

Exocarpos capnodioides* (Santalaceae), a new species from southern Australia allied to *E. aphyllus

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SHORT COMMUNICATION

The genus *Exocarpos* Labill. comprises approximately 27 species, 12 of which occur in Australia and its offshore island territories. *Exocarpos aphyllus* R.Br. is a widespread species occurring throughout arid and semi-arid mainland Australia. During fieldwork in south-western Western Australia in the 1990s, apparent differences in the habit and branching pattern in plants of *E. aphyllus* occurring in the southern wheatbelt were noted by the author, suggesting these plants may represent an undescribed taxon. Subsequent preparation of a treatment of the Santalaceae for the fifth edition of the *Flora of South Australia* (Lepschi & Barlow 2012) confirmed the existence of a second taxon, along with its occurrence in South Australia. This species is formally described here as *Exocarpos capnodioides*, and a revised description of its closest relative, *E. aphyllus* is provided for comparison.

Exocarpos capnodioides* Lepschi, *sp. nov.

Type: unmanaged Reserve 31111, north-east of Lake Grace, off south boundary track, east of Burngup Rd North, Western Australia, 1 October 2020, *M. Hislop* 4834 (*holo*: CANB 838235!; *iso*: AD, K, L, MEL, NY, PERTH 09251766, all *n.v.*).

Exocarpos sp. Ardath (J. Buegge D 62), Western Australian Herbarium, in *Florabase*, <https://florabase.dpaw.wa.gov.au/> [accessed 14 April 2022].

Erect, *shrub* or small *tree* (0.4–)1–2(–3) m tall, light green to green, yellowish green or yellowish, very rarely glaucous, rapidly glabrescent (mature branchlets glabrous); young growth densely puberulous with simple to dendritic hairs <0.05–0.2 mm long, the hairs reddish to reddish brown or blackish brown, the indumentum sometimes matted (with individual hairs difficult to discern), some scattered, colourless, translucent hairs sometimes also present. Fertile *branchlets* subterete to terete, diverging at 10°–40°(–70°) from the main branchlet, 1.2–3.3 mm diam., longitudinally ridged, the ridges minutely verruculose to smooth, 0.3–0.6 mm wide, furrows between the ridges <0.05 mm wide, minutely papillate to almost smooth. *Leaves* persistent (retained on the branchlets and gradually weathering away), scale-like, sessile, glabrescent, yellowish brown when young, ageing greyish, appressed to rarely ascending (spreading-ascending to spreading when subtending an inflorescence), straight to slightly incurved, very broadly triangular to rounded-triangular or broadly ovate, 0.4–0.9 mm long, 0.6–1.3 mm wide,

apex obtuse to rounded; young leaves sparsely to moderately puberulous with simple to dendritic, crisped to flexuose hairs, <0.05–0.2 mm long, the hairs reddish to reddish brown, some colourless, translucent hairs sometimes also present. *Inflorescence* a simple (very rarely compound), condensed spike of 5–8 (very rarely –14) flowers; rhachis 1.3–2.5 mm long, hairy, densely puberulous with simple to dendritic, straight to flexuose hairs <0.05–0.2 mm long, the hairs reddish to reddish brown or blackish brown, the indumentum often matted and becoming scurfy (with individual hairs difficult to discern) and greyish with age. *Bracts* scale-like, sessile, cupped, hairy, sometimes glabrescent, densely puberulous with simple to dendritic, straight to flexuose hairs <0.05–0.2 mm long, the hairs reddish to reddish brown or blackish brown, the indumentum often matted and becoming scurfy (with individual hairs difficult to discern); broadly to depressed ovate, 0.4–0.5 mm long, 0.6–0.7 mm wide, apex rounded. *Flowers* obscurely pedicellate, floral tube and pedicel *c.* 0.2 mm long. *Tepals* glabrous to minutely papillate, more or less ovate, 0.8–1.1 mm long, 0.5–0.7 mm wide, pale yellow to orangey yellow in life (rarely recorded as green or yellow-green), drying yellowish brown; apex incurved, thickened. *Anthers* broadly to very broadly elliptic, 0.2 mm long; filaments 0.15–0.2 mm long. *Disc* shallowly lobed, 0.6–0.7 mm diam. *Style* 0.2 mm long; stigma obscurely trilobed. *Fruit* a drupe, poorly known, fruit (possibly immature) ellipsoid to subglobose, 2.5–3 mm long, smooth to indistinctly longitudinally ribbed (due to ornamentation on endocarp) when dry, drying greenish brown, glabrescent, puberulous with simple to dendritic, straight to flexuose hairs <0.05–0.2 mm long, the hairs reddish to reddish brown or blackish brown, some colourless, translucent hairs also sometimes present, the indumentum often matted and becoming scurfy (with individual hairs difficult to discern). Fruiting receptacle poorly known (possibly immature), ± transversely elliptic, orange-red to (possibly) red, hairy with simple to dendritic, crisped to flexuose hairs <0.05 mm long, the hairs reddish to reddish brown or blackish brown, *c.* 2 mm long, edibility unknown. (Figure 1)

