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Desmocladus (Restionaceae) enlarged to include the Western Australian genera *Harperia*, *Kulinia* and *Onychosepalum*[1]

Barbara G. Briggs

National Herbarium of New South Wales, Botanic Gardens Trust Sydney, Mrs Macquaries Road, Sydney NSW 2000, Australia.
barbara.briggs@rbgsyd.nsw.gov.au

Abstract

A recent phylogeny of the restiid clade of Poales based on chloroplast DNA data has shown several currently recognised genera of Leptocarpoideae to be paraphyletic or polyphyletic. In the largely Western Australian *Desmocladus* clade, *Kulinia*, *Onychosepalum* and *Harperia* appear embedded in *Desmocladus*. These are here included in *Desmocladus* and the new combinations *D. confertospicatus, D. eludens, D. eyreanus, D. ferruginipes, D. lateriflorus, D. laxiflorus, D. microcarpus* and *D. nodatus* are provided.

Introduction

Recently Briggs et al. (2014) presented a phylogeny of the restiid clade of Poales that included new data and analyses for the largely Australasian subfamily Leptocarpoideae. The phylogeny indicated that the three small Western Australian genera *Kulinia* B.G.Briggs & L.A.S.Johnson (Briggs and Johnson 1998), *Onychosepalum* Steud. (Steudel 1855) and most or all species of *Harperia* W.Fitzg. (Fitzgerald 1904) are embedded within *Desmocladus* Nees (Nees 1846). Similar results were also found by Briggs et al. (2010) with fewer taxa sampled. The relevant part of a phylogenetic tree from Briggs et al. (2014) based on concatenated *trn*L–F and *trn*K data from the chloroplast genome is shown in Figure 1. Morphological characteristics do not provide support for the further division of *Desmocladus*, rather support its expansion to include the smaller genera embedded within it. To provide a classification that accords with the phylogenetic findings, eight new combinations are required, synonymising these three genera under *Desmocladus*.

The *Desmocladus* clade

The *Desmocladus* clade was recognised by Briggs and Johnson (1999), being named after its first-named and largest genus, and is supported by analyses of chloroplast DNA data (Briggs et al. 2010, 2014). The clade is characterised morphologically by uninterrupted culm chlorenchyma, lacking pillar cells and sclerenchyma

[1]This paper is dedicated to my former colleague Elizabeth Anne Brown (1956–2013), remembering especially her notable achievements in the study of bryophytes and Ericaceae, her love of fieldwork, and her service for many years as Scientific Editor of *Telopea*.

girders (Cutler 1969, Briggs and Linder 2009), hyaline tepals that are often reduced in number, exserted anthers (except two parthenogenetic wholly female species), gynoecia with a single fertile carpel, a shortly stipitate ovary, fruit a nut (except possibly *Catacolea*, for which mature fruits are not known) with a woody pericarp and a thickened base of the style usually persisting as a conical cap on the fruit. Among its members, *Catacolea*, *Coleocarya* and *Kulinia* were monotypic. *Kulinia* was distinguished by its culms consisting of only two internodes and its distinctive indumentum of branched hairs. *Onychosepalum* has included three species (Meney *et al*. 1996; Briggs and Johnson 2001) and the phylogenetic analyses show it as monophyletic but embedded in *Desmocladus*. It was distinguished from *Desmocladus* by the glabrous, generally unbranched culms of a single internode or with 1–2 culm sheaths, and the few (2–7) flowers in male spikelets.

Harperia has included four species but these were admittedly morphologically diverse (Briggs and Johnson 1999). Their most distinctive feature was a central mass of sclerenchyma and, in most species, multiple pith cavities in the culm, whereas other members of the clade mostly have a single pith cavity. The stalked, branched hairs of their culm indumentum also differed from the multicellular but unbranched hairs of the species referred to *Desmocladus*. *Harperia* is polyphyletic (**Fig. 1**), with three species separately placed among the species of *Desmocladus*. The position of the fourth species, *H. eyreana*, is more problematical since *trn*K data placed it embedded in *Desmocladus* whereas *trn*L–F data show it allied to the related genus *Coleocarya*. In morphology it resembles *H. ferruginipes*, and differs strongly from *Coleocarya*. Branches are short in this region of the tree and *H. eyreana* differs from other *Harperia* species in few bases in both the *trn*L–F and *trn*K sequences. Indeed several branches of the tree collapse in a bootstrap analysis of the same data, producing a large polychotomy including all these species. Unfortunately, there has not been an opportunity to sample or sequence again this rare species which occurs near the remote south-east coast of Western Australia. I regard the finding from *trn*K data as the better guide to its relationships and so all species of *Harperia* are here transferred to *Desmocladus*. The type species, *H. lateriflora*, is in any case embedded within *Desmocladus*. The great majority of species of the clade are in the south of Western Australia, but the single species of *Coleocarya* is found in coastal districts of south-east Queensland and northern New South Wales. It is retained at generic rank because (accepting the position of *H. eyreana* indicated by *trn*K) it appears as sister to the enlarged *Desmocladus* in most analyses (e.g. Fig. 1) and is distinctive in its monoecy and the position of its 1-flowered female spikelets. Further studies on this relationship may be warranted.

