

# Introduction

It is recorded that Ernest Galpin was the first person to collect plants in Swaziland. Galpin, a banker and plant enthusiast, was transferred to Barberton in June 1889, where he lived until the end of 1892 before being transferred to Queenstown (Gunn & Codd 1981). During this time he collected numerous plants from the surrounding mountains, which were sent to Kew, Harry Bolus at the Cape, Medley Wood at the Durban Botanical Garden, MacOwan at the South African Museum herbarium, and Zurich. Further collections were made in 1890 by E. Saltmarshe, who visited the Bulembu area, or the Havelock Concession, as it was known at the time. In 1906 Harry Bolus visited Mbabane and collected at Dalriach outside Mbabane and also travelled to the middleveld. Miss Mabel Stewart was the first Swaziland resident who is known to have collected in that country, at first around Mbabane and later at Hlatikhulu where she lived. Her specimens were sent to South African herbaria and many of them are housed in the South African Museum (SAM) herbarium at the Compton Herbarium, Kirstenbosch (Gunn & Codd 1981).

The Englishman Joseph Burt Davy arrived in South Africa in 1903 and in March that year he took up a post as botanist and agrostologist in the newly formed Transvaal Department of Agriculture, where he worked until his retirement in October 1913 (Gunn & Codd 1981). Burt Davy was a keen botanist and published *A first check-list of flowering plants and ferns of the Transvaal and Swaziland* in 1912 with the assistance of Pott-Leendertz. This was the first list in which plants from Swaziland were included. In 1919 Burt Davy returned to England and started working on *The manual of flowering plants and ferns of the Transvaal with Swaziland, South Africa*. Two parts of this proposed four-part publication were published in 1926 and 1932, but Burt Davy died and the project was terminated (Gunn & Codd 1981). These two parts list 217 plant species for Swaziland (Compton 1966), of which nine are pteridophytes.

Professor R.H. Compton visited Swaziland in 1947 with Dr. G.W. Reynolds and was so ex-

cited by the flora that after his retirement in 1953 as Director of the then National Botanic Gardens of South Africa, he moved to Swaziland and settled on the farm Ukutula outside Mbabane (Compton 1966). Two years later he was asked by the Swaziland government to start a botanical survey of the country and was provided with a technical assistant, a four-wheel drive vehicle, and a small herbarium building. Unfortunately, in 1966 his subsidy, transport and herbarium building were withdrawn and fieldwork was stopped. He was able to devote all his attention to this project and the preliminary results of this task were published in 1966 as *An annotated check-list of the flora of Swaziland* (Compton 1966). In this list, 73 pteridophyte species were recorded for the country. For an unknown reason the pteridophytes were omitted from the *Flora of Swaziland* (Compton 1976). Today, this monumental work in which 2 118 species are described, still remains the standard work for the flora of the country. Additions were published by Kemp in 1981. More recently, *A flora checklist for Swaziland* (Kemp 1983) was published, bringing the number of pteridophytes known for the country to 90 species.

During 2001 I conducted a survey of pteridophyte specimens housed in some of the southern African herbaria, and concluded that no pteridophytes are known from large parts of the country. Several species occurring in neighbouring South Africa have never been recorded for Swaziland. As a consequence, an intense pteridophyte survey was carried out in the area during the period 5 to 23 May 2002, during which nearly 400 specimens were assembled. The first set of this collection is housed in the Compton Herbarium (NBG). The aim of the survey was to collect and record the distribution of pteridophytes throughout Swaziland. During this period several species were recorded for the first time in the country bringing the number of species currently known for the region to 112. The season during which the survey was carried out was unfortunately a very dry one and the lowveld and Lubombo region still remain poorly known. It is expected that several more pteridophyte species will be added later.

In this publication the family and generic sequence follows Roux (2001), whilst the species are arranged alphabetically for convenience. In the species descriptions the lower and higher size ranges recorded are bracketed, and statistical means are given for stomata and spores. The statistical mode is given for the number of indurated annulus, epistomium and hypostomium cells per sporangium. Ecological as-

pects are dealt with under the following headings (definitions for the terms are provided in the glossary):

#### Habitat preferences

- Substrate preferences (terrestrial, epilithic, epiphyte, or chamaeophyte)
- Soil and moisture conditions
- Light requirements

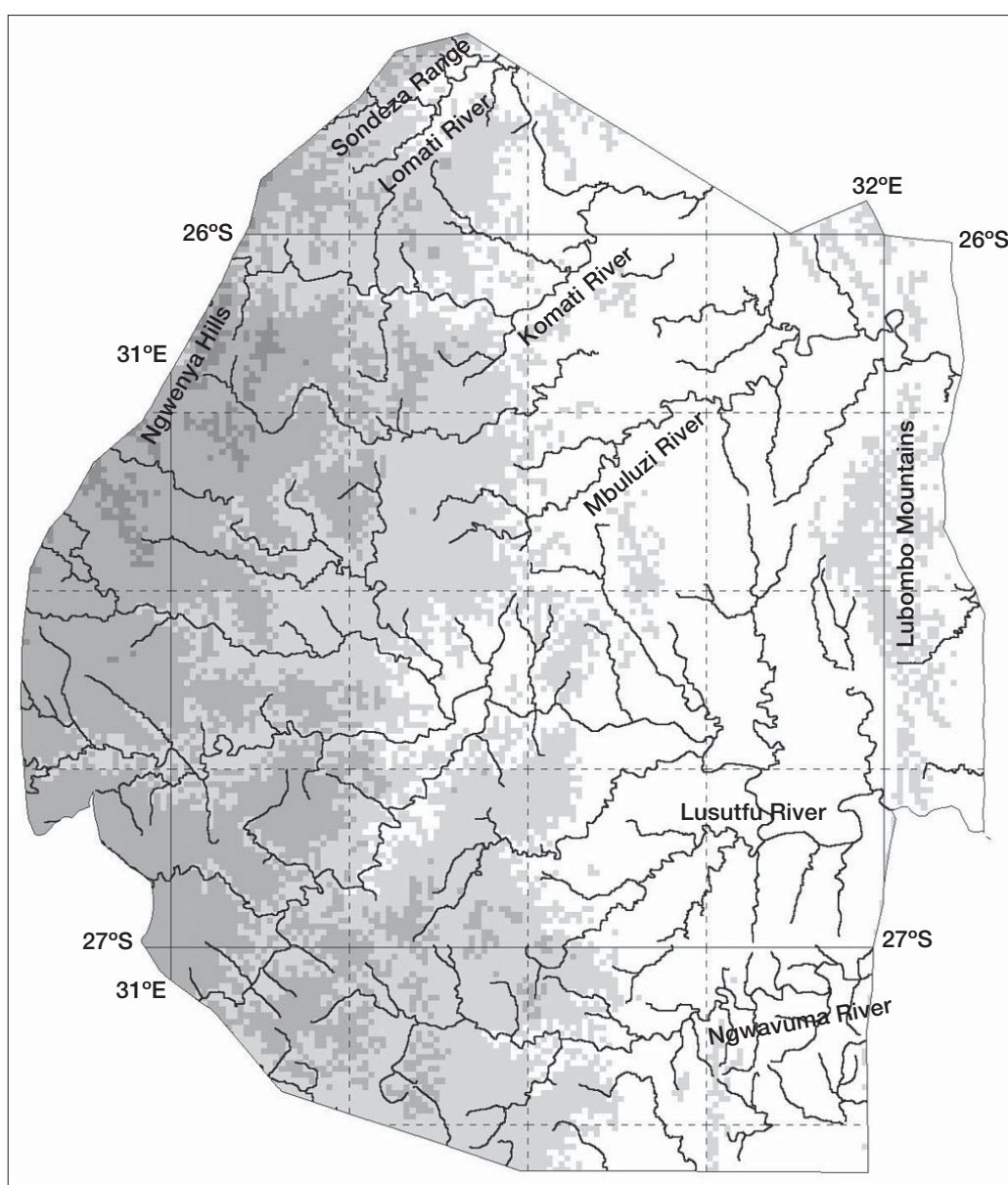


Figure 1. Map of Swaziland illustrating the topography with contours at 500 m intervals, perennial streams and rivers, and the major mountain ranges.

#### Adaptive features

- Life forms (mega-, meso-, micro-, nanophanerophytes, hemicryptophytes, geophytes or therophytes)
- Structure of the photosynthetic organs (hygro-, meso-, xeromorphic), hydrostatics (poikilohydry)
- Vegetative reproduction
- Seasonal behaviour
- Fire resistance

To indicate the distribution of species within Swaziland a two-system approach is followed. Global Positioning System (GPS) readings are generally not available for older collections and since the exact locality cannot be plotted, the quarter-degree square in which the plant was collected is shaded. Where GPS readings are available, the collecting locality is indicated by a dot. For distributions outside Swaziland, but still within the African region, the level 3 regional names of Brummit (2001) are followed. Author citations follow the style of Brummitt & Powell (1992), journal abbreviations are given as in *Botanico-Periodicum-Huntiarum/Supplement* (Bridson 1991), and abbreviations of book titles follow Stafleu & Cowan (1976–1988). Herbarium acronyms are based on Holmgren *et al.* (1990).

## Topography

Swaziland occupies an area of 17 364 km<sup>2</sup> ( $\pm$  1 735 300 ha) and is located on the eastern rim of southern Africa, where it lies between the latitudes 25°43' and 27°19' S, and the longitudes 30°47.5' and 32°06' E (Figure 1). It is situated along the eastern watershed of the Drakensberg running north-south. Four major river systems, the Komati, Mbuluzi, Lusutfu and Ngwavuma rivers, drain the country. These are all perennial rivers originating on the Mpumalanga highveld to the west of the country which form deep valleys as they cut through the mountainous terrain.

The Sondeza, Makhonjwa and Ngwenya mountains along the northern and north-western border of the country form the highest region, reaching 1 837 m at Ngwenya North. To the south, however, the terrain gradually becomes less mountainous, but still forms part of the highveld region, or Inkangala, as it is known to

the siSwati, with Lundzi at 1 540 m and Sicunusa at 1 100 m above sea-level. The highveld is the region lying above 1 000 m.

The middleveld occupies the region between 400 and 1 000 m above sea-level. In the western parts of the country it intrudes into the highveld in deep valleys. Although the transition between the highveld and middleveld is usually gradual, the descents from the highveld may also be abrupt, as from Mbabane to the Ezulweni valley, and the descent into the Komati valley on the road between Mbabane and Pigg's Peak. Although still hilly, the region is less undulating, with numerous smaller seasonal and perennial streams originating in or flowing through the region. Infrequent along these drainage channels are small alluvial flats with seasonal marshes. In contrast to the western middleveld, where granite and gneiss are the predominant rock formations, the eastern Lubombo mountain range consists of lavas. The Lubombo region runs parallel to that of the western middleveld, but is less fragmented. However, three gorges are formed where the Mbuluzi, Lusutfu and Ngwavuma rivers cut through the mountain range. The highest point in this region, Isateki, reaches 774 m above sea-level. Streams originating on the Lubombo range are usually seasonal, which, north of the Lusutfu river, drain east and west.

The lowveld, or Ihlandze, is the region which lies below 400 m. This almost featureless region is gently undulating with alluvial flats often forming along the main river systems. The region is currently used for intensive cattle and sugarcane farming, but a small area, the Hlane Wild Life Sanctuary, has been set aside for conservation.

## Geology

Rock formations in Swaziland consists of many igneous and volcano-sedimentary types (Keyser 1997). These formations were laid down over an exceptionally long period, which can be divided into a series of Precambrian events which took place during the Swazian and Randian Erathems and a, geologically speaking, more recent Postcambrian or Mesozoic event (Table 1).

The current Swaziland landscape is characterised by a large number of granite and gneiss plutons. These formations extend over large areas and are the predominant rock types in the country. Granite and granitoid rocks are igneous types and are therefore viewed as the

base on which other rock formations developed. These overlying formations have eroded and weathered away, exposing the igneous types.

The approximately nine gneiss and granite plutons exposed today were formed during the

**Table 1. Stratigraphy of the major volcano-sedimentary and igneous rock formations in Swaziland. (Rock formation codes follow Keyser 1997, whilst the approximate ages are given in square brackets).**

	Volcano-sedimentary rocks		Igneous formations
Phanerozoic	Karoo Sequence P-Tr	Lebombo Group  Unidentified lava	Jozini Formation Jj [ $\pm$ 200]  Letaba Formation Jl [ $\pm$ 205] Sandstone Trc
Randian	Usushwana Complex Ru [2 900]	Hlelo Granite Suite  Piet Retief Gobba Suite  Mozaan Group Rmz [2 860]	Dolerite dykes Jd Mswati Granite Suite Rmw [2 723] Biotite granite Kwetta Granite Rkw [2 780]  Nhlangano Granite Gneiss Rnh [2 822] Hlatikulu Granite Rhl [2 875]
Swazian	Barberton Sequence [ $\pm$ 3 500]	Moodies Group Zm Fig Tree Group Zf Onverwacht Group Zo	Mpuluzi Granite Zmp [3 079] Quartz monzonite Unnamed gneiss Zmh [ $<$ 3 100] Hornblende tonalitic gneiss Usuthu Suite Zus [3 100] Granodiorite, diorite, tonalite, quartz gabbro  Mlika granodiorite Zml [ $\pm$ 3 150] Granodiorite Tsawela gneiss Zts [3 458] Hornblende-biotite tonalite gneiss Unidentified gneiss Zmg [3 553] Ngwane gneiss Zng [3 644] Tonalitic gneiss



ment. This event was followed by a period during which sediments were deposited on the lava, followed by repeated cycles of volcanic activity and sediment deposition. Some of the sedimentary rocks are ocean-floor muds, chert (fine-grained quartz) and carboniferous shale. The carboniferous shales and chert contain primitive microfossils. In this group a number of ultramafic complexes occur as igneous intrusions and in many of these, chrysotile asbestos has been mined at the old Havelock Mine, now Bulembu.

