces the likelihood of self-pollination and promotes outcrossing, as the stigmas become receptive before the pollen is shed within the same flower.

Another factor contributing to floral variation is heterostyly (Dessein 2005). Heterostyly, observed in many species of Rubiaceae (Robbrecht 1988), including *Pomax* (Florabase 2023), involves the reciprocal positioning of anthers and stigmas in two floral morphs within a single species (Endress 1994). This floral adaptation minimises the risk of self-fertilisation and is characterised by flowers with either long-styled form or a short-styled form (distylous), or flowers with styles and stamens of nearly equal length (tristylous). In *Pomax*, heterostyly has been observed in herbarium specimens collected from July to December in Queensland (Fig. 1E & F). However, most flowers examined have styles with stamens of almost equal length, making them homostylous (Fig. 1D).

All *Pomax* species are andromonoecious (Fig. 1A & D), meaning they bear both male and bisexual flowers (Endress 1994; Groom & Lamont 2015). This reproductive strategy increases cross-pollination opportunities by

facilitating transfer of pollen between male and female flowers. Whilst single gender plants of *Pomax* exist (e.g. a female only specimen of *P. rupestris* (AD 231100) (Fig. 1B)), dioecy is highly uncommon, but may occur temporally.

Another intriguing phenomenon contributing to floral variation in *Pomax* is cleistogamy. Cleistogamous flowers remain permanently closed and do not undergo anthesis (flower opening). Instead, they self-pollinate within the closed flower. This strategy is particularly prevalent in *Pomax* species during the warmest time of the year and was observed in glasshouse cultivated plants (Fig. 1G & H), although it may occur at a different time in its natural habitat. Intermittent cleistogamy is thought to be a response to environmental cues such as day length and temperature and may play a role in influencing the genetic diversity and adaptability of populations (Jones 2012).

Past applications of the name *Pomax umbellata* are considered to apply to three taxa. The name *P. umbellata* and other names that are considered taxonomic synonyms are typified in this paper. Two new species are also proposed: *Pomax beanii* Ngugi (previously named as *P. umbellata* var. *mitchelliana* Domin) and *P. abunda* Ngugi.

Materials and methods

This study is based on the examination and collection of all three species from the wild, seed grown or cultivated plants at Toowong, and a morphological examination of herbarium collections held at the Queensland Herbarium (BRI) and specimens loaned from the Northern Territory Herbarium (DNA, NT), National Herbarium of New South Wales (NSW), and National Herbarium of Victoria (MEL). High resolution images of material from the British Museum (BM), National Botanic Garden of Belgium (BR), Conservatoire & Jardin botaniques de la Ville de Genève (G), Royal Botanic Gardens, Kew (K), Martin-Luther-Universität (HAL)

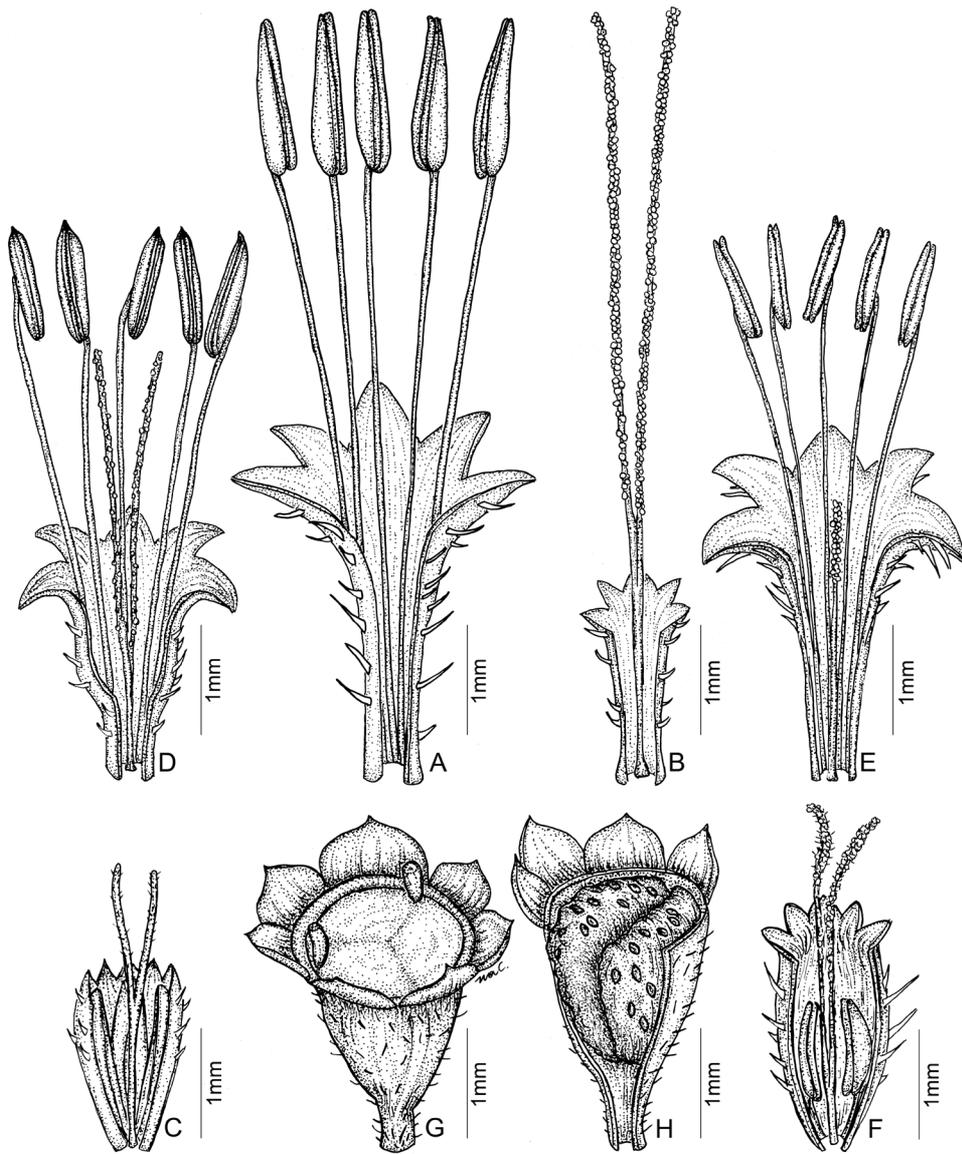


Fig. 1. Variation in *Pomax* flowers (scales as indicated by bar). A. *P. umbellata* male flower. B. *P. rupestris* female flower. C. *P. abunda* protogynous functional female flower; D. *P. abunda* protogynous functional male flower. E. *P. abunda* short-styled flower, F. *P. abunda* long styled flower. G & H. *P. abunda* showing cleistogamy. A from Yates AY 2021075 (BRI); B from Duval 1282 (AD); C from Ngugi 108 (BRI). D from Bean 30388 (BRI). E from Forster PIF24712 & Booth (BRI); F from Forster PIF46899 & Leiper (BRI); G & H from Bean ARB31497 (BRI). Del. N. Crosswell.

and National Museum Prague (PR), were also examined (indicated with ! in specimen citations), either via JSTOR Global Plants or from images provided by curators.

Fertile specimens collected from August to December were selected for measurements to ensure consistency in flowering patterns; however, no discernible variation was observed outside this period. Measurements of the corolla, stamens and style were taken from dried material reconstituted with hot water, while all other measurements were undertaken on dried material using a ruler or microscope eyepiece graticule. Stereomicroscopy using a Nikon SMZ25 (Nikon, Japan) and Scanning Electron Microscopy (SEM) using a desktop Phenom Pure (ThermoFisher Scientific, The

Netherlands) were used to clearly visualise and characterise features such as the stem indumentum, presence of colleters on stipules, leaf indumentum, fruit dehiscence and seed position, pollen grain shape, and idioblasts on the seeds.

