

A new hierarchy conserving nomenclature for the *Dendrobium speciosum* Sm. complex (Orchidaceae: Epidendroideae)

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Introduction

The taxonomic history of the *Dendrobium speciosum* (Orchidaceae sect. *Dendrocoryne*) complex has been reviewed (Adams *et al.* 2006a), and three new taxa described and analysed numerically (Adams *et al.* 2006ab). On the basis of these studies and a biological review (Adams 1991) nine varieties have been established, including the description of the type by Smith (1804).

Considering published results, primarily morphology and principal co-ordinate analysis (Adams *et al.* 2006 abc), and the internal transcribed spacer of nuclear DNA (ITS-DNA) (Burke *et al.* 2008), we recognise a northern subspecies *pedunculatum*, and a southern subspecies *speciosum* as indicated in the following classification. A new hierarchy is presented, with accompanying major characteristics for typical and commonly occurring forms, and distributions for each taxon. More detailed descriptions and distribution maps are provided in Adams *et al.* (2006 abc), and full synonymy and information concerning types is listed in Clements (1989).

Dendrobium speciosum Sm. subsp. *speciosum*

Dendrobium speciosum Sm. var. *speciosum*, *Exotic Botany* 1:17, t.10 (1804)

Syn. *Thelychiton speciosus* (Sm.) M.A.Clem. & D.L.Jones, *Orchadian* 13, 492 (2002) in part; *Thelychiton epiphyticus* D.L.Jones & M.A.Clem, *Australian Orchid Research* 5, 39 (2006) in part.

Large robust plants, mainly lithophytic, occasionally epiphytic in rainforest habitat e.g. Kangaroo Valley, New South Wales; occasional plants with aerial roots, pseudobulbs to 50 cm long, wide at the base and tapering towards apex; racemes 15–60 cm long, 18–115 flowered; flowers relatively large, vertical height 4.2–8.0 cm, horizontal width 4.3–7.8 cm, well spaced, pure white to yellow.

Flowering: August to October.

Abstract

A new hierarchy with two sub species is presented for the *Dendrobium speciosum* Sm. complex, considering previously published distributional, morphological, principal coordinate and ITS-DNA analyses. There are seven varieties in the southern subspecies *speciosum*, and two in the northern subspecies *pedunculatum*.

Keywords: Taxonomy, classification, species complex, *Dendrocoryne*

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Distribution: Genoa (eastern Victoria) north to Bulahdelah and Barrington Tops, New South Wales, and inland to Munghorn Gap, New South Wales. Intergrades with var. *hillii* north of the Hunter River, New South Wales.

***D. speciosum* var. *hillii* Masters, *Gardeners Chronicle* (new series) p. 112, f. 18. (1877).**

Syn. *Thelychiton tarberi* (M.A.Clem. & D.L.Jones) M.A.Clem. & D.L.Jones, *Orchadian* **13**, 492 (2002).

Typical plants large, medium to tall epiphytes or lithophytes, forming very large clumps in dense rainforest; often with well developed aerial roots; pseudobulbs erect to 75 cm long, virtually non-tapering; large leaves up to 30 cm long; racemes short to long (26–70 cm), 45–240 flowered; flowers mainly small, occasionally medium sized, vertical height 3.4–5.2 cm, horizontal width 2.9–5.3 cm, white to cream or occasionally pale yellow flowers, from well spaced on racemes to densely packed in crowded ‘foxtails’ with the most flowers per raceme in the species.

Flowering: August to October

Distribution: South of the Hawkesbury River, New South Wales, to Mt. Mee – Crows Nest in southern Queensland where it intergrades with var. *grandiflorum*.

***D. speciosum* Sm. var. *grandiflorum* F.M.Bailey, *Botany Bulletin, Department Agriculture, Queensland* **14**, 12 (1896).**

Syn. *Thelychiton rex* (M.A.Clem. & D.L.Jones) M.A.Clem. & D.L.Jones, *Orchadian* **13**, 492 (2002).

