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## Two new species and three new combinations in Cyperaceae of New Caledonia and Australia

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### Abstract

Two new species of Cyperaceae endemic to the ultramafic area of southern New Caledonia are described: *Chorizandra gigantea* J.Raynal ex K.L.Wilson and *Schoenus rivularis* J.Raynal ex K.L.Wilson. New combinations are made for three species of Cyperaceae in Australia and New Caledonia: *Machaerina johnsonii* (K.L.Wilson) K.L.Wilson, *M. planifolia* (Benth.) K.L.Wilson and *M. veillonis* (J.Raynal) K.L.Wilson.

### Introduction

New Caledonia is a hotspot for biodiversity, with a flora that is both rich and highly endemic at specific level. Nearly 78% of flowering plant species are endemic, with the level of endemism rising to 92% for species on the ultramafic substrate that covers nearly one-third of the island (Jaffré 1992, Morat et al. 2012). The family Cyperaceae is well represented in New Caledonia, with about 90 native species, about 35% of them endemic (Morat et al. 2012). The late Jean Raynal clarified the systematics of many members of the family Cyperaceae found in New Caledonia. However, his premature death left several species undescribed. Two of these are here published, using the manuscript epithets he had written on specimens in P. New combinations are made for another New Caledonian species and two from Australia in light of recent molecular studies (e.g. Viljoen et al. 2013) indicating that *Baumea* and *Machaerina* belong in the same clade.

I dedicate this paper to the memory of Jean Raynal (1933–1979), a botanist truly ‘au tout rang mondial’ (Leroy 1980), and also to my late colleague Elizabeth Brown (1956–2013), who shared my enthusiasm for the fascinating flora of New Caledonia.

#### *Chorizandra* R.Br.

*Chorizandra* is a small genus of six species, found only in Australia and New Caledonia. It belongs to subfamily Mapanioideae, members of which have inflorescence structures that differ from the rest of the family. What appear to be spikelets on casual observation in this subfamily are actually compact, complex spike-like reproductive units. These units are subtended by an inflorescence bract and a split prophyllar bract; they are made up of a variable number of usually scale-like bracts that are sterile (often scattered through the unit) or subtend a single anther or a female flower (only the uppermost). The long-running debate about whether the female flower is truly terminal in Mapanioideae – a key difference from the structure of indeterminate spikelets found in the rest of the family – has been resolved in the affirmative by the ontogenetic and gene protein study of *Lepironia* (Prychid and Bruhl 2013). Eiten (1976) regarded this basic reproductive unit as a pseudanthium.

Kukkonen (1984) called this unit a spicoid, defined as a lateral, determinate or closed floral unit that would be called a spikelet except that it terminates in a flower. Simpson (1992) followed this terminology for *Mapania*. In the *Flora of New South Wales* and *Flora of Victoria* treatments (Wilson 1993, 1994a, respectively) I used the term pseudospikelet as a neutral descriptive term suitable for a general audience. Developmental studies such as those on *Exocarya sclerioides* (Richards et al. 2006), *Paramapania parvibractea* (Vrijdaghs et al. 2006) and *Lepironia articulata* (Prychid and Bruhl 2012) are clarifying the reproductive units in the subfamily. The current investigation of *Chorizandra* by C. Prychid and J. Bruhl (pers. comm.) is not yet completed, so I am here using the terminology of Wilson (1993, 1994a), viz., calling the basic reproductive unit a pseudospikelet and using the term glume for the bracts that subtend male or female reproductive parts.

The inflorescence in *Chorizandra* is head-like: a dense cluster of numerous pseudospikelets. ‘Core’ is here used for the solid central area of the inflorescence to which the pseudospikelets are attached. The axis of a pseudospikelet remains attached to the core after the floral parts of the pseudospikelet drop at maturity. The shape of the core is easily observed on over-mature specimens or, if material is plentiful, by cutting longitudinal and transverse sections of the inflorescence.

Glume shape in *Chorizandra* changes gradually from the base to apex of a pseudospikelet. Glumes range from more or less folded laterally and concave near the base of the pseudospikelet to flattened (or cucullate in *C. cymbaria*) near the top, the basal glumes broadening to their apex (often spathulate) while those near the top of the pseudospikelet are more or less linear (parallel-sided). Glume length in the following description refers to the widest glume in a pseudospikelet (i.e., those near the base of the pseudospikelet). Glume colour in the genus is generally paler (white to pale brown) at the base of a glume and darker golden brown or red-brown at the apex of a glume.



