EDINBURGH JOURNAL OF BOTANY 60 (3): 581–607 (2004)
DOI: 10.10M/S0960428603000428

THE FLORA OF THE DRAKENSBERG ALPINE CENTRE

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The Drakensberg Alpine Centre (DAC) comprises the 40,000km^2 high-altitude range of hills, mountain peaks and escarpment plateau bordering the eastern interior of southern Africa. Renowned for its species-rich flora and high levels of endemism, the DAC is here shown to support over 2800 specific and infraspecific native taxa, with c.16% of the angiosperm taxa being endemic, the latter equalling the flora of KwaZulu-Natal. Comparisons of the DAC's largest families and genera are made with those of the Cape Floral Region and KwaZulu-Natal, and the largest families are also compared with those of the Afromontane and Pondoland regions. In addition, comparisons are made between the high-altitude floras of southern and south-central Africa on the basis of their Cape element.

Keywords. Drakensberg Alpine Centre, endemism, floristics, high-altitude flora, radiation, southern Africa.

Introduction

Geography and physiography

White's (1978) classification of the Afromontane archipelago recognized seven regional mountain systems, of which the Drakensberg Range is the most southern. This Range forms part of the Great Escarpment at the eastern periphery of the southern African plateau (Partridge & Maud, 1987), extending for almost 1000km from Elliot in the south, to Tzaneen in north-eastern South Africa.

The Drakensberg Alpine Centre (DAC) is a composite of high-altitude enclaves centred within the greater Drakensberg Range and includes its highest peaks (Fig. 1). The DAC straddles the high plateau of Lesotho and South Africa (western boundary of KwaZulu-Natal), between latitudes 28°30′S–31°20′S and longitudes 27°00′E–29°40′E (Tyson *et al.*, 1976), covering an area of c.40,000km^2 (Killick, 1994). It comprises the Eastern Cape Drakensberg and Witteberge, the KwaZulu-Natal Drakensberg, the Lesotho Drakensberg (Maloti Mountains) and the eastern Free State (Fig. 1). The highest mountain is Thabana Ntlenyana (3482m), a local Sesotho name meaning 'beautiful little mountain' (Killick, 1994).

Geology and climate

The geology of the DAC is relatively simple, consisting of horizontal strata of sedimentary and igneous deposits (Van Zinderen Bakker, 1981). The escarpment

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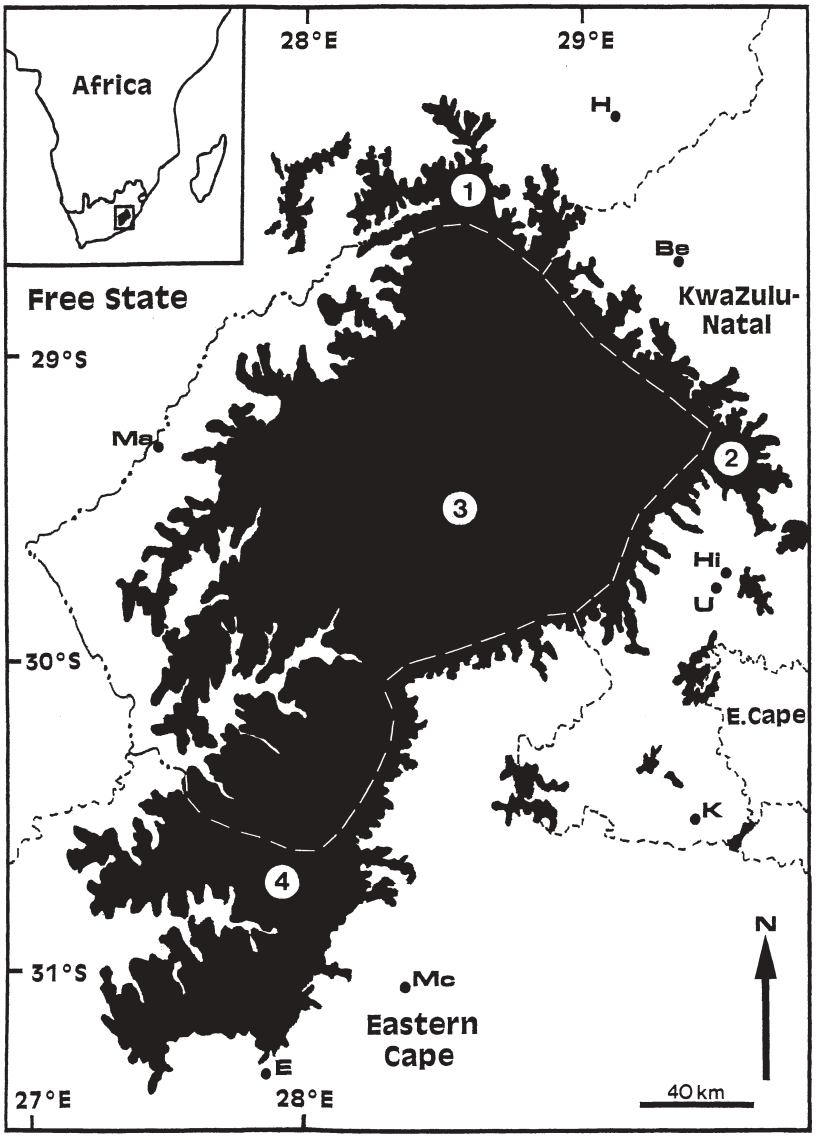

FIG. 1. The Drakensberg Alpine Centre (DAC) comprising (1) eastern Free State, (2) KwaZulu-Natal Drakensberg, (3) Lesotho Maloti Mountains and (4) Eastern Cape Drakensberg and Witteberge. Adapted from Hilliard & Burtt (1987). Abbreviations for towns: Be, Bergville; E, Elliot; H, Harrismith; Hi, Himeville; K, Kokstad; Ma, Maseru; Mc, Maclear; U, Underberg.

and plateau regions are dominated by a substantial igneous (≈ basalt) deposit of the Drakensberg Group. The early Jurassic basalt is a remnant of dramatic lava flows that spread across most of Gondwana approximately 160 to 180 million years ago, heralding the beginning of the Gondwana breakup (King, 1982; Whitmore *et al.*,

1999). These basalts are underpinned by sandstones of the Clarens Formation (previously Cave Sandstone). These aeolian sandstones represent an epoch of Late Triassic desertification. Both igneous and sandstone deposits form part of the Karoo Supergroup (Whitmore *et al.*, 1999).

The climate is classified as temperate with summer rainfall. Mean annual rainfall varies from c.640mm to 1800mm (Tyson *et al.*, 1976). The thin soils on the summit plateau are generally waterlogged during summer and are subjected to freeze–thaw processes during winter (Killick, 1994).

Terminology and context

The term 'Drakensberg Alpine Centre' of Van Wyk & Smith (2001) is an update of Killick's (1994) 'Drakensberg Alpine Region', which makes the distinction from the Afroalpine region of tropical east and north-east Africa. 'DAC' is synonymous with earlier names such as the 'Eastern Mountain Region' in a southern African context (Phillips, 1917) and the 'South-eastern Mountain Regional Mosaic' in an African context (Hilliard & Burtt, 1987). Subregions within the greater DAC should still be referred to as 'Drakensberg' and not 'DAC'.

Materials and methods

The native and exotic floras of the DAC were compiled from several sources, using the Flora accounts of Lesotho (Jacot Guillarmod, 1971; Kobisi & Kose, 2003), the southern KwaZulu-Natal Drakensberg (Hilliard & Burtt, 1987; Meter *et al.*, 2002) and the uKhahlamba-Drakensberg Park (Porter *et al.*, 1999), in conjunction with field guides to the trees (Pooley, 1993) and mountain flowers (Pooley, 2003) of the Eastern Region. The flora of the Eastern Cape Drakensberg is less well known and was further supplemented by inventories from quarter degree grid squares generated by PRECIS (National Herbarium, Pretoria Computerised Information System; Gibbs Russell, 1985). Species totals were further verified using Arnold & De Wet (1993), in combination with specific taxon treatments and with specimens lodged in the Natal University Herbarium (NU). Suspect records were omitted. The boundaries of the DAC follow the 1800m contour limit used by Hilliard & Burtt (1987) and Van Wyk & Smith (2001), and include outlying enclaves such as Little Bamboo Mountain (2421m), Kamberg (2095m), Mahwaqa Mountain (2083m) and the Ngele Range (2268m). Floristic ties between the southern KwaZulu-Natal Drakensberg and these outliers are strong (J. Granger, unpublished data), which further justifies their inclusion in the DAC. The 1800m benchmark altitude was difficult to maintain, because the DAC's alpine regions spread to slightly lower elevations at its northern and southernmost limits ($\geqslant$1700m). The checklist arrangement conforms mostly to the Englerian system followed by Arnold & De Wet (1993), with *Scrophulariaceae*, *Asparagaceae* and *Hyacinthaceae* following Hilliard (1994, 1999), Fellingham & Meyer (1995) and Speta (1998), respectively. Lists of the native and

exotic angiosperm floras of the DAC are presented as two appendices; both include infraspecific taxa and putative hybrids. All floristic analyses use only native taxa.