Occupying the central core of the Barberton Group is the Fig Tree Group, which consists of fine-grained sediments with some interbedded pillow lavas. The sediments include banded chert, banded ironstone and shale in the lower part, and greywacke (dark sandstone) in the upper. Again, some of the cherts and shales are carboniferous and contain primitive microfossils. The Fig Tree rocks were deposited in relatively deep water and the sediments were derived from the erosion of oceanic islands.

In contrast, the younger and overlying Moodies Group displays evidence of having been deposited in shallow water, as ripple marks and shrinkage cracks have been observed. The rock succession consists mainly of conglomerates, quartzites, sandstone, shales, banded iron formations, and minor volcanic interlayers.

The Barberton Group has undergone several stages of deformation producing small- and large-scale folds and faults. This deformation was largely caused by the intrusion of several granite bodies, the largest being the Mpuluzi granite batholith which forms part of the Nelspruit suite. The Mpuluzi batholith has been radiometrically dated to be 3 079 m.y. old. During the Swazian Erathem several other igneous formations were also formed (Table 1).

During the Randian Erathem (3 100 – 2 650 m.y.), further volcano-sedimentary and igneous formations were formed. A relatively narrow strip of quartzitic sediments consisting of quartzites, conglomerates, grits and schists with some lavas extends into the south-western part of Swaziland. This, the Pongola Sequence, is stratigraphically subdivided into the lower

Nsuze Group and the upper Mozaan Group (Kent & Matthews 1980).

The Nsuze Group is predominantly a volcanic succession composed mainly of altered fine-grained andesites, with a few acid lavas and, rarely, with quartzitic and schist sediments. Lava in the Nsuze group has a radiometric age of  $\pm 3\ 090$  m.y. Xenoliths of Nsuze rocks are frequently found in Hlatikulu Granite in the Hluti area.

The Mozaan Group is composed of a thick succession of alternating quartzites and shales with lavas at or near the top. The quartzites are light coloured and the shales gray to dark grey.

The Pongola Sequence has been intruded by the Usushwana Complex, radiometrically dated at 2 900 to 3 000 m.y. The complex is subdivided into the Piet Retief Gabbro Suite, which consists predominantly of quartz gabbro (coarse-grained dolerite), and the Hlelo Granite Suite, which consists of granodiorite and microgranite (granites with different chemical properties). The Usushwana Complex has intruded some of the older granites and in turn has been intruded by granites dated between  $\pm 2\ 200$  and 2 880 m.y. (Kent 1980).

Apart from erosion, which leads to the exposure of the granitic baserock, no major geological events appear to have taken place during the period from the end of the Randian Erathem to the Phanerozoic and in particular the Jurassic (205—140 m.y.). During this period, basalt poured out over large areas of southern Africa. These basaltic lavas and rheolites form the Lubombo mountains. The Lebombo Group of lavas forms part of the Karoo Supergroup and is divided into the lower Letaba Formation consisting of basalt and the Jozini Formation, which is rhyolitic (Johnson *et al.* 1980).

## Climate

The climate of Swaziland, like the topography, can also be divided into the highveld, middleveld, and lowveld regions. The highveld region has a humid near-temperate climate with a mean minimum temperature of 11°C and a mean maximum temperature of 22°C. During

the winter months (May–August), severe frosts may occur in lower-lying areas. The mean annual rainfall for the region is  $\pm 1\ 270$  mm, but at higher altitudes along the Ngwenya mountains it is  $\pm 1\ 800$  mm. In Swaziland most of the precipitation occurs during October to March. The middleveld has a subtropical climate and frosts are rare or absent. The mean minimum temperature for the region is  $13^{\circ}\text{C}$  and the mean maximum temperature is  $26^{\circ}\text{C}$ . The mean annual rainfall for the region is 940 mm. The lowveld has a subhumid, almost tropical climate with a mean minimum temperature of  $15^{\circ}\text{C}$  and a mean maximum temperature of  $29^{\circ}\text{C}$ . The mean annual rainfall for the region is 787 mm.

## Vegetation

Acocks (1975) recognises seven vegetation types in Swaziland (Figure 3). Each has been grouped into a broader vegetation type as a result of its affinity with similar types. Four of these vegetation types occur in Swaziland:

- I. Coastal tropical forests
- II. Inland tropical forest types
- III. Tropical bush and savanna types and
- IV. False grassveld types

Each of the vegetation types occurring in Swaziland is briefly described giving some of its features, distribution, and listing a number of species commonly occurring in it.

### I. Coastal tropical forests Zululand Thornveld

This vegetation type is more or less restricted to the middleveld and occupies the summit and eastern slopes of the Lubombo mountains as well as the Ingwavuma drainage basin in the southern part of Swaziland. In its original state, parts of it probably formed forests and scrub-forests. On the steeper slopes of the Lubombo range, tree species such as *Rauvolfia caffra* Sond., *Aloe barbarae* Dyer, *Euphorbia ingens* E.Mey. ex Boiss., *Albizia adiantifolia* (Schumach.) W.Wight and *Erythrina caffra* Thunb. occur. In the Ingwavuma basin forest thickets of this vegetation type occur as isolated pockets on the more protected slopes and along drainage channels. It has been replaced by grassveld where *Themeda triandra* Forssk.,

*Heteropogon contortus* (L.) Roem. & Schult., *Eragrostis racemosa* (Thunb.) Steud. and *Hyparrhenia* E.Fourn. form the dominant species.

### II. Inland tropical forest types North-eastern Mountain Sourveld

In Swaziland this vegetation type occurs on the highveld ranging from the area around Forbes Reef southwards to Mbabane, and again on the Mahlangatsha hills. The climax is thought to have been forest, but has largely been replaced by sour grassveld. Small and scattered forest patches are currently restricted to narrow ravines, boulder-forests and along drainage lines where they receive some protection from seasonal veldfires. Slightly larger patches of climax forest still occur near Hhoro and in the Ugutugulo ravine. Some of the more common tree species include *Podocarpus latifolius* (Thunb.) R.Br. ex Mirb., *Strelitzia caudata* R.A.Dyer, *Rapanea melanophloeos* (L.) Mez, *Syzygium gerrardii* (Harv. ex Hook.f.) Burt Davy, *Halleria lucida* L. and *Kiggelaria africana* L., whilst *Cyperus albostrigatus* Schrad., *Plectranthus* spp. *Dietes* sp., *Begonia* sp. and *Oplismenus hirtellus* (L.) P.Beauv. commonly grow on the forest floor. The grassveld, which replaces the forests, is sour with *Themeda triandra* Forssk. being the dominant species. Other common grasses include *Loudetia simplex* (Nees) C.E.Hubb., *Monocymbium cerisiiforme* (Nees) Stapf, *Tristachya biseriata* Stapf, and *Hyparrhenia hirta* (L.) Stapf.

### Lowveld Sour Bushveld

Lowveld sour bushveld occurs on the middleveld and covers the foothills of the Swaziland mountains extending into the Komati, Ingwempisi and Mahamba valleys. Although fairly densely forested in some parts, it currently forms a more or less open parkland with well developed trees spaced in tall grass. Trees commonly found in this vegetation type include *Sclerocarya birrea* (A.Rich.) Hochst. *Pterocarpus angolensis* DC., *Diospyros mespeliformis* Hochst. ex A.DC., *Lonchocarpus capassa* Rolfe and *Terminalia sericea* Burch. ex DC. The grassveld is tall with a fair number of low shrubs. Some of the more common

grasses and shrubs include *Hyparrhenia cymbaria* (L.) Stapf, *Cymbopogon excavatus* (Hochst.) Stapf ex Burt Davy, *Diospyros galpinii* (Hiern) DeWinter and *Elephantorrhiza elephantina* (Burch.) Skeels.

### III. Tropical Bush and Savanna types

#### Lowveld

As the name implies, the Lowveld vegetation occurs in the lowveld plains in Swaziland. This vegetation type is a typical *Acacia nigrescens*-

*Sclerocarya-Themeda* savanna and has no clear-cut boundaries. It replaces Zululand thornveld and Lowveld sour bushveld. Tree species associated with this vegetation type include *Acacia nigrescens* Oliv., *Sclerocarya birrea* (A.Rich.) Hochst., *Ziziphus mucronata* Willd., *Acacia davyi* N.E.Br. and *Phyllanthus reticulatus* Poir. The dominant grasses include *Themeda triandra* Forssk., *Panicum maximum* Jacq., *Setaria incrassata* (Hochst.) Hack. and *Eragrostis superba* Peyr. Large parts of this vegetation type have been transformed into sugarcane fields.

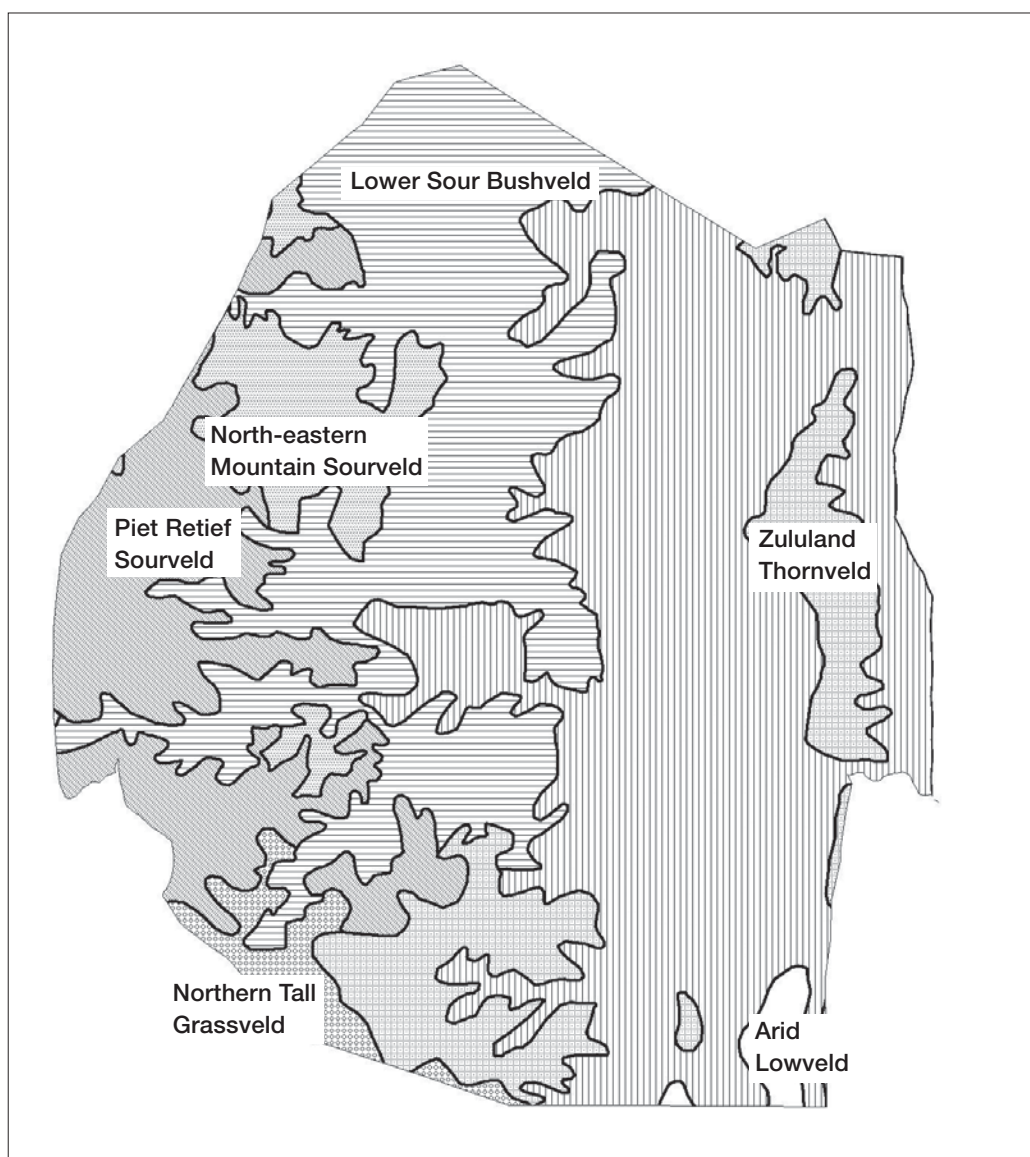


Figure 3. Distribution of the vegetation of Swaziland following Acocks (1975).