The distribution maps (**Map 1–3**) were compiled from localities and/or geocode information provided on the labels of specimens at BRI, NSW, MEL and NT and were created using Esri (2021). Common abbreviations in the specimen citations include NP for National Park and SF for State Forest. References to herbaria use the official abbreviations as listed in the *Index Herbariorum* (<https://www.nybg.org/plant-research-and-conservation/>).

Taxonomy

Key to the species of *Pomax*

- 1 Leaves sessile or with short petiole up to 0.5 mm long **2**
- 1. Leaves petiolate, petiole > 0.6 mm long **4**
- 2 Stems hairy; leaves glabrous on upper surface, hairy on margins and lower surface, apex acuminate or attenuate **3**
- 2. Stems glabrous; leaves glabrous throughout, apex long attenuate ***P. rupestris***
- 3 Hairs on leaves and stems mixed, mostly shortly uncinata, or otherwise erect or flexuose; peduncle reflexed after anthesis; seeds obdeltoid, 2.2–3.8 mm long; growing on arid zone sand dunes ***P. ammophila***
- 3. Hairs on leaves and stems mostly straight and erect, or flexuose; peduncle incurved before and after anthesis; seeds obovoid to triangular, 1.8–2.4 mm long; growing on hills and mountains ***P. beanii***
- 4 Plant with prostrate stems, rooting at nodes; leaves broadly elliptic or ovate with up to 3 or 4 (occasionally 7) pairs of lateral veins; stipules mostly reflexed, up to 4 mm long; habitat usually coastal lowlands ***P. umbellata***
- 4. Plant with erect stems, not rooting at nodes; leaves elliptic with up to 2 or 3 pairs of lateral veins; stipules mostly erect, up to 1.8 mm long; habitat inland ***P. abunda***

1. *Pomax umbellata* (Gaertn.) Sol. ex A.Rich., *Mém. Soc. Hist. Nat. Paris* 5: 146 (1834); *Opercularia umbellata* Gaertn., *Fruct. Sem. Pl.* 1: 112, t. 24, Fig. 4 (1788); *Pomax umbellata* var. *umbellata*, Domin, *Biblioth. Bot.* 89: 628 (1929). **Type citation:** “ex herbario Banksiano. Habitat in Neo-

hollandia”. **Type:** Australia. New South Wales. Botany Bay, 28 April–6 May 1770, [J.] Banks & [D.] Solander s.n. (holo: BM 001040393!).

Pomax hirta DC., *Prodr. [A.P. de Candolle]* 4: 615 (1830), *nom. illeg.*; *P. umbellata* var. *hirta* (DC.) Domin, *Biblioth. Bot.* 89: 627

(1929), *nom illegit.* **Type citation:** “in Novâ-Hollandiâ. ... Sieb! nov. holl. n. 250. (v.s.)”. **Type:** Fl. Novae Holl. exsicc. [Australia. New South Wales. Port Jackson], [1 June 1823–December 1823], [F.W.] Sieber 250 (lecto [here designated]; HAL 113344!; isolecto: BR 000000574345!, BR 00000074378!, G 00667917! [topmost specimen on sheet], K 000772231! [top three specimens on sheet]).

Pomax glabra DC., *Prodr. [A.P. de Candolle]* 4: 615 (1830); *P. umbellata* var. *glabra* (DC.) Domin, *Biblioth. Bot.* 89: 627 (1929). **Type citation:** “in Novâ-Hollandiâ ad Port Jackson. ... (v.s.)”. **Type:** Australia. New South Wales. Port Jackson, in 1829, *Gaudichaud [C. Gaudichaud-Beaupré] s.n.* (holo: G 00667919!).

Opercularia banksiana Schult., *Mant. 3 (Schultes & Schultes f.)* 3: 261 (1827), *nom. illeg.*

Pomax umbellata var. *ovatifolia* Domin, *Biblioth. Bot.* 89: 627 (1929). **Type citation:** “N. S. Wales: R. BROWN Iter Australiense 1802 – 05 No. 3485 p.p.; Botany Bay, in arenosis, R. BROWN; SIEBER Fl. Novae Holl. exsicc. No. 250 p.p. Süd-Queensland: Stradbroke Island, auf Sand (DOMIN III. 1910)”. **Type:** Australia. Queensland. MORETON DISTRICT: Stradbroke Island, 1909–1910, *K. Domin 8629* (lecto [here designated]; PR 531258!). **Residual syntypes:** [Australia. New South Wales.] Botany Bay, in 1802, *R. Brown Iter Australiense 1802–05, 3485 p.p. (n.v.)*; [Australia. New South Wales.] Botany Bay, in 1802, *R. Brown s.n. (n.v.)*; Fl. Novae Holl. exsicc. [Australia. New South Wales. Port Jackson], [1 June 1823–December 1823], [F.W.] Sieber 250 (BR 000000574345!, BR 00000074378!, G 00667917! [topmost specimen on sheet], HAL 113344!, K 000772231! [top three specimens on sheet]).

Perennial herb, with a decumbent habit. Stems prostrate, rooting at nodes, terete, herbaceous, internodes 17–60 mm long; indumentum pubescent comprising mixed short simple erect hairs or sometimes with flexuose short silky hairs, 0.2–0.8 mm long; mature stem remains green without outer surface layers decorticating. Stipules

interpetiolar, linear to narrowly triangular or ovate, or sometimes lobed, reflexed or sometimes erect, 0.8–4 mm long, 0.2–1.5 mm wide; indumentum comprising short simple hairs, 0.2–2 mm long, sometimes longer along margins; colleters along margins. Leaves opposite; petiolate for 0.6–6.6 mm; lamina oval or ovate, 12–27 mm long, 4–11 mm wide, margins entire or sinuate, light green; base acute or decurrent; apex acute; lateral veins up to 7, distinct; indumentum spreading, 0.1–0.7 mm long and can be longer on veins to 1.5 mm, evenly spread above and below. Inflorescence terminal or axillary near the top, 2–4 flowers fused at their bases to form a capitulum; andromonoecious. Flowering peduncles 3–8 mm long; indumentum pubescent, comprising erect hairs 0.1–0.3 mm long, elongating as it matures. The female parts of bisexual flowers develop before male parts. Fruiting peduncles 5–15 mm long; fruiting calyx 0.2–1.8 mm long, apex obtuse, acute, or acuminate. Pistillate flowers: corolla 0.9–2.3 mm long, lobes 4 or 5, 0.1–0.2 mm long, light green with pink tinge or purple, indumentum external, papillate to spreading, hairs 0.1–0.4 mm long; style filiform, 3.5–4 mm long, deeply bifid, stigma plumose. Staminate flowers: corolla 1.7–3.4 mm long, lobes 4 or 5, 0.2–0.5 mm long, light green with pink tinge, externally glabrous or with indumentum of sparse hairs 0.1–0.5 mm long; stamens 3–5, filaments exerted, 1.4–3.5 mm long, anthers 1–2.5 mm long. Fruits an operculate campanulate capsule, obconical, non-fleshy, 2–3.3 mm long, 1.5–2.5 mm wide; locules 1–4, seed per locule 1; indumentum comprising sparse or very sparse, erect hairs 0.1–0.4 mm long; empty capitulum persistent for some time after seed dehiscence. Seeds ellipsoidal or obovoid, 1.4–1.9 mm long, 0.9–1 mm wide, 0.2–0.6 mm broad, ridge on dorsal surface $\frac{1}{2}$ to $\frac{3}{4}$ of seed length; covered with white idioblasts containing calcium oxalate crystals (raphides). Pollen tricolporate, oblate. **Fig. 2 & 4.**