The features previously used to distinguish *Kulinia*, *Onychosepalum* and *Harperia* may all be regarded as apomorphies that have arisen from the more 'generalised' form shown by the majority of *Desmocladus* species which have multiple culm nodes and mostly branching culms. With *Desmocladus* enlarged by the inclusion of these three genera, it consists of 23 species and the genera of the *Desmocladus* clade may be distinguished as follows.

Key to genera of *Desmocladus* clade

1 Plants monoecious, male spikelets terminal on culms, female spikelets in the axils of lower culm sheaths ..... *Coleocarya*

1* Plants dioecious or (less often) apomictic and known only from female plants 2

2 Culms strongly compressed, mostly of a single internode above several basal sheaths; male spikelets on slender pendulous or spreading stalks; male glumes scarious, acuminate but without a mucro or rigid awn ..... *Catacolea*

2* Culms terete or compressed on one side only (circular or crescentic in transverse section), of one or more internodes; male spikelets terminal or axillary on culms or culm branches, male glumes with a stout mucro or rigid awn 3

3 Female spikelets several- or many-flowered; culms unbranched, of several internodes; mostly with almost half the length of the male and female glumes consisting of an acute rigid black awn ..... *Lepidobolus*

3* Female spikelets 1- or more-flowered, culms branched or unbranched, of several or a single internode; glume awns mostly shorter and paler or not acute; if the awn long and acute then culms of only one or two internodes ..... *Desmocladus*