## Arid Lowveld

Arid lowveld covers a small area of the southern lowveld region. It is also a typical *Acacia nigrescens-Sclerocarya* savanna, but with *Digitaria* sp. being the dominant grass. Other trees typically associated with this vegetation type are *Spirostachys africana* Sond., *Ziziphus mucronata* Willd. and *Acacia erubescens* Welw. ex Oliv. Along the Lubombo it forms a dense thicket which includes species such as *Euclea undulata* Thunb., *Spirostachys africana* Sond., *Atalaya alata* (Sim) H.O.Forbes, *Schotia brachypetala* Sond. and *Cladostemon kirkii* (Oliv.) Rax & Gilg. As a result of the poor soils the area is unsuitable for cultivation, but is used for cattle ranching.

## VI. False Grassveld types

### Piet Retief Sourveld

This vegetation type is restricted to the highveld and is a sour grassveld type with forests and scrub-forests in sheltered places. Forest relicts include *Scolopia mundii* (Eckl. & Zeyh.) Warb., *Faurea speciosa* (Welw.) Welw., *Halleria lucida* L. and *Myrsine africana* L. Typical grassveld species include *Themeda triandra* Forssk., *Eragrostis racemosa* (Thunb.) Steud., *Monocymbium cerisiiforme* (Nees) Stapf, *Heteropogon contortus* (L.) Roem & Schult. and *Hyperrhena hirta* (L.) Stapf. Large parts of this vegetation type have been lost as a result of afforestation.

### Northern Tall Grassveld

This sourveld type is a patchwork of grassveld

with scrub and relic forest patches in areas less prone to regular burning. The grassveld is dominated by *Tristachya leucothrix* Nees, *Eragrostis racemosa* (Thunb.) Steud., *Microchloa caffra* Nees, and *Diheteropogon amplexus* (Nees) J.Clayton. Forbes include *Senecio latifolius* DC., *Acalypha angustata* Sond. var. *glabra* Sond., *Indigofera oxytropis* Benth. ex Harv., *Diospyros galpinii* (Hiern) DeWinter, and *Hypoxis argentea* Harv. ex Baker.

## Conservation

The conservation and improvement of the natural resources of Swaziland have been called for since 1951 (Compton 1968), but it was only in 1960 that the first national park, the Mlilwane Wildlife Sanctuary, was proclaimed. The King acquired what is now the Hlane Game Reserve during the 1940s as a private ranch, but it was proclaimed as a reserve in 1967. This situation has, however, changed dramatically during the last four decades with the establishment of six nature reserves in various parts of the country (Table 2). These reserves have been located to conserve portions of the different vegetation types occurring in the country and the fauna associated with them.

The reserves cover approximately 3.25% of the land area of the country, which is in stark contrast to the 6.16% used for afforestation (Scharfetter 1987). In an effort to conserve larger areas, a transfrontier park between the Malolotja Nature Reserve and the 49 000 ha Songimvelo Game Reserve in the Mpumalanga Province of South Africa came into being during 2002. Talks with the government of Mozambique are underway to establish a transfrontier

**Table 2. Proclaimed nature reserves administered by the Swaziland National Trust Commission (Greyling & Huntley 1984).**

Reserve	Date proclaimed	Area (hectares)	Vegetation type
Mlilwane Wildlife Sanctuary	1960	4 545	North-eastern Mountain Sourveld & Lowveld Sour Bushveld
Hlane Game Reserve	1967	14 164	Lowveld
Malolotja Nature Reserve	1977	18 000	Lowveld Sour Bushveld & Piet Retief Sourveld
Mlawula Nature Reserve	1980	12 000	Lowveld
Ndzindza Nature Reserve	1980	5 500	Lowveld
Mkhaya Nature Reserve	1981	6 000	Lowveld

park which will include the Mlawula and Ndzindza Nature Reserves.

Although there is legislation to control burning, the cultivation and destruction of vegetation along streams and rivers, and the collecting or destruction of plant material, the laws are not strictly enforced. As a result, areas falling outside the reserves are regularly burnt, agricultural lands are established within metres of streams and riverbanks, and in some areas the vegetation is severely altered as a result of uncontrolled grazing. The small fragmented evergreen forest patches on the high and middleveld are severely threatened by a number of activities. For example, the uncontrolled grazing of cattle in such forests at Hlathikhulu and

Hluti is not only resulting in the erosion of the forest floor, but has led to the almost total destruction of the undergrowth. Regeneration of these forests is therefore not taking place and ultimately they will disappear if this practice is continued. Contributing to this is alien encroachment, in particular by *Acacia mearnsii* DeWild., and in several areas parts of forests are cleared for the illegal cultivation of dagga (*Cannabis sativa* L.).

In the lowveld, particularly in the Mbuluzi valley and Mananga mountains, the scrambling shrub *Chromolaena odorata* (L.) R.M.King & H.Rob. forms impenetrable thickets along streams and riverbanks, smothering the natural vegetation.

# Taxonomy

## Key to the families:

- 1a Sporangia variously borne, but not in sori abaxially on the lamina:
- 2a Sporangia borne on peltate sporangiophores arranged in a terminal strobilus ..... **Equisetaceae**
- 2b Sporangia borne at sporophyll axils, adaxially near leaf bases, in a fertile spike inserted near the base of a sterile lamina, or in nut-like sporocarps at or on the stipe base:
- 3a Sporangia fused to form a 2- or 3-locular synangium, or the sporangia fused to form a sporophore inserted at the base of a sterile tropophore:
- 4a Synangia borne adaxially at the base of forked sporophylls ..... **Psilotaceae**
- 4b Sporangia borne on a sporophore with as many as 30 sporangium pairs, inserted at the base of the sterile tropophore ..... **Ophioglossaceae**
- 3b Sporangia solitary in the sporophyll axils, adaxially near the leaf bases, or in nut-like sporocarps:
- 5a Sporangia borne in nut-like sporocarps ..... **Marsileaceae**
- 5b Sporangia borne singly in sporophyll axils or adaxially near the sporophyll base:
- 6a Leaves ligulate; heterosporous ..... **Selaginellaceae**
- 6b Leaves eligulate; homosporous ..... **Lycopodiaceae**
- 1b Sporangia borne singly, in pairs, in sori, or in synangia abaxially on the lamina:
- 7a Sporangia fused to form synangia ..... **Marattiaceae**
- 7b Sporangia solitary, in pairs, or many grouped in sori:
- 8a Sterile fronds simple:
- 9a Sterile lamina linear:
- 10a Fertile lamina with pectinately arranged fertile segments ..... **Schizaeaceae**
- 10b Fertile lamina simple with sporangia in longitudinal grooves.... **Vittariaceae**
- 9b Sterile lamina oblong or narrowly elliptic, acute, acuminate or attenuate:
- 11a Sporangia acrostichoid ..... **Lomariopsidaceae**
- 11b Sporangia in circular, elliptic or linear sori:
- 12a Indusium reniform; veins forked, free ..... **Oleandraceae**
- 12b Exindusiate; veins forming a reticulate network ..... **Polypodiaceae**
- 8b Sterile fronds pinnatifid or pinnately compound:
- 13a Sporangia not borne in distinct sori, but rather on a highly skeletonised part of the lamina:
- 14a Sterile lamina 2-pinnate; sporangia borne on the apical pinnae ..... **Osmundaceae** (*Osmunda*)
- 14b Sterile lamina 1-pinnate; sporangia borne on the highly modified erect basal pinna pair ..... **Anemiaceae** (*Anemia*)
- 13b Sporangia usually borne in sori, if not, then the lamina not differentiated:
- 15a Lamina pseudodichotomously branched ..... **Gleicheniaceae**
- 15b Lamina pinnately branched:
- 16a Lamina membranous, one cell layer thick (unistratose) ..... **Hymenophyllaceae**
- 16b Lamina herbaceous to coriaceous and always more than one cell layer thick:
- 17a Sori elongate, along a vein abaxially on the lamina, or along a near-marginal vascular commissure; if indusiate, the indusium then linear:
- 18a Sori exindusiate:
- 19a Lamina adaxially and abaxially with hyaline unicellular acicular hairs ..... **Thelypteridaceae** (*Stegnogramma*)
- 19b Lamina without acicular hairs: .. **Pteridaceae** (*Pityrogramma*)

- 20a Lamina abaxially with a yellow farina .....  
 ..... **Pteridaceae** (*Pityrogramma*)
- 20b Lamina abaxially without a yellow farina .....  
 ..... **Osmundaceae** (*Toodea*)
- 18b Sori indusiate:
- 21a Indusium along a vein abaxially on the lamina:
- 22a Lamina flabellately branched. **Pteridaceae** (*Actiniopteris*)
- 22b Lamina pinnately branched:
- 23a Scales clathrate; lamina glabrous or scaled, rarely with  
 hairs ..... **Aspleniaceae**
- 23b Scales not clathrate; lamina variously set with  
 pluricellular hairs ..... **Woodsiaceae**
- 21b Indusium along a near-marginal vascular commissure or a  
 modified lamina margin:
- 24a Fronds dimorphic:
- 25a Plants free-floating aquatics ..... **Parkeriaceae**
- 25b Plants terrestrial ..... **Blechnaceae**
- 24b Fronds monomorphic:
- 26a Lamina variously set with hairs only .....  
 ..... **Dennstaedtiaceae**
- 26b Lamina glabrous or variously set with scales and hairs  
 ..... **Pteridaceae**
- 17b Sori uni- or bisporangiate, if plurisporangiate, then elliptic, lunate,  
 circular and abaxially on the lamina, or terminally at the apex of a free  
 vein branch and marginal; if indusiate, the indusium then cupulate,  
 reniform or peltate:
- 27a Sori uni- or bisporangiate ..... **Anemiaceae** (*Mohria*)
- 27b Sori plurisporangiate:
- 28a Indusium inferior ..... **Cyatheaceae**
- 28b Indusium superior or a modified lamina margin:
- 29a Sori marginal:
- 30a Lamina with acicular pluricellular hairs along the  
 veins ..... **Dennstaedtiaceae** (*Hypolepis*)
- 30b Lamina without acicular hairs along the veins .....  
 ..... **Pteridaceae** (*Adiantum*)
- 29b Sori superficial:
- 31a Sori exindusiate:
- 32a Fronds articulated to short phyllopodia .....  
 ..... **Polypodiaceae**
- 32b Fronds not articulated to phyllopodia:
- 33a Lamina to 1-pinnate, not acroscopically  
 developed ..... **Thelypteridaceae**
- 33b Lamina 2 to 3-pinnate, acroscopically developed  
 ..... **Dryopteridaceae** (*Polystichum*)
- 31b Sori indusiate:
- 34a Indusium cup-shaped .....  
 ..... **Dennstaedtiaceae** (*Microlepis*)
- 34b Indusium elliptic, peltate, or reniform:
- 35a Pinnae articulated to the rachis .....  
 ..... **Nephrolepidaceae**
- 35b Pinnae not articulated to the rachis:
- 36a Lamina never basiscopically developed .....  
 ..... **Thelypteridaceae**

- 37a Lamina 1-pinnate; indusium reniform and variously set with glands and hairs ..... **Thelypteridaceae**
- 37b Lamina 2-pinnate; indusium elliptic and centrally attached, glabrous .....  
..... **Dryopteridaceae** (*Didymochlaena*)
- 36b Lamina basiscopically developed:
- 38a Lamina variously set with pluricellular acicular hairs ..... **Tectariaceae**
- 38b Lamina variously set with scales and non-acicular hairs ..... **Dryopteridaceae**

## PSILOACEAE Kanitz

The Psilotaceae is a family of two genera: *Tmesipteris* Bernh. is confined to tropical Asia and western Oceania, and *Psilotum* Sw. has a pantropical distribution. The family has no obvious close affinity to any other group of vascular plants and is best treated as an independent group. *Psilotum* is often grouped with the extinct Psilophytes, the Rhyniales and Zosterophyllales dating from the Devonian some 400 million years ago. More recently it has been suggested that *Psilotum* forms part of a lineage which includes the Ophioglossidae and which is basal in the Moniliformopses, a group which includes the eusporangiate and leptosporangiate ferns (Pryer *et al.* 2001). These plants are all characterised by dichotomously branched stems, the absence of roots, a relatively simple vascular structure and thick-walled, homosporous synangia. The earliest known fossil record of a modern psilophyte fern dates to the early Oligocene.

**Psilotum** Sw. in J. Bot (Schrader) 1800(2): 109 (1801). Type: *Psilotum nudum* (L.) P.Beauv.

*psilom* (Greek) = naked, bare; *nudum* = nude

Generic description as for the family. A genus of two species with a pantropical distribution.

**Psilotum nudum** (L.) P.Beauv., Prodr. aethéogam.: 112 (1805); Jacobsen, Ferns Sthn. Afr.: 30, fig. 73, map 1 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 1, fig. 1, t. 1, 1a, map 1 (1986); Burrows, Sthn. Afr. Ferns: 10, ill. 1, t. 1a, pl. 1.1, map (1990); Roux, SABONET Rep. 13: 16 (2001). *Lycopodium nudum* L., Sp. pl. 2: 110 (1753). Type: In Indiis, *sine coll. s.n.* [LINN 1257.1!, lecto., designated by Proctor (1977)].

