

# *Cycas distans* P.I.Forst. & B.Gray (Cycadaceae), a new species from southern Cape York Peninsula, Queensland

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## Summary

Forster, P.I. & Gray, B. (2017). *Cycas distans* P.I.Forst. & B.Gray (Cycadaceae), a new species from southern Cape York Peninsula, Queensland. *Austrobaileya* **10(1)**: 74–84. A new species of *Cycas* from the Mitchell River watershed in southern Cape York Peninsula in Queensland is described, illustrated and diagnosed as *C. distans* P.I.Forst. & B.Gray. It is known from two populations and does not occur in any conservation reserves. A conservation status of Endangered is recommended for the species.

Key Words: Cycadaceae, *Cycas*, *Cycas distans*, *Cycas platyphylla*, Australia flora, Queensland flora, Mitchell River catchment, new species, taxonomy, Endangered conservation status

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## Introduction

The genus *Cycas* L. has 29 species recognised for Australia (Hill 1998; Forster 2001, 2005, 2011). Although some species are widespread, most tend to occur in geographically discrete areas in few (in several instances one) to many populations, commonly restricted to particular geological substrates. Botanical exploration in remote areas of Queensland continues to reveal previously undocumented populations of *Cycas* of known and previously unknown species. The new species (*C. distans* P.I.Forst. & B.Gray) described in this paper appears to be endemic to the Mitchell River watershed on southern Cape York Peninsula (Rustomji *et al.* 2010; Caitcheon *et al.* 2012) that flows west to the Gulf of Carpentaria. It was probably first collected in 1988 by Christine Dalliston (northern population); however, this collection is scanty (a very small, perhaps juvenile leaf and some loose microsporophylls) and adequate fertile material from this location remains to be recollected. In September 2015 a substantial

population was located by Bruce Gray near the Mitchell River (southern population), and fertile material collected. A further visit to this location in late 2015 was undertaken so that a morphological description based on *in situ* plants could be made.

Putative speciation processes in Australian *Cycas* have been discussed previously (Forster 2011) with a favoured model of speciation occurring by genetic drift in isolated populations, rather than genetic selection *per se* (*cf.* Gorelick 2009) with the species often being defined on a combination of many small differences, rather than any major difference in overall habit. *C. distans* is hypothesised to be most closely related to *C. platyphylla* on a morphological basis, existing as a similar appearing species that is geographically disjunct, having diverged initially as an allopatric population from common ancestors. This distribution and speciation pattern is characteristic of *Cycas* in Australia, but particularly over the long latitudinal range for the genus in Queensland.

The known populations of *Cycas distans* are roughly equidistant (150–190 km) to those of three *Cycas* species (*C. media* subsp.

*banksii* K.D.Hill, *C. platyphylla*, *C. tuckeri* K.D.Hill); however, these taxa occur in dissimilar habitats and are unlikely to have had any genetic connection with *C. distans* for some time given the large area of apparently unsuitable habitat inbetween. Genetic connectivity in *C. megacarpa* K.D.Hill has been demonstrated to exist to around 8.5 km with populations beyond this distance tending to diverge (James *et al.* 2017), so a distance of 150–190 km for these four northern species, putatively far exceeds the potential for sporadic gene flow. *Cycas platyphylla* is the only other *Cycas* that also occurs in the Mitchell River watershed with populations in the far eastern upper catchment of the Walsh River. The Walsh River eventually combines with the Mitchell River, and the studied population of *C. distans* is only c. 10 km to the north of the current day watercourse; whereas both *C. media* subsp. *banksii* and *C. tuckeri* occur in eastern flowing catchments. The Mitchell River catchment drains part of the highly complex geological Hodgkinson Province of Palaeozoic origin (Vos *et al.* 2006) with the location of *Cycas distans* (altitude c. 195 m) being to the west of the Palmerville and Mitchell fault zones, whereas *C. platyphylla* is well to the east of these zones at altitudes of 500–840 m.

