A taxonomic revision of *Argophyllum* J.R.Forst. & G.Forst. (Argophyllaceae) in Australia

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Summary

Bean, A.R. & Forster, P.I. (2018). A taxonomic revision of *Argophyllum* J.R.Forst. & G.Forst. (Argophyllaceae) in Australia. ***Austrobaileya*** **10(2): 207–235.** The genus *Argophyllum* is taxonomically revised for Australia with eleven species recognised from Queensland and northeast New South Wales. All Australian species are endemic and seven new species are described: *A. curtum* A.R.Bean & P.I.Forst., *A. ferrugineum* A.R.Bean & P.I.Forst., *A. heterodontum* A.R.Bean & P.I.Forst., *A. iridescens* A.R.Bean & P.I.Forst., *A. jagonis* A.R.Bean & P.I.Forst., *A. loxotrichum* A.R.Bean & P.I.Forst. and *A. palumense* A.R.Bean & P.I.Forst. Lectotypes are chosen for *A. cryptophlebum* Zemann and *A. lejourdanii* F.Muell. All species are fully described and illustrated. Notes are provided on their distribution (including maps), habitat and proposed conservation status.

Key Words: Argophyllaceae, *Argophyllum cryptophlebum*, *Argophyllum curtum*, *Argophyllum ferrugineum*, *Argophyllum heterodontum*, *Argophyllum iridescens*, *Argophyllum jagonis*, *Argophyllum loxotrichum*, *Argophyllum nullumense*, *Argophyllum palumense*, *Argophyllum verae*, Australia flora, New South Wales flora, Queensland flora, new species, identification key, distribution maps, conservation status

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Introduction

The genus *Argophyllum* was established by Forster and Forster (1776) in their publication *Characteres Generum Plantarum* with the single species *A. nitidum* J.R.Forst. & G.Forst., based on material they collected from New Caledonia. Eleven species are currently accepted for New Caledonia (Guillaumin & Virot 1953; Plant List 2018).

In Australia, the first record of an *Argophyllum* was provided by Mueller (1863) with the description of *A. lejourdanii* F.Muell. from north Queensland. Subsequent descriptions of new species and varieties from Australia have been by Mueller (1892), Baker (1899), Bailey (1900), Zemann (1907), Ewart *et al*. (1909) and Forster (1990). Prior to this account, four published species were recognised for Australia, but collections made over the last 25 years in north Queensland have indicated that further undescribed species are present (Forster 2007, 2010, 2017). This revision names these new species, and clarifies the typification of some published names. An updated key for identification (*cf.* Forster 1990) is also provided.

Argophyllum has been variously placed in the family Grossulariaceae (e.g. Cronquist 1981; Mabberley 1997), Saxifragaceae (e.g. Endlicher 1839; Engler 1890, 1928; Schlechter 1906) or Escalloniaceae (e.g. Willis 1966; Takhtajan 1983; Thorne 2000) along with (to differing degrees) other indigenous non-endemic Australian genera such as *Polyosma* Blume and *Quintinia* A.DC., and the endemic *Abrophyllum* Benth., *Anopterus* Labill., *Cuttsia* F.Muell. and *Tetracarpaea* Hook. (*cf.* Morley 1981a). Ongoing molecular and morphological studies by a number of authors have strongly inferred that this disposition of genera is artificial and that *Argophyllum* is most closely allied to *Corokia* A.Cunn. (included in Cornaceae by Morley (1981b)). These two genera now comprise the Argophyllaceae (Engl.) Taktj. and are unique in the shared characters of T-hairs and corolline ligules (Kårehed *et al*. 1999; Kårehed 2007). The genera *Abrophyllum*

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and *Cuttsia*, together with the New Guinean *Carpodetus* J.R.Forst. & G.Forst. are best placed in the family Rousseaceae (Stevens 2001 onwards) and *Anopterus*, *Polyosma* and *Quintinia* in Escalloniaceae (Gustafsson & Bremer 1997; Kårehed *et al*. 1999; Kårehed 2007; Stevens 2001 onwards). *Tetracarpaea* has been recently placed in its own family Tetracarpaeaceae (Stevens 2001 onwards).

Ecology

All species of *Argophyllum* are small to medium sized shrubs with soft foliage and little secondary wood development in the stems. Many species of *Argophyllum* occupy ecotonal areas on the edge of rainforest where light levels are relatively high, although montane species such as *A. cryptophlebum* often grow in areas of low light adjacent to streams. Some species are also abundant on rocky pavements and outcrops (e.g. *A. heterodontum* and *A. iridescens*) where there is little woody competition due to skeletal substrates. Plants of all species usually occur in quite dense colonies often with individuals of similar size indicating recruitment or regrowth after irregular fire events.

Argophyllum species are mainly associated with soils derived from specific volcanic substrates (**Table 1**) although the most widespread species *A. nullumense* is more catholic in this respect and *A. verae* is notable for also occurring on sandstone. The wide substrate occupation by *A. nullumense* is also reflected in the species having the greatest longitudinal distribution of the Australian species.

Table 1. Australian *Argophyllum* species – geological preference and general habitat type

Species	Geological substrate	General habitat type
A. cryptophlebum	granite	ecotone between rainforest and sclerophyll open forest; rainforest stream edges
A. curtum	basalt	sclerophyll open forest; rainforest stream edges
A. ferrugineum	rhyolite	ecotone between rainforest and sclerophyll open forest; rainforest or gallery forest stream edges
A. heterodontum	granite	rainforest or gallery forest stream edges; rock pavement and outcrops
A. iridescens	granite	rock pavement and outcrops on ecotonal edge of rainforest
A. jagonis	granite	rainforest stream edges
A. lejourdanii	granite	rock pavement and outcrops
A. loxotrichum	granite, ignimbrite, metamorphics, rhyolite	rainforest or gallery forest stream edges
A. nullumense	andesite, basalt, basalt intermixed with trachyte, granite, granodiorite, rhyolite, metamorphics/ metasediments	ecotone between rainforest and sclerophyll open forest; rainforest stream edges
A. palumense	granite	sclerophyll open forest
A. verae	granite, sandstone	clifflines above rainforest; ecotone between rainforest and sclerophyll open forest

Speciation Hypothesis

The Australian species of *Argophyllum* comprise a geographic replacement series in eastern Australia from north-eastern New South Wales to the Glennie Tableland on northern Cape York Peninsula in Queensland. This distribution is discontinuous both at the continental scale and at the local population scale with the individual populations occupying specific habitats that are disjunct and sometimes ephemeral (e.g. fire prone ecotones, rock outcrops and pavements). These habitats approximate those where many species of *Plectranthus* L'Hér. and *Zieria* R.Br. also occur, both those genera exhibiting somewhat similar patterns of speciation and distribution to *Argophyllum*. This habitat occupancy pattern has been previously equated (Duretto & Forster 2007; Forster 2011) to the 'islands on islands' effect of Porembski *et al.* (2000) that is hypothesised to drive genetic diversity and subsequent speciation (Carlquist 1974; Grant 1981; Seine *et al*. 2000; Kruckeberg 2002).

The species of *Argophyllum* recognised as a result of this revision differ in characters of the foliage (lamina teeth, venation, indumentum type and cover), inflorescence, flowers and seed; however, they all adhere to the basic pattern of being straggly shrubs with soft, discolorous foliage and small cream to yellow flowers. The subtle differences in morphology with occupation of a relatively narrow range of recurring habitat niches (**Table 1**) in an allopatric disjunct pattern is considered a 'non-adaptive radiation' with a 'high lineage diversification rate' (Savolainen & Forest 2005). This pattern of speciation is widespread both in Australia and elsewhere (Linder 2003) particularly for plants that do not appear to be particularly well adapted to long range dispersal. Webb *et al*. (1986) mentioned that the seeds of *Argophyllum* are wind dispersed; however, there remains no published information to support this observation and casual observations of all the species in the wild does not corroborate this proposal. Speciation is likely to have occurred by the long term process of population fragmentation as a result of recurrent and continuous climatic sifting through millennia with local adaptation following genetic drift resulting in the morphological differences outlined here.

Biogeography

Argophyllum is extant, albeit with no shared species, only in eastern Australia and New Caledonia. Molecular sequencing of the species from both centres remains to be researched hence no analysis of the overall relationships within the genus can be attempted at this time. Miocene fossil leaf cuticles attributed to *Argophyllum* have been described from deposits in New Zealand (Pole 2008) and if these are correctly identified, it would indicate an historical distribution in Australia and components of Zealandia other than New Caledonia.

The distribution of the genus in eastern Australia wholly in rainforest or vegetation communities adjacent to rainforest enables some observations to be made in relation to species disposition in relation to putative biogeographic barriers (Bryant & Krosch 2016). Perhaps the most significant of these observations pertain to the widespread *Argophyllum nullumense* as the species occurs on either side of two major biogeographic barriers, *viz*. Brisbane Valley Barrier and St Lawrence Gap, but not north of the Burdekin Gap. The most biogeographically significant population centre for *A. nullumense* remains the single population at Finch Hatton Gorge in the Eungella Range at *c*. 490 km disjunct from the Mt Castle Tower populations. Surprisingly *A. nullumense* has not been found at the upland 'sky island' refuge at Kroombit Tops (*cf.* Forster 2011) or in the Bulburin uplands in the Bobby Range, although it is present at the nearby Many Peaks Range.

Argophyllum verae is restricted to north of the Laura Basin in two greatly disjunct population centres (*c*. 270 km apart) on radically different geologies yet has not been found in upland areas of the McIlwraith Range inbetween. *Argophyllum iridescens* is known only from north of the Black Mountain Corridor (BMC) in the greater Daintree lowlands. Whilst *A. curtum*, *A.*

heterodontum and *A. jagonis* are Wet Tropics bioregion endemics restricted to south of the BMC, *A. cryptophlebum* and *A. loxotrichum* are especially notable for being north and south of the putative corridor, albeit always at higher altitudes. The northern and southern population centres for *A. cryptophlebum* are disjunct by *c*. 105 km and for *A. loxotrichum* by *c*. 225 km respectively. *Argophyllum ferrugineum* and *A. lejourdanii* are both restricted to north of the Burdekin Gap, but do not extend north throughout the Wet Tropics bioregion beyond the Tully Falls/Koolmoon Creek area and near Cardwell respectively. *Argophyllum palumense* is restricted to high altitudes northwest of Townsville in the Paluma – Mt Spec area.

The overall conclusion from these observations is that populations of the species recognised in this revision occur repeatedly in minor centres of endemism and refugia in areas of higher moisture levels than the norm or with reduced competition from other woody vegetation (rocky pavements and outcrops). Some species (e.g. *A. cryptophlebum*, *A. jagonis* and *A. loxotrichum*) are restricted to refugia of very high rainfall populated by scores of other similarly distributed vascular plants. Whilst some species are geographically restricted in their overall distribution (e.g. *A. curtum*, *A. ferrugineum*, *A. heterodontum*, *A. jagonis*, *A. palumense*), others are widespread and characterised by large disjunctions between population centres (e.g. *A. loxotrichum*, *A. nullumense*, *A. verae*). These latter species are putatively examples of surviving, ancient population fragmentations rather than recent examples of long range dispersal.

Materials and methods

This revision is based on traditional methods utilising data derived from plant morphology. Species are defined on the principal of morphological discontinuity in character states, with a minimum of two such states for taxon distinction. They are arranged alphabetically in the taxonomic account with notes provided about putative affinities between them. Taxa are in all cases allopatric in this particular group. All species have been examined in the field by one or both authors. A number of taxa have been examined from plants cultivated at Tolga by Garry Sankowsky and at Cooroy by Maurie Tucker.

Herbarium holdings at BRI, CANB, CNS, MEL, NSW and W have been utilised as the primary source of data. Common abbreviations in the specimen citations are LA (Logging Area), Mt (Mountain), NP/NPR (National Park/National Park Reserve), SF/SFR (State Forest/State Forest Reserve) and TR (Timber Reserve). Collections originally deposited in the C.S.I.R.O. herbarium at Atherton (QRS) are now housed in the Australian Tropical Herbarium (CNS) at Cairns.

Taxonomy

Argophyllum J.R.Forst. & G.Forst., *Char. Gen. Pl.* ed. 2: 29 (1776). **Type:** *A. nitidum* J.R.Forst. & G.Forst.

Perennial shrubs or small trees. Stipules absent. Branchlets terete. Leaves alternate, discolorous, petiolate; margins crenate, dentate or entire. Indumentum (in Australia) very dense on branchlets and leaf undersides. All hairs biramous, with a very short 'stalk', and two elongated unequal arms, usually parallel to the lamina surface (hence T-shaped), but sometimes spreading at about 40–60° from the lamina surface (hence Y-shaped). Flowers bisexual, actinomorphic. Calyx gamosepalous, the lobes 5, deltate; petals 5, deltate, not fused; corolla appendages 5, attached near the base of each petal on adaxial surface, proximal half fused, distally divided into 15–25 filamentous segments. Stamens 5, antesepalous; anthers versatile. Style simple, stigma swollen, entire, globose. Ovules 50–60 per loculus. Capsules cupular, 2–3-locular; fruiting valves splitting longitudinally from the apex, so that the number of fruiting teeth is always twice the number of locules. Seeds brown, ellipsoidal, surface with a coarse reticulate pattern.

22 species, 11 in Australia (Queensland and New South Wales), and 11 in New Caledonia.

