

Denhamia trichoclada J.J.Halford and *Elaeodendron bicolor* J.J.Halford (Celastraceae): two new species from the Wet Tropics of northern Queensland.

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Summary

Halford J.J. (2024). *Denhamia trichoclada* J.J.Halford and *Elaeodendron bicolor* J.J.Halford (Celastraceae): two new species from the Wet Tropics of northern Queensland. *Austrobaileya* **14**: 12–26. Two new species of Celastraceae R.Br. are described, viz. *Denhamia trichoclada* J.J.Halford and *Elaeodendron bicolor* J.J.Halford. Both new species are illustrated, and notes are provided on distribution, habitat and conservation status. Identification keys to the Australian *Denhamia* and Australian *Elaeodendron* species are also provided.

Key Words: Celastraceae; *Denhamia*; *Denhamia trichoclada*; *Elaeodendron*; *Elaeodendron bicolor*; flora of Australia; flora of Queensland; Wet Tropics; taxonomy; identification key

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Introduction

Celastraceae R.Br. in Queensland is currently comprised of 15 genera and 35 described species (with the exclusion of taxa from within Stackhousiaceae R.Br., which is still recognised in Queensland) (Jessup & Halford 2022). Of these, many regionally endemic species occur in the highly diverse rainforests of the Wet Tropics of northern Queensland.

Two new species of Celastraceae from the Wet Tropics, viz. *Denhamia trichoclada* and *Elaeodendron bicolor* are described in this paper. An accompanying key is provided for each species to demonstrate the characteristics that separate these two species from all other species that are present within their respective genera from within the Australian flora.

Materials and methods

Dried and spirit material of both new species were examined for all available specimens from BRI and CNS, as were representative specimens from morphologically similar taxa in those genera. Measurements were made from dried material. Targeted fieldwork (particularly for *D. trichoclada*) was

carried out in July of 2022 to supplement the morphological examinations. Live specimens of *Elaeodendron bicolor* present within the Brisbane Botanic Gardens living collection were also observed and collected. Measurements are inclusive in the descriptions, i.e., 1.0–1.7 is given as 1–1.7.

National Park is abbreviated as NP and State Forest/State Forest Reserve is abbreviated as SF/SFR in the specimen citations.

Taxonomy

Denhamia trichoclada J.J.Halford sp. nov.

With morphological affinity to *Denhamia bilocularis* (F.Muell.) M.P.Simmons, but differing by the presence of glandular trichomes on branchlets, peduncles and pedicels (glabrous in *D. bilocularis*), and by the mostly paniculate inflorescences (racemose in *D. bilocularis*). **Type:** Queensland. COOK DISTRICT: SFR 144, 22 April 1976, B. Hyland 3416RFK (holo: BRI [AQ 384107]; iso: CANB, CNS, NSW *distribuendi*).

Maytenus sp. aff. *M. bilocularis*: Christophel *et al.* (1993: 3, 17, 35, 79).

Maytenus sp. aff. *M. bilocularis*: Hyland & Whiffin (1993a: 111, 115, 173).

Maytenus sp. aff. *M. bilocularis*: Hyland & Whiffin (1993b: 63).

Maytenus sp. aff. *M. bilocularis*: Hyland *et al.* (1994: 302).

Maytenus sp. (Windsor Tableland BH 3416RFK): Hyland *et al.* (1999: 60).

Maytenus sp. (Windsor Tableland): Cooper & Cooper (2004: 118).

Maytenus sp. Windsor Tableland (B.Hyland 3416RFK): Centre for Australian National Biodiversity Research (2010).

Denhamia bilocularis (*pro parte*): CHAH (2021).

Shrub or small tree to 7 m tall; outer bark mottled, pale grey to pale brown, smooth, sometimes becoming fissured and flaky with age; inner bark layer thin, brightly orange; branchlets brown, striate, covered in minute glandular trichomes, becoming glabrescent with time; stipules linear-triangular, to 2 mm long, caducous. Leaves alternate, petioles 3–12 mm long, with or without minute glandular trichomes; lamina elliptic, rarely ovate, thin and flexible, 4–13.5 cm long and 1.5–4.5 cm wide (length : breadth ratio range approx. 2–3 : 1), the base attenuate and the apex acuminate to acute, margins minutely and irregularly toothed, almost appearing entire, ± glabrescent with minute glandular trichomes (if so, hairs confined to the base of the lamina), minutely and sparsely scabrous (more so on the adaxial surface), mid to dark green and shiny above, paler and matt below, new growth deep red, midvein raised on both surfaces, secondary veins 4–8 pairs. Inflorescence mostly paniculate or occasionally racemose; peduncles to 2.8 mm long, brown, covered in minute capitate glandular trichomes. Flowers bisexual, 5-merous; pedicels to 2.2 mm long, brown;

sepals concave, broadly ovate, to 1 mm long, sparsely to densely clothed in glandular trichomes on the abaxial surface, erose; petals oblong-ovate, concave, 1.8–2.4 mm long and 1.5–2 mm wide, white, creamy yellow or pale green; staminal filaments 0.5–1.1 mm long, anthers latrorse; disc to 1.4 mm diameter, ovary glabrous, 2-locular, style to 0.8 mm long, stigma 2-lobed and more or less splayed, sometimes pubescent with short glandular trichomes. Capsule obovoid, 5–8 mm long and 3–6 mm diam., ripening through yellow to orange or red-brown; seed 1, to 3.5 mm long and 3 mm wide, red-brown, surrounded by a thin, somewhat membranous aril, whitish through to yellow. **Figs. 1 & 2.**

