Dendrobium speciosum var. curvicaule ‘Harry Klose’

Photo Peter Adams
**Dendrobium speciosum** Sm., The Great *Dendrobium*, is a single-species complex

P.B. Adams, J.M. Burke and S.D. Lawson  
The School of Botany, University of Melbourne Victoria 3010  
and National Herbarium of Victoria,  
Royal Botanic Gardens, Melbourne, South Yarra 3141

**Summary**

The *Dendrobium speciosum* species complex presents taxonomic problems due to wide morphological variation within and between populations. It has an almost continuous distribution along the east coast of Australia, from near the Annan River on Cape York Peninsula, to eastern Victoria, with disjunct populations along the Tropic of Capricorn. A study with adequate sampling required measurement of 500 living individuals from the entire distribution range over 15 flowering seasons. Numerical taxonomy and DNA sequencing were used to search for sub-groupings. Results indicate that *D. speciosum* is a single species of nine varieties which may intergrade, with no evidence to support proposals for separate species or description of further varieties or other taxa. Variation was due to size characteristics associated with different habitats and geographical areas. There were no discrete differences in characters between varieties. Two new varieties were described from central Queensland, var. *blackdownense* and var. *carnarvonense*, with var. *capricornicum* Clemesha retained for plants of east Capricorn. *Dendrobium speciosum* var. *curvicaule* Bailey is shown to be a name of uncertain application, and has been neotypified to apply to the southern group of north Queensland plants between St. Lawrence and Mt. Dryander, and on the Whitsunday Islands. North of Townsville, plants of var. *pedunculatum* intergrade with a medium to tall rainforest form, which separates with a small overlap in analyses from var. *curvicaule* plants south of Townsville. We have formally described these rainforest forms, previously referred to as var. *curvicaule*, as a new variety, var. *boreale*, occurring between Cooktown and Mt. Elliot (south of Townsville). *Dendrobium speciosum* var. *speciosum*, var. *hillii*, and var. *grandiflorum* are retained.

**Introduction**

In spring 2004, we commenced a review to celebrate the bicentenary of the first description by Sir James E. Smith of *Dendrobium speciosum*, the Great *Dendrobium* (Exotic Botany 1804). The work summarized here began after the 1981 Sixth New South Wales Regional Orchid Conference at Wauchope, when Rosalie Martin organized a visit to see dendrobiums in their natural habitat. In October 1981 we located the most southerly colonies of *D. speciosum* in East Gippsland, Victoria. Major bushfires in March 1983 decimated the plants (Adams and Lawson 1984), but they recovered, and flowered magnificently nine years later.

The Great Dendrobium odyssey then led us northwards. Several years living in Queensland allowed us to study populations in more remote areas with considerable field, numerical, laboratory and taxonomic work.

In studying *D. speciosum* our key objectives have been to develop a broader understanding of the species complex and its biology, beyond taxonomic debates. In this paper we report our major findings, consider the published evidence and explain the reasons for recent suggested name changes. Descriptions of new taxa from our recently published work (Adams et al 2006a, 2006b) are reprinted here. It is difficult to avoid some scientific terms, and a glossary at the end of this review may help readers.

**Historical Review**

The type specimen of *D. speciosum* is held in the herbarium of the Linnaean Society in London (LINN) and is labelled 'Port Jackson New South Wales’. JE Smith’s original description is brief and the illustration resembles a South American Epidendrum. “Nectary a lip without a spur. Petals 5; the 2 lower external ones forming a pouch with their base. Lid vertical. Flowers often reversed. “Flowers reversed. Cluster solitary, many flowered. Lip three-lobed. Leaves radical, coriaceous.” Franz Bauers illustration (Stwart and Skain, 1993) showed *D speciosum* flowers without a labellum and with red spotted petals and sepals. Details of the history of descriptions are provided in Adams et al (2006b).

Most reviews have been descriptive, based on a relatively small number of morphological characters, and subjective impressions of a
**Dendrobium speciosum var. pedunculatum.** North-west of Atherton.

**Dendrobium speciosum var. boreale.** Rainforest plant from which type specimen was prepared.

**Dendrobium speciosum var. boreale.** Short form, Paluma Range.

**Dendrobium speciosum var. boreale.** Rainforest form, Windsor Tableland.
limited number of plants from the extensive distribution range. Rupp (1930) recognized the complexity of the species: “no satisfactory classification of the varieties has been made, and the task would be very difficult”. Previous taxonomic reviews have suggested five varieties (Dockrill 1969), six varieties (Clemesha 1981), five species (Jones 1988, Clements 1989), six subspecies (Banks and Clemesha 1991) and six intergrading varieties (Adams 1991, Dockrill 1992). These proposals were reviewed by Burke (1998) and Burke and Adams (2002). Several other early descriptions of varieties were later shown to be hybrids or other species.

The six varieties of *D. speciosum* - var. *speciosum* (Smith 1804), var. *hillii* (Masters 1877), var. *grandiflorum* (Bailey 1896), var. *curvicaule* (Bailey 1896), var. *pedunculatum* (Clemesha 1981) and var. *capricornicum* (Clemesha 1982), were separated mainly on differences in pseudobulb shape and floral characteristics, and the descriptions encompass only part of the complex. Clemesha (1986) and Gregory (1980, 1988) commented on the wide variability of plants from central and northern Queensland at a time when their relationships were very uncertain. Since that decade we have systematically explored and documented new areas of distribution and variation, particularly in remote and isolated populations in central Queensland.

Objective techniques using numerical taxonomy were performed initially by Burke (1998) followed by a publication in the CSIRO journal Australian Systematic Botany (Burke and Adams 2002). We have recently published three papers concerning *D. speciosum* in international journals that are peer reviewed by other orchid taxonomists, using morphometric analyses to assess variation (Adams et al 2006a, 2006b, 2006c). In this review, we present the key findings of our long term study, including DNA analysis.

**Materials and Methods**

**Field Studies:** The regions in Figure 1 were studied in the flowering season over a 25 year period to determine the distribution range, and the variation in floral and vegetative characteristics. Special attention was given to the distribution limits of described varieties, and areas where *D. speciosum* was not previously recorded. Areas were carefully sampled to encompass the variation. For each population, a large number of individuals representing all plant and floral forms were examined, and gross morphological and numerical analyses undertaken, along with supporting photographs and pressed floral records. Plant locations, population features and conservation status will not be published here, as these details can lead to illegal and indiscriminate collecting, even within National Parks and timber reserves. Herbarium specimens were prepared where necessary, including representative voucher specimens for all taxa, deposited in the Herbarium, School of Botany, Melbourne University. A living reference collection, photographic library and pressed floral parts have been maintained.

**Sampling:** All measurements were made on living plants, as pickled or pressed material is unsuitable to assess character detail and variation. Studies from 1993-1998 were later extended to central Queensland, from Carnarvon Gorge to Yeppoon, and south from Cooktown to Bundaberg, focussing on the areas presenting the greatest potential for finding different taxa. Field trips were conducted under permit from Queensland Parks and Wildlife Service and other state authorities. Where plants were limited, some plants in private collections were examined if we could establish full authentication.

**Numerical Studies:** Well established numerical taxonomic methods were initially evaluated as a scientific approach for delineating taxa. The Australian species in *Dendrobium* sect. *Dendrocoryne* (Dockrill 1992) and their natural hybrids were used as a model for comparing taxa proposed using traditional subjective techniques against numerical techniques (Burke 1998). Variation in the section was initially investigated using 76 characters. Of these, 48 characters were considered of taxonomic value for analysing *Dendrocoryne* (Adams et al 2006c) and 33 characters for *D. speciosum* analysis (Adams et al 2006a, 2006b). For each plant, characters were measured on three parts where possible, then averaged. The first leaf from the base of the pseudobulb was used for leaf measurements (Table 1).
Table 1. Morphological characters used in analyses for variation within and between populations of *Dendrobium speciosum*.

