

## ***Samolus intricatus* (Primulaceae), a new species of Brookweed from semi-arid to arid-zone wetlands of north-western Western Australia**

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### **SHORT COMMUNICATION**

Flora surveys of the Fortescue Marsh (known as *Martuyitha* to the *Nyiyaparli* People and *Manggurdu* to the *Banjima* People) in the Pilbara region, Western Australia, identified a taxon of *Samolus* L. with an unusually divaricate and tangled habit that was subsequently assigned the phrase name of *Samolus* sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702). This taxon is part of a complex of several allied taxa that occur in the northern half of Western Australia and are currently assigned to either a varietal status of *S. repens* (J.R.Forst. & G.Forst.) Pers. or an informal name recognised on the Western Australian Plant Census (The Western Australian Herbarium 1998-). The morphological distinctiveness of this particular entity is sufficient to describe it here as a new species.

***Samolus intricatus*** A.S.Markey, *sp. nov.*

*Type:* Fortescue Marsh, Western Australia [precise locality withheld for conservation reasons], 11 August 2013, A. Markey, M. Lyons & C. McCormick FM 9705 (*holo:* PERTH 08552207!; *iso:* AD, BRI, DNA, MEL, NSW).

*Samolus* sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702), Western Australian Herbarium, in *FloraBase*, <https://florabase.dbca.wa.gov.au/> [accessed 4 November 2024].

*Samolus* sp. Great Sandy Desert SVL (2912), S. van Leeuwen, *Biological Survey of the south-western Little Sandy Desert*, p. 61 (2002), *nom. inval.*, *nom. nud.*

Upright, 0.30–1(–1.5) m tall, tufted to rounded perennial *subshrub* with many (> 10) robust stems arising from a clumped or linear, reddish rhizome, becoming intertwined with adjacent stems to form a much-branched, rounded and tangled cluster. *Stems* erect, wiry, terete, flexuose, tangled, lime-green, 0.6–2.6 mm wide, widest at bases, hairless but surfaces distinctly verrucose from being covered in minute, raised salt glands and scurfy from salt deposits, becoming distinctly wrinkled or scabrous when dry. *Lateral branches* alternate, arising from stem axes at a wide internal branching angle ranging from (40–)50–140°, then curving upwards parallel to the stem. *Basal leaves* caducous, absent in mature plants, present only in seedlings as a basal rosette of 5–25 (increasing in number with seedling development), sessile, obovate-spathulate, 10–25 mm long, 5–15 mm wide, fleshy, smooth, glabrous, sparsely scattered with salt glands; apex obtuse to truncate; margins entire; midrib indistinct or barely discernible. *Cauline leaves* scattered along stems, reduced to scales, sessile, triangular to broadly triangular, 0.7–1.5(–2.0) mm long and 0.9–1.7 mm wide on upper stems, and 1.0–2.1(–3.0) mm long and 0.5–0.9 mm wide on lower stems; apex acute, deflexed and hooked on upper stems, adpressed and regularly breaking off on lower