Plants very variable, epiphytic or lithophytic, larger rainforest forms epiphytic with well developed aerial roots; pseudobulbs erect, very long (up to 95 cm); leaves medium to large, up to 37 cm; racemes short to very long, 25–80 cm, 40–125 flowered; flower density from openly spaced to densely clustered; flowers small to some of the largest in the species, vertical height 4.7–8.2 cm, horizontal width 4.8–8.1 cm, from pale yellow to deep gold, occasionally bicoloured, rarely white, often with a very long dorsal sepal.

Flowering: August to October

Distribution: From Mt. Mee – Crows Nest in southern Queensland to Mt. Morgan in Queensland, and inland to Monto and Cania Gorge. Merges with var. *hillii* in the south, where flowers are smaller.

***D. speciosum* Sm. var. *capricornicum* Clemesha, *Orchadian* **7**, 103 (1982).**

Syn. *Thelychiton capricornicum* (Clemesha) M.A.Clem. & D.L.Jones, *Orchadian* **13**, 491 (2002).

Plants very variable, many different forms on volcanic plugs and in forested areas; usually lithophytic without aerial roots, often short, compact and set in rock crevices; pseudobulbs to 19 cm long, usually cylindrical, curved with rigid, sometimes channelled leaves; racemes 17–50 cm, 11–68 flowered, with open to clustered arrangement; flowers small to medium sized, vertical height 3.4–5.9 cm, horizontal width 3.9–5.6 cm, white to deep gold, presenting from cupped to widely opened.

Flowering: May to August

Distribution: Just north of Mt. Morgan to Byfield and west to Berserker Range, Queensland.

***D. speciosum* Sm. var. *blackdownense* P.B.Adams, *Telopea* **11**, 195 (2006).**

Syn. *Thelychiton coriaceus*, D.L.Jones & M.A.Clem., *Australian Orchid Research* **5**, 37 (2006), in part.

Plants very variable in size and shape; pseudobulbs to 30 cm long; leaves, racemes and flowers variable; racemes 23–60 cm long, 14–115 flowered; flower density varying from openly spaced to densely clustered, forming a brush; flowers small to medium sized, vertical height 3.5–5.4 cm, horizontal width 3.9–5.4 cm, off white to deep gold, usually opening widely; some similarities to var. *capricornicum*, but flowers later; usually less robust plants and flowers than is found in var. *carnarvonense*.

Flowering time: August to September

Distribution: Disjunct, from Expedition Range, Queensland to the northern limit of Blackdown Tableland, Queensland.

***D. speciosum* Sm. var. *carnarvonense* P.B.Adams, *Telopea* **11**, 195 (2006).**

Syn. *Thelychiton coriaceus*, D.L.Jones & M.A.Clem., *Australian Orchid Research* **5**, 37 (2006) in part.

Robust plants, usually lithophytic, often urn shaped, often but not always with wide based pseudobulbs to 33 cm long, tapering towards the apex; occasional aerial roots; rigid leaves similar to var. *speciosum*; racemes rather short, 20–50 cm, 25–87 flowered;

flowers of heavy substance, moderate size, vertical height 5.1–6.6 cm, horizontal width 5.5–6.3 cm, cream to gold, often cupped; similar to var. *speciosum* and some forms of var. *boreale* in northern Queensland.

Flowering: August to September

Distribution: Disjunct, in the gorges of the Carnarvon region, Queensland.

D. speciosum* Sm. var. *curvicaule* F.M.Bailey, *Botany Bulletin, Department Agriculture, Queensland 14, 12 (1896).

Syn. *Thelychiton spectabilis* D.L.Jones & M.A.Clem., *Australian Orchid Research 5*, 42 (2006).

Plants very variable, pseudobulbs to 55 cm long, curved, fusiform or linear, sometimes with prominent edges in distal centimetres; aerial roots absent to prominent; racemes 20–65 cm long, 20–135 flowered, with open to closely spaced arrangement; flowers small to large, vertical height 4–7.2 cm, horizontal width 4.1–7.1 cm, white or cream to yellow, with some of the widest floral segments in the species.

Flowering: August to September

Distribution: St. Lawrence to Mt. Dryander, north of Prosperine and the Whitsunday Islands, Queensland. Intermediates between var. *curvicaule* and var. *capricornicum* occur south of Sarina.

