

THE HIBISCUS PANDURIFORMIS COMPLEX (MALVACEAE) IN AUSTRALIA

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SUMMARY

The *Hibiscus panduriformis* Burm.f. species complex in Australia is revised. Six species are recognised, of which one is the widespread *H. panduriformis*; one, *H. austrinus*, is based upon *H. panduriformis* var. *australis*; and four represent new species, *H. apodus*, *H. calcicola*, *H. fluvialis*, and *H. multilobatus*. A new variety is recognised in *H. austrinus*, namely var. *occidentalis*. Distribution maps are provided for all taxa and an exsiccatae list is included.

Key words: *Hibiscus*, Malvaceae, Australia, key, taxonomy.

INTRODUCTION

Hibiscus panduriformis Burm.f. was described in 1768 by Burman (1768). Burman's material apparently originated from the Indian-Malesian region (Merrill, 1921; Stafleu, 1971). No authentic specimens are known to exist and the description and characterisation of the species by Burman are rather poor but, despite this, the identity of the plant to which Burman was referring is clear (Van Borssum Waalkes, 1966).

In his revision of *Hibiscus*, Hochreutiner (1900) treated *H. panduriformis* as having three varieties: var. *tubulosus* (Cav.) Hochr. (nom. illeg. = *H. panduriformis*), var. *senegalensis* Hochr., and var. *australis* Hochr. Hochreutiner (1900) gave the distribution of the varieties as: var. *panduriformis*: tropical Africa, India and Malaya; var. *australis*: Australia; var. *senegalensis*: tropical Africa, but his infraspecific taxonomy for *H. panduriformis* has not been accepted by all subsequent authors. Exell (1961) reported that there was variation within this species in Africa and noted that the stems might be tomentose or hirsute and the flowers pubescent or glabrous. However, Exell could not find combinations of these features that supported the recognition of infraspecific taxa. In his treatment of *H. panduriformis* for the Malesian region, Van Borssum Waalkes (1966) noted Hochreutiner's (1900) infraspecific taxonomy, even though he did not give prominence to the appropriate variety, i.e. var. *panduriformis*, in his account.

Examination of herbarium specimens collected in Australia showed that there is considerably more variation within Australia than had been indicated by Hochreutiner (1900) and Van Borssum Waalkes (1966). Only some of the specimens can be assigned reasonably to var. *australis*. Others agree with the description of var. *panduriformis* as

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given in Van Borssum Waalkes (1966, as *H. panduriformis*) and Sivarajan & Pradeep (1996) and some specimens do not agree with any of the previously recognised varieties. The present revision of the taxonomy of the *H. panduriformis* complex in Australia was undertaken in order to resolve some of these uncertainties.

Across the range of the Australian material studied, there was much variation. The indumentum of vegetative organs in a single collection ranged from consisting of a single hair type (commonly short soft stellate hairs) to a mixture of four hair types (long coarse stellate hairs, long soft stellate hairs, short soft stellate and glandular hairs). Variation existed between collections in other features such as epicalyx lobe number, corolla size (14–80 mm long) and style arm length (0.2–6.5 mm long). Although there was much variation *across* the specimens studied, it was clear that variation *within* specimens was low. Furthermore, it was observed that there was correlation between geography and ecology for particular combinations of character states. We have concluded that the *H. panduriformis* complex within Australia comprises six species, five of which are endemic.

It might be argued that indumentum characters have been over-emphasised in the present study relative to other morphological features. However, hair types are important taxonomically in Malvaceae. Several recent authors, Rakshit & Kundu (1970), Phuphathanaphong et al. (1989), Wilson (1993) and Wilson & Craven (1995) used hair types in defining species. Van Borssum Waalkes (1966: 19) noted in his account of Malesian Malvaceae that every species can be characterised by its indumentum.

Until recently, *H. panduriformis* s.l. was thought to be the only species of *H.* sect. *Trichospermum* Hochr. that occurred in Australia. A second species, *H. brennanii* Craven & Fryxell, has been described from the Northern Territory (Craven & Fryxell, 1993). The two are distinguished by the following features: *H. panduriformis* s.l.: distal leaves on flowering shoots distinctly petiolate, leaves discolorous, corolla yellow; *H. brennanii*: distal leaves on flowering shoots sessile or subsessile, leaves concolorous, corolla pink. Their ecologies and distributions also differ with *H. panduriformis* s.l. commonly being a species of grassland to woodland communities on sandy to clay soils across northern Australia, while *H. brennanii* occurs on skeletal soils over sandstone. The latter species is presently known from a single locality in the Alligator Rivers region of the Northern Territory (Craven & Fryxell, 1993); its distribution is given in Map 1 to permit comparison with that of the other Australian representatives of the section.