**Vegetative characters**
1. Pseudobulb length (cm)
2. Pseudobulb width at base (cm)
3. Pseudobulb width at midpoint (cm)
4. Pseudobulb width at top (cm)
5. Number of internodes
6. Collum (narrowing of pseudobulb above swollen base) 0 = absent, 1 = 0.5 – < 1.0 cm long, 2 = 1.0-2.0 cm long, 3 = >2.0 cm long
7. Number of leaves
8. Leaf length (cm)
9. Leaf width (cm)
10. Leaf thickness (mm)
11. Aerial roots 0 = nil, 1 = 1-3 per 10 pseudobulbs, 2 = 4-25 per 10 pseudobulbs (roots usually > 10 cm in height), 3 = >25 per 10 pseudobulbs (roots usually erect and > 30 cm in height)

**Floral characters**
12. Number of flowers
13. Rachis length (cm)
14. Peduncle length (cm)
15. Peduncle width (mm)
16. Flower length (dorsal sepal tip – lateral sepal tips) (cm)
17. Flower length (dorsal sepal tip – mentum) (cm)
18. Flower width across petals (flattened) (cm)
19. Flower width at mentum (flattened) (cm)
20. Dorsal sepal length (cm)
21. Dorsal sepal width at base (cm)
22. Petal length (cm)
23. Petal width at base (mm)
24. Individual lateral sepal width at base (cm)
25. Width of lateral sepals at widest point (flattened) (cm)
26. Distance between lateral sepal tips (flattened) (cm)
27. Inner width of lateral sepals at widest point (flattened) (cm)
28. Distance from base of lateral sepals to their tips (cm)
29. Pedicel length (cm)
30. Midlobe length (cm)
31. Midlobe width (cm)
32. Forelobe length (cm)
33. Forelobe width (cm)

^ Forelobe = lateral lobes plus lamina

Data were collected from 500 plants throughout the distribution range, and grouped into regions based on latitude and distribution of previously designated taxa. This is a representative sample from several thousand individuals closely observed in the field. The following numbers of representative plants were used in the regional analyses (see Figure 1): Region 1a – 42 plants, Region 1b – 32 plants, Region 2 – 28 plants, Region 3 – 19 plants, Region 4 – 24 plants, Region 5 – 41 plants, Region 6 – 45 plants, Regions 7 and 8 – 50 plants (total 281).

The analyses used computer techniques to objectively compare similarities and differences in individuals. ANOVA (Analysis of Variance) was applied to detect any significant differences between populations for each characteristic. This simple method is not useful for defining groups, but results highlighted that each character intergraded between regions. Figure 2 exemplifies the wide variation evident in many characteristics.
Dendrobium speciosum var. boreale. Short form, erect racemes.

Dendrobium speciosum var. curvicaule. On Tulip Oak (Argyroderdon)

Open rocky habitat of Dendrobium speciosum var. boreale, Mt. Lewis.
Dendrobium speciosum var. curvicaule, Clarke Range.

Dendrobium speciosum var. curvicaule, Clarke Range.

Dendrobium speciosum var. curvicaule 'Crediton Cream'
The Orchadian, Volume 15 Number 5

Photographs: Photographs were taken using a Nikon FE2 with Fuji Velvia 50 ASA slide film. They have been selected to illustrate the range of floral forms, unusual and similar forms, and flowers from the interfaces of regional varieties. A range of horticultural quality is represented, as occurs naturally.

Results

Numerical Studies: When numerical techniques are used to study the species in sect. Dendrocoryne, the species form discrete groups (Figure 3). In contrast, the key results for D. speciosum summarized in Figures 4-10 demonstrate a single species complex with continuous variation. Full results, including all relevant PCoA axes, can be viewed in Adams et al 2006a, 2006b, 2006c. No analytic techniques differentiated discrete sub-groupings when all regions were considered together (Figure 4). There was a major overlap of all individuals from regions known for particular taxa. In each region individuals tended to group loosely together, but there are outliers in all groups. Plants of Region 6 (var. hillii) and Region 1a separate to a degree, but still overlap considerably as a part of the main complex.

Regional Principal Coordinates Analysis:
As the PCoA (Figure 4) indicated a species complex, regional subsets of plants were analysed to further examine for possible taxa below the level of species.

Regions 1 and 2 (North Queensland): The northern rainforest group of var. curvicaule has minimal overlap in ordination space with the southern rainforest group of var. curvicaule of Region 2 (Figure 5). There is considerable overlap between plants of var. pedunculatum in open forested dry country west of the divide, and northern groups of var. curvicaule. There is little overlap between var. pedunculatum and southern var. curvicaule. A separate analysis of var. curvicaule (southern rainforest group) reveals no sub-groupings in Region 2 (Figure 6).

Regions 3 and 4 (Central Queensland): Along the Tropic of Capricorn, the analysis indicates three sub-groupings. A Carnarvon area group and Blackdown Tableland group abut one another with minimal overlap, and var. capricornicum of east Capricorn overlaps with the Blackdown Tableland group to some extent (Figure 7). There is extensive variation in these regions, especially for Blackdown Tableland, the

Regional Principal Coordinates Analysis: Morphological data were range-standardized and subjected to numerical pattern analysis with the PATN package as previously described (Burke and Adams 2002). In this account we present results of Principal Coordinates Analyses (PCoA). The simplest explanation of this more powerful type of analysis is that all characters are compared for each plant, and a point representing each plant placed on the axes or in a three-dimensional box like map coordinates. The distance between points represents approximate degrees of similarity of plants. The important characters responsible for the distribution of individuals on the axes can be identified (for full details of methods see Adams et al 2006a). All ordinations were done in three dimensions, but only the axes showing the best separation of groups are presented in the figures.

DNA Analysis: Molecular studies using the internal transcribed spacer (ITS) region of the 18S - 26S nuclear ribosomal DNA repeat unit were carried out on representatives of all 9 varieties of D. speciosum, using standard techniques. The ITS region is commonly used to study orchids at the level of genera and species. It is variable and considered most likely to identify sub-groups.

Figure 1. Regions as defined for the study of Dendrobium speciosum.
Figure 2. Variation one character ‘pseudobulb width at base’ of *Dendrobium speciosum* in different regions.

Figure 3. Three dimensional ordination from PCoA using vegetative and floral morphological characters of five species of *Dendrocoryne*, showing that plants of each species cluster together.
Dendrobium speciosum var. capricornicum. Habitat of volcanic plugs with Hoop pine (Araucaria).

Dendrobium speciosum var. capricornicum. Gold form, Capricorn coast.

Dendrobium speciosum var. capricornicum. White form, Capricorn volcanic plug.
Dendrobium speciosum var. carnarvonense. Habitat, Carnarvon Gorge.

Dendrobium speciosum var. carnarvonense. Carnarvon Gorge.

Dendrobium speciosum var. carnarvonense. Cream form, Carnarvon Gorge.
volcanic plugs, Byfield and Shoalwater Bay. Plants at Mt. Jim Crow, for example, ordinate at a considerable distance from plants from the other plugs. Shorter plants from isolated populations at Sarina and Clairview (southern part of Region 2) and Mt. Morgan (northern part of Region 5) overlap in ordination space with the three groups in Regions 3 and 4. Blacktown Tableland and Carnarvon Gorge are separated due to the high character values at Carnarvon Gorge for forelobe length, flower length, dorsal sepal length, forelobe width, petal length and individual lateral sepal width. Plants on the plugs separate from Blackdown Tableland and Carnarvon Gorge due to lower values for pseudobulb and leaf length.

Regions 5 and 6 (southern Queensland and northern NSW): There is a small degree of overlap between plants of Region 5 (var. grandiflorum) and plants of Blackdown Tableland and Carnarvon Gorge, but no overlap between plants of Region 5 and east Capricorn (Adams et al 2006b). There are no significant sub-groupings revealed in Regions 5 (var. grandiflorum) and 6 (var. hillii) (Figures 8, 9). Intermediates are found at the junction between Regions 5 and 6, where the distribution of D. speciosum is continuous.

Regions 7 and 8 (southern NSW and Victoria): Populations in these regions (the habitat of var. speciosum) form a fairly cohesive group with no significant sub-groupings (Figure 10), similar to the PCoA of Regions 5 and 6.

DNA Studies: DNA analyses of the 9 varieties indicated that there were very minor nucleotide base differences associated with geography. Within the six southern-most varieties there was a difference of only two base pairs in a sequence of approximately 700 base pairs. There were less than six base differences between the three northern-most varieties. These findings are consistent with a single variable species and do not provide support for raising varieties to species level.

Figure 4. Ordination from PCoA of Dendrobium speciosum individuals from throughout the distribution range using vegetative and floral morphological characters. Individuals are identified by region (see Figure 1). The ordination shows that the variation is continuous and forms a complex.

Figure 5. Ordination from PCoA using vegetative and floral morphological characters of Dendrobium speciosum individuals in North Queensland. Northern rainforest plants (var. boreale) cluster separately from southern rainforest plants (var. curvicaule).

Figure 6. Ordination from PCoA using vegetative and floral morphological characters of Dendrobium speciosum var. curvicaule from different localities. No sub-groupings are evident at Eungella, Cathu or elsewhere.

Figure 7. Ordination from PCoA using vegetative and floral morphological characters of Dendrobium speciosum from Central Queensland. Plants of these regions cluster separately and abut one another.

Figure 8. Ordination from PCoA using vegetative and floral morphological characters of Dendrobium speciosum var. grandiflorum from different localities. No sub-groupings are evident.

Figure 9. Ordination from PCoA using vegetative and floral morphological characters of Dendrobium speciosum var. hillii from different localities. No sub-groupings are evident.