***Etymology*:** From the Greek *argos* meaning white, and *phyllon* meaning a leaf.

Key to *Argophyllum* species in Australia

1 Inflorescences borne strictly in leaf axils **2**
1. Inflorescence wholly or predominantly terminal (basal branch of inflorescence may be in uppermost 1 or 2 leaf axils) **9**

2 New vegetative growth creamy-white **3**
2. New vegetative growth brown or rusty-coloured **6**

3 Biramous hairs on upper leaf surface with arms obliquely ascending (Y-shaped); branchlets and lower leaf surface with spreading hairs . . . . . **8. A. loxotrichum**
3. Biramous hairs on upper leaf surface with arms ± parallel to surface (T-shaped); branchlets and lower leaf surface with ± appressed hairs **4**

4 Lamina marginal teeth 1.7–3.2 mm long . . . . . **10. A. palumense**
4. Lamina marginal teeth absent or up to 0.7 mm long **5**

5 Leaves 2.8–4.5 times longer than wide; marginal teeth 30–45 on each side . . . . . **5. A. iridescens**
5. Leaves 1.8–2.4 times longer than wide; marginal teeth 19–25 on each side or teeth absent . . . . . **11. A. verae**

6 Upper surface of fully expanded leaves glabrous, although hairs are present on young leaves **7**
6. Upper surface of fully expanded leaves with persistent hairs **8**

7 Leaf teeth prominent, unequal, longer ones 1–4.5 mm long; ovary 2 or 3-locular . . . . . **4. A. heterodontum**
7. Leaf teeth small, inconspicuous, ± equal, 0.3–1 mm long; ovary 2-locular . . **2. A. curtum**

8 Tertiary veins on lower leaf surface brown; longest hairs on upper leaf surface 0.5–0.7 mm long; seeds 0.5–0.6 mm long . . . . . **3. A. ferrugineum**
8. Tertiary veins creamy white on fully expanded leaves; longest hairs on upper leaf surface 0.8–1 mm long; seeds 0.4–0.5 mm long . . . . . **7. A. lejourdanii**

9 Leaves (2.6–) 3–4.6 times longer than wide; petioles 7–14 mm long; petals and corolla appendages yellow; hairs on upper leaf surface 0.2–0.3 mm long . . . . . **9. A. nullumense**
9. Leaves 1.3–2.9 times longer than wide; petioles 13–38 mm long; petals and corolla appendages white; hairs on upper leaf surface 0.3–0.7 mm long **10**

10 Branching of inflorescence mostly dichotomous, branches spreading at 60–90° from adjacent branch; petioles and young branchlets with creamy or white indumentum; hairs on upper leaf surface 0.5–0.7 mm long; leaf teeth (sometimes reduced to marginal glands) 11–29 pairs . . . . **6. A. jagonis**
10. Branching of inflorescence mostly monochasial, branches spreading at 30–60° from adjacent branch; petioles and young branchlets with usually brown or rusty-coloured indumentum; hairs on upper leaf surface 0.3–0.5 mm long; leaf teeth (sometimes reduced to marginal glands) 7–14 pairs . . . . . **1. A. cryptophlebum**

1. Argophyllum cryptophlebum Zemann, *Ann. Naturh. Hofm. Wien* 22: 283 (1907). **Type citation:** "Sayer: Mt. Bellenden Ker, 1887 (Granite). – S. Johnson: Mt. Bartle-Frère 1891 (Granite)." **Type:** Queensland. Cook District: Mt Bellenden Ker, in 1887, *W.A. Sayer 84* (lecto [here designated]: MEL 2288067; isolecto: MEL 2288065, MEL 2288066, W 10220).

Argophyllum nitidum var. *fulvum* F.M.Bailey (as 'fulva'), *Queensl. Fl.* 2: 533 (1900). **Types:** Queensland. Cook District: Mount Bellenden Ker, in 1887, *W.A. Sayer 84* (syn: MEL 2288067, MEL 2288066, MEL 2288065); Mt Bartle Frere, *s.dat.*, *S. Johnson s.n.* (syn: BRI [AQ200705], MEL 2288064).

Argophyllum cryptophlebium B.Hyland, *orth. var.*; B.Hyland *et al.* in W.E.Cooper & W.T.Cooper, Appendix I: Provisional Species List, *Fruits of the Rainforest* 305 (1994).

Shrub 2–7 m high, often with decumbent stems. Hairs on new growth brown or rusty; hairs more than 10 cm from growing point brown or rusty. Petiole 13–38 mm long; fully expanded lamina broadly-elliptic, ovate, or broadly ovate, 41–131 mm long, 21–61 mm wide, 1.5–2.9 times longer than wide; 5–7 secondary veins on either side of midrib. Lamina apex usually acute, sometimes shortly acuminate; base cuneate, not oblique. Lamina margins denticulate, with teeth all about the same size, 7–14 on each side of the lamina, the teeth 0.3–0.8 mm long; margins sometimes entire, with teeth reduced to small glands. Upper surface of fully expanded lamina green, glabrous or sometimes with persisting T-shaped hairs 0.3–0.5 mm long. Lower surface of lamina white or rusty-brown, hairs appressed; secondary veins rusty, slightly raised; tertiary veins rusty or white, ± flush with indumentum. Inflorescences terminal, paniculate cymose, 56–122 mm long, densely tomentose, primary axis 12–105 mm long, secondary branches 8–34 mm long; branching of inflorescence mostly monochasial, branches spreading at 30–60° from adjacent branch; bracts narrowly-deltate, 1.5–4 mm long. Pedicels 1–2 mm long; flowering hypanthium cupular, 2.5–3.3 mm diameter. Calyx lobes 0.9–1.5 mm long; petals 1.9–2.5 mm long, white, corolla appendages white, 0.6–1.3 mm long. Staminal filaments 0.8–1.1 mm long; anthers 0.35–0.6 mm long. Style 0.9–1.2 mm long; ovary 2-locular. Capsules with cupular hypanthium, 3–3.6 mm long, 3.3–4 mm diameter, teeth 4, exserted. Seeds 0.55–0.65 mm long. **Fig. 1A–C**.

***Additional specimens examined*: Queensland.** Cook District: Daintree NP, Mt Sorrow track, 4 km W of Cape Tribulation, Dec 1997, *Forster PIF21989 et al.* (BRI, K, L, MEL, NSW); Mt Sorrow, W of Cape Tribulation, Dec 1997, *Jago 4585 & Forster* (BRI); Mt Alexander [Thornton Peak], Daintree River, Dec 1929, *Kajewski 1489* (BRI); Thornton Peak, Sep 1984, *Irvine 2237* (CNS); Mt Pieter Botte, Mar 1992, *Russell 19* (BRI); Mt Hemmant, Jul 1973, *Webb & Tracey 11753* (BRI); North Bell Peak, summit area, Malbon Thompson Range, Nov 1995, *Forster PIF18042 et al.* (BRI, K, L, MEL, NSW); Bell Peak North, Nov 1995, *Jago 3645 & Forster* (BRI); Summit of Bellenden Ker, Aug 1989, *Bostock 990 & Guymer* (BRI); *ibid*, Jun 1985, *Buchanan 7101* (CANB, CNS); Mt Bellenden Ker, Aug 1913, *Cambage 3827* (NSW); Wooroonooran NP, headwaters East Mulgrave River, Nov 2000, *Forster PIF26417 et al.* (BRI, MEL, NSW); Wooroonooran NP near Tower 5 Bellenden Ker cablecar, 5 km W of Bellenden Ker township, Nov 2000, *Forster PIF26420 et al.* (A, BISH, BRI, K, L, MEL, NSW); Wooroonooran NP, East Mulgrave River, Nov 2000, *Forster PIF26439 et al.* (BRI, MEL); Summit of Mt Bellenden Ker, Aug 1971, *Hyland 5319* (BRI, CNS); NE peak of Mt Bartle Frere, Oct 1992, *Jago 1067* (BRI); East Mulgrave River, Nov 1995, *Jago 3697 et al.* (AD, BRI, CANB, DNA, MEL); *ibid*, Nov 1995, *Jago 3713 et al.* (BRI); Mt Bellenden Ker, Dec 1892, *Podenzana s.n.* (CANB 7707927 [ex BM]); NPR 904, Wooroonooran, SE of Bellenden Ker Centre Peak, Dec 1996, S*mall 7* (BRI, CNS); Bellenden Ker, summit, Jun 1949, *Smith 4201* (BRI); Mt Bellenden Ker, summit of the Centre Peak, Jun 1969, *Smith 14673a* (BRI, CANB, MEL, NSW); Bellenden Ker, Jan 1923, *White s.n.* (BRI [AQ200706], NSW 190874).

***Distribution and habitat*:** *Argophyllum cryptophlebum* is endemic to the Wet Tropics bioregion of northeast Queensland, occurring in the Cape Tribulation area, the Bellenden Ker – Bartle Frere massif, and on Bell Peak (**Map 1**). It is confined to areas where annual rainfall exceeds 3000 mm, and at altitudes above 600 metres. Plants occur on the edges of rainforest (microphyll moss/fern vinethicket), within rainforest, or along watercourses, always on granite substrates.

***Phenology*:** Flowers are recorded from July to December; fruits from March to December.

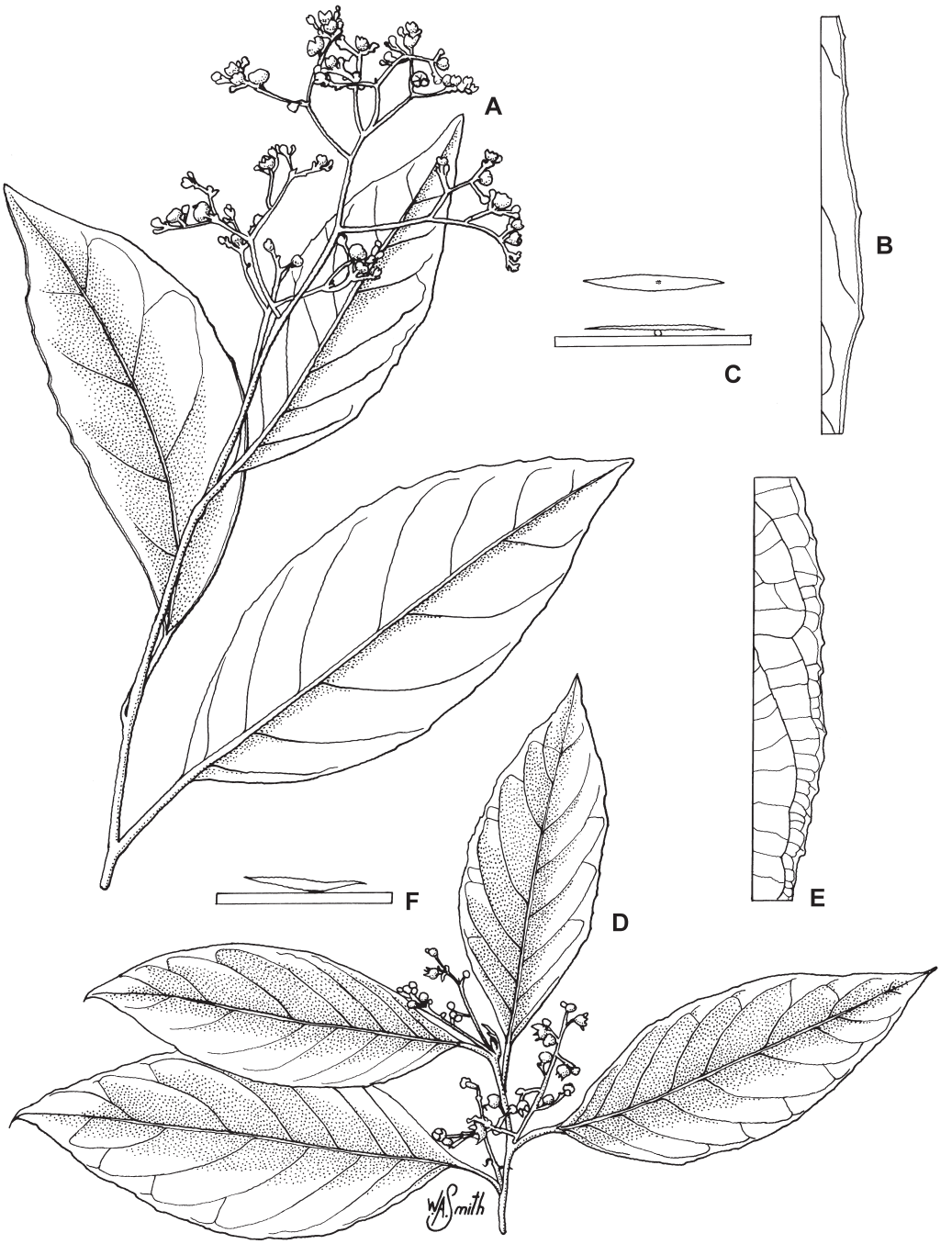

Fig. 1A–C. ***Argophyllum cryptophlebum***. A. flowering branchlet ×0.8. B. lamina margin ×2. C. hair from upper leaf surface ×60; **D–F.** ***A. curtum***. D. flowering branchlet ×0.6. E. lamina margin ×2. F. hair from upper leaf surface ×60. A–C from *Forster PIF26439 et al.* (BRI); D–F from *Forster PIF30959 & Jensen* (BRI, holotype). Del. W. Smith.

***Typification*:** Bailey (1900) treated this species as a variety (*fulvum*) of the New Caledonian *Argophyllum nitidum* and cited the same specimens used by Zemann in the protologue for *A. cryptophlebum*.

The *Sayer 84* collection is fertile and of good quality; the sheet selected as lectotype for the name *Argophyllum cryptophlebum* includes a field label with the number '84' written on it.

***Affinities*:** *Argophyllum cryptophlebum* is putatively closely related to the two Australian species with terminal inflorescences: *A. jagonis* and *A. nullumense* (see Affinities under those species). It is also apparently similar to *A. nitidum* from New Caledonia.

***Notes*:** Populations of *Argophyllum cryptophlebum* from the Cape Tribulation area have somewhat longer petioles than plants further south, and populations from Bell Peak often have smaller laminae than found elsewhere. These differences are not consistent and hence not considered to be taxonomically significant.

***Conservation status*:** *Argophyllum cryptophlebum* is currently classified as **Vulnerable** under the Queensland NCA (1992). The species occurs in six population centres; some of these (e.g. Bellenden Ker/East Mulgrave River) comprise a number of poorly defined subpopulations insomuch as the area remains poorly explored. There are no immediate threats to these six populations; however, they are in many instances greatly disjunct indicating little recent genetic connectivity. All of these high altitude populations are under threat from environmental changes associated with climate change. The classification of **Vulnerable** based on the criterion **D2** remains relevant for this species.

***Etymology*:** The epithet is from the Greek *crypto-* meaning hidden, and *phlebos*, a vein. This probably alludes to the obscure tertiary venation of the leaves in this species.