stems; lacking a midrib, glabrous, developing from green to scarious and brown. *Inflorescence* a terminal raceme of 3–7(–9) flowers, 1.0–4.6(–6.0) cm long. *Pedicels* hairless, scurfy, lime-green, covered in salt glands, 2–8(–10) mm long, 0.3–0.7 mm wide, becoming progressively shorter towards top of raceme, emerging from raceme axis at a wide angle of 50–120° before curving upwards, with a single scale-like, light brown bract 0.7–1.2 mm long, adnate to the pedicel at positions varying from near the base to the middle. *Flowers* actinomorphic. *Calyx* campanulate, green, glabrous, verrucose with many minute raised salt glands and appearing scurfy from salt crystals, ratio of calyx lobes:tube length 0.8–1.0. *Calyx tube* (hypanthium) (0.9–)1–2(–2.2) mm long, lengthening in fruit. *Calyx lobes* 5 (occasionally 6 or 7), triangular or triangular-ovate, 1.0–2.0(–2.3) mm long, (0.8–)1.0–1.5 mm wide; margins minutely hyaline; apex acute or minutely mucronate. *Corolla* regular, white, glabrous, smooth, (3.0–)4.0–6.5 mm long, fused at base into a *tube* 1.5–3.0(–3.2) mm long. *Corolla lobes* 5 (occasionally 6 or 7), spreading, narrowly elliptic to narrowly oblong, (1.7–)2.0–3.6(–3.8) mm long, (1.2–)1.5–2.2 mm wide; apex obtuse to rounded. *Ovary* half inferior, glabrous, ovoid, 2–3 mm long. *Ovules* many (> 50). *Style* terminal, glabrous, white, 2.0–4.0(–4.5) mm long. *Stigma* simple to discoid. *Stamens* 5, antepetalous, alternating with 5 antesepalous staminodes, both adnate to and exserted from mouth of corolla tube, held above deflexed corolla lobes. *Anthers* white to pale yellow, 0.8–1.7(–1.9) mm long, opening by introrse longitudinal dehiscence, topped by an apical process 0.2–0.4(–0.5) mm long. *Filaments* equal, white, glabrous, 1.1–2.0(–2.3) mm long. *Staminodes* white, filamentous, glabrous, (0.7–)1.0–1.5(–2.3) mm long, half to same length of and more slender than fertile filaments. *Fruit* an ovoid denticidal capsule, 3.3–4.7(–5.0) mm long and 2–3 mm wide, dehiscing apically by 4 or 5 (rarely 6) valves. *Seeds* many (> 50) per capsule, yellow-brown to red-brown, cuboid with angular walls and a reticulately patterned surface, 0.21–0.46 mm wide, 0.30–0.71 mm high. (Figures 1, 2)

*Diagnostic characters.* *Samolus intricatus* may be distinguished from all other members of the genus by the following combination of characters: divaricately branched stems that become interlaced and tangled, cauline leaves reduced to brown, dry and scarious scales < 2 mm in length, with scales along upper stems decurved with hooked apices and those along the lower stems adpressed and with their tips often breaking off, an absence of basal rosette of leaves in mature plants and the plant forming a rounded, densely branched shrub 30–100 cm tall.

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 1 Oct. 2014, J. Bull & D. Roberts ONS F 221.01 (PERTH); 14 Oct. 2016, J. Bull & J. Waters ONS RF 60.01 (PERTH); 27 July 2007, G. Byrne 2792 (NSW n.v., PERTH); 7 Sep. 2004, R.J. Chinnock 9793 (PERTH); 31 Aug. 2013, A. Markey & R. Coppen FM 10962 (PERTH); 16 Sep. 2013 A. Markey & C. McCormick FM 9704 (BRI, CANB, DNA, MEL, PERTH); 31 July 2013, A. Markey, S. Dillon, M. Lyons & C. McCormick FM 10964 (PERTH); 8 Aug. 2013, A. Markey, S. Dillon, M. Lyons & C. McCormick FM 10963 (PERTH); 11 Aug. 2013, A. Markey, M. Lyons & C. McCormick FM 9706 (PERTH); 8 Apr. 1990, A.A. Mitchell 1833 (PERTH); 27 July 1996, A.A. Mitchell PRP 1284 (PERTH); 30 Mar. 1984, K.R. Newbey 10084 (PERTH); 16 Oct. 1996, S. van Leeuwen 2912 (PERTH); 8 Sep. 2002, S. van Leeuwen 5167 (PERTH); 3 May 2014, G. Wells s.n. (PERTH).

*Phenology.* Flowering and fruiting occur from March to October, with fruit maturation and seed release occurring soon after anthesis. Flowers are fragrant and attract insect pollinators, including species of Blue-banded Bees (*Amegilla* sp.). Seeds are shed into the immediate surrounds, dispersed within the land-form possibly by wind and/or water. Soil moisture is important for flowering, and plants along permanent pools will continue flowering over several months. Plants on saline floodplain margins will recover from drought, grow vigorously and flower in response to floodplain and lake inundation events following summer cyclonic rainfall in the catchment.

