

Restionaceae – a synopsis

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The following notes covering the monocot family Restionaceae were presented and discussed at the end-of-year Auckland Botanical Society workshop held at the Auckland Regional Botanic Gardens in December 2003. Sedges and rushes were also discussed by Rhys Gardner, Chris McKain and Mike Wilcox respectively.



Terry Hatch with *Cannomois virgata*, October 2004 (Photo by Steve Benham).

Introduction

Restiads are a rather bizarre, old group of Southern Hemisphere graminoids belonging to the Gondwanan monocot family Restionaceae (Johnson & Briggs 1981). Some authorities have placed Restionaceae in the Order Restiales being a sister group to the Poales, allied to the grasses. Evolution of the restiads occurred in isolation on parallel lines in different lands from a common ancestor before the separation of Gondwana i.e. in the late Cretaceous. Radiation occurred at the same time as Proteaceae were being dispersed. Sea-levels were dropping and large sandy areas of the epicontinental seabed were being exposed providing ideal habitats for restiad colonisation, as were margins of swamps and watercourses. Grasses did not arrive until much later – in the Eocene epoch.

Restionaceae comprise 53 genera and 300 species of xeromorphic plants. The main centres of distribution are Australasia and southern Africa. The family is a particularly important component of the Mediterranean climate floras of SW Western Australia and the Cape Province of South Africa. There are two notably disjunct taxa – *Apodasmia chilensis*, a Chilean species, and *Dapsilanthus disjunctus* in South East Asia, both of which were formerly placed in *Leptocarpus*.

Australia has the largest diversity of restionaceous genera - according to Briggs and Johnson (1999) there are 34 genera / 152 species, with 100+ in the SW Botanical Province of Western Australia. Southern Africa has 19 genera and 320 species – fewer genera but larger speciation according to Linder 1984. New Zealand has 3 genera and 4 species. Habitats range

from dry heathlands, sandplains, vleis, to permanent swamps.

The first collections of Restionaceae were made in the late 17th Century at the Cape of Good Hope and were erroneously described as horsetails – *Equisetum capense* subsequently named *Elegia capensis*.

Diagnostic characters

- leaves on adult plants reduced to open sheaths on aerial stems
- wind pollinated – stigmas exerted from the flowers pendent in the windstream
- flowers have no nectaries
- pollen is not sticky (unlike insect pollinated plants) and it is dispersed like dust – pollen grains are round and smooth which improves their aerodynamics
- all species are dioecious although there is a southern African species *Ischyrolepis feminea* in which no males are known to exist but still appears to set seed. Perhaps apomixis exists in Restionaceae?
- some species have bracts and spathes which encircle spikelets of female flowers – these act as air-scoops which funnel wind past the styles resulting in pollen dropping in
- seed dispersal methods vary – wind, gravitational, water, ants. A most unusual seed dispersal mechanism occurs in the Australian genus *Alexgeorgea* in which the fruits develop geocarpically on subterranean rhizomes where they remain attached to the parent clone until germination
- vast majority of species germinate after fire although similar germination rates occur after natural or human disturbance – therefore restiads are regarded as disturbance opportunists
- form tussocks or creeping rhizomes. The latter have survival mechanism by creating thick mats of growth which re-sprout after fires

Australian Restionaceae

Of the 152 species in 34 genera, 86% of them flower between late winter and summer with 37% flowering during winter/spring and 50% late spring / summer. Some 73% show a protracted seed development period of 10-12 months – probably climate related. Around 90% of species possess non-specialised seeds with regards to seed dispersal – these are distributed passively by wind and water. Dry land species from the genera *Desmocladus*, *Hypolaena*, *Loxocarya* are known as pseudo-arillate taxa. These have seeds with small appendages (elaiosomes) which contain oils that are ant attractants. Ants carry off the nuts underground thus protecting them from fire and mice.

Only three species are totally dependent on fire for regeneration by seed, the majority being re-sprouters.

Loxocarya gigas from Western Australia is the largest, with culms 2.5 metres tall. Only a few remnant populations of viable size now remain. Farmers cut the bamboo-like culms and weave them into fences and windbreaks.

Southern African Restionaceae

With 19 genera 320 species, the Restionaceae take the place of Poaceae in the Cape Floristic Region. All 19 genera occur in the SW Cape province of South Africa. Only in southern Africa does Restionaceae dominate whole vegetation types e.g. fynbos. Restiads are found on the oligotrophic soils – whereas Poaceae occur on nutrient rich soils. Being wind pollinated there are some good fossil deposits, with the oldest fossil pollen from the Palaeocene epoch 65-60 million years ago in Namaqualand. During the Miocene epoch restionaceous pollen had been mixed with pollen from plants of a tropical origin. This was before the advent of today's sclerophytic flora. During the Pliocene these tropical species were replaced with modern fynbos species, indicating that restiads must have already been pre-adapted for the summer drought climate that was evolving at this time.

There are three methods of seed dispersal:

- wind – some species have winged seeds other have persistent perianths that can act as wings
- ants – elaiosomes found on the nuts of *Cannomois* and 4 other genera
- dehiscent ovaries – ornamentation on seed coats varies from one species to another. Texture and shape mimics sand grains on which it has fallen.