***Dendrobium speciosum* Sm. subsp. *pedunculatum* (Clemesha) D.P.Banks & Clemesha**

D. speciosum* Sm. var. *pedunculatum* Clemesha. *Orchadian 6, 261 (1981).

Syn. *Thelychiton pedunculatus* (Clemesha) M.A.Clem. & D.L.Jones, *Orchadian 13*, 491 (2002).

Plants lithophytic, or infrequently found on bases of trees, short, compact; pseudobulbs to 36 cm long,

often stout, erect or mildly curving; without aerial roots; leaves very coriaceous, often with purple pigmentation associated with high light exposure; racemes 16–60 cm, 9–72 flowered; peduncles often longer than the rachis, but may be considerably shorter; flowers small to medium sized, vertical height 2.8–4.5 cm, horizontal width 3.1–4.7 cm, off-white to yellow, open widely or cupped, well spaced or clustered forming a brush.

Flowering: July to September

Distribution: Lumholz National Park, south of Atherton Tableland, to Parker River headwaters, Queensland. This represents a narrow strip of open forest and rocky hillsides. Habitat, with intergrading forms between var. *pedunculatum* and var. *boreale*, has been much reduced by land clearance on the Tableland.

D. speciosum* Sm. var. *boreale* P.B.Adams, J.M.Burke and S.D.Lawson, *Australian Systematic Botany 19, 259 (2006).

Syn. *Thelychiton rupicola* D.L.Jones & M.A.Clem., *Australian Orchid Research 5*, 40 (2006); *Thelychiton biconvexus* D.L.Jones & M.A.Clem., *Australian Orchid Research 5*, 36 (2006); *Thelychiton curvicaulis* (F.M.Bailey) M.A.Clem. & D.L.Jones, *Orchadian 13*, 491 (2002).

A very variable taxon in shape, habitat, pseudobulb shape and size; epiphytic and lithophytic; pseudobulbs from slender in southern part of range to broad, and tall, to 70 cm long and robust in northern part, variably curved, some northern forms sharply edged in distal half; racemes 18–80 cm long, 10–125 flowered; flowers small to medium sized, vertical height 3.1–5.2 cm, horizontal width 3.3–5.5 cm, white to pale yellow, usually well spaced, widely open and circular (star-like) in outline due to approximately equal vertical and horizontal presenting dimensions. Intergrades occur with var. *pedunculatum*, with peduncles of various lengths making identification difficult.

Key to subspecies of *Dendrobium speciosum*

- 1 Plants lithophytic, variable, leaf-bearing axes 5–71 cm long, peduncles shorter, equal or longer than the rachis, racemes with 10–125 flowers, white, cream, occasionally pale yellow, vertical height 2.8–5 cm, horizontal width 3.1–5.5 cm, usually presenting with approximately equal vertical and horizontal dimensions when flowers are well open. Plants of northern Queensland from Mt. Elliot to Cape Melville **subspecies *pedunculatum***
- 1: Plants epiphytic or lithophytic, variable, leaf-bearing axes 10–95 cm long, peduncles shorter than the rachis, racemes with 11–240 flowers, white, cream, yellow to deep gold, vertical height 3.4–8.1 cm, horizontal width 2.9–8.0 cm, usually presenting with vertical dimensions greater than the horizontal. Plants occurring from eastern Victoria to Proserpine area, Queensland **subspecies *speciosum***

Flowering time: July to September

Distribution: Mt. Elliot, south of Townsville, to Cape Melville (north Queensland).

Discussion

The subspecies are based on morphological results and well supported clades identified from ITS sequences (Burke *et al.* 2008; Fig. 1), and correlate well with geographic distribution (Adams *et al.* 2006a). Below this rank there are no consistent and reliable qualitative morphological characters to distinguish the varieties described in Adams *et al.* (2006abc). Most of the variability in the complex is due to variation in size and colour characteristics of floral parts, and to different sizes of leaves and stems. The two subspecies differ in horizontal and vertical dimensions of the open flowers. The dimensions of the northern subspecies are similar, conferring a rounded outline, while the vertical dimension is greater in the southern subspecies, producing a vertical oval outline. In general, the northern subspecies has smaller, less robust flowers,

but these are also relatively frequent in var. *hillii*, var. *blackdownense*, var. *capricornicum*, and in var. *grandiflorum* in the southern part of its distribution range. The key to subspecies is based on combinations of morphological characters and distribution. It is not possible to construct a reliable key to the varieties due to the continuum of variability, and identifications are best made on the basis of detailed descriptions and especially on geographical origin of plants as outlined above and in Adams *et al.* (2006ac).