Additional selected specimens examined: Queensland. PORT CURTIS DISTRICT: Agnes Water area, Miriam Vale Shire, Aug 1983, *Gibson 581* (BRI). BURNETT DISTRICT: At the summit, Mount Perry, Nov 2022, *Ngugi et al. LBN446* (BRI). WIDE BAY DISTRICT: Great Sandy NP, Fraser Island, Wathumba Swamp, 5 km SW of Orchid

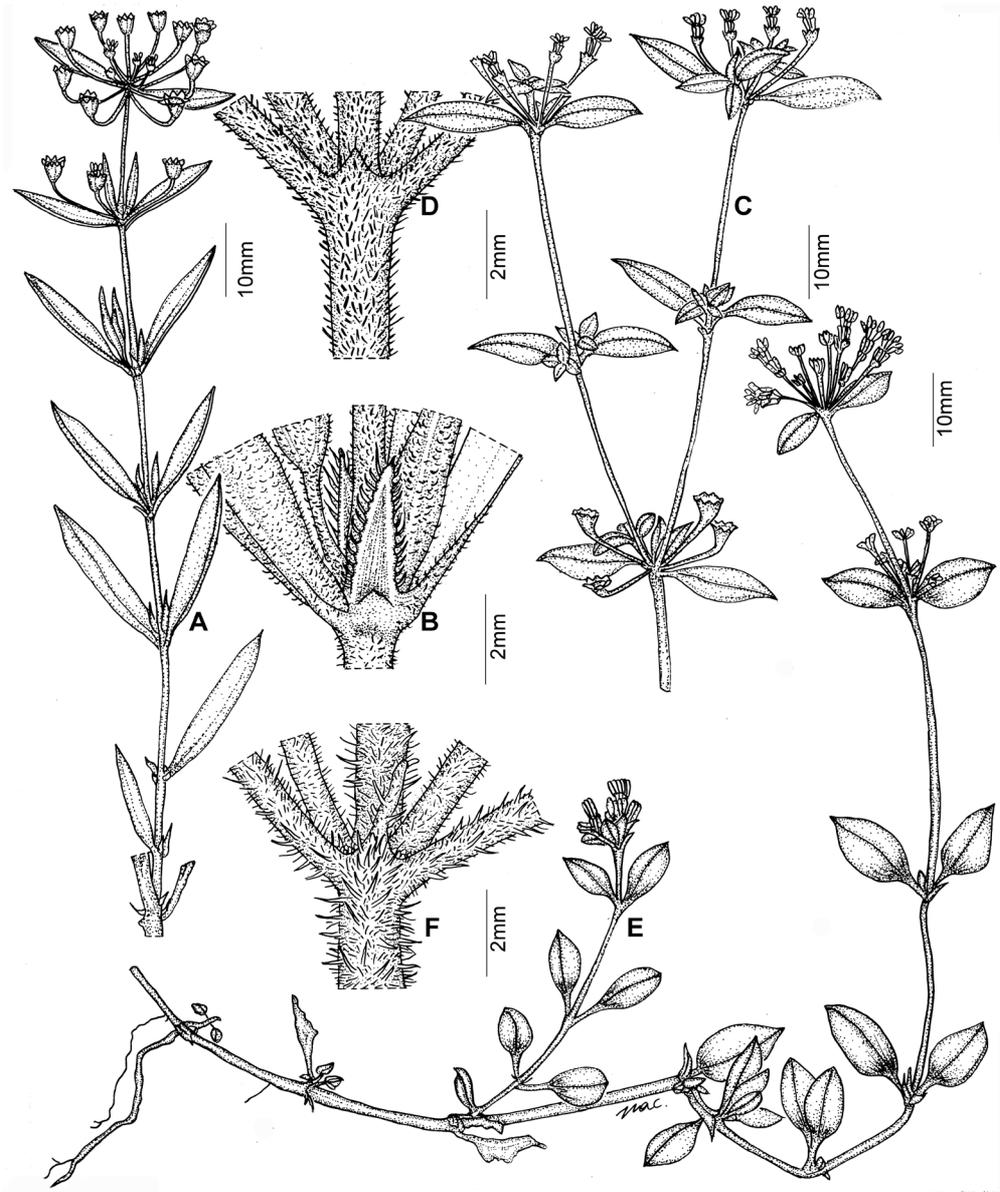


Fig. 2. A. *Pomax beanii* showing erect habit. B. *P. beanii* showing narrowly triangular stipule. C. *P. abunda* showing erect habit. D. *P. abunda* showing short triangular stipule. E. *P. umbellata* showing rooting at node. F. *P. umbellata* showing linear stipule. A from *Bean 27968* (BRI); B from *Bean 34701*; C & D from *Ngugi 109* (BRI); E & F from *Ngugi 110 & Louden* (BRI).

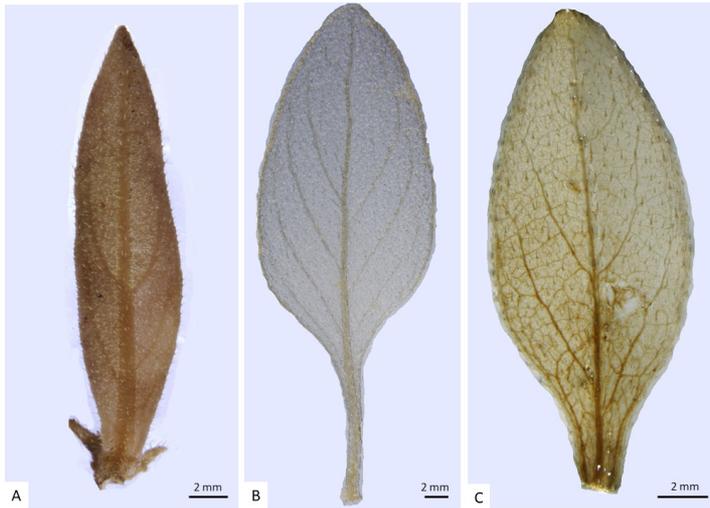


Fig. 3. Comparison of *Pomax* leaves. A. *P. beanii*. B. *P. umbellata*. C. *P. abunda*. A from Ngugi 500 & Forster (BRI); B from Ngugi 110 & Louden (BRI); C from Ngugi 108 (BRI).