TAXONOMY

1. *Hibiscus apodus* Juswara & Craven, *spec. nov.* — Fig. 1; Map 1

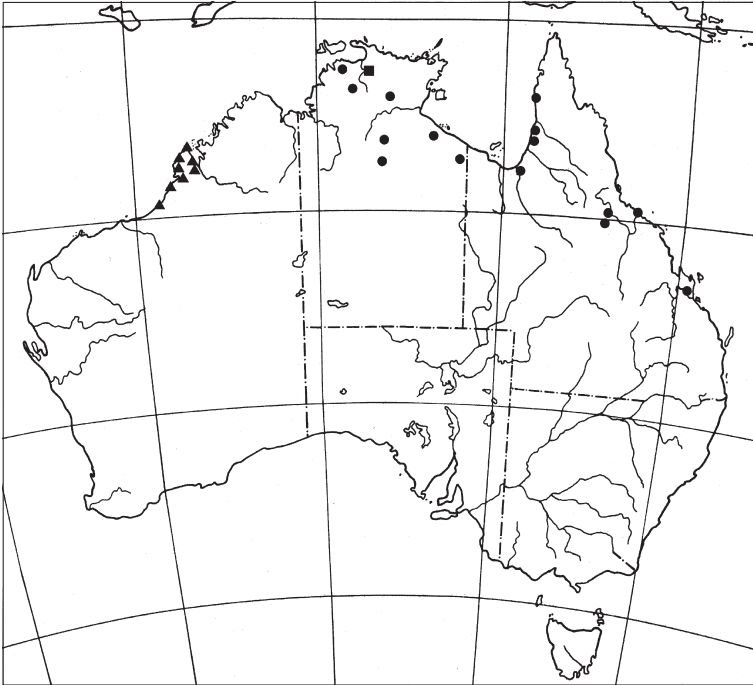
Affinis *H. panduriformi* Burm.f. a qua ramulis sine trichomatibus longis grossisque, lamina folii brevior (21–58 mm longa, in *H. panduriformi* 21–186 mm longa), corollis 0.5–1 plo longiore (in *H. panduriformi* 3.6–4.4 plo longiore), sine pedunculo, ramulis styli longioribus (1.5–4 mm longis, in *H. panduriformi* 0.2–1 mm longis) differt. — Typus: Fryxell, Craven & Stewart 4550 (holo CANB; iso BRI, MEL, NY, PERTH), Australia, Western Australia, 5 km NNE of Broome, 29 May 1985.

Shrubs to 2 m tall. *Branchlets* long and short soft stellate-hairy, with glandular hairs, indumentum obscuring the epidermis, long soft stellate hairs 1.5–2 mm long, short

stellate hairs 0.2–0.3 mm long. *Leaves* with the petiole 20–50 mm long, blade short soft stellate-hairy, indumentum whitish to yellowish, in overall shape broadly elliptic, 3-lobed, 21–58 by 14–60 mm, 0.5–1 times as long as the petals of the subtended flower, margin serrate-dentate to crenate, base cordate, apex acute to rounded. *Flowers* without a peduncle, pedicel present. *Epicalyx* shorter than the calyx, short soft stellate-hairy, 7-segmented, segments shortly connate at the base, narrowly spatulate to linear-obovate, 7–15 by 0.5–1 mm. *Calyx* short soft stellate-hairy on the abaxial surface, campanulate, 12–18 mm long, lobes ovate, apex acute, 3-nerved. *Petals* yellow with red basal spots, short coarse stellate-hairy on the abaxial surface, glabrous on the adaxial surface, 35–57 by 14–43 mm, rounded at the apex. *Staminal column* glabrous, 22–27 mm long, antheriferous throughout, filaments 0.5–1 mm long. *Ovary* hairy, style arms 1.5–4 mm long. *Capsule* hairy, 12–16 by 8–10 mm, beak 1 mm long. *Seeds* angular reniform, 2.5–3 mm long, concentrically ribbed, glabrous or short brownish stellate-hairy.

Distribution — Australia (coastal country in the northwest Kimberley region of Western Australia, especially frequent in the Dampier Peninsula area).

Habitat — Recorded as occurring in low woodland with *Eucalyptus terminalis*, *Lysiphylum cunninghamii* and *Atalaya hemiglauca* on red sand soils; in the understorey of a regenerating *Melaleuca acacioides* thicket; on a coastal sand dune above high tide mark with *Spinifex*, *Tribulus* and mangrove nearby; on black soil; in cleared country on subsaline crumbly grey soil; and in grassland. This species has been recorded from



Map. 1. Distribution of *Hibiscus apodus* Juswara & Craven (▲), *H. brennanii* Craven & Fryxell (■) and *H. panduriformis* Burm.f. (●).



Fig. 1. Holotype of *Hibiscus apodus* Juswara & Craven. — Scale bar = 5 cm.

quite diverse soil types and it is not unexpected that the communities that it has been recorded from are also diverse. Given that the geographic range of *H. apodus* is not especially large, it is of interest that it is found in such a range of habitats.

Notes — 1. *Hibiscus apodus* is the only Australian species of the complex that lacks a peduncle although, in common with the other species, it is pedicellate. This, together with the distinctive small leaves and large flowers, makes it easily distinguished from its relatives.

2. The specific epithet is derived from the Latin *a*, without, and *podos*, foot, in reference to the lack of a peduncle.

