

A REVISION OF THE GENUS
***LEDEBOURIA* ROTH (HYACINTHACEAE)**
IN SOUTH AFRICA

by

STEPHANUS VENTER

Submitted in fulfillment of the
requirements for the degree of
Master of Science.

Department of Botany, Faculty of Science,
University of Natal,
Pietermaritzburg.

1993

Supervisor: Mr. T.J. Edwards



DECLARATION

The results of the research done for this thesis have not been submitted to any other University. Except where acknowledged in the text, all data is the result of my own research carried out in the Department of Botany, Natal University and Department of Botany, University of the North, Sovenga, under supervision of Mr. T.J. Edwards.



Stephanus Venter

Signed at: *Pietersburg*

Date: *10/08/1993*

ABSTRACT

Members of the genus *Ledebouria* Roth (Hyacinthaceae), which occur in South Africa, are revised. This genus occurs throughout Africa, India and Madagascar. 33 Species are recognized and placed into nine provisional infrageneric groups.

A multidisciplinary approach was used in an attempt to provide natural groupings. The following characters were analysed; morphology, micromorphology, palynology and caryology. Aspects of ovary structure and leaf micromorphology proved especially useful in the synthesis of infrageneric and specific concepts.

Keys, descriptions, illustrations, distributional, ecological, medicinal and toxicological data are provided. This study is based on plants in their natural habitat, cultivated specimens and representative herbarium specimens from herbaria in South Africa and in Europe.

UITTREKSEL

Verteenwoordigers van die genus *Ledebouria* Roth (Hyacinthaceae), wat in Suid-Afrika voorkom, is hersien. Hierdie genus kom voor oral op die Afrika kontinent, in Indië en Madagaskar. 33 Spesies word herken en in nege voorlopige infrageneriese groepe geplaas.

n' Multidisiplinêre benadering was gebruik om natuurlike groeperings te verkry. Die volgende kenmerke is geanaliseer; morfologie, mikromorfologie, palinologie en kariologie. Aspekte van die vrugbeginsel struktuur en blaar mikromorfologie was veral behulpzaam met die sintese van infrageneriese en spesifieke begrippe.

Identifikasie sleutels, beskrywings, illustrasies, verspreiding, ekologiese data en medisinale gebruike word verskaf. Hierdie studie is gebaseer op plante in hulle natuurlike habitat, gekweekte plante asook van herbarium materiaal in Herbaria in Suid-Afrika en Europa.

CONTENTS

Frontispiece - <i>Ledebouria</i>	I.
Declaration	II.
Abstract	III.
Contents	IV.
Unpublished name changes in the thesis	VII.
1.0 INTRODUCTION	1.
2.0 HISTORICAL SYNOPSIS	2.
2.1. The characters used by the various authors in their placement of <i>Ledebouria</i>	2.
2.2. Revisions of <i>Scilla</i> subgenus <i>Ledebouria</i>	4.
2.3. Dr. F.Z. van der Merwe's contribution	4.
3.0 MATERIALS AND METHODS	6.
4.0 GENERIC DELIMITATION	10.
5.0 MORPHOLOGY	14.
5.1. Habit	14.
5.2. Roots	14.
5.3. Bulb	15.
5.4. Leaves	16.
5.5. Intraspecific leaf variation	19.
5.6. Leaf anatomy	22.
5.7. Inflorescence	25.
5.8. Floral characters	32.
5.8.1. Perianth	32.
5.8.2. Stamens and pollen	32.
5.8.3. Ovary	35.
5.8.4. Capsule and seed	36.
5.8.5. Caryology	37.

6.0	INFRAGENERIC CLASSIFICATION	42.
6.1.	Phenotypic variation	42.
6.2.	Genotypic variation	42.
6.3.	Designation of ranks	43.
6.3.1.	Species ranks	43.
6.3.2.	Species arrangement and sectional ranks	43.
7.0	PHENOLOGY AND LEAF PERIOD	44.
7.1.	Flowering period	44.
7.2.	Pollination biology	46.
8.0	SEED DISPERSAL	48.
8.1.	Wind dispersal	48.
8.2.	Water dispersal	48.
9.0	ECOLOGY, HABITAT AND ADAPTIVE STRATEGIES	49.
10.0	PHENETICS	59.
11.0	PHYTOGEOGRAPHY	66.
11.1.	Distribution	66.
11.2.	Factors promoting speciation and distribution	70.
12.0	TAXONOMY	71.
12.1.	Generic description	71.
12.2.	Key to the sections	72.
12.3.	Key to the species	73.
12.4.	Species descriptions	79.
13.0	<i>NOMINA DUBIA AND NOMINA EXCLUSA</i>	340.
14.0	HYBRIDS	341.

15.0	CULTURAL USES	341.
15.1.	Food	341.
15.2.	Medicine	341.
15.3.	Poisoning	342.
15.4.	Vernacular names	344.
16.0	CAPTIONS TO ILLUSTRATIONS AND TABLES	345.
	ACKNOWLEDGMENTS	364.
	REFERENCES	365.

UNPUBLISHED NAME CHANGES IN THE THESIS**(a) New combinations**

Ledebouria asperifolia (Van der Merwe) S. Venter

Ledebouria ensifolia (Eckl.) S. Venter

Ledebouria galpinii (Bak.) S. Venter

Ledebouria lepida (N.E. Br.) S. Venter

Ledebouria minima (Bak.) S. Venter

Ledebouria petiolata (Van der Merwe) S. Venter

Ledebouria rupestris (Van der Merwe) S. Venter

Ledebouria sandersonii (Bak.) S. Venter

(b) New taxa

Ledebouria atro-brunnea S. Venter

Ledebouria coriacea S. Venter

Ledebouria crispa S. Venter

Ledebouria dolomiticola S. Venter

Ledebouria glauca S. Venter

Ledebouria monophylla S. Venter

Ledebouria papillata S. Venter

Ledebouria parvifolia S. Venter

1.0. INTRODUCTION

The genus *Ledebouria* Roth belongs to the family Hyacinthaceae (Dahlgren *et al.* 1985). The distribution of the genus includes the African Continent, India and Madagascar. The centre of diversity is in the Transvaal and Natal Provinces of the Republic of South Africa. Members of this genus occur in desert, grassland, woodland and even on forest floors (Entabeni Forest on the Soutpansberg, northern Transvaal).

The genus *Ledebouria* was described by Roth in 1821 with *Ledebouria hyacinthina* L., from India, as the type species. This species was transferred to the genus *Scilla* L. and provided the basionym for the largest section of *Scilla* namely the section *Ledebouria* (Baker 1870d). Jessop (1970) reinstated the genus *Ledebouria*.

Basically three revisions of *Ledebouria* have been done. The first was Baker's monograph of *Scilla*, section *Ledebouria* and the genus *Drimiopsis* published in January 1870. This was followed in September by a revision of the herbaceous capsular gamophyllous *Liliaceae* (Baker 1870b). Baker (1896) also published the revision of *Scilla* in *Flora Capensis*. 74 Years later, Jessop (1970) completed the last revision for the genus.

The large degree of phenotypic variation in *Ledebouria*, particularly with regard to habit and leaf maculation, has resulted in the publication of 102 species in four different genera. This led to numerous combinations and changes throughout the taxonomic history of the genus. As a result the species concepts are a source of considerable nomenclatural and taxonomic confusion.

In this revision 33 species are recognized and placed in nine sections. The aim of this study was to produce a logical classification of the genus *Ledebouria*.

2.0. HISTORICAL SYNOPSIS

2.1. The characters used by the various authors in their placement of *Ledebouria*.

Various authors described *Ledebouria* species placing them under several different genera. A summary of the taxonomic treatments by the various authors is depicted in Table 1.

Table 1. Summary of the taxonomic treatments of *Ledebouria* by the various authors.

AUTHOR	DATE	FAMILIAL PLACEMENT	GENERIC PLACEMENT	CHARACTERS USED
Linnaeus <i>f.</i>	1782	Liliaceae	<i>Hyacinthus</i>	Corolla shape; leaf attitude and shape.
Jacquin <i>f.</i>	1794	Liliaceae	<i>Lachenalia</i>	Leaf shape; maculation and attitude; scape, raceme and petal attitude.
Andrews	1803	Liliaceae	<i>Lachenalia</i>	Leaf shape and number; petal shape and colour; ovary shape.
Ker-Gawler	1811	Liliaceae	<i>Drimia</i>	Leaf shape and maculation; raceme attitude and flower characters.
Trattinick	1814	Liliaceae	<i>Lachenalia</i>	Leaf maculation and colour; inflorescence attitude; petal and ovary shape.
Von Schrank	1820	Liliaceae	<i>Scilla</i>	Leaf, scape, raceme, perianth, stamens, ovary and fruit characters.
Roth	1821	Liliaceae	<i>Ledebouria</i>	Bulb, leaves, scape, raceme, flower, ovary, capsule and seed characters.
Schrader	1827	Liliaceae	<i>Drimia</i>	Bulb, leaf, scape, raceme and flower characters.
Hooker <i>f.</i>	1866	Liliaceae	<i>Scilla</i>	Bulb, leaf, scape, raceme, flower and ovary characters.
Baker	1868	Liliaceae	<i>Drimia</i>	Bulb, leaf, scape, raceme, flower and ovary characters.
Baker	1870	Liliaceae	<i>Scilla</i> sub-genus <i>Ledebouria</i>	Perianth segment shape and filament bases.
Jessop	1970	Liliaceae	<i>Ledebouria</i>	Bulb, leaf, inflorescence, perianth and ovary characters.
Dahlgren <i>et al.</i>	1982	Hyacinthaceae	<i>Ledebouria</i>	Roots, bulb, leaf, inflorescence, flower and fruit characters.

Roth (1821) described the genus *Ledebouria* based on the following: corolla six-lobed, stamens fused to base of tepals, ovary stipitate, style thin and simple, locules three with base connected. The stipitate ovary is the diagnostic character of the genus *Ledebouria* (Roth l.c.).

Schrader (1827) ignored Roth's circumscription of *Ledebouria*, and followed Ker-Gawler (1803) in his broad concept of *Drimia* using mostly inflorescence and floral characters. Hooker (1866) conformed to Linnaeus' and von Schrank's (1820) circumscription of *Scilla* (Hooker 1866).

Baker (1868) described two new species which he hesitantly placed under *Drimia*. His innovative classification was the first to distinguish between *Scilla*, *Lachenalia* and *Drimia* as sub-genera. Baker transferred *Ledebouria hyacinthina*, described by Roth, to the genus *Scilla* (Baker 1870c).

The most recent revision of *Ledebouria* forms part of a study by Jessop (1970) in the bulbous Liliaceae. He concentrated on the generic concepts of *Scilla*, *Ledebouria* and *Drimiopsis* and reinstated the genus *Ledebouria*, based on its stipitate ovary.

In 1982 Dahlgren *et al.* subdivided the Liliaceae *sensu lato* into various families placing *Ledebouria* within the Hyacinthaceae.

Linnaeus described the genus *Hyacinthus* which differs from *Ledebouria* in the shoots surrounded by basal, tubular, membranous squamae; leaves linear; stamens short, epitepalous; perianth tube short; ovary sessile. From the above characters it is clear that Linnaeus *f.* placed *Hyacinthus revolutus* under the wrong genus. The genus *Lachenalia* as it is accepted today, was published by Jacquin (1794). It differs from *Ledebouria* in the upper flowers of the raceme being mostly vestigial, the outer perianth lobes being shorter than the inner lobes and the ovary being sessile. Jacquin (l.c.), Andrews (l.c.) and Trattinick (l.c.) failed to observe these differences between *Ledebouria* and *Lachenalia*.

The genus *Drimia*, described in 1799, was considered congeneric with *Ledebouria* by Ker-Gawler (l.c.), Schrader (l.c.) and Baker (1870a). *Drimia* differs from *Ledebouria* in its: loose imbricate bulb scales; spurred lower bracts; tubular, caducous perianth, exserted stamens, cohering apically and flattened seeds.

Von Schrank (*l.c.*), Hooker *f.* (*l.c.*) and Baker did not emphasize the stipitate ovary of *Ledebouria* and instead maintained a broad concept of *Scilla*. *Scilla* also differs from *Ledebouria* in the bulb scales being hard and tightly set, immaculate leaves; central inflorescence; basally spreading perianth lobes; sessile ovary and many ovules per locule.

2.2. Revisions of *Scilla* sub-genus *Ledebouria*.

Baker (1870c) described two tribes, the Hyacintheae embracing the genus *Drimia* and the Scilleae with the genus *Scilla*. Baker also described three new species of the sub-genus *Ledebouria* and provided a key for all 28 existing *Scilla* species.

In 1896 Baker completed his second revision of *Scilla*. Here he described only members of the sub-genera *Euscilla* and *Ledebouria* covering 48 species of *Ledebouria* with 16 new species. Many of the species he recognized were known from single specimens or sometimes only from illustrations. Baker never visited South Africa and the living plants he used for the descriptions were all grown in hothouses in Great Britain.

This revision was the most complete work on the genus *Scilla*. Jessop's revision would follow 73 years later and would encompass a multidisciplinary approach including: morphology, cytology, anatomy, cytochemistry and ontogeny.

Jessop (1970) stresses that only a few species of *Ledebouria* are defined on really satisfactory qualitative characters. These species are *L. hypoxidioides*, *L. viscosa*, *L. ovatifolia* and perhaps *L. luteola*.

2.3. Dr. F. Z. van der Merwe's contribution.

Between 1935 - 1960 Van der Merwe gathered information on the genus *Scilla* with the idea of revising it. This information, contained in three files, is housed at the National Herbarium, Pretoria.

Van der Merwe concentrated on the generic concepts of the Scilleae and recognized three genera within *Scilla*. Most of the species were retained in *Scilla* (Van der Merwe 1943a) and he described the genus *Resnova* (Van der Merwe 1946) for a small group of plants with sessile ovaries and ascending perianth segments, which are never blue or blue-purple. He erected the genus *Schizocarphus* (Van der Merwe 1943b) for the plants, very closely related to *Scilla*, in which the tops of the bulbs are fibrous. The genus *Resnova* is regarded as a synonym of *Drimiopsis* by Jessop (Jessop 1972a).

On his trips throughout Natal and Transvaal, Van der Merwe made thorough collections of *Ledebouria* and *Scilla*. All these plants were grown for him by the garden staff of the Division of Botany and Plant Pathology, Department of Agriculture, Pretoria. Many of these plants were illustrated in "Flowering Plants of Africa" with descriptions provided by Van der Merwe.

3.0 MATERIALS AND METHODS

Chromosome counts.

Young flower buds were collected between 11h00 and 14h00 and placed into Carnoy's solution (6 parts ethanol - 3 parts chloroform - 1 part glacial acetic acid). Anthers were separated from the flower buds, placed on a clean microscope slide and macerated with an aluminium rod. A drop of aceto carmine was placed over the anther material with 0.5 ml ferri-acetate and mixed together. This was heated over an alcohol lamp, a cover slide placed on the material and heated again. Pressure was applied to the cover slide after placing it between blotting paper. The microscope slides were made permanent by freezing them with carbondioxide. The coverglass was lifted off and the slide immersed into 100% ethanol for 5 minutes. A small drop of euparal was placed on the material and a cover glass placed on top. These slides were kept on a hotplate at 40°C for 24 days. The finished product was studied under a Reichert Microscope.

Computer programmes.

The programme NTSYS-pc was used to analyse data sets. The resultant output file from the one programme is used as the input file for the next programme. The initial data matrix file DATA was prepared with the WS2000+ programme and incorporated into the NTSYS-pc programme. The following procedures were followed for cluster analysis.

- a) OUTPUT - A:DATA
- b) STAND - input A:DATA
output SDATAC
- c) SIMINT - input SDATAC
output SIMINTC

-
- d) SAHN - input SIMINTC
 output SAHNC
- e) COPH - input SAHNC
 output COPHC
- f) MXCOMP - input X = SIMINTC
 Y = COPHC
 output MXCOMPC
- g) TREEG - input SAHNC
 output = Phenogram

The DELTA program was used to give concise representation and manipulation of taxonomic descriptions. Three basic DELTA format files, SPECS = specifications file, CHARS = character file and the ITEMS = items file were generated. The CHARS list was done with the WS2000+ programme and incorporated into the DELTA programme. The ITEMS file contains the descriptions of the 33 *Ledebouria* species followed by the SPECS file with specifications on the character types, number of states, implicit values and dependant characters.

DELTA was used to generate identification keys, descriptions in natural language and summary of the data. INTKEY was used to retrieve information on descriptions of species, separation characters to separate a particular species from the other species, to determine the differences between two species and to display the similarities between two species.

Cultivation.

Plants of the various species of *Ledebouria* were cultivated in an aridarium at the University of the North.

Drawings of the plants.

Drawings of the various species were made from live specimens collected in the veld, SEM micrographs and using a camera lucida.

Electron microscopy.

Plant material of *Ledebouria* was fixed in F.A.A. (formalin - acetic acid - alcohol) at a ratio of 1:18:1 or in 2.5 % glutaraldehyde. After fixation, the samples were washed for three successive periods of 10 minutes each in 0.2 M Phosphate buffer (pH 7.2) (Glauert 1980). The samples were then dehydrated for 10 minutes in 50 % acetone, 10 minutes in 70 % acetone and 30 minutes in 100 % acetone. The samples were then ultrasonically cleaned, and placed in 100 % acetone for 60 minutes. The samples were critical point dried, placed on stubs with double - sided tape and Gold - Palladium coated for 2 minutes. Material was viewed with Hitachi 450 and Hitachi S - 570 scanning electron microscopes at an accelerating voltage of 10 KV. Voucher specimens are housed in the Herbarium of the University of the North (UNIN) and the National Herbarium (PRE), Pretoria. Measurements of epidermal cells and stomata were taken from scanning electron micrographs.

Pollination studies.

Populations of various species were visited at various times of the day to determine the visiting hours of the insects. Insects were collected with a swipe net, suction tube or directly into plastic vials. The insects were transferred into a Cyanide Killing Bottle for 20 minutes and then placed in small glass vials.

Rock sampling.

Rock samples (hand specimens) were collected at all the populations visited by the author and identified with the help of geologists from the office of the Geological Survey, Pietersburg and the Department of Geology, University of the North, Sovenga.

Seed distribution.

A population of *L. revoluta* was chosen with individuals spread over a flat area (0° - 5°) to individuals growing on a slope (15° - 30°). The soil texture varies from fine sandy soil to coarse gritty soil. Seeds in the capsules of a specific individual plant were marked with a red vegetable dye. The distances that the dyed seed travelled were measured after 10 different rainstorms.

Soil sampling.

A sieve analysis was undertaken on soil samples collected at *Ledebouria* localities. Soil samples were screened through a 2 mm mesh and immersed in 100% hydrogen peroxide to oxidize the organic component. The sample was dried and sieved through two further screens 0.02 and 0.002 mm gauge. Soil depth was measured with a measuring tool designed and built by the author for this purpose. It consists of a 7 mm diameter drill bit welded onto a 1300 mm long shaft of hardened rod iron, 7 mm in diameter. At the top end of the shaft a 300 mm long piece of rod iron was welded to form a cross bar for pressing or turning the tool into the ground. The long main shaft was marked off in centimeters. Soil depth was measured at various individual plants in a population by inserting this tool into the ground next to the plants. At least 30 measurements were taken per population depending on the population size. An average soil depth was calculated from these readings.

4.0 GENERIC DELIMITATION

The recent restructuring of the Liliaceae sensu lato by Dahlgren and Clifford (1982), is widely accepted. The classification of *Ledebouria* accepted by the author, is as follows:

Superorder	LILIIFLORAE
Order	Asparagales
Family	Hyacinthaceae
Genus	<i>Ledebouria</i>

The following genera constitute the Hyacinthaceae in South Africa (Gibbs Russell 1985):

Albuca L. (57 spp.), *Amphisiphon* Schltr. (1 sp.), *Androsiphon* Schltr. (1 sp.), *Bowiea* Harv. ex Hook.f. (2 spp.), *Daubenya* Lindl. (1 sp.), *Dipcadi* Medic. (14 spp.), *Drimia* Jacq. ex Willd. (14 spp.), *Drimiopsis* Lindl. (5 spp.), *Eucomis* L' Herit. (13 spp.), *Galtonia* Decne. (2 spp.), *Lachenalia* Jacq.f. ex Murray (96 spp.), *Ledebouria* Roth (33 spp.), *Litanthus* Harv. (1 sp.), *Massonia* Thunb. ex Houtt. (5 spp.), *Neobakeria* Schltr. (4 spp.), *Neopatersonia* Schönk. (3 spp.), *Ornithogalum* L. (62 spp.), *Polyxena* Kunth (3 spp.), *Pseudogaltonia* O. Kuntze (1 sp.), *Rhadamanthus* Salisb. (11 spp.), *Scilla* L. (5 spp.), *Schizobasis* Bak. (1 sp.), *Tenicroa* Raf. (5 spp.), *Thuranthus* C.H. Wright (3 spp.), *Urginea* Steinh. (26 spp.), *Veltheimia* Gledisch (2 spp.) and *Whiteheadia* Harv. (1 sp.).

The generic position of *Ledebouria* has been in question since its inception. Two species of *Ledebouria* were described as *Drimiopsis*, first *D. engleri* [= *L. rautanenii* (Schinz) S. Venter *ined.*] by Krause (1914), and then *D. papillosa* (= *L. scabrida* Jessop) by Dinter (1921). Jessop (1970) reinstated Roth's genus *Ledebouria* basing it mainly on the unique stipitate ovary.

Ledebouria is a well defined genus which is easily distinguished from the other genera in the Hyacinthaceae both in vegetative and floral characters. The most significant difference is the shape of the ovary. *Drimiopsis* and *Scilla* resemble

Ledebouria closely. The vegetative differences between these three genera are shown in Table 2.

Table 2. Differences between the genera *Ledebouria*, *Drimiopsis* and *Scilla*.

GENUS	BULBSCALES	LEAVES
<i>Ledebouria</i>	Membranous to fleshy	With or without spots
<i>Drimiopsis</i>	Fleshy and loose	With or without spots
<i>Scilla</i>	Hard, dry and tightly packed	Without spots

The leaves of *Ledebouria* and *Drimiopsis* are very similar in shape, texture, marking and colouration (Figure 2). The leaves of *Scilla* are firmer, resulting from the lignified sheath around the vascular bundles (Jessop 1972a), without any spots and often covered with hairs. Some glabrous forms of *S. natalensis* occur in the Olivier's Hoek Pass area (pers. obs.).

In *Ledebouria* and *Drimiopsis* the inflorescence is axillary and fleshy but in *Scilla* it is terminal and rigid. The inflorescences in *Ledebouria* and *Drimiopsis* are mostly flaccid, whereas they are always erect in *Scilla*.

Although some species of *Ledebouria* have cucullate perianth lobes, these are never as pronounced as in *Drimiopsis*. In *Scilla* the apices of the perianth lobes are always acute to acuminate. The filaments are basally fused in *Scilla* but are separate in *Drimiopsis* and *Ledebouria*.

Figure 1 - 6. 1. The bulbs of A, *Ledebouria revoluta* (L.f.) Jessop (Venter 13,209); B, *Drimiopsis* sp. nov. [Venter 13,459 (UNIN)] and C, *Scilla dracomontana* Hilliard [Edwards s.n. (UNIN)] to show the differences in the bulb scales. Bar = 50 mm.

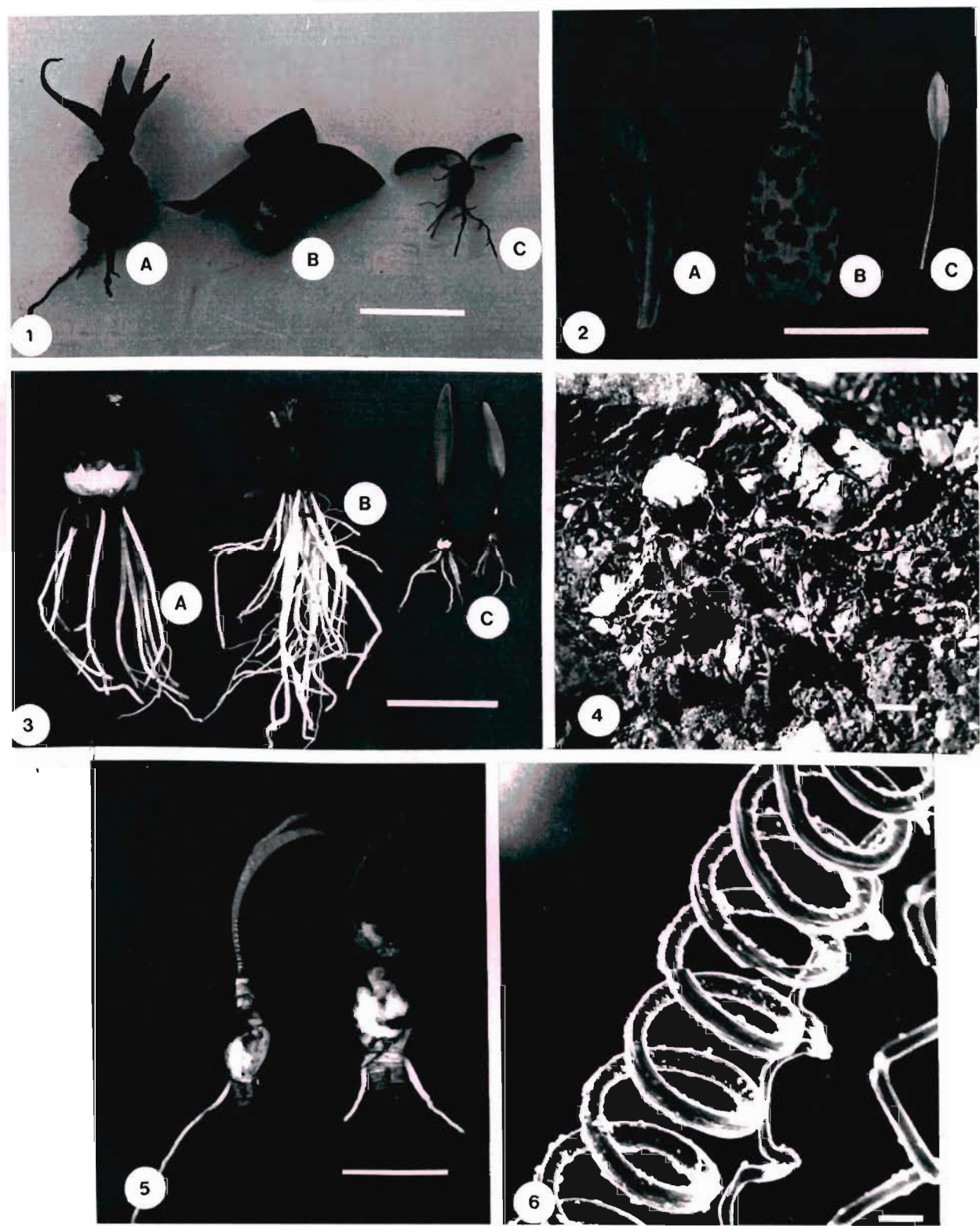
Figure 2. Leaves of the genera A, *Scilla natalensis* Planch. [Venter s.n. (UNIN)]; B, *Ledebouria revoluta* (Venter 13,209) and *Drimiopsis burkei* Bak. [Venter s.n. (UNIN)] to show the differences in the leaves. Bar = 100 mm.

Figure 3. Three different types of root in the genus *Ledebouria*. A, contractile roots of *L. revoluta* (Venter 13,207); B, fusiform roots of *L. apertiflora* (Bak.) Jessop (Venter 12,686) and C, fleshy roots of *L. cooperi* (Hook.f.) Jessop (Glen 2295). Bar = 50 mm.

Figure 4. Plants of *L. crispa* S. Venter showing the gregarious habit (Venter 11,202). Bar = 10 mm.

Figure 5. Basal stems of *L. glauca* S. Venter (Venter 13,368). Bar = 50 mm.

Figure 6. SEM micrograph of the spiral threads in the leaves of *L. crispa* (Venter 13,209a). Bar = 5 μ m.



5.0. MORPHOLOGY

5.1. Habit.

Ledebouria species are geophytic with annual leaves. Plants vary in size from 3 mm tall, with the leaves appressed to the ground (*L. galpinii*), to 1 meter tall (*L. zebrina*) with erect, apically flaccid leaves. A few species are soboliferous which results in the formation of colonies consisting of few clones connected by subterranean stolons up to 200 mm long. The largest colony recorded for a soboliferous individual was 5 meters in diameter in *L. cooperi* (Venter 13,342).

Species growing on cliffs and steep moist slopes, have pendulous leaves. In the cliffs at Serala Peak in the north-eastern Transvaal, *L. floribunda* grows with leaves hanging down the cliff face. Plants from this colony cultivated in an aridarium at the University of the North retained this habit.

5.2. Roots.

Roots vary from white (fleshy roots), pink (fusiform roots) to brown and dark brown (contractile and 'wire' roots).

Contractile roots are hard, at maturity, with transverse wrinkles caused by contraction of the root which is accommodated by corrugation of the cortex. These roots compensate for the pseudomonopodial growth of the bulb by drawing it firmly downwards, and are formed annually (Figure 3A).

Branching fleshy roots are common in *Ledebouria* and are up to 10 mm in diameter. They occur in species growing in moist habitats or in deep sandy soils i.e. Kalahari sand. *L. glauca* is common in Kalahari sand near Van Zylsrust and produces basal stems and fleshy roots (Figure 3C).

Fusiform roots are usually soft and are restricted to *L. apertiflora* and *L. ensifolia*. These species have poorly developed bulbs. The roots assume the storage function of the bulbs. Roots are spread around the plant near the surface to enhance the uptake of moisture. This is possibly an adaptation to the habitat

of these taxa as both occur in sandy soils in dry woodland and shrubland (Figure 3B).

'Wire' roots occur in taxa with large bulbs, growing in compact or stoney soil. These roots are dark brown and difficult to break (*L. marginata*). They may be up to 450 mm long and are rarely branched.

5.3. Bulb.

According to Jessop (1970) the development of the bulbs in *Ledebouria* is monopodial. Müller-Doblies (1971) showed the development of the bulb in *Galanthus* to be sympodial. Ontogenetically the inflorescence has a terminal position with the structure of the bulb a sympodium. This study shows that there is no evidence that monopodial bulbs exist.

The bulb is sometimes reduced to a thickening or swelling in the leaves. This is common in soboliferous species of marshy habitats (*L. cooperi*). In *L. ensifolia* the bulb is small and clothed in many layers of dry, hard, dark brown to purplish brown bulb scales.

Plants of *Ledebouria* are usually solitary, however *L. revoluta* and *L. asperifolia* may produce up to seven daughter bulbs. *L. crispa* is strongly gregarious with up to 30 plants in a single clump (Figure 4). *L. socialis* is also gregarial with bulbs forming on the basal stem.

Bulb elevation is variable. Usually bulbs are hypogeal, a few species have semi - epigeal bulbs where 25 - 50% of the bulb is exposed (*L. crispa* and *L. concolor*). Only two species (*L. dolomiticola* and *L. socialis*) have epigeal bulbs with 80 - 100% exposed. These species occur on rock sheets or in deeper soil but always retain an epigeal habit.

Basal stems occur in a few taxa. In *L. dolomiticola* and *L. papillata* they are up to 10 mm long. In *L. viscosa* basal stems are up to 130 mm long and 20 mm in diameter and in exceptional cases branching occurs (Figure 5).

Bulb width at flowering time for adult plants varies from 5 mm (*L. galpinii*) to 220 mm (*L. revoluta*) with the bulb from 10 mm to 230 mm long. Bulb shape is variable intraspecifically and is therefore of limited taxonomic use.

The colour of the interior of the bulb is usually white but can be purple (*L. ovatifolia*), or with the upper part of the bulb purplish and the upper part of the bulb scales markedly spotted. These markings are diagnostic in *L. inquinata*, even when the bulb scales are dry. The dead bulb scales may be membranous or hard and rigid as in *L. atro-brunnea*. Colour of the bulb scales varies from a light honey-brown to blackish-brown, various shades of purple also occur. The bulb scales are normally tightly clustered but can, in some species, be loosely arranged (*L. ovatifolia* and *L. galpinii*).

Torn bulb scales produce spiral threads, derived from the xylem, in some species (Figure 6). These threads are usually sparse, but in *L. luteola* and *L. ovatifolia* they are prolific and may be used as a diagnostic character (See chapter 5.6.).

The occurrence of a subterranean or epigeal neck on bulbs is not common. When it occurs it is smooth or, more usually, covered by dry leafbases and varies from 10 - 70 mm in length and from 5 - 20 mm in diameter.

Some species are soboliferous and form bulblets at the base of the bulb scales but more commonly bulblets are formed at the base of the bulb or on the basal stem. Some species form bulblets on the upper surface of broken basal stems resulting in small colonies above ground.

5.4. Leaves.

The leaves of *Ledebouria* are rosulate and there is only one hysteranthous species (*L. undulata*).

In most of the species the leaves are fully emerged at flowering time. Species in the subsection *Stellatae* have partly emerged leaves at flowering time.

Leaves are predominantly spreading or in some instances erect (*L. atro-brunnea*) or appressed to the ground (*L. galpinii* and *L. monophylla*). In *L. ovatifolia* the leaves are usually appressed to the ground except in certain populations on the South Coast between Durban and Scottburgh. The leaves of these plants tend to spread. *L. marginata*, *L. leptophylla* and *L. atro-brunnea* have spirally twisted leaves. Drier and rockier habitats, have more twisted leaves.

L. monophylla is the only *Ledebouria* species with a single leaf. Very rarely, under optimum conditions, the plants may produce another leaf which always remains poorly developed. The highest number of leaves counted on a single plant of *Ledebouria* is 25 (an old specimen of *L. marginata*).

In *Ledebouria* cataphylls are rare. Up to three cataphylls occur and these are usually exerted above ground level. These cataphylls contain chlorophyll only in the above ground parts.

Leafshape varies from linear to ovate (Table 3) and with various combinations between these limits (Figure 7). In some species the leafbase is petiolate (Table 3). The leafbase is usually canaliculate but can be rolled, terete or flat. Leaf apices may be obtuse, emarginate, acute or acuminate.

Leaves are mostly fleshy and soft but can be leathery, or leathery with prominently raised veins. The texture of the lamina margin is smooth, finely serrate, ciliate or papillate. In addition the margin may be smooth, thickened or undulate. In *L. inquinata* the proximal part of the lamina margin becomes undulate only in adult plants. Margins are mostly concolorous but may be discolorous green, -red, -white or -purple.

Upper and lower lamina surfaces are usually smooth but may be pitted (*L. galpinii*), viscid (*L. viscosa*), hairy (*L. hypoxidioides*) or with rows of asperities (*L. asperifolia*). The occurrence of hairs and cilia on the leaf surface of *Ledebouria* is rare but consistent. In *L. lepida* and *L. parvifolia* hairs are unicellular but in *L. hypoxidioides* they occur in stellate groups.

Table 3. Leaf characters for the genus *Ledebouria* in South Africa.

SPECIES	SHAPE	BASE	TEXTURE	APEX
<i>L. apertiflora</i>	lanceolate	canaliculate	fleshy	acute
<i>L. asperifolia</i>	lanceolate	canaliculate	fleshy	acute
<i>L. atro-brunnea</i>	lanceolate	canaliculate	fleshy	acute
<i>L. concolor</i>	oblong-lanceolate	flat	fleshy	obtuse
<i>L. cooperi</i>	lanceolate	canaliculate	fleshy	acute
<i>L. coriacea</i>	lanceolate	canaliculate	leathery	acute
<i>L. crispa</i>	linear-lanceolate	canaliculate	fleshy	acute
<i>L. dolomiticola</i>	lanceolate	canaliculate	fleshy	acute
<i>L. ensifolia</i>	ensiform	canaliculate	fleshy	acute/obtuse
<i>L. floribunda</i>	lanceolate	canaliculate	fleshy	acute
<i>L. galpinii</i>	ovate/spathulate	canaliculate	fleshy	acuminate
<i>L. glauca</i>	lanceolate	canaliculate	leathery	acute
<i>L. hypoxidioides</i>	ovate-lanceolate	canaliculate	fleshy	acute
<i>L. inquinata</i>	lanceolate	canaliculate	fleshy	acute
<i>L. lepida</i>	lanceolate	canaliculate	fleshy	acute
<i>L. leptophylla</i>	linear	canaliculate	leathery	acute
<i>L. luteola</i>	linear-lanceolate	canaliculate	fleshy	acute
<i>L. macowanii</i>	linear-lanceolate	canaliculate	fleshy	acute/obtuse
<i>L. marginata</i>	lanceolate	flat	leathery	acuminate
<i>L. minima</i>	linear	canaliculate	fleshy	acute
<i>L. monophylla</i>	ovate	canaliculate	succulent	obtuse/acute
<i>L. ovalifolia</i>	oblanceolate	canaliculate	fleshy	obtuse
<i>L. ovatifolia</i>	ovate/deltate	canaliculate	fleshy	acute
<i>L. papillata</i>	linear/lanceolate	petiolate	fleshy	acute/acuminate
<i>L. parvifolia</i>	lanceolate/oblong	canaliculate	fleshy	acute
<i>L. petiolata</i>	lanceolate	petiolate	fleshy	acuminate
<i>L. revoluta</i>	lanceolate	canaliculate	fleshy	acute
<i>L. rupestris</i>	lanceolate	petiolate	fleshy	acute
<i>L. sandersonii</i>	lanceolate/ovate	canaliculate	fleshy	acute
<i>L. socialis</i>	oblanceolate	canaliculate	fleshy	acute
<i>L. undulata</i>	linear-lanceolate	canaliculate	fleshy	acute
<i>L. viscosa</i>	spathulate	flat	fleshy	obtuse
<i>L. zebrina</i>	oblong/lanceolate	flat	fleshy	acute

During mist spells, the pitted areas on the leaves of *L. galpinii* fill with water. The thick resinous layer on the leaves of *L. viscosa* appears to be unpalatable for animals as no plants were found showing signs of herbivory. The hairy leaves of *L. hypoxidioides* closely resemble the strong fibrous leaves of *Hypoxis villosa* L.f. (Hypoxidaceae). It is easily mistaken for the unpalatable *Hypoxis* plant.

The colour of the upper and lower lamina surfaces are variably green, glaucous or pruinose. When maculated, the surface markings occur as longitudinal stripes, or combinations of stripes and spots, spots and blotches or tessellation at the lamina base. These markings are usually dark green or various shades of purple. The markings on the leaves of *Ledebouria* species are highly variable except in *L. glauca*, *L. lepida* and *L. papillata* where the purple cross bands on the petioles are always present. This cross banding also occurs in other families and genera, in some *Urginea* spp., *Sypharissa* spp. (Obermeyer 1980), *Rhadamanthus fasciatus* B. Nord. (Nordenstam 1970), *Albuca* and four *Ornithogalum* spp. (Müller-Doblies 1981) and *Habenaria ciliata* Lindl. (Bolos 1913).

The leaf shape and colour of *L. leptophylla* are cryptic. In early spring when the grass is not green, the dull linear leaves and greyish-pink flowers of *L. leptophylla* are difficult to distinguish.

Prominent costae occur in *L. marginata*. This tends to be a feature of plants growing in drier habitats.

5.5. Intraspecific leaf variation within the species.

Within all of the species there is a wide range of variation in qualitative as well as quantitative features.

L. monophylla and *L. papillata* are the only species where the vegetative and flowering periods are synchronous, four months in *L. monophylla* and three months in *L. papillata* (Table 4). Plants with a long vegetative period (longer than six months) are primarily grassveld species. Variation occurs in some species where the leaves die whilst the plant is in fruit (*L. ovalifolia*).

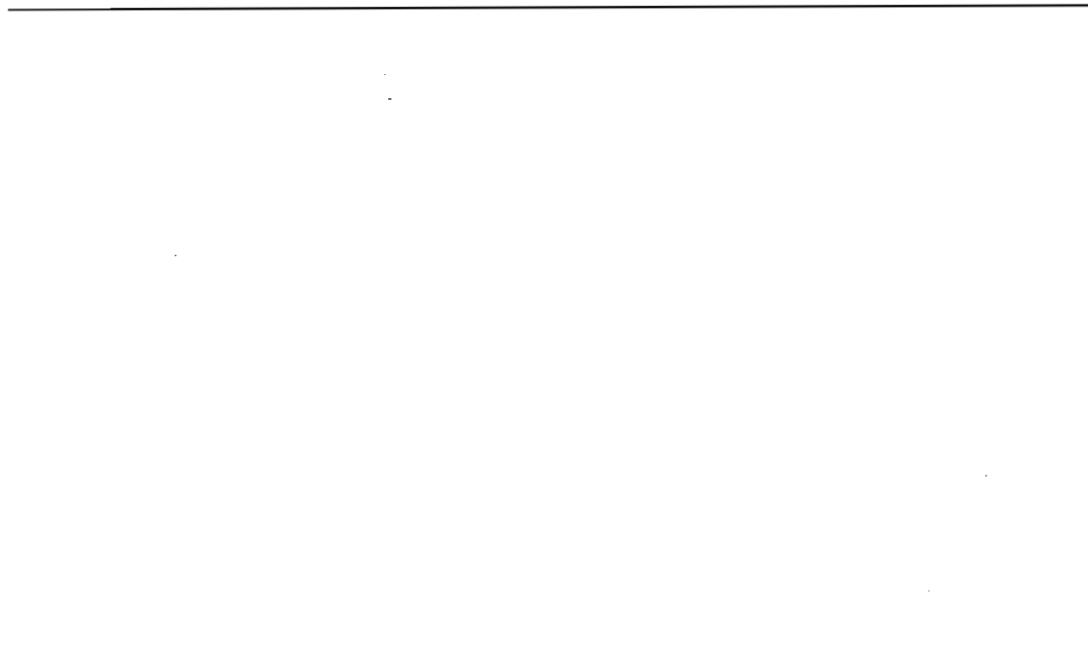
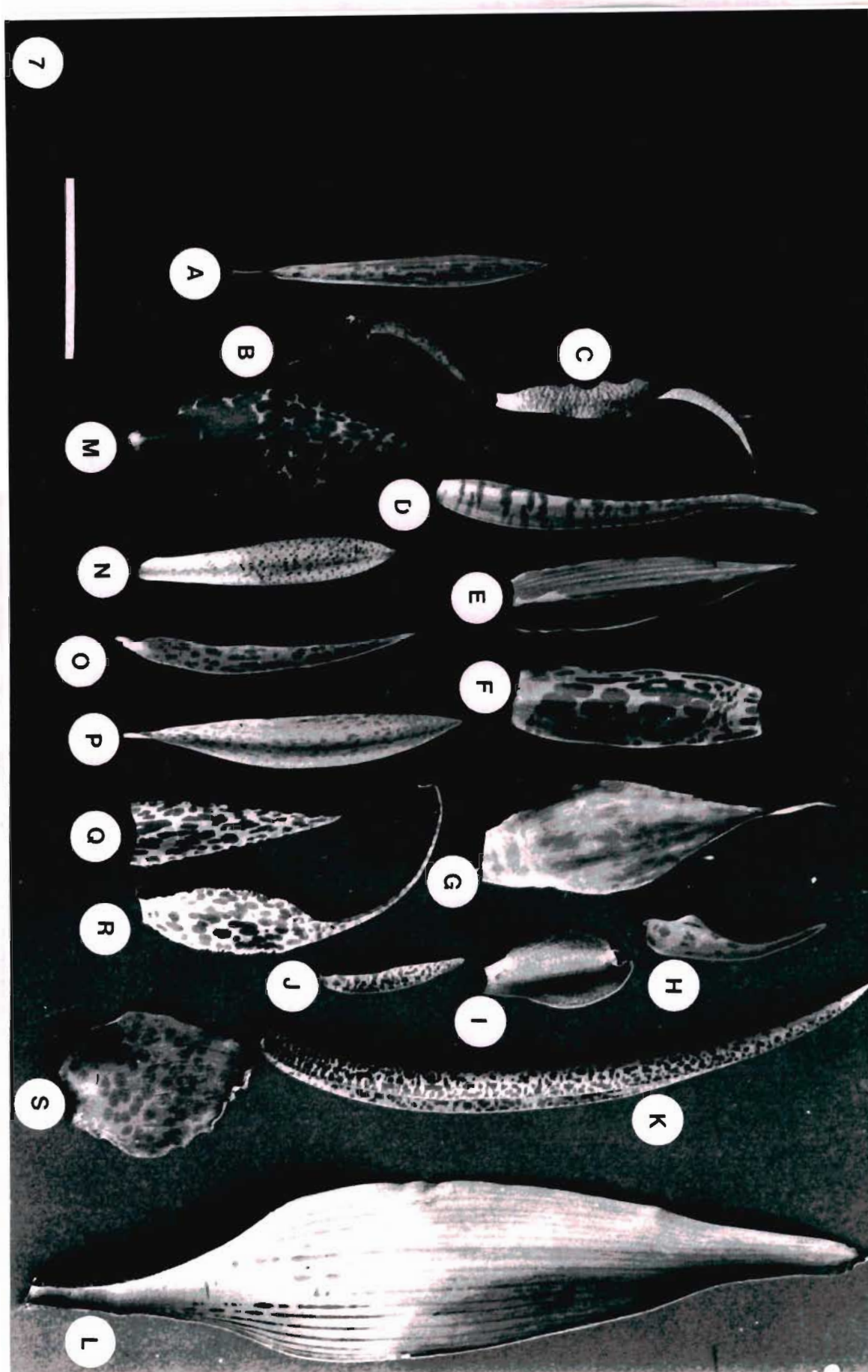


Figure 7. Different leafshapes in *Ledebouria*. A, *L. cooperi* (Venter 13,342); B, *L. revoluta* (Venter 13,207); C, *L. revoluta* (Venter 13,203); D, *L. luteola* (Venter 13,217); E, *L. revoluta* (Venter 13,362); F, *L. revoluta* (Venter 13,363); G, *L. marginata* (Venter 13,358); H, *L. asperifolia* (Venter 13,382); I, *L. revoluta* (Scott-Shaw s.n.); J, *L. cooperi* (Venter 13,334); K, *L. floribunda* (Venter 13,315); L, *L. zebrina* (Cunningham s.n.); M, *L. revoluta* (Venter 13,322); N, *L. cooperi* (Venter 13,388); O, *L. asperifolia* (Venter 13,382); P, *L. cooperi* (Venter 13,383); Q, *L. revoluta* (Venter 13,257); R, *L. inquinata* (Venter 13,335) and S, *L. ovatifolia* (Venter 13,337). Bar = 100 mm.



There are only a few species of *Ledebouria* where the shape of the lamina is stable (*L. atro-brunnea*, *L. crispa*, *L. galpinii*, *L. monophylla*, *L. petiolata* and *L. viscosa*). The remaining species exhibit a wide range in leaf shape and size, *L. cooperi* and *L. revoluta* are exceptional in this regard.

Lamina colour and markings vary intraspecifically even within populations. To show the extent of variation in mottling on the lamina, *L. cooperi* is discussed. The lamina is green on both sides or with spots and blotches of purple on the abaxial surface. In some populations the markings on both surfaces comprise of deep purple, longitudinal stripes and form a stark contrast to the light green background. This form has been in cultivation in America for the last 15 years, (E. van Jaarsveld, pers. comm.). Similar longitudinal purple stripes occur in Natal populations of *L. zebrina* (Bak.) S. Venter.

5.6. Leaf anatomy.

Jessop (1970) provides descriptions of transverse sections of leaves in *Ledebouria*. He mentions that the vascular bundles are arranged in a single row with the xylem uppermost and without lignification of the bundle sheath. Lignification is restricted to the tracheary elements. No prominent palisade layer has been observed, but in *L. floribunda* the two adaxial rows of mesophyll cells are almost twice as tall as they are broad.

The presence of crystals especially raphides in the cells is common.

In most species the leaves, when torn, produce spiral threads (Figure 6). These originate from the xylem thickening. They do not stain with thiobarbituric acid nor with phloroglucine + HCl, therefore they are not lignified (Badenhuizen 1954). The average diameter of these spirals is 2.7 μm . According to Badenhuizen (1954) there are two types of spiral threads, the R-type (removable type) and the NR-type (non-removable type).

R-type spirals occur in the metaxylem and leave distinct impressions on the wall when removed. The substance in which the impressions are made is pectin (Badenhuizen 1954). The NR-spirals are protoxylem and can be stained by saffranin, phloroglucine + HCl and thiobarbituric acid, thus showing them to be lignified.

Table 5. Microsculpturing of the leaf surfaces.

Species	Character of adaxial epidermal cells	Stomata	Character of abaxial epidermal cells.
<i>L. apertiflora</i>	Smooth; long and narrow; apices truncate.	In deep crypts.	Smooth; nearly as broad as long; apices truncate.
<i>L. asperifolia</i>	With wax platelets; cells four-sided; apices truncate.	In shallow crypts.	With wax platelets; cells four-sided; apices truncate.
<i>L. atro-brunnea</i>	Thick covering of wax platelets; cells long and narrow; keel roundish; apices truncate.	In deep crypts.	Thick covering of wax platelets; prominent rib on the keel; apices forked.
<i>L. concolor</i>	Covered with waxy layer; cells long and narrow; four-sided; apices truncate.	In shallow crypts.	Thick layer of wax; cells long and narrow; four-sided; apices truncate.
<i>L. cooperi</i>	Smooth; long and narrow; extended out to stomata; apices truncate.	In shallow crypts.	Smooth; long and narrow; four-sided; apices truncate.
<i>L. coriacea</i>	Covered with thick waxy layer; cells short and wide; eight-sided; lengthened out to stomata; apices truncate.	In deep crypts.	Waxy layer thin; cells longer than narrow; apices truncate.
<i>L. crispa</i>	Covered with thin waxy layer; cells very long and narrow; four-sided; apices forked.	In deep crypts.	Waxy layer thin; cells shortly rectangular; apices truncate.
<i>L. dolomiticola</i>	Covered with thick waxy layer; cells very long and narrow; keeled; apices truncate.	In shallow crypts.	Waxy layer thick; cells long and narrow; keels round; apices truncate.
<i>L. ensifolia</i>	Covered with thin waxy layer; cells very long and narrow; apices truncate.	In shallow crypts.	Waxy layer thin; cells long and narrow; four-sided; apices truncate.
<i>L. floribunda</i>	Smooth; cells very long and narrow; four-sided; apices truncate.	In shallow crypts.	Smooth; cells long and narrow; four-sided; apices truncate.
<i>L. galpinii</i>	Smooth; cells rectangular; four-sided; apices truncate.	In shallow crypts.	Smooth; cells rectangular; four-sided; apices truncate.
<i>L. glauca</i>	Covered with thick waxy layer; cells rectangular; four-sided; apices round.	In shallow crypts.	Waxy layer thick; cells longer than broad; eight-sided; apices square.
<i>L. hypoxidioides</i>	Surface covered in long hairs; cell surface smooth; boundaries not prominent.	Protrude above cells.	Surface covered in long hairs; cell surface smooth; boundaries not prominent.
<i>L. inquinata</i>	Covered with thin waxy layer; cells shortly rectangular; four-sided; apices truncate.	In shallow crypts.	Smooth; cells very long and narrow; four-sided; apices truncate.
<i>L. lepida</i>	Smooth; scattered rows of papillae; cells short and broad; four- to eight-sided; apices truncate.	In shallow crypts.	Smooth; cells long and narrow; four-sided; apices truncate.

Table 5. Continued.....

<i>L. leptophylla</i>	Smooth; cells long and narrow; lengthened out to stomata; apices deeply forked.	In deep crypts.	Smooth; cells long and narrow; apices forked.
<i>L. luteola</i>	Cells smooth; covered with small warts; cells long and narrow; apices truncate.	In deep crypts.	With scattered wax platelets; cells very long and narrow; apices truncate.
<i>L. macowanii</i>	Smooth; cells long and narrow, lengthened out to stomata; apices truncate.	Very shallow crypts.	Smooth; cells long and narrow, lengthened out to stomata; apices truncate.
<i>L. marginata</i>	Smooth; cells very long and narrow, apices tapered or forked.	In shallow crypts.	Smooth; cells long and narrow; lengthened out to stomata; apices forked.
<i>L. minima</i>	Smooth; cells short and broad; six- to eight-sided; strongly lengthened to stomata; apices truncate.	In deep crypts.	Smooth; cells very long and narrow; apices truncate.
<i>L. monophylla</i>	Smooth; cells narrowly rectangular; apices tapered.	In shallow crypts.	Smooth; cells short and broad, mostly six-sided; apices truncate to tapered.
<i>L. ovalifolia</i>	Smooth; cells mostly narrowly rectangular; apices truncate.	In shallow crypts.	Smooth; scattered rows of papillae; cells short and broad, six-sided; apices truncate.
<i>L. ovatifolia</i>	Covered with thin layer of wax; cells branched, long and narrow; apices rounded.	In deep crypts.	With thin layer of wax; cells branched, long and narrow; apices rounded.
<i>L. papillata</i>	Smooth; cells rectangular, lengthened out to stomata; apices truncate; scattered rows of papillae.	In shallow crypts.	Smooth; cells rectangular, lengthened out to stomata; apices truncate.
<i>L. parvifolia</i>	Smooth; dense rows of papillae; cells short and broad, six- to eight-sided; apices truncate.	In deep crypts.	Smooth; cells long rectangular; apices truncate.
<i>L. petiolata</i>	Smooth; cells rectangular, lengthened out to stomata; apices tapered.	In shallow crypts.	Smooth; cells long rectangular; apices tapered.
<i>L. revoluta</i>	Covered with thin layer of wax; cells long and narrow; apices tapered.	In shallow crypts.	With thin layer of wax; cells long and narrow; apices tapered.
<i>L. rupestris</i>	Covered with thin layer of wax; cells narrowly rectangular, lengthened out to stomata; apices truncate.	In shallow crypts.	Smooth; cells very long and narrow; apices truncate.
<i>L. sandersonii</i>	Smooth; cells narrowly rectangular; apices truncate.	In shallow crypts.	Smooth; cells narrowly rectangular; apices truncate.
<i>L. socialis</i>	Smooth; cells long and narrow; apices truncate.	Protrude above cells.	Smooth; cells short and broad, six-sided; apices truncate.
<i>L. undulata</i>	Covered with thick layer of wax platelets; cells rectangular; apices truncate.	In deep crypts.	With thick layer of wax platelets; cells narrowly rectangular; apices truncate.
<i>L. viscosa</i>	Covered with thick layer of resin; cells rectangular; apices truncate.	In shallow crypts.	With thick layer of resin; cells rectangular; apices truncate.
<i>L. zebrina</i>	Covered with thick waxy layer; cells narrowly rectangular; apices truncate.	In shallow crypts.	Waxy layer thick; cells narrowly rectangular; apices truncate.

The microsculpturing of the leaf surfaces is diagnostic for certain species (Table 5). Microsculpturing of leaves is an aid to classification in various families. Glen & Hardy (pers. comm.) studied the genus *Aloe* L. making use of epidermal leaf characters in their final synthesis. Glen & Hardy (1990) used SEM studies of the adaxial leaf surfaces of *Aloe parvibracteata* Schönl. and *Aloe dumetorum* Mathew & Brandham to show that *A. dumetorum* does not belong to the *Aloe maculata* All. group. Van Jaarsveld (1989) found that the sculpturing of the outer leaf epidermis is most useful and of diagnostic value in distinguishing taxa in the genus *Gasteria* Duval .

In *Ledebouria* the adaxial and abaxial surfaces of the lamina are usually smooth but can be lacunose (*L. galpinii*), papillate (*L. papillata*), asperate (*L. asperifolia*), ciliate (*L. lepida*), viscosa (*L. viscosa*) or covered with hairs (*L. hypoxidioides*). The main textural features of the leaves are the rows of papillae and cilia. Some of the species (*L. coriacea*, *L. dolomiticola* and *L. marginata*) have a thick waxy cuticle. In *L. marginata* this glaucous waxy layer can be rubbed off. The cuticle in *L. coriacea* is so resilient that after repeated washes in ethanol and acetone it is still visible under the Scanning Electron Microscope.

Epidermal cell measurements for the genus range as follows: adaxial surface, 100 - 200 x 6 - 10 μm ; abaxial surface 30 - 70 x 10 - 20 μm .

5.7. Inflorescence.

The inflorescence of *Ledebouria* is a simple unbranched axillary raceme. A single raceme is produced annually in 10 species but in the other members 2 - 14 may be produced. In most species inflorescences are declinate but some are erect. In *L. revoluta* the inflorescence is initially erect but gradually becomes declinate. The length of the inflorescence varies from 30 - 300 mm. The scape varies from 1 - 6 mm in diameter. The base of the scape is normally terete, but may be compressed, winged or angular. It is green, purplish-brown or purple and may frequently be spotted or striped basally.

The rachis is either consistently smooth or ridged. Flowers are spirally arranged and racemes are either dense or lax. The overall shape is dependent on pedicel length, posture and insertion and varies from cylindric to globose.

Figure 8. Flower bracts. A, *L. concolor*, vestigial bract (Venter s.n.); B, *L. floribunda* (Venter 13,315); C, *L. apertiflora* (Mauve et al. 179); D, *L. atrobrunnea* (Venter 13,483); E, *L. ovatifolia* (Venter 13,376) and F, *L. zebrina* (Venter 13,395). Bar = 500 μ m. Bracteoles indicated with an arrow.

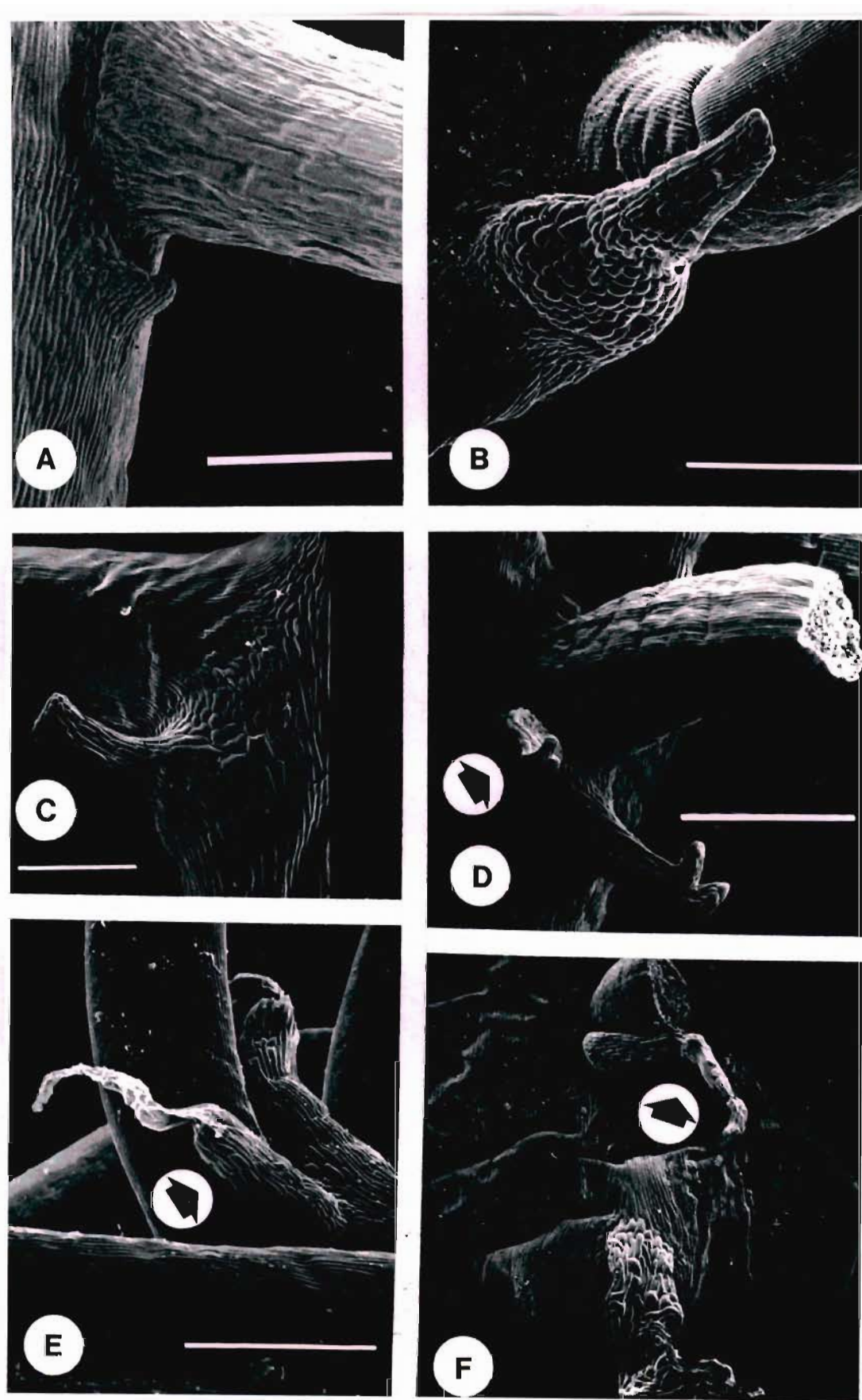


Figure 9. *L. revoluta* flower. A, lateral view. B, distal view. Both from *Venter 13,007* (X 8).

Figure 10. Tepal apices of A, *Drimiopsis burkei* Bak. (*Venter 13,341*) and B, *Ledebouria apertiflora* (Bak.) Jessop (*Mauve et al. 179*) (X 16).

Figure 11. Various parts of the ovary (X16).

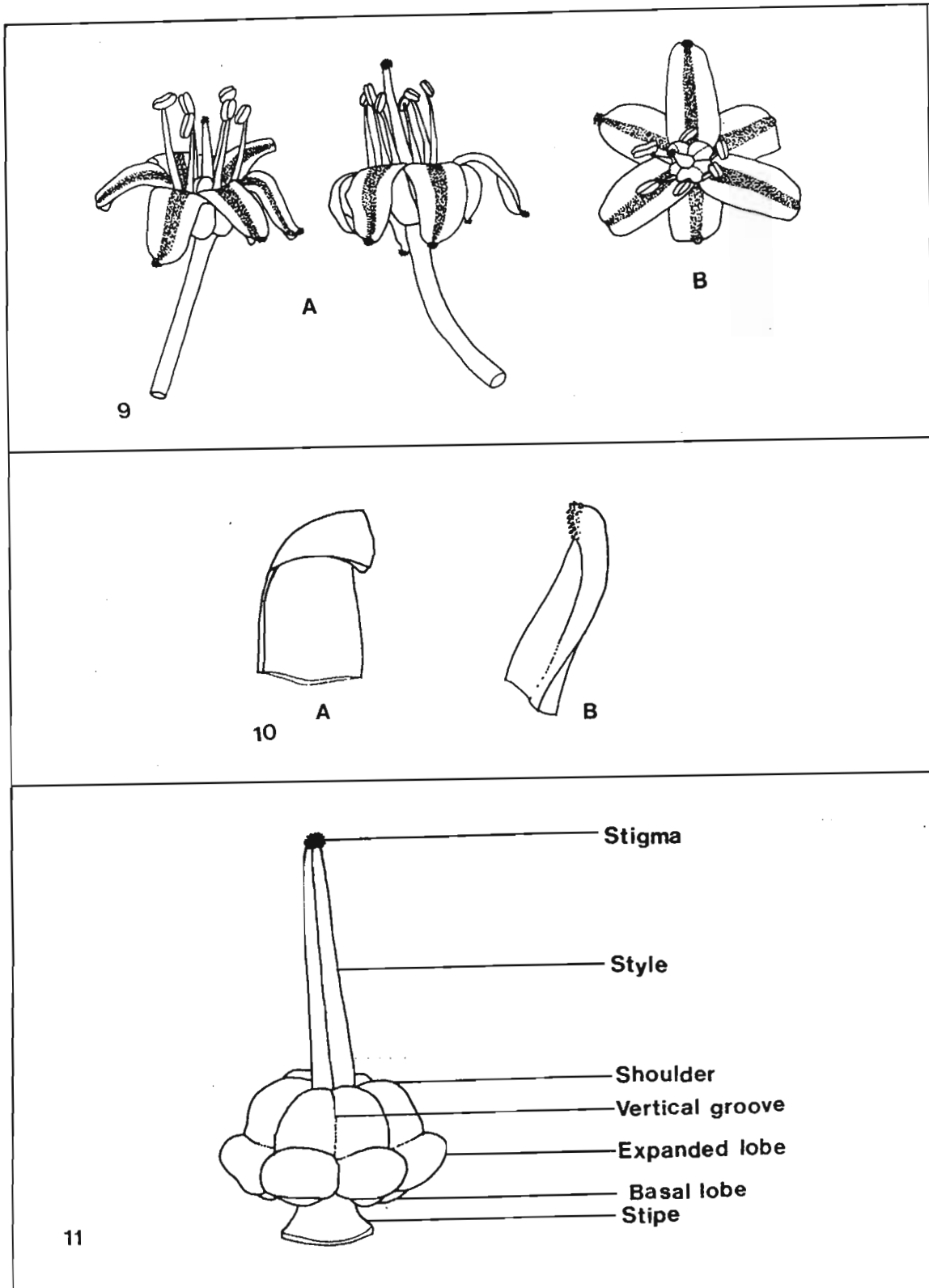
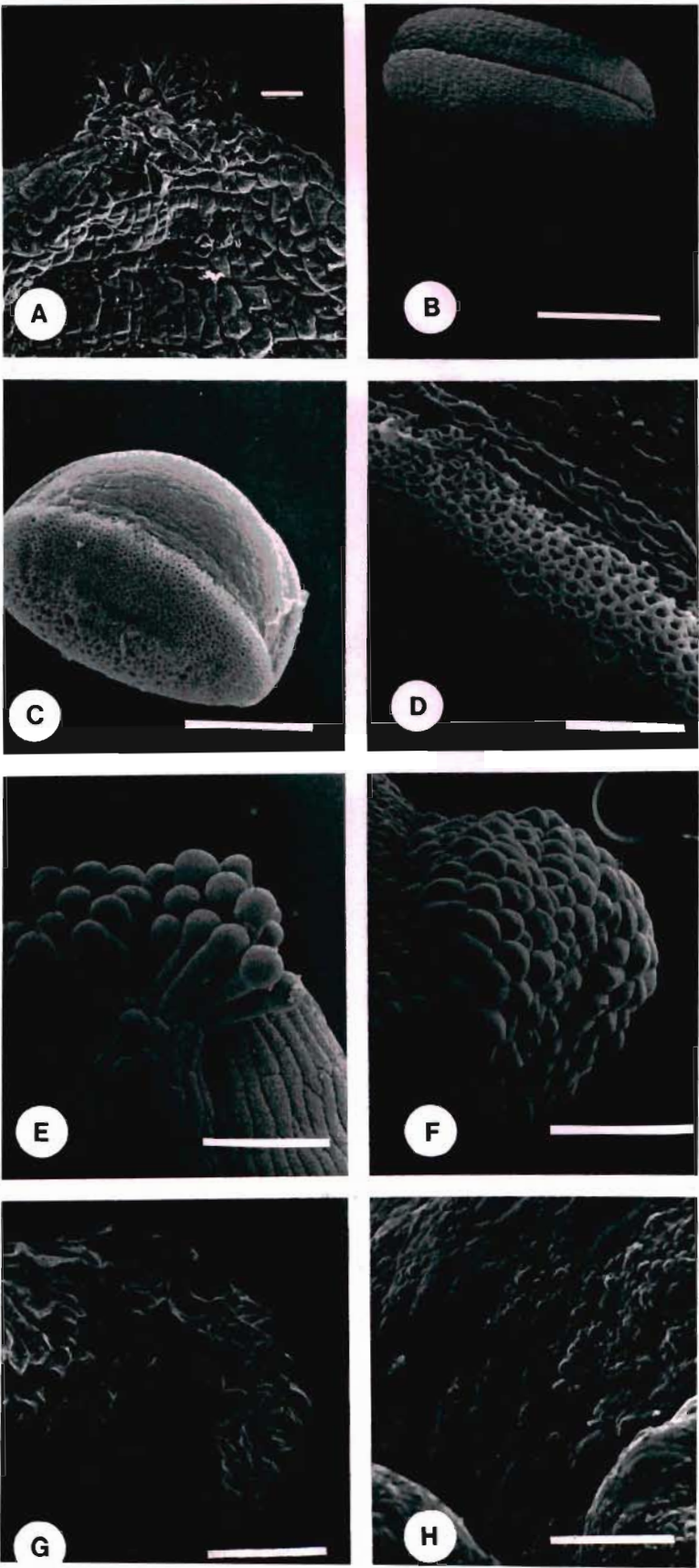


Figure 12. SEM micrographs of A, tepal apex in *L. zebrina* (Bak.) S. Venter (Venter 13,395). Bar = 50 μm . B, anther of *L. ensifolia* (Eckl.) S. Venter (Venter 13,521). Bar = 0.38 mm. C, pollen grain of *L. revoluta* (L.f.) Jessop (Venter 13,207). Bar = 12.6 μm . D, reticulate exine of *L. revoluta* (Venter 13,207). Bar = 5 μm . E, stigma of *L. revoluta* (Venter 13,257). Bar = 86 μm . F, nectaries on the base of the ovary lobes in *L. sandersonii* (Bak.) S. Venter (Venter 13,465). Bar = 200 μm . G, seed surface of *L. glauca* S. Venter (Venter 13,386). Bar = 1.2 mm. H, detail texture of the testa of *L. luteola* Jessop. Bar = 43 μm .



Pedicels are patent, drooping or curved but are always initially erect, becoming horizontal when the flower opens and cernuous after fertilization. They vary in length from 2 - 20 mm and vary from white to white speckled with pink or purple. Pedicels become green after fertilization.

In *L. concolor* floral bracts are absent or, at most, vestigial. In other species the bracts are sometimes accompanied by lateral bracteoles. Flower bracts can either be membranous or fleshy and vary in length from 0.5 - 6.0 mm. Shape is of taxonomic importance (Figure 8). Colour varies considerably through pink, purple, grey, white and green.

5.8. Floral characters.

5.8.1. Perianth.

Perianth shape is variable from almost tubular to stellate or campanulate with recurved or reflexed lobes. Perianth length varies considerably in some species (*L. cooperi*, *L. ovatifolia* and *L. revoluta*). Lobes are oblong, linear, lanceolate or ovate.

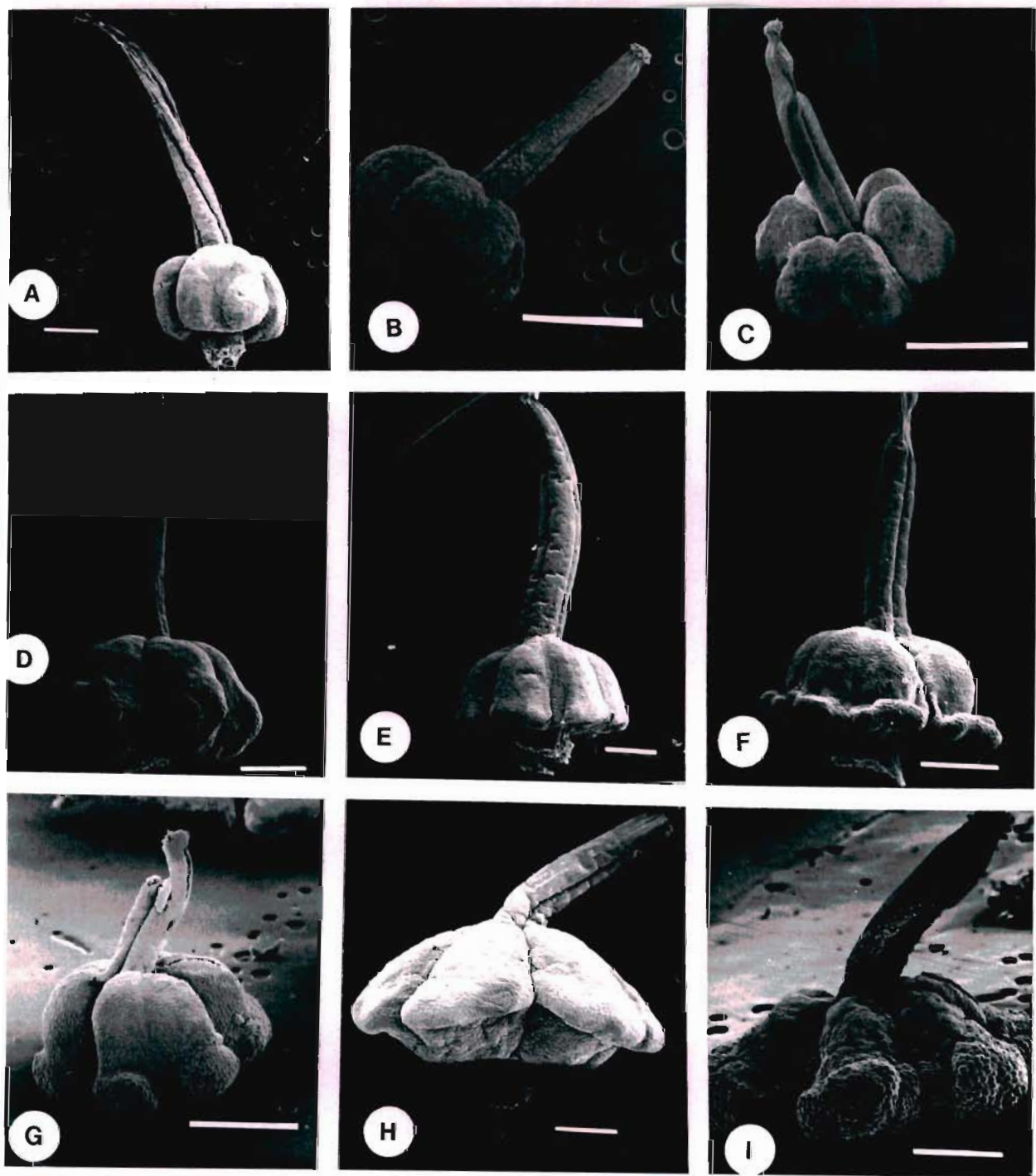
Tepal apices are acute, obtuse, or with recurved points. In some species apices are cucullate however these are very different from the connivent tepals of *Drimiopsis* (Figure 10). Papillae on the apex of the perianth lobe help to keep the lobe apices together while the flower is still in bud (Figure 12A).

Colour is, in most cases, not of taxonomic importance. Tepals are green, green on white, green on pink, brown on pink or pink to purple.

5.8.2. Stamens and pollen.

Stamens are patent, erect or connivent. Filament apices are usually acute but may be truncate. The filament bases are cylindrical or occasionally slightly flattened. Filament colour is usually more intense than that of the perianth lobes, and varies through maroon, pink, white and green. The distal part of the filament is more intensely coloured. In some species the filaments are free from the tepals and exhibit swollen bases.

Figure 13. SEM micrographs of the different ovary shapes. A, *L. undulata* (Jacq.) Jessop (*Müller-Doblies* 89129). Bar = 500 μm . B, *L. papillata* S. Venter (*Venter* 13,186). Bar = 1 mm. C, *L. parvifolia* S. Venter (*Venter s.n.*). Bar = 1 mm. D, *L. ensifolia* (Eckl.) S. Venter (*Venter* 13,278). Bar = 500 μm . E, *L. apertiflora* (Bak.) Jessop (*Mauve et al.* 179). Bar = 500 μm . F, *L. leptophylla* (Bak.) S. Venter (*Venter* 13,251). Bar = 500 μm . G, *L. asperifolia* (Van der Merwe) S. Venter (*Venter* 13,382). Bar = 0.86 mm. H, *L. zebrina* (Bak.) S. Venter. Bar = 500 μm . and I, *L. hypoxidioides* (Schönl.) Jessop (*Venter* 13.311). Bar = 500 μm .



The anthers in *Ledebouria* are epipeltate and dehisce longitudinally. They are normally yellow but can be white, pale yellow, pale violet or deep violet in colour (Figure 12B).

Only a few publications deal with pollen morphology of the South African species of the Asparagales. Pollen in *Ledebouria* is mono-sulcate. The exine is reticulate (Erdtman 1969; Faegri & Iversen 1975). Morphology of grains according to Jessop (1970) is as follows: grains 37.7 - 61.5 μm long, monosulcate; exine smooth to reticulate with the lumina less than 0.1 μm long and decreasing in size towards the poles. The degree of reticulation also varies intra specifically (Figure 12C & 12D).

Our examination reveals that pollen is consistent throughout the genus. Slight variation occurs in shape and size of the pollen infra-specifically (Figure 12).

5.8.3. Ovary.

The length of the stigmatic lobes differs slightly between certain species. Initially the lobes are appressed but part when the stigma reaches maturity.

The length of the style at anthesis varies in different species. As the flower opens the style curves outwards so that the stigma protrudes away from the perianth during elongation and eventually becomes erect thus avoiding contact with the anthers. The stigma can be lower than, at the same level as or held higher than the anthers when receptive.

The style is terete or triangular in cross-section and is white, green, purple or with the upper part purple and the lower part white. It varies in length from 4.0 - 6.0 mm and in some species is shorter than the ovary (Table 6).

Ovary shape is taxonomically useful (Table 6, figure 13). The ovary is 3-lobed in *L. galpinii*, *L. monophylla* and *L. ovalifolia* and 6-lobed in the remaining species. If ovary shoulders are present, these are tapered into the style, rectangular or raised. Basal lobes of the ovary are sometimes present (Figure 11) with nectaries on these in some species (Figure 12F). The stipe is usually as long as it is broad varying from 0.25 - 2.0 mm.

Table 6. Ovary and fruit characters.

1 = length in mm. 2 = width in mm. 3 = Style length : ovary length

SPECIES	OVARY				FRUIT
	Lobe shape	1	2	3	shape
<i>L. apertiflora</i>	obtusely deltate	1.0	1.2	1.5 : 1	clavate
<i>L. asperifolia</i>	narrowly transversely elliptic	1.0	2.0	5 : 1	globose
<i>L. atro-brunnea</i>	obtusely deltate	1.0 - 1.5	2.0 - 2.5	2 : 1	clavate
<i>L. concolor</i>	narrowly transversely elliptic	1.0 - 1.5	2.5	4 : 1	cylindrical
<i>L. cooperi</i>	narrowly transversely oblong	2.0	4.0	1.5 : 1	globose
<i>L. coriacea</i>	obtusely deltate	1.25	2.0	3 : 1	globose
<i>L. crispa</i>	obtusely deltate	2.5	3.0	1.5 : 1	globose
<i>L. dolomiticola</i>	narrowly transversely oblong	1.5	2.5	2 : 1	globose
<i>L. ensifolia</i>	narrowly transversely oblong	1.0	2.5	1.5 : 1	globose
<i>L. floribunda</i>	widely trullate	1.75	1.5	8 : 1	clavate
<i>L. galpinii</i>	depressed ovate	1.5	1.0	2 : 1	globose
<i>L. glauca</i>	narrowly transversely oblong	0.5	1.0	6 : 1	globose
<i>L. hypoxidioides</i>	obtusely deltate	1.5	3.0	3 : 1	globose
<i>L. inquinata</i>	obtusely deltate	1.0	1.8	3 : 1	globose
<i>L. lepida</i>	depressed ovate	0.8	1.25	4 : 1	globose
<i>L. leptophylla</i>	narrowly transversely oblong	1.0	2.0	3 : 1	globose
<i>L. luteola</i>	obtusely deltate	3.0	4.0	1 : 1	globose
<i>L. macowanii</i>	obtusely deltate	1.5	2.0	1.2 : 1	clavate
<i>L. marginata</i>	narrowly transversely oblong	0.75	1.5	4 : 1	globose
<i>L. minima</i>	depressed ovate	0.5	1.12	4 : 1	clavate
<i>L. monophylla</i>	depressed ovate	1.0	2.0	1.5 : 1	globose
<i>L. ovalifolia</i>	depressed ovate	1.5	2.0	1.3 : 1	globose
<i>L. ovatifolia</i>	narrowly transversely elliptic	1.75	3.0	2 : 1	globose
<i>L. papillata</i>	depressed ovate	1.5	2.5	2.3 : 1	globose
<i>L. parvifolia</i>	narrowly transversely oblong	1.0	2.0	3 : 1	globose
<i>L. petiolata</i>	obtusely deltate	1.0	2.0	2.5 : 1	globose
<i>L. revoluta</i>	narrowly transversely elliptic	0.75 - 1.0	1.75 - 2.0	7 : 1	clavate
<i>L. rupestris</i>	obtusely deltate	1.0	2.0	1.5 : 1	clavate
<i>L. sandersonii</i>	narrowly transversely oblong	1.0	2.0	3 : 1	globose
<i>L. socialis</i>	obtusely deltate	2.0	2.5	1.5 : 1	globose
<i>L. undulata</i>	narrowly transversely oblong	1.5	2.0	3 : 1	globose
<i>L. viscosa</i>	obtusely deltate	1.0	2.0	1.5 : 1	clavate
<i>L. zebrina</i>	obtusely deltate	2.25	3.0	2 : 1	clavate

5.8.4. Capsule and seed.

Jessop (1975), used different types of seed surface to form five major groups in the Liliaceae sensu lato:

1. The Massonia Group.
2. The Ornithogalum Group.
3. The Undulate Margin Group.
4. The Angular Cell Group.
5. The Drimia Group.

Ledebouria can be grouped into Jessop's Massonia Group. According to Jessop (1975), cells are arranged in regular rows, more or less 4-angled and 15.0 - 25.0 μm in diameter.

The fruit is a 3-lobed, loculicidal capsule but some of the locules can abort leaving a 2-lobed or 1-lobed fruit. The shape is cylindrical, globose or clavate with the base either truncate or tapering. The outer and inner surfaces of the valves are smooth.

Seed shape varies considerably within species. The testa is black, reddish-brown, brown or yellowish-brown and variously wrinkled. The material studied has mostly 5-angled or 6-angled cells randomly arranged. They are 21.5 - 43.0 x 13.0 - 21.5 μm . Seed length varies from 1.0 - 5.0 mm.

5.8.5. Caryology.

Only three papers on *Ledebouria* cytology have been published (Giménez-Martin 1959, Fernandes & Neves 1962 and Jessop 1972b).

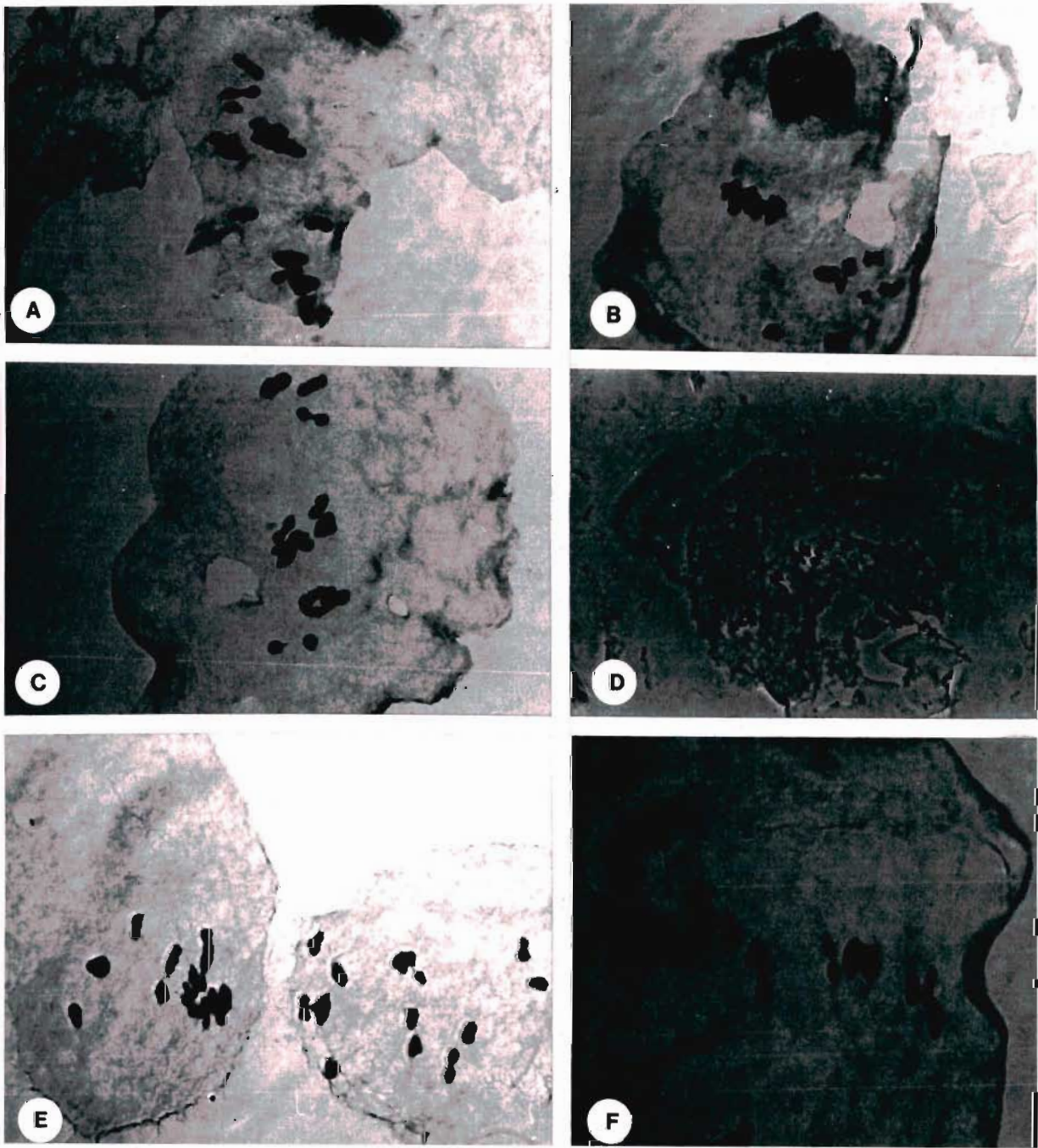
Materials and methods are outlined on page 6.

Giménez-Martin (l.c.) gives a somatic number of 12 for *L. leptophylla* and Fernandes & Neves (l.c.) give a somatic number of 24 for *L. apertiflora*. Jessop (l.c.) reports on meiotic chromosomes from pollen mother cells of *Ledebouria*. The chromosomes are depicted in the form of idiograms. The results of his study are given in table 7.

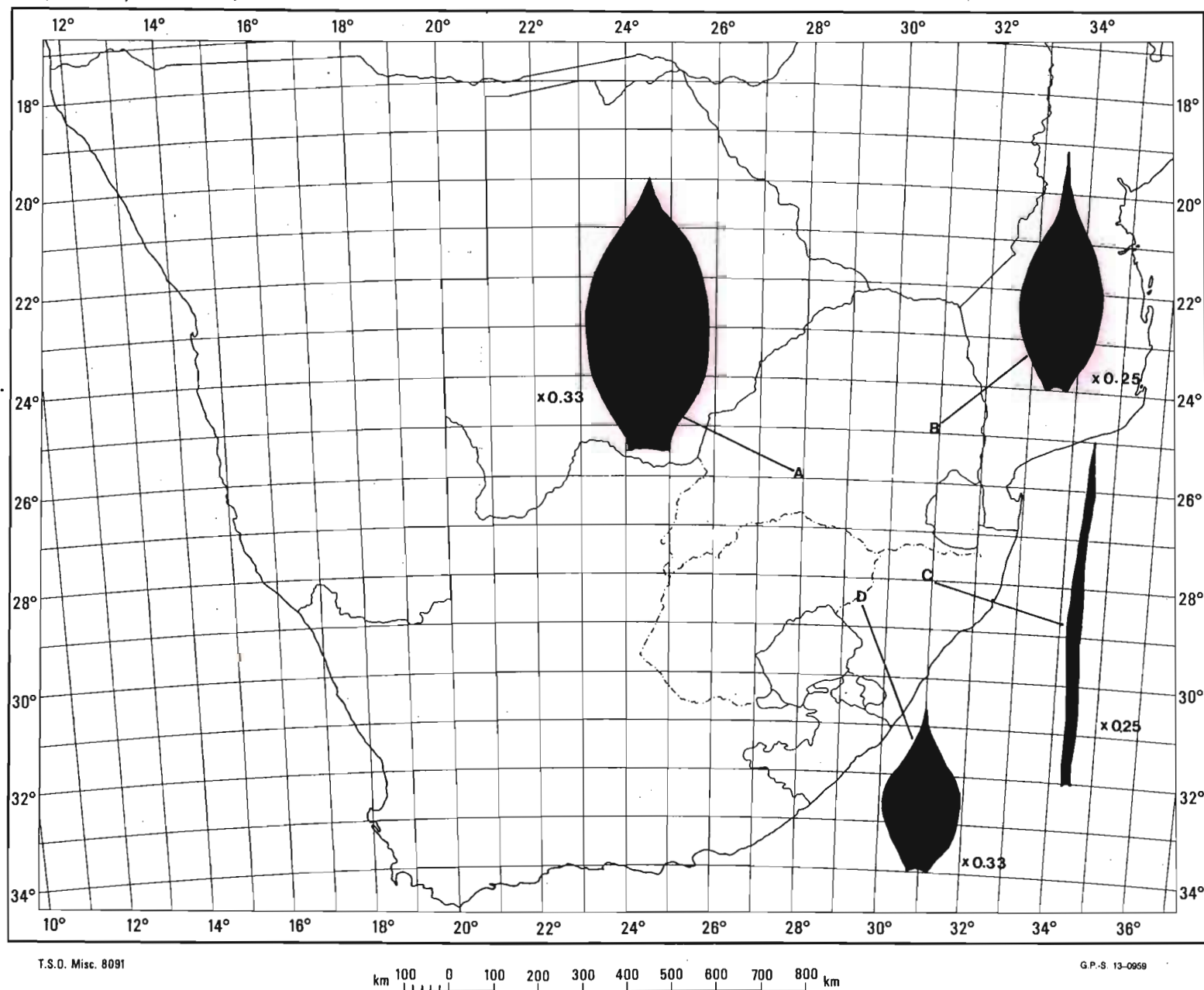
Table 7. Results of Jessop's chromosome studies (1972).

Meiotic chromosome count	n = 10 - 17	n = 18	n = 27	n = 30	n = 46
Species	<i>L. cooperi</i> <i>L. marginata</i> <i>L. revoluta</i> <i>L. socialis</i>	<i>L. concolor</i>	<i>L. ovatifolia</i>	<i>L. floribunda</i>	<i>L. luteola</i>

Figure 14. Meiotic chromosomes (metaphase I) *L. apertiflora*: $2n = 26$. A - C from *Venter s.n.* and *L. ensifolia*: $2n = 30$. D - F from *Venter 13,278*. A, C and E X 1000; B, X 600 and F X 400.



Map 1. Pictorialized map showing the variation in leafshape, in *L. marginata* (Bak.) Jessop. A, Venter 13,487. B, Venter 13,246. C, Venter 13,358 and Venter s.n.



Jessop (1972b) gives somatic numbers for *L. ensifolia* ranging from 20 to 30.

Jessop (l.c.) detected no evidence for abnormalities, during meiosis in his study. It was found that the chromosomes did not fall into natural size categories. No correlation was found between chromosome numbers and distribution or chromosome size. Jessop misidentified some of the material he used for chromosome counts. This led to the great variation in chromosome numbers he encountered for some of the species.

The present author reports somatic numbers of 26 for *L. apertiflora* and 30 for *L. ensifolia* (Figure 14). No basic number is given here for *Ledebouria*. This would only be possible after chromosome counts were done for all the South African species.

6.0. INFRAGENERIC CLASSIFICATION.

6.1. Phenotypic variation.

The phenotype results from interactions between the genotype and the environment. The extent to which the same genotype can give rise to different phenotypes is known as phenotypic plasticity. The degree of plasticity is thus under genetic control (Richards 1986). Many phenotypic modifications are also adaptive (Grant 1963). To distinguish phenotypic from genotypic variation, a thorough study must be made of populations in the field, as well as growing and studying plants under uniform conditions.

The first detailed studies of natural populations of *Ledebouria* were undertaken by Jessop (1970) who last revised the genus. The long lists of synonyms for certain species reflect the phenotypic variability in this genus.

In the present study populations of each species were examined in the field to account for intraspecific variation.

Leaf arrangement and floral structure remain mostly unaffected but bulb size, leaf dimensions and maculation and flowering time vary. In the case of *L. ensifolia*, for example, the shape and colour of the leaves are more plastic than the flower shape and flower colour.

6.2. Genotypic variation.

The occurrence of many small populations with occasional transfer of genes may be an antidote for the loss of genetic diversity. If a population is smaller than approximately 50 effectively breeding individuals there is an increased risk of fixation of alleles and loss of diversity due to inbreeding (Richards 1986).

6.3. Designation of ranks.

6.3.1. Species rank.

For pragmatic purposes the rank of species is given to taxa where at least two stable discontinuous characters are present (abrupt variation). In *Ledebouria* three major convergent characters recognized. Fusiform roots occur in both *L. apertiflora* and *L. ensifolia*. In the arid habitats of these species, the storage function of the bulb is primarily taken over by the roots. Loose bulb scales occur in *L. sandersonii*, *L. monophylla* and certain forms of *L. cooperi*. This character commonly occurs in species growing in moist or marshy ground. Three typical grassland species, *L. luteola*, *L. marginata* and *L. ovatifolia* possess multiple thread bundles in the bulb scales and leaves. These different species developed this character independently possibly as an adaptation to herbivory.

A solitary inflorescence, reflexed tepals, many-lobed ovary and glabrous leaves are regarded as primitive characters. According to this combination of characters, *L. coriacea*, *L. crispa*, *L. dolomiticola* and *L. undulata* are considered primitive. It is postulated that these primitive features have been successfully retained as the above-mentioned species occur in dense populations or grow with individual plants closely packed together.

6.3.2. Species arrangement and sectional ranks.

The objective was to produce a natural classification with taxa in monophyletic groups. Nine sections and nine subsections were identified. The classification of sections is based on: mature bulb size, bulbil occurrence; leaf number, texture, occurrence of helical threads; ovary morphology and capsule shape.