**Fig. 1.** *Chorizandra gigantea* – typical example of this taxon (NSW201918) showing elongated culms and compact pseudolateral inflorescence (at bottom right).



**Fig. 2.** *Chorizandra gigantea*. **A**, culm showing pluritubulose pith. **B**, an older inflorescence (top) showing the raised solid core covered in pseudospikelet axes from which most of the floral parts have fallen, and a younger inflorescence (bottom) showing the partly sheathing base and more or less unitubulose pith of the lowest inflorescence bract and the dried styles exerted from pseudospikelets (NSW201918).

***Chorizandra gigantea*** J.Raynal ex K.L.Wilson, **sp. nov.**      **Figs 1, 2**

**Diagnosis:** A *C. cymbaria* culmis grandioribus ac non verruculosus, plerumque pluritubulosis, inflorescentia globosa, ellipsoidea vel hemispherica differt. A *C. australis* culmis plerumque pluritubulosis, glumis minoribus pallidoribus differt.

**Type:** New Caledonia: Province Sud: Grand Lac, *H.S. MacKee* 3375, 15 Nov 1955; holo: P607399; iso: NSW46045.

*Erect* aquatic perennial, with culms closely packed on a tough rhizome. *Culms* terete, 90–200 cm long, 3–7 mm diam. about halfway along its length, pluritubulose, rarely unitubulose above (transverse septa not obvious externally when fresh), glabrous, longitudinally finely striate but not verruculose, mid-green. *Lower leaves* reduced to sheaths; *upper leaf blades* terete, to 180 cm long, shorter than culms, about same diameter as culms, pluritubulose, rarely unitubulose above; sheaths loose, pale brown at maturity, to 30 cm long, variably septate-nodulose on adaxial surface. *Lowest inflorescence bract* erect, appearing continuous with culm, 12–40 cm long, pluritubulose or rarely unitubulose, septa not visible externally; margins of the base of this bract and of several much smaller inflorescence bracts above the lowest hyaline to yellow-chartaceous, not or faintly red-dotted, slightly enlarged but not strongly sheathing inflorescence. Inflorescence pseudolateral, hemispherical to globose or ellipsoid, dense, 10–24 mm long, 7–15 mm diam., with numerous pseudospikelets; core raised-ellipsoid to ovoid or hemispherical. *Pseudospikelets* with several sterile glumes at the base, c. 10–16-flowered, flowers all male except for uppermost, which is female. *Glumes* spirally arranged, 3.5–5.0 mm long, to 1.5 mm wide, spatulate to nearly linear, thin-textured, whitish near their base, pale brown to red-brown in upper half and with narrow whitish band at apex, glabrous, at least several lower glumes keeled near apex; apex more or less praemorse, obtuse to acute. *Stamen* 1 per flower; anther 1.5–2.2 mm long, excluding apical appendage 0.1–0.3 mm long. *Style* 3–5-fid, white when fresh. *Fruit* (only seen immature) obovoid, with 8–12 longitudinal ridges, with faint and irregular transverse ridges, tough, c. 3.5 mm long, c. 1.8 mm diam., dull red-brown.

**Distribution:** The Plaine des Lacs region in the south-east of New Caledonia.

**Habitat:** This aquatic species grows in water to at least 2 m deep, with culms and inflorescences extending 0.5–1 m above water level, in lakes and waterholes associated with streams through the maquis on ultramafic soils.

**Phenology:** Flowering apparently June to March; no mature fruit seen. Limited fertile material was available. In particular, specimens with mature fruits are needed.

**Conservation status:** The species was assessed as VU (Vulnerable) by Jaffré et al. (1998), under the informal name '*Chorizandra* sp. (MacKee 43278)'. Jaffré et al. (1998, 2010) point to the paucity of conservation areas throughout New Caledonia, and the limited statutory protection afforded by many of the existing reserves, particularly from disturbance caused by mining. All of the known localities of this species on the Plaine des Lacs and along the Rivière des Lacs fall within the recently declared Ramsar site Les Lacs du Grand Sud Néocalédonien (Barnaud et al. 2014), but that status probably confers no real protection against disturbance caused by the neighbouring nickel-mining sites, whether from activities associated with the open-cut mining itself, other land clearing, or changes to the hydrological regime. The only territorial reserve that the species is known to occur in, the Chute de la Madeleine special botanical reserve, offers no statutory protection from any future mining disturbance, whether it occurs upstream or adjoining the reserve.