We also compared the flora of the DAC with other high-altitude floras of southern and south-central Africa on the basis of their Cape element, a temperate component common to the high-altitude floras of sub-Saharan Africa. The numbers of Cape elements in each high-altitude flora were derived from inventories of their constituent taxa: Nyika (C. Willis *et al*., unpublished data); Mt. Mulanje (Whyte, 1894; Chapman & White, 1970); Chimanimani (Phipps & Goodier, 1962; Wild, 1964, 1968); Wolkberg Centre (Van der Schijff & Schoonraad, 1971; Deall & Backer, 1989; Matthews *et al.*, 1993; Stalmans *et al.*, 1997); DAC (Carbutt & Edwards, 2001, and this study); KwaZulu-Natal Drakensberg, Eastern Cape Drakensberg and Sneeuberge (all from PRECIS).

Results and discussion

Historical overview – flora and vegetation

The DAC is regarded as being the only true alpine region in southern Africa (Linder, 1990), which, in conjunction with the Cape Floral Region (CFR), or Cape Floral Kingdom (Goldblatt & Manning, 2000), constitutes the southern (Gondwanan) source of the temperate flora of Africa (Hilliard & Burtt, 1987; Linder, 1990, 1994). The flora of the DAC is an interesting repository for taxa of diverse origin, including both temperate and subtropical elements (Killick, 1963; Hilliard & Burtt, 1987). The Cape element is a noteworthy constituent (Hilliard & Burtt, 1987; Carbutt & Edwards, 2001). The DAC's close alliance with the CFR (Weimarck, 1941; Killick, 1978; Hilliard & Burtt, 1987; Bainbridge *et al.*, 1991) is evident at the generic and sometimes higher taxonomic ranks, including: *Orchidaceae–Disinae* (Linder, 1983), *Scrophulariaceae–Manuleae* (Hilliard, 1994), *Asteraceae* (Hilliard, 1978) and *Iridaceae* (Goldblatt, 1983). Studies on the floras of the Eastern Cape and KwaZulu-Natal Drakensberg have linked both to the CFR and Afromontane regions (Killick, 1963; Bester, 1998).

The DAC is recognized as one of southern Africa's eight 'hot-spots' of botanical diversity as indexed by species richness and endemism (Cowling & Hilton-Taylor, 1994). PRECIS estimated the DAC flora at 2046 vascular plant species, with a subsequent total of 2153 vascular plant species ($\pm$2000 angiosperms) given by Porter *et al.* (1999). No existing account has satisfactorily surveyed the entire DAC flora. Previous accounts either were based on smaller regions occurring within the DAC or are outdated (e.g. Phillips, 1917); see Table 1. Determining the true representation of its flora is very important in order to appraise its value as a centre of both diversity and endemism.

The high plant diversity of the DAC is also evident in its rich array of life-forms. The vegetation of the DAC is diverse because it includes both the mesic vegetation of the KwaZulu-Natal escarpment and the vegetation of the drier Eastern Cape Drakensberg and Lesotho interior. The rainfall gradient between the windward

TABLE 1. Summary of some regional angiosperm floras contributing to that of the Drakensberg Alpine Centre (DAC). The Eastern Mountain Region is loosely equivalent to the DAC

Study region	Families	Genera	Species
Eastern Mountain Region (Phillips, 1917)	91	466	1553
Cathedral Peak Wilderness Area (Killick, 1963)	91	373	861
Lesotho (Jacot Guillarmod, 1971)	95	526	1537
Southern KwaZulu-Natal Drakensberg (Hilliard & Burtt, 1987)	91	404	1375
Eastern Cape Drakensberg (Bester, 1998)	116	506	1926
Drakensberg Alpine Centre (this survey)	134	630	2520

KwaZulu-Natal Drakensberg escarpment and the more leeward Lesotho and Eastern Cape interior (Carbutt & Edwards, 2001) appears to play a significant role in the distribution of taxa.

The DAC is located within the Grassland Biome (Rutherford & Westfall, 1986; Low & Rebelo, 1996), hence the high number of grass species and grassland forbs. Pockets of indigenous forest, however, are common, especially in the northern, warmer and wetter habitats of the DAC (Hilliard & Burtt, 1987), occupying south and south-east facing aspects, mostly on steep gradients in sheltered sites excluded from fire. The montane forests support ferns, mosses and other cryptogams, whilst hygrophilous, aquatic and lithophilic communities occupy the DAC's wetlands, tarns and rocky outcrops.

Both the floristic and vegetative diversity may be accounted for by the altitudinal, climatic, topographic and edaphic gradients on a broad scale (Bainbridge *et al.*, 1991), and the multitude of micro-habitats (combinations of relief, aspect, exposure and slope angle) on a finer scale (Körner, 1999), which collectively present suitable ecological niches for prolific species coexistence. The DAC, particularly the southern KwaZulu-Natal Drakensberg, is fairly well botanized, thanks mainly to the collecting of Olive Hilliard and Bill Burtt in the 1970s and 1980s.

Floristic analysis

The native flora of the DAC is richer than previously thought, comprising 2818 taxa, most of which are angiosperms (2520 or c.89%, see Appendix 1), with c.7% bryophytes, c.3% pteridophytes and 0.2% gymnosperms (Table 2). The 2818 taxa represent 205 families and 781 genera (mean = 3.6 species per genus); see Table 2. Dicotyledons constitute over half the families, genera and species (Table 2).

Species/genus indices are highest in the angiosperms, especially in the monocotyledons, and lowest in the bryophytes and gymnosperms. The high proportion of bryophyte families relative to species is a reflection of the many small genera per family. By contrast, the monocotyledons are characterized by a large number of species per family, possibly the result of rapid speciation in conjunction with the spread of

TABLE 2. Synopsis of the native flora of the Drakensberg Alpine Centre

	Bryophytes		Pteridophytes		Gymnosperms		Angiosperms: Monocotyledons		Angiosperms: Dicotyledons		
	No.	%	No.	%	No.	%	No.	%	No.	%	Total
Families	47	23.0	21	10.2	3	1.5	29	14.1	105	51.2	205
Genera	114	14.6	34	4.4	3	0.4	205	26.2	425	54.4	781
Species	200	7.1	93	3.3	5	0.2	872	30.9	1648	58.5	2818

the Grassland Biome (Meter *et al.*, 2002). The low overall contribution made by gymnosperms is a feature common to southern Africa (Arnold & De Wet, 1993).

The floristic diversity of the DAC approaches half of that in KwaZulu-Natal (c.44%), almost a third of that in the CFR (c.29%), and over a tenth of the diversity in southern Africa (c.13%); see Table 3. The floras of the DAC and KwaZulu-Natal share many similarities in terms of endemism, species/genus indices, species density and their 10 largest genera (Table 3). Species densities of the DAC and KwaZulu-Natal approach that of the CFR (Table 3), which is indicative of the richness of their floras relative to their physical area.

The number of exotic angiosperm taxa in the DAC is 166, or c.6% of the total angiosperm flora (Appendix 2). The 166 taxa, 80% of which are dicotyledons, are placed in 32 families and 100 genera. *Poaceae* and *Asteraceae* contribute the most species, a reflection of the success of these two groups in general. Although not a true measure of species richness, combining the figures for natives and exotics gives a total of 2984 taxa. The spread of invasives has been accelerated by the accessibility of the DAC. The many roads and mountain passes (e.g. Sani Pass) provide disturbed sites that are easily colonized. Overgrazing by domestic animals and the predominance of agricultural lands within Lesotho has exacerbated the spread of invasives, all of which pose serious threats to conservation efforts in the DAC.