Additional selected specimens examined: Queensland. COOK DISTRICT: SFR 144, Piccaninny Creek, Aug 1982, *Dansie s.n.* (CNS [QRS 506227.1]); Julatten, on Pinnacle Road c. 3.9 km E of Black Mt Road intersection, Jul 2022, *Halford JJH1313 & Booth* (BRI); Near bank of Flin Creek, c. 8 km NE [1 km SE] of ‘The Pinnacle’, c. 8 km NE of Julatten, Jan 1977, *Moriarty 2201* (CNS); c. 1 km S of ‘The Pinnacle’, & c. 12 km SSE of Mossman, Jun 1978, *Moriarty 2319* (BRI, CNS); Black Mountain, Jul 1999, *Jago 5302 et al.* (BRI); *ibid.*, Jul 1999, *Jago 5305 et al.* (BRI); *ibid.*, Jul 1999, *Jago 5312 et al.* (BRI); SFR 1973 (Black Mountain Road), Aug 1968, *Martin s.n.* (CNS [QRS 2577.1]).

Distribution and habitat: *Denhamia trichoclada* is currently known from three localities in the Wet Tropics of northern Queensland (**Map 1**): the Mount Windsor Tableland; the peak of the Black Mountain monolith and adjacent lower elevation surrounds between Julatten and Kuranda; and northwest of Black Mountain in the upper reaches of Flin Creek (vicinity of The Pinnacle). At Mount Windsor Tableland and Black Mountain peak it has been collected at high elevation on granite, from simple notophyll vine forest at the former and low wind-sheared notophyll vine forest on rocky outcrops at the latter. In the upper Flin Creek catchment and the lower elevation surrounds of Black Mountain the species occurs in simple to complex mesophyll to notophyll vine forest on metamorphics, usually in association with creeks and drainage lines. The species has an elevation range of between 375 m and 1150 m.



Fig. 1. *Denhamia trichoclada*. A. fruiting branchlet. B. trichomes on an inflorescence. C. adult leaf. D. paniculate inflorescence. E. flower. F. flower with petals removed. G. mature fruit. A, B & D–F from *Hyland 3416RFK* (BRI); C & G from *Halford JJH1313 & Booth* (BRI). Del. N. Crosswell.



Fig. 2. *Denhamia trichoclada*. Trichomes on inflorescence. From *Hyland 3416RFK* (BRI). Del. M. Fabillo.

Individuals present in the upper Flin Creek catchment and at Black Mountain may form part of a broader subpopulation that, based on current knowledge, is disjunct from individuals present at Mount Windsor Tableland, thereby constituting two subpopulations for the species. Of these two subpopulations, it is likely the Windsor Tableland subpopulation is larger, given the greater extent of available habitat. Interestingly, no individuals have thus far been recorded on Mount Spurgeon or Mount Lewis, both of which provide suitable habitat between the two currently known subpopulations; nor has it been recorded in the continuously linked forests of the Daintree National Park to the east of Mount Windsor Tableland.

Phenology: Based on herbarium records and personal observations, flowers have been recorded in April and July and mature fruits have been recorded in April, July and August.

Notes: *Denhamia trichoclada* is unique within the genus for possessing glandular trichomes in young stems and inflorescences. The functions of glandular trichomes in plants include, amongst other traits, the defence of plant parts from herbivores and pathogens through the accumulation and secretion of volatile oils (Glas *et al.* 2012). Whilst there has been no research into the evolution and function of glandular trichomes in *D. trichoclada*, it would be interesting to know if their development could possibly

be an adaptation to protect new growth – particularly that which supports reproductive organs – from herbivores and pathogens in the wet, tropical, closed forest habitats in which the species occurs. High levels of both plant predation and attack from plant pathogens are known to occur in tropical rainforests (Coley & Barone 1996) and are thought to be drivers in plant diversity and composition (Bagchi *et al.* 2014). Heavy predation of inflorescences has been observed in a rare, glabrous species of *Denhamia* from central Queensland, which is thought to limit its reproductive output (Halford & Jessup 2020).