The northern and southern subspecies are separated by a relatively dry area of about 125 km from north to south, in the Burdekin basin between Mt. Elliot, the southern limit of var. *boreale*, and the Proserpine area, the northern limit of var. *curvicaule*. South of Proserpine, the five east coast varieties var. *curvicaule*, var. *capricornicum*, var. *grandiflorum*, var. *hillii*, and var. *speciosum*, in north to south order, occupy regions with some identifiable intergrading at parts of their margins (Adams *et al.* 2006ac). Prior to the molecular era, Banks and Clemesha (1990) raised the rank of all

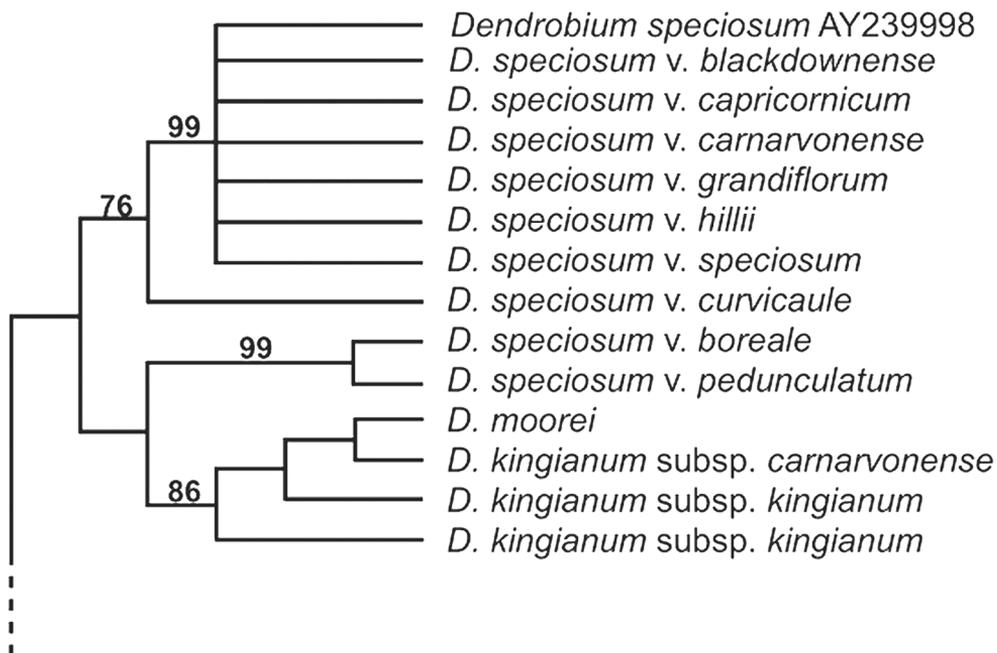


Figure 1. Phylogeny of *D. speciosum* on the basis of ITS sequence data. Part of a strict consensus tree of 51 most equally parsimonious trees, with *Dendrobium cunninghamii* as the outgroup. Numbers above branches are bootstrap values (adapted from Burke *et al.* 2008; *Aust. Syst. Bot.* <http://www.publish.csiro.au/nid/150/paper/SB07038.htm>).

previously described varieties to subspecies on the basis of separate distributions. More recent field work has revealed that the only significant breaks in the distribution of the complex are in the Burdekin basin, and the disjunct distribution of var. *blackdownense* and var. *carnarvonense*. Intermediates are found between varieties, especially between var. *hillii* and var. *grandiflorum*, but also in remote areas between var. *hillii* and var. *speciosum*, var. *grandiflorum* and var. *capricornicum*, and var. *curvicaule* and var. *capricornicum*.