2. Argophyllum curtum A.R.Bean & P.I.Forst. **sp. nov.** with affinity to *A. lejourdanii*, but differing by the small and inconspicuous teeth on the leaf margin, and the glabrous upper surface of the fully expanded leaves. **Typus:** Queensland. Cook District: Freshwater Forest Reserve, Lake Morris road, 12 May 2005, *P.I. Forster PIF30959 & R. Jensen* (holo: BRI [2 sheets + spirit]; iso: CNS, L, MEL, NSW, *distribuendi*).

Shrub 2–5 m high. Hairs on new growth rusty or brown; hairs more than 10 cm from growing point white or creamy. Petiole 13–28 mm long; fully expanded lamina elliptic to broadly-elliptic, 109–170 mm long, 42–70 mm wide, 2.3–3.3 times longer than wide; 6–9 secondary veins on either side of midrib. Lamina apex shortly acuminate or acute; base cuneate, not oblique or occasionally oblique by up to 4 mm. Lamina margins denticulate, with teeth all about the same size, 23–38 on each side of the lamina, the longer teeth 0.3–1 mm long. Upper surface of fully expanded lamina green, glabrous. Hairs on upper surface of developing leaves appressed, 0.3–0.6 mm long. Lower surface of lamina white or creamy-coloured, hairs appressed; secondary veins brown to creamy, raised; tertiary veins creamy, ± flush with indumentum. Inflorescences axillary, paniculate, 35–93 mm long, densely tomentose, primary axis 30–82 mm long, secondary branches 9–32 mm long, bracts narrowly-deltate, 1.8–5 mm long. Pedicels 0.5–3 mm long; flowering hypanthium cupular, 2.6–3.5 mm diameter. Calyx lobes 0.9–1.4 mm long; petals 2.3–3.2 mm long, white, corolla appendages white, *c*. 1.3 mm long. Staminal filaments 1–1.2 mm long; anthers 0.7–0.8 mm long. Style *c*. 1.2 mm long; ovary 2-locular. Capsules with hemispherical hypanthium, 2.8–3.5 mm long, 4.3–5.5 mm diameter, teeth 4, exserted. Seeds 0.45–0.55 mm long. **Fig. 1D–F**.

***Additional specimens examined*: Queensland.** Cook District: McKinnon Creek, SW of Edmonton, Jun 1996, *Forster PIF19260 et al.* (A, BRI, MEL, NSW); Lake Morris road, Aug 1995, *Jago 3547* (BRI); Crystal Cascades, Jul 2000, *Cooper 1365 & Cooper* (BRI); Saddle Mountain, near Kuranda, Aug 1967, *Brass 33632* (BRI); *ibid*, Jul 1968, *Brass 33879* (CNS); Barron River gorge, on side of road to Hydro-electric station, Dec 2009, *Dowe s.n.* (CNS 134163.1); Gadgarra, Atherton, Jun 1929, *Kajewski 1090* (BRI); Track SW of Wright's Lookout to Surprise Creek, 5 km S of Kuranda, Jul 1994, *Jobson 3096 & Wiecek* (BRI, CANB, NSW).

***Distribution and habitat*:** *Argophyllum curtum* is endemic to the Wet Tropics bioregion of northeast Queensland where it is found in a relatively small area from Kuranda to Edmonton, near Cairns (**Map 2**). This species grows in open forest with (for example) *Eucalyptus pellita* F.Muell. and *Syncarpia glomulifera* (Sm.) Nied., or on the edges of streams in rainforest (complex notophyll vineforest), on sandy loam derived from granite alluvium. Altitude ranges from 120–630 metres.

***Phenology*:** Flowers are recorded for May to August; fruits from June to August.

***Affinities*:** *Argophyllum curtum* is similar to *A. lejourdanii*, but differing by the shorter marginal teeth on the leaves, up to 1 mm long (up to 2.2 mm long for *A. lejourdanii*), the upper surface of fully expanded leaves glabrous (hairs persistent for *A. lejourdanii*), the leaf hairs 0.3–0.6 mm long (0.8–1 mm long for *A. lejourdanii*), and the capsules 4.3–5.5 mm diameter (3.8–4.3 mm diameter for *A. lejourdanii*).

***Conservation status*:** *Argophyllum curtum* is known from five or six extant populations with the population recorded as 'Gadgarra, Atherton' by Frank Kajewski having not been relocated to date. There are no immediate threatening processes evident for the species; however, the available habitat for potential occurrence within the area of occupancy is relatively small and subject to weed invasion and environmental changes from stochastic events. A suitable conservation status is **Vulnerable** based on the criterion **D2** (IUCN 2012).

***Etymology*:** From the Latin *curtus*, meaning cut short, or short. This is given in reference to the short marginal teeth on the leaves.

3. Argophyllum ferrugineum A.R.Bean & P.I.Forst. **sp. nov.** Distinguished by the axillary inflorescences, persistent hairs on the upper leaf surface, and rusty or brown hairs on the veins of fully expanded leaves. **Typus:** Queensland. North Kennedy District: Tully Falls weir, 23 November 1995, *P.I. Forster PIF18195 & T. Spokes* (holo: BRI [2 sheets + spirit]; iso: CNS, K, MEL, NSW).

Argophyllum sp. (Koolmoon Creek B.Gray 1040); Forster (2007, 2010, 2017).

Shrub 1–4 m high. Hairs on new growth rusty or brown; hairs on branchlets more than 10 cm from growing point rusty or brown. Petiole 18–30 mm long; fully expanded lamina elliptic to obovate or broadly-elliptic, 117–182 mm long, 38–76 mm wide, 1.9–2.7 times longer than wide; 8–10 secondary veins on either side of midrib. Lamina apex shortly acuminate, or occasionally acute; base cuneate, not oblique or occasionally oblique by up to 3 mm. Lamina margins dentate, with teeth all about the same size, or varying in length (alternating long and short), 17–49 on each side of the lamina, the longer teeth 0.7–2 mm long. Upper surface of fully expanded lamina green, with persistent hairs, sparse to moderately dense, appressed, 0.5–0.7 mm long. Lower surface of lamina white or sometimes rusty-coloured, hairs appressed; secondary veins brown, raised; tertiary veins brown, ± flush with indumentum. Inflorescences axillary, paniculate, 33–75 mm long, densely tomentose, primary axis 25–63 mm long, secondary branches 9–30 mm long, bracts narrowly-deltate, 2–6.3 mm long. Pedicels 1.3–2 mm long; flowering hypanthium cupular, 3.1–3.9 mm diameter. Calyx lobes 1.5–1.9 mm long; petals 4–4.2 mm long, white, corolla appendages white, 1–1.4 mm long. Staminal filaments 1–1.6 mm long; anthers 0.8–0.9 mm long. Style 1.1–1.6 mm long; ovary 2-locular. Capsules with cupular to hemispherical hypanthium, 2.8–3.3 mm long, 3.8–5 mm diameter, teeth 4, slightly exserted. Seeds 0.5–0.6 mm long. **Figs. 2A–C, 3**.

***Additional specimens examined*: Queensland.** North Kennedy District: SF 251, Cannanbullen Falls, Nov 1996, *Gray 6921* (BRI, CNS); South Coochimberrum LA, 1.5 km SE of Mt Koolmoon, May 2001, *Ford AF2836* (BRI, CNS); Rhyolite pinnacle *c.* 1.75 km ESE of Mt Koolmoon, Jan 2010, *Jago RLJ7357* (BRI); Koolmoon Creek crossing of old forestry road, Nov 1996, *Jago 4149* (BRI); SFR 251, Tableland LA, Oct 1978, *Gray 1040* (BRI); Koolmoon Creek, Sep 1950, *Smith 4727* (BRI); *ibid*, Oct 1995, *Gray 6354* (BRI, CNS); SFR 251, Tableland LA, Koolmoon Creek, Dec 1995, *Gray 6473* (BRI, CNS); Tully Falls, Jan 1948, *Fielding NQNC11948* (CNS); *ibid*, Oct 1995, *Ford 1631* (BRI, CNS); Tully Falls weir, Jun 1995, *Forster PIF16753* (AD, BRI, CNS, K, MEL, NSW); *ibid*, May 2003, *Forster PIF29391 &*

Fig. 2A–C. ***Argophyllum ferrugineum***. A. flowering branchlet ×0.5. B. lamina margin ×2. C. hair from upper leaf surface ×40; **D–F.** ***A. heterodontum***. D. flowering branchlet ×0.5. E. lamina margin ×2. F. hair from upper leaf surface ×60. A–C from *Forster PIF18195 & Spokes* (BRI holotype); D–F from *Elick 153* (BRI). Del. W. Smith.

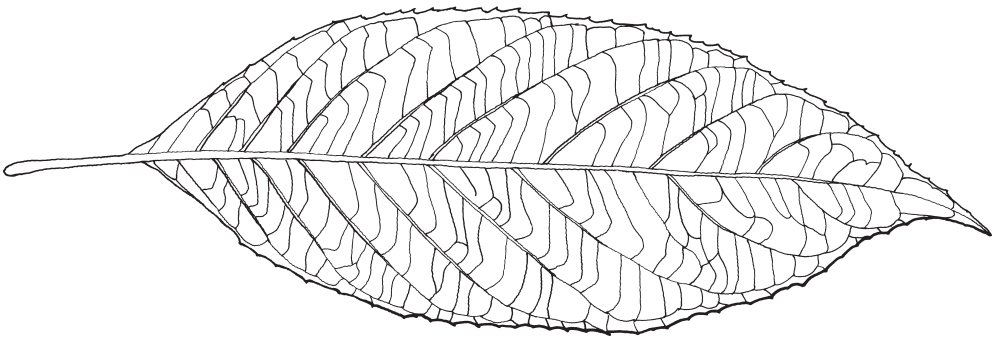

Fig. 3. ***Argophyllum ferrugineum***. Leaf venation ×0.7. From *Forster PIF18195 & Spokes* (BRI, holotype). Del. W. Smith.

Jensen (A, BRI, L, MEL, NSW); Kareeya Power Station weir, *c*. 500 m upstream from Tully Falls, *s.dat*., *Haig s.n*. (BRI [AQ582641]); SFR 756, Park LA, Tully Weir Road, Aug 1998, *Ford 2092* (BRI, CNS); Mt Collins, Kirrama area, Nov 1995, *Irvine 2370* (CNS); Conn Creek, SE of Kirrama, Nov 1995, *Bradford s.n*. (CNS [QRS 108605]).

***Distribution and habitat*:** *Argophyllum ferrugineum* is endemic to the Wet Tropics bioregion of northeast Queensland where it is mainly confined to a small area southeast and south-south-east of Ravenshoe, in the Tully Falls and Koolmoon Creek areas, with an outlier west of Cardwell near Kirrama (**Map 3**). It grows in rocky rhyolite areas with shallow soil usually along stream edges, either in open forest with *Banksia aquilonia* (A.S.George) A.S.George, *Callitris macleayana* (F.Muell.) F.Muell., *Lophostemon confertus* (R.Br.) Peter G.Wilson & J.T.Waterh., *Melaleuca recurva* (R.D.Spencer & Lumley) Craven, or on the margins of depauperate rainforest (simple notophyll vineforest). Altitude ranges from 600–1080 metres.

***Phenology*:** Flowers are recorded from August to January; fruits from October to June.

***Affinities*:** *Argophyllum ferrugineum* is putatively close to *A. lejourdanii*, but differs by the shorter hairs (0.5–0.7 mm long) of the upper leaf surface, the persistently rusty branchlets, the brown or rusty hairs on the tertiary veins of the lower leaf surface persisting on fully expanded leaves, the longer calyx lobes, and the larger seeds.

***Conservation status*:** *Argophyllum ferrugineum* is known from four or perhaps five poorly defined populations within a relatively small area of occurrence from near Mt Koolmoon to near Kirrama west of Cardwell. There are no obvious immediate threatening process for this species; however, the habitat is subject to weed invasion and environmental changes from stochastic events. The extent to which *A. ferrugineum* occurs away from the mainly roadside collection sites needs to be determined in this area. A suitable conservation status for this species is **Vulnerable** based on the criterion **D2**.

***Etymology*:** The specific epithet is formed from the Latin *ferrugineus* meaning rusty, given in reference to the colour of veins on the lower leaf surface in this species.

4. Argophyllum heterodontum A.R.Bean & P.I.Forst. **sp. nov.** with affinity to *A. lejourdanii*, but differing by the glabrous upper surface of fully expanded leaves, the shorter leaf hairs, the marginal leaf teeth of variable length and the longer pedicels. **Typus:** Queensland. Cook District: Walsh's Pyramid, 2 km SE of Gordonvale, 27 May 2003, *P.I. Forster PIF29378 & R. Jensen* (holo: BRI [1 sheet]; iso: MEL, NSW).

Argophyllum lejourdanii var. *cryptophlebum* F.M.Bailey (as 'cryptophleba'), *Queensland Fl.* 2: 533 (1900); *A. nitidum* var. *cryptophlebum* (F.M.Bailey) Ewart, Jean White & B.Rees

(as 'cryptophleba'), *Proc. Roy. Soc. Vic.* 22: 10 (1909). **Type:** Queensland. Cook District: Mulgrave River, Bellenden Ker Expedition, in 1889, *F.M. Bailey s.n.* (holo: BRI [AQ200726]).

Shrub or small tree 2–6 m high. Hairs on new growth rusty or brown; hairs more than 10 cm from growing point creamy-white. Petiole 17–35 mm long; fully expanded lamina elliptical, broadly-elliptical or ovate, 92–143 mm long, 33–55 mm wide, 2.5–3.3 times longer than wide; 6–10 secondary veins on either side of midrib. Lamina apex acuminate; base cuneate, not oblique or occasionally oblique by up to 2 mm. Lamina margins dentate, with teeth usually varying in length (alternating long and short), 24–61 on each side of the lamina, the longer teeth 1–4.5 mm long. Upper surface of fully expanded lamina green, glabrous; sparse hairs present on young expanding lamina, appressed, 0.5–0.7 mm long. Lower surface of lamina white, hairs appressed; secondary veins brown or white, raised; tertiary veins white, ± flush with indumentum. Inflorescences axillary, paniculate, 35–90 mm long, densely tomentose, primary axis 20–73 mm long, secondary branches 7–14 mm long, bracts narrowly-deltate, 1.5–8.5 mm long. Pedicels 1.4–2.5 mm long; flowering hypanthium cupular, 2.8–4 mm diameter. Calyx lobes 1.2–1.5 mm long; petals 2.6–3.6 mm long, white, corolla appendages white, 1.4–1.5 mm long. Staminal filaments 1.3–1.6 mm long; anthers 0.8–0.9 mm long. Style 1.4–1.5 mm long; ovary 2–3-locular. Capsules with cupular hypanthium, 3–4 mm long, 3.5–4.8 mm diameter, teeth 4 or 6. Seeds 0.45–0.55 mm long. **Figs. 2D–F, 8F**.