*Psilotum triquetrum* Sw. in J. Bot. (Schrader) 1800(2): 109 (1801), *nom. superfl.* for *Lycopodium nudum* L., now *Psilotum nudum* (L.) P.Beauv. Sim, Ferns S. Afr.: 247, pl. 156, t. 2 (1892); Sim, Ferns S. Afr., 2nd edn: 342, pl. 181, t. 2 (1915).

*Bernhardia capensis* Müll. Berol. in Bot. Zeitung (Berlin) 1858: 239 (1858). Type: Natal, *K.W.L. Pappe s.n.* (?KR, holo.).

Plants epilithic or epiphytic. *Rhizome* short-decumbent, dichotomously branched, rootless, to 1.5 mm in diameter, with rhizoids; *stems* aerial, chlorophyllose, erect or pendent, once or several times dichotomously branched, to 160 mm long, to 2 mm in diameter, gla-



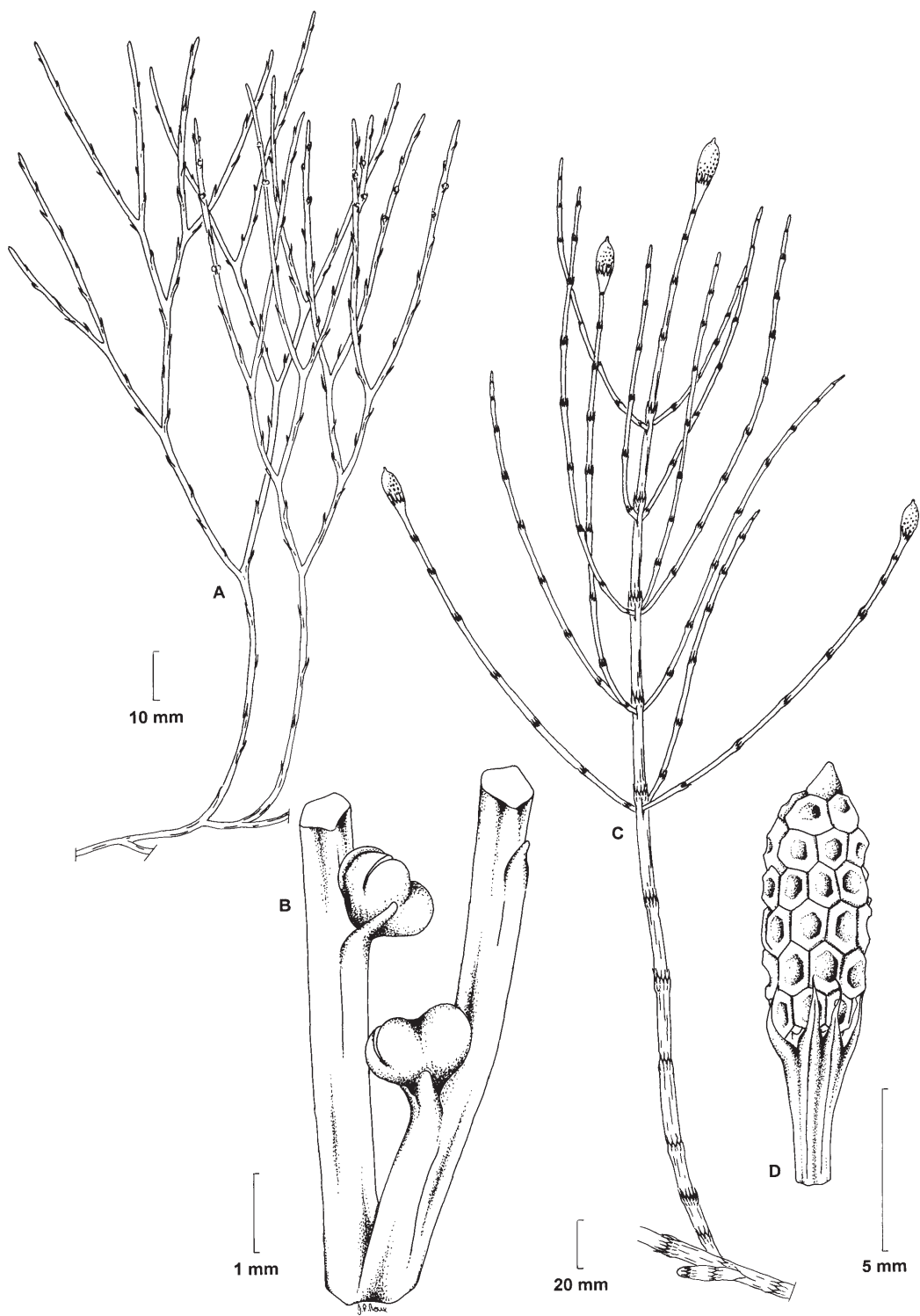


Figure 4 A & B, *Psilotum nudum*, A, habit, B, section of stem showing synangia; C & D, *Equisetum ramosissimum*, C, habit, D, strobilus.

brous, angular or sulcate; with anomocytic stomata in the sulci. *Leaves* rudimentary, simple, lanceolate, adnate, spaced, estomate, to 1.5 mm long. *Sporangia* fused to form a sessile, 2- or 3-locular, thick-walled synangium borne adaxially at the base of forked sporophylls, to 2.5 mm in diameter, each locule dehisces with a longitudinal slit. *Spores* numerous, achlorophyllaceous, elongate-ellipsoid, monolete, irregularly rugate, 60–75 µm long. Chromosome number based on  $2n = 104$ . Figure 4 A & B.

**Vernacular names:** Whisk fern; Stoffervaring (Afr.).

**Ecology:** Epilithic, in shaded, seasonally moist rock crevices, usually along or near streams and in riverine forests. Not edaphically bound, in Swaziland the species grows on granitoid and basaltic rocks. Hemicryptophyte, mesoxerophytic; branches xeromorphic. Vegetative reproduction by rhizome branching. Seasonal pattern apparently non-existent.

**Distribution:** Rare in Swaziland, but possibly more widespread, but overlooked, occurring between 150 and ± 1 250 m. Widespread in sub-Saharan Africa, pantropical.

## EQUISETACEAE Rich. ex DC.

The relationships of the Equisetaceae are controversial—they have been considered as sisters to the angiosperms (Rothwell 1999), sisters to the ferns (Kenrick & Crane 1997), basal to the euphyllophyte lineage (Stevenson & Loconte 1996) and, more recently, in the lineage of eusporangiate ferns (Pryer *et al.* 2001). The Equisetaceae is a well-defined group of extinct and extant plants not clearly related to any other group of pteridophytes. The group dates back to the Devonian, ± 300 million years ago. *Equisetum* accumulates large quantities of silica, which strengthens the plant, in the epidermal cell walls of the aerial shoots.

**Equisetum** L., Sp. pl. 2: 1061 (1753). Lectotype: *Equisetum fluviatile* L., designated by Hauke (1978).

*equus* = horse; *seta* = bristle or hair

Generic description as for the family. A near-cosmopolitan genus of about 15 species, most of which occur in America. The genus is absent from Australia and New Zealand.

**Equisetum ramosissimum** Desf., Fl. atlant. 2: 398 (1799); Milde, Monogr. Equiset.: 428, t. 24 (1865); Sim, Ferns S. Afr.: 240, pl. CL (1892); Sim, Ferns S. Afr., 2nd edn: 343, pl. 174 (1915); Jacobsen, Ferns Sthn. Afr.: 158, fig. 102a-b, map 15 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 29, fig. 1, t. 2, 2a, map 20 (1986); Burrows, Sthn. Afr. Ferns: 37, ill. 1, t. 33, pl. 5.3, map (1990). *Hippochaete ramosissimum* (Desf.) Börner, Fl. deut. Volk: 282 (1912). Type: Tunisia, Jebel Zaghouan, *Desfontaines s.n.* (P, holo.).

*Equisetum thunbergii* Wikstr. in Kongl. Svenska Vetensk. Acad. Handl. 2: 4 (1821). Type: Cape Province, *Thunberg s.n.* (UPS, holo.).

*Equisetum burchellii* Vaucher, Monographie des prêles: 47, t. 10 (1822). *Equisetum ramosissimum* Desf. var. *burchellii* (Vaucher) Milde, Monogr. Equiset.: 443 (1865). Type: Africa australis extratropica, n. 2464, *Burchell s.n.* (K, iso.).

*Equisetum ramosissimum* Desf. var. *capense* Milde, Monogr. Equiset.: 442 (1865). Type: Promontorium bonae Spei, 1844, *Drège & Zeyher s.n.* (missing).

*Equisetum ramosissimum* Desf. var. *dregeanum* Milde, Monogr. Equiset.: 447 (1865). Type: Promontorium bonae Spei, *Drège s.n.*, *Thunberg s.n.* (UPS, holo.).

*Equisetum ramosissimum* Desf. var. *arcuatum* Milde, Monogr. Equiset.: 448 (1865). Type: Promontorium bonae Spei, ad rivum parvum prope Gekan, *Drège s.n.* (LZ†).

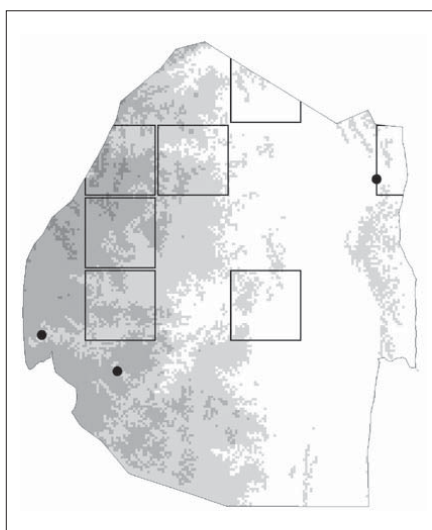
*Equisetum ramosissimum* Desf. var. *flagelliferum* Milde, Monogr. Equiset.: 449 (1965). Type: Ad margines aqueductum urbis Palmarum et alibi insulae Teneriffa, *sine coll. s.n.* (not located); Natal, in palud. ripae Togela fluvii, *Gueinzius s.n.* (W, syn.).

*Equisetum ramosissimum* Desf. var. *distortum* Milde, Monogr. Equiset.: 451 (1865). Type: Promontorium bonae Spei, *Mundt & Maire s.n.* (missing).

*Equisetum ramosissimum* Desf. var. *natalense* Milde, Monogr. Equiset.: 452 (1865). Type: Natal-Küste, *Gueinzius s.n.* (missing).

subsp. **ramosissimum**: Roux, SABONET Rep. 13: 17 (2001).

Plants terrestrial. *Rhizome* subterranean, jointed, 3–6 mm in diameter, roots borne in whorls at the nodes. *Stems* erect, to 1.5 m tall, to 5 mm in diameter, branches borne in whorls at the nodes, up to 14 in each whorl, to 130 mm long, to 1.5 mm in diameter, main stem and branches ridged, bearing siliceous tubercles or bands, with regular rows of paracytic sunken stomata in the sulci, in cross section with a prominent central canal and small vallecular (under sinuses) and carinal (under ridges) canals. *Leaves* membranous to thinly chartaceous, each with a single central vein, whorled, fused into a nodal sheath, to 11 mm long, ending in acuminate teeth, to 2 mm long, turning black with age, margins hyaline, estomate. *Sporangia* elongate, thin-walled, dehiscing longitudinally, borne on stalked, peltate sporangiophores forming a strobilus terminally on a main stem or branch, to 18 mm long, to 5 mm in diameter, each sporangiophore bears 6–9 sporangia. *Spores* spheroidal, chlorophyllose, with 4 spathulate hygroscopic elaters. Figure 4 C & D.



*ramosissimum* = many-branched

**Vernacular names:** Scouring rush, Horsetail; Bewerasiegras, Dronkgras, Drilgras, Lidjiesgras, Perdestert, Paardestaart (Afr.); Mohlaka-photoane (Ses.); Ishobalehashi, Isikhumukele (Zulu).

**Ecology:** Terrestrial, generally in humid sand, gravel, mud or silt on floodplains and in stream and riverbeds. Often also invasive in cultivated fields. Exposed or in partial shade. Geophyte, mesoxerophytic; aerial stems meso-xeromorphic. Seasonal pattern apparently non-existent, strobili possible throughout the year. Vegetative reproduction by the subterranean branched rhizome. Pyrophytic.

**Distribution:** The species is widespread in Swaziland, occurring along most of the major draining systems at altitudes ranging from  $\pm$  150 m along the Mlawula River to 800 m on the western highveld. The species is widespread in the eastern parts of west central tropical Africa, east and south tropical Africa, south tropical and southern Africa, Macaronesia, the western Indian Ocean region, Egypt, southern and central Europe and Asia, except Malaysia. *Equisetum ramosissimum* Desf. subsp. *debile* (Roxb. ex Vaucher) Hauke occurs from India and southern China through Malaysia to New Caledonia and Fiji.

**Uses:** *Equisetum* is of economic importance to the stock farmer as it is poisonous when consumed in large quantities, the toxic principle probably being the enzyme thiaminase that destroys vita-

min B1. This causes livestock to appear drunk and puts them at risk of harming themselves. The Sesotho use the plant for various ailments and rituals. Phillips (1917) reports that the rhizomes are cooked and a decoction is drunk by barren women so that they may become pregnant. The plant is used as a charm to drive caterpillars from the maize fields. This is done by encapsulating some of the caterpillars in clay balls which are then burnt in the fields. The Zulu use the sap from the plant to relieve toothache and it is also applied to the wound after tooth extraction (Gerstner 1939).