Many species regenerate after fire except for *Elegia cuspidata* and *Cannomois virgata*. These are mat-formers producing thick layers of rhizomes which survive better than the tussock-formers. As defence against browsing vertebrates older restiad clumps are heavily lignified, young culms are rich in tannins and silicon is present in the culms

Several of the African restiads are useful to man. For thatching several species were regionally important e.g. *Chondropetalum tectorum* W. Cape and *Thamnochortus insignis* – S.Cape. The latter species is the only one used today. The use of restiads for thatching only began in the early 1900s. Culms are cut in winter on rotation, every 5 years. Other uses are

Restiads cultivated in New Zealand - June 2004

Taxa

Apodasmia similis (Edgar) B.G.Briggs & L.A.S.Johnson
Askidiosperma esterhuyseniae (Pillans) H.P.Linder
Baloskion tetraphyllum (Labill.) B.G.Briggs & L.A.S.Johnson
Calopsis paniculatus (Rottb.) Desv.
Empodisma minus (Hook.f.) L.A.S.Johnson & D.F.Cutler

Date of introduction to NZ.

NZ sp.
 1988
 1968
 2003
 NZ sp.

house construction – *Cannomois virgata*, brooms – *Cannomois paniculatus*; soil binders to prevent and control soil erosion; horticultural uses – hardy plants, sculptural landscaping species, and easy to grow. Their popularity has increased since the 1990s when propagation became easier with the advent of smoke treatment for breaking dormancy although this method doesn't have any effect on the nut-fruited species.

New Zealand Restionaceae

Apodasmia similis (syn. *Leptocarpus similis*)

N., S., Stewart Island, Chatham Islands (Briggs & Johnson, 1998). Leaves reduced to persistent sheaths closely appressed to culm. Culms 50-150 cm. long, grey green or reddish orange. Coastal ecology among dunes and salt marshes. Inland on marshy lake shore and near hot springs at Rotorua.

Empodisma minus (syn. *Calorophus minor*)

N., S., Stewart Island, but rare in Marlborough and Canterbury. Eastern and southern Australia and Tasmania. Lowland swamps and mountain bogs. Culms 15-40cm long, sometimes up to 1m and much branched. Leaves reduced to mucronate sheaths closely appressed to culm. Ovary – 1 locular – small ovoid nut.

Sporadanthus ferrugineus – bamboo rush.

(specific epithet *ferrugineus* refers to the distinctive rusty-coloured inflorescences). A new endemic taxon described by de Lange *et al.* (1999). Late successional species of raised peat bogs of the northern North Island. It is killed by fire so recruitment is from seed. Distinguished from *S. traversii* by its more robust brittle culms with swollen bases, different coloured rhizome scales and culms and smaller dehiscent fruit. Up to 4 m high, forming dense rafts on acidic peat from Kaitaia in the north to just south of Hamilton. In the Waikato restiad bogs commenced development about 13,000 B.P. Over time the accumulation of *Empodisma* restiad peat caused the surface to rise creating favourable conditions for *Sporadanthus*.

Sporadanthus traversii

A Chatham Island endemic, less specialised in its habitat preference than *S. ferrugineus*. Colonises a variety of mid – late successional peat habitats, coastal scarps, peaty dune hollows and lake margins. Eliminated by fire but can re-establish faster than *S. ferrugineus* which can take up to 12 years.

Taxa	Date of introduction to NZ.
<i>Cannomois virgata</i> Hochst.	1990
<i>Chondropetalum ebracteatum</i> (Kunth) Pillans	1990
<i>Chondropetalum hookerianum</i> Pillans	1990
<i>Chondropetalum mucronatum</i> Pillans	1989
<i>Chondropetalum tectorum</i> (L.f.) Rafin.	1989
<i>Dovea macrocarpa</i> Kunth	1989
<i>Elegia capensis</i> (Burm.f.) Schelpe	1988
<i>Elegia cuspidata</i> Masters	1988
<i>Elegia equisetacea</i> Masters	1989
<i>Elegia fenestrata</i> Pillans	1990
<i>Elegia filacea</i> Masters	2003
<i>Elegia grandis</i> Kunth	1988
<i>Elegia grandispicata</i> Linder	1990
<i>Elegia spathacea</i> Masters	1989
<i>Elegia thyrsoifera</i> (Rottb.) Pers.	1990
<i>Ischyrolepis sieberi</i> (Kunth) Linder	2003
<i>Ischyrolepis ocreata</i> (Kunth) Linder	1990
<i>Ischyrolepis subverticillata</i> Steud.	1989
<i>Restio bifurcus</i> Nees ex Masters	1989
<i>Restio festucaeformis</i> Masters	2003
<i>Restio quadratus</i> Masters	2003
<i>Rhodocoma arida</i> H.P.Linder & J.H.Vlok	1990
<i>Rhodocoma capensis</i> Nees ex Steud	1990
<i>Rhodocoma fruticosa</i> (Thunb.) Linder	1990
<i>Rhodocoma gigantea</i> (Kunth) Linder	1990
<i>Sporadanthus ferrugineus</i> de Lange <i>et al.</i>	NZ sp.
<i>Sporadanthus traversii</i> (F.Muell.) F.Muell. ex Kirk	NZ sp.
<i>Staberoha aemula</i> Pillans	1990
<i>Staberoha remota</i> Pillans	1990
<i>Thamnochortus cinereus</i> Linder	1988
<i>Thamnochortus comptonii</i> Pillans	1990
<i>Thamnochortus fraternus</i> Pillans	2003
<i>Thamnochortus insignis</i> Masters	1987
<i>Thamnochortus platypteris</i> Kunth	1989
<i>Thamnochortus rigidus</i> Esterh.	1990
<i>Thamnochortus spicigerus</i> (Thunb.) Sprengel	1989

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