TABLE 3. Statistics relating to the native vascular floras of the Cape Floral Region and southern Africa (from Goldblatt & Manning, 2002), KwaZulu-Natal (amended from Scott-Shaw, 1999) and the Drakensberg Alpine Centre (DAC; this survey). Inconsistencies with Tables 1 and 2 are due to figures here being for all vascular plants as opposed to angiosperms, to be consistent with Goldblatt & Manning (2002)

Region	Physical area (km^2)	Total species	Total genera	Species endemism (%)	Mean species/ genus	Species/ 10^3 km^2	10 largest genera (%)
Southern Africa	2,674,000	20,367	2130	80.3	9.6	7.6	15.1
Cape Floral Region	90,000	9030	990	68.7	9.1	100.3	21.4
KwaZulu-Natal	92,300	6000	1258	16.0	4.8	65.0	±15.0
DAC (this survey)	40,000	2618	667	15.7	3.9	65.0	17.2

TABLE 4. Ranking of the larger families that contribute 1% or more species to the native angiosperm flora of the Drakensberg Alpine Centre, together with the number of genera per family

Rank	Family	Total species	% of total	Total genera	% of total	Species/genus
1.	*Asteraceae*	430	17.1	65	10.3	6.6
2.	*Poaceae*	267	10.6	86	13.7	3.1
3.	*Fabaceae*	136	5.4	32	5.1	4.3
4.	*Scrophulariaceae*	133	5.3	31	4.9	4.3
5.	*Orchidaceae*	130	5.2	22	3.5	5.9
6.	*Cyperaceae*	122	4.8	20	3.2	6.1
7.	*Iridaceae*	97	3.8	14	2.2	6.9
8.	*Asclepiadaceae*	87	3.5	22	3.5	4.0
9.	*Hyacinthaceae*	55	2.2	16	2.5	3.4
10.	*Asphodelaceae*	50	2.0	5	0.8	10.0
11.	*Lamiaceae*	47	1.9	14	2.2	3.4
12.	*Apiaceae*	38	1.5	15	2.4	2.5
12.	*Mesembryanthemaceae*	38	1.5	5	0.8	7.6
13.	*Geraniaceae*	37	1.5	3	0.5	12.3
14.	*Rubiaceae*	36	1.4	20	3.2	1.8
15.	*Ericaceae*	35	1.4	2	0.3	17.5
15.	*Hypoxidaceae*	35	1.4	4	0.6	8.8
16.	*Crassulaceae*	34	1.3	3	0.5	11.3
17.	*Santalaceae*	32	1.3	3	0.5	10.7
18.	*Euphorbiaceae*	30	1.2	8	1.3	3.8
19.	*Gentianaceae*	28	1.1	3	0.5	9.3
20.	*Brassicaceae*	27	1.1	7	1.1	3.9
21.	*Amaryllidaceae*	26	1.0	9	1.4	2.9
21.	*Campanulaceae*	26	1.0	2	0.3	13.0
		$\Sigma = 1976$	$\Sigma = 78.5\%$	$\Sigma = 411$	$\Sigma = 65.3\%$	

Largest families

The larger families, contributing 1% or more species to the angiosperm flora, are presented in Table 4. Collectively they contain c.79% of the species and c.65% of the genera. The seven largest families contribute over half of the angiosperm total (c.52%). Monocotyledonous families form a large proportion of the seven largest angiosperm families (c.47%) relative to their total representation in the angiosperm flora (c.24%). The largest families of the DAC include disproportionately high numbers of Cape elements (Carbutt & Edwards, 2001).

The *Asteraceae* are the largest contributor of species (c.17%) and the second largest contributor of genera (c.10%) to the angiosperm flora of the DAC (Table 4). Their dominance is a feature common to all floras of subregions within the DAC (Table 5) and to many other floras, including those of KwaZulu-Natal and the CFR (c.11% each; Goldblatt & Manning, 2002) and the Afromontane and Pondoland

TABLE 5. Comparisons of the five largest angiosperm families in areas relevant to this investigation. See also details of the largest angiosperm families of the DAC (Table 4). In each case '*Liliaceae*' was used by the authors quoted in the broadest sense

Eastern Cape Drakensberg (Bester, 1998)	Southern KwaZulu-Natal Drakensberg (Hilliard & Burtt, 1987)	Northern KwaZulu-Natal Drakensberg (Killick, 1963)	Lesotho (Jacot Guillarmod, 1971)	Legalameeste (Stalmans *et al.*, 1997)	Sabie (Deall & Backer, 1989)	Wolkberg Centre* (Matthews *et al.*, 1993)	Pondoland (Oribi Gorge & Umtamvuna) (Meter, 1998)
Asteraceae	*Asteraceae*	*Asteraceae*	*Asteraceae*	*Asteraceae*	*Asteraceae*	*Liliaceae*	*Asteraceae*
Poaceae	*Poaceae*	*Poaceae*	*Poaceae*	*Poaceae*	*Fabaceae*	*Iridaceae*	*Fabaceae*
Fabaceae	*Liliaceae*	*Liliaceae*	*Scrophulariaceae*	*Fabaceae*	*Poaceae*	*Asteraceae*	*Poaceae*
Scrophulariaceae	*Orchidaceae*	*Cyperaceae*	*Fabaceae*	*Liliaceae*	*Rubiaceae*	*Lamiaceae*	*Liliaceae*
Orchidaceae	*Scrophulariaceae*	*Scrophulariaceae*	*Liliaceae*	*Rubiaceae*	*Liliaceae*	*Orchidaceae*	*Rubiaceae*

*Families referred to here are those with the most endemics on quartzitic substrates.

regions (Table 5). This family has readily speciated in the Grassland Biome (Meter *et al.*, 2002), the dominant habitat of the DAC. Radiation of the *Poaceae* in the DAC is not surprising in a grassland-dominated system. They are the second largest contributor of species (c.11%) and the largest contributor of genera (c.14%) to the angiosperm flora (Table 4). The *Poaceae* also feature strongly in the flora of KwaZulu-Natal (Hilliard & Burtt, 1987), yet poorly in the CFR (Goldblatt & Manning, 2002).

Species/genus indices $\geqslant 10$ are prevalent in six families: *Ericaceae*, *Campanulaceae*, *Geraniaceae*, *Crassulaceae*, *Santalaceae* and *Asphodelaceae*; see Table 4. These are relatively medium-sized families dominated by the single large genera *Erica* L., *Wahlenbergia* Schrad. ex Roth, *Pelargonium* L'Hérit., *Crassula* L., *Thesium* L. and *Kniphofia* Moench, respectively (Table 6).

A comparison of the five largest angiosperm families for regions within the DAC, and for regions of the northern Drakensberg Range and Pondoland, is presented in Table 5. The overlap of families is striking. The largest families of Pondoland are equally represented in the Legalameeste and Sabie regions of the northern

TABLE 6. Ranking of the larger genera that contribute 17 or more species to the native angiosperm flora of the Drakensberg Alpine Centre

Rank	Genus	Family	D = dicotyledon, M = monocotyledon	Total species	% of total
1.	*Helichrysum*	*Asteraceae*	D	102	4.0
2.	*Senecio*	*Asteraceae*	D	100	4.0
3.	*Erica*	*Ericaceae*	D	34	1.3
4.	*Disa*	*Orchidaceae*	M	32	1.3
5.	*Crassula*	*Crassulaceae*	D	30	1.2
5.	*Delosperma*	*Mesembryanthemaceae*	D	30	1.2
5.	*Thesium*	*Santalaceae*	D	30	1.2
6.	*Eragrostis*	*Poaceae*	M	25	1.0
7.	*Hypoxis*	*Hypoxidaceae*	M	24	1.0
7.	*Lotononis*	*Fabaceae*	D	24	1.0
7.	*Sebaea*	*Gentianaceae*	D	24	1.0
8.	*Wahlenbergia*	*Campanulaceae*	D	22	0.9
9.	*Cyperus*	*Cyperaceae*	M	20	0.8
9.	*Kniphofia*	*Asphodelaceae*	M	20	0.8
9.	*Pelargonium*	*Geraniaceae*	D	20	0.8
10.	*Gladiolus*	*Iridaceae*	M	19	0.8
11.	*Berkheya*	*Asteraceae*	D	18	0.7
11.	*Moraea*	*Iridaceae*	M	18	0.7
11.	*Rhus*	*Anacardiaceae*	D	18	0.7
12.	*Euryops*	*Asteraceae*	D	17	0.7
12.	*Habenaria*	*Orchidaceae*	M	17	0.7
12.	*Hesperantha*	*Iridaceae*	M	17	0.7
				$\Sigma = 661$	$\Sigma = 26.5\%$

Drakensberg (Table 5). The largest families of the DAC (Table 4) are similar to the largest families of a number of localized regions within the DAC (Table 5) and KwaZulu-Natal (Hilliard & Burtt, 1987). All these regions form part of the Eastern Region characterized by summer rainfall.

Largest genera

The 22 genera contributing 17 or more species comprise more than a quarter of the angiosperm flora (c.27%), with 11 genera contributing 24 or more species (c.18%); see Table 6. Eleven of the genera contributing 17 or more species are Cape elements (Carbutt & Edwards, 2001), emphasizing the link between the floras of the DAC and CFR. The 10 largest genera of the DAC are also prominent in the northern KwaZulu-Natal Drakensberg (Killick, 1963), the southern KwaZulu-Natal Drakensberg (Hilliard & Burtt, 1987), the Eastern Cape Drakensberg (Bester, 1998) and Lesotho (Jacot Guillarmod, 1971), thus emphasizing their widespread dominance.

The prominence of *Helichrysum* Mill. and *Senecio* L. (Table 6), a reflection of the dominance of the *Asteraceae* (Table 4), has been mentioned in numerous flora accounts, particularly with regard to the floras of the Afromontane and Eastern regions (citations as for *Asteraceae* aforementioned). The larger genera of the DAC differ from those of KwaZulu-Natal (Hilliard & Burtt, 1987) and the CFR (Goldblatt & Manning, 2002) because the former include more subtropical taxa and the latter typically fynbos taxa. The proportion of dicotyledons to monocotyledons is only slightly lower in the genera contributing 17 or more species (Table 6) than in the angiosperm flora as a whole (Table 2).