## LYCOPODIACEAE P.Beauv. ex Mirb.

Lycopodiaceae represents one of three evolutionary lines within the extant Lycopodiopsida. This ancient line of plants was well-established during the Devonian (Collinson 1996), with many species having attained arborescent dimensions during the Carboniferous period. Most phylogenetic studies place the group above the bryophytes (Bremer *et al.* 1987; Donoghue 1994). Both these groups lack the inverted repetition in the chloroplast genome, which is present in all other extant pteridophytes. The family of more than 400 species has a near-cosmopolitan distribution.

### Key to the genera:

- 1a Stems isotomously branched, without elongate indeterminate main stems; roots usually forming a basal tuft; sporophylls and vegetative leaves alike, or the sporophylls, if smaller, persistent ..... **Huperzia**
- 1b Stems anisotomously branched, branches differentiated into elongate, indeterminate main stems and determinate branchlet systems; roots emerging at intervals on the lower side of the main stem; sporophylls strongly modified and ephemeral:
  - 2a Strobili pendent and sessile, or erect and ending in simple (rarely branched) stems that arise dorsally on the creeping stems, or the strobili erect on the overtopping vegetative shoots ..... **Lycopodiella**
  - 2b Strobili erect, pedunculate, borne terminally or on branchlet stems which arise in a dorsilateral position on the main stem ..... **Lycopodium**

**Huperzia** Bernh. in J. Bot. (Schrader) 1800(2): 126 (1801). Type: *Huperzia selago* (L.) Bernh. ex Schrank & Mart., designated by Rothmaler (1944).

*Huperz* = after Johann Peter Huperz, a German botanist (?–1816)

A genus of 200 to 300 species with near-cosmopolitan distribution.

Plants epilithic or epiphytic. *Stems* with a basal tuft of roots, erect or pendulous, several times isotomously branched. *Leaves* coriaceous to firmly herbaceous, simple, isophyllous, homophyllous or heterophyllous, firmly herbaceous to coriaceous, acicular or oblong, acute, imbricate. *Sporophylls* coriaceous to firmly herbaceous, simple, not conspicuously differentiated from the vegetative leaves, or gradually or abruptly smaller than the vegetative leaves, broadly ovate. *Sporangia* reniform or subcircular, isovalvate. *Spores* subtriangular, trilete, foveolate.

### Key to the species:

- Plants heterophyllous; leaves oblong, acute; sporophylls gradually or abruptly reduced to form distinct strobili ..... **H. gnidioides**
- Plants homophyllous; leaves acicular; sporophylls not conspicuously reduced to form distinct strobili ..... **H. verticillata**

**Huperzia gnidioides** (L.f.) Trevis. in Atti Soc. Ital. Sci. Nat. 17: 247 (1875); Roux, SABONET Rep. 13: 19 (2001). *Lycopodium gnidioides* L.f., Suppl.: 448 (1782); Sim, Ferns S. Afr.: 243, pl.

CLIII (1892); Sim, Ferns S. Afr., 2nd edn: 326, pl. 177a, b (1915); Burt Davy, Man pl. Transvaal 1: 96 (1926); Jacobsen, Ferns Sthn. Afr.: 135, fig. 77a, b, map 5 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 9, fig. 3, t. 1, 1a, map 5 (1986); Burrows, Sthn. Afr. Ferns: 14, ill. 3, t. 5–5b, pl. 1.5 (1990). *Plananthus gnidioides* (L.f.) P.Beauv., Prodr. aethéogam.: 110 (1805). *Urostachys gnidioides* (L.f.) Herter ex Nessel, Bärlappgewächse: 187 (1939). Type: Isle de France, *Sonnerat per Thouin s.n.* (?P, ?iso.).

*Lycopodium funiculosum* Lam., Encycl. 3: 649 (1792). *Lepidotis funiculosa* (Lam.) P.Beauv., Prodr. aethéogam.: 108 (1805). Type: Cap. b. esp., *sine coll. s.n.* (P!, holo.).

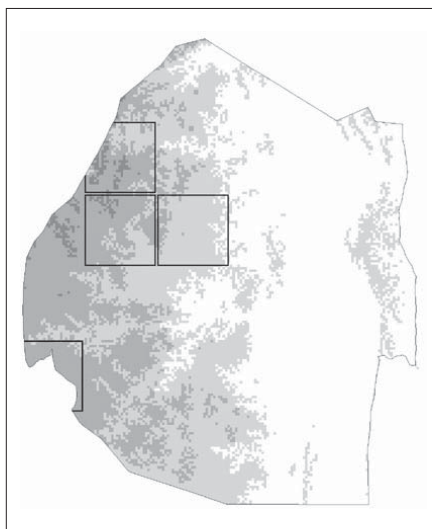
*Lycopodium flagelliforme* Schrad. in Gött. Gel. Anz. 1818: 920 (1818). Type: Prom. bon. spei, *Hesse s.n.* (LE, holo.; GOET, iso.).

*Lycopodium ambiguum* Schrad. in Gött. Gel. Anz. 1818: 920 (1818). Prom. bon. spei, *Hesse s.n.* (LE, holo.).

*Lycopodium pinifolium* Kaulf., Enum. filic.: 7 (1824). *Lycopodium gnidioides* L.f. var. *pinifolium* (Kaulf.) Pappe & Rawson, Syn. fil. Afr. austr.: 49 (1858); Jacobsen, Ferns Sthn. Afr.: 136, fig. 78, map 5 (1983). Type: Promontorio bonae spei, *sine coll. s.n.* (?PH, holo.).

*gnidioides* = refers to the imbricate, *Gnidia*-like (Thymeliaceae) leaves

Plants epilithic or epiphytic. *Stems* with a basal tuft of roots, erect with the apices arching, or pendulous, several times isotomously branched, up to 380 mm long, to 5 mm in diameter. *Leaves* isophyllous, heterophyllous; vegetative leaves coriaceous, narrowly oblong, entire, acute to broadly acute, imbricate, to 10 mm long, to 2 mm wide. *Sporophylls* gradually or abruptly smaller than the vegetative leaves, broadly ovate, entire, acute, imbricate, to 3 mm long, to 2 mm wide. *Sporangia* reniform, isovalvate, to 1.5 mm in diameter. *Spores* yellow, subtriangular, trilete, foveolate, (38–)40(–42)  $\mu\text{m}$  in equatorial diameter, (24–)26(–30)  $\mu\text{m}$  in polar diameter. Figure 5 A–D.



**Vernacular names:** Hard clubmoss; Harde wolfsklou (Afr.).

**Ecology:** Epilithic, in exposed or shaded, seasonally moist rock crevices or shallow soil pockets. Hemicryptophyte, mesoxerophyte; leaves mesoxeromorphic. In Swaziland the species is confined to granitoid rocks. Seasonal pattern apparently non-existent. Vegetative reproduction by the formation of stems from near the base of the main stem, rooting when in contact with the substrate. No drought-dormancy.

**Distribution:** Sporadic in the western highveld region of Swaziland, occurring at altitudes ranging between 1 350 and 1 675 m. *Huperzia gnidioides* also occurs in mesic regions of sub-Saharan Africa and the western Indian Ocean region.

**Huperzia verticillata** (L.f.) Trevis. in Atti Soc. Ital. Sci. Nat. 17: 248 (1875); Roux, SABONET Rep. 13: 21 (2001). *Lycopodium verticillatum* L.f., Suppl.: 448 (1782); Sim, Ferns S. Afr.: 243, pl. CLII (1892); Sim, Ferns S. Afr., 2nd edn: 325, pl. 178 (1915); Jacobsen, Ferns Sthn. Afr.: 133, fig. 75, map 3 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 7, map 3 (1986); Burrows, Sthn. Afr. Ferns: 12, ill. 2, t. 3, 3a, pl. 1.3, map (1990). *Plananthus verticillatus* (L.f.) P.Beauv., Prodr. aethéogam.: 112 (1805). *Stachygynandrum verticillatum* (L.f.) P.Beauv., Prodr. aethéogam.: 113 (1805). *Urostachys verticillatus* (L.f.) Herter in Beih. Bot. Centralbl. 39: 249 (1922). Type: Insulae de Bourbon, *Sonnerat per Thouin s.n.* (SBT, holo.).

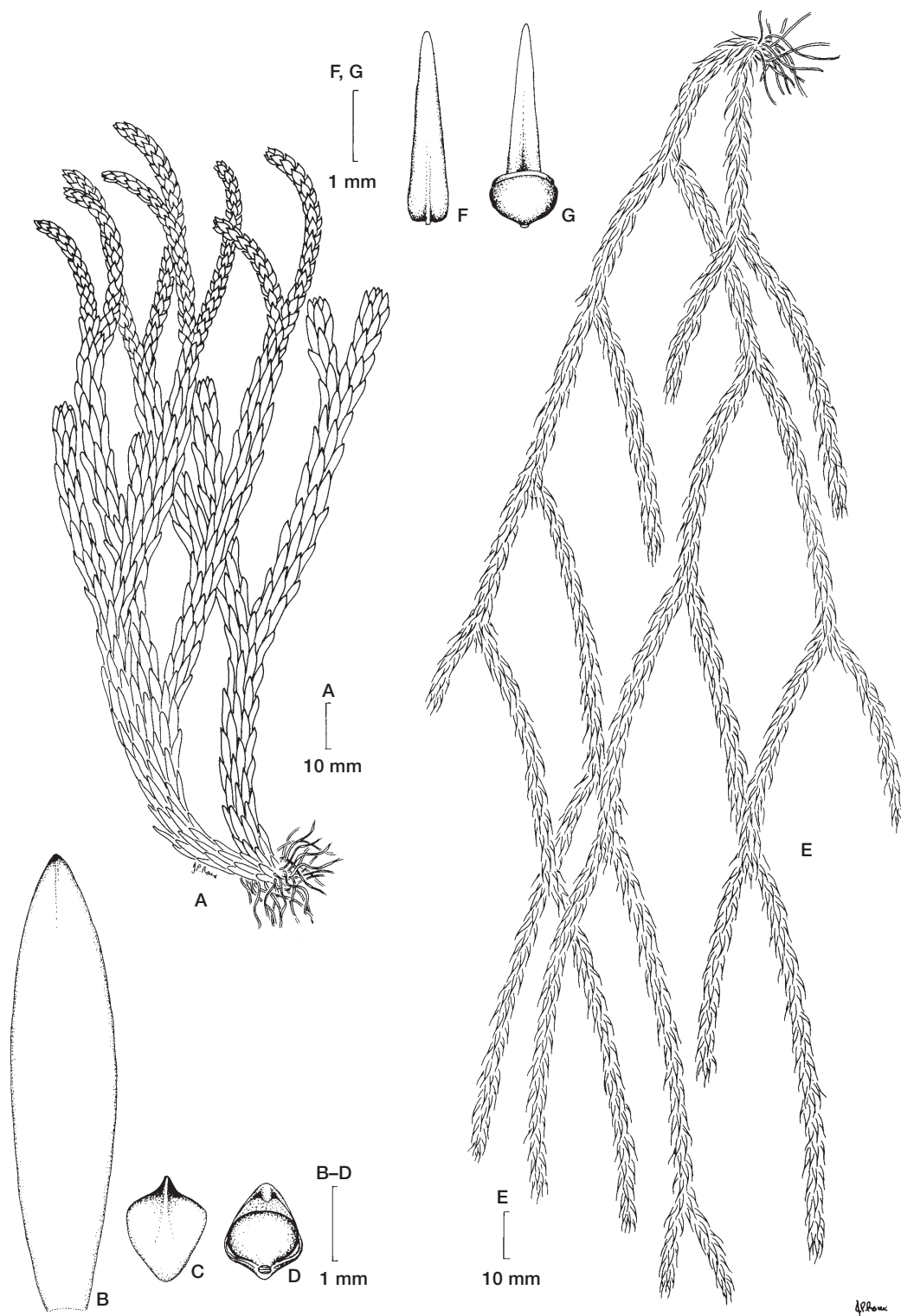


Figure 5 A–D, *Huperzia gnidioides*, A, habit, B, leaf, C, abaxial surface of sporophyll, D, adaxial view of sporophyll showing the sporangium; E–G, *H. verticillata*, E, habit, F, leaf, G, adaxial surface of sporophyll showing the sporangium.

*verticillus* = whorled

Plants epilithic. *Stems* with a basal tuft of roots, pendulous, several times isotomously branched, to 520 mm long, to 2 mm in diameter. *Leaves* isophyllous, homophyllous, firmly herbaceous, acicular, loosely imbricate, to 7 mm long, to 0.7 mm wide. *Sporophylls* not conspicuously smaller than the vegetative leaves, firmly herbaceous, acicular, entire, loosely imbricate, to 7 mm long, to 0.7 mm wide. *Sporangia* reniform to subcircular, isovalvate, to 1 mm in diameter. *Spores* yellow, subtriangular, trilete, foveolate, (30–)31(–32)  $\mu\text{m}$  in equatorial diameter, (20–)21(–22)  $\mu\text{m}$  in polar diameter. Figure 5 E–G.