Diagnostic characters. *Exocarpos capnodioides* may be recognised by the distinctive, reddish, reddish brown or blackish brown indumentum, most readily observed on the floral rhachis, but also present on young vegetative growth as well as the bracts, fruits and the fruiting receptacle. Some colourless, translucent hairs may be present on some plants, but these are infrequent and are scattered amongst the otherwise distinctively coloured hairs of this species. Plant height, branching pattern and tepal colour are additional characters which aid in separation of *E. capnodioides* from its closest relative *E. aphyllus* (see ‘Affinities’ below).

Other specimens examined. WESTERN AUSTRALIA: adjacent railway line, southern end of Water Reserve, Ardath, July 1998, *J. Buegge* D 62 (BRK *n.v.*, PERTH); 25.5 km due NNE of Mt Ney, 8 Aug. 1983, *M.A. Burgman & S. McNee* MAB1841 (PERTH); 18 km W of Beete, 20 Aug. 1995, *R.J. Cranfield* 10244 (PERTH); 6.8 km E of Twilight Cove, 6 Apr. 2000, *R. Davis* 9218 (PERTH); Flints Farm, house yard, 50 km NE of Hyden, 8 Aug. 2000, *J.M. Flint* 172 (PERTH); property of R. & J. Newman, E side of Magenta Road, between Grant & Ardler Road, SE of Newdegate, 27 Sep. 2007, *M. Hislop & H. Mills* WW 215 – 23 (NRB *n.v.*, PERTH); property of W. Newman, S of Tack Road between Old Ravensthorpe Road and Traco Road, SE of Newdegate, 24 Sep. 2008, *M. Hislop & H. Mills* WW 230 – 6 (PERTH); unmanaged Reserve 31111, NE of Lake Grace, off S boundary track, E of Burngup Rd North, 1 Oct. 2020, *M. Hislop* 4835 (CANB, PERTH); Kumarl, Aug. 1938, *L. Horbury s.n.* (PERTH 02363658); 8.9 km SW of Duck Road on Holland Track Road, *c.* 20 km W of Holt Rock, 11 Aug. 1996, *B.J. Lepschi* 2847 & *T.R. Lally* (PERTH); 11 miles [*c.* 17.7 km] E of Corrigin on the road to Bendering, 13 July 1970, *B.R. Maslin* 509 (PERTH); 5 km N of Lake Cronin, 23 Aug. 1979, *K.R. Newbey* 5818 (PERTH); 8 km N of Point Dover, 4 Sep. 1968, *P.G. Wilson* 7702 (PERTH). SOUTH AUSTRALIA: Hundred of Ramsay. Section 141, 8 Sep. 1963, *B.J. Blaylock* 1023 (AD); between Bute and Kadina, 4 July 1968, *B. Copley* 1928 (AD, OSH *n.v.*); near Mt Bosanquet, 16 Sep. 1972, *F.A. Mason* (AD); Flora and Fauna reserve, Hundred of Hambidge, north-east of Lock, 8