The Cape element in high-altitude floras

The Cape element is a useful reference when comparing temperate floras in sub-Saharan Africa because it is often one of the largest contributors of genera (e.g. the southern KwaZulu-Natal Drakensberg; Hilliard & Burtt, 1987). Cape elements increase steadily from the Sneeuberge and peak in the DAC, where the highest numbers in any high-altitude flora of southern and south-central Africa are to be found (72 genera), the majority of which are also accounted for by the KwaZulu-Natal Drakensberg (67 genera); see Fig. 2. The Sneeuberge and Eastern Cape Drakensberg accommodate the fewest Cape elements south of the greater DAC, possibly because of their drier climates (Carbutt & Edwards, 2001). We correlated the increase in numbers of Cape elements towards the DAC with an increase in altitude and rainfall, and an overall decrease in temperature (Carbutt & Edwards, 2001). Numbers decline northwards from the DAC towards south-central Africa (Fig. 2), a function of increasing distance from the CFR. The total for Mulanje, however, is considered an underestimate because inventories for the region are either unavailable or archaic. The anticipated total is somewhere between those for

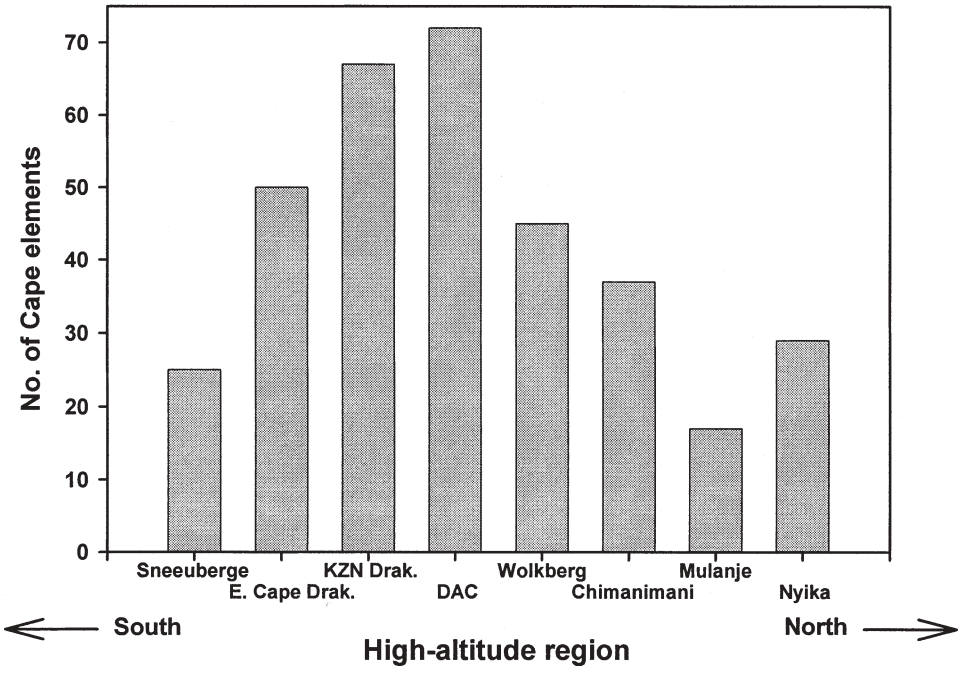

FIG. 2. The number of Cape elements for high-altitude regions in southern and south-central Africa. Abbreviations: E. Cape Drak., Eastern Cape Drakensberg; KZN Drak., KwaZulu-Natal Drakensberg; DAC, Drakensberg Alpine Centre.

Chimanimani and Nyika. If the northward trend of decreasing Cape elements continues into tropical Africa as expected, this pattern would suggest either a southern origin in the Cape region or extinction in the northern stations as taxa migrated southwards during suitable climatic epochs.

The high number of Cape elements in the DAC suggests a historical refugium whose climatic and edaphic environments, and their various interactions, appear most conducive to their survival.

Species endemism

An estimated 410 angiosperms are endemic to the DAC, giving a figure of c.16% endemism. This is lower than that recorded in previous accounts (Hilliard & Burtt, 1987; Carbutt & Edwards, 2001; Van Wyk & Smith, 2001) because of the diluting effect of a native flora that is larger than previously recognized.

The KwaZulu-Natal Drakensberg, particularly, is recognized as a major centre of rare and endemic species, with c.60% of the DAC's endemics occurring there and c.26% strictly endemic to this region (Porter *et al.*, 1999). The southern KwaZulu-Natal Drakensberg is colder and drier than that further north (Hilliard

& Burtt, 1987), forming the basis for distinguishing two further subcentres of endemism, the northern and southern KwaZulu-Natal Drakensberg.

Generic endemism

Five genera are endemic to the DAC, three of which are monotypic. *Dracomonticola* H.P. Linder & Kurzweil was erected by Linder & Kurzweil (1999) to accommodate *Neobolusia virginea* (Bolus) Schltr. as *Dracomonticola virginea* (Bolus) H.P. Linder & Kurzweil, a diminutive, white-flowered member of the *Orchidaceae* restricted to the wet basalt seeps of the DAC. This left *Neobolusia* Schltr. with the single species *N. tysonii* (Bolus) Schltr., a wider-ranging orchid that occurs in moist grasslands (Linder & Kurzweil, 1999). *Polevansia* De Winter (*Poaceae*), described in 1966, was then known only from the two collections of *P. rigida* De Winter made in the Mokhotlong district of Eastern Lesotho (De Winter, 1966). *Strobilopsis* Hilliard & Burtt (*Scrophulariaceae*) contains the annual or perennial herb *S. wrightii* Hilliard & Burtt, bearing a dense, terminal to subterminal, erect inflorescence of pale mauve flowers with orange centres (Hilliard & Burtt, 1977; Hilliard, 1994). It favours the shallow soils of sandstone outcrops of the Clarens Formation, and is particularly abundant in Lesotho's Sehlabathebe National Park. *Glumicalyx* Hiern (*Scrophulariaceae*) is a genus of six species, previously in *Zaluzianskya* F.W. Schmidt. All species of *Glumicalyx* are characterized by a dense, terminal inflorescence of trumpet-shaped flowers, with variations of yellow, orange and red, that droop or hang downwards, except when in fruit (Hilliard & Burtt, 1977; Hilliard, 1994). They favour boulder-strewn gullies, wet gravel patches and the bases of rocky drip faces. *Heteromma* Benth. (*Asteraceae*) comprises three species of coarse, tall herbs and subshrubs with bright yellow, discoid heads (Hilliard & Burtt, 1973; Hilliard, 1977), often forming dense stands in mesic environments, ranging from *Leucosidea* boulder-bed scrub and forest margins to rank hygrophilous grasslands and drainage lines. The endemic genera of the DAC therefore occupy a wide spectrum of habitats typical of mountainous terrain.

Generic near-endemism

Six genera are near-endemic to the DAC, three being monotypic. *Craterocapsa* Hilliard & Burtt (*Campanulaceae*) and *Rhodohypoxis* Nel (*Hypoxidaceae*), although both centred in the DAC, have outliers to both the north and south (Hilliard & Burtt, 1973, 1978). *Guthriea* H. Bol. (*Achariaceae*) contains the single species *G. capensis* H. Bol. (Killick, 1976), the only high-altitude member of the family; it favours damp, rocky, grassy slopes leading up to the escarpment. Although centred in the DAC, outlying populations occur in the Sneeuberge Mountains of the Eastern Cape, c.350km south-west of the southern DAC. *Huttonaea* Harv. (*Orchidaceae*) comprises five species of slender, terrestrial herbs, either of shaded forest or of steep, damp grasslands, with outliers occurring to the north, south and east of the DAC

(Linder & Kurzweil, 1999). *Saniella verna* Hilliard & Burtt (*Hypoxidaceae*) is a diminutive, crocus-like geophyte with white flowers coloured canary-yellow in the throat. It grows in wet, basalt gravel beds and along the marshy drainage lines of short, damp turf on the Drakensberg summit, and is spring-flowering (October and November). The genus was considered endemic to the DAC (Hilliard & Burtt, 1978, 1987) until the rediscovery of *Empodium occidentale* (Nel) B.L. Burtt in the Roggeveld Escarpment in the south-western Cape led to the recircumscription of *Saniella* Hilliard & Burtt and other *Hypoxidaceae* (Burtt, 2000). The Roggeveld species was subsequently transferred to *Saniella*, which now contains two species, namely *S. occidentalis* (Nel) B.L. Burtt and *S. verna*, with disjunct distributions. The genus *Saniella* is therefore no longer endemic (and not considered near-endemic) to the DAC. *Thamnocalamus* Munro is southern Africa's only endemic bamboo. The only species, *T. tessellatus* (Nees) Soderstrom & Ellis, favours moist, sheltered ravines in mountainous areas (c.1600–2700m). Although confined mostly to the DAC, outlying populations occur near Harrismith and Ficksburg in the Free State to the north and north-west respectively, and in the Hogsback region of the Amatole Mountains in the Eastern Cape, to the south (Soderstrom & Ellis, 1982; Gibbs Russell *et al.*, 1990). *Glekia* Hilliard was erected to accommodate the wide-ranging *G. krebsiana* (Benth.) Hilliard, which inhabits bare cliffs and rocky mountainsides at altitudes between c.1200 and 2150m; it favours the drier regions of the DAC, especially western Lesotho and the Eastern Cape Drakensberg and Witteberge. It occurs as far west as Graaff Reinet in the Eastern Cape (Hilliard, 1994).