**Vernacular names:** Weeping clubmoss; Treur wolfsklou (Afr.).

**Ecology:** Epilithic, on moist or seasonally moist moss-covered rocks in evergreen forests, in light or deep shade, usually near water. Often also on rocks in boulder-forests away from water, but then within the mist belt. Hemicryptophyte, mesoxerophyte; vegetative stems mesomorphic. Seasonal pattern pronounced when growing in environments subject to seasonal moisture fluctuations. Vegetative reproduction often occurs by the rooting of stems where in contact with the substrate. No drought-dormancy, but may wilt during the dry winter months. No resistance to fire.

**Distribution:** In Swaziland the species appears to be confined to the north-western corner of the country, occurring at altitudes ranging between 1 000 and 1 400 m. The species is confined to forest patches along streams, in mountain ravines, and in boulder-forests. *Huperzia verticillata* is widespread in sub-Saharan Africa, the western Indian Ocean region, tropical America, and Polynesia.

**Lycopodium** L., Sp. pl. 2: 1100 (1753), emend. Rothm. in Feddes Repert. Spec. Nov. Regni Veg.: 63 (1944). Lectotype: *Lycopodium clavatum* L., designated by Britton & Brown (1913).

*lycos* (Greek) = wolf; *pous* = foot

Generic description as for the species. A genus of approximately 40 species with near-cosmopolitan distribution.

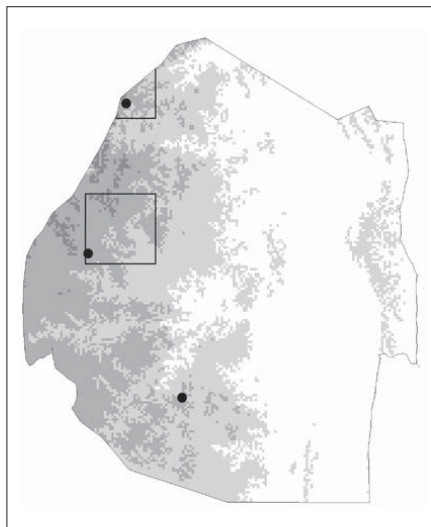
**Lycopodium clavatum** L., Sp. pl. 2: 1101 (1753); Sim, Ferns S. Afr.: 245, pl. CLV, fig. 1 (1895); Sim, Ferns S. Afr., 2nd edn: 328, pl. 180, fig. 1 (1915); Jacobsen, Ferns Sthn. Afr.: 140, fig. 82, map 9 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 11, map 8 (1986); Burrows, Sthn. Afr. Ferns.: 18, ill. 4, t. 8, pl. 2.2, map (1990); Roux, SABONET Rep. 13: 21, 22 (2001). *Lepidotis clavata* (L.) P.Beauv., Prodr. aethéogam.: 108 (1805). Type: Herb. Burser XX: 49 [UPS, lecto., designated by Jonsell & Jarvis (1994)]

*Lepidotis inflexa* P.Beauv., Prodr. aethéogam.: 109 (1805). *Lycopodium inflexum* (P.Beauv.) Sw., Syn. fil.: 179 (1806). *Lycopodium clavatum* L. var. *inflexum* (P.Beauv.) Spring in Mém. Acad. Roy. Sci. Belgique 15: 90 (1842). Type: Ins. Borboniae, *Bory de St. Vincent s.n.* (G, holo.).

*Lycopodium clavatum* L. var. *natalense* Nessel in Feddes Repert.: 36: 191, t. 176 (1934), as '*nataliense*'. Type: Natal, an trocken en Berghängen, *Holz s.n.* (?BONN, holo.).

*clavatum* = club-shaped

Plants terrestrial. *Stems* wide-creeping, rooting at irregular intervals, anisotomously branched, main stems with indeterminate growth, to 2 mm in diameter, isophyllous, lateral branches erect, arising in a dorsilateral position on the main stem, isophyllous, fertile branches erect, anisotomously branched, sparsely leafy, isophyllous, heterophyllous, to 180 mm long. *Leaves* herbaceous, acicular, entire, aristate, patent to imbricate, to 7 mm long, to 1 mm wide. *Strobili* terminal, in groups of 3–5, to 30 mm long, isophyllous, sporophylls ephemeral, herbaceous, subpeltate, often with a basispic membrane on the stalk, narrowly to broadly ovate, aristate, lacinate, to 4.5 mm long, to 2 mm wide. *Sporangium* reniform, short-stalked, borne adaxially near the sporophyll base, isovalvate, to 1.3 mm in diameter. *Spores* spheroidal to subtriangular, trilete, reticulate, (34–)37.5(–38)  $\mu\text{m}$  in equatorial diameter, (30–)31(–34)  $\mu\text{m}$  in polar diameter. Figure 6 A–C.



**Vernacular names:** Running clubmoss, Common clubmoss; Algemene wolfsklou (Afr.); Inwele (Zulu).

**Ecology:** Terrestrial, on moist or seasonally moist slopes in grasslands, forest margins, and disturbed or man-made habitats such as road cuttings, growing in exposed or partially shaded conditions. Not edaphically bound. Nanophanerophyte, mesoxerophyte; vegetative stems mesoxeromorphic, leaves mesoxeromorphic. Seasonal pattern pronounced; strobili appear to be formed between November and April; no drought-dormancy. Vegetative reproduction by the wide-creeping, many-branched stems.

**Distribution:** In Swaziland the species appears to be confined to the higher-lying western parts of the country, occurring at altitudes of between 125 and 1 500 m. The species is widespread in sub-Saharan Africa and the western Indian Ocean region.

**Use:** The Zulu use the whole plant for magical purposes (Hutchings *et al.* 1996), whilst the Sesotho smoke the plant mixed with *Selaginella caffrorum* (Milde) Hieron. to relieve headaches (Jacot-Guillarmod 1971).

**Lycopodiella** Holub in Preslia 36: 20, 22 (1964). Type: *Lycopodiella inundata* (L.) Holub

*Lycopodiella* = derived from the related *Lycopodium* with the diminutive suffix *-ella*

A genus of perhaps 40 species with mainly pantropical distribution.

Plants terrestrial. *Stems* procumbent or wide-creeping, rooting at irregular intervals, anisotomously branched, main stems with indeterminate growth, terete or dorsiventrally flattened, isophyllous or anisophyllous, with erect, simple or branched aerial shoots which arise dorsally, or dorsilaterally on the main stems, of determinate growth, isophyllous, heterophyllous. *Leaves* imbricate, appressed or patent and curving upwards, coriaceous to carnosaceous, adnate, acicular, lanceolate or subulate, often carinate, usually entire, those near the strobili often irregularly denticulate, often with short hair-like appendages on the basispic wing decurrent on the stems. *Strobili* terminal, sessile and pendent or pedunculate and erect, solitary at apex of fertile branches, isophyllous, sporophylls imbricate, coriaceous, adnate, ovate-acuminate to broadly ovate-acuminate, arose to



Figure 6 A–C, *Lycopodium clavatum*, A, habit, B, leaf, C, adaxial view of sporophyll showing the sporangium; D–F, *Lycopodiella cernua*, D, habit, E, leaf, F, adaxial view of sporophyll showing the sporangium; G–J, *L. sarcocaulon*, G, habit, H, dorsal leaf, I, lateral leaf, J, adaxial view of sporophyll showing the sporangium.

lacerate. *Sporangia* sessile, reniform to subglobose, borne adaxially at the sporophyll base, isovalvate or anisovalvate. *Spores* spheroidal, trilete, rugate-reticulate.

### Key to the species:

Stems wide-creeping, terete, isophyllous ..... **L. cernua**  
 Stems procumbent, dorsiventrally flattened, anisophyllous ..... **L. sarcocaulon**

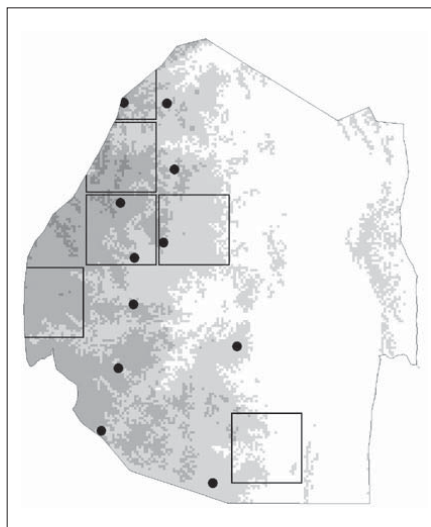
**Lycopodiella cernua** (L.) Pic.Serm. in Webbia 23: 166 (1968); Roux, SABONET Rep. 13: 23 (2001). *Lycopodium cernuum* L., Sp. pl. 2: 1103 (1753); Sim, Ferns S. Afr.: 244, pl. CLIV, fig. 1 (1892); Sim, Ferns S. Afr., 2nd edn: 327, pl. 179, fig. 1 (1915); Burt Davy, Man pl. Transvaal 1: 96 (1926); Jacobsen, Ferns Sthn. Afr.: 138, fig. 25, 80, map 7 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 11, fig. 4, t. 1, 1a, map 7 (1986); Burrows, Sthn. Afr. Ferns: 18, ill. 4, t. 7, pl. 2.1, map (1990). *Lepidotis cernua* (L.) P.Beauv., Prodr. aethéogam.: 101 (1805). *Palhinhaea cernua* (L.) Vasc. & Franco in Bol. Soc. Brot., sér. 2, 41: 25 (1967). Type: ?India, *sine coll. s.n.* (LINN 1257.13!, lecto., designated by Stearn 1979, notula in LINN).

*Lycopodium heeschii* Müll.Berol. in Bot. Zeitung (Berlin) 19: 164 (1861). Type: Sierra Leone, littoris Senegambiae, ad ripas fluminis in monte prope Freetown, 15/08/1844, *Heesch s.n.* (not located).

*Lycopodium secundum* Müll.Berol. in Bot. Zeitung (Berlin) 19: 164 (1861). Type: Cape Province and Natal, *Gueinzius s.n.* (syn., not located).

*cernuus* = slightly drooping

Plants terrestrial. *Stems* terete, wide-creeping, rooting at irregular intervals, anisotomously branched, main stems with indeterminate growth, to 3 mm in diameter, isophyllous, aerial shoots arise dorsally on the main stems, erect, to 1 m long, branched, of determinate growth, isophyllous, heterophyllous. *Leaves* coriaceous, acicular, usually entire, those near the strobili often with a few scattered teeth, patent, curving upwards, often with short hair-like appendages on the basiscopic wing decurrent on the stems, to 5 mm long, to 0.5 mm wide. *Strobili* terminal, sessile and pendent, solitary at apex of aerial branches, isophyllous, to 10 mm long, sporophylls coriaceous, ovate-acuminate to broadly ovate-acuminate, lacerate, to 1.6 mm long, to 1 mm wide. *Sporangia* reniform to subglobose, borne adaxially at the sporophyll base, anisovalvate, to 0.5 mm in diameter. *Spores* spheroidal, trilete, the laesura arms usually depressed in a narrow sulcus, proximal face nearly smooth, distal face granulate. Figure 6 D–F.



**Vernacular name:** Nodding clubmoss, Fairy Christmas tree; Wolfsklou (Afr.).

**Ecology:** Terrestrial, along perennial streams, among grasses, sedges and other low-growing scrub in full sun, but less frequently also in full shade in seepage areas on the edge of, or rarely, in evergreen forests, and in man-made habitats such as road cuttings and ditches. Hemicryptophyte, mesophyte; stems mesoxeromorphic, long-lived; leaves mesomorphic. Not edaphically bound. Seasonal pattern apparently non-existent, no drought-dormancy, strobili collected in January, April, May, August, September and December. Vegetative reproduction by the wide-creeping, much-branched stems rooting at irregular intervals. Grows in areas subjected to regular burns, but no fire scars were observed.

**Distribution:** *Lycopodiella cernua* appears to be confined to the more moist higher-lying parts of Swaziland, occurring at altitudes ranging between 912 and 1 400 m. This pantropical species is widespread in sub-Saharan Africa.

***Lycopodiella sarcocaulon*** (A.Braun & Welw. ex Kuhn) Pic.Serm. in *Webbia* 23: 166 (1968); Roux, SABONET Rep. 13: 23 (2001). *Lycopodium sarcocaulon* A.Braun & Welw. ex Kuhn, *Filic. afr.*: 210 (1868). *Pseudolycopodiella sarcocaulon* (A.Braun & Welw. ex Kuhn) Holub in *Folia Geobot. Phytotax.* 18: 442 (1983). Type: Angola, districtus Huíla, in declivibus spongiosis editioribus de Morro de Lopollo, *Welwitsch* 168 [K, lecto., designated by Nessel (1939); P, isolecto.].

*Lycopodium carolinianum* L. var. *grandifolium* Spring in *Mém. Acad. Roy. Sci. Belgique* 24: 46 (1850); Jacobsen, *Ferns Sthn. Afr.*: 139, fig. 81, map 8 (1983); Schelpe & Anthony, *Fl. S. Afr., Pterid.*: 13, fig. 2, t. 3, map 11 (1986); Burrows, *Sthn. Afr. Ferns*: 20, ill. 4, t. 10b, map (1990). Type: South Africa, Transvaal, Magaliesberg, *Burke* 531 [K!, lecto., designated by Schelpe & Anthony (1986)].