*Distribution and habitat.* *Samolus intricatus* is known from only three locations in northern Western Australia, with its main distribution on the Fortescue Marsh (*Martuyitha* / *Manggurdu*) in the Pilbara and two disjunct, outlying areas in the Little Sandy Desert: one centred on the Beyondie Lake – Sunshine Lake region, and another location on the margin of Savory Creek (Figure 3). *Samolus intricatus* grows





**Figure 1.** *Samolus intricatus*. A – plants along a permanent freshwater pool on the Fortescue Marsh, showing the erect, tangled, divaricate branching habit; B – green, rounded shrubs in samphire shrubland on Fortescue Marsh; C – seedlings, showing the rosette of basal leaves which subtend young stems; D – flower; E – fruit; F – mature plant, showing rhizome and stems with no basal leaves and tangled, divaricately branching stems; G – raceme showing upturned pedicels, wide branching angle and sinuous raceme; H – *Samolus* sp. Millstream (M.I.H. Brooker 2076) showing raceme with erect linear pedicels and comparatively straight rachis. Images from A. Markey, M. Lyons & R. Coppen FM 9706 (C), A. Markey, S. Dillon & H. Robertson FM 10964 (D), A. Markey, S. Dillon C. M. Lyons & McCormick FM 10963 (E), A. Markey & R. Coppen FM 9705 (F–G), and A. Markey LCVS 108 (H). Photographs by A. Markey (A, C–H) and Steven Dillon (B).