The combined number of endemic and near-endemic genera in the DAC is 11. There are no endemic families.

Conclusions: the DAC's conservation status

Little more than 5% (c.2194km^2) of the DAC is protected in the form of nature reserves, national parks and wilderness areas (Killick, 1994). A transboundary initiative is currently underway to integrate the KwaZulu-Natal Drakensberg (managed by Ezemvelo KZN Wildlife as the 'uKhahlamba-Drakensberg Park') with a portion of the Lesotho escarpment and interior, through the efforts of the Maloti-Drakensberg Transfrontier Project. This project serves as the framework to consolidate the conservation efforts of two neighbouring countries and ensure the sustainable use of unique natural and cultural resources. The uKhahlamba-Drakensberg Park was listed as a World Heritage Site on 29 December 2000 by the World Heritage Convention, for both natural and cultural attributes (Derwent *et al.*, 2001).

Acknowledgements

We thank Rob Scott-Shaw (KwaZulu-Natal Wildlife) for joint field trips and the National Botanical Institute Pretoria for use of their PRECIS database. Funding

from the Natal University Research Fund, National Research Foundation, Ernest Oppenheimer Memorial Trust and Wildlife & Environment Society of South Africa (Sani Branch) is gratefully acknowledged. We also extend our thanks to the referees for valuable input.

References

Arnold, T. H. & De Wet, B. C. (1993). Plants of southern Africa: names and distribution. *Mem. Bot. Surv. S. Afr*. 62: 1–825.

Bainbridge, W. R., Motsamai, B. & Weaver, L. C. (1991). *Report of the Drakensberg/Maluti Conservation Programme*. Pietermaritzburg: Natal Parks Board.

Bester, S. P. (1998). *Vegetation and flora of the southern Drakensberg escarpment and adjacent areas*. MSc thesis, University of Pretoria, Pretoria.

Burtt, B. L. (2000). *Saniella* and its relation to other South African genera of Hypoxidaceae. *Edinburgh J. Bot.* 57(1): 63–70.

Carbutt, C. & Edwards, T. J. (2001). Cape elements on high-altitude corridors and edaphic islands: historical aspects and preliminary phytogeography. *Syst. Geogr. Plants* 71: 1033–1061.

Chapman, J. D. & White, F. (1970). *The Evergreen Forests of Malawi*. Oxford: Commonwealth Forestry Institute.

Cowling, R. M. & Hilton-Taylor, C. (1994). Patterns of plant diversity and endemism in southern Africa: an overview. In: Huntley, B. J. (ed.) *Botanical Diversity in Southern Africa*, pp. 31–52. Pretoria: National Botanical Institute.

Deall, G. B. & Backer, A. P. (1989). The vegetation ecology of the Eastern Transvaal Escarpment in the Sabie area. 3. Annotated checklist. *Bothalia* 19(1): 91–110.

Derwent, S., Porter, R. & Sandwith, T. (2001). *Maloti-Drakensberg Transfrontier Conservation and Development Programme*. Pietermaritzburg: Ezemvelo KwaZulu-Natal Wildlife.

De Winter, B. (1966). New and interesting records of African flowering plants. Gramineae. *Bothalia* 9: 130–134.

Fellingham, A. C. & Meyer, N. L. (1995). New combinations and a complete list of *Asparagu*s species in southern Africa (Asparagaceae). *Bothalia* 25: 205–209.

Gibbs Russell, G. E. (1985). PRECIS: The National Herbarium's computerised information system. *S. Afr. J. Sci*. 81: 62–65.

Gibbs Russell, G. E., Watson, L., Koekemoer, M., Smook, L., Barker, N. P., Anderson, H. M. & Dallwitz, M. J. (1990). *Grasses of Southern Africa*. Pretoria: Botanical Research Institute.

Goldblatt, P. (1983). Geography of Iridaceae in Africa. *Bothalia* 14: 559–564.

Goldblatt, P. & Manning, J. C. (2000). *Cape Plants: A Conspectus of the Cape Flora*. Strelitzia 9. National Botanical Institute and the Missouri Botanical Garden.

Goldblatt, P. & Manning, J. C. (2002). Plant diversity of the Cape region of southern Africa. *Ann. Missouri Bot. Gard*. 89: 281–302.

Hilliard, O. M. (1977). *Compositae in Natal*. Pietermaritzburg: University of Natal Press.

Hilliard, O. M. (1978). The geographical distribution of Compositae native to Natal. *Notes Roy. Bot. Gard. Edinburgh* 36: 407–425.

Hilliard, O. M. (1994). *The Manuleae – a Tribe of Scrophulariaceae*. Edinburgh: Edinburgh University Press.

Hilliard, O. M. (1999). *The Tribe Selagineae (Scrophulariaceae)*. Kew: Royal Botanic Gardens.

HILLIARD, O. M. & BURTT, B. L. (1973). Notes on some plants of southern Africa chiefly from Natal: III. *Notes Roy. Bot. Gard. Edinburgh* 32(3): 303–387.
HILLIARD, O. M. & BURTT, B. L. (1977). Notes on some plants of southern Africa chiefly from Natal: VI. *Notes Roy. Bot. Gard. Edinburgh* 35(2): 155–178.
HILLIARD, O. M. & BURTT, B. L. (1978). Notes on some plants from southern Africa chiefly from Natal: VII. *Notes Roy. Bot. Gard. Edinburgh* 36(1): 43–76.
HILLIARD, O. M. & BURTT, B. L. (1987). *The Botany of the Southern Natal Drakensberg*. Cape Town: National Botanic Gardens.
JACOT GUILLARMOD, A. (1971). *Flora of Lesotho*. Lehre: J. Cramer.
KILLICK, D. J. B. (1963). An account of the plant ecology of the Cathedral Peak area of the Natal Drakensberg. *Mem. Bot. Surv. S. Afr.* 34: 1–178.
KILLICK, D. J. B. (1976). Achariaceae. 3. *Guthriea*. *Flora S. Afr.* 22: 132–134.
KILLICK, D. J. B. (1978). The Afroalpine region. In: WERGER, M. J. A. (ed.) *Biogeography and Ecology of Southern Africa*, pp. 515–542. The Hague: W. Junk.
KILLICK, D. J. B. (1994). Drakensberg Alpine Region – Lesotho and South Africa. In: DAVIS, S. D. & HEYWOOD, V. H. (eds) *Centres of Plant Diversity*, pp. 257–260. Oxford: Oxford University Press.
KING, L. C. (1982). *The Natal Monocline: Explaining the Origin and Scenery of Natal, South Africa*. Pietermaritzburg: Natal University Press.
KOBISI, K. & KOSE, L. E. (2003). *A Checklist of Lesotho Grasses*. Pretoria: South African Botanical Diversity Network.
KÖRNER, C. (1999). *Alpine Plant Life: Functional Plant Ecology of High Mountain Systems*. Heidelberg: Springer-Verlag.
LINDER, H. P. (1983). The historical phytogeography of the Disinae (Orchidaceae). *Bothalia* 14: 565–570.
LINDER, H. P. (1990). On the relationship between the vegetation and floras of the Afromontane and the Cape regions of Africa. *Mitt. Inst. Allg. Bot. Hamburg* 23: 777–790.
LINDER, H. P. (1994). Afrotemperate phytogeography: implications of cladistic biogeographical analyses. In: SEYANI, J. H. & CHIKUNI, A. C. (eds) *Proceedings of the XIIIth Plenary Meeting AETFAT, Malawi*, pp. 913–930. Zomba: National Herbarium and Botanic Gardens.
LINDER, H. P. & KURZWEIL, H. (1999). *Orchids of Southern Africa*. Rotterdam: A. A. Balkema.
LOW, A. B. & REBELO, A. G. (eds) (1996). *Vegetation of South Africa, Lesotho and Swaziland*. Pretoria: Department of Environmental Affairs and Tourism.
MATTHEWS, W. S., VAN WYK, A. E. & BREDENKAMP, G. J. (1993). Endemic flora of the north-eastern Transvaal Escarpment, South Africa. *Biol. Conserv.* 63: 83–94.
METER, E. B. (1998). *A synfloristic comparison of Oribi Gorge and Umtamvuna Nature Reserves*. MSc thesis, University of Natal, Pietermaritzburg.
METER, E. B., EDWARDS, T. J., RENNIE, M. A. & GRANGER, J. E. (2002). A checklist of the plants of Mahwaqa Mountain, KwaZulu-Natal. *Bothalia* 32(1): 101–115.
PARTRIDGE, T. C. & MAUD, R. R. (1987). Geomorphic evolution of southern Africa since the Mesozoic. *S. Afr. J. Geol.* 90: 179–208.
PHILLIPS, E. P. (1917). A contribution to the flora of the Leribe plateau and environs. *Ann. S. Afr. Mus.* 16: 1–379.
PHIPPS, J. B. & GOODIER, R. (1962). A preliminary account of the plant ecology of the Chimanimani Mountains. *J. Ecol.* 50: 291–319.
POOLEY, E. (1993). *The Complete Field Guide to Trees of Natal, Zululand and Transkei*. Durban: Natal Flora Publications Trust.