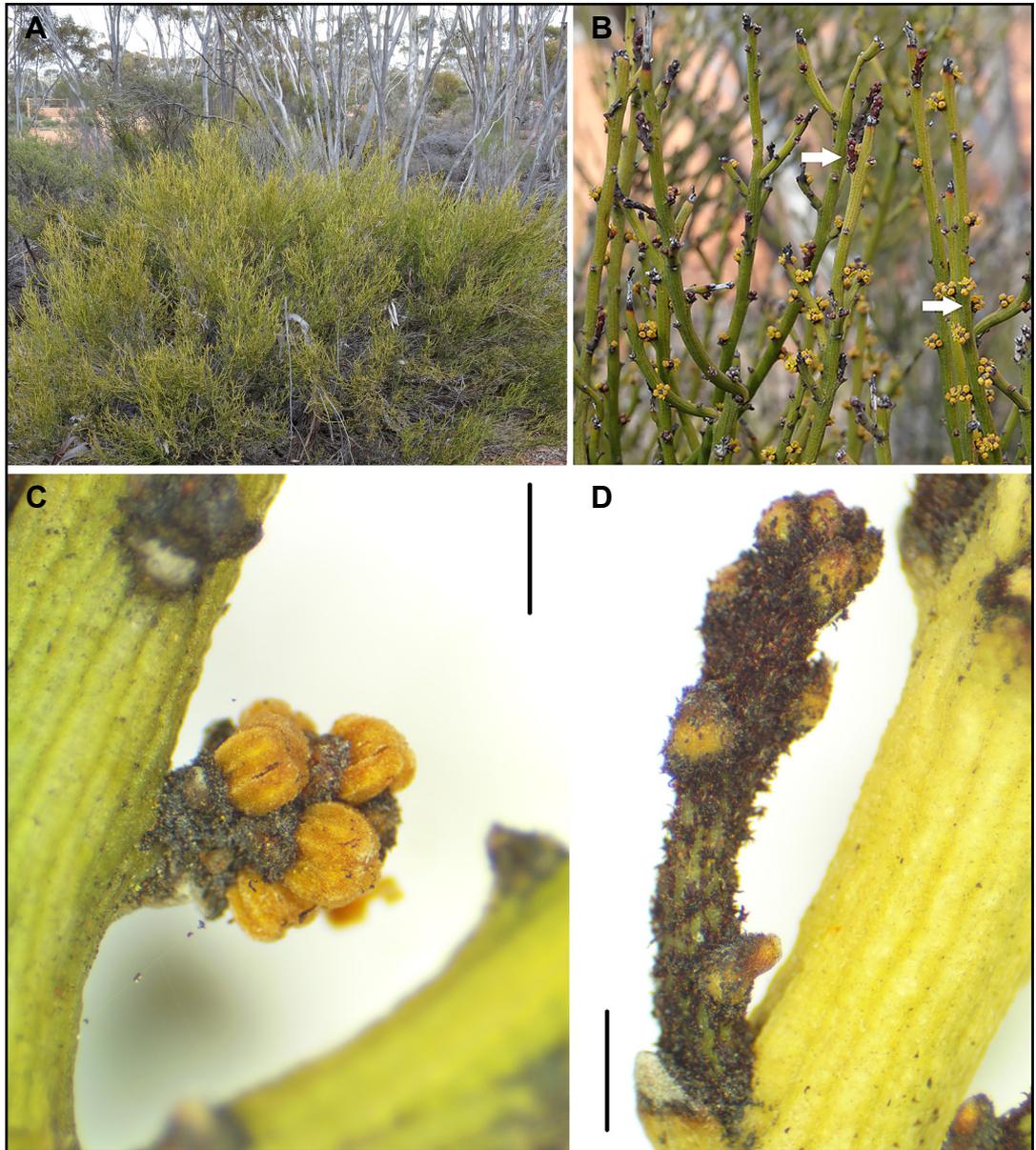


Figure 1. *Exocarpos capnodioides*. A – habit; B – flowering plant with young growth, showing yellow to orange yellow tepals (arrows indicate dark coloured indumentum visible on inflorescence rhachises and young shoots); C – inflorescence showing matted, scurfy, dark coloured indumentum on the floral rhachis. D – young shoot showing dark coloured indumentum. Scale bar = 1 mm (C, D). Images taken by M. Hislop (A, B) and A.N. Schmidt-Lebuhr (C, D). Associated voucher specimens: *M. Hislop* 4834 (holotype collection) (A, B) and *M. Hislop* 4835 (C, D).

Nov. 1960, *R.L. Specht* 2392 (AD); 1.5 miles [c. 2.4 km] N of Winulta P.O., 14 Sep. 1961, *D.E. Symon s.n.* (AD 98662822); 4.83 km N of Long Plains, 6 July 1971, *D.J.E. Whibley* 3387 (AD, *M n.v.*, *MO n.v.*, *ODU n.v.*, *PRE n.v.*).

Phenology. Flower buds recorded December, February, March and July; flowers recorded between July and November. Developing fruits recorded during April; fruits recorded between July and October.

Distribution and habitat. Occupies a disjunct range in Western Australia and South Australia (Figure 2). In Western Australia, *E. capnodioides* occurs in the south-west of the state, in an area bounded approximately by Koolyanobbing, Corrigin, Lake Cronin and Mt Ragged. Collections from Point Dover (south of Caiguna) and Twilight Cove (south of Cocklebidy), appear as disjunct from the otherwise easternmost occurrences of the species in Western Australia, near Mt Ragged. However, this could be an artefact of inadequate collecting between Cape Arid and these localities, reflecting the limited and difficult access to this part of the southern coastline of the state. In South Australia, it occurs on the Eyre and Yorke Peninsulas, south of approximately 33°S, eastwards to Long Plains (north-north-west of Mallala). Recorded from a variety of substrates, e.g. sand, sandy clay or sand over clay, sandy loam, loam, clay loam and clay, but mostly from heavier soils (i.e. loam or clay), sometimes along ephemeral creek lines or other low-lying sites. Also recorded from dunes adjacent to playa lakes and in a saltpan area in Western Australia. Some South Australian populations are recorded as occurring near rock outcrops. Parent materials recorded include granite, ironstone, laterite, limestone and gypsiferous substrate. Occurs in eucalypt woodland and mallee communities with a shrubby understorey.