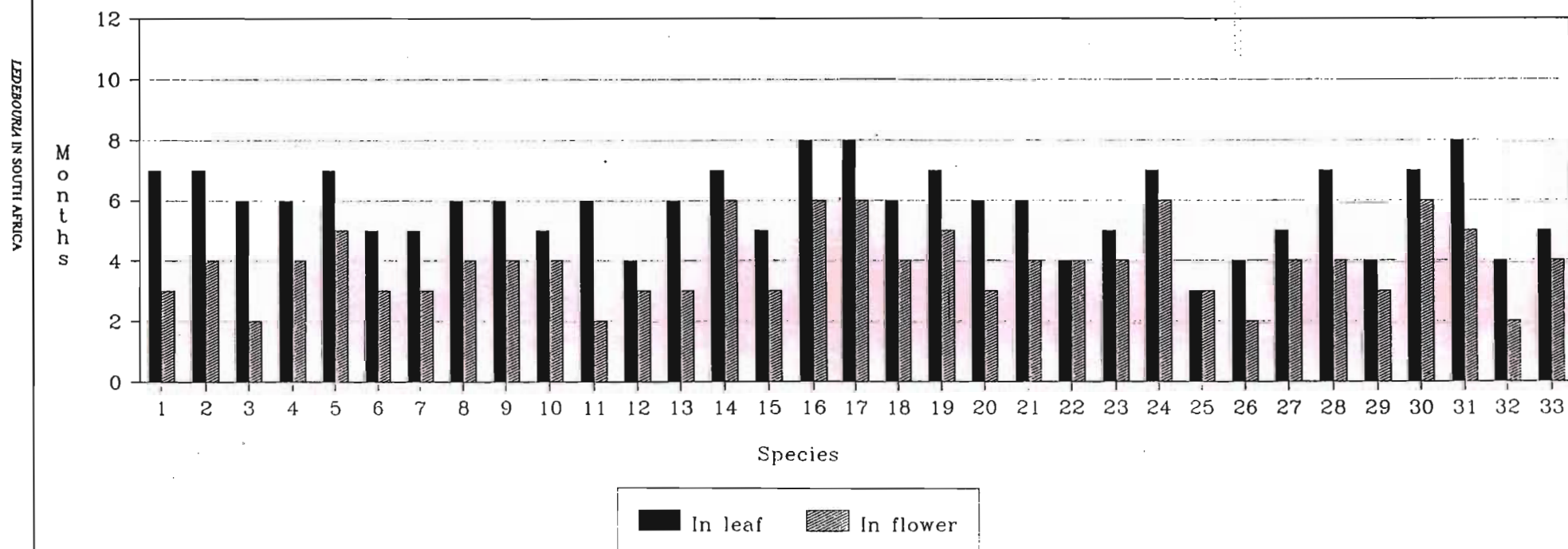
7.0. PHENOLOGY AND LEAF PERIOD.

7.1. Flowering period.

Table 8. Flowering period (●) of the genus *Ledebouria* in South Africa.

Species	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
<i>L. apertiflora</i>										●	●	●
<i>L. asperifolia</i>									●	●	●	●
<i>L. atro-brunnea</i>									●	●	●	●
<i>L. concolor</i>	●									●	●	●
<i>L. cooperi</i>	●	●								●	●	●
<i>L. coriacea</i>										●	●	●
<i>L. crispa</i>										●	●	●
<i>L. dolomiticola</i>	●	●	●	●							●	●
<i>L. ensifolia</i>	●	●									●	●
<i>L. floribunda</i>	●									●	●	●
<i>L. galpinii</i>										●	●	●
<i>L. glauca</i>										●	●	●
<i>L. graminifolia</i>	●							●	●	●	●	●
<i>L. hypoxidioides</i>	●										●	●
<i>L. inquinata</i>	●							●	●	●	●	●
<i>L. lepida</i>	●										●	●
<i>L. luteola</i>	●	●							●	●	●	●
<i>L. macowanii</i>	●									●	●	●
<i>L. marginata</i>	●								●	●	●	●
<i>L. minima</i>	●									●	●	●
<i>L. monophylla</i>	●									●	●	●
<i>L. ovalifolia</i>	●	●	●	●								
<i>L. ovatifolia</i>	●							●	●	●	●	●
<i>L. papillata</i>										●	●	●
<i>L. parvifolia</i>										●	●	
<i>L. petiolata</i>	●	●	●	●								
<i>L. revoluta</i>								●	●	●	●	
<i>L. rupestris</i>									●	●	●	
<i>L. sandersonii</i>	●	●	●	●							●	●
<i>L. socialis</i>							●	●	●	●	●	
<i>L. undulata</i>	●											●
<i>L. viscosa</i>	●	●	●	●								
<i>L. zebrina</i>										●	●	●

All *Ledebouria* species flower either at the beginning of the rainy season or well into it (September to April).

Table 4. Phenology of the genus *Ledebouria* in South Africa.Phenology of *Ledebouria* in South Africa.

7.2. Pollination biology.

During mid-morning light intensity and temperatures are high, acting as stimulants for insect activity (Faegri and Van der Pijl 1979). The beginning of nectar secretion reflects the activity period of the pollinator class and is in general one to four hours before the pollinators become active (Bentley & Thomas 1983). Nectar secretion in the flower can be affected by local climatic conditions such as temperature and rain (Bentley & Thomas 1983).

There appears to be a close correlation between pollinator needs (nectar, pollen and oil) and floral attraction (colour, shape and odour) (Rebelo 1987). These are primary and secondary attractants respectively.

In *Ledebouria* specific flower colour does not seem to be a determining factor. Bees were seen visiting flowers ranging from green to purplish-pink. U.V. reflectance would possibly throw more light on this. The scape and rachis are brightly coloured in some species and may contribute to pollinator attraction.

In most ecosystems, social bees are the dominant pollinators (Richards 1986). Bees are associated with all flower types except those with narrow tubes. Pollen from a flower of a particular species is unlikely to be received by a flower of the same species. Because of this more energy is required for pollen production per ovule fertilized (Richards 1986). For short distance attraction the surface texture of the flower together with odour are important factors (Faegri & Van der Pijl 1966).

Throughout the distributional range of *Ledebouria*, the butterfly fauna is very rich except in the southern and south-western Cape which has a relatively depauperate butterfly fauna (Cottrell 1978).

Wasps are opportunistic foragers and have a low fidelity to specific flowers (Rebelo 1987).

In *Ledebouria*, the flowers are numerous and born on long inflorescences with unsophisticated shapes and simple pollen presentation and receipt.

In the case of *Ledebouria*, nectar plays a minor role in attraction and was observed only in *L. cooperi* and *L. revoluta*. Extrafloral nectaries are situated on the flowering axis just above the pedicel. These amorphous nectaries secrete nectar seen as small shiny drops of liquid. Other nectaries occur as large papillae at the base of the ovary lobes (Figure 12F).

Pollinators visit the flowers of *Ledebouria* from mid-morning (10h00) to early afternoon (15h00).

***Lepidoptera:* (Psychophily)**

The only butterflies recorded visiting *Ledebouria* flowers, are from the family *Lycaenidae*, the largest family of southern African butterflies (Dickson & Kroon 1978; Migdol 1987). In the north-eastern Transvaal, on the high-lying areas, *Euchrysops subpallida* Bethune-Baker and *Lepidochrysops patricia* Trimen (Vari & Kroon 1986), were recorded visiting the flowers of *L. revoluta* and *L. luteola*.

Hymenoptera:

Wasps. (Vespidophily)

On two occasions wasps were seen visiting flowers of *Ledebouria*.

Bees. (Mellitophily)

The main bee pollinator of *Ledebouria* is *Apis mellifera adansonii* (Honey bee). Specimens of the stingless bee (*Trigona gribodoi*) were collected at Tzaneen in the eastern Transvaal, visiting the inflorescences of *L. revoluta* (Skaife 1979). These specimens were covered with *L. revoluta* pollen. The reward for the pollinator of *Ledebouria* is only pollen which is used as an energy source. Long range attractants for bees include colour and scent. *L. sandersonii*, *L. cooperi*, *L. monophylla* and *L. zebrina* have a strong, sweet and fresh odour that attracts bees.

8.0. SEED DISPERSAL.

8.1. Wind dispersal.

In many of the species the erect infructescence and capsules are adapted to seed dispersal by wind (anemochory). The whole infructescence moves about in the wind and the seeds fall to the ground where they are sometimes further dispersed by water (Van der Pijl 1969).

8.2. Water dispersal.

Exposed seeds in the capsules of *L. revoluta* were marked with red vegetable dye to make sure that only those seeds were used for distance measuring. Distances travelled by the marked seed were measured after light and heavy rain storms.

The longest distance recorded for seed of any *Ledebouria* species transported by water, is 5.2 meters from the mother plant.

The most important method of dispersal of *Ledebouria* seed is by hydrochory with rainwash (ombrohydrochory).

9.0. ECOLOGY, HABITAT AND ADAPTIVE STRATEGIES.

Acocks (1988) "Veld Types of South Africa" was used for habitat description. Vegetation structural groups and formation classes follow the system of Edwards (1983).

The genus *Ledebouria* occurs in both winter and summer rainfall areas.

The veld types with the highest species density are predominantly woodland with large areas of grassveld or pure grassveld types.

Ledebouria species occur in the following vegetation types:

Coastal Tropical Forest

Coastal Forest and Thornveld (10 spp.)
Pondoland Coastal Plateau Sourveld (8 spp.)
Ngongoni Veld (10 spp.)
Eastern Province Thornveld (7 spp.)

Inland Tropical Forest

North-eastern Mountain Sourveld (18 spp.)
Lowveld Sour Bushveld (7 spp.)

Tropical Bush and Savanna

Lowveld (4 spp.)
Arid Lowveld (3 spp.)
Turf Thornveld (3 spp.)
Arid Sweet Bushveld (6 spp.)
Mopani Veld (2 spp.)
Kalahari Thornveld (3 spp.)
Mixed Bushveld (6 spp.)
Sourish Mixed Bushveld (4 spp.)
Sour Bushveld (13 spp.)

Karoo

Valley Bushveld (11 spp.)
Karroid Broken Veld (4 spp.)
Central Upper Karoo (2 spp.)
Arid Karoo (2 spp.)
Succulent Karoo (1 sp.)
Namaqualand Broken Veld (1 sp.)

Temperate and Transitional Forest and Scrub

Highland and Dohne Sourveld (21 spp.)
Natal Mist belt 'Ngongoni Veld (12 spp.)
Coastal Fynbos (4 spp.)

Pure Grassveld

Cymbopogon - *Themeda* Veld (6 spp.)
North-eastern Sandy Highveld (6 spp.)
Themeda - *Festuca* Alpine Veld (10 spp.)
Stormberg Plateau Sweetveld (6 spp.)

False Grassveld

Natal Sour Sandveld (6 spp.)
Pietersburg Plateau False Grassveld (11 spp.)

L. cooperi, *L. monophylla* and *L. minima* are commonly found growing in seepages, especially in mountain terrain but only *L. cooperi* is recorded growing in water (mostly running water).

Twelve species of *Ledebouria* are recorded from open short grassland which is common in mountainous and flat areas throughout South Africa. Of these *L. inquinata*, *L. asperifolia*, *L. minima*, *L. parvifolia* and *L. sandersonii* favour grassy mountain slopes. *L. cooperi*, *L. leptophylla*, *L. luteola*, *L. marginata*, *L.*

ovalifolia, *L. ovatifolia* and *L. revoluta* favour flat to gently undulating areas. Ten species are found in open low grassland to which *L. petiolata* is restricted. *L. monophylla*, *L. rupestris*, *L. leptophylla*, *L. galpinii*, *L. minima* and *L. sandersonii* are typically small grassveld species of high altitude.

L. ovatifolia was found growing in closed tall grassland of the secondary dunes at Scottburgh on the Natal South Coast. These plants have atypical spreading to erect leaves in contrast to the usually flat leaves of this species. The long thick grass cover is possibly the cause of this growth pattern. Plants collected from this population produced normal leaves the next season.

Ledebouria occur in evergreen shrubland at high altitude. On the Karoo and Namaqualand Flats *L. undulata* grow sparingly between short evergreen shrub in full sun.

27 Species were recorded growing in some form of Woodland with the largest number of *Ledebouria* populations in deciduous woodland. There is a correlation between the diversity of *Ledebouria* species and the occurrence of deciduous woodland. Most species occur in low deciduous woodland (19 species).

Evergreen woodland is typical of high rainfall areas in South Africa, on the mountain tops of the Transvaal and the coastal flats of the eastern Cape and Natal. Of the five *Ledebouria* species in the evergreen low woodland, only *L. concolor* and *L. ensifolia* grow on the coastal flats with *L. concolor* favouring the shady areas. In the eastern Transvaal, *L. asperifolia* grows on rock outcrops and steep mountain slopes covered with evergreen woodland. *L. floribunda* occurs commonly in deep or light shade in evergreen tall woodland.

Most of the species (21 spp.) occur predominantly on mountain or hillslopes (Table 10). Eight species occur on flatlands along the coast and on plateau areas on the mountains. Of these, *L. viscosa* occurs only on inland plateaus near Thabazimbi. *L. minima* occurs on plateaus of the Transvaal Drakensberg escarp with *L. coriacea* and *L. ovalifolia* on coastal flats in the Cape Province. There are relatively few species growing on hill or mountain tops. Occasionally plants of *L. asperifolia*, *L. inquinata* and *L. revoluta* are found growing in these areas.

Table 10. Aspect, slope and topography of *Ledebouria* in South Africa

SPECIES	ASPECT	SLOPE (degrees)	TOPOGRAPHY
<i>L. apertiflora</i>	S,W	0-30	Flats and low hills.
<i>L. asperifolia</i>	E,W	5-90	Flats and mountain slopes.
<i>L. atro-brunnea</i>	S,E	15-30	Hillslopes.
<i>L. concolor</i>	S,E	0-15	Lowlands near sea.
<i>L. cooperi</i>	N,S,E,W,NE,SW	5-45	Flats to mountain slopes.
<i>L. coriacea</i>	E,SE	0- 5	Lowlands near sea.
<i>L. crispa</i>	N,E	5-10	Hill slopes.
<i>L. dolomiticola</i>	E,ES	30-90	Mountain slopes.
<i>L. ensifolia</i>	N,W	10-30	Flats and mountain slopes.
<i>L. floribunda</i>	W	15-90	Mountain and hill slopes.
<i>L. galpinii</i>	N,W,SW	0-10	Mountain tops.
<i>L. glauca</i>	S,E,W	0-10	Flats.
<i>L. hypoxidioides</i>	N,E	5-10	Hill slopes.
<i>L. inquinata</i>	N,S,E,W	0-45	Flats and hill slopes.
<i>L. lepida</i>	W	0- 5	Mountain slopes.
<i>L. leptophylla</i>	N,S,E,W	0-30	Flats to mountain tops.
<i>L. luteola</i>	W	0- 5	Flats to hillslopes.
<i>L. macowanii</i>	S,E	0-30	Mountain and hill slopes.
<i>L. marginata</i>	S,E,SE	5-30	Flats to mountain tops.
<i>L. minima</i>	W	5-10	Flats to mountain tops.
<i>L. monophylla</i>	S,E,SW	0-15	Mountain tops.
<i>L. ovalifolia</i>	E	0- 5	Flats.
<i>L. ovatifolia</i>	N,S,E,W,SE	0-30	Flats to mountain tops.
<i>L. papillata</i>	N,SE	0-15	Flats and mountain slopes.
<i>L. parvifolia</i>	E	15-30	Mountain slopes.
<i>L. petiolata</i>	S,W	0-30	Mountain tops.
<i>L. revoluta</i>	N,S,E,W,NE,NW	0-45	Flats to mountain tops.
<i>L. rupestris</i>	E	5-10	Mountain tops.
<i>L. sandersonii</i>	S	15-30	Mountain slopes and tops.
<i>L. socialis</i>	N	5-15	Flats to hill slopes.
<i>L. undulata</i>	S,W	0-15	Flats.
<i>L. viscosa</i>	S	0- 5	Flats.
<i>L. zebrina</i>	E	15-45	Mountain slopes.

Of the 33 species, 25 are commonly found in full sun. Some of them, (19 spp.) are restricted to this exposure with 18 species found growing in various degrees of shade. Only four of these (*L. concolor*, *L. floribunda*, *L. rupestris* and *L. socialis*) tolerate dense shade. Some species occur in the shade of trees as well as in full sun (*L. asperifolia* and *L. zebrina*), but here exposed plants are more robust.

The genus is concentrated in the moist eastern part of South Africa with only *L. undulata* in the dry Karoo and Namaqualand.

The lowest temperature experienced across the geographical range of *Ledebouria* is -7 °C with 47 °C the maximum in the Limpopo Valley and at Upington. Night temperatures are mostly mild, day temperatures soar to a maximum in January.

Frost occurs over most of South Africa (0 - 40 days) except in areas near the coast, Transvaal Lowveld and the northern Transvaal. The Drakensberg in the eastern Cape, Natal and Lesotho receive more than 150 days of frost per annum and snowfall in winter (Stamp & Morgan 1972). On the high plateau of the Drakensberg soil temperatures frequently drop below freezing point. Only *L. sandersonii* tolerates these conditions.

The distribution of *Ledebouria* is closely associated with the annual precipitation. Approximately 27% of the surface is medial (600 - 1000 mm/annum) and 4% of the surface is moist receiving 1000+ mm per annum (Barnard *et al.* 1972). The highest diversity of species and density in numbers occurs in the medial and moist areas.

Winter rain predominates in the south-western and southern Cape from April to September. An intermediate area that receives summer and winter rains extends as a narrow belt from behind the fold mountains of the Cape Province up to Fraserburg to Goodhouse on the Orange River (Cowling & Roux 1987). In summer rainfall areas, rain falls mostly from October to March.

Mist occurs over the high lying areas of the great escarp and isolated mountains scattered throughout South Africa. Most of the endemic *Ledebouria* species (*L. galpinii*, *L. monophylla*, *L. parvifolia*, *L. petiolata*, *L. rupestris* and *L. sandersonii*) occur in this mist belt.

Plants of *Ledebouria* occur from sea level on the coastal plain up to 3,400 meters above sea level at Njasuthi on the Natal Drakensberg Escarp above Giant's Castle Game Reserve. However more species occur on the high lying areas than on the low lying areas of the interior and coastal plain.

Twelve species were found growing on sandstone of the Witteberg, Natal, Beaufort and Uitenhage Groups (SACS 1980). Of these, only *L. ovalifolia* seems to be restricted to sandstone.

Dolomites are frequently favoured by *Ledebouria* with six species commonly occurring on this substrate. *L. dolomiticola* has only been recorded from the dolomites of the Eccles Formation in the Chuniespoort Group (SACS 1980). Five species of *Ledebouria* occur on the chert rocks of the Sheba Formation in the Fig Tree Group but none of the species seem to be restricted to this rock type.

Granites occur either as intrusions or as part of the basement structure (Du Toit 1956; SACS 1980). No species of *Ledebouria* are restricted to granitic soils. Six species were found on granite with *L. revoluta* the most common.

Dolerite intrusions in the form of sheets, dykes and sills (Blatt *et al.* 1972; Truswell 1970; Thornbury 1969) occur over most of South Africa, associated with characteristic clay to clay-loam soils. Four species were found in association with this substrate.

Three species were found on andesitic tuff and lava of the Westonaria Formation of the Ventersdorp Supergroup. *L. ovatifolia* and *L. revoluta* are the most common species on this rock type. Schists and serpentinite occur in the Komati Formation of the Onverwacht Group at Barberton and near Pietersburg in the Mothiba Formation of the Pietersburg Group (SACS 1980). Four species occur on these rocks with *L. crispa* restricted to the schists and serpentinites in the Pietersburg Area.

One species, *L. hypoxidioides*, occurs on Dwyka tillite, but is not restricted to it (Truswell 1970).

L. coriacea and *L. papillata* from the Port Elizabeth Area occur on Tertiary limestones of the Alexandria Limestone Formation (SACS 1980) with *L. coriacea* endemic to this area (Map 15).

Only two *Ledebouria* species show in their distribution to be associated with specific geological formations. *L. crispa* is a serpentinite endemic so far only recorded from the serpentinite and schists of the Mothiba Formation in the Pietersburg Group. *L. dolomiticola* is endemic to the dolomites of the Eccles Formation in the Chuniespoort Group in the Strydpoort Mountains south of Pietersburg.

The genus *Ledebouria* occurs on nearly all soil types with the exception of some species that occur only on certain soil types (Table 11, figure 15a). Thirteen *Ledebouria* species occur commonly on quartzite derived soils and *L. galpinii*, *L. lepida*, *L. monophylla*, *L. rupestris* and *L. viscosa* may be restricted to quartzitic soils.

Table 11. The major soil types (Buckman & Brady 1969):

Sand	Sand 100%		
Loamy sand	Sand 85%	silt 10%	clay 5%
Sandy loam	Sand 65%	silt 25%	clay 10%
Loam	Sand 45%	silt 40%	clay 15%
Silty loam	Sand 20%	silt 60%	clay 20%
Silty clay loam	Sand 15%	silt 55%	clay 30%
Clay loam	Sand 28%	silt 37%	clay 35%
Clay	Sand 25%	silt 30%	clay 45%

Methods and Materials for soil type evaluation on page 9.

Clay loam and sandy soil seem to be the most frequently inhabited substrate. Dolerite, granite, chert breccia, dolomite, lava and serpentinite are the mother material for the clay loam soils. Seven species were found growing in clay loam with a fine granular to coarse granular structure. Six species were found growing on various forms of lithosols that vary from 10 mm thick on rock sheets to 3000 mm thick on scree slopes. *L. marginata* and *L. ovatifolia* are the only species found on gritty sandy loam.

Sandy soils are derived from sandstone, quartzite, conglomerate and granite. Various structures and a percentage of humus occur in the sandy soil types. Five species occur on gritty sandy soils especially on small plateau areas on gentle to medium slopes. These soils are always shallow, 50 - 200 mm deep.

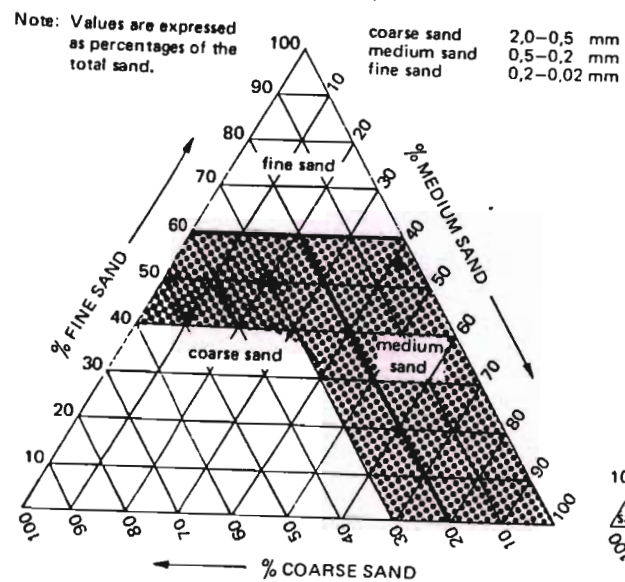
Deep sandy soil with a loose structure is common in the northern and western Transvaal, western Orange Free State and north-central Cape Province. These soils are aeolian and occur on limestone or calcrete (Van der Merwe 1962). Three species were found growing in this substrate and *L. viscosa* is restricted to it.

Sandy loams are distributed throughout South Africa. Sandy loam is derived from granite, quartzite, conglomerate, schist or sandstone. In mountainous areas, sandy loam lithosols are common and seven species occur on them. *L. atro-brunnea* and *L. zebrina* are endemic to this substrate. On small mountain plateaus the sandy loam tends to be of a gritty nature harbouring four species of *Ledebouria*. Of these, *L. lepida* is endemic to the substrate. Humus-rich sandy loam is an uncommon soil type, occurring only in mountainous areas of Natal and the eastern Transvaal. *L. floribunda*, *L. petiolata* and *L. rupestris* were collected growing in this soil, often in shady conditions.

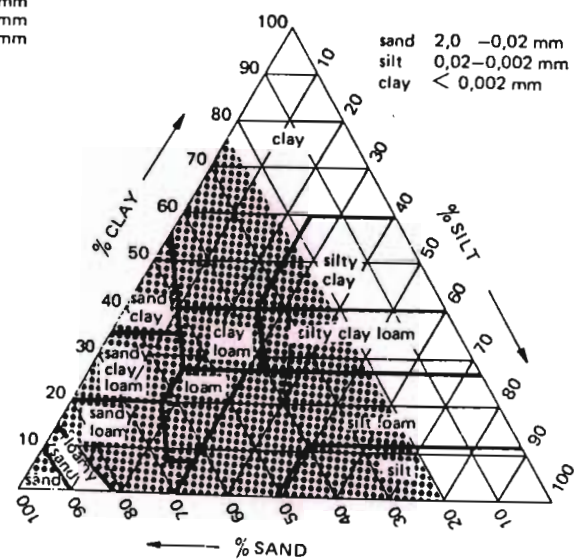
Loamy soils are commonly associated with quartzite, chert, ferrous shales and tillite. Four *Ledebouria* species were collected in loamy lithosols and three species in gritty loam. No species were encountered that are restricted to loamy soils.

Of the seven biomes in South Africa (Rutherford & Westfall 1986), *Ledebouria* is represented in the Savanna, Grassland, Nama-Karoo, Succulent-Karoo and Fynbos biomes. The Savanna and Grassland biomes carry the largest number of *Ledebouria* species (Chapter 10).

Figure 15a. Graphic guide for sandy soil textural classification with A, the different types of sandy soil for *Ledebouria* (shaded portion) and B, soil textures of the habitats (shaded portion).



SAND GRADE CHART

A

TEXTURE CHART

B

10.0. PHENETICS AND RELATEDNESS.

Rohlf and Sokal (1981) express the view that, if a classification is intended to represent a similarity scheme, it is phenetic and if it is intended to show evolutionary branching sequences it is cladistic. Similarly Cain and Harrison (1960) "refer to arrangement by overall similarity based on all available characters without any weighting as *phenetic*". A phenetic classification is thus based upon the overall present-day similarities and differences of living organisms. The only approach to phenetic classification is when the classification is performed by phenetic similarity clustering. The phenetic approach to classification uses all available characters of the species being classified without *a priori* weighting. The diagnostic feature of phenetic classification is to provide a convenient general-purpose framework for accommodating the diversity of plants (McNeil 1978).

The programme NTSYS-pc (Numerical Taxonomy and Multivariate Analysis System) has been used in this thesis to analyse data sets for the species of *Ledebouria* in South Africa. NTSYS-pc is a system of programmes that is used to find and display structure in multivariate data. This programme can be run on an IBM compatible PC (XT or AT) computer with RAM memory capacity of 360 K. To run the programme consult the manual "NTSYS-pc, Numerical Taxonomy and Multivariate Analysis System" (Rohlf 1988).

To describe the relationship amongst taxa it is necessary to reduce dimensions of space by using cluster analysis. Cluster analysis produces a hierarchical classification of species based on a similarity matrix. An interactive file for cluster analysis and coordinates analysis based on the data matrix of the *Ledebouria* species for South Africa is used. To arrive at a phenogram, it is essential to follow a strict series of steps making use of various programmes in NTSYS-pc.

Clusters which are identical in the analyses are called "ball clusters". These would be the only clusters in a strict consensus tree between these two trees (Rohlf 1988). These are usually the most distinct clusters in a set of data.

The tree matrix is an efficient method for describing a system of nested clusters where each cluster has a corresponding level (Rohlf 1988).

The DELTA (DEscription Language for TAXonomy) programme is used for concise representation and manipulation of taxonomic descriptions. To run DELTA, an IBM compatible PC-XT or AT with at least 512K memory is needed. The format-conversion programme, CONFOR, converts the coded description into natural language and into formats required by programmes for key-generation, interactive identification, and numerical classification (Dallwitz & Paine 1986).

There are four major types of output from the DELTA-format data: the printed key, interactive key, natural language descriptions and a summary of the data. To run the programme DELTA, refer to the " User's Guide to the DELTA System" (Dallwitz and Paine 1986).

One of the major advantages of DELTA is the output of descriptions into natural language. The descriptions in chapter 12.0 are all generated by DELTA.

SUMMARY gives information on the character, type of character, number of states, distribution of states, items coded, standard deviation as well as the minimum and maximum for that character. This is a great help when two or more species are compared or differences between species studied.

INTKEY is an interactive programme for identifying a specimen by comparing its characteristics with stored descriptions of species. The INTKEY programme was used for various information retrieval computations. The most important computation is the identification of an unidentified specimen. To identify a specimen, information about the specimen to be identified, is entered, eliminating species whose descriptions do not match the description of the specimen, until only one species remains.

When comparing the data sets of the UPGMA clustering method (Unweighted pair-group method, arithmetic average) and COMPL (complete-link method) clustering methods, they show 9 ball clusters in common. These are the clusters indicating the subsections *Acutilobae*, *Erectifoliae*, *Stellatae*, *Zebrinae*, *Piliferae*, *Asperifoliae*, *Glaucæ*, *Ebractae* and *Longicollae* .

In the phenogram, (Figure 15b) labels of the objects being clustered are plotted to the right and the clustering (splitting levels) is shown along the ordinate. Each vertical line in the phenogram cut by the phenon line corresponds to a cluster (section or species) whose members are the species connected to that fragment of the phenogram (Rohlf 1975). The adequacy of a phenogram in representing taxonomic structure is indicated by a high cophenetic correlation, and if r (cophenetic correlation) = 0.8 the phenogram is satisfactory in this respect (Sneath & Sokal 1973). The closeness of fit for the cluster analysis for *Ledebouria* shows that $r = 0.81428$.

The electronic grouping of the sections in the phenogram corresponds well with intuitive grouping. In this grouping, *L. asperifolia* was placed within the section *Magnibulbae* but the globose capsule and smaller bulb places it within section *Globosae*. Initially *L. undulata* was in a group of its own based on the hysternanthus habit. It is best placed in section *Efiliferae* due to the torn leaves lacking threads and the distinct neck of the bulb.

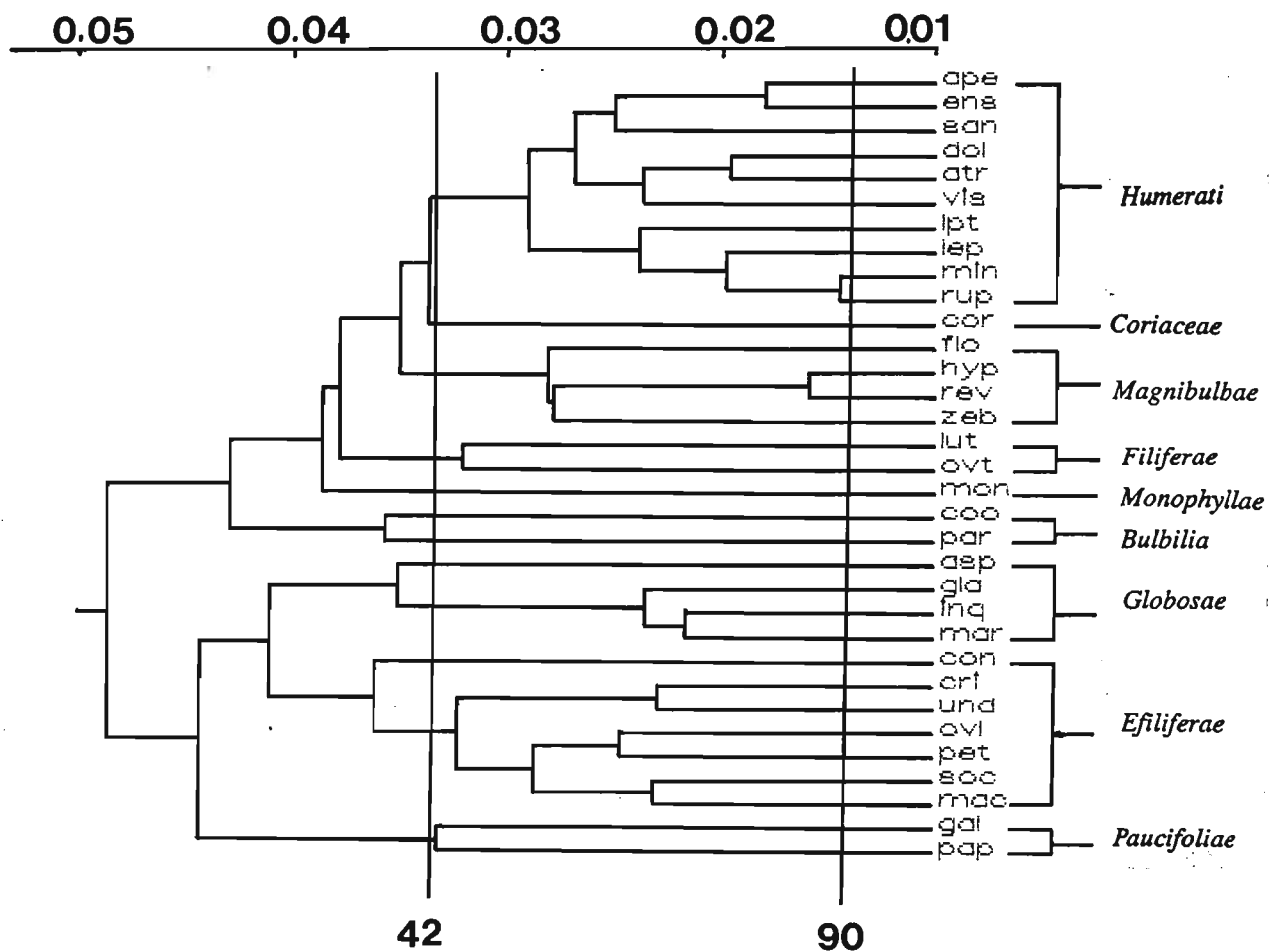
The 42 phenon connates groups (sections) affiliated at no lower than 42% on the similarity scale used in the analysis. This phenon level was chosen as it indicates the nine sections as well formed clusters.

In the phenogram two phenon lines are used. They indicate fixed levels of similarity. The first line at a similarity value of 42% indicates the 42 phenons. These are regarded as sections. They are again divided into various subsections. The area above the 90% phenon line indicates the different species.

The characters used to distinguish between sections are not influenced by the environment.

The presence of a single leaf and erect inflorescence in the monotypic (*L. monophylla*) *Monophyllae* is sufficient to distinguish it from other sections. This section shows an interesting disjunction between the main distribution area at Graskop and the limited range at Pietermaritzburg.

Phenogram from tree matrix: sahnc
 ID records:
 "Ledebouria for South Africa"
 " STAND: input=data, divide=STD, subt=YBAR, direction=C
 " SIMINT: input=sdatac, coeff=EYCLID, direction=C
 " SAHN: input=simintc, method=UPGMA, tie=WARN
 type=5, size=33 by 2, nc=0



Section *Coriaceae* has only one member, *L. coriacea*. The leathery leaves with thickened margins and the erect inflorescence with few flowers is diagnostic to section *Coriaceae*. It is postulated that *L. coriacea* grows in close packed populations to ensure pollination of the flowers resulting in a good fruit formation. *L. coriacea* is known from a single locality on the coast near Port Elizabeth.

In spite of the fact that threads in torn bulb scales and leaves are a common feature in some monocot groups, it is felt that the presence or absence of these threads in a section is stable enough to use as a distinguishing character. Section *Efiliferae* consists of members that show no threads in torn bulb scales or leaves. The small (1.0 - 1.3 mm long) globose ovary readily separates it from the section *Paucifoliae*. *L. crispa* and related *L. undulata* both have undulate spreading leaves and solitary erect inflorescences. These species grow in full sun and occupy gravely areas covered with little vegetation. Section *Efiliferae* is widely distributed with most of the species in the Cape.

The section *Paucifoliae* is the only section with members (*L. galpinii* and *L. papillata*) having less than five leaves, prominent cataphylls and a depressed-ovate ovary. This combination of characters is sufficient to render sectional status. *L. galpinii* is a Transvaal endemic and occurs around Kaapsche Hoop in short montane grassland. *L. papillata* occupies a variety of habitats in the Transvaal and eastern Cape.

There are six species (*L. cooperi*, *L. crispa*, *L. dolomiticola*, *L. galpinii*, *L. parvifolia* and *L. socialis*) with bulblets. Members of the section *Bulbilia* (*L. cooperi* and *L. parvifolia*) show a prominent cataphyll. The bulblets and the cataphyll distinguishes this section. *L. cooperi* is widely distributed in South Africa except for the Cape with only a few widely distributed localities. *L. parvifolia* is recorded from an isolated valley near Graskop in montane grassland.

Many species (16 species) show threads when bulb scales and leaves are torn. Members of section *Filiferae* (*L. luteola* and *L. ovatifolia*) reveal copious threads in the bulb scales and leaves when torn. It is postulated that these species are adapted to veld fires and herbivory in their grassland habitat. This section occupies most of the eastern half of South Africa. The distribution of *L. luteola* and *L. ovatifolia* is similar.

The combination of bulb scales without threads when torn and prominent shoulders to the apex of the ovary is sufficient to support sectional status to *Humerati*. *L. apertiflora* and related *L. ensifolia* have fusiform roots, thin cylindrical bulbs, many dry bulb scales and occur in dry lowland habitat types. These characters are adaptations to xeric conditions. Section *Humerati* is widely distributed with members of subsection *Erectifoliae* and *L. lepida* and *L. rupestris* of the subsection *Stellatae* each known from a different locality in the central and eastern Transvaal.

In section *Magnibulbae* (four species), species are grouped together on the basis of mature bulbs (flowering bulbs) 60 - 150 mm wide, inflorescence 80 - 350 -flowered and 8 - 15 mm long pedicel. This combination of characters circumscribe the section. *L. floribunda* and *L. zebrina* have inflorescences exceeding 200 mm in length carrying between 60 - 150 flowers. They occupy similar habitats in montane grassland and montane woodland. Section *Magnibulbae* is widely distributed in South Africa. *L. hypoxidioides* is the only species in this section with a restricted distribution, in and around Grahamstown.

Mature bulbs being 20 - 40 mm in diameter plus prominently globose capsules characterises section *Globosae*. Under exceptional conditions plants in other sections may have bulbs between 20 - 30 mm diameter but then the capsules are not globose. *L. marginata* shows similar thread bundles in the leaves as section *Filiferae* but does not correlate to characters such as bulb 25 - 50 mm wide, copious threads in bulb scales and capsules not globose. The thread bundles in *L. marginata* are regarded as convergent. Members of *Globosae* are widely distributed in the eastern half of South Africa with *L. inquinata* restricted to Transvaal.

11.0. PHYTOGEOGRAPHY.

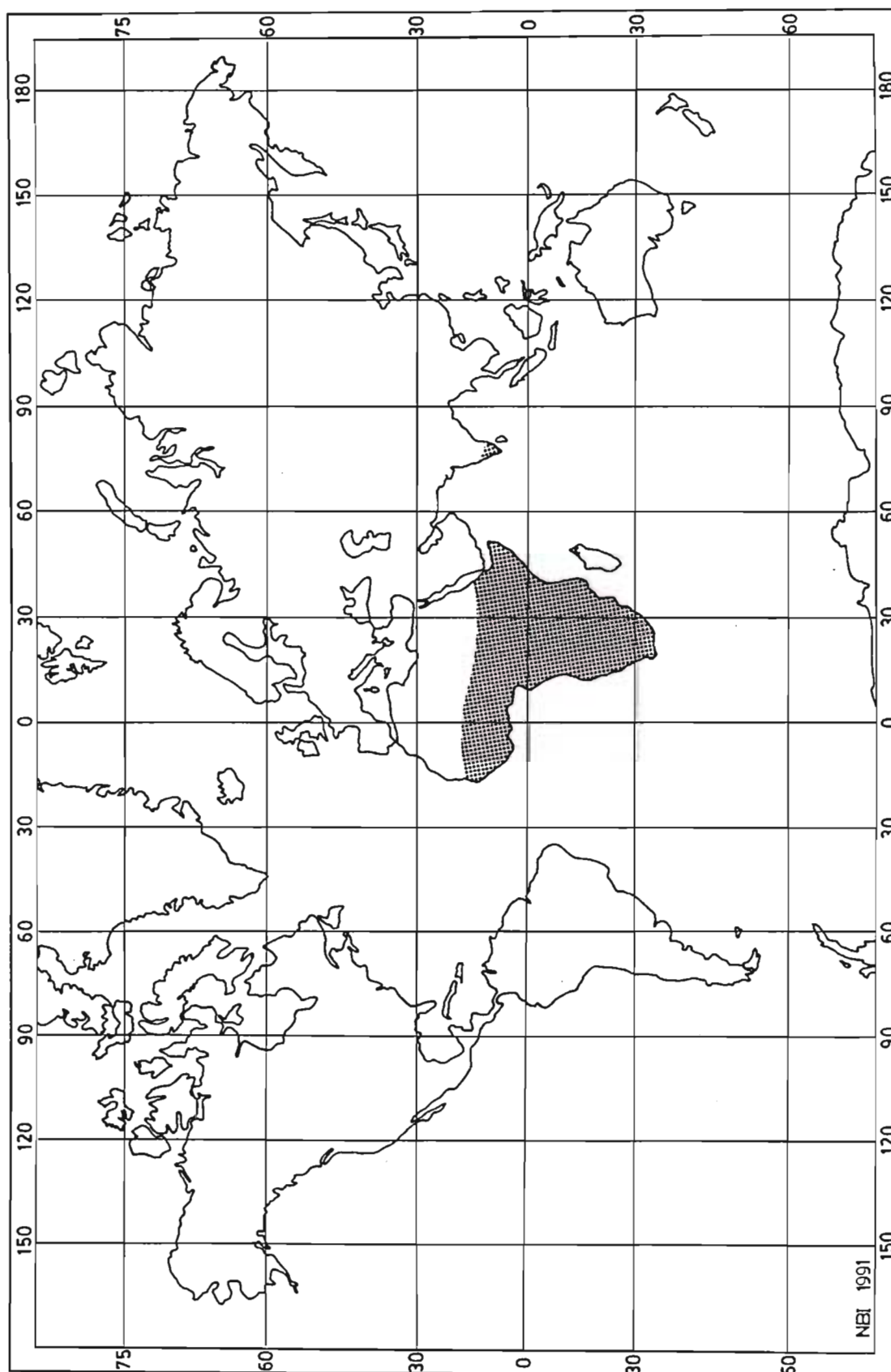
11.1 Distribution.

The genus *Ledebouria* occurs in the south-eastern part of India, the Island Nossi-Bé on the north-western coast of Madagascar (Humbert 1935) and throughout most of Africa (Map 2). *Ledebouria* appears to be absent from Australia and South America, which together with India and Africa, formed part of greater Gondwana. This is an indication that *Ledebouria* arose after the separation of Africa from the rest of the Gondwana masses at the end of the Triassic (Goldblatt 1978). In the countries north of South Africa, the largest concentration of species occurs on the mountain ranges that receive high rainfall. Isolated populations occur in drier areas in desert type vegetation of Namibia and Angola (pers. obs.).

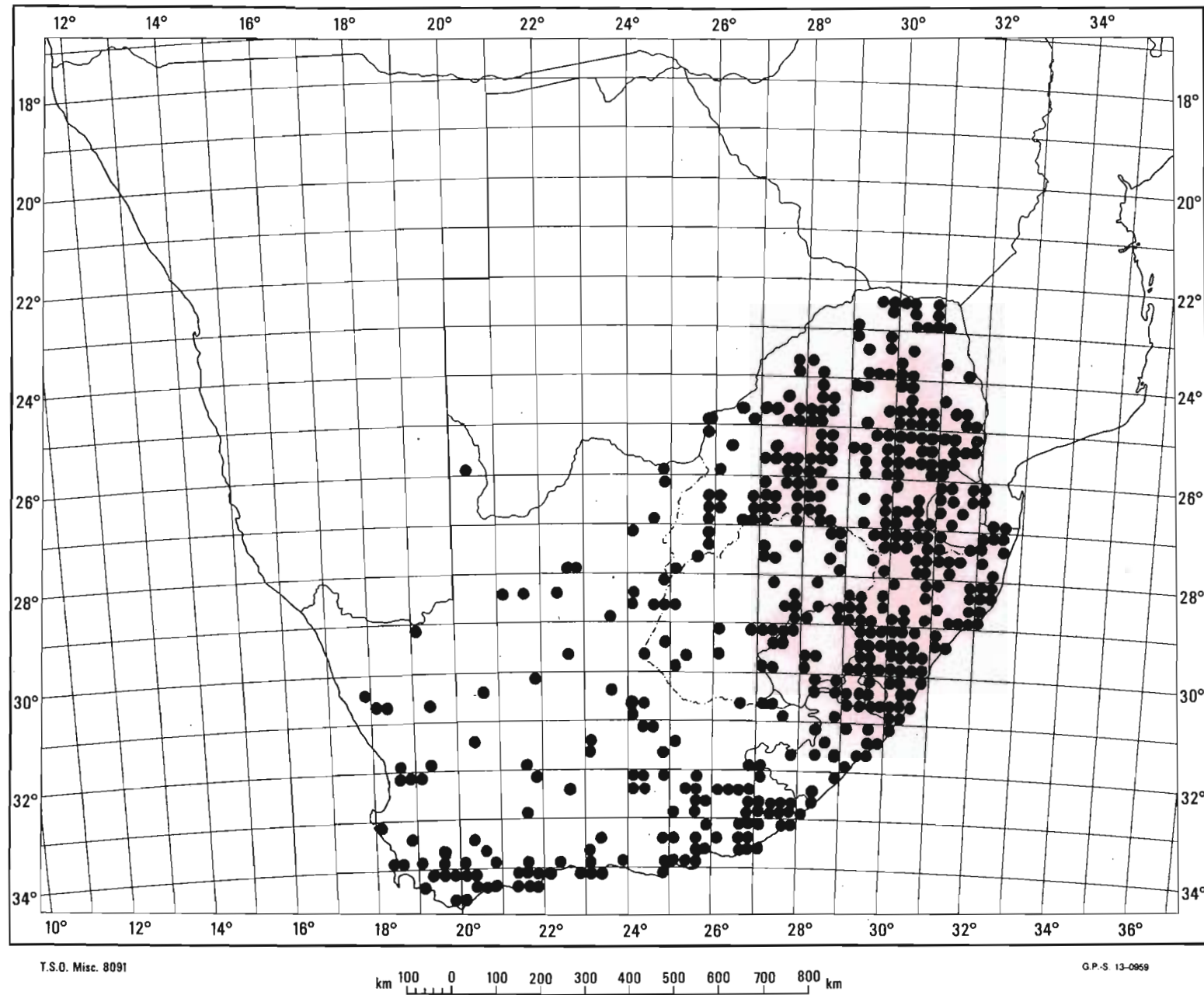
Ledebouria has its main centre of diversity in the eastern part of southern Africa, notably Natal and Transvaal. The distribution is correlated to rainfall in South Africa (Map 3).

The greatest species diversity (Map 4) occurs in the eastern and central Transvaal, 8 - 14 species per degree square down to Swaziland with 10 species in the 2631 (Mbabane) degree square to the Natal Midlands with 7 - 10 species per degree square, whereas the Natal Uplands has 7 - 9 species per degree square. Only the 3227 (Stutterheim) degree square in the Cape has a high density (9 spp.). The areas in South Africa with the lowest diversity are the Karoo, Namaqualand, northern Cape and the Kalahari. All degree squares covering this area have between one and three species. Map 4 was compiled from herbarium material and localities recorded in the literature.

Most of the sections in *Ledebouria* have a wide distribution except the monotypic sections *Coriacea* (Port Elizabeth) and *Monophyllae* (Graskop and Pietermaritzburg). Section *Erectifoliae* has three species. *L. atro-brunnea* occurs in high altitude woodland on quartzite near Rustenburg. *L. dolomiticola* also occurs in high altitude woodland but on dolomitic rock on the Strydpoort Mountain. *L. viscosa* occurs in deep red sandy soil in low altitude woodland near Thabazimbi. These three species are all endemic to the Transvaal.

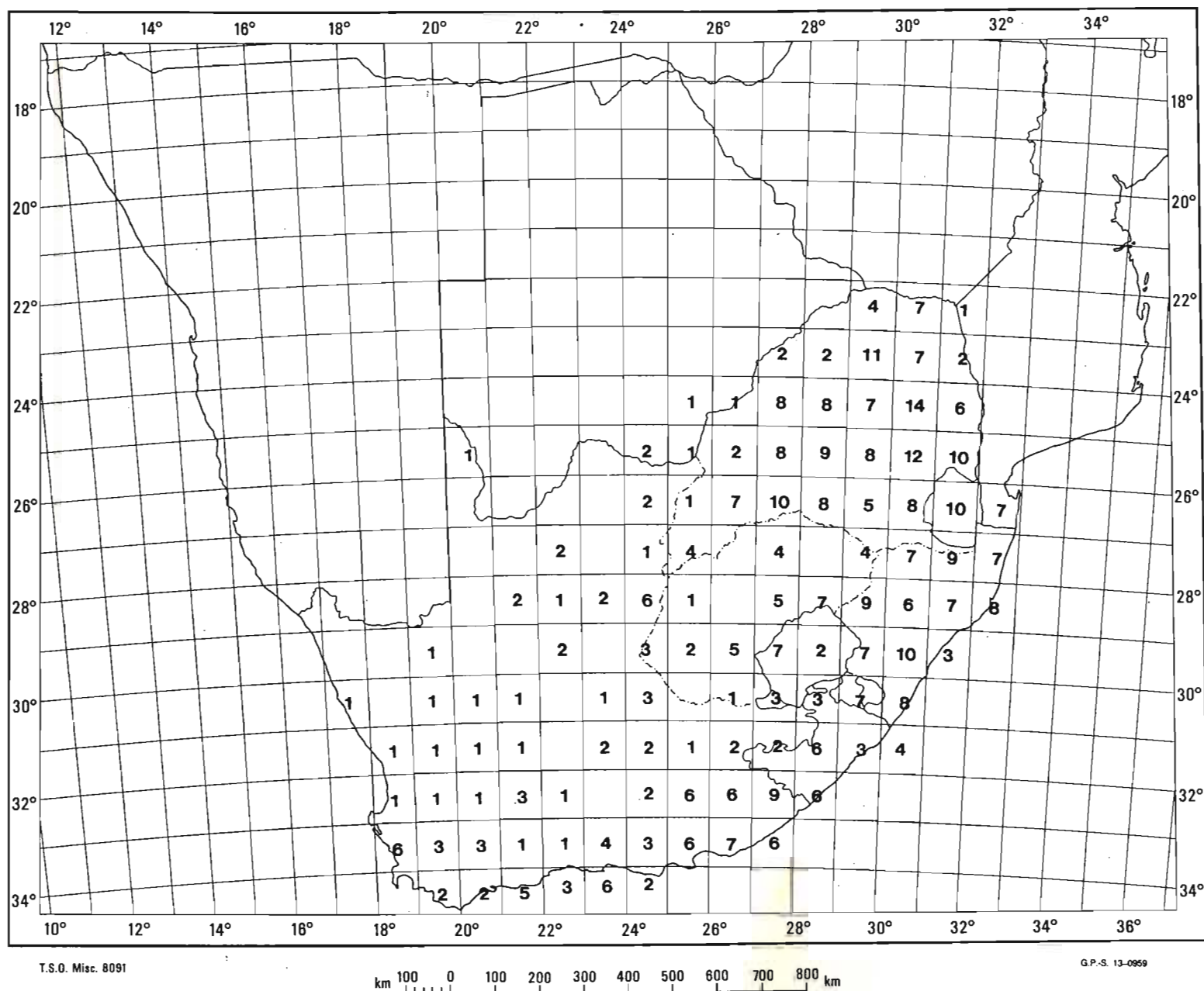


Map 3. Known distribution of the genus *Ledebouria* Roth in South Africa.



LEDEBOURIA IN SOUTH AFRICA

Map 1. Concentration of species of *Ledebouria* in geographical degree squares.



11.2. Factors promoting speciation and distribution.

Environmental fluctuations can effectively isolate populations and thereby accelerate allopatric speciation. Under favourable conditions marginal populations may be established. When conditions become severe these populations may be isolated and differentiate (Valentine 1967).

Evolution tends to accelerate in arid regions where species on the margin of their distribution range become isolated leading to specialization and eventual speciation (Stebbins 1952, Axelrod 1972).

Mountains act as refugia for many plant taxa, especially during climatic changes (Van Jaarsveld 1989). It can be hypothesized that during drier periods in the past, many *Ledebouria*, *Gasteria* Duval and *Othonna* L. species survived on mountains in the cooler and moister habitats with only a few species that could survive outside this refuge, in hotter and drier areas (Van Jaarsveld 1989). Today most *Ledebouria* species occur on mountain ranges.

12.0. TAXONOMY.

12.1. Generic description.

Ledebouria Roth in *Novae Plantarum Species* :194 (1821); Jessop in *Jl S. Afr. Bot.* 36(4): 244 (1970); Dyer in *Gen. S. Afr. Fl. Plants* 2: 937 (1983).

Scilla L. *pro parte* Baker in *Flora Cap.* 6: 478 (1896); Phillips in *Gen. S. Afr. Fl. Plants* :191 (1951).

Type: *L. hyacinthina* Roth (= *S. indica* Bak.), from India, Curtis's *Bot. Mag.* 60: t.3226 (1833).

Plants solitary or gregarious. **Roots** wiry, contractile, fleshy or fusiform. **Bulb** 10 - 200 mm diameter; sometimes necked; bulb scales brown to purple; tips truncate or elongate; basal stem occasionally present; sometimes with threads when torn; live bulb scales loosely or tightly arranged; bulblets sometimes produced; basal stem 0 - 120 mm long; cataphylls 0 - 3. **Leaves** 1 - 20; partly or fully developed at flowering; erect to adpressed, sometimes spirally twisted; sometimes petiolate; lamina linear to ovate; fleshy or leathery, green to purple with or without darker green or purple markings. **Inflorescences** 1 - 10, racemose, 4 - 150 -flowered; longer or shorter than the leaves. **Peduncle** smooth or papillate; sometimes marked. **Raceme** lax or dense; cylindric to globose. **Bracts** with or without bracteoles, 0.25 - 1.0 x 0.5 - 5.0 mm, deltate to linear. **Pedicels** spreading; 1.0 - 15.5 mm long. **Perianth** almost tubular to stellate; segments linear to oblong, green to purple sometimes with a green keel; apex acute, obtuse or sharply upward curving. **Stamens** erect or spreading, filaments white, green, pink to purple, base cylindric to slightly flattened, free or epipetalous; anthers white, yellow or violet. **Ovary** stipitate, 3- or 6-lobed, lobes variously shaped, base glabrous or papillate, distal lobes present or absent, apex of ovary tapering into the style, rectangular or raised. **Style** triangular to terete; stigma papillate. **Capsule** trilocular, cylindrical, globose or clavate. **Seed** globose, drop-shaped or disc-shaped, surface strongly wrinkled.

12.2. Key to the sections.

1. Leaf single Section **MONOPHYLLAE**
 Leaves 2 or more 2.
2. Leaves thickly leathery, not spreading,
 inflorescence few - flowered Section **CORIACEAE**
 Leaves fleshy, spreading, inflorescence dense 3.
3. Bulb neck prominent 4.
 Bulb neck absent 5.
4. Leaves without threads when torn, more than 4;
 ovary globose, 1.0 mm long Section **EFILIFERAE**
 Leaves with threads when torn, 2 - 4; ovary
 depressed-ovate, 1.5 mm long Section **PAUCIFOLIAE**
5. Cataphylls present; leaves without threads
 when torn, bulblets often present Section **BULBILIA**
 Cataphylls absent; leaves with threads when
 torn 6.
6. Bulb scales and leaves with copious threads
 when torn Section **FILIFERAE**
 Bulb scales and leaves lack copious threads
 when torn (although a few are often
 present) 7.
7. Bulb scales lacking threads when torn; apex of
 ovary forming prominent shoulders
 Section **HUMERATI**
 Bulb scales producing some threads when torn;
 apex of ovary lacks prominent shoulders 8.

-
8. Mature bulbs 60 - 150 mm wide; raceme cylindric;
capsules variously shaped but not globose
..... Section **MAGNIBULBAE**
- Mature bulbs 20 - 60 mm wide; raceme not
cylindric; capsules globose Section **GLOBOSAE**

12.3. Key to the species.

1. Bulb epigeal 2.
Bulb semi-epigeal 3.
Bulb hypogeal 4.
2. Inflorescence erect; bracts fleshy; apex of
ovary not forming shoulders; seed black;
plants gregarious; eastern Cape 30. *L. socialis*
- Inflorescences flaccid; bracts membranous;
ovary shoulders present; seed brown;
plants solitary; north-eastern Transvaal 4. *L. dolomiticola*
3. Inflorescence erect; bulb scales attenuate,
dead bulb scales brown; ovary shoulders
tapering into the style; north-eastern
Transvaal 26. *L. crispa*
- Inflorescences flaccid; bulb scales truncate,
dead bulb scales purplish-brown; ovary
shoulders raised; eastern Cape 25. *L. concolor*
4. Inflorescences erect 5.
Inflorescences flaccid 15.
5. Ovary 3-lobed 6.
Ovary 6-lobed 8.

-
6. Bulb scales truncate, with threads when torn;
 leaf solitary, margin discoloured; rachis
 ridged; base of peduncle compressed;
 eastern Transvaal 18. *L. monophylla*
- Bulb scales attenuate, without threads when
 torn; leaves more than 1, margin concolorous;
 rachis smooth; base of peduncle terete 7.
7. Upper leaf surface smooth; leaves without
 threads when torn, margin smooth; bulb
 ovoid, bulblets absent; Cape 28. *L. ovalifolia*
- Upper leaf surface hairy; leaves with
 threads when torn, margin ciliate; bulb
 obovoid, bulblets present; eastern
 Transvaal 20. *L. parvifolia*
8. Petiole present 33. *L. papillata*
 Petiole absent 9.
9. Bulb scales with threads when torn 10.
 Bulb scales without threads when torn 12.
10. Upper leaf surface smooth; leaves with threads
 when torn, margin discoloured, texture
 leathery; seed brown; widespread 11.
- Upper leaf surface hairy; leaves without
 threads when torn, margin concolorous,
 texture fleshy; seed black; north-
 western Transvaal 8. *L. lepida*
11. Rachis smooth; bracts fleshy; bulb scales
 attenuate; apex of ovary with rounded
 shoulders; eastern Cape 11. *L. coriacea*
- Rachis ridged; bracts membranous; bulb scales
 truncate; ovary shoulders absent;
 Transvaal and northern Cape 22. *L. glauca*
-

-
12. Rachis smooth; inflorescences longer than
leaves; tepals not cucullate 13.
- Rachis ridged; inflorescences shorter than
leaves; tepals cucullate 14.
13. Upper leaf surface viscid; live bulb scales
tightly arranged; bracts membranous; ovary
shoulders absent; north-western Transvaal 6. *L. viscosa*
- Upper leaf surface not viscid; live bulb scales
loose; bracts fleshy; ovary shoulders
rounded; widespread 3. *L. sandersonii*
14. Leaves fully developed at anthesis, with threads
when torn; bulb scales attenuate; live
bulb scales tightly arranged; bracts
membranous; widespread 12. *L. floribunda*
- Leaves absent at anthesis, without threads
when torn; bulb scales truncate; live
bulb scales loosely arranged; bracts fleshy;
Cape 27. *L. undulata*
15. Petiole present; eastern Transvaal 16.
- Petiole absent; not restricted to eastern
Transvaal 17.
16. Rachis smooth; upper leaf surface hairy,
without threads when torn; seed brown 10. *L. rupestris*
- Rachis ridged; upper leaf surface smooth,
with threads when torn; seed
yellowish-brown 29. *L. petiolata*
17. Ovary 3-lobed 18.
- Ovary 6-lobed 19.
-

-
18. Bulb scales truncate, with threads when torn;
upper leaf surface with lacunae; rachis
ridged; ovary shoulders absent; Kaapsche
Hoop area 32. *L. galpinii*
Bulb scales attenuate, without threads when torn;
upper leaf surface smooth; rachis smooth;
ovary shoulders rounded; Cape 28. *L. ovalifolia*
19. Bulb scales with threads when torn 20.
Bulb scales without threads when torn 28.
20. Leaves spirally twisted 21.
Leaves straight 22.
21. Ovary shoulders present; bulb obovoid; leaves
leathery, difficult to tear, margin
discolorous; widespread 24. *L. marginata*
Ovary shoulders absent; bulb cylindrical; leaves
fleshy, easily torn, margin concolorous;
north-western Transvaal 5. *L. atro-brunnea*
22. Leaves hairy, margin ciliate; bracts fleshy;
tepals lanceolate; eastern Cape 13. *L. hypoxidioides*
Leaves glabrous, margin smooth; bracts
membranous; tepals oblong; widespread 23.
23. Leaves partly emerged at anthesis24.
Leaves fully developed at anthesis 26.
24. Bulb scales truncate, live bulb scales loosely
arranged; leaves glossy, lower surface
monochromatic, base canaliculate 17. *L. ovatifolia*
Bulb scales attenuate; live bulb scales tightly
arranged; leaves lustreless, lower surface
dichromatic, base flat25.
-

-
25. Ovary shoulders present; bulb ovoid, 30 - 35 mm
diameter; bulb scales with prominent purple
blotches; leaf margin discolourous; seed
brown 23. *L. inquinata*
- Ovary shoulders absent; bulb obovoid, 100 - 150 mm
diameter; bulb scales without purple blotches;
leaf margin concolorous; seed black 15. *L. zebrina*
26. Seed black; tepals not cucullate; pedicels
green; perianth predominantly green 15. *L. zebrina*
- Seed brown; tepals cucullate; pedicel pink;
perianth pink to purple 27.
27. Bulb ovoid; leaves fleshy, glossy, margin
concolorous, venation obscure 14. *L. revoluta*
- Bulb obovoid; leaves leathery, lustreless, margin
discolorous, venation prominent 17. *L. luteola*
28. Leaves with threads when torn; rachis ridged 29.
- Leaves without threads when torn; rachis smooth 31.
29. Leaves spirally twisted, partly emerged at
anthesis, margin concolorous; tepals
linear; seed black 7. *L. leptophylla*
- Leaves straight, fully developed at anthesis,
margin discolourous; tepals oblong; seed brown 30.
30. Ovary shoulders tapering into the style; bulb
ovoid; leaf margin smooth; venation
obscure 12. *L. floribunda*
- Ovary shoulders raised; bulb subglobose; leaf
margin papillate; venation prominent 21. *L. asperifolia*
31. Bracts fleshy 32.
- Bracts membranous 36.
-

-
32. Ovary shoulders present, base of ovary lobes
 smooth 33.
 Ovary shoulders absent, base of ovary lobes
 papillate 35.
33. Ovary shoulders truncate; leaf apex obtuse,
 venation prominent; perianth stellate 31. *L. macowanii*
 Ovary shoulders tapering into the style; leaf
 apex acute, venation obscure; perianth
 recurved 34.
34. Live bulb scales loosely arranged; dead bulb scales
 brown; lower leaf surface monochromatic;
 inflorescences longer than leaves 3. *L. sandersonii*
 Live bulb scales tightly arranged; dead
 bulb scales purplish-brown; lower leaf surface
 dichromatic; inflorescences same length
 as leaves 1. *L. apertiflora*
35. Leaves linear to narrowly elliptic; perianth
 stellate 9. *L. minima*
 Leaves lanceolate to oblong; perianth sharply
 reflexed 2. *L. ensifolia*
36. Ovary shoulders present; bulb obovoid, live
 bulb scales tightly arranged, bulblets
 absent; leaves elliptic 1. *L. apertiflora*
 Ovary shoulders absent; bulb subglobose,
 live bulb scales loose, bulblets present;
 leaves lanceolate 19. *L. cooperi*
-

12.4. Species descriptions.

Section **HUMERATI** *S. Venter*

Section **Humerati** *S. Venter*, sect. nov., squamis efibrosis; ovarii lobis ad apicem prominenter rotundatis.

Species typica: *Ledebouria apertiflora* (Bak.) Jessop.

Typus: Saund. Ref. Bot. 1: t.19., "Cape, *Cooper s.n.*" (1868).

Species: *L. apertiflora* (Bak.) Jessop, *L. ensifolia* (Eckl.) *S. Venter*, *L. sandersonii* (Bak.) *S. Venter*, *L. dolomiticola* *S. Venter*, *L. atro-brunnea* *S. Venter*, *L. viscosa* Jessop, *L. leptophylla* (Bak.) *S. Venter*, *L. lepida* (N.E. Br.) *S. Venter*, *L. minima* (Bak.) *S. Venter* and *L. rupestris* (Van der Merwe) *S. Venter*.

Plants solitary. **Bulbscales** without threads when torn. **Leaves** erect to spreading. **Ovary** with prominent shoulders.

Subsectio **Acutilobae** *S. Venter*, subsect. nov., tepalorum apicibussigillatim acutis.

Species typica: *L. ensifolia* (Eckl.) *S. Venter*.

Species: *L. apertiflora* (Bak.) Jessop, *L. ensifolia* (Eckl.) *S. Venter*, *L. sandersonii* (Bak.) *S. Venter*.

Plant without threads when torn. **Bracts** fleshy. **Tepal apices** markedly acute.

1. *LEDEBOURIA APERTIFLORA* (Bak.) Jessop

Ledebouria apertiflora (Bak.) Jessop in Jl S. Afr. Bot. 36(4): 254 (1970).

Drimia apertiflora Bak. in Saund. Ref. Bot. 1: t.19 (1868).

Type: Saund. Ref. Bot. 1: t.19 (1968)!. (lecto. selected here - Art. 9.3, Greuter *et al.* 1988).

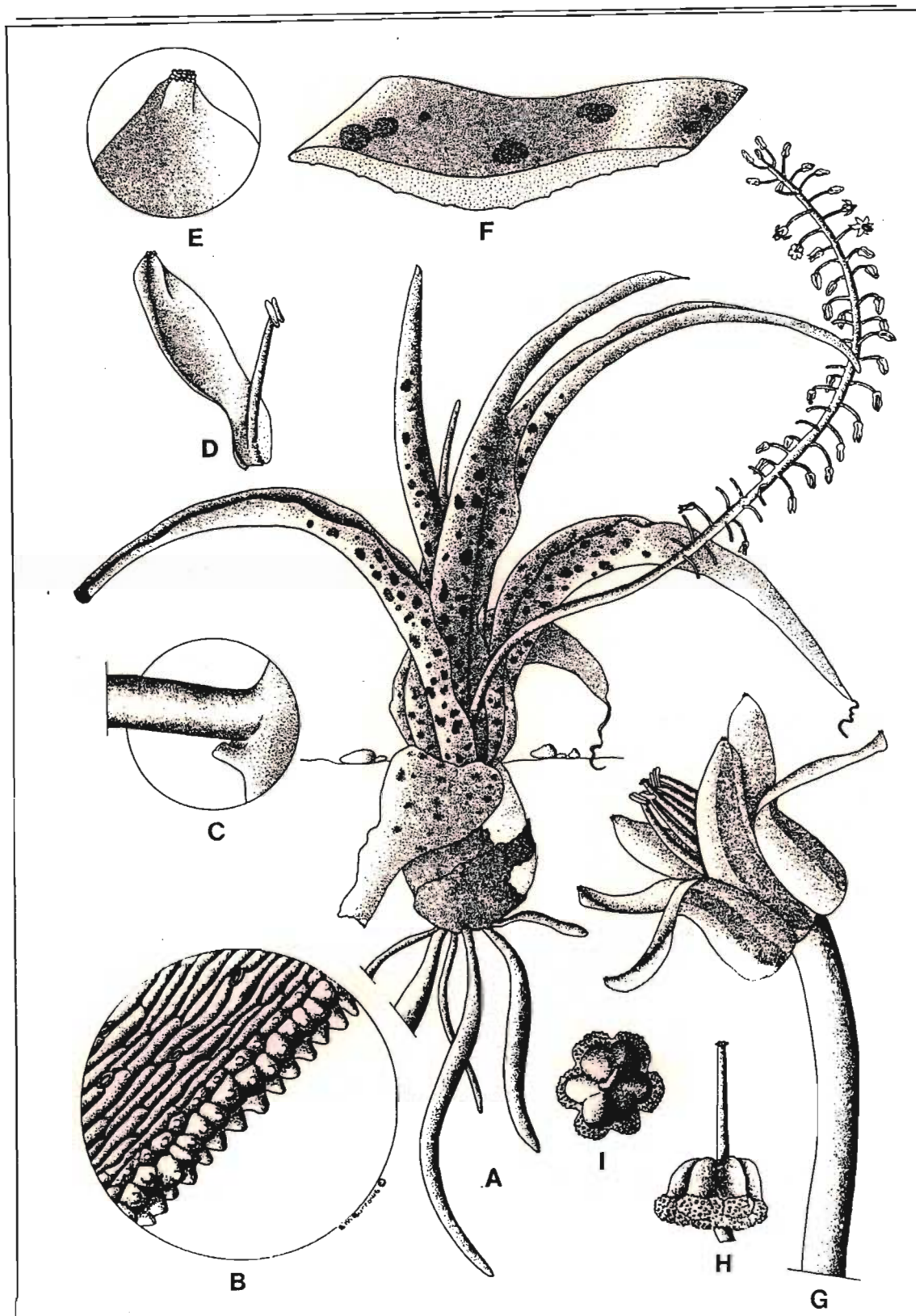


Figure 16. Illustration of *L. apertiflora* (Bak.) Jessop. A, habit X 1. B, lamina margin X 300. C, bract X 10. D, tepal with stamen X 10. E, apex of tepal X 20. F, section through lamina X 5. G, flower X 10. H, lateral view of ovary X 10 and I, dorsal view of ovary X 10. All from Venter *s.n.*

Scilla lorata Bak. in Saund. Ref. Bot. 3(Append.): 14 (1870).

Iconotype: As for *Drimia apertiflora*.

Scilla linearifolia Bak. in Saund. Ref. Bot. 3: t.184 (1870).

Iconotype: Saund. Ref. Bot. 3: t.184. (1870)!

Scilla apertiflora (Bak.) C.A. Sm. in Kew Bull. :250 (1930).

Type: As for *Drimia apertiflora*.

Plants solitary. **Bulb** hypogeal, 40 - 50 x 40 - 50 mm, $\pm$ obovoid; dead bulb scales purplish-brown, apices attenuate, live bulb scales fleshy, tightly arranged, without threads when torn, white inside. **Leaves** fully developed at anthesis, 5 - 10, spreading, lanceolate, 100 - 225 x 7 - 25 mm, without threads when torn, fleshy, surfaces maculate to fasciate, green with darker green or purple spots and blotches in the lower part, venation obscure; margins smooth but sometimes undulate; leaf base canaliculate; apex acute. **Inflorescences** 2, dense, cylindric, 50 - 100 x 15 - 20 mm, flaccid, 30 - 70-flowered, as long or longer than the leaves; scape basally terete, green-spotted, dark green to purple in lower part, glabrous; rachis smooth, scape smooth, 80 - 225 mm long. **Bracts** semi - fleshy to membranous, 0.5 x 0.2 mm, deltoid to linear, green, bracteole sometimes absent. **Pedicels** spreading, 6 - 12 mm long, pink or green. **Perianth** 5 - 6 mm long, tepals recurved, equal, oblong, 6 x 1.5 mm, apex acute, cucullate, pink to purple with a green keel. **Stamens** erect, 5.0 - 5.5 mm long, filaments maroon to pink, epitepalous; anthers 1 mm long, yellow. **Ovary** ovoid, 6 -lobed, 1 x 1.2 mm, lobes obtusely deltate, glabrous, apex tapering into the style. **Style** 1.5 mm, terete, glabrous, white to purple; stigma below the anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, clavate; base truncate. **Seed** drop-shaped, $\pm$ 3 mm long, strongly wrinkled, brown. **Chromosome number** $2n = 26$. (Figure 16).

L. apertiflora differs from *L. cooperi* in the absence of bulblets and bracteoles; acute tepal apices (Figure 16E), style 1.5 mm long and ovary 1.2 mm wide. *L. revoluta* differs from *L. apertiflora* in having threads in the leaves and bulb scales when torn, its ridged rachis, wider tepals ($\pm$ 3 mm) with obtuse apices, longer style (6 mm) and ellipsoidal ovary.

Specific epithet etymology.

Refers to the open flowers.

Variation.

A variable species without fixed bulbshape which is influenced by the soil and rainfall. Plants of *L. apertiflora* can be placed into two groups according to the lengthened, closely packed or open and spreading, hardened dead bulb scale apices (Map 5). In map 5 the area indicated by black dots shows the distribution of plants with the truncate bulb scales. The area indicated by black squares shows the recorded distribution of plants with dead bulb scales much lengthened and hardened. After the leaves have died back, a rosette of dead bulb scales protrudes up to 20 mm above the soil surface.

Leaf shape is polymorphic. Linear to linear-lanceolate leaved plants were placed in *Scilla linearifolia* (Baker 1870a). The colour of the leaves varies from light green (Jozini, northern Natal) to glaucous green (Messina, northern Transvaal) and may have or lack markings. Populations in the Lebombo Mountains of northern Natal and Swaziland tend to have strongly undulate leaf margins.

Flower colour is also variable but predominantly pink to purple with a green keel. Populations in northern Swaziland, eastern and northern Transvaal tend towards green with only traces of pink at the base of the tepals. Whitish-green flowers are recorded from the Pongola Area (*Nel 103*).

Jessop (1970) failed to define this species accurately resulting in specimens of *L. cooperi* (Hook.f.) Jessop and *L. revoluta* (L.f.) Jessop being placed in *L. apertiflora*.

Flowering period

From October to December.

Map 5. Pictorialized map of *L. apertiflora* with the known distribution of the tapered and truncate bulb scaled plants.

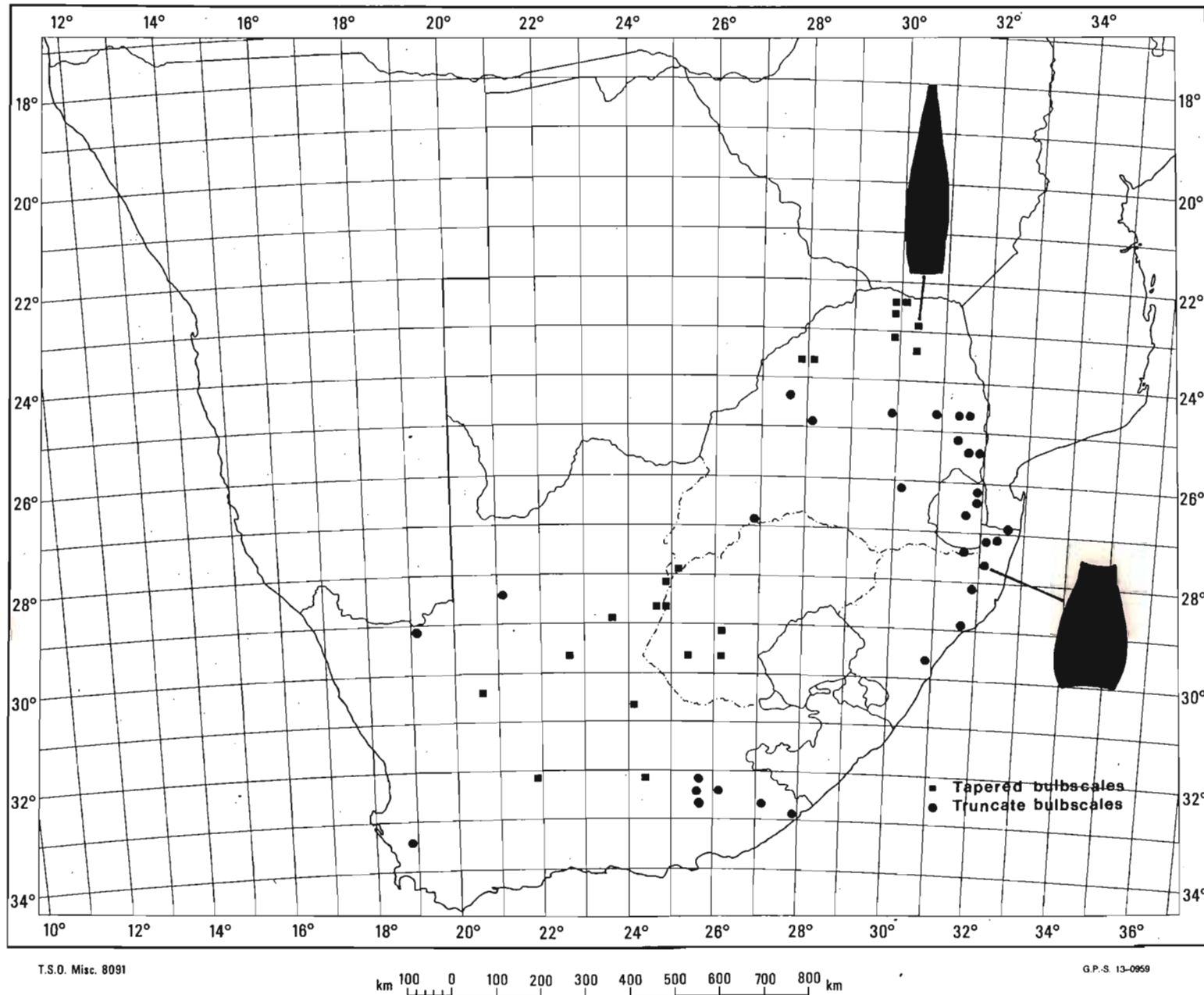
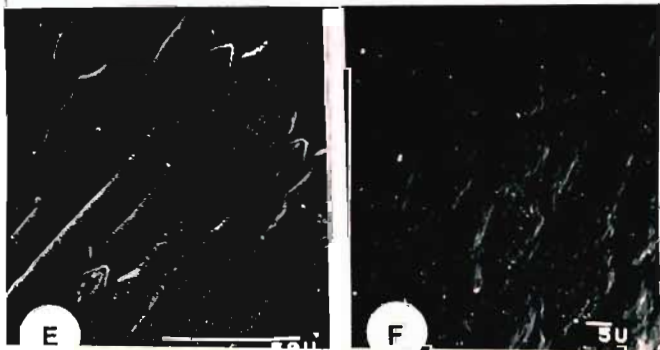
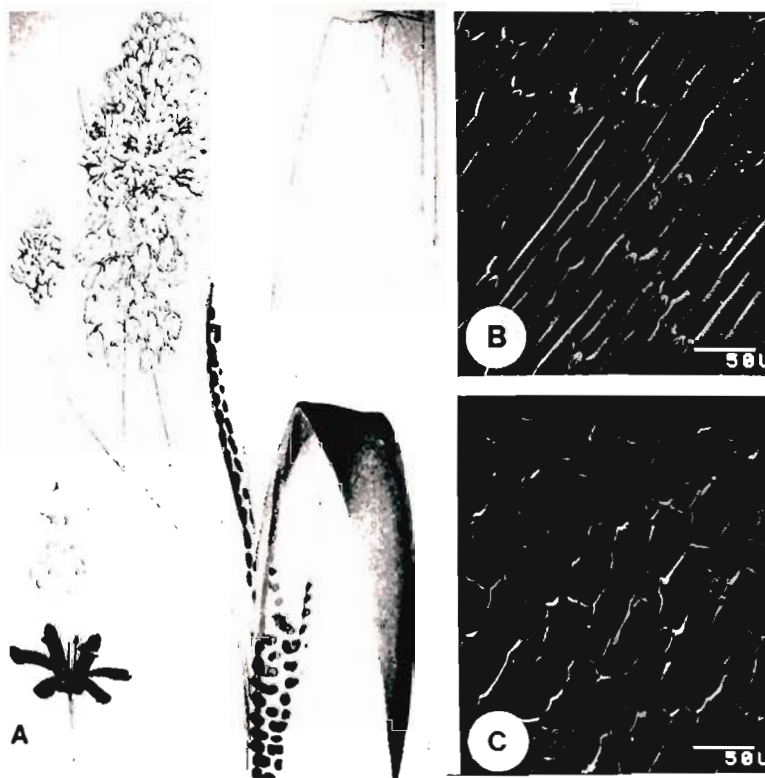


Figure 17. A, lectotype of *L. apertiflora* (Bak.) Jessop under *Drimia apertiflora* Bak. in Saunders Refugium Botanicum 1 : t. 19 (1868); B, SEM micrograph of the adaxial lamina surface. C, SEM micrograph of the abaxial lamina surface. D, habitat near Phalaborwa, north-eastern Transvaal. The vegetation consists of closed deciduous tall *Combretum apiculatum* - *C. imberbe* - *Acacia nigrescens* woodland; E, SEM micrograph of stomata and F, SEM micrograph of the fine texture of the testa. B - C and E - F from Venter *s.n.*



Distribution (Map 5).

Southern Cape to Zimbabwe border excluding Transkei and Lesotho. Suitable habitats exist in Transkei and the species may have been overlooked. *L. apertiflora* is not a plant of montane grassland and is unlikely to occur in Lesotho. It is restricted to the drier woodland areas with sandy soil.

Habitat

L. apertiflora is recorded from areas where the underlying rock strata is either granite or gneiss (Transvaal), limestone (Cape) or rhyolite from the Jozini Formation, Lebombo Group and feldspathic sandstone from the Mlazi Formation, Natal Group (SACS 1980).

Soils are mostly sandy to a rocky sandy loam or sometimes clay loam. Some of the Orange Free State populations occur on brackish clay loam near Fouresmith. On the floodplains below the Lebombo Mountains, some plants were found at Mkuze, growing in yellow-brown clay.

In the Transvaal, *L. apertiflora* is associated with woodland (Figure 17D) whereas in the Cape, it is mostly associated with shrubland.

Dense populations of *L. apertiflora* rarely occur. The only dense populations encountered during the survey are on the foothills of the Blouberg in northern Transvaal. Here the plants grow as scattered individuals. In some areas plants are heavily grazed.

Historical background

Baker, in April 1868, described *L. apertiflora* as *Drimia apertiflora* from a living plant that flowered in 1868 with Mr. Wilson Saunders at Reigate. Two years later, Baker placed *D. apertiflora* into the genus *Scilla* under the name *S. lorata*, discarding the earlier specific epithet, stating "Placing this in *Scilla*, the specific name first given is appropriate no longer" (Baker 1870d; Smith 1930).

Specimens examined

VENDA. - 2230 (Messina): Thate Vondo (-CD), *Venter 12,242* (UNIN).

TRANSVAAL. - 2229 (Waterpoort): Messina, farm Fontainbleau, *Venter 12,824* (UNIN); Mopane (-DB), *Strey 3475* (PRE). 2230 (Messina): Messina (-AC), *Moss & Rogers 92* and *208* (J). 2327 (Ellisras): Villa Nora (-DB), *Smook 4228* (PRE). 2328 (Baltimore): Villa Nora, farm Wellust (-CA), *Schmidt 95* (PRU). 2329 (Pietersburg): Louis Trichardt (-BB), *Martley s.n.* sub BOL 22,502 (BOL). 2330 (Tzaneen): Giyani, Middle Letaba Dam (-AD), *Venter 13,065* (UNIN). 2427 (Thabazimbi): Thabazimbi, Krantzberg (-BC), *Van der Merwe 2024* (PRE). 2428 (Nylstroom): Warmbaths (-CC), *Leendertz 6651* (PRE). 2429 (Zebediela): Lulu Mountains, farm Parys (-DB), *Barnard & Mogg 703* (PRE). 2430 (Pilgrim's Rest): Klaserie, *Venter 12,686* and *12,708* (UNIN). 2431 (Acornhoek): Timbavati Game Reserve (-CB), *Zimbatis 1515* (PRE); Manyeleti Game Reserve, (-DA), *Bredenkamp 1187* (PRE). 2531 (Komatipoort): Kruger National Park, Skipberg (-AB), *Van der Schyff 3214* (NPB); Malelane (-BC), *Lang s.n.* sub PRE 30,410 (PRE); Komatipoort (-BD), *Moss & Rogers 540* (J), *Rogers 22,210* (J); Kruger National Park, Randspruit, *Van Wyk 4803* (NPB). 2626 (Klerksdorp): Klerksdorp, farm Drooge Spruit (-DD), *Ubbink 706* (PUC). 2630 (Carolina): Carolina (-AA), *Moss & Rogers 1375* (J). 2725 (Bloemhof): Christiana, Kameelpan (-CC), *Theron 5477* (PRE).

ORANGE FREE STATE. - 2925 (Jagersfontein): Fauresmith (-CB), *Verdoorn 883* (PRE). 2926 (Bloemfontein): Bloemfontein (-AA), *Smith 8751B* (PRE); Griqualand West, Mostertshoek (-CA), *Acocks H993* (PRE).

SWAZILAND. - 2631 (Mbabane): Stegi (-BD), *Compton 31,216* (NBG), Palata, *Compton 31,216A* (PRE); Bulunga Poort (-DA), *Compton 32,375* (NBG), *Karsten s.n.* sub PRE 703,802 (PRE). 2632 (Bela Vista): Nkumbane Valley (-AA), *Culverwell 253* (PRE); Abercorn Drift (-CC), *Moll & Pooley 4182* (NH). 2732 (Ubombu): Ingwavuma Poort (-AA), *Compton 29,817* (NBG).

NATAL. - 2731 (Louwsburg): Pongola Plaas (-BC), *Nel 103* (PRE); Jozini Dam (-BD), *Strey 5346* (NH), *Strey & Moll 3649* (PRE), *Scott-Smith 105* (NU). 2732 (Ubombu): Ingwavuma Poort (-AA), *Van der Merwe 2732* (PRE), *Compton 29,460* (PRE); Ndumu Game Reserve (-AB), *Pooley 669* (NU); Mkuze Game Reserve (-CA), *Goodman 793* (NH). 2831 (Nkandla): Hlabisa (-BB), *Harrison 231* (NH); Mtunzini, Umhlatuzi Flats (-DC), *Venter 2564* (BLFU), Umhlatuzi Bridge, *Lawn 1862* (NH). 2930 (Pietermaritzburg): Inanda (-DB), *Wood 1208* (NBG).

CAPE. - 2821 (Upington): Upington, The Halt (-AC), *Glover s.n.* sub BOL 22,500 (BOL). - 2823 (Griekwastad): Campbell (-DC), *Power s.n.* sub GRA A7422 (GRA). 2824 (Kimberley): Warrenton (-BB), *Adams 212* (BOL); Barkley West (-DA), *Acocks 1466* (PRE); Kimberley (-DB), *Oliver 127* (NBG), *Wilman s.n.* sub BOL 13,939 (BOL), Kimberley, Platrand, *Brueckner 920* (PRE). 2919 (Pofadder): Pella (-AA), *Pearson 3596* (BOL). 2922 (Prieska): Prieska (-DA), *Bryant J173* (STE), *Moss 10,857* (J), *Acocks 2548* (PRE). 3020 (Brandvlei): Brandvlei (-BC), *Frandsen s.n.* sub NBG 142,872 (NBG). 3024 (De Aar): De Aar (-CA), *Moss 10,851* (J), *Purcell s.n.* sub BOL 50,892 (BOL). 3221 (Merweville): Beaufort West, Layton (-BB), *Shearing 1142* and *1174* (PRE). 3224 (Graaff Reinet): Karoo National Park (-AB), *Palmer 1104* (PRE). 3225 (Somerset East): Cradock (-BA), *Zietsman 1292* (PRE); Mortimer (-BC), *Kersit 9306* (BOL); Somerset East (-DA), *Barker 9178* (NBG). 3226 (Fort Beaufort): Glenthorne (-AC), *Acocks 16,273* (PRE). 3227 (Stutterheim): Keiskamma Hoek, Red Hill (-CA), *Steyner 59* (GRA), Hogsback, *Grant 3006* (PRE); Kubusie Valley (-DD), *Wehmeyer 9* (PRE). 3318 (Cape Town): Riebeeck West (-BD), *Van der Merwe 1745* (PRE).

2. *LEDEBOURIA ENSIFOLIA* (Eckl.) S. Venter

Ledebouria ensifolia (Eckl.) S. Venter, comb. nov.

Type: As for *Drimia ensifolia*.

Drimia ensifolia Eckl. in S. Afr. Quart. J. 1: 364 (1830).

Type: CAPE - District Uitenhage, Zwartkops River, *Zeyher 10* (K!, lecto. selected here; PRE!, photo.).

Scilla ensifolia (Eckl.) Britten in Journ. Bot. 46: 201 (1908).

Type: As for *D. ensifolia*.

Drimia ludwigii Miq. in Bull. Sc. Phys. Neerl. :39 (1839).

Type: CAPE - Cap B. Spei, *Ecklon & Zeyher 1064* (U, holo.; GRA!; PRE!).

Idothea (?) *ludwigii* Kunth in Enum. Pl. 4: 681 (1843).

Type: As for *Drimia ludwigii*.

Scilla prasina Bak. in Saund. Ref. Bot. 3(App.): 10 (1870).

Type: CAPE - Kaffirland, *Gill s.n.* (K!, holo.; PRE!, photo.).

Scilla ludwigii Bak. in Saund. Ref. Bot. 3(App.): 9 (1870).

Type: CAPE - Cap B. Spei, *Zeyher 4262* (K!, holo.; PRE!, iso.).

Scilla pusilla Bak. in J. Bot., Lond. 5: 183 (1876).

Type: Transkei - Bazeia, *Bauer 293* (K!, holo.; BOL!, drawing; PRE!, photo.).

Scilla ecklonii Bak. in Bot. Jahrb. 15(35): 7 (1892).

Type: Cape, Tambukiland, mountains between Silo and Windvogelberg, *Ecklon & Zeyher No. 12* (B!, holo.).

Plants solitary. **Bulbs** hypogeal, 40 - 60 x 20 - 30 mm, cylindrical; dead bulb scales hard, dark brown to purplish-brown, apices attenuate, live bulb scales membranous, tightly arranged, without threads when torn, white inside. **Leaves** fully developed at anthesis, 5 - 10, spreading, narrowly ovate to ensiform, 80 - 150 x 15 - 40 mm, without threads when torn, fleshy, surfaces dull glaucous green, adaxial surface without markings or with darker green or purple blotches, abaxial surface without markings, venation obscure; margin smooth; leafbase canaliculate; apex obtuse to acute. **Inflorescences** 1 - 3, dense, cylindric, 50 - 120 x 10 - 20 mm, flaccid, 30 - 100 -flowered, longer than the leaves; scape terete at base, green to brownish-green, glabrous; rachis smooth, scape smooth, 50 - 200 mm long. **Bracts** fleshy, 1 x 1 mm, deltoid, green, without bracteoles. **Pedicels** spreading, 3 - 4 mm long, green. **Perianth** 3 mm long, tepals sharply reflexed, subequal, oblong, 3 x 1.5 mm, apex acute, green to pink with a dull green keel. **Stamens** erect, 3 mm long, filaments pink, epitepalous; anthers 1 mm long, yellow. **Ovary** ellipsoidal, 6 -lobed, 1.0 x 2.5 mm, lobes narrowly transversely oblong, apex shoulders rectangular, base of lobes papillate. **Style** 1.5 mm long, triangular, glabrous, purple; stigma equal height to anthers; stipe 0.5 x 1.0 mm. **Capsule** 3 - lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 3 - 5 mm long, surface strongly wrinkled, brown. **Chromosome number** $2n = 30$. (Figure 18).

L. ensifolia is closely related to *L. apertiflora* sharing fusiform roots, dark dry bulb scales, acute tepals and the apex of the ovary with prominent shoulders. *L. ensifolia* differs from *L. apertiflora* in the cylindrical bulbs, ensiform leaves and inflorescence which are longer than the leaves.

Specific epithet etymology.

Refers to the sword-shaped leaves.

Flowering time

From November to February.

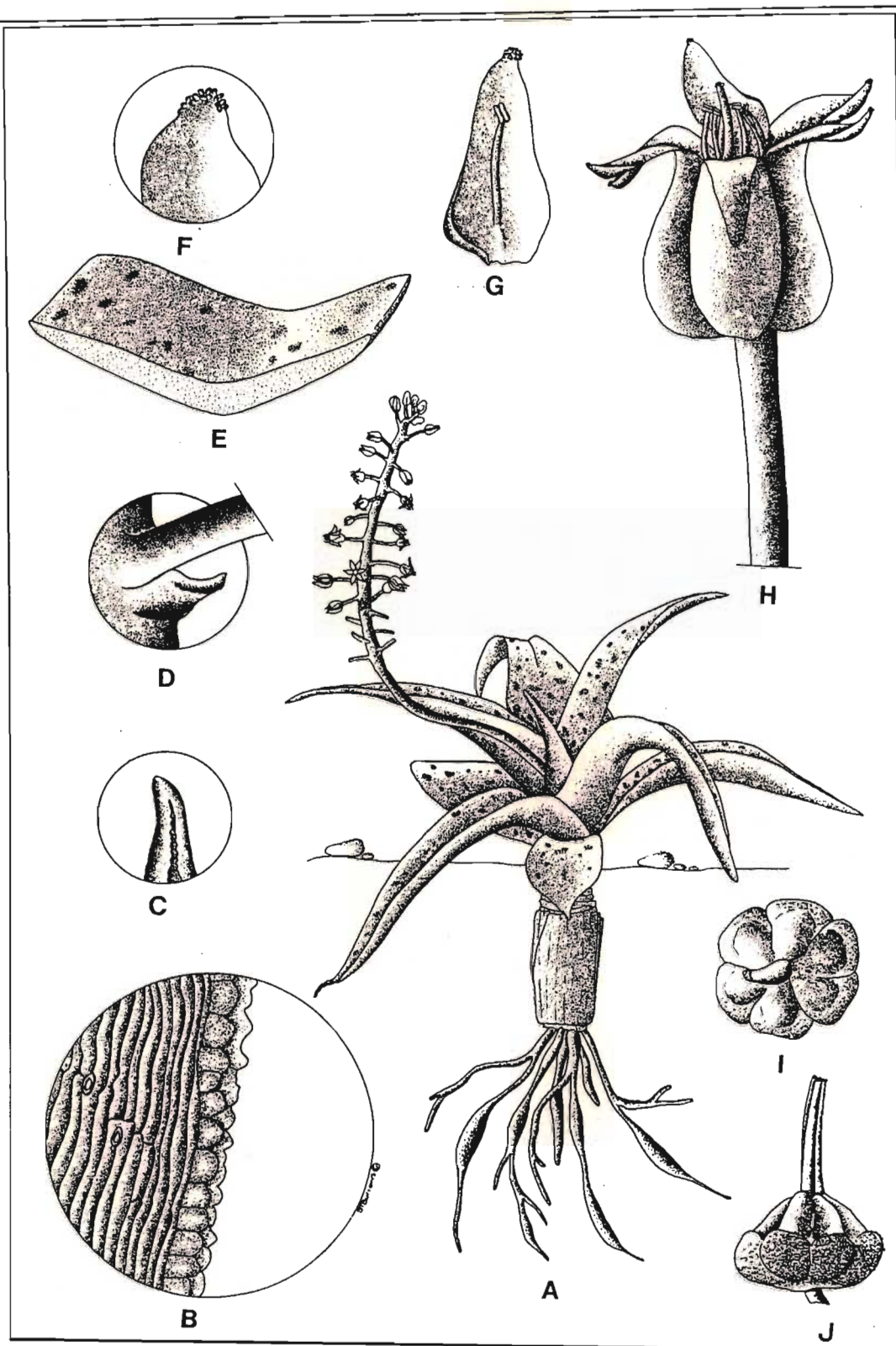


Figure 18. Illustration of *L. ensifolia* (Eckl.) S. Venter. A, habit X 1; B, lamina margin X 300; C, lamina apex X 10; D, bract X 10; E, section through lamina X 5; F, tepal apex X 20; G, tepal with stamen X 10; H, flower X 10; I, ovary dorsal view X 10; J, ovary lateral view X 10. All from *Smith 155*.