POOLEY, E. (2003). *Mountain Flowers: A Field Guide to the Flora of the Drakensberg and Lesotho*. Durban: The Flora Publications Trust.
PORTER, R., SCOTT-SHAW, C. R. & THOMSON, P. *et al.* (1999). *Nomination Proposal for the Drakensberg Park to be listed as a World Heritage Site*. Pietermaritzburg: KwaZulu-Natal Nature Conservation Service.
'PRECIS'; see GIBBS RUSSELL, G. E. (1985).
RUTHERFORD, M. C. & WESTFALL, R. H. (1986). Biomes of southern Africa: an objective categorization. *Mem. Bot. Surv. S. Afr.* 54: 1–98.
SCOTT-SHAW, C. R. (1999). *Rare and Threatened Plants of KwaZulu-Natal and Neighbouring Regions*. Pietermaritzburg: KwaZulu-Natal Nature Conservation Service.
SODERSTROM, T. R. & ELLIS, R. P. (1982). Taxonomic status of the endemic South African bamboo, *Thamnocalamus tessellatus*. *Bothalia* 14(1): 53–67.
SPETA, F. (1998). Systematische analyse der gattung *Scilla* L. s. l. (Hyacinthaceae). *Phyton* 38(1): 1–224.
STALMANS, M., BALKWILL, K. & MENTIS, M. T. (1997). An analysis of the flora of Legalameeste Nature Reserve, Northern Province. *S. Afr. J. Bot*. 63(6): 305–329.
TYSON, P. D., PRESTON-WHYTE, R. A. & SCHULZE, R. E. (1976). *The Climate of the Drakensberg*. Pietermaritzburg: The Town and Regional Planning Commission.
VAN DER SCHIJFF, H. P. & SCHOONRAAD, E. (1971). The flora of the Mariepskop Complex. *Bothalia* 10: 461–500.
VAN WYK, A. E. & SMITH, G. F. (2001). *Regions of Floristic Endemism in Southern Africa*. Hatfield: Umdaus Press.
VAN ZINDEREN BAKKER, E. M. (1981). The high mountains of Lesotho – a botanical paradise. *Veld & Flora* 67: 106–108.
WEIMARCK, H. (1941). Phytogeographical groups, centres and intervals within the Cape flora: a contribution to the history of the Cape element seen against climate changes. *Lunds Univ. Årsskr*. 37: 1–109.
WHITE, F. (1978). The Afromontane region. In: WERGER, M. J. A. (ed.) *Biogeography and Ecology of Southern Africa*, pp. 463–513. The Hague: W. Junk.
WHITMORE, G., UKEN, R. & METH, D. (1999). *KwaZulu-Natal: 3500 Million Years of Geological History*. Richards Bay Minerals and the Geology Education Museum.
WHYTE, A. (1894). The plants of Milanji, Nyasaland. *Trans. Linn. Soc. Bot.* 4: 1–68.
WILD, H. (1964). The endemic species of the Chimanimani Mountains and their significance. *Kirkia* 4: 125–157.
WILD, H. (1968). Phytogeography in south central Africa. *Kirkia* 6: 197–222.

An invited contribution to the Festschrift for B.L. Burtt's ninetieth birthday

APPENDIX 1

The native angiosperm flora of the Drakensberg Alpine Centre

Numbers in parentheses after each family are total numbers of genera and species; those after each genus are species numbers. All taxa are arranged alphabetically.

ANGIOSPERMAE-DICOTYLEDONAE

Acanthaceae (9/13)
Adhatoda (1)
Barleria (1)
Blepharis (2)
Chaetacanthus (1)
Crabbea (2)
Hypoestes (1)
Isoglossa (3)
Justicia (1)
Thunbergia (1)

Achariaceae (2/2)
Ceratiosicyos (1)
Guthriea (1)

Aizoaceae (3/16)
Limeum (5)
Pharnaceum (4)
Psammotropha (7)

Amaranthaceae (1/2)
Cyathula (2)

Anacardiaceae (3/20)
Protorhus (1)
Rhus (18)
Smodingium (1)

Apiaceae (15/38)
Agrocharis (1)
Alepidea (14)
Anginon (1)
Annesorhiza (1)
Bupleurum (1)
Centella (2)
Conium (3)
Dracosciadium (1)
Heteromorpha (2)
Lichtensteinia (1)
Peucedanum (5)
Pimpinella (2)
Polemannia (2)
Sanicula (1)
Sium (1)

Apocynaceae (2/2)
Carissa (1)
Strophanthus (1)

Aquifoliaceae (1/1)
Ilex (1)

Araliaceae (2/3)
Cussonia (2)
Seemannaralia (1)

Asclepiadaceae (22/87)
Anisotoma (1)
Asclepias (15)
Aspidoglossum (6)
Aspidonepsis (4)
Brachystelma (10)
Cordylogyne (1)
Cynanchum (1)
Fanninia (1)
Gomphocarpus (1)
Huernia (1)
Miraglossum (3)
Pachycarpus (8)
Parapodium (1)
Periglossum (3)
Riocreuxia (3)
Sarcostemma (1)
Schizoglossum (13)
Secamone (1)
Sisyranthus (3)
Stapelia (1)
Stenostelma (1)
Xysmalobium (8)

Asteraceae (65/430)
Amellus (1)
Arctotis (3)
Artemisia (1)
Aster (8)
Athanasia (2)
Athrixia (6)
Berkheya (18)

Callilepis (1)
Cenia (1)
Chrysanthemoides (2)
Chrysocoma (2)
Cineraria (11)
Comborhiza (1)
Conyza (6)
Cotula (9)
Crepis (2)
Delairea (1)
Denekia (1)
Dicoma (1)
Dimorphotheca (2)
Eriocephalus (2)
Eumorphia (3)
Euryops (17)
Felicia (12)
Garuleum (3)
Gazania (3)
Geigeria (2)
Gerbera (5)
Gnaphalium (5)
Gymnopentzia (1)
Haplocarpha (2)
Helichrysum (102)
Heteromma (3)
Hirpicium (2)
Ifloga (2)
Inulanthera (7)
Lactuca (4)
Lasiospermum (1)
Lepidostephium (1)
Macowania (7)
Metalasia (1)
Mikaniopsis (1)
Nidorella (6)
Nolletia (2)
Oncosiphon (1)
Osteospermum (7)
Othonna (3)
Pegolettia (1)
Pentzia (5)
Phymaspermum (4)
Plecostachys (1)
Printzia (3)
Pseudognaphalium (3)
Pterothrix (1)
Pulicaria (1)
Relhania (2)
Schistostephium (2)
Senecio (100)
Sonchus (7)
Stoebe (1)
Tarchonanthus (1)
Tolpis (1)
Troglophyton (1)
Ursinia (6)
Vernonia (6)

Balsaminaceae (1/1)
Impatiens (1)

Basellaceae (1/1)
Anredera (1)

Begoniaceae (1/1)
Begonia (1)

Boraginaceae (6/15)
Afrotysonia (1)
Anchusa (1)
Cynoglossum (5)
Ehretia (1)
Lithospermum (4)
Myosotis (3)

Brassicaceae (7/27)
Aplanodes (1)
Erucastrum (2)
Heliophila (6)
Lepidium (8)
Matthiola (1)
Rorippa (4)
Sisymbrium (5)

Buddlejaceae (2/5)
Buddleja (4)
Gomphostigma (1)

Campanulaceae (2/26)
Craterocapsa (4)
Wahlenbergia (22)

Capparaceae (1/1)
Cleome (1)

Caryophyllaceae (5/21)
Cerastium (4)
Dianthus (6)
Drymaria (1)
Silene (7)
Stellaria (3)

Celastraceae (5/10)
Gymnosporia (3)
Hippocratea (1)

Lauridia (1)
Maytenus (3)
Pterocelastrus (2)

Chenopodiaceae (1/1)
Chenopodium (1)

Clusiaceae (1/5)
Hypericum (5)

Combretaceae (1/2)
Combretum (2)

Convolvulaceae (5/13)
Convolvulus (5)
Falkia (1)
Ipomoea (5)
Merremia (1)
Turbina (1)