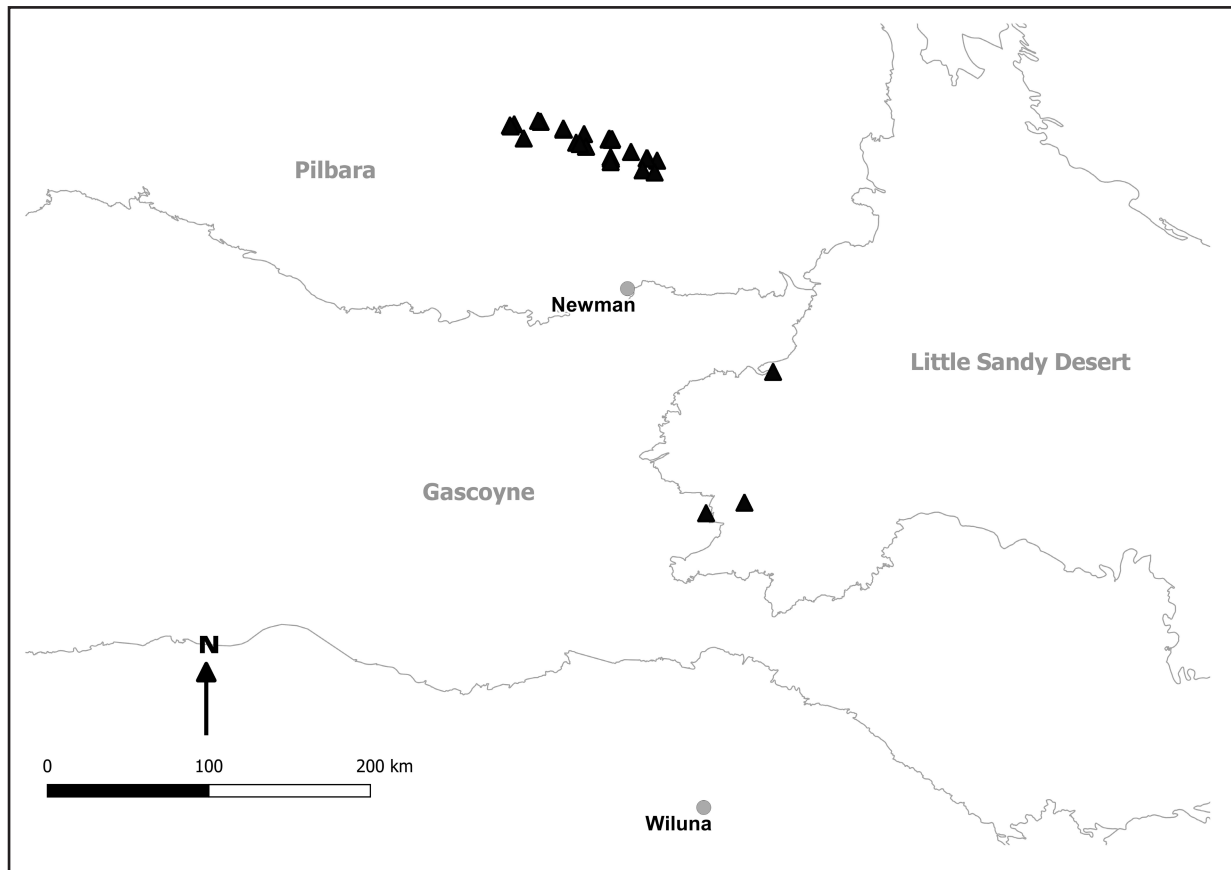


**Figure 2.** Herbarium specimens illustrating A – the tangled, divaricate branching and wide branching angles of *Samolus intricatus* (PERTH 08552185); B – the untangled, narrow-angled branching of *S. sp.* Millstream (M.I.H. Brooker 2076) (PERTH 07809689).

in deep, heavy, silty clays on the margins of salt lakes and saline floodplains, particularly at sites with seasonal freshwater inflows. Plants are also found adjacent to saline lake beds in *Melaleuca* shrublands on low, sandy rises, and in *Triodia* hummock grasslands. On Fortescue Marsh, it primarily grows in samphire shrublands in association with *Tecticornia indica* subsp. *biden*, *T. sp.* Dennys Crossing (K.A. Shepherd & J. English KS 552), *T. globulifera*, *Muellerolimon salicorniaceum*, *Duma florulenta*, *Eremophila spongiorcarpa*, *Melaleuca glomerata* and *M. xerophila*. It is also an important component of *Eucalyptus victrix*, *E. camaldulensis* and/or *Acacia ampliceps* dominated riparian vegetation on deep, water-logged clays fringing permanent to semi-permanent freshwater pools. Plants at Savory Creek were recorded in *Tecticornia* spp. samphire shrublands. In the Beyondie Lake – Lake Sunshine region, plants grow on small sandy rises adjacent to lake margins in association with shrublands of *Melaleuca interioris* and samphires of *Tecticornia bibenda*, *T. sp.* Dennys Crossing (K.A. Shepherd & J. English KS 552) and *T. indica* (Phoenix Environmental Pty Ltd 2018).

**Conservation status.** *Samolus intricatus* is currently listed as Priority One under the Conservation Codes for Western Australian Flora, under the name *Samolus* sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702) (Western Australian Herbarium 1998-). It is found in the Fortescue Marsh Land System (Payne 2004), which itself is listed at the state level as a Priority Ecological Community (DBCA 2023, Markey 2017), and occurs in wetland habitats that are uncommon in the wider Pilbara and Little Sandy Desert regions. Current threats include trampling and browsing by cattle, and mining and exploration activities at Fortescue Marsh and in the Beyondie Lakes – Sunshine Lake region may impact populations through clearing, earthworks, roadworks or changes to surface water flows or groundwater levels and water quality.

**Etymology.** The specific epithet is from the Latin *intricatus* (entangled, intricate, and complex), which refers to the tangled, interlaced branching of the stems and inflorescences which leads to distinctively



**Figure 3.** Known distribution of *Samolus intricatus* in the Pilbara, Little Sandy Desert and Gascoyne biogeographic regions in north-western Western Australian compiled from herbarium records held at the Western Australian Herbarium and from field observations made by the author at Fortescue Marsh. Biogeographic regions given are from version 7 of the Interim Biogeographic Regionalisation of Australia (IBRA7) (DCCEEW 2024).

flexible, springy, and densely divaricate plants that rebound back to their original form after being pushed (Figure 1).

**Vernacular Name.** A suggested vernacular name is Bouncing Brookweed, in reference to the distinctively elastic and pliable nature of the shrub.