Map 6. Known distribution of *L. ensifolia* (Eckl.) S. Venter

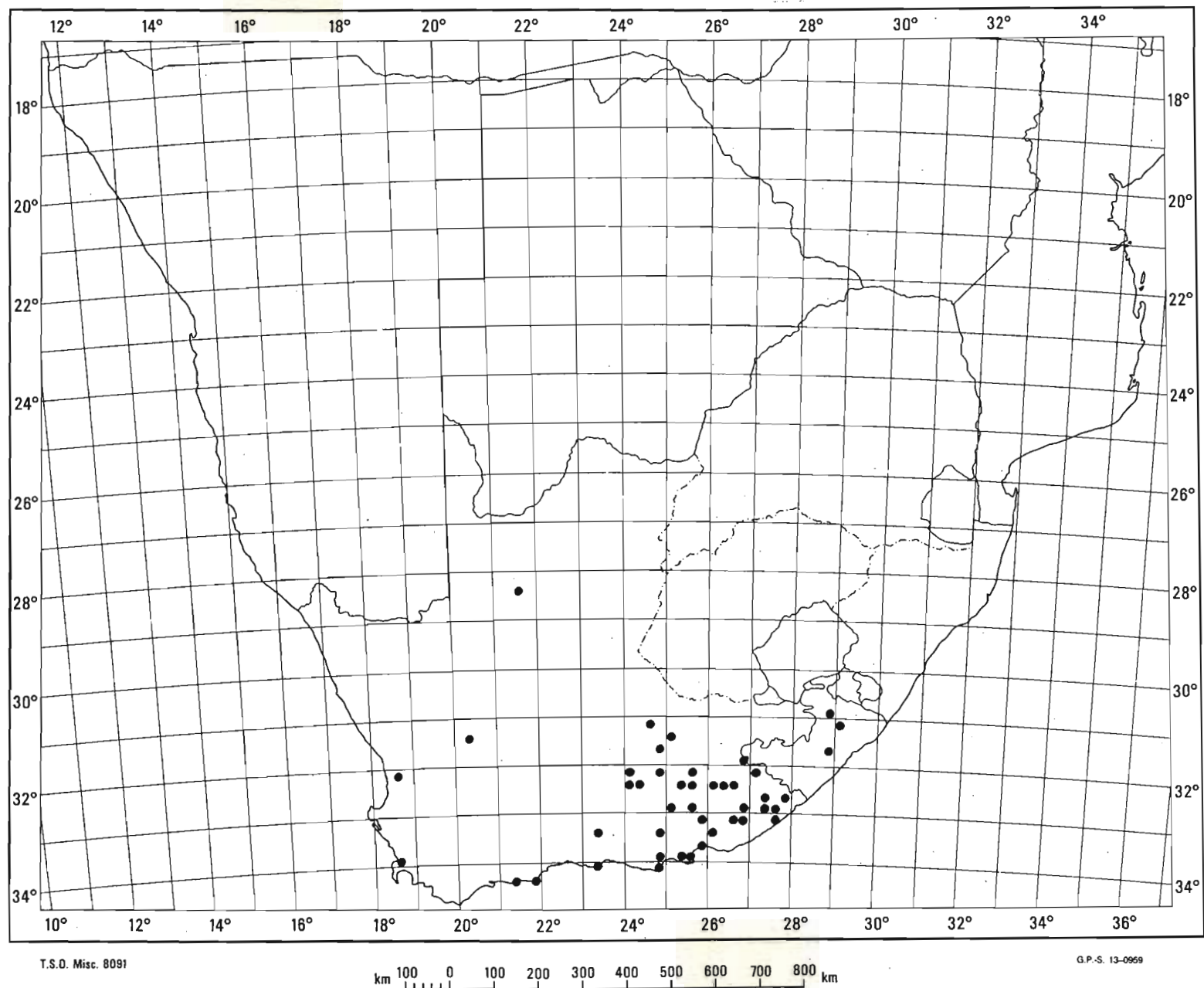
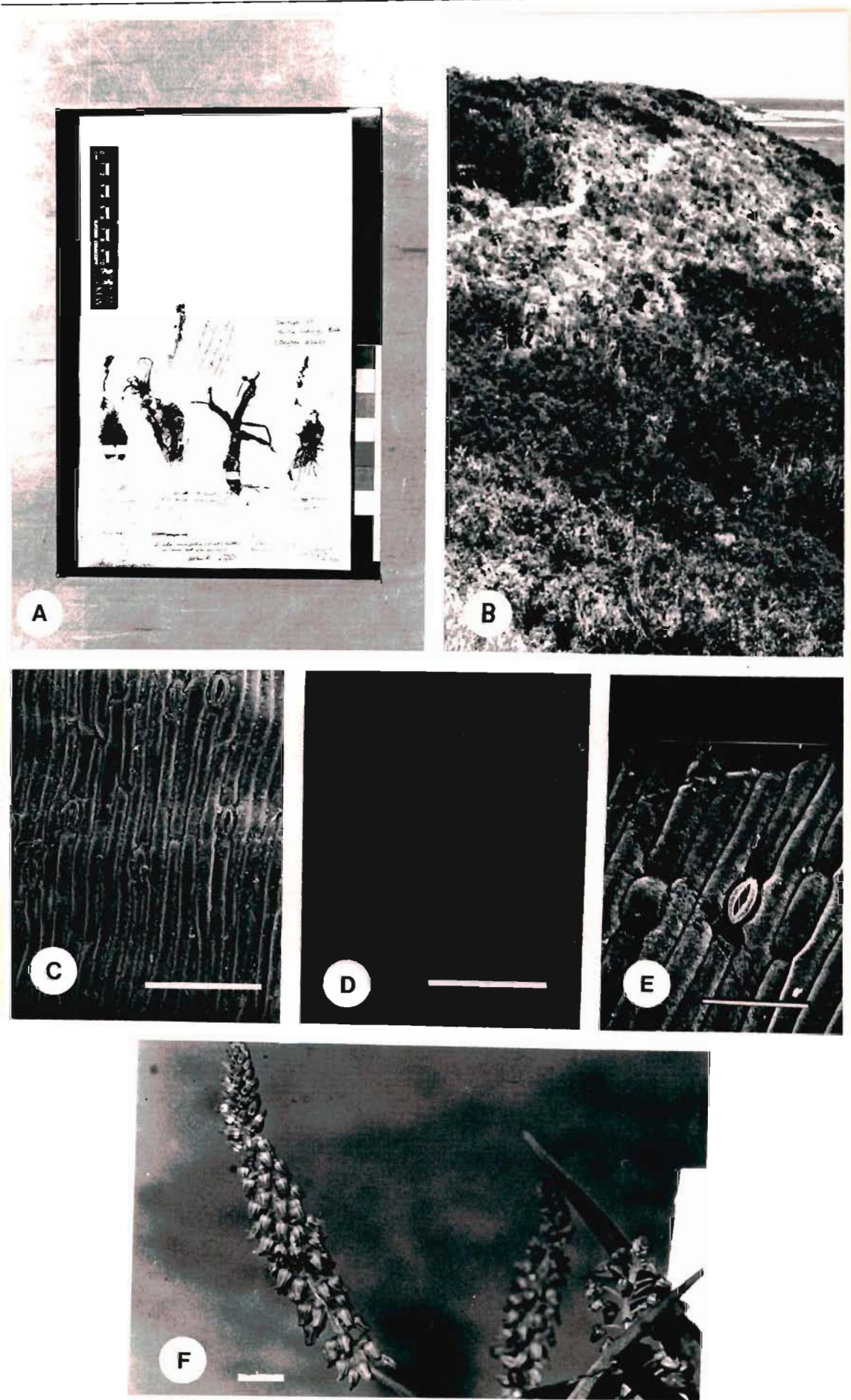


Figure 19. A, lectotype of *L. ensifolia* (K); B, habitat at the Zwartkops River estuary. The vegetation consists of tall, closed, evergreen shrubland; C, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; D, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of stomata. Bar = 50 μ m; F, inflorescence. Bar = 10 mm. C - F from *Venter 13,278*.



Distribution (Map 6).

Eastern Cape with a few scattered localities in the western Cape, northern Cape and Transkei.

Habitat

Most populations occur on quartzites and sandstones of the Dirkskraal Sandstone Formation of the Witteberg Group. These are commonly known as the Witteberg Quartzites. *L. ensifolia* occurs commonly on sandy soils derived from quartzites and sandstone. A few populations were found growing in loamy to clay-loam soils with one population growing in clay soil.

L. ensifolia occurs most commonly in woodland and shrubveld (Figure 19B). Plants grow in full sun or light shade.

Variation

Leaves of plants growing near the coast tend to be thinner (probably due to the higher rainfall) than those of plants growing in drier inland habitats. A few populations with pure green flowers were found in the vicinity of Grahamstown (Venter 13,256). Flowers with a slight sweet scent were recorded in some of the Transkei populations.

Historical background

Although Ecklon named this species *Drimia ensifolia*, he noted that together *D. nitida* and = *D. lanceaefolia* Ker. (*L. revoluta*) differ markedly from most *Drimia* species and perhaps represent a distinct genus (Ecklon 1830).

In publishing *Idothea ludwigii*, Kunth placed a questionmark in front of the species name, indicating his uncertainty about the specific name (Kunth 1843).

Baker described *Scilla ludwigii* from material collected by Zeyher (Zeyher 4262). He collected these specimens at the Zwartkops River Valley and adjoining hills from Villa Paul Maré to Uitenhage on one of his regular visits to the area. The description of *S. ludwigii* and *Drimia ludwigii* are very similar and Baker did not mention his reasons for describing *S. ludwigii*.

Baker (1876) expressed the view that *Scilla pusilla* is closely allied to *Scilla prasina* Bak. A specimen labelled as *Bauer 293* sub BOL 23281 is in fact a collection of *Ledebouria sandersonii* (Bak.) S. Venter. As the species are very different, it is assumed that in handling the specimens, labels were misplaced. The holotype leaves no doubt that *S. pusilla* is a synonym of *L. ensifolia*.

As *Drimia ensifolia* was placed in synonymy under *Scilla ludwigii*, a name published 50 years after *D. ensifolia*, Britten (1908) made a new combination *Scilla ensifolia* (Eckl.) Britten, using the oldest description.

Specimens examined

TRANSKEI. - 3128 (Umtata): Umtata Waterfall (-DB), *Schönland 3774* (GRA). 3129 (Port St. Johns): Annesville, Sipetu (-AA), *Strever 164* (NH). 3028 (Matatiele): Mount Frere (-DD), *Venter 13,325* (UNIN).

CAPE. - 3421 (Riversdale): Gouritz River Mouth (-BD), *Schlechter 18* (BOL). 3423 (Knysna): Plettenberg Bay (-AB), *Smart s.n.* (BOL). 3424 (Humansdorp): Humansdorp (-BB), *Jeppe 4946* (BOL). 3318 (Cape Town): Grey Reservoir (-DC), *Schönland 146* (GRA). 3323 (Willowmore): Willowmore (-AD), *Barker 5013* (NBG). 3324 (Steytlerville): Campher's Poort (-AA), *Barker 5007* (NBG); Pienaarspoort (-AD), *Barker 5070* (NBG); Uitenhage, Kleinpoort (-BD), *Barker 5071* (NBG); Hankey, along Klein River (-DD), *Venter 13,278* (UNIN). 3325 (Port Elizabeth): Zuurberg (-AD), *Repton 5887* (PRE); Kommadagga, Water Tower Hill (-BB), *Perry 1626* (NBG); Sheldon, *Hutton 493a* (BOL); Humansdorp (-CC), *Barker 6900* (NBG); Uitenhage, Zwartkops River Mouth (-CD), *Zeyher 4262* (BOL); *Ecklon & Zeyher 1064* (BOL); Alexandria, Congo's Kraal (-DB), *Archibald 4104* (PRE); Port

Elizabeth, Komachs, *Paterson* 2392 (BOL); Bluewater Bay, *Urton* 889 (PEU); Redhouse, *Paterson* 387 (BOL). 3326 (Grahamstown): Grahamstown, Woest Hill (-AC), *Venter* 13,254 (UNIN); Grahamstown, *Venter* 13,256 (UNIN); *Hepburn s.n.* (BOL); Queenstown, *Page s.n.* (BOL); *Jacot Guillarmod* 10,089 (GRA); Mayor's Seat, *Rogers s.n.* (GRA); Sutherland's Farm, *Deacon* 3 (GRA); Committee Drift (-BB), *Van der Merwe* 1879 (PRE); Albany, Manley Flats (-BC), *Rogers* 28366 (GRA). 3327 (Peddie): Peddie (-AA), *Herre s.n.* (BOL); *Leighton* 2648 (BOL); East London, Kidd's Beach (-BA), *Hall* 235 (NBG). 3218 (Clanwilliam): Middelburg, Grootfontein (-BA), *Gill* 21 (PRE). 3224 (Graaff Reinett): SW of Aberdeen (-AC), *Barker* 7120 (NBG); Graaff Reinett, Lettskraal Station (-BB), *Acocks* 16,235 (PRE). 3225 (Somerset East): Cradock (-BA), *Barker* 7064 (NBG); Mortimer (-BC), *Davison* 25 (BOL); Somerset East, Boschberg (-DC), *Venter* 13,286 (UNIN); *MacOwan s.n.* (GRA); -3226 (Fort Beaufort): Alice (-DD), *Venter* 13,319 (UNIN). 3227 (Stutterheim): Stutterheim Townlands (-CB), *Venter* 13,418 (UNIN); King Williamstown (-CD), *Landrey* sub PRE 35,336 (PRE); East London, Fort Jackson (-DC), *Atkins* 3121 (PRE). 3124 (Hanover): Dwaal Station (-BA), *Acocks* 16,315 (PRE); Middelburg, Barend's Kraal (-DB), *Thorne s.n.* (BOL). 3125 (Steynsburg): Middelburg, Farm Bangor (-AC), *Bolus* 14,110 (BOL); Albany, Fish River (-CD), *Van der Merwe* 1895 (PRE).

Without precise locality

- Cap B. Spei, *Ecklon & Zeyher* 1064 (GRA, PRE, U); *Ecklon & Zeyher* 4262 (K, PRE); Kaffirland, *Gill s.n.* (K, PRE).

3. *LEDEBOURIA SANDERSONII* (Bak.) S. Venter

Ledebouria sandersonii (Bak.) S. Venter, comb.nov.

Scilla sandersonii Bak. in Saund. Ref. Bot. 3 (App.): 5 (1870).

~ **Type:** Transvaal, without precise locality, *Sanderson s.n.* (K!, holo.; PRE!, photo.).

Scilla baurii Bak. in Flora Cap. 6: 484 (1896).

~ **Type:** Cape, Tembuland, Bazeia Mountain, *Bauer 550* (K!, holo.; PRE!, photo.; SAM!).

~ *Scilla tysonii* Bak. in Flora Cap. 6: 484 (1896).

~ **Type:** Cape, Griqualand East, *Tyson s.n.* (K!, holo.; BOL! & GRA! drawing).

~ *Scilla oostachys* Bak. in Flora Cap. 6: 487 (1896).

~ **Type:** Natal, Upper Umkomaas, *Wood 4627* (K!, holo.; NH!; PRE!, photo.; BOL!, drawing).

~ *Scilla diphylla* Bak. in Flora Cap. 6: 489 (1896).

~ **Type:** Transvaal, Barberton, Saddleback Range, *Galpin 1182* (K!, holo.; BOL!; GRA!; NH!; PRE!; SAM!).

~ *Scilla bella* Markötter in Ann. Univ. Stell. 8 (Sec. A No. 1.): 13 (1930).

~ **Type:** Natal, Oliviers Hoek Pass, *Thode s.n.* in STE 3372 (STE!, holo.; PRE!, photo.).

Plants solitary. **Bulb** hypogeal, 10 - 30 x 10 - 15 mm, ovoid to subglobose; dead bulb scales brown, membranous, apices attenuate, live bulb scales loosely arranged, without threads when torn, white inside. **Leaves** fully developed at anthesis, 1 - 6, spreading or sometimes appressed, ovate to lanceolate, 15 - 75 x 18 - 30 mm, without threads when torn, fleshy, adaxial surface green sometimes with dark purple blotches, abaxial surface green suffused purple to wholly purple, venation obscure; margin smooth; leaf base canaliculate; apex acute.

Inflorescences 1 - 2, dense, oblong, 20 - 25 x 18 - 20 mm, erect to flaccid, 12 - 20 -flowered, longer than the leaves; scape terete at base, green, glabrous; rachis smooth, scape smooth. **Bracts** fleshy, 1 x 0.5 mm, dentate, pink to purple without bracteoles. **Pedicels** spreading, 6 - 8 mm long, pink. **Perianth** 3 mm long, tepals recurved, equal, oblong, 3 x 1 mm, apex acute, pink sometimes with a green keel. **Stamens** erect, 2.75 mm long, filament with upper part purple and lower part white, epitepalous; anthers 0.75 mm long, pale yellow. **Ovary** ovoid, 6 -lobed, 1 x 2 mm, lobes narrowly transversely oblong, apex tapering into style, base of lobes with papillate nectaries. **Style** 3 mm long, triangular, glabrous, purple; stigma equal height to anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 2.5 mm long, surface strongly wrinkled, brown. (Figure 20).

L. sandersonii is related to *L. apertiflora* and *L. ensifolia*. Together they form the subsection *Acutilobae*. *L. sandersonii* differs from the abovementioned species in the thin fleshy roots, loosely arranged live bulb scales, ovate to lanceolate leaves and dense oblong raceme.

Specific epithet etymology.

Commemorates the journalist, trader and draughtsman John Sanderson (Gunn & Codd 1981).

Flowering period

From August to March with peak flowering from October to November.

Distribution (Map 7).

Distributed in the eastern part of South Africa. The species is most abundant in Natal.

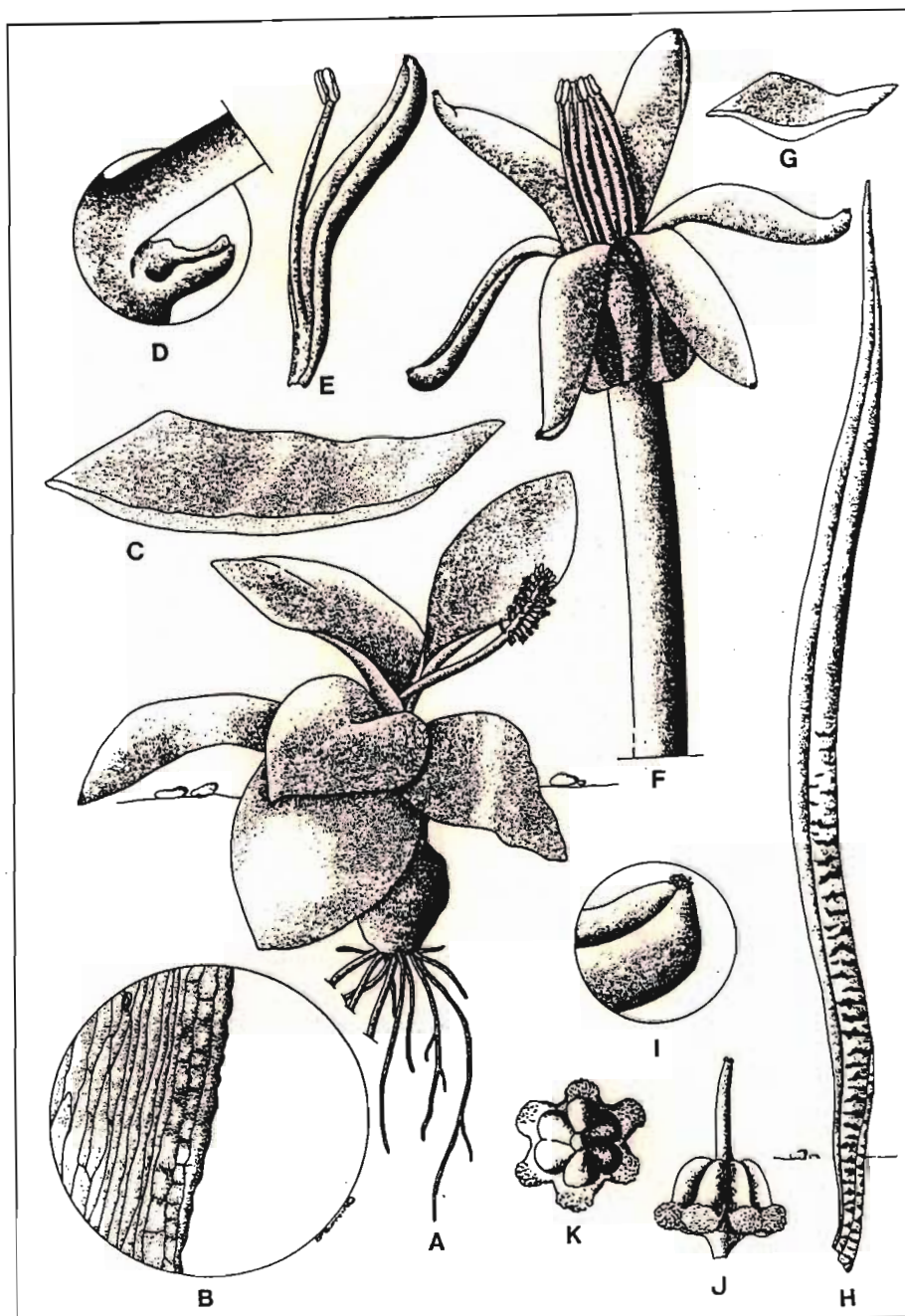
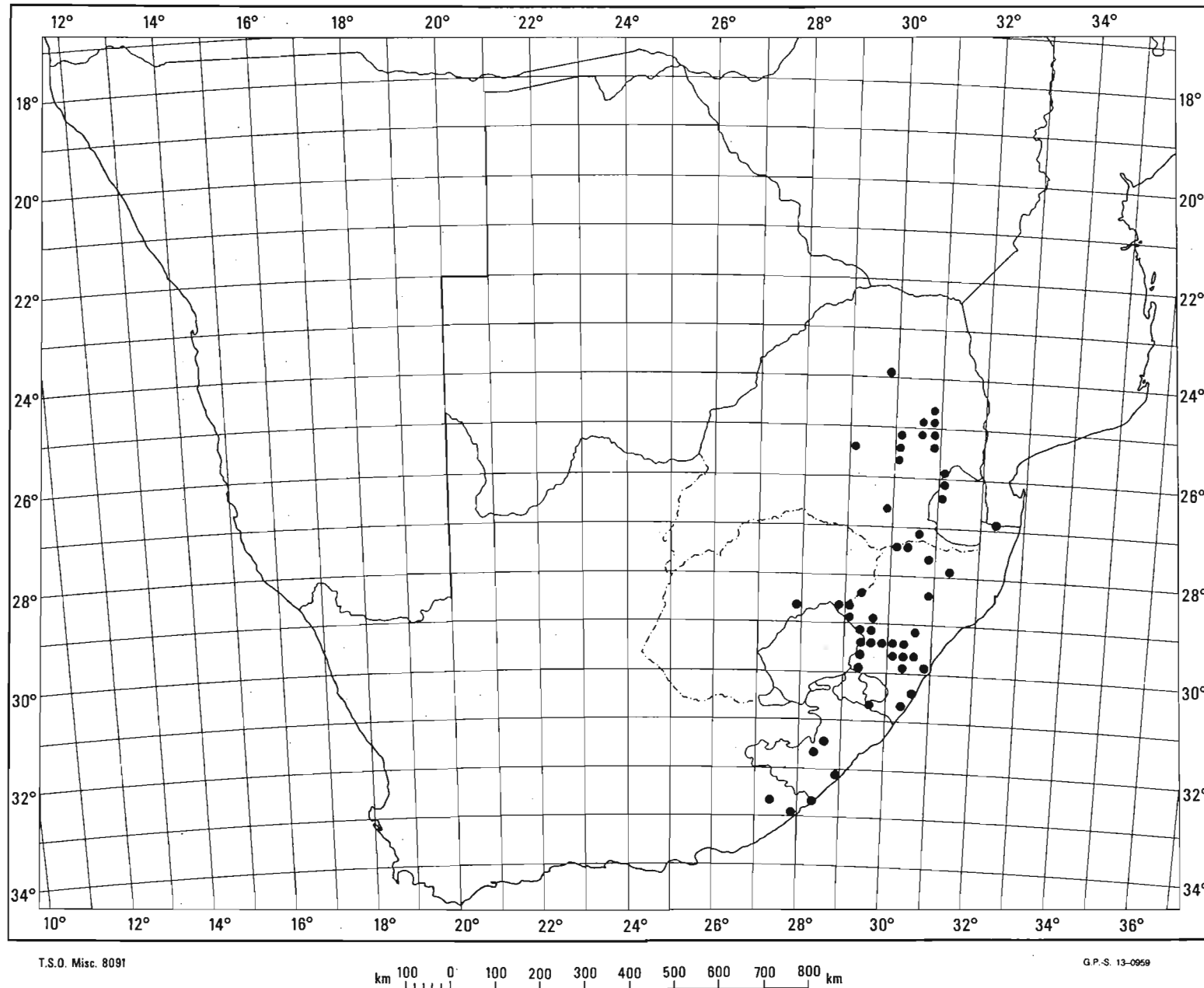


Figure 20. Illustration of *L. sandersonii* (Bak.) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 2; D, bract X 10; E, tepal with stamen X 10; F, flower X 10; G, section through lamina depicted in H, X 2; H, lamina, shade form X 1; I, tepal apex X 20; J, ovary lateral view X 10; K, ovary dorsal view X 10. A - F from *Crouch* 7 and H to K from *Venter* 13,464.

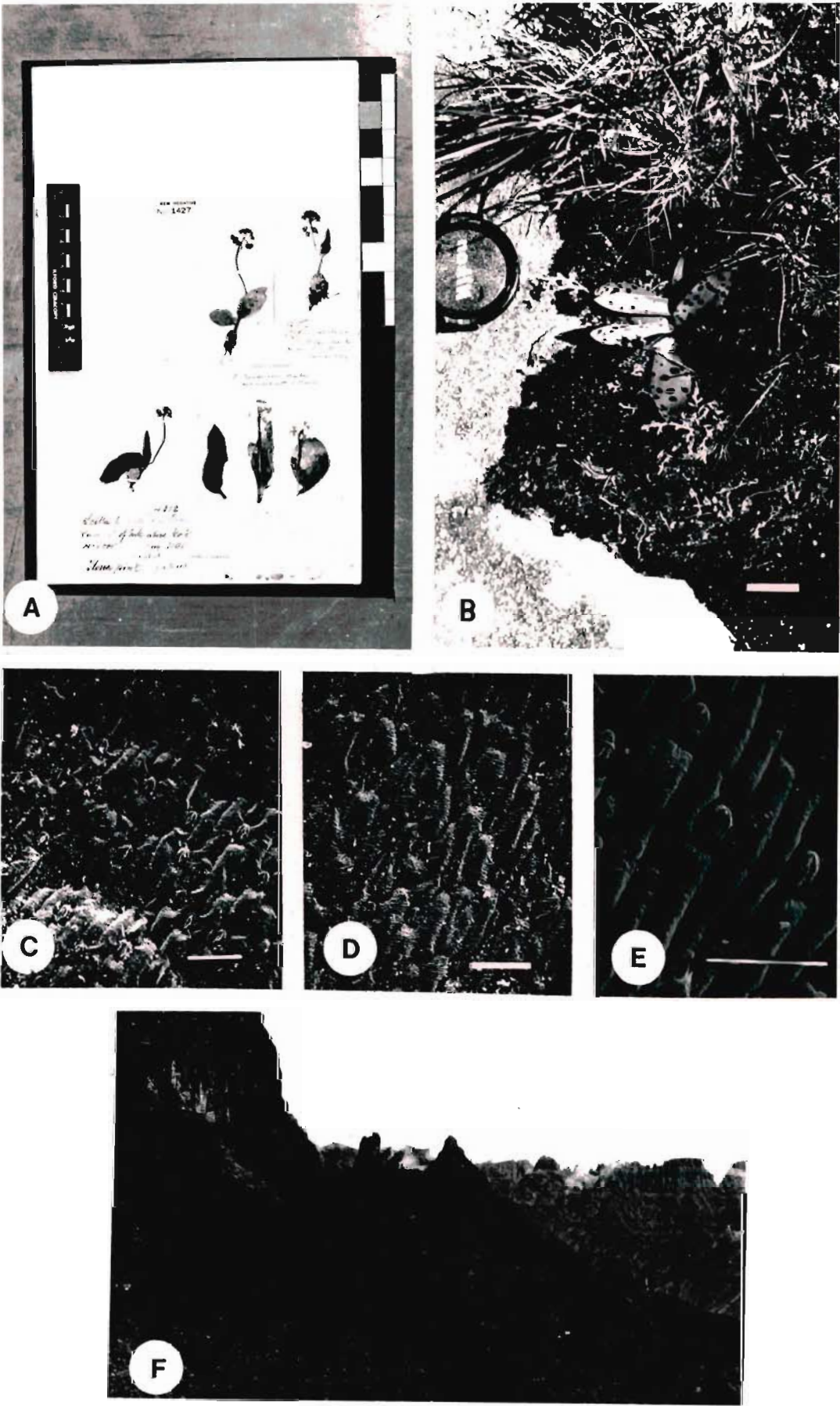
Map 7. Known distribution of *L. sandersonii* (Bak.) S. Venter



T.S.O. Misc. 8091

G.P.S. 13-0959

Figure 21. A, type of *L. sandersonii* (Bak.) S. Venter (K); B, plants of the spotted-leaf form, near Dullstroom, eastern Transvaal. Bar = 25 mm; C, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; D, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of stomata. Bar = 50 μ m; F, habitat in the basalts at Cathedral Peak. The vegetation consists of short montane grassland. C - E from *Crouch 7*.



Habitat

L. sandersonii occurs in humusrich, shallow (5 - 60 mm deep) to deep (30 - 260 mm), medium grained (0.25 - 1 mm ϕ) to coarse grained (1 - 3 mm ϕ), well drained grey to greyish-brown sandy soil. Most of the plants occur in shallow soil overlaying the rock sheets. The few populations on the Natal Drakensberg escarp are all on Drakensberg Basalt of the Drakensberg Group (Figure 21F). Soils derived from the basalt are blackish, shallow (10 - 160 mm deep), coarse grained (1 - 3mm ϕ) and medium drained (Van der Merwe 1962). These soils are subject to freezing during the winter months.

L. sandersonii is associated with montane grassland. Along the Transvaal Drakensberg escarp and Steenkampsberg, *L. sandersonii* commonly grows on the edges of shallow seepages, sometimes in soil sodden for months.

Variation

Plants growing in seepages have loosely arranged live bulb scales compared with the thinner and the relatively tightly arranged live bulb scales of plants in drier habitats. *L. sandersonii* has two distinct forms, an immaculate form and a mottled form (Figure 21B). Mixed populations of these forms have not been recorded. Tepal colour varies from dark pinkish purple to light pink with a prominent green keel.

Specimens examined

TRANSVAAL - 2329 (Pietersburg): Haenertsburg (-DD), *Pott 4725* (PRE). -2430 (Pilgrim's Rest): Vaalhoek (-DB), *Rogers 25,065* (J); Mariepskop (-DB), *Raal 1676* (Transvaal Provincial Administration); *Venter 12,771* (UNIN); Morgenzon Nature Reserve (-DC), *Kluge 2070* (PRE); Mount Sheba (-DC), *Kerfoot 8168* (PRE); Graskop (-DD), *Thorncroft 18,299* (PRE); Graskop, Stanley Bush (-DD), *Raal 1038* (Transvaal Provincial Administration); Mac Mac (-DD), *Van der Merwe 1594* (PRE); Sabie (-DD), *Koeleman s.n.* sub

PRE 36,634 (PRE). -2530 (Lydenburg): Draaikraal (-AA), *Hurling & Nel s.n.* sub BOL 22492 (BOL); Steenkampsberg (-AC), *Bloem 128* (PRE); *Pole-Evans 2031* (PRE); Dullstroom (-AC), *Drews 18* (PRE); *Killick & Strey 2552* (PRE); Dullstroom, Suikerboskop (-AC), *Burgoyne 372* (PRU); Verloren Vallei Nature Reserve (-AC), *Bloem 128* (PRU); Hartebeesvlakte (-BA), *Mohle 34* (PRE); Witklip Plantation (-BD), *Kluge 278* (PRU); *Kluge 105* (PRE); Dullstroom, Lakenvlei Spruit (-CA), *McMurtry 5204* (Johannesburg Botanical Garden); Belfast (-CA), *Van der Merwe 1228* (PRE). -2531 (Komatipoort): Saddleback Range (-CC), *Van der Merwe 1823* (PRE). -2730 (Vryheid): Wakkerstroom, Hlangapies (-AB), *Van der Merwe 2075* (PRE); Kwa-Madlangampisi, farm Groothoek (-BA), *du Toit 95* (PRE).

SWAZILAND -2631 (Mbabane): Forbes Reef (-AA), *Compton 30,122* (PRE); *Compton 31,727* (NBG, PRE); *Compton 26,130* (NBG); *Compton 27,803* (NBG, PRE); Mbabane (-AC), *Compton 30,781* (NBG); *Moss 25,942* (J); *Rogers 11,589* (BOL); Mbabane, Abner's Farm (-AC), *Compton 26,106* (NBG); Stroma (-AC), *Compton 25,196* (NBG). -2632 (Bela Vista): Ndumu (-CD), *Compton 30,338* (NBG).

ORANGE FREE STATE -2827 (Senekal): Vrede (-DB), *O'Meara s.n.* (BOL, NBG). -2829 (Harrismith): Harrismith, Platberg (-AC), *Jacobsz 2615* (NBG).

NATAL -2730 (Vryheid): Altemooi (-AD), *Thode 3368* (STE); Tendeka Rock (-DB), *Gerstner 5097* (PRE). -2731 (Louwsburg): Ngome (-CD), *Strey 9362* (NH, PRE); Ngome State Forest (-CD), *Nicholas & Van der Berg 1764* (NH, Killick Herbarium). -2828 (Bethlehem): Bester's Vlei (-DB), *Bolus s.n.* sub BOL 22,496 (BOL); Royal National Park (-DB), *Van der Merwe 2613* (NU). -2829 (Harrismith): Van Reenen, Nolens Volens (-AD), *Jacobsz 1660* (PRE); Oliviers Hoek Pass (-CA), *Wilson 1086* (PRE); *Thode s.n.* sub STE 3372 (STE); Cathedral Peak (-CC), *Killick 1607* (PRE, Killick Herbarium); *Killick 1570* (PRE); *Killick 1114* (PRE); Fongosi River (-DC), *Fisher 265* (NU). -2830 (Dundee): Babanango (-BD), *Van der Merwe 2786* (PRE); Griffins Hill (-CC), *Acocks 10,734* (NH). -2929 (Underberg): Cathkin Park (-AB), *Henrici 3526* (PRE); Tabamhlope (-BA), *Dowling 222* (NU); Ntabamhlope

Peak (-BA), *Van der Merwe* 2564 (PRE); Mpendhle, Mulangane (-BC), *Hilliard & Burt* 18,611 (NU); Estcourt, farm Lanner Veane (-BC), *Manning & Balkwill* 338 (NU); Kamberg (-BD), *Gordon-Grey* 99 (NU); Cobham Nature Reserve (-CB), *Hilliard & Burt* 9316 (NU); Underberg, Chameleon Cave (-CB), *Hilliard & Burt* 17,740 (NU, PRE); Bamboo Mountain (-CB), *Hilliard & Burt* 15,632 (NU); *Grice s.n.* (NU); *Hilliard & Burt* 15,603 (PRE); Castle View Farm (-CB), *Hilliard & Burt* 13,644 (PRE); Mkomazi River (-CB), *Hilliard & Burt* 15,861 (PRE); Garden Castle (-CD), *Van der Merwe* 2761 (NU); *Van der Merwe* 2762 (NU, PRE). -2930 (Pietermaritzburg): Merrivale (-AC), *Moll* 1341A (NU); *Moll* 1341b (NU); Ivanhoe (-AC), *Moll* 2597 (NU); Howick (-AC), *Wood* 3479 (NH); *Wood* 8136 (NH); Drayton, Nottingham Road (-AC), *Smith* 188 (NU); Karkloof (-AD), *Stirton* 12,251 (UNIN); Greytown (-BA), *Wylie s.n.* sub PRE 34,293 (PRE); *Wylie s.n.* sub NH 21,692 (NH); Elandskop, farm Glazley (-CA), *Morris* 107 (PRE); Elandskop (-CA), *Webb* 37 (NU); Zwartkops (-CB), *Lindahl* 52 (NU); *Williams* 66 (NU); Pietermaritzburg (-CB), *Van der Merwe* 2846 (PRE); Pietermaritzburg, Town Hill (-CB), *Van der Merwe* 2602 (NU); *Bond* 1296 (NBG); Richmond (-CD), *Vivyan s.n.* sub BOL 50,786 (BOL); Umgeni, Kransberg (-DA), *Thode* 5400 (STE); Gilletts (-DD), *Wood* 11,568 (PRE); *Wood* 19,249 (PRE). -3029 (Kokstad): Kokstad, Mount Currie (-AD) *Goossens* 245 (PRE); Ngeli Mountain (-DA), *Van Wyk* 7513 (PRU); Ngeli Peak (-DA), *MacDevette* 1311 (NH). -3030 (Port Shepstone): Umdoni Park (-BC), *Jarman & Grey* 394 (NU); Port Shepstone (-CB), *Brown* 323 (BOL); Port Shepstone, farm The Valleys (-CB), *Mogg* 13,884 (PRE); Sea Park (-CB), *Elery s.n.* sub NBG 73,436 (NBG).

TRANSKEI -2929 (Underberg): Sehlabathebe National Park (-CC), *Hoener* 2081 (PRE). -3128 (Umtata): Mhlhlani Forest (-BC), *Perry* 3415 (NBG); Baziya Forest Station (-CB), *Van der Merwe* 1881 (PRE). -3228 (Butterworth): Elliotdale, The Haven (-BB), *Gordon-Grey* 812 (NU); Kentani (-CB), *Pegler* 1141 (BOL).

CAPE -3227 (Stutterheim): Stutterheim (-CB), *Rogers* 12,796 (GRA); Gonubie (-DD), *Batten* 6 (NBG).

Subsectio **Erectifoliae** S. Venter, subsect. nov., bulbis cylindricis; foliis erectis.

Species typica: *L. viscosa* Jessop.

Species: *L. dolomiticola* S. Venter, *L. atro-brunnea* S. Venter, *L. viscosa* Jessop.

Bulbs cylindrical. **Leaves** erect, concolorous. **Raceme** lax.

4. *LEDEBOURIA DOLOMITICOLA* S. Venter

Ledebouria dolomiticola S. Venter, sp. nov., ad *L. socialem* (Bak.) Jessop affinis sed bulbis erectis cylindricis epigaeis; foliis glaucis erectis et inflorescentia flaccidis differt.

Type: Lebowa, Strydpoort Mountain, Donkerkloof, Farm Rivierplaats 354, Venter 13,089a (PRE!, holo.; NU!, UNIN!).

Bulbs epigeal, 40 - 100 x 15 - 30 mm, elliptic to cylindrical, in dense groups; dead bulb scales thinly membranous, brown, apices attenuate, live bulb scales tightly arranged, without threads when torn, white inside; bulblets on basal stem. **Leaves** fully developed at anthesis, 3 - 5, erect, lanceolate, 80 - 100 x 8 - 20 mm, without threads when torn, fleshy, surfaces with a dull lustre, glaucous green without markings, venation obscure; margin smooth; leaf base canaliculate; apex acute. **Inflorescence** solitary, lax, cylindric, 40 - 60 x 20 - 30 mm, flaccid, 30 - 40 -flowered, longer than leaves; scape terete at base, green, glabrous; rachis smooth, scape smooth, 60 - 90 mm long. **Bracts** membranous, 1.5 x 0.25 mm, linear-lanceolate, grey to white with bracteoles present. **Pedicel** spreading horizontally, 8 - 10 mm long, white to purple. **Perianth** 5 mm long, tepals recurved, subequal, oblong, 5 x 1.0 - 1.5 mm, apex obtuse, pink to purple with a green keel. **Stamens** erect, 3 mm long, filaments maroon, epitepalous; anthers 0.5 mm long, yellow. **Ovary** globose, 6 -lobed, 1.5 x 2.5 mm, lobes narrowly transversely oblong, apex shoulders raised, basal lobes present. **Style** 3 mm long, triangular, glabrous, purple above and white below; stigma above anthers; stipe 0.25 - 0.5 mm. **Capsule** 3 - lobed, symmetrical, globose; base truncate. **Seed** globose, 4 mm long, surface strongly wrinkled, brown. (Figure 22).

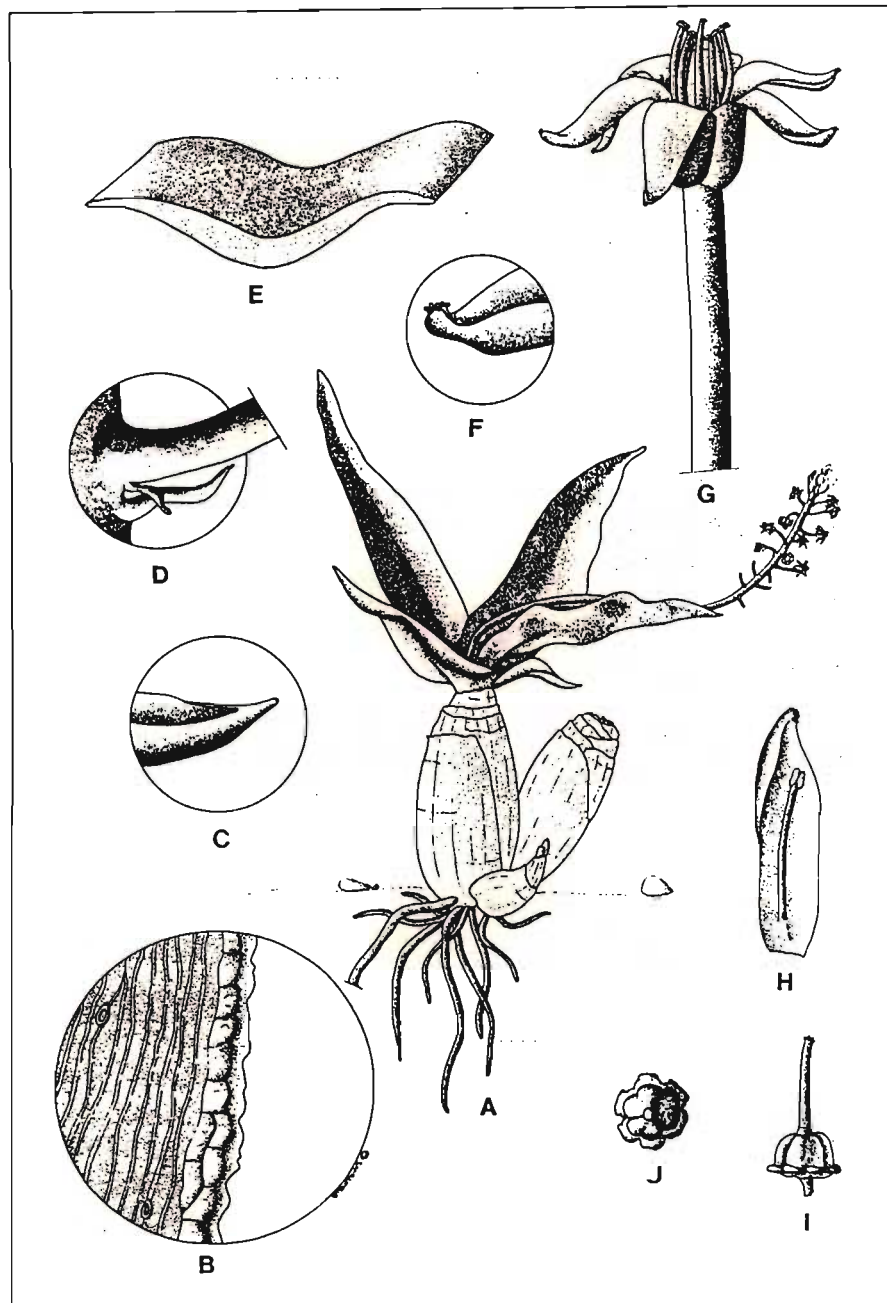


Figure 22. Illustration of *L. dolomiticola* S. Venter. A, habit X 1; B, lamina margin X 300; C, lamina apex X 20; D, bract and bracteole X 10; E, section through lamina X 5; F, tepal apex X 20; G, flower X 10; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from Venter 13,208a.

Map 8. Known distribution of *L. dolomiticola* S. Venter

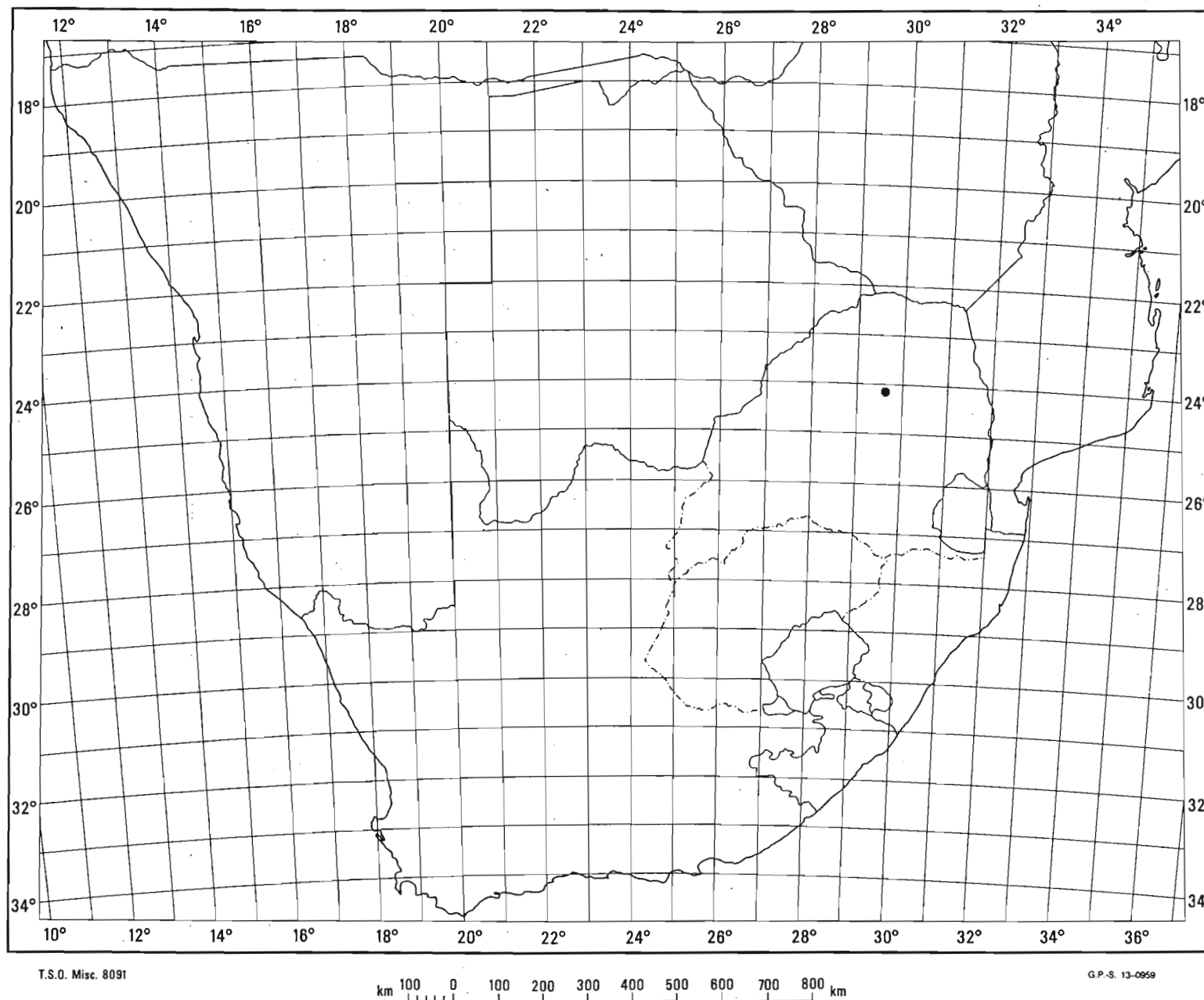
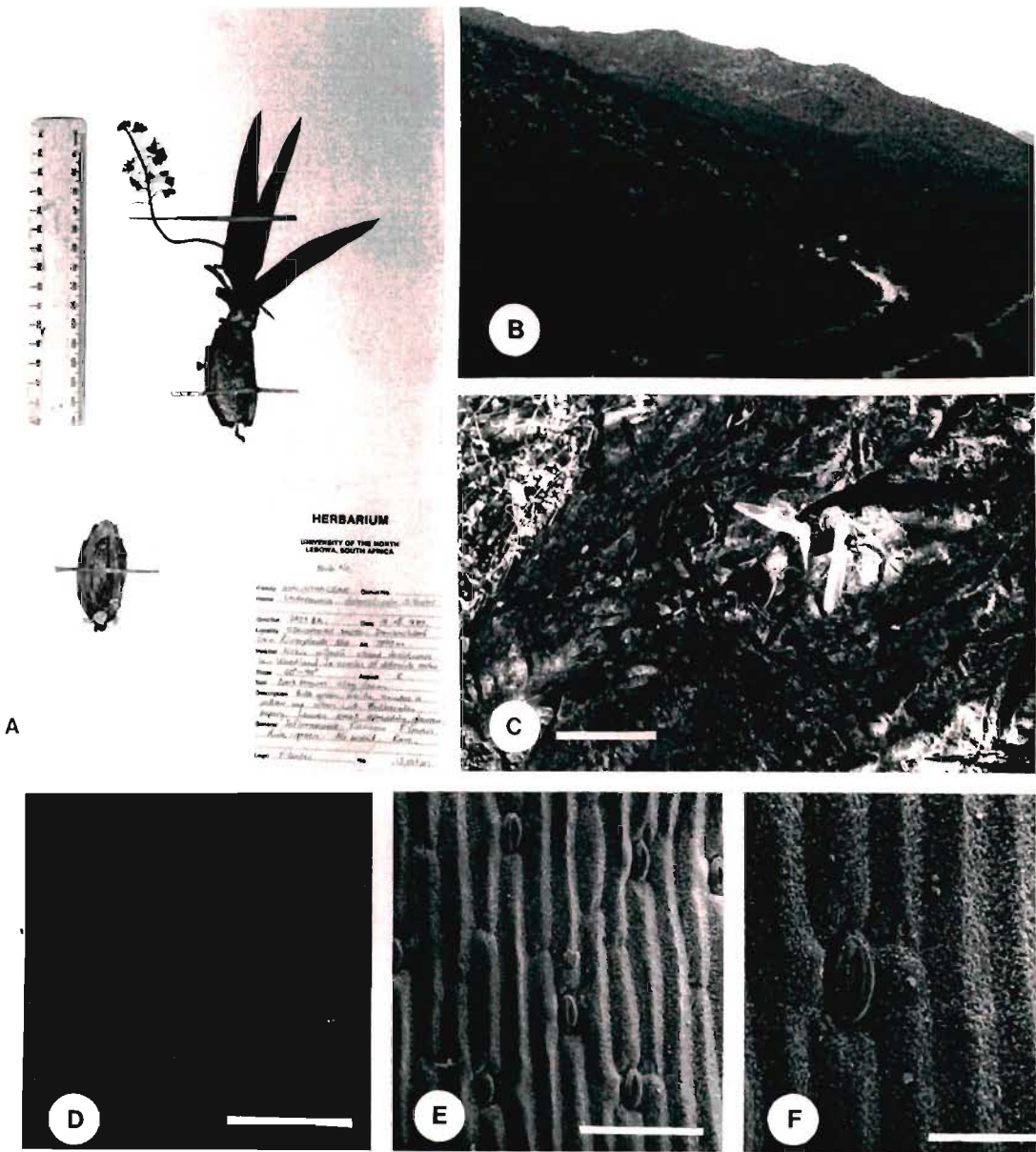


Figure 23. A, holotype of *L. dolomiticola* S. Venter (PRE); B, habitat at Donkerkloof, the type locality. The vegetation consists of closed deciduous low *Kirkia wilmsii* - *Dombeya autumnalis* - *Obetia tenax* woodland on dolomite; C, plants of *L. dolomiticola* growing in rock cracks showing the epigeal bulbs. Bar = 100 mm; D, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; E, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; F, SEM micrograph of stomata. Bar = 43 μ m. D - F from Venter 13,089a.



L. dolomiticola is closely related to *L. atro-brunnea* and *L. viscosa* in having cylindrical bulbs, erect leaves (uncommon in *Ledebouria*) and the ovary apex forming prominent shoulders. *L. dolomiticola* differs from both in its epigeal bulbs and membranous dead bulb scales.

Specific epithet etymology.

Refers to the rock type upon which this species is localized.

Flowering period

From January to April.

Distribution (Map 8).

Known only from the Strydpoort Mountain near Pietersburg, north eastern Transvaal.

Habitat

Plants are limited to dolomite of the Eccles Formation of the Chuniespoort Group (SACS 1980). Where an increase in chert (quartz) content in the dolomite occurs *L. dolomiticola* appears to be excluded. The steep slopes and cliffs upon which *L. dolomiticola* grows experience high temperatures especially during summer months. The soil is a dark brown clay loam. Plants tend to grow in rock cracks (Figure 23C) with some plants in lithosols.

Population structure

Two populations are known, the smaller consists of few (± 35) individuals on a 90° cliff. The larger population consists of ± 121 individuals, on a steep 30° - 45° slope covered mostly in large dolomitic rocks. Adult plants predominate with 5 - 18 epigeal bulbs per plant.

Specimens examined

TRANSVAAL. - (2429): Strydpoort Mountain, Donkerkloof, Farm Rivierplaats 354 (-BA), *Venter 13,089a* (PRE, UN, UNIN).

5. *LEDEBOURIA ATRO-BRUNNEA* S. Venter

Ledebouria atro-brunnea S. Venter, sp. nov., ad *L. marginatam* (Bak.) Jessop affinis sed squamis duris, atro-brunneis et foliis glaucis erecto-tortis clare differt.

Type: Transvaal, Rustenburg, Kroondal on farm Zuurplaat 337, *Venter 13,460* (PRE!, holo.; NU!; UNIN!).

Plants solitary. **Bulb** hypogeal, 30 - 60 x 20 - 30 mm, cylindrical; dead bulb scales purplish-brown, very hard, apices attenuate, live bulb scales loosely arranged, with threads when torn, bulb white spotted heavily purple inside. **Leaves** partly emerged at anthesis, 4 - 6, erect, spirally twisted, linear-lanceolate, 60 - 80 x 3 - 10 mm, with threads when torn, fleshy, surfaces dull glaucous green, venation obscure; margin smooth but wavy in lower part; leaf base canaliculate; apex acute. **Inflorescences** 1 - 4, lax, oblong, 20 - 50 x 25 - 30 mm, flaccid, 30 - 60 -flowered, longer than the leaves; scape compressed at base, purple with darker spots, glabrous; rachis ridged, 25 - 60 mm long. **Bracts** semi-fleshy, 1 x 0.25 - 0.5 mm, linear to bifurcate, grey-white with bracteoles always present. **Pedicels** spreading, 6 - 7 mm long, speckled or plain coloured pink. **Perianth** 5 mm long, tepals recurved, subequal, linear-oblong, 5 x 1.5 mm, apex acute, slightly cucullate, pink to purple with a green keel. **Stamens** erect, 3 - 4 mm long, filaments pink, base slightly flattened, epitepalous; anthers 0.75 - 1.0 mm long, violet. **Ovary** ovoid, 6 -lobed, 1.0 - 1.5 x 2.0 - 2.5 mm, lobes obtusely deltate, apex shoulders absent, basal lobes present. **Style** 2.0 - 2.5 mm long, triangular, glabrous, purple; stigma equal height to anthers; stipe 0.25 x 0.25 - 0.5 mm. **Capsule** 2- to 3 - lobed, symmetrical, clavate; base truncate. **Seed** drop-shaped, 4 - 5 mm long, surface strongly wrinkled, reddish-brown. (Figure 24).

L. atro-brunnea is related to *L. dolomiticola* and *L. viscosa* in having cylindrical bulbs ~~with membranous dead bulb scales~~ and erect leaves but is distinguished by the twisted leaves and the very hard bulb scales.

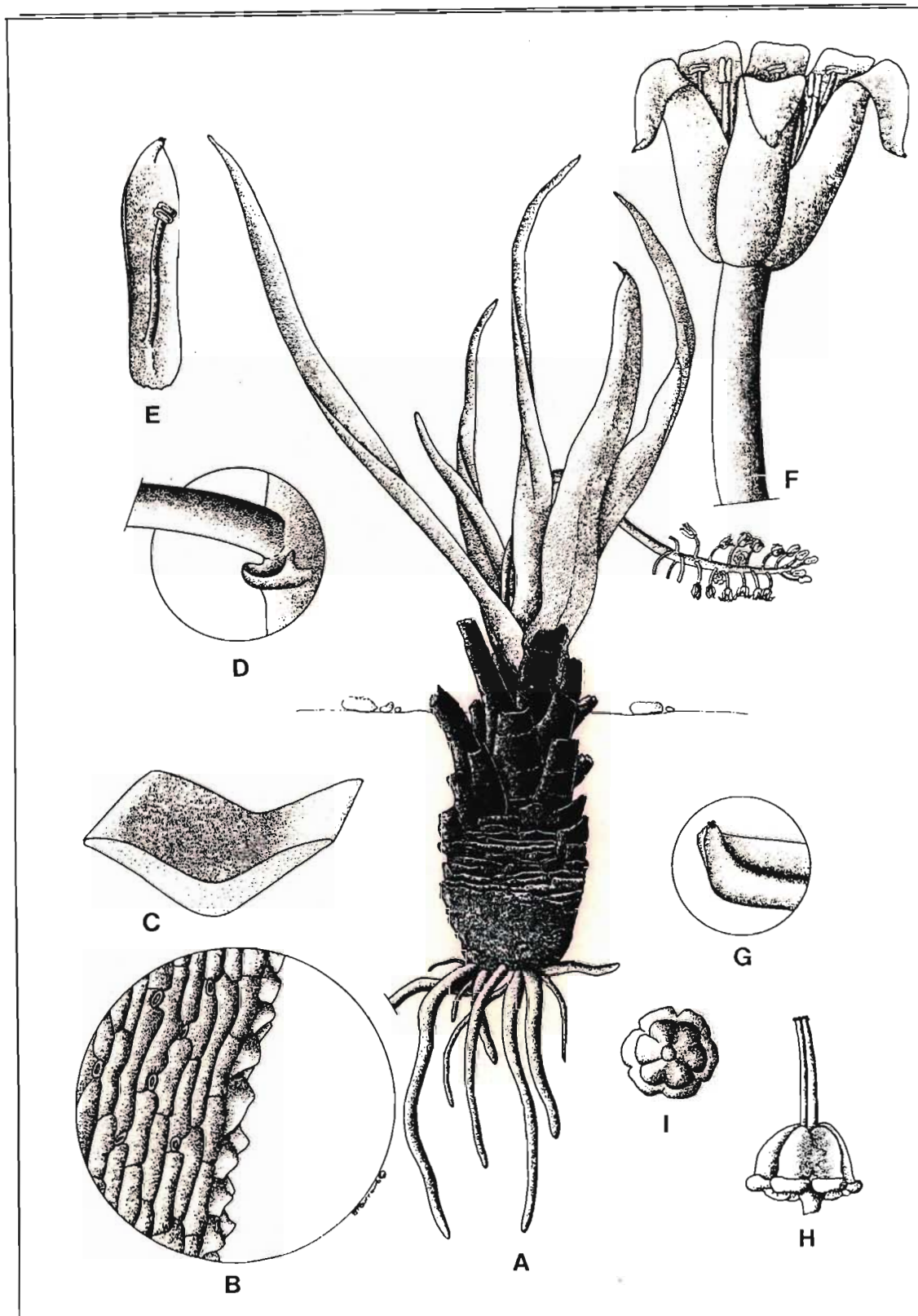


Figure 24. Illustration of *L. atro-brunnea* S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, bract X 20; E, tepal with stamen X 10; F, flower X 10; G, tepal apex X 20; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from Venter 13,460.

Map 9. Known distribution of *L. atro-brunnea* S. Venter

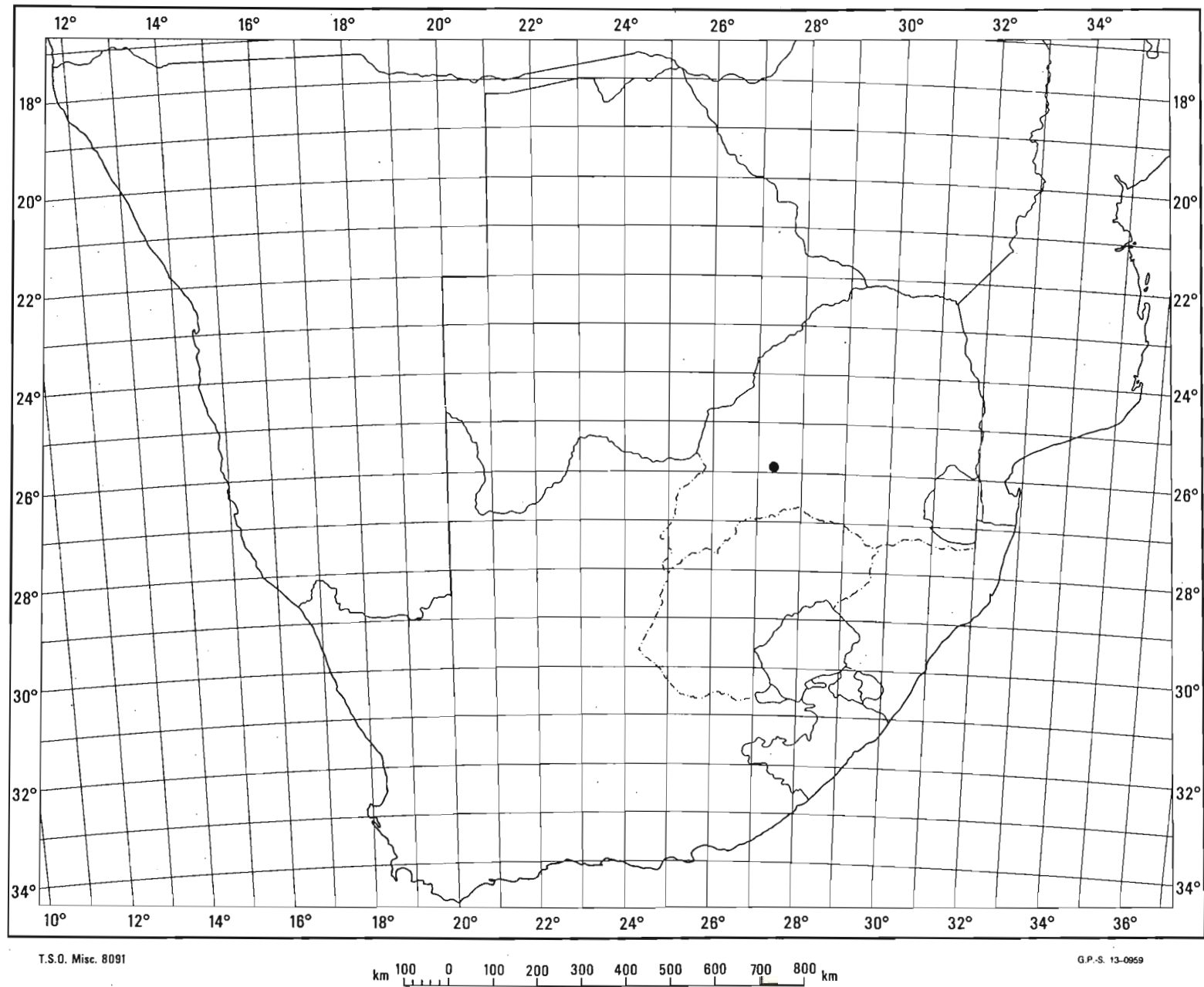
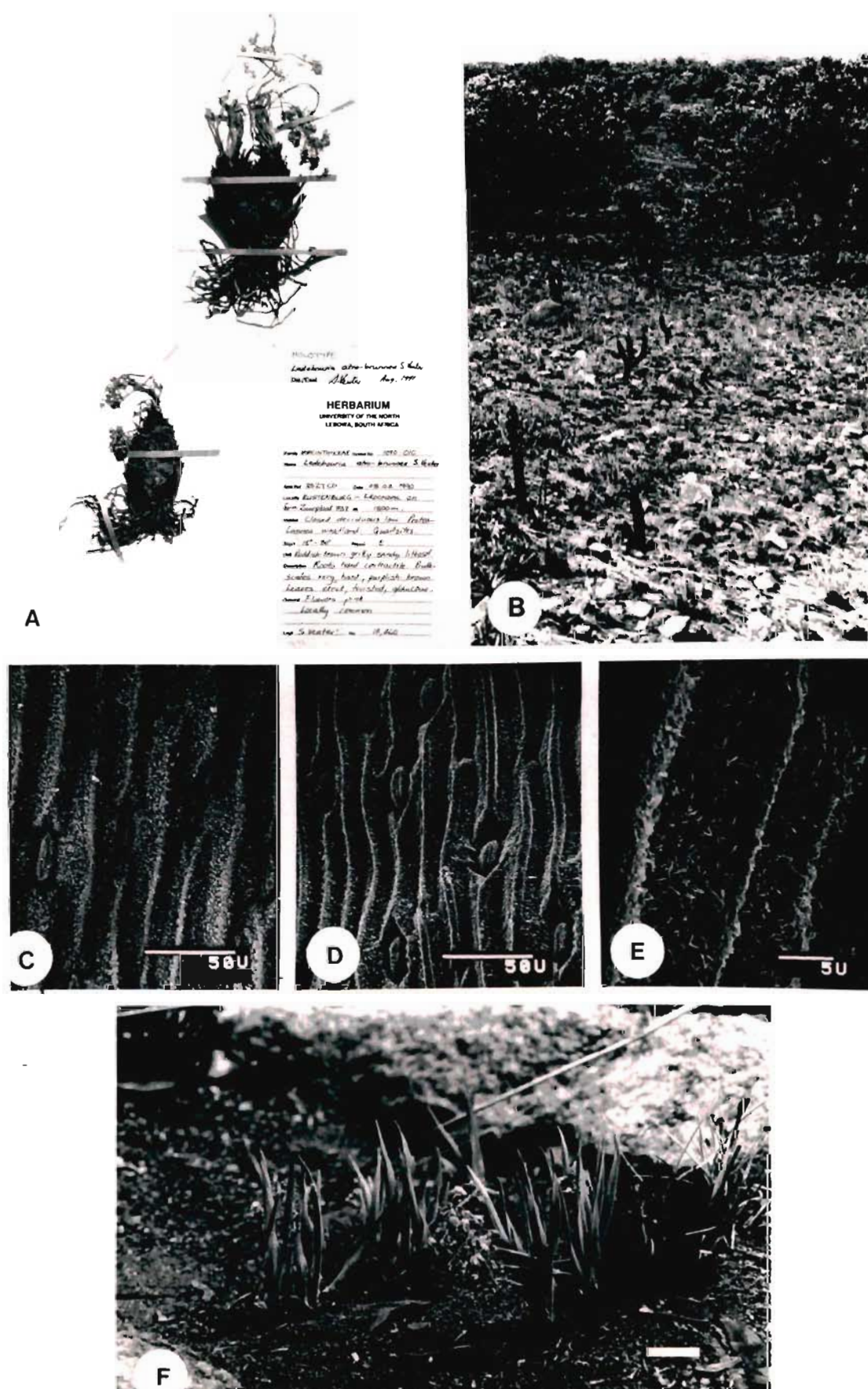


Figure 25. A, holotype of *L. atro-brunnea* S. Venter (PRE); B, habitat near Kroondal, north-western Transvaal. The vegetation consists of closed deciduous tall *Protea caffra* subsp. *caffra* - *Xerophyta retinervis* - *Parinari capensis* woodland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of wax platelets forming the cuticle; F, plants of *L. atro-brunnea* showing the colonial growth and the erect, twisted leaves. Bar = 30 mm. C - F from Venter 13,460.



Specific epithet etymology.

Refers to the dark brown bulb scales.

Flowering period

From October to December.

Distribution (Map 9).

Kroondal near Rustenburg, north-western Transvaal, at the foothills of the Magaliesberg.

Habitat

Throughout its distribution range, the rocks are from the Magaliesberg Quartzite Formation of the Pretoria Group. These rocks are coarse, recrystallised quartzite forming mother material for the shallow reddish-brown sandy lithosol.

The vegetation is Bankenveld (Acocks 1988) and consists of closed deciduous low *Protea caffra* var. *caffra* - *Lannea discolor* woodland (Figure 25B).

Population structure

A single population of $\pm 500 \times 1000$ m was found consisting of ± 300 individuals. Plants were scattered or occasionally occurred in small clumps (Figure 25F). Most of the plants were adults. Few seedlings in the two leaf stage were seen but many seeds were collected next to most of the adult plants. The leaves of the seedlings are erect from the two leaf stage and purple underneath, becoming glaucous with age.

The only protection afforded plants is from grass tussocks. Veld fires commonly occur and the very hard dead bulb scales protect the viable inner leaves. The apices of the dead bulb scales possibly act as a defence mechanism against herbivores.

Variation

Plants growing in the shade of trees and shrubs have more prominent dead bulb scales and the leaves of the plants growing in shade tend to be less twisted. Plants grown under controlled conditions in an aridarium at the University of the North, Sovenga, showed leaf twisting to be independant of moisture regimes.

Specimens examined

TRANSVAAL. - 2527 (Rustenburg): Kroondal, Farm Zuurplaat 337 (-CD), *Venter 13,460* (NU, PRE, UNIN); *Venter 13,483* (PRE, UNIN).

6. *LEDEBOURIA VISCOSA* Jessop

Ledebouria viscosa Jessop in Jl S. Afr. Bot. 36(4): 264 (1970).

Type: Transvaal, Thabazimbi, Kransberg, *Meeuse 10,493* (PRE!, holo.).

Plants solitary. **Bulb** hypogeal, 50 - 60 x 12 - 20 mm, cylindrical; dead bulb scales brown, membranous, apices attenuate, live bulb scales fleshy, tightly arranged, without threads when torn, white inside; basal stem up to 120 mm long. **Leaves** fully developed at anthesis, 1 - 3, erect, oblanceolate to spatulate, 90 - 230 x 17 - 30 mm, without threads when torn, fleshy, surfaces covered with a thick resinous layer, viscid, immaculate, dark green with sometimes a purple tinge, venation sometimes prominent; margins smooth; leaf base flat to very shallowly canaliculate; apex obtuse. **Inflorescence** solitary, lax, cylindric, 100 x 300 mm, erect, 20 - 30 -flowered, longer than the leaves; scape terete at base, green, glabrous; rachis smooth, 150 - 170 mm long. **Bracts** membranous, 1.5 x 0.5 mm, linear-lanceolate, bifurcate at base of raceme, grey to white, without bracteoles. **Pedicels** spreading horizontally, 7 - 8 mm long, white. **Perianth** 5 mm long, almost tubular, tepals equal, linear - oblong, 5 x 1.5 mm, apex acute, pink to purple with a green keel. **Stamens** erect, 4 - 5 mm long, filaments maroon, epitepalous; anthers 1 mm long, pale violet. **Ovary** ovoid, 6 -lobed, 1 x 2 mm, lobes deltate, apex shoulders prominent. **Style** 1.5 mm long, terete, glabrous, white; stigma below anthers; stipe 0.5 x 0.5 mm. **Capsule** 2 - 3 lobed, asymmetrical, clavate; base truncate. **Seed** drop-shaped, 4 mm long, surface strongly wrinkled, brown. (Figure 26).

L. viscosa is related to *L. dolomiticola* and *L. atro-brunnea*. Together they constitute the subsection *Erectifoliae*.

L. viscosa cannot be confused with other *Ledebouria* species in South Africa. The erect viscid leaves and solitary erect inflorescence are diagnostic (Figure 26A).

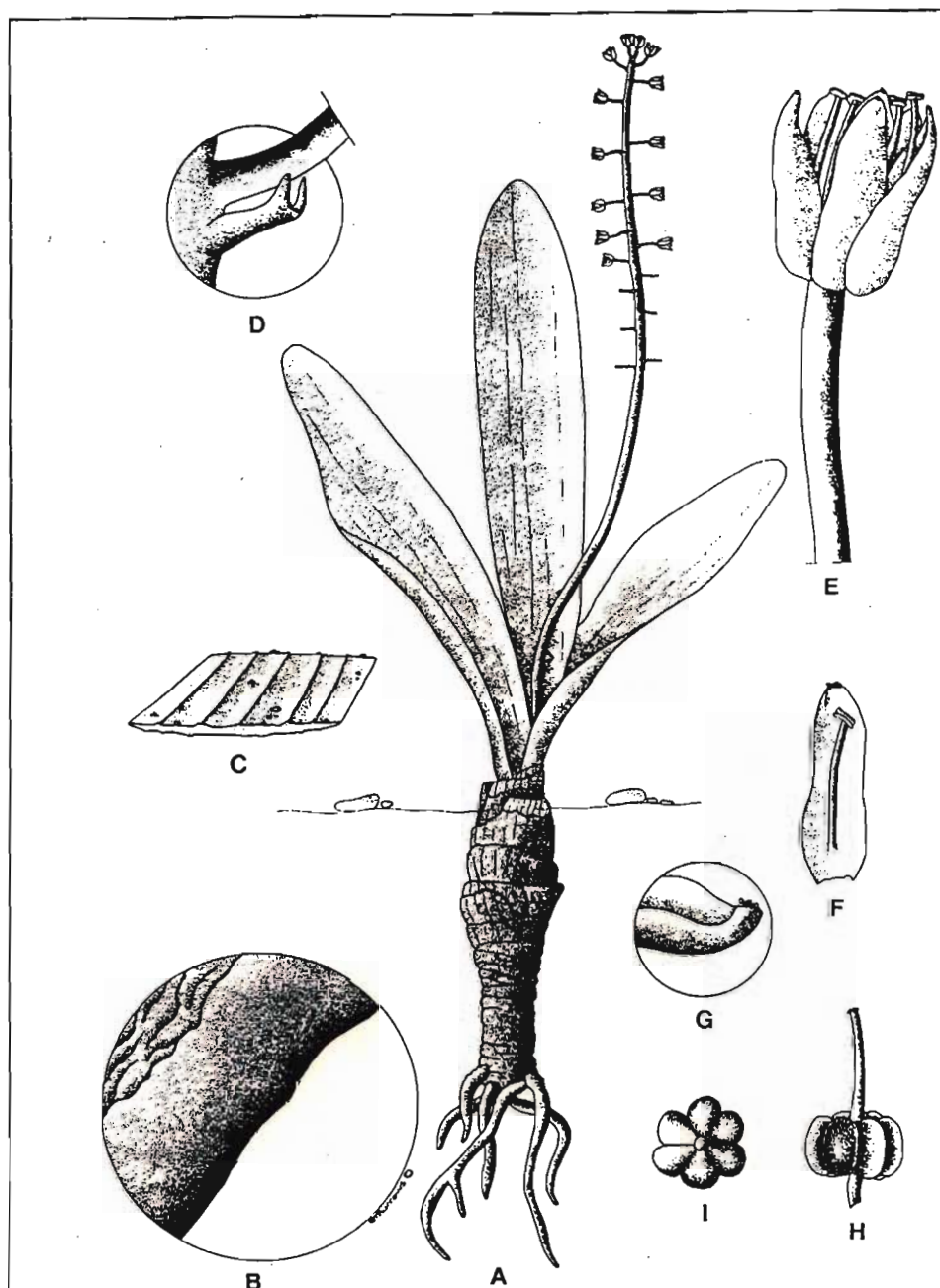


Figure 26. Illustration of *L. viscosa* Jessop. A, habit X 1; B, lamina margin X 300; C, section through lamina X 2; D, bract X 10; E, flower X 10; F, tepal with stamen X 10; G, tepal apex X 20; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from *Venter* 13,455.

Map 10. Known distribution of *L. viscosa* Jessop

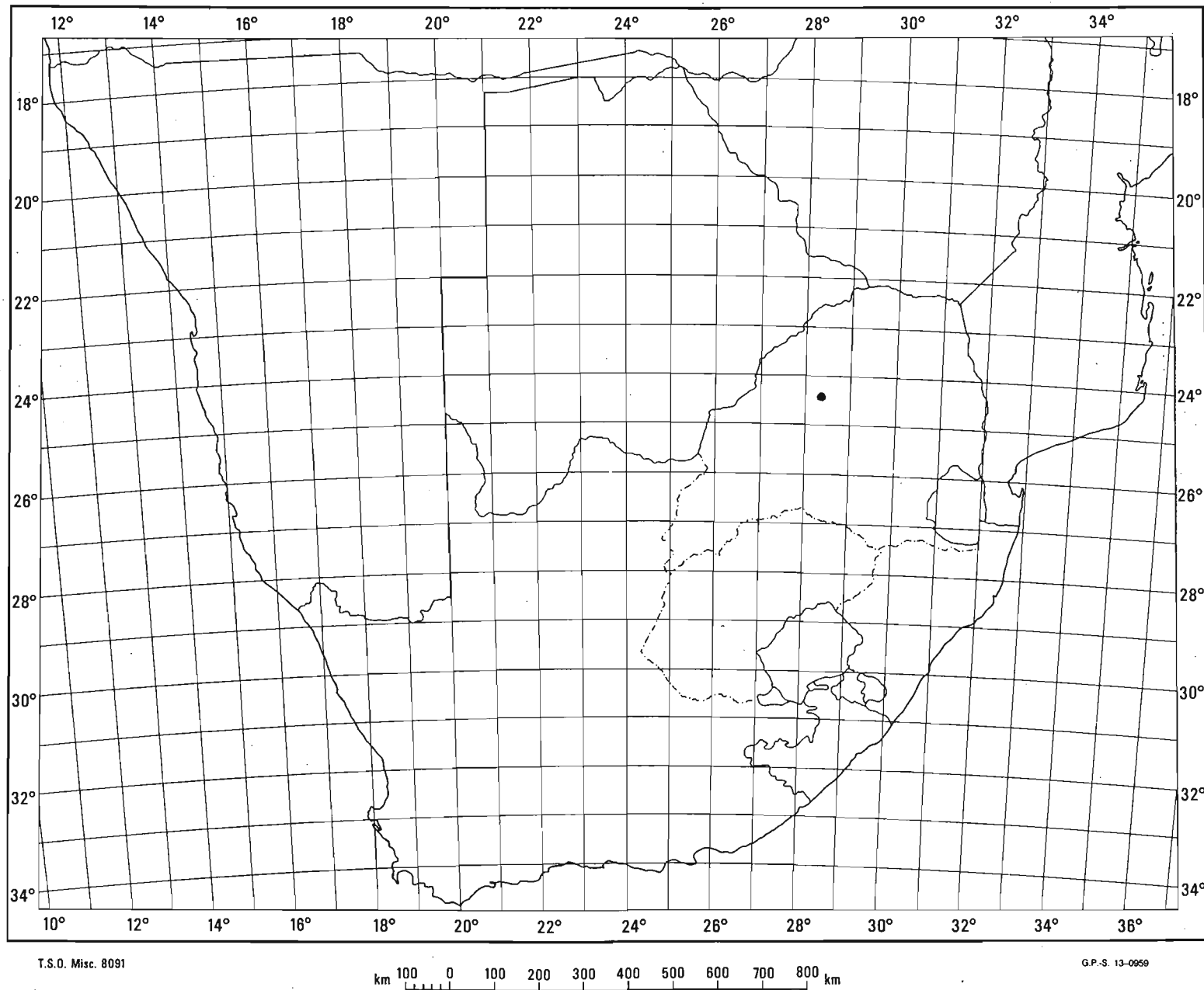
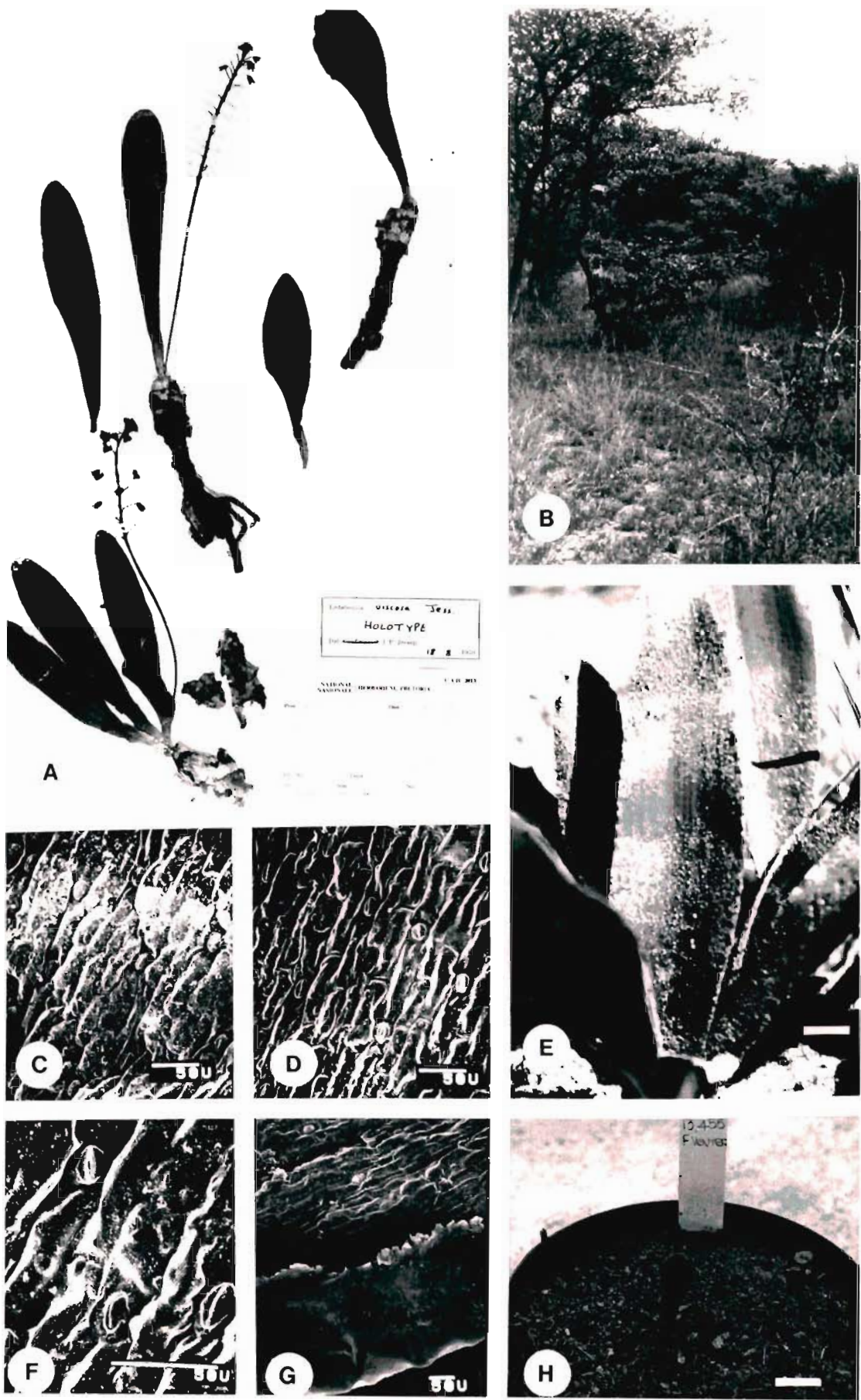


Figure 27. A, holotype of *L. viscosa* Jessop (PRE); B, habitat near Thabazimbi. The vegetation consists of closed deciduous low *Terminalia sericea* - *Acacia tortilis* subsp. *heteracantha* - *Grewia flava* - *Digitaria eriantha* woodland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, leaves of *L. viscosa* with sand particles adhering to the surfaces. Bar = 10 mm. F, SEM micrograph of the stomata; G, SEM micrograph showing the thick resinous covering of the lamina; H, leaf unrolling, a unique character in *Ledebouria*. Bar = 20 mm. C - H from Venter 13,455.



Specific epithet etymology.

Describes the viscid leaves (Figure 27E).

Flowering period

From January to April. Most plants flower during March and April.

Distribution (Map 10).

Endemic around Thabazimbi in the north-western Transvaal.

Habitat

Known populations of *L. viscosa* occur on well drained, loose, red to brown, medium grained (0.25 - 1.0 mm ϕ) deep sandy soil of the Gordonia Sand Formation of the Kalahari Group.

The vegetation consists mainly of closed deciduous tall *Terminalia sericea* - *Acacia tortilis* subsp. *heteracantha* - *Digitaria eriantha* woodland (Figure 27B).

Specimens examined

TRANSVAAL -2427 (Thabazimbi): Kransberg (-BC), *Meeuse 10, 493* (PRE); Kransberg, farm Waterval (-BC), *Dyer & Ehrens 4201* (PRE); farm Buffelshoek 446 (-DA), *Venter 13,455* (UNIN).

Subsectio **Stellatae** *S. Venter*, subsect. nov., perianthio sigillatim stellato.

Species typica: *L. rupestris* (Van der Merwe) *S. Venter*.

Species: *L. leptophylla* (Bak.) *S. Venter*, *L. lepida* (N.E. Br.) *S. Venter*, *L. minima* (Bak.) *S. Venter*, *L. rupestris* (Van der Merwe) *S. Venter*.

Leaves with adaxial surface concolorous. **Raceme** 10 - 25 mm long. **Perianth** stellate; tepal apices acute.

7. *LEDEBOURIA LEPTOPHYLLA* (Bak.) *S. Venter*

Ledebouria leptophylla (Bak.) *S. Venter*, comb. nov.

Scilla leptophylla Bak. in Flora Cap. 6: 483 (1896).

Type: Transvaal, Near the Devil's Kantoer, Kaapsche Hoop, *Bolus* 7623 (K !, holo.; BOL !, drawing and iso.).

Scilla graminifolia Bak. in Bull. Herb. Boiss. ser. 2(4): 1001 (1904).

Type: Transvaal, Modderfontein, *Conrath* 703 (K!, holo.; BOL!, drawing; GRAZ; PRE!, photo.; Z!).

Ledebouria graminifolia (Bak.) Jessop in Jl S. Afr. Bot. 36(4): 259 (1970).

Type: Same as *S. graminifolia*.

Scilla stenophylla Van der Merwe in Flower. Pl. S. Afr. 25: t.959 (1944).

Type: Natal, Paulpietersburg, *Van der Merwe* 2655 (PRE!, holo.).

Plants solitary. **Bulb** hypogeal, 40 - 60 x 20 - 30 mm, obovoid to globose; dead bulb scales light to dark brown, membranous, apices attenuate, live bulb scales fleshy, tightly arranged, without threads when torn, white inside. **Leaves** partly emerged at anthesis, 8 - 20, erect or sometimes spreading, spirally twisted, linear, 60 - 150 x 2 - 5 mm, with threads when torn, thinly fleshy to slightly

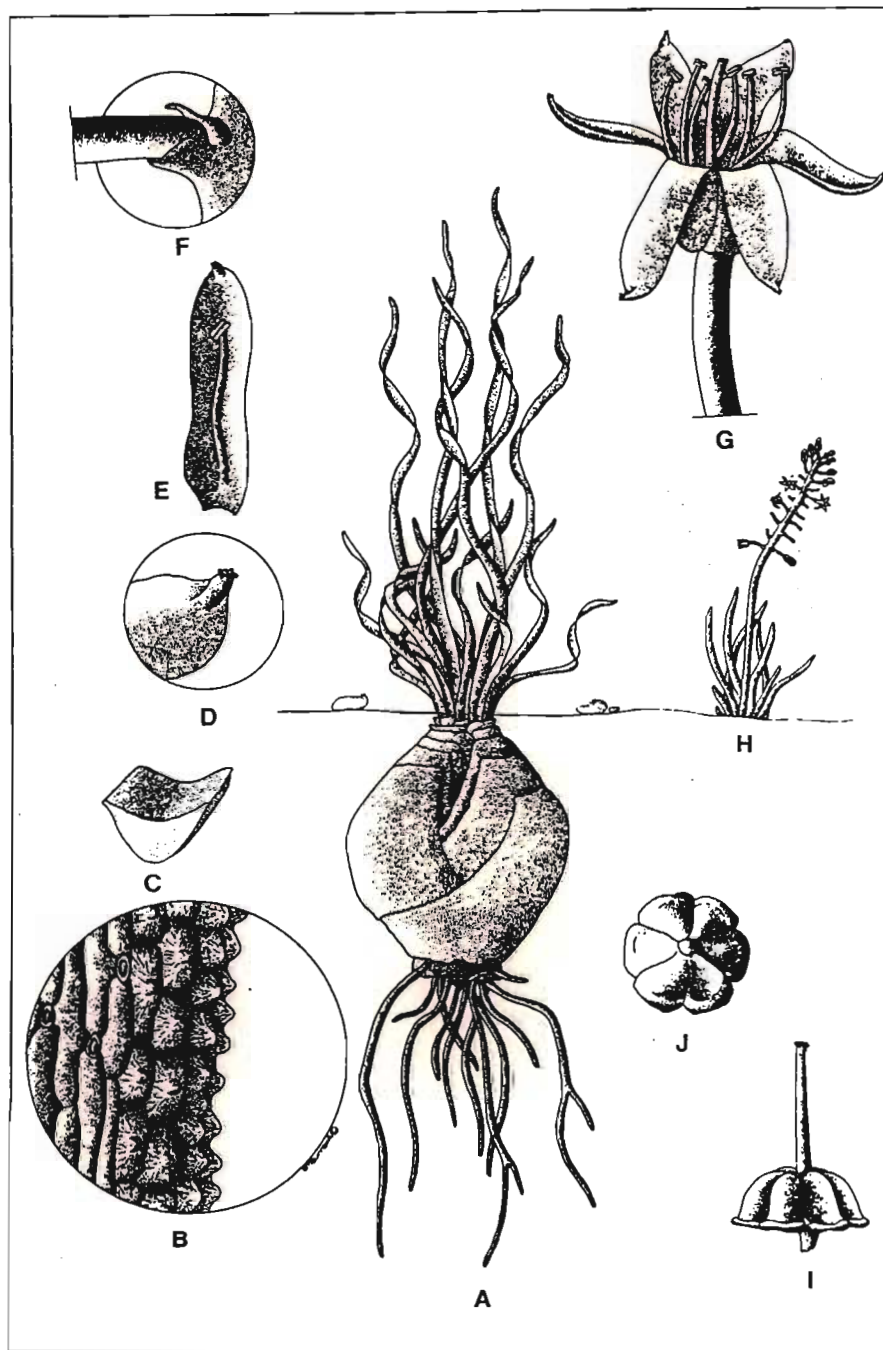
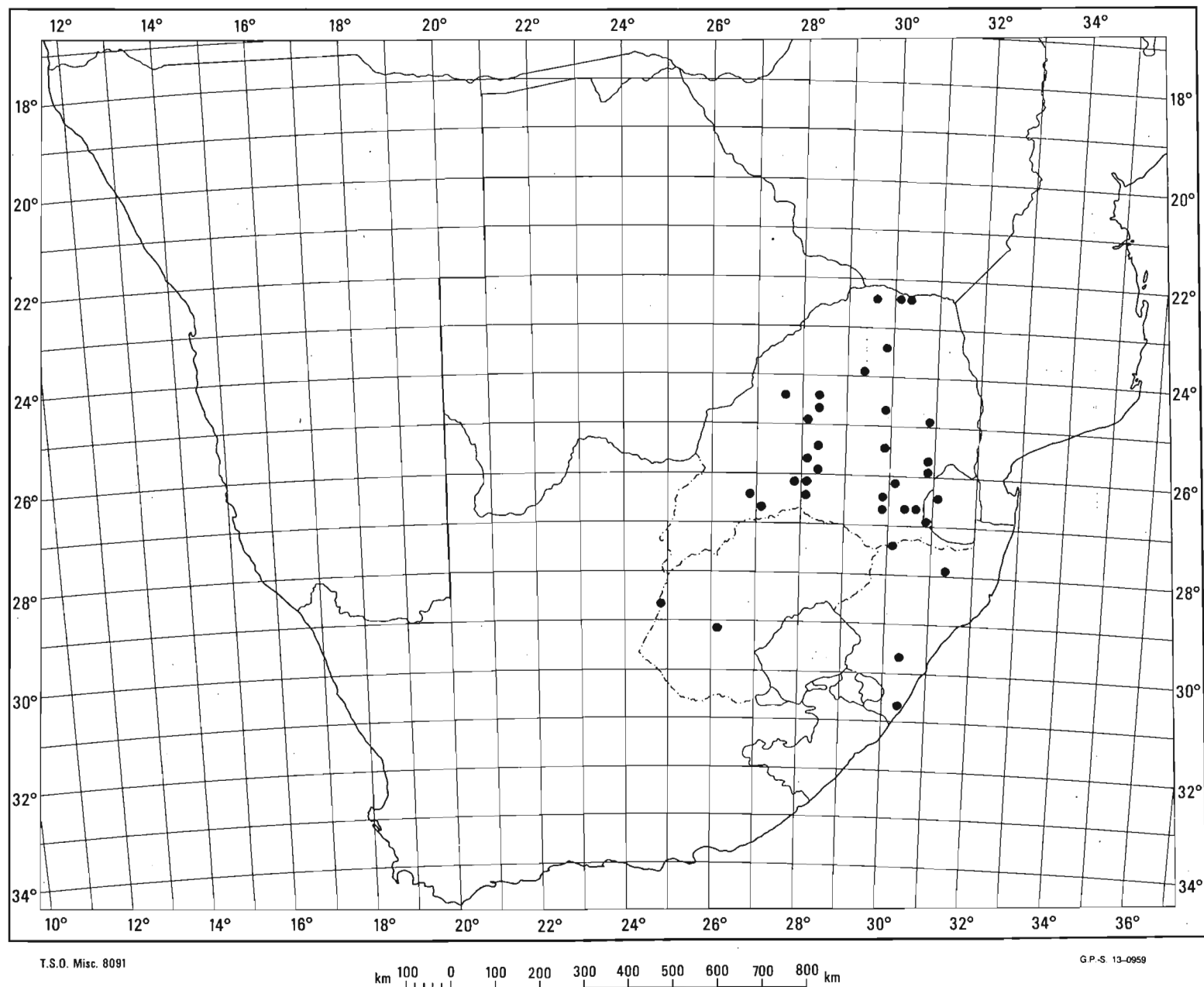


Figure 28. Illustration of *L. leptophylla* (Bak.) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 10; D, tepal apex X 20; E, tepal with stamen X 10; F, bract with bracteole X 10; G, flower X 10; H, habit of nonspiral-leaved form X 1; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Venter 13,214* except H from *Venter 13,251*.