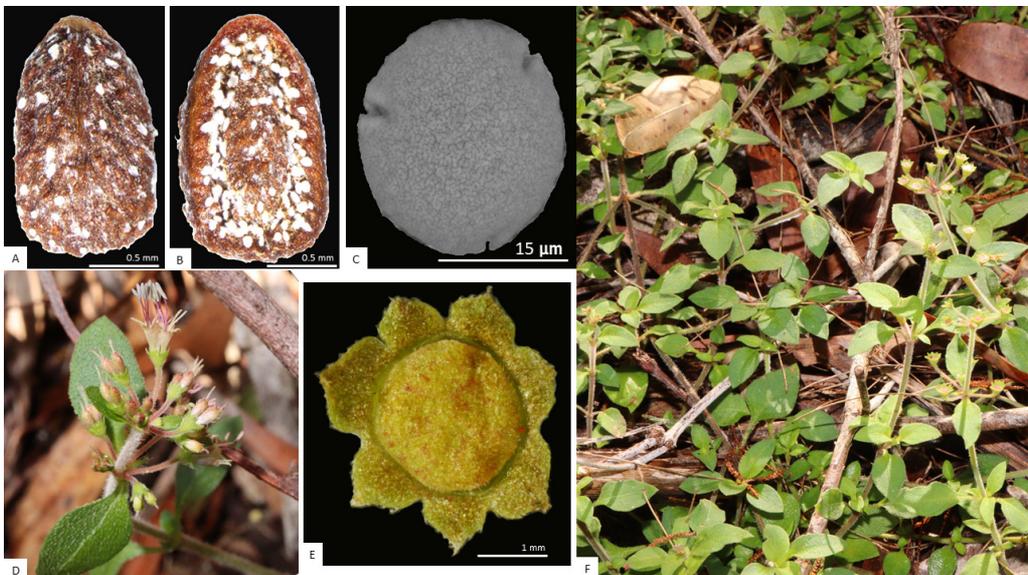


Fig. 4. Flowers, fruit, seed and pollen of *Pomax umbellata* (scales as indicated by bar). A. seed dorsal view. B. seed ventral view. C. SEM of pollen grain showing oblate, tricolporate surface pattern. D. flowers in each capitulum fused by their ovaries. E. fruit showing outer lid and calyx. F. prostrate habit. A & B from Halford QM1864 (BRI); C–F from Ngugi 110 & Louden (BRI).

Beach, Nov 2002, *Forster PIF29015* (BRI, MEL, NSW); Camp Milo, c. 40 miles [64.4 km] E of Gympie, Aug 1965, *Hockings s.n.* (BRI [AQ00637235]); Wide Bay Training Area (Australian Defence Force), Tin Can Bay, Mosquito Creek, Dec 2015, *Forster PIF43675 & Thomas* (BRI); Great Sandy NP, Great Walk, Feb 2022, *Yates NAY2022035* (BRI). MORETON DISTRICT: Kendall Access Fire Trail, near Kendall St, Bribie Island, Aug 2021, *Ngugi 110 & Loudon* (BRI); 2 km N of Coolum Beach, c. 130 km N of Brisbane, Dec 1975, *Sharpe 1891* (BRI); Moreton Island, Cowan Cowan, Oct 1973, *Durrington 1134 & Levine* (BRI); Stradbroke Island, Sep 1935, *Goy 42* (BRI); Caloundra, Aug 1932, *Blake 4159* (BRI); Jorl Court, near Stringybark road, S of Buderim, Mar 1993, *Bean 5822* (BRI); Mudjimba Environmental Park, S of Coolum, Aug 1994, *Bean 7774* (BRI, MEL); Sippy Creek, S of Buderim, Sep 1999, *Bean 15291* (BRI); Woogoompah Island, c. 3 km SE of Jacobs Well, Sep 2003, *Halford Q7917 & Battanoff* (BRI); Cathy Crawford Picnic Area, Sonia Road, Miami, Jun 2003, *Bean 20493* (BRI); Godlonton Reserve, Broadwater St., Runaway Bay, May 2003, *Bean 20460* (BRI); North Stradbroke Island, Brown Lake, Oct 2006, *Stephens 2410061 & Sharp* (BRI); Just E of Cowan Cowan on eastern side of main road, Moreton Island, Sep 2008, *Holland 1496 & Beggs* (BRI); Bribie Island, 100 m W of southern beach access car park off Arcadia Avenue, Nov 2015, *Halford QM1864* (BRI); Somerset Trail, The Gantry, Mt Mee, D'Aguilar NP, Jun 2023, *Ngugi LBN583* (BRI). **New South Wales.** 1 km S of Hastings Point, near Kingscliff, Apr 2001, *Bean 17590* (BRI, NSW); Minyon Falls, NNE of Lismore, Jul 1993, *Bean 6206* (BRI); Watt's Folly Road, Nightcap Range, Whian Whian SF, c. 15 km W of Mullumbimby, Dec 1977, *Haegi 1512* (BRI, NSW); Candole Forest Road, Candole SF, E of Grafton, Sep 2011, *Bean 31145* (BRI, NSW); Toukley, Sep 1975, *Seur 282* (NSW); Blackwall Mount, Woy Woy, Aug 1969, *McBarron 17685* (NSW); Kurnell Peninsula, top of sandy ridge c. 200 m along Muru fire trail from Visitor Centre, Botany Bay NP, Sep 2005, *Crayn 991 & Coveny* (NSW); Area NE of the Bombah Point ferry, Myall Lakes NP, Sep 1988, *Greuter 20519* (NSW); Seal Rocks, Jul 1979, *Fox 7907010* (NSW); Near Botany, Nov 1950, *Willows 11* (NSW).

Distribution and habitat: *Pomax umbellata* occurs in coastal eastern Australia from central Queensland down to central New South Wales (**Map 1**). It grows mainly in coastal environments, predominantly in open mixed forests (wallum) of eucalypts with an understorey of open heath on white sand or in areas adjacent to notophyll vine forests on sand or other substrates (**Fig. 5**).

Notes: *Pomax umbellata* is most similar to *P. abunda* but can be distinguished by the prostrate habit, the presence of rooting at nodes, mature stems that remain green without the outer surface layers decorticating,

longer stipules (0.8–4 mm long) and leaves that are widely elliptic, oval or ovate with 2–4 pairs of distinct lateral veins.

Typification: *Pomax umbellata* was the first species in the genus to be collected, by Banks and Solander in 1770 along the east coast of Australia on James Cook's exploration voyage. Solander initially assigned the name *Pomax umbellata* to their material (BM 001040393!), but this remained unpublished. When Gaertner (1788) published *De Fructibus et Seminibus Plantarum*, the species was placed under the genus *Opercularia*, with Solander's manuscript name in synonymy. The original manuscript name of Solander was referred to by Richard (1834) when the name was recombined into *Pomax*.

Pomax hirta and *P. glabra* were both described by de Candolle (1830). *Pomax hirta* was synonymised with *P. umbellata* by Bentham (1867) and has not been recognised as a valid species since. *Pomax hirta* is an illegitimate name due to de Candolle (1830) including *Opercularia umbellata* as a synonym. The type collection of *P. hirta* (Sieber 250) is likely to be present in multiple herbaria as Sieber is known to have made up to 23 sets of many of his collections (JGP 2025). So far, duplicates of this collection have been seen at BR, G, HAL and K. A lectotype is designated for this name based on the HAL sheet as it was verified (i.e. seen) by de Candolle according to the sheet notation.

The original type material of *Pomax glabra* is extant at G and examination of an image of this material (G 00667919) confirmed that *P. glabra* is synonymous with *P. umbellata*, as first proposed by Bentham (1867). The Gaudichaud-Beaupré material clearly shows the stems rooting at the nodes and leaves that are obovate and with up to seven distinct abaxial veins.

Domin (1928) based his *Pomax umbellata* var. *ovatifolia* on multiple specimens, including the type collection of *P. hirta* (Sieber 250). The Robert Brown collections have not yet been located; however, Domin's own excellent collection is extant at PR and this is chosen as the lectotype for the name.



Fig. 5. Habitat of *Pomax umbellata* on Fraser Island, with plants indicated by blue arrow. Photo: M. Ngugi.

Collections in herbaria that have been referred to *Pomax umbellata* from the North Kennedy and Cook pastoral districts of Queensland appear to have more affinity with *P. beanii* based on morphology. These populations require further fieldwork examination and collection of additional material to resolve their taxonomic identity.

Phenology: Flowers have been recorded from August through November, with occasional

sparse flowering observed from February to May. Fruits have been recorded for every month of the year.

Conservation status: *Pomax umbellata* is widespread with numerous populations throughout coastal areas in eastern Australia. It occurs in many national parks in Queensland and New South Wales. The recommended conservation status for the species is **Least Concern** based on criterion B (IUCN 2021).