Cornaceae (1/1)
Curtisia (1)

Crassulaceae (3/34)
Cotyledon (1)
Crassula (30)
Kalanchoe (3)

Cucurbitaceae (7/11)
Citrullus (1)
Coccinia (1)
Cucumis (3)
Kedrostis (2)
Mukia (1)
Peponium (1)
Zehneria (2)

Dipsacaceae (2/7)
Cephalaria (5)
Scabiosa (2)

Droseraceae (1/4)
Drosera (4)

Ebenaceae (2/7)
Diospyros (5)
Euclea (2)

Ericaceae (2/35)
Erica (34)
Ericinella (1)

Escalloniaceae (1/1)
Choristylis (1)

Euphorbiaceae (8/30)
Acalypha (5)
Adenocline (2)
Andrachne (1)
Chamaesyce (1)
Clutia (8)
Euphorbia (11)
Micrococca (1)
Phyllanthus (1)

Fabaceae (32/136)
Acacia (5)
Amphithalea (1)
Argyrolobium (15)
Aspalathus (3)
Calpurnia (4)
Chamaecrista (1)
Crotalaria (1)
Dalbergia (1)
Desmodium (1)
Dichilus (3)
Dolichos (4)
Dumasia (1)
Elephantorrhiza (2)
Eriosema (6)
Erythrina (2)
Hoffmannseggia (1)
Indigofera (15)
Lessertia (6)
Lotononis (24)
Medicago (2)
Melolobium (6)
Otholobium (2)
Pearsonia (1)
Pseudarthria (1)
Psoralea (2)
Rhynchosia (9)
Sphenostylis (1)
Sutherlandia (3)
Tephrosia (5)
Trifolium (4)
Vigna (3)
Zornia (1)

Flacourtiaceae (5/10)
Casearia (1)
Dovyalis (3)
Kiggelaria (1)
Scolopia (3)
Trimeria (2)

Fumariaceae (1/1)
Cysticapnos (1)

Gentianaceae (3/28)
Chironia (3)
Sebaea (24)
Swertia (1)

Geraniaceae (3/37)
Geranium (13)
Monsonia (4)
Pelargonium (20)

Gesneriaceae (1/5)
Streptocarpus (5)

Greyiaceae (1/1)
Greyia (1)

Gunneraceae (1/1)
Gunnera (1)

Haloragaceae (1/1)
Laurembergia (1)

Hamamelidaceae (1/1)
Trichocladus (1)

Icacinaceae (2/2)
Apodytes (1)
Cassinopsis (1)

Illecebraceae (3/4)
Corrigiola (1)
Herniaria (2)
Pollichia (1)

Lamiaceae (14/47)
Acrotome (1)
Aeollanthus (1)
Ajuga (1)
Becium (2)
Hemizygia (2)
Leonotis (4)
Mentha (3)
Plectranthus (5)
Pycnostachys (1)
Salvia (6)
Satureja (4)
Stachys (14)
Syncolostemon (1)
Teucrium (2)

Lauraceae (2/3)
Cryptocarya (2)
Ocotea (1)

Lentibulariaceae (1/5)
Utricularia (5)

Linaceae (1/1)
Linum (1)

Lobeliaceae (3/18)
Cyphia (7)
Lobelia (9)
Monopsis (2)

Lythraceae (1/1)
Rotala (1)

Malvaceae (5/13)
Abutilon (1)
Anisodontea (3)
Hibiscus (7)
Pavonia (1)
Sida (1)

Meliaceae (1/1)
Ekebergia (1)

Melianthaceae (2/2)
Bersama (1)
Melianthus (1)

Menispermaceae (2/2)
Cissampelos (1)
Stephania (1)

Menyanthaceae (1/1)
Nymphoides (1)

Mesembryanthemaceae (5/38)
Chasmatophyllum (2)
Delosperma (30)
Mossia (1)
Rabiea (1)
Ruschia (4)

Moraceae (1/2)
Ficus (2)

Myricaceae (1/3)
Morella (3)

Myrsinaceae (3/4)
Maesa (1)
Myrsine (2)
Rapanea (1)

Myrtaceae (2/2)
Eugenia (1)
Syzygium (1)

Ochnaceae (1/2)
Ochna (2)

Oleaceae (2/4)
Chionanthus (2)
Olea (2)

Oliniaceae (1/1)
Olinia (1)

Onagraceae (2/5)
Epilobium (4)
Ludwigia (1)

Oxalidaceae (1/8)
Oxalis (8)

Papaveraceae (1/1)
Papaver (1)

Periplocaceae (1/2)
Raphionacme (2)

Phytolaccaceae (1/3)
Phytolacca (3)

Piperaceae (1/2)
Peperomia (2)

Pittosporaceae (1/1)
Pittosporum (1)

Plantaginaceae (1/1)
Plantago (1)

Podostemaceae (1/1)
Sphaerothylax (1)

Polygalaceae (2/17)
Muraltia (4)
Polygala (13)

Polygonaceae (4/16)
Fallopia (1)
Persicaria (3)
Polygonum (3)
Rumex (9)

Portulacaceae (2/4)
Anacampseros (3)
Talinum (1)

Primulaceae (2/2)
Anagallis (1)
Lysimachia (1)

Proteaceae (1/6)
Protea (6)

Ptaeroxylaceae (1/1)
Ptaeroxylon (1)

Ranunculaceae (4/9)
Anemone (2)
Clematis (1)
Ranunculus (4)
Thalictrum (2)

Resedaceae (2/2)
Oligomeris (1)
Reseda (1)

Rhamnaceae (4/5)
Phylica (2)
Rhamnus (1)
Scutia (1)
Ziziphus (1)

Rhizophoraceae (1/1)
Cassipourea (1)

Rosaceae (7/20)
Agrimonia (1)
Alchemilla (5)
Cliffortia (9)
Geum (1)
Leucosidea (1)
Prunus (1)
Rubus (2)

Rubiaceae (20/36)
Anthospermum (5)
Burchellia (1)
Canthium (3)
Cephalanthus (1)
Conostomium (1)
Galium (6)
Galopina (1)
Hyperacanthus (1)
Kohautia (1)
Nenax (1)
Oldenlandia (1)
Pachystigma (1)
Pavetta (2)
Pentanisia (3)
Psydrax (1)
Pygmaeothamnus (1)
Rothmannia (2)
Rubia (2)
Spermacoce (1)
Tricalysia (1)

Rutaceae (5/6)
Agathosma (1)
Calodendrum (1)
Clausena (1)
Vepris (1)
Zanthoxylum (2)

Salicaceae (1/2)
Salix (2)

Santalaceae (3/32)
Osyridicarpos (1)
Osyris (1)
Thesium (30)

Sapindaceae (2/3)
Allophylus (2)
Hippobromus (1)

Scrophulariaceae (31/133)
Alectra (6)
Aptosimum (1)
Bartsia (1)
Bowkeria (1)
Buchnera (3)
Cycnium (1)
Diascia (10)
Diclis (2)
Glekia (1)
Glumicalyx (6)
Graderia (1)
Halleria (1)
Harveya (8)
Hebenstretia (5)
Hyobanche (3)
Jamesbrittenia (11)
Limosella (7)
Lindernia (2)
Manulea (7)
Melasma (1)
Mimulus (1)
Nemesia (11)
Phygelius (2)
Selago (12)
Sopubia (2)
Striga (4)
Strobilopsis (1)
Sutera (5)
Teedia (1)
Veronica (2)
Zaluzianskya (14)

Solanaceae (3/12)
Lycium (2)
Solanum (9)
Withania (1)

Sterculiaceae (2/16)
Dombeya (2)
Hermannia (14)

Thymelaeaceae (6/20)
Dais (1)
Englerodaphne (1)
Gnidia (13)
Passerina (2)
Peddiea (1)
Struthiola (2)

Tiliaceae (3/4)
Grewia (2)
Sparrmannia (1)
Triumfetta (1)

Trimeniaceae (1/1)
Xymalos (1)

Ulmaceae (1/1)
Celtis (1)

Urticaceae (5/9)
Didymodoxa (2)
Droguetia (1)
Laportea (2)
Parietaria (1)
Urtica (3)

Vahliaceae (1/1)
Vahlia (1)

Valerianaceae (1/3)
Valeriana (3)

Verbenaceae (2/3)
Clerodendrum (2)
Lantana (1)

Violaceae (1/2)
Hybanthus (2)

Viscaceae (1/3)
Viscum (3)

Vitaceae (1/3)
Rhoicissus (3)

Zygophyllaceae (1/1)
Tribulus (1)

ANGIOSPERMAE-MONOCOTYLEDONAE

Agapanthaceae (1/2)
Agapanthus (2)

Alliaceae (1/8)
Tulbaghia (8)

Amaryllidaceae (9/26)
Ammocharis (1)
Apodolirion (1)
Boophone (1)
Brunsvigia (4)
Crinum (1)
Cyrtanthus (10)
Haemanthus (2)
Nerine (5)
Scadoxus (1)