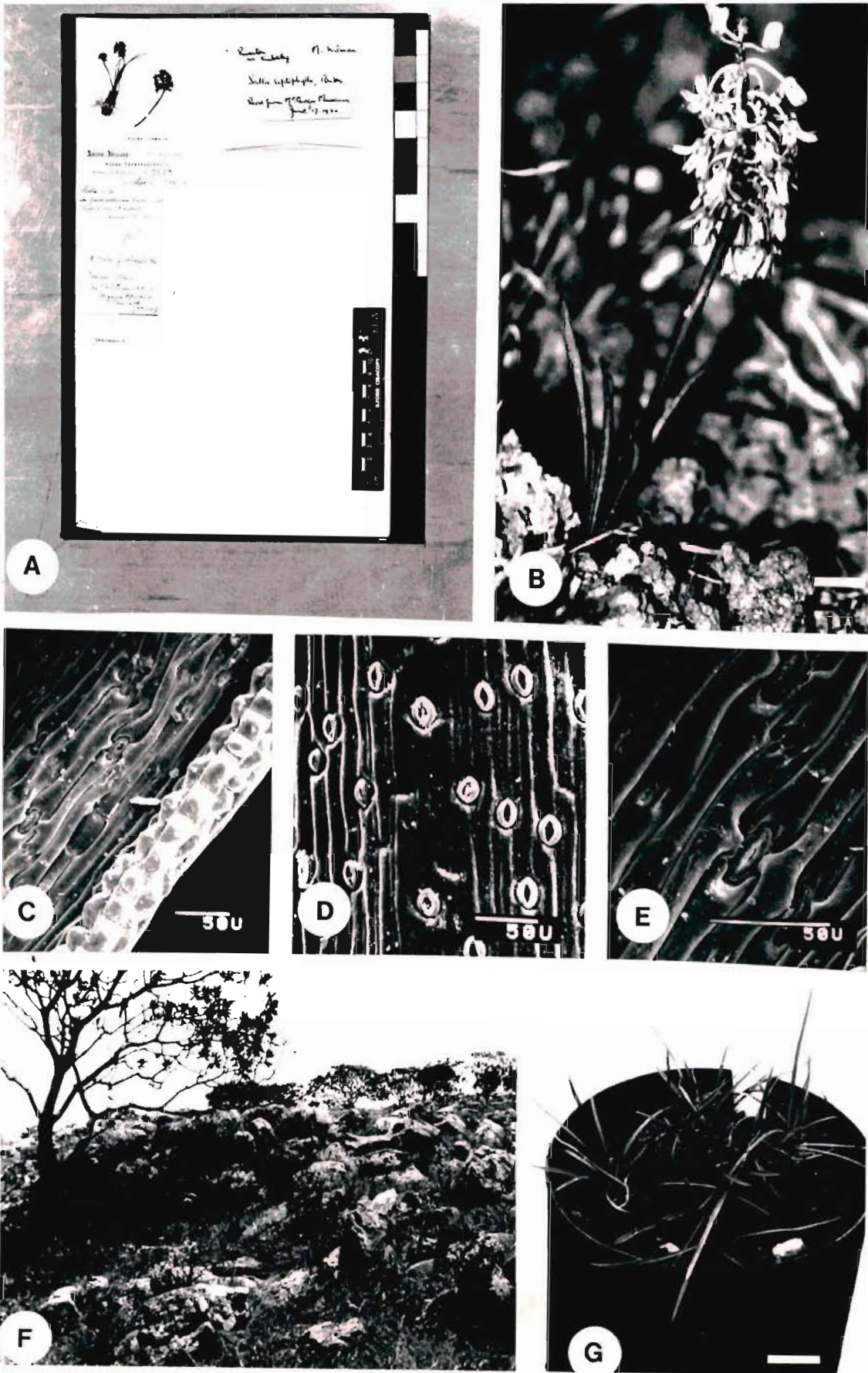
Map 11. Known distribution of *L. leptophylla* (Bak.) S. Venter



T.S.O. Misc. 8091

G.P.S. 13-0959

Figure 29. A, holotype of *L. leptophylla* (Bak.) S. Venter (K); B, miniature form resembling *L. minima* (Bak.) S. Venter. Bar = 20 mm; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, habitat at Angle Station, between Barberton and Havelock. The vegetation consists of open low *Protea roupelliae* var. *roupelliae* - *Helichrysum splendidum* - *Xerophyta retinervis* woodland; G, plants with nonspiral leaves. Bar = 20 mm. B and G from Venter 13,251 and C - E from Venter 13,214.



leathery, surfaces with a dull lustre, grey-green to glaucous green, abaxial surface with dull purple spots and cross bars at base, venation mostly prominent; margin smooth to finely papillate; leaf base canaliculate; apex acute. **Inflorescences** 1 - 3, dense, oblong, 25 x 15 mm, erect to flaccid, 25 - 30-flowered, longer than the leaves; scape terete at base, green, glabrous; rachis ridged, scape smooth, 18 - 20 mm long. **Bracts** membranous, 1 x 0.25 mm, linear - lanceolate, grey to white, with bracteoles. **Pedicels** spreading, 4 mm long, pink. **Perianth** 4 - 6 mm long, stellate, tepals suberect, equal, 4 - 6 x 1.75 mm, apex obtuse, pink with a green keel. **Stamens** erect, 4 - 6 mm long, filaments maroon, epitepalous; anthers 1 mm long, pale violet. **Ovary** ovoid, 6-lobed, 1 x 2 mm, lobes narrowly transversely oblong, apex shoulders rectangular, base lobed. **Style** 3 mm long, terete, glabrous, purple; stigma equal height to anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop - shaped, 2 - 3 mm long, surface strongly wrinkled, black. (Figure 28).

L. leptophylla is related to *L. minima* in having glaucous, linear leaves, stellate flowers and prominent ovary shoulders but differs in the papillate lamina margin, leaves with threads when torn, ridged rachis, prominent bracteole and ovary shoulders.

Specific epithet etymology.

Describes the narrow, linear leaves.

Flowering period

From August to January with peak flowering in November.

Distribution (Map 11).

L. leptophylla occurs mainly in woodlands of the Transvaal with scattered localities in Swaziland, Natal and the Orange Free State.

Habitat

L. leptophylla grows in full sun in open grassveld areas. In high lying areas it occurs in montane grassland only.

Variation

There are two distinct forms of *L. leptophylla*. One form has leaves slightly twisted, 4 - 5 mm wide, spreading and green. It occurs on the Transvaal Drakensberg Escarp between Graskop and Sabie (Venter 13,251) (Figure 29G). The more common form has strongly twisted glaucous green leaves 2 - 4 mm wide, leathery textured and copious threads when torn (Venter 13,214).

The flower colour varies from green (rare), pink with a green keel (common form) to pink. Although the flowers of *L. leptophylla* are stellate, the proximal half of the tepals tends to bend slightly backwards in some plants.

Specimens examined

TRANSVAAL. - 2229 (Waterpoort): Messina, Dongola (-BC), *Pole-Evans* 4373 (PRE). -2230 (Messina): Messina (-AC), *Moss & Rogers* 7 (J); *Moss & Rogers* 205 (J). -2329 (Pietersburg): Bandelierkop (-BD), *Van der Merwe* 1727 (PRE); Pietersburg (-CD), *Venter* 13,332 (UNIN); *Venter* 13,367 (UNIN). -2330 (Tzaneen): Middle Letaba Dam (-AD), *Venter* 13,064 (UNIN). -2427 (Thabazimbi): Kranzberg (-BC), *Van der Merwe* 2025 (PRE); *Van der Merwe* 2019 (PRE). -2428 (Nylstroom): Vaalwater, Geelhoutkop (-AD), *Venter* 13,214 (UNIN); Nylstroom (-CB), *Häfstrom & Acocks* 233 (PRE); Warmbaths (-CC), *Leendertz* 6654 (PRE); *Leendertz* 6653 (J). -2429 (Zebediela): Sekoekoeniland (-DB), *Van der Merwe* 1768 (PRE). -2430 (Pilgrim's Rest): Graskop, Kowyn's Pass (-DD), *Venter* 12,573 (UNIN); Mac Mac (-DD), *Venter* 13,251 (UNIN). -2528 (Pretoria): Pretoria (-CA), *Moss* 8594 (J); *Mogg* 15,189 (PRE); Pretoria, Faerie Glen (-CD), *Van Wyk* 2379 (PRU); -2529 (Witbank): Stoffberg (-BD), *Van der Merwe* 2025 (PRE). -2530 (Lydenburg): Kaapsche

Hoop (-DB), *Rogers 21,408* (J); Nelshoogte, Thorncroft Nature Reserve (-DD), *Raal & Raal 1602* (Transvaal Provincial Administration). -2626 (Klerksdorp): Ventersdorp, farm Somerville (-BD), *Louw 2292* (PUC). -2627 (Potchefstroom): Potchefstroom (-CA), *Venter 13,220a* (UNIN). -2628 (Johannesburg): Widsor Park (-AA), *Gilliland 26138* (J); Zoo Koppies (-AA), *Moss 7144* (J); Edenvale, Rietfontein (-AA), *Venter 13,340* (UNIN); Alberton (-AC), *Moss 13,902* (J); Palmietfontein (-AC), *Lloyd s.n.* (J). -2629 (Bethal): Ermelo (-BD), *Scholars 60* (PRE); Between Ermelo and Breyten (-BD), *Venter 3540* (PRE). -2630 (Carolina): Carolina (-AA), *Rogers 21,300* (J); Amsterdam, Lichfield (-DD), *Van der Merwe 1071* (PRE). -2730 (Vryheid): Piet Retief, between Wittenberg and Bergen (-BB), *Acocks 11,735* (BOL).

SWAZILAND. - 2631 (Mbabane): Bomvu Ridge (-AC), *Karsten s.n.* (PRE); Sibebe Hill (-CB), *Prior 257* (PRE).

ORANGE FREE STATE. - 2824 (Kimberley): Riverton (-DB), *Wilman s.n.* sub BOL 22,488 (BOL). -2926 (Bloemfontein): Bloemfontein (-AA), *Moss 10,806* (J); *Potts 1340* (BOL).

NATAL. - 2731 (Louwsburg): Ngotshe, Ngome (-CD), *Hilliard & Burt 8421* (NU, PRE). -2930 (Pietermaritzburg): Oribi Airfield (-CB), *Moll 1861* (NU).

8. *LEDEBOURIA LEPIDA* (N.E. Br.) S. Venter

Ledebouria lepida (N.E. Br.) S. Venter, comb. nov.

Scilla lepida N.E. Br. in Kew Bull. : 299 (1921).

Type: Transvaal, Palala River, *Breyer s.n.* in Herb. Rogers 24009 (K!, holo.; BOL!, drawing; PRE!).

Plants solitary. **Bulb** hypogeal, 10 - 15 x 10 - 15 mm, ovoid to subglobose; dead bulb scales brown, membranous, apices attenuate, live bulb scales fleshy, tightly arranged, with threads when torn, white inside. **Leaves** fully developed at anthesis, 2 - 3, spreading or sometimes erect, lanceolate, 30 - 50 x 8 - 20 mm, without threads when torn, fleshy, adaxial surface with rows of cilia, surfaces glossy dark green with purple cross bars at the leaf base, immaculate above, venation prominent; margins occasionally revolute, with rows of cilia; leaf base canaliculate; apex acute. **Inflorescences** 1 - 2, dense, oblong, 10 - 15 x 10 - 12 mm, erect, 13 - 20-flowered, longer than the leaves; scape terete at base, purple, pilose; rachis smooth, 30 - 50 mm long. **Bracts** fleshy, 0.5 x 0.5 mm, dentate, pink to purple, with bracteoles. **Pedicels** spreading, 2.0 - 2.5 mm long, purple. **Perianth** 3.0 - 3.5 mm long, stellate, tepals suberect, equal, oblong to linear, 3.0 - 3.5 x 1.5 mm, apex acute, pink to purple. **Stamens** erect, 3 mm long, filaments maroon, epitepalous; anthers 1 mm long, violet. **Ovary** globose, 6-lobed, 0.75 - 0.80 x 1.25 - 1.50 mm, lobes depressed ovate, apex tapering into the style. **Style** 3 mm long, triangular, glabrous, purple; stigma above anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** globose, 2 mm long, surface strongly wrinkled, black. (Figure 30).

Together with *L. leptophylla* (Bak.) S. Venter, *L. minima* (Bak.) S. Venter and *L. rupestris* (Van der Merwe) S. Venter, it comprises the subsection *Stellatae*.

A distinctive feature of this species is the pilose scape and the small flowers.

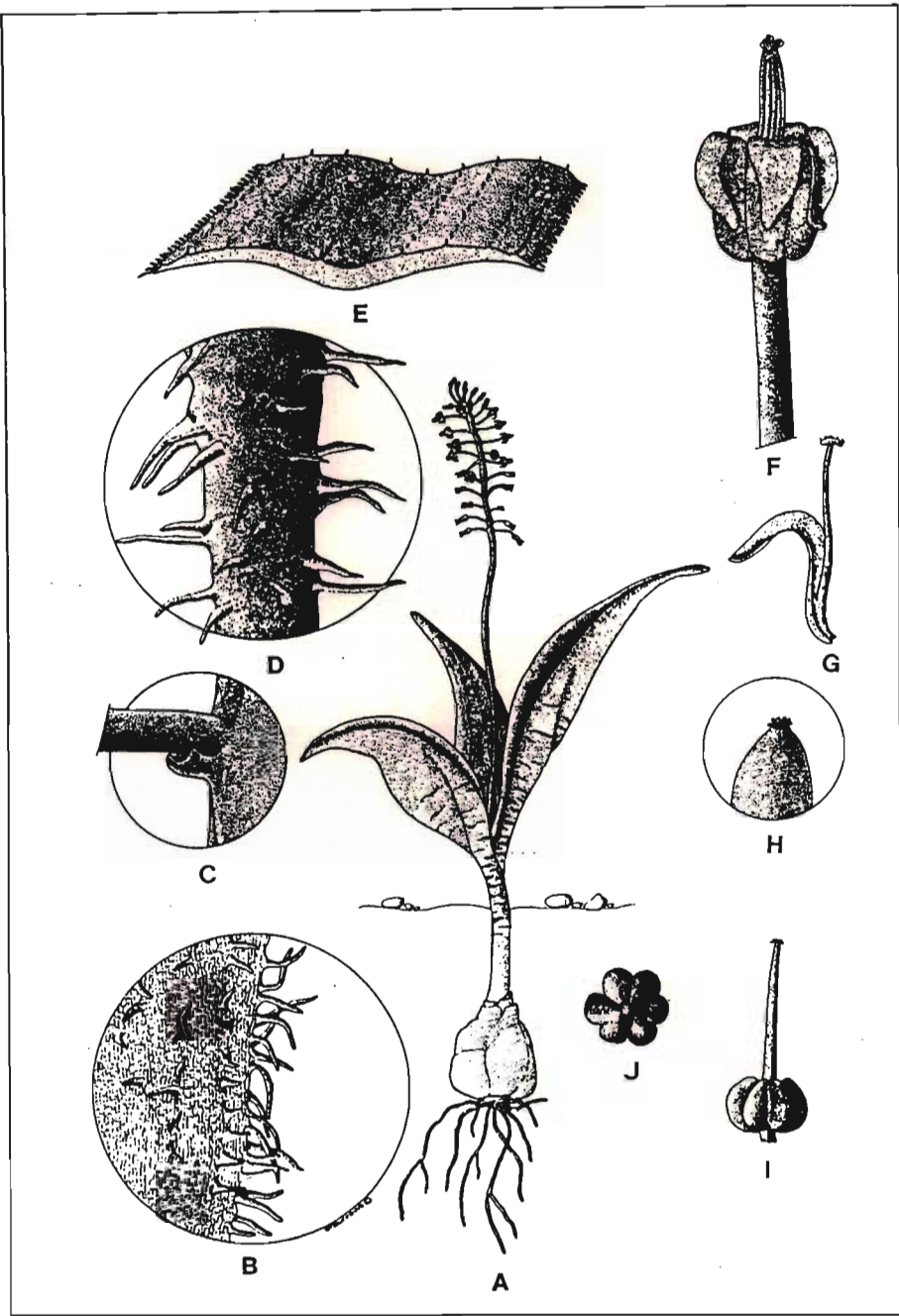


Figure 30. Illustration of *L. lepida* (N.E. Br.) S. Venter. A, habit X 1; B, lamina margin X 300; C, bract X 10; D, hairs on peduncle X 10; E, section through lamina X 2; F, flower X 10; G, tepal with stamen X 10; H, tepal apex X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Venter 13,415*.

Map 12. Known distribution of *L. lepida* (N.E. Br.) S. Venter

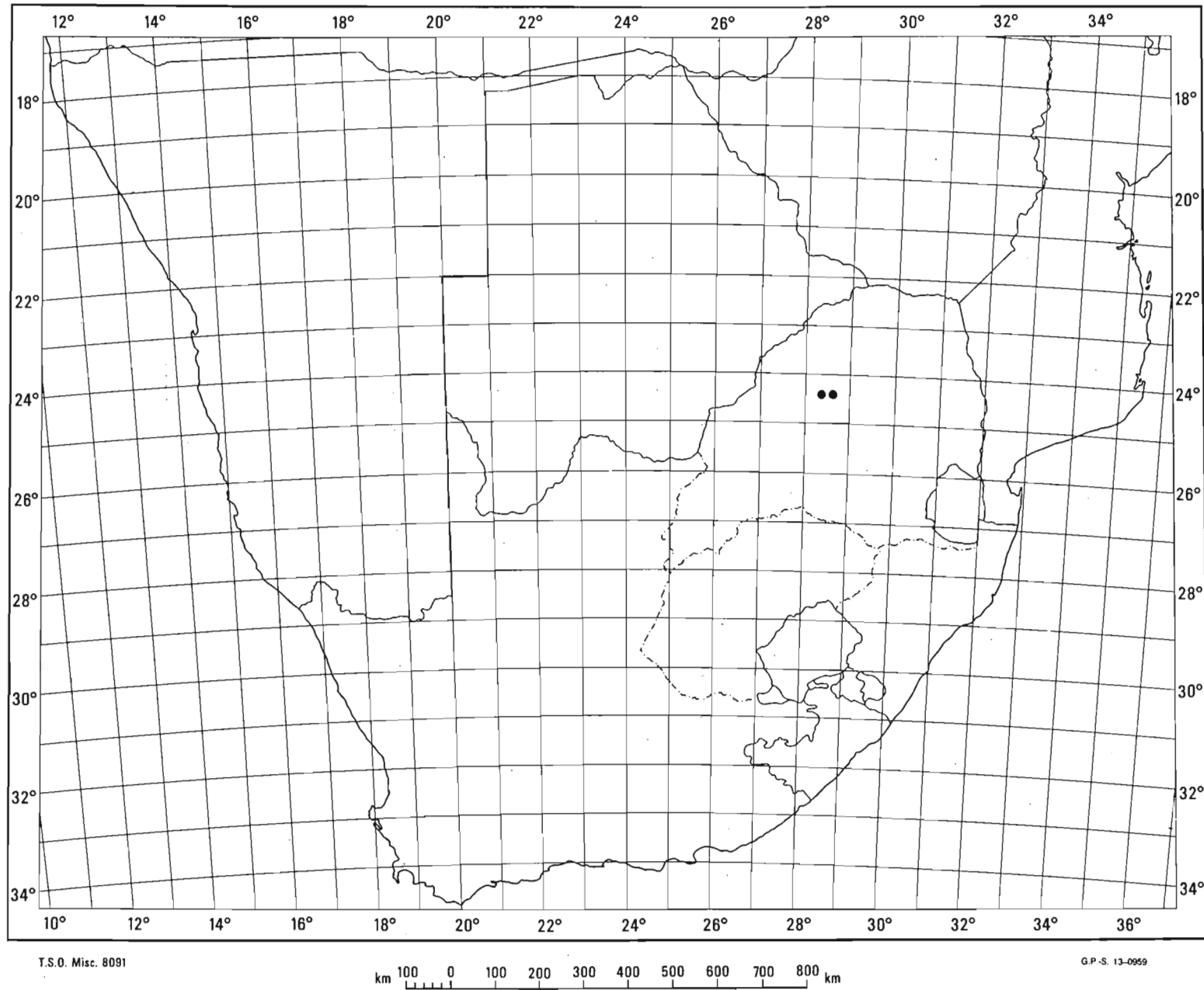
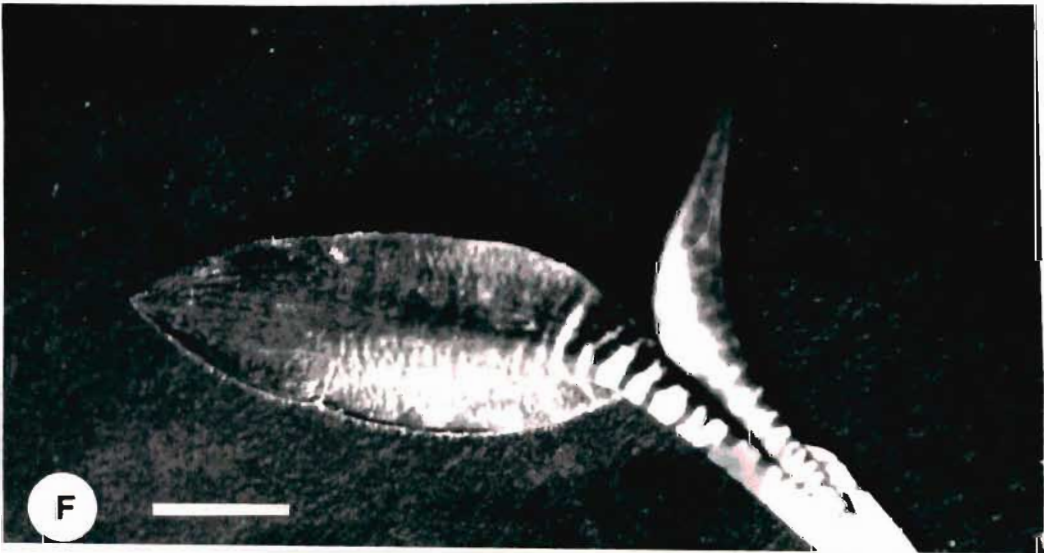
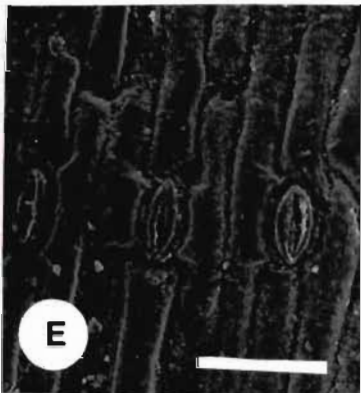
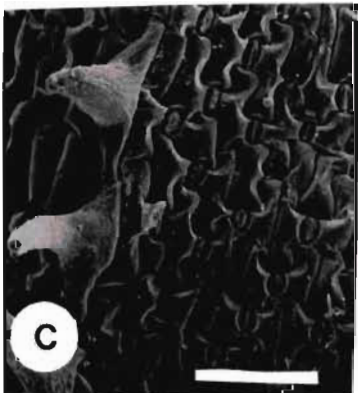
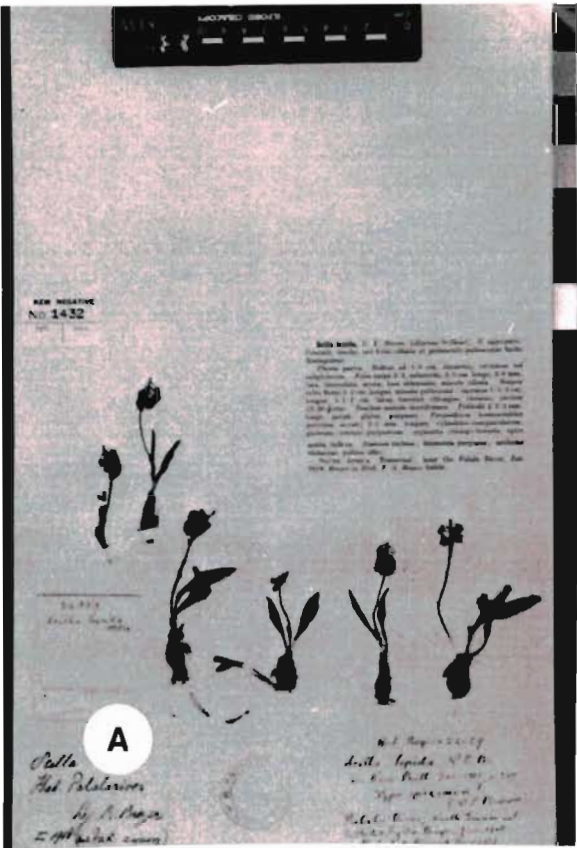


Figure 31. A, holotype of *L. lepida* (N.E. Br.) S. Venter (K); B, habitat near Palala, Waterberg. The vegetation consists of closed deciduous low *Combretum zeyheri* - *Mimusops zeyheri* - *Freylinia tropica* woodland; C, SEM micrograph of the adaxial lamina surface. Bar = 100 μm ; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata. Bar = 43 μm ; F, abaxial surface of the lamina showing the prominent purple zebra stripes on the petiole. Bar = 10 mm. C - F from Venter 13,415.



Specific epithet etymology.

Refers to the hairs on the leaves and scape.

Flowering period

From November to January. Peak flowering in December.

Distribution (Map 12).

A Transvaal and Waterberg endemic. This species is known only from the Palala area.

Habitat

The rocks in the Palala area are feldspathic sandstones of the Vaalwater Formation in the Waterberg Group (SACS 1980). The soils derived from these rocks are a gritty brown sandy loam with the grain size usually 0.5 - 2.0 mm diameter. These soils are usually shallow (10 - 45 mm) where the rocks form outcrops but deeper (100 - 450 mm) along the drainage lines.

L. lepida grows in seepages in *Combretum* woodland. The vegetation is a closed deciduous low *Combretum nelsonii* - *Rhoicissus digitata* - *Heteropyxis natalensis* Woodland (Figure 31B).

Specimens examined

TRANSVAAL. - 2428 (Nylstroom): Vaalwater, Geelhoutkop (-AD), Van der Merwe 324 (PRE); Vaalwater, Palala (-BC), Breyer s.n. sub Herb F.A. Rogers 24,009 (K, PRE); Venter 13,415 (UNIN).

9. *LEDEBOURIA MINIMA* (Bak.) S. Venter

Ledebouria minima (Bak.) S. Venter, comb. nov.

Type: As for *Scilla minima*.

Scilla minima Bak. in Saund. Ref. Bot. 3(App.): 6 (1870).

Type: Transvaal, on Macalisberg, *Burke s.n.* (K!, holo.; BOL!, drawing; PRE!, photo.).

Plants solitary. **Bulb** hypogeal, 8 - 10 x 4 - 7 mm, ovoid to obovoid; dead bulb scales brown to whitish, membranous, apices attenuate, live bulb scales membranous, tightly arranged, without threads when torn, white inside. **Leaves** fully developed at anthesis, 2 - 5, spreading, linear, 24 - 36 x 2 - 3 mm, without threads when torn, fleshy, surfaces dull green with dull purple cross bars at base of leaf, venation obscure; margin smooth; leaf base canaliculate; apex acute. **Inflorescences** 1 - 2, lax, oblong, 18 - 24 x 10 - 12 mm, flaccid, 12 - 20-flowered, longer than the leaves; scape terete at base, green, glabrous; rachis smooth, scape smooth, 38 - 50 mm long. **Bracts** fleshy, 1 x 0.5 mm, dentate, pink to purple, without bracteoles. **Pedicels** spreading, mostly horizontal, 3 - 4 mm long, pink. **Perianth** 2 mm long, stellate, tepals slightly recurved, equal, linear-oblong, 2 x 1 mm, apex acute, keel green on pink. **Stamens** erect, 2 mm long, filaments pink, epitepalous; anthers 0.5 mm long, violet. **Ovary** depressed ellipsoidal, 6-lobed, 0.5 x 1.12 mm, lobes depressed-ovate, glabrous with base of lobes papillate. **Style** 2 mm long, triangular, glabrous, purple; stigma carried above anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, clavate; base truncate. **Seed** drop-shaped, 3 mm long, surface strongly wrinkled, brown. (Figure 32).

L. minima is closely allied to *L. rupestris* (Van der Merwe) S. Venter. It differs in the glabrous, linear leaves and absence of bracteoles. Together with *L. lepida* and *L. leptophylla* they constitute the subsection *Stellatae*.

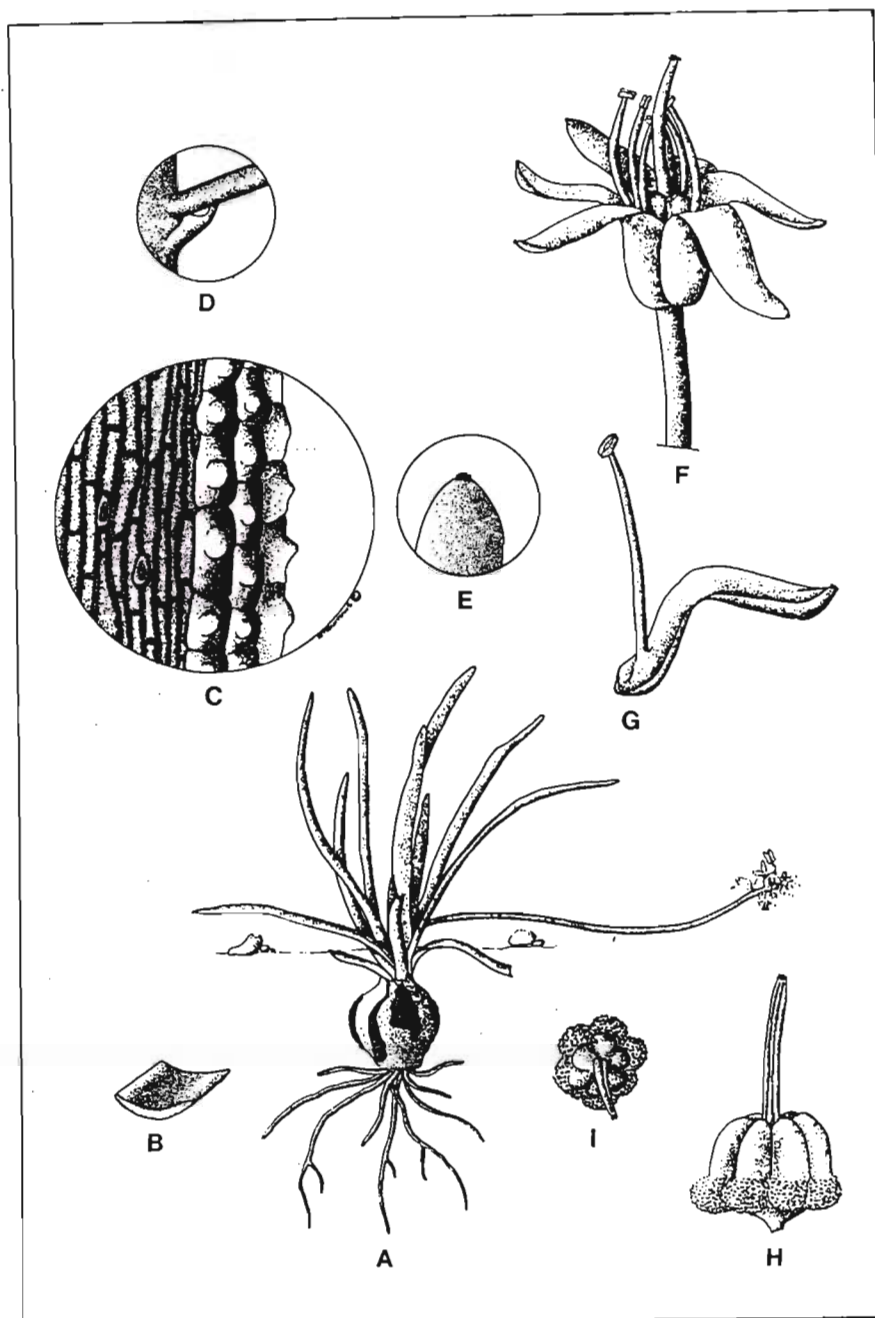


Figure 32. Illustration of *L. minima* (Bak.) S. Venter. A, habit X 1; B, section through lamina X 5; C, lamina margin X 300; D, bract X 10; E, tepal apex X 20; F, flower X 10; G, tepal with stamen X 10; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from Venter 13,404.

Map 13. Known distribution of *L. minima* (Bak.) S. Venter

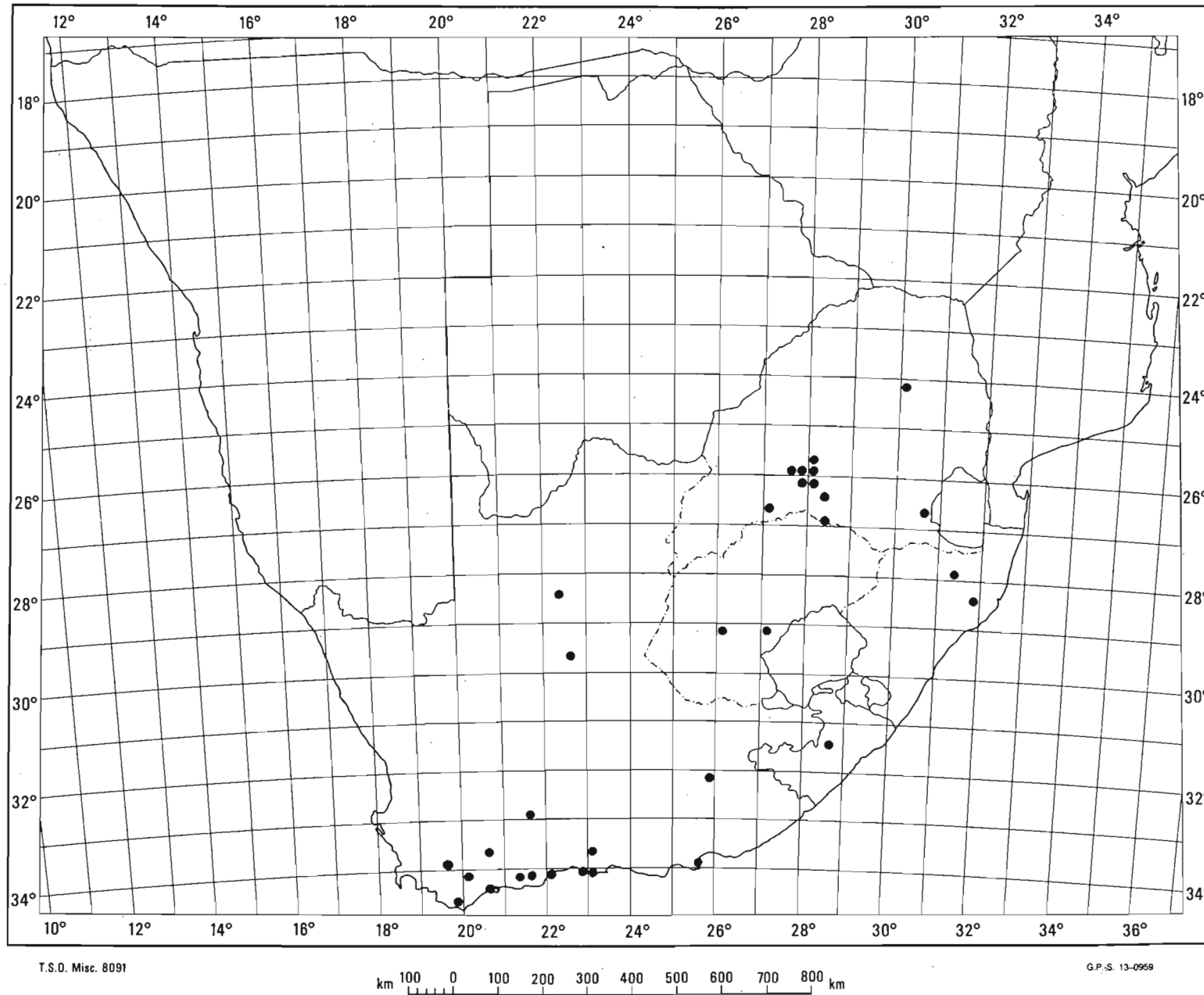
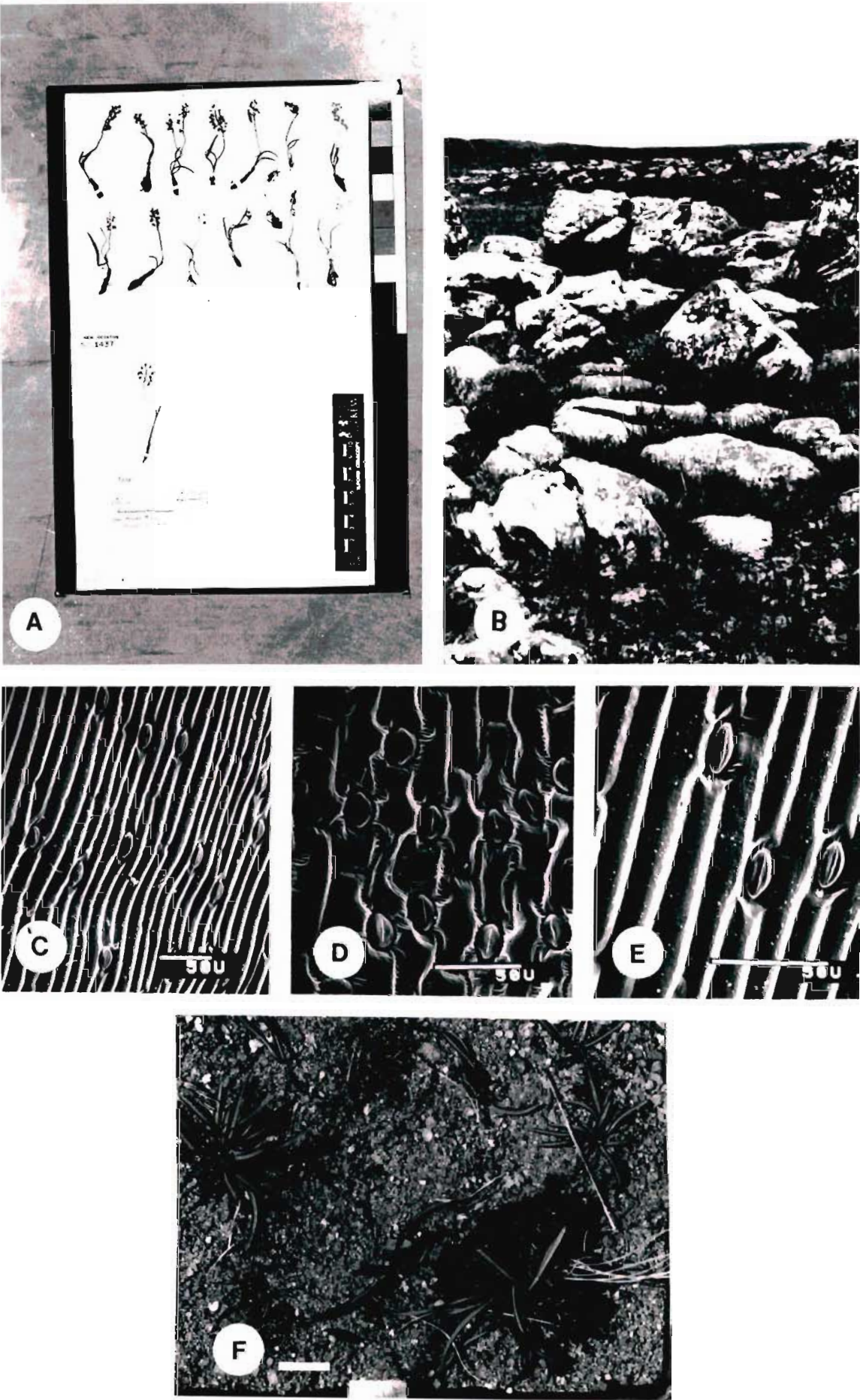


Figure 33. A, holotype of *L. minima* (Bak.) S. Venter (K); B, habitat on "The Downs" near Trichardtsdal, north-eastern Transvaal. The vegetation consists of *Tristachya leucothrix* - *Panicum natalense* - *Scilla natalensis* montane sour grassland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, plants showing filiform leaves. Bar = 20 mm. C - F from *Venter 13,404*.



Specific epithet etymology.

Describing the small stature of the plants.

Flowering period

From October to March with peak flowering from October to December.

Distribution (Map 13).

Throughout South Africa with two centres of distribution. The first centre around the PWV (Pretoria - Witwatersrand - Vereeniging) area and the second covering the southern Cape.

Habitat

L. minima grows in medium grained (0.25 - 0.25 mm ϕ) shallow (1 - 5 mm deep) humusrich sandy to loamy soil. Most of the populations seen occur in perennial seepages in short grassland (Figure 33B).

Population areas are usually small (< 200 m²). Leaf shape and colour of seedlings resemble grass making them cryptic.

Variation

Markings on the leaves in the northern populations tend to be restricted to dull purple cross bands at the leafbase. The Cape populations have plants with purple-mottled leaves, somewhat broader than their northern counterparts.

Some individuals have plain pink flowers compared to the normal pink flowers with a green keel on the tepals.

Specimens from Gordonia (*Leistner 2034*) and Prieska (*Bryant 743*) are here referred to as *L. minima* but differ in their broader leaves and larger flowers.

Specimens examined

TRANSVAAL - 2430 (Pilgrim's Rest): The Downs (-AA), *Stalmans* 832 (PRE). -2527 (Rustenburg): Magaliesberg, Rietpoort (-DC), *Moss & Maguire s.n.* sub J 22362 (J); Rustenburg, farm Uitkomst (-DD), *Coetzee* 438 (PRU). -2528 (Pretoria): Irene (-CC), *Obermeyer* 77 (PRE); *Leendertz* 923 (PRE). -2627 (Potchefstroom): Modderfontein (-BB), *Lloyd s.n.* (PRE); *West s.n.* sub J 31505 (J); Florida (-BB), *Dahlstrand* 1015T (PEU); Sterkfontein Caves (-BB), *Mogg* 36,275 (J); Potchefstroom, Boskop (-CA), *Ubbink* 506 (PUC); Potchefstroom (-CA), *Ubbink* 742 (PRE). -2628 (Johannesburg): Johannesburg (-AA), *Moss* 20,518 (J); Elsburg (-AA), *Lloyd s.n.* (J); Northcliff (-AA), *Gilliland s.n.* (J); Thorntree Kloof (-AA), *Moss* 5588 (J); *Moss* 10,813 (J); Frankenwald (-AA), *Van Rensburg* 25,411 (J); *Van Rensburg* 25,313 (PRE); *Phillips s.n.* sub J 25892 (J); *Jessop* 687 (PRE); *Jessop* 690 (PRE); Heidelberg, farm Schoongesicht 302 (-AD), *Burt Davy* 15,427 (BOL); Vaaldam, farm Sandfontein (-CD), *Aspoas s.n.* sub J 48392 (J).

ORANGE FREE STATE - 2927 (Maseru): Thaba Nchu, Mensvretersberg (-AA), *Peeters et al.* 323 (PRE). -2926 (Bloemfontein): Bloemfontein (-AA), *Müller* 420 (NBG,PRE); Hillandale (-AA), *Wassenfall* 856 (NBG).

NATAL - 2731 (Louwsburg): Ngome Forestry (-CD), *Van Wyk* 7095 (PRU).

CAPE - 2822 (Glen Lyon): Gordonias, Skeurberg Mountains on farm England (-AD), *Leistner* 2034 (PRE). 2922 (Prieska): Prieska (-DA), *Bryant* 743 (BOL); *Bryant s.n.* sub STE 18328 (STE); *Fuller* 114 (BOL). 3221 (Merweville): Prince Albert (-DC), *Krige s.n.* sub BOL 12980 (BOL). -3320 (Montagu): Kareevlakte (-DA), *Perry* 1240 (NBG). 3323 (Willowmore): Uniondale, Kouga (-CA), *Esterhuisen* 4672 (BOL). 3325 (Port Elizabeth): Bluewater Bay (-DC), *Urton* 890 (PEU); 3419 (Caledon): Zoetendals Vlei (-DB), *Fellingham* 396 (STE). 3420 (Bredasdorp): Potberg Nature Reserve (-BC), *Burgers* 1812 (STE). 3421 (Riversdale): Glen (-AB), *Muir* 3004 (BOL). 3422 (Mossel Bay): Mossel Bay (-AA), *Marloth* 7784 (PRE); Belvedere (-BB), *Duthie* 506 (STE). 3423 (Knysna): Knysna Heads (-AA), *Schönland* 3677 (BOL).

10. *LEDEBOURIA RUPESTRIS* (Van der Merwe) S. Venter

Ledebouria rupestris (Van der Merwe) S. Venter, comb. nov.

Scilla rupestris Van der Merwe in Flower. Pl. S. Afr. 21: t.828 (1941).

Type: Transvaal, near Mac Mac and Sabie, Van der Merwe 1586 (PRE!, holo.).

Plants mostly gregarious, sometimes solitary. **Bulb** hypogeal, 20 x 15 mm, ovoid; dead bulb scales brown, membranous, apices attenuate, live bulb scales fleshy, tightly arranged, without threads when torn, white inside. **Leaves** fully developed at anthesis, 3 - 6, spreading, lanceolate to oblanceolate, 30 - 100 x 5 - 10 mm, without threads when torn, fleshy, surfaces immaculate, glossy green, adaxial surface covered in rows of asperities, venation obscure; margins ciliate; leaf base canaliculate, petiolate, petiole 10 - 30 mm long; apex acute. **Inflorescence** solitary, lax, cylindric, 20 x 15 mm, flaccid, 8 - 10-flowered, longer than the leaves; scape terete at base, green, glabrous; rachis smooth, 50 - 60 mm long. **Bracts** fleshy, 1 x 0.25 - 0.50 mm, linear to bifurcate, pink to purple with bracteoles. **Pedicels** spreading, 2 mm long, pink. **Perianth** 4 mm long, stellate, tepals slightly recurved, equal, 4 x 1.0 - 1.5 mm, apex acute, pink to pink with a green keel. **Stamens** spreading, 3.5 mm long, filament maroon, epitepalous; anthers 0.5 mm long, violet. **Ovary** ovoid, 6-lobed, 1 x 1.5 - 2.0 mm, lobes obtusely deltate, glabrous, apex tapering into the style. **Style** 1.5 mm long, triangular, glabrous, purple above and white below; stigma at same height than anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, asymmetrical, clavate, base tapering. **Seed** drop-shaped, 3 - 4 mm long, surface strongly wrinkled, brown. (Figure 34).

pedicels papillose

L. rupestris is closely related to *L. minima*. The leaves and bulb scales lack threads when torn, leaves are monochromatic, racemes lax with a smooth rachis, bracts fleshy and the stellate flowers with acute tepals. Together with *L. lepida* and *L. leptophylla* they form the subsection *Stellatae*.

L. rupestris is easily distinguished by its petiolate leaves with adaxial asperities.

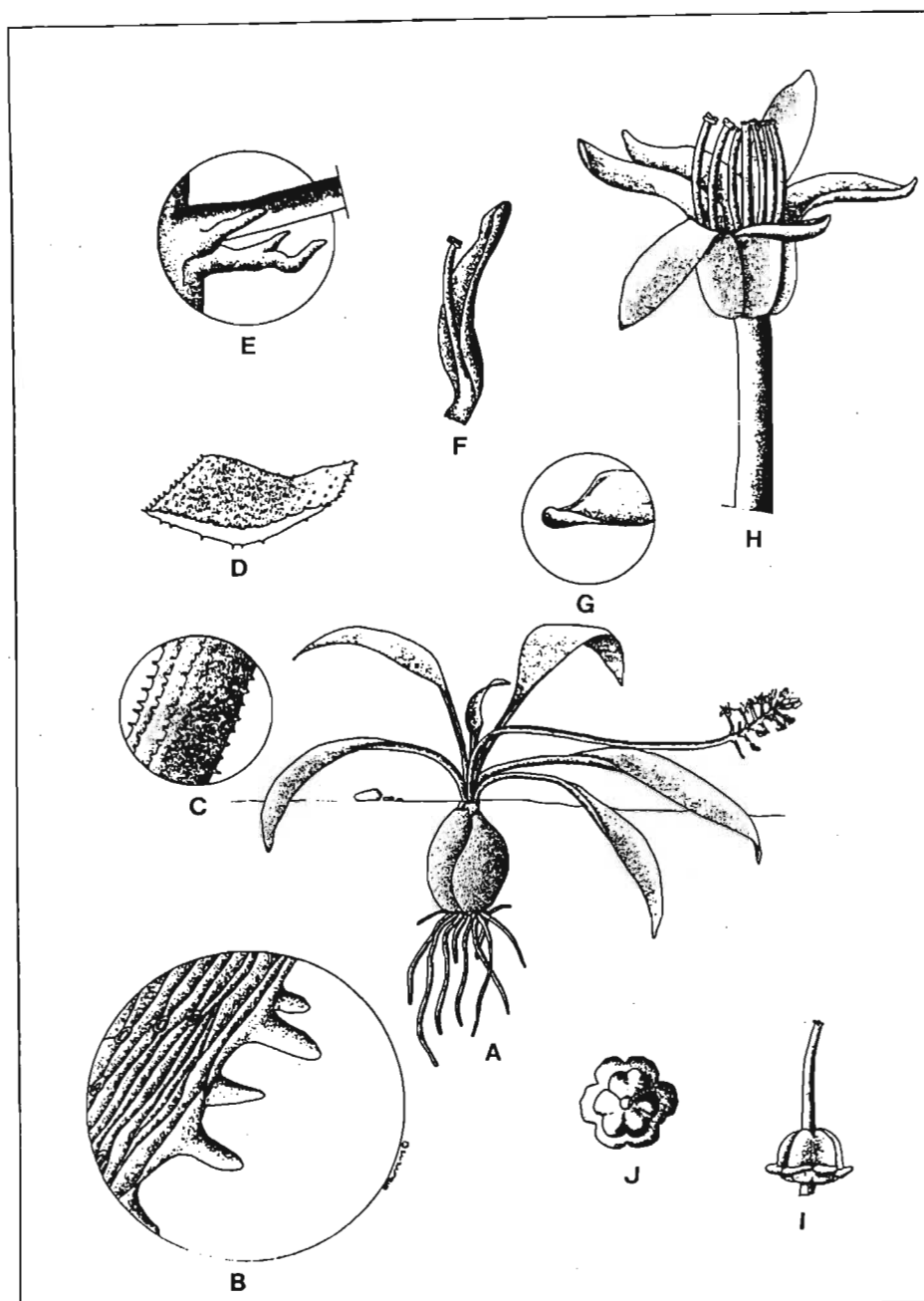


Figure 34. Illustration of *L. rupestris* (Van der Merwe) S. Venter. A, habit X 2; B, lamina margin X 300; C, section of the peduncle X 10; D, section through lamina X 5; E, bract with bracteole X 10; F, tepal with stamen X 10; G, tepal apex X 20; H, flower X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from Venter 13,250.

Map 14. Known distribution of *L. rupestris* (Van der Merwe) S. Venter

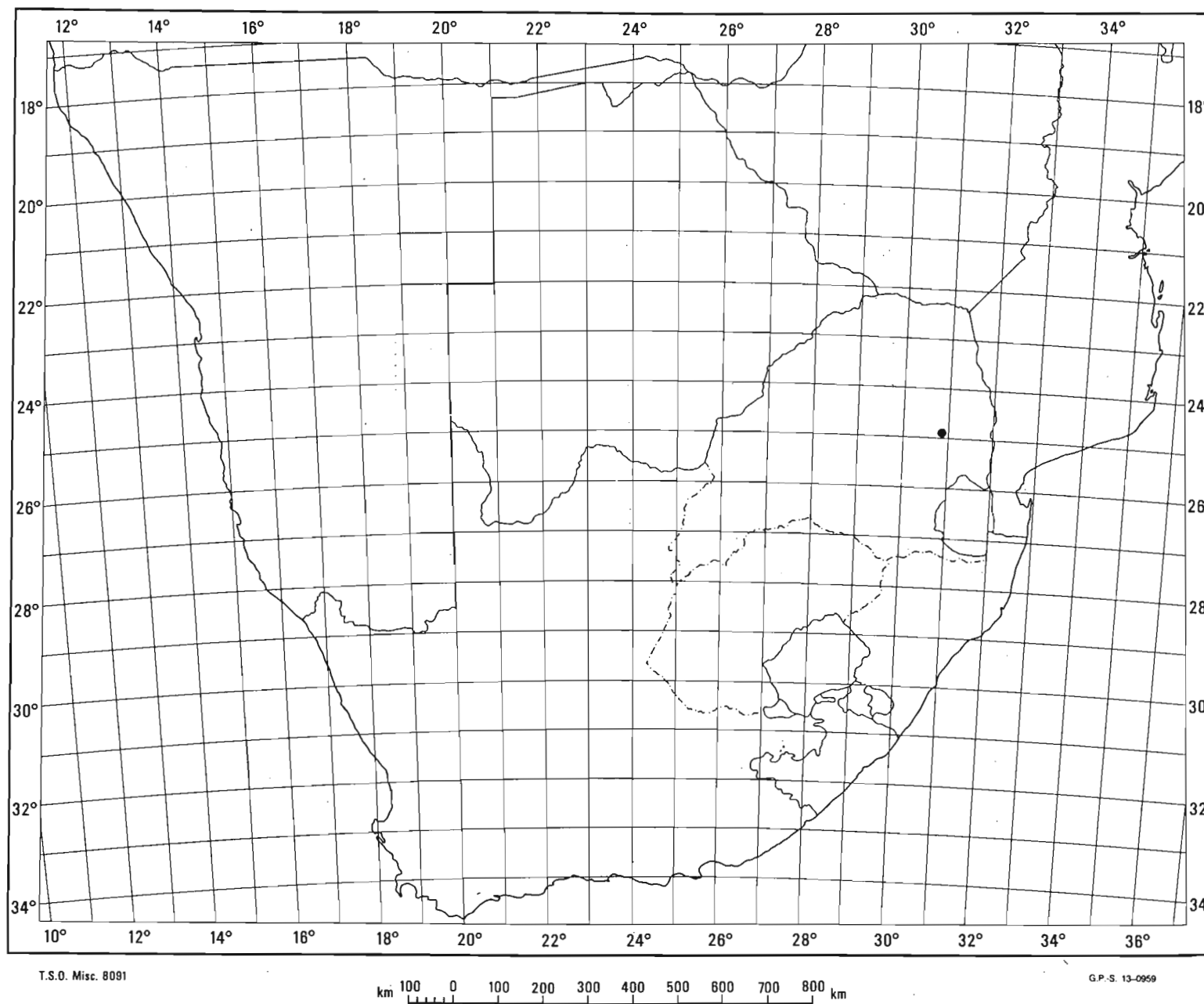
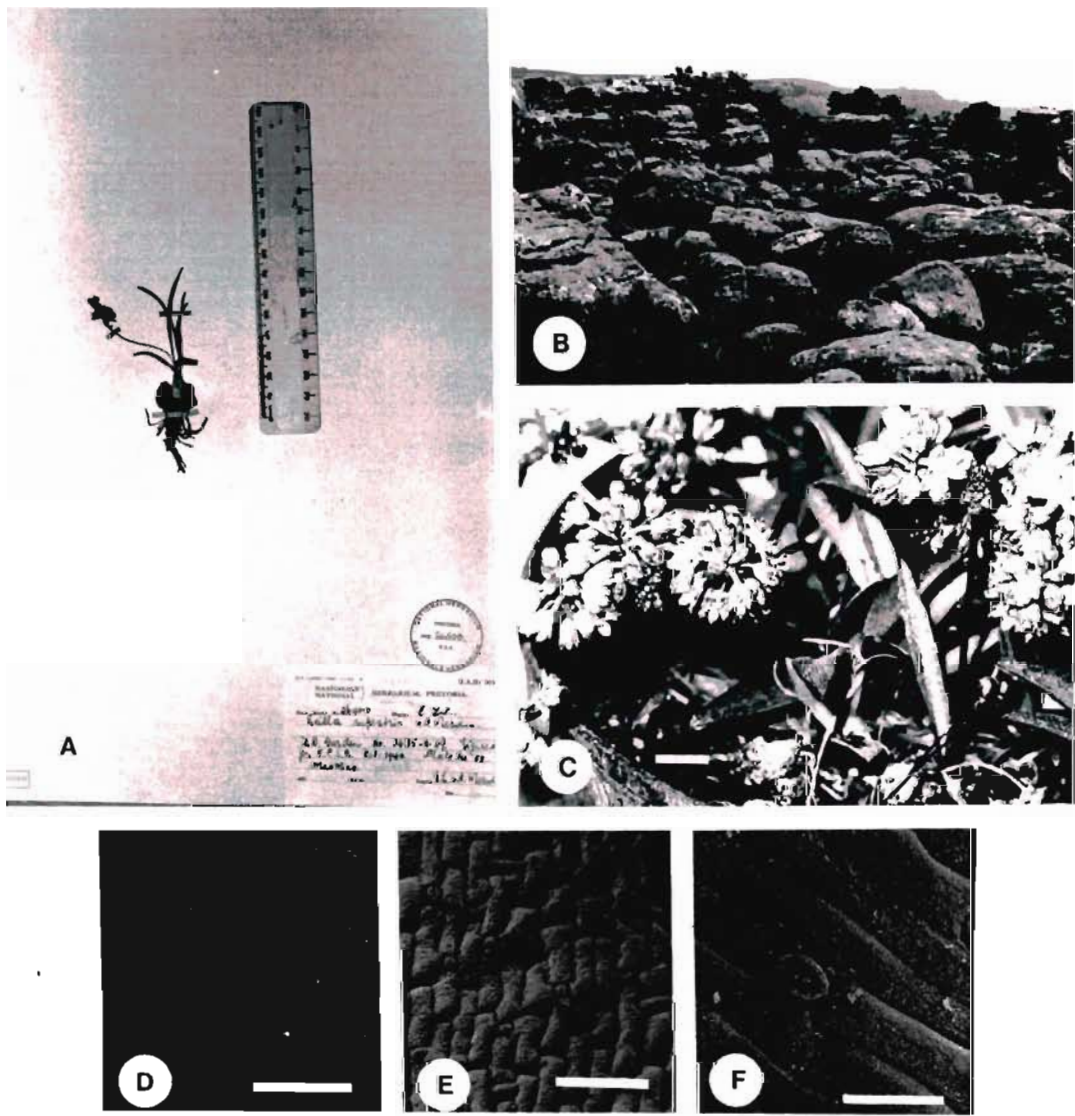


Figure 35. A, holotype of *L. rupestris* (Van der Merwe) S. Venter (PRE); B, habitat near Mac Mac Falls, eastern Transvaal. The vegetation consists of open short *Pteridium aquilinum* - *Parinari capensis* - *Digitaria eriantha* montane grassland; C, plants showing globose inflorescences with stellate flowers. Bar = 20 mm; D, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; E, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; F, SEM micrograph of a stomata. Bar = 43 μ m. C - F from Venter 13,250.



Specific epithet etymology.

Describes the rock-dwelling habit of this species.

Flowering period

From September to November.

Distribution (Map 14).

Only known from Mac Mac near Sabie in the eastern Transvaal.

Habitat

The rocks in this area consist of Black Reef Quartzite and conglomerate of the Wolkberg Group. Soil derived from these rocks is a shallow (5 - 120 mm), medium grained (0.25 - 1.0 mm ϕ), well drained sandy soil. *L. rupestris* grows in peaty humusrich sandy soil pockets in the rock cracks with *Selaginella dregei* (Presl) Hieron. covering the surfaces. These pockets are sheltered, receiving full sunlight only at noon.

The vegetation is interspersed with massive boulders and is an open short montane grassland flanked by closed evergreen low woodland (Figure 35B).

Variation

Only one specimen could be found that matches the type (*Van der Merwe 1,586*) which is probably somewhat aberrant. The type specimen lacks the lanceolate lamina and long petiole.

Specimens examined

TRANSVAAL - 2430 (Pilgrim's Rest): Mac Mac (-DD), *Van der Merwe 1586* (PRE); Mac Mac Falls (-DD), *Venter 13,250* (UNIN).

Sectio **Coriaceae** S. Venter, sect. nov., foliis crassicoriaceis crassimarginatis; inflorescentia erecta pauciflorifera.

Species typica: *Ledebouria coriacea* S. Venter.

Typus: Cape, Port Elizabeth, 'The Aloes' Railway Station, Venter 13,307 (PRE).

Plants 40 - 50 mm tall. **Bulbs** 15 - 20 mm wide. **Leaves** appressed to ground, thickly leathery, lamina margin thickened. **Inflorescence** solitary, erect, few flowered, rachis smooth.

Distribution and habitat.

Port Elizabeth area, in closed evergreen succulent shrubland.

The only section with thickly leathery leaves, thickened lamina margins and few-flowered inflorescences.

11. *LEDEBOURIA CORIACEA* S. Venter

Ledebouria coriacea S. Venter, sp. nov., ad *L. cooperi* (Hook.f.) Jessop arcte affinis sed foliis coriaceis marginibus incrassatis; inflorescentia erecta solitaria et ovarii lobis ad apicem conspicue rotundatis prominentibus bene distinguenda.

Type: Cape, Port Elizabeth, 'The Aloes' Railway Station, S. Venter 13,307 (PRE!, holo.; NU!; UNIN!).

Plants gregarious. **Bulb** hypogeal, 30 - 40 x 15 - 20 mm, cylindrical to obovoid; dead bulb scales brown, apices attenuate, live bulb scales fleshy, white, tightly arranged, with threads when torn. **Leaves** fully developed at anthesis, 2 - 9, spreading but mostly appressed, lanceolate, 30 - 50 x 8 - 15 mm, with sparse threads when torn, leathery, surfaces dull, green with faint darker green blotches, venation obscure; margins thickened; leafbase canaliculate; apex acute. **Inflorescence** solitary, lax, oblong to cylindric, 30 - 40 x 15 - 20 mm, erect, 15 - 20 -flowered, longer than the leaves; scape terete at base, green,

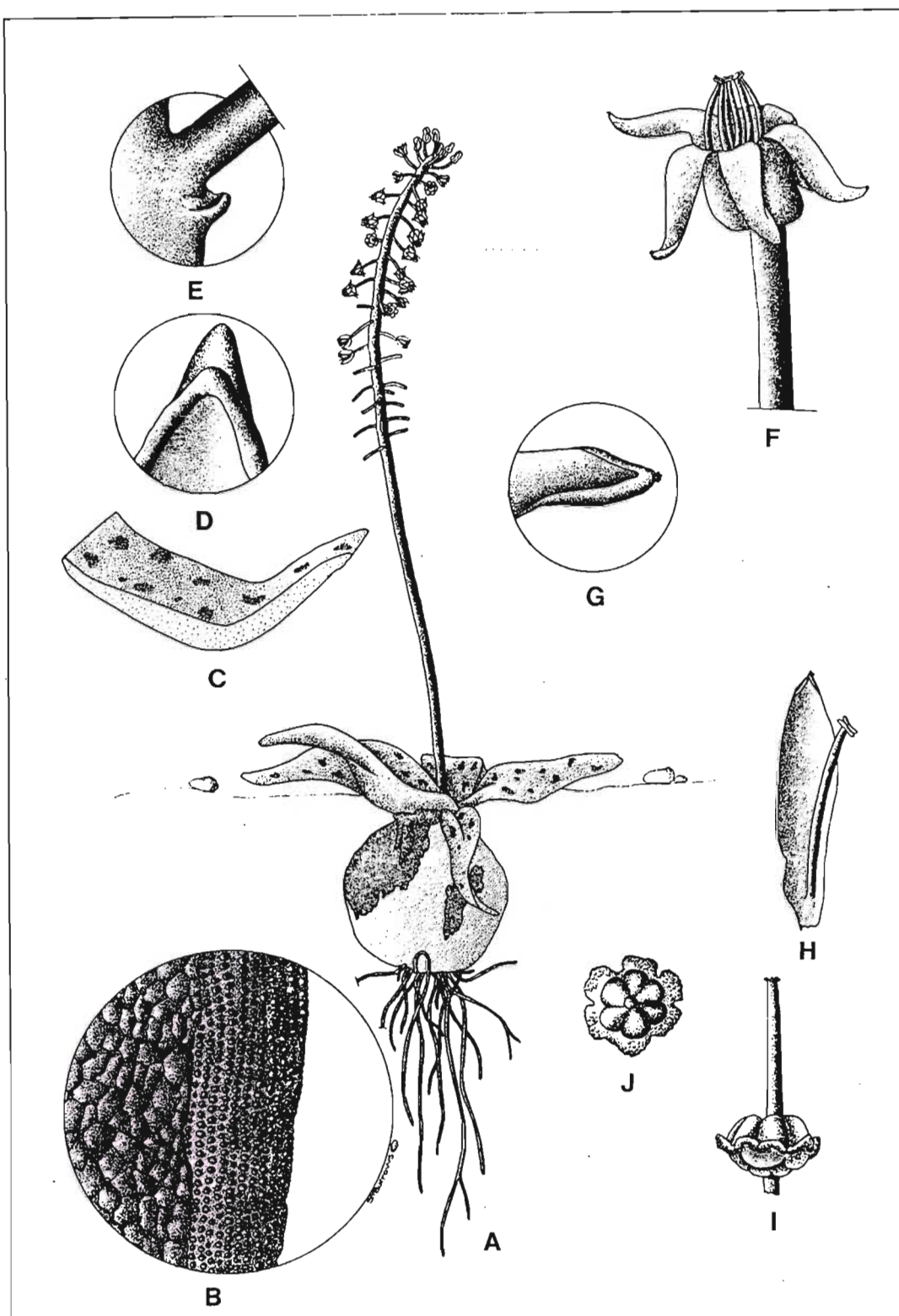


Figure 36. Illustration of *L. coriacea* S. Venter. A, habit X 2; B, lamina margin X 300; C, section through lamina X 5; D, lamina apex X 20; E, bract X 10; F, flower X 10; G, tepal apex X 10; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Venter 13,307*.

Map 15. Known distribution of *L. coriacea* S. Venter

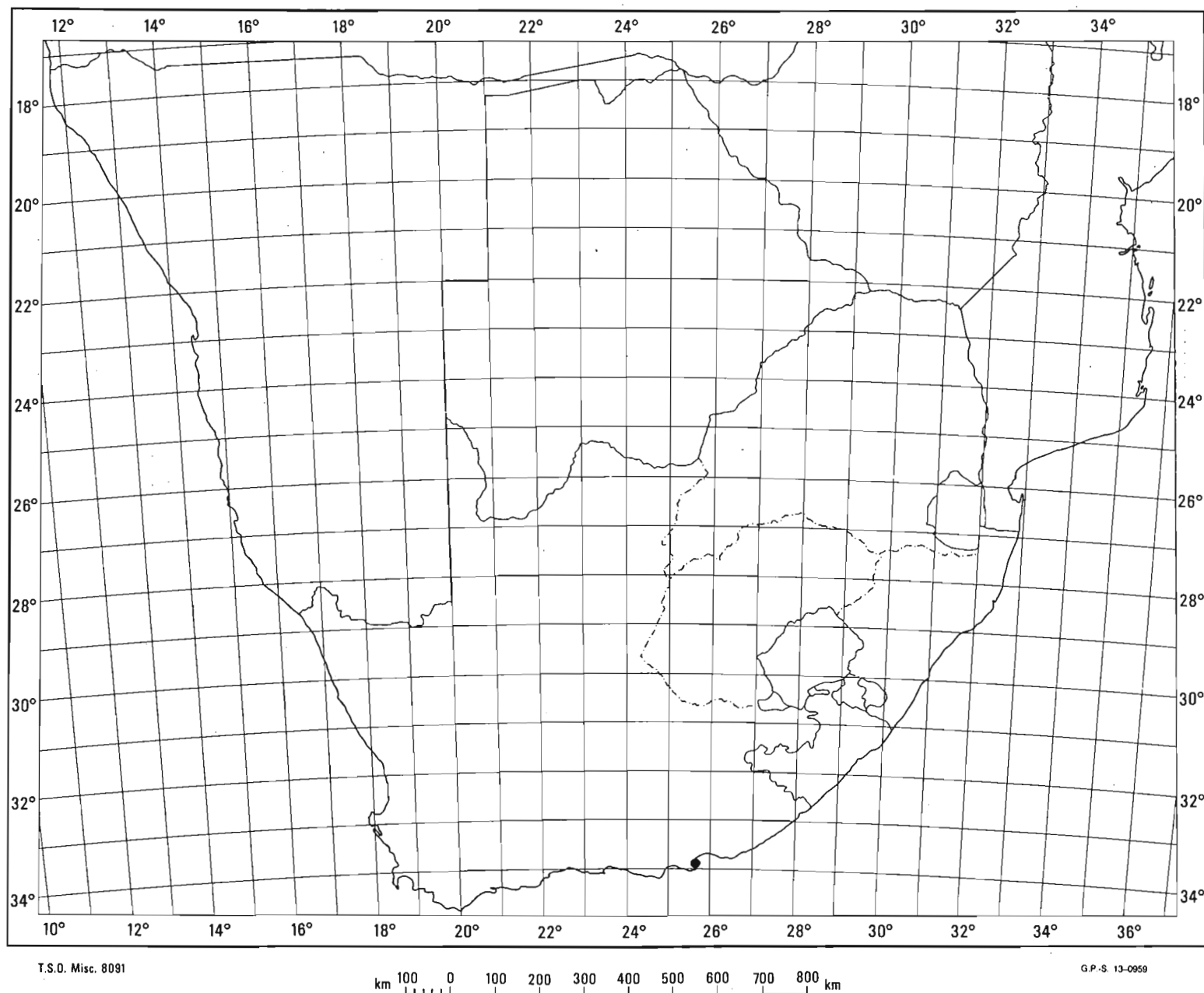
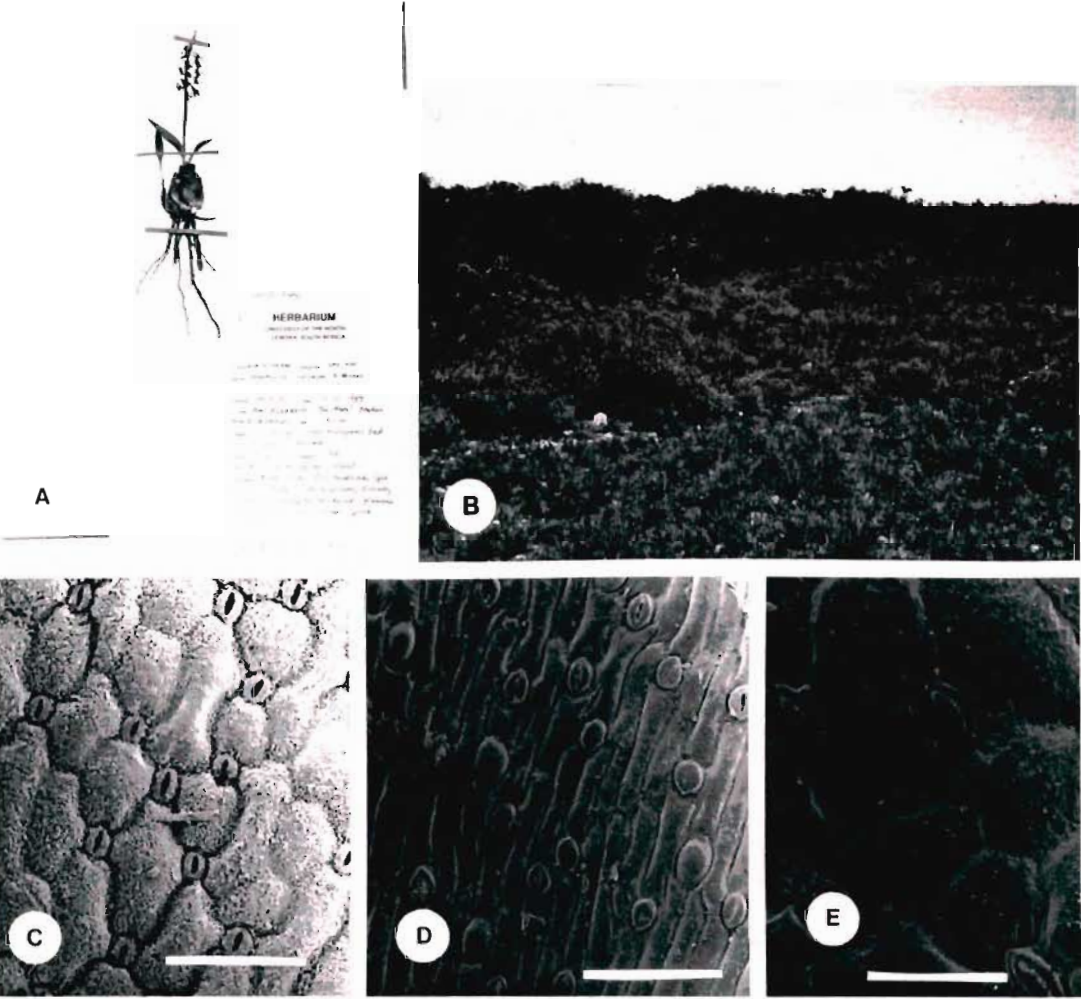


Figure 37. A, holotype of *L. coriacea* S. Venter (PRE); B, habitat at 'The Aloes' near Port Elizabeth. The vegetation consists of evergreen tall *Euclea undulata* - *Ficus burtt-davyi* - *Brachylaena floribunda* shrubland with open patches covered in *Pteronia incana* (Burm.) DC. *L. coriacea* occurs under the *Pteronia* shrublets; C, SEM micrograph of the adaxial lamina surface. Bar = 100 μm ; D, SEM micrograph of the abaxial lamina surface. Bar = 100 μm ; E, SEM micrograph of stomata. Bar = 43 μm . A and C - E from Venter 13,307.



glabrous; rachis smooth, 40 - 50 mm long. **Bracts** fleshy, 0.75 x 0.75 mm, deltoid, green with bracteoles. **Pedicels** cernuous, 5 mm long, deltate, speckled pink soon turning green. **Perianth** 5 mm long, tepals recurved, equal, oblong, 5 x 1.5 mm, apex acute, slightly cucullate, green suffused purple. **Stamens** erect, 3 mm long, upper part of filament purple, lower part white, base slightly flattened, epitepalous; anthers 1 mm long, violet. **Ovary** ovoid, 6 -lobed, 1.25 x 2 mm, lobes deltate, apex shoulders raised. **Style** $\pm$ 3.5 mm long, triangular, glabrous, purple; stigma above anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 2 mm long, surface strongly wrinkled, brown. (Figure 36).

L. coriacea is not closely allied to other *Ledebouria* species.

Specific epithet etymology.

Alluding to the leathery leaves.

Flowering period

From October to December.

Distribution (Map 15).

Known only from 'The Aloes' railway station near Port Elizabeth where it is rare.

Habitat

'The Aloes' is situated on alluvial sand and fine gravel underlain by calcrete (SACS 1980). All the populations grow in brown gritty sand, sometimes interspersed with large pieces of calcrete.

Most of the plants occur in light shade provided by *Pteronia incana* (Burm.) DC. (Figure 37B).

Population structure

Five populations were found in a 5 km radius of 'The Aloes'. The smallest population consisted of 11 adult plants, and the largest population numbered 158 individuals. Approximately 95% of the populations consist of closely packed adult plants with juveniles on the outer perimeter. Only a few seedlings in the two-leaf stage were found. Even at this stage of development the leaves are markedly leathery compared with seedlings of other species.

Variation

Plants growing in full sun tend to be more prominently marked on the adaxial surface of the leaves.

Specimens examined

CAPE. - 3325 (Port Elizabeth): Port Elizabeth, 'The Aloes' Station (-DC), *Venter 13,307* (PRE, NU, UNIN).

Sectio **Magnibulbae** S. Venter, sect. nov., bulbis maturis 60 - 150 mm diam.; inflorescentia floribus plus quam octoginta; pedicellis 8 - 15 mm longis.

Species typica: *Ledebouria zebrina* (Bak.) S. Venter.

Lecto-typus: Transvaal, Near Barberton, *Galpin 1184* (GRA).

Species: *L. floribunda* (Bak.) Jessop, *L. hypoxidioides* (Schönl.) Jessop, *L. revoluta* (L.f.) Jessop and *L. zebrina* (Bak.) S. Venter.

Plants solitary, 0.25 - 0.7 m tall. **Bulb** 60 - 150 mm wide, torn bulb scales producing threads. **Leaves** 4 - 10, pulling threads when torn. **Inflorescence** 80 - 350 -flowered; rachis ridged; raceme cylindric, 20 - 50 mm wide; pedicel 8 - 15 mm long. **Perianth** 5 - 7 mm long.

Distribution and habitat

From the southern Cape to northern Transvaal. Coastal shrubland to montane grassland.

12. *LEDEBOURIA FLORIBUNDA* (Bak.) Jessop

Ledebouria floribunda (Bak.) Jessop in Jl S. Afr. Bot. 36(4): 251 (1970).

Scilla floribunda Bak. in Saund. Ref. Bot. 3: t.188 (1870).

Type: Cap. b. Spei, *Cooper s.n.* (K!, holo.; PRE!, photo.).

Scilla pendula Bak. in Saund. Ref. Bot. 3 Appendix: 14 (1870).

Type: Cape of Good Hope, *Burchell s.n.* (K!, holo.; BOL!, drawing).

Scilla princeps Bak. in Saund. Ref. Bot. 3: t.189 (1870).

Type: Cape of Good Hope, *Cooper s.n.* (K!, holo.; PRE!, photo.).

Scilla polyantha Bak. in Gardnr's Chron. 9: 104 (1878).

Type: Natal, York, *Bull s.n.* (K!, holo.; PRE!, photo.).

Scilla tricolor Bak. in Gardnr's Chron. 14: 230 (1880).

Type: Cape, Port Elizabeth, *Elwes s.n.* (K!, painting; BOL!, copy of painting; PRE!, photo. of painting).

Scilla subsecunda Bak. in Gardnr's Chron. 16: 38 (1881).

Type: Cape, Eastern Districts, *Bowker 218* (K!, holo.; BOL!, drawing; PRE!, photo.).

Scilla lauta N.E. Br. in Kew Bull. :299 (1921).

Type: Transvaal, Pietersburg Div., The Downs, *Rogers 23,990* (K!, holo.; BOL!, drawing; PRE!, photo.).

Plants solitary. **Bulb** hypogeal, 60 - 100 x 25 - 35 mm, ovoid; dead bulb scales brown, apices attenuate, live bulb scales fleshy, tightly arranged, lacking threads when torn, purplish inside. **Leaves** fully developed at anthesis, 4 - 6, spreading, lanceolate, 200 - 300 x 40 - 50 mm, with threads when torn, fleshy, glossy, with spots and blotches, green and basally purple, venation obscure; margins smooth; leaf base flat to shallowly canaliculate; apex acute. **Inflorescences** 1 - 3, dense, cylindric, 150 - 200 x 30 - 50 mm, erect to flaccid, 60 - 100-flowered, shorter than or as long as the leaves; scape terete at base, green, glabrous; rachis ridged, 150 - 225 mm long. **Bracts** membranous, 1.5 x 0.5 mm, linear-lanceolate, pink to purple with bracteoles sometimes present. **Pedicels** spreading to horizontal, 12.5 - 15.6 mm long, pink. **Perianth** 7 - 9 mm long, stellate, tepals equal, oblong, 7 - 9 x 3 mm, apex obtuse, cucullate, green to pink with a green keel. **Stamens** erect, 5 - 6 mm long, filaments purple above, white below, epitepalous; anthers 0.75 mm long, yellow. **Ovary** ellipsoidal, 6-lobed, 0.75 x 1.5 mm, lobes widely trullate, apex tapering into style, basal lobes present. **Style** 6 mm long, triangular, glabrous, purple; stigma equal height to anthers; stipe 0.25 x 0.5 mm. **Capsule** three-lobed, symmetrical, clavate; base truncate. **Seed** drop-shaped, 4 - 5 mm long, strongly wrinkled, brown. (Figure 38).

L. floribunda can be confused with *L. revoluta* but differs in the bulb scales having threads when torn, tepals 2 - 4 mm longer, stigma and stamens equal height, ovary widely trullate not narrowly transversely elliptic and the seed 3.0 - 3.5 mm longer.

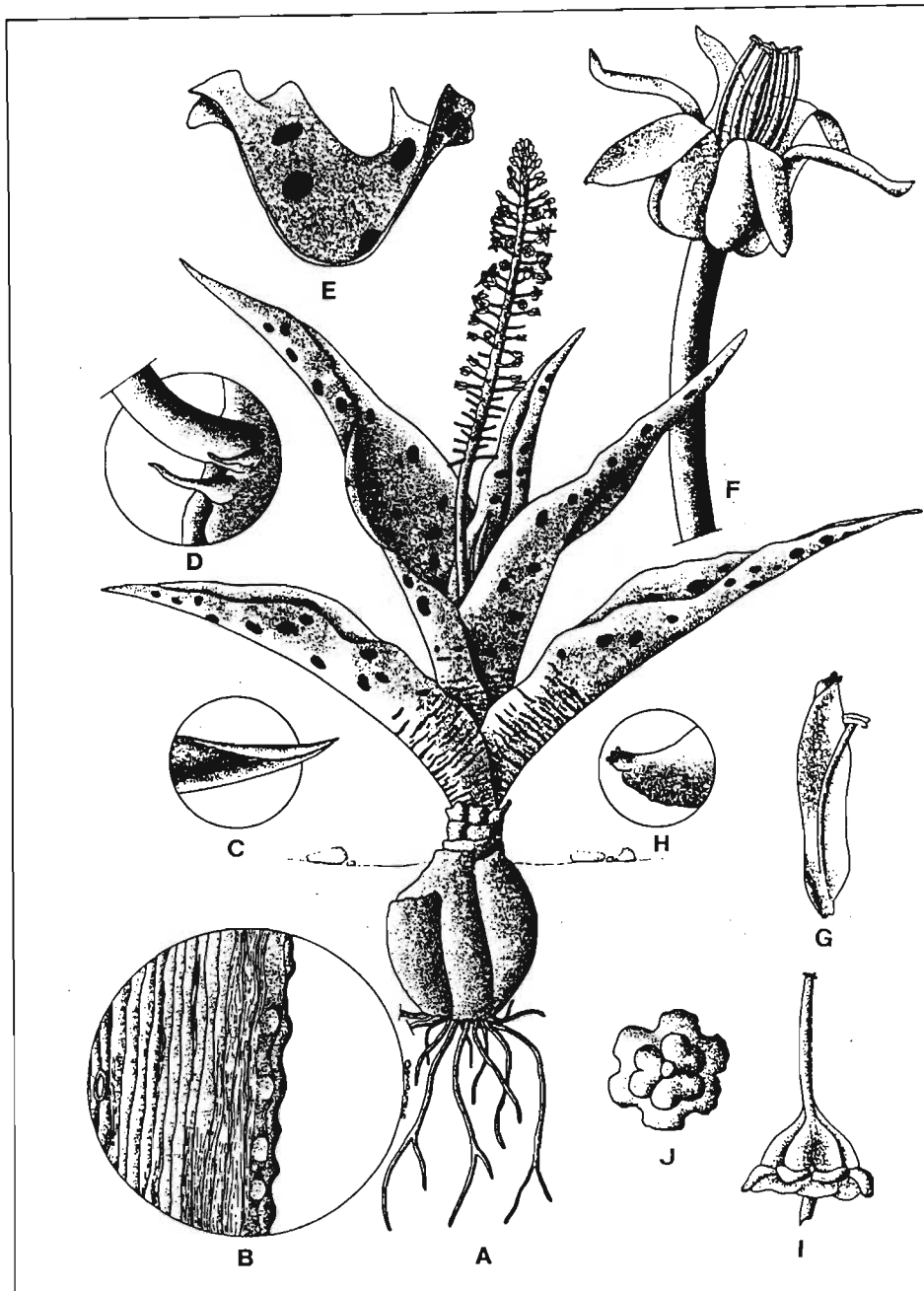


Figure 38. Illustration of *L. floribunda* (Bak.) Jessop. A, habit X 0.5; B, lamina margin X 300; C, lamina apex X 5; D, bract with bracteole X 10; E, section through lamina X 1; F, flower X 10; G, tepal with stamen X 10; H, tepal apex X 20; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Venter 13,475*.

Map 16. Known distribution of *L. floribunda* (Bak.) Jessop

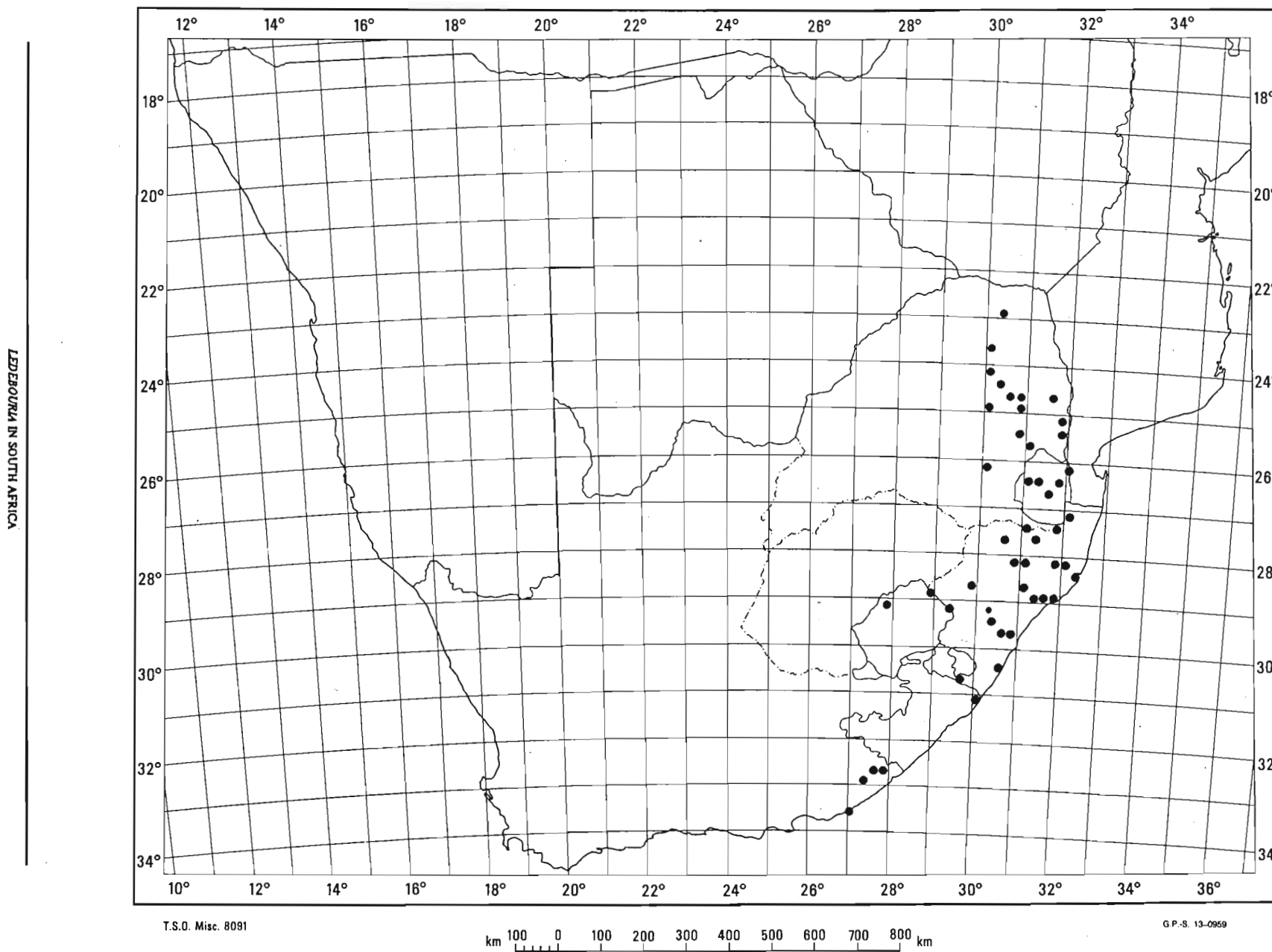
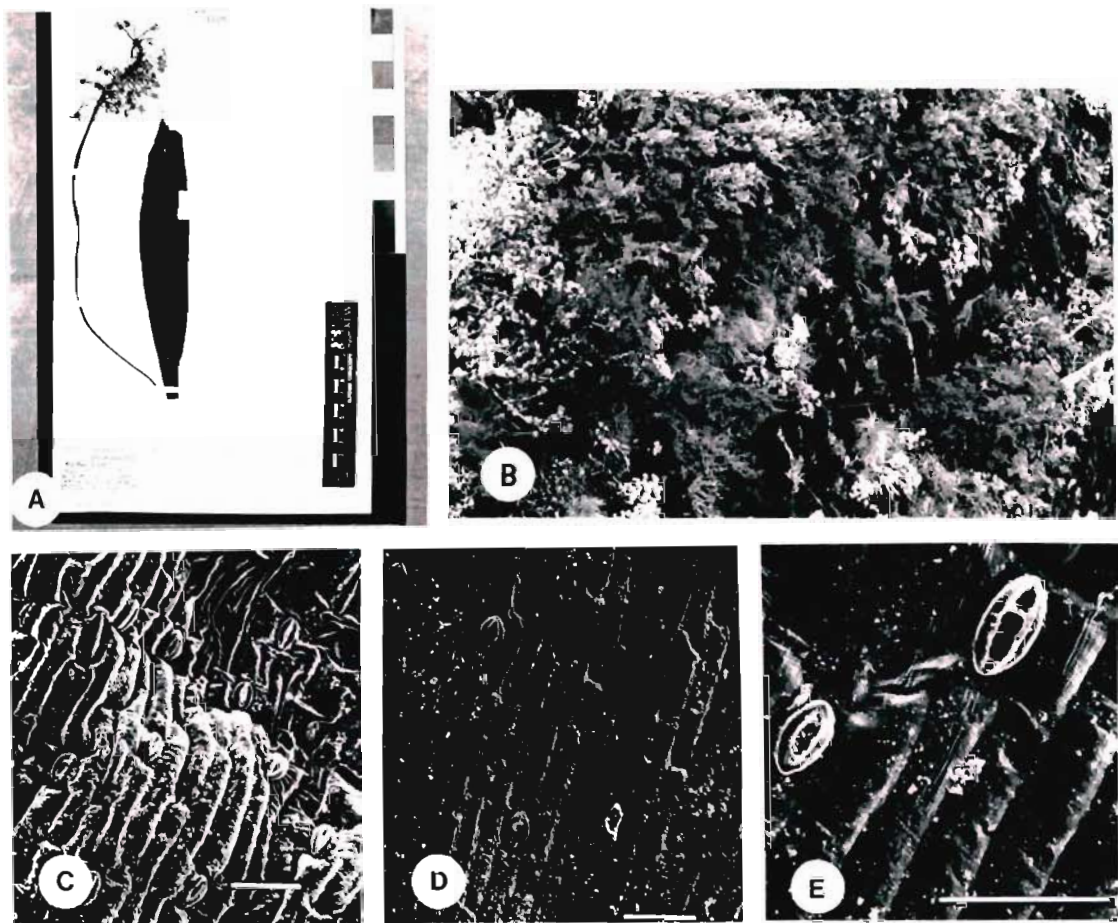


Figure 39. A, type of *L. floribunda* (Bak.) Jessop (K); B, habitat at Thabina Falls in the Wolkberg Wilderness Area near Tzaneen. The vegetation consists of evergreen low *Cliffortia linearifolia* - *Agapanthus inapertus* subsp. *pendulus* - *Helichrysum splendidum* shrubland in a seepage area next to a waterfall; C, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; D, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of stomata. Bar = 50 μ m. C - E from Venter 13,475.



Specific epithet etymology.

Means flowering profusely.

Flowering period

From October to January

Distribution (Map 16).

Restricted to the moist eastern parts of South Africa. Mostly associated with mountainous areas.

Habitat

It is clear from herbarium material, literature, and populations visited in the veld, that *L. floribunda* occurs mostly on quartzites and sandstones. In the Nelspruit area, *L. floribunda* grows on the Kaap Valley Granites (SACS 1980).

L. floribunda grows in humus-rich soils in shade of scrub and montane forest. Most of the specimens collected were found growing in moist situations (Figure 39B).

Population structure

Plants are either closely packed (*Venter 13,400*) or scattered. Most of the plants seen in the veld were adult plants. It appears that on steep slopes and cliffs where the plants grow, seed is washed away from the adult plants.

Variation

The leaves tend to be longer and narrower in the Cape and Natal than in any other area. Intermediate forms occur in Swaziland. In some populations the purple markings on the leaves are distinctly raised (*Venter 13,400*).

Historical background

Burchell (1822) collected the type material of *Scilla pendula* Bak. around Kommadagga in the Somerset Division. These bulbs were cultivated by Burchell at his father's Fulham Nursery (Hutchinson 1946, Gunn and Codd 1980). He completed a description of this plant naming it *Drimia pendula* but it was never published. This description is on the type sheet at Kew. His main plant collection was presented to Kew by Miss Burchell, presumably his daughter.

There is no note as to the name of the collector on the type sheet or a collector mentioned in the type description of *Scilla polyantha*. Mr. Bull in Great Britain cultivated bulbs he received from York, Natal and flowered these plants in December 1877. These plants were forwarded to Baker at Kew.

Specimens examined

VENDA. - 2230 (Messina): Dzamba (-CD), *Van Wyk & Theron 4683* (PRU).

TRANSVAAL. - 2230 (Messina): Entabeni State Forest (-CC), *Venter 13,400* (UNIN). -2430 (Pilgrim's Rest): The Downs (-AA), *Moss & Rogers 291* (J); *Rogers 23,990* (K); Ohrigstad, Branddraai, Road (-DA), *Young A621b* (PRE); Klaserie (-DB), *Venter 12,708*. (UNIN); Pilgrim's Rest (-DD), *Rogers 14,955* (J). -2531 (Komatipoort): Komatipoort (-BD), *Moss & Rogers 546* (J); Nelspruit, farm Rhenosterkop (-CA), *Onderstall 1314* (PRE). -2630 (Carolina): Carolina (-AA), *Moss & Rogers 1376* (J).