The distribution of *E. capnodioides* overlaps that of *E. aphyllus* in the southern part of the range of the latter species, and both species have been collected from the same reserves in Western Australia and South Australia. However, no instances of direct sympatry or mixed populations have been documented, and it is not known whether there is any ecological separation between the taxa.

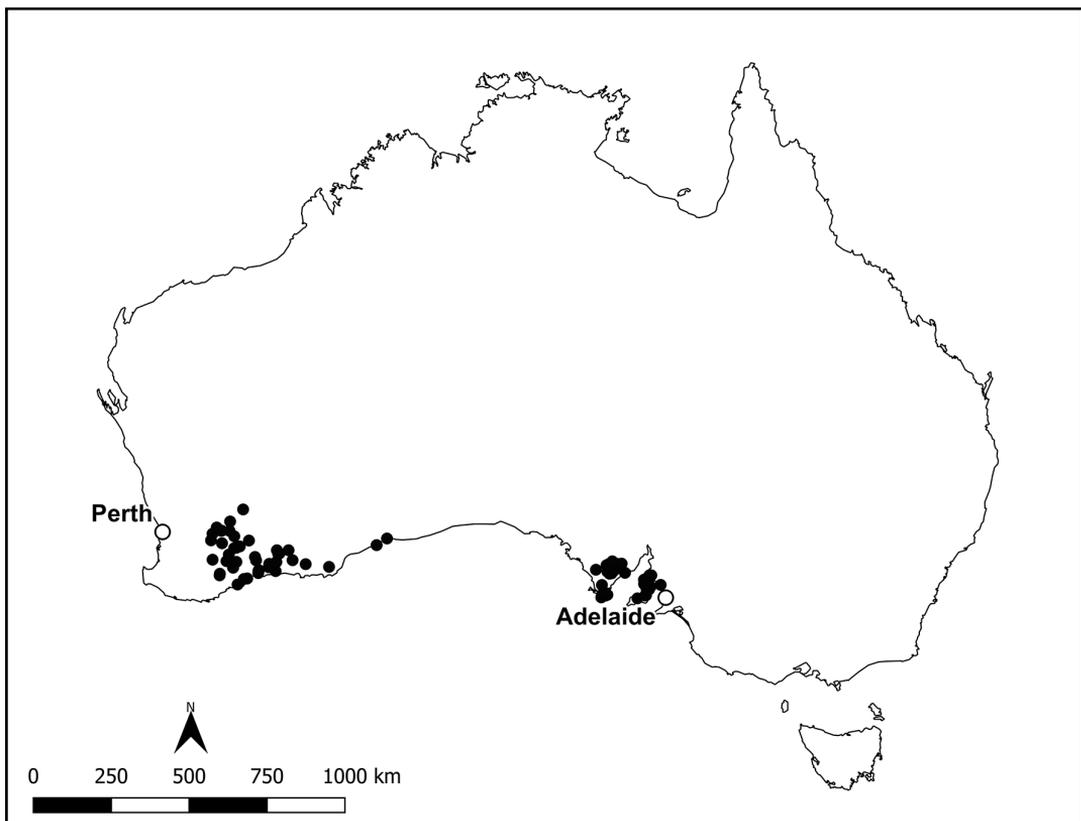


Figure 2. Distribution of *Exocarpos capnodioides* in Australia.

Conservation status. Not considered at risk. Represented in conservation reserves in both Western Australia and South Australia.

Etymology. The epithet refers to the resemblance of the distinctive, dark indumentum of this species (especially on the floral rhachis) to the hyphae of ascomycete fungi in the family Capnodiaceae commonly known as sooty moulds (Chomnunti *et al.* 2014). The indumentum of *E. capnodioides* has previously been misinterpreted as a fungal infection (see below under ‘Notes’).