***Additional selected specimens examined*: Queensland.** Cook District: Walsh's Pyramid, Mulgrave River, *s.dat*., *s.coll*. (BRI [AQ200708], MEL, NSW); S of Gordonvale, Sep 1935, *Blake 9751* (BRI); Base of Walsh's Pyramid, near Gordonvale, May 1962, *Blake 21773* (BRI); Walsh's Pyramid, N slopes, Nov 1954, *Blake 19769* (BRI); Middle slopes of Walsh's Pyramid, Jul 1993, *Forster PIF13765* (BRI, CNS); Walsh's Pyramid, Aug 1938, *Flecker NQNC5060* (BRI); *ibid*, Aug 1959, *Thorne et al. 23184* (BRI); *ibid*, Sep 1972, *Webb & Tracey 13783* (BRI, CNS); *ibid*, Jul 1980, *Irvine 2032* (BRI); Massey Creek Falls, Bellenden Ker NP, Feb 1996, *Jago 3791 & Jensen* (BRI); Along track to Clamshell Falls, Oct 1996, *Elick 153* (BRI, CNS); Behana Creek, 2.6 km S from locked gate at water treatment plant on Behana Gorge road, S of Gordonvale, Jul 2005, *Halford Q8485 & Jensen* (BRI); upstream of Butcher Creek Falls, Jun 1995, *Hunter JH4166* (BRI).

***Distribution and habitat*:** *Argophyllum heterodontum* is endemic to the Wet Tropics bioregion of northeast Queensland where it is known from a small area south of Gordonvale mainly centred around Walsh's Pyramid, together with a disjunct population near Butchers Creek Falls (**Map 2**). It occurs in skeletal soil on pavements and rock outcrops (granite at Walsh's Pyramid and Behana Creek; basalt/metamorphics at Butcher Creek Falls) in open situations with woodland dominated by Myrtaceae (*Eucalyptus granitica* L.A.S.Johnson & K.D.Hill, *E. reducta* L.A.S.Johnson & K.D.Hill, *Lophostemon confertus*) or with little other woody vegetation.

***Phenology*:** Flowers are recorded from May to November; fruits are recorded from May to November.

***Typification*:** Mueller wrote the name *A. nitidum* var. *cryptophlebum* on the herbarium label of MEL 2288065, an isolectotype of *A. cryptophlebum* Zemann. Then Bailey (1900) caused confusion by describing *A. lejourdanii* var. *cryptophlebum*, attributing the varietal epithet to "F. v. M. in herb.". However, Bailey used a specimen of his own as the type and not the specimen in MEL annotated by Mueller. Bailey's taxon is not related to *A. cryptophlebum,* but clearly has affinities to *A. lejourdanii*.

Ewart *et al*. (1909) obviously went back to the source of the name (MEL 2288065) and presumed that this was the specimen to which Bailey was referring. On that basis, Ewart *et al*. (1909) stated that the var. *cryptophlebum* should be placed under *A. nitidum* rather than *A. lejourdanii*.

Bailey's var. *cryptophlebum* should be attributed to him alone, rather than "F.Muell. ex F.M.Bailey" because Mueller applied the name to a different taxon from Bailey.

***Affinities*:** *Argophyllum heterodontum* is similar to *A. lejourdanii*, but differs by the longer and markedly unequal marginal teeth

on the leaves, up to 4.5 mm long (up to 2.2 mm long for *A. lejourdanii*), the upper surface of fully expanded leaves glabrous (hairs persistent for *A. lejourdanii*), the leaf hairs 0.5–0.7 mm long (0.8–1.0 mm long for *A. lejourdanii*), the pedicels 1.4–2.5 mm long (1–1.5 mm for *A. lejourdanii*), and the ovaries sometimes 3-locular (consistently 2-locular for *A. lejourdanii*).

***Conservation status*:** *Argophyllum heterodontum* is known from three populations, all occurring in National Park (Gadgarra, Wooroonooran), although the most northerly stands of the species at the base of Walsh's Pyramid are on Freehold title along the walking track up the mountain before it enters the National Park. The *Argophyllum* co-occurs with another localised endemic *Plectranthus gratus* S.T.Blake (listed as **Vulnerable**), although that species is known from at least five populations (Forster 1996), with two lacking *A. heterodontum*. There exists similar habitat to the southwest of Walsh's Pyramid that should be explored for other subpopulations of both species.

A suitable conservation status for *Argophyllum heterodontum* is **Vulnerable** (criterion **D2** from IUCN 2012). There are no pressing threatening processes for the species; however, the populations and subpopulations are likely to be impacted by too frequent burning of the habitat and by weed invasion (e.g. introduced pasture/weed grasses such as *Sporobolus* species) or by stochastic events.

***Etymology*:** From the Greek *heteros* (different), and *odontos* (tooth). This refers to the acute teeth on the leaf margins that vary greatly in size.

5. Argophyllum iridescens A.R.Bean & P.I.Forst. **sp. nov.** with affinity to *A. lejourdanii*, but differing by the small and inconspicuous teeth on the leaf margin, the creamy-white new growth, and the larger seeds. **Typus:** Queensland. Cook District: Mt Hedley, 3 km ENE of Rossville, Timber Reserve 165, 15 April 1999, *P.I. Forster PIF24277 & R. Booth* (holo: BRI [2 sheets + spirit]; iso: AD, CNS, K, L, MEL, NSW, US *distribuendi*).

Shrub *c.* 2 m high. Hairs on new growth white or creamy; hairs more than 10 cm from growing point creamy-white. Petiole 10–15 mm long; fully expanded lamina elliptical, 89–174 mm long, 30–53 mm wide, 2.8–4.5 times longer than wide; 8–11 secondary veins on either side of midrib. Lamina apex acuminate; base cuneate, not oblique or occasionally oblique by up to 5 mm. Lamina margins denticulate, with teeth all about the same length, 30–49 on each side of the lamina, the teeth 0.3–0.7 mm long. Upper surface of fully expanded lamina green, glabrous or sparsely hairy; hairs appressed, 0.8–1.2 mm long. Lower surface of lamina white, hairs appressed; secondary veins white, raised; tertiary veins white, ± flush with indumentum. Inflorescences axillary, paniculate, 33–77 mm long, densely tomentose, primary axis 28–63 mm long, secondary branches 5–15 mm long, bracts narrowly-deltate, 1.3–2.9 mm long. Pedicels 1.5–3 mm long; flowering hypanthium cupular, 3.4–3.6 mm diameter. Calyx lobes 1.3–1.5 mm long; petals 3.2–3.5 mm long, white, corolla appendages white, *c.* 1.2 mm long. Staminal filaments 1.3–1.5 mm long; anthers *c.* 0.7 mm long. Style 1.3–1.5 mm long; ovary 2-locular. Capsules with cupular hypanthium, 3–3.3 mm long, 3.6–4.1 mm diameter, teeth 4. Seeds 0.45–0.6 mm long. **Fig. 4A–C**.

***Additional specimen examined*: Queensland.** Cook District: V.C.L. Noah, Jun 1975, *Hyland 8289* (BRI).

***Distribution and habitat*:** *Argophyllum iridescens* is endemics to the Wet Tropics bioregion of northeast Queensland and known from two locations; Mt Hedley, south of Cooktown, and near Noah Creek, between Daintree and Cape Tribulation (**Map 2**). It grows on large granite outcrops, at the ecotone between sparsely vegetated pavements and notophyll rainforest. Altitudes are between 400 and 500 metres.

***Phenology*:** Flowers and fruits are recorded from April and June.

***Affinities*:** *Argophyllum iridescens* is similar to *A. lejourdanii*, but differs by the small and inconspicuous marginal teeth on the leaves, up to 0.7 mm long (up to 2.2 mm long for *A. lejourdanii*), the long acuminate leaf apex

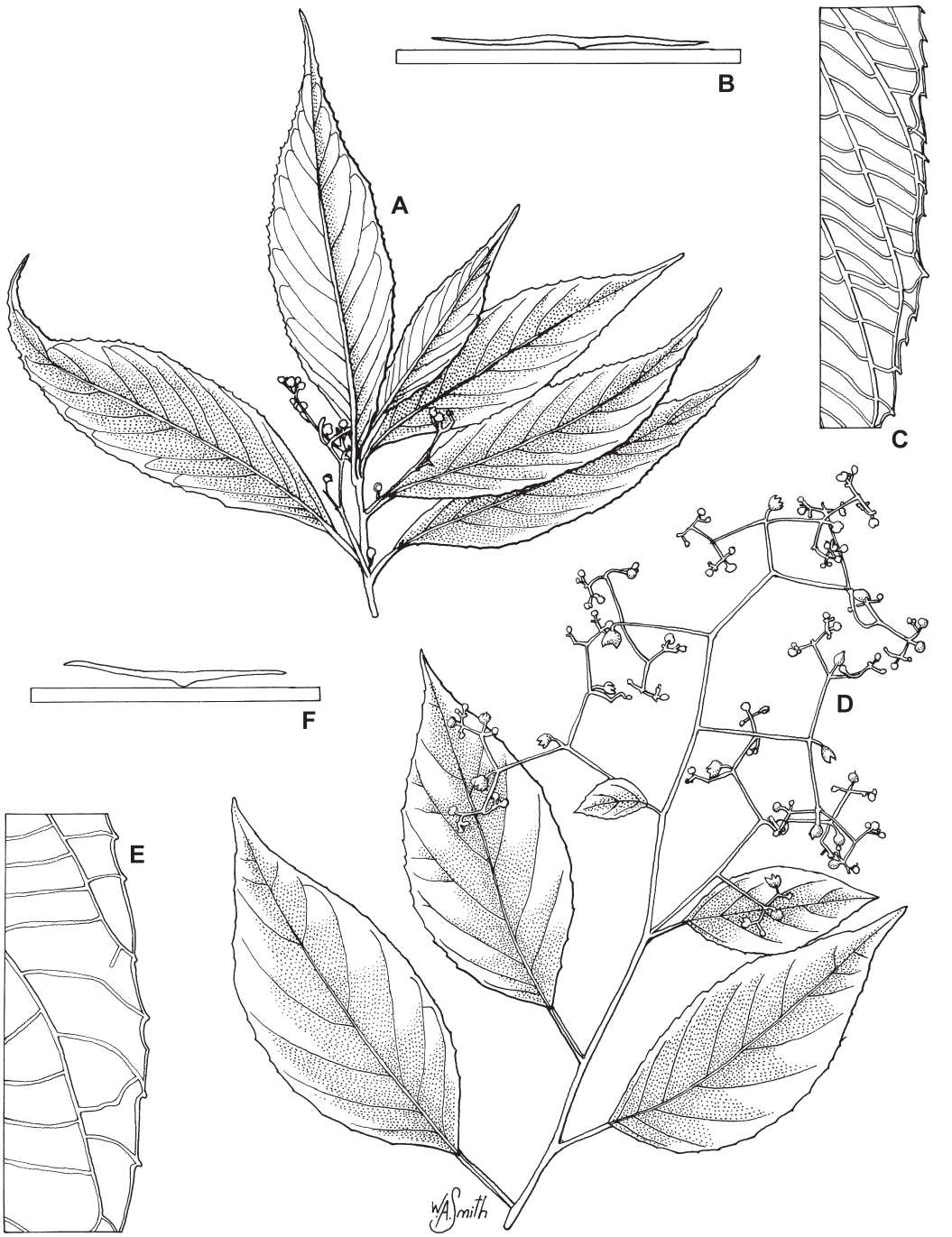

Fig. 4. A–C. ***Argophyllum iridescens.*** A. flowering branchlet ×0.6. B. hair from upper leaf surface ×40. C. lamina margin ×2; **D–F.** ***A. jagonis***. D. flowering branchlet ×0.6. E. lamina margin ×2. F. hair from upper leaf surface ×60. A–C from *Forster PIF24277 & Booth* (BRI, holotype); D–F from *Jago 3553* (BRI, holotype). Del. W. Smith.

(shortly acuminate for *A. lejourdanii*), the creamy-white new growth (rusty new growth for *A. lejourdanii*), and the seeds 0.5–0.65 mm long (0.4–0.5 mm long for *A. lejourdanii*). *A. iridescens* differs from *A. palumense* by the petioles 10–15 mm long (21–29 mm long for *A. palumense*), and the marginal teeth on the leaves 0.3–0.7 mm long (1.7–3.2 mm long *A. palumense*).

***Conservation status*:** One population of *Argophyllum iridescens* occurs in Daintree NP and the second at Mt Hedley is closely adjacent (*c.* 100 m distant) to Ngalba Bulal NP in unreserved land and probably will be eventually found in the National Park with further exploration as similar habitat occurs there. There are no obvious threatening processes; however, the species can be categorised as **Vulnerable** based on the criterion **D2** (IUCN 2012).

***Etymology*:** From the Latin *iridescens*, meaning iridescent, displaying different colours when viewed from different angles. The lower leaf surface shows alternating bands of brilliant white and steely-grey which change position depending on the direction of the light source.

6. Argophyllum jagonis A.R.Bean & P.I.Forst. **sp. nov.** with affinity to *A. cryptophlebum*, but differing by the white branchlets and leaf veins, the greater number of leaf marginal teeth, and the dichotomously branched inflorescences. **Typus:** Queensland. Cook District: The Boulders, Babinda Creek, 19 August 1995, *R.L. Jago 3553* (holo: BRI [2 sheets]; iso: AD, CNS, K, L, MEL, NSW, US, *distribuendi*).

Argophyllum sp. (Babinda L.S. Smith 10213); Forster (2007, 2010, 2017).