2. *Hibiscus austrinus* Juswara & Craven, *stat. & nom. nov.* — Map 2a, b

Based on: *Hibiscus panduriformis* var. *australis* Hochr. (1900) 96, replaced synonym. — Type: *n.97* Herb. Boissier (holo G), Australia, Port Darwin (Palmerston), Dec. 1891.

Notes — 1. Unfortunately, the epithet ‘*australis*’ is preoccupied by *H. australis* (F. Muell.) Kuntze, and a new name is required for the plant at species level. The epithet ‘*austrinus*’ from the Latin *austrinus*, southern, is proposed above as the replacement.

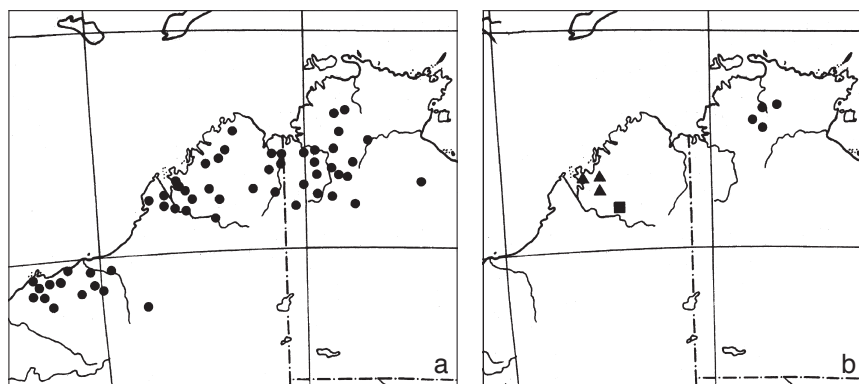
2. *Hibiscus austrinus* is characterised by having dense branchlet indumentum composed of short or short and long stellate hairs and a 5–7-segmented epicalyx. Two varieties are recognised within the species.

a. var. *austrinus* — Map 2a

Subshrubs or shrubs to 1–2 m tall. *Branchlets* short soft stellate-hairy, without glandular hairs, indumentum obscuring the epidermis, short soft stellate hairs 0.3–0.5 mm long. *Leaves* with petiole 20–124 mm long, blade short soft stellate-hairy, the indumentum yellowish or rarely whitish, in overall shape broadly elliptic, 3-lobed, 26–134 by 19–160 mm, 0.6–1.6 times as long as the petals of the subtended flower, margin serrate-dentate to crenate, base cordate, apex acute. *Flowers* with the peduncle 2–34 mm long, pedicel present. *Epicalyx* shorter to longer than the calyx, short soft stellate-hairy, 5–7-segmented, segments shortly connate at base, spatulate to narrowly spatulate, 10–35 by 1–4 mm. *Calyx* short soft stellate-hairy on the abaxial surface, campanulate, 15–34 mm long, lobes ovate, apex acute, 3-nerved. *Petals* yellow with red basal spots, short coarse stellate-hairy on the abaxial surface, glabrous on the adaxial surface, 38–80 by 25–64 mm, rounded at the apex. *Staminal column* glabrous, 13–80 mm long, antheriferous throughout, filaments 1.5–2 mm long. *Ovary* hairy, style arms 1–6.5 mm long. *Capsule* hairy, 16–20 by 12–15 mm, the beak 1–2 mm long. *Seeds* angular reniform, 3–3.5 mm long, concentrically ribbed, glabrous or short brownish to yellowish stellate-hairy.

Distribution — Australia (from the Pilbara area north to the Kimberley region in Western Australia, and from the Victoria River area to the McArthur area in the Northern Territory).

Habitat — Recorded as occurring in grassy woodland on heavy grey loam on a flood plain; on black soil; on red loam by roadsides; on a riverine levee; on alluvial soils on calcrete with *Eucalyptus patellaris*; and on sandy loam soil. Although widespread and common, relatively little has been recorded of its ecology, but *H. austrinus* var. *aus-*



Map 2. Distribution of a. *Hibiscus austrinus* Juswara & Craven var. *austrinus*; b. *H. austrinus* var. *occidentalis* Juswara & Craven (▲), *H. calcicola* Juswara & Craven (■) and *H. multilobatus* Juswara & Craven (●).

trinus seems to be tolerant of a wide range of soil types and appears to be a woodland taxon, although it was once recorded from a levee.

Note — The typical variety differs from var. *occidentalis* mainly in the lack of long soft stellate hairs in the former. Other differences such as the longer peduncle and style arms in var. *austrinus* (2–34 mm and 2–6.5 mm long, respectively, in var. *austrinus* and up to 3 mm and 1.5–3.5 mm long in var. *occidentalis*) may not be as significant given that var. *occidentalis* is known from only few collections (whereas var. *austrinus* is known from c. 125 collections).

b. var. *occidentalis* Juswara & Craven, var. nov. — Fig. 2; Map 2b

A var. *typica* ramulis trichomatibus longis mollibusque (et trichomatibus brevibus mollibusque), pedunculo brevioribus (0–3 mm longo, in subsp. *austrino* 2–34 mm longo), ramulis styli interdum brevioribus (1.5–3.5 mm longis, in var. *austrino* 2–6.5 mm longis) differt.