Denhamia trichoclada differs further from *D. bilocularis* by the development of usually paniculate inflorescences, which are lacking in the latter (racemose or singular if the axis develops into a leafy shoot). The two species may also differ in their preferred habitats, with *D. trichoclada* having a propensity to inhabit well developed rainforests (simple to complex, mesophyll to notophyll vine forests), whereas *D. bilocularis* is most often found in microphyll vine forests, vine thickets and wet tall open forests. The ranges of the two species do not overlap, with *D. bilocularis* extending as far north as the Atherton Tableland, to the west of the town of Atherton, some 120 km to the south of the Mount Windsor Tableland population and 70 km from the Black Mountain population. They are also separated by the Black Mountain Corridor

biogeographical boundary (Moritz *et al.* 2009; Bryant & Krosch 2016).

While specimens from the Atherton Tableland were included in earlier publications with the possibility of their being a distinct species allied to *D. bilocularis* (e.g. Cooper & Cooper 2004), specimens from this location lack the glandular trichomes of *D. trichoclada*, and in those seen, also lack the paniculate inflorescences. A focused population genetics study on the Atherton Tablelands subpopulation of *D. bilocularis* and *D. trichoclada* may allow for a better understanding of the relationship between the two taxa: if, when or how species divergence has taken place, and whether such divergence has been driven by the influence of the Black Mountain Corridor biogeographical boundary. The Black Mountain Corridor has previously been linked to allopatric speciation within a number of other rainforest plant genera, such as those in Australian *Gillbeea* F.Muell. (Rozefelds & Pellow 2000) and *Lomandra* Labill. (Wang 2021), and as an impediment to gene flow across populations of *Elaeocarpus* L. (Rosetto *et al.* 2007; Mellick *et al.* 2014) and *Dendrobium* Sw. (Burke *et al.* 2013). Further studies in population genetics might not only provide a better understanding of the relationship between *D. trichoclada* and *D. bilocularis*, but may also prove useful to understanding the overall genetic health of *D. trichoclada* for conservation purposes.

Key to Australian *Denhamia* species (adapted from Halford & Jessup 2020; nomenclature as per Jessup & Halford 2022):

- 1 Ovary perfectly 2 or 3-locular with ovules 2 per locule at base of septa; septa connate, touching axially in fruit; valves of capsules crustaceous (**Australian taxa formerly in *Maytenus***) 2
1. Ovary perfectly or imperfectly 2–5-locular with ovules 2–10 per locule, not confined to base of septa; septa touching near apex, base connate but otherwise not touching axially in fruit, valves of capsules mostly woody (***Denhamia* in the original sense**) 8
- 2 Aril thick, restricted to base of seed 3
2. Aril thin, surrounding at least half of seed 4
- 3 Flowers 4-merous, disc *c.* 1 mm diameter E Qld, NE NSW **D. disperma**
3. Flowers 5-merous; disc *c.* 2.3 mm diameter N NT, N WA **D. muelleri**
- 4 Flowers in fascicles NE Qld. **D. fasciculiflora**
4. Flowers in racemes or panicles 5
- 5 Flowers mostly in panicles, sometimes racemes; inflorescence axes and young stems covered in capitate glandular trichomes. NE Qld. **D. trichoclada**
5. Flowers always in racemes; inflorescences and young stems glabrous 6
- 6 Leaves bright green, concolorous or rarely discolorous; margins always entire, not recurved Qld, N NSW, NT and N WA **D. cunninghamii**
6. Leaves discolorous, grey-green below, darker above; margins usually serrate, slightly recurved 7
- 7 Leaves narrowly lanceolate, narrowly ovate, obovate or oblanceolate, length:breadth 12–4.5:1, apices usually acuminate, mucronate or acute. SE QLD, E NSW **D. silvestris**
7. Leaves broadly lanceolate, elliptic, ovate or obovate, length:breadth 3–2:1, apices usually obtuse to slightly acuminate. E Qld, NE NSW. **D. bilocularis**
- 8 Adult leaves serrate or serrulate, sometimes obscurely so 9
8. Adult leaves entire 12
- 9 Ovary perfectly 3–5-locular; capsule depressed-globular or slightly obovoid; septa connate axially in fruit. E Qld. **D. pittosporoides**
9. Ovary perfectly or imperfectly 3-locular; capsule ovoid; septa not connate axially in fruit 10
- 10 Capsule 2.7–5.5 cm long and walls 3–5 mm thick; style 1–1.5 mm long; lamina thickly covered in waxy cuticle on the abaxial surface; petiole 5–13 mm long. Central Qld. **D. megacarpa**
10. Capsule less than 2.4 cm long or walls less than 2 mm thick 11
- 11 Style to 0.3 mm long; lamina 0.5–3 cm long; petiole 0.6–1 mm long. SE Qld. **D. parvifolia**
11. Style greater than 1 mm long; lamina more than 3 cm long; petiole more than 1 mm long 12