Figure 10. Ordination from PCoA using vegetative and floral morphological characters of Dendrobium speciosum var. speciosum from different localities. There are no sub-groupings in the Illawarra, Victoria-southern NSW or elsewhere. The two circles on the right hand side represent intermediates between var. speciosum and var. hillii.
Habitat of *Dendrobium speciosum* var. *blackdownense*.

*Dendrobium speciosum* var. *blackdownense*. Gold form, Blackdown Tableland.

*Dendrobium speciosum* var. *blackdownense*. Cream form, Blackdown Tableland.
Dendrobium speciosum var. blackdownense. White form, Blackdown Tableland.

Dendrobium speciosum var. blackdownense. Brush flowered form, Blackdown Tableland.
New Taxa
From our field observations and numerical analyses in all parts of the distribution range we described the following taxa (Adams et al 2006c, 2006b), which are reprinted here for the convenience of readers.

*Dendrobium speciosum* var. *blackdownense*.

**Breif Description**: Plants variable but often urn-shaped, axes short to medium, racemes medium to long in relation to plant height, few to very many flowered, small to medium sized opening widely, tepals off white to deep gold.

**Type**: Queensland, Leichhardt District, Blackdown Tableland 4/9/1994 P. B. Adams and S. D. Lawson. (holo: QRS; iso: BRI MEL)

Leaf bearing axes 9-28 cm long, 2.1-3.8 cm wide, round to oval in cross section, variably erect or curved, 1.9-3.5 cm wide at the base, width at apex 1.5-2.8 cm. Occasional plants show a tendency to produce aerial roots. *Leaves* 2-4, 9-20 cm long and 4.3-7 cm wide, variably sub-elliptic or sub-oblong, concave, rigid, 1-2 mm thick, axes and leaves may exhibit purple pigment in areas exposed to direct light. *Racemes* 1-3, 23-58 cm long, the peduncle 8-15.5 cm long and 4-6 mm wide, rachis 15-42 cm long with 1-4 medium sized bracts along the peduncle length, rachis with 14-113 flowers from openly spaced to densely clustered, forming a brush, pedicel including ovary 2.3-3.7 cm long. *Flowers* usually opening widely, vertical length 3.5-5.4 cm and horizontal width 3.9-5.4 cm, off white to deep gold. Labellum variously marked with purple spots or short bars, tepals very variable in width and substance. *Dorsal sepal* 1.8-3 cm long and 0.5-0.8 cm wide at the base, tapering to an obtuse-rounded apex. *Lateral sepal* 1.6-2.4 cm long and 0.7-1 cm wide at base, falcato-oblong and obtuse at apex. Petals 1.8-2.7 cm long and 3-4 mm wide, almost linear and ending acutely at apex. *Labellum* 0.8-1.3 cm long and 0.9-1.2 cm wide when flattened. Forelobe 0.5-0.7 cm long and 0.9-1.2 cm wide, incurved and subtriangular, midlobe on a short claw, 0.3-0.6 cm long and 0.7-1.0 cm wide when flattened, presenting as a curved channel with a short acute apex. *Column* about 5 mm long with a foot approximately 6 mm long at right angles to it. Mentum bifid, rounded, length from ovary to apex about 2 mm, callus raised, 2-ridged, low profiled, with a yellow or orange colour, labellum barred or spotted over forelobe and midlobe, markings diffuse and very variable.

**Variation**: The most variable in vegetative and floral form of all the described varieties, with flowers densely or openly spaced, flowers white to deep gold, and plant height and shape varying over a wide range of habitats. (see photographs).

**Flowering time**: August-September

**Distribution**: from the northern limit of Blackdown Tableland southwards along the Expedition Range, southern limit not determined.

**Etymology**: The epithet refers to the Blackdown Tableland.

**Notes**: Plants of Blackdown Tableland are geographically separated (disjunct) from plants of the Great Dividing Range to the west and coastal ares to the east by flood plains that are unsuitable habitat for *D. speciosum*. Usually lithophytic, occasionally epiphytic in sclerophyll forests, dry rainforest and exposed rocky cliff faces, often forming dense populations on huge boulders associated with *Drynaria* fern, out of reach of fire. Often urn or basket shaped. Some plants develop a few aerial roots, some are very short and compact at maturity. Although very variable, plants can usually be distinguished from var. *carnarvonense* plants, which tend to be more robust, with large flowers of very heavy substance. There is overlap in both floral and vegetative characters with plants of var. *capricornicum*, which can often, but not always, be distinguished by shorter axes, shorter leaves, more upright plant shape, and usually an earlier flowering time (May-July).

*Dendrobium speciosum* var. *carnarvonense*.

**Brief Description**: Plant robust, usually urn-shaped, axes short to medium, wide at the base, racemes short to medium, flowers large, cupped, segments wide, of heavy substance, forelobe wide and long, tepals cream to gold.


Leaf bearing axes 15-33 cm long, 2.1-3.1 cm wide, round to oval in cross section, variably curved and often urn-shaped with a wide axis base, 2-5.2 cm, width at the apex 1.3-2.2 cm,
occasional plants show a tendency to produce aerial roots. Leaves 2-3, 14.8-24 cm long and 4.6-7.4 cm wide, variably sub-elliptic or sub-oblanceolate, concave, rigid, 1.2-2.0 mm thick, axes and leaves may exhibit purple pigment in areas exposed to direct light. Racemes 1-2, 21-47 cm long, the peduncle 7-14.8 cm long and 4.5-7 mm wide, rachis 14.5-31.5 cm long with 1-4 medium bracts along the peduncle length, rachis with 25-87 flowers moderately clustered, pedicel including ovary 2.7-4.5 cm long. Flowers usually cupped and of heavy substance, vertical length 5.1-6.6 cm and horizontal width 5.5-6.3 cm, cream to gold, labellum variously marked with purple spots or short bars. Dorsal sepal 2.8-3.9 cm long and 0.5-0.8 cm wide at the base, tapering to an obtuse-rounded apex. Lateral sepals 2.1-2.5 cm and 0.8-1.1 cm wide at base, falcate-oblanceolate and obtuse at apex. Petals 2.4-3.4 cm long and 2.8-4 mm wide, almost linear and ending acutely at apex. Labellum 1.1-1.4 cm long and 1-1.3 cm wide when flattened. Forelobe 0.7-0.8 cm long and 1.1-1.4 cm wide, incurved and subtriangular, midlobe on a short claw, 0.4-0.6 cm long and 0.9-1.0 cm wide when flattened, presenting as a curved channel with a short acute apex. Column about 5 mm long with a foot approximately 6 mm long at right angles to it. Mentum bifid, rounded, length from ovary to apex about 7 mm, callus raised, 2-ridged, low profiled, with a yellow or orange colour, labellum barred or spotted over forelobe and midlobe, markings diffuse and variable.

Flowering time: August-September

Distribution: Gorges of the Carnarvon region (Canarvon Range), geographically separate from other varieties.

Etymology: The epithet refers to the Carnarvon Region

Notes: Usually lithophytic, along escarpments and rocky creeks, robust plants of medium height with strong inflorescences and medium to large flowers of heavy substance, deep cream to gold, usually distinguishable from those of var. blackdownense by these characteristics. The plants are larger and more robust compared to var. capricornicum, and their flowers usually have wider segments and much heavier substance. They most closely resemble var. speciosum in plant form, and flower shape and substance, as noted by Gregory (1988) (see photographs). New growths often show a strong development of purple anthocyanin pigment, like var. capricornicum and var. blackdownense. The pigment is usually not evident in mature leaves.


Brief Description: Leaf-bearing axes short to long (13-71 cm), rarely curved; collum usually prominent; peduncle moderately long (8–29 cm) but not longer than rachis; flowers well spaced; tepals off white to pale yellow, broad in relation to length; lateral sepals moderately broad (0.7-1.0 cm) with little incurving.

Synonyms

Plants very variable in shape and habit, occasionally producing aerial roots. Leaf-bearing axes 12.6-71.0 cm long, 1.4-4.6 cm wide at midpoint, with little tapering or shorter and fusiform, usually with a prominent collum at base 1.3-4.4 cm long, axis at base 1.3-2.7 cm wide, oval or flattened in cross section, erect or curved or gently angled once or twice in distal half, sharply edged over distal half (especially notable in axes of taller plants 1-2 years old), tapering or broadening towards apex 1.2-4.2 cm wide. Leaves terminal, erect and narrower in shorter forms, 2-4, 9-34 cm long, 5-11 cm wide, sub-elliptic to oblongate with a sheathing base, concave, rigid, 1-2.6 mm thick, relatively thin, large, and flexible in dense shade, relatively small and thick when exposed. Axes and leaves sometimes showing purple pigment in areas exposed to strong light. Racemes 1-3,
Dendrobium speciosum var. grandiflorum. Gold form, Mt. Larcom.