— *Typus*: *Beaglehole* 52782 (holo PERTH; iso DNA), Australia, Western Australia, junction of Stuart and Robinson Rivers, ± 72 km NNW of Derby, 13 June 1976.

Subshrubs or shrubs to 0.6 m tall. *Branchlets* long and short soft stellate-hairy, without glandular hairs, indumentum obscuring the epidermis, long soft stellate hairs 2.2–3.4 mm long, short soft stellate hairs 0.3–0.5 mm long. *Leaves* with the petiole 20–45 mm long, blade short soft stellate-hairy, indumentum yellowish or rarely whitish, in overall shape broadly elliptic, 3-lobed, 31–93 by 21–72 mm, 1–1.4 times as long as the petals of the subtended flower, margin serrate-dentate to crenate, base cordate, apex acute. *Flowers* with the peduncle obsolete or up to 3 mm long, pedicel present. *Epicalyx* shorter than the calyx, short soft stellate-hairy, 6- or 7-segmented, segments shortly connate at base, spatulate, 10–16 by 3.5–5 mm. *Calyx* short soft stellate-hairy on the abaxial surface or rarely also long soft stellate-hairy, campanulate, 18–30 mm long, lobes ovate, apex acute, 3-nerved. *Petals* yellow with red basal spots, short coarse stellate-hairy on the abaxial surface, glabrous on the adaxial surface, 34–54 by 24–42 mm, rounded at the apex. *Staminal column* glabrous, 13–17 mm long, antheriferous throughout, filaments



Fig. 2. Holotype of *Hibiscus austrinus* var. *occidentalis* Juswara & Craven. — Scale bar = 5 cm.

0.7–1.7 mm long. *Ovary* hairy, style arms 1.5–3.5 mm long. *Capsule* hairy, 12–16 by 12–15 mm, beak 1–2 mm long. *Seeds* angular reniform, 3–3.5 mm long, concentrically ribbed, glabrous or short brownish to yellowish stellate-hairy.

Distribution — Australia (the west Kimberley area in Western Australia).

Habitat — Recorded as occurring in open woodland with tussock grasses on black clay plain; on a river bank; and by a creek on a flood plain in heavy clay. Its ecology is generally similar to that of var. *austrinus*.

Notes — 1. This variety occurs within the general ranges of *H. apodus* and *H. austrinus* s.l. More research is needed to investigate the possible hybrid origin of the variety; the long soft stellate hairs may have been introgressed into *H. austrinus* in the northwestern part of its range from *H. apodus* which also grows in the western Kimberley area.

2. The varietal epithet is derived from the Latin *occidentalis*, west, in reference to the geographic distribution of the plant.

3. *Hibiscus calcicola* Juswara & Craven, *spec. nov.* — Fig. 3; Map 2b

Affinis *H. panduriformi* Burm. f. a qua ramulis sine trichomatibus glandularibus, trichomatibus longis grossisque plerumque longioribus (2–3.5 mm longis, in *H. panduriformi* 1.7–2.3 mm longis), lamina folii corollis 1.2plo longiore (in *H. panduriformi* 3.6–4.4plo longiore), ramulis styli longioribus (2–3 mm longis, in *H. panduriformi* 0.2–1 mm longis) differt. — Typus: *Tracey 13889* (holo BRI; iso DNA, PERTH, QRS), Australia, Western Australia, Geikie Gorge National Park, 22 May 1981.

Shrubs to 1.5 m tall. *Branchlets* long coarse and short soft stellate-hairy, without glandular hairs, indumentum not obscuring the epidermis, coarse stellate hairs 2–3.5 mm long, soft stellate hairs 0.3–0.5 mm long. *Leaves* with the petiole 15–32 mm long, blade short soft stellate-hairy, indumentum yellowish, in overall shape broadly elliptic, 3-lobed, 31–55 by 28–60 mm, 1.2 times as long as the petals of the subtended flower, margin serrate-dentate to crenate, base cordate, apex acute. *Flowers* with the peduncle obsolete or up to 2 mm long, pedicel present. *Epicalyx* shorter than the calyx, short soft stellate-hairy, 6- or 7-segmented, segments shortly connate at the base, spatulate, 18–20 by 3.5–4 mm. *Calyx* short soft stellate-hairy on the abaxial surface, campanulate, 24–26 mm long, lobes ovate, the apex acute, 3-nerved. *Petals* yellow with red basal spots, short coarse stellate-hairy on the abaxial surface, glabrous on the adaxial surface, 34–36 by 18–25 mm, rounded at the apex. *Staminal column* glabrous, 16–18 mm long, antheriferous throughout, filaments 0.5–1 mm long. *Ovary* hairy, style arms 2–3 mm long. *Capsule* hairy, 15–20 by 12–13 mm, beak 1 mm long. *Seeds* angular reniform, 3–3.5 mm long, concentrically ribbed, short brownish to yellowish stellate-hairy or rarely glabrous.

Distribution — Australia (Geikie Gorge in northern Western Australia).

