

**ASGAP PALM & CYCAD STUDY GROUP**

ISSN 1142-2425

Newsletter No. 86 June 2003

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**Cycads in cultivation at Greenbank :**

A number of Northern Territory and Kimberleys Cycas species have been slowly declining over the past five to fifteen years, with the last *C. calcicola* rotting off last winter, after 15 years. Several (10-12) small *C. armstrongii* seedlings have died off over the last five years, and four or so *C. maconochiei* & *C. conferta*, and one or two each of *C. arnhemica*, *C. pruinosa* and *C. furfuracea*.

All showed similar symptoms, flushing a little later each year, with fewer fronds, and often going dormant earlier, and eventually dying due to a lack of energy reserves. A *C. canalis* with a trunk @ feet tall at transplanting has grown perfectly well, as has a *C. arnhemica* with a 45 cm trunk. The latter has been kept dry while leafless, while the former is in the ground, & has grown about 20 cm of trunk since 1988.

North Queensland Cycas species were a little different, with *C. cairnsiana* seedlings often dying in the winter in early years, but almost all those which lasted five years are still on hand, growing slowly, after twelve years or so. In winter they lose most, but usually not all, of their fronds. *C. angulata* plants have a different habit, with some dying down in winter, as in the wild, and others choosing any time of the year. None have died. *C. silvestris* also survived, but grow slowly, unlike up on Cape York. *C. media* ssp. *ensata* from Cape York are growing quite well: some defoliated last winter. The more southerly sub-species of *C. media* have not defoliated unless frosted.

**SUBSCRIPTIONS :** Subs are due on July 03, & the table below shows what my records say regarding you. A tick means paid-up, a blank means 'not paid', & N.A. means 'not applicable'.

Years: 99-'00   '00-'01   '01-'02   '02-'03   '03-'04   '05 & later

**HYBRIDS, HYBRID SWARMS AND LIKELY NEW SPECIES IN N.S.W. MACROZAMIAS :**

I have had two recent visits from Mike Young, who is semi-retired from the Mt. Lofty (Adelaide) Botanic Garden, but is still active in both their living and herbarium fern and cycad collections. He has spent many days looking at N.S.W. macrozamia in habitat, so that he can be sure of correct identification of the macrozamia for the collection he is setting up at Mt. Lofty, as well as satisfying his own interest in cycad systematics.

In most plants and animals, hybrids are intermediate between the parents, for most traits. Many cycad hybrids, on the other hand, show some fronds that look like one parent, and on the same plant, some that look like the other. This phenomenon is shown in many apparent hybrids between *M. polymorpha* and *M. glaucophylla*, and also *M. diplomera* and *M. heteromera*.

Fig. 1 displays a probable F1 hybrid between green-leaved *M. polymorpha* and the blue-leaved *M. glaucophylla*, while Fig. 2 shows a likely hybrid between *M. diplomera* and *M. heteromera*. Note divided leaflets at the lower part of the frond, & undivided leaflets at the upper part. Since most cycad seeds germinate fairly close to their female parent, it is often possible to locate the likely parents of an apparent hybrid, especially in the case of *polymorpha*-*glaucophylla* hybrids. These two species only have a narrow zone of overlap, and may have only come into relatively recent contact. The *diplomera*-*heteromera* overlap is far wider, and many plants appear to be later-generation hybrids.

At the northern end of its distribution, *M. polymorpha* plants all have simple leaves. It extends quite a bit further north than is recognised in current literature, such as Hill & Osborne's book. *M. heteromera* and *M. polymorpha* seem to form a cline, with *M. polymorpha* at the southern end almost all having divided leaflets. Plants near Coonabarabran seem about halfway between the two extremes. Plants near Bulgadic seem to fit the latter generations of a *heteromera*-*diplomera*-*polymorpha* swarm, with plants

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showing varying traits of all three "species". Plants in Binnaway State Forest appear to be "pure" diplomera.