Dendrobium speciosum var. grandiflorum. White form, west of Miriam Vale.
18-76 cm long; peduncle 8-29 cm long, 3-8 mm wide, shorter or no longer than the rachis, with 1-5 prominent bracts; rachis 10-48 cm long, with 9-125 star-like flowers openly spaced and displayed. Pedicel including ovary 2.5-5.3 cm long. Flowers usually opening widely, 3-5 cm long vertically, 3.3-5.5 cm wide horizontally when flattened, off white to cream, occasionally pale yellow, with purple spots or short bars marking the forelobe and midlobe of the labellum; tepals presenting with wide bases and heavy substance. Dorsal sepal 1.8-3.0 cm long, 0.55-0.9 cm wide at base, tapering from base to an obtuse-rounded apex. Lateral sepals 1.3-2.1 cm long, 0.7-1.0 cm wide at base, falcato-oblong, slightly incurved, obtuse at apex. Petals 1.6-2.7 cm long, 2-5 mm wide, almost linear, ending acutely at apex. Labellum 1.1-1.7 cm long, 1-1.3 cm wide; forelobe 0.7-1.0 cm long, 1-1.3 cm wide when flattened, incurved, subtriangular; midlobe on a short claw, 0.4-0.7 cm long, 0.6-1.0 cm wide when flattened, presenting as a curved channel with a short acute apex. Column about 5 mm long, with a foot about 6 mm long and at right angles to it. Mentum bifid, rounded, about 7 mm long from ovary to apex. Callus raised, 2-ridged, low profiled, yellow to orange.

Flowering: July, August, September, usually later than var. pedunculatum.

Distribution: Annan River, south to Mt. Elliot, south of Townsville.

Etymology: The epithet alludes to the most northerly distribution of any variety of D. speciosum (Latin: borealis = northern).

Notes: Lithophytic or epiphytic in and around rainforest, variable in size but commonly tall in densely shaded rainforest gullies. Lithophytic plants in more exposed sites are shorter with similar floral characters, often associated with small shrubs and moss beds. East of the Great Dividing Range, from Mt. Elliot south of Townsville to the Annan River from almost sea level to over 1200 m.

Relationship to other taxa and forms: There is a small degree of overlap with var. curvicaule in morphology and numerical characteristics. Dendrobium speciosum var. boreale is clearly distinguished from typical var. pedunculatum in drier habitats, the latter having smaller pseudobulbs, shorter racemes and usually smaller flowers with more rounded segments. In drier rainforest and sclerophyll forests e.g. Tinaroo Dam, Paluma, Bluewater, Mt. Elliot, Hidden Valley; and in wet rainforest with high light conditions e.g. Tully, smaller plants show floral and vegetative characteristics that are intermediate in morphology between rainforest forms and var. pedunculatum (Figure 5). These forms are interpreted as shorter variants of var. boreale. Previously many of these plants were confused with D. pedunculatum. The PCoA ordination indicates overlap between var. boreale and var. pedunculatum in a continuum. The intermediate forms have variable peduncle length, from shorter to longer in relation to rachis. Axes of var. boreale are not significantly curved unless growing on vertical surfaces.

At Paluma and Hidden Valley some plants are shorter, 20-40 cm, with narrower cylindrical axes and small rounded white flowers up to 90 per raceme. To the north there is a gradation towards the typical rainforest form of var. boreale, as the habitat becomes wetter, and rainforest canopy denser. Southwards to Townsville and beyond, where populations are more isolated and close to sea level, they may be diminutive with a less distinct or absent collum.

Dendrobium speciosum Sm. var. curvicaule
F. M. Bailey


Type: Not found.


Brief Neotype Diagnosis

Leaf-bearing axes short to medium (10.7-42 cm long), collum usually inconspicuous, peduncle short (7.5-16 cm long), flowers moderately spaced to crowded, off white to bright yellow, tepals variably long, lateral sepals broad (0.8-1.2 cm wide), variably incurving.

In the protologue of his var. curvicaule, Bailey described the provenance of the material on which he based his description as follows: ‘Hab.: Lady Elliot’s Island, from whence Mr. Soutter received the plants now (September) flowering in the bushhouse, Bowen Park’. Lady Elliot Island is a coral cay. Clemesha (1981) provides a brief outline of the removal of vegetation from the island during guano-mining activities at the
end of the nineteenth century. Given its dry exposed habitat, it is most unlikely that the plant forwarded by Soutter to Bailey was collected on Lady Elliot Island. As far as is known, and from our field surveys, *D. speciosum* does not grow on any coral cay. From habitat studies we do not accept that the specimen received by Bailey came from Lady Elliot Island. If present, it would have been var. *grandiflorum*, which occurs at that latitude.

In the Queensland Herbarium there is a solitary specimen bearing the name var. *curvicaule* in Bailey’s handwriting. No collector, locality or date is recorded on the herbarium sheet, which has been assumed by researchers to be the type of var. *curvicaule*. The specimen is very fragmentary consisting of a short piece of stem, with an attached leaf, an inflorescence axis, two buds and a flower. The specimen does not accord well with all of the elements in the description in the protologue, differing among other characters in that the leaf is elliptical in shape, not “oblong, the end somewhat pointed”, and the inflorescence axis is 30 cm long, consisting of a 16 cm peduncle and 14 cm rachis, not “9 or 10 inches” (22 or 25.5 cm). Given these discrepancies it seems unlikely that this specimen is part of the original material on which the name was based, and was another collection determined by Bailey. We do not consider that the specimen had an origin from the southern rainforests of north Queensland, as the leaf is 13.6 cm, which is below the lower limit of the range for leaf length, and outside the leaf dimensions commensurate with a raceme length of 30 cm for var. *curvicaule*. The peduncle is also too long in relation to the rachis length. The short, broad segments of the solitary flower reflect an origin from other areas in central or northern Queensland.

Bailey’s description of var. *curvicaule* is insufficiently diagnostic to enable the taxon to which the name applies to be clearly identified. This, coupled with the fragmentary nature of the putative type specimen, significant differences between the specimen and the description, and uncertainty concerning the provenance of the type itself, has led to ambiguity concerning the correct application of the name var. *curvicaule*. Given the persistent uncertainty surrounding the correct application of the name var. *curvicaule*, we decided to designate a neotype that unambiguously applies this name to the “southern rainforest” variety of *Dendrobium speciosum* from northern Queensland.

**Synonyms**


Plants very variable in shape and size, aerial roots prominent in occasional plants. Leaf bearing axes curved, fusiform or linear, 10.7-52 cm long, 1.7-5.1 cm wide at midpoint, with an indistinct or absent collum at base, if collum present then widening distally over only 1-2 cm, axis at base 1.3-4.0 cm wide, round to oval in cross section. Apex of axes usually narrowing to 1.4-3.4 cm wide, variably sharply edged only in the distal few centimetres. Leaves terminal, 2-4, 15-26.6 cm long, 4-9.2 cm wide, leaf shape variable, sub-elliptic to oblanceolate with a short sheathing base, concave, rigid, 1-2.7 mm thick, thinner, larger and more flexible leaves in dense shade, smaller and thicker when exposed to sun. Racemes 1-3, 20-65 cm long, peduncle 7.5-16 cm long, 3.7-7.9 cm wide, shorter than the rachis with prominent bracts; rachis 12.5-45.5 cm long, bearing 20-135 flowers, open or very closely spaced and overlapping, pedicel including ovary medium to very long, 2.2-5.2 cm long. Flowers small to large, usually opening widely but sometimes cupped, 4-7.1 cm long vertically, 4.1-7 cm wide horizontally when flattened, off white to deep yellow segments with heavy substance, labellum white to cream, variously marked with purple spots or bars on forelobe and midlobe. *Dorsal sepal* 2.2-4.1 cm long, 0.6-1.0 cm wide at base, tapering from base to an obtuse-rounded apex. *Lateral sepals* 1.4-2.5 cm long, 0.8-1.2 cm wide, falcato-oblong and obtuse at apex. Petals relatively long 2.1-3.6 cm long, 3-5 mm wide at base, almost linear and ending acutely. *Labellum* 0.9-1.5 cm long, 1-1.3 cm wide, forelobe 0.6-0.9 cm long, 1-1.3 cm wide when flattened, incurved and subtriangular, midlobe on a short claw, 0.3-0.6 cm long, 0.7-1.6 cm wide when flattened, presenting as a curved channel with short acute apex. *Column* about 5mm long with a foot 5-6 mm long at right angles to it, mentum bifid, rounded, 6-7 mm from ovary to apex. Callus raised, 2-ridged, low profiled, orange coloured.