The distribution of cycad populations is commonly dispersal limited (*cf.* Primack & Miao 1992) insomuch as apparently suitable habitat is abundant but the cycads peter out. Although a number of vertebrates (birds, mammals) putatively disperse cycad seed (Forster 2007; James *et al.* 2017), this dispersal is usually local (*sensu* Cain *et al.* 2000) and mostly within close proximity to the adult plants. The large size and weight of *Cycas* seed precludes both extremely long range (i.e. more than 1 km, *cf.* Corlett 2009) and long range (more than 100 m, *sensu* Cain *et al.* 2000) dispersal by everything apart from gravity and water. Rivers are important dispersal corridors for plants (Merritt & Wohl 2002) and the waterways that form the Mitchell River catchment have been eroding the landscape for millennia so it is not inconceivable that directed dispersal of cycad seed has occurred down the catchment due to

the unidirectional water flow (*cf.* Pulliam 1988) which currently has a very large discharge volume (>8 000 000 ML/year) (DNRM 2017; Brooks *et al.* 2009). Nevertheless, such a dispersal event (or events) must have not been a normal occurrence, but rather from an extreme or chance event (Higgins *et al.* 2003; Nathan 2006) such as catchment flooding and the landscape in which it occurred would not have been the same as that existing now. An analogous dispersal/speciation scenario has been described for *Livistona* palms (Kondo *et al.* 2012) that have seeds of a similar size and that morphologically appear suited to similar dispersal vectors. This dispersal scenario is compounded for cycads due to their dioecious nature and potential dependence on insects for pollination (Kono & Tobe 2007; Terry *et al.* 2009). An alternative hypothesis is that the cycad populations were continuous in the past and that extinction of the intervening populations has eventuated in the current disposition with the two species diverging morphologically.

## Materials and methods

The species description is based on examination by both authors of live plants in habitat and herbarium collections at the Australian Tropical Herbarium (CNS) and the Queensland Herbarium (BRI). The structure of the description is modelled on that for *Cycas terryana* P.I.Forst. (Forster 2011).

## Taxonomy

***Cycas distans*** P.I.Forst. & B.Gray **sp. nov.** with affinity to *C. platyphylla* but differing in the more robust habit (stems to 3.5 m tall and 15–30 cm diameter versus to 1.5 (?4) m tall and 10–15 cm diameter), longer median leaflets (130–236 mm long versus 90–170 mm long), very small (12–20 × 4–8 cm), narrowly-ovoid male cones (versus larger (15–20 × 8–11 cm) and ovoid) and much smaller megasporophylls 9–16 cm long (versus 6–32 cm long), with a smaller lamina 25–35 × 19–30 mm (versus 50–80 × 16–37) and with shorter apical spines (5–10 mm long versus 20–25 mm long). **Typus:** Queensland. COOK DISTRICT: Mitchell River catchment, 25 September 2015, *B. Gray 9689* & *S. Kitchener*

(holo: BRI [3 sheets + carpological]; iso: CNS *distribuendi*).

Arborescent cycad with stems to 3.5 m high (rarely multiheaded with 2 heads), 15–30 cm thick and with a bulbous base. Leaves 60–117 cm long, somewhat wavy towards the apex, strongly keeled in cross-section, olive-green, initially strongly blue-grey and tomentose; opposing leaflets inserted at 30–45° to the rachis and becoming flatter with age, the rachis usually terminated by paired leaflets, tomentose, glabrescent; petiole 25–34 cm long, 4–8 mm diameter, strongly blue-grey tomentose above, and dull olive green below, with 0–26 short teeth (pinnacanth) at top of petiole, 2–3.5 mm long and spaced 8–9 mm apart, often spineless. Leaflets 156–244 per leaf, 8–10 mm apart, straight to inflexed forward towards top of leaf, evenly spaced in lower half of leaf, then becoming more interleaved and more strongly keeled in upper half of leaf, flexible, margins recurved; median leaflets at 30–50° to the rachis, 130–236 mm long, 5.5–6.5 (–8.5) mm wide, olive-green with glaucous blue pruinose bloom when young; ± flat in cross section,

decurent for 4–12 mm, absent at base of leaf, midrib slightly raised above, more prominent below and yellowish. New growth densely tomentose with ferruginous-brown indumentum, glabrescent. Cataphylls initially soft, soon pungent, linear, 8–10 cm long, densely tomentose for entire length with fawn-ferruginous indumentum, more ferruginous-brown near base. Microsporangiate cones narrowly-ovoid, 12–20 cm long, 4–9.5 cm diameter, with dense fawn-ferruginous indumentum; microsporophylls 14–28 mm long, fertile zone 8–15 mm long, 4–9 mm wide; apical spine antrorsely recurved, 4–7 mm long. Megasporophylls 9–16 cm long, when young with dense ferruginous-brown indumentum, aging grey, eventually glabrescent and olive-green; ovules 2 to 4; lamina broadly triangular 25–35 mm long, 19–30 mm wide, strongly dentate with well developed, antrorse teeth 2–4 mm long, apical spine 5–10 mm long. Seeds ovoid, 28–32 mm long, 23–29 mm diameter, sarcotesta *c.* 3 mm thick, blue pruinose, olive green beneath wax covering, cream-yellow then becoming purplish-red when ripe. **Figs. 1–13.**



Fig. 1. *Cycas distans* habitat (population vouchers: Forster PIF43235A & B *et al.*, BRI). Photo: P.I.Forster.