Shrub 1–3 m high. Hairs on new growth white or creamy; hairs more than 10 cm from growing point white or creamy. Petiole 14–24 mm long; fully expanded lamina broadly-elliptic to broadly-ovate, 79–145 mm long, 40–85 mm wide, 1.3–2.5 times longer than wide; 6–9 secondary veins on either side of midrib. Lamina apex usually acuminate, sometimes acute; base cuneate, not oblique. Lamina margins denticulate, with teeth all about the same size, or alternating smaller and longer teeth, 11–29 on each side of the lamina, the longer teeth 0.2–1 mm long; margins rarely entire, with teeth reduced to small glands. Upper surface of fully expanded lamina green, glabrous; hairs on developing leaves appressed, 0.5–0.7 mm long. Lower surface of lamina white, hairs appressed; secondary veins white, slightly raised; tertiary veins white, ± flush with indumentum. Inflorescences terminal, dichasially cymose, 98–205 mm long, densely tomentose, primary axis 78–185 mm long, secondary branches 15–25 mm long; branching of inflorescence mostly dichotomous, branches spreading at 60–90° from adjacent branch; bracts narrowly-deltate, 1.5–4 mm long. Pedicels 1.3–2.5 mm long; flowering hypanthium cupular, 2.5–3.2 mm diameter. Calyx lobes 1–1.1 mm long; petals 2.1–2.2 mm long, white to pale yellow, corolla appendages white, 1–1.3 mm long. Staminal filaments 0.8–1.1 mm long; anthers 0.5–0.6 mm long. Style 1–1.1 mm long; ovary 2-locular. Capsules with cupular hypanthium, 3.4–4 mm long, 3.3–4 mm diameter, teeth 4, exserted. Seeds 0.4–0.5 mm long. **Fig. 4D–F.**

***Additional specimens examined*: Queensland.** Cook District: R758, Fisher's Creek, South Johnstone River, Jul 1982, *Dansie AFO5187* (CNS); Russell River, Bartle Frere, Nov 1936, *Flecker NQNC2614* (CNS); Babinda Creek, Happy Valley, Jul 1943, *Flecker NQNC8229* (BRI, CNS); The Boulders, near Babinda, Aug 1959, *Thorne 23070 & Tracey* (BRI); *ibid*, Feb 1996, *Forster PIF18564 et al.* (BRI, K, L, MEL, NSW); NPR 904 Wooroonooran, *c.* 0.9 km up Babinda Creek from The Boulders, Jun 1997, *Ford 1937* (BRI, CNS); The Boulders, Babinda, Aug 1968, *Briggs 2049a* (NSW); *ibid*, Oct 1995, *Gray 6326* (BRI, CNS); *ibid*, Oct 1995, *Gray 6328* (CNS); *ibid*, Nov 1995, *Gray 6422* (BRI, CNS); *ibid*, Jan 1996, *Gray 6520* (CNS); *ibid*, Jan 1996, *Gray 6522* (CNS); The Boulders, Babinda Creek, Aug 1963, *Hyland AFO2828* (BRI); The Boulders, Babinda Creek, *c.* 6 km W of Babinda, Aug 1954, *Smith 5333* (BRI); The Boulders, Babinda Creek, 6.5 km W of Babinda, Sep 1957, *Smith 10213* (BRI); East Mulgrave River, Dec 1994, *Hunter JH1705* (BRI); *ibid*, Nov 1995, *Jago et al. 3712* (BRI); Mt Isley W of Edmonton, Dec 1996, *Jago 4218* (BRI); SFR 310, Mulgrave River, Jun 1965, *Dansie AFO3288* (CNS); Russell River, above Jiyer Cave, Oct 2001, *Jago 6047* (BRI); Johnstone River, in 1882, *Berthoud s.n.* (MEL 2234434); *ibid*, Sep 1917, *Ladbrook 93* (BRI); *ibid*, Oct 1917, *Michael s.n.* (BRI [AQ200723]); Innisfail, in 1918, *Michael 263* (NSW); 4.2 km along Woopen Creek Road, NW of Innisfail, Jul 2007, *Bean 26766* (BRI); Fleming Road, South Johnstone, 9 km SW of Innisfail, Jul 2007, *Bean 26633* (BRI, DNA, MEL, NSW).

***Distribution and habitat*:** *Argophyllum jagonis* is endemic to the Wet Tropics bioregion of northeast Queensland from the Babinda – Innisfail area, the Mulgrave River and at Mt Isley, west of Edmonton (**Map 3**). It grows in rainforest (complex mesophyll vineforest) on infertile soils, derived from granite or metamorphics, and often near watercourses. The localities near Babinda are amongst some of the wettest places in the Australian tropics with a mean average rainfall of 3500 mm. Altitudes mostly range from 20–120 metres, but as high as 950 metres at Mt Isley.

***Phenology*:** Flowers are recorded from June to November; fruits between July and February.

***Affinities*:** *Argophyllum jagonis* is closely related to *A. cryptophlebum*, but differs by the white new growth, branchlets, and abaxial leaf veins (all rusty-brown for *A. cryptophlebum*); the branching of the inflorescence mostly dichotomous, branches spreading at 60–90° from adjacent branch (mostly monochasial, branches spreading at 30–60° for *A. cryptophlebum*); the 11–29 pairs of leaf teeth (7–14 for *A. cryptophlebum*); and the seeds 0.4–0.5 mm long (0.55–0.65 mm long for *A. cryptophlebum*).

***Conservation status*:** *Argophyllum jagonis* is known from seven or eight extant populations, four occur in Wooroonooran NP, one in Little Mulgrave NP and two in road reserves. Early collections from 'Innisfail' and 'Johnstone River' may refer to a generalised area that is equivalent to an extant population, extinct populations or the place of specimen dispatch. Much of the lowland vegetation outside of National Parks and State Forests in the Babinda – Innisfail area has now been cleared for agriculture and small remnants on road reserves and private land remain under threat from 'tidy up' clearing or weed invasion. The extant populations are disjunct and occur in relatively small patches of suitable habitat that are also subject to weed invasion; however, there are no obvious threats and the overall area of occurrence has been poorly explored. An appropriate conservation status is **Least Concern** (Queensland *NCA 1992*).

***Etymology*:** This species is named for Robert L. Jago of Stratford, Cairns and is in recognition of his knowledge of the Wet Tropics flora supported by his many excellent collections of herbarium material donated to the Queensland Herbarium.

7. Argophyllum lejourdanii F.Muell. (as 'Lejourdani'), *Fragm*. 4(25): 33 (1863); *A. lejourdanii* F.Muell. var. *lejourdanii*, *Queensl. Fl*. 2: 533 (1900). **Type citation:** "In silvis montis Elliot Australiae orientalis tropicae. Fitzalan et Dallachy". **Type:** Queensland. North Kennedy District: Mt Elliott, 4 August 1863, *J. Dallachy s.n.* (lecto: MEL 568352 [here designated]; isolecto: K 000739401).

Shrub or small tree 2–3 m high. Hairs on new growth rusty or brown; hairs more than 10 cm from growing point creamy-white. Petiole 20–32 mm long; fully expanded lamina elliptical, broadly-elliptical or ovate, 122–173 mm long, 44–79 mm wide, 1.9–2.8 times longer than wide; 7–10 secondary veins on either side of midrib. Lamina apex acuminate or acute; base cuneate, not oblique or occasionally oblique by up to 5 mm. Lamina margins dentate to denticulate, with teeth about the same length, 15–49 on each side of the lamina, the teeth 0.5–2.2 mm long. Upper surface of fully expanded lamina green, sparsely hairy; hairs appressed, 0.8–1 mm long. Lower surface of lamina white, hairs appressed; secondary veins brown or white, raised; tertiary veins white, ± flush with indumentum. Inflorescences axillary, paniculate, 39–101 mm long, densely tomentose, primary axis 23–90 mm long, secondary branches 8–24 mm long, bracts narrowly-deltate, 1.4–12 mm long. Pedicels 1–1.5 mm long; flowering hypanthium cupular, 2.8–3.1 mm diameter. Calyx lobes 1.1–1.3 mm long; petals 2.6–3.5 mm long, white, corolla appendages white, 1.3–1.5 mm long. Staminal filaments 1.3–1.8 mm long; anthers *c*. 0.7 mm long. Style 1.3–1.7 mm long; ovary 2-locular, rarely 3-locular. Capsules with hemispheric hypanthium, 2.4–3 mm long, 3.8–4.3 mm diameter, teeth 4 or rarely 6. Seeds 0.4–0.5 mm long. **Fig. 5D–F**.

***Additional selected specimens examined*: Queensland.** North Kennedy District: 43 km NW of Ingham, Gowrie LA, Aug 1990, *Halford Q307* (BISH, BRI); Murray Falls, *c*. 12 miles [19 km] S of Tully, Dec 1966, *Everist 7967*

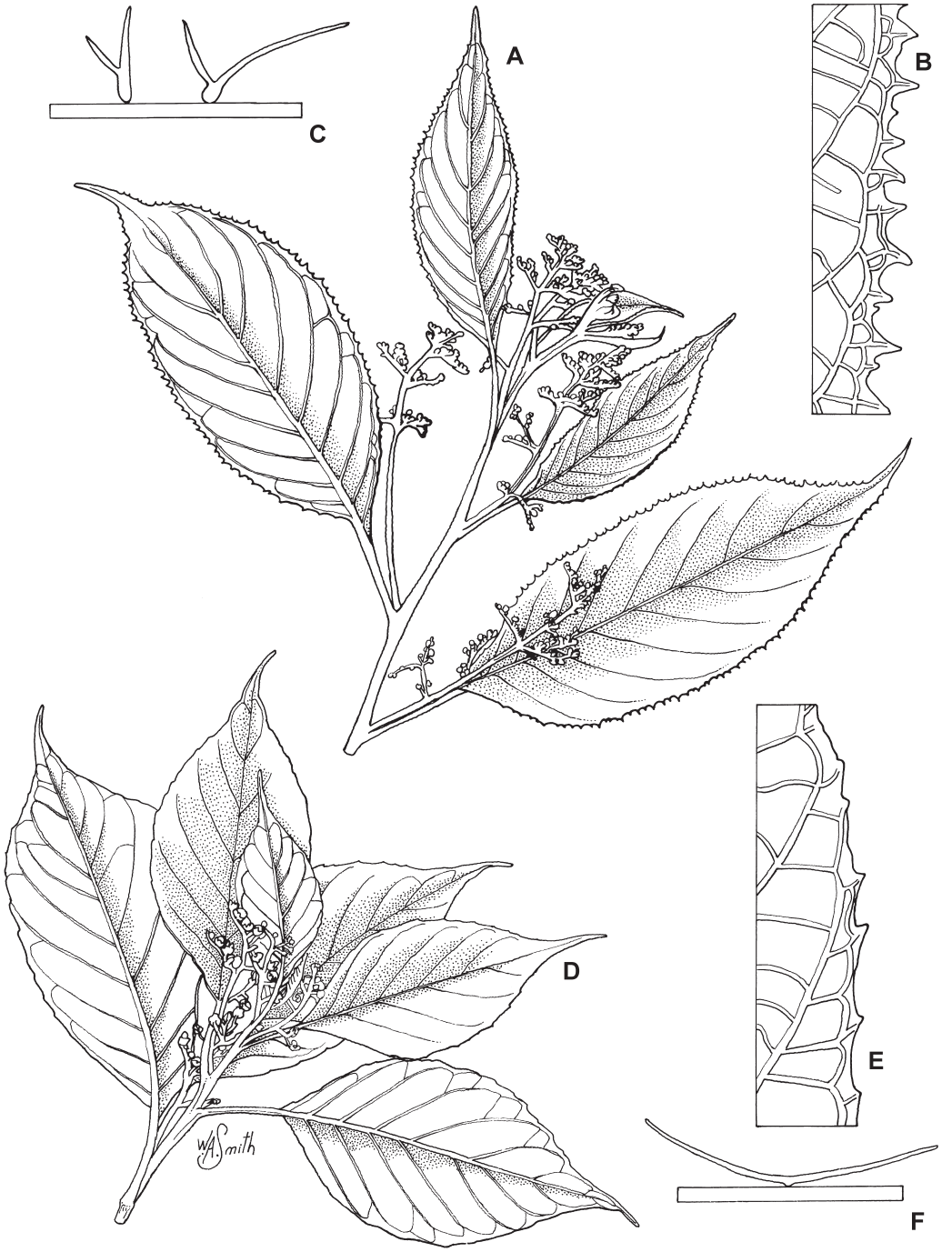

Fig. 5. A–C. *Argophyllum loxotrichum*. A. flowering branchlet ×0.5. B. lamina margin ×2. C. hairs from upper leaf surface ×60; **D–F. *A. lejourdanii***. D. flowering branchlet ×0.6. E. lamina margin ×2. F. hair from upper leaf surface ×40. A–C from *Ford 4691* (BRI); D–F from *Forster PIF8348 & Bean* (BRI). Del. W. Smith.

(BRI); 37 km along Kirrama Road, towards Kirrama Station, Feb 1996, *Forster PIF18367 & Ryan* (BRI, CNS, MEL); Kirrama Range, 11.5 km from Kennedy, Jun 1994, *Forster PIF15257* (BRI); SF 461, Compartment 7, Nov 1976, *Thorsborne & Thorsborne 324* (BRI); Five Mile Creek near Cardwell, Aug 1979, *Byrnes 3924* (BRI); Near South Pinnacle, 25 km SW of Townsville, Sep 1992, *Bean 5065* (BISH, BRI); Elliot Toe, Bowling Green Bay NP, 9 km NNE of Woodstock, May 1991, *Forster PIF8348 & Bean* (BRI, CANB, CNS, K); Mt Elliot, Jun 1985, *Cumming s.n.* (BRI [AQ398182]); NPR 253 (Mt Elliot), Dec 1977, *Hyland 9586* (CNS).

***Distribution and habitat*:** *Argophyllum lejourdanii* is endemic to the Brigalow Belt and Wet Tropics bioregions of northeast Queensland and occurs from Murray Falls near Cardwell to Mt Elliot, south of Townsville (**Map 1**). It inhabits granite rock outcrops and pavements on slopes or the edges of watercourses. Altitude is typically less than 100 metres around Cardwell, but up to 600 metres near Townsville.