SWAZILAND. - 2631 (Mbabane): Ukutula (-AC), *Compton 24,489* (NBG); Manzini, Bulunga Poort (-DA), *Karsten s.n.* (NBG).

LESOTHO. - 2927 (Maseru): Maseru (-BB), *Gormley & Barber 19* (PRE).

NATAL. - 2730 (Vryheid): Utrecht, 13 km on Paulpietersburg road (-AA), *Buthelezi 227* (NH). -2731 (Louwsburg): Itala Nature Reserve (-AC), *Brown & Shapiro 140* (PRE); Gwaliweni (-BD), *Van der Merwe 2719* (PRE); Louwsburg, $\pm$ 21 km on road to Nongoma (-CB), *Schrire 1116* (NH). -2732 (Ubombo): Ingwavuma (-AA), *Wells 2229* (PRE). -2828 (Bethlehem): Mount-aux-Sources (-DD), *Van der Merwe 2614* (PRE). -2831 (Nkandla): Nkandhla (-CA), *Jessop 1062* (GRA); Eshowe (-CD), *Lawn 1162* (NH); Mtunzini, Ubisana Valley (-DC), *Venter 1228* (BLFU); Ngoya, *Venter 602* (NH).

CAPE. - 3227 (Stutterheim): Pirie (-CC), *Sim 619* (NU), *Sim 621* (NU); King Williamstown (-CD), *Sim 620* (NU); Komgha (-DB), *Flanagan 1112* (BOL). -3326 (Grahamstown): Grahamstown, Bloukrantz (-BC), *Van Jaarsveld 9088* (NBG).

Without precise locality.

- Cap B. Spei, *Cooper s.n.* (K, PRE); Cape of Good Hope, *Cooper s.n.* (K, PRE); *Burchell s.n.* (BOL, K); Cape, Eastern Districts, *Bowker 218* (BOL, K, PRE).

13. *LEDEBOURIA HYPOXIDIOIDES* (Schönl.) Jessop

Ledebouria hypoxidioides (Schönl.) Jessop in Jl S. Afr. Bot. 36(4): 263 (1970).

Scilla hypoxidioides Schönl. in Rec. Albany Mus. 1: 48 (1903).

Type: Cape, Grahamstown, *Daly & Sole 435* (GRA!, holo.; BOL!; SAM!; Z!).

Plants solitary. **Bulb** hypogeal, 80 - 100 x 40 - 60 mm, ovoid, dead bulb scales purplish-brown, apices attenuate, live bulb scales fleshy, tightly arranged, with copious threads when torn, white inside. **Leaves** fully developed at anthesis, 4 - 6, spreading, ovate-lanceolate, 100 - 140 x 20 - 40 mm, with threads when torn, fleshy, pilose, venation obscure, dull green with faint darker green blotches above; base canaliculate; apex acute. **Inflorescences** 1 - 2, flaccid, dense, 30 - 120 -flowered, longer than leaves. **Peduncle** glabrous, compressed at base, green spotted purple, 50 - 120 mm long; rachis ridged. **Raceme** dense, cylindric; 40 - 120 x 20 - 30 mm. **Bracts** with bracteoles; fleshy, 0.5 x 0.25, lanceolate, white to purple. **Pedicels** spreading; 12 - 15 mm long, green. **Perianth** 5 mm long; tepals recurved, equal, lanceolate, 5 x 2 mm, green tinted pink sometimes with a green keel; apex curving sharply upwards, cucullate. **Stamens** erect, 4 - 5 mm long; filaments pink, base slightly flattened, epitepalous; anthers 1 mm long, pale yellow. **Ovary** ovoid, 6 -lobed, 1.5 x 3 mm, expanded lobes obtusely deltate; apex shoulders raised. **Style** 5 mm long, triangular, glabrous, purple; stigma higher than anthers; stipe 0.5 x 0.25 mm. **Capsule** symmetrical, globose, 3 -lobed; base truncate. **Seed** 4 mm long, drop-shaped, surface strongly wrinkled, reddish-brown. (Figure 40).

L. hypoxidioides cannot be confused with any other *Ledebouria* in being the only species with pilose leaves (Figure 41F & G).

Specific epithet etymology.

Describe the leaves likened to that of the genus *Hypoxis* L. (Hypoxidaceae).

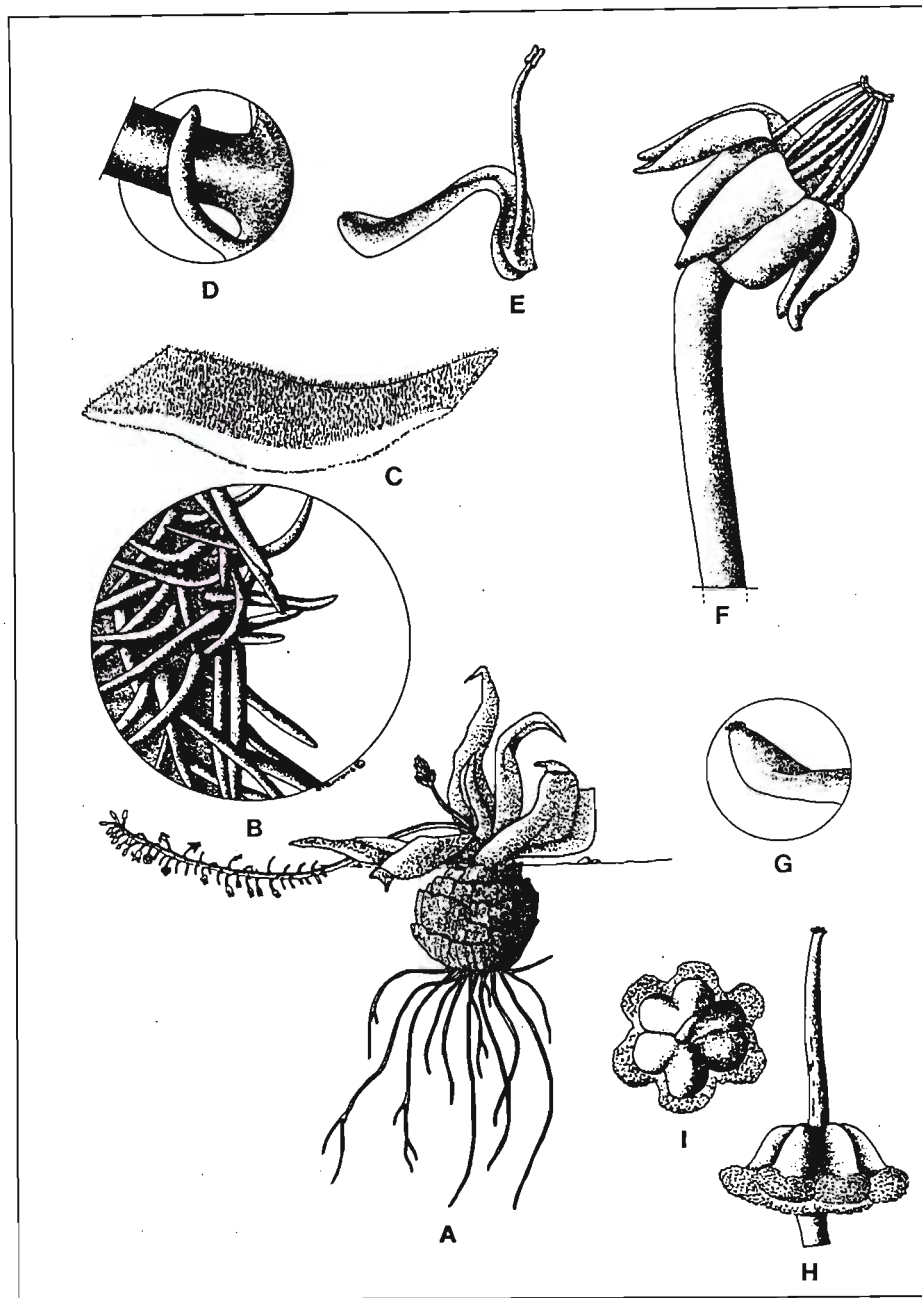


Figure 40. Illustration of *L. hypoxidioides* (Schönl.) Jessop. A, habit X 0.25; B, lamina margin X 110; C, section through lamina X 2; D, bract X 10; E, tepal with stamen X 10; F, flower X 8; G, tepal apex X 20; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from *Venter* 13,311.

Map 17. Known distribution of *L. hypoxidioides* (Schönl.) Jessop

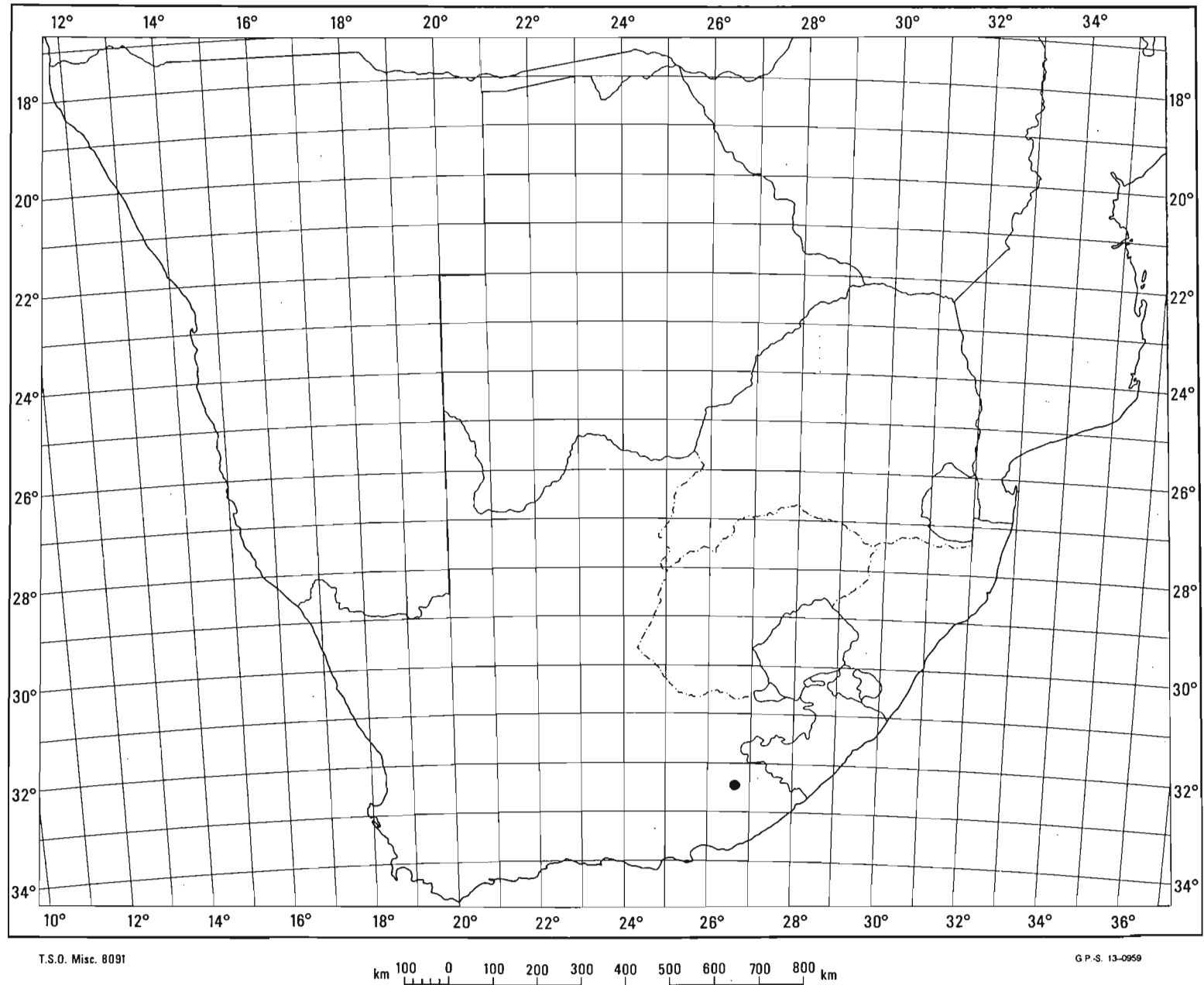
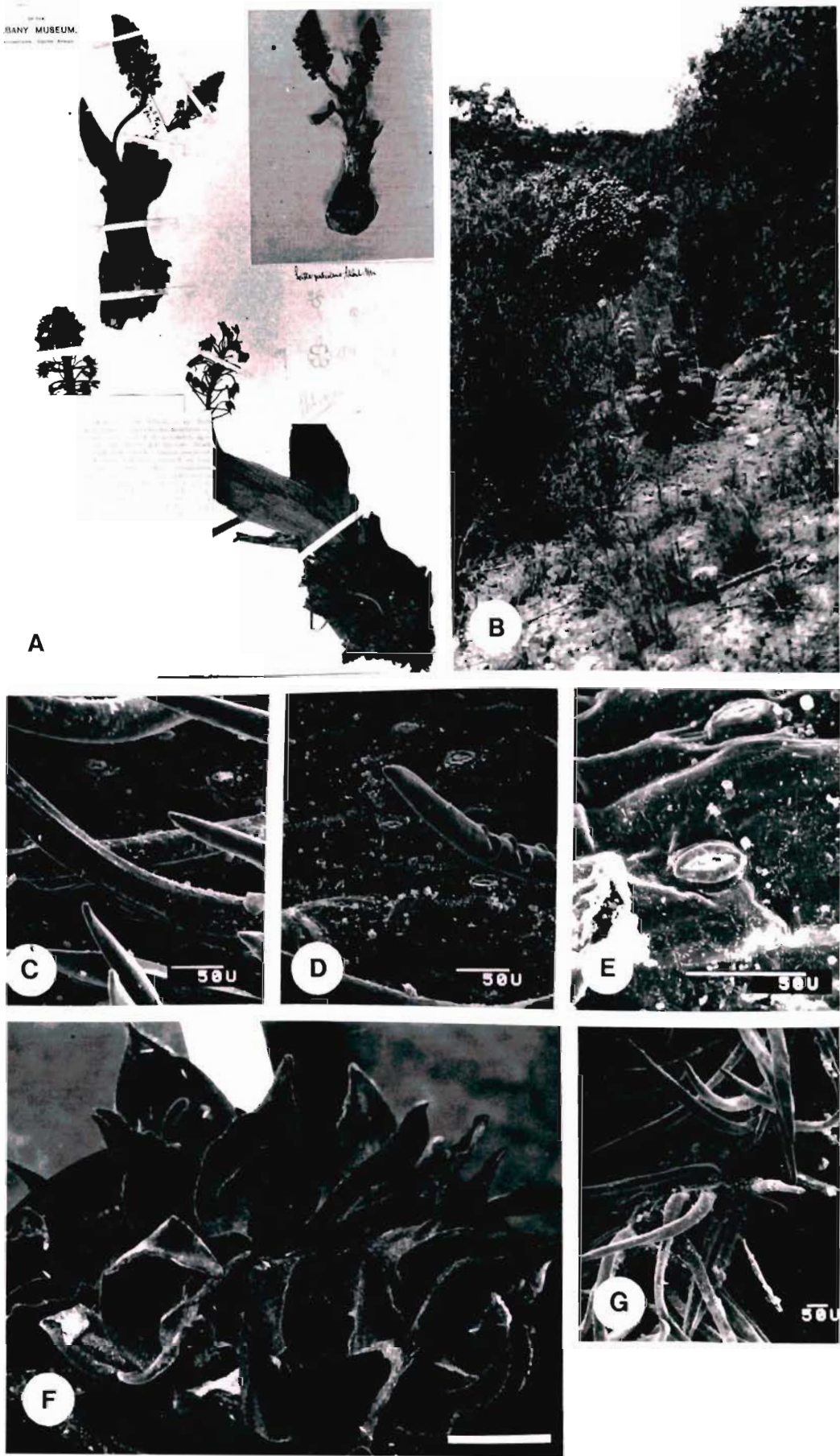


Figure 41. A, holotype of *L. hypoxidioides* (Schönl.) Jessop (GRA); B, habitat at Grahamstown. The vegetation consists of False Fynbos with *Passerina rigida* - *Ficus burtt-davyi* - *Euphorbia tetragona* shrubveld; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, plants from the type locality. Note the hairy leaves. Bar = 10 mm; G, SEM micrograph of the leaf surface to show the hairs. C - G from *Venter 13,311*.



Flowering period

From October to December.

Distribution (Map 17).

L. hypoxidioides is known only from the hills around Grahamstown.

Habitat

L. hypoxidioides occurs mainly on Dwyka Tillite of the Dwyka Formation of the Karoo Sequence (SACS 1980). Soil derived from tillite is a brown loamy soil, with a fine grained structure, usually 200 - 2000 mm deep. On the north-western side of Grahamstown, it occurs on the Dirkskraal Sandstone Formation, Witteberg Group of the Cape Supergroup (SACS 1980). Soils derived from this sandstone are grey-brown gritty sandy loam, 10 - 250 mm deep.

Plants of *L. hypoxidioides* occur in open grassy areas between trees and shrubs (Figure 41B). Although it prefers to grow in short grass in the sandstone areas, areas with long grass are favoured on tillite.

L. hypoxidioides is a relatively rare plant known from only a few scattered populations.

Specimens examined

CAPE. - 3326 (Grahamstown): Grahamstown (-AC), *Van der Merwe* 2138 (PRE); *Bayliss* 3110 (STE); Grahamstown, behind Fort England (-AC), *Daly & Sole* 435 (BOL, GRA, SAM); *Venter* 13,311 (UNIN); Grahamstown, Settlers Hill (-AC), *Venter* 13,424 (UNIN).

14. *LEDEBOURIA REVOLUTA* (L.f.) Jessop

Ledebouria revoluta (L.f.) Jessop in Jl S. Afr. Bot. 36(4): 255 (1970).

Hyacinthus revolutus L.f. in Suppl. Plant.: 204 (1781).

Type: Cape, Cap. bonae Spei, *Thunberg s.n.* (UPS, holo.; BOL & PRE!, on Herb. Thunb. Microfiche no. 8508).

Lachenalia lanceaefolia Jacq. in Icones Pl. Rar. 2: t.402 (1794).

Iconotype: Jacquin in Icones Pl. Rar. 2: t.402 (1794).

Phalangium revolutum (L.f.) Pers. in Syn. Pl. 1: 367 (1805).

Type: Cap. bonae Spei, *Thunberg s.n.* (UPS, holo.; BOL & PRE!, on Herb. Thunb. Microfiche no. 8508).

Lachenalia lanceaefolia Sims var. *maculata* Tratt. in Archiv der Gawächskunde 2: 132, t.168 (1814).

Iconotype: Tratt. in Archiv der Gwächskunde 2: t.168 (1814).

Scilla maculata Schrank in Pl. Rar. Hort. Acad., Monac. 2: fol.100, t.100. "Promontium Bonae Spei". (1820).

Iconotype: As for *Drimia lanceaefolia* Lodd. var. *longipedunculata* Schrader.

Drimia acuminata Lodd. in Bot. Cab.: t.1041 (1825).

Iconotype: Lodd. Bot. Cab. : t.1041. "Cape of Good Hope" (1825).

Drimia lanceaefolia Lodd. var. *longipedunculata* Schrader in Blumenb.: 30 (1827).

Iconotype: Pl. Rar. Hort. Acad., Monac. 2.: fol.100, t.100 "Promontium Bonae Spei" (1819).

Scilla revoluta (L.f.) Bak. in Saund. Ref. Bot. 3(app.): 6 (1870).

Type: Cape, Caledon Div., on Donker Hoek mountain, *Burchell 7982* (K, holo.).

Scilla spathulata Bak. in Saund. Ref. Bot. 3: t.187 (1870).

Iconotype: Saund. Ref. Bot. 3: t.187, "Cape of Good Hope, *Cooper s.n.*" (1870).

Scilla livida Bak. in Gdnrs' Chron. 20: 166 (1883).

Type: Cape of Good Hope, Hort. F. Horsman & Co." (K!, holo.; PRE!, photo.; BOL!, drawing).

Scilla polyantha Bak. var. *angustifolia* Bak. in Flora Cap. 6: 488 (1896).

Type: Transvaal, Saddleback Mountain, Barberton, *Galpin 1096* (PRE!, holo.).

Scilla moschata Schönl. in Rec. Albany Mus. 3: 60 (1914).

Type: Cape, Stutterheim, *Rogers 12,786* (GRA!, holo.; PRE!, photo.).

Scilla carnosula Van der Merwe in Flower. Pl. S. Afr. 24: t.958 (1944).

Type: Natal, near Greytown, *Van der Merwe 2592* (PRE!, holo.).

Plant solitary. **Bulb** hypogeal, 60 - 80 x 40 - 60 mm, ovoid; dead bulb scales brown to purplish brown, membranous, apices attenuate, live bulb scales membranous, live bulb scales tightly arranged, with threads when torn, white to purple inside. **Leaves** fully developed at anthesis, 5 - 10, spreading, lanceolate, 80 - 130 x 30 - 90 mm, with threads when torn, fleshy, adaxial surface green with darker green to purple spots and blotches, abaxial surface green or variously marked purple, venation obscure; margin smooth; leaf base canaliculate; apex acute. **Inflorescences** 4 - 10, dense, cylindrical, 70 - 120 x 30 - 40 mm, flaccid, 30 - 70 -flowered, longer than the leaves; scape terete at base, green spotted purple, glabrous; rachis ridged, 90 - 110 mm long. **Bracts** membranous, 1 x 0.5 - 1.0 mm, lanceolate to linear, white to purple with bracteoles mostly present. **Pedicels** spreading, 10 - 13 mm long, pink to white speckled pink. **Perianth** 5 mm long, tepals recurved, equal, oblong, 5 x 3 mm, apex obtuse and thinly cucullate, green fused pink to dark pink with a green keel. **Stamens** erect, 5 mm long, filaments maroon, base slightly swollen, epitepalous; anthers 1 mm long, pale yellow. **Ovary** ellipsoidal, 6 -lobed, 0.75 - 1.0 x 1.75 - 2.0 mm, lobes narrowly transversely elliptic, distal lobes present,

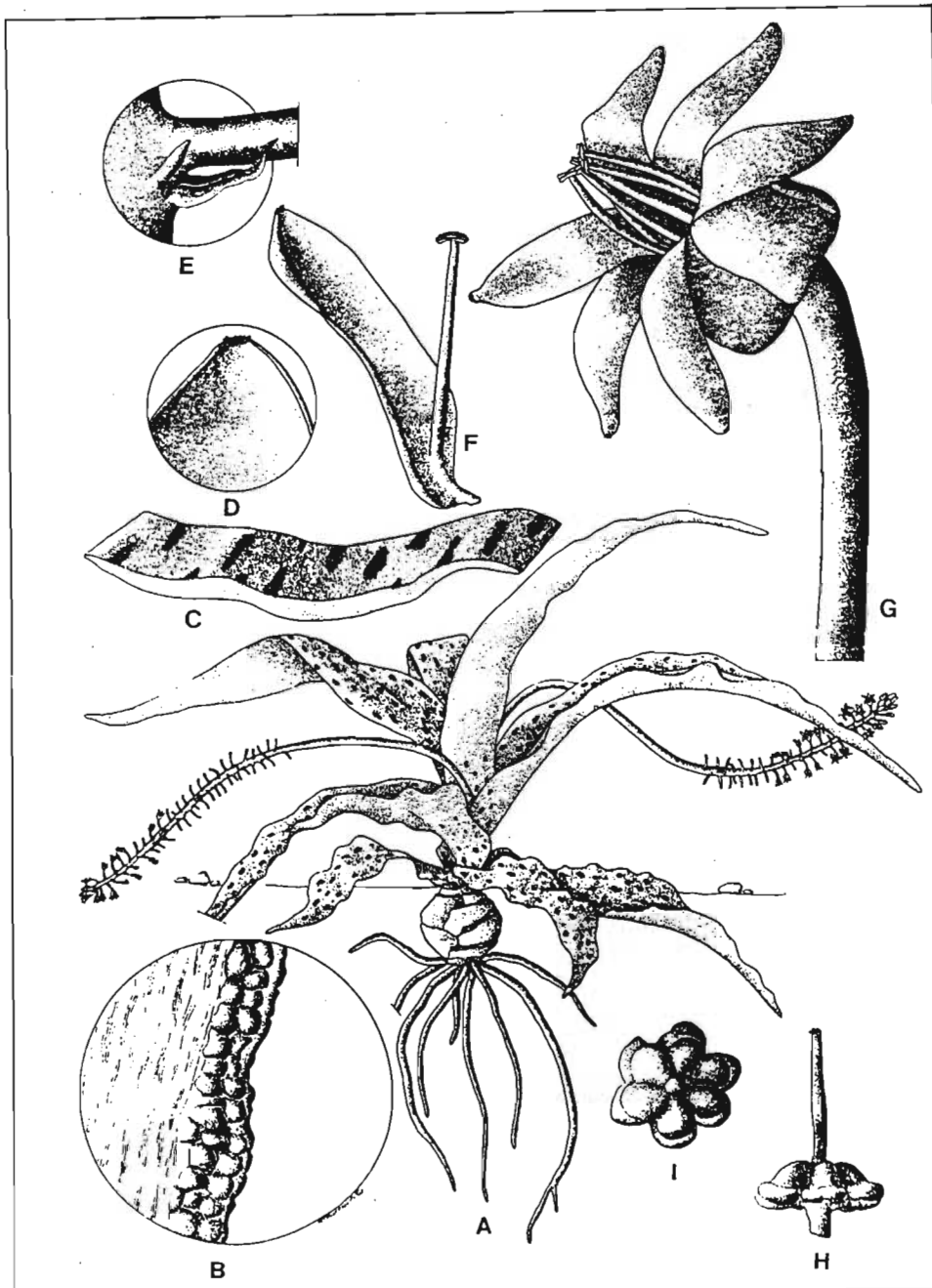


Figure 42. Illustration of *L. revoluta* (L.f.) Jessop. A, habit X 0.5; B, lamina margin X 300; C, section through lamina X 2; D, apex of tepal X 20; E, bract with bracteole X 10; F, tepal with stamen X 10; G, flower X 10; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from *Venter 13,430*.

Map 18. Known distribution of *L. revoluta* (L.f.) Jessop

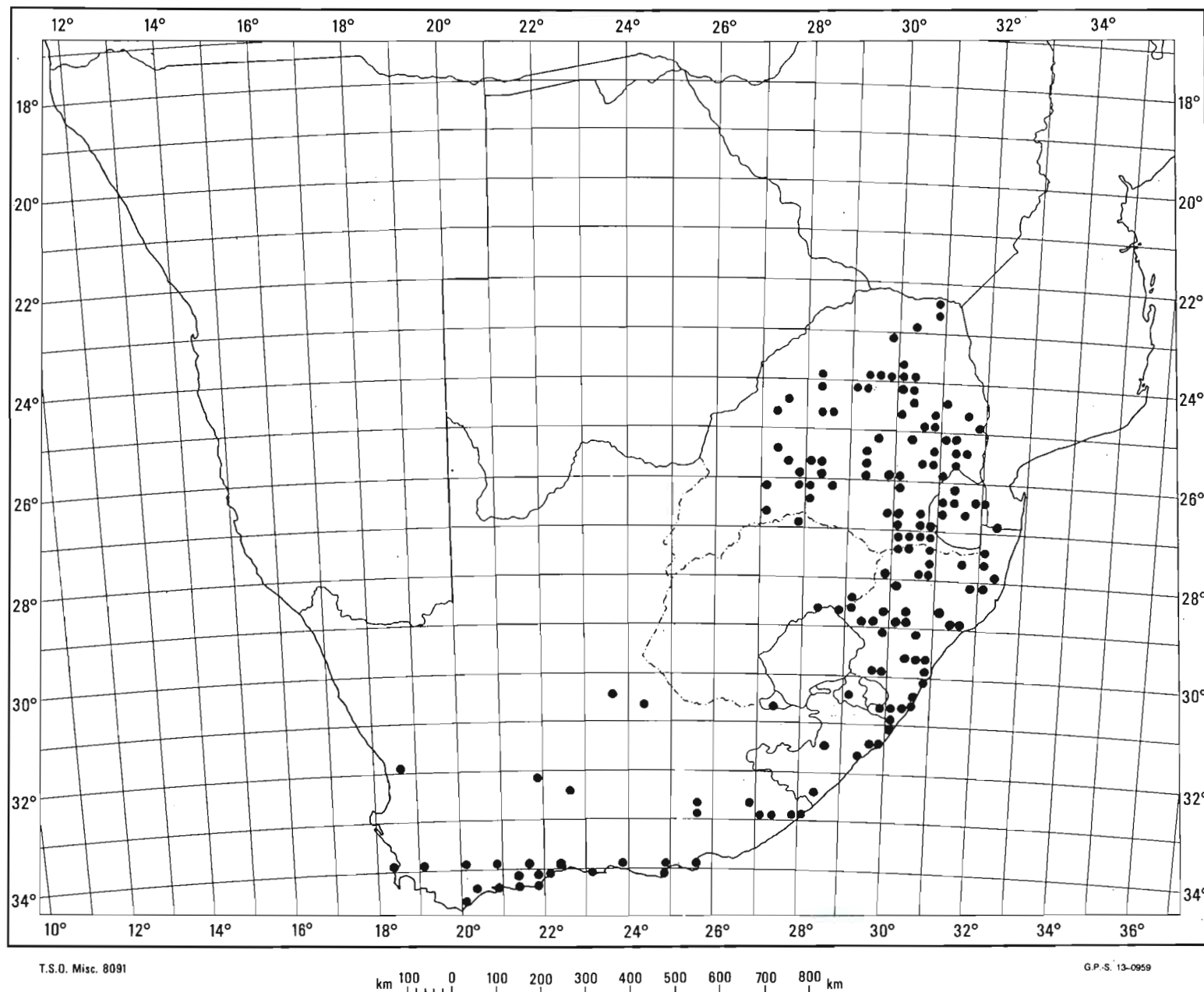
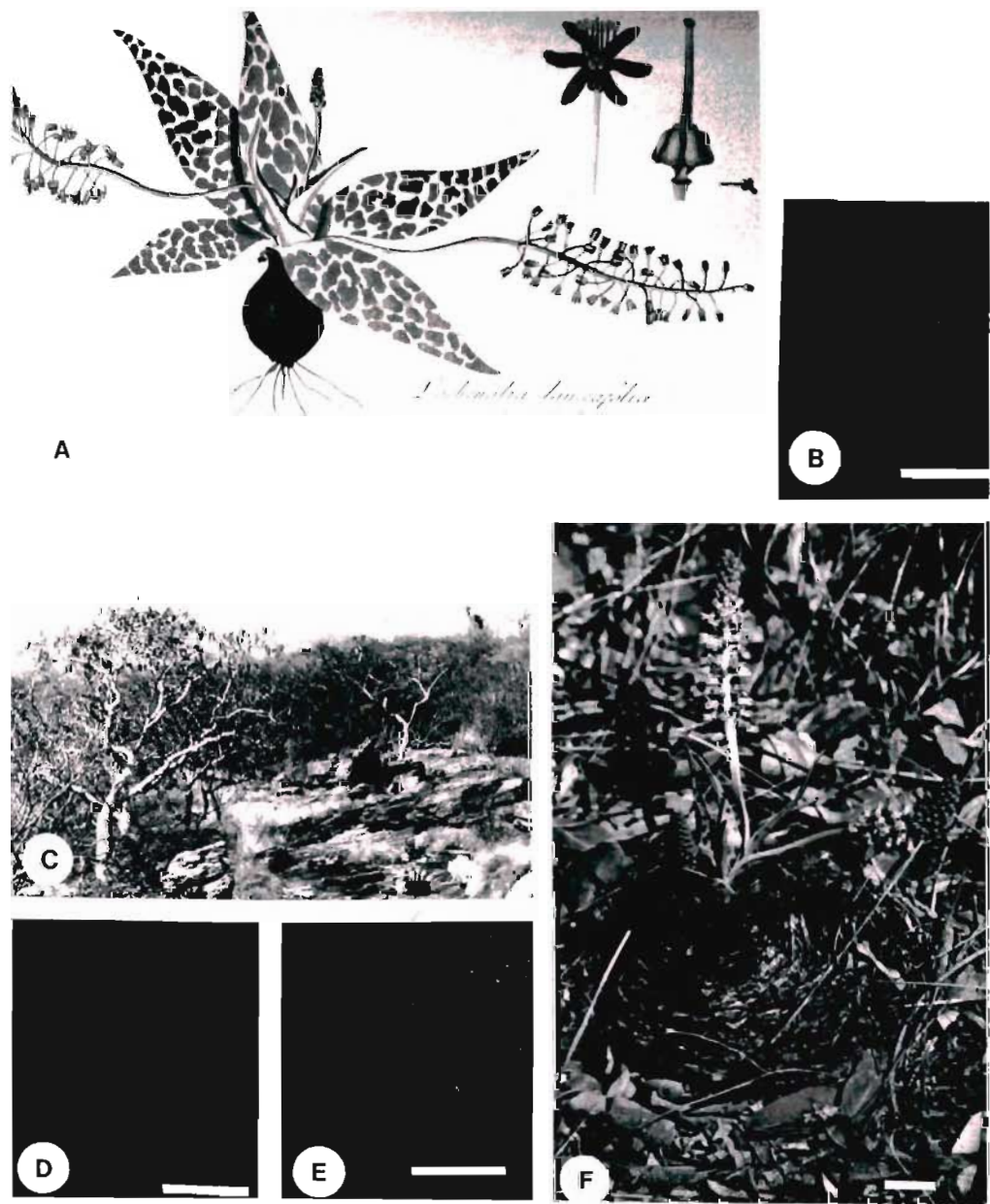


Figure 43. A, type of *L. revoluta* (L.f.) Jessop under *Lachenalia lanceaefolia* Jacq. in *Icones Plantarum Rariorum* 2: t.402 (1794); B, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; C, habitat near Thabazimbi in the Waterberg, north-western Transvaal. The vegetation consists of closed deciduous low *Albizia tanganyicensis* var. *tanganyicensis* - *Croton gratissimus* var. *subgratissimus* - *Myriothamnus flabellifolia* woodland; D, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; E, SEM micrograph of stomata. Bar = 43 μ m; F, plant of *L. revoluta* with thickly packed dry bulb scales for protection against fire. Bar = 30 mm. B and D - E from Venter 13,009.



apex forming shoulders. **Style** 6 mm long, triangular, glabrous, purple; stigma above anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, clavate, base truncate. **Seed** drop-shaped, 1.0 - 1.5 mm long, surface strongly wrinkled, brown. (Figure 42).

L. revoluta is closely related to *L. hypoxidioides*. Together with *L. zebrina* (Bak.) S. Venter and *L. floribunda* they form the section *Magnibulbae*. *L. hypoxidioides* is easily separated from *L. revoluta* in that the leaves are covered with long hairs.

Specific epithet etymology.

Describes the revolute perianth segments.

Flowering period

Flowering extends over most of the year with the plants in the Cape Province flowering mostly from April to August, the rainy season. In the summer rainfall areas *L. revoluta* flowers from October to February with a peak from October to November.

Distribution (Map 18).

L. revoluta is recorded throughout the eastern half of South Africa except in Lesotho. The species is concentrated in the Transvaal and Natal.

Habitat

L. revoluta is the most widespread *Ledebouria* species in South Africa occurring on many soil types and in most of Acocks's veld types. It is absent however from the Karoo, Namaqualand and the Richtersveld.

Most of the specimens were collected in woodland vegetation (Figure 43C). Plants occur mainly in full sun but some lightly shaded populations were encountered.

Variation

Plants of *L. revoluta* growing in frequently burnt woodlands have dry bulb scales which do not disintegrate but form a thick layer around the bulb and presumably insulate it from heat damage (Figure 43F). Plants from moist habitats tend to have very few dry bulb scales.

The leaves are polymorphic in shape, fleshiness and markings. Leaf shape varies from linear-lanceolate (*Van der Merwe 2714*) to broadly ovate (*Venter 13,381*). The 'albomarginata' form of *L. revoluta* has leaves appressed to the ground similar to *L. ovatifolia*. The lamina margin is broad, hyaline and distinctly whitish. These plants may prove to be a separate species. They are tentatively included within *L. revoluta* in this revision. Flower colour varies from green tinged with pink, to a dark pinkish purple. Flowers are sometimes scented.

Historical background

Trattinick described *Lachenalia lanceaefolia* Sims var. *maculata* (1814) and based it on Curtis's Botanical Magazine t.643. The illustration of *L. lanceaefolia* var. *maculata* is a composite copy of Curtis's Botanical Magazine t.643 (plant) and the flower, gynoecium and small drawing of a flower from Jacquin's *Icones Plantarum Rariorum*. Trattinick was the first to mention the differences between Redouté's (1807) plant and the plant in Curtis's Botanical Magazine. C.A. Smith compared type material at Kew and came to the conclusion that the type of *Scilla livida* Bak. agrees in all essential details with the Redouté plate thus he placed Trattinick's plant in synonymy under *S. livida* (Smith 1930).

Common names: Wave-leaved Hyacinth, Wave-leaved Cape Hyacinth (Aiton 1789), Lanzenblättrige Lachenalie (Willdenouw 1799), Spotted Copperas-leaved Lachenalia (Ker-Gawler 1803).

Specimens examined

VENDA. -2230 (Messina): Thate Vondo (-BD), *Hemm 640* (J); Tate Vondo (-CD), *Steynberg 640* (PRE); Dzamba (-CD), *Van Wyk & Theron 4838* (PRU); Mutale, Lokokoko (-DB), *Hardy 6094* (PRE).

TRANSVAAL. -2328 (Baltimore): Vaalwater, farm Kliphoek (-CD), *Venter 11,198* (UNIN). -2329 (Pietersburg): Schyffontein (-BB), *Van der Merwe 1202* (PRE); Pietersburg (-CD), *Venter 13,207* (UNIN); Solomondale (-DC), *Van der Merwe 1188* (PRE); Haenertsburg (-DD), *Pott 4737* (PRE); *Venter 13,191* (UNIN). -2330 (Tzaneen): Duiwelskloof (-CA), *Venter 13,371* (UNIN); George's Valley (-CC), *Venter 13,333* (UNIN); Letsitele Valley (-CD), *Van der Merwe 1173* (PRE). -2427 (Thabazimbi): Thabazimbi, farm Groothoek (-BC), *Raal 1251* (LYD); Thabazimbi (-CB), *Jourdan s.n.* sub NBG 227/39 (NBG). -2428 (Nylstroom): Sterkstroom (-AB), *Van der Merwe 1761* (PRE); Nylstroom (-CB), *Strydom 1802* (PRE); Naboomspruit (-DA), *Mauve 4315* (PRE); farm Mosdene (-DA), *Galpin M363* (PRE). -2429 (Zebediela): Potgietersrust (-AA), *Van der Merwe 1210* (PRE); Pietersburg, farm Vrederust (-AB), *Van der Merwe 1959* (PRE). -2430 (Pilgrim's Rest): Wolkberg Wilderness Area (-AA), *Venter 11,073* (UNIN); Dublin Mine (-AA), *Fourie 593* (PRE); Lekgalameetsi Nature Reserve (-AA), *Stalmans 1439* (PRE, UNIN); Kromellenboog Mine (-AD), *Venter 13,203* (UNIN); Mariepskop (-DB), *Van der Schyff 6381* (PRE, PRU); Mount Sheba Nature Reserve (-DC), *Onderstall 1384* (PRE); Lisbon Falls (-DD), *Louw 2365* (STE). -2431 (Acornhoek): Hoedspruit (-AC), *Van der Merwe 2005* (PRE); Manyeleti Game Reserve (-DA), *Bredenkamp 1349* (PRE); Leeupan (-DD), *Van der Schyff 4069* (BOL). -2527 (Rustenburg): Brits, farm Welgevonden (-AD), *Mogg 14,505* (PRE); Crocodile River (-DA), *Van der Merwe 1833* (PRE); Hartebeespoort Dam (-DD), *Van der Merwe 2173* (PRE). -2528 (Pretoria): Pretoria (-CA), *Theron 175* (PRE); Meyerspark (-CA), *Theron 175* (PRU); *Jonker 25* (PRE); Trigaardts Poort (-CA), *Van der Merwe s.n.* sub PRE 35304 (PRE); Fountains (-CA), *Repton 1* (PRE); *Van der Merwe 2002* (PRE); Klapperkop (-CA), *Smith 601* (PRE); Roodeplaat Dam Nature Reserve (-CB), *Van Rooyen 3088* (PRU); *Van Rooyen 2576* (PRU); Rietvlei (-CD), *Codd 1755* (PRE). -2529 (Witbank):

Loskop Dam Nature Reserve (-AD), *Mogg* 30,723 (J); Loskop, farm Donkerhoek (-AD), *Theron* 1894 (PRE, PRU); Tautesberg, Diepkloof (-BA), *Van der Merwe* 2226 (PRE); Middelburg (-CB), *du Plessis* 395 (PRU); *Young* A15 (PRE); Middelburg, farm Soetvelden (-CD), *Van der Merwe* 2197 (PRE); Belfast, farm Wonderfontein (-DD), *Van der Merwe* 1575 (PRE). -2530 (Lydenburg): Steenkampsberg, Boschhoek (-AB), *Young* A438 (PRE); Nelspruit (-BD), *Van Jaarsveld* 20 (NBG); *Van Jaarsveld* 35 (NBG); *Van der Merwe* 1791 (PRE); Brondal (-BD), *Van der Merwe* 1809 (PRE); Rosehaugh (-BD), *Sim s.n.* sub BOL 3640/14 (BOL); Belfast, farm Schoongesicht (-CA), *Van der Merwe* 1239 (PRE); Witkloof (-CC), *Van der Merwe* Sc.3 (PRE); Coetzeestroom (-DA), *Van der Merwe* 1647 (PRE); Berlin Forest Station (-DA), *Fourie* 505 (PRE); Kaapsche Hoop (-DB), *Van der Merwe* 1527 (PRE). -2531 (Komatipoort): Mestelspruit (-AA), *Van der Schyff* 3906 (PRE); Skipberg (-AB), *Van der Schyff* 1127 (KNP); Malelane (-AD), *Codd* 5510 (PRE); Impala Station (-BC), *Kluge* 2597 (PRE); Kaapmuiden (-CB), *Rogers* 24,661 (PRE); Malelane (-CB), *Codd* 5510 (PRE); Barberton (-CC), *Van der Merwe* 1818 (PRE); *Galpin* 508b (PRE); Barberton, farm Oosterbeek (-CC), *Venter* 13,378 (UNIN); Saddleback Range (-CC), *Van der Merwe* 1816 (PRE). -2627 (Potchefstroom): Ventersdorp, farm Goedgedacht (-AA), *Sutton* 629 (PUC); Roodepoort, Ruimsig (-BB), *Steel* 50 (PRE); Potchefstroom (-CA), *Van der Westhuizen* 431 (PUC); Dassiesrant (-CA), *Van Wyk* 1025 (PUC); Sasolburg (-DD), *Theron* 694 (PRE). -2628 (Johannesburg): Kloof (-AA), *Moss* 10,812 (J); Frankenwald (-AA), *Gilliland s.n.* sub J 25,410 (J); Edenvale (-AA), *Venter* 13,336 (UNIN); Klipriviersberg (-AC), *Gilliland s.n.* sub J 26,295 (J); Delmas (-BA), *Van der Merwe* 1041 (PRE); -2629 (Bethal): Ermelo, Nooitgedacht (-DB), *Balsinhas* 2829 (PRE). -2630 (Carolina): Carolina (-AA), *Moss & Rogers* 1377 (J); *Moss & Rogers* 1299 (J); Maviriestad (-CA), *Pott* 5190 (BOL); Amersfoort, Kalkoenkranz (-CC), *Turner* 319 (PRE); Amsterdam (-DA), *Van der Merwe* 1092 (PRE); Piet Retief, farm Wolwenkop (-DC), *Venter* 13,365 (UNIN); Piet Retief (-DC), *Van der Merwe* 1837 (PRE); Kemp Station (-DD), *Venter* 13,362 (UNIN); *Venter* 13,363 (UNIN). -2730 (Vryheid): Piet Retief, Hlangapies Mountain (-AA), *Van der Merwe* 111 (PRE); Amsterdam (-AB), *Van der Merwe* 1055 (PRE); Wakkerstroom, Watervalberge (-AC), *Van der Merwe* 2059 (PRE); Wakkerstroom, farm Oshoek (-AD), *Devenish* 287 (PRE); Piet Retief (-BB), *Steyn s.n.* sub PRE 13,397 (PRE).

SWAZILAND. -2631 (Mbabane): Malandela (-AB), *Compton* 32,483 (NBG); Mbabane (-AC), *Compton* 23,796 (NBG); *Compton* 27,043 (NBG; PRE); Ukutula (-AC), *Compton* 25,194 (NBG); Highveld (-AC), *Bolus s.n.* sub BOL 12,407 (BOL); Dalriach (-AC), *Compton* 28,478 (NBG); Black Umbeluzi River (-AC), *Compton* 28,066 (PRE); Manzini (-AD), *Karsten s.n.* sub NBG 71,331 (NBG); *Compton* 31,077 (PRE); Mankaiana (-CA), *Compton* 29,062 (PRE); *Compton* 31,581 (PRE); Mhlambanyati (-DA), *Dlamini s.n.* sub PRE 703,374 (PRE).

ORANGE FREE STATE. -2828 (Bethlehem): Clarens (-CB), *de Leeuw s.n.* (BOL). -2829 (Harrismith): Harrismith Botanical Garden (-AC), *Jacobsz* 2282 (PRE).

NATAL. -2632 (Bela Vista): Ndumu Game Reserve (-CD), *Moll* 4165 (DWEST); Tembe Elephant Park (-CD), *Ward* 1372 (NH). -2729 (Volksrust): Newcastle (-DD), *Van der Merwe* 2081 (PRE). -2730 (Vryheid): Utrecht, farm Retirement (-AC), *Hilliard & Burtt* 18,553 (NU); *Devenish* 1597 (PRE); Vryheid (-DD), *Venter* 13,360 (UNIN); *Van der Merwe* 2402 (PRE); Zinguin Mountain (-DB), *Van der Merwe* 2745 (NU). -2731 (Louwsburg): Magut (-DA), *Van der Merwe* 2714 (PRE). -2732 (Ubombo): Jozini area (-AC), *Vahrmeyer* 1258 (PRE); Sordwana State Forest (-CD), *Van Wyk* 951 (NH); Mkuzi (-CA), *Van der Merwe* 2410 (PRE); Mkuzi Game Reserve (-CA), *Ward* 3515 (NH). -2828 (Bethlehem): Royal National Park (-DB), *Hutchinson et al.* 131 (NH). -2829 (Underberg): Oliviers Hoek Pass (-CA), *Thode s.n.* sub STE 3369 (STE); Estcourt, farm Heartsease (-CD), *Du Toit* 2 (PRE); Colenso (-DB), *Stirton* 12,292 (UNIN); Draycott (-DC), *Van der Merwe* 2560 (PRE). -2830 (Dundee): Impati Mountain (-AA), *Shirley* 69 (NU); Weenen, Culvers (-CC), *Rogers* 28,271 (GRA); Mudon (-CD), *West* 1215 (PRE). -2831 (Nkandla): Hlabisa, farm Palm Ridge (-BB), *Harrison* 283 (NH); Itala Nature Reserve (-CA), *McDonald* 158 (NU); Eshowe (-CD), *Lawn* 968 (NH); Ngoye Forest (-DC), *Huntley* 716 (NU); *Ward* 1624 (NH). -2832 (Mtubatuba): Hluhluwe Game Reserve (-AA), *Ward* 3348 (NH); *Ward* 1878 (NH). -2929 (Underberg): Estcourt (-BB), *West* 1347 (PRE); Hele Hela (-DC), *Strey* 9203 (NH); Bulwer (-DD), *Van der Merwe* 2764 (PRE). -2930 (Pietermaritzburg): Greytown (-BA), *Schrire* 1592 (NH); *Wyllie* 27,969 (NH, PRE); *Van der Merwe* 2592 (PRE);

Pietermaritzburg (-CB), *Carnegie s.n.* sub NBG 358/31 (BOL, NBG); *Allsopp 951* (NH); *Scott s.n.* (NU); *Douwes-Dekker 19* (NU); Duncairn (-CB), *Warren 42* (PRE); Oribi (-CB), *Lawson 615* (NH); Fox Hill (-CB), *Van der Merwe 2555* (NU); Scottsville (-CB), *Frankish 42* (NU); Thornville, Richmond (-CB), *Moll 3422* (NU); Thornville, Tala Farm (-CB), *Moll 3422* (PRE); Drummond (-DA), *Hilden s.n.* (BOL); Inanda (-DB), *Strey 5337* (NH); Mid Illovo (-DC), *Thode s.n.* sub STE 3385 (STE); Isipingo North (-DD), *Ward 460* (DWEST); Krantzkloof Nature Reserve (-DD), *Palmer 26* (NH); *Haygarth s.n.* sub STE 83 (STE); *Haygarth s.n.* sub STE 85 (STE); Silverglen Nature Reserve (-DD), *Ngwenya 414* (NH); Westville (-DD), *Walsh 23* (NU); Westville, Athol Heights (-DD), *Feldman s.n.* (NU). -3029 (Kokstad): Impendhle (-AC), *Levett 9* (NH); Elandskop (-AC), *Pascoe s.n.* sub NBG 428/44 (NBG); Harding (-DB), *Van der Merwe 2756* (NU). -3030 (Port Shepstone): Umkomaas (-BB), *Van der Merwe 2766* (NU); *Archbell s.n.* sub NBG 252/32 (NBG); Vernon Crookes Nature Reserve (-BC), *Balkwill & Cadman 2254* (J); Umgaye Flats (-BC), *Rudatis 222* (STE); Oribi Gorge (-CA), *Nicholson 1867* (PRE); *Balkwill & Cron 187* (J); Izotsha (-CB), *Rump s.n.* (NU); Izingolweni (-CC), *Wood 162* (NU); Umzumbi (-DA), *Van der Merwe 2534* (NU, PRE). -3130 (Port Edward): Port Edward (-AA), *Moss 19,143* (J); *Strey 4934* (NH); *O'Conner 40* (NU); Umtamvuna Nature Reserve (-AA), *Abbott 1311* (NH, PRU); *Abbott 2131* (PRU); *Abbott 1493* (NH).

TRANSKEI. -3027 (Lady Grey): Sterkspruit (-CB), *Van der Merwe 1790(a)* (PRE). -3128 (Umtata): Mahlahlani Forest Reserve (-BC), *Perry 2431* (NBG). -3129 (Port St. Johns): Ntsubane Forest Reserve (-BC), *Venter & Vorster 33* (PRE); Mkambathi Nature Reserve (-BD), *Shackleton 23* (KEI); *Smook 6113* (PRE); Bizana (-CB), *Loughlin s.n.* (BOL). -3228 (Butterworth): Willowvale, Ngqaqini area (-AD), *Van Eeden B420* (PRE); Dwessa Forest (-BD), *Linder 1210* (PRE).

CAPE. -3024 (De Aar): De Aar (-CB), *Smook 3550* (PRE). -3118 (Vanrhynsdorp): Clanwilliam, Nardouw Kloof (-DC), *Stokoe s.n.* sub BOL 64,493 (BOL). -3221 (Merweville): Fraserburg, Layton (-BB), *Shearing 750* (PRE). -3222 (Beaufort West): Beaufort West (-BC), *de Jager s.n.* (BOL). -3225 (Somerset East): Somerset east (-DA), *Harris s.n.* sub NBG 2605/29

(NBG); Boschberg (-DC), *MacOwan 1840* (GRA). -3226 (Fort Beaufort): Hogsback Forestry Reserve (-DB), *Dahlstrand 1834* (J). -3227 (Stutterheim): Prospect (-CC), *Flanagan 112* (BOL); King Williams Town (-CD), *Barker s.n.* sub BOL 891/32 (BOL). -3228 (Butterworth): Butterworth (-CC), *Taylor 3654* (NBG). -3319 (Worcester): Klein Drakenstein (-CC), *du Plessis s.n.* sub STE 19,664 (STE). -3320 (Montagu): Bonnievale (-CC), *Compton et al. s.n.* sub NBG 558/41 (NBG); Swellendam, Warmwaterberg (-DD), *Van Niekerk 564* (BOL). -3321 (Ladismith): Riversdale, Gouritz Bridge (-DC), *Acocks 21,632* (PRE). -3322 (Oudshoorn): George (-CD), *Bolus s.n.* sub BOL 22,497 (BOL). -3323 (Willowmore): Joubertina (-DD), *Fourcade 2404* (BOL). -3324 (Steytlerville): Hankey, Zuurbron (-DD), *Fourcade 3216* (BOL). -3325 (Port Elizabeth): Port Elizabeth (-DC), *Copeman s.n.* sub PRE 35,301 (PRE); *Cruden 377* (PRE); Zwartkops River (-DC), *Ecklon & Zeyher s.n.* (BOL); Redhouse (-DC), *Paterson 923* (BOL); Donkin Reserve (-DC), *Troughton s.n.* (GRA). -3326 (Grahamstown): Albany, Mitford Park (-AA), *Britton s.n.* sub BOL 22,498 (BOL); Alicedale (-AC), *Cruden 211* (GRA); Howison's Poort (-AD), *Hall 223* (NBG); Albany, Manley Flats (-BC), *Leighton 2638* (BOL); Grahamstown (-BC), *Glass s.n.* sub BOL 23,299 (BOL); Blaauwkrantz (-BC), *Sinclair 1052* (GRA); Fraser's Camp (-BD), *Barker 6995* (NBG). -3419 (Caledon): Greyton (-BA), *Van der Merwe 2139* (PRE). -3421 (Riversdale): Riversdale (-AB), *Muir 2708* (BOL). -3420 (Bredasdorp): De Hoop, Hardevlakte (-AD), *Van Wyk 2148* (STE); Westfield (-BD), *Forrester 312* (NBG); Bredasdorp Flats (-CA), *Taylor 7680* (STE); *Leighton s.n.* sub BOL 50,841 (BOL). -3421 (Riversdale): Riversdale (-AB), *Muir 3003* (BOL); *Muir 1877* (BOL, PRE); Riversdale, farm Tolange (-AB), *Bohnen 7284* (STE); Stillbay (-AD), *Bohnen 5763* (PRE); Albertinia (-BB), *Hall 4680* (NBG). -3422 (Mossel Bay): Groot Brak (-AA), *Bayer 2321* (NBG). -3423 (Knysna): Knysna (-AA), *Thesin s.n.* sub BOL 275/13 (BOL); *Duthie s.n.* sub BOL 1197/15 (BOL). -3424 (Humansdorp): Jeffrey's Bay (-BB), *Fourcade 3937* (BOL).

15. *LEDEBOURIA ZEBRINA* (Bak.) S. Venter

Ledebouria zebrina (Bak.) S. Venter, comb. nov.

Scilla zebrina Bak. in Saund. Ref. Bot. 3: t.185 (1870).

Type: "Cape of Good Hope, *Cooper s.n.*" Saund. Ref. Bot. 3: t.185 (1870).

Scilla microscypha Bak. in Gdnr's Chron. 16: 102 (1881).

Type: Cape, eastern Provinces, *Bowker s.n.* (K!, holo.; PRE!, photo.).

Scilla megaphylla Bak. in Flora Cap. 6: 490 (1896).

Type: Transvaal, near Barberton, *Galpin 1184* (GRA!, lecto.; NH!; PRE!, photo.; SAM!) (lecto. selected here - Art. 9.3, *Greuter et al.* 1988).

Scilla grandifolia Schönl. in Rec. Albany Mus. 3: 61 (1914).

Type: Transvaal, Tzaneen, Duiwelskloof, *F.A. Rogers s.n.* (GRA!, holo.; PRE!, photo.).

Plants solitary. **Bulb** hypogeal, 100 - 150 x 100 - 150 mm, obovoid; dead bulb scales purplish brown, membranous, apices attenuate, live bulb scales tightly arranged, with threads when torn, white inside. **Leaves** partly to fully developed at anthesis, 4 - 6, spreading, lanceolate to oblong-lanceolate, 300 - 500 x 90 - 120 mm, with threads when torn, fleshy, dull green, sometimes with longitudinal purple stripes or with large purple blotches, venation obscure; margin smooth; leaf base flat to very shallowly canaliculate; apex acute. **Inflorescences** 4 - 10, dense, cylindric, 150 - 200 x 30 - 37 mm, flaccid, 100 - 150 -flowered, longer than leaves; scape base winged to angled, green, glabrous; rachis ridged, 225 - 310 mm long. **Bracts** membranous, 1.5 x 0.5 mm, linear-lanceolate, green with bracteoles below bracts. **Pedicels** spreading, 8.3 - 12.5 mm long, green. **Perianth** 4.2 - 7.7 mm long; tepals recurved, equal, oblong, 4.2 - 7.7 x 1.5 mm, apex obtuse, light green with darker green keel. **Stamens** erect, 4 mm long, green, epitepalous; anthers 1 mm long, pale yellow. **Ovary** ovoid, 6 -lobed, 2.25 x 3 mm, lobes deltate, basal lobes present, apex tapering into style. **Style** 3 mm long, triangular, glabrous, white to light green; stigma above anthers; stipe 0.25 x 0.25 mm. **Capsule** three-lobed, symmetrical, clavate, base truncate. **Seed** drop-shaped, 4 mm long, surface strongly wrinkled, black. (Figure 44).

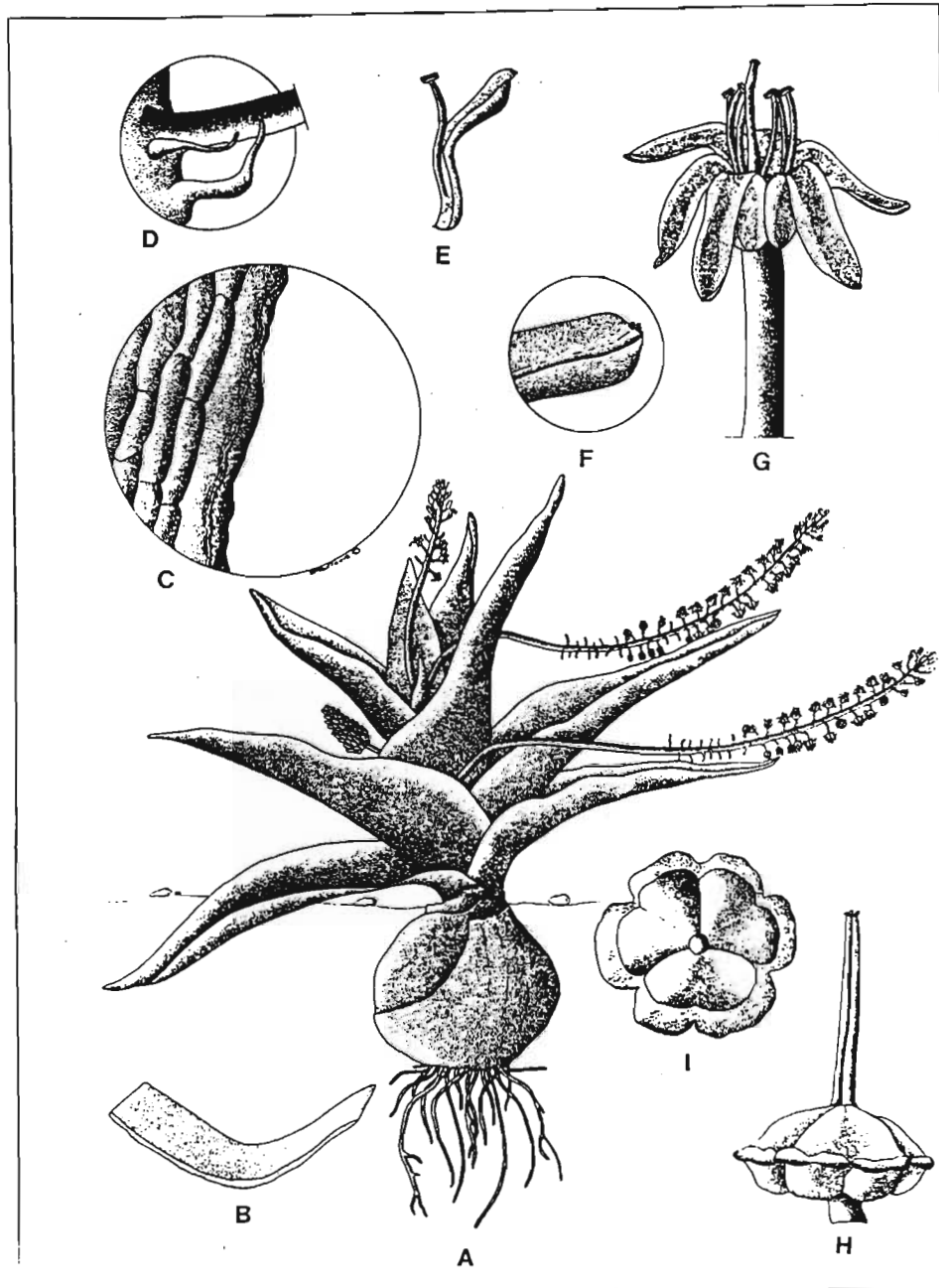


Figure 44. Illustration of *L. zebrina* (Bak.) S. Venter. A, habit X 0.25; B, section through lamina X 0.5; C, lamina margin X 300; D, bract with bracteole X 5; E, tepal with stamen X 5; F, apex of tepal X 10; G, flower X 5; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from *Venter 13,395*.

Map 19. Known distribution of *L. zebrina* (Bak.) S. Venter

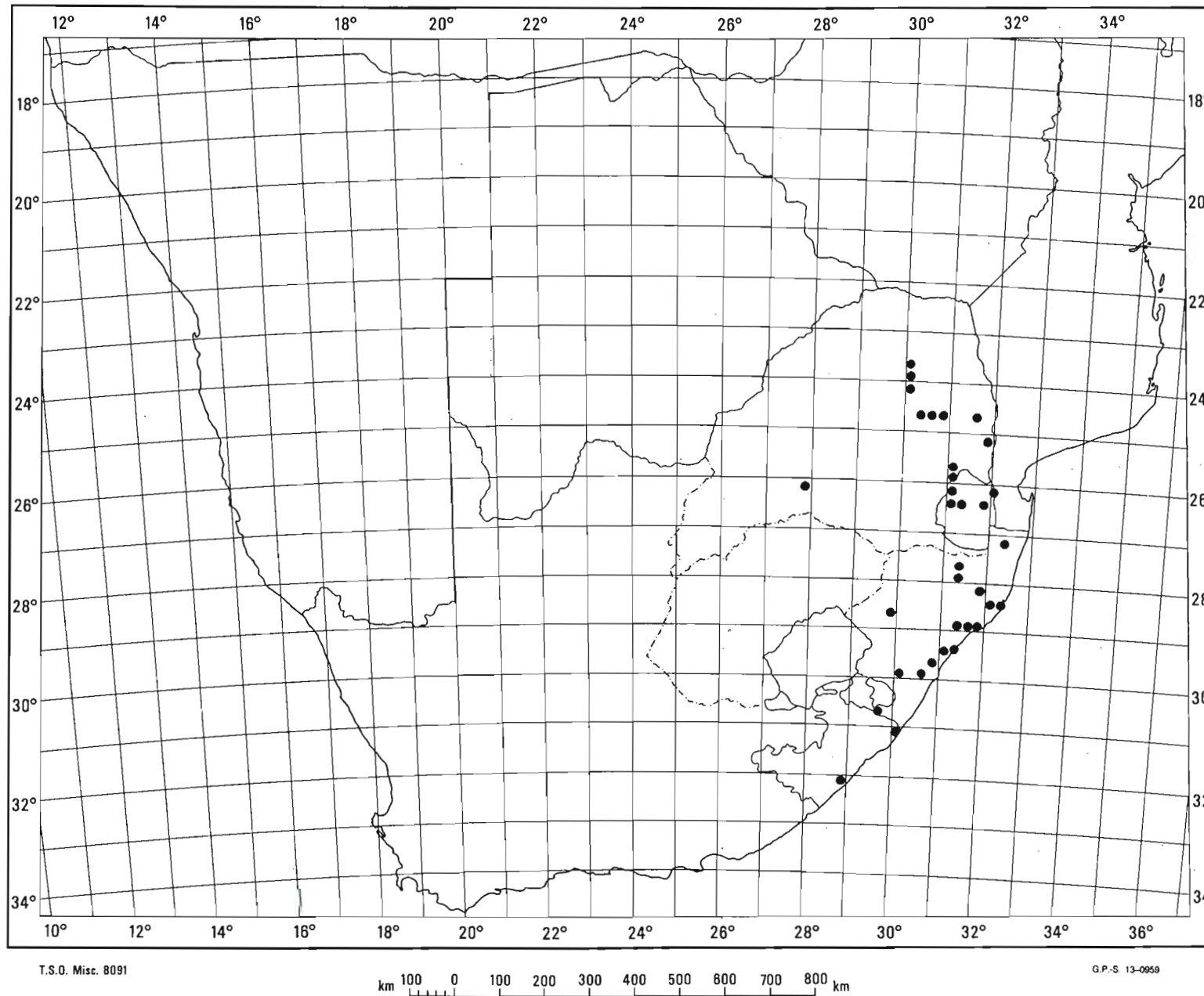
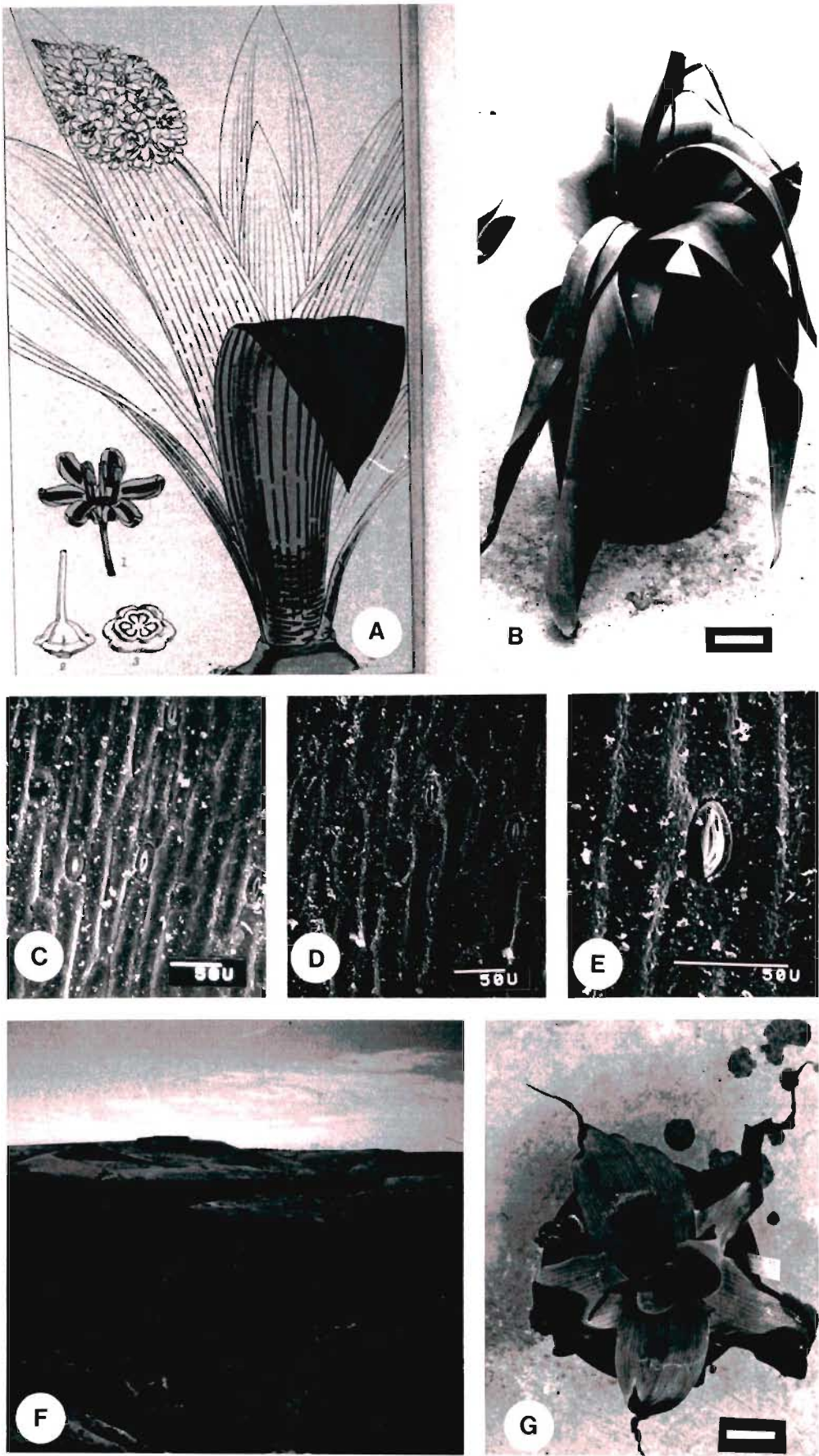


Figure 45. A, type of *L. zebrina* (Bak.) S. Venter under *Scilla zebrina* Bak. in Saunders Refugium Botanicum 3: t.185 (1870); B, plant with leaves 1000 mm long showing growth habit. Bar = 60 mm; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of a stomatum; F, habitat near Barberton. The vegetation consists of closed evergreen low *Acacia sieberana* var. *woodii* - *Pavetta edentula* - *Schotia brachypetala* woodland; G, plant from Noodsberg near Greytown showing the prominent purple zebra stripes on the leaves. Bar = 60 mm. B - E from Venter 13,395 and G from Smith 115.



L. zebrina is closely related to *L. revoluta*, *L. hypoxidioides* and *L. floribunda*. Together they constitute the section *Magnibulbae*. *L. zebrina* is easily distinguished from all other species by its size.

Specific epithet etymology.

Describes the purple, parallel longitudinal lines on the leaves.

Flowering period

From August to January with a peak from October to November.

Distribution (Map 19).

Occurs in eastern South Africa to Mooketsi in the north with an isolated locality in the Magaliesberg.

Habitat

L. zebrina grows in shallow (10 - 120 mm deep), fine grained (0.025 - 0.25 mm ϕ) to medium grained (0.25 - 1.0 mm ϕ), humus-rich sandy soils derived from quartzites and conglomerates. They usually grow in moist, shaded conditions often associated with forest vegetation.

In the Magaliesberg the *L. zebrina* populations grow in humus-rich black sandy soil derived from Magaliesberg Quartzite. This soil is medium grained (0.25 - 0.5 mm ϕ) and up to 26 mm deep in places. Plants occur in dense shade in kloof forest vegetation.

Variation

Plants from Barberton are the largest. The leaves are either immaculate or with dark green to purple blotches or striae (Figure 45G). Flower colour varies from near white (Swaziland), to green suffused with pink in the northern Transvaal.

Specimens examined

TRANSVAAL. -2330 (Tzaneen): Duiwelskloof, Westfalia (-CA), *Scheepers* 468 (UNIN); Tzaneen (-CC), *Rogers* 12,504 (J); *Rogers* 12,527 (J). -2430 (Pilgrim's Rest): The Downs (-AA), *Moss & Rogers* 460 (J); Wolkberg, farm Fertilis (-AA), *Van der Merwe* 2254 (PRE); Nelspruit (-CB), *Van der Merwe* 1792 (PRE); Abel Erasmus Pass, farm California 228 KT (-DA), *Raal et al.* 978 (LYD); Pilgrim's Rest, farm Vaalhoek (-DB), *Rogers* 20,974 (PRE); *Rogers* 25,010 (BOL, J). -2431 (Acornhoek): Manyeleti Game Reserve (-DA), *Bredenkamp* 1167 (PRU). -2530 (Lydenburg): Nelspruit (-BD), *Rogers* 16,208 (BOL); *Buitendag* 263 (NBG); *Van Jaarsveld* 107 (NBG). -2531 (Komatipoort): Paben Outpost (-BB), *Van Wyk* 4806 (PRE); Randspruit (-BB), *Van der Schyff* 4022 (KNP); Nelspruit, farm Rhenosterkop (-CA), *Onderstall* 937 (PRE); Baberton Townlands (-CC), *Venter* 13,395 (UNIN); *Van der Merwe* 1825 (PRE); *Thorncroft* 2762 (PRE); *Rogers* 24,663 (PRE). -2627 (Potchefstroom): Sterkfontein Caves (-BB), *Mogg* 35,541 (J).

SWAZILAND. -2631 (Mbabane): Komati Old Ferry (-AA), *Compton* 29,820 (NBG); Mbabane (-AC), *Martin s.n.* (NBG); Manzini (-AD), *Kemp* 431 (PRE); Manzini, near Bremersdorp (-AD), *Compton* 28,105 (NBG); Stegi (-BD), *Compton* 31,239 (NBG); *Malboch s.n.* (NBG); Mbuluzi, Mlawula Nature Reserve (-BD), *Culverwell* 2003 (PRE). -2632 (Bela Vista): Umbuluzi Gorge, Ndzindza Nature Reserve (-AA), *Culverwell* 1256 (PRE).

NATAL. -2731 (Louwsburg): Itala Nature Reserve (-CB), *Jordaan* 2077 (NH); *McDonald* 419 (NU); *McDonald* 344 (NU); Ngotshe, Ngome area (-CD), *Hilliard & Burt* 8479 (NU). -2732 (Ubombo): Tembe Elephant Park (-AB), *Ward* 2146 (NH). -2829 (Ladysmith): Ladysmith (-DB), *Van der Merwe* 2603

(PRE). -2831 (Nkandla): Hlabisa, Hluhluwe Valley (-BB), *Scott-Smith & Ward 1* (NH); Hluhluwe Nature Reserve (-BB), *Ward 1559* (NU); Eshowe (-CD), *Lawn 1105* (NH); *Gerstner s.n.* (NBG); *Acocks 12,965* (PRE); Mtunzini, Ubisana Valley (-DC), *Venter 1228* (BLFU); *Venter 566* (NH); Mtunzini, "Twinstreams" (-DD), *Hilliard & Burtt 6849* (NU). -2832 (Mtubatuba): Hlabisa, Dukuduku Farm (-AC), *Strey 5557* (NH); St. Lucia Bay (-AD), *Henry s.n.* (NBG). -2930 (Pietermaritzburg): Richmond, Hela Hela (-CC), *Strey 9234* (NH); Pietermaritzburg (-DB), *Van der Merwe 2094* (PRE); *Strey 4360* (NH); Bothas Hill (-DC), *Wood 4,776* (NH). -2931 (Stanger): Darnall (-AD), *Lutchminarain 27* (DWEST); Stanger (-AD), *Sewbarun 3* (DWEST); Durban, Clover Estate (-CC), *Nair 16* (DWEST). -3029 (Kokstad): Alfred, Weza (-DA), *Law s.n.* (NU). -3130 (Port Edward): Umtamvuna Nature Reserve (-AA), *Abbott 2148* (NH).

CAPE. -3228 (Stutterheim): East London, Gonubie (-BB), *Carter s.n.* (NBG).

Sectio **Filiferae** S. Venter, sect. nov., squamis longitudinaliter copiose fibrosis.

Species typica: *Ledebouria luteola* Jessop.

Typus: Transvaal, 6.5 miles south of Hammanskraal, *Codd 5625* (PRE).

Species: *L. luteola* Jessop and *L. ovatifolia* (Bak.) Jessop.

Plants 100 - 200 mm tall. **Bulb** 25 - 50 mm wide, torn bulb scales produce copious threads. **Leaves** pulling threads when torn. **Inflorescence** a dense raceme, 30 - 50 mm long; rachis ridged; bracts membranous, bracteoles present. **Capsule** globose.

Distribution and habitat

From the eastern Cape to northern Transvaal. Coastal grassland and woodland to montane grassland.

16. LEDEBOURIA LUTEOLA Jessop

***L. luteola* Jessop** in Jl S. Afr. Bot. 36(4): 260 (1970).

Type: Transvaal, 6.5 miles south of Hammanskraal, *Codd 5625* (PRE!, holo.).

Plants solitary. **Bulb** hypogeal, 35 - 50 x 25 - 30 mm, obovoid; dead bulb scales brown, membranous, apices attenuate, live bulb scales tightly arranged, with copious threads when torn, white inside. **Leaves** fully developed at anthesis, 4 - 10, spreading, linear-lanceolate to lanceolate, 45 - 90 x 5 - 22 mm, with copious threads when torn, leathery, with a dull lustre, purple spots and blotches with purple cross bands at base, sometimes with dull purple to darker green blotches, venation obscure; margin smooth, undulate at base; leaf base canaliculate; apex acute. **Inflorescences** 1 - 2, dense, elliptic, 30 - 40 x 15 - 20 mm, flaccid, 30 - 60 -flowered, longer than leaves; scape base terete, green, glabrous; rachis ridged, 50 - 70 mm long. **Bracts** membranous, 1.5 x 0.5 mm, bifurcate to linear, grey to white, with bracteoles. **Pedicels** spreading, 4 mm long, pink. **Perianth** 4 - 6 mm long, tepals suberect to recurved, equal, oblong, 4 - 6 x 3 mm, apex obtuse, cucullate, pink to purple with green keel. **Stamens** erect, 4 -

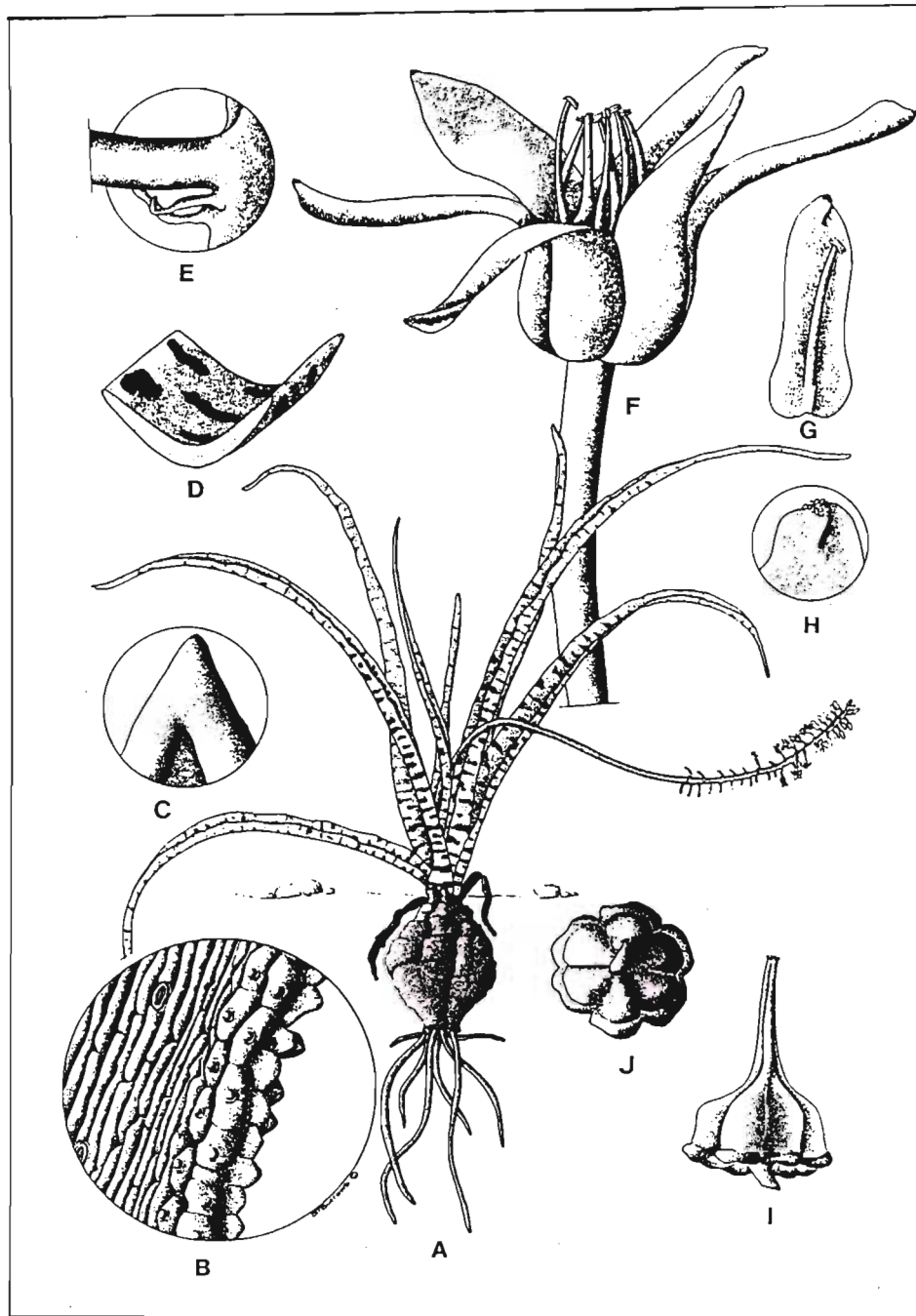


Figure 46. Illustration of *L. luteola* Jessop. A, habit X 1; B, lamina margin X 300; C, apex of lamina X 20; D, section through lamina X 5; E, bract with bracteole X 10; F, flower X 20; G, tepal with stamen X 20; H, apex of tepal X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Venter 13,458*.

Map 20. Known distribution of *L. luteola* Jessop

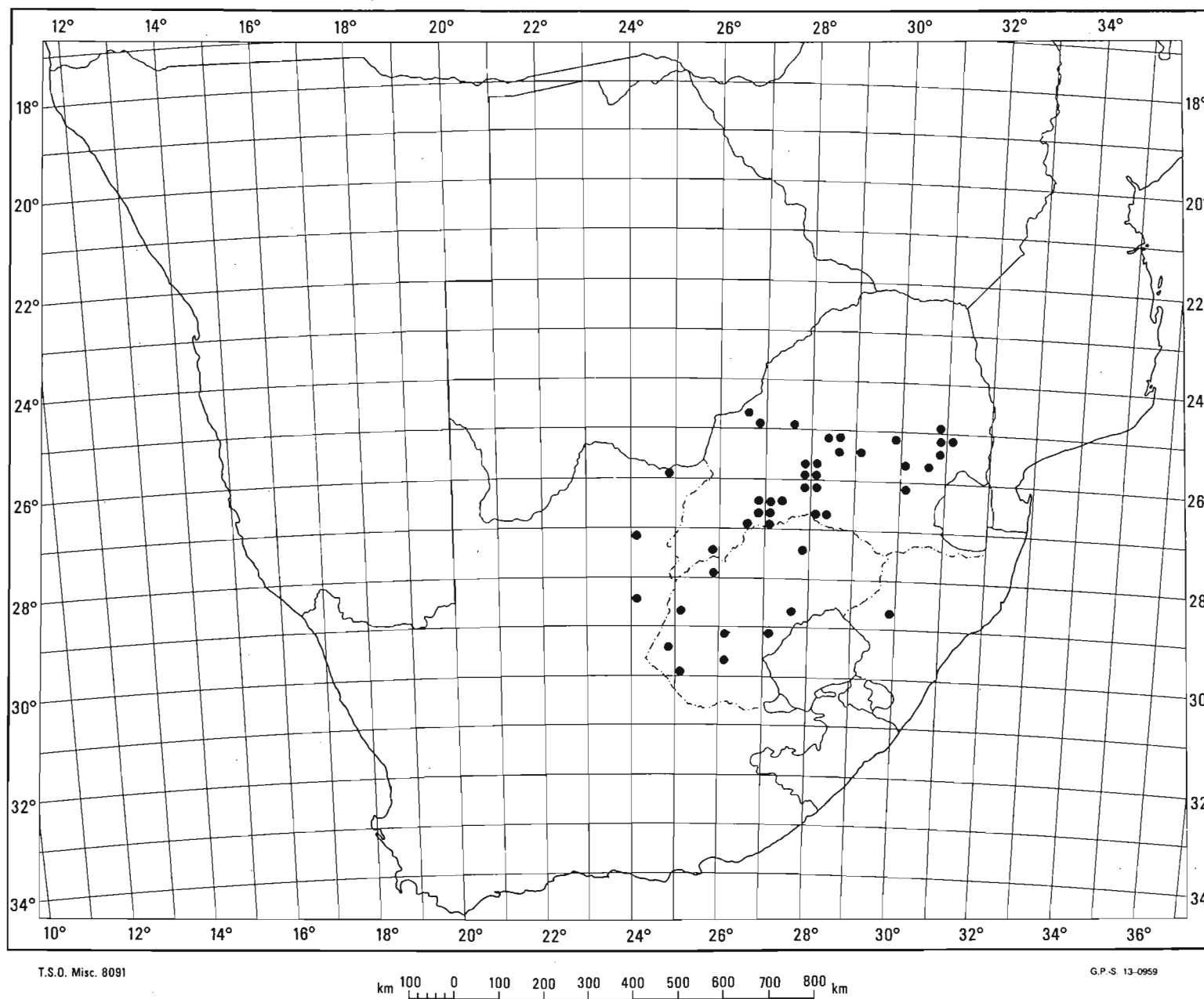
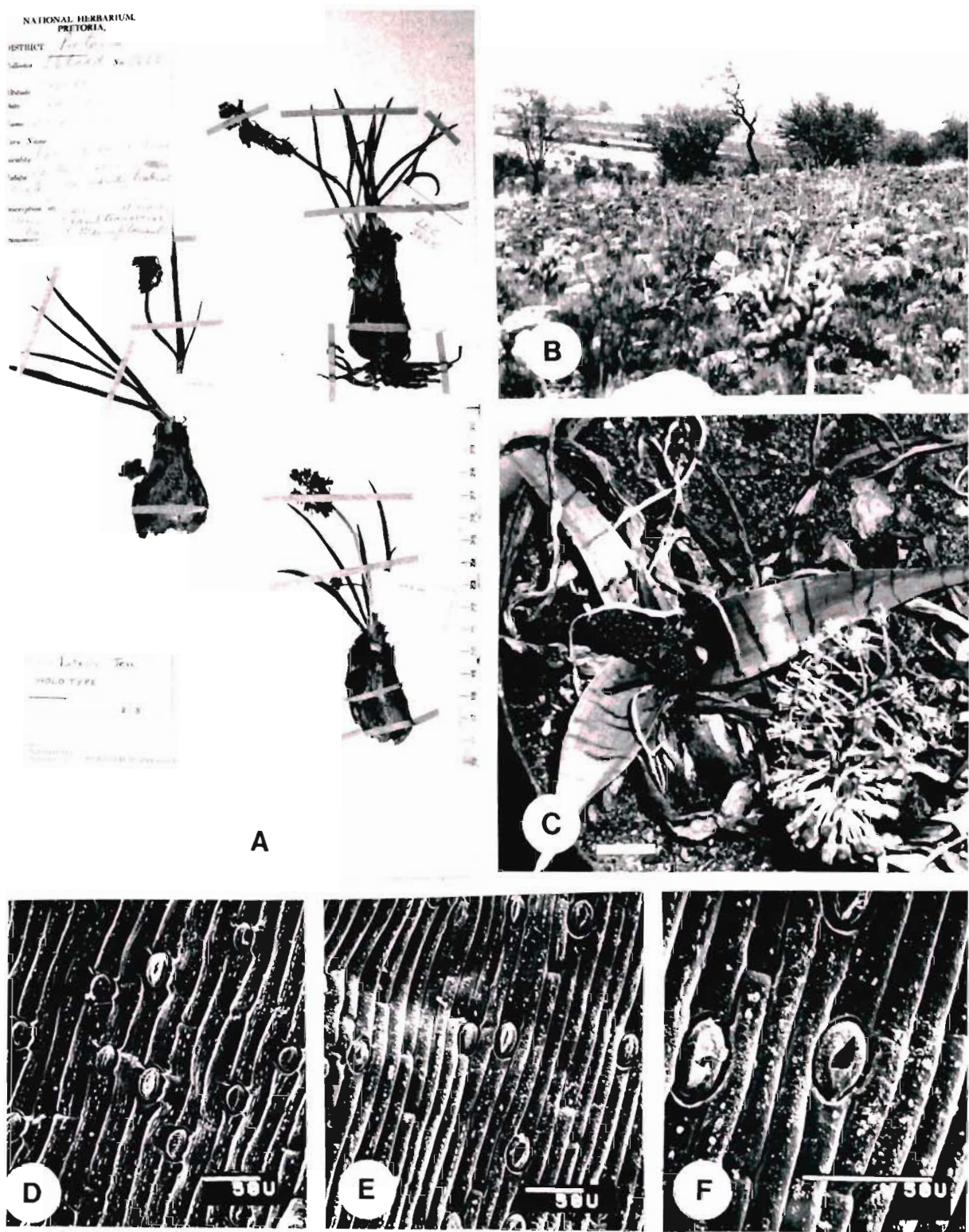


Figure 47. A, holotype of *L. luteola* Jessop (PRE); B, habitat at Potchefstroom. The vegetation consists of open deciduous low *Acacia caffra* - *Aloe greatheadii* var. *davyana* - *Themeda triandra* woodland; C, plant with the previous years leaves still on the plant. Bar = 10 mm; D, SEM micrograph of the adaxial lamina surface; E, SEM micrograph of the abaxial lamina surface; F, SEM micrograph of stomata. C - F from Venter 13,217.



5 mm long, filaments maroon, epitepalous; anthers 0.75 mm long, pale violet. **Ovary** ovoid, 6 -lobed, 3 x 4 mm, lobes obtusely deltate, basal lobes present, apex tapering into style. **Style** 3 mm long, triangular, glabrous, purple; stigma above anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shape, 4 mm long, surface strongly wrinkled, brown. (Figure 46).

L. luteola is closely related to *L. ovatifolia* (Bak.) Jessop, together comprising the section *Filiferae*. *L. luteola* differs in the apices of the bulb scales not at all truncate, leaves spreading and linear-lanceolate to lanceolate.

Specific epithet etymology.

Referring to the colour of the live bulb scales.

Flowering period

From August to February with a peak from October to November.

Distribution (Map 20).

Most common in the southern half of the Transvaal and the whole Orange Free State. A few localities are recorded in the extreme north-eastern Cape with a single locality at Ladysmith in Natal.

Habitat

L. luteola occurs in woodland and grassland but is principally a Highveld element (Figure 47B). Jessop (1970) mentions that *L. luteola* occurs in damp areas. The opposite was found to be the case during the present study.

Some plants show signs of grazing by the Common Duiker (*Sylvicapra grimmia* L.) (Smithers 1983) according to spoor and droppings found.

Variation

The eastern Transvaal populations have more erect inflorescences with longer and darker perianths.

Specimens examined

TRANSVAAL. - 2426 (Mochudi): Derdepoort, farm Buffelsdooring (-DA), *Chadwick* 286 (PRE). -2427 (Thabazimbi): Rooiberg (-DC), *Van der Merwe s.n.* (PRE). -2430 (Pilgrim's Rest): Graskop, Lisbon Falls (-DD), *Venter* 13,241 (UNIN). -2524 (Vergelee): Molopo Nature Reserve (-DD), *Peeters et al.* 222 (PRE). -2527 (Rustenburg): Rustenburg, Paul Kruger (-DB), *Van der Merwe* 1127 (PRE); Rustenburg, farm Uitkomst 499 JQ (-DD), *Coetzee* 210 (PRE); Zwartkops (-DD), *Moss* 19,059 (J). -2528 (Pretoria): Rust der Winter (-AB), *Pole-Evans* 3892 (PRE); Herzogville (-BA), *Greyling* 4 (PRU); Pretoria, Van Riebeeck Nature Reserve (-BC), *Kok* 220 (PRE); Pretoria (-CA), *Moss* 10,810 (J); Bon Accord Dam (-CA), *Van der Merwe* 1988 (PRE); Irene (-CC), *Leendertz* 925 (BOL). -2529 (Witbank): Buffelshoek (-AC), *Van der Merwe* 2018 (PRE); -2530 (Lydenburg): Sabie (-BB), *Van der Merwe s.n.* (PRE); Nelspruit (-BD), *Buitendag* 639 (NBG); Belfast (-CA), *Van der Merwe* 1938 (PRE); *Van der Merwe* 1227 (PRE); Starvation Creek Nature Reserve (-DA), *Kluge* 1351 (PRE). -2531 (Komatipoort): Kruger National Park, Numbi (-AA), *Van der Schyff* 733 (KNP). -2626 (Klerksdorp): Ventersdorp, farm Somerville (-BD), *Louw* 3884 (PUC); *Louw* 4232 (PUC); Klerksdorp (-DC), *Strydom* 2259 (PRE); Ventersdorp, farm Goedgedacht (-DD), *Louw* 1982 (PUC); *Sutton* 631 (PRE). -2627 (Potchefstroom): Rysmierbult (-AC), *Ubbink* 730 (PUC); Carltonville, Abe Bailey Nature Reserve (-AD), *Van Wyk* 312 (PUC); *Van Wyk* 271 (PUC); Witpoortjie (-BB), *Gilliland s.n.* (J); *Lloyd s.n.* sub J 26,629 (J); *Moss* 4133 (J); Potchefstroom (-CA), *Bredenkamp & Smith* 94 (PUC); *Venter* 13,226 (UNIN); Dassiesrant (-CA), *Van der Westhuizen* 941 (PUC); Boskop (-CA), *Louw* 481 (PUC); Klington (-CA), *Goossens* 1660 (PUC). -2628 (Johannesburg): Johannesburg (-AA), *Moss* 19,048 (J); Klipriviersberg (-AA), *Lloyd s.n.* (J); Rietfontein (-AA), *Moss* 10,807 (J); Bedford (-AA), *Gilliland s.n.* (J); Zoo Koppies (-AA), *Rogers* 19,605 (J); Melville (-AA), *Gilliland s.n.*

(J); *MacNae 1166* (J); Suikerbosrand (-CA), *Bredenkamp 1000* (PRU); *Bredenkamp 27* (PRU). -2630 (Carolina): Carolina (-AA), *Gilliland s.n.* (J). -2725 (Bloemhof): Wolmaranstad, farm Boskuil (-BD), *Sutton 465* (PUC).

ORANGE FREE STATE. - 2725 (Bloemhof): Hoopstad (-DD), *Zietsman 1356* (PRE). -2727 (Kroonstad): Heilbron, Vegkop (-BD), *Van der Merwe 1134* (PRE). -2825 (Boshof): Boshof (-CA), *Potts 1058* (BLFU). -2827 (Senekal): Senekal, farm Doornkop (-DA), *Sutton 631* (PUC). -2924 (Hopetown): Hopetown, farm Panfontein (-BD), *Kok 220* (PRU). -2925 (Jagersfontein): Parys (-CC), *Van der Merwe 2188* (PRE). -2926 (Bloemfontein): Bloemfontein (-AA), *Potts 2862* (BLFU); *Potts 1340* (BLFU); *Müller 379* (BLFU); Bloemfontein, Rhenoster Spruit (-AA), *Potts 2801* (BLFU); Bloemfontein, Vaalbank (-CA), *Smith 8602b* (PRE). -2927 (Maseru): Exelsior, Mensvleterberg (-AA), *Zietsman 24* (PRE).