- 12 Style 1.2–1.7 mm long; pedicel 1.7–3 mm long; lamina 3–9 cm long and 1.1–3.7 cm wide, petiole 1.5–4 mm long; capsule 1.6–2.4 cm long. CYP, Qld. **D. peninsularis**
12. Style 2–2.5 mm long; pedicel to 1 mm long; lamina 4–12 cm long and 1–4.5 cm wide, petiole 2–5 mm long; capsule 1–1.7 cm long. E. Qld, NE NSW **D. celastroides**
- 13 Valves of capsules coriaceous; septa at least partially connate or touching axially. NE NSW **D. moorei**
13. Valves of capsule woody; septa not touching axially 14
- 14 Capsule valves 0.3–0.5 mm thick; petiole 0.6–1 mm long. SE Qld **D. parvifolia**
14. Capsule valves 0.9–5 mm thick; petiole 4–13 mm long 15
- 15 Filaments 0.5–1 mm long; style very short or obsolete; ovary with 6 ovules per carpel; capsule valves 3–3.5 mm thick. N NT, N WA. **D. obscura**
15. Filaments *c.* 1.3 mm or more long; style 0.4–1.5 mm long; ovary with 8–10, rarely 6, ovules per carpel. 16
- 16 Pedicels 4–11 mm long; lamina with a thick waxy cuticle on the abaxial surface; inflorescence a complex cyme; capsule 2.7–5.5 cm long and 3–5 mm thick; petals 4–5 mm long. Central Qld. **D. megacarpa**
16. Pedicels no more than 4 mm long; lamina lacking a thick waxy cuticle on the abaxial surface; inflorescence a simple cyme or raceme; capsule no greater than 4.5 cm long or 3 mm thick. 17
- 17 Petals 3–3.5 mm long; capsule ovoid, rarely obovoid, 1.5–2.8 cm long; inflorescence many-flowered. N & Central Qld. **D. oleaster**
17. Petals 3.5–4.5 mm long; capsule fusiform or obovoid, 25–45 mm long; inflorescence 1–3-flowered. NE Qld. **D. viridissima**

Conservation status: Based on calculations using the GeoCAT conservation assessment tool (Bachman *et al.* 2011), *Denhamia trichoclada* currently has an extent of occurrence (EOO) of 72 km² and an area of occupancy (AOO) of 20 km². Most of the currently known locations of *D. trichoclada* are within the reserve system and the area in which it grows at Mount Windsor Tableland is relatively intact, due largely to the extent of protected area. Despite the apparent extent of quality habitat, in most locations where the species is known to occur, it appears to be naturally quite rare (J. Halford pers. obs. from targeted surveys in 2022).

From observation, the preferred habitat of *Denhamia trichoclada* appears to be gaps and margins within the rainforest environment, hence the species may require ample

available light to persist or alternatively, be outcompeted in its absence. As an example, individuals present on the Black Mountain monolith appear confined to large rocky outcrops at the mountain peak where there is sufficient available light in what is otherwise a densely structured low forest.

The population has also been impacted historically by habitat destruction. These impacts have been greatest in the Julatten – Black Mountain subpopulation where habitat has been fragmented by land clearing for forestry and agriculture, and to a lesser extent in the Mount Windsor Tableland subpopulation, where forestry activities ceased in 1989. Whilst it is difficult to know the original size and extent of the Julatten – Black Mountain subpopulation, past land clearing has undoubtedly reduced the population size from its pre-European level.

Although the broader area in which the species occurs has been well surveyed in the past 50 or more years, the quantity of specimens housed in herbaria is notably low. Despite this paucity in historical collecting, targeted searches in the Mount Spurgeon, Mount Lewis and Daintree NPs may result in new locations for this species, increasing the currently limited EOO and AOO. Likewise, further targeted survey in appropriate habitat at Mount Windsor Tableland NP, Mowbray NP and Kuranda NP may lead to an increase in known population size. Whilst further targeted surveys would undoubtedly increase the known EOO, AOO and population size of this species, any increase may unlikely be significant to warrant a listing of Near Threatened or Least Concern. Based on current knowledge and applying the precautionary principal, a listing of Endangered would be recommended for *D. trichoclada*, based on criterion D1 (IUCN 2012); however, due to the extent of potentially suitable habitat and a lack of targeted search in remote areas of the aforementioned National Parks, a recommendation of **Data Deficient** is currently more appropriate for this species.

Etymology: The species epithet is derived from the Greek pronoun *tricho*, meaning hair, and *clados*, meaning shoot or branch; and refers to the glandulose trichomes present on new shoots and inflorescence axes, a defining feature in this species.

***Elaeodendron bicolor* J.J.Halford sp. nov.**

With morphological affinity to *E. australe* Vent., but differing in the strongly flanged to angular stems (terete or rarely angular in *E. australe*); the larger leaves to 17 cm long and 8 cm wide on mature plants and sapling leaves to 21 cm long and 9 cm wide (to 11 cm long and 4.5 cm wide, with sapling leaves to 13 cm long and 7 cm wide in the larger leaved, typical variety of *E. australe*); and fruit exocarp colour varying from entirely red to entirely black or a combination of red and black (exocarp consistently red throughout in *E. australe*). **Type:** Queensland. Cook DISTRICT: State Forest 144, Mt Windsor Tableland, 30 October 1999, *P.I. Forster PIF25128* & *R. Booth* (♂) (holo: BRI [AQ

681339 comprising 1 sheet and spirit]; iso: CANB, CNS, K, L, MEL, NSW).