**Affinities.** Based on its bracteate pedicels, erect habit and reduced cauline leaves, and referring to the molecular phylogenies presented by Wanntorp and Anderberg (2011), *S. intricatus* is assumed here to belong to a clade of mostly Australian taxa that includes phrase-named taxa or varieties of *S. repens* (J.R.Forst. & G.Forst.) Pers. s. lat. (cf. Bentham 1868), *S. eremaeus* S.W.L.Jacobs (from freshwater creeks in central Australia), *S. porosus* (L.f.) Thunb. (a South African species), *S. caespitosus* Keighery (from saline seasonal wetlands in southern Western Australia) and *S. junceus* R.Br. (from wetland and damp habitats in southern and western Western Australia) (Jacobs 1980; Wheeler 1987; Keighery 1988). The phylogenetic analysis of Wanntorp and Anderberg (2011) suggests that *S. repens* is paraphyletic, with the erect varieties being more genetically distant from the procumbent variety. This creeping, often coastal variety from southern Australia, Chile and Oceania is listed on the Western Australian Plant Census as *S. repens* (J.R.Forst. & G.Forst.) Pers. var. *repens* (synonym: *S. repens* var. *procumbens* R. Knuth (Pax & Knuth 1905)). *Samolus intricatus* is distinguished from *S. repens* var. *repens* by its erect, comparatively tall (> 30 cm) habit where robust stems with scale leaves arise from rhizomes to form rounded, tufted, clumps of shrubs, while the latter sends up leafy, wiry stems 2–40 cm in length and which range from prostrate to weakly ascending, resulting in plants that are sprawling, semi-prostrate herbs or form dense, spreading mats. The cauline leaves of *S. repens* var. *repens* are abundantly distributed along the stems and are distinctly green, fleshy and range from 1–2.5 cm in length. The staminodes of *S. repens* var. *repens* are distinctly longer than the stamens, whereas these are subequal to marginally shorter in *S. intricatus*. While

*S. intricatus* has a brown, scale-like bract located above the base to the middle of the pedicel, in *S. repens* var. *repens* this subtending bract is leaf-like, green and located at the base of the pedicel. Wanntorp and Anderberg (2011) interpreted this condition as being ebracteate in the procumbent variety.

*Samolus intricatus* appears to be most closely allied to a currently unresolved complex of four Western Australian taxa that all share a tall, erect, robust and clumped habit, the other taxa being *S. sp.* Millstream (M.I.H. Brooker 2076), *S. sp.* Shark Bay (M.E. Trudgen 7410), *S. repens* var. *floribundus* Benth. and *S. repens* var. *paucifolius* Benth. It is distinguished from these other four taxa by its dichotomously branched and interlaced racemes, stems and lateral branches, and having cauline leaves reduced to small, brown, scarious scales scattered sparingly along the stems. The other four taxa have relatively larger cauline leaves that are linear or linear-elliptic to linear-obovate, which are well-developed, fleshy and green, their stem branching is not divaricate nor tangled, the stem and panicle branching angles of the other taxa are smaller ( $< 50^\circ$ ), and the flowers have straight pedicels. The stems of *S. intricatus* and *S. sp.* Millstream (M.I.H. Brooker 2076) share a similar range of widths (1.5–2.5(–3) mm) and flexibility, while the stems of the other three taxa can be wider ( $> 2.7$  mm) and comparatively more rigid and stout. In the flowers of *S. intricatus* the corolla is always white and, unlike the other taxa, never pale pink when in bud or open, and the calyx lobes are more broadly triangular than for *S. sp.* Shark Bay (M.E. Trudgen 7410), *S. repens* var. *floribundus* and *S. repens* var. *paucifolius*. Calyx lobes of the latter two taxa can be up to twice the length of those in *S. intricatus*. *Samolus sp.* Millstream (M.I.H. Brooker 2076) is the most likely variant to be confused with *S. intricatus*, particularly by the similar flowers and small, decurved cauline leaves in the upper stems, but can be readily distinguished by narrow branching angles and a lack of divaricate branching in the stems, flowers with straight pedicels, and larger cauline leaves which remain green. Leaves in *Samolus sp.* Millstream (M.I.H. Brooker 2076) range from linear and short (1.5–3.5 mm) on the upper stems to linear-spathulate and 5–9 mm long on the lower stems. *Samolus intricatus* forms a dense, tangled, perennial bush that is generally free-standing but can grow through adjacent shrubs, whereas *S. sp.* Millstream (M.I.H. Brooker 2076) is an erect, untangled, free-standing shrub.