**Flowering:** August-September

**Distribution:** Mt. Dryander north east of Proserpine, to St. Lawrence from almost sea level to 1150 m, also on the Whitsunday Islands.

**Notes:** Commonly epiphytic in and
around rainforest; often on *Argyrodon dendron actinophyllum ssp. actinophyllum* (F. M. Bailey) Edlin, *Argyrodon polyandrum* (L. S. Sm.), *Archontophoenix alexandrae* (F. Muell.) H. L. Wendle. & Drude, *Toona australis* (F. Muell.) Harms and other tall trees; lithophytic on exposed areas and open creek sites. This is predominantly a rainforest variety with a well defined distribution, variation in plant form relating to position on trunks and in the canopy. The floral forms vary in size and colour characteristics and vary in horticultural quality from fair to outstanding. Exposed plants on rocks and shrubs outside the rainforest are usually shorter and may have purple pigments in leaves and axes. Axes are not uniformly curved, many plants having erect pseudobulbs. The name ‘curvicaule’ is misleading. Plants of various shapes, including planar, subplanar, semi-um, and urn will revert to an urn shape when grown in even light, with variable straight or mildly curving pseudobulbs. This indicates that prevailing conditions, rather than genetic factors, determine pseudobulb and plant shape. Although this taxon is variable, there are no identifiable subtaxa in its area of distribution (Figure 6).

### Relationship to Other Taxa and Forms:

*Dendrobium speciosum* var. *curvicaule* has a minimal overlap in characteristics with var. *boreale* on the Atherton Tablelands and north and south of Townsville. In PCoA there is overlap between these varieties and var. *pedunculatum* (Figure 5). The distance between typical forms of var. *boreale* and var. *curvicaule* is no more than 125 km, which represents an area of unsuitable habitat. In the total analysis of *D. speciosum* (Burke and Adams 2002) we have also shown numerical overlap between plants now ascribed to var. *curvicaule*, and populations attributable to var. *capricornicum* in east Capricorn, and also overlaps with plants in west Capricorn (Blackdown Tableland and Carnarvon Gorge).

### Descriptions of other varieties

These are based on measurements of 453 plants combined with field observations. Occasional plants may be encountered with measurements outside of the ranges of values presented here.

*Dendrobium speciosum* Sm. var. *speciosum* Sm (1804) Plants variable, basket or urn shaped, with curved axes or more erect if axes less curved. Usually lacking aerial roots, but occasional plants produce them; axes and leaves exhibiting purple pigmentation in parts exposed to direct light. Leaf bearing axes usually wide based and tapering towards the apex, 13-51 cm long, 2.1-4.5 cm wide at midpoint, round to oval in cross section, variably erect or curved, 2.8-6.0 cm wide at base, 1.4-3.2 cm wide at apex. Leaves terminal, 2-5, rigid to very rigid, concave, sub-elliptic to ovate, occasionally oblancoceleate, relatively broad at the sheathing base, 9-20 cm long and 4-12 cm wide, 1-2 mm thick. *Racemes* 1-4, 14.5-57 cm long; peduncle 5-16 cm long, 4.6-9.5 mm wide, with 1-4 medium sized bracts; rachis 15-41 cm long, 18-115-flowered; flower density varying from openly spaced to fairly densely clustered. Pedicel including ovary 2.7-5.6 cm long. *Flowers* usually opening moderately or widely, variable in substance, vertical height 4.2-8 cm, horizontal width 4.3-7.8 cm, off white to deep gold, labellum variously and diffusely marked with purple spots or short bars over forelobe and midlobe. *Dorsal sepal* 2.5-4.6 cm long, 0.4-1.0 cm wide at the base, tapering to an obtuse-rounded apex. *Lateral sepals* 1.8-3.9 cm long, 0.7-1.2 cm wide at base, falcato-oblong, obtuse at apex. Petals 2.2-4.1 cm long, 2-5 mm wide, slightly falcate, with an acute apex. *Labellum* 1.1-1.7 cm long, 0.8-1.5 cm wide when flattened; forelobe 0.6-0.9 cm long, 0.8-1.5 cm wide, incurved, subtriangular; midlobe shortly clawed, 0.3-0.8 cm long, 0.6-1.2 cm wide when flattened, presenting as a curved channel with a short acute apex; callus slightly raised, 2-ridged, yellow to orange. *Column* 4-5 mm long with a foot 5-6 mm long at right angles to it. Mentum bifid, rounded, 6-7 mm from ovary to apex.

### Flowering time:

August - October, or November in eastern Victoria.

### Distribution:

From Genoa, eastern Victoria (formerly at Cann River, but reportedly extinct there now), north to Bulahdelah, Barrington Tops, New South Wales. Inland, west 200 km to Munghorn Gap near Mudgee, New South Wales.

Notes: Large robust plants which may form dense colonies covering whole rock faces on the eastern escarpments of the Great Dividing Range. Occurs from sea level to the tops of ranges in open and closed sclerophyll forest and rainforest. In rainforest it is also lithophytic and less frequently an epiphyte, occasionally with aerial roots. Pseudobulbs wide at base, often curved and tapering towards the apex. Flowers relatively large and well spaced, including superior horticultural forms. Larger
flowered forms occur in the northern half of the range, from pure white to golden yellow. The variety is variable in size, plant shape and floral dimensions, but less so than most of the more northerly varieties, and intergrades with var. hillii primarily north of the Hunter River, New South Wales. In wetter and more favourable habitat in the Illawarra and Wattagan Mountains, very robust, showy plants are found, but do not form sub-groups.

**Dendrobium speciosum Sm. var. hillii Masters (1877)**

Plants variable, tall and upright in habit, commonly producing aerial roots, especially prominent and erect in large rainforest plants. Leaf bearing axes 16-68 cm long, 1.8-5.2 cm wide at midpoint, oval in cross section, may be considerably flattened, collum usually present, variably erect or gently curved, 1.4-4.4 cm wide at base, 1.5-4.2 cm wide at apex. *Leaves* terminal, 2-5, often very large, rigid, concave, sub-elliptic to oblongate, occasionally ovate, relatively broad at the sheathing base, 13-28 cm long, 6-12 cm wide, 1-2 mm thick. *Racemes* 1-4, 26-65 cm long; peduncle 6-13.6 cm long, 4-9.5 mm wide, with 1-4 medium sized bracts; rachis 20-51 cm long, 44-221-flowered: flower density varying from openly spaced to densely clustered. Pedicel including ovary 2.3-4.6 cm long. *Flowers* small to medium, opening variably, may remain cupped, usually light in substance, vertical height 3.4-5.2 cm, horizontal width 2.9-5.3 cm, usually off white to pale yellow, the labellum variously and diffusely marked with purple spots or short bars over forelobe and midlobe. *Dorsal sepal* 1.9-3.7 cm long, 0.4-0.6 cm wide at the base, tapering to an obtuse-rounded apex. *Lateral sepals* 1.4-2.7 cm long, 0.6-0.9 cm wide at base, falcato-oblong, obtuse at apex. Petals 1.8-3.2 cm long, 2-3 mm wide, slightly falcate, with an acute apex. *Labellum* 0.8-1.3 cm long, 0.7-1.0 cm wide when flattened; forelobe 0.5-0.8 cm long, 0.7-1.0 cm wide, incurved, subtriangular; midlobe shortly clawed, 0.3-0.5 cm long, 0.5-0.8 cm wide when flattened, presenting as a curved channel with a short acute apex; callus slightly raised, 2-riddged, yellow to orange. *Column* 4-5 mm long with a foot 4-6 mm long at right angles to it. Mentum bifid, rounded, 5-6 mm from ovary to apex. **Flowering time:** August - October **Distribution:** Occurs, or formerly occurred, just south of the Hawkesbury River in central eastern New South Wales, to Mt. Mee – Crows Nest in southern Queensland, where it begins to intergrade with var. grandiflorum.

**Notes:** In optimal moist rainforest habitat, these plants are very large epiphytes with pseudobulbs more than a metre in height, and forming masses in the canopy several metres in diameter. They are much more abundant and larger in upland forest. In more exposed and drier habitat, rainforest or open forests, they are smaller, and occur as lithophytes or epiphytes. Recognizable by erect, relatively slender, virtually non-tapering pseudobulbs, relatively large leaves and long racemes crowded with many small, white to cream, or occasionally pale yellow flowers. Aerial roots are less common in more exposed sites. At the western limit and at the intergrade with *D. speciosum*, plants may be squat, atypical, and with widely spaced large flowers which are difficult to identify as this variety.