Cassine australis var. (Windsor Tableland B.P.Hyland 5574): Jessup (1997: 45).

Cassine australis var. *australis*: Cooper & Cooper (1994: 66).

Elaeodendron australe var. (Windsor Tableland B.P.Hyland 5574): Jessup (2002: 44; 2007: 44; 2010: 39): Jessup & Halford (2022).

Elaeodendron australe var. *australe* (*pro parte*): Cooper & Cooper (2004: 115).

Illustrations: Cooper & Cooper (1994: 67), as *Cassine australis* var. *australis*; Cooper & Cooper (2004: 115), as *Elaeodendron australe* var. *australe*.

Dioecious woody shrub or small tree to 8 m tall, trunk erect, bark grey, nondescript. Branchlets strongly angled to flanged, the remnants of which occasionally persisting as faint patterned ridges on older branches, green; stipules triangular or cuspidate, to 1 mm long, caducous. Leaves thinly coriaceous; petioles 5–12 mm long, channelled adaxially; lamina opposite, broadly ovate to ovate, or broadly elliptic to elliptic, 6–17 cm long and 3–8 cm wide (sapling leaves larger, to 21 cm long and 9 cm wide), apices mostly obtuse to acute, sometimes round in sapling leaves and occasionally acuminate on mature leaves, bases obtuse to acute, sometimes round in sapling leaves, adaxial surface glossy, mid-green in colour, the midvein more or less level, the abaxial surface paler with the midvein prominently raised, secondary veins comprising 4–8 pairs, margins shallowly crenate to almost entire. Inflorescence an axillary cyme, peduncles highly variable in length to 13 mm. Flowers 4-merous, pedicels to 6 mm long; calyx lobes 0.7–1.5 mm long with erose margins; petals broadly ovate, 1.5–2 mm long and 0.9–1.6 mm wide; male flowers with staminal filaments 0.5–0.9 mm long, inserted on the margin of the disc, anthers latrorse, disc shallowly conical, the pistillode an undeveloped style forming a small projection from the centre of the disc; female flowers with 4 staminodes inserted on the disc margin, disc *c.*1.4 mm across, ovary

ovoid to conical, 2-locular, style to 0.3 mm long, stigma entire, slightly clavate. Fruit 10–22 mm long and 8–10 mm wide, exocarp thin, ripening through orange-red to (rarely) entirely red or black or (commonly) variously marked with both colours, mesocarp fleshy, endocarp a stone to ± 1 mm thick, containing one seed. **Fig. 3.**

Additional selected specimens examined: Queensland. COOK DISTRICT: Annan River (Yuku Baja-Muliku) NP, Mt Ellen, SSW of Cooktown, Apr 2017, *Forster PIF45066 & McDonald* (BRI); Shiptons Flat, Jun 1996, *Jago 4026 & Roberts* (BRI); SFR 144 (Windsor Tableland), Oct 1971, *Hyland 5574* (BRI); SFR 144 (Windsor Tableland, Dec 1978, *B. Gray 1193* (BRI, CNS); Mt Windsor Tableland, c. 9 km N of lower Spencer Creek crossing, Jul 2022, *Halford JJH1314 & Booth* (BRI); *ibid*, Jul 2022, *Halford JJH1335 & Booth* (BRI); Hunters Creek Road from Mt Molloy to Julatten, Feb 1996, *Gray 6635* (BRI, CNS); Bunda Bugal (Black Mountain–Harris Peak), Kuranda NP, southern ridgeline towards the top, Aug 2022, *Halford JJH1342 et al.* (BRI); Dinden Forest Reserve, 9.8 km along Bridle Creek Road from Davies Creek Road, E of Mareeba, Aug 2004, *Ford AF4405 & Hewett* (BRI); Wrights Creek, Edmonton, Feb 1996, *Jago 3768* (BRI). NORTH KENNEDY DISTRICT: SF 461, Stony Creek, c. 3 km S of Cardwell, c. 80 m upstream from power line, Jun 1978, *Thorsborne 447 & Travers* (BRI); SF 461, Five Mile Creek, c. 6.5 km S of Cardwell, c. 1.5 km W of Bruce Highway, Oct 1978, *Thorsborne 481 & Travers* (BRI); Mt Fox, 70 km SW of Ingham, Apr 1992, *Halford Q932* (BRI); Little Crystal Creek, on road from Bruce Hwy to Paluma, Oct 1992, *Cummings 12340* (BRI); Paluma Range, Hervey Holding, Jun 1974, *Hyland 7284* (BRI, CNS). MORETON: Brisbane Botanic Gardens Mt Coot-tha, Australian Plant Communities section (cultivated, ex hort.), Jun 2022, *Halford JJH1289 & Gilby* (BRI); *ibid*, Sep 2022, *Halford JJH1388 & Gilby* (BRI); *ibid*, Sep 2022, *Halford JJH1389 & Gilby* (BRI).