*sarco* (Greek) = fleshy; *caulis* = stem

Plants terrestrial. *Stems* epigeal, procumbent, rooting at irregular intervals, dorsiventrally flattened, anisotomously branched, to 2.5 mm in diameter, anisophyllous, main stem of indeterminate growth, fertile branches formed laterally on the main or lateral branches, simple, erect, sparsely leafy, isophyllous, heterophyllous, to 280 mm long, to 1.6 mm in diameter. *Leaves* on sterile branches carnosely coriaceous, imbricate, dorsal leaves appressed, adnate, lanceolate to subulate, entire, to 5 mm long, to 1 mm wide, lateral leaves adnate, inequilaterally lanceolate, often falcate, to 12 mm long, to 3 mm wide, fertile branch leaves spaced, coriaceous, adnate, subulate, carinate, entire, to 4.5 mm long, to 1.5 mm wide. *Strobili* terminal on the erect, unbranched stem, isophyllous, to 55 mm long, sporophylls imbricate, coriaceous, adnate, ovate-acuminate, erose, to 4 mm long, to 2.5 mm wide. *Sporangium* reniform, sessile, borne adaxially near the sporophyll base, isovalvate, to 1.8 mm in diameter. *Spores* pale yellow, spheroidal, trilete, rugate-reticulate, to (40–)44.6(–48)  $\mu\text{m}$  in equatorial diameter. Figure 6 G–J.



**Vernacular names:** Fleshy club moss; Vlesige wolfsklou (Afr.).

**Ecology:** Terrestrial, among grasses and sedges in permanently wet sites and seepage areas along perennial streams in higher lying grasslands, usually in poorly drained black turf or peat. In full sunlight or in very light shade of low (grazed) vegetation. Hemicryptophyte, mesophyte; stems mesomorphic; leaves mesomorphic. Seasonal pattern apparently non-existent, no drought-dormancy, found with strobili in May and June. Vegetative reproduction by the creeping many-branched stems. Pyrophytic.

**Distribution:** *Lycopodium sarcocaulon* appears to be confined to the higher-lying areas of north-western Swaziland, occurring at altitudes ranging between 1 200 and 1 400 m. The species is restricted to south tropical Africa and the eastern parts of southern Africa.

## SELAGINELLACEAE Willk.

Selaginellaceae, together with Lycopodiaceae and Isoetaceae, form one of the three evolutionary lines within the Lycopodiopsida. The Selaginellales and Isoetales are tied together by heterospory and the leaves being ligulate. Selaginellales have a long fossil record from the Devonian onwards, a period of more than 400 million years. Extant *Selaginella* number approximately 700 species, and are largely confined to the tropical areas of the world.

The root of *Selaginella* is interesting in that in some species it originates superficially rather than endogenously, has no rootcap until entering the substrate and is capable of developing as a leafy stem under certain conditions. This led to the introduction of the term 'rhizophore' for these organs as they show features of both the stem and the root.

**Selaginella** P.Beauv., Mag. Encycl. 9: 478 (1804), *nom. cons.* Type: *Selaginella selaginoides* (L.) Link.

*Selaginella* = the diminutive form of *Selago*, a name given by Pliny to some coniferous trees, and taken up by Linnaeus for *Lycopodium*.

Plants terrestrial or epilithic. *Stems* stout or herbaceous, epigeal or subterranean, wide-creeping, rooting at branching points, anisotomously branched, isophyllous or anisophyllous, primary branches prostrate, ascending or erect, anisotomously branched, dorsiventrally flattened or not, isophyllous or anisophyllous, if anisophyllous, then with 2 ranks of median leaves dorsally, heterophyllous. *Leaves* ligulate, simple, spaced or imbricate, appressed or not, herbaceous to coriaceous, adnate, sessile, or peltate, linear, subulate, lanceolate, oblong-elliptic, ovate, or broadly acinaciform, margins erose, serrulate, fimbriate or ciliate, aristate or not, glabrous or granulate, lateral leaves often patent. *Strobili* sessile, solitary at the apex of secondary and lower order branches, sporophylls simple, ephemeral or not, isophyllous or anisophyllous, if anisophyllous, then dorsally in 2 ranks, herbaceous to coriaceous, peltate, ovate-acuminate to broadly ovate-acuminate, often carinate, ciliate to lacerate, aristate or not. *Sporangia* sessile or short-stalked, reniform or spheroidal, borne adaxially at sporophyll base, isovalvate or anisovalvate; megasporangia basal, few; microsporangia apical, more numerous, subtended by a membranous ligule. *Megaspores* often of 2 sizes, globose, trilete ridge indistinct, smooth, punctulate or cristate; *microspores* globose or subtriangular, trilete, scabrate, echinate or minutely foveo-reticulate.

### Key to the species:

- 1a Strobili anisophyllous; sporophylls in 2 ranks ..... **S. dregei**
- 1b Strobili isophyllous; sporophylls in 4 ranks:
  - 2a Primary branches erect ..... **S. imbricata**
  - 2b Primary branches prostrate:
    - 3a Median leaves to 1.5 mm long; lateral leaves to 2 mm long; leaf surfaces granulate  
..... **S. mittenii**
    - 3b Median leaves to 2.6 mm long; lateral leaves to 3.2 mm long; leaf surfaces glabrous  
..... **S. kraussiana**

**Selaginella dregei** (C.Presl) Hieron. in Hedwigia 39: 315, t. 36 (1900); Jacobsen, Ferns Sthn. Afr.: 143, fig. 84, map 10 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 17, fig. 6, t. 2–2b, map 13 (1986); Burrows, Sthn. Afr. Ferns: 22, ill. 5, t. 13, 13a, pl. 3.1, map (1990); Roux, SABONET Rep. 13: 25 (2001). *Lycopodium dregei* C.Presl, Abh. Böhm. Ges. Wiss. 5, 3: 583 (1845). *Selaginella rupestris* (L.) Spring var. *recurva* A.Braun forma *dregei* (C.Presl) A.Braun ex Kuhn, Filic. afr.: 214 (1868), as '*dregeana*'. *Bryodesma dregei* (C.Presl) Soják in Preslia 64: 154 (1993). Type: Umsikaba

River, *Drège s.n.* (PR, holo.; BM, iso.).

*Selaginella dregei* (C.Presl) Hieron. var. *buchmanniana* Hieron. in *Hedwigia* 39: 317 (1900).

Type: Südost-Afrika, Pondoland, *Buchanan* 9 (B!, holo.).

*Selaginella dregei* (C.Presl) Hieron. var. *pretoriensis* Hieron. in *Hedwigia* 39: 317 (1900).

Type: Transvaal, near Pretoria, colles supra Aapiesrivier, *Rehmann* 4333 [B!, lecto., designated by Tryon (1955)].

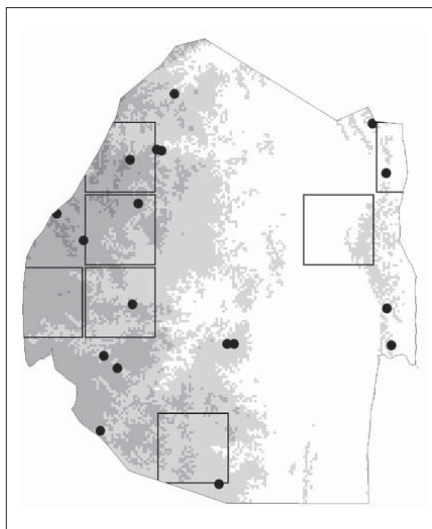
*Selaginella dregei* (C.Presl) Hieron. var. *rehmanniana* Hieron. in *Hedwigia* 39: 317 (1900).

Type: Transvaal, Houtbosch, *Rehmann* 5576 [B!, lecto., designated by Tryon (1955); BOL, K, isolecto.].

*Selaginella rupestris* sensu Burt Davy, *Man pl. Transvaal* 1: 97 (1926).

*dregei* = after J.F. Drège (1794–1881), a German horticulturist, botanical collector and traveller who collected extensively in South Africa from 1826 to 1834.

Plants terrestrial or epilithic. *Stems* stout, epigeal, wide-creeping, rooting at branching points, anisotomously branched, isophyllous, primary branches prostrate or ascending, anisotomously branched, to 0.5 mm in diameter, isophyllous, heterophyllous. *Leaves* imbricate, glaucous, coriaceous, adnate, linear to subulate, ciliate, aristate, abaxially with a tapering groove along the vein housing the stomata, to 2.8 mm long, to 0.5 mm wide. *Strobili* sessile, solitary at the apex of secondary or lower order branches, to 5 mm long, anisophyllous, sporophylls ephemeral, dorsally in 2 ranks, coriaceous, sessile, ovate-acuminate to broadly ovate-acuminate, ciliate, aristate, abaxially with a tapering groove along the vein housing the stomata, to 2.5 mm long, to 1.25 mm wide. *Sporangia* sessile, reniform, borne adaxially at sporophyll base, anisovalvate, to 1 mm in diameter; megasporangia basal, few; microsporangia apical, more numerous, subtended by a membranous ligule. *Megaspores* yellow, globose, trilete ridges indistinct, 350–440 µm in equatorial diameter; *microspores* yellowish-brown, subtriangular, trilete, scabrate, 40–50 µm in equatorial diameter. Figure 7 A–D.



**Vernacular names:** Drège's resurrection fern; Grys opstandingsvaring (Afr.).

**Ecology:** Terrestrial or epilithic, usually in shallow soil pockets on exposed or lightly shaded sheet rock. Hemicryptophyte, xerophyte; stems and leaves xeromorphic. Not edaphically bound. Seasonal pattern pronounced, actively growing during the rainy season, dormant during the dry winter months, poikilohydrous. Vegetative reproduction by the epigeal, wide-creeping and much-branched stems. Often grows in vegetation subjected to frequent burning.

**Distribution:** *Selaginella dregei* is widespread and fairly common throughout Swaziland, occurring at altitudes ranging between 150 and 1 555 m. The species is widespread in sub-Saharan Africa.

***Selaginella imbricata*** (Forssk.) Spring ex Decne. in *Arch. Mus. Hist. Nat.* 2: 193, t. 7 (1841); Sim, *Ferns S. Afr.*, 2nd edn: 336, pl. 184, fig. 3a–d (1915); Jacobsen, *Ferns Sthn. Afr.*: 144, fig. 87, map 11 (1983); Schelpe & Anthony, *Fl. S. Afr.*, Pterid.: 19, fig. 5, t. 2–2c, map 15 (1986); Burrows, *Sthn. Afr. Ferns*: 26, ill. 5, t. 19, 19a, pl. 3.4, map (1990); Roux, *SABONET Rep.* 13: 26 (2001). *Lycopodium imbricatum* Forssk., *Fl. aegypt.-arab.* cxxv, 187 (1775). Type: Yemen, Hadie, at Uahfât,

29/03/1763, *P. Forsskål s.n.* (C!, holo., p.p.; LD, iso.).

*imbricatus* = overlapping

Plants terrestrial or epilithic. *Stems* stout, epigeal, wide-creeping, rooting at branching points, anisotomously branched, terete, to 1 mm in diameter, set with brown, imbricate leaves, isophyllous, herbaceous, peltate, ovate, carinate, lacerate, to 2.2 mm long, to 1.3 mm wide; primary branches grouped, erect, anisotomously branched in the upper half, dorsiventrally flattened, anisophyllous, with 2 rows of median leaves dorsally, heterophyllous. *Leaves* dark green adaxially, paler abaxially, imbricate, appressed, coriaceous, median leaves peltate, inequilaterally ovate or broadly acinaciform, lacerate, glabrous, to 2.5 mm long, to 1.5 mm wide, lateral leaves peltate, broadly acinaciform, erose, the thin convex border acroscopically directed, dry with age, to 3 mm long, to 1.8 mm wide. *Strobili* sessile, solitary at apex of secondary and lower order branches, square in frontal view, sporophylls spirally arranged, isophyllous, coriaceous, peltate, ovate, carinate, lacerate, to 1.3 x 1 mm. *Sporangia* short-stalked, spheroidal, isovalvate, to 0.7 mm in diameter, subtended by a membranous, ovate ligule. *Megaspores* globose, trilete ridge indistinct, smooth or punctulate, of 2 sizes, 150 µm and 300 µm in equatorial diameter; *microspores* globose, trilete, minutely foveo-reticulate, 70–80 µm in equatorial diameter. Figure 7 E–H.



**Vernacular names:** Scaled resurrection fern; Skubblaar opstandingsvaring.

**Ecology:** Terrestrial or epilithic, usually in exposed or lightly shaded shallow soil pockets or rock crevices where it may form small stands. In Swaziland the species is restricted to basaltic soils. Geophyte, xerophyte; xeromorphic. Vegetative reproduction by the creeping and branched rhizome. Seasonal pattern pronounced, actively growing during the rainy season, dormant during the dry winter months or during periods of prolonged drought when the branches become inrolled, poikilohydrous.

**Distribution:** Sporadic; in Swaziland the species is known from a single collection made in the Mlawula Nature Reserve at an altitude of ± 250 m, in the north-eastern corner of the country. The species occurs in the Arabian peninsula, east and south tropical Africa, southern Africa and the western Indian Ocean region.