**Etymology:** From the Greek *gigas*, a giant, in reference to the culms, which are much longer than any other species in the genus. Specimens of this species in P were given the manuscript epithet 'gigantea' by the late Jean Raynal. It is my pleasure to preserve the epithet and the authorship as given above in memory of that excellent cyperologist whose career was cut tragically short.

**Notes:** This species was referred to by Cook et al. (1974, p. 196), but the name was a *nomen nudum* there.

The glumes are not as dark red-brown at the apex as commonly found in other species in this small genus. *Chorizandra* differs from *C. cymbaria* R.Br., the only other species in New Caledonia, in having much longer culms, which are never verruculose. It has an inflorescence core that is elongated as in *C. cymbaria* but differs in being prominently raised with shorter, more slender pseudospikelet axes, and the complete inflorescence shape is globose to hemispherical rather than clearly elongated as in *C. cymbaria*, which has fewer pseudospikelets. Culms, leaves and the main inflorescence bract are generally pluritubulose but culms and leaves may rarely be unitubulose above (particularly in more slender plants), whereas *C. cymbaria* has the culms and leaves, although always unitubulose above, often pluritubulose towards the base (including in most specimens from New Caledonia).

The species differs from *C. australis* K.L.Wilson, the only species of comparable size and the most strongly aquatic of the Australian species, in having culms, leaves and inflorescence bract pluritubulose (rarely unitubulose near apex) whereas in *C. australis* the culms, leaves and lowest inflorescence bract are mostly

unitubulose (culms often pluritubulose below). The inflorescence core in *C. gigantea* is ellipsoid to ovoid or hemispherical (globose to hemispherical in *C. australis*). Glumes in *C. gigantea* are pale red-brown in the upper half, shorter and usually narrower (3.5–5 mm long, to 1.5 mm wide) compared to those of *C. australis* (dark red-brown in the upper half, 5–6 mm long, to 2.5 mm wide).

**Specimens examined:** New Caledonia: Province Sud: Rivière des Lacs en aval de la Chute, *J.-F. Cherrier per H.S. MacKee* 43278, 26 Sep 1986 (P1727435); Grand Lac, *A.U. Daeniker* 291, 12 Oct 1924 (P6897640); Marais Kiki, *H. Huerlimann* 3168, 17 Jul 1958 (G), *H. MacKee* 4157, 25 Mar 1956 (NSW241289); Grand Lac, *H.S. MacKee* 36983, 4 Jun 1979 (P6897635 to P6897639); Lac en Huit, *G. McPherson* 2992, 30 Aug 1980 (MO n.v., NSW242561), *J. Raynal & T. Jaffré* 16482, 28 Sep 1971 (P1227433, BISH n.v., G n.v., MO n.v., NSW881425), *K.L. Wilson* 7755, *P. Weston & J.-M. Veillon*, 5 Feb 1991 (NSW237201); Chute de la Madeleine, *K.L. Wilson* 7016, 17 Mar 1987 (NSW201918, NE); Noumea–Yaté road, 1.8 km NE of Rivière des Lacs, *K.L. Wilson* 7192, 28 Mar 1987 (NSW196527).

### *Machaerina* Vahl

Recent molecular studies (Viljoen et al. 2013 and references therein) indicate that *Baumea* Gaudich. is better treated as part of a more broadly circumscribed *Machaerina*. Combinations in the latter genus exist for all but one of the species found in New Caledonia and two in Australia, so the missing combinations are here made. Further study is needed to clarify relationships within this clade.

***Machaerina johnsonii*** (K.L.Wilson) K.L.Wilson, **comb. nov.**

**Basionym:** *Baumea johnsonii* K.L.Wilson, *Telopea* 1: 457 (1980).

**Type citation:** Holotype: New South Wales: Central Tablelands: Govetts Leap, Blackheath, *E.F. Constable* 5576A, 10.xii.1964 (NSW). Isotypes: BRI, CANB, CHR, K, P.

**Type:** Australia: New South Wales: Central Tablelands: Govetts Leap, Blackheath, *E.F. Constable* 5576A, 10 Dec 1964; holo: NSW688397; iso: BRI-AQ311471, CANB2944931, CHR382501B, K883953, P601877.

***Machaerina planifolia*** (Benth.) K.L.Wilson, **comb. nov.**

**Basionym:** *Cladium tetraquetrum* var. ? *planifolium* Benth., *Flora Australiensis* 7: 407 (1878).

*Baumea planifolia* (Benth.) K.L.Wilson, *Telopea* 5: 589 (1994).