Anthericaceae (1/7)
Chlorophytum (7)

Aponogetonaceae (1/2)
Aponogeton (2)

Araceae (1/2)
Zantedeschia (2)

Asparagaceae (1/11)
Asparagus (11)

Asphodelaceae (5/50)
Aloe (14)
Bulbine (8)
Haworthia (1)
Kniphofia (20)
Trachyandra (7)

Colchicaceae (4/12)
Androcymbium (4)
Littonia (1)
Sandersonia (1)
Wurmbea (6)

Commelinaceae (2/3)
Commelina (2)
Cyanotis (1)

Cyperaceae (20/122)
Ascolepis (1)
Bulbostylis (7)
Carex (13)
Carpha (1)
Cyperus (20)
Eleocharis (3)
Ficinia (8)
Fimbristylis (1)
Fuirena (4)
Isolepis (9)
Kyllinga (5)
Lipocarpha (2)
Mariscus (5)
Pycreus (11)
Rhynchospora (1)
Schoenoplectus (6)
Schoenoxiphium (10)
Scirpus (7)
Scleria (5)
Tetraria (3)

Dioscoreaceae (1/4)
Dioscorea (4)

Eriocaulaceae (1/3)
Eriocaulon (3)

Eriospermaceae (1/5)
Eriospermum (5)

Haemodoraceae (1/1)
Barberetta (1)

Hyacinthaceae (16/55)
Albuca (9)
Bowiea (1)
Dipcadi (3)
Drimia (4)
Drimiopsis (1)
Eucomis (5)
Galtonia (3)
Lachenalia (1)
Ledebouria (5)
Litanthus (1)
Massonia (1)
Merwilla (3)
Ornithogalum (8)
Schizocarphus (1)
Thuranthos (1)
Urginea (8)

Hydrocharitaceae (1/2)
Lagarosiphon (2)

Hypoxidaceae (4/35)
Empodium (2)
Hypoxis (24)
Rhodohypoxis (8)
Saniella (1)

Iridaceae (14/97)
Aristea (9)
Crocosmia (3)
Dierama (12)
Dietes (1)
Freesia (1)
Gladiolus (19)
Gynandriris (1)
Hesperantha (17)
Homeria (1)
Moraea (18)
Romulea (6)
Syringodea (1)
Tritonia (2)
Watsonia (6)

Juncaceae (2/12)
Juncus (11)
Luzula (1)

Lemnaceae (1/1)
Lemna (1)

Luzuriagaceae (1/1)
Behnia (1)

Orchidaceae (22/130)
Angraecum (2)
Bonatea (1)
Brachycorythis (2)
Brownleea (5)
Corycium (5)
Diaphananthe (1)
Disa (32)
Disperis (12)
Dracomonticola (1)
Eulophia (14)
Habenaria (17)
Holothrix (4)
Huttonaea (5)
Liparis (1)
Mystacidium (1)
Neobolusia (1)
Polystachya (1)
Pterygodium (4)
Satyrium (14)
Schizochilus (5)
Stenoglottis (1)
Tridactyle (1)

Poaceae (86/267)
Agrostis (8)
Alloteropsis (2)
Andropogon (6)
Anthoxanthum (3)
Aristida (12)
Arundinella (1)
Axonopus (1)
Bewsia (1)
Bothriochloa (2)
Brachiaria (6)
Brachypodium (2)
Bromus (4)
Catalepis (1)
Chloris (3)
Colpodium (1)
Ctenium (1)
Cymbopogon (6)
Cynodon (5)
Deschampsia (1)
Diandrochloa (1)
Digitaria (14)
Diheteropogon (2)
Diplachne (2)
Echinochloa (4)
Ehrharta (3)
Eleusine (3)
Elionurus (1)
Enneapogon (2)
Eragrostis (25)
Eulalia (1)
Eustachys (1)
Festuca (8)
Fingerhuthia (2)
Harpochloa (1)
Helictotrichon (5)
Hemarthria (1)
Heteropogon (1)
Hordeum (1)
Hyparrhenia (8)
Imperata (1)
Ischaemum (1)
Karroochloa (2)
Koeleria (1)
Leersia (1)
Loudetia (2)
Melica (2)
Melinis (3)
Merxmuellera (7)
Microchloa (2)
Microstegium (1)
Miscanthus (2)
Monocymbium (1)

Oplismenus (2)
Oropetium (1)
Panicum (10)
Paspalum (6)
Pennisetum (5)
Pentaschistis (12)
Perotis (1)
Phacelurus (1)
Phragmites (2)
Poa (2)
Pogonarthria (1)
Polevansia (1)
Polypogon (1)
Rendlia (1)
Schismus (1)
Schizachyrium (1)
Schmidtia (1)
Setaria (9)
Sporobolus (9)
Stiburus (2)
Stipa (2)
Stipagrostis (3)
Streblochaete (1)
Styppeiochloa (1)
Tetrachne (1)
Thamnocalamus (1)
Themeda (1)
Trachypogon (1)
Tragus (3)
Tribolium (1)
Trichoneura (1)
Triraphis (1)
Tristachya (1)
Urochloa (2)

Potamogetonaceae (1/3)
Potamogeton (3)

Restionaceae (3/5)
Ischyrolepis (1)
Restio (3)
Rhodocoma (1)

Typhaceae (1/1)
Typha (1)

Velloziaceae (2/3)
Talbotia (1)
Xerophyta (2)

Xyridaceae (1/2)
Xyris (2)

Appendix 2

The exotic angiosperm flora of the Drakensberg Alpine Centre

Numbers in parentheses after each family are total numbers of genera and species; those after each genus are species numbers. All taxa are arranged alphabetically.

ANGIOSPERMAE-DICOTYLEDONAE

Amaranthaceae (5/10)
Achyranthes (2)
Alternanthera (2)
Amaranthus (4)
Gomphrena (1)
Guilleminea (1)

Apiaceae (7/7)
Ammi (1)
Anthriscus (1)
Apium (1)
Caucalis (1)
Chamarea (1)
Ciclospermum (1)
Daucus (1)

Asteraceae (20/32)
Acanthospermum (2)
Achillea (1)
Ambrosia (2)
Anthemis (1)
Bidens (4)
Carduus (1)
Chrysanthellum (1)
Chrysanthemum (1)
Cichorium (1)
Cirsium (1)
Coreopsis (1)
Galinsoga (2)
Gamochaeta (1)
Hypochoeris (2)
Schkuhria (1)
Tagetes (1)
Taraxacum (5)
Tragopogon (1)
Xanthium (2)
Zinnia (1)

Boraginaceae (3/4)
Buglossoides (1)
Echium (2)
Lappula (1)

Brassicaceae (7/8)
Barbarea (1)
Capsella (1)
Cardamine (2)
Coronopus (1)
Crambe (1)
Raphanus (1)
Turritis (1)

Cactaceae (1/1)
Opuntia (1)

Cannabaceae (1/1)
Cannabis (1)

Caryophyllaceae (1/1)
Spergula (1)

Chenopodiaceae (2/7)
Atriplex (1)
Chenopodium (6)

Convolvulaceae (1/1)
Cuscuta (1)

Euphorbiaceae (1/1)
Ricinus (1)

Fabaceae (2/2)
Melilotus (1)
Vicia (1)

Fumariaceae (1/1)
Fumaria (1)

Geraniaceae (1/1)
Erodium (1)

Illecebraceae (1/1)
Paronychia (1)

Lamiaceae (2/2)
Lamium (1)
Marrubium (1)

Malvaceae (1/4)
Malva (4)

Nyctaginaceae (1/1)
Boerhavia (1)

Onagraceae (1/8)
Oenothera (8)

Papaveraceae (1/1)
Argemone (1)

Plantaginaceae (1/2)
Plantago (2)

Polygonaceae (2/3)
Emex (1)
Persicaria (2)

Portulacaceae (1/1)
Portulaca (1)

Rosaceae (5/7)
Cotoneaster (1)
Duchesnea (1)
Pyracantha (1)
Rosa (2)
Rubus (2)

Rubiaceae (2/2)
Richardia (1)
Sherardia (1)

Rutaceae (1/1)
Ruta (1)

Salicaceae (1/3)
Salix (3)

Scrophulariaceae (2/2)
Linaria (1)
Verbascum (1)

Solanaceae (5/11)
Datura (1)
Nicandra (1)
Nicotiana (2)
Physalis (3)
Solanum (4)

Verbenaceae (2/6)
Lantana (1)
Verbena (5)

ANGIOSPERMAE-MONOCOTYLEDONAE

Agavaceae (1/1)
Agave (1)

Poaceae (17/33)
Aira (1)
Arundo (1)
Avena (2)
Briza (1)
Bromus (5)
Cortaderia (1)
Dactylis (1)
Holcus (1)
Hordeum (1)
Lamarckia (1)
Lolium (5)
Pennisetum (2)
Phalaris (4)
Poa (2)
Sorghum (2)
Vulpia (2)
Zea (1)