2. *Pomax beanii* Ngugi, sp. nov.

Similar to *P. ammophila* but differs by leaves narrowly elliptic or narrowly lanceolate and up to 5 mm wide vs *P. ammophila* where the leaves are narrowly elliptic or lanceolate and up to 7 mm wide; with erect peduncles vs *P. ammophila* with recurved peduncles; and smaller seeds 1.8–2.4 mm long, vs *P. ammophila* where the seeds are much larger 2.2–3.8 mm long. **Type:** Australia. Queensland. MORETON DISTRICT: Alice Creek, 7.5 km ESE of Murphys Creek Rail Siding. 13 August 1990, *P.I. Forster PIF7096* & *L.H. Bird* (holo: BRI [AQ00473393] iso: CANB [CBG], K, MEL, NSW).

Pomax umbellata var. *mitchelliana* Domin, *Biblioth. Bot.* 89: 627 (1929). **Type citation:** Queensland: “Subtrop. N. Holland, MITCHELL II. IX. 1846 No. 281...et No. 545 (Camp 29): East Coast, Port II., R. BROWN 1802 als. *P. suffruticosa*”. **Type:** Queensland. Subtrop. N. Holland, 11 September 1846, *T. Mitchell 281* (lecto [here designated]: CGE 00055355!).

Perennial herb or small shrub, with an erect habit, 15–50 cm high. Stems terete, somewhat woody, internodes \leq 42 mm long, puberulous, scabrid, indumentum comprising mixed short simple erect hairs or flexuose short hairs, or sometimes with uncinat hairs, 0.1–0.4 mm long; green, turning brown as it matures with outer surface layers decorticating. Stipules interpetiolar, narrowly triangular or triangular or rarely lobed, erect or reflexed, 1.9–3 mm long, 0.3–1 mm wide; hairs mostly along margins, 0.05–0.8 mm long; colleters along margins. Leaves opposite; sessile or shortly petiolate, 0.4–0.5 mm long; lamina narrowly elliptic or lanceolate, 12–30 mm long, 3–7 mm wide, margins fimbriate with mostly uncinat hairs 0.2–0.5 mm long, adaxially green and with sparse minute hairs mostly c. 0.1 mm, abaxially lighter in colour; base decurrent, attenuate; apex acute or attenuate; lateral veins mostly of 2 pairs, occasionally 3. Inflorescence terminal or axillary, mainly 3(or 4), flowers fused at their bases to form a capitulum; andromonoecious. Flowering peduncles 2–17 mm long, indumentum puberulous, hairs 0.1–0.3 mm long, elongating

as it matures. Pistillate flowers: corolla 1.2–4.2 mm long, lobes 4 or 5, 0.3–1 mm long, cream, indumentum external, sparse, hairs 0.4–0.5 mm long; style filiform, 2.1–6.5 mm long, deeply bifid, stigma plumose. Staminate flowers: corolla 5 or 6 lobed, 2–4.5 mm long, 0.5–1.5 mm long, cream, indumentum external, sparse or very sparse, hairs 0.05–0.4 mm long, mostly around the edges; stamens 2–6, filaments exerted, anthers 1–3.3 mm long. Fruiting peduncles 1–20 mm long, erect in umbel. Fruits an operculate capsule, non-fleshy, obconical, 3–4.5 mm long, 1–2.7 mm wide, glabrous; locules 1–3, seed per locule 1; indumentum minute, sparse or very sparse, hairs 0.05–0.1 mm long; fruiting calyx 0.7–2.2 mm long, apex obtuse, acute or acuminate; empty capitulum persistent for some time after seed dehiscence. Seeds obovoid or triangular, c. 2.4 mm long, 1.1–1.5 mm wide, 0.5–0.9 mm broad, ridge on dorsal surface $\frac{1}{2}$ to $\frac{3}{4}$ of seed length; covered with white idioblasts containing calcium oxalate crystals (raphides). Pollen tricolporate, oblate **Fig. 2 & 6.**

Additional selected specimens examined: Queensland. PORT CURTIS DISTRICT: Portion 36, Castletower, 17 km SE of Calliope, Jul 1989, *Gibson TO1639* (BRI). LEICHHARDT DISTRICT: Blackdown Tableland NP, just N of Horseshoe Lookout, Dawson Range, Apr 2024, *Forster PIF49196* (BRI, MEL, NSW); Carnarvon NP, Jul 1960, *Gittins 323* (BRI); Carnarvon NP, Goodliffe Section, c. 50 m N of old disused track from Tambo to Cungelella, May 2015, *Halford QM1792* & *Mathieson* (BRI); Minerva Hills NP, Virgin Rock Walking Track, Apr 2021, *Halford QM3512* (BRI); Lonesome NP, NE of Injune, Nov 2021, *Mathieson MTM3400* & *Ferguson* (BRI); *ibid*, Nov 2021, *Mathieson MTM3403* & *Ferguson* (BRI); Lookout area, Arcadia Valley road, Lonesome NP, Apr 2022, *Bean 34701* (BRI). WARREGO DISTRICT: Near ‘Carnarvon’, 50 miles [80.5 km] SSW of Springsure, Aug 1966, *Gittins T92* (BRI); W boundary of Chesterton Range NP, N of Morven, Sep 1995, *Bean 8988* & *Grimshaw* (BRI). DARLING DOWNS DISTRICT: Gurulmundi SF, off Gurulmundi Road; Glenaubyn, May 2025, *Forster PIF50112* (BRI, CANB, MEL). MORETON DISTRICT: Between Alice Creek and Goldmine Road, 15 km from Helidon, May 2023, *Ngugi LBN500* & *Forster* (BRI).

Distribution and habitat: *Pomax beanii* occurs mainly in inland Queensland, ranging from the central highlands (Blackdown Tableland, Carnarvon Ranges) south to the Chesterton Range and Gurulmundi, with a markedly disjoint occurrence near Helidon



Fig. 6. Leaves, fruit and seed of *Pomax beanii* (scales as indicated by bar). A. seed dorsal view B. seed ventral view. C. leaves showing hairs along the margins. D. Developing fruit showing variable calyx lobes in shape and size. E. Inflorescence showing erect peduncles. A & B from Forster PIF7096 & Bird (BRI); C–E from Ngugi LBN500 & Forster (BRI). Photos A & B: L. Ngugi; Photos C–E: G. Leiper.



Fig. 7. Habitat for *Pomax beanii* at the type locality, with plants indicated by blue arrow. (Ngugi LBN500 & Forster, BRI). Photo: L. Ngugi.

in the western Moreton district (**Map 2**). It is typically found in rocky clifftop habitats within open woodlands dominated by eucalypts where it grows in skeletal soils in crevices of sandstone boulders and pavements (**Fig. 7**). These habitats may partially act as refugia from fire; however, they are still susceptible to burning during intense fire events. It often occurs in close proximity (often less than 1 metre) (type locality; Blackdown Tableland, P.I. Forster, *pers. obs.* April 2024; Gurulmundi SF, P.I. Forster, *pers. obs.* May 2025) to populations of *P. abunda*; however, the latter is invariably in deeper soil within more fire prone vegetation adjacent to the rocky habitats of the former.

Notes: *Pomax beanii* was first collected in 1846 by Sir Thomas Mitchell during his fourth expedition in eastern Australia. The species is notable for its perennial woody habit with the plants often forming small subshrubs. Individuals observed at Blackdown Tableland NP, Gurulmundi SF and Helidon are estimated to be between five and 20 years old and appear to resprout from the rootstock after low intensity fires.