**Fig. 2.** *Cycas distans*. Large individual with S. Kitchener for scale (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

**Additional specimens examined:** Queensland. COOK DISTRICT: On Pinnacle to Kimba Road, Jun 1988, *Dalliston CC41* (BRI); Mitchell River catchment, Sep 2015, *Gray 9688 & Kitchener* (BRI, CNS); *ibid.*, Sep 2015, *Gray 9690 & Kitchener* (BRI, CNS); *ibid.*, Nov 2015, *Forster PIF43235A, Kitchener & McDonald* (BRI); *ibid.*, Nov 2015, *Forster PIF43235B, Kitchener & McDonald* (BRI).

**Distribution and habitat:** The two populations both occur in the Mitchell River catchment. Plants occur as dense to sporadic populations in bloodwood – stringybark woodland dominated by *Eucalyptus tetradonta* F.Muell. with occasional *Corymbia clarksoniana* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson and *Erythrophleum chlorostachys* (F.Muell.) Baill., on red sandy soil derived from laterised surfaces at altitudes between 195 and 240 m above sea level.

**Notes:** A superficial examination of the southern cycad population immediately gives the impression that the plants are overall very similar to *Cycas platyphylla*, but noticeably trunked to 3.5 m tall and with thicker stems (**Figs. 1 & 2**). *Cycas platyphylla* invariably

occurs in skeletal soils on rocky slopes (metasediments and volcanics such as granites and rhyolites) and it is rare to find individuals that are more than 1.5 m tall with records of plants 2 m high usually including the leaves as part of the overall measurement. Hill (1992) mentions “rarely to 4 m”; however, we have not observed individuals to this height. The two species differ most noticeably by leaf morphology and male reproductive features. *C. distans* has longer median leaflets, very small, narrowly-ovoid male cones and much smaller megasporophylls (**Table 1**). The leaflets of *C. distans* do also appear as more apically inflexed than in *C. platyphylla*; however, examination of herbarium material of the latter found that this also occurs in that species. There are also some apparent differences in indumentum cover and colour on the cataphylls and megasporophylls (**Table 1**); however, this can vary depending on environmental conditions and subjectivity, hence it is not emphasised in the current comparison.

**Table 1.** Comparison of character states for *Cycas distans* and *C. platyphylla*

Character State	<i>C. distans</i>	<i>C. platyphylla</i>
<b>Stem size</b>	to 3.5 m tall × 15–30 cm diameter	to 1.5 (?4) m tall × 10–15 cm diameter
<b>Median leaflet size (length × width in mm)</b>	130–236 × 5.5–6.5 (–8.5)	90–170 × 4–6
<b>New growth indumentum colour*</b>	ferruginous-brown	orange-brown
<b>Leaflet colour mature leaves*</b>	olive-green after being initially blue-grey	olive-green after being initially bluish
<b>Cataphyll indumentum colour*</b>	ferruginous-fawn	orange-brown
<b>Microsporangiate cones</b>	narrowly-ovoid, 12–20 × 4–8 cm	ovoid, 15–20 × 8–11 cm
<b>Megasporophyll dimensions</b>	9–16 cm long; lamina 25–35 × 19–30 mm; apical spine 5–10 mm long	16–32 cm long; lamina 50–80 × 16–37; apical spine 20–25 mm long