**Type citation:** New South Wales: Northern Tablelands: New England, *C. Stuart*, [no date]; K.

**Lectotype** (Wilson 1994b: 589): Australia: New South Wales: Northern Tablelands: New England, *C. Stuart*, [no date]; K883968.

***Machaerina veillonis*** (J.Raynal) K.L.Wilson, **comb. nov.**

**Basionym:** *Baumea veillonis* J.Raynal, *Adansonia*, ser. 2, 13(4): 469 (1974).

**Type citation:** *J. Raynal & J.-M. Veillon* 16620, in uliginosis sylvae densae humidae Mois de Mai dictae prope flumen Album dictum ad partem austro-orientalem insulae Novae Caledoniae, 6.3.1973 (holo-, P!; iso-, NOU!).

**Type:** New Caledonia: Province Sud: Mois de Mai, *J. Raynal & J.-M. Veillon* 16620, 6 Mar 1973; holo: P607383; iso: BISH n.v., CHR n.v., E n.v., G n.v., K883926, L n.v., MO2195529, NOU, NSW805850, NY1163753, P607384, P607385, P752576, TNS n.v.

### *Schoenus* L.

*Schoenus* (Cyperaceae subfamily Cyperoideae tribe Schoeneae) as currently circumscribed is at its most diverse in Australia (over 110 species). There are several endemic species in New Caledonia, one of which is here described. Relationships within the genus and generic limits in tribe Schoeneae are being investigated further with Jeremy Bruhl (NE) and associates Adele Gibbs and Paul Musili, Russell Barrett (CANB) and Tony Verboom, Muthama Muasya and associates (Cape Town, South Africa).

In *Schoenus* there are usually several to numerous leaves clustered at the base of a culm. Only the basal leaf uppermost on a culm should be compared for ligule and sheath apex details. All leaves below that uppermost leaf tend to have reduced blades and deeply split sheaths in all species.





Fig. 3. *Schoenus rivularis* – isotype (NSW877938).



**Fig. 4.** A, Nuts of *Schoenus rivularis*, that on the right with remnant stylebase still attached. B, Nuts of *S. pauciflorus* with hypogynous bristles (left) and *S. rivularis* (right). C, Junction of leaf blade and sheath showing ligule (arrowed) in *S. rivularis*. (*S. rivularis*: NSW877938; *S. pauciflorus*: NSW90813). Scale bar = 1 mm.

***Schoenus rivularis*** J.Raynal ex K.L.Wilson, *sp. nov.*

**Figs 3, 4**

**Diagnosis:** A *S. paucifloro* vaginis foliorum hebetatibus pallidioribusque complanatis que fissibus profundeque, periantho destituto differt.

**Type:** New Caledonia: Province Sud: Col de Plum, *J. Raynal and H.S. MacKee 16446*, 26 Sep 1971; holo: P607450; iso: NOU, NSW877938, P607451, P710604).

*Erect* slender perennial, tufted, very shortly rhizomatous, 45–75 cm tall. *Culms* 1-noded, rarely not noded, obscurely trigonous to terete, longitudinal ribs very prominent when dried, glabrous, to 45 cm long, 0.6–1.0 mm diam. *Leaves* mostly basal, with well-developed blade and pseudopetiole, combined length to 35 cm; blade more or less trigonous in cross-section, ribbed on the angles, glabrous except for minute antrorsely aculeate prickle hairs towards the tapering, long-acute apex; sheath equitant (flattened laterally), pale yellowish brown to grey-brown with thinner textured pallid margins, not tightly clasping the culm, split adaxially for most of its length with margins not overlapping; junction of sheath and pseudopetiole/blade lacking a ligule but marked by a slight change in colour and texture; the single cauline leaf is similar but usually with the sheath darker red-brown and split adaxially for about half of its length. *Lowest inflorescence bract* erect, longer than inflorescence, 5–35 cm long; bracts at upper nodes of inflorescence much shorter. *Inflorescence* slender, 3–14 cm long, with several very short internodes and usually with 1 long internode to 10 cm long, giving the overall appearance of 2 narrow-oblong clusters of spikelets. *Spikelets* more or less long-pedicellate (pedicel to 10 mm long), 10–15 mm long, 2- or 3-flowered; glumes 3–5, 8–11 mm long, very narrow-ovate, long-acute, pale to dark yellow-brown or red-brown on the sides (darker near the green midrib), whitish on the margins, glabrous except for sparse