Affinities. *Exocarpos capnodioides* is most closely related to *E. aphyllus*. Both species share a similar overall morphology, apparent ecological requirements and phenology. *Exocarpos capnodioides* may be separated from *E. aphyllus* most readily by indumentum. Hairs in *E. capnodioides* are characteristically reddish to reddish brown or blackish brown (although some scattered, colourless, translucent hairs may also occur on some plants), as compared to hairs in *E. aphyllus*, which are colourless and translucent. Plant habit, height and branching pattern also differ between the two species, although there is considerable overlap in these characters and the latter is difficult to quantify, at least on herbarium material. Differences in habit and branching pattern are best observed in living plants. *Exocarpos capnodioides* is a shrub, (0.4–)1–2(–3) m tall, while *E. aphyllus* may be a shrub or small tree, 1–3(–6) m tall. The branching pattern in *E. capnodioides* also tends to be \pm erect, with fertile branchlets diverging from the stem at 10°–40°(–70°) from the main branchlet, while in *E. aphyllus* branching tends to be less erect and more divaricate, with fertile branchlets diverging at (10°–)20°–70° from the main branchlets. Differences are also evident in tepal colour, with tepals in *E. capnodioides* pale yellow to orangey yellow in life (rarely recorded as green or yellow-green), drying yellowish brown, while tepals in *E. aphyllus* are green, yellow-green or greenish yellow in life (rarely recorded as pale yellow or yellow), drying greenish to yellowish brown.

Notes. The fruit and fruiting receptacle of *E. capnodioides* is poorly known. Several fruiting collections of this species have been seen, but it is unclear whether these represent mature material (cf. description above), and limited information is available as to the form and colour of the fruit and receptacle in life. Possibly immature receptacles on *M. Hislop* 4834 are dull orange-red, and collectors notes on *P.G. Wilson* 5677 (PERTH) records ‘fruit red’, and this may also refer to the colour of the fruiting receptacle. Morphology of mature fruits and the fruiting receptacle in *E. capnodioides* could be expected to be similar to that of *E. aphyllus* (see description below). Flower (tepal) colour in two specimens of *E. capnodioides* (*Hickman & Gilfillan* 1361 and 1481, both PERTH) is recorded as ‘white’, but this is likely to be in error and could be the result of confusion with other superficially similar, ‘leafless’, shrubby Santalaceae occurring in the same area (e.g. *Choretrum glomeratum* or *Leptomeria* spp.). Tepals in white-flowered species of Australian Santalaceae dry whitish, rather than yellowish brown (Lepschi, pers. obs.), as is the case in *Hickman & Gilfillan* 1361 and 1481.

The distinctive habit and branching pattern of *E. capnodioides* was noted by J.G.O. Tepper on two collections of this species from near Ardrossan on South Australia’s Yorke Peninsula made in 1879 (*Tepper* 337 (AD 95715016 and MEL 1639 *p.p.*) and *Tepper* 527 (MEL 1639 *p.p.*)). Tepper notes ‘This *Exocarpos* seems quite distinct in habit from *E. aphylla* [*sic*] ...’ and refers to the generally lower stature ‘3–5 ft and 4–6 ft’ of *E. capnodioides* vs ‘5–8 ft’ for *E. aphyllus* and the more erect and less divaricate branching pattern of *E. capnodioides* (‘branches very thickly set, upright’ and ‘branches ... thickly packed ... stiff and upright’) as compared with *E. aphyllus*. Swiss botanist and Santalaceae specialist Hans Ulrich Stauffer (1929–1965) appears to have misinterpreted the indumentum of *E. capnodioides* as a fungal infection. Nearly all material of *E. capnodioides* examined by Stauffer (and determined by him as *E. aphyllus*), is annotated with the comment ‘infected by a capnodiaceous fungus!’ No evidence of such fungal infections has been seen by the present author on either *E. capnodioides* or *E. aphyllus*, although both species occasionally exhibit scattered blackish specks, mainly on older vegetative growth

(branchlets). The nature and origin of this speckling is unknown, but it appears infrequently as widely scattered, small, dark spots on the epidermis, and does not resemble the distinctive indumentum of *E. capnodioides*.

Exocarpos aphyllus R.Br., *Prodr. Fl. Nov. Holland.* 357 (1810) (as ‘aphylla’). *Type citation*: ‘(J.M.D.) v.v.’ *Type specimen*: Anch[orage]: VIII [Thistle Is.] South Coast [South Australia], *s. dat.*, R. Brown *s.n.* [Iter Austral. 3203] (*lecto*, designated by Stauffer, *Mitt. Bot. Mus. Univ. Zürich* ccxiii. (Rev. Anthobol.) 169 (1959): BM 001015639 image!; *isolecto* or *syn*: BM 001015640 image!, E 00346093 image!, K 000880816 image!, K 000880817 image!, NSW120386 *n.v.*). *Xylophyllos aphyllus* (R.Br.) Kuntze, *Revis. Gen. Pl.* 2: 589 (1891).

Exocarpos leptomerioides F.Muell. ex Miq., *Ned. Kruidk. Arch.* iv. 103 (1859) (as ‘Exocarpus’). *Type citation*: ‘Ad. fl. Murray (STUART), ...’. *Type specimen*: [illegible] fl. Murray versus M. Brown [Mount Brown], [South Australia], *s. dat.*, *leg. ign. s.n.* (*lecto*, designated by Stauffer, *Mitt. Bot. Mus. Univ. Zürich* ccxiii. (Rev. Anthobol.) 169 (1959): U 0006458 image!; *isolecto*: HBG 510385 image!, MEL 1672!).