Typification: Domin (1929) described *Pomax umbellata* var. *mitchelliana*, but this name has not subsequently been applied to collections in Australian herbaria. Domin referenced two syntypes: the first syntype was described as “Six inches high. Among Rocks” from Queensland: Subtrop. N. Holland, on 11 Sept 1846, collected by T.L. Mitchell 281, Camp 29. This syntype specimen was also mentioned by Mitchell (1848) in his journal, where he noted that it was found on sandstone rocks. The Mitchell material (CGE 00055345) has narrow leaves and erect peduncles. These characteristics, along with its habitat on sandstone rocks, match the species being described as *P. beanii*. The second syntype specimen collected by Robert Brown in 1802 from the East Coast of Australia, has not yet been located and as the Mitchell collection is both fertile and extant, it is here selected as the lectotype for Domin’s varietal name.

Phenology: Flowers have been recorded from July to November, with occasional sparse flowering occurring in April. Fruits have been recorded for every month of the year.

Conservation status: *Pomax beanii* is widespread with numerous populations throughout central and inland areas in Queensland. It occurs in several national parks and reserves. The recommended conservation for the species is **Least Concern** based on criterion B (IUCN 2021).

Etymology: The specific epithet honours Anthony (Tony) Bean, an outstanding taxonomist at the Queensland Herbarium. His extensive collections have significantly contributed to our understanding of Queensland’s plants. He is also widely recognised as a great mentor and has been especially supportive of the first author.

3. *Pomax abunda* Ngugi, sp. nov.

With affinity to *Pomax umbellata*, differing by the erect habit vs *P. umbellata* with prostrate stems; absence of rooting at nodes vs *P. umbellata* rooting at nodes; shorter stipules (0.8–1.8 mm long) vs *P. umbellata* (0.8–4 mm long); leaves oval or elliptic, with non-distinct abaxial lateral veins of mostly 3 pairs vs *P. umbellata* with distinct lateral veins of mostly 4 pairs. **Type:** Australia. Queensland. MORETON DISTRICT: Along the Gap Creek Track, Mt Coot-tha, Brisbane, 6 July 2021, L.B. Ngugi 108 (holo: BRI [AQ1023877, comprising 2 sheets]; iso: DNA, MEL, NSW).

Illustrations: Hawkeswood (1977: as *P. umbellata*); James (1992: 490 as *P. umbellata*); Ross (1993: 328, Fig. 46E, as *P. umbellata*); Jeanes (1999: 633, Fig. 123H, as *P. umbellata*).

Short-lived perennial herb, with an erect habit, 15–25 cm high. Stems herbaceous, erect, terete, internodes \leq 30 mm long, indumentum smoothly pubescent, comprising mixed short erect, simple hairs or sometimes with flexuose short silky hairs, 0.1–0.7 mm long; green, turning brown as it matures with outer surface layers decorticating. Stipules interpetiolar, triangular or rarely deltate,

erect, 0.8–1.8 mm long, 0.4–1 mm wide; indumentum of short simple hairs, 0.1–0.7 mm long, sometimes longer along margins; colleters along margins. Leaves opposite, oval or elliptic or narrowly elliptic, 9–18 mm long, 3–6 mm wide, margins entire, green; petiole 0.5–3.5 mm long; base decurrent, acute or attenuate; apex acute rarely obtuse; lamina indumentum patent, hairs 0.1–0.4 mm long and can be longer on veins to 0.5 mm or can be tuberculate, evenly spread above and below on lamina and on margins; indistinct lateral veins comprising 2 or 3 pairs. Inflorescence terminal or axillary near the top; 2–4 flowers fused at their bases to form a capitulum; andromonoecious. Flowering peduncles 3–9 mm long, indumentum puberulous, erect, hairs 0.05–0.6 mm long, elongating with maturity; the female parts of bisexual flowers develop before male parts. Pistillate flowers: corolla 0.4–1.5 mm long, lobes 4 or 5, 0.1–0.3 mm long, red, indumentum external, papillate or sparsely hairy, hairs 0.1–0.3 mm long, sometimes glabrous; style filiform, 1.2–1.5 mm long, deeply bifid, stigma plumose. Staminate flowers: corolla 2.3–3 mm long, 4 or 5 lobed, 0.3–0.7 mm long, red, indumentum sparse or very sparse, mostly around the edges or sometimes glabrous, hairs where present 0.05–0.4 mm long; stamens 3–5, filaments exerted for 1.8–3.8 mm long, anthers 1.2–1.6 mm long. Fruiting peduncles 4–10 mm long, erect in umbel. Fruits an operculate campanulate capsule, obconical, non-fleshy, 2.5–4 long, 1.5–2.8 wide; locules 1–3, seed per locule 1; indumentum erect, sparse or very sparse, hairs 0.1–1.5 mm long; fruit calyx 0.3–1 mm long, apex obtuse, acute or acuminate. Empty capitulum persistent for some time after seed dehiscence. Seeds ellipsoidal or obovoid, 1.6–2 mm long, 1–1.1 mm wide, 0.4–0.7 mm broad, ridge on dorsal surface $\frac{1}{2}$ to $\frac{3}{4}$ of seed length; covered with white idioblasts containing calcium oxalate crystals (raphides). Pollen tricolporate, oblate. **Fig. 2 & 8.**

Additional selected specimens examined: Queensland. LEICHHARDT DISTRICT: Blackdown Tableland NP, just N of Horseshoe Lookout, Dawson Range, Apr 2024, *Forster PIF49193* (BRI); Boolimba Bluff Track, Carnarvon Gorge, Carnarvon NP, Dec 2021, *Ngugi 116 et al.* (BRI). WARREGO DISTRICT: Carnarvon Station

Reserve, c. 50 m off the SWER track after the turn near the edge of the escarpment, Oct 2014, *Collins 239 & Toms* (BRI, CANB). BURNETT DISTRICT: Tarong – Maidenwell Road, at NE corner of Tarong NP, Aug 2021, *Phillips 3335* (BRI). WIDE BAY DISTRICT: Mount Walsh NP, Utopia Falls section, Waterfall Creek, Oct 2021, *Yates NAY2021073* (BRI). DARLING DOWNS DISTRICT: Dalby SF, N of Dalby – Kogan Road, Jan 2024, *Forster PIF48938 & Leiper* (BRI); Eastern edge of Eena SF, c. 25 km NW of Inglewood, Dec 2007, *Bean 27055* (BRI, CANB). MORETON DISTRICT: Campbells Folly, 4 km SW of Tylerville, Sep 1992, *Forster PIF11541 & Leiper* (BRI); Western end of Esk NP, SW of Esk, Oct 2015, *Bean 32405* (BRI); Between Toohy Ridge Track and Planchonella Track, Toohy Forest, Brisbane, Aug 2021, *Ngugi 109* (BRI); Lower Portals Track, Mt Barney NP, Nov 2021, *Ngugi 119 & Ngugi* (BRI); Mt May, Mt Barney NP, May 2022, *Ngugi & Yates s.n.* (BRI [AQ1045526]); Mt Ernest, McPherson Range, Sep 1990, *Forster PIF7360 & Leiper* (BRI). **New South Wales.** Sugarloaf SF, SE of Tabulam, Sept 1999, *Bean 15530* (BRI); Allens Road, SF 273 Yearinan, Pilliga Scrub, Nov 1993, *Forster PIF14218 & Machin* (BRI); Purlewaugh Road, c. 2.5 km W of Premer, Mar 2023, *Phillips 3707 & Phillips* (BRI); Currarong, Sep 1981, *Coveny 10961 & James* (NSW); Cumberland SF, West Pennant Hills, Oct 1976, *Coveny 8513* (NSW); Como, Sep 1897, *Camfield s.n.* (BRI [AQ0125171]); Bruxner Highway, 6.7 km E of Yetman, Nov 1983, *Coveny 11668 & Wilson* (BRI, NSW); Waa Gorge (68 km NE of Narrabri by road), Mount Kaputar NP, Nov 1976, *Coveny 9001 & Roy* (NSW); Wilmatha Hill, 45 miles [72.4 km] NE of Condobolin, Aug 1974, *Milthorpe 2538 & Cunningham* (NSW); 3.5 km NNW of Tabletop Mountain, c. 9 km NW of Tumut Minjary NP, Nov 2001, *Crawford 6763* (CANB, NSW); Just off highway between Bell and Lithgow, Blue Mountains, Jun 1986, *Clarke s.n.* (BRI [AQ0494941]); Bumbury Range, near Bindogandry Creek, Goobang Nature Reserve, Oct 2000, *Hill et al. 5626* (BRI, NSW). **Victoria.** Avon – Mount Hedrick Natural Feature Scenic Reserve, Oct 1984, *Beaulehole 77849* (MEL); Mount Ellery, Dec 1990, *Pescott s.n.* (BRI [AQ931535]); Just N of the Fernbank–Munro Road, c. 6 km W of Fernbank, Dec 2009, *Jeanes 2270 & Hare* (MEL, NSW); Gippsland, Nowa Nowa, Jan 1970, *Henshall 1560* (DNA); Ample 8, Yalmy Forest Management Block, East Gippsland, Nov 1983, *Chesterfield 50* (MEL); c. 19 km NW from Maffra, on road to Huggetts Crossing on the Avon River, 1 km W from Huggetts Lookout, Jan 1999, *Cochrane 439* (MEL); 4.6 km NW along Genoa Creek Road from Princes Highway, Mar 1984, *Parkes EG189* (MEL); Mount Nugong, Feb 1996, *Kissane 2650* (MEL).