Habitat — Recorded as occurring on red clay soils on limestone at the foot of limestone karst.

Notes — 1. The species is easily distinguished by the branchlet indumentum; its long coarse stellate hairs are especially noteworthy. The lack of appreciation of the diversity within a plant group often leads to that group being under collected and hence poorly known in herbaria; this may be one of the reasons for the paucity of collections of

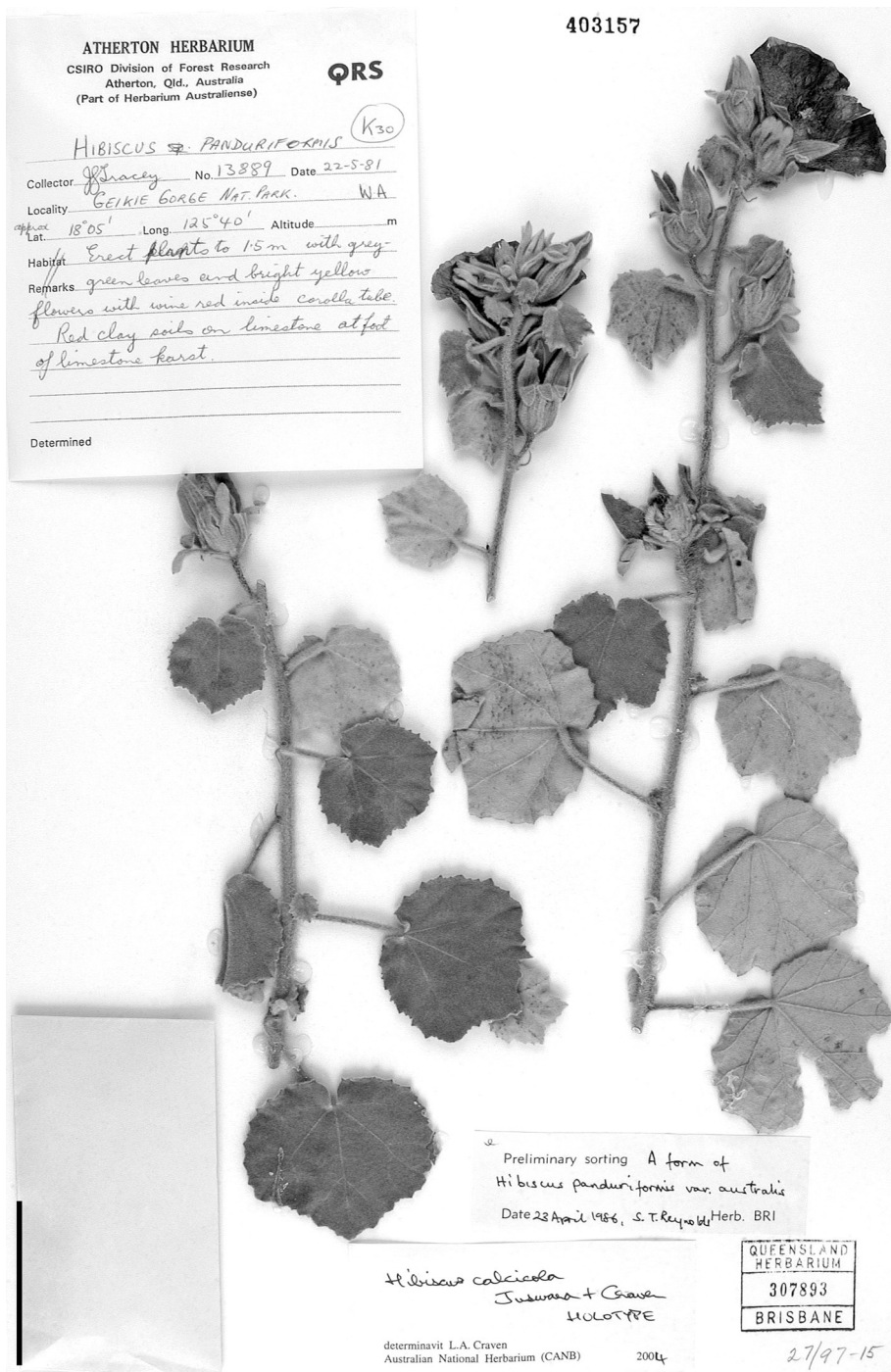


Fig. 3. Holotype of *Hibiscus calcicola* Juswara & Craven. — Scale bar = 5 cm.

H. calcicola, presently known only from the type collection. Further specimen collections are needed to fully circumscribe the species and to define its range. In view of the lack of thorough investigation in northern Australia, the species could well occur in other areas of limestone in the Fitzroy River Basin.