Erect, *shrub* or small *tree* 1–3(–6) m tall, light to dark green or grey-green, rarely yellowish green or yellowish or glaucous, rapidly glabrescent (mature branchlets glabrous); young growth sparsely to moderately puberulous with minute papillae or simple to dendritic hairs <0.05–0.1 mm long, the hairs colourless. Fertile *branchlets* subterete to terete, diverging at (10°–)20°–70° from the main branchlets, 0.9–3 mm diam., longitudinally ridged, the ridges minutely papillate to smooth, 0.2–0.6 mm wide, furrows between the ridges <0.05–0.1 mm wide, minutely papillate to almost smooth. *Leaves* persistent (retained on the branchlets and gradually weathering away), scale-like, sessile, glabrescent, but hairs frequently persisting along margins and on adaxial surface, greenish brown to yellowish brown when young, ageing greyish, appressed to rarely ascending (spreading-ascending to spreading when subtending an inflorescence), straight to slightly incurved, triangular to broadly rounded-triangular or rarely ovate, 0.3–0.7 mm long, 0.4–1 mm wide, apex acute to obtuse; young leaves sparsely to moderately puberulous with apparently simple, crisped to flexuose hairs, <0.05–0.1 mm long, the hairs colourless. *Inflorescence* a condensed, simple (or rarely compound) spike of 6–14(–25) flowers; rhachis (1.3–)2–5(–6.5) mm long, hairy, densely puberulous with apparently simple, straight hairs <0.05 mm long, the hairs colourless. *Bracts* scale-like, sessile, cupped, hairy, densely puberulous with apparently simple, straight hairs <0.05–0.1 mm long, the hairs colourless; broadly to depressed ovate, 0.4–0.5 mm long, 0.6–1 mm wide, apex rounded. *Flowers* obscurely pedicellate, floral tube and pedicel 0.2 mm long. *Tepals* glabrous to minutely papillate, rounded-triangular to ovate, 0.6–1.0 mm long, 0.6–0.8 mm wide, green, yellow-green or greenish yellow in life (rarely recorded as pale yellow or yellow), drying greenish to yellowish brown; apex incurved, thickened. *Anthers* broadly to very broadly elliptic, 0.2 mm long; filaments 0.15–0.2 mm long. *Disc* shallowly lobed, 0.6–0.8 mm diam. *Style* 0.2 mm long; stigma obscurely trilobed. *Fruit* a drupe, mature fruit ellipsoid to subglobose, drying greenish brown, smooth to indistinctly longitudinally ribbed (due to ornamentation on endocarp) when dry, glabrescent, puberulous with simple to dendritic, crisped to flexuose hairs <0.05 mm long, the hairs colourless, 3–5 mm long. Fruiting receptacle depressed obovoid to transversely elliptic, orange-red to dark red when mature, hairy with simple to dendritic, crisped to flexuose hairs <0.05 mm long, the hairs colourless, *c.* 2 mm long, the receptacle edible. (Figure 3)

Other specimens examined. WESTERN AUSTRALIA: 10 km W of homestead in Giralia Station, S of Exmouth Gulf, 28 June 2006, *D.J. Edinger* 5996 C (PERTH); W edge of Mortlock Creek, Wongan Hills, 17 July 1976, *K.F. Kenneally* 5364 (PERTH); Nungarin Reserve, 1978, *G. Perry* 804 (PERTH). SOUTH AUSTRALIA: 12 km SE of homestead, Kokatha Station, 8 Sep. 1995, *F.J. Badman* 8573