Distribution and habitat: *Elaeodendron bicolor* is known to occur from Annan River (Yuku Baja-Muliku) NP south of Cooktown, south to the Paluma Range NP west of Townsville, (Map 2). It occurs on igneous geology (predominately granite) and associated alluvium, usually in simple notophyll vine forest, although preferred habitat may range from complex notophyll vine forests in the coastal ranges to the mesic extreme of semi evergreen vine thickets at Mt Fox. The species has an elevation range of between 65 and 1000 m.

Phenology: Flowers have been recorded in October – December, February, April, June and August. Fruit have been recorded in February, June, August and October.

Notes: *Elaeodendron bicolor* was previously included within *E. australe* under the phrase name *E. australe* var. (Windsor Tableland B.Hyland 5574) (Jessup & Halford 2022). However, *E. bicolor* is separated geographically from the typical variety of this species by the Burdekin Gap, a broad biogeographical barrier that represents the northern limit of the Brigalow Belt (see Bryant & Krosch 2016). The nearest, most northern recorded specimen of *E. australe* var. *australe*, is from the Clarke Range northwest of Mackay, a distance of c. 270 km from *E. bicolor*. The vastness of the Burdekin Gap biogeographical barrier, coupled with a paucity of refugial mesic outposts within its bounds, has likely led to genetic separation between these two taxa for a considerable time, effectively eliminating gene flow.

Whilst the typical variety of *Elaeodendron australe* is similarly restricted to more mesic forests, *E. australe* var. *integrifolium* (Tratt.) DC. has a preference for more xeric vine thickets and *Acacia harpophylla* F.Muell. ex Benth. dominated forests and woodlands. This variety is therefore more likely to occupy pockets of these vegetation types where they occur within the Burdekin Gap. However, the occurrence of *E. australe* var. *integrifolium* appears extremely sporadic in the north of its range and the preference for different habitats suggests gene exchange between *E. bicolor* and *E. australe* var. *integrifolium* would also be very limited if not non-existent.

Within *Elaeodendron bicolor*, fruiting specimens housed at both BRI and CNS are somewhat suggestive of a colour gradient within the fruit exocarp that approximates a latitudinal gradient, with predominantly black exocarp colour observed in the north of its range (e.g. Mount Windsor Tableland) and mainly red in the south of its range (e.g. south of Cardwell).