NATAL. - 2829 (Harrismith): Ladysmith (-DB), *Van der Merwe 2606* (PRE).

CAPE. - 2724 (Taung): Vryburg, farm Zoetvlei (-AA), *Speedy 19/21A* (PRE). -2824 (Kimberley): Barkley West, between Gaap & Kneukel (-AC), *Acocks 8501* (PRE).

17. *LEDEBOURIA OVATIFOLIA* (Bak.) Jessop

Ledebouria ovatifolia (Bak.) Jessop in Jl S. Afr. Bot. 36(4): 262 (1970).

Scilla ovatifolia Bak. in Saund. Ref. Bot. 3: t.183 (1870).

Type: Natal, *Cooper s.n.* (K!, holo.; PRE!, photo.).

Scilla lanceaefolia (Jacq.) Bak. var. *ovatifolia* Bak. in Jl Linn. Soc. 11(54): 252 (1870).

Iconotype: Saund. Ref. Bot. 3: t.183. "Cap. B. Spei, *Cooper s.n.*"

Scilla lanceaefolia sensu Wood & Evans in Natal Plants 3(4): t.202 (1900), non *Lachenalia lanceaefolia* Jacq.

Scilla guttata C.A. Sm. in Kew Bull. : 243 (1930).

Type: Natal, Durban Div., *Cooper s.n.* (K!, holo.).

Scilla cicatricosa C.A. Sm. in Kew Bull. : 246 (1930). Nom. nov. only.

Scilla climacocarpha C.A. Sm. in Kew Bull. : 249 (1930).

Type: Orange Free State, Bethlehem, *Phillips 3068* (PRE!, holo.).

Scilla albomarginata Van der Merwe in Flower. Pl. S. Afr. 24: t.947 (1944).

Type: Natal, Umzinto, *Van der Merwe 2669* (PRE!, holo.).

Scilla elevans Van der Merwe in Flower. Pl. S. Afr. 24: t.948 (1944).

Type: Natal, Vryheid, *Van der Merwe 2677* (PRE!, holo.).

Scilla collina Hutch. in Bot. in S. Afr. :344 (1946).

Type: Transvaal, Soutpansberg, Klein Australe, *Smuts & Gillett 4186* (K!, holo.; PRE!, photo.).

Plants solitary. **Bulb** hypogeal, 35 - 70 x 30 - 50 mm, ovoid; dead bulb scales brown to purple, apices truncate, live bulb scales fleshy, loosely arranged, with copious threads when torn, white to purple inside. **Leaves** partly emerged at anthesis, 4 - 15, sometimes spreading, mostly appressed, ovate to deltate, 50 - 120 x 36 - 60 mm, with threads when torn, thickly fleshy, adaxial surface green with purple or dark green spots and blotches, abaxial surface green or more commonly purple, venation obscure; margin smooth, white to purple; leaf base canaliculate; apex acute. **Inflorescences** 1 - 4, dense, ovate, 30 - 50 x 25 - 30 mm, flaccid, 30 - 40 -flowered, longer than the leaves; scape basally compressed, green, glabrous; rachis ridged, 50 - 70 mm long. **Bracts** membranous, 1 x 0.5 mm, linear to lanceolate, pink to purple with bracteoles. **Pedicels** spreading, 7 - 12 mm long, pink to purple. **Perianth** 5 mm long, tepals recurved, equal, oblong, 5 x 1.5 mm, apex obtuse, pink to purple with a green keel. **Stamens** erect, 5 mm long, filaments maroon, epitepalous; anthers 1 mm long, yellow. **Ovary** cylindrical, 6 -lobed, 1.75 x 3 mm, lobes narrowly transversely elliptic, apex forming shoulders. **Style** 3.5 mm long, triangular, glabrous, purple; stigma above anthers; stipe 1 x 1 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** globose, 3 - 4 mm long, surface strongly wrinkled, brown. (Figure 48).

L. ovatifolia is closely related to *L. luteola*. Together they constitute the section *Filiferae*. *L. ovatifolia* differs from *L. luteola* in the truncate apices of the bulb scales (Figure 49B) and the partly emerged, ovate to deltate, mostly humifuse leaves.

Specific epithet etymology.

Describes the ovate leaves.

Flowering period

From August to March with a peak from August to November. Plants from the lowveld areas of Transvaal and Natal flower later than plants from high lying areas.

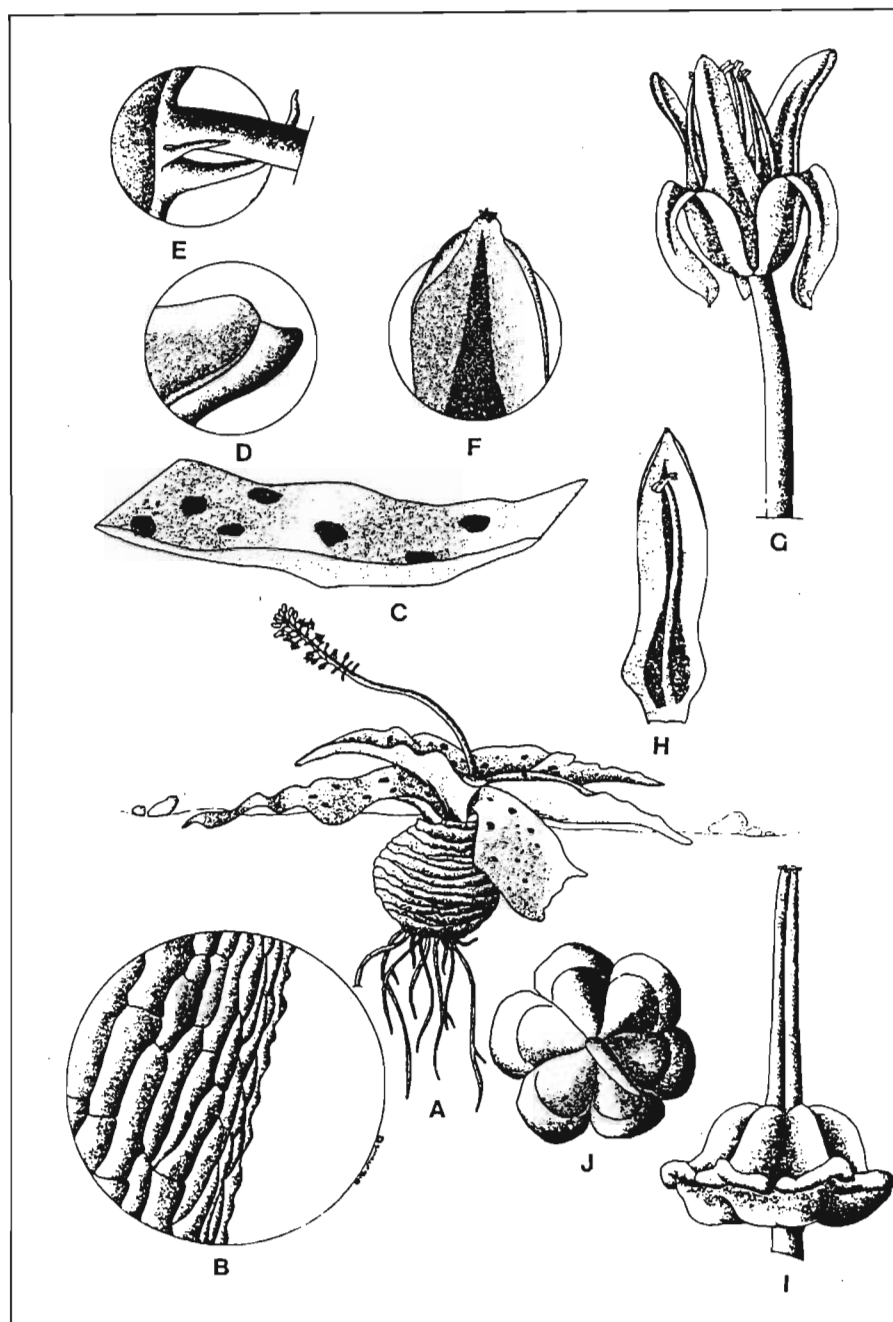


Figure 48. Illustration of *L. ovatifolia* (Bak.) Jessop. A, habit X 0.5; B, lamina margin X 300; C, section through lamina X 2; D, apex of lamina X 20; E, bract with bracteole X 10; F, apex of tepal X 20; G, flower X 5; H, tepal with stamen X 5; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Stirton 11,180*.

Map 21. Known distribution of *L. ovatifolia* (Bak.) Jessop

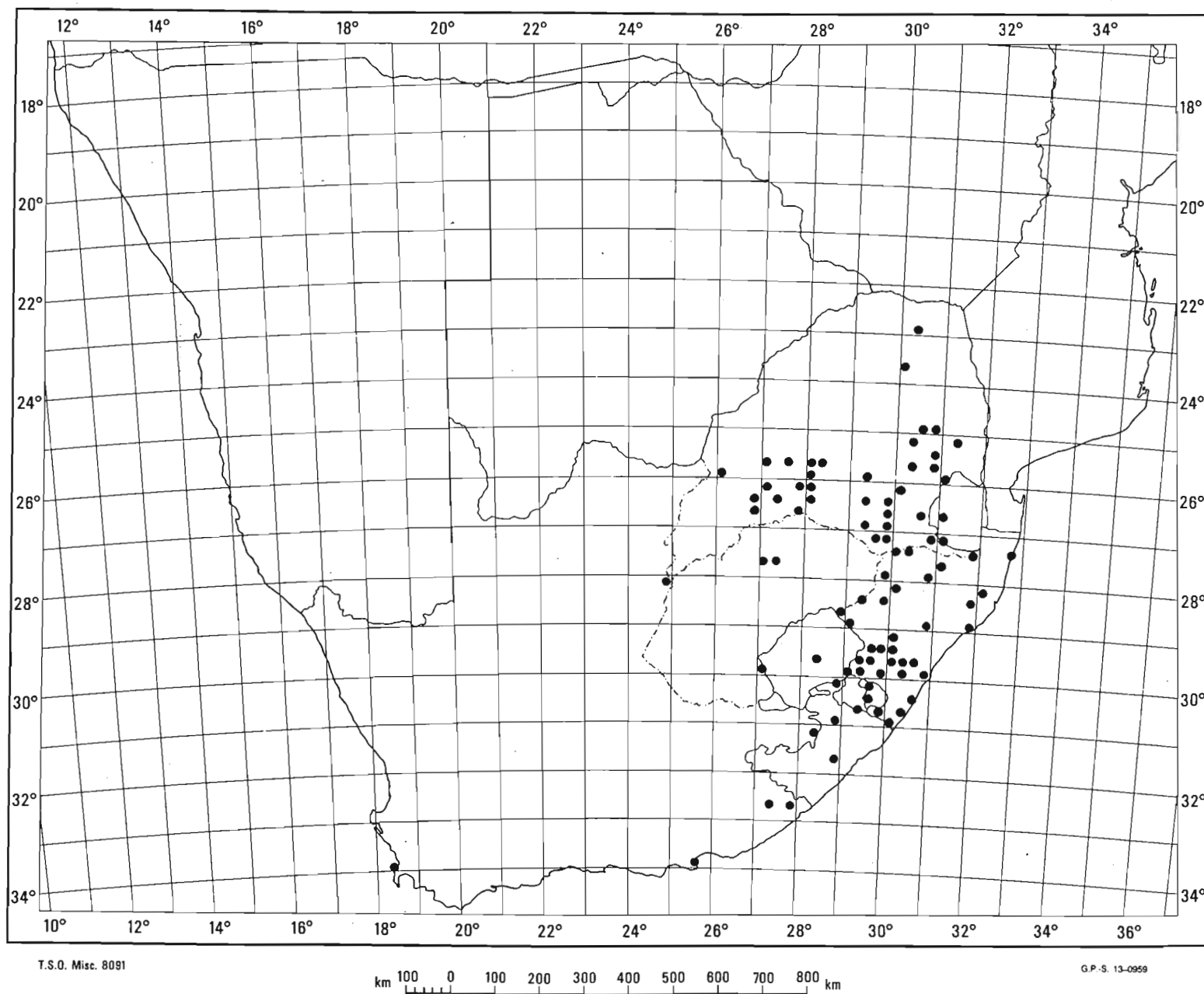
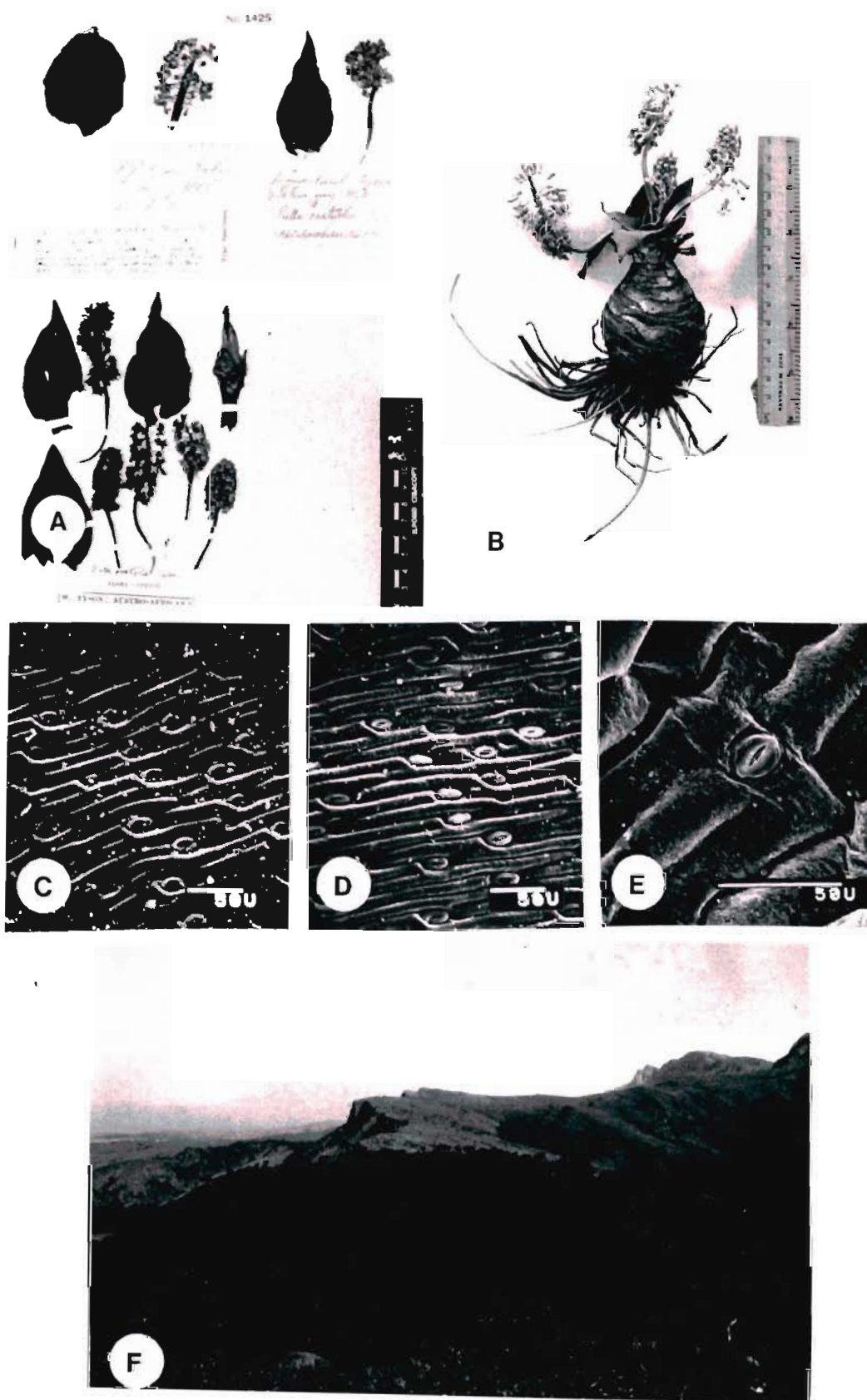


Figure 49. A, holotype of *L. ovatifolia* (Bak.) Jessop (distal left) (K); B, plant of *L. ovatifolia* showing the truncate apices of the bulb scales; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of a stoma; F, habitat near Trichardtsdal, north-eastern Transvaal. The vegetation consists of open low evergreen *Protea roupelliae* var. *roupelliae* - *Themeda triandra* woodland. B from *Van der Merwe* 2172 and C - E from *Venter* 13,349.



Distribution (Map 21).

Widely distributed throughout Transvaal, Swaziland, Orange Free State, Lesotho, Natal and Transkei with a few scattered localities in the eastern and northern Cape.

Habitat

L. ovatifolia grows in grassland or woodlands (then in large open grassy areas between the trees and bushclumps) (Figure 49F).

Leaves are occasionally grazed but the copious threads in the bulb scales protect it from being eaten by animals except the Porcupine (*Hystrix africaeaustralis* Peters).

Variation

Plants of *L. ovatifolia* growing in shady conditions tend to have more lanceolate spreading leaves (Venter 13,372) with dull darker green or purplish markings (sometimes immaculate). Such plants, collected at Vryheid, led Van der Merwe to describe a separate species namely *Scilla elevans* (1944b).

Historical background

The plant described by Wood & Evans (1900) as *Scilla lanceaefolia* does not agree with the figure of the nomenclatural type (Jacquin 1794). Wood & Evans cite no specimen but state that the plant figured was collected around Durban. The name *S. lanceaefolia* used by Wood & Evans belongs to *Ledebouria revoluta* (L.f) Jessop, consequently C.A. Smith (1930) proposed the name *Scilla cicatricosa* for this plant.

Smith (1930) correctly states that the plant described by Baker (1870d) as *Scilla lanceaefolia*, is not the same as *S. lanceaefolia* sensu Jacquin. Smith (1930) failed to recognise Baker's species as *Ledebouria ovatifolia* as stated by him in the synonym list under *Scilla guttata* where he mentions *Scilla lanceaefolia* (Jacq.) Bak. var. *ovatifolia* Bak. as a synonym.

Specimens examined

VENDA. -2230 (Messina): Thate Vondo (-CD), *Mugwedi 1312* (PRE).

TRANSVAAL. -2330 (Tzaneen): Westfalia Estate (-CA), *Scheepers 468* (PRE). -2430 (Pilgrim's Rest): Mount Sheba Nature Reserve (-DC), *Kerfoot 94* (J); *Kerfoot 82* (J); Pilgrim's Rest (-DD), *Rogers 14,951* (J, PRE); *Rogers 14,701* (J); Graskop, Lisbon Falls (-DD), *Venter 13,248* (PRE). -2527 (Rustenburg): Rustenburg Nature Reserve (-CA), *Jacobsen 1031* (PRE). -2528 (Pretoria): Pretoria (-CA), *Van der Merwe 1989* (PRE); Fountains Valley (CA), *Van der Merwe 2001* (PRE); Wonderboompoort (-CA), *Labuschagne s.n.* (PRE); Wonderboom (-CA), *Rogers 21,718* (J); Meyerspark (-CA), *Theron 176* (PRU); Trigaardts Poort (-CB), *Van der Merwe s.n.* (PRE); Roodeplaat Dam Nature Reserve (-CB), *Van Rooyen 2007* (PRU); *Van Rooyen 2319* (PRU); Olifantsfontein (-CC), *Van der Merwe 1971* (PRE). -2529 (Witbank): Middelburg, farm Doornkop 273 JS (-CD), *du Plessis 727* (PRU); Middelburg, Soetevelde (-CD), *Van der Merwe 2198* (PRE). -2530 (Lydenburg): Lydenburg, farm Nooitgedacht 266 (-AB), *Van der Merwe 1778* (PRE); Sabie (-BB), *Rogers 23,030* (PRE); Nelspruit (-BD), *Van Jaarsveld 18* (PRE); Witklip Plantation (-BD), *Kluge 127* (PRE); *Kluge 128* (PRE, PRU); Waterval - Boven (-CB), *Rogers 227* (GRA); *Rogers 5116* (PRE); Machadodorp, Bambi Hotel (-CB), *Booyesen s.n.* (BLFU); Machadodorp, Goedverwagting (-CB), *Van der Merwe 1252* (PRE). -2531 (Komatipoort): Pretorius Kop (-AB), *Letty 204* (PRE); *Van der Schyff 3226* (KNP); Barberton (-CC), *Van der Merwe 1817* (PRE); *Galpin 508* (PRE); Barberton, Maid of the Mist Mountain (-CC), *Venter 12,543* (UNIN); Barberton, farm Oosterbeek (-CC), *Venter 13,376* (UNIN). -2626 (Klerksdorp): Ventersdorp, farm Somerville (-BD), *Louw 3917* (PUC); *Bosch & Kruger s.n.* (PUC); Ventersdorp, farm

Goedgedacht (-DB), *Sutton 467* (PUC). -2627 (Potchefstroom): Abe Bailey Nature Reserve (-AD), *Van Wyk 213* (PUC); Modderfontein (-BB), *Van der Merwe 1983* (PRE); Sterkfontein (-BB), *Mogg 34,438* (J); Vereeniging (-DB), *Burt Davy 17,149* (BOL). -2628 (Johannesburg): Johannesburg (-AA), *Moss 7347* (J); Bedford (-AA), *Gilliland s.n.* (J); Morningside (-AA), *Gilliland s.n.* (J); Bryanston (-AA), *Dahlstrand 364T* (PEU); Limbro Park (-AA), *Gilliland s.n.* (J); Houghton Hill (-AA), *Cohen s.n.* sub J 31,881 (J); Klipriviersberg (-AC), *Gilliland s.n.* (J); Wattles (-AC), *Moss 10,811* (J); Rosettenville (-AC), *Moss 18,929* (J). -2629 (Bethal): Bethal (-AD), *Leendertz 10,139* (PRE); Breyton (-BD), *Steyn 976* (NBG); Standerton, farm Starkville (-CD), *Venter 2049* (PRE); Bethal, Vermaakskraal (-DD), *Turner 1154* (PRE). -2630 (Carolina): Carolina (-AA), *Galpin 7* (BOL); *Rogers 21,301* (J); *Rogers 19,604* (J); *Galpin 13,096* (PRE); Lichfield (-DA), *Van der Merwe 1073* (PRE). -2729 (Volksrust): Wakkerstroom, Sandspruit (-BA), *Gillispie 12,506A* (PRE); Amersfoort (-BB), *Turner 1107* (PRE). -2730 (Vryheid): Wakkerstroom, Oshoek (-AD), *Devenish 175* (PRE).

SWAZILAND. -2631 (Mbabane): Mankaiana, Ntondozi (-CA), *Compton 30,892* (NBG, PRE).

ORANGE FREE STATE. -2727 (Kroonstad): Kroonstad (-CA), *Chesnell 124* (J); Vals River (-CB), *Pont 298* (PRE).

LESOTHO. -2927 (Maseru): Mafeteng (-CC), *Dieterlen 1361* (PRE).

NATAL. -2729 (Volksrust): New Castle, Chelmsford (-DD), *Smit chf.011* (NU). -2730 (Vryheid): Vryheid, farm Groenvlei (-AD), *Strey 9078* (NH); Vryheid (-DD), *Van der Merwe 2399* (PRE); Vryheid Nature Reserve (-DD), *Schrire 1272* (NU). -2731 (Louwsburg): Hlatikulu, farm Goedegun (-AA), *Ross 1470* (NU); Josini (-BD), *Strey 4621* (PRE); Itala Nature Reserve (-CA), *McDonald 184* (NU). -2732 (Ubombo): Mazengwenya (-BD), *Ward 1558* (NH). -2828 (Bethlehem): Royal National Park (-DB), *Schelppe 1747* (NH). -2829 (Harrismith): Swinburne (-AD), *Coetzee s.n.* (BOL); Ladysmith, farm Elandsplaagte (-BD), *Rendles 54* (NU); Cathedral Peak (-CC), *Esterhuysen 15,463* (BOL). -2830 (Dundee): Dundee Airfield (-AA), *Shirley 114* (NU);

Dundee, Impati Hill (-AA), *Shirley 1* (NU); Kranskop (-AA), *Johnson 3900* (NH); *Schrire 1557* (NH); Muden (-CD), *Cromwright s.n.* sub NBG 73,448 (NBG). -2831 (Stanger): Hlabisa, farm Palm Ridge (-BB), *Harrison 122* (NH); Mtunzini, Umhlatusi Flats (-DD), *Venter 2563* (PRE). -2832 (Mtubatuba): Hluhluwe Game Reserve (-AA), *Fakude & Bourquin 11* (NU, PRE); Poplela, Sunset, Petlos Krantz (-CB), *Rennie 78* (NU); -2929 (Underberg): Kamberg, Fourteen Streams (-BC), *Cooke 5227* (BOL); Kamberg (-BD), *Wright 1855* (NU); *Wright 2221* (NU); *Ruddock 20* (NU); Sani Pass (-CB), *Hilliard & Burt 18,055* (NU); Cathedral Peak (-CC), *Everson 231* (PRE); Underberg (-CD), *Van der Merwe 2760* (NU, PRE); Garden Castle (-CD), *Hilliard 8159* (NU); Loteni Game Reserve (-DA), *Phelan 128* (NU); *Cunningham 2131* (NH); Underberg, Nkonzo State Forest (-DD), *Nicholas & Norris 1148* (CPF, NH, PRE); Polela, Highbury (-DD), *Landsdell s.n.* sub NH 42772 (NH). -2930 (Pietermaritzburg): Tweedie (-AC), *Mogg 1302* (PRE); Lions River (-AC), *Strey 3514* (PRE); Caversham (-AC), *Mogg 1491* (PRE); Zwartkop Location (-AC), *Moll 1142* (PRE); Lidgetton (-AC), *Mogg 1408* (PRE); Nottingham Road (-AC), *Galpin 9445* (PRE); Merrievale (-CA), *Smith s.n.* (PRE); Pietermaritzburg (-CA), *Sanden-Smith 19* (NH); Clarendon (-CB), *Newmark 49* (NU); Hayfield (-CB), *Nicholas 1998* (CPF, NH); Howick (-CB), *MacDevette 1070* (NH); *Foley s.n.* (BOL); Scottsville (-CB), *Daffey s.n.* (NU); Zwartkops (-CD), *Lawson 237* (NU); New England Road (-CD), *Lachman 3* (NU); Town Hill (-CD), *Clarkson 62* (NU); *Killick 184* (NU); Oribi Airfield (-CD), *Brayshaw 17* (NU); Richmond (-CD), *Vyvyan 30* (BOL); Cato Ridge (-DA), *McClean & Ogilvie s.n.* (NH); *Van der Merwe 2533* (PRE); *Ross 2160* (NH, NU); Inchanga (-DA), *Loubser 15* (NU); Kloof, Daviesville (-DD), *Herre s.n.* (BOL). -2931 (Stanger): Durban (-CC), *Wood 181* (BOL); *Wood 1392* (NH). -3029 (Kokstad): Glen Garry, Mealiefontein (-BC), *Strey 9165* (NH); Kokstad (-CB), *Tyson 1123* (BOL); Weza (-DA), *Strey 10,500* (NH); Harding Road (-DB), *Strey 6977* (NH). -3030 (Port Shepstone): Scottburgh (-BC), *Venter 13,195* (UNIN); Port Shepstone (-CB), *Warren s.n.* (PRE); Umtamvuna Nature Reserve (-CC), *Abbott 2100* (PRU).

TRANSKEI. -3028 (Matatiele): Ramatseliso Gate (-BB), *Boardman 147* (PRE); Mount Frere (-DD), *Venter 13,324* (UNIN). -3128 (Umtata): Umtata, UNITRA Campus (-DB), *Hutchings 589* (KEI).

CAPE. -2824 (Kimberley): Warrenton (-BB), *Adams 98* (BOL). -3128 (Umtata): MaCclear (-AB), *Wederman & Oberdieck 1156* (PRE). -3227 (Stutterheim): Stutterheim, Evelyn Valley (-CB), *Barker 4228* (NBG); Komgha (-DB), *Flanagan 1301* (BOL). -3318 (Cape Town): Claremont (-CD), *Schlechter 2940* (BOL). -3325 (Port Elizabeth): Port Elizabeth (-DC), *Fourcade s.n.* sub NBG 73,449 (NBG).

Sectio **Monophyllae** S. Venter, sect. nov., folio unico humifuso; inflorescentia erecta, racemo globoso.

Species typica: *Ledebouria monophylla* S. Venter.

Typus: Transvaal, Graskop, Paradise Camp, Venter 13,235 (PRE).

Species: *L. monophylla* S. Venter.

Plants solitary, 30 - 50 mm tall. **Bulbs** 10 - 20 mm wide; apices of dry bulb scales truncate. **Leaf** single, appressed to ground, thickly fleshy. **Inflorescence** solitary, erect. **Peduncle** thick, base compressed. **Raceme** globose. **Perianth** stellate.

Distribution and habitat

Transvaal Drakensberg Escarp and two isolated localities near Pietermaritzburg, Natal.

Occurs in montane grassland.

18. *LEDEBOURIA MONOPHYLLA* S. Venter

Ledebouria monophylla S. Venter, sp. nov., ad *L. cooperi* (Hook.f.) Jessop sed folio singulo, late ovato adpresso; inflorescentia solitaria erecta, pedunculo basi compresso et floribus stellaribus, lobis cucullatis distinctissima.

Type: Transvaal, Graskop, Paradise Camp, Venter 13,235 (PRE!, holo.; NU!; UNIN!).

Plants solitary. **Bulbs** hypogeal, 10 - 20 x 8 - 12 mm, ovoid; dead bulb scales light brown, apices truncate, live bulb scales fleshy, tightly arranged, with threads when torn, white inside. **Leaf** single, sometimes partly emerged but usually fully developed at anthesis, appressed to ground, broadly ovate, 30 - 40 x 30 - 40 mm, without threads when torn, thickly fleshy, glossy green, immaculate, venation obscure; margin smooth, red; leaf base canaliculate; apex

obtuse to acute. **Inflorescence** solitary, erect, dense, globose, 10 - 15 x 15 mm, erect, 20 - 30 -flowered, longer than the leaves; scape basally compressed, green spotted purple, glabrous; rachis ridged, 10 - 30 mm long. **Bracts** fleshy, lanceolate to bifurcate, pink with bracteoles. **Pedicels** spreading, 3 - 5 mm long, pink. **Perianth** 4 mm long, stellate, tepals equal, oblong, 4.0 x 1.5 mm, apex obtuse, cucullate, pink to purple. **Stamens** spreading, 1.5 - 4.0 mm long, filament base slightly flattened, upper part purple with lower part white, free; anthers 0.5 mm long, yellow. **Ovary** globose, 3 -lobed, 1 x 2 mm, lobes depressed ovate, shoulders raised. **Style** 1.5 mm long, triangular, glabrous, purple; stigma above anthers; stipe 0.25 x 0.25 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 1.5 mm long, surface strongly wrinkled, brown. (Figure 50).

L. monophylla is not closely allied to other South African species. It is characterized by the solitary, appressed fleshy leaf, the solitary inflorescence with depressed peduncle, globose raceme and stellate flowers (Figure 50).

Specific epithet etymology.

Alludes to the single leaf.

Flowering period

From September to December with a peak from September to October.

Distribution (Map 22).

L. monophylla occurs in the eastern Transvaal with a single record from Zwartkop near Pietermaritzburg, Natal.

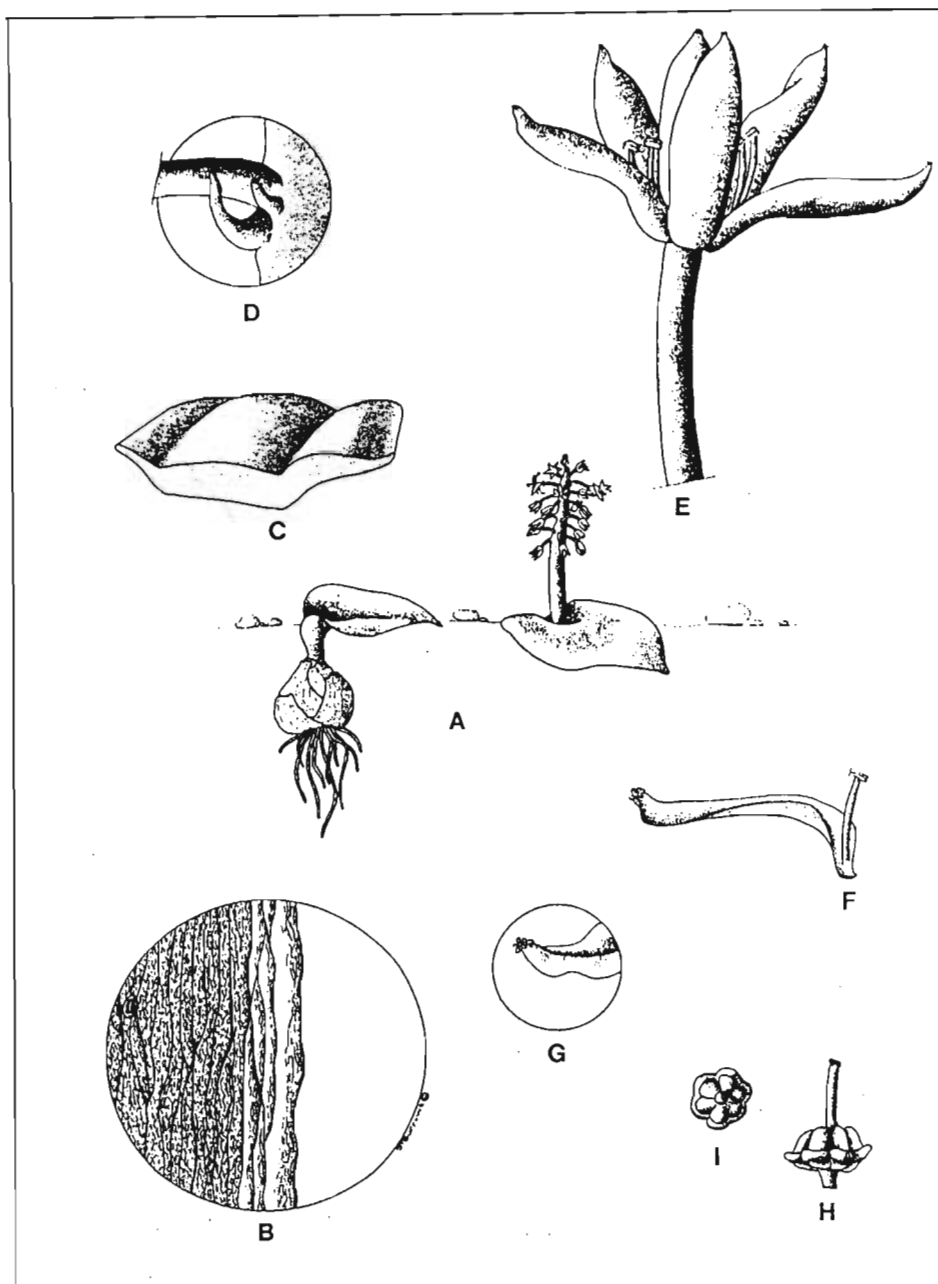


Figure 50. Illustration of *L. monophylla* S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, bract with bracteole X 10; E, flower X 10; F, tepal with stamen X 10; G, apex of tepal X 20; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from Venter 13,235.

Map 22. Known distribution of *L. monophylla* S. Venter

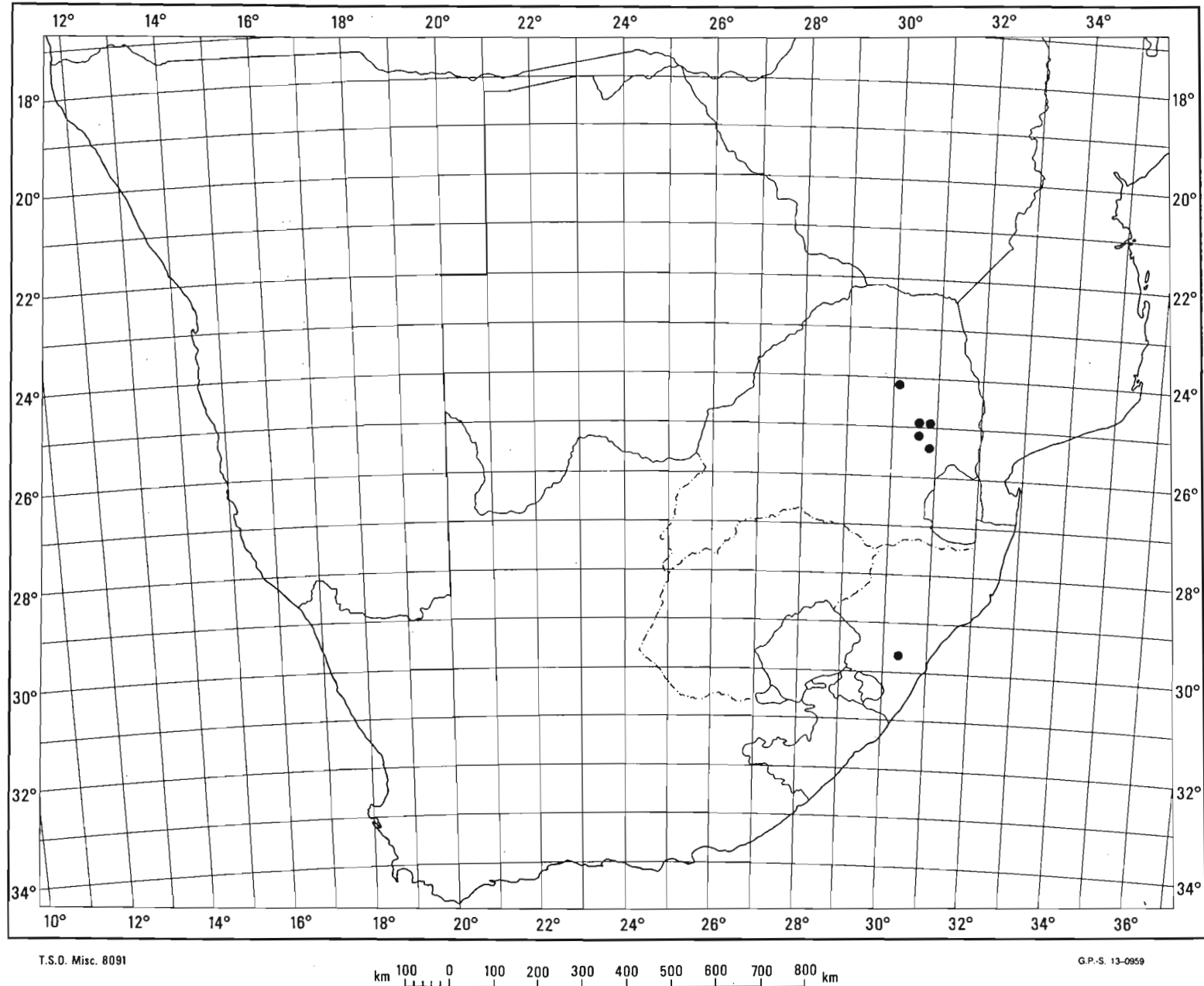
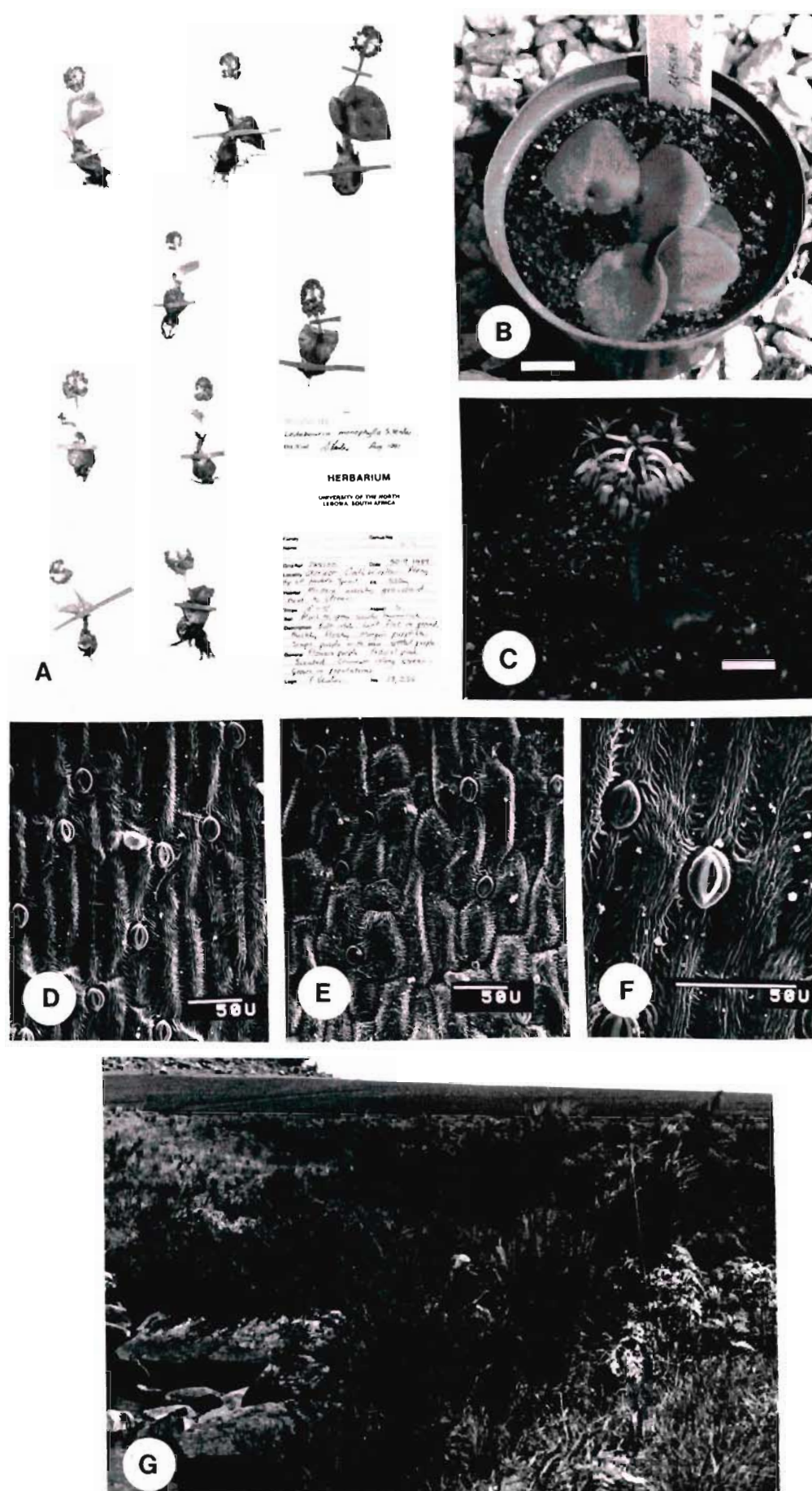


Figure 51. A, holotype of *L. monophylla* S. Venter (PRE); B, plants showing the solitary humifuse leaf. Bar = 20 mm; C, plant in habitat near Graskop, showing the solitary leaf and erect globose inflorescence. Bar = 10 mm; D, SEM micrograph of the adaxial lamina surface; E, SEM micrograph of the abaxial lamina surface; F, SEM micrograph of stomata; G, habitat at the type locality near Graskop. The vegetation consists of closed evergreen low *Erica leucopelta* - *Passerina montana* - *Pteridium aquilinum* shrubland. A - F from Venter 13,235.



Habitat

L. monophylla occurs in humusrich, medium grained (0.25 - 1.0 mm ϕ) deep (30 - 300 mm) grey to black peaty sands derived from quartzites and sandstones. The habitat vegetation is mainly montane grassland and Fynbos next to the streams (Figure 51C). Populations are scattered and consist of up to 200 individuals.

Variation

Plants growing in full sun away from moisture tend to have less succulent, red-tinged leaves. Flower colour varies from light pink to dark pink.

Historical background

The earliest specimen (*Thorncroft* 998) was collected in 1917 at Graskop. The next specimen was collected 50 years later (*Rauh & Schlieben* 9785).

Venter 13,235 shows a developmental series of plants and is thus chosen as the type.

Specimens examined

TRANSVAAL - 2430 (Pilgrim's Rest): Trichardtsdal, farm Malta (-AA), *Junod* 4434 (PRE); Mount Sheba Nature Reserve (-DC), *Geliffe et al.* 93 (J); Graskop (-DD), *Thorncroft* 998 (PRE); Paradise Camp (-DD), *Venter* 12,602 (UNIN); *Venter* 13,235 (NU, PRE, UNIN); Graskop, Stanley Bush Kop (-DD), *Raal et al.* 1038 (PRE); God's Window (-DD), *Mogg* 33,289 (J). -2530 (Lydenburg): Mt. Anderson (-BA), *Mohle* 427 (PRE); Long Tom Pass (-BA), *Rauh & Schlieben* 9785 (PRE); Witklip (-BD), *Kluge* 199 (PRU).

NATAL - 2930 (Pietermaritzburg): Zwartkop (-CB), *MacDevette* 1076 (NH).

Sectio **Bulbilia** *S. Venter*, sect. nov., bulbis cataphyllisque frequentibus.

Species typica: *Ledebouria parvifolia* *S. Venter*.

Typus: Transvaal, Pilgrim's Rest, *Venter s.n.* (PRE).

Species: *L. cooperi* (Hook.f.) Jessop and *L. parvifolia* *S. Venter*.

Plants 25 - 35 mm tall. **Bulb** 10 - 25 mm long, torn scales lacking threads, bulblets present. **Leaves** with 1 cataphyll, leaves spreading, 10 - 20 mm wide. **Inflorescence** rachis smooth. **Perianth** lobe apex obtuse. **Ovary** lobes narrowly transversely oblong; style 3 mm long. **Capsule** globose.

Distribution and habitat.

Coastal bush, woodland to montane grassland.

Subsectio **Zebrinae** *S. Venter*, subsect. nov., tepalis ad apicem valde cucullatis.

Species typica: *L. cooperi* (Hook.f.) Jessop.

Species: *L. cooperi* (Hook.f.) Jessop.

Inflorescence as long or shorter than the leaves, rachis smooth. **Bracts** with bracteoles always present. **Tepals** with apices strongly cucullate. **Ovary** 2 mm long.

19. **LEDEBOURIA COOPERI** (Hook.f.) Jessop

Ledebouria cooperi (Hook.f.) Jessop in Jl S. Afr. Bot. 36(4): 247 (1970).

Scilla cooperi Hook.f. in Bot. Mag. 92: t.5580 (1866).

Type: Cape, *Cooper s.n.* (K!, holo.; PRE!, photo.).

Scilla subglauca Bak. in Saund. Ref. Bot. 3: t.186 (1870).

Iconotype: Saund. Ref. Bot. 3: t.186, "Cape of Good Hope, *Cooper s.n.*".

Scilla concinna Bak. in Saund. Ref. Bot. 4: t.235 (1870).

Type: Saund. Ref. Bot. 4: t.235. "Cape Colony, *Cooper s.n.*".

Scilla exigua Bak. in Jl Linn. Soc. (Bot.) 13: 247 (1873).

Type: Natal, Camperdown, Farm Assegai Kraal, *Sanderson 670* (TCD, holo.).

Scilla barberi Bak. in Jl Linn. Soc. (Bot.) 13: 247 (1873).

Type: Transkei, Ad ripas fluminis Tsomo, *Barber 805*. Type not found.

Scilla saturata Bak. in J. Bot. 3: 365 (1874).

Type: Orange Free State, *Cooper 993* (K!, holo.; PRE!, photo.).

Scilla adlamii Bak. in Gdnrs' Chron. 9(3): 521 (1891).

Type: Natal, *Adlam s.n.* (K!, holo.; BOL!, drawing; PRE!, photo.).

Scilla fehri Bak. in Bot. Jahrb. 15(35): 7 (1892).

Type: Transvaal, Pretoria, *Fehr s.n.* (Z!, holo.).

Scilla inandensis Bak. in Flora Cap. 6: 483 (1896).

Type: Natal, Inanda, *Wood 630* (SAM!, lecto.; BOL!; NH!).

Scilla globosa Bak. in Flora Cap. 6: 484 (1896).

Type: Natal, Griqualand Orientalis, In humilosis prope Kokstad, *Tyson 1557*. (SAM!, holo.; BOL!).

Scilla rogersii Bak. in Flora Cap. 6: 486 (1896).

Type: Cape Colony, *Rogers s.n.* (K!, holo.; PRE!, photo.).

Scilla palustris Wood & Evans in J. Bot. 37: 251 (1899).

Type: Natal, in swamp near Newcastle, *Wood 6501* (NH!, holo.; PRE!, photo.).

Scilla rehmannii Bak. in Bull. Herb. Boiss. 2(1): 853 (1901).

Type: Natal, Inanda, *Rehmann 8277* (Z!, holo.).

Scilla aggregata Bak. in Bull. Herb. Boiss. ser. 2(4): 1001 (1904).

Type: Transvaal, Modderfontein, *Conrath 701* (K!, holo.; GRAZ; PRE!, photo.).

Scilla tristachya Bak. in Bull. Herb. Boiss. ser. 2(4): 1001 (1904).

Type: Transvaal, Modderfontein, *Conrath 693* (GRAZ, holo.; BOL!, drawing ; PRE!, photo.; Z.).

Scilla conrathii Bak. in Bull. Herb. Boiss. ser. 2(4): 1002 (1904).

Type: Transvaal, Modderfontein, *Conrath 699* (K!, holo.; GRAZ; PRE!, photo.).

Scilla londonensis Bak. in Bull. Herb. Boiss. ser. 2(4): 1002 (1904).

Type: Cape, East London, *Conrath 694* (GRAZ; PRE!, photo.).

Scilla glaucescens Van der Merwe in Flower. Pl. S. Afr. 23: t.912 (1943).

Type: Transvaal, Carolina, on farm Onbekend, *Van der Merwe 2073* (PRE!, holo.).

Plants solitary or gregarious. **Bulb** hypogeal, 10 - 25 x 10 - 25 mm, subglobose; dead bulb scales brown to purple, membranous, apices attenuate, live bulb scales loosely arranged, without threads when torn, white inside. **Cataphyll** solitary, exerted beyond ground level. **Leaves** fully developed at anthesis, 3 - 8, spreading, lanceolate to oblanceolate, 200 - 250 x 16 - 18 mm, without threads when torn, fleshy, glossy, green to glaucous green, upper surface with dark green or purplish spots and blotches, lower surface with longitudinal stripes and spots, venation sometimes prominent; margin light green; leaf base canaliculate; apex acute. **Inflorescences** 1 - 3, dense (rarely open), cylindric to sub-globose, 50 - 80 x 20 - 30 mm, erect to flaccid, 20 - 60 -flowered, as long or longer than the leaves; scape terete at base, green, glabrous; rachis smooth, 0 - 150 mm long. **Bracts** membranous, 1.5 x 0.5 mm, linear to bifurcate, pink to purple with bracteoles sometimes present. **Pedicels** spreading, 6 - 12 mm long, pink. **Perianth** 4 - 7 mm long, tepals recurved, equal, oblong, 4 - 5 x 1.5 - 2.0 mm, apex obtuse, strongly cucullate, pink to deep pink with a green keel. **Stamens**

erect, 3 - 4 mm long, filaments pink, free; anthers 1 mm long, pale yellow. **Ovary** ovoid, 6 -lobed, 2 x 4 mm, lobes narrowly transversely oblong, shoulders of apex raised. **Style** 3 mm long, triangular, glabrous, purple; stigma above anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 4 mm long, surface strongly wrinkled, yellowish-brown to brown. (Figure 52).

L. cooperi is most closely related to *L. parvifolia* S. Venter but differs in having glabrous leaves.

Specific epithet etymology.

Commemorates Mr. Thomas Cooper, who collected the type material.

Flowering period

From October to February.

Distribution (Map 23).

Throughout higher rainfall areas of South Africa mostly Natal and the Transvaal. Poorly represented in the eastern Cape.

Habitat

L. cooperi usually occurs in moist habitats (Figure 53B), on humic clay soils. Soils include clay loams, sandy loams and on the mountain ranges a sandy peat. Soils in the low lying habitats tend to be rich in clay and are inundated with water for long periods.

This species occurs in grassland. Most of the recorded localities are situated in marshy grassland areas.

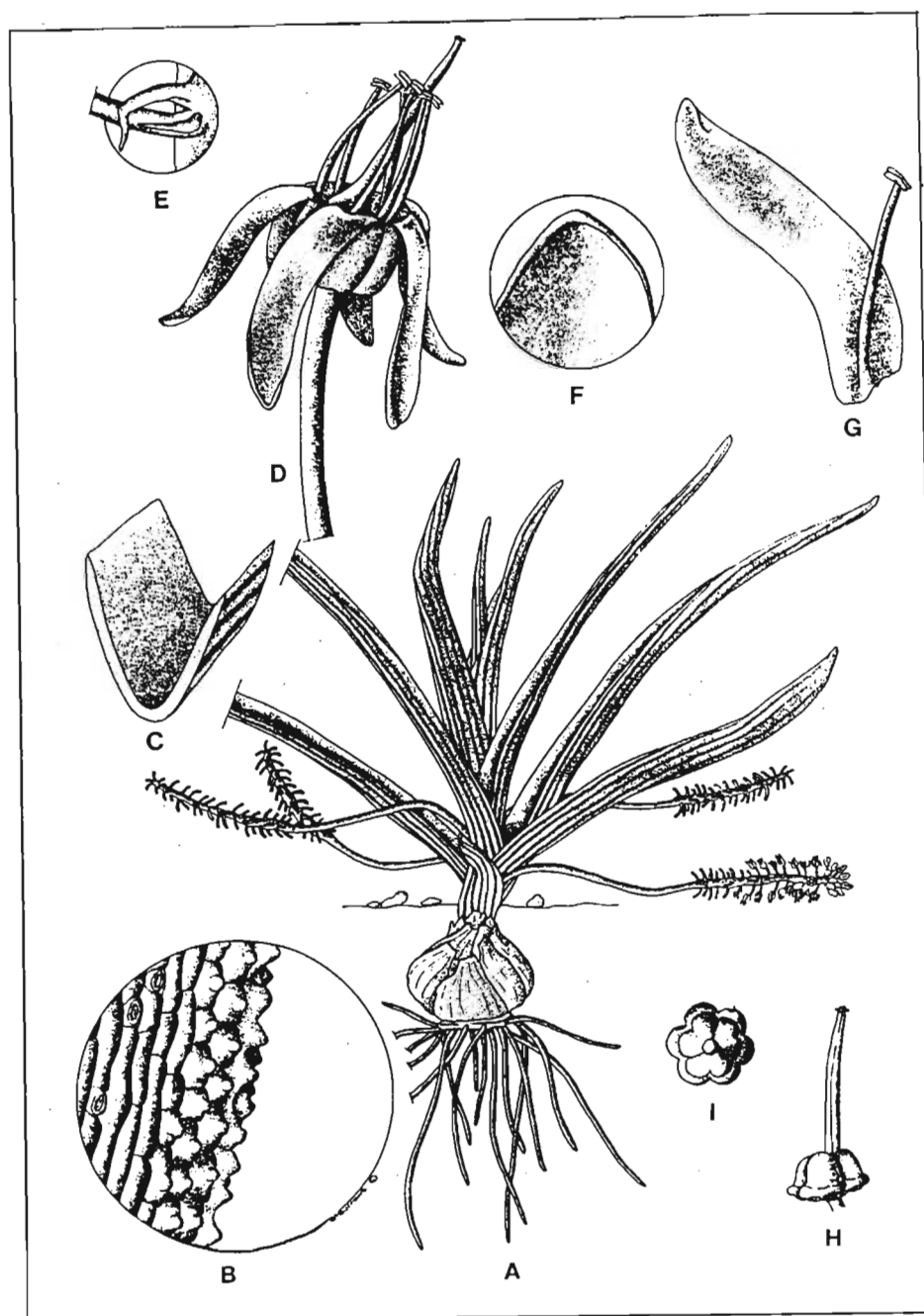


Figure 52. Illustration of *L. cooperi* (Hook.f.) Jessop. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, flower X 10; E, bract with bracteole X 10; F, apex of lamina X 20; G, tepal with stamen X 10; H, ovary lateral view X 10; I, Ovary dorsal view X 10. All from *Crouch 97*.

Map 23. Known distribution of *L. cooperi* (Hook.f.) Jessop

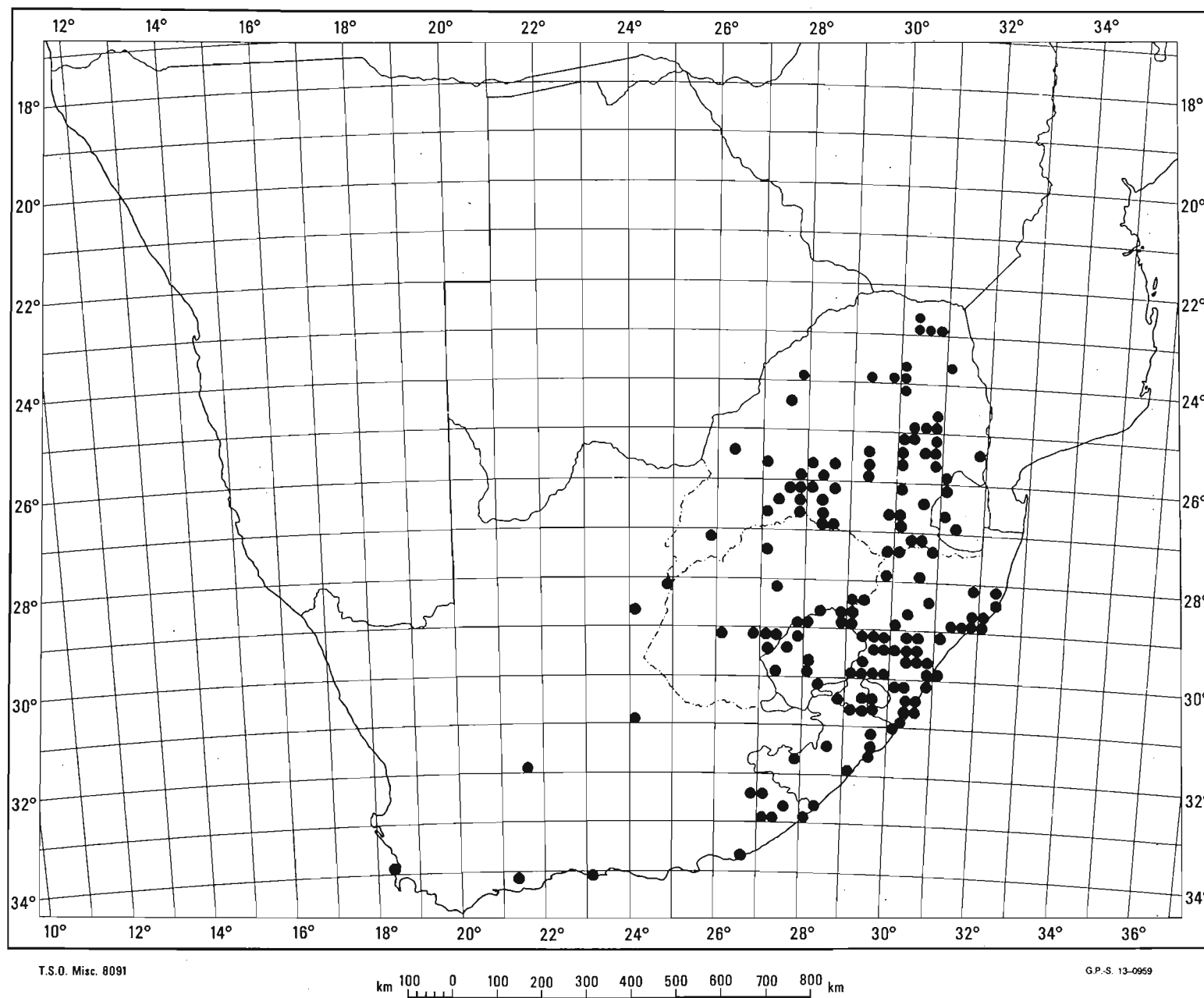
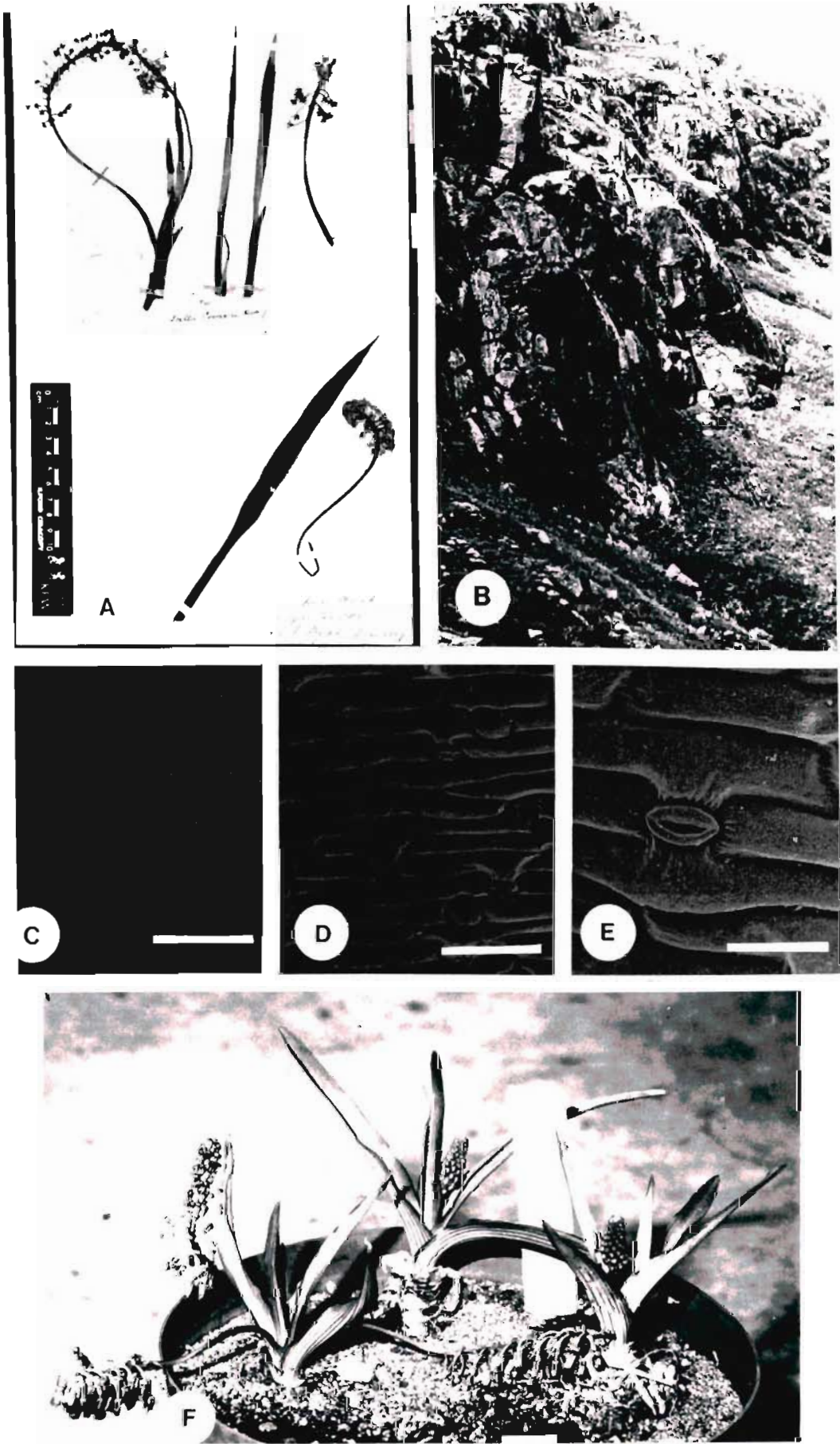


Figure 53. A, holotype of *L. cooperi* (Hook.f.) Jessop (distal specimen) (K); B, habitat on slopes of Mount Currie near Kokstad with montane grassland and swampy areas; C, SEM micrograph of the adaxial lamina surface. Bar = 100 μm ; D, SEM micrograph of the abaxial lamina surface. Bar = 100 μm ; E, SEM micrograph of a stomatum. Bar = 43 μm ; F, plants of *L. cooperi* showing parallel purple markings on the lamina. Bar = 20 mm. C - F from *Venter 13,194*.



Variation

The number of synonyms reflect the variability of this species. Baker described most of the species now regarded as synonyms of *L. cooperi*.

Historical background

Hooker (1866) described *Scilla cooperi* to commemorate Thomas Cooper who collected the first specimens. These were cultivated at Kew and flowered in 1863 and the original description was drawn up from this material (Baker 1870d).

Baker (1896) described *S. globosa* from material collected near Kokstad (*Tyson 1557*). In his description, Baker does not mention either a collecting number or the herbarium where the type is housed. The specimen *Tyson 1557* was mentioned by Jessop (1970) but with reservation indicated by a question mark. From the literature (Gunn & Codd 1981) and herbarium material it is shown that the above specimen is indeed the type of *S. globosa*. The Rev. W.M. Rogers made various collections in the Riversdale and George areas from 1860 - 1862. The type of *S. rogersii* (*Rogers s.n.*) is without locality, but, on the type sheet there is a note in pencil by Archdeacon F.A. Rogers that his father could have collected the specimen at George. This may be the case for there is a specimen in the Moss Herbarium (J) collected by the Rev. Rogers at George, which matches the type.

Van der Merwe (1943b) described *S. glaucescens* from material he collected. He expresses the view that *S. glaucescens* resembles *S. cooperi* in its general appearance but differs, in its relatively wider and shorter leaves, and the absence of vertical stripes on the abaxial surfaces. These characters are not regarded as diagnostic by the present author.

Specimens examined

TRANSVAAL. - 2327 (Ellisras): Waterberg, Farm Elandsbosch (-DD), *Page s.n.* sub J 31,823 (J). - 2329 (Pietersburg): Woodbush (-CD), *Moss* 15,586 (J); Haenertsburg (-DD), *Pott* 13,681 (PRE). - 2330 (Tzaneen): Westfalia Estate (-CA), *Scheepers* 695 (UNIN, PRE); Tzaneen (-CC), *Rogers* 12,526 (BOL). - 2427 (Thabazimbi): Leeupoort Tin Mine (-BC), *Rogers* 22,764 (J); Kransberg, Farm Groothoek (-BC), *Jacobsen* 3493 (PRE); Waterberg, Farm Bergkrans (-BC), *Jacobsen* 3500 (PRE). - 2429 (Zebediela): Makapansgat (-AA), *Leendertz* 896 (BOL). - 2430 (Pilgrim's Rest): Serala Wilderness Area (-AA), *Venter* 11,119 (UNIN); *Venter* 11,038 (UNIN); *Venter* 10,239 (LYD); Lekgalameetse Nature Reserve (-AA), *Stalmans* 668 (UNIN); The Downs (-AA), *Moss* 11,711 (J); Mount Sheba (-CD), *Kerfoot et al.* 246 (J); Mariepskop (-DB), *Van der Schijff* 6363 (PRU); *Van der Schijff* 6332 (PRU); *Venter* 12,732 (UNIN); *Raal* 1676 (J); Mount Sheba Nature Reserve (-DC), *Kerfoot* K8107 (J); *Kerfoot* 8168 (J); *Goodman s.n.* sub J 63,701 (J); Ohrigstad Nature Reserve (-DC), *Jacobsen* 1580 (PRE); *Jacobsen* 1803 (LYD); Pilgrim's Rest (-DD), *Rogers* 14,952 (J); *Rogers* 14,953 (J); *Rogers* 18,619 (J); *Rogers* 14,956 (J); Graskop (-DD), *Pienaar* 756 (PRE); *Holland s.n.* sub BOL 50,788 (BOL); Graskop, Paradise Camp (-DD), *Venter* 8885 (LYD); Kowyns Pass (-DD), *Venter* 12, 578 (UNIN); *Louw* 2354 (STE); *Prosser* 1500 (PRE); God's Window (-DD), *Venter* 13,239 (UNIN); Belvedere (-DD), *Davidson* 448 (J); Macmac (-DD), *Van der Merwe* 343 (PRE). - 2527 (Rustenburg): Rustenburg Nature Reserve (-CA), *Jacobsen* 1034 (PRE); Rustenburg Kloof (-CA), *Lanham* 80 (PRE); Rustenburg (-CD), *Pegler* 975 (BOL); Rustenburg, Farm Uitkomst (-DD), *Coetsee* 438 (PRU); Hennops River (-DD), *Prosser* 1629 (PRE); - 2528 (Pretoria): Pretoria (-CA), *Vogts s.n.* sub NBG 1639/28 (NBG); Pretoria, Faery Glen (-CA), *Mogg s.n.* sub PRE 36,658 (PRE); *Schweikerdt* 27,640 (PRE); Wonderboom Reserve (-CA), *Repton* 1992 (PRE); Knoppiesfontein (-CA), *Van der Merwe* 1999 (PRE); Bronkhorstspuit (-CD), *Codd & De Winter* 3138 (PRE); Premier Mine (-DA), *Rogers* 25,250 (PRE); Premier Mine, Farm Kaffirkraal (-DA), *Moss* 19,098 (J); Pretoria (-CA), *Vogts s.n.* sub BOL 1639/28 (BOL); Rietvlei Reserve (-CD), *Repton* 3132 (PRE). - 2529 (Witbank): Middelburg, Farm Doornkop (-CB), *du Plessis* 615 (PRU); *du Plessis* 928 (PRU); *du Plessis* 1145 (PRE); Middelburg, Farm Donkerhoek (-CB), *Theron* 1852 (PRU); .lm 0.50"

Middelburg, Hoedspruit Vlei (-CD), *Van der Merwe* 2007 (PRE); Carolina, Farm Hillside (-CD), *Van der Merwe* Sc.2. (PRE); Middelburg (-CD), *Young* A58a (PRE). - 2530 (Lydenburg): Steenkampsberg (-AA), *Codd* 8059 (PRE); Sabie, Hartbeesvlakte (-AB), *Kluge* 2335 (PRE); Verloren Vallei Nature Reserve (-AC), *Bloem* 127 (PRU); Dullstroom (-AC), *Strey* 3435 (PRE); *Hunter* 55 (Johannesburg Botanical Garden); Sabie (-BB), *Moss* 7345 (J); *Koeleman* s.n. sub PRE 35,461 (PRE); *Koeleman* s.n. sub PRE 35,485 (PRE); Wonderkloof Nature Reserve (-BC), *Elan-Puttick* 309 (PRE); Houtbosloop (-BC), *Van der Merwe* 1788 (PRE); Witklip Plantation (-BD), *Kluge* 105 (PRU); Rosehaugh (-BD), *Sim* s.n. sub BOL 50,807 (BOL); Carolina, Farm Bergendal (-CA), *Galpin* s.n. sub BOL 22,494 (BOL); Belfast (-CA), *Van der Merwe* 1228 (PRE); *Franks* s.n. sub PRE 9,769 (PRE); *Bolus* s.n. sub BOL 12,406 (BOL); Long Tom Pass (-CA), *Stirton* 232 (NU); Kaapsche Hoop (-DB), *Venter* 13,390 (UNIN); *Van Jaarsveld* 960 (NBG); Kaapsche Hoop, Duiwels Kantoor (-DB), *Thode* A1650 (NH, PRE). - 2531 (Komatipoort): Barberton, Reception Siding (-BD), *Rogers* 22,175 (J); Barberton (-CC), *Rogers* 24,653 (PRE); Saddleback Range (-CC), *Van der Merwe* 1822 (PRE); Maid of the Mist (-CC), *Venter* 12,558 (UNIN); Angle Station (-CC), *Venter* 13,388 (UNIN); Havelock, Nottingham Peak (-CC), *Saltmarshe* 1053 (PRE). - 2627 (Potchefstroom): Welverdiend (-AD), *Louw* 88 (PUC); Magaliesberg (-BA), *Van der Merwe* 2039 (PRE); Krugersdorp (-BB), *Behr* 963 (PRE); Johannesburg, Discovery (-BB), *Lucas* s.n. sub J 36,311 (J); Mulders Drift (-BB), *Gilliland* s.n. sub J 26,178 (J); Witpoortjie (-BB), *Gilliland* s.n. sub J 26,628 (J); *Hugo* s.n. sub STE 31,923 (STE); *Moss* 7143 (J); Johannesburg, Jackson's Drift (-BD), *Gilliland* s.n. sub PRE 26,273 (PRE); *Lloyd* s.n. sub J 26,863 (J); Potchefstroom (-CA), *Louw* 1613 (PUC); *Badenhuizen* s.n. sub J 28,588 (J); Boskop Dam (-CA), *Ubbink* 1279 (PUC); *Louw* 2295 (PUC); Heidelberg Kloof (-CB), *Moss* 25,860 (J); Vereeniging (-DB), *Leendertz* s.n. sub TM 3948 (PRE); *Leendertz* 3947 (PRE). - 2628 (Johannesburg): Johannesburg (-AA), *Moss* 2723 (J); Modderfontein (-AA), *Van der Merwe* 1948 (PRE); Lynn Park (-AA), *Munday* 553 (J); Olifantsvlei (-AA), *Dimovic* s.n. sub J 28,083 (J); *Lucas* s.n. sub J 35,244 (J); Bryanston (-AA), *Gilliland* s.n. sub J 26,272 (J); *Gilliland* s.n. sub J 26,269 (J); *Lucas* 325 (J); Florida (-AA), *Moss* 9757 (J); Florida Marsh (-AA), *Moss* 7350 (J); Houghton Estate (-AA), *Moss* 2161 (J); Killarney Vlei (-AA), *Moss* 4136 (J); Heidelberg (-AD), *Leendertz* 1051 (PRE); Delmas,

Olifantsfontein (-BA), *Van der Merwe* 1972 (PRE); *Van der Merwe* 1973 (PRE); Heidelberg (-CB), *Moss* 17,723 (J); Vaaldam, Farm Sandfontein (-CD), *Aspoas s.n.* sub J 48392 (J). - 2629 (Bethal): Ermelo, Farm Nooitgedacht (-DB), *Henrici* 1296 (PRE); *Dyer* 4165 (PRE); Ermelo at Vaal River (-DB), *Van der Merwe Sc.1.* (PRE). - 2630 (Carolina): Carolina (-AA), *Rogers* 19,600 (J); *Rogers* 19,112 (J); *Rogers* 19,109 (J); *Rogers* 19,601 (J); *Rogers* 19,602 (J); Ermelo, The Gem (-BC), *Van der Merwe* 1097 (PRE); *Walker s.n.* sub PRE 36,647 (PRE); Mavriestad (-CA), *Pott* 15,257 (PRE). - 2725 (Bloemhof): Wolmaranstad, Leeuwfontein (-BB), *Van Wyk* 1385 (PUC). - 2730 (Vryheid): Wakkerstroom (-AC), *Rogers* 22,493 (BOL); Wakkerstroom, Farm Groothoek (-BA), *Bührman* 26 (PRE); Hlangapies Mountain (-BA), *Van der Merwe* 2073 (PRE); *Van der Merwe* 1115 (PRE); Wakkerstroom, Farm Oshoek (-BA), *Devenish* 102 (PRE); *Devenish* 99 (PRE).

SWAZILAND. - 2631 (Mbabane): Forbes Reef (-AA), *Compton* 26,130 (PRE); *Compton* 29,552 (NBG); Black Mbuluzi Valley (-AA), *Compton* 28,066 (NBG); Usutu Forest (-CA), *Mott* 455 (PRE); Hlatikulu (-CD), *Stewart* 2530 (NBG); *Stewart* 2529 (NBG); *Ross* 1761 (PRE).

NATAL. - 2729 (Volksrust): Top of Majuba (-BD), *Van der Merwe* 2776 (PRE); Chelmsford Nature Reserve (-DD), *Smit* 005 (NU). - 2730 (Vryheid): Hlangapies Mountain (-AB), *Van der Merwe* 1115 (PRE); Utrecht, Farm Retirement (-AC), *Hilliard & Burt* 18,565 (NU); Vryheid (-BD), *Van der Merwe* 2463 (PRE); *Germishuizen* 2264 (PRE); Kambula Mountain (-DD), *Acocks* 11,767 (NH). - 2731 (Louwsburg): Ntendeka Wilderness Area (-CD), *Van Wyk* 6983 (PRU). - 2828 (Bethlehem): Royal National Park (-DB), *Bews* 337 (NU); Mount-aux-Sources (-DD), *Edwards* 314 (NU); *Schweickerdt s.n.* sub PRE 34,919 (PRE). - 2829 (Harrismith): Tintwa Spruit (-AC), *Van der Merwe* 2702 (PRE); Tintwa Mountain (-AD), *Van der Merwe* 6298 (PRE); Van Reenen (-AD), *Jacobsz* 1659 (PRE); Oliviers Hoek Pass (-CA), *Gower* 27 (NU); Bergville (-CB), *Killick* 1009 (PRE); Cathedral Peak (-CC), *Schelp* 922 (NU). - 2830 (Dundee): Babanango (-BD), *Van der Merwe* 2787 (PRE); *King* 293 (PRE); Weenen, Griffins Hill (-CC), *Acocks* 10,678 (PRE); Umhlamba Mountain (-CC), *Acocks* 13,867 (PRE). - 2831 (Nkandla): Hlabiza, Monzi (-BB), *Pooley* 1874 (NU); Eshowe (-CD), *Thode* A1269 (PRE); Empangeni (-

DB), *Roberts 12* (BOL); Mtunzizni, Ngoye Forest (-DC), *Venter 2487* (BLFU); *Lowrey & Van Wyk 1068* (J); Mtunzini, Himewith (-DD), *Mogg 4412* (PRE). -2832 (Mtubatuba): Simbomvini (-AB), *Nicolas & MacDevette 2141* (NH); St. Lucia Resort (-AD), *Pooley 1986* (NU); *Pooley 2164* (NU). - 2929 (Underberg): Cathkin Park (-AB), *Goossens 1941* (PUC); Giants Castle (-AB), *Symons 26,040* (PRE); *Symons 517* (PRE); Estcourt, Ntabamhlope Vlei (-BA), *Downing 255* (NU); *Van der Merwe 2576* (PRE); *Mauve 4374* (PRE); Ntabamhlope (-BA), *West 621* (NBG); *West 844* (PRE); Broadmoor Vlei (-BB), *Downing 232* (NU); *Downing 173* (NU); Mpenhle, Mulangane Ridge (-BC), *Hilliard & Burt 16,972* (PRE); Impendhle (-BC), *Huntley 72* (NU); Highmoor Forest (-BC), *du Toit 2556* (PRE); Mpendhle, Carters Creek (-BC), *Hilliard & Burt 18,643* (NU); *Hilliard & Burt 16,972* (NU); Lions River, Kamberg (-BD), *Wright 1900* (NU); *Wright 2259* (NU); Polela (-CB), *Rennie 80* (NU); Underberg, Bamboo Mountain (-CB), *Grice s.n.* (NU); Sani Pass (-CB), *Gillies 42* (NU); Upper Tugela (-CC), *Everson & Muller s.n.* (CPF); Underberg, Garden Castle (-CD), *Van der Merwe 2763* (PRE); Underberg (-CD), *Dyer 3265* (PRE); Himeville (-DC), *Arnold 524* (PRE); *Scott 32* (NU); *Hiercel 73* (NU); Donnybrook (-DD), *Van der Merwe 2758* (PRE); *Van der Merwe 2759* (PRE). - 2930 (Pietermaritzburg): Rietvlei (-AB), *Fry s.n.* sub PRE 5731 (PRE); Lions River, Umgani Poort (-AC), *Moll 1373* (NU); *Moll 2428* (NU); *Moll 1388* (NU); Lions River (-AC), *Moll 1181* (NU); Lions River, Balgowan (-AC), *Moll 1197* (NU); Howick, Midmar (-AC), *Moll 1110* (NU); Nottingham Road (-AC), *Galpin 10,265* (PRE); Dargle Road (-AC), *Mogg 5698* (PRE); *Mogg 5701* (NH); Cramond, Blinkwater (-AD), *Wortmann 3* (NU); Greytown (-BA), *Wylie s.n.* sub BOL 22,516 (BOL); Dalton (-BC), *Hardley 46* (NU); Swartkop (-CB), *MacDevette 1404* (NH); Pietermaritzburg (-CB), *Allsopp 478* (NH); *Venter 13,194* (UNIN); World's View (-CB), *Moll 2628* (NU); Fox Hill (-CB), *Fisher 402* (NU); Mgeni Poort (-DA), *Moll & Mauve 2428* (PRE); Umzinyathi (-DB), *Wood 1356* (NH); Inanda Swamp (-DB), *Wood 1356* (NH); Inanda (-DB), *Wood 1056* (NH); Eisdumbeni (-DB), *Wood 4791* (NH); Krantzklouf Nature Reserve (-DD), *Collocott 23* (NU); *Haygarth s.n.* sub STE 84 (STE); Isipingo Flats (-DD), *Ward 6813* (PRE); Kloof, Highbury (-DD), *Landsdell s.n.* sub NH 42,771 (NH). - 2931 (Stanger): Mapumulo, Thring's Post (-AA), *Moll 2316* (NU); Brighton Beach (-CC), *Lutchminarain 28* (DWEST); Durban Bluff (-CC), *Hennessy s.n.* (DWEST); Durban (-CC), *Singh*

24 (DWEST); *Badri* 28 (DWEST). - 3028 (Matatiele): Matatiele (-BD), *McLoughlin s.n.* sub BOL 50,774 (BOL). - 3029 (Kokstad): Mt. Currie (-AD), *Van der Merwe* 2109 (PRE); Sneezeewood Plantation (-BC), *Strey* 9175 (PRE); Mvenyani (-CA), *Bandert* 115 (GRA); Kokstad (-CB), *Bayliss* 2497 (NBG); Weza State Forest (-DA), *Balkwill et al.* 2368 (J). - 3030 (Port Shepstone): Ixopo (-AA), *Mogg* 2300 (PRE); Kenterton (-AB), *Thode s.n.* sub STE 3388 (STE); Dumisa Station (-AD), *Rudatis* 704 (PRE); Isipingo Beach (-BB), *Ward* 972 (NU); Isipingo (-BB), *Jankee* 16 (DWEST); Pennington (-BC), *Weintraub s.n.* sub J 31,814 (J); Alexandra (-BC), *Rudatis* 217 (STE); Umtentwini (-CB), *Vogel s.n.* sub NBG 48/61 (NBG); Uvongo (-CD), *Mogg* 13,540 (PRE); Southbroom (-CD), *Wulff* 28 (NU); Umzumbi (-DA), *Van der Merwe* 2534 (PRE). - 3130 (Port Edward): Port Edward (-AA), *Stirton* 12,141 (UNIN); *Van der Merwe* 2664 (PRE); *Moss* 19,144 (J); Umtamvuna Nature Reserve (-AA), *Abbott* 3993 (PRU); *Strey* 4487 (NH); *Stirton* 12,085 (UNIN); Leisure Bay (-AA), *Ubbink* 80A (PUC).

ORANGE FREE STATE. - 2727 (Kroonstad): Vals River (-AC), *Pont* 520 (PRE). - 2827 (Senekal): Steynsrust (-AB), *Grobler* 89 (BLFU); Doornkop (-DD), *Goossens* 777 (PRE). - 2828 (Bethlehem): Clarence (-CB), *Van Hoepen* 18,269 (PRE). - 2829 (Harrismith): (-AC), *Compton* 22,491 (BOL); *Compton* 13,218 (NBG); Harrismith, Farm Bloemhof (-AC), *Van der Zyde s.n.* sub NBG 133,281 (NBG). - 2926 (Bloemfontein): Naval Hill (-AA), *du Preez* 8 (PRE); Thaba Nchu (-BB), *Roberts* 2866 (PRE). - 2927 (Maseru): Mensvretersberg (-AA), *Peeters et al.* 323 (J).

LESOTHO. - 2828 (Bethlehem): Butha Buthe (-CC), *Ashton s.n.* sub BOL 22,525 (BOL); Leribe, *Dieterlen* 57c (NBG); *Dieterlen* 57 (NBG); *Dieterlen* 662 (STE). - 2927 (Maseru): Roma (-AC), *Schmitz* 7959 (PRE); *Dieterlen* 57a (PRE); Tebetebeng River (-BB), *Guillarmod* 364 (PRE). - 2928 (Marakabei): Semonkong (-CA), *Davidson* 3037 (J). - 3028 (Matatiele): Thaba Tsueu (-AB), *Page s.n.* sub BOL 22,489 (BOL).

TRANSKEI. - 3128 (Umtata): Nqadu (-BC), *Hutchings* 832 (KEI); Mjika, Mahlahlane Forestry (-BC), *Hutchings* 1313 (KEI). - 3129 (Port St. Johns): Mgodini River (-BA), *Strey* 10,083 (PRE); Ntsubane Forest Station (-

BC), *Venter & Vorster 52* (PRE); Magwa Falls, *Balkwill et al. 1869* (J); *Hutchings 774* (KEI); Magwa Tea Estate, *Hutchings 1183* (KEI); *Germishuizen 1182* (PRE); Coffee Bay (-CC), *Tyson s.n.* sub PRE 57,458 (PRE).

CAPE. - 2824 (Kimberley): Rooipoort (-CA), *Wilman s.n.* sub BOL 22,513 (BOL); - 3024 (De Aar): Katberg (-CC), *Young 15,011* (J). - 3121 (Fraserburg): Fraserburg (-DC), *Nel s.n.* sub STE 15,814 (STE). - 3227 (Stutterheim): Cathcart, Fairford (-AC), *Cotterrell 131* (GRA); Pirie (-CC), *Sim 618* (PRE); King Williams Town (-CD), *Norris s.n.* (NBG); *Sim 1702* (NU); Gonubie River (-DA), *Carter s.n.* sub BOL 22,517 (BOL). - 3228 (Butterworth): Kentani (-CB), *Pegler 297* (PRE); *Pegler 1141* (PRE); *Pegler 1464* (PRE). - 3318 (Cape Town): Claremont (-CD), *Schlechter 2959a* (PRE). - 3326 (Grahamstown): Trappe's Valley (-BD), *Daly 582* (GRA). - 3421 (Riversdale): Glen Leith (-AB), *Muir 3004* (PRE). - 3423 (Knysna): Knysna Heads (-AA), *Fourcade 2030* (BOL).

Without precise locality

- Orange Free State, *Cooper 993* (K, PRE).
- Natal, *Adlam s.n.* (K, PRE).
- Cape, *Cooper s.n.* (K, PRE); Cape Colony, *Rogers s.n.* (K, PRE).

Subsectio **Piliferae** *S. Venter*, subsect., nov. foliis adaxialiter pilosis, pilis seriatim longitudinaliter dispositis.

Species typica: *L. parvifolia* *S. Venter*.

Species: *L. parvifolia* *S. Venter*.

Basal stem present. **Lamina** with rows of hairs on adaxial surface. **Inflorescence** solitary, erect; rachis smooth. **Bracteoles** always absent.

20. *LEDEBOURIA PARVIFOLIA* *S. Venter*

Ledebouria parvifolia *S. Venter* sp.nov., ad *L. cooperi* (Hook.f.) Jessop cognata sed foliis applanatis, lamina adaxiali pilis longitudinaliter seriatum instructa et inflorescentia sine bracteolis valde distincta.

Type: Transvaal, Graskop, near Lisbon Falls, farm Lisbon 531 KT, *Venter s.n.* (PRE!, holo.).

Plants solitary. **Bulb** hypogeal, 10 - 25 x 10 - 25 mm, obovoid; dead bulb scales brown, membranous, apices attenuate, live bulb scales fleshy, tightly arranged, without threads when torn, white inside; bulblets present on basal stem; basal stem 2 - 4 mm long. **Cataphyll** one, exerted above ground level. **Leaves** fully developed at flowering, 2 - 3, appressed to ground, lanceolate to oblong, 15 - 30 x 15 - 20 mm, with threads when torn, fleshy, surfaces dull green, adaxial surface with rows of hair-like papillae, venation obscure; leaf margin ciliate; leaf base canaliculate; apex acute. **Inflorescence** solitary, lax, elliptic, 15 - 20 x 10 - 15 mm, erect, 8 - 12 -flowered, longer than the leaves; scape terete at base, purple, glabrous; rachis smooth, 10 - 15 mm long. **Bracts** fleshy, 0.5 x 0.5 mm, deltoid, pink to purple without bracteoles. **Pedicels** cernuous, 3 mm long, pink. **Perianth** 3 mm long, tepals recurved, equal, oblong, 3 x 1 mm, apex obtuse, pink with a green keel. **Stamens** erect, 3 mm long, pink, epitepalous; anthers 0.5 mm long, pale violet. **Ovary** ovoid, 3 -lobed, 1 x 2 mm, lobes narrowly transversely oblong, apex shoulders raised. **Style** 3 mm long, triangular, glabrous, purple; stigma equal height than anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 3 mm long, drop-shaped, surface strongly wrinkled, brown. (Figure 54).

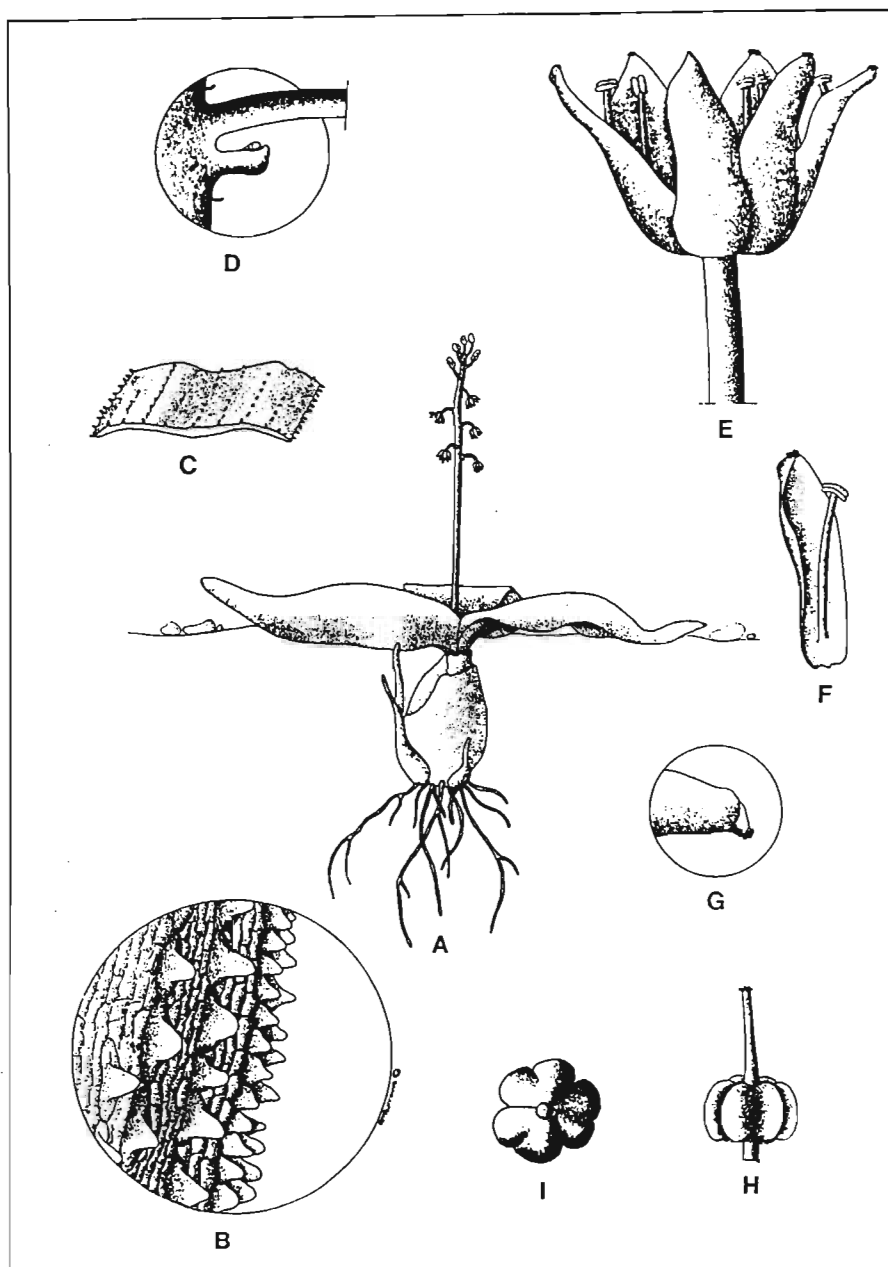
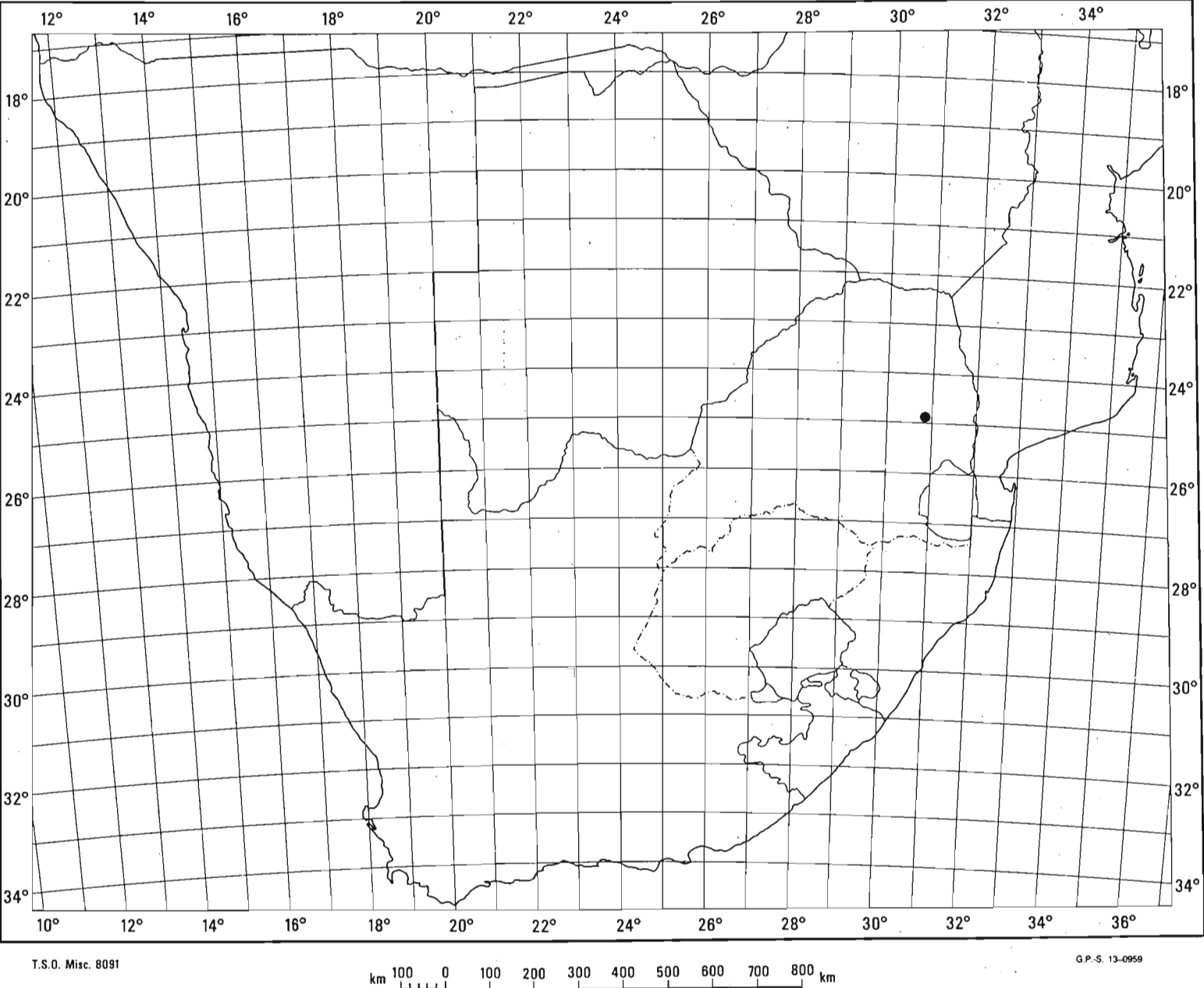


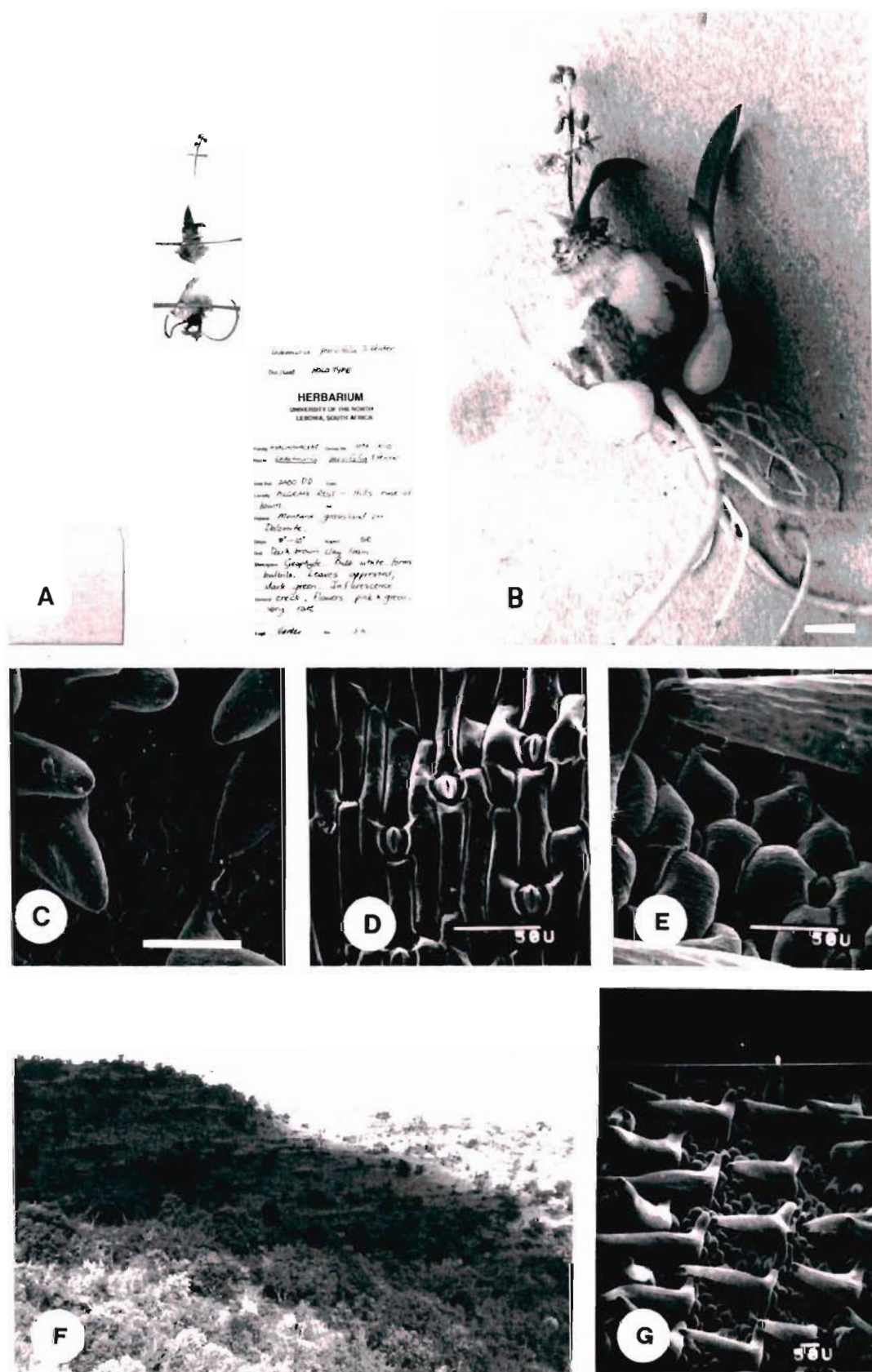
Figure 54. Illustration of *L. parvifolia* S. Venter. A, habit X 2; B, lamina margin X 300; C, section through lamina X 3; D, bract X 10; E, flower X 15; F, tepal with stamen X 15; G, tepal apex X 20; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from Venter *s.n.*

Map 24. Known distribution of *L. parvifolia* S.Venter.