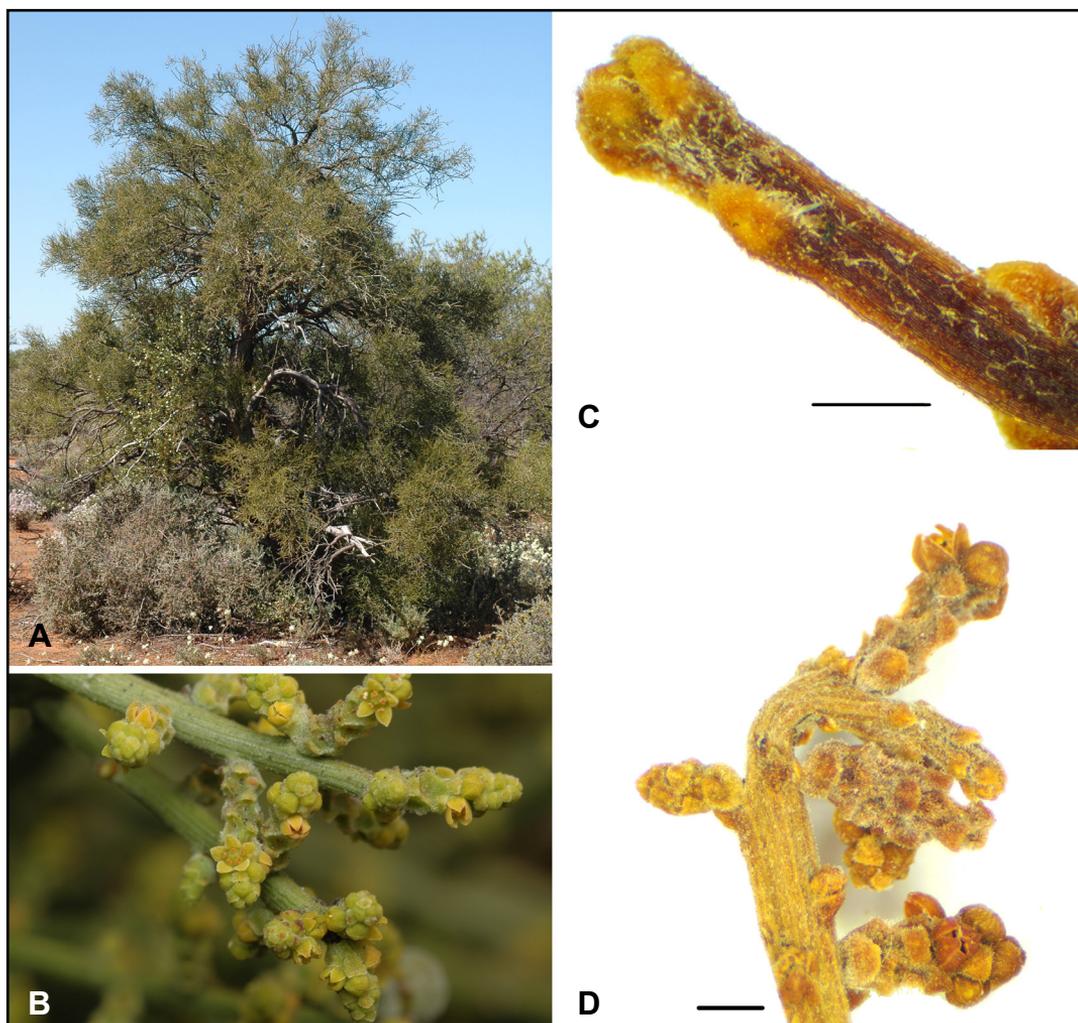


Figure 3. *Exocarpos aphyllus*. A – habit; B – flowering plant showing greenish yellow to yellow tepals. Colourless indumentum visible on inflorescence rachises. C – young shoot showing colourless indumentum. D – flowering branchlet. Colourless indumentum visible on young shoot at centre right, inflorescence rachises and bracts. Scale bar = 1 mm (C, D). Images taken by M. Fagg (A, B) and A.N. Schmidt-Lebuhn (C, D). Associated location and voucher specimens: photographed c. 35 km north of Yalgoo, WA, © M. Fagg 2009 (A); R.W. Purdie 7330 (B) and R.A. Saffrey 811 (C, D).

(AD); Garden Well Island [Lake Gairdner], 10 Apr. 1993, R.J. Bates 32006 (AD); Clements Gap Conservation Park, 10 Oct. 1988, H.P. Vonow 765 (AD, CANB). QUEENSLAND: 3 miles [c. 4.8 km] NE of Leyburn, 9 Jan. 1964, H.U. Stauffer & S.L. Everist 5528 (CANB, Z n.v.); c. 40 km N of Goondiwindi along Leichhardt Highway, 8 Feb. 1983, I.R. Telford 9521 & G. Butler (CANB). NEW SOUTH WALES: S side of North Boundary Fire Trail, 5.8 km W of West Fire Trail, Tarawi Nature Reserve, 8 Nov. 2000, P.C. Jobson 6670, A.E. Orme & G.M. Towler (CANB, NSW n.v.); 34 miles [c. 54 km] N of Deniliquin, 21 Jan. 1966, J.H. Leigh S402 & W.E. Mulham (CANB); Mt Murchison Station, Wilcannia, 2 Aug. 1966, P.N. Martensz s.n. (CANB 315135, MU). VICTORIA: south shore of Rocket Lake, 60 km SW of Mildura, 9 Oct. 1977, B. Barnsley 73, M.D. Crisp & D.J. Cummings (AD, CANB, MEL); 1 km E of Nyah West on Nyah West to Murray Valley Highway road, 7 Sep. 1991, B. Hadlow 641 (CANB, MEL).