***Phenology*:** Flowers are recorded from May to December; fruits in February, August, November and December.

***Affinities*:** *Argophyllum lejourdanii* is distinguished by its axillary inflorescences, the persistent hairs (longest ones 0.8–1 mm long) of the upper leaf surface, the brown or rusty new growth, and the white hairs on the lower leaf surface of fully expanded leaves. It is morphologically similar to *A. ferrugineum* (see notes there) and the two species can be regarded as an example of an allopatric speciation event.

***Notes*:** Populations from the Cardwell area tend to have longer leaf-teeth than those further south. In some specimens from the Townsville area, the teeth are almost lacking.

Prior to this revision, the name *Argophyllum lejourdanii* has been applied to a number of collections that are now variously assigned to *A. ferrugineum*, *A. heterodontum*, *A. iridescens*, *A. loxotrichum* and *A. palumense*.

***Conservation status*:** *Argophyllum lejourdanii* occurs in a number of National Parks (Bowling Green Bay, Girramay, Girringun) and whilst there are no obvious threats, the rock pavement/outcrop habitat is subject to weed invasion, particularly by introduced pasture/weed grasses such as *Sporobolus* species. There are at least eight populations based on geographical discontinuity and more are likely given the largely unexplored nature of much of the species range of occurrence. At this stage a conservation status of **Least Concern** (Queensland *NCA 1992*) is recommended.

***Etymology*:** Named for Alfred Lejourdan, 'Ingénieur agricole, Directeur du Jardin des Plantes' an agricultural engineer and Director at the Jardin botanique E.M. Heckel (Jardin botanique de Marseille). Lejourdan was one of Mueller's correspondents and supplied seeds to the Royal Botanic Gardens, Melbourne. He was best known for his 1864 treatise *De La Maladie Noire Des Plantes*.

8. Argophyllum loxotrichum A.R.Bean & P.I.Forst. **sp. nov.** with affinity to *A. lejourdanii*, but differing by the leaf hairs with obliquely ascending arms, the shorter overall hair length, and the creamy-white new growth. **Typus:** Queensland. North Kennedy District: Stony Creek, near Wallaman Falls, west of Ingham, 12 August 1951, *S.T. Blake 18791A* (holo: BRI; iso: CANB, K, MO).

Shrub or small tree 2–3.5 m high. Hairs on new growth white or creamy; hairs more than 10 cm from growing point creamy-white. Petiole 16–24 mm long; fully expanded lamina elliptical, broadly-elliptical or ovate, 108–178 mm long, 43–73 mm wide, 1.7–2.8 times longer than wide; 7–9 secondary veins on either side of midrib. Lamina apex acuminate; base cuneate, not oblique or occasionally oblique by up to 12 mm. Lamina margins dentate, with teeth all about equal in length or sometimes varying in length (alternating long and short), 12–87 on each side of the lamina, the longer teeth 0.8–3.5 mm long. Upper surface of fully expanded lamina pale green, with a moderately dense indumentum of biramous hairs, the arms obliquely ascending, the longer arm 0.4–0.6 mm long, the shorter arm 0.1–0.3 mm long. Lower surface of lamina white, hairs ascending (not appressed); secondary veins white or creamy, raised; tertiary veins white, ± flush with indumentum. Inflorescences

axillary, paniculate, 48–146 mm long, densely tomentose, primary axis 40–131 mm long, secondary branches 6–29 mm long, bracts narrowly-deltate, 2.2–7.5 mm long. Pedicels 0.5–1.2 mm long; flowering hypanthium cupular, 3.1–3.8 mm diameter. Calyx lobes 0.7–1.8 mm long; petals 2.1–3.2 mm long, white, corolla appendages white, 1–1.5 mm long. Staminal filaments 1.1–1.3 mm long; anthers 0.5–0.9 mm long. Style 0.9–1.1 mm long; ovary 2-locular. Capsules with cupular hypanthium, 2.6–3 mm long, 3.8–4.5 mm diameter, teeth 4. Seeds 0.5–0.6 mm long. **Fig. 5A–C, 8E**.

***Additional specimens examined*: Queensland.** Cook District: Mt Somerset, N of Mossman, Aug 2003, *Jago 6513* (BRI); Black Mountain, Jul 1999, *Jago 5309 et al.* (BRI); Road from Mossman to Mt Molloy, Mowbray Forest, Nov 2000, *Gottsberger 21-261100* (CNS); Rex Range, Feb 1995, *Gray 5958* (CNS); *ibid*, Oct 1995, *Gray 6333* (CNS); Rex Range, lower slopes, Sep 1993, *Sankowsky 1421* (CNS); Spring Creek Falls, Mar 1996, *Jago 3891* (BRI); *c.* 1.5 km W of Captain Cook Highway, N of Cairns; junction of Viever and Hartley Creeks, Jul 2005, *Halford Q8521 & Jensen* (BRI). North Kennedy District: Lannercost Range, *c.* 30 km W of Ingham, Jun 1982, *Telford 8772* (BRI, CANB, NSW); walking track, Wallaman Falls NP, *c.* 50 km W of Ingham, Jan 1997, *Bean 11587* (BRI); Girringun NP, *c.* 1 km from Stony Creek bridge along road to Garrawalt Creek, W of Ingham, Sep 2005, *Ford 4691* (BRI); 400 metres E of Stony Creek on the Seaview Range, Dec 1995, *Irvine 2373* (CNS); Mt Fox, Jan 1949, *Clemens s.n.* (BRI [AQ417080]); Princess Hills section of Lumholtz NP, 314 km by road NNW of Charters Towers, Sep 2002, *Thomas 2411* (BRI).

***Distribution and habitat*:** *Argophyllum loxotrichum* is endemic to the Wet Tropics bioregion of northeast Queensland and occurs in two distinct and greatly disjunct population centres that are *c.* 225 km apart. The southern populations are west of Ingham and the northern populations between Cairns and Mossman (**Map 1**). The southern populations occur in grassy woodland with *Corymbia intermedia* (R.T.Baker) K.D.Hill & L.A.S.Johnson, *Lophostemon suaveolens* (Sol. ex Gaertn.) Peter G.Wilson & J.T.Waterh. and *Allocasuarina torulosa* (Aiton) L.A.S.Johnson, or on the ecotone between this forest and rainforest (simple notophyll vineforest), or in "light" rainforest. The northern populations inhabit stunted complex notophyll vineforest. The geological substrate may be granite, metamorphics or rhyolite. Altitudes range from 100–1060 metres, but mostly around 500 metres.

***Phenology*:** Flowers are recorded for January and February, and from May to November; fruits are recorded from January, July, September and October.

***Affinities*:** *Argophyllum loxotrichum* is similar to *A. lejourdanii*, but differs by the hairs on the upper leaf surface having obliquely ascending arms (arms parallel to the leaf surface for *A. lejourdanii*), the overall hair length (sum of the length of the two arms) 0.6–0.8 mm long (0.8–1 mm long for *A. lejourdanii*), and the creamy-white new growth (rusty new growth for *A. lejourdanii*).

***Notes*:** Collections of this species prior to this revision have been usually identified as *Argophyllum lejourdanii.*

Specimens from the Cairns – Mossman area populations tend to have fewer teeth on the leaf margins, and the teeth are often shorter than those from the Ingham area.

***Conservation status*:** *Argophyllum loxotrichum* is known from at least ten populations based on geographical discontinuity. At least six of these occur in National Parks (Girrungun, Kuranda, Macalister Range, Mowbray). There are no known threats, although the rocky habitats are subject to invasion from introduced pasture/ weed grasses such as *Sporobolus* species. The area of occupancy is small within the overall area of occurrence due to the limited occurrence of the habitat patches. At this stage a conservation status of **Least Concern** (Queensland *NCA 1992*) is recommended.

***Etymology*:** From the Greek *loxos* (slanting or oblique) and *trichos* (hair). This refers to the slanting arms possessed by the biramous hairs in this species, resulting in Y-shaped hairs.

9. Argophyllum nullumense R.T.Baker, *Proc. Linn. Soc. N.S.W.* 24: 439 (1899); *A. nitidum* var. *nullumense* (R.T.Baker) Ewart, Jean White & B.Rees, *Proc. Roy. Soc. Victoria*, ser. 2, 22: 10 (1909). **Type citation:** "a plant from Nullum Mt., Murwillumbah (W.B.)" **Type:** New South

Wales. Nullum Mt, Murwillumbah, December 1896, *W. Baeuerlen 1873* (lecto: NSW 371693 [here designated]; isolecto: BRI [AQ342381], CANB 00552737, MEL 2234901, NSW 505695, NSW 372756).

[*Argophyllum nitidum auct. non* J.R.Forst. & G.Forst.; F.Muell., *Vict. Nat.* 9: 5 (1892); R.T.Baker, *Proc. Linn. Soc. N.S.W.* 22: 232 (1897); F.M.Bailey, *Queensl. Fl.* 2: 533 (1900)].

Shrub 1.5–4 m high. Hairs on new growth white or creamy; hairs more than 10 cm from growing point white or creamy. Petiole 9–14 mm long; fully expanded lamina elliptic to narrowly-elliptic, 81–186 mm long, 23–56 mm wide, 2.6–4.6 times longer than wide; 7–11 secondary veins on either side of midrib. Lamina apex shortly acuminate, or occasionally acute; base cuneate, not oblique. Lamina margins serrate, with teeth all about the same size, or varying in length (alternating long and short), 2–9(–12) on each side of the lamina, the longer teeth 0.3–2 mm long. Upper surface of fully expanded lamina green, glabrous; hairs on developing leaves appressed, 0.2–0.3 mm long. Lower surface of lamina white or creamy, hairs appressed; secondary veins white, raised; tertiary veins white, ± flush with indumentum. Inflorescences terminal, paniculate cymose, 53–130 mm long, densely tomentose, primary axis 32–108 mm long, secondary branches 17–58 mm long, bracts narrowly-deltate, 2–8 mm long. Pedicels 1.3–2 mm long; flowering hypanthium cupular, 2.9–3.5 mm diameter. Calyx lobes 0.8–1.5 mm long; petals 2.4–2.9 mm long, white, corolla appendages white, 1.8–2 mm long. Staminal filaments 1.2–1.3 mm long; anthers 0.6–0.7 mm long. Style 1.7–2 mm long; ovary 2-locular. Capsules with cupular hypanthium, 3.4–4.3 mm long, 3.4–4.2 mm diameter, teeth 4, exserted. Seeds 0.55–0.7 mm long. **Figs. 6, 8A–D**.

***Additional selected specimens examined*: Queensland.** South Kennedy District: R 573 Eungella, Finch Hatton Gorge, May 1975, *Hyland 8243* (CNS); Finch Hatton Gorge, Eungella NP, Jan 1991, *Pearson 431* (BRI). Port Curtis District: Portion 36, Castletower, 17 km SE of Calliope, Oct 1988, *Gibson TOI333* (BRI, MO, NSW); Mt Castletower NP, W slopes, Feb 1995, *Forster PIF16196* (BRI, MEL); TR 99, Many Peaks Range, 12 km SSW of Bororen, Jan 1992, *Gibson TOI1143* (BRI); Colosseum Creek, SF 645, Oct 1993, *Thomas et al. RFR193* (BRI, NSW). Wide Bay District: Marsupial LA, SF 391, ENE of Kalpowar, Sep 1995, *Bean 8926 & Robins* (BRI, MEL); TR 375, Palm Valley, Coast Range, Dec 1989, *Forster PIF6159* (BRI, CANB, CNS, K, NSW); *c.* 15 km SSE of Biggenden, in the Coast Range at 'Utopia', Oct 1986, *Russell-Smith 1847 & Lucas* (BRI). Moreton District: 4.3 km past bridge over Little Nerang Creek, Mudgeeraba to Springbrook Road, Feb 1991, *Forster PIF7799 & Leiper* (BRI, CNS); Egg Rock, Numinbah Valley, Jan 1991, *Bean 2855* (BRI); Warrie Circuit track, Springbrook NP, Jan 1993, *Thomas & Barry s.n.* (BRI [AQ363323]); Springbrook NP, Twin Falls Circuit track, Aug 2006, *Forster PIF31816* (BRI); Waterfall Creek, Numinbah Valley, Gold Coast City Council Conservation Area, Oct 2013, *Forster PIF40574 & Leiper* (BRI); Camp Eden, Currumbin Valley, Dec 1997, *Forster PIF22031 & Leiper* (BRI, CNS, MEL); Lamington NP, Echo Point Bithongabel, May 1948, *Smith 3630 & Webb* (BRI); Lamington NP, track above Picnic Rock, West Canungra Creek, May 2012, *Forster PIF38711 et al.* (BRI, US). **New South Wales.** Mt Warning, Sep 1972, *Rodd 2240* (BRI, NSW); Head of Goolmangar Creek, Feb 1980, *Floyd 1456* (BRI); beside road following Bilambil Creek to Bilambil, 9.2 km W of Stotts Island, Feb 1990, *Davies 1559 & Richardson* (AD, BRI, CANB, MEL, NSW); Tumbulgum, Feb 1897, *Baeuerlen s.n.* (BRI [AQ342385); Mt Neville track, Mt Nardi, NE of Nimbin, Feb 2000, *Bean 16015* (BRI, MEL, NSW).

***Distribution and habitat*:** *Argophyllum nullumense* has the largest distribution range and greatest number of populations of the Australian species in the genus. The species is endemic to eastern Australia with three population centres (from Terania Creek, northeast NSW, to Lower Beechmont in the South East Queensland bioregion; Mt Walsh NP north to Castle Tower NP in the South East Queensland bioregion; Finch Hatton Gorge in Eungella NP in the Central Queensland Coast bioregion) (**Map 4**). The single population at Finch Hatton Gorge in the Eungella Range is *c.* 490 km disjunct from the Castle Tower populations.

This species is also the most catholic in its habitat preferences, occurring variously on the edges of rainforest streams and the ecotonal margins of rainforest (complex notophyll vineforest) and wetter sclerophyll open forest, on diverse substrates (andesite, basalt, basalt intermixed with trachyte, granite, granodiorite, rhyolite, metamorphics/ metasediments). Altitudes range between *c.* 100 and 1050 m.