\*colours are variable depending on age and environmental conditions



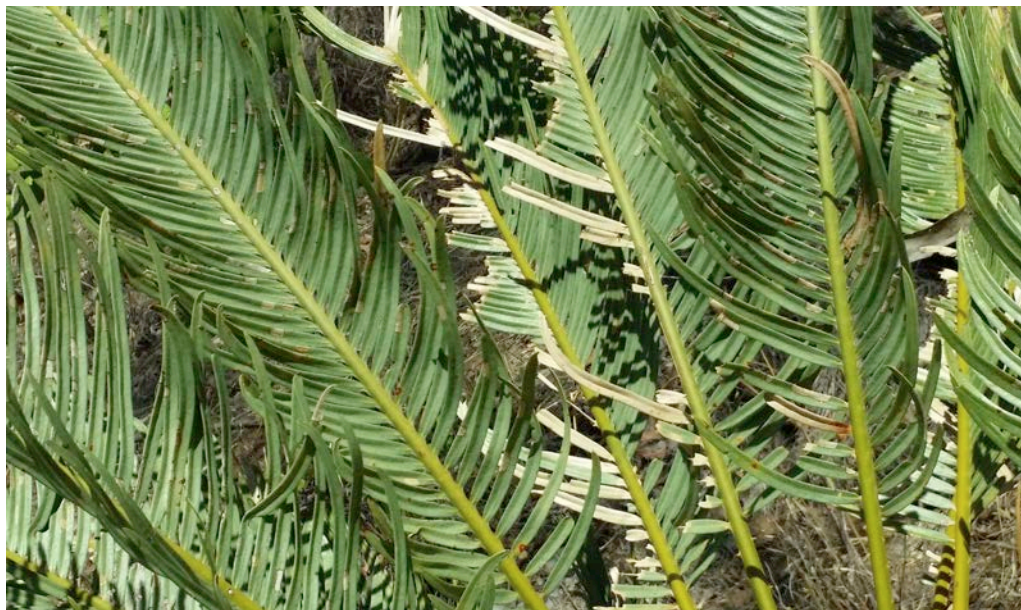
**Fig. 3.** *Cycas distans*. New expanding leaves demonstrating indumentum colour and cover (population vouchers: Forster PIF43235A & B *et al.*, BRI). Photo: P.I.Forster.



**Fig. 4.** *Cycas distans*. Individual photographed in September, demonstrating glaucous blue colour of leaves (population voucher: Gray 9688, BRI). Photo: B.Gray.



**Fig. 5.** *Cycas distans*. Multiheaded individual resulting from past damage to growing point (population vouchers: Forster PIF43235A & B *et al.*, BRI). Photo: P.I.Forster.



**Fig. 6.** *Cycas distans*. Leaves showing inflexion of leaflets (population vouchers: Forster PIF43235A & B *et al.*, BRI). Photo: P.I.Forster.



**Fig. 7.** *Cycas distans*. Shoot apex of female plant with young expanding megasporophylls surrounded by cataphylls (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: K.R. McDonald.



**Fig. 8.** *Cycas distans*. Female plant with old megasporophylls (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

**Etymology:** The species epithet is from the Latin *distans* (the present participle of *distō*) and means ‘standing apart’, an allusion to the disjunct occurrence of this species.

**Conservation status:** The species is known from two populations with only one of these having been examined this century. At the single population that has been visited, there is probably less than 1000 plants in total scattered over an area of two or three hectares, with very few seedlings or juvenile plants evident (**Fig. 13**). Whilst there are no known obvious threats to the species (apart from inappropriate fire regimes that may impact on reproduction and recruitment [*cf.* Forster 2007]), the number of populations and individuals warrant the species being

listed as **Endangered** on the criterion B2 (a,b) (IUCN 2001). This area of southern Cape York Peninsula has been inadequately explored for flora away from roads and tracks so potentially more populations of this species may be yet discovered. The general habitat type where the species has been found is widespread in the region, so causal threatening processes common to many cycads (failure of recruitment leading to skewed population structures, lack of dispersal despite available habitat) (Forster 2007) appear to be operating.

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**Fig. 9.** *Cycas distans*. Male plant with cone at pollen shedding stage (population vouchers: Forster PIF43235A & *B et al.*, BRI). Photo: K.R. McDonald.





**Fig. 10.** *Cycas distans*. Male plant with old dried cone (population vouchers: Forster PIF43235A & B et al., BRI). Photo: P.I.Forster.



**Fig. 12.** *Cycas distans*. Mature seed cleaned of sarcotesta (population vouchers: Forster PIF43235A & B et al., BRI). Photo: P.I.Forster.



**Fig. 13.** *Cycas distans*. Clumped seedlings around an adult female plant (population vouchers: Forster PIF43235A & B *et al.*, BRI). Photo: P.I.Forster.

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