minute prickly hairs along midrib and occasionally sparse short white hairs at apex, sides nerveless; basal 2 glumes may be sterile or with vestigial hypogynous bristles or bisexual; next 2 glumes with bisexual flowers; uppermost glume usually reduced, subtending a potentially bisexual flower that usually remains immature. *Hypogynous* bristles absent, or occasionally vestigial bristles to 0.7 mm long, remaining on the spikelet axis. *Stamens* 3; anthers c. 3.3–3.5 mm long, apiculus no more than 0.1 mm long. *Style* 3-fid, branching for 1/3–2/3 of its length, of similar thickness throughout, dark red-brown at maturity. *Nut* narrow-ellipsoid, with 3 prominent angles (not strongly ribbed), shining, more or less smooth (minute isodiametric reticulate pattern visible at high magnification), whitish to dark grey, 1.8–2.0 mm long, 0.7–0.9 mm diam.

Specimens examined: New Caledonia: Province Sud: Parc de la Rivière Blanche, *H. Huerlimann 3431*, 4 Sep 1958 (P6896146); Route de Yaté, 43 km après le croisement des routes de Plum et de Yaté, *T. Jaffré 555*, 16 Dec 1971 (P2206078, P6896144, P6896145, NSW877951); Plaine des Lacs, *T. Jaffré 1944*, Aug 1977 (P2206079, BISH n.v., G n.v., MO n.v., NOU, NSW877254); Baie Ngo, Plaine du Champ de Bataille, *H.S. MacKee 24462*, 22 Oct 1971 (P6896149, BISH n.v., CHR n.v., G n.v., MO n.v., NSW877255); rive S du lac de barrage de Yaté, 1.5 km N de la Mine du Marais Kiki, *J. Raynal and T. Jaffré 16460*, 28 Sep 1971 (P6898143, NSW877952); Col de Plum, NE face of Mont Dore, *K.L. Wilson 7810*, 9 Feb 1991 (NSW237317, NE); southern side of Yaté Reservoir, c. 1 km directly NNW of Mine du Marais Kiki, *K.L. Wilson 7816*, 9 Feb 1991 (NSW237353); Nouméa–Yaté road, on southern side of Yaté Reservoir (10.5 km E of turnoff to Rivière Bleue Park), *K.L. Wilson 10004*, 20 Aug 2001 (NSW479489, K, MO, NE, NOU, P).

**Distribution:** Scattered in the southern ultramafic region of the main island of New Caledonia, from Col de Plum in the west to near Yaté in the east.

**Habitat:** Usually in open sedge-dominated swampy areas in the maquis, commonly associated with small streams and drainage lines. Jaffré (1980) noted this species as part of the extensive herbaceous layer at some sites of his low-growing Groupe VII (Association à *Pancheria communis* et *Mooria buxifolia*) vegetation type, occurring on damp sites on the Plaine des Lacs.

**Phenology:** Poorly known but flowering at least August–September; fruiting at least October–February.

**Conservation status:** The species is relatively widespread over the southern ultramafic region, so has not been officially listed as threatened. It is not clear whether this rather inconspicuous species is more common than the relatively few specimens suggest, so its status needs further investigation. It has not been collected in any conservation reserves, but some populations fall within the Ramsar site Les Lacs du Grand Sud Néocalédonien (Barnaud et al. 2014). Its long-term survival could be affected, like most of the species in this region, by disturbance caused by mining and wildfire (Jaffré et al. 1998, 2010).

**Notes:** This species is morphologically similar in overall form to *S. pauciflorus* (Hook.f.) Hook.f. from New Zealand. It differs from that species in its paler, dull, more strongly flattened, deeply split leaf sheaths (dark red-brown, smooth and shining, more or less rounded and not split or shortly split (for 0.5–5 mm from apex) sheaths in *S. pauciflorus*) and its lack of hypogynous bristles (six bristles to twice as long as the fruit in *S. pauciflorus*) (Fig. 4). Both species show similarities to a small group of temperate South American species: *S. andinus* (Philippi) H.Pfeiff., *S. antarcticus* (Hook.f.) Dusén and *S. rhynchosporoides* (Steud.) Kuek. Kuekenthal (1938) placed all four of the then known species in subgenus *Schoenus* section *Longisetes* Kuek. along with *S. neocalledonicus* C.B. Clarke (and including *S. juvenis* C.B. Clarke as a variety of that). These latter two species show more affinity to section *Nudicaules* Kuek.

Though not formally published until now, the species name has very occasionally been used in past ecological texts (e.g. Jaffré 1980).

**Etymology:** From the Latin *rivulus*, a small stream or rivulet, referring to the occurrence of this species near small open streams and drainage lines in the maquis.

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