**Dendrobium speciosum Sm. var. grandiflorum F. M. Bailey (1896)**

Plants variable, often epiphytic, with very large rainforest forms, commonly with well developed aerial roots. Leaf bearing axes 17-95 cm long, 2.6-5.5 cm wide at midpoint, oval or flattened oval in cross section, variably erect or curved, 1.8-3.3 cm wide at base, 1.5-3.2 cm wide at apex. *Leaves* terminal, 2-6, often large, rigid, concave, sub-elliptic to oblanceolate, with a short sheathing base, 12-37 cm long, 5-10 cm wide, 1-2 mm thick. *Racemes* 1-4, short to very long, 25-70 cm long; peduncle 9-16 cm long, 4.5-9.5 mm wide, with 1-5 medium sized bracts; rachis 16-54 cm long, 41-123-flowered: flower density varying from openly spaced to densely clustered, small to large sized including some of the largest in the species. Pedicel including ovary 3.2-5.7 cm long. *Flowers* very variable in substance, usually opening widely, pale yellow to deep gold, occasionally bicolour with a cream-white centre, and rarely pure white, vertical height 4.7-8.1 cm, horizontal width 4.8-8.0 cm, the labellum variously and diffusely marked with purple spots or short bars over forelobe and midlobe. *Dorsal sepal* tends to be much larger in relation to other segments, 2.7-4.7 cm long, 0.6-0.9 cm wide at base, tapering to an obtuse-rounded apex. *Lateral sepals* 2.3-4.5 cm long, 0.8-1.1 cm wide at base, falcato-oblong, obtuse at apex. Petals 2.4-4.2 cm long, 3-5 mm wide, slightly falcate, with an acute apex. *Labellum* 1.1-1.6 cm long, 1.7-2.5 cm wide when flattened; forelobe 0.6-0.9 cm long, 1-1.4 cm wide, incurved, subtriangular; midlobe shortly clawed, 0.4-0.7 cm long, 0.7-1.1 cm wide when flattened, presenting as a curved channel with a short acute apex; callus slightly raised, 2-riddged, yellow to orange. *Column* 5-6 mm long with a foot 5-7 mm long at right angles.
to it. Mentum bifid, rounded, 6-8 mm from ovary to apex.

Flowering time: August - October

Distribution: Including the interface with var. hillii, it occurs from Mt. Mee - Crow’s Nest, to the Mt. Morgan area.

Notes: Found in suitable rainforest habitat where it forms dense populations in the canopy on many rainforest trees and hoop pines (*Araucaria cunninghamii* Aiton ex D. Don) and along rocky creeks and escarpments. Pseudobulbs may be almost one metre long in the rainforest, and similar to, but often thicker than those seen in var. hillii, with very large leaves in shady habitat. In more exposed situations as epiphytes or lithophytes, plants may be only 20 cm high, with short, straight or curved pseudobulbs. In the south of the range there is a gradual merging with var. hillii, where many plants are short, smaller, or with pale yellow flowers. Deep yellow colour and large flowers with prominent dorsal sepals help to distinguish only some plants of the variety. Unusual coloured forms of yellow flowers with white centres are reported between Kroombit Tops and Miriam Vale.

**Dendrobium speciosum** Sm. var. *capricornicum* Clemesha (1982)

Plants variable, relatively short and compact, small to medium sized, usually upright in shape and lithophytic, without aerial roots; axes and leaves exhibiting purple pigmentation in parts exposed to direct light. Leaf bearing axes usually cylindrical, 7-19 cm long, 2-3.8 cm wide at midpoint, round to oval in cross section, variably erect or curved, 2-3.9 cm wide at base, 1.6-2.5 cm wide at apex. *Leaves* terminal, 2-5, very rigid and coriaceous, often channelled, sub erect, ovate to oblanceolate, with a short sheathing base, 5-16 cm long, 4.5-6 cm wide, 1-3 mm thick. *Racemes* arching or erect, 1-2, 17-49 cm long; peduncle short to long, 9-22 cm long, 5-7 mm wide, with 1-3 medium sized bracts; rachis 8-27 cm long, 11-68-flowered; flower density varying from openly spaced to clustered. Pedicel including ovary 2.7-4.4 cm long. *Flowers* usually opening widely, very variable in substance, vertical height 3.4-5.9 cm, horizontal width 3.9-5.6 cm, off white to deep gold, the labellum variously and diffusely marked with purple spots or short bars over forelobe and midlobe. *Dorsal sepal* 2.1-3.4 cm long, 0.5-0.8 cm wide at the base, tapering to an obtuse-rounded apex. *Lateral sepals* 1.6-2.9 cm long, 0.7-1.1 cm wide at base, falcato-oblong, obtuse at apex. Petals 1.9-3.0 cm long, 3-5 mm wide, slightly falcate, with an acute apex. *Labellum* 1-1.6 cm long, 1-1.2 cm wide when flattened; forelobe 0.6-0.9 cm long, 1-1.2 cm wide, incurved, subtriangular; midlobe shortly clawed, 0.4-0.7 cm long, 0.8-1.1 cm wide when flattened, presenting as a curved channel with a short acute apex; callus slightly raised, 2-ridged, yellow to orange. *Column* 4-5 mm long with a foot 5-6 mm long at right angles to it. Mentum bifid, rounded, 6-7 mm from ovary to apex.

Flowering time: May – August

Distribution: Mt. Morgan area to Byfield, and west to Berserker Range.

Notes: In east Capricorn, localised colonies with short and very coriaceous leaves are restricted to suitable habitat on volcanic plugs, and in forest and creek side locations at Byfield. On volcanic plugs, plants are exposed to full sun, and only their leaves may be evident between rock crevices. The bulk of the pseudobulbs are protected between layers of stone. In the northern part of the range occasional colonies occur with a wide variety of plant form, and well spaced yellow to gold flowers.

**Dendrobium speciosum** Sm. var. *pedunculatum* Clemesha (1981)

Plants variable, usually short, compact lithophytes without aerial roots. Leaf-bearing axes 4.1-36 cm long, 1.8-4.4 cm wide at midpoint, round to oval in cross section, collum usually absent, 1.2-3.7 cm wide at base, erect or mildly curving. Apex of axes usually narrowing to 1.1-2.7 cm wide. *Leaves* terminal, tending erect, 2-4, 6.3-19.3 cm long, 3.2-8.6 cm wide, leaf shape variable, sub-elliptic to ovate, very coriaceous and rigid, 1.1-2.5 mm thick. Axes and leaves exhibiting purple pigmentation in parts exposed to direct light. *Racemes* arching or erect, 1-2, 17-49 cm long; peduncle longer or shorter than the rachis, 8.4-30.7 cm long, 2.2-5.7 mm wide with bracts; rachis 7.5-26.2 cm long, with 9-72 flowers, open or very closely spaced and overlapping forming a brush. Pedicel including ovary medium to very long, 1.9-4 cm long. *Flowers* usually opening widely or cupped, 2.8-4.5 cm long vertically, 3.1-4.7 cm wide horizontally when flattened, off-white to yellow segments of heavy substance, labellum white to cream, variously marked with purple spots or bars on...
forelobe and midlobe. *Dorsal sepal* 1.8-2.7 cm long, 0.45-0.78 cm wide at base, tapering from base to an obtuse-rounded apex. *Lateral sepals* 1.3-2.1 cm long, 0.7-1.1 cm wide, falcato-oblong and obtuse at apex. Petals 1.5-2.5 cm long, 0.2-0.38 cm wide at base, almost linear and ending acutely. *Labellum* 0.9-1.6 cm long, 0.9-1.3 cm wide when flattened, forelobe 0.6-0.9 cm long, incurved and subtriangular; midlobe on a short claw, 0.3-0.6 cm long, 0.65-1.0 cm wide when flattened, presenting as a curved channel with short acute apex. *Column* about 5 mm long with a foot about 6 mm long at right angles to it, mentum bifid, rounded, 6-7 mm long from ovary to apex. Callus raised, 2-ridged, low profiled, orange colour.

**Flowering time:** July - September

**Distribution:** Parker River headwaters to Girringun National Park, south of Atherton Tableland, representing a narrow strip of open forest with rocky outcrops west of a line drawn through Mareeba, Atherton and Ravenshoe. The type specimen is from this area. The distribution is smaller than previously considered, and habitat has been reduced by altered land use.

**Notes:** Occurs on and to the west of the Great Dividing Range in northern Queensland, including some plants formerly described as var. *pedunculatum*. Short but more robust plants east of a line between Mareeba and Atherton in wetter forest are forms of var. *boreale*, scattered diffusely along rocky exposed watercourses, cliff faces and escarpments, and occasionally found on the base of small trees. Leaves tend to be very coriaceous, and may exhibit purple anthocyanin pigment. There is usually only one raceme per pseudobulb, which is apical with well spaced (occasionally close) pale cream to yellow flowers of heavy substance. The peduncle is often as long as or longer than the rachis, but forms are found with much shorter peduncles.