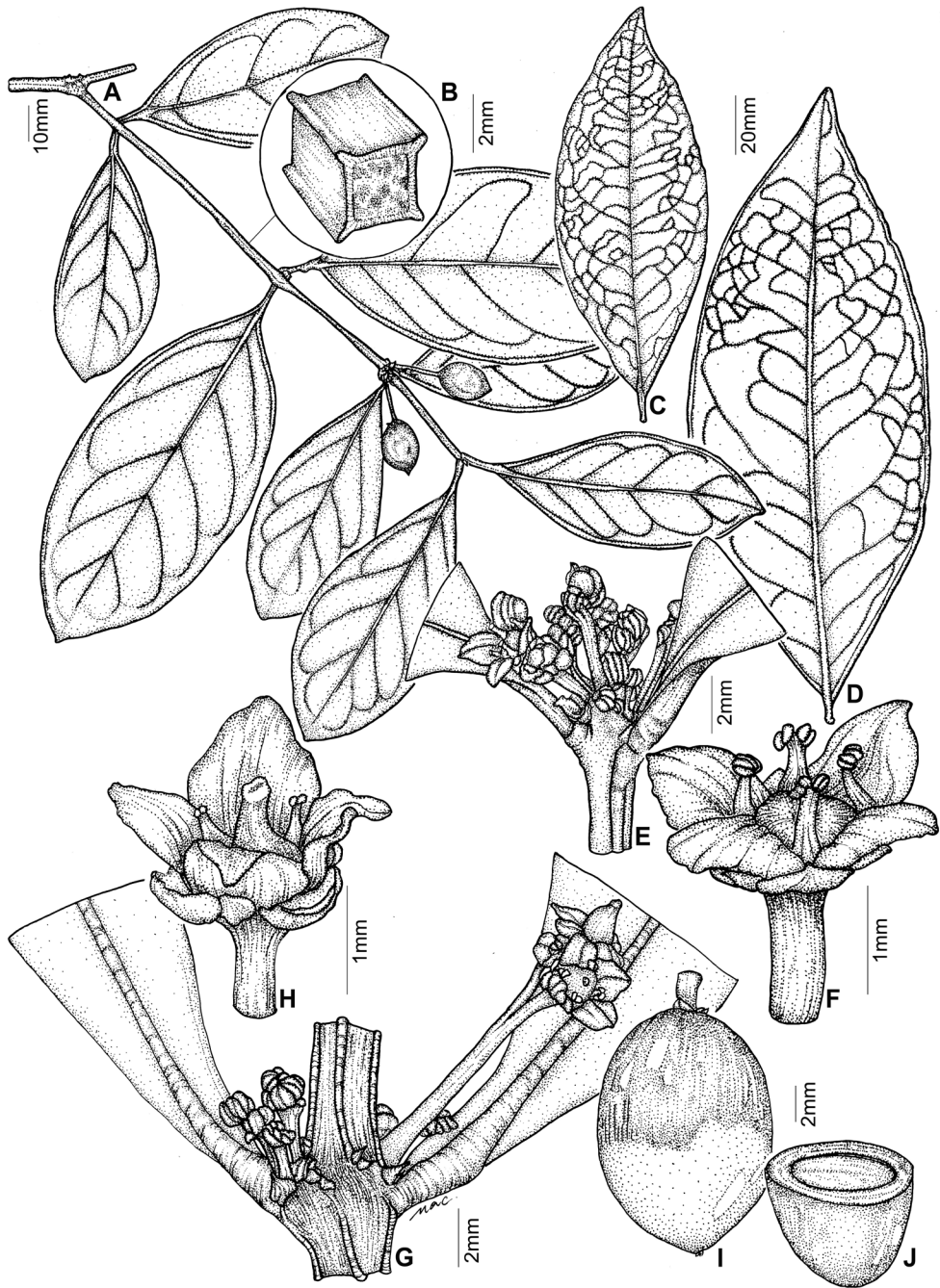


Fig. 3. *Elaeodendron bicolor*. A. fruiting branchlet. B. flanged stem. C. adult leaf. D. juvenile leaf. E. male inflorescences. F. male flower. G. female inflorescences. H. female flower. I. mature fruit. J. mature fruit dissected. A, B & I, J from Halford JJH1289 & Gilby (BRI); C from Halford JJH 1314 & Booth (BRI); D from Halford JJH1335 & Booth (BRI); E, F from Halford JJH1389 & Gilby (BRI); G, H from Halford JJH1388 & Gilby (BRI). Del. N. Crosswell.

Observations on fruiting plants reveal a high level of variation present in endocarp colour present in the fruit of one individual at one point in time. Fruit ripen from green through to entirely orange, maturing from almost entirely red to entirely black. Plants may display fruit at varying stages of development or may produce fruit that are entirely at the same stage of development, as was observed in a recent survey at Black Mountain in which all fruit were developing towards maturity and their endocarps were entirely orange [see *Halford JJH1342 et al.* (BRI)]. It is possible fruiting herbarium specimens collected in the southern part of the species' range were collected with fruit slightly immature, and therefore still entirely orange.

There currently exists a spatial gap in the collecting records within this species distribution that incorporates the Bellenden Ker Range south to the Walter Hill Range (approximately Gordonvale to

Tully), essentially creating two perceived subpopulations. This current gap in the known distribution of the species somewhat corresponds with the observed fruit colour variation. It is possible that the higher rainfall area of the Bellenden Ker Range that supports more complex closed forests excludes *Elaeodendron bicolor*, although this apparent spatial gap may simply be a product of under collecting. Plants fitting the description of *E. bicolor* have occasionally been observed in disjunct patches of Araucarian dominated vine forests in the western margins of rainforest within the Atherton Tableland (west of Bellenden Ker Range) south through Koombaloo NP (A. Ford pers. comm.). The existence of individuals along the western margin of the Wet Tropics would allow for some geneflow to occur between plants north and south of the Bellenden Ker and Walter Hill Ranges, thus limiting the likelihood of isolation which may lead to significant population structuring.

Key to Australian species of *Elaeodendron* (adapted from Jessup 1984)

- 1 Perianth 3 (rarely 4)-merous; ovary 3-locular; fruit globular, exocarp colour consistently black throughout when ripe ***Elaeodendron melanocarpum***.
- 1. Perianth 4-merous; ovary 2-locular; fruit ovoid or broadly ellipsoid, exocarp orange, red with or without areas of black (or rarely with a few fruit black throughout) when ripe 2
- 2 Stems flanged to angled; mature leaves to 17 cm long and 8 cm wide (to 21 cm long and 9 cm wide in saplings), exocarp colour of ripe fruit red, black or most often a combination of the two ***Elaeodendron bicolor***
- 2. Stems terete, rarely angled; mature leaves to 11 cm long and 4.5 cm wide (to 13 cm long and 7 cm wide in saplings), exocarp colour of ripe fruit consistently red throughout ***Elaeodendron australe***

Conservation status: *Elaeodendron bicolor* has an EOO of 16, 139 km² and an AOO of 68 km², based on calculations derived from the GeoCAT conservation assessment tool (Bachman *et al.* 2011). Within this extent much of the preferred habitat is intact, often albeit patchily distributed within other unsuitable forest types that are continuously linked throughout the landscape. The species is well protected, the majority of current

records being within the reserve system. Whilst the AOO is low, reflecting the patchy distribution of preferred habitat, there is a probability the species is under collected throughout its range and targeted surveys would likely see an increase in the number of known locations and AOO. Therefore, a listing of **Least Concern** is recommended for this species.