The use of the name *pedunculatum* for the northern subspecies follows automatically from rules of priority (McNeill *et al.* 2006, Art. 11.4). It is unfortunate and somewhat confusing in that it has an entirely different connotation to that used previously. The variety *pedunculatum* occupies a very small distribution in comparison with var. *boreale*, and the vast majority of plants in the northern subspecies belong to var. *boreale* and lack the diminutive stature and long peduncles of var. *pedunculatum*.

The relationship of var. *curvicaule*, as a sister group to the six most southern varieties in the southern subclade (Fig.1), correlates well with its central adjacent geographic position and floral affinities. In the Clairview to Marlborough area, which has been poorly surveyed with respect to orchids, there are scattered small colonies with morphological features intermediate between var. *curvicaule* and var. *capricornicum* (Adams *et al.* 2006b). These plants have been numerically analysed, and in ordinations are outliers in the var. *curvicaule* cluster, supporting an intermediate status (Adams *et al.* 2006c).

Clements (1989), recognizing the above similarities, initially listed var. *capricornicum* as a variant of var. *curvicaule* on the basis of plant habit and habitat, before reconsidering it as a separate entity (Clements and Jones 2002). Variety *curvicaule* is the most confused name in the complex, as prior to 2006 it was used for plants from Eungella to Proserpine, and also for plants well to the north of the Burdekin basin in North Queensland. The northern plants have been numerically analysed and described as var. *boreale* (Adams *et al.* 2006b), and a neotype established for the Eungella-Proserpine group, which retained the name var. *curvicaule*. Previously Clements and Jones (2002) had proposed *Thelychiton curvicaulis* for *D. speciosum* var. *curvicaule* F.M. Bailey, referring to plants from the Eungella area, and also to plants north of

the Burdekin Basin in North Queensland. Jones *et al.* (2006) then proposed *Thelychiton curvicaulis* for a north Queensland variant that we do not recognize as a distinct entity, but as part of *D. speciosum* var. *boreale*.

Using *D. cunninghamii* as an outgroup, analysis of ITS-DNA of all *Dendrobium* sect. *Dendrocoryne* species, including all of the *D. speciosum* taxa of Adams *et al.* (2006a) revealed a northern lineage of var. *pedunculatum* and var. *boreale* from north Queensland with 99% bootstrap support, and a southern lineage with 76% bootstrap support, including the six southernmost varieties with almost identical ITS sequences, and var. *curvicaule* (Burke *et al.* 2008) (Fig. 1). In Figure 1, var. *boreale* and var. *pedunculatum* are sister taxa to *D. kingianum* and *D. moorei*, but there is no support for this relationship in the consensus tree (Burke *et al.* 2008), in which the northern and southern subspecies represent separate clades. A feature of the ITS-DNA results is a very poor correlation between them and the morphological characteristics of described varieties throughout the distribution range. In central and southern Queensland, New South Wales and Victoria, there are almost no differences in ITS sequences in six varieties. North of Mackay, Queensland, the ITS variations do not correlate with a wide range of morphologies in three varieties. This marker is relatively uninformative in classification of the complex below the level of subspecies.

The preliminary cladogram of Jones *et al.* (2006) also indicates northern and southern lineages. Burke *et al.* (2008) rejected the recognition of *Thelychiton* as a distinct genus and the splitting of *D. speciosum* into eleven species as proposed by Jones *et al.* (2006). Several of these taxa – *T. biconvexus*, *T. rupicola*, *T. curvicaulis* and *T. epiphyticus* and their stated distributions, have not been evident as separate entities in our extensive field surveys, and the first three of these are regarded as habitat variants of var. *boreale*. At many sites, several of these may be found in close proximity in shaded and exposed situations and on different aspects of, for example, Mt. Lewis and Mt. Finnegan.

The classification presented above combines information from all available studies, refining the taxonomic hierarchy of the species to accord with the published evidence, while requiring the fewest taxonomic changes, one of the *desiderata* of the International Code of Botanical Nomenclature (McNeill *et al.* 2006).

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