**Variation Within and Between Regions**

Continuous variation between and within regions, and plants of intermediate type at areas of overlap emphasize the interpretation of *D. speciosum* as a single species complex.

**Region 1 (North Queensland):** A large distribution area with wide variation of plant and floral form, mainly in size characteristics, with var. *pedunculatum* intergrading in a narrow zone with var. *boreale*. Variety *pedunculatum* is confined to a narrow strip to the west of var. *boreale* in open exposed forest and cliff faces. Northwest of Townsville (e.g. Paluma Range) and further north of Townsville (e.g. Tully) more compact plants with heavily textured white flowers and long racemes have been noted. These plants have a distinctive appearance, peduncles varying from short to almost half the length of the raceme. Some of these have previously been called var. *compactum* and var. *pedunculatum*. We interpret these plants as shorter forms of var. *boreale*, occurring usually in more open situations.

**Region 2 (North Queensland):** Plants with a wide range of vegetative and floral morphology, described as var. *curvicaule* with little overlap with var. *boreale*. Flowers are generally large and cream coloured, of heavy substance, and include superior horticultural forms well known to growers. There is overlap with other varieties (Figure 4). The detailed ordination of var. *curvicaule*, including all major localities from Proserpine, Cathu, Eungella, Crediton, to Sarina and Clairview, does not indicate any clustering to suggest more than one taxon (Figure 6).

**Region 3 (East Capricorn, Central Queensland):** Plants on different volcanic plugs vary considerably in pseudobulb and leaf dimensions, floral colour (white to yellow) and form. The volcanic plugs where var. *capricornicum* occurs is a small region around Rockhampton, Emu Park, Yeppoon and Shoalwater Bay. From Yeppoon north to Clairview, very isolated populations are intermediate in morphology with var. *curvicaule*. There is considerable overlap with Regions 1, 2, 4, 7 and 8 in PCoA analysis, and no characteristics which differ significantly from other regions. Diminutive forms sheltered by rocky ledges are present in very exposed, desiccating conditions at the limits of suitable habitat.

**Region 4 (West Capricorn, Central Queensland):** This has the greatest variation in size characteristics, and numerical analyses indicate three varieties in PCoA results along the Tropic of Capricorn (Figure 7). We have defined var. *blackdownense* and var.
carnarvonense using the most distinctive characters. Findings confirm comments by others including Walsh (2002) that these plants do not fit with descriptions of var. capricornicum, a separate population more than 200 km east. Plants of var. carnarvonense are usually robust with tapering pseudobulbs like southern forms of var. speciosum, and the heavy textured flowers show much less variation than var. blackdownense. Some of the variability and unusual forms are shown in the photographs.

Region 5 (Southern Queensland): Many of these plants meet the description of var. grandiflorum, but there is considerable overlap in PCoA with plants of Regions 2, 4, 7 and 8. Pseudobulbs are usually larger than other regions apart from Region 6. This variety is usually considered to have larger gold flowers, but there are many shorter and smaller flowering forms with cream to yellow flowers, which are of variable and lesser horticultural merit. Rainforest plants are taller and larger, while lithophytes in harsher conditions are more compact.

Region 6 (Southern Queensland and northern New South Wales): Most plants are recognizable as var. hillii, except at the limits where they intergrade with var. speciosum and var. grandiflorum. There are atypical attenuated forms at the western limit. This region showed the greatest number of plants with mean values for characteristics significantly different from other regions, notably larger dimensions in vegetative features, and smaller dimensions in the flowers. They overlap with Region 5 mainly due to vegetative similarities. They are large epiphytic plants with long narrow pseudobulbs, frequent aerial roots, and long 'foxtail' racemes of white to cream flowers, typical of rainforest habitats. Lithophytic plants are more squat and compact in more open situations.

Regions 7 and 8 (Southern NSW and Victoria): Plants in var. speciosum range exhibit a great overlap of characteristics with other regions. Mean pseudobulb width at the base (Figure 2), and midlobe length are generally greater than for other regions, while other characters are not significantly different. Many descriptions emphasize the large basal width and robustness of curved pseudobulbs, for plants growing as lithophytes. Plants are smaller in the south (Region 8), usually with cream yellow flowers. In the north (Region 7) they become larger with longer racemes and large fairly well spaced flowers which are yellow-cream to pure white, on fairly upright racemes. Geographical location rather than specific characteristics define var. speciosum, and there are no identifiable subtaxa despite the variation in form (Figure 10). Most regions within the distribution show considerable variation in plant form and flower quality in different habitats.

Associations with Habitat

The associations of populations with different habitats assists assignment to varieties in Region 1 and on the volcanic plugs of Region 3 (Table 2). Much of the variation in D. speciosum appears to correlate with differences in climate and habitat. In large areas of rainforest, plants may be fairly uniform and tall, and identifiable as a ‘rainforest form’, but a short distance away, shorter and more variable forms occupy a greater range of conditions. Increased light and exposure favour shorter, more compact plants. On exposed cliffs and volcanic plugs, plants survive in crevices with only their leaves apparent. Plant forms are usually altered to only a small degree when grown under the same conditions, indicating some genetic fixity.

Table 2: Associations of varieties with habitats in regions

<table>
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<th>Region</th>
<th>Variety</th>
<th>Rainforest</th>
<th>Sclerophyll or Riparian</th>
<th>Forest, or Riparian</th>
<th>Rocky Plugs</th>
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</table>

The Orchadian, Volume 15 Number 5
Table 3. Taxonomic nomenclature for *Dendrobium speciosum*

<table>
<thead>
<tr>
<th>Region No.</th>
<th>Region</th>
<th>Taxa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>North Queensland</td>
<td>var. boreale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>var. pedunculatum</td>
</tr>
<tr>
<td>2.</td>
<td>Whitsunday</td>
<td>var. curvicaule</td>
</tr>
<tr>
<td>3.</td>
<td>East Capricorn (central Queens)</td>
<td>var. capricornicum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and atypicals specified by locality</td>
</tr>
<tr>
<td>4.</td>
<td>West Capricorn (central Queens)</td>
<td>var. blackdownense</td>
</tr>
<tr>
<td></td>
<td></td>
<td>var. carnarvonense</td>
</tr>
<tr>
<td>5.</td>
<td>Southern Queensland</td>
<td>var. grandiflorum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>intermediates with var. hillii specified by locality</td>
</tr>
<tr>
<td>6.</td>
<td>Northern NSW</td>
<td>var. hillii</td>
</tr>
<tr>
<td></td>
<td></td>
<td>intermediates with var. speciosum specified by locality</td>
</tr>
<tr>
<td>7.</td>
<td>Southern NSW</td>
<td>var. speciosum</td>
</tr>
<tr>
<td>8.</td>
<td>Far south NSW to Victoria</td>
<td>var. speciosum</td>
</tr>
</tbody>
</table>

**Recommended Nomenclature:** The *D. speciosum* complex is regarded as a single species of nine varieties within a continuum of variation. A few plants are impossible to categorize as a particular variety, and are best classified according to their geographical origin. We propose retention of varieties, together with geographical notation, as the most practical and stable approach to nomenclature (Table 3). This is in line with recommendations (Stuessy 1990) that changes of rank below the level of species should be avoided if patterns of variation are already described and well known by a particular rank, in this case, varieties. We have comprehensively sampled all regions and do not consider there is evidence to warrant the description of further taxa in any of the Regions 1-8. We have retained all previously described varieties. Newly described varieties in Regions 1 and 4 represent partially distinctive sub-groups. We consider that varieties, as used for 200 years, are the best interpretation of the results of a very large data set, and that the three newly described varieties are as distinctive, but not more so, than those previously described. The evidence based on a lack of consistent character differences between all subgroups leads directly to this conclusion.

**Discussion**

**Taxonomic Approaches:** The International Code of Botanical Nomenclature (ICBN) does not define clearly taxonomic ranks of species, subspecies and varieties, resulting in different interpretations by taxonomists. Orchid growers and scientists find this confusing. Orchid growers are often frustrated by name changes, and feel pressured to accept taxonomic proposals, although proposals are not automatically accepted by scientists and committees set up to make decisions on nomenclature. Traditional practices may be overruled in the interests of nomenclatural stability. An important and recent example is the conservation of the name *Acacia* with an Australian type by an international committee of nomenclatural specialists (Brummitt 2004) and the Nomenclatural Section of the XVII International Botanical Congress in Vienna in 2005 (Orchard and Maslin 2005). Detailed study, evidence and explanation are required to support proposed new species and genera, in line with the proposals of Entwisle and Weston (2005) to minimize change for well known plants of high interest (such as *D. speciosum*), which has had varietal names for up to 200 years.