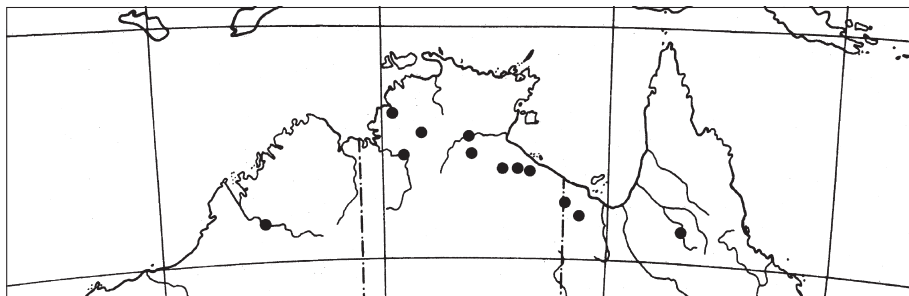
2. The epithet '*calcicola*' is proposed for this species because of its recorded association with limestone (calcium, hence limestone, and the Latin *-cola*, inhabitant or dweller).

4. *Hibiscus fluvialis* Juswara & Craven, *spec. nov.* — Fig. 4; Map 3

Affinis *H. panduriformi* Burm. f. a qua ramulis sine trichomatibus mollibus vel glandularibus, trichomatibus longis grossisque brevioribus (1.3–1.6 mm longis, in *H. panduriformi* 1.7–2.3 mm longis), segmentis epicalycis 6–7 (in *H. panduriformi* segmentis 7–9) differt. — Typus: Fryxell & Craven 4242 (holo CANB; iso AD, BISH, BRI, DNA, K, L, MEL, NY, PERTH, UC, US), Australia, Northern Territory, Daly River Mission, 22 May 1983.

Subshrubs or shrubs to 3 m tall. *Branchlets* long and short coarse stellate-hairy, without glandular hairs, indumentum not obscuring the epidermis, long coarse stellate hairs 1.3–1.6 mm long, short coarse stellate hairs 0.2–0.4 mm long. *Leaves* with the petiole 25–100 mm long, blade short soft stellate-hairy, indumentum whitish to yellowish, in overall shape broadly elliptic, 3-lobed, 36–106 by 28–95 mm, 2–4.7 times as long as the petals of the subtended flower, margin serrate-dentate to crenate, base cordate, apex acute. *Flowers* with the peduncle obsolete or up to 5 mm long, pedicel present. *Epicalyx* shorter to longer than the calyx, short soft stellate-hairy, 6- or 7-segmented, segments shortly connate at base, narrowly spatulate to linear-obovate, 9–20 by 1–2 mm. *Calyx* short soft stellate-hairy on the abaxial surface, campanulate, 14–20 mm long, lobes ovate, apex acute, 3-nerved. *Petals* yellow with red basal spots, short coarse stellate-hairy on the abaxial surface, glabrous on the adaxial surface, 15–24 by 8–12 mm, rounded at the apex. *Staminal column* glabrous, 10–17 mm long, antheriferous throughout, filaments 0.2–0.4 mm long. *Ovary* hairy, style arms 0.4–1 mm long. *Capsule* hairy, 14–20 by 10–12 mm, beak 1–2 mm long. *Seeds* angular reniform, 2–3 mm long, concentrically ribbed, glabrous or short brownish stellate-hairy.

Distribution — Australia (on the Fitzroy River at Noonkanbah in Western Australia, from the Victoria River eastwards to the McArthur River area in the Northern Territory, and in the Gregory River area in Queensland).



Map. 3. Distribution of *Hibiscus fluvialis* Juswara & Craven.



Fig. 4. Holotype of *Hibiscus fluvialis* Juswara & Craven. — Scale bar = 5 cm.

Habitat — Recorded as occurring in riverine habitats such as riparian closed forest; on flat sandy area in open forest of *Melaleuca leucadendra*; in a sandy river bed; in sand above river under *Casuarina*; and with *Casuarina cunninghamiana*, *Syzygium forte* and *Terminalia microcarpa*. Interestingly, the species appears to be associated always with rivers and seems usually to occur on sandy substrates.

Notes — 1. Characteristic features of this species are the small flowers (corolla 15–24 mm long), lack of glandular hairs on the branchlets and the short style arms (0.2–1 mm long).

2. The specific epithet of *H. fluvialis* is derived from the Latin *fluvialis*, stream, in reference to the riverine habitat in which this species typically occurs.

5. *Hibiscus multilobatus* Juswara & Craven, *spec. nov.* — Fig. 5; Map 2b

Affinis *H. panduriformi* Burm.f. a qua ramulis sine trichomatibus longis grossisque vel glandularibus, lamina folii corollis 0.8–1plo longiore (in *H. panduriformi* 3.6–4.4plo longiore), pedunculo longiore (7–48 mm longo, in *H. panduriformi* 0–6 mm longo), segmentis epicalycis 12–19 (in *H. panduriformi* 7–9), corolla longiore (45–74 mm longa, in *H. panduriformi* 15–37 mm longa), ramulis styli longioribus (3–5 mm longis, in *H. panduriformi* 0.2–1 mm longis) differt. — Typus: *Slee, Craven, Dunlop & Munns 2784* (holo CANB; iso DNA, MEL), Australia, Northern Territory, Kakadu National Park to Koolpin Gorge road, c. 6 km due E of El Sharana, 23 April 1990.