LEDEBOURIA IN SOUTH AFRICA

Figure 55. A, holotype of *L. parvifolia* S. Venter (PRE); B, plant showing the bulbils, small leaves and the solitary inflorescence. Bar = 20 mm; C, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, habitat near Pilgrim's Rest, eastern Transvaal. The vegetation consists of closed deciduous low *Dombeya rotundifolia* subsp. *rotundifolia* - *Acacia ataxacantha* - *Scilla natalensis* woodland; G, SEM micrograph of the rows of hairs on the adaxial lamina surface; A - F from Venter s.n..



L. parvifolia is related to *L. cooperi* but differs in its humifuse leaves with longitudinal rows of hair-like papillae, solitary, erect, lax inflorescence and 3-lobed ovary.

Specific epithet etymology.

Describes the small leaves.

Flowering period

From October to December.

Distribution (Map 24).

Endemic to the eastern Transvaal, known from a single locality.

Habitat

L. parvifolia grows on the Malmani Formation dolomite of the Chuniespoort Group in the Transvaal Sequence (SACS 1980). Soil derived from these rocks is a shallow (10 - 120 mm deep), dark brown, fine grained (0.025 - 0.25 mm ϕ) clay loam with many rock particles. Most of the hill slopes are comprised of dolomite rocks and cliffs and covered in montane grassland with scattered *Dombeya rotundifolia* (Hochst.) Planch. var. *rotundifolia* and *Faurea speciosa* (Welw.) Welw. trees (Figure 55G).

Specimens examined

TRANSVAAL. - 2430 (Pilgrim's Rest): Graskop, Lisbon Waterfall, farm Lisbon 531 KT, Venter s.n. (PRE).

Sectio **Globosae** S. Venter, sect. nov., bulbis maturis 20 - 40 (-60) mm dia.; capsulis sigillatim globosis.

Species typica: *Ledebouria inquinata* (C.A. Sm.) Jessop.

Typus: Transvaal, near Pretoria, along Aapias River, *Burke s.n.* (K!).

Species: *L. asperifolia* (Van der Merwe) S. Venter, *L. glauca* S. Venter, *L. inquinata* (C.A. Sm.) Jessop and *L. marginata* (Bak.) Jessop.

Plants solitary. **Leaves** spreading to erect-spreading, producing threads when torn. **Inflorescences** with raceme dense, oblong; rachis ridged; bracts membranous. **Capsule** distinctly globose.

Distribution and habitat

Eastern and northern Cape to northern Transvaal. Grassland and woodland.

Subsectio **Asperifoliae** S. Venter, subsect. nov., foliis scapo dense asperatis.

Species typica: *L. asperifolia* (Van der Merwe) S. Venter.

Species: *L. asperifolia* (Van der Merwe) S. Venter.

Leaves and scape with asperities. **Rachis** ridged; bracteoles absent.

21. *LEDEBOURIA ASPERIFOLIA* (Van der Merwe) S. Venter

Ledebouria asperifolia (Van der Merwe) S. Venter comb.nov.

Scilla asperifolia Van der Merwe in Flower. Pl. S. Afr. 24: t.944 (1944).

Type: Natal, hillsides at Ladysmith, *Van der Merwe 2604* (PRE!, holo.; NU!).

Plants solitary. **Bulb** hypogeal, 40 - 50 x 40 - 50 mm, subglobose; dead bulb scales purplish-brown, apices attenuate, live bulb scales membranous, tightly arranged, without threads when torn, white inside, sometimes forming a neck 10 - 20 x 5 - 10 mm. **Leaves** fully developed at anthesis, 4 - 8, spreading, lanceolate to ovate, 100 - 170 x 25 - 100 mm, with threads when torn, fleshy, with a dull lustre, adaxial surface green often with dull dark green to purple

blotches, abaxial surface either green, basally purple or the whole under surface purple, venation mostly prominent, with rows of tongue-shaped asperities, sometimes only adaxial; margins finely papillate; leaf base canaliculate; apex acute to obtuse. **Inflorescences** 1 - 3, dense, elliptic, 50 - 120 x 20 - 30 mm, flaccid, 30 - 50 -flowered, as long or longer than the leaves; scape terete at base, green to purple, covered with tongue-shaped papillae; rachis ridged, 50 - 150 mm long. **Bracts** membranous, 1 x 0.5 mm, lanceolate, grey-white with bracteoles absent. **Pedicels** spreading, 10 - 20 mm long, white to pink. **Perianth** 5 mm long, tepals recurved, subequal, oblong, 5 x 1 mm, apex cuspidate, cucullate, pink to purple with a brown keel. **Stamens** erect, 5 mm long, filaments maroon, epitepalous; anthers 1 mm long, pale violet. **Ovary** ellipsoidal, 6 -lobed, 1 x 2 mm, lobes narrowly transversely elliptic, apex shoulders raised. **Style** 5 mm long, terete, glabrous, purple; stigma equal height to anthers; stipe 1 x 0.5 mm. **Capsule** one- to three-lobed, asymmetrical, globose; base truncate. **Seed** globose, 3 mm long, surface strongly wrinkled, brown. (Figure 56).

The only species with which *L. asperifolia* can be confused, is *L. revoluta*. The tongue-shaped asperities on the leaves and scape are however diagnostic.

Specific epithet etymology.

Referring to the asperity covered leaves.

Flowering period

From September to December.

Distribution (Map 25).

Occurs in Natal, a few localities in Swaziland and the mountainous areas near Barberton, the Transvaal Drakensberg escarp and as far north as Pietersburg.

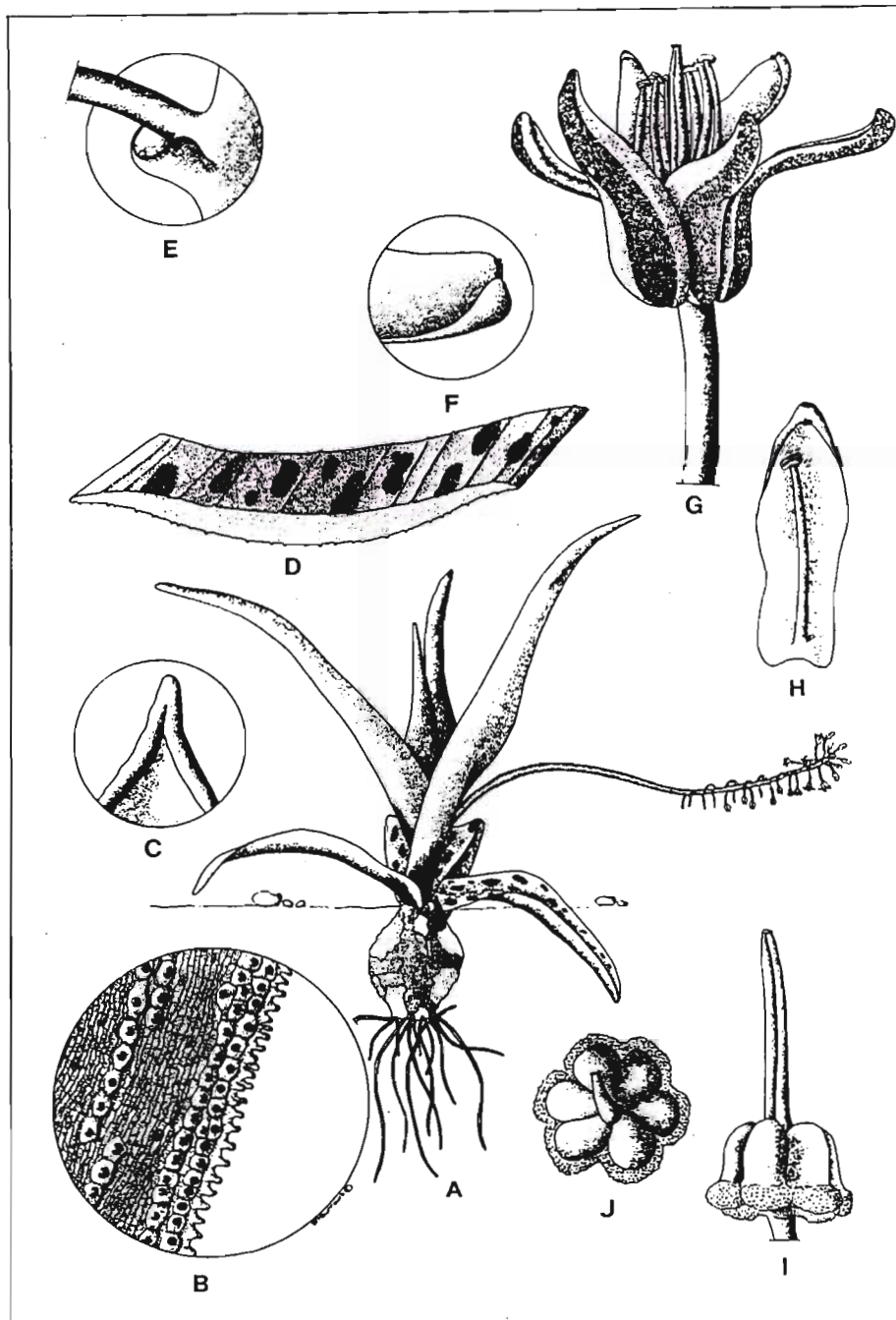


Figure 56. Illustration of *L. asperifolia* (Van der Merwe) S. Venter. A, habit X 1; B, lamina margin X 300; C, leaf apex X 10; D, section through lamina X 4; E, bract X 10; F, tepal apex X 20; G, flower X 10; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Venter 13,249*.

Map 25. Known distribution of *L. asperifolia* (Van der Merwe) S. Venter

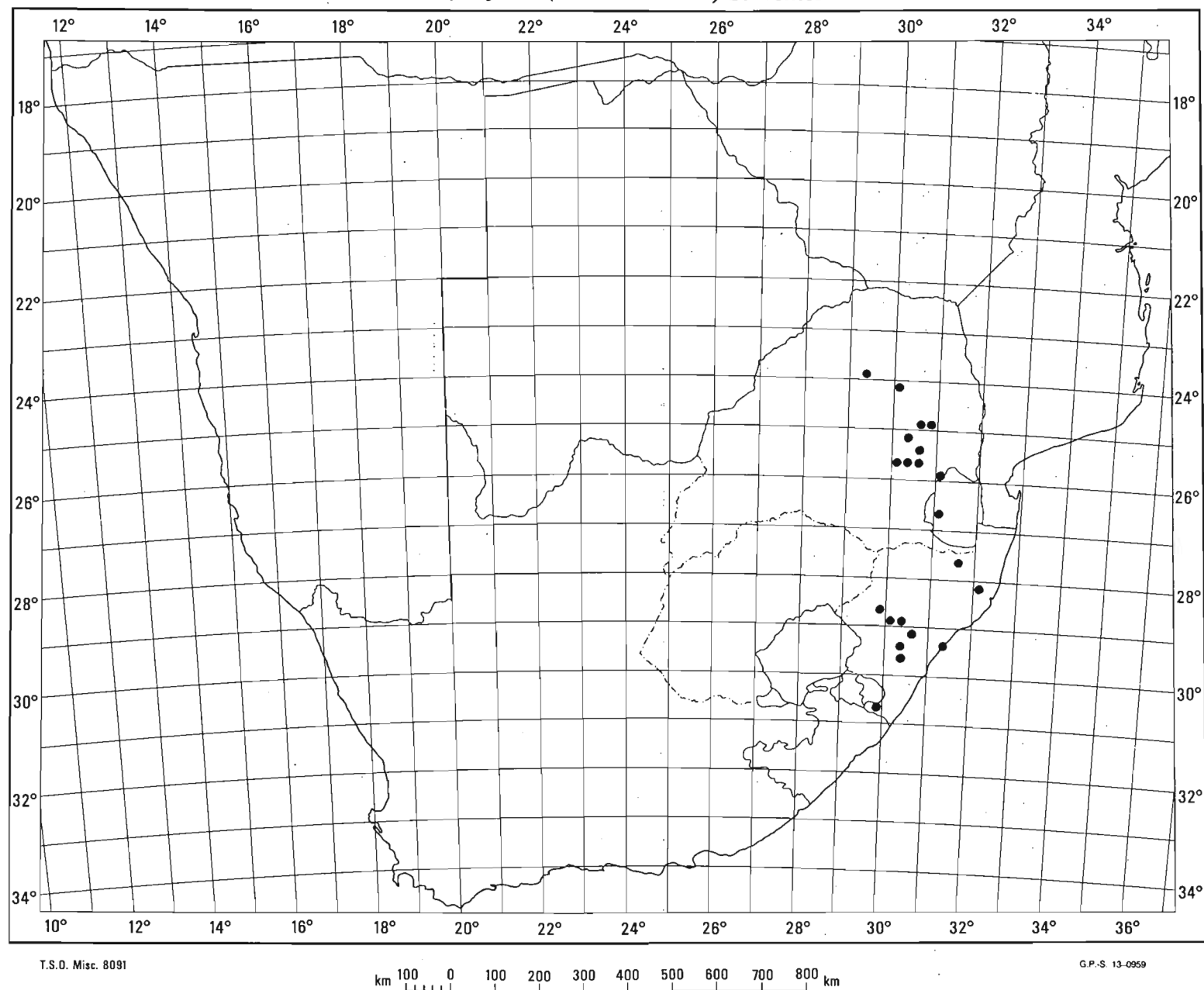


Figure 57. A, holotype of *L. asperifolia* (Van der Merwe) S. Venter (PRE); B, habitat on the the Makonjwa Mountain between Barberton and Havelock. Plants were collected (Venter 13,382) on the cliffs in the foreground; C, plants of *L. asperifolia* after a recent veld fire, Lisbon Falls, Graskop. Bar = 100 mm; D, plant from Barberton showing the rows of asperities on the leaves. Bar = 10 mm; E, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; F, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; G, SEM micrograph of stomata. Bar = 43 μ m. C from Venter 13,249 and D - G from Venter 13,382.



Habitat

L. asperifolia occurs on dolerite dykes, sandstones, shales, quartzites and conglomerates, banded ironstone, chert, dolomite and granite. *L. asperifolia* is not restricted by soil type, but most of the populations occur either on clay loams or sandy loams.

During this survey, *L. asperifolia* was encountered growing in various woodland types. The southern populations are all associated with *Acacia* woodland.

Population structure

Plants grow mostly as scattered individuals except near Pilgrim's Rest where, at the foot of dolomite cliffs, isolated colonies were encountered (Figure 57C).

Variation

Leaves of plants growing in the shade tend to be longer and narrower, not as fleshy, and with less asperities. Markings on the leaves vary considerably. Mottling of the leaves is uncommon in *L. asperifolia*, although plants with prominent purple mottling occur in the mountains around Barberton (Figure 57D).

Historical background

This species was discovered and described by Dr. F.Z. van der Merwe from collections made near Ladysmith, Natal. Jessop (1970) in his studies on the bulbous Liliaceae, placed *S. asperifolia* under *L. revoluta*.

Specimens examined

TRANSVAAL. - 2329 (Pietersburg): Pietersburg (-CD), *Venter s.n.* (UNIN). - 2430 (Pilgrim's Rest): Ohrigstad Nature Reserve (-DC), *Jacobsen 1839* (PRE); Graskop, Lisbon Falls (-DD), *Venter 13,249* (UNIN). - 2530 (Lydenburg): Between Lydenburg and Houtbosloop (-AB), *Van der Merwe 1784* (PRE); Farm Nooitgedacht (-AB), *Van der Merwe 1777* (PRE); Belfast, farm Schoongesicht (-CA), *Van der Merwe 1239* (PRE); Carolina, tunnel at Waterval Boven (-CB), *Van der Merwe 1245* (PRE); Starvation Creek Nature Reserve (-DA), *Kluge 1104* (PRE). - 2531 (Komatipoort): Barberton, farm Oosterbeek (-CC), *Venter 13,382* (UNIN); Tienie Louw Nature Reserve (-CC), *Buitendag 1140* (PRE).

SWAZILAND. - 2631 (Mbabane): Manzini, Malkerns (-CA), *Compton s.n.* (PRE).

NATAL. - 2731 (Louwsburg): Pongola, Magut (-DA), *Van der Merwe 2715* (PRE). - 2829 (Harrismith): Ladysmith (-DB), *Van der Merwe 2604* (PRE). - 2830 (Dundee): Weenen (-CC), *Acocks 13,863* (PRE); Muden Townlands (-CD), *Wylie s.n.* (NH). - 2832 (Mtubatuba): Hluhluwe Game Reserve (-AA), *Ward 3288* (NU). - 2930 (Pietermaritzburg): Otto's Bluff (-AD), *Feldman s.n.* (NH); 10m north of Greytown (-BA), *Mogg s.n.* (PRE); Epol Hill (-CB), *Noel 2720* (NU). - 2931 (Stanger): Eshowe, Mandini (-AB), *Edwards 1598* (NU). - 3029 (Kokstad): Harding (-DB), *Van der Merwe 2756* (PRE).

Subsectio **Glaucæ** S. Venter, subsect. nov., foliis glaucis; bracteolis bracteam aequantibus.

Species typica: *L. glauca* S. Venter.

Species: *L. glauca* S. Venter, *L. inquinata* (C.A. Sm.) Jessop, *L. marginata* (Bak.) Jessop.

22. *LEDEBOURIA GLAUCA* S. Venter

Ledebouria glauca S. Venter sp. nov., ad *L. cooperi* (Hook.f.) Jessop cognata sed foliis coriaceis, glaucis; inflorescentiis erectis, quam foliis brevioribus; ovario basi lobato manifeste differt.

Type: Transvaal, Pietersburg, Fauna Park, Venter 13,368 (PRE! holo.; NU!)

Plants solitary. **Bulb** hypogeal, 15 - 70 x 15 - 30 mm, cylindrical; dead bulb scales light brown, apices truncate, attenuate only at the extreme tips, live bulb scales fleshy, with threads when torn, white inside, neck 3 - 30 x 3 - 10 mm; basal stem 5 - 50 x 10 - 20 mm. **Leaves** fully developed at anthesis, 2 - 4, spreading, oblanceolate, 50 - 100 x 8 - 18 mm, with threads when torn, leathery, dull, glaucous with purple stripes and blotches, purple cross bars at base of leaf, venation obscure; margins finely papillate; leaf base canaliculate; apex acute. **Inflorescences** 1 - 2, dense, oblong to cylindrical, 30 - 50 x 10 - 20 mm, erect, 16 - 60 -flowered, shorter than leaves; scape terete at base, spotted purple, glabrous; rachis ridged, 20 - 30 mm long. **Bracts** membranous, 1 - 2 x 0.5 mm, lanceolate to bifurcate, white to pinkish purple, bracteoles present. **Pedicels** spreading horizontally; 5 - 8 mm long, pink. **Perianth** 5 mm long, tepals recurved, equal, oblong, 5 x 1.5 mm, apex obtuse, cucullate, green and pink to purple with a green keel. **Stamens** erect, 3 - 4 mm long, filaments slightly flattened at base, maroon, epitepalous; anthers 1 mm long, yellow. **Ovary** ovoid, 6 -lobed, 0.5 x 1 mm, lobes narrowly transversely oblong, distal lobes present. **Style** 3 mm long, triangular, glabrous, purple; stigma equal height to anthers; stipe 0.25 x 0.25 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 3 - 5 mm long, surface strongly wrinkled, brown. (Figure 58).

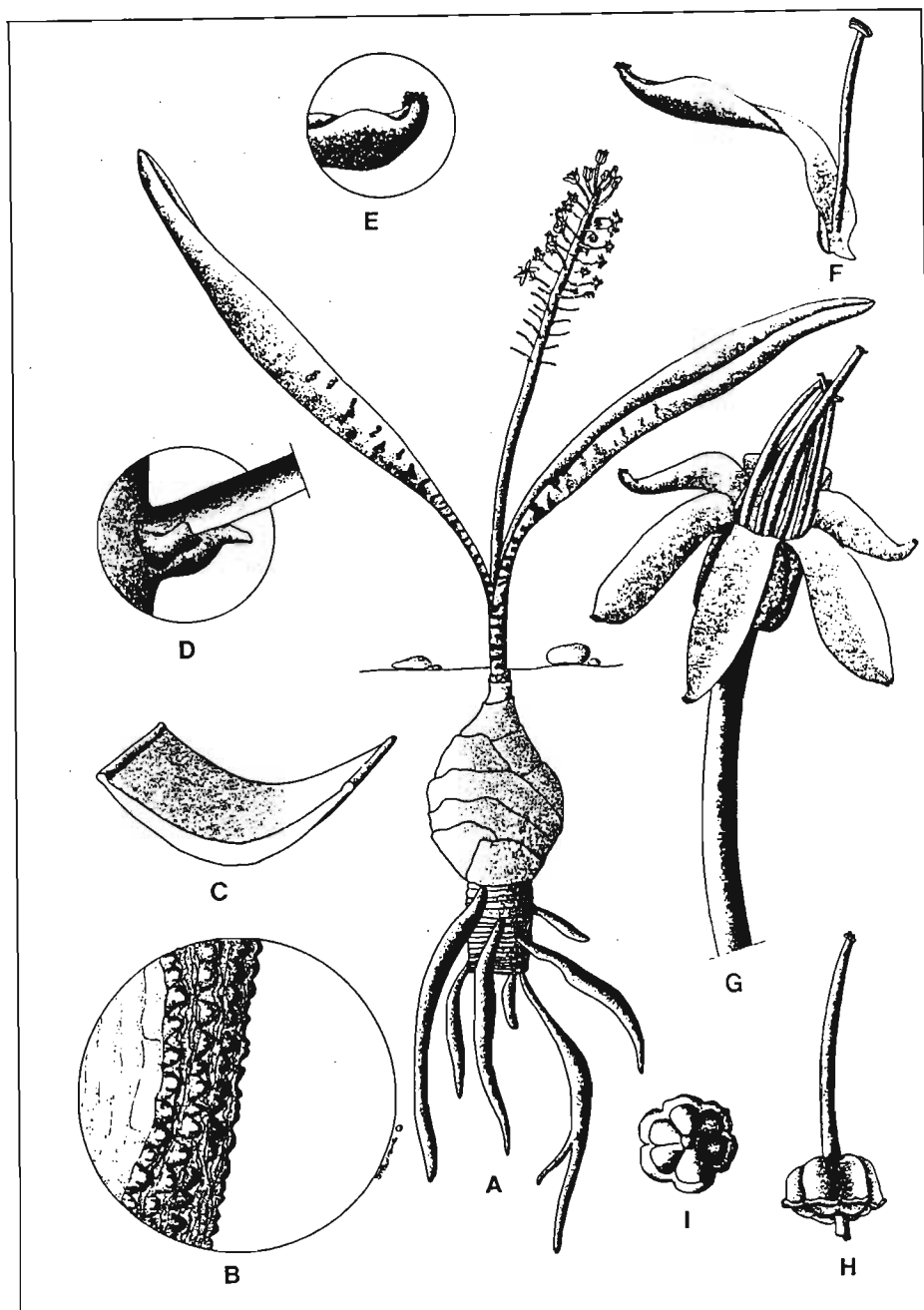
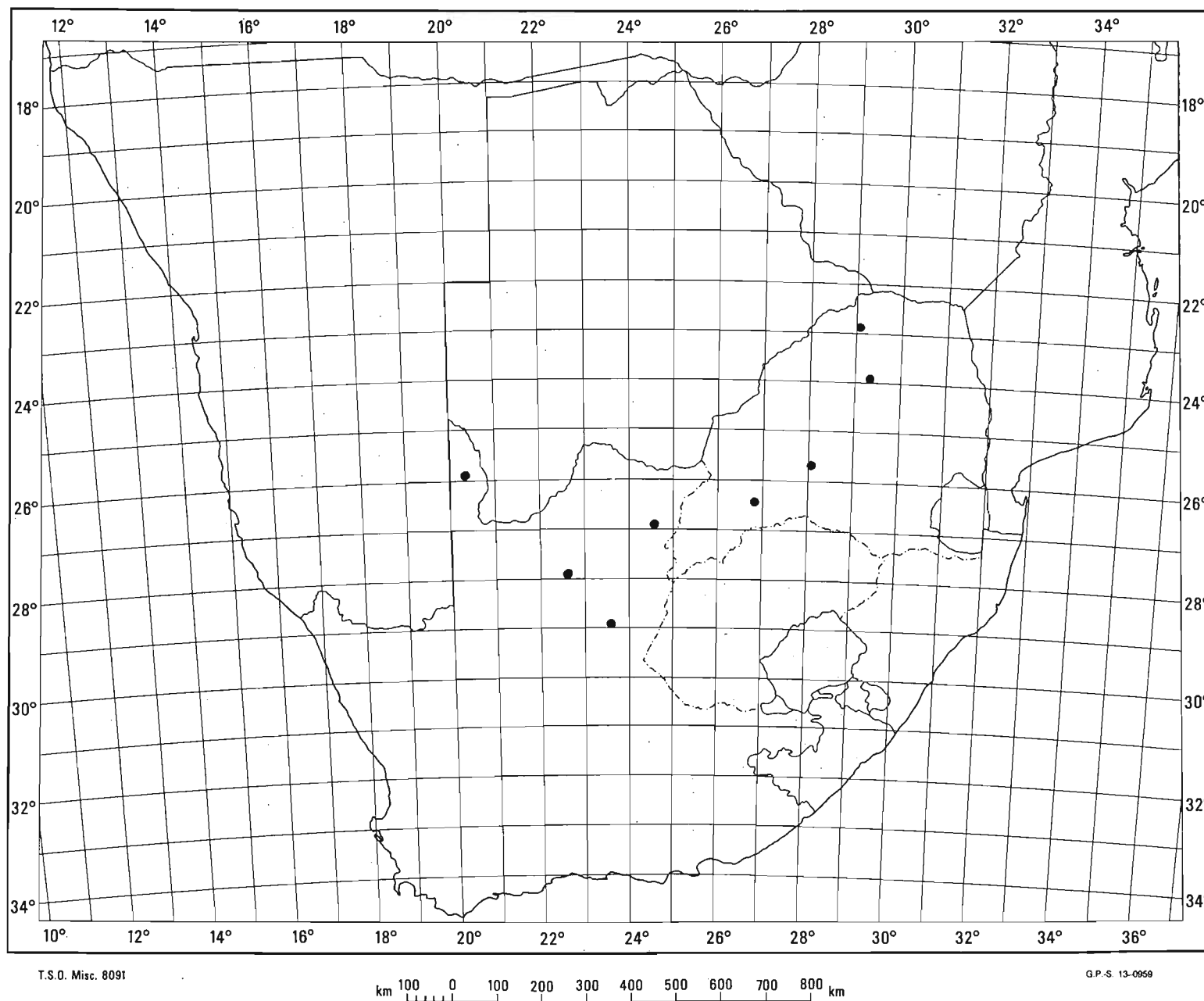


Figure 58. Illustration of *L. glauca* S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, bract with bracteole X 10; E, apex of tepal X 20; F, tepal with stamen X 10; G, flower X 10; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from *Venter 13,368*.

Map 26. Known distribution of *L. glauca* S. Venter



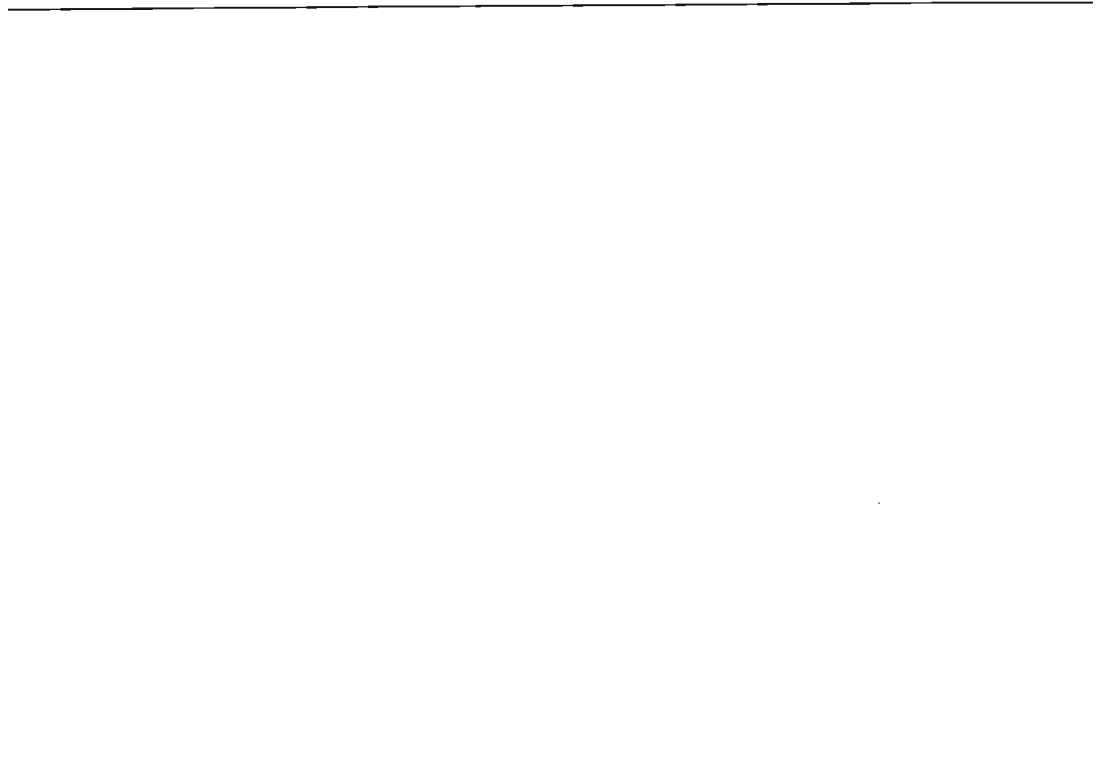
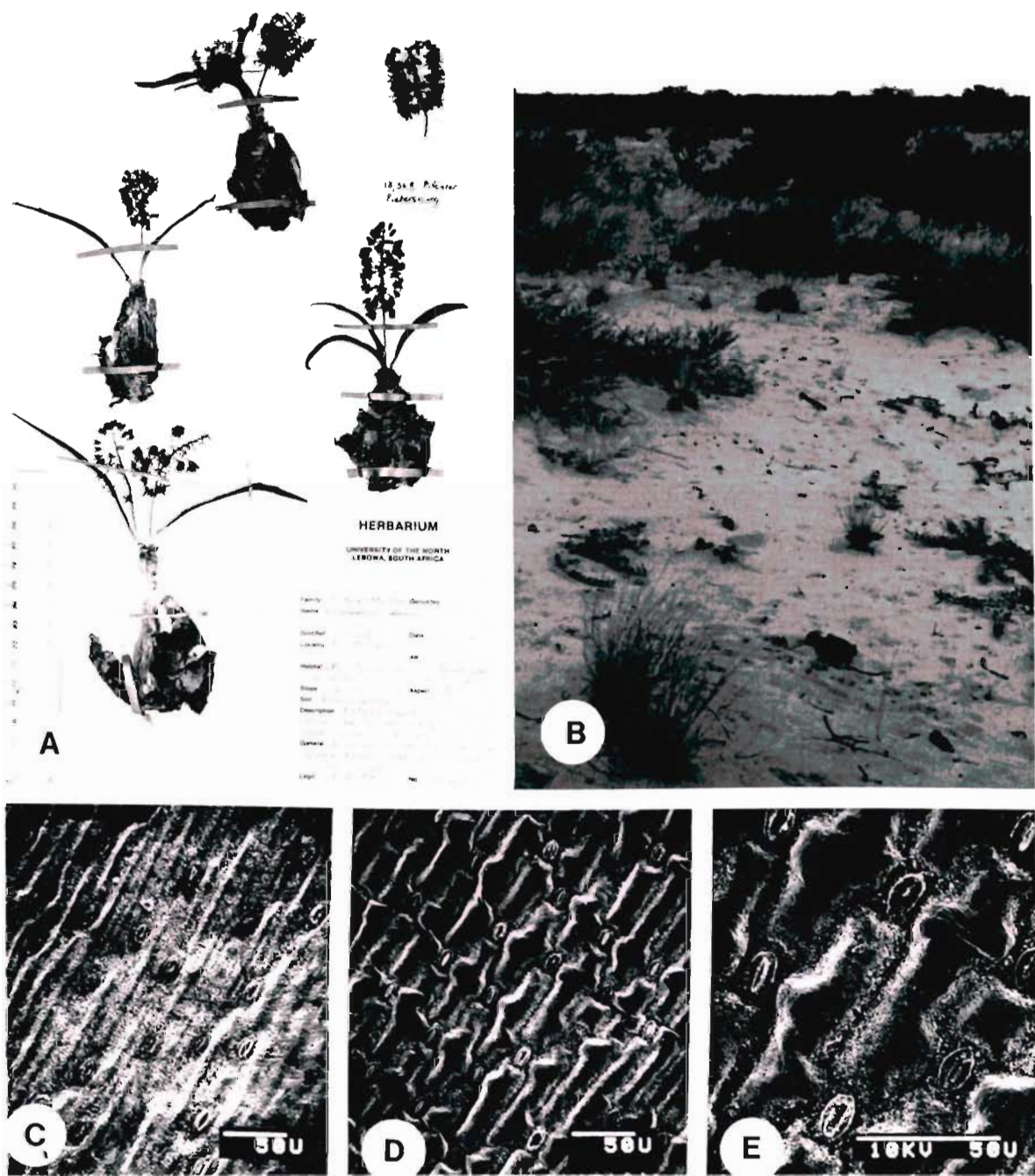


Figure 59. A, holotype of *L. glauca* S. Venter (PRE); B, habitat in the Kalahari near Vanzylsrus. The vegetation consists of open low *Acacia erioloba* - *A. haematoxylon* - *Stipagrostis uniplumis* woodland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata. A and C - E from *Venter 13,368*.



L. glauca is closely related to *L. inquinata* (C.A. Sm.) Jessop and *L. marginata* (Bak.) Jessop, but differs in having a basal stem and thickly leathery leaves.

Specific epithet etymology.

Referring to the glaucous colour of the plant.

Flowering period

From October to December.

Distribution (Map 26).

Known to occur in the Transvaal and the northern Cape.

Habitat

L. glauca occurs on sandy soils of various textures and origins favouring open grassy and sandy areas in full sun, between the trees and shrubs of various woodland types (Figure 59B). Various *Acacia* species and *Grewia flava* DC. tend to be the dominant woody members.

Plants occur mostly as scattered individuals in the veld. Groups of three to seven plants occur occasionally near Van Zylsrust (northern Cape). This species is rare. On few occasions seedlings were noted growing around the adult plants (within a radius of four meters).

Historical background

The first record of *L. glauca* appears to be *Acocks 1427* collected during December 1936. Since then, few collections have been made mostly from the northern Transvaal and northern Cape.

Specimens examined

TRANSVAAL. - 2229 (Waterpoort): Vivo, Langjan Nature Reserve (-CC), *Zwanziger 539* (PRE). - 2329 (Pietersburg): Pietersburg, Flora Park (-CD), *Venter 13,368* (PRE, UN, UNIN). - 2528 (Pretoria): La Montagne (-CA), *Van Wyk 2414* (PRE). - 2626 (Klerksdorp): Ventersdorp, farm Somerville (-BD), *Louw 2980* (PUC).

CAPE. - 2520 (Mata Mata): Kalahari Gemsbok Park (-CD), *Van Rooyen 2904* (PRU); *Leistner 1001* (PRE). - 2624 (Vryburg): Vryburg, farm Zoetvlei (-DC), *Speedy 91* (NBG). - 2722 (Olifantshoek): Katok (-DC), *de Lange 136* (UNIN). - 2823 (Griekwastad): Campbell (-DC), *Acocks 1427* (PRE).

23. *LEDEBOURIA INQUINATA* (C.A. Sm.) Jessop

Ledebouria inquinata (C.A. Sm.) Jessop in Jl S. Afr. Bot. 36(4): 257 (1970).

Scilla inquinata C.A. Smith in Kew Bull. :248 (1930).

Type: Transvaal, near Pretoria along Aapies River, *Burke s.n.* (K!, holo.; PRE!, photo.). Designated here as lectotype (Greuter *et al.* 1988. Article 7.5).

Plants solitary. **Bulb** hypogeal, 30 - 35 x 30 - 35 mm, ovoid; dead bulb scales brown speckled with purple apically, membranous, apices attenuate, live bulb scales tightly arranged, with sparse threads when torn, purplish inside, neck 8 - 10 x 5 - 8 mm. **Leaves** partly emerged at anthesis, 6 - 10, spreading, linear-lanceolate to lanceolate, 50 - 80 x 8 - 20 mm, with threads when torn, fleshy, surfaces dull glaucous green with dark green to purple markings, venation obscure; margins smooth, undulate at base; leaf base shallowly canaliculate; apex acute. **Inflorescences** 2 - 3, dense, oblong, 20 - 60 x 12 - 30 mm, flaccid, 40 - 60-flowered, shorter than the mature leaves; scape terete at base, green spotted dull purple, rachis ridged, 15 - 30 mm long. **Bracts** membranous, 1.5 x 1 mm, linear to lanceolate, grey to white with bracteoles. **Pedicels** spreading, 7 mm long, pink. **Perianth** 4 mm long, tepals recurved, equal, oblong, 4 x 1.5 mm, apex obtuse, cucullate, pink to purple with a brown keel. **Stamens** erect, 2 mm long, filaments maroon, epitepalous; anthers 0.5 mm long, yellow. **Ovary** depressed globose, 6-lobed, 1 x 1.8 mm, lobes obtusely deltate, apex shoulders raised, basal lobes present. **Style** 3 mm long, triangular, glabrous, purple; stigma above anthers; stipe 0.2 x 0.4 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** globose, 2 - 3 mm long, surface strongly wrinkled, brown. (Figure 60).

Together with *L. glauca* and *L. marginata* (Bak.) Jessop, *L. inquinata* belongs to the subsection *Glaucæ* but is distinguished by the purple spots and blotches on the live bulb scales (Figure 61D), leaves undulate at the base and depressed globose ovary.

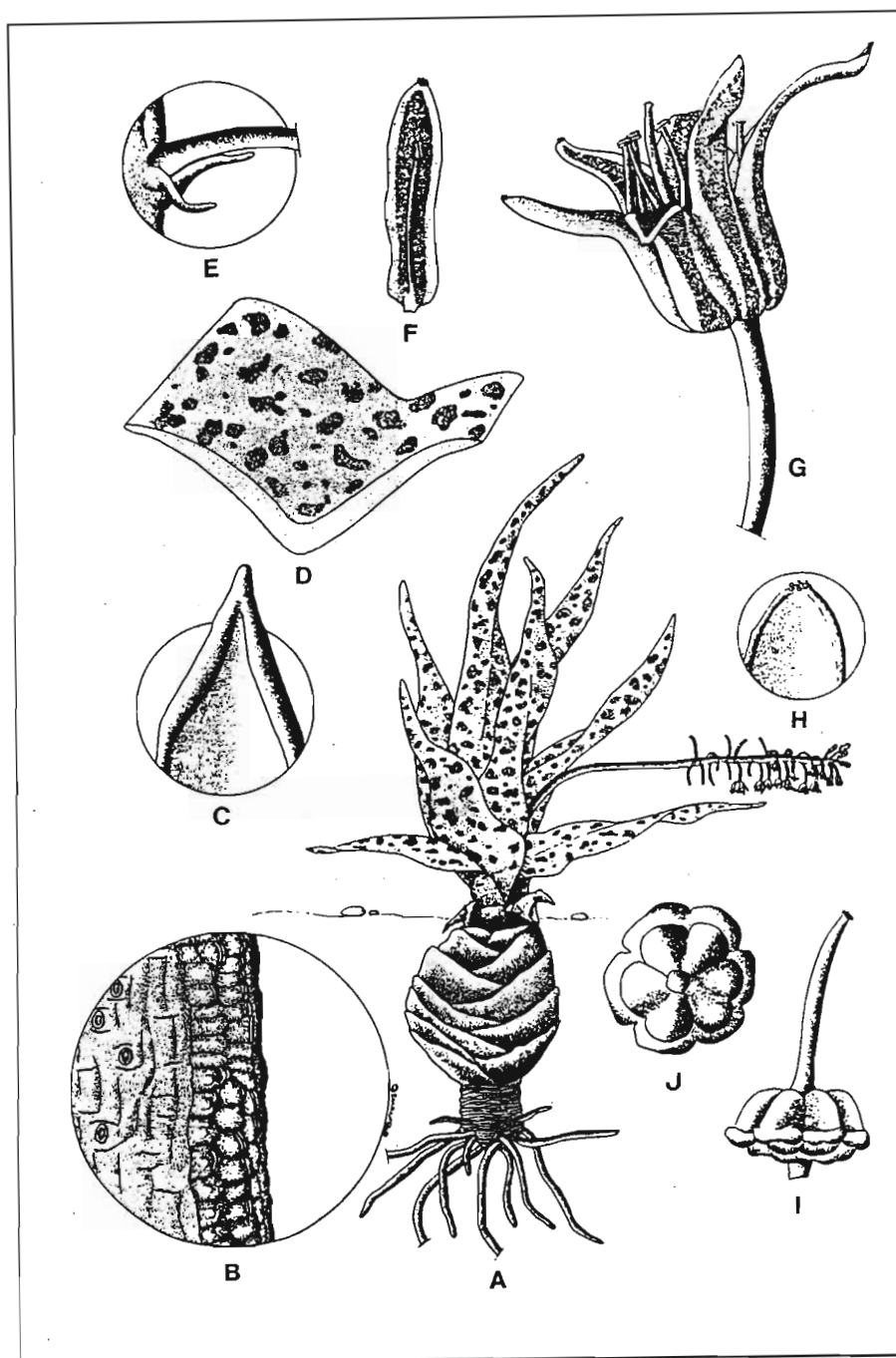
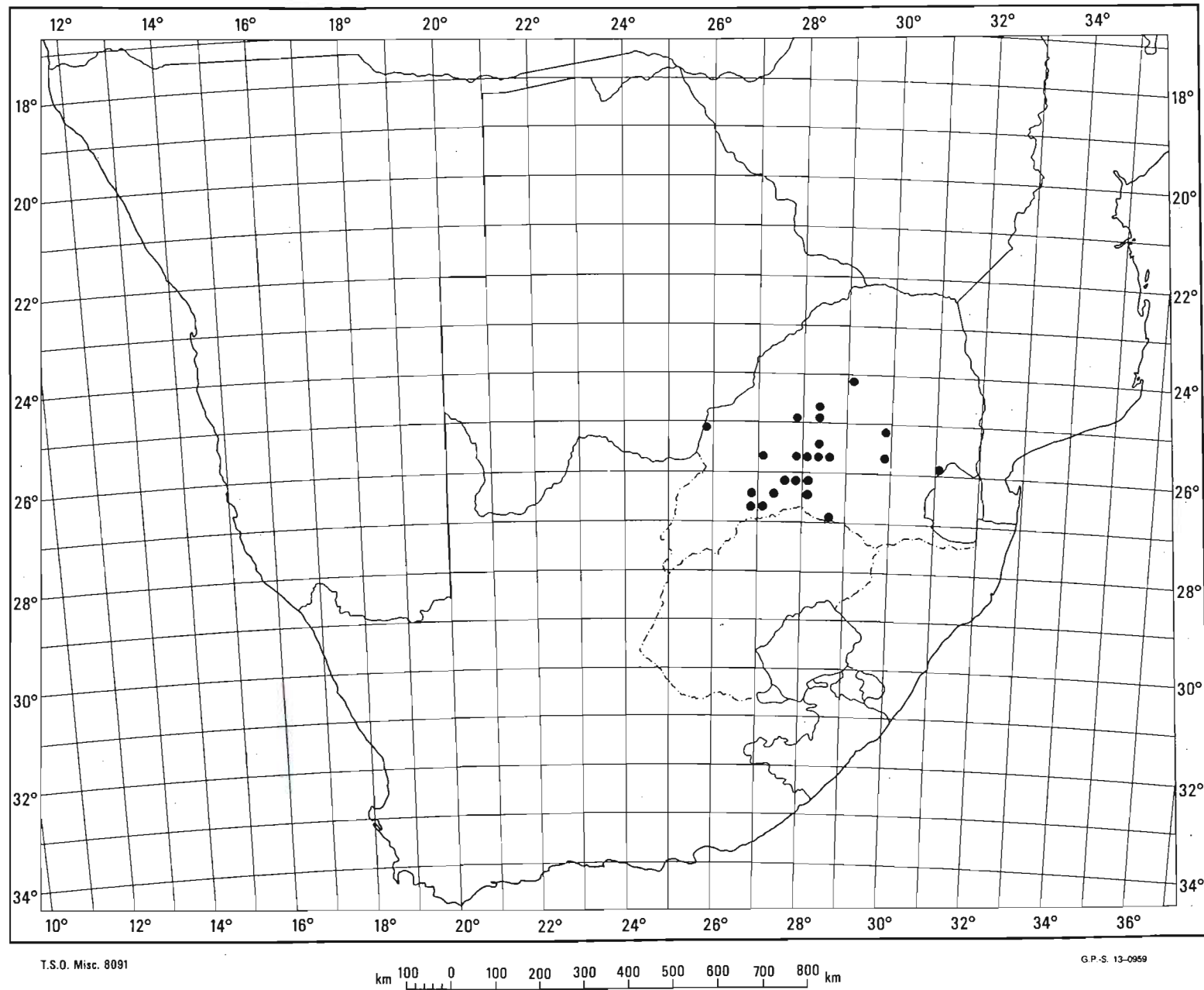


Figure 60. Illustration of *L. inquinata* (C.A. Sm.) Jessop. A, habit X 1; B, lamina margin X 300; C, apex of lamina X 10; D, section through lamina X 5; E, bract with bracteole X 10; F, tepal with stamen X 10; G, flower X 10; H, apex of tepal X 20; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Venter 13,343*.

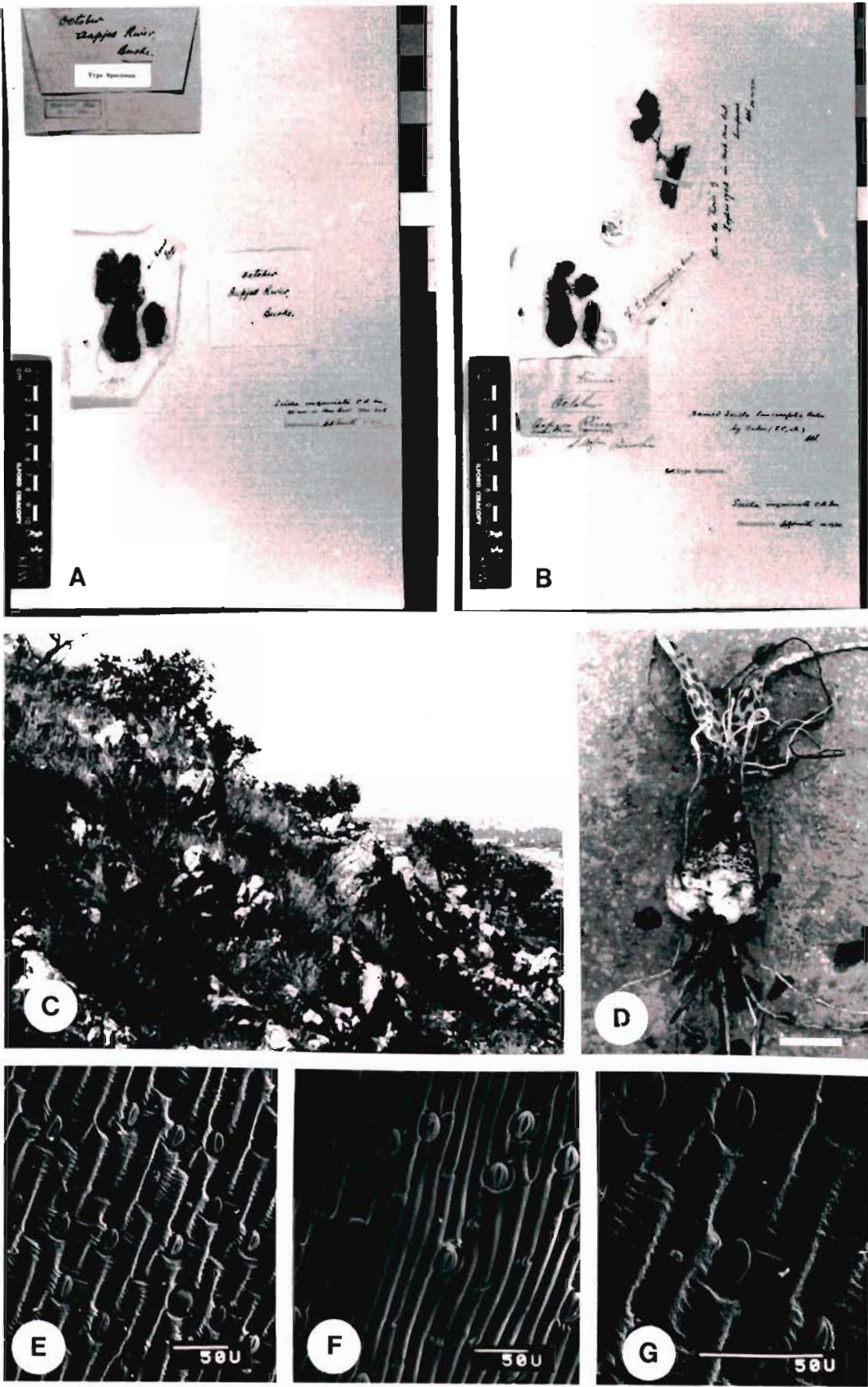
Map 27. Known distribution of *L. inquinata* (C.A. Sm.) Jessop



T.S.O. Misc. 8091

G.P.S. 13-0959

Figure 61. A, lectotype of *L. inquinata* (C.A. Sm.) Jessop (K); B, isotype of *L. inquinata* designated by Smith as co-type (K); C, habitat at Linksfield Ridge, Bedfordview, with open evergreen *Protea caffra* subsp. *caffra* - *Aloe greatheadii* var. *davyana* - *Digitaria eriantha* woodland; D, plant showing the diagnostic mottling on the live bulb scales. Bar = 25 mm; E, SEM micrograph of the adaxial lamina surface; F, SEM micrograph of the abaxial lamina surface; G, SEM micrograph of stomata. D - G from *Venter 13,343*.



Specific epithet etymology.

Means stained, describing the prominent purple blotches on the dry bulb scales.

Flowering period

From August to November peaking in September.

Distribution (Map 27).

Transvaal and the southern part of Botswana.

Variation

Plants from near Graskop tend to be larger and more robust (*Venter 13,241*) than plants from the central and western Transvaal.

Jessop (1970) apparently failed to see the differences between the type specimens and material he recognized as *L. inquinata*. This material is in fact an undescribed species related to *L. atro-brunnea*.

Specimens examined

TRANSVAAL. - 2429 (Zebediela): Potgietersrust (-AA), *Leendertz 1453* (PRE). - 2430 (Pilgrim's Rest): Graskop, Lisbon Waterfall (-DD), *Venter 13,241* (UNIN). - 2527 (Rustenburg): Rustenburg (-CA), *Leendertz 10,140* (PRE); Rustenburg Nature Reserve (-CA), *Coetzee 1513* (PRE); *Venter 13,231* (UNIN). - 2528 (Pretoria): Hammanskraal, farm Kromdraai (-AD), *Venter 13,335* (UNIN); Pretoria (-CA), *Burt Davy 2200* (PRE); *McLea 101* (BOL); *Tillwich s.n.* (PRU); *Moss 10,810* (J); *Leendertz 4049* (PRE); Horns Neck (-CA), *Perry 2019* (NBG); Meintjies Kop (-CA), *Mogg 14,077* (PRE);

Queenswood (-CA), *Theron 193* (PRU); Groenkloof (-CA), *Mogg 3009* (PRE); Onderstepoort (-CA), *Smith 6035* (PRE); Waverley (-CB), *Venter 13,344* (UNIN); *Venter 13,345* (UNIN); Pienaars Poort (-CB), *Leeman s.n.* (PRE); Roodeplaat Dam (-CB), *Van Rooyen 2666* (PRU); Fountains Valley (-CC), *Venter 13,350* (UNIN). - 2529 (Witbank): Middelburg, Tantes Berg (-BB), *Young A148* (PRE); Hartebeeshoek (-DB), *Verdoorn & Mogg s.n.* (PRE). - 2626 (Klerksdorp): Ventersdorp, farm Goedgedacht (-BD), *Sutten 630* (PUC); Ventersdorp, farm Morgenzon 42 (-BD), *Mogg 22,209* (J). - 2627 (Potchefstroom): Welverdiend (-AD), *Louw 3* (PRU, PUC); Krugersdorp, farm Zwartkrans (-BA), *Franklin 10* (J); Sterkfontein Caves (-BB), *Mogg 35,540* (J); Roodepoort (-BB), *Moss 13,418* (J); Potchefstroom (-CA), *Ubbink 692* (PUC); Boskop (-CA), *Louw 360* (PUC); Dassiesrant (-CA), *Venter 13,222* (UNIN); Scandinavia Drift (-CC), *Venter 13,227* (UNIN). - 2628 (Johannesburg): Johannesburg (-AA), *Norwood Young 786* (J); *Moss 18,927* (J); Milner Park (-AA), *Moss 13,703* (J); Sandton, Buccleuch (-AA), *Venter 338* (UNIN); Witwatersrant (-AA), *Moss 19,078* (J); Killarney (-AA), *Page s.n.* (J); Westcliffe (-AA), *Moss 12,071* (J); Melville Koppies (-AA), *Knep & Higgs s.n.* (J); West Morningside (-AA), *Gilliland s.n.* (J); Bryanston (-AA), *Dahlstrand 363T* (PEU); Thorntree Kloof (-AA), *Moss s.n.* sub J 31,789 (J); Edenvale (-AA), *Venter 13,338* (UNIN); Alberton, Klipriviersberg (-AC), *Gilliland s.n.* (J, PRE); Krugersdorp, Witpoortjie (-DC), *Hugo s.n.* sub STE 31,924 (STE).

24. *LEDEBOURIA MARGINATA* (Bak.) Jessop

Ledebouria marginata (Bak.) Jessop in Jl S. Afr. Bot. 36(4): 260 (1970).

Scilla marginata Bak. in Bull. Herb. Boiss. ser. 2(4): 1002 (1904).

Type: Transvaal, Modderfontein, *Conrath 703b* (GRAZ!; PRE!, photo.; Z.).

Scilla neglecta Van der Merwe in Flower. Pl. S. Afr. 22: t.865 (1942).

Type: Transvaal, Pretoria, Colbyn, *Van der Merwe 2441* (PRE!, holo.).

Plants solitary. **Bulb** hypogeal, 60 - 80 x 30 - 50 mm, obovoid; dead bulb scales light to dark brown, membranous, apices attenuate, live bulb scales tightly arranged, with threads when torn, white inside, neck 50 - 70 x 20 mm. **Leaves** partly emerged at anthesis, 4 - 10, erect to erect-spreading, spirally twisted, lanceolate, 120 - 150 x 10 - 100 mm, with thick bundles of threads when torn, difficult to tear, leathery, dull glaucous green with dark green to purple spots and blotches with cross bars at base of lamina on the abaxial surface, venation prominent; margins smooth, basal part usually undulate; leaf base nearly flat to shallowly canaliculate; apex acute. **Inflorescences** 4 - 10, dense, oblong; 20 - 100 x 20 - 50 mm, flaccid, 80 - 100-flowered, as long or longer than leaves; scape winged at base, green spotted darker; rachis ridged, 50 - 100 mm long. **Bracts** membranous, 3 x 0.5 mm, linear to lanceolate, grey to white with bracteoles. **Pedicels** spreading, 3 - 10 mm long, pink. **Perianth** 3 - 4 mm long, tepals recurved, subequal, oblong to lanceolate, 3 - 4 x 1.5 mm, apex obtuse, cucullate, pink to purple with green to brown keel. **Stamens** erect, 3 mm long, filaments maroon, epitepalous; anthers 0.75 mm long, yellow. **Ovary** globose, 6-lobed, 0.75 x 1.5 mm, lobes narrowly oblong, apex shoulders raised. **Style** 3 mm long, triangular, glabrous, upper half purple, lower half white; stigma equal height to anthers; stipe 0.12 x 0.2 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 2 - 3 mm long, surface strongly wrinkled, yellowish brown. (Figure 62).

L. marginata is closely related to *L. inquinata* and *L. glauca* but is easily distinguished by the tough glaucous leaves and many inflorescences.

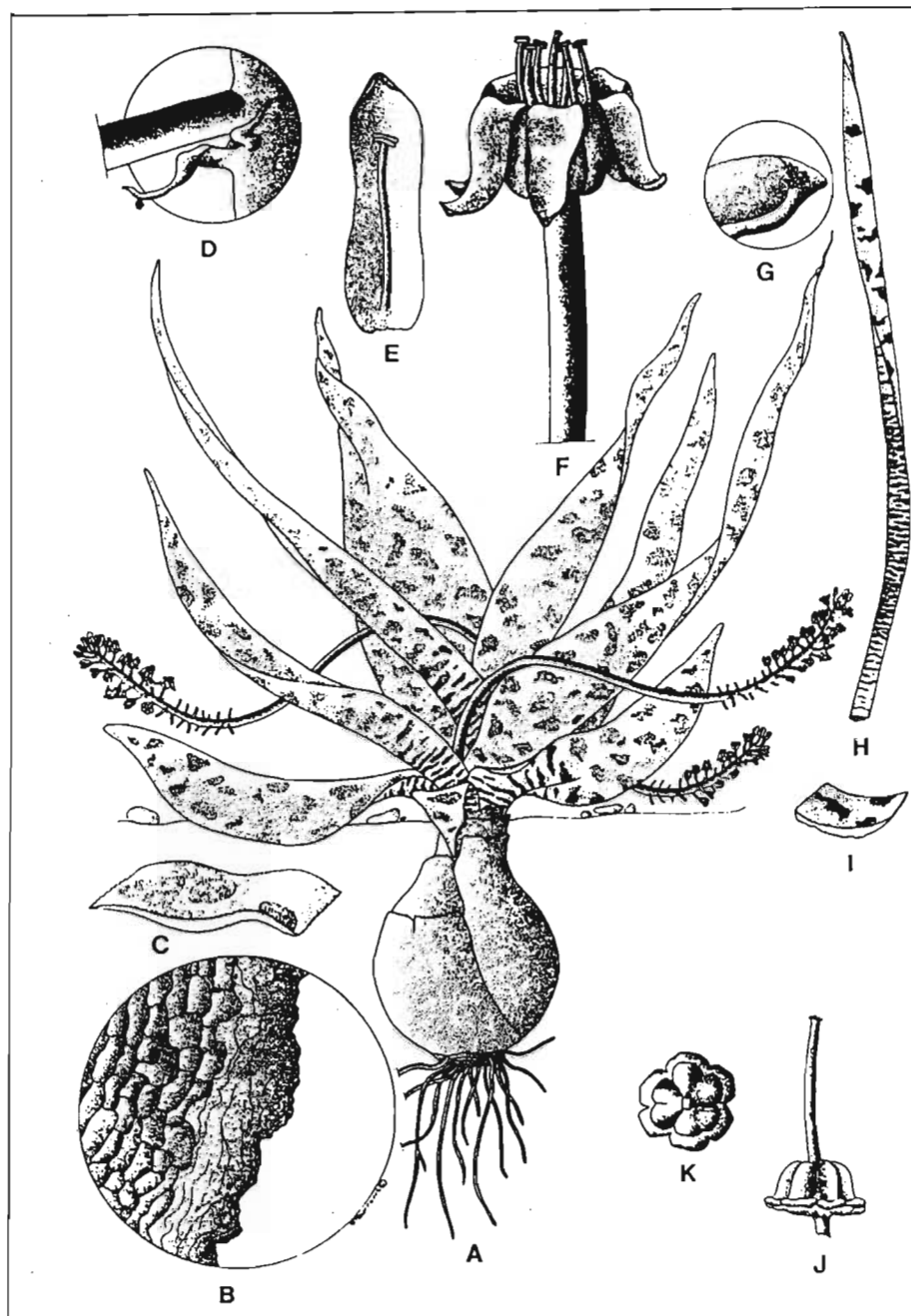


Figure 62. Illustration of *L. marginata* (Bak.) Jessop. A, habit X 0.5; B, lamina margin X 300; C, section through lamina X 1; D, bract with bracteole X 10; E, tepal with stamen X 10; F, flower X 10; G, apex of tepal X 20; H, lamina of the narrow leaved form from Vryheid X 0.5; I, section through lamina of H. X 2; J, ovary lateral view X 10; K, ovary dorsal view X 10. A - G and J - K from *Venter 13,327* and H - I from *Venter 13,364*.

Map 28. Known distribution of *L. marginata* (Bak.) Jessop

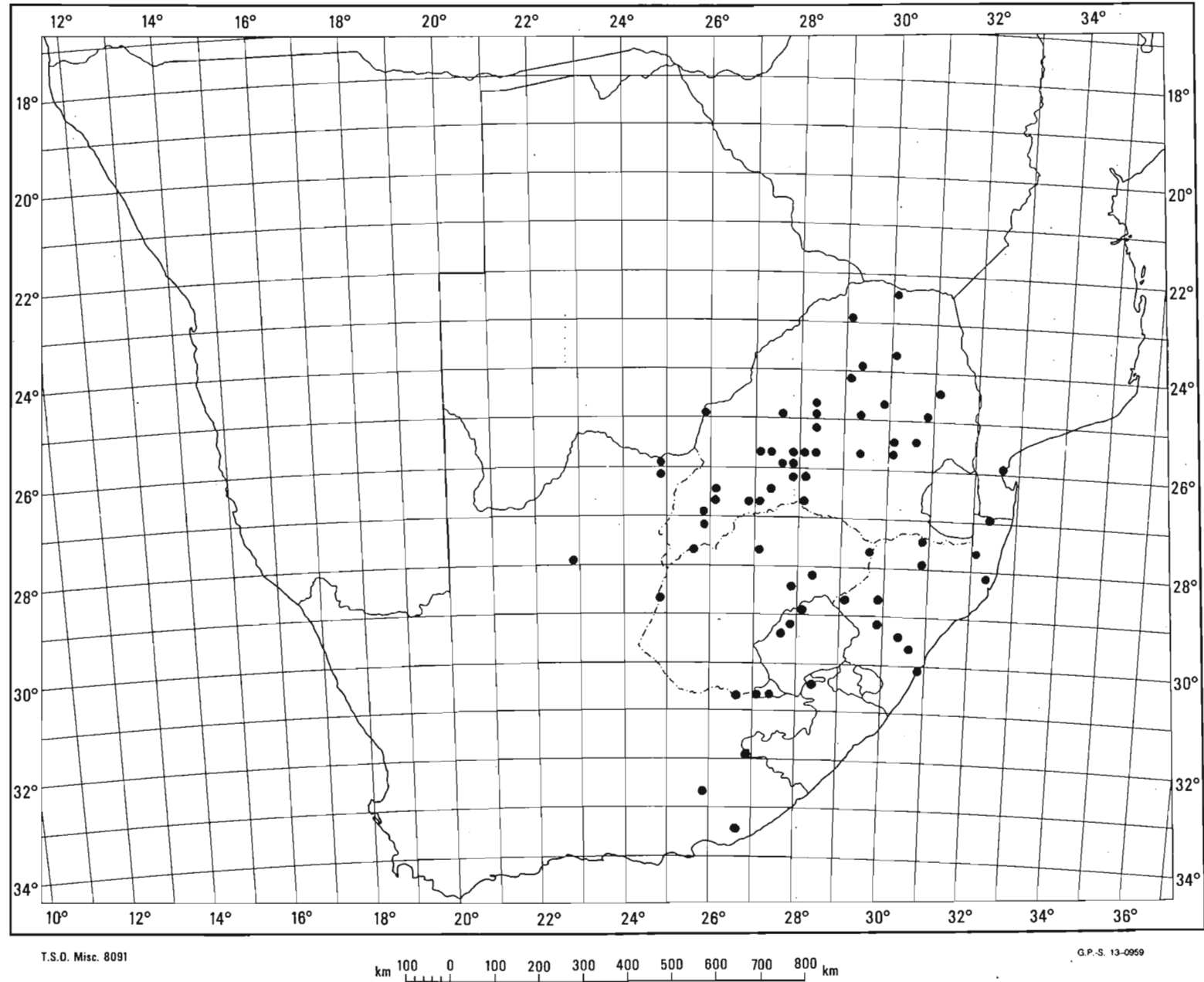
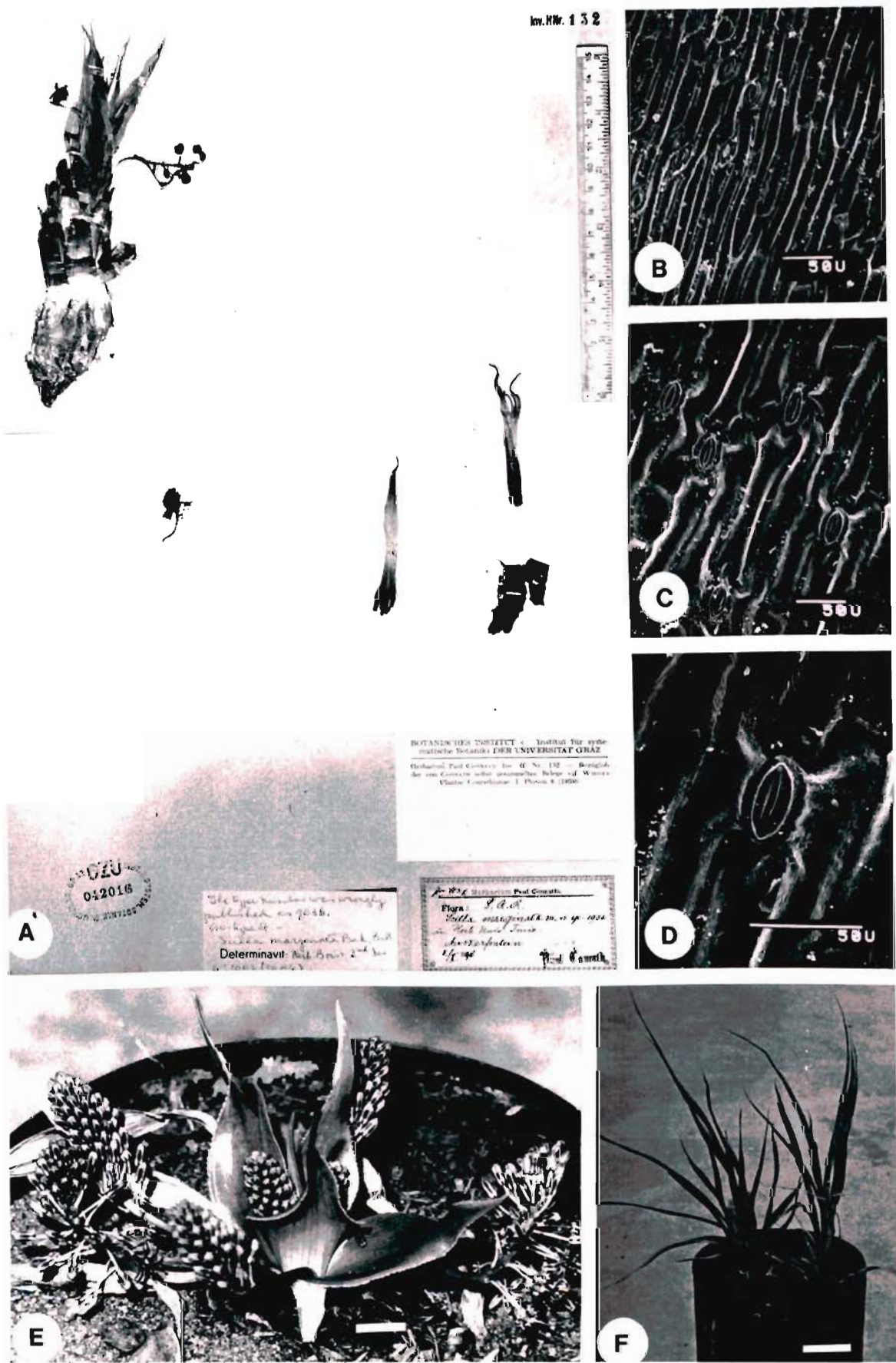


Figure 63. A, lectotype of *L. marginata* (Bak.) Jessop (GRAZ); B, SEM micrograph of the adaxial lamina surface; C, SEM micrograph of the abaxial lamina surface; D, SEM micrograph of a stomatum; E, plant showing diagnostic twisted leaves. Bar = 30 mm; F, plants of the narrow-leaved form from near Vryheid. Bar = 40 mm. B - E from *Venter 13,230* and F from *Venter 13,358*.



Specific epithet etymology.

In reference to the broad membranous lamina margin.

Flowering period

From August to February with a peak from September to November.

Distribution (Map 28).

Widely distributed in Transvaal, Natal, Orange Free State with scattered localities in Lesotho, north-eastern and eastern Cape.

Habitat

Although some plants of *L. marginata* occur on fine to medium grained (0.025 - 0.25 mm ϕ) soils derived from andesitic tuff and schist, most plants occur on soils derived from either sandstone, conglomerate or quartzite.

L. marginata is associated with grasslands and grassy areas in woodland but rarely occurs in *Acacia* woodland on heavy clay soils. It is common in short grassland but rare in tall grassland, where it occurs on rock outcrops. Only one population, that on the farm Rhenosterspruit at Lanseria, was found in semi-shade underneath *Acacia caffra* (Thunb.) Willd. on dolomite rock outcrops in closed deciduous low woodland (Venter 13,487).

L. marginata is susceptible to grazing. Leaf apices were eaten leaving the strong fibres exposed.

Variation

In *L. marginata* there are two groups with respect to leaf shape. The first group, the largest, has typical *L. marginata* leaves but the second group has long narrow leaves (Map 1., Fig. 62H) (Venter 13,358) and occurs in the Vryheid - Piet Retief area. The leaves of these plants are all erect with a characteristic spiral twist. Leaf colour varies. In the Krugersdorp area, plants are immaculate (Venter 13,487) with those from Waverley, Pretoria, heavily marked with dull purple (Venter 13,346).

The common flower colour is pink, with green keels to the perianth segments but plants with entirely green flowers grow at the Lisbon Falls near Graskop (Venter 13,246).

The spiral twist of the leathery, glaucous green leaves and the undulate lamina margins are distinctive (Figure 63E).

Specimens examined

TRANSVAAL. - 2229 (Waterpoort): Langjan Nature Reserve (-CC), Zwanziger 365 (PRE). - 2230 (Messina): Messina (-AC), Rogers 22,967 (J). - 2329 (Pietersburg): Pietersburg (-CD), Moss 15,693 (J). - 2330 (Tzaneen): Duiwelskloof (-CA), Van der Merwe s.n. (PRE). - 2425 (Gaborone): Zeerust, farm Koedoesrant 9 KO (-DD), Krynauw 192 (LYD). - 2427 (Thabazimbi): Rooiberg, farm Blaauwbank (-DC), Van der Merwe 1964 (PRE); Rooiberg (-DC), Van der Merwe 2020 (PRE); Van der Merwe 2475 (PRE). - 2428 (Nylstroom): Nylstroom (-CB), Jacques s.n. (PRE); 19 Miles north of Nylstroom (-CB), Van der Merwe 1954 (PRE); 5 Miles east of Warmbaths (-CD), Collett s.n. (PRE). - 2429 (Zebediela): Potgietersrust (-AA), Leendertz 10,136 (PRE); Arabie (-CD), Ellery 288 (PRE). - 2430 (Pilgrim's Rest): Graskop, Lisbon Falls (-DD), Venter 13,246 (UNIN). - 2431 (Acornhoek): Hoedspruit (-AC), Van der Merwe 2004 (PRE). - 2524 (Vergelee): Molopo Nature Reserve (-DD), Peeters et al. 222 (J). - 2526 (Zeerust): Zeerust (-CA), Van der Merwe 1213 (PRE). - 2527 (Rustenburg): Rustenburg (-CA), Nation

351 (BOL); Rustenburg Nature Reserve (-CA), *Coetzee 1518* (PRE); Kroondal (-CB), *Louw 3455* (PUC); Brits, farm Welgevonden (-DB), *Mogg s.n.* (PRE); Witwatersrantberg, Skeerpoort (-DC), *Bidlingmaier 7* (PRU); Magaliesberg, farm Zeekoeihoek (-DC), *Van der Merwe 2038* (PRE); Rustenburg, farm Uitkomst 499 JQ (-DD), *Coetzee 233* (PRE). - 2528 (Pretoria): Pretoria (CA), *Moss 11,712* (J); Knoppiesfontein (-CA), *Van der Merwe 1998* (PRE); Pienaars River (-AB), *Venter 13,327* (UNIN); Van Riebeeck Nature Reserve (-CA), *Kok 220* (PUC); Wonderboompoort (-CA), *Repton 1818* (PRE); Roodeplaat Nature Reserve (-CB), *Van Rooyen 2194* (PRE, PRU); *Van Rooyen 3534* (PRU); *Van Rooyen 2667* (PRU); *Van Rooyen 1942* (PRU); *Van Rooyen 2865* (PRU); Brumeria (-CB), *Codd 3143* (PRE); Baviaanspoort (-CB), *Goossens 31* (PRE). - 2529 (Witbank): Middelburg, farm Doornkop 273 JS (-CB), *Du Plessis 567* (PRU). - 2530 (Lydenburg): Dullstroom (-AC), *Van der Merwe 1273* (PRE); Farm Verloren Vallei (-AC), *Drews 48* (PRE); Sudwalas Kraal (-BC), *Liebenberg 3035* (PRE); Belfast (-CA), *Van der Merwe s.n.* (PRE). - 2625 (Delareyville): Wolmaranstad, farm Strydpoort (-DD), *Sutton 466* (PRE). - 2626 (Klerksdorp): Lichtenburg, farm Hakboslaagte (-AC), *Kinges 1818* (PRE); Ventersdorp, farm Goedgedacht (-DB), *Sutton 628* (PUC). - 2627 (Potchefstroom): A. Bailey Nature Reserve (-AD), *Van Wyk 272* (PRE); Witpoortjie (-BB), *Gilliland s.n.* (PRE); Modderfontein (-BB), *Van der Merwe 1982* (PRE); *Van der Merwe 2010* (PRE); Randparkridge (-BB), *Taylor 136* (J); Krugersdorp (-BB), *Codd 3157* (PRE); Roodepoort (-BB), *Behr 15* (NBG); Sterkfontein Caves (-BB), *Lucas & Glen sub Mogg 34,650* (J); *Mogg 36,694* (J); *Mogg 34,564* (J); Potchefstroom (-CA), *Botha & Ubbink 1543* (PRE); Klington (-CA), *Goossens 1660* (PRE). - 2628 (Johannesburg): Johannesburg (-AA), *Watt & Brandwyk 2254* (PRE); Frankenwald (-AA), *Gilliland s.n.* (J); Milner Park (-AA), *Moss 13,663* (J); *Moss 7348* (J); *Moss 19,060* (J); Germiston(-AA), *Dryden s.n.* (BOL); Germiston, Lombardy Estate (-AA), *Holden 14,151* (PRE); Rietfontein (-AA), *Moss 10,808* (J); Melville Koppies (-AA), *Macnae s.n.* (J); Parktown (-AA), *Walker s.n.* sub J 27,357 (J); Mulder's Drift road (-AA), *Gilliland s.n.* (J); Forest Hill (-AA), *Moss 10,026* (J); Houghton Estate (-AA), *Moss 2162* (J); Bryanston (-AA), *Gilliland s.n.* (J); *Lloyd s.n.* sub J 26,620 (J); Van Wyk's Rust (-AA), *Dimovic s.n.* sub J 28,056 (J); Bedford Hill (-AA), *Gilliland s.n.* (J); Thorntree Kloof (-AA), *Moss 6203* (J); Suikerbosrand Nature Reserve (-CA), *Bredenkamp 982* (PUC). - 2725 (Bloemhof): Wolmaranstad, farm Vaalbosch (-BB), *Van Wyk 2429* (PRE); Wolmaranstad, farm Rooipoort (-BB).

ORANGE FREE STATE. - 2727 (Kroonstad): Kroonstad (-CA), *Pont* 624 (BLFU). - 2729 (Volksrust): Memel (-DA), *Muller* 1034 (PRE). - 2824 (Kimberley): Boshof, 14 miles north of Kimberley (-DB), *Leistner* 2875 (PRE). - 2827 (Senekal): Between Paul Roux and Senekal (-BD), *Zietsman* 70 (PRE). - 2828 (Bethlehem): Bethlehem (-AB), *Van der Merwe* 1143 (PRE). - 2829 (Harrismith): Sterkfontein Dam (-CA), *Blom* 103 (PRE).

LESOTHO. - 2927 (Maseru): Mamathes, Lenea (-BB), *Jacot-Guillarmod* 2744 (PRE); Roma (-BC), *Schmitz* 8024 (PRE); *Schmitz* 6745 (PRE).

NATAL. - 2632 (Bela Vista): Tembe Elephant Park (-CD), *Ward* 1702 (NH). - 2730 (Vryheid): Vryheid (-BB), *Van der Merwe* 2465 (PRE); Vryheid Hill (-DD), *Venter* 13,358 (UNIN). - 2732 (Ubombo): Ubombo (-CA), *Van der Merwe* 2839 (PRE). - 2828 (Bethlehem): Leribe (-CC), *Dieterlen* 228 (NBG). - 2829 (Harrismith): Ladysmith (-DB), *Ditton s.n.* sub NBG 390/39 (NBG). - 2832 (Mtubatuba): Sibomvini, Eastern shores State Forest (-AB), *Van Wyk* 904 (CPF). - 2929 (Underberg): Estcourt (-BB), *Van der Merwe* 2359 (PRE); *Van der Merwe* 2443 (PRE). - 2930 (Pietermaritzburg): Albert Falls (-AD), *Van der Merwe* 2601 (PRE); Camperdown (-DA), *Van der Merwe* 2419 (PRE). - 3030 (Port Shepstone): Umkomaas (-BB), *Archbell s.n.* (BOL).

TRANSKEI. - 3028 (Matatiele): Ongeluksnek (-AD), *Strever* 303 (KEI).

CAPE. - 2624 (Vryburg): Clober (-BB), *Lamb s.n.* sub NBG 51/26 (NBG). - 2722 (Olifantshoek): Olifantshoek (-DD), *Thorne s.n.* (BOL). - 3026 (Aliwal North): Elandshoek (-DA), *Bolus* 158 (BOL); *Bolus* 213 (BOL); Doctor's Drift (-DA), *Gerstner* 67 (PRE). - 3027 (Lady Grey): Lady Grey (-CA), *Van der Merwe* 1855 (PRE); Herschel, Sterkspruit (-CB), *Hepburn s.n.* sub GRA 7426 (GRA). - 3126 (Queenstown): Queenstown (-DD), *Galpin* 1659 (GRA). - 3225 (Somerset East): Cookhouse (-DB), *Rogers s.n.* (BOL). - 3326 (Grahamstown): Grahamstown (-BC), *Zeyher* 9 (BOL).

Sectio **Efiliferae** *S. Venter*, sect. nov., foliis plus quam quatuor; ovario globoso usque ad 1 mm longo.

Species typica: *Ledebouria ovalifolia* (Schrad.) Jessop.

Typus: Lodd. Bot. Cab. :278 (1818) sub *Drimia lanceaefolia*.

Species: *L. concolor* (C.A. Sm.) Jessop, *L. undulata* (Jacq.) Jessop, *L. crispa* *S. Venter*, *L. socialis* (Bak.) Jessop, *L. macowanii* (Bak.) *S. Venter*, *L. ovalifolia* (Schrad.) Jessop, *L. petiolata* (Van der Merwe) *S. Venter*.

Plants 50 - 120 mm tall. **Bulbs** 10 - 30 mm wide, neck prominent, torn bulb scales without threads. **Leaves** erect, spreading or appressed to ground, without threads when torn. **Stamens** erect. **Ovary** 1 - 1.5 mm long, globose.

Distribution and habitat.

Throughout South Africa, from semi - desert through coastal woodland, to montane grassland.

The only section with a prominent neck to the bulb and when torn, lacking threads in the leaves.

Subsectio **Ebractae** *S. Venter*, subsect. nov., bracteis carentibus brevissimae usque ad 0.25 mm.

Species typica: *L. concolor* (Bak.) Jessop.

Species: *L. concolor* (Bak.) Jessop.

25. *LEDEBOURIA CONCOLOR* (Bak.) Jessop

Ledebouria concolor (Bak.) Jessop in Jl S. Afr. Bot. 36(4): 254 (1970).

Drimia cooperi Bak. in Saund. Ref. Bot. 1: t.18 (1868).

Type: Cap. B. Spei, *Cooper s.n.* (K!, holo.; PRE!, photo.).

Scilla concolor Bak. in Saund. Ref. Bot. 3, Appen.: 13 (1870).

Type: As for *Drimia cooperi*.

Plants gregarious. **Bulbs** mostly semi-epigeal, 60 - 120 x 30 - 50 mm, obovoid; dead bulb scales purplish-brown, membranous with horizontal ridges, inner bulb scales white, fleshy, apices truncate, without threads when torn; neck of bulb 3 - 20 x 10 - 20 mm, basal stem present. **Leaves** fully developed at anthesis, 4 - 6, spreading, lanceolate to oblong, 100 - 125 x 30 - 40 mm, without threads when torn, fleshy, glabrous, concolorous, glossy green, venation prominent; margins smooth; leaf base flat to shallowly canaliculate; apex obtuse. **Inflorescences** 1 - 3, dense, oblong to cylindric, 80 - 120 x 30 - 40 mm, longer than the peduncle, erect to flaccid, 30 - 50 -flowered, longer than the leaves; scape terete at base, green, glabrous; rachis smooth, 50 - 75 mm long. **Bracts** absent or vestigial. **Pedicel** spreading horizontally then drooping, 4 - 8 mm long, green. **Perianth** 3.7 - 6.2 mm long, tepals recurved, equal, oblong, 4 - 7 x 2 - 3 mm, apex obtuse, slightly cucullate, green with a tinge of pink at base, keel green. **Stamens** erect, 4 - 5 mm long, filaments green to pink, epitepalous; anthers 1 mm long, yellow. **Ovary** globose, 6 -lobed, 1.0 - 1.5 x 2.5 mm, lobes narrowly transversely elliptic, base papillate, apex shoulders raised. **Style** 4 mm long, triangular, glabrous, purple; stigma equal height to anthers; stipe 0.5 x 0.5 mm. **Capsule** two- to three-lobed, asymmetrical, cylindrical; base truncate. **Seed** disc-shaped, 3.5 - 4.0 mm long, surface strongly wrinkled, brown. (Figure 64).

L. concolor is not closely allied to any other species of *Ledebouria* in South Africa.

Specific epithet etymology.

Referring to the immaculate leaves.

Flowering period

From October to March.

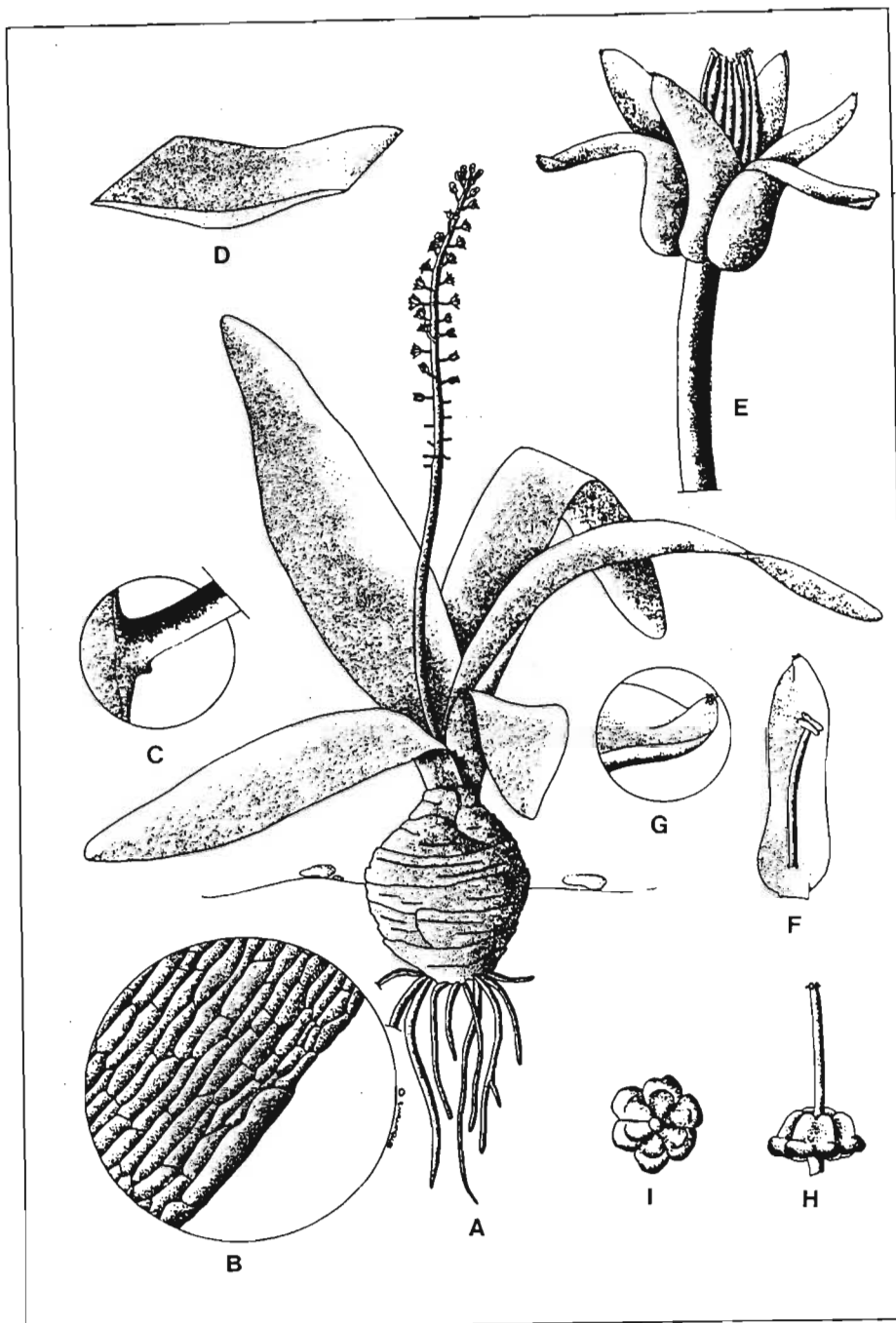
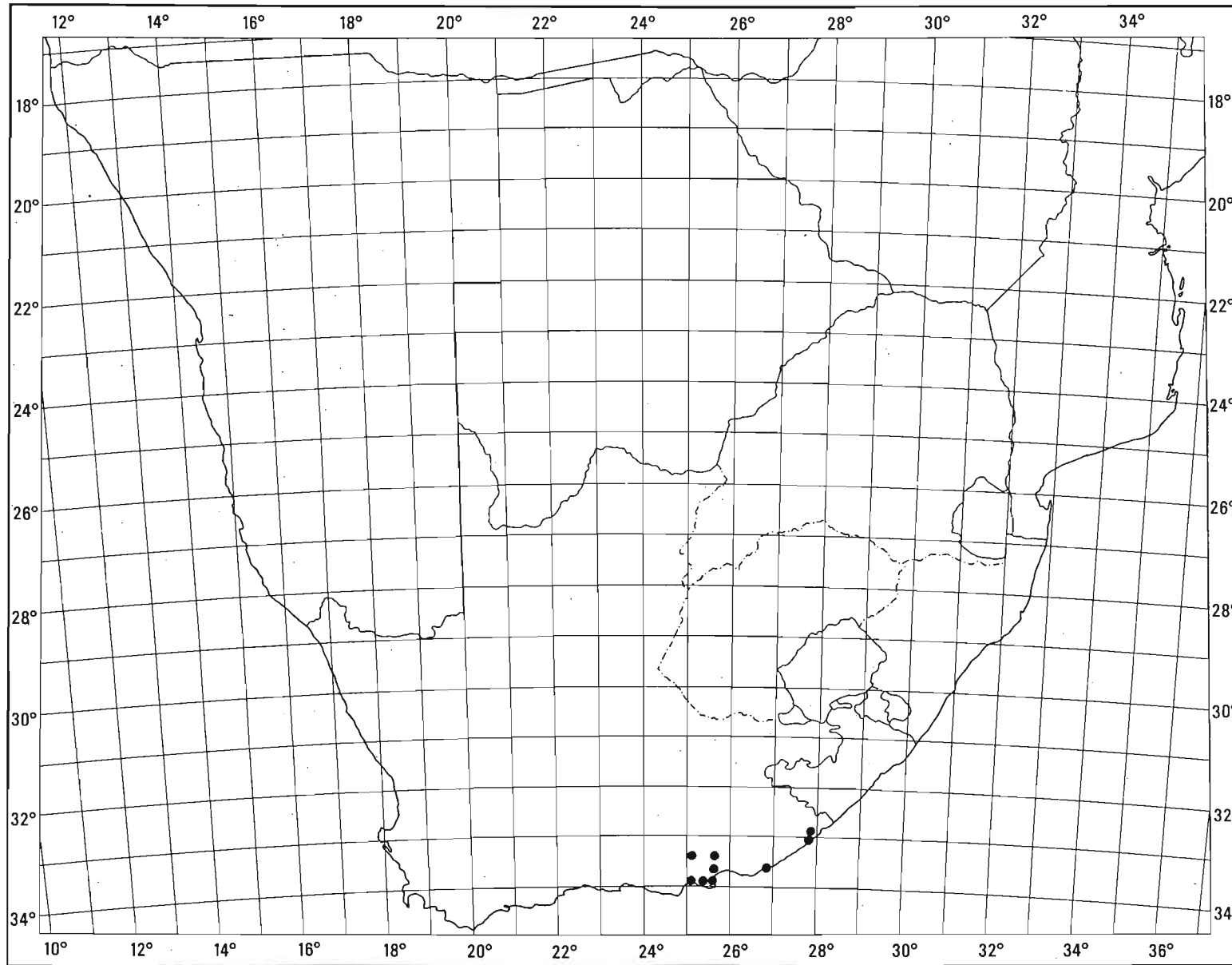


Figure 64. Illustration of *L. concolor* (Bak.) Jessop. A, habit X 1; B, lamina margin X 300; C, vestigial bract X 10; D, section through lamina X 2; E, flower X 10; F, tepal with stamen X 10; G, apex of tepal X 20; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from *Stirton 12,474*.