Distribution and habitat: *Pomax abunda* occurs widely across eastern Australia from central Queensland south to Victoria (**Map 3**). It is the most commonly encountered and collected species within the genus. It grows in various environments but is most often found in crevices of volcanic rocks or flat gravelly areas with diverse substrates in open eucalypt



Fig. 8. Fruits, flowers, and seed of *Pomax abunda* (scales as indicated by bar). A. flowers and fruits at different stages. B. protogynous flower. C. matured fruit showing outer lid ready to dehisce. D. seed dorsal view. E. seed ventral view. All from *Ngugi 108* (BRI).



Fig. 9. Habitat of *Pomax abunda* along Lower Portals track, Mount Barney NP, with plants indicated by blue arrows. (*Ngugi 119* & *Ngugi*, BRI). Photo: L. Ngugi.

forests and woodlands. Seeds of this species are stimulated by fire, so it can be abundant in areas that have been burnt, regenerating in large numbers from the soil seed bank (Fig. 9), then gradually disappearing in the absence of fire (Specht *et al.* 1977). Local dispersal of seed is likely facilitated by water movement or ingestion by mammals, with seeds being dispersed in faecal pellets (Tokushima & Jarman 2010).

Notes: *Pomax abunda* exhibits significant variability in appearance across its range, as previously noted by Hawkeswood (1980). This variation mainly relates to habit and age of the plants with young ‘lush’ individuals often appearing quite different from older ‘hardened’ individuals within the same habitat. The presence and density of hairs on the plant’s foliage may be also influenced by environmental factors, such as climate, elevation and edaphic differences. At higher elevation habitats in Queensland (e.g. summits of Mt May (BRI, AQ1045526) and Mt Ernest (BRI, AQ473863), and more temperate localities in New South Wales and Victoria, *P. abunda* exhibits noticeably hairy foliage. This morphological adaptation is likely a response to colder climates.

Phenology: Flowers have been recorded from July to November, while fruits have been observed throughout the year.

Conservation status: *Pomax abunda* is widespread across inland eastern Australia. It occurs in numerous national parks in Queensland, New South Wales, and Victoria. The recommended conservation status for the species based on criterion B of IUCN is **Least Concern** (IUCN 2021).

Etymology: The specific epithet is derived from the Latin “abundus”, meaning prolific, abounding. This refers to the plant’s tendency to grow prolifically within its preferred habitats.

Acknowledgements

A special appreciation is extended to the numerous collectors who generously volunteered their time to collect and contribute specimens and photographs: Natasha Yates, David Halford, Andrew Pengelly, Sue Phillips, Rigel Jensen, Geoff Sinclair, Mary Loudon, Samuel Ngugi, Timothy Ngugi and Michael Ngugi. LN is very grateful to Tony Bean for his field work and generous guidance. Sincere thanks to Nicole Crosswell for the illustrations, Jiaorong Lee for the distribution maps, Melody Fabillo for the microscopy and Dorothy Sampayo for proofreading the initial manuscript. We gratefully acknowledge the loan of material from other Australian herbaria and Ota Sida (PR), Raneer Prakash (BM) and Sally Dawson (K) for their assistance with locating and photographing historical *Pomax* specimens. The management staff for the Helidon location are thanked for their assistance in providing access to the site during the most recent visit.