Subshrubs or shrubs to 3 m tall. *Branchlets* short soft stellate-hairy, without glandular hairs, indumentum obscuring the epidermis, short soft stellate hairs 0.8–1.2 mm long. *Leaves* with the petiole 20–60 mm long, blade short soft stellate-hairy, indumentum yellowish, in overall shape broadly elliptic, 3-lobed, 48–75 by 45–73 mm, 0.8–1 times as long as the petals of the subtended flower, margin serrate-dentate to crenate, base cordate, apex acute to rounded. *Flowers* with the peduncle 7–48 mm long, pedicel present. *Epicalyx* shorter than the calyx, short soft stellate-hairy, 12–19-segmented, segments shortly connate at base, narrowly spatulate to spatulate, 10–21 by 1–3 mm. *Calyx* short soft stellate-hairy on abaxial surface, campanulate, 20–28 mm long, lobes ovate, apex acute, 3-nerved. *Petals* yellow with red basal spots, short coarse stellate-hairy on the abaxial surface, glabrous on the adaxial surface, 45–74 by 35–38 mm, rounded at the apex. *Staminal column* glabrous, 15–26 mm long, antheriferous throughout, filaments 0.5–1 mm long. *Ovary* hairy, style arms 3–5 mm long. *Capsule* hairy, 18–25 by 14–19 mm, beak 1–2 mm long. *Seeds* angular reniform, 3–3.5 mm long, concentrically ribbed, glabrous or short brownish to yellowish stellate-hairy.

Distribution — Australia (the Katherine-upper South Alligator River area in the Northern Territory).

Habitat — Recorded as occurring in tall grassland with scattered trees of *Eucalyptus koolpinensis* in low lying area on red clay; on alluvial soil with *Sorghum* spp. near a floodway; on a lightly timbered plain on heavy grey stony pedocalcis soil; in partially cleared savannah on low ground; in an alluvial depression fringed with *Eucalyptus oligantha* and dominated by *Sorghum australiense*, *Chrysopogon latifolius*, other grasses and herbs; and on a sandy channel bank. The available specimen label data indicates that *H. multilobatus* occurs in low-lying situations that probably are seasonally inundated.



Fig. 5. Holotype of *Hibiscus multilobatus* Juswara & Craven. — Scale bar = 5 cm.

Notes — 1. This species is easy to recognise by the numerous epicalyx segments (12–19) and the longish soft stellate hairs of the branchlets (0.8–1.2 mm long).

2. The specific epithet of this species is derived from the Latin *multus*, many, and *lobus*, lobe, in reference to the numerous epicalyx segments.

6. *Hibiscus panduriformis* Burm.f. — Map 1

Hibiscus panduriformis Burm.f. (1768) 151, t. 47, f. 2. — *Hibiscus tubulosus* Cav. (1787) 161, t. 68, f. 2, nom. illeg. — *Abelmoschus panduriformis* (Burm.f.) Hassk. (1843) 134. — *Hibiscus panduriformis* var. *tubulosus* (Cav.) Hochr. (1900) 96, nom. illeg. — Type: A specimen has not been located and the name is typified by the illustration that forms part of the protologue.

Hibiscus velutinus DC. (1824) 452. — Type: *Riedlé s.n.* (holo n.v., photograph v. G-DC), Timor.

Subshrubs or shrubs to 3 m tall. *Branchlets* long coarse and soft stellate-hairy and short soft stellate-hairy, with glandular hairs, indumentum not obscuring the epidermis, long coarse stellate hairs 1.7–2.3 mm long, long soft stellate hairs 2.5–4 mm, short soft stellate hairs 0.3–0.4 mm long. *Leaves* with the petiole 20–180 mm long, blade short soft stellate-hairy, indumentum whitish to yellowish, in overall shape broadly elliptic, 3-lobed, 21–186 by 19–151 mm, 3.6–4.4 times as long as the petals of the subtended flower, margin serrate-dentate to crenate, base cordate, apex acute. *Flowers* with the peduncle obsolete or up to 6 mm long, pedicel present. *Epicalyx* shorter than the calyx, short soft stellate-hairy, 7–9-segmented, segments shortly connate at the base, narrowly spatulate to linear-obovate, 5–12 by 1–2 mm. *Calyx* short soft stellate-hairy on the abaxial surface, campanulate, 10–18 mm long, lobes ovate, apex acute, 3-nerved. *Petals* yellow with red basal spots, short coarse stellate-hairy on the abaxial surface, glabrous on the adaxial surface, 15–37 by 8–10 mm, rounded at the apex. *Staminal column* glabrous, 8–18 mm long, antheriferous throughout, filaments 0.6–1 mm long. *Ovary* hairy, style arms 0.2–1 mm long. *Capsule* hairy, 10–16 by 8–12 mm, beak 1–2 mm long. *Seeds* angular reniform, 2–3 mm long, concentrically ribbed, glabrous or short brownish to yellowish stellate-hairy.

Distribution — Australia (scattered in the Darwin, Newcastle Waters and McArthur River areas of the Northern Territory and scattered in the Gulf of Carpentaria, Charters Towers-Townsville, and Rockhampton areas of Queensland). As mentioned below, the species also occurs in Africa, Asia and Malesia.