**Selaginella kraussiana** (Kunze) A.Braun, Index sem. Hort. bot. Berol. 1859: 22 (1860); Sim, Ferns S. Afr.: 252, pl. CLVII, t. 1 (1892); Sim, Ferns S. Afr., 2nd edn: 335, pl. 182, t. 1 (1915); Burt Davy, Man pl. Transvaal 1: 97 (1926); Jacobsen, Ferns Sthn. Afr.: 146, fig. 89a, b, map 13 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 20, fig. 6, t. 1, 1a, map 16 (1986); Burrows, Sthn. Afr. Ferns: 28, ill. 6, t. 21, 21a (1990); Roux, SABONET Rep. 13: 26 (2001). *Lycopodium kraussianum* Kunze in Linnaea 18: 114 (1844). Type: Ad portum Natalensem inter Omfondi et Tagela in sylvis umbrosis humidis, et in coronis rupium saxis adpressum, nec non in faucibus umbrosis sylvarum prope rivulum haud procul a Chakas-Kraal, *Gueinzius s.n.* [K, lecto., designated by Bizzarri (1975); FI, P, W, isosyn.].

*Selaginella hortensis* Mett., Fil. hort. bot. Lips.: 125, 128 (1856). Type: Cultra in Horto Botanico Lipsiensi (LZ†; K, lecto., designated by Bizzarri (1975); B 120828, isolecto.).

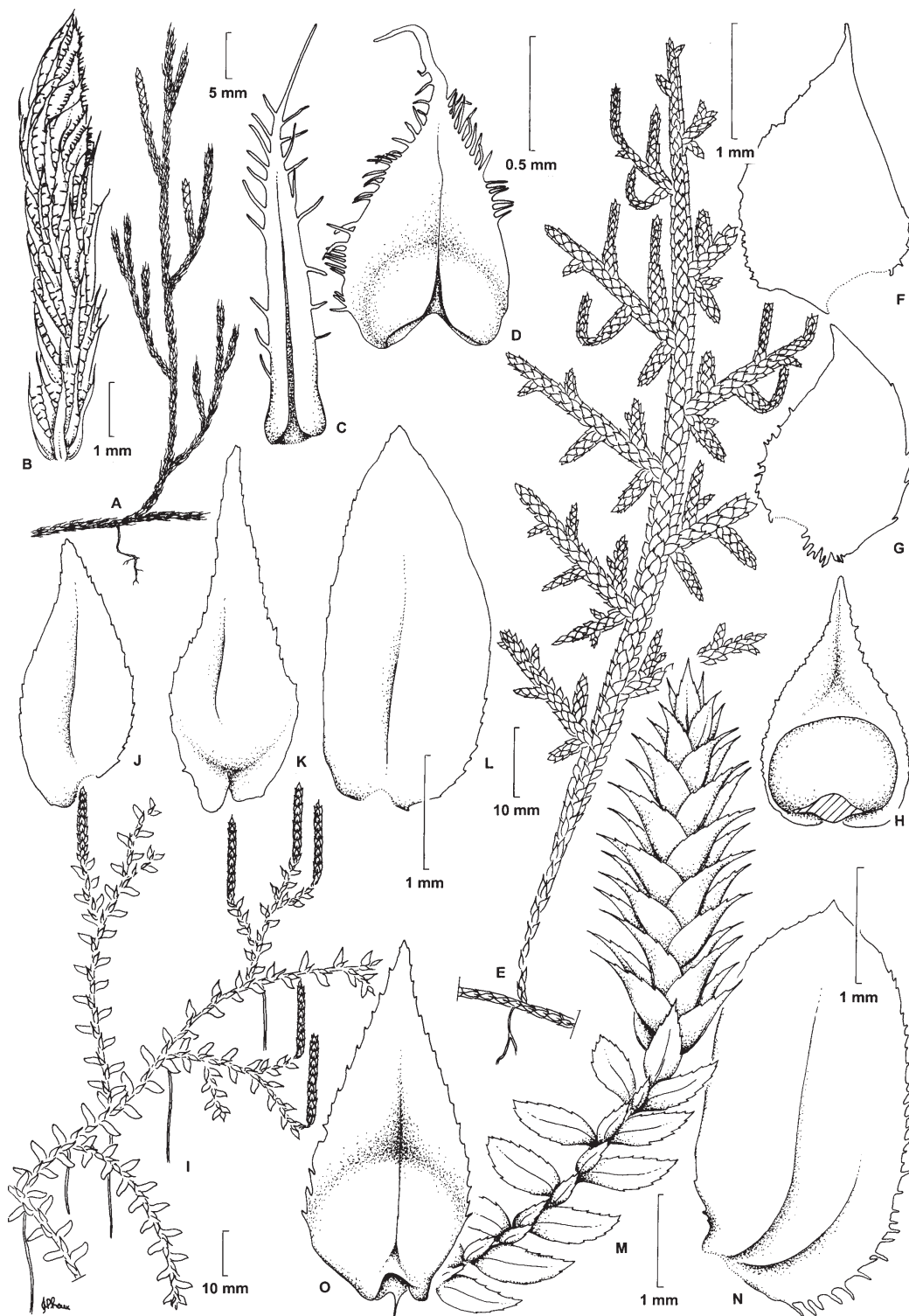
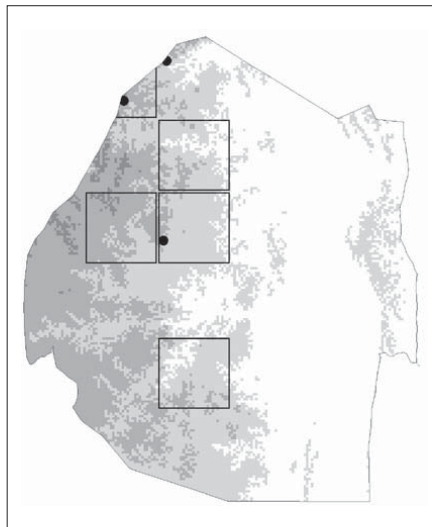


Figure 7 A–D, *Selaginella dregei*, A, habit, B, lateral view of strobilus, C, abaxial view of leaf, D, abaxial view of sporophyll; E–H, *S. imbricata*, E, habit, F, lateral leaf, G, dorsal leaf, H, adaxial view of sporophyll showing the sporangium; I–L, *S. kraussiana*, I, habit, J, dorsal leaf, K, abaxial view of sporophyll, L, lateral leaf; M–O, *S. mittenii*, M, fertile branch section, N, lateral leaf, O, abaxial view of sporophyll.

*kraussiana* = after F. Krauss (1820–1890), Director of the Natural History Museum in Stuttgart, who travelled in South Africa between 1837 and 1840.

Plants terrestrial or epilithic. *Stems* herbaceous, epigeal, wide-creeping, rooting at branching points, anisotomously branched, anisophyllous, forming loose mats, terete, to 1 mm in diameter, primary branches prostrate or ascending, to 1 mm in diameter, anisophyllous, heterophyllous. *Leaves* pale green, spaced to imbricate, herbaceous to thinly herbaceous, median leaves dorsally in 2 ranks, sessile, lanceolate to ovate-lanceolate, the base inequilateral, the outer lobe largest, serrulate, the midrib raised adaxially, glabrous, to 2.6 mm long, to 1 mm wide, lateral leaves more or less patent, sessile, oblong-elliptic, the base inequilateral, the acroscopic lobe largest, serrulate, the midrib raised adaxially, to 3.2 mm long, to 1.5 mm wide. *Strobili* sessile, solitary at the apex of secondary and lower order branches, to 17 mm long, isophyllous, sporophylls ephemeral, isophyllous, herbaceous, lanceolate to lanceolate-ovate, carinate, serrulate, to 1.6 mm long, to 0.6 mm wide. *Sporangia* subtended by a membranous, ovate ligule, spheroidal, megasporangia sessile, in axil of sporophylls, isovalvate, to 0.5 mm in diameter, subtended by a membranous oblong ligule, to 0.2 mm long, microsporangia short-stalked. *Megaspores* basal in strobilus, pale yellow, 4 per sporangium, globose, trilete, perispore cristate, reticulate, exospore (544–)572(–608)  $\mu\text{m}$  in diameter; *microspores* yellow, numerous, globose, trilete, echinate, the spine bases joined to form a reticulum of ridges, exospore (34–)36.25(–40)  $\mu\text{m}$  in diameter. Figure 7 I–L.



**Vernacular names:** Krauss' spike moss, Forest selaginella, Spreading spike moss; Woud aarmos (Afr.).

**Ecology:** Terrestrial or epilithic, growing in moist to wet conditions in forests where the plants generally form large tangled stands, usually in deep shade. Not edaphically bound. Hemicryptophyte; stems mesomorphic; leaves mesomorphic. Vegetative reproduction by the wide-creeping, many-branched stems. Seasonal pattern apparently non-existent, no drought-dormancy, not capable of withstanding prolonged dry periods; strobili collected in February and May.

**Distribution:** The species appears to be confined to moist ravines and forests in the western half of the country, occurring between 900 and 1 220 m. Elsewhere the species is widespread in sub-Saharan Africa and in Macaronesia.

**Uses:** The species is widely cultivated as a garden ornamental or as a potplant for interior decoration.

**Selaginella mittenii** Baker in J. Bot. 21: 81 (1883); Jacobsen, Ferns Sthn. Afr.: 145, fig. 88, map 12 (1983); Schelpe & Anthony, Fl. S. Afr., Pterid.: 20, fig. 5, t. 3, 3a, map 17 (1986); Burrows, Sthn. Afr. Ferns: 28, ill. 6, t. 20, 20a, pl. 3.7, map (1990); Roux, SABONET Rep. 13: 27, fig. 2E (2001). Type: Tanzania, Usagura mountains, 01/1883, *Mitten s.n.* (K!, holo.).

*Selaginella welwitschii* Baker in J. Bot. 21: 81, 82 (1883). Type: Angola, on dry rocks of the Pedras of Pungo Andongo, *Welwitsch* 43 (K!, holo.).

*Selaginella mackenii* Baker in J. Bot. 22: 89 (1884). Type: Natal, Tugela River, *Gerrard & McKen* 237 (K!, holo.).

*Selaginella cooperii* Baker in J. Bot. 22: 89 (1884). Type: Orange Free State, *Cooper* 1056 (K!, holo.).

*Selaginella tectissima* Baker in J. Bot. 22: 89 (1884). Type: Magaliesberg, *Sanderson s.n.* (K!, holo.).

*Selaginella depressa* sensu Sim, Ferns S. Afr., 2nd edn: 334, pl. 168c (1915), non Spring (1843).

Plants terrestrial or epilithic. *Stems* herbaceous, epigeal, wide-creeping, rooting at branching points, anisotomously branched, forming loose mats, terete, to 0.5 mm in diameter, primary branches prostrate, dorsiventrally flattened, anisophyllous, dorsally with 2 ranks of appressed leaves, heterophyllous. *Leaves* imbricate, green, herbaceous, median leaves sessile, lanceolate to ovate, the base inequilaterally cordate, the outer lobe largest, serrulate, fimbriate towards the base, epidermis granulate, to 1.5 mm long, to 0.8 mm wide, lateral leaves more or less patent, sessile, ovate to broadly ovate, the base inequilateral, the acroscopic lobe largest, amplexicaul, serrate, fimbriate towards the base, to 2 mm long, to 1.8 mm wide. *Strobili* sessile, solitary at the apex of secondary and lower order branches, to 6 mm long, isophyllous, sporophylls ephemeral, herbaceous, lanceolate, carinate, serrulate, to 1.5 mm long, to 0.8 mm wide. *Sporangia* globose, sessile, in axil of sporophylls, isovalvate, to 0.8 mm in diameter, subtended by a membranous oblong ligule. *Megaspores* basal in strobilus, yellow, 4 per sporangium, trilete, globose, scabrate, (312–)314(–320)  $\mu\text{m}$  in diameter; *microspores* yellow, numerous, globose, monolete or trilete, colliculate, monolete exospore (184–)211.2(–232)  $\mu\text{m}$  in diameter, trilete exospore (136–)154(–176)  $\mu\text{m}$  in diameter. Figure 7 M–O.



*mittenii* = after W. Mitten (1819–1906), a British bryologist

**Vernacular names:** Mitten's spike moss; Dwerg aarmos (Afr.).

**Ecology:** Terrestrial or epilithic, in permanent or seasonally moist conditions in exposed or sheltered habitats at waterfalls, soil banks along streams, boulder bases, and among grass tussocks in rocky areas. In light or deep shade. Not edaphically bound. Hemicryptophyte, mesophyte; leaves mesomorphic. Seasonal pattern apparently non-existent when growing in relatively stable habitats, but drought-dormant in more exposed conditions, strobili collected in February, April to June and November. Vegetative reproduction by the creeping, many-branched stems. Grows in areas subjected to regular burns and where plants are not adequately sheltered they are scorched or killed.

**Distribution:** With the exception of the lowveld, *Selaginella mittenii* is relatively common throughout Swaziland, occurring at altitudes ranging between 650 and 1 560 m. The species is confined to east and south tropical Africa, and southern Africa.