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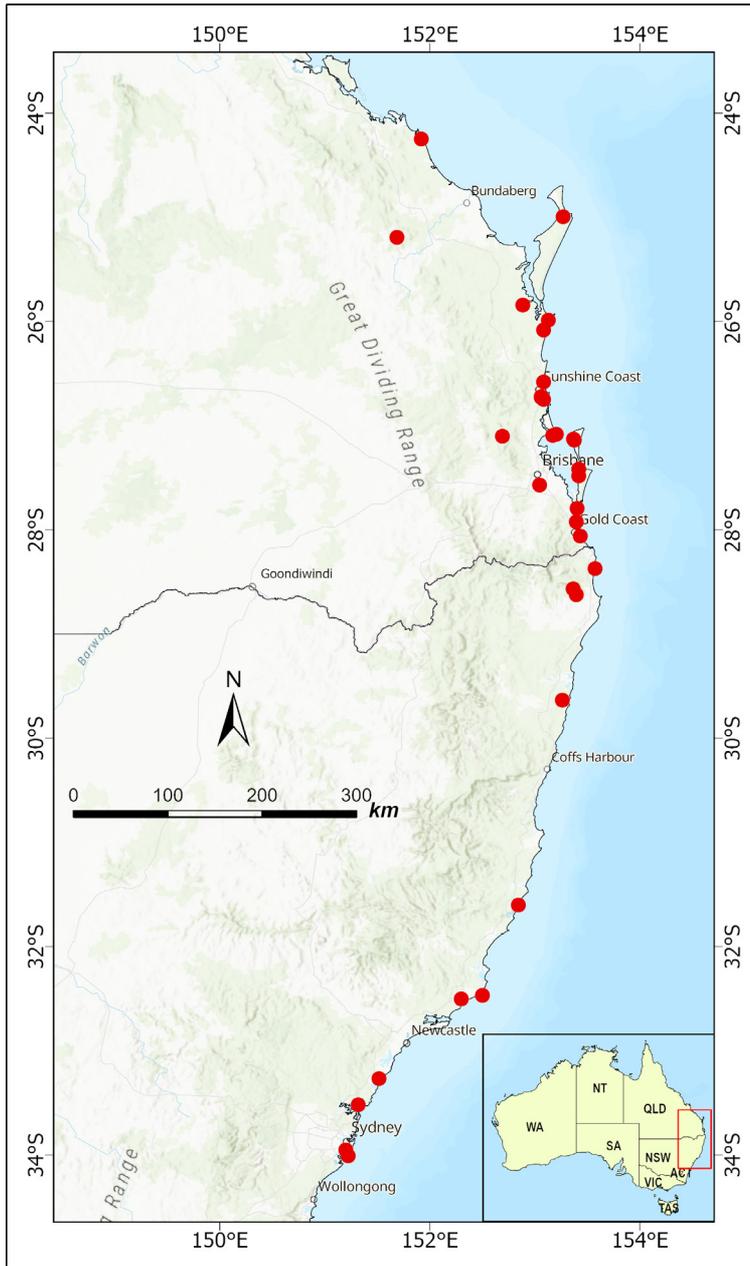
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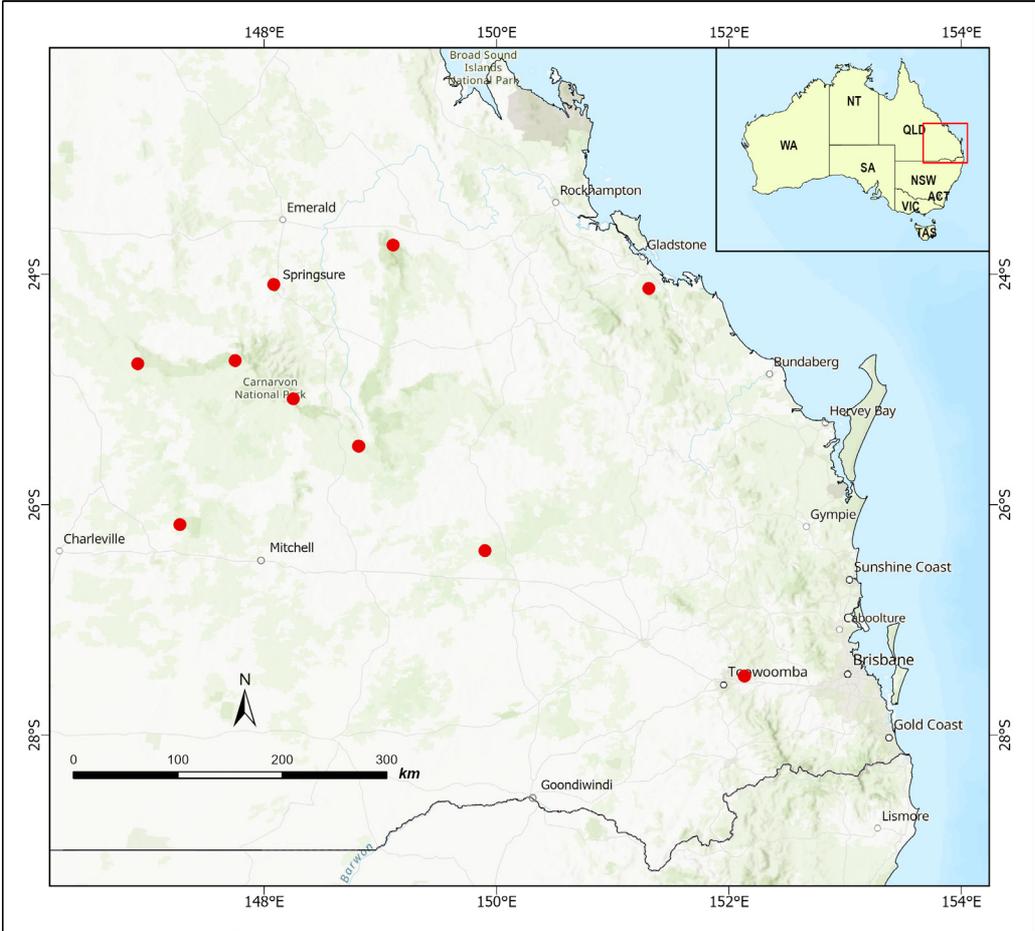
Author contributions

LBN conceived the project, undertook fieldwork and examination of herbarium material, wrote the initial draft of the manuscript, organised and prepared the illustrations and maps, and revised drafts.

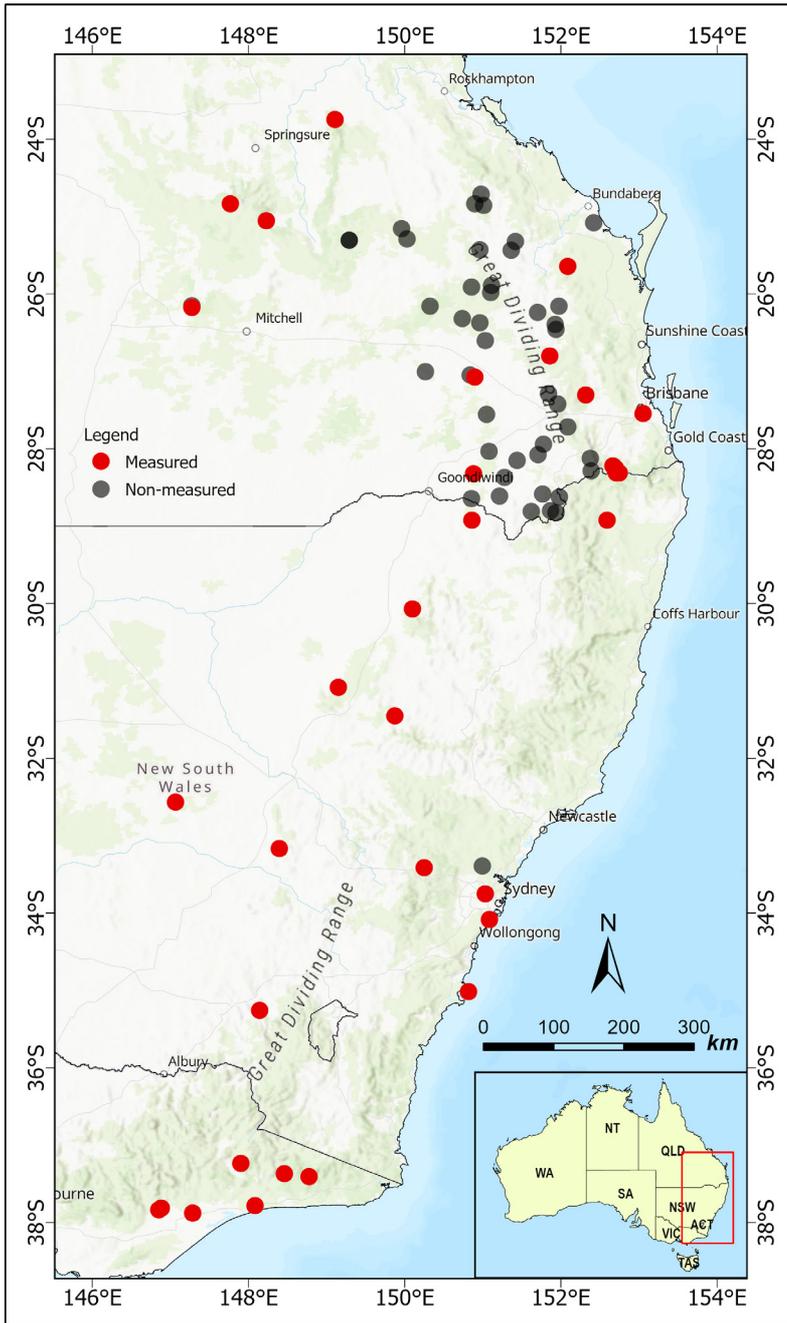
PIF partly supervised the project, collected additional material, examined herbarium material of potential type specimens, resolved typification of names, and revised drafts.



Map 1. Distribution of *Pomax umbellata*.



Map 2. Distribution of *Pomax beanii*.



Map 3. Distribution of *Pomax abunda*. Red circles represent specimens measured for the description, grey circles represent other specimens identified as this species.