Mike has also been surveying various populations of *M. secunda*, *reducta*, *spiralis*, *communis*, *concinna*, *montana* and *flexuosa*. All these species contain areas with great variation, due to hybridising in many or all cases. *Secunda-reducta* hybrids are common in some areas.

I will comment on the possible new species embedded in *M. communis*, *M. spiralis*, *M. flexuosa* and *M. montana*, after Mike (and/or I) has looked at them more closely. He has lodged specimens from most of these areas, with the Adelaide Herbarium, and for recent collections, also the Brisbane Herbarium. Paul Forster at the latter has published quite a few papers on *Macrozamia*s, and he and a collaborator at the University of Queensland are hoping to be funded next year for a DNA study of the small *macrozamia*s, both in "pure" and hybrid populations.

One of the incentives to studying DNA is that recent studies of isozyme differentiation between the *M. heteromera* group (including *M. heteromera*, *M. humilis*, *M. sp. aff. humilis*, *M. sp. aff. heteromera* and *M. polymorpha*; I.K. Sharma et al., 1999 *Biochem. Systematics and Ecology* 27: 67-77) and the *M. pauli-guilielmi* group (including *M. pauli-guilielmi*, *parcifolia* and *crassifolia*; I.K. Sharma et al., 1998, *Biochem. Systematics and Ecology*, 26: 45-54) have not always supported species boundaries based on morphological traits. The first paper mentioned found little difference between the five species. Other plant studies have sometimes shown poor correlation between allozyme data and morphological traits, and allozymes are unusual genes being co-dominant and recognisable by their electric charges (in gel electro-phoresis). Direct DNA studies should sample a random group of more "ordinary" genes, and larger numbers of them, and so be more reliable due to both factors. Small amounts of leaf tissue can be stored for decades (did I hear millennia?) before analysis, if handled correctly.

#### CYCAS VARIANTS :

My wife and I are just back from fifteen days in the Northern Territory. Much of the time was spent in social engagements, or searching for flowering plants, but we saw many cycads also. The late onset of the wet season (we still had showers in early June) led to burnt areas of the Top End having all cycads busy with flushes of new leaves. In most populations of *Cycas armstrongii* and *C. canalis* the new leaves were bright green, but ten percent or so were blue. In *C. maconochiei* all were bluish green at the sites visited (Finniss River, Cox Peninsula, Dundee Beach, Fogg Bay), with unburnt areas a dull green as would be usual.

In the area around the Douglas Hot Springs, not far from Pine Creek as the crow flies, but nearer Adelaide River township by road, there were quite a few cycads, but none with tall trunks. Most had blue leaves, and some were green, and all had healthy fronds although the area had not been burned recently. The late Wet keeping the cycads from going deciduous already? About half the cycads had narrow leaflets, and the rest had broad leaflets, with none having medium-sized leaflets. Perhaps one or both types had been planted by man.

#### CYCADS AND INSECTS :

A lot of research in recent years has demolished the old idea of all cycads being exclusively wind-pollinated: perhaps none are. The majority appear to be pollinated by beetles, with many African and American cycads seeming to be pollinated each by a specific species of beetle ("God must have loved beetles, he made so many of them"). This specificity may help to explain why many African cycad species have such small and localised populations.

In Australia, many cycads produce pheromones (chemical sexual attractants) which attract either beetles or thrips, and some produce both. Weevils also play a part. Research on pheromones is proceeding. Most local cycads are pollinated by more than one insect, and doubtless all can also be partly wind-pollinated when growing in dense stands.

#### FROST DAMAGE :

To my surprise, last winter several *M. moorei* plants with trunks about 0.8m were frosted. The fronds, although full size, were relatively new, and must have still been a bit soft. Not all fronds were affected.

and those that were were not affected along their full length. Older fronds were not affected. The frosted areas turned coppery-brown, not the white of full-frost-destruction. The frost that did the damage was -6 degrees C. down the slope a little, but less near the M. moorei I would think.

TOP



FIG. 2



FIG. 1