Habitat — Recorded as occurring on black basaltic soil, in swampy *Eucalyptus* woodland on black soil; in a floodway with *Acacia*, *Iseilema* and *Eragrostis*; and on a river flood plain. The ecology of *H. panduriformis* is much less variable than that of *H. apodus* and *H. austrinus*. The black soil country in which the species occurs typically is poorly drained during the monsoon season although it becomes very dry during the dry season. These habitats are generally consistent with the ecology recorded for *H. panduriformis* by Van Borssum Waalkes (1966).

Notes — 1. No authentic specimens of *H. panduriformis* are known to exist (Van Borssum Waalkes, 1966; Sivarajan & Pradeep, 1996) but the name can be typified by the plate in the protologue. The locality from which Burman's specimens came is not precisely known. Merrill (1921) indicated that they may have come from India or Java.

2. The holotype of the name *H. velutinus*, a species included in *H. panduriformis* by Van Borssum Waalkes (1966), is lodged at G-DC and cannot be borrowed but an

image of the specimen was obtained. The species appears to be placed correctly with *H. panduriformis*.

3. So that the extent of variation across the *H. panduriformis* s.l. complex could be assessed, representative specimens from Africa, Madagascar, India and Indonesia were borrowed from G and K. Specimens from India and Indonesia (including Timor) were consistent with Burman's plate of *H. panduriformis* and the interpretation of this species adopted by Van Borssum Waalkes (1966) and Sivaraman & Pradeep (1996). Some of the African specimens also belong to this taxon indicating that *H. panduriformis* s.s. is widespread. Other specimens from Africa, in our opinion, are not conspecific with *H. panduriformis* s.s. and probably equate to a taxon established for African plants by Hochreutiner (1900), *H. panduriformis* var. *senegalensis* Hochr. (= *H. senegalensis* Guill. & Perr. nom. illeg., non Cav.), the type which we have not seen. It thus appears that there may be at least two specific level entities of the complex in Africa, i.e. *H. panduriformis* s.s. and a species requiring a new name in place of the illegitimate name *H. senegalensis* Guill. & Perr.

4. Two of the Australian species have glandular hairs, *H. panduriformis* and *H. apodus*. For recognition purposes, the glandular hairs are a good identification feature and these, together with the leaf blade being 3.6–4.4 times as long as the corolla and the short style arms (0.2–1 mm long), adequately characterise *H. panduriformis*.

5. A collection in MEL (*Palmer s.n.*, Queensland, Mitchell River, 1882) may represent this species. The material lacks glandular hairs as far as we can ascertain but, despite lacking adequate foliage, has the general facies of *H. panduriformis*. On the sheet also is a sample of bark fibre and the specimen label in the handwriting of F. Mueller bears the text "Fibre used by the natives of N. Queensl."

KEY TO THE SPECIES OF HIBISCUS SECTION TRICHOSPERMUM IN AUSTRALIA

- 1a. Distal leaves on flowering shoots sessile or subsessile, leaves concolorous, flowers pink ***H. brennanii***
- b. Distal leaves on flowering shoots distinctly petiolate, leaves discolorous, flowers yellow 2
- 2a. Branchlets with glandular hairs (in addition to stellate hairs) 3
- b. Branchlets without glandular hairs (only stellate hairs present) 4
- 3a. Petals 35–37 mm long; leaf blade 0.5–1 times as long as the petals, 21–58 mm long; peduncle absent; style arms 1.5–4 mm long **1. *H. apodus***
- b. Petals 15–37 mm long; leaf blade 3.6–4.4 times as long as the petals, 21–186 mm long; peduncle obsolete or up to 6 mm long; style arms 0.2–1 mm long **6. *H. panduriformis***
- 4a. Petals 15–24 mm long; leaf blade 2–4.7 times as long as the petals; style arms 0.4–1 mm long **4. *H. fluvialis***
- b. Petals 34–80 mm long; leaf blade 0.6–1.6 times as long as the petals; style arms 1–6.5 mm long 5
- 5a. Epicalyx 5–7-segmented; branchlets with the short soft stellate hairs 0.3–0.5 mm long (long coarse or long soft stellate hairs may also be present) 6

- b. Epicalyx 12–19-segmented; branchlets with the short soft stellate hairs 0.8–1.2 mm long (long coarse or long soft stellate hairs are absent) . **5. H. multilobatus**
- 6a. Branchlet indumentum obscuring the epidermis, the indumentum composed of soft stellate hairs (whether these long and short or only short) 7
- b. Branchlet indumentum not obscuring the epidermis, the indumentum composed of short soft and long coarse stellate hairs **3. H. calcicola**
- 7a. Branchlet indumentum composed of short soft stellate hairs; peduncle 2–34 mm long; style arms 1–6.5 mm long **2a. H. austrinus** var. **austrinus**
- b. Branchlet indumentum composed of short and long stellate hairs; peduncle up to 3 mm long; style arms 1.5–3.5 mm long. **2b. H. austrinus** var. **occidentalis**

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