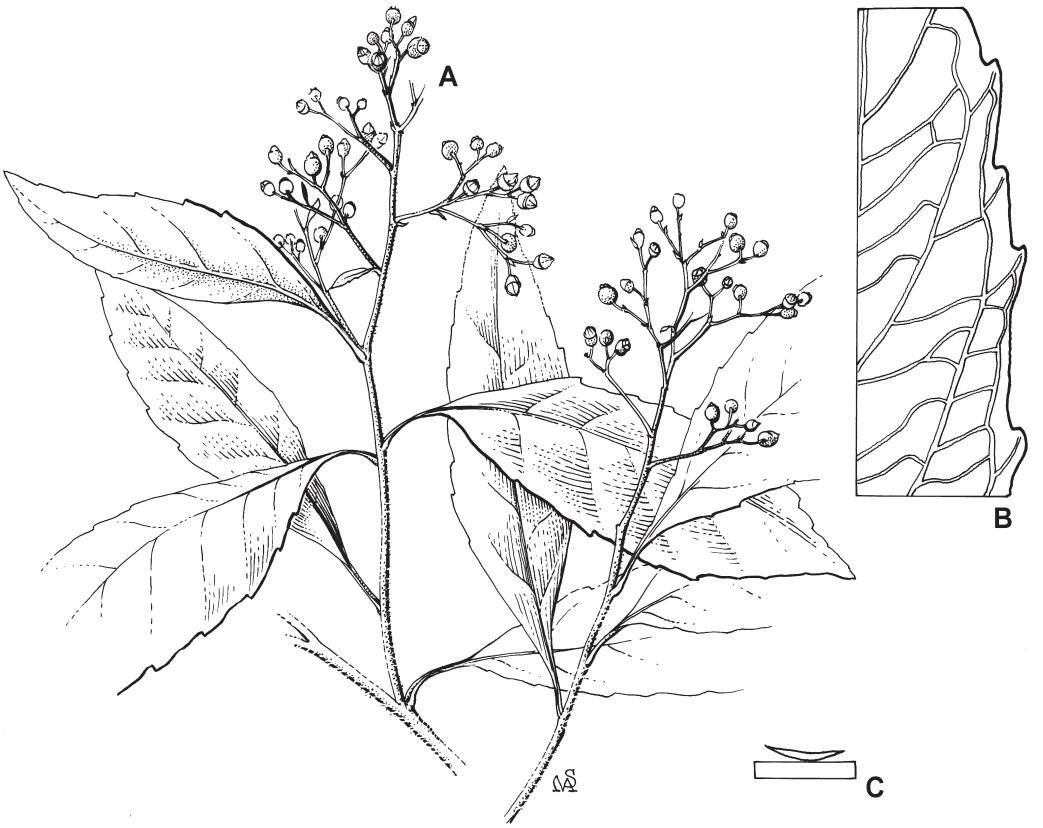

Fig. 6. ***Argophyllum nullumense***. A. flowering branchlet ×0.6. B. lamina margin ×2. C. hair from upper leaf surface ×60. A–C from *Forster PIF6159* (BRI). Del. M. Saul & W. Smith.

***Phenology*:** Flowers are recorded from September to February; fruits are recorded for every month of the year.

***Typification*:** The name *Argophyllum nitidum*, based on a collection from New Caledonia, was first misapplied to this species by Mueller (1892).

The fertile and dated William Baeuerlen gathering from Mt Nullum is the only possible candidate for the type of *A. nullumense* and the best sheet at NSW is here selected as lectotype for the name.

***Affinities*:** *Argophyllum nullumense* appears to be allied to *A. cryptophlebum*, but differs by the creamy-white new growth (brown or rusty for *A. cryptophlebum*); the leaves (2.6–3–4.6 times longer than broad (1.5–2.9 times for *A. cryptophlebum*); the petioles 7–14 mm long (13–38 mm long for *A. cryptophlebum*), and the hairs on the leaves 0.2–0.3 mm long (0.3–0.5 mm long for *A. cryptophlebum*).

***Conservation status*:** This species is widespread with many populations. It occurs in a number of National Parks in New South Wales and Queensland (Bulburin, Castle Tower, Eungella, Lamington, Mt Walsh, Mt Warning, Nightcap, Springbrook, Warro). The appropriate conservation status for the species is **Least Concern**.

***Etymology*:** The epithet refers to the type locality, Mt Nullum, in north-eastern New South Wales.

10. Argophyllum palumense A.R.Bean & P.I.Forst. **sp. nov.** with affinity to *A. lejourdanii*, but differing by the white or creamy new vegetative growth, the mostly narrower leaves, the shorter hairs of the upper leaf surface, and the larger seeds. **Typus:** Queensland. North Kennedy District: 1.5 km east of Mt Zero, Mt Zero – Taravale sanctuary, NW of Townsville, 17 May 2009, *A.R. Bean 28892 & R. Jensen* (holo: BRI).

Shrub or small tree 1–6 m high. Hairs on new growth white or creamy; hairs more than 10 cm from growing point creamy-white. Petiole 21–29 mm long; fully expanded lamina elliptical, 116–178 mm long, 36–60 mm wide, 2.4–3.8 times longer than wide; 6–8 secondary veins on either side of midrib. Lamina apex acuminate; base cuneate, not oblique. Lamina margins dentate, with teeth of varying length (alternating long and short), 26–61 on each side of the lamina, the longer teeth 1.7–3.2 mm long. Upper surface of fully expanded lamina green, sparsely hairy; hairs appressed, 0.6–0.8 mm long. Lower surface of lamina white, hairs appressed; secondary veins white, raised; tertiary veins white, ± flush with indumentum. Inflorescences axillary, paniculate, 35–113 mm long, densely tomentose, primary axis 25–92 mm long, secondary branches 9–27 mm long, bracts narrowly-deltate, 2–12 mm long. Pedicels 1.2–1.5 mm long; flowering hypanthium cupular, 3–3.5 mm diameter. Calyx lobes 1.1–1.4 mm long; petals 3.3–3.5 mm long, white, corolla appendages white, 1.2–1.3 mm long. Staminal filaments 1.3–1.6 mm long; anthers 0.9–1 mm long. Style 1–1.8 mm long; ovary 2-locular. Capsules with cupular hypanthium, 2.6–3.2 mm long, 3.4–4 mm diameter, teeth 4. Seeds 0.5–0.6 mm long. **Fig. 7A–C**.

***Additional specimens examined*: Queensland.** North Kennedy District: Mt Spec, Mar 1933, *White 8972* (BRI); 6 km from Hidden Valley towards Paluma, May 1991, *Bean 3060* (BRI); Ewan Road, Mt Spec area, *c.* 17.6 km from Paluma, Sep 1974, *Williams 51* (BRI); Hidden Valley road, west of Paluma township, Dec 2001, *Franks AJF0112004* (BRI); 17 km past Paluma on road to Hidden Valley, Jan 1992, *Forster PIF9478* (BRI, DNA, K, MEL); 8.5 km from Paluma along road to Hidden Valley, Aug 1996, *Telford 12143* (BRI, CANB, NE); Crystal Creek on lower slopes of Mt Spec, Feb 1980, *Stanley 8032A* (BRI); Near Palm Tree Creek, Thornton Gap Road, Mar 2001, *Ford AF2754* (BRI, CNS); Paluma Range, Bluewater area, Nov 1990, *Jackes 9056* (BRI).

***Distribution and habitat*:** *Argophyllum palumense* is endemic to the Wet Tropics bioregion of northeast Queensland from a restricted area of mountainous terrain northwest of Townsville, including the Paluma – Hidden Valley area, Bluewater State Forest, and Thornton Gap (**Map 1**). It inhabits creek banks or hillsides on sandy soils derived from granite, in wet sclerophyll forest dominated by (for example) *Corymbia intermedia* and *Eucalyptus portuensis* K.D.Hill, and often with a rainforest understorey. Altitude ranges from 500 to 900 metres.

***Phenology*:** Flowers are recorded from May to December; fruits from November to March.

***Affinities*:** *Argophyllum palumense* is morphologically similar to *A. lejourdanii*, but differs by the white or creamy new vegetative growth (rusty or brown for *A. lejourdanii*), the leaves 2.4–3.8 times longer than broad (1.9–2.8 times for *A. lejourdanii*), the hairs of the upper leaf surface 0.6–0.8 mm long (0.8–1 mm long for *A. lejourdanii*), and the seeds 0.5–0.6 mm long (0.4–0.5 mm long for *A. lejourdanii*).

***Conservation status*:** *Argophyllum palumense* has a narrow range of occurrence with probably three known populations. One of these occurs in Paluma Range NP (Crystal Creek) and another in the Mt Zero – Taravale Nature Refuge. Most collections have been made from adjacent to the Ewan – Paluma road between Paluma and Hidden Valley; however, this population (with a number of subpopulations) is not conserved. There are no obvious threatening processes; however, the species has a relatively small overall area of occupancy within the known area of occurrence and is subject to stochastic events. A suitable conservation status is **Vulnerable** based on the criterion **D2** (IUCN 2012).

***Etymology*:** The epithet refers to the small township of Paluma, near where most collections have been made.

11. Argophyllum verae P.I.Forst., *Austrobaileya* 3: 173 (1990). **Type:** Queensland. Cook District: 1 km N of Maloney's Springs, 19 June 1989, *P.I. Forster PIF5285 & M.C.*

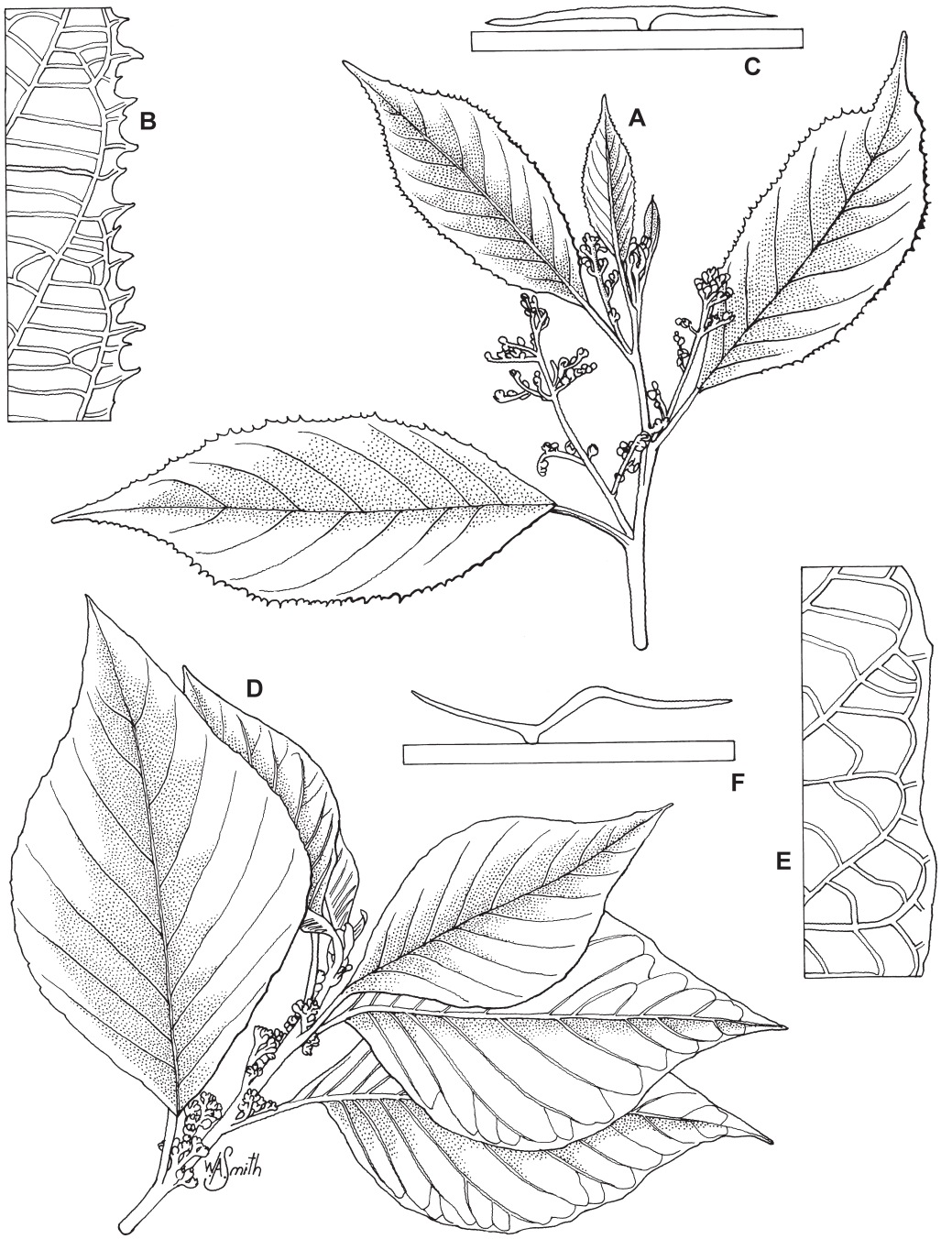

Fig. 7. A–C. ***Argophyllum palumense***. A. flowering branchlet ×0.6. B. lamina margin ×2. C. hair from upper leaf surface ×60; **D–F.** ***A. verae***. D. flowering branchlet ×0.5. E. lamina margin ×2. F. hair from upper leaf surface ×60. A–C from *Bean 28892 & Jensen* (BRI); D–F from *Gray 6810* (BRI). Del. W. Smith.

Tucker (holo: BRI [3 sheets + spirit material]; iso: CANB, CNS, K, MEL, MO, P).

Shrub 1.5–2 m high. Hairs on new growth white or creamy; hairs more than 10 cm from growing point creamy-white. Petiole 12–30 mm long; fully expanded lamina broadly elliptical, 89–174 mm long, 30–95 mm wide, 1.8–2.4 times longer than wide; 8 or 9 secondary veins on either side of midrib. Lamina apex acute; base cuneate, not oblique or oblique at base by up to 9 mm. Lamina margins entire or denticulate, with teeth all about the same length, 19–25 on each side of the lamina, the teeth 0.3–0.7 mm long. Upper surface of fully expanded lamina grey-green, with sparse to moderately dense hairs; hairs appressed or sometimes ascending, 0.7–1 mm long. Lower surface of lamina white, hairs obliquely ascending; secondary veins white, raised; tertiary veins white, ± flush with indumentum. Inflorescences axillary, paniculate, 23–68 mm long, densely tomentose, primary axis 10–47 mm long, secondary branches 5–20 mm long, bracts deltate, 1.5–7.5 mm long. Pedicels 0.6–2 mm long; flowering hypanthium cupular, 3–3.4 mm diameter. Calyx lobes 1.5–2.3 mm long; petals 2.7–3.3 mm long, white, corolla appendages white, 1.1–1.5 mm long. Staminal filaments 1–1.6 mm long; anthers 0.5–0.8 mm long. Style 0.8–1.4 mm long; ovary 2-locular. Capsules with cupular hypanthium, 2.6–3 mm long, 2.6–4 mm diameter, teeth 4. Seeds 0.4–0.5 mm long. **Fig. 7D–F**.