Map 29. Known distribution of *L. concolor* (Bak.) Jessop



T.S.O. Misc. 8091

km 100 0 100 200 300 400 500 600 700 800 km

G.P.S. 13-0959

Figure 65. A, holotype of *L. concolor* (Bak.) Jessop (lower specimen) (K); B, habitat at the mouth of the Zwartkops River near Port Elizabeth. The vegetation consists of closed evergreen tall *Sideroxylon inerme* - *Aloe ferox* - *Euphorbia ledenii* shrubland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata. C - E from *Van Jaarsveld 9060*.



Distribution (Map 29.).

Eastern Cape and two localities in the Ciskei. Most of the localities are in the Port Elizabeth - Uitenhage area.

Habitat

Most of the populations occur on sandstone or shales of the Sondags River Formation from the Uitenhage Group (SACS 1980). A few populations occur on alluvial material from Cenozoic deposits just north- east of Port Elizabeth.

Soils found at the localities are either a brown, humusrich sandy loam or a grey, humusrich sandy soil.

L. concolor is associated with Acocks veld type 23 - Valley Bushveld (Acocks 1988). The vegetation consists mostly of closed evergreen *Dombeya cymosa* - *Dalbergia obovata* - *Euphorbia triangularis* woodland (Figure 65B). At Addo the populations occur in the shade of closed evergreen tall *Sideroxylon inerme* - *Azima tetraacantha* - *Scutia myrtina* shrubland. Plants grow in light to dense shade.

Population structure

Mostly small populations of between 20 - 50 individuals. The populations near East London consist of 150 - 300 individuals. Most of the young plants are those formed on the basal stems but seedling recruitment is also high. Most adult plants flower every season with approximately 60% fruit formation.

Variation

Some populations tend to have plants with dry bulb scales and attenuate apices showing the characteristic horizontal ridges, whereas populations in the Addo area tend to have bulb scales with the apices truncate. The leaves are mostly concolorous but a few individuals have been recorded as having dull dark green blotches on the adaxial surfaces.

Specimens examined

CAPE. - 3325 (Port Elizabeth): Glenconner (-AC), *Long 1320* (PRE); Port Elizabeth, farm Oudekraal (-BC), *Van Jaarsveld 9060* (NBG); Enon (-BC), *Thode A2779* (PRE); Gamtoos River Drift (-CC), *Fourcade 3625* (BOL); Addo (-DA), *Barker 5089* (NBG); Komachs (-DC), *Paterson s.n.* (BOL); Redhouse (-DC), *Paterson 2678* (GRA), *Paterson 4611* (BOL); *Paterson 2603* (GRA); Port Elizabeth (-DC), *Drège 138* (BOL); Zwartkops River (-DC), *Zeyher 4261* (BOL). - 3326 (Grahamstown): Bathurst, Kowie West (-DB), without collectors name (BOL). - 3327 (Peddie): East London (-BB), *Rattray s.n.* (BOL).

Subsectio **Longicollae** S. Venter, subsect. nov., bulbi collo longissimo, 7 - 15 x 5 - 10 mm.

Species typica: *L. crispa* S. Venter.

Species: *L. crispa* S. Venter, *L. undulata* (Jacq.) Jessop, *L. ovalifolia* (Schrad.) Jessop, *L. petiolata* (Van der Merwe) S. Venter, *L. socialis* (Bak.) Jessop, *L. macowanii* (Bak.) S. Venter.

26. *LEDEBOURIA CRISPA* S. Venter

Ledebouria crispa S. Venter, sp. nov., ab *L. undulata* (Jacq.) Jessop differt habitu synantho bulbis semi-epigaeis gregariis; foliis 2 - 3 mm latis; inflorescentia laxa; ovarii lobis basalis.

Type: Transvaal, Lebowa, Farm Majebees Kraal 1002 LS, Venter 11,202 (PRE!, holo.; UN!; UNIN!).

Plants gregarious. **Bulb** semi-epigeal to epigeal, 15 - 30 x 10 - 20 mm, ovoid to obovoid; dead bulb scales honey-brown, membranous, apices attenuate, live bulb scales fleshy, tightly arranged, without threads when torn, white inside, neck of bulb 5 - 10 x 4 - 5 mm, bulblets present, at bases of bulb-leaves. **Leaves** fully developed at anthesis, 4 - 6, spreading to erect, linear-lanceolate, 20 - 70 x 2 - 3 mm, without threads when torn, fleshy, dull glaucous green, without markings, venation obscure; margins undulate to crispate; leaf base canaliculate; apex acute. **Inflorescence** solitary, lax, cylindric, 20 - 30 x 13 - 15 mm, erect, 8 - 12-flowered, longer than the leaves; scape terete at base, green to purplish-brown, glabrous; rachis smooth, 40 - 50 mm long. **Bracts** membranous, 1.2 - 1.5 x 0.5 mm, linear-lanceolate, grey to white with bracteoles. **Pedicels** spreading, 2 - 4 mm long, pink speckled white. **Perianth** 3 - 3.5 mm long, tepals sharply reflexed, equal, oblong, 5 x 1.5 mm, apex acute, slightly cucullate, pink to purple with a dull green keel. **Stamens** erect, 3.0 - 3.5 mm long, filaments pink, epitepalous; anthers 0.5 mm long, mauve. **Ovary** depressed ovoid, 6-lobed, 2.5 x 3 mm, lobes obtusely deltate, apex tapering into the style, basal lobes present. **Style** 3.5 mm long, terete, glabrous, white; stigma equal height to the anthers; stipe 1 x 1 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 3.0 x 1.5 mm, surface strongly wrinkled, black. (Figure 66).

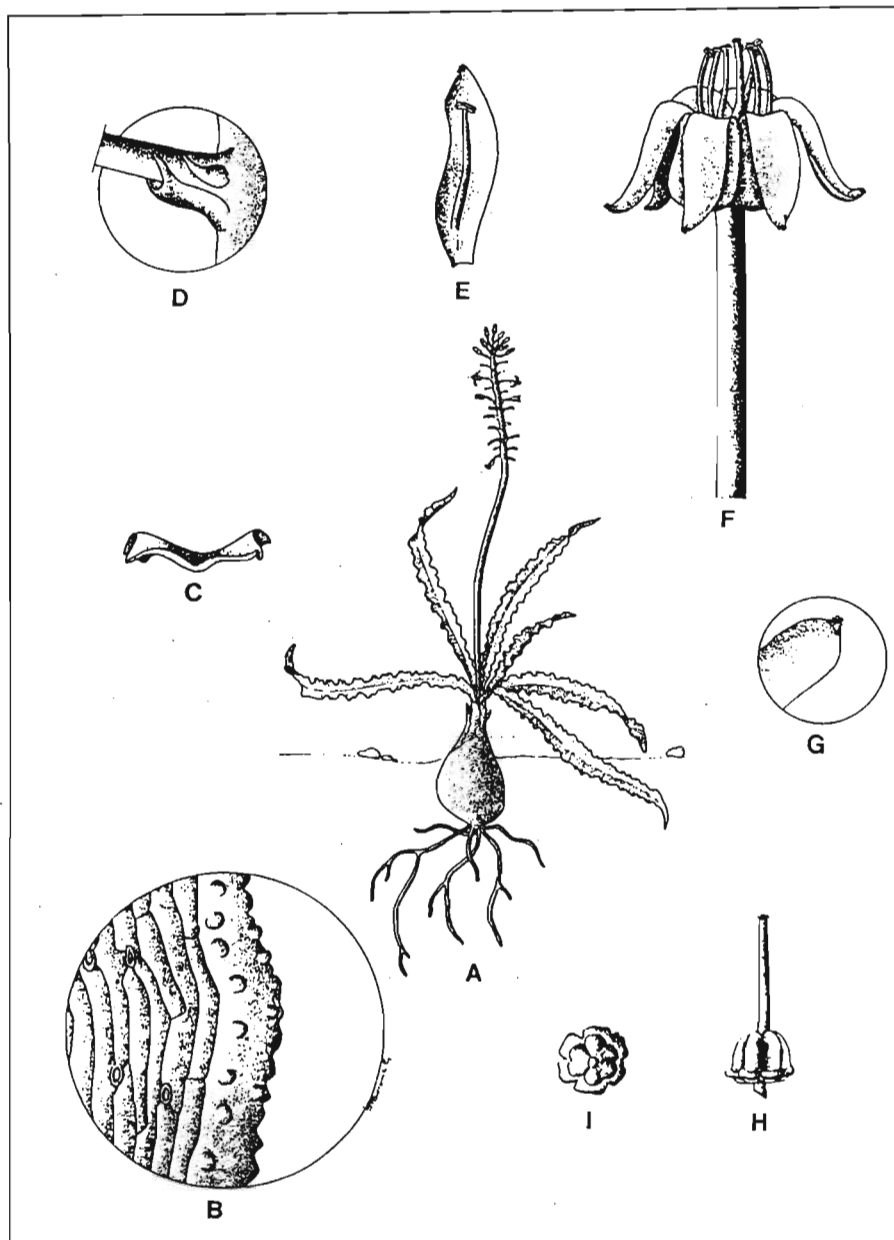


Figure 66. Illustration of *L. crista* S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5. D, bract with bracteole X 10; E, tepal with stamen X 10; F, flower X 10; G, apex of tepal X 10; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from *Venter 11,202*.

Map 30. Known distribution of *L. crista* S. Venter

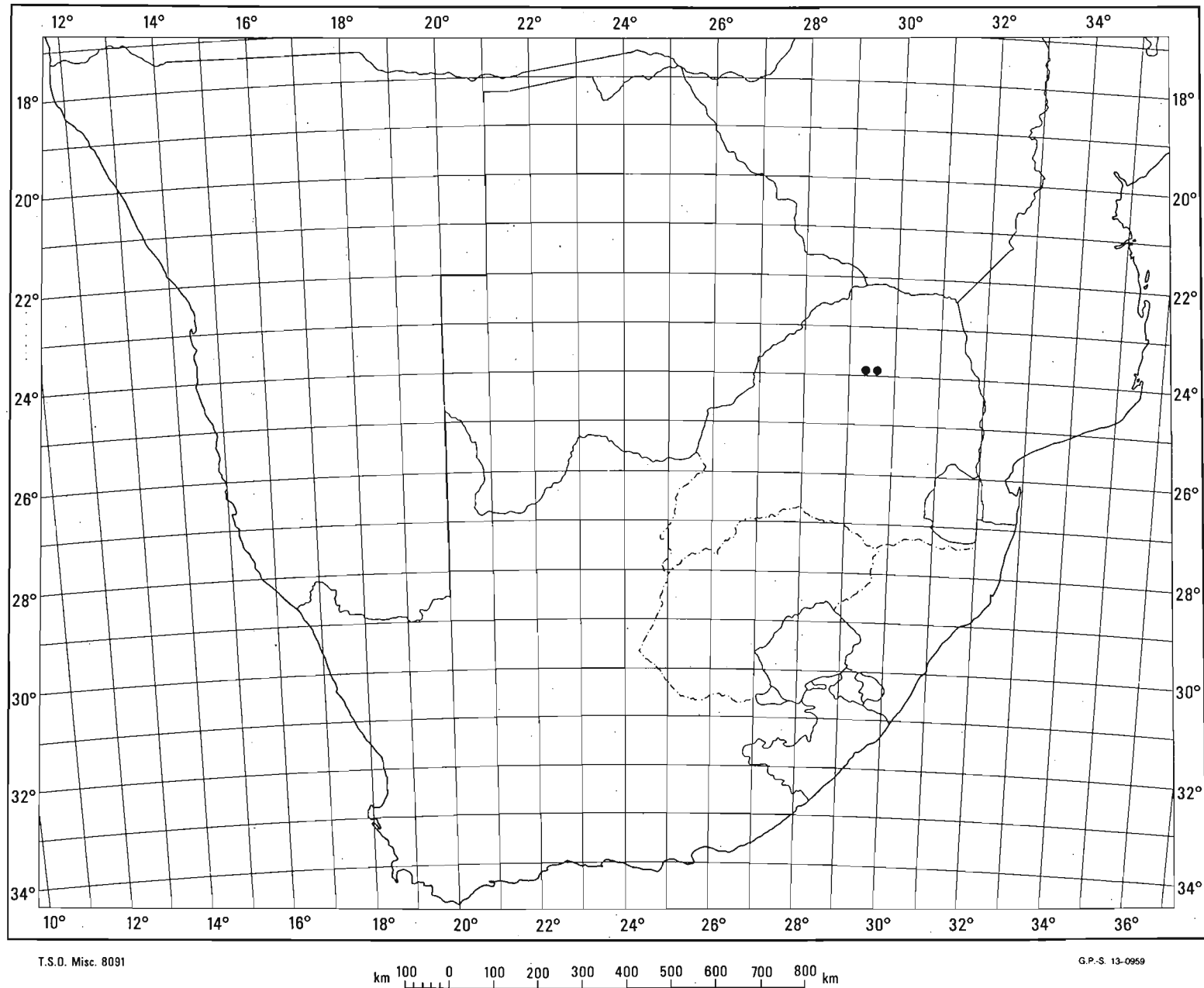
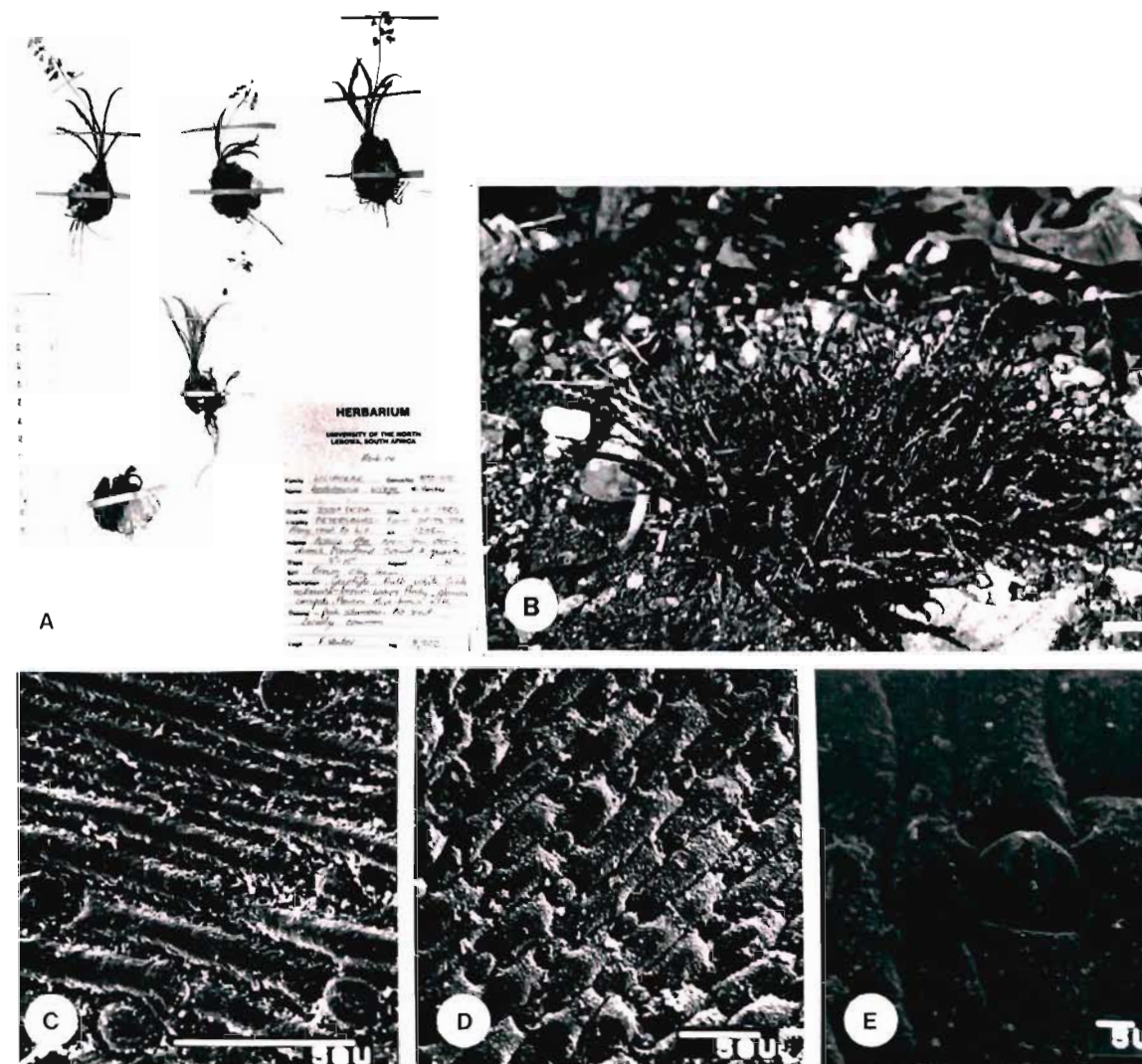


Figure 67. A, holotype of *L. crispa* S. Venter (PRE); B, colony of plants showing the typical colonial growth. Bar = 20 mm; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of a stoma. All from *Venter 11,202*.



L. crispa is closely related to *L. undulata* (Jacq.) Jessop but differs in having the bulb 15 - 25 mm long whereas with *L. undulata* the bulb can be 30 - 50 mm long. In *L. crispa* the leaf margin is always crisped and 2 - 3 mm wide whereas with *L. undulata* the leaf margin is only undulate and 8 - 20 mm wide and rather firmer in texture.

Specific epithet etymology.

Describes the lamina margin.

Flowering period

From October to December.

Distribution (Map 30).

Known only from around Pietersburg in the north-eastern Transvaal.

Habitat

L. crispa is restricted to the ultramaphic rocks (quartzitic schist and chlorite-talc schist) of the Mothiba Formation of the Pietersburg Group (SACS 1980). These rocks result in a series of low hills between Potgietersrust and Houtboschdorp. The soil at both cited localities is brown sandy loam lithosols of schist overlaid by white quartz. Some of the plants grow in rock cracks with very little soil but prefer to grow in the loose quartz rubble. At both localities *L. crispa* grows in full sun.

Plants grow in scattered groups of 5 - 20 plants (Figure 67B) or occasionally as individuals. Ten seeds from different plants were sown and kept under controlled conditions (Aridarium at the University of the North). Three seeds germinated after three weeks, six seeds after five weeks and one seed after eight weeks. All the seeds were $\pm$ the same age. This erratic germination was found to be common with all *Ledebouria* species.

Specimens examined

TRANSVAAL. - 2329 (Pietersburg): Pietersburg Game Reserve (-CD),
Venter 13,209a (PRE, UNIN); Lebowa, farm Majebeskraal 1002 LS (-DC),
Venter 11,202 (PRE, UN, UNIN).

27. *LEDEBOURIA UNDULATA* (Jacq.) Jessop

Ledebouria undulata (Jacq.) Jessop in Jl S. Afr. Bot. 36(4): 258 (1970).

Drimia undulata Jacq. in Icones Plantarum Rariorum 2(15): t.376 (1794).

Iconotype: Icones Plantarum Rariorum 2(15): t.376 (1794).

Scilla undulata (Jacq.) Bak. in Saund. Ref. Bot. 3(Append.): 11 (1870). Nom. illegit., non *S. undulata* Desf., 1798.

Scilla undulatifolia Von Poelln. in Ber. dt. Ges. 41: 209 (1944).

Type: As for *Drimia undulata* Jacq.

Plant solitary. **Bulb** hypogeal, 50 - 60 x 30 - 50 mm, ovoid; dead bulb scales light brown, membranous, apices truncate, live bulb scales fleshy, loosely arranged, without threads when torn, white inside, neck 10 - 20 x 10 - 20 mm. **Leaves** hysteranthous, 3 - 9, spreading, linear-lanceolate to lanceolate, 70 - 110 x 6 - 10 mm, without threads when torn, fleshy, glabrous, dull green to glaucous green, venation sometimes prominent; margins undulate; leaf base canaliculate; apex acute. **Inflorescence** solitary, dense, cylindric, 25 - 40 x 15 - 25 mm, erect, 20 - 30-flowered, shorter than the leaves; scape terete at base, green, glabrous; rachis ridged, 15 - 20 mm long. **Bracts** fleshy, 1 x 0.5 mm, linear to dentate, green to pinkish with bracteoles present. **Pedicels** spreading horizontally, 3 - 7 mm long, pink. **Perianth** 5 - 6 mm long, tepals recurved, equal, oblong, 5 - 6 x 1.0 - 1.5 mm, apex acute, thickly cucullate, pink with a brown keel. **Stamens** spreading, 4 mm long, filaments white, epitepalous; anthers 0.5 mm long, yellow. **Ovary** globose, 6-lobed, 1.5 x 2 mm, lobes narrowly transversely oblong, apex tapering into style. **Style** 5 mm long, triangular, glabrous, white; stigma above anthers; stipe 0.25 x 0.25 mm. **Capsule** three-lobed, symmetrical, globose, base truncate. **Seed** drop-shaped, 3 mm long, surface strongly wrinkled, brown. (Figure 68).

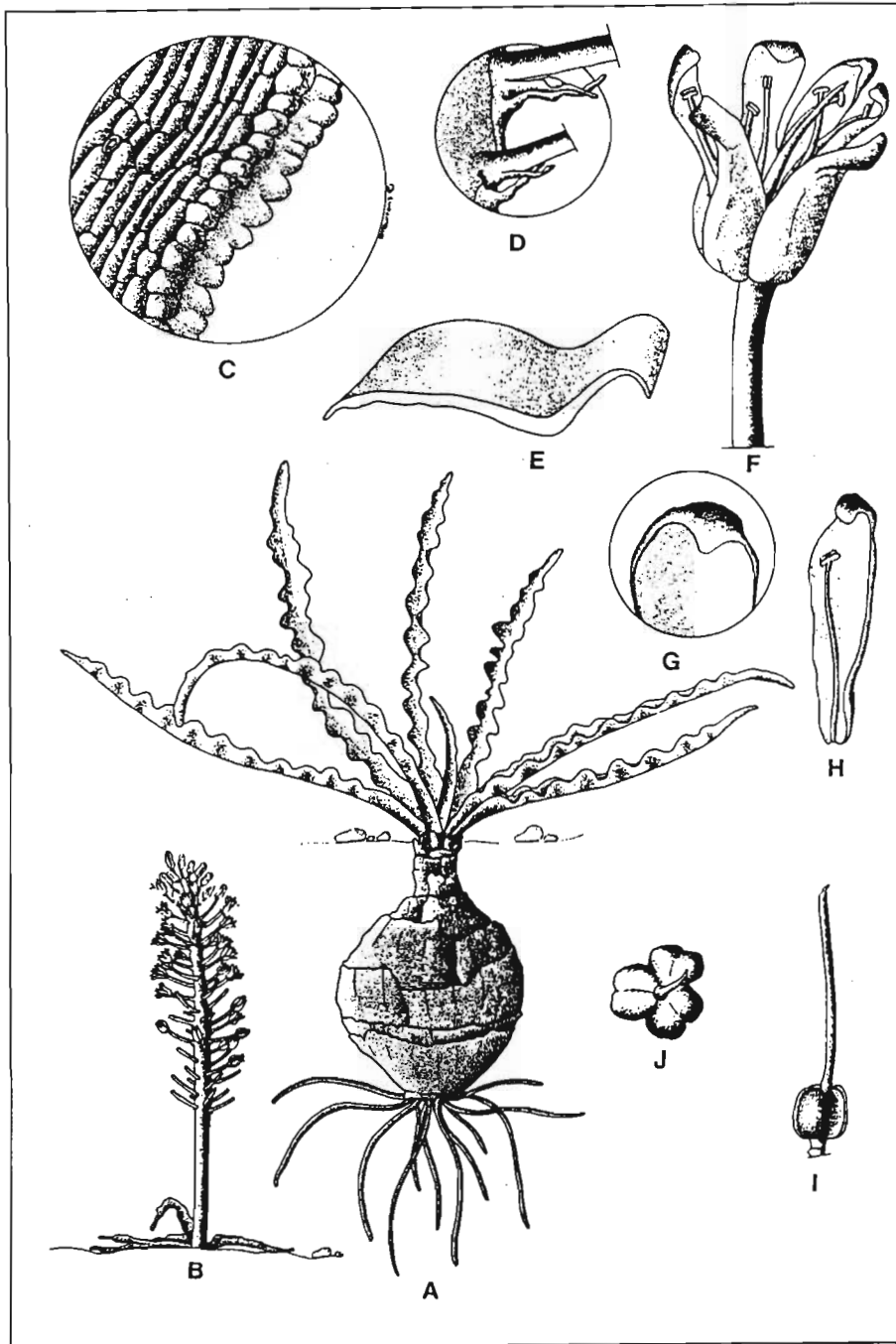


Figure 68. Illustration of *L. undulata* (Jacq.) Jessop. A, habit, leafing period X 1; B, habit, flowering period X 1; C, lamina margin X 300; D, bracts with bracteoles X 10; E, section through lamina X 4; F, flower X 10; G, apex of tepal X 20; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. A and C - J from Müller-Doblies 89129 and B from Hall 3200.

Map 31. Known distribution of *L. undulata* (Jacq.) Jessop

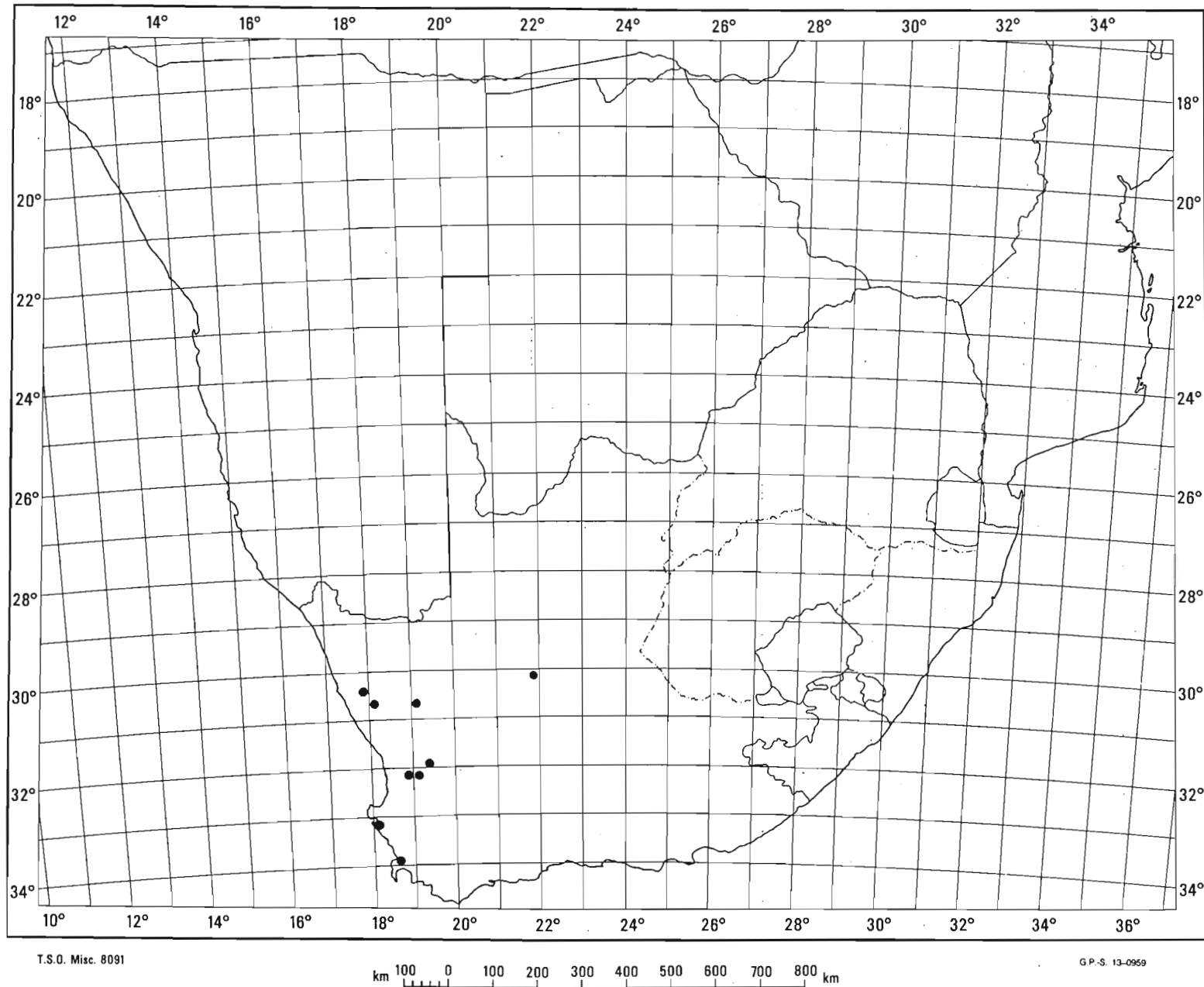
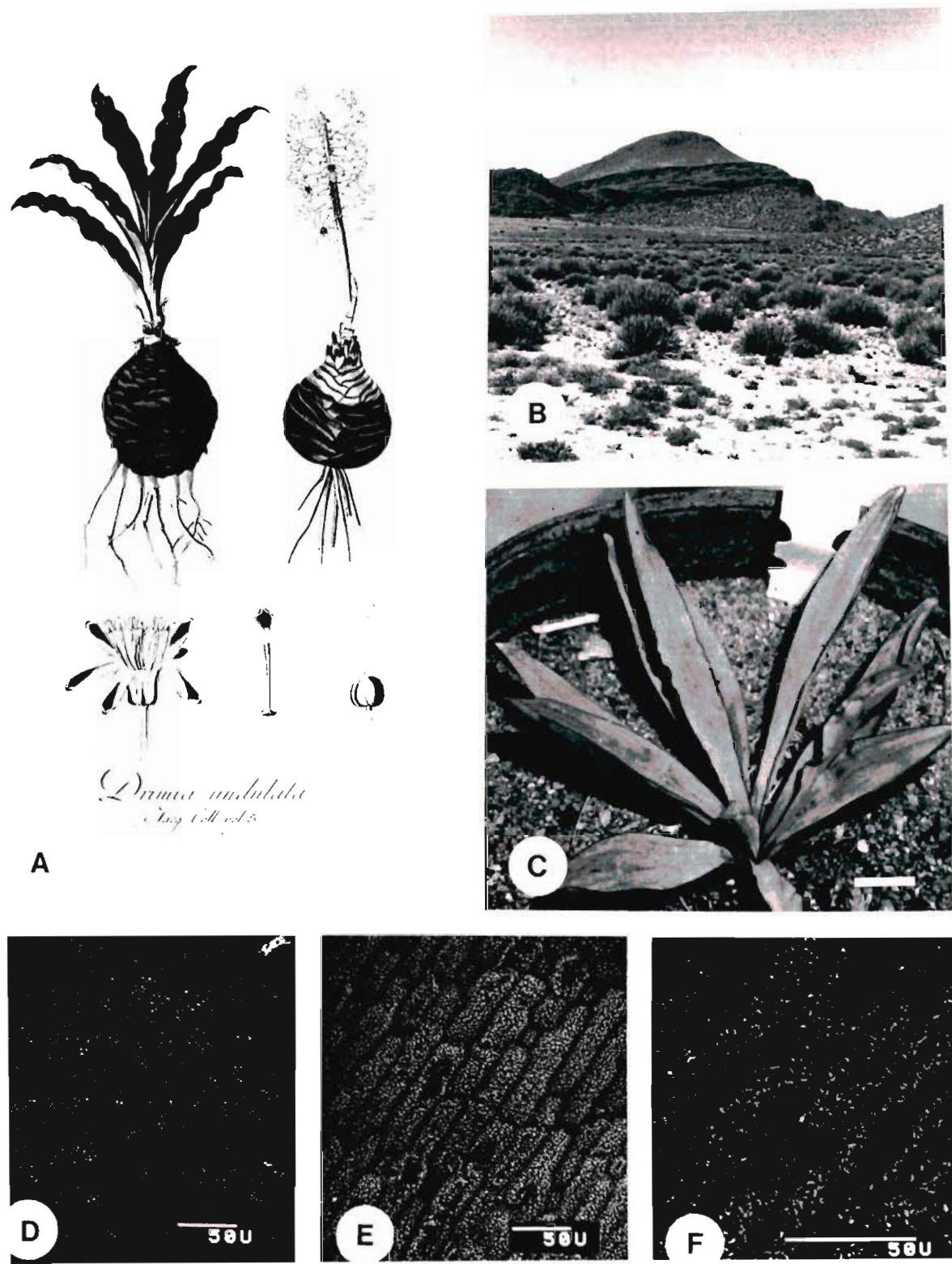


Figure 69. A, type of *L. undulata* (Jacq.) Jessop under *Drimia undulata* Jacq. in *Icones Plantarum Rariorum* 2: t.376 (1794); B, habitat on the Gamsberg Flats, Bushmenland. The vegetation consists of closed *Euphorbia mauritanica* - *Euclea undulata* shrubland; C, plant of *L. undulata* with semi-fleshy leaves and the inflorescence absent. Bar = 10 mm; D, SEM micrograph of the adaxial lamina surface; E, SEM micrograph of the abaxial lamina surface; F, SEM micrograph of stomata. C - F from *Müller-Doblies* 89129.



L. undulata is the only hysteranthous species of *Ledebouria*. In leaf it is easy to identify by the fleshy texture and dull green to glaucous colour.

L. undulata is closely related to *L. crispa* and belongs to the subsection *Longicollae*, section *Efiliferae*. It differs from *L. crispa* in having the bulb 50 - 60 mm long whereas with *L. crispa* the bulb is 15 - 30 mm long. In *L. undulata* the leaf margin is undulate with the lamina being 6 - 10 mm wide whereas with *L. crispa* the leaf margin is crispate and 2 - 3 mm wide and rather thinner in texture.

The absence of leaves at anthesis in *L. undulata* is the major difference between *L. undulata* and *L. crispa*.

Specific epithet etymology.

Describes the undulate lamina margin.

Flowering period

L. undulata flowers sporadically depending on rainfall. Most flowering herbarium specimens were collected between June and September.

Distribution (Map 31).

A Cape endemic.

Habitat

L. undulata occurs on well drained, medium grained (0.25 - 1.0 mm ϕ) to coarse grained (1 - 3 mm ϕ), shallow (10 - 50 mm deep) sandy soil derived from gneiss or granite. The vegetation is typical Namaqualand Broken Veld (Acocks 1988) (Figure 69B).

Around Clanwilliam populations occur on Ceres Formation sandstone of the Bokkeveld Group (SACS 1980). Soil derived from these rocks is well drained, medium grained (0.25 - 1.0 mm ϕ) and deep (120 - 320 mm). The vegetation is primarily succulent veld with a few woody shrubs in protected areas.

From Langebaan to the Olifants River on the west coast, *L. undulata* occurs on Kalahari Group sand on limestone. This consists of greyish-brown loose sandy material, varying in depth from 10 - 320 mm (Van der Merwe 1962). The vegetation consists mostly of woody shrubs with Restionaceae and smaller Fynbos elements in the open areas.

Variation

Plants growing in moist habitats tend to have thinner live bulb scales, leaves more fleshy and greener with a glossy surface lacking venation. Plants in xeric habitats have longer, semi-fleshy, dull glaucous green leaves with prominent venation and undulate margins.

Specimens examined

CAPE. - 2917 (Springbok): 2 km SE of Steinkopf (-BC), *Müller-Doblies 89129* (UNIN). - 3017 (Hondeklipbaai): Karkams (-BD), *Snijman 280* (NBG). - 3018 (Kamiesberg): Garies (-CA), *Leighton 2393* (BOL); *Compton 18,851* (NBG). - 3019 (Loeriesfontein): Near Kliprand (-CA), *Perry 1966* (NBG); - 3022 (Carnarvon): Carnarvon (-CC), *Steyner s.n.* (NBG). - 3119 (Calvinia): Clanwilliam, Botterkloof Pass (-CD), *Hall 3221* (NBG). - 3218 (Clanwilliam): Clanwilliam (-BB), *Leipoldt s.n.* (BOL); *Van der Merwe 19* (PRE). - 3219 (Wuppertal): Pakhuis Pass (-AA), *Compton 4,826* (BOL). - 3318 (Cape Town): Langebaan, Donkergat (-AA), *Hall 3,200* (PRE); Hopefield (-AB), *Bolus s.n.* (BOL); *Hall 3131* (NBG); Malmesbury (-DC), *Gillett 3639* (BOL).

Without precise locality

Little Namaqualand, *Zeyher 11* (BOL).

28. *LEDEBOURIA OVALIFOLIA* (Schrad.) Jessop

Ledebouria ovalifolia (Schrad.) Jessop in Jl S. Afr. Bot. 36(4): 246 (1970).

Drimia ovalifolia Schrad. in Blumenb. :28 (1827).

Iconotype: Lodd. Bot. Cab. 3: t.278, sub *Drimia lanceaefolia*, (1818).

Lachenalia reflexa Andr. in Bot. Rep. 5: t.299 (1803), nom. illegit., non Thunb.

Drimia lanceolata Schrad. in Blumenb. :28 (1827).

Iconotype: Andr. Bot. Rep. 5: t.299, sub *Lachenalia reflexa* Andr.(1803).

Drimia gawleri Schrad. in Blumenb. :30 (1827).

Iconotype: In (1811) Curtis's Bot. Mag. 33: t1380, sub *Drimia lanceaefolia* (ß), (1811).

Scilla lanceolata (Schrad.) Bak. in Saund. Ref. Bot. 3(Append.): 14 (1870).
nom. illegit., non Viviani (1830).

Scilla revoluta (L.f.) Bak. sensu Bak. in Flora Cap. 6: 485 (1896).

Scilla ovalifolia (Schrad.) C.A. Sm. in Kew Bull. :245 (1930).

Iconotype: Andrews Bot. Rep. 5: t.229 (1803).

Scilla doratophylla C.A. Sm. in Kew Bull. :245 (1930).

Type: As for *Drimia lanceolata* Schrad.

Scilla genadendalensis Von Poelln. in Port. Acta biol., ser.B, 1: 212 (1945).

Type: Cape, Genadendal, *Schlechter 10,327* (PRE!, lecto.; BOL!; Z!). The PRE specimen designated here as lectotype (Greuter *et al* 1988).

Plants solitary. **Bulbs** hypogeal, 10 - 20 x 10 - 15 mm, ovoid; dead bulb scales brown, membranous, apices attenuate, live bulb scales tightly arranged, without threads when torn, white inside, neck $\pm$ 5 mm long and wide. **Leaves** partly emerged at anthesis, 2 - 4, appressed to ground, sometimes spreading, oblanceolate, 30 - 50 x 20 - 30 mm, without threads when torn, fleshy, smooth or with short rows of papillae; dull green, abaxial surface purple, sometimes purple cross bars at base of lamina, venation obscure; margins finely papillate; leaf base canaliculate; apex obtuse. **Inflorescence** solitary, lax, elliptic, 15 - 30 x 15 - 20 mm, flaccid to erect, 4 - 12 -flowered, longer than leaves. **Peduncle** glabrous, terete at base, green, glabrous; rachis smooth, 30 - 50 mm long. **Bracts** semi-fleshy, 1 x 0.5 mm, deltoid, pink to purple without bracteoles. **Pedicels** spreading horizontally, 4 - 7 mm long, pink. **Perianth** 3.5 - 4.0 mm long, tepals recurved, equal, oblong, 3.5 - 4.0 x 1 mm, apex obtuse, pink to purple, keel dull green. **Stamens** erect, 2.5 - 3.0 mm long, base slightly flattened, swollen, maroon, epitepalous; anthers 1 mm long, violet. **Ovary** ovoid, 3 -lobed, 1.5 x 2 mm, lobes depressed ovate, apex shoulders raised. **Style** 2 mm long, terete, glabrous, purple; stigma above anthers; stipe 0.25 x 0.25 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 3 mm long, surface strongly wrinkled, brown. (Figure 70).

L. ovalifolia resembles *L. petiolata* (Van der Merwe) S. Venter but differs in the leaves partly emerged at anthesis, petiole not as well formed, solitary inflorescence, rachis smooth, no bracteoles and obtuse tepal apices. Together with *L. socialis* (Bak.) Jessop and *L. macowanii* (Bak.) S. Venter they constitute the subsection *Longicollae*.

Specific epithet etymology.

Describes the oval leaf shape.

Flowering period

From January to August with a peak from January to April.

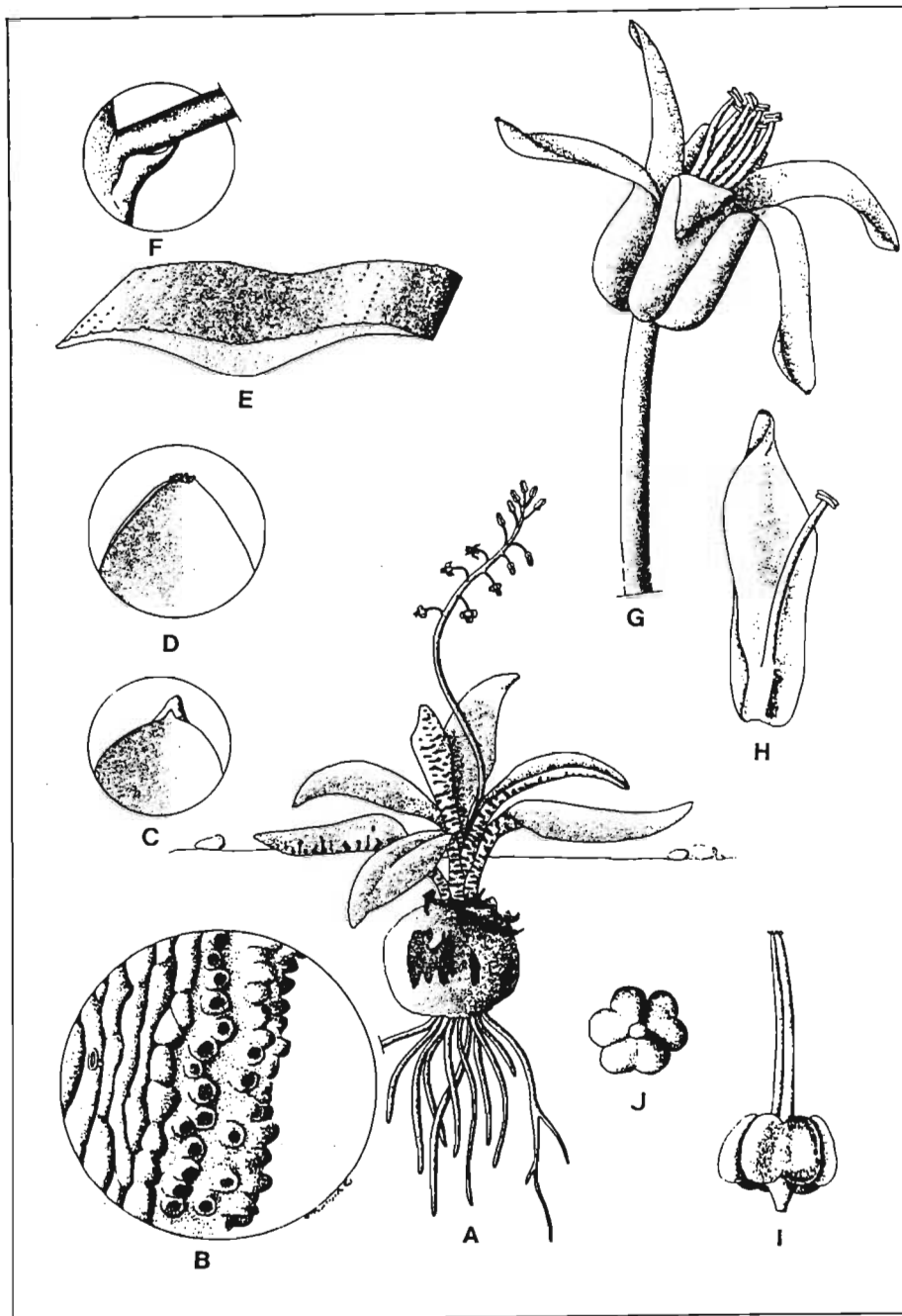
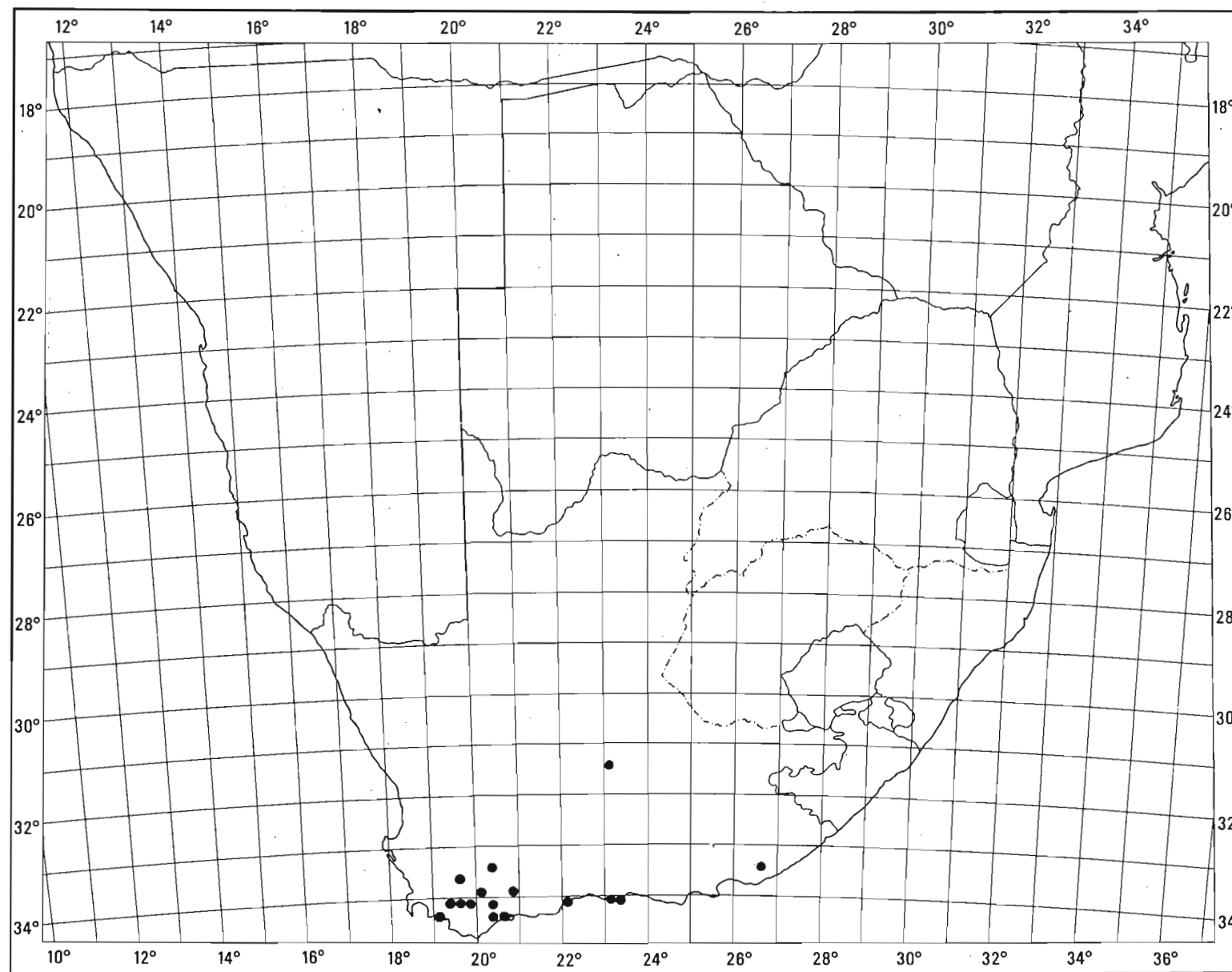


Figure 70. Illustration of *L. ovalifolia* (Schrad.) Jessop. A, habit X 1; B, lamina margin X 300; C, apex of lamina X 20; D, apex of tepal X 20; E, section through lamina X 5; F, bract X 10; G, flower X 10; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from *Venter 13,263*.

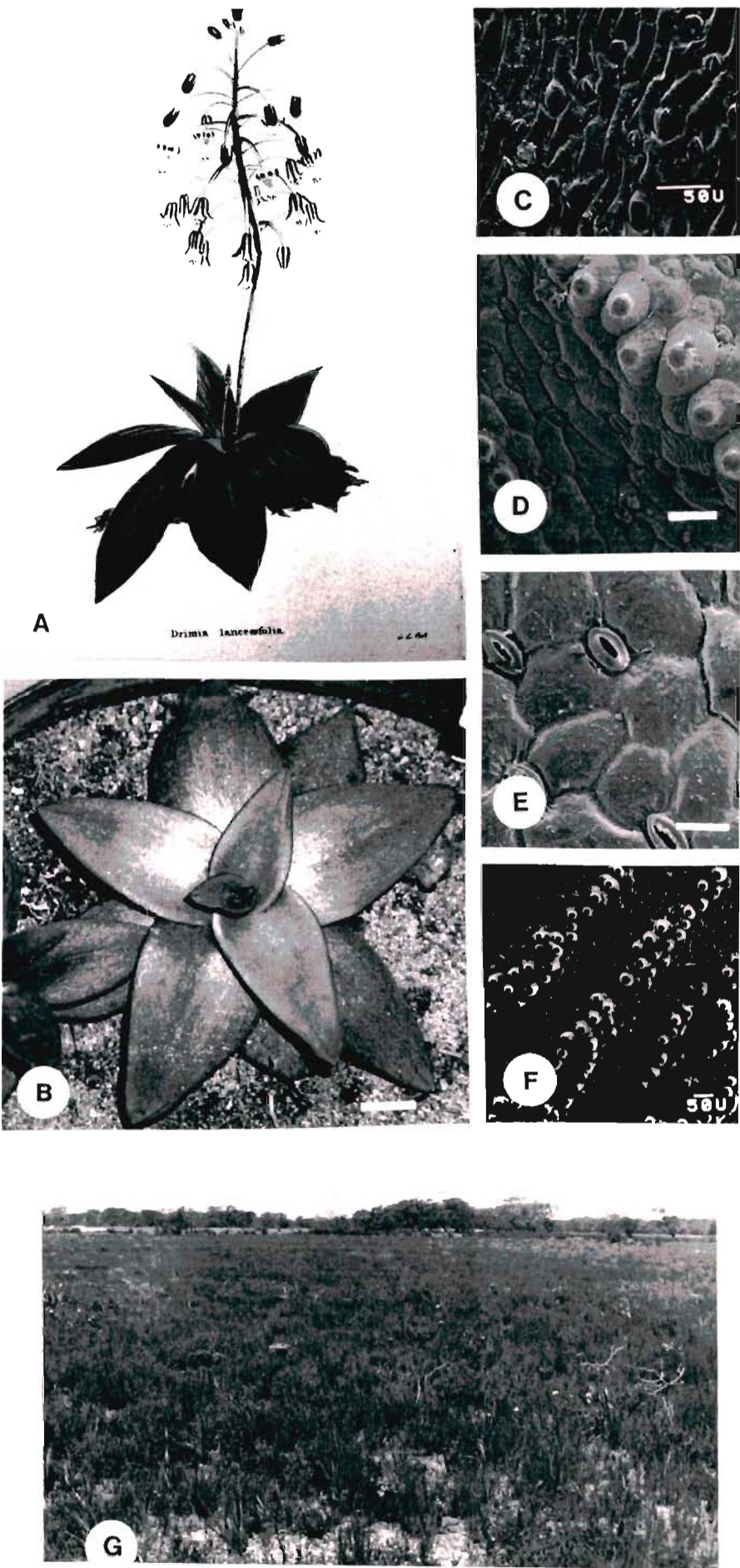
Map 32. Known distribution of *L. ovalifolia* (Schrad.) Jessop



T.S.O. Misc. 8091

G.P.S. 13-0959

Figure 71. A, type of *L. ovalifolia* (Schrad.) Jessop under *Drimia lanceaefolia* Lodd. in Loddiges Botanical Cabinet 3: t.278 (1818); B, plant of *L. ovalifolia* with flatly spreading leaves. Bar = 20 mm; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface. Bar = 50 μm ; E, SEM micrograph of stomata. Bar = 20 μm ; F, SEM micrograph of the parallel rows of papillae on the abaxial lamina surface; G, habitat at Baakens River, Port Elizabeth. The vegetation consists of *Protea* - *Watsonia* - *Leucospermum* Fynbos. B - F from Venter 13,263.



Distribution (Map 32).

Endemic to the Cape. Most localities are in the southern Cape with an isolated locality at Grahamstown.

Habitat

L. ovalifolia grows in open areas between shrubs and grass in Fynbos and shrubland in sandstone areas (Figure 71G). Soils are medium grained (0.25 - 1.0 mm ϕ), well drained acidic sandy soils. These soils are from 30 - 750 mm deep with the surface horizon containing grit, gravel and small pebbles consisting of white quartz fragments and fine iron oxide concretions (Van der Merwe 1962).

Variation

A few populations have plants with leaves larger and not appressed but slightly spreading, especially those in light shade. The purple or dark green stripes at the base of the lamina may be indistinct but are always present. The small papillae on the adaxial lamina surface are absent in some populations.

Specimens examined

CAPE. - 3319 (Worcester): Worcester, De Doorns (-DA), *Walters 1837* (NBG). - 3320 (Montagu): Bredasdorp, De Hoop (-AD), *Barker 8744* (NBG); The Baths (-CC), *Page s.n.* sub BOL 17,407 (BOL); Swellendam, between Lemoenshoek and Naauwkrantz (-DD), *Stokoe s.n.* sub NBG 99,678 (NBG). - 3322 (Oudtshoorn): George, Lancewood (-DD), *de Villiers s.n.* sub STE 17,034 (STE). - 3326 (Grahamstown): Mayor's Seat (-BC), *Daly 846* (GRA). - 3419 (Caledon): Caledon Hill (-AB), *Purcell 80 - 88* (NBG); Bot River Valley (-AC), *Guthrie 2321* (BOL); Between Onrust and Hawston (-AC), *Thomas s.n.* sub NBG 92,553 (NBG); Riviersonderend Mountains (-BA), *Lewis 2980* (NBG);

Genadendal (-BA), *Bolus & Gillett 880* (BOL); *Schlechter 10,327* (BOL); Near Lindeshof (-BB), *Esterhuysen s.n.* (BOL). - 3420 (Bredasdorp): Swellendam, 10 O' Clock Mountain (-AB), *Wurts 560* (NBG); De Hoop, Potberg Nature Reserve (-AD), *Burgers 1723* (STE); Swellendam, Potteberg (-BC), *Lewis 3224* (BOL). - 3422 (Mossel Bay): George, Great Brak River (-AA), *Fourcade 3878* (BOL). - 3423 (Knysna): Plettenberg Bay, Formosa (-AB), *Fourcade 597* (BOL); *Fourcade 1052* (BOL).

29. **LEDEBOURIA PETIOLATA** (Van der Merwe) S. Venter

Ledebouria petiolata (Van der Merwe) S. Venter comb.nov.

Scilla petiolata Van der Merwe in Flower. Pl. S. Afr. 21: t.832 (1941).

Type: Transvaal, North of Graskop, *Strydom s.n.* sub PRE 26,397 (PRE!, holo.; iso!).

Plants solitary. **Bulb** hypogeal, 10 - 30 x 10 - 15 mm, obovoid; dead bulb scales brown, membranous, apices attenuate, live bulb scales tightly arranged, with sparse threads when torn, white inside, neck 20 x 5 - 8 mm. **Leaves** fully developed at anthesis, 5 - 8, spreading, broadly lanceolate, 40 - 60 x 5 - 8 mm, without threads when torn, fleshy, dull green tinged with purple, or abaxial surface purple, immaculate, venation obscure; margins finely papillate and thickened; petiole up to 30 x 1 mm; apex acute. **Inflorescence** 1 - 2, lax, elliptic, 15 x 30 mm, flaccid, 15 - 20-flowered, longer than the leaves; scape terete at base, green, glabrous; rachis ridged, 70 - 100 mm long. **Bracts** fleshy, 0.5 x 0.5 mm, dentate, pink to purple with bracteoles. **Pedicels** spreading, 8 - 9 mm long, purple. **Perianth** 4 - 7 mm long, tepals recurved, equal, oblong, 5 x 1.5 - 2.0 mm, apex acute, thinly cucullate, bright pink with sometimes a green keel. **Stamens** erect, 4.5 mm long, filaments maroon, epitepalous; anthers 0.5 mm long, yellow. **Ovary** ovoid, 6-lobed, 1 x 2 mm, lobes obtusely deltate, apex tapering into style. **Style** 2.5 mm long, triangular, glabrous, purple above and white below; stigma equal height to anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, globose; base truncate. **Seed** drop-shaped, 2.5 mm long, strongly wrinkled, yellowish-brown. (Figure 72).

Cannot be confused with any other *Ledebouria* species. The long, thin petiole is unique.

Specific epithet etymology.

Describes the prominent petiole.

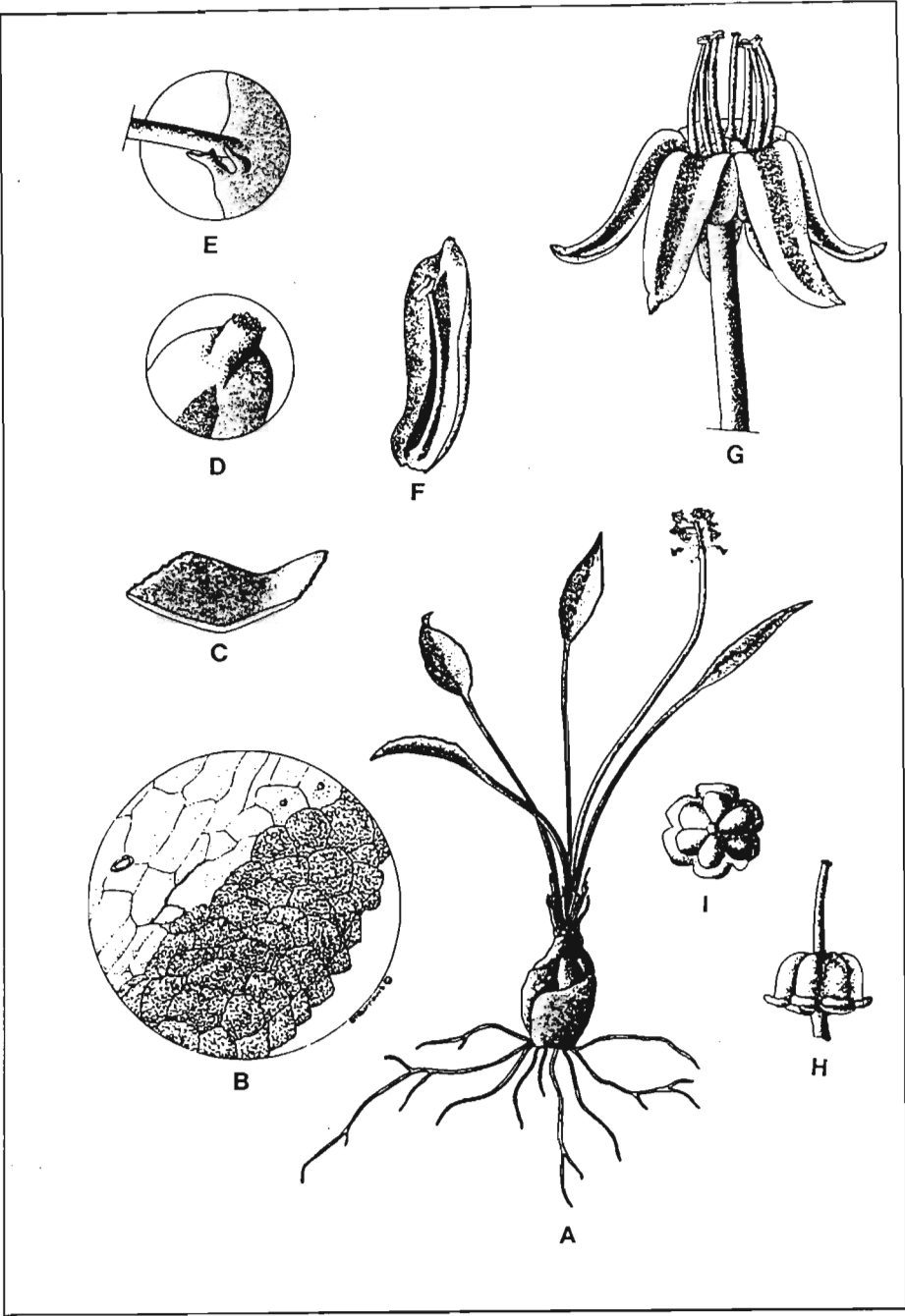


Figure 72. Illustration of *L. petiolata* (Van der Merwe) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, apex of tepal X 20; E, bract with bracteole X 10; F, tepal with stamen X 10; G, flower X 10; H, ovary lateral view X 10; I, ovary dorsal view X 10. All from *Middleton s.n.*.

Map 33. Known distribution of *L. petiolata* (Van der Merwe) S. Venter

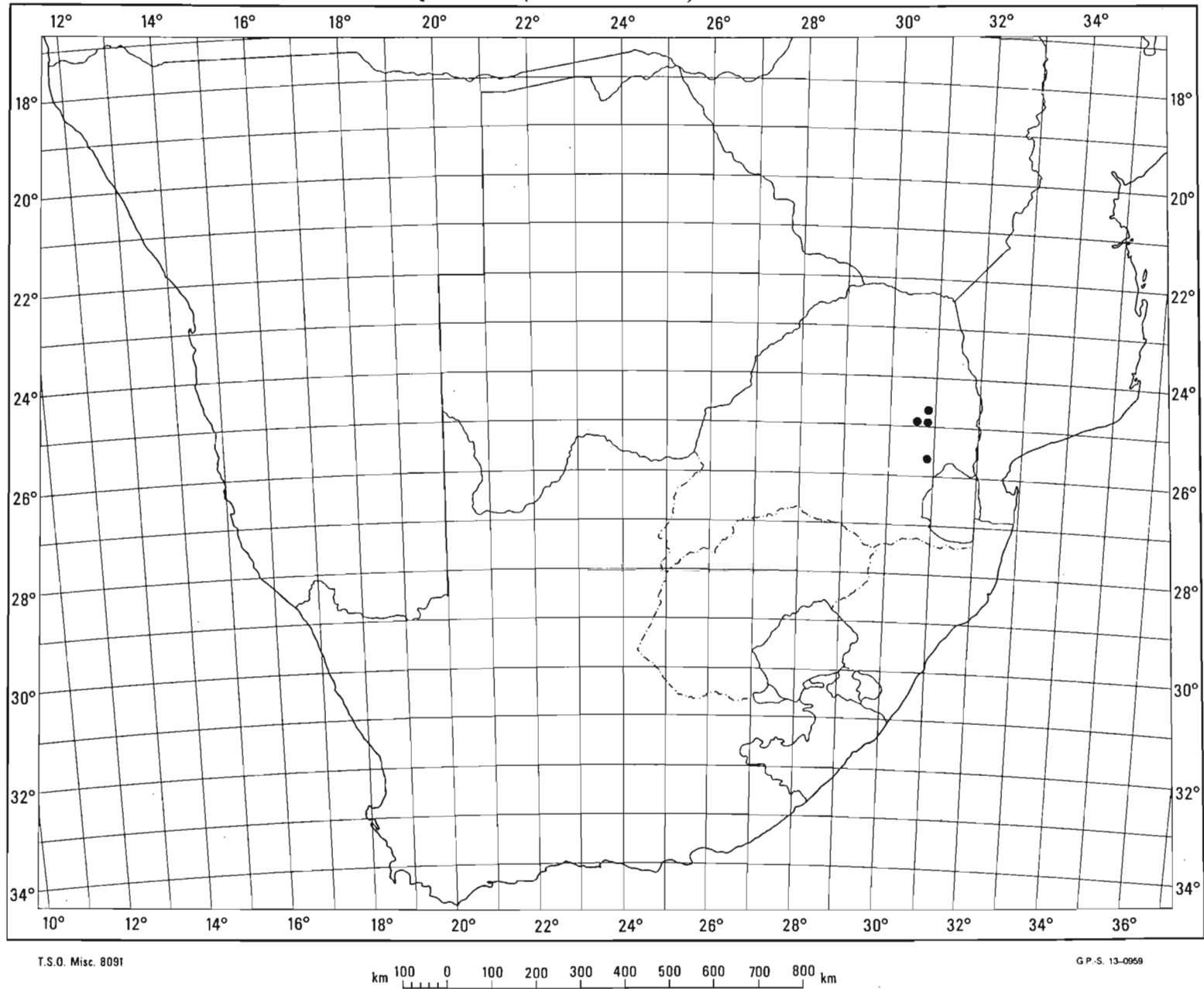
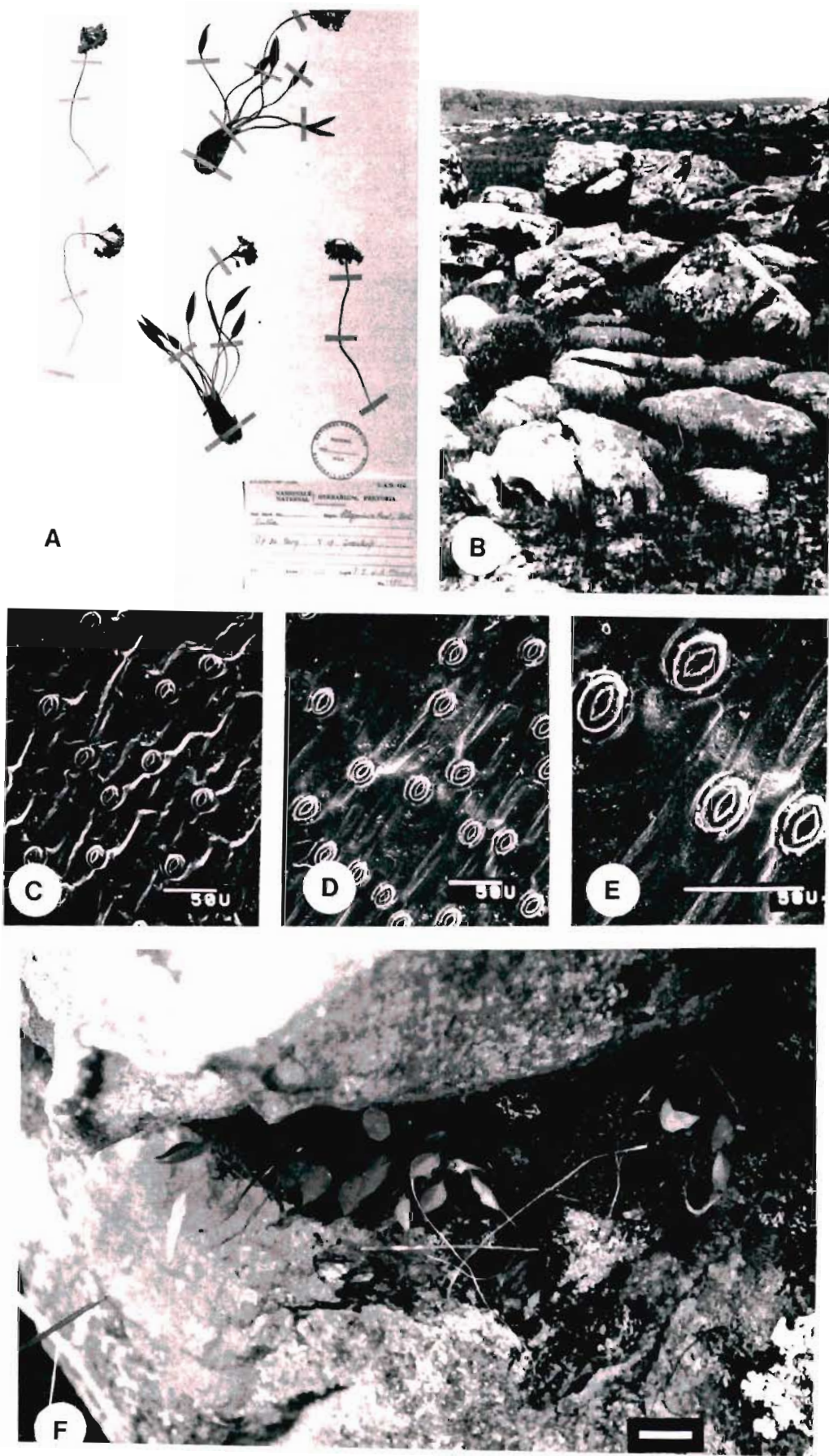


Figure 73. A, holotype of *L. petiolata* (Van der Merwe) S. Venter (PRE); B, habitat near Graskop. The vegetation consists of open short *Passerina montana* - *Ischyrolepis schoenoides* - *Panicum natalense* grassland. C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, plants of *L. petiolata* typically growing in moss filled rock cracks. Bar = 20 mm. C - F from Venter *s.n.*



Flowering period

From September to January with most flowering specimens collected during January.

Distribution (Map 33).

Known only from the Graskop and Kaapsche Hoop areas on the Transvaal Drakensberg Escarp.

Habitat

L. petiolata occurs on Black Reef Quartzite of the Wolkberg Group (SACS 1980). Soil derived from these rocks is shallow (10 - 50 mm deep), medium grained (0.25 - 1.0 mm ϕ) grey sandy soil. Plants grow mostly in rock cracks and shallow soil associated with the moss *Fissidens submarginatus* Bruch ex Krauss (Figure 73F). The vegetation is montane grassland with scattered *Aloe arborescence* Mill. and *Rhus tumulicola* S. Moore var. *tumulicola* shrubs (Figure 73B).

Variation

The main variation found in *L. petiolata* is in the colour of the abaxial lamina surface. This can either be green or purple depending on the exposure to sunlight.

Specimens examined

TRANSVAAL. - 2430 (Pilgrim's Rest): Bourke's Luck, De Berg (-DB), Van der Merwe 1591 (PRE); Belvedere (-DD), Davidson 483 (J); Pirow's Grave (-DD), Venter s.n. (UNIN); Graskop (-DD), Strydom s.n. sub PRE 26,397 (PRE).

30. *LEDEBOURIA SOCIALIS* (Bak.) Jessop

Ledebouria socialis (Bak.) Jessop in Jl S. Afr. Bot. 36(4): 253 (1970).

Scilla socialis Bak. in Saund. Ref. Bot. 3: t.180 (1870).

Type: Natal, without precise locality, *Cooper 3635* (K!, holo.; PRE!, photo.).

Scilla paucifolia Bak. in Saund. Ref. Bot. 3: t.181 (1870).

Iconotype: Saund. Ref. Bot. 3: t.181, "Cape, *Cooper s.n.*" 1870.

Scilla laxiflora Bak. in Gdnr's Chron. 9: 668 (1891).

Type: Hortus N.E. Brown, Kew. (K!, holo.; BOL!, drawing).

Scilla violacea Hutch. in Kew Bull. : 511 (1932).

Type: Cape, Uitenhage Div., Hankey, *Hutchinson & Long s.n.* (K!, holo.; BOL!; PRE!).

Ledebouria violacea (Hutch.) W.L. Tjaden in British Cactus and Succ. Journ. 7(1): 11 (1989).

Type: As for *Scilla violacea* Hutch.

Plants gregarious. **Bulb** epigeal, 40 - 50 x 30 - 36 mm, ovoid to obovoid; dead bulb scales brown to purple, membranous, apices attenuate, live bulb scales fleshy, tightly arranged, without threads when torn, white inside, neck of bulb 10 - 15 x 5 - 10 mm, bulblets on basal stem. **Leaves** fully emerged at anthesis, 3 - 4, spreading, oblanceolate, 50 - 75 x 20 - 25 mm, without threads when torn, fleshy, glossy, adaxial surface green to green with a silvery sheen, immaculate or with darker green to purple blotches, abaxial surface green to purple, venation obscure; margins smooth; leaf base canaliculate; apex acute. **Inflorescence** solitary, lax, cylindric, 30 - 50 x 20 - 30 mm, erect, 10 - 30-flowered, longer than leaves; scape terete at base, brownish to green; rachis smooth, 50 - 70 mm long. **Bracts** fleshy, 0.5 x 1 mm, deltoid, green without bracteoles. **Pedicels** spreading, 3 - 4 mm long, pink to green. **Perianth** 3.5 -

4.0 mm long, tepals recurved, equal, oblong, 3.5 - 4.0 x 1.5 - 2.0 mm, apex obtuse, lobes whitish green to pink with a green keel. **Stamens** erect, 3.5 - 4.0 mm long, filaments with upper part purple, white below, epitepalous; anther 0.5 mm long, yellow. **Ovary** ellipsoidal, 6 -lobed, 2 x 2.5 mm, lobes obtusely deltate, apex shoulders raised. **Style** 3 mm long, triangular, glabrous, purple above and white below; stigma above anthers; stipe 0.25 x 0.25 mm. **Capsule** three-lobed, globose; base truncate. **Seed** drop-shaped, 3 mm long, surface strongly wrinkled, black. (Figure 74).

L. socialis is closely related to *L. macowanii* (Bak.) S. Venter but differs in having epigeal bulbs. Both these species belong to the subsection *Longicollae*.

L. socialis is the only species with epigeal bulbs, an erect inflorescence and small flowers with strongly reflexed lobes.

Specific epithet etymology.

Describes the gregarial habit.

Flowering period

From July to December peaking from October to November.

Distribution (Map 34).

Endemic to the Cape Province. Most of the known localities are in the eastern Cape.

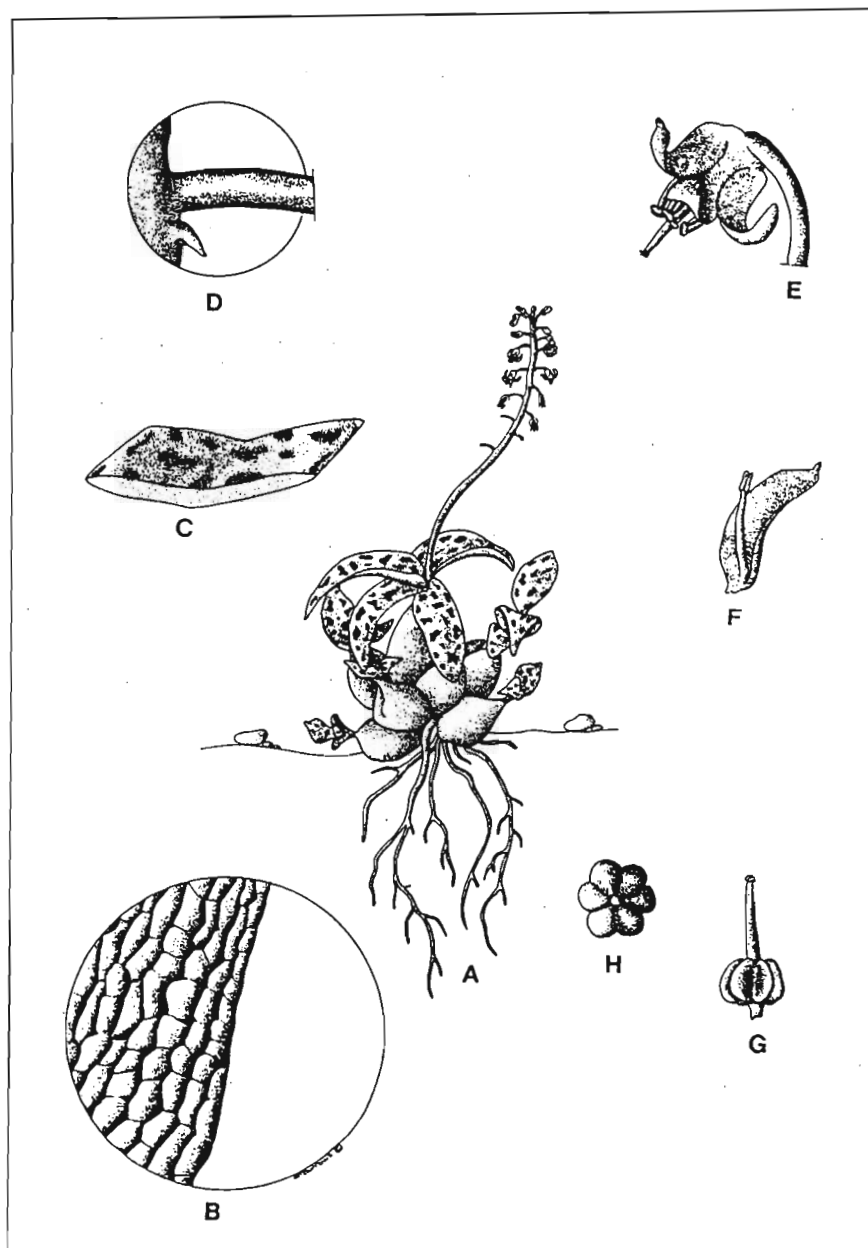


Figure 74. Illustration of *L. socialis* (Bak.) Jessop. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, bract X 10; E, flower X 10; F, tepal with stamen X 10; G, ovary lateral view X 10; H, ovary dorsal view X 10. All from *Venter 13,272*.

Map 34. Known distribution of *L. socialis* (Bak.) Jessop

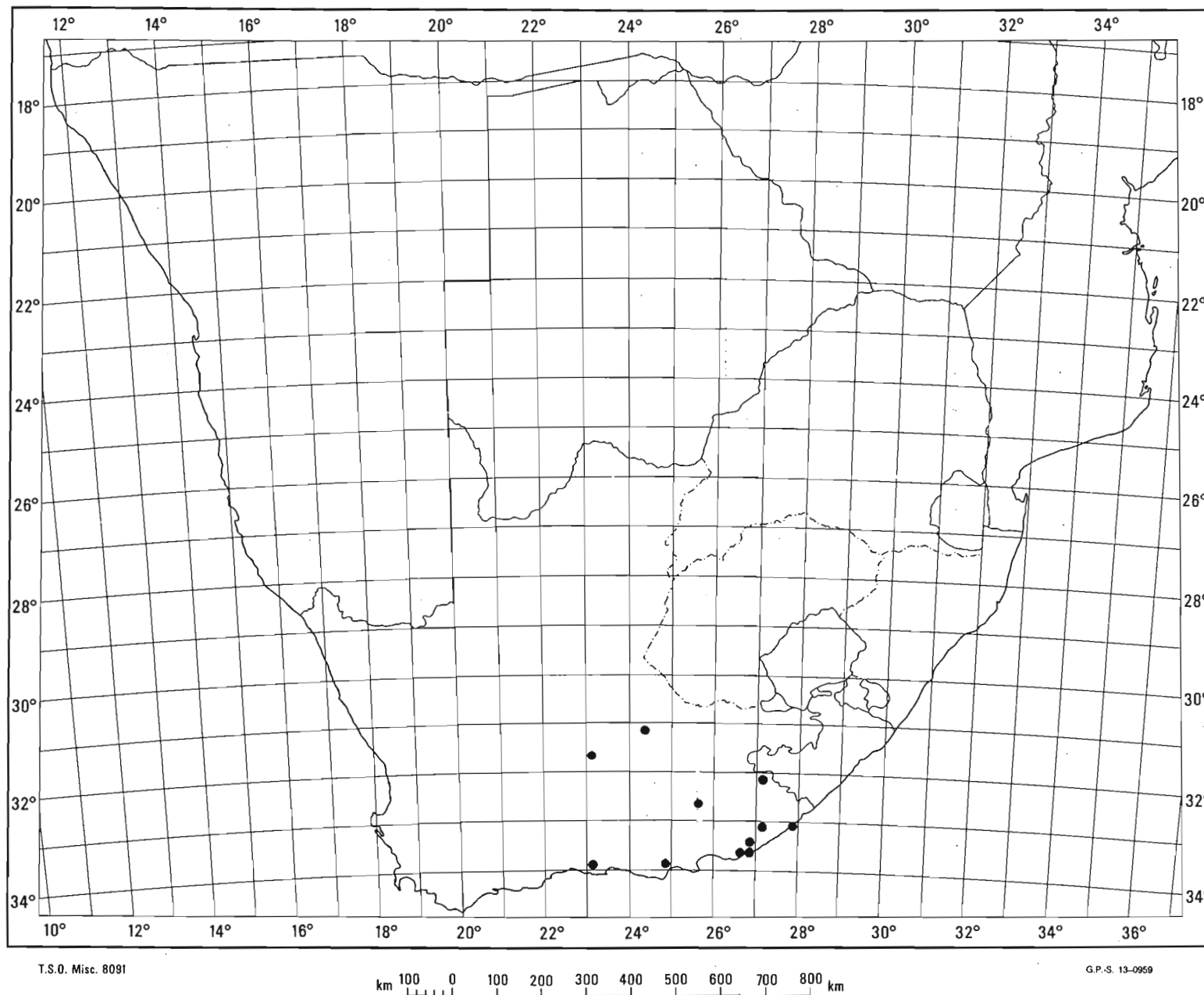
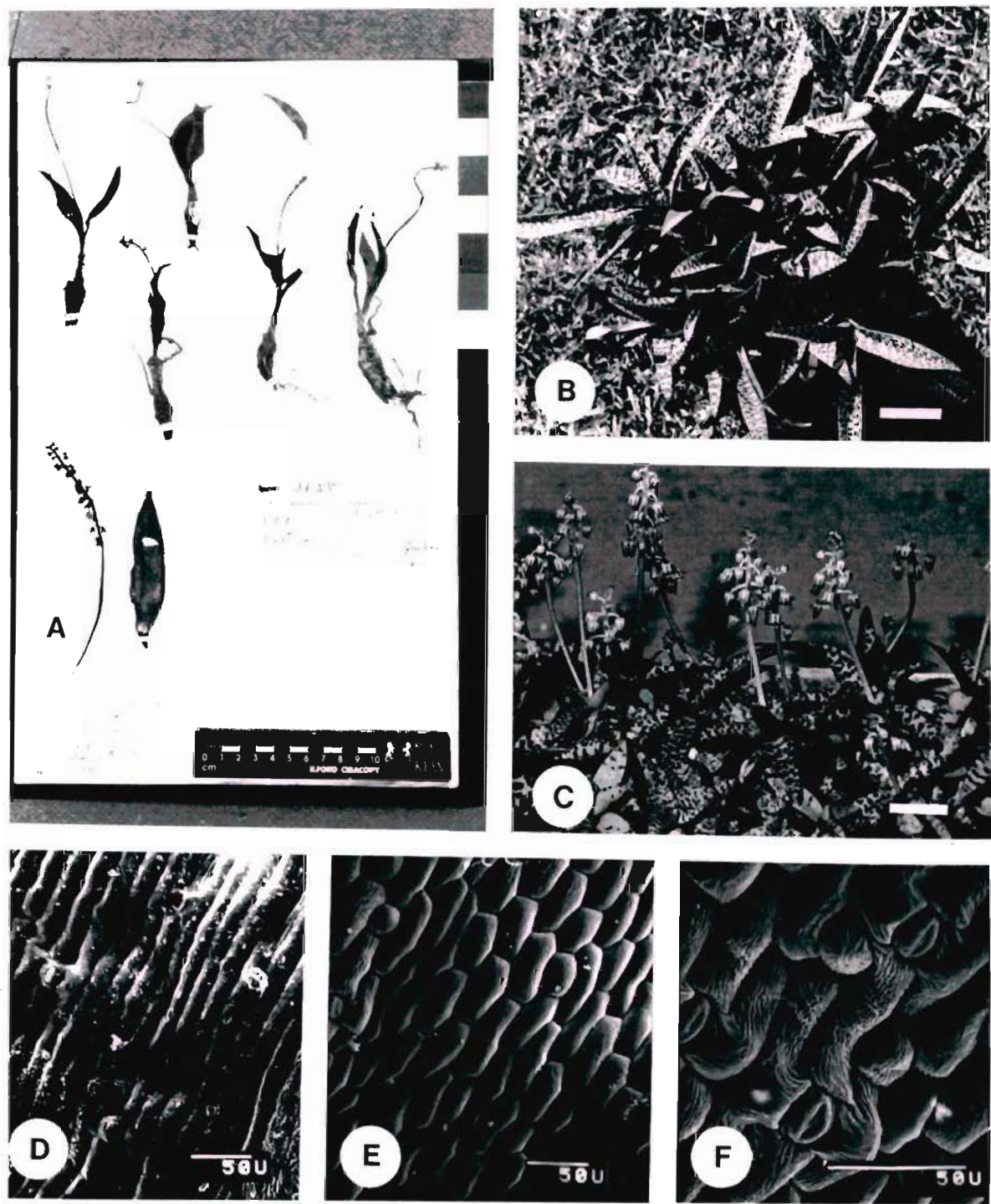


Figure 75. A, holotype of *L. socialis* (Bak.) Jessop (K); B, plant showing the gregarious habit. Plant growing in deep shade. Bar = 40 mm; C, plants showing the pendulous flowers. Bar = 20 mm; D, SEM micrograph of the adaxial lamina surface; E, SEM micrograph of the abaxial lamina surface; F, SEM micrograph of stomata. B - F from *Venter 13,272*.



Habitat

L. socialis occurs on sandstone in fine to medium grained (0.025 - 1.0 mm ϕ), shallow (10 - 24 mm) to deep (50 - 320 mm) well drained humusrich sandy soil.

It usually grows in shade mostly in closed evergreen woodland. A few populations occur in evergreen scrub forest. Sometimes a thick layer of litter covers the plants. Most of the localities are in Acocks veld type 23 - Valley Bushveld. The distribution of *L. socialis* correlates with river valleys.

Variation

Plants of *L. socialis* growing in full sun tend to be smaller with ovoid bulbs, short scapes and pink flowers with dull green tepal keels. The colour of the bulb scales varies from green to a deep purple.

The leaf colour variation has caused confusion since 1870 in horticultural circles. Plants in cultivation originated from collections made of green-leaved, mottle-leaved and silvery-leaved forms. The latter being the most popular. This resulted in Tjaden (1989) making the new combination *Ledebouria violacea* (Hutch.) W.L. Tjaden based on leaf colour only.

Historical background

Baker (1870a) in his description of *Scilla socialis* cites the locality as "Cape of Good Hope, discovered by Mr. Cooper", but on the type specimen the locality is given as Natal. It was described from a plant cultivated by Mr. Wilson Saunders at Reigate about 1870 (Baker 1896). The species has never been re-collected in Natal and Cooper's locality in Natal remains a mystery.

Specimens examined

CAPE. - 3123 (Victoria West): Victoria West (-CA), *Bolus s.n.* (NBG). - 3323 (Willowmore): Albany, Paardekraal (-CC), *Dyer 2156* (GRA). - 3324 (Steytlerville): Hankey (-DD), *Long s.n.* (BOL). - 3325 (Port Elizabeth): Addo (-DA), *Barker 4969* (NBG). - 3326 (Grahamstown): Fraser's Camp (-BD), *Barker 6986* (NBG); Blaauwkrantz (-BD), *Hilner 100* (GRA); Kariega River (-DA), *Van Wyk & Kok 5840* (PRE); Kowie (-DB), *Tyson 19,250* (PRE); Port Alfred (-DB), *Schönland 1554* (GRA). - 3327 (Peddie): Peddie (-AA), *Herre s.n.* (BOL); Line drift (-AA), *Leighton s.n.* (BOL); East London (-BB), *Rattray 234* (GRA); *Rattray s.n.* (BOL).

31. *LEDEBOURIA MACOWANII* (Bak.) S. Venter

Ledebouria macowanii (Bak.) S. Venter comb.nov.

Scilla macowanii Bak. in Gdnr's Chron. 3: 748 (1875).

Type: Cape, Somerset Division, Boschberg, *MacOwan 1841* (GRA!, lecto.; BOL!; PRE!, photo.; Z). Here designated as lectotype (Greuter *et al* 1988).

Scilla nelsonii Bak. in Flora Cap. 6: 488 (1896).

Type: Cape, Vaal River, *Nelson 167* (K!, holo.; PRE!).

Plants solitary. **Bulb** hypogeal, 15 - 30 x 15 - 30 mm, ovoid; dead bulb scales brown, membranous, apices attenuate, live bulb scales tightly arranged, without threads when torn, neck of bulb 5 x 10 mm, bulb white inside. **Leaves** fully developed at anthesis, 3 - 4, spreading, linear-lanceolate, 75 - 100 x 6 - 8 mm, without threads when torn, fleshy, dull green, abaxial surface green with occasional purple spots and blotches in lower third to half, venation obscure; margins smooth; leaf base canaliculate; apex obtuse to acute. **Inflorescences** 1 - 2, lax, cylindric, 25 - 60 x 17 - 25 mm, flaccid, 20 - 40 -flowered, as long to longer than the leaves; scape base terete, green spotted purple; rachis smooth, 40 - 100 mm long. **Bracts** fleshy, 0.5 x 0.5 mm, deltoid, green to pink without bracteoles. **Pedicels** spreading, 6 - 7 mm long, pink to purple. **Perianth** 4 mm long, stellate, tepals slightly recurved, equal, oblong, 4 x 1.5 mm, apex obtuse, green tinged pink. **Stamens** spreading, 3.8 mm long, filaments with upper part purple and white below, epitepalous; anthers 0.5 mm long, pale violet. **Ovary** globose, 6 -lobed, 1.5 x 2 mm, lobes obtusely deltate, apex shoulders raised. **Style** 1.8 - 2.0 mm long, triangular, glabrous, purple; stigma exceeding anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, clavate; base tapering. **Seed** drop-shaped, 3 - 4 mm long, surface strongly wrinkled, brown. (Figure 76).

L. macowanii is closely related to *L. socialis* with the bulbs hypogeal and not epigeal.

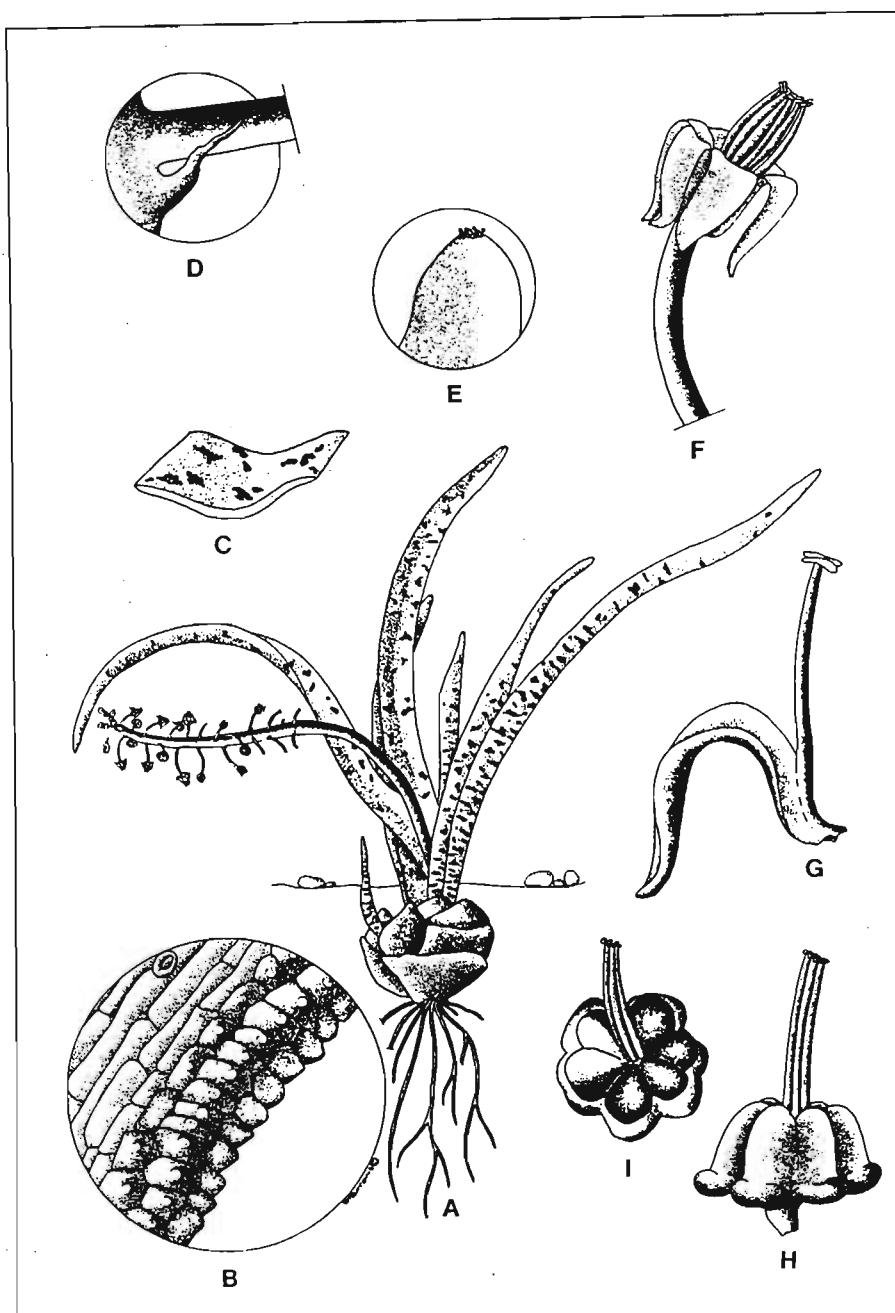


Figure 76. Illustration of *L. macowannii* (Bak.) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 2.5; D, bract X 10; E, apex of tepal X 10; F, flower X 5; G, tepal with stamen X 10; H, ovary lateral view X 10; I, ovary dosal view X 10. All from *Venter 13,413*.

Map 35. Known distribution of *L. macowannii* (Bak.) S. Venter