The ICBN advocates minimal taxonomic change consistent with the scientific evidence and the “avoidance of the useless creation of names” which adds nothing new to the understanding of plants (Greuter et al.,2000) Hopper and Brown (2004) emphasis a parallel situation in reviewing the “unwarranted nomenclatural upheaval” in splitting of Caladenia and Pterostylis proposed by Szlachetko, Clements and Jones. Study of DNA, enzymes, and phylogeny relationships are all used to determine relationships between taxa, and decisions about taxonomic rank. All require complex interpretation and will not always provide a definitive answer. They are expensive when hundreds of plants need to be examined. Objective numerical methods are time consuming and laborious, but have the capacity to differentiate species, as demonstrated in our study for section
Dendrobium speciosum var. hillii. Beechmont, southern Queensland.

Dendrobium speciosum var. hillii. Gloucester, New South Wales.

Dendrobium speciosum var. hillii. Bonalbo, northern New South Wales.
Dendrocoryne (Adams et al. 2000c).

Traditional approaches to studies of variation have included descriptions based on limited characters and small areas of a large distribution range, using relatively small numbers of plants. This has resulted in reported discrete differences in one or several characters in sub-groups to form species, for example, peduncle length, thick erect pseudobulbs, aerial roots, glossy leaves and notched midlobes (Clements 1989). When our study was expanded to adequately sample all regions, including more recent findings in central Queensland, field studies, numerical and DNA analyses revealed no discrete differences in characters, and the size differences formed a continuum. Our data supports a single species concept and does not provide any support for proposals to upgrade newly described varieties to the status of species. Many Australian orchid species require a similar comprehensive study to establish a taxonomic treatment that the majority is likely to accept.

How many taxa?
How many different names are required to discuss a plant that most people know simply as *D. speciosum*? The first descriptions of *D. speciosum* used varieties – var. *speciosum*, var. *grandiflorum* and var. *curvicaule*. As more regions were surveyed, more taxa were described (Figure 12). In considering the total distribution and current nine varieties, it has become clear that variation is so marked that continuing to describe more taxa is unnecessary. Is it really going to help orchid growers if more minor variants are added, particularly at species level? In practice, herbaria, horticulturalists and growers need readily identifiable, discrete and consistent characters to identify plant specimens. *Dendrobium speciosum*, *D. kingianum* (Adams and Lawson 1995), *D. tetragonum* (Adams et al. 2006c) and many other Australian epiphytic and terrestrial orchids are species complexes that are best understood by continuing to use ranks below the rank of species.

Breeding: All plants may be designated as *D. speciosum* for the purposes of breeding, and it is helpful to include geographical origin (as well as breeder and dates). Records need careful maintenance because of the long time interval between pollination and resultant flowering plants. Line bred seedlings are generally proving to be superior to most wild collected plants. Selfings should always be identified.

Royal Horticultural Society (RHS) registration of hybrids will be simplified by the continued use of the single species concept. Common names such as Rock Lily and King Orchid have historical significance and will continue to be used. Smith’s original 1804 nomenclature using ‘speciosum’ (showy) and ‘the great Dendrobium’ continue to convey appreciation of the species.

Exhibition and Judging: The conclusions of this study lead to a simple nomenclature for judging classes of plants, as a single species is much easier in designing show schedules. In practice, exhibitors and judges are familiar with the problems of categorizing *D. speciosum* on the show bench. Schedules usually designate *D. speciosum* based on varieties, but as more line bred and intervarietal plants are exhibited, they may be judged in their own categories.

Evolution and Conservation: Epiphytic and lithophytic *Dendrobium speciosum* may still be found in large populations in and around tropical and subtropical rainforests, but is now present in smaller relictual colonies in drier rainforest, eucalypt forest, and non forest areas, mainly as a lithophyte. Plants at the limits of climatic tolerance are often attenuated, but do not segregate as distinct sub-groups. Over long periods of time with persistent isolation and environmental pressure, the current isolated populations may change further, forming more distinct taxa. We are further analysing DNA sequences to determine the relationships of plants in different areas, and within populations, and their potential for adaptation with changing climate.

*Dendrobium speciosum* is likely to have evolved from an ancestral plant resembling present day *Dendrobium* in the wet tropical rainforests which dominated much of Australia in the Tertiary period 65 million years ago. The distribution would have been more continuous than the present day, and appears to be reducing in area due to increasing aridity, more frequent firing, and progressive loss of habitat since settlement. We have noted a serious decrease in numbers in every region throughout the past twenty years associated with increasing habitat loss, drought and overcollection. Many populations are vulnerable and may become endangered or lost. Land management practices should target the survival of plants in all regions, as significant variants may be lost.
Figure 11. Distribution of taxa of *Dendrobium speciosum*.
Dendrobium speciosum var. speciosum. Genoa, Victoria.

Dendrobium speciosum var. speciosum. From area where var. hillii intergrades with var. speciosum (intermediate characteristics).

Dendrobium speciosum var. speciosum. Illawarra area.

Dendrobium speciosum var. speciosum ‘Charlie’
Figure 12. Descriptions of *Dendrobium speciosum* taxa over 200 years.

*Dendrobium speciosum* var. *grandiflorum*. Large plant of rainforest origin, west of Maryborough.
Acknowledgements
We thank the Queensland Parks and Wildlife Service for permits to study plants. Bruce Gray, Jim Bataldo, John Nuss, Noel Grundon, Grant Paterson, Stewart Penman, Grahame and Margaret Muller and David Adams assisted in the field work, and Professor Pauline Ladiges, Bill Lavarack, Peter Weston and Geoff Stocker critically reviewed various manuscript drafts. Ted and Barbara Gregory, Professor Gary Nelson, Harry Klose, Gerry Walsh, Bill Dobson, David Mitten, Michael Harrison, Denis Sinclair, Gary Knight, Kevin Crowther, Tony Clarke, Len Field, Mick Korzenowski, Ted Walmsley and Tony Blewitt provided valuable information and discussion. Thanks also to Jim Ross and Neville Walsh (Royal Botanic Gardens, Melbourne) and staff of Royal Botanic Gardens, Sydney, for assistance with taxonomy and Latin diagnosis. Stuart Gardner and Malcolm McGowan provided computer assistance. We thank the many orchid growers and land owners who assisted the work. This paper has been peer reviewed and we appreciate the suggestions offered.

References


Glossary
Attenuated – shortened or reduced in size.
Colium – distinct narrowing at the base of the pseudobulb.
Complex – group of plants with many similarities and overlapping characteristics where it is difficult or impossible to further subdivide into separate groups.
Disjunct – distribution in which potentially interbreeding populations are separated by sufficient distance to prevent breeding.
Epithet – an adjective or other term used to express an attribute.
Etymology – the derivation of a word; an account of the history of a word.
Phylogenetic – the evolutionary history and line of descent of a species or higher taxonomic group.
Riparian – zone of vegetation adjacent to streams or rivers.
Polymorphic – occurring in several different forms.
Principal Coordinates Analysis (PCoA) – an ordination technique which represents individuals as points in space. Distance between points reflects the relationship between individuals.

Protologue – the description and other details accompanying the first publication of the taxonomic name.
Sampling - selection of representative plants from a population or area for study of morphology and measurement (does not mean plant collection).
Sclerophyll – hard leafed plants e.g. *Eucalyptus*, in contrast to softer-leafed rainforest plants.

**Appendix**

Latitudes and longitudes of locations referred to in figures.

<table>
<thead>
<tr>
<th>Locality</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
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<tbody>
<tr>
<td>Benny's Tops</td>
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<td>151° 56' E</td>
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<tr>
<td>Blackdown Tableland</td>
<td>23° 50' S</td>
<td>149° 03' E</td>
</tr>
<tr>
<td>Broken Back Range</td>
<td>32° 50' S</td>
<td>151° 17' E</td>
</tr>
<tr>
<td>Carnarvon Gorge</td>
<td>25° 04' S</td>
<td>148° 15' E</td>
</tr>
<tr>
<td>Cathu</td>
<td>20° 49' S</td>
<td>148° 38' E</td>
</tr>
<tr>
<td>Clairview</td>
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<td>149° 28' E</td>
</tr>
<tr>
<td>Crediton</td>
<td>21° 14' S</td>
<td>148° 25' E</td>
</tr>
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<td>Dorrigo</td>
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<td>152° 43' E</td>
</tr>
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<td>East Victoria</td>
<td>Approx. 37° 28' S</td>
<td>Approx.149° 35' E</td>
</tr>
<tr>
<td>Eungella</td>
<td>21° 06' S</td>
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<td>Approx.149° 51' E</td>
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<td>145° 34' E</td>
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<td>152° 21' E</td>
</tr>
<tr>
<td>Yarwun</td>
<td>23° 50' S</td>
<td>151° 07' E</td>
</tr>
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Dendrobium speciosum var. grandiflorum 'Lemon Ice'.

Dendrobium speciosum var. pedunculatum.