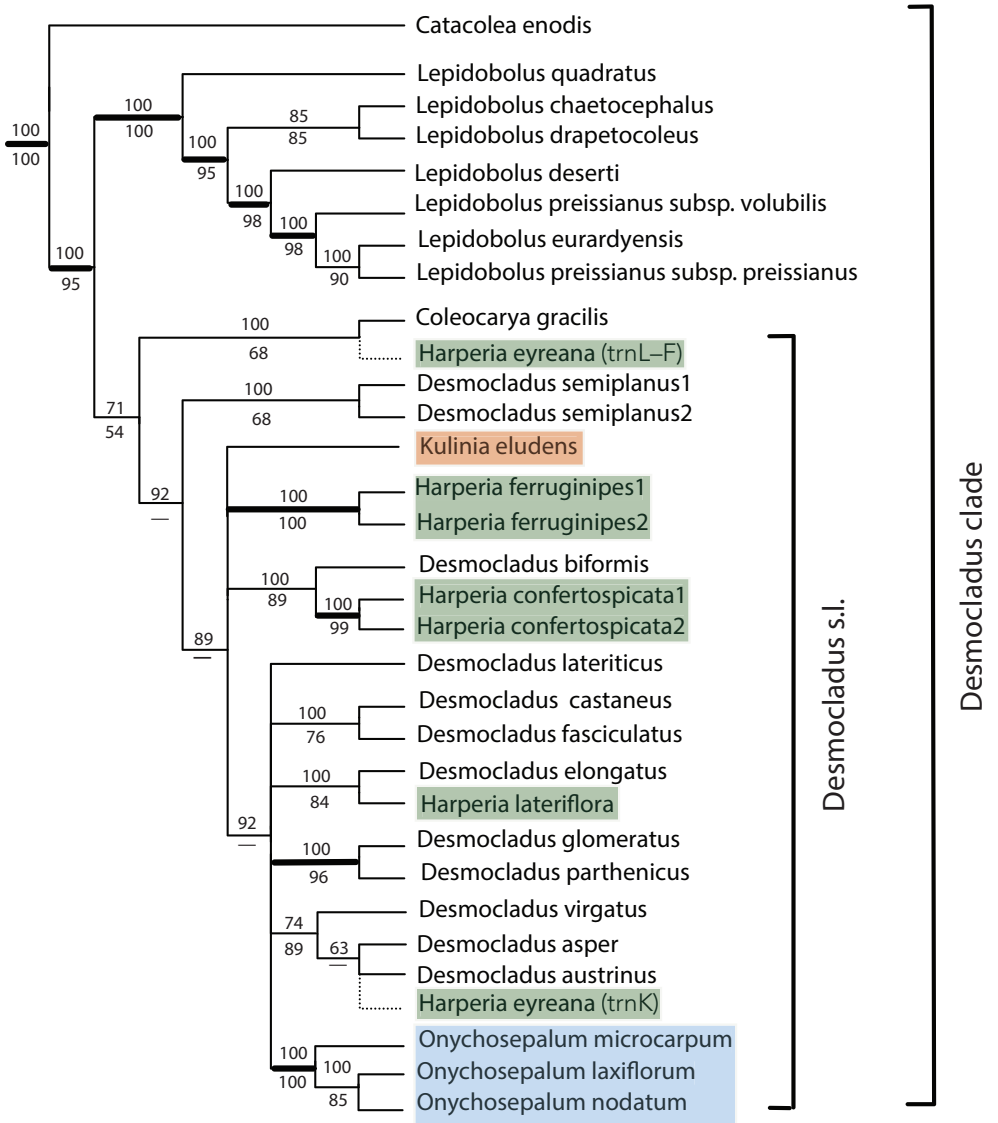

Fig. 1. Phylogenetic tree of the *Desmocladus* clade, from Bayesian analysis of concatenated *trn*L–F and *trn*K chloroplast data, showing *Kulinia*, *Onychosepalum* and *Harperia* species embedded in *Desmocladus* (modified from a phylogeny of the restiid clade presented by Briggs et al. (2014) where GenBank accession numbers are given). Bayesian posterior probabilities are shown above the branches; bootstrap values from maximum parsimony PAUP* analyses of the same data below the branches. Thick lines have 100% Bayesian posterior probability and also >95% parsimony support. Branches that collapse in the PAUP tree based on the same data are indicated by a dash below the line. The conflicting results for *H. eyreana* are shown with *trn*L–F and *trn*K indicated at the relevant positions. (Duplicate samples of species are numbered 1 and 2.)

New combinations under *Desmocladus*

The names by which taxa have recently been known are also given if different from the basionym.

Desmocladus confertospicatus (Steud.) B.G.Briggs, **comb. nov.**

Basionym: *Restio confertospicatus* Steud., *Syn. Pl. Glumac.* 2: 256 (1855).

Synonym: *Harperia confertospicata* (Steud.) B.G.Briggs & L.A.S.Johnson

Desmocladus eludens (B.G.Briggs & L.A.S.Johnson) B.G.Briggs, **comb. nov.**

Basionym: *Kulinia eludens* B.G.Briggs & L.A.S.Johnson, *Telopea* 7: 349 (1998) (Type of *Kulinia* B.G.Briggs & L.A.S.Johnson).

Desmocladus eyreanus (B.G.Briggs & L.A.S.Johnson) B.G.Briggs, **comb. nov.**

Basionym: *Harperia eyreana* B.G.Briggs & L.A.S.Johnson, *Telopea* 9: 248 (2001).

Desmocladus ferruginipes (K.A.Meney & J.S.Pate) B.G.Briggs, **comb. nov.**

Basionym: *Harperia ferruginipes* K.A.Meney & J.S.Pate, *Telopea* 6: 651 (1996).

Desmocladus lateriflorus (W.Fitzg.) B.G.Briggs, **comb. nov.**

Basionym: *Harperia lateriflora* W.Fitzg., *J. West Aust. Nat. Hist. Soc.* 1: 35 (1904) (Type of *Harperia* W.Fitzg.).

Desmocladus laxiflorus (Steud.) B.G.Briggs, **comb. nov.**

Basionym: *Onychosepalum laxiflorum* Steud., *Syn. Pl. Glumac.* 2: 249 (1855) (Type of *Onychosepalum* Steud.).

Desmocladus microcarpus (K.A.Meney & J.S.Pate) B.G.Briggs, **comb. nov.**

Basionym: *Onychosepalum microcarpum* K.A.Meney & J.S.Pate, *Telopea* 6: 664 (1996).

Desmocladus nodatus (B.G.Briggs & L.A.S.Johnson) B.G.Briggs, **comb. nov.**

Basionym: *Onychosepalum nodatum* B.G.Briggs & L.A.S.Johnson, *Telopea* 9: 252 (2001).

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