Phenology. Flowers recorded all months of the year; mature fruits recorded between April and December.

Distribution and habitat. Widespread in the drier parts of mainland Australia, excluding the Northern Territory, mostly south of 25° latitude (Figure 4). *Exocarpos aphyllus* has a more or less continuous distribution from the Exmouth area in Western Australia, south and east through the wheatbelt and arid parts of the state, including the southern margin of the Nullarbor Plain, eastwards through southern South Australia (including Kangaroo Island), north-western Victoria, west of the Great Dividing Range in New South Wales, and north to the Darling Downs district of Queensland. Recorded from a wide variety of substrates, e.g. bird guano, sand (including dunes), sandy clay or sand over clay, sandy loam, loam, clay loam and clay, ranging from skeletal soils in rocky sites or over rock pavement, to deeper substrates, sometimes along ephemeral creek lines and other low-lying sites or semi-saline areas associated with salt lakes. Parent materials recorded include basalt, granite, gypsum, laterite, limestone, quartzite, sandstone and shale. Recorded from woodland communities (often with a shrubby understorey) with a variety of tree species (predominantly *Acacia*, *Callitris*, *Casuarina* and *Eucalyptus*), as well as mallee woodlands, *Acacia*, *Melaleuca* and other shrubland or ‘scrub’ communities. See under *E. capnodioides* for discussion on sympatry.

Conservation status. Not considered at risk. Widespread and common in suitable habitat and represented in several conservation reserves in all mainland states.

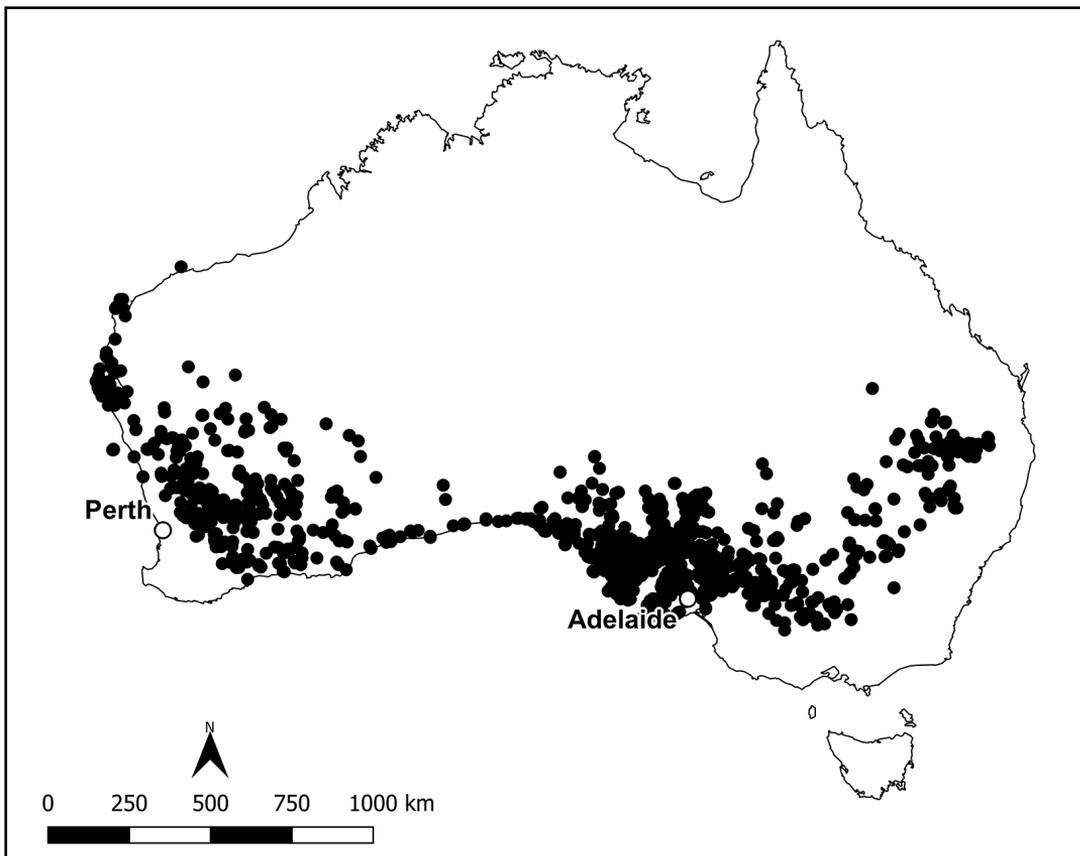


Figure 4. Distribution of *Exocarpos aphyllus* in Australia.

Acknowledgements

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