Etymology: The species epithet, *bicolor* is Latin for two-coloured (*bi* meaning two, *color* meaning colour) and is given in reference to the exocarp of the fruit, which are variously red and black.

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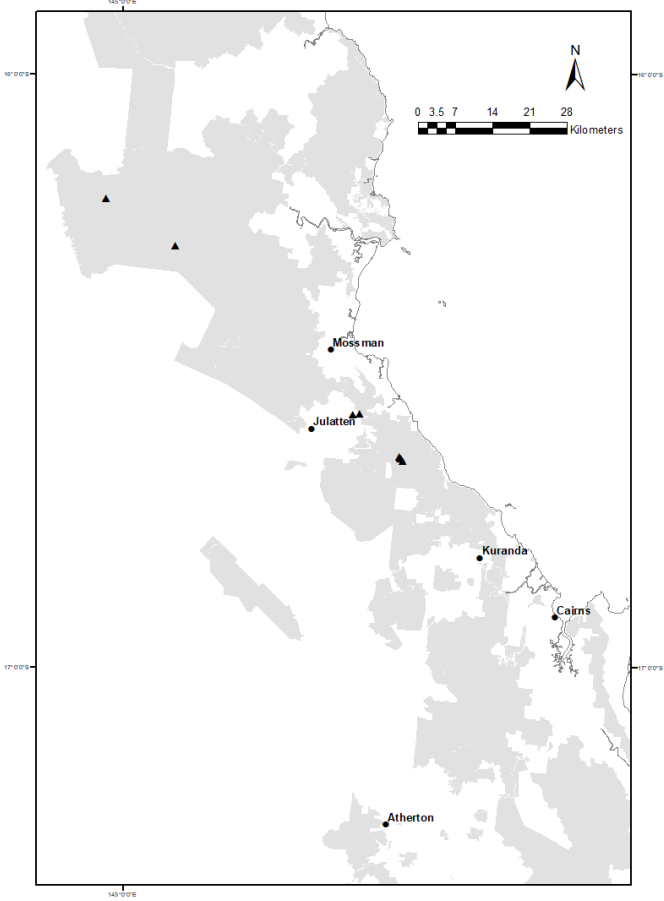
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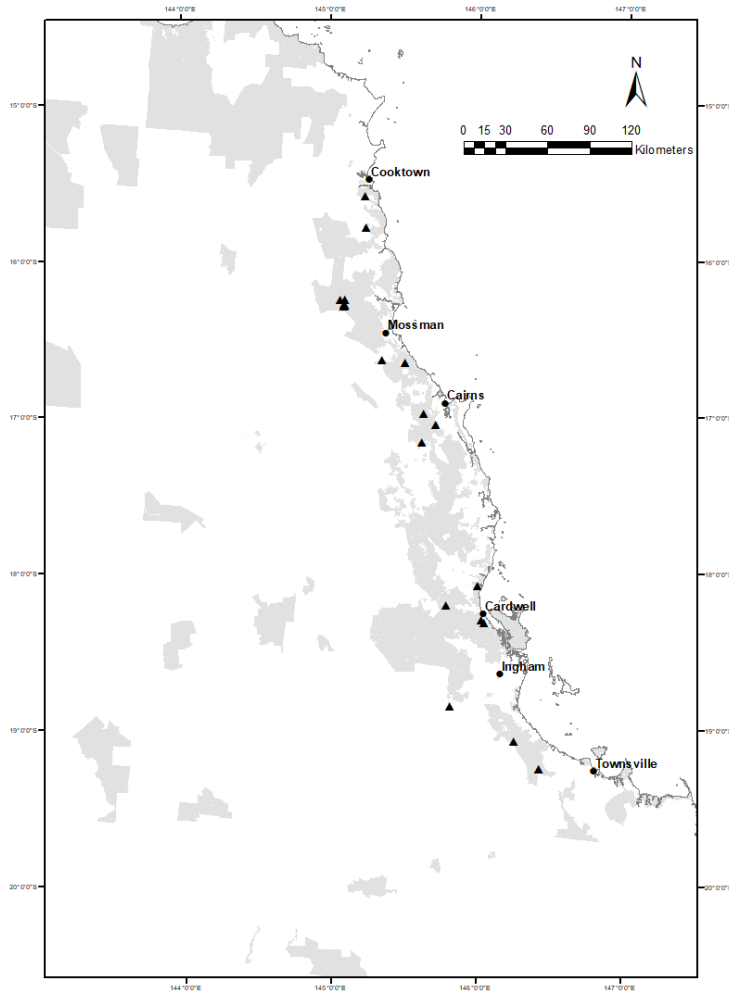
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Map 1. Distribution of *Denhamia trichoclada*. The shaded areas represent conservation reserves.



Map 2. Distribution of *Elaeodendron bicolor*. The shaded areas represent conservation reserves.