Like *S. intricatus*, *S. junceus* possesses cauline scale leaves sparsely scattered along stems  $> 30$  cm long, but *S. junceus* differs by having unbranched to few-branched stems with a smaller branching angle and a rush-like, non-divaricate habit, the basal leaves are often persistent on mature plants, and flowering stems terminate in elongate, linear racemes or panicles from 5–27 cm long with flowers on straight pedicels subtended by a bract adnate to the base. Both *S. intricatus* and *S. eremaeus* have an erect habit exceeding 30 cm in height, but *S. eremaeus* is distinguished from *S. intricatus* by its broad, spatulate basal and cauline leaves which reach lengths of 11 cm and 5 cm respectively (Jacobs 1980).

*Samolus intricatus* shares a similar divaricate branching habit to the flowering stems of *S. caespitosus* but is distinguished from the latter species by having continuously replaced stems  $> 30$  cm tall that arise from a woody, stout, horizontal rhizome, and single bracts subtending branches and pedicels. The longevity of individual stems of *S. intricatus* is unknown, but repeated observation has shown that shrubs will persist and grow over successive seasons if conditions are favourable. Conversely, *S. caespitosus* has an annual flowering stem that doesn't exceed 30 cm in height and arises from a persistent basal rosette of leaves, with each branch subtended by pairs of longer (up to 7 mm) bracts (Keighery 1988).

*Notes.* *Samolus intricatus* resides in semi-arid to arid wetland habitats that experience a range of extreme conditions, from flooding to severe drought, thermal stress and high salinity. Being a halophyte, excess salts are excreted through epidermal salt glands that appear as pores within raised bumps (Adam & Wiecek 1983) and that cover the stems, pedicels and calyces. Stems are the primary photosynthetic tissues and are produced from a robust hypogeogenous rhizome that is key to the plant's recovery after disturbance. Shrubs can tolerate periods of inundation in riparian and flood-prone habitats, and resprout readily after floodwaters subside. The entire shoot system can senesce during the extremely hot and dry conditions experienced on salt lake and floodplain margins, but vigorous new shoot growth recommences when cooler, wetter conditions return. Plants along permanent freshwater pools will remain green and actively growing throughout hot, dry periods.

The branching structure of the stems, raceme axis and pedicels can make interpretation of the inflorescence type difficult in *S. intricatus*. Racemes can appear as a corymbose raceme because of the upturned pedicels and twisting of the rachis, and groups of terminal racemes coming off the stems can make that section appear like an irregular panicle.

The *Nyiyaparli* name for *Samolus intricatus* is *Gurrungali*, and it was used to produce white smoke for signalling while mustering sheep around *Martuyitha* (*Karlka Nyiyaparli* Aboriginal Corporation 2023, Roy Hill Pty Ltd and *Karlka Nyiyaparli* Aboriginal Corporation 2021).

*Identification.* The key to Australian species of *Samolus* by Jacobs (1980), which was amended by Keighery (1988), is further modified here to include *S. intricatus* with a couplet that distinguishes it from *S. junceus*.

1. Mature plants with few or no leaves. If leaves present either these are normal sized and basal or very reduced and cauline..... 5
- 1: Mature plants with basal and / or cauline leaves (at least on lower stems) well developed ..... 2
5. Stems unbranched or sparsely branched, straight and untangled, basal leaves present on mature plants, flowers on straight, slender pedicels, arranged on a long raceme with a linear rachis up to 27 cm in length, found in south-western Western Australia..... ***S. junceus***
- 5: Stems divaricately branched and intricately tangled, basal leaves absent on mature plants, flowers on bent, upwardly reflexed pedicels, arranged on a short raceme with a non-linear rachis < 6 cm in length, found in semi-arid to arid zones in north-western Western Australia ..... ***S. intricatus***

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