***Additional specimens examined*: Queensland.** Cook District: Maloneys Springs, Bromley, Jun 1996, *Forster PIF19320* (BRI, MEL); Mahoneys [*sic*] Springs, head of Hann River, Jun 1996, *Gray 6810* (BRI, CNS); *ibid*, Jun 1996, *Gray 6813* (BRI, CNS); Glennie Tableland, Aug 2008, *Wannan 5357 et al*. (BRI); NW slopes of Melville Range, Cape Melville, Oct 1992, *Neldner 4160 & Clarkson* (BRI); Cape Melville NP, 11 km SW of Cape Melville, Oct 1992, *Fell DGF2692 & Stanton* (BRI); Cape Melville NP, Melville Range, May 2014, *Forster PIF41463* (BRI). Cultivated. Kholo, ex NW slopes of Melville Range, Cape Melville, Jan 2004, *Tucker s.n*. (BRI [AQ743188]).

***Distribution and habitat*:** *Argophyllum verae* is endemic to the Cape York Peninsula bioregion of far north Queensland where it is known from two population centres (**Map 2**) that are greatly disjunct by *c*. 270 km. On the Glennie Tableland it inhabits clifflines bordering microphyll vinethicket or notophyll vineforest on shallow soils over sandstone at a distance of *c*. 20 km from the coast. At Cape Melville it occurs in wind-sheared (due to the constant high velocity wind) microphyll/notophyll vineforest on granite boulder slopes in immediate vicinity or within 3 km to the sea. These two habitats are markedly different both in substrate, marine influence and the vegetation mix that is present.

***Phenology*:** Flowers are recorded in June; fruits in June, August and October.

***Affinities*:** *Argophyllum verae* is perhaps closest to *A. loxotrichum*, but differs from that species by the less consistently Y-shaped hairs on the leaves, the overall hair length (sum of the length of the two arms) 0.6–0.8 mm long (0.7–1.0 mm long for *A. loxotrichum*); the marginal leaf teeth absent or 0.3–0.7 mm long (0.8–3.5 mm long for *A. loxotrichum*); the marginal leaf teeth (when present) in 19–25 pairs (12–87 pairs for *A. loxotrichum*); and the primary axis of the inflorescence 10–47 mm long (40–131 mm long for *A. loxotrichum*).

***Notes*:** Given the considerable disjunction between the two population centres for this species, it is remarkable that plants from either centre are still quite similar in overall features. The main difference between the two is that those from the Glennie Tableland always have thicker leaf laminae in comparison to those from Cape Melville. It is not known if this variation is due to anatomical differences; however, it is maintained when the plants are grown in a common garden situation.

***Conservation status*:** *Argophyllum verae* is currently listed as **Vulnerable** under the Queensland *NCA* (1992). The two subpopulations at the Glennie Tableland are separated by *c*. 5 km and are wholly within the Olive River Environmental Reserve. However, the rugged sandstone escarpment and gorges of the Glennie Tableland remain poorly explored away from the few access points, so it is feasible that further subpopulations exist. At Cape Melville, all three subpopulations are within Cape Melville NP and similarly the area remains poorly explored. Whilst there are

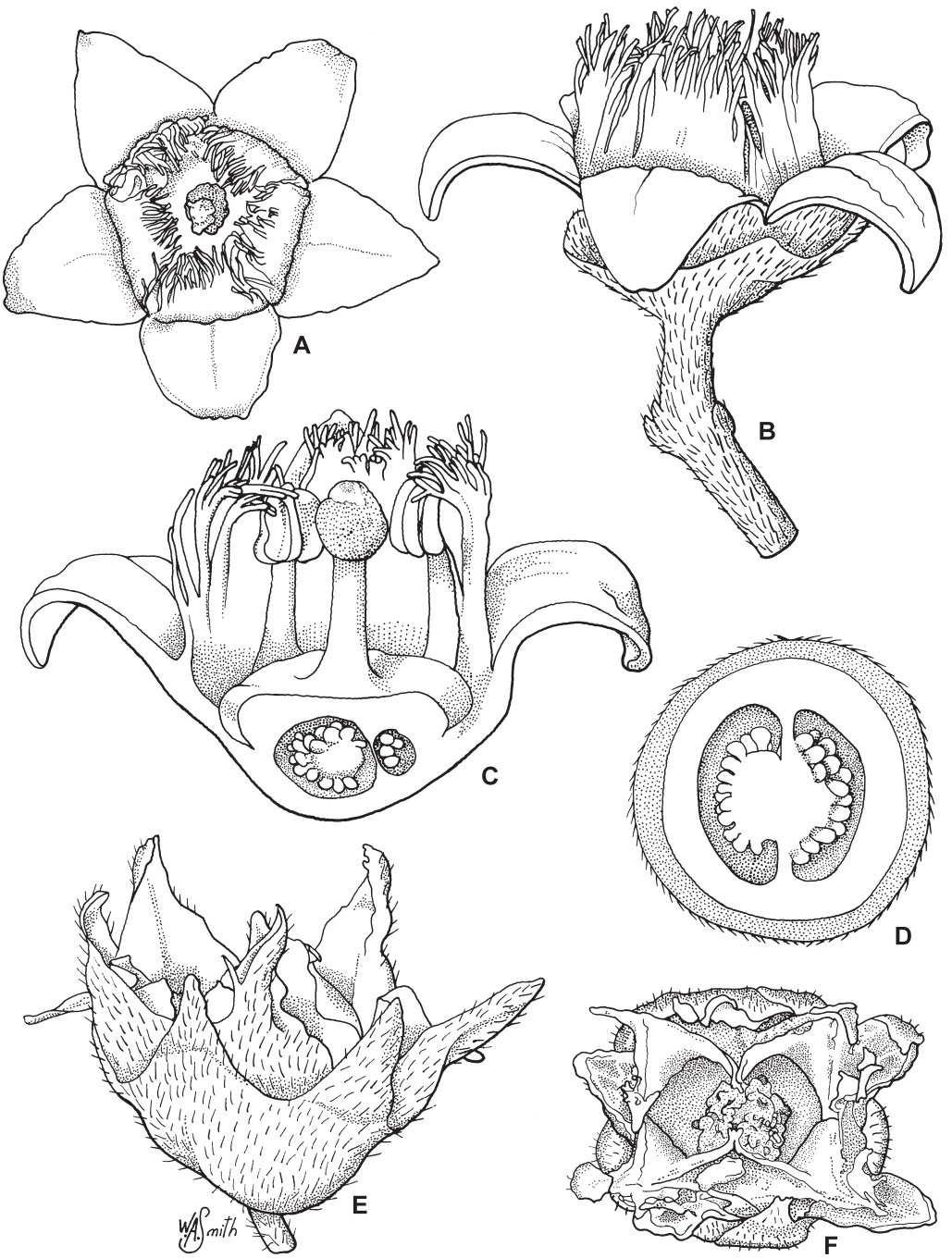

Fig. 8. ***Argophyllum*** flowers and fruits. A. flower from above ×9. B. side view of flower including calyx and pedicel ×12. C. half flower × 15. D. transverse section of ovary ×18. E. side view of fruit ×12. F. fruit from above ×12. A–D, ***A. nullumense*** (*Forster PIF22031 & Leiper*, BRI); E, ***A. loxotrichum*** (*Bean 11587*, BRI); F, ***A. heterodontum*** (*Blake 19769*, BRI).

no immediate threats to this species, the area of available habitat for potential occupancy within the overall area of occurrence is relatively small and the species is subject to stochastic events. The category of **Vulnerable** based on the criterion **D2** remains suitable for this species.

***Etymology*:** The species was named for Vera Scarth-Johnson (b. 1912, d. 1999), a botanical collector and noted botanical artist (Forster 1990).

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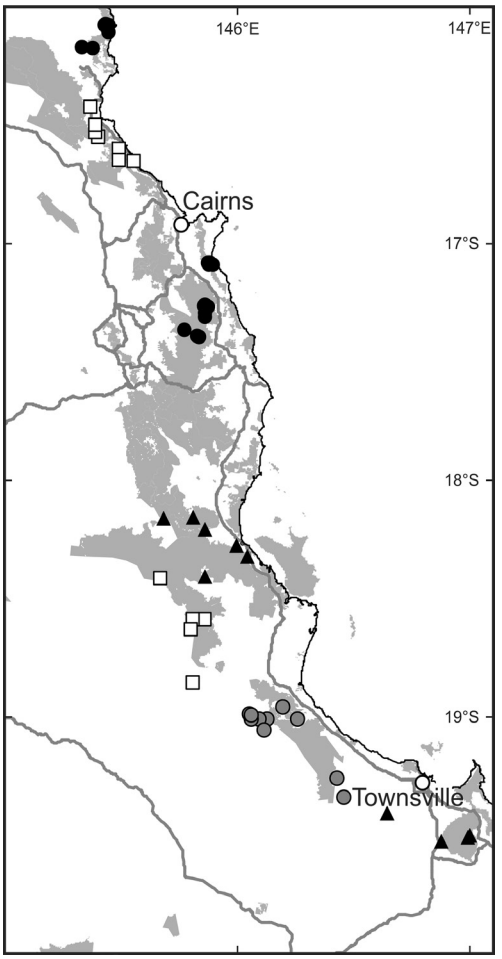
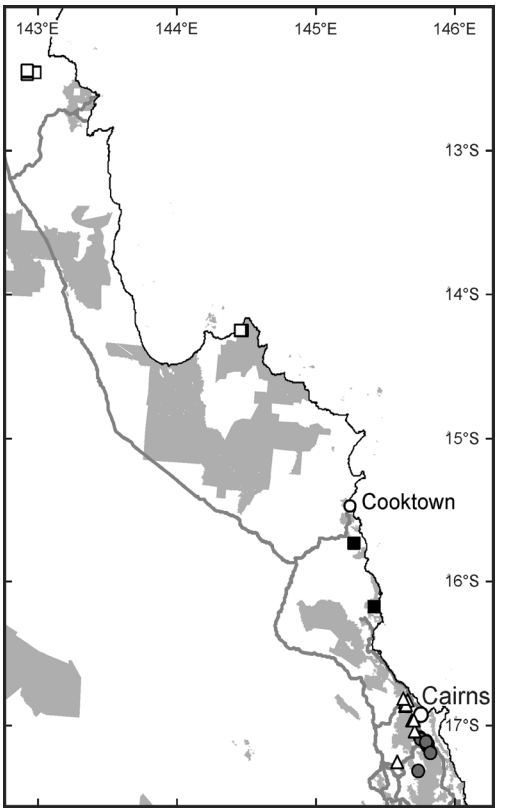
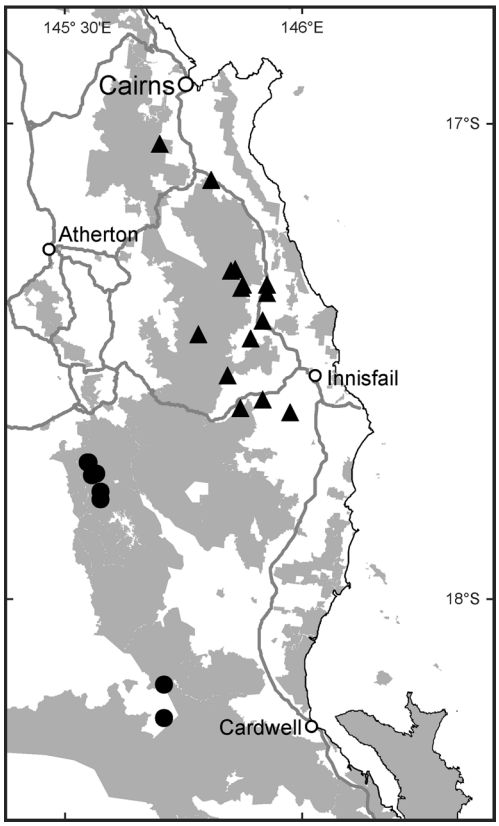


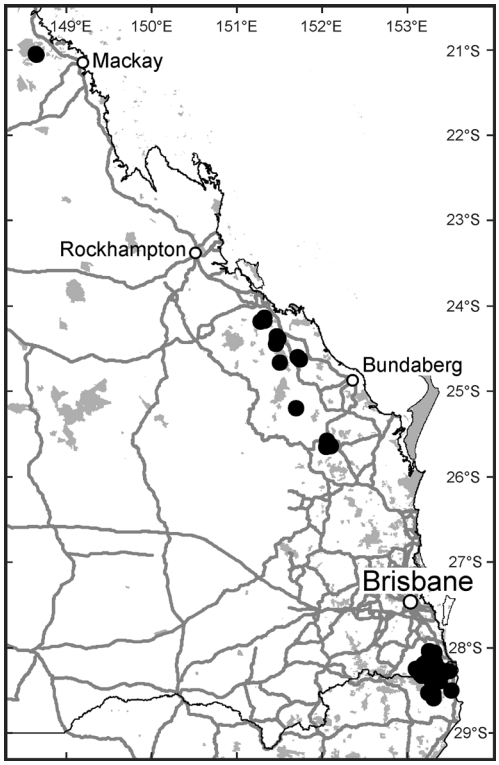
Map 1. Distribution of ***Argophyllum*** species. ● ***A. cryptophlebum***, ▲ ***A. lejourdanii***, □ ***A. loxotrichum***, ● ***A. palumense***.



Map 2. Distribution of ***Argophyllum*** species. △ ***A. curtum***, ● ***A. heterodontum***, ■ ***A. iridescens***, □ ***A. verae***.



Map 3. Distribution of ***Argophyllum*** species. ● ***A. ferrugineum***, ▲ ***A. jagonis***.



Map 4. Distribution of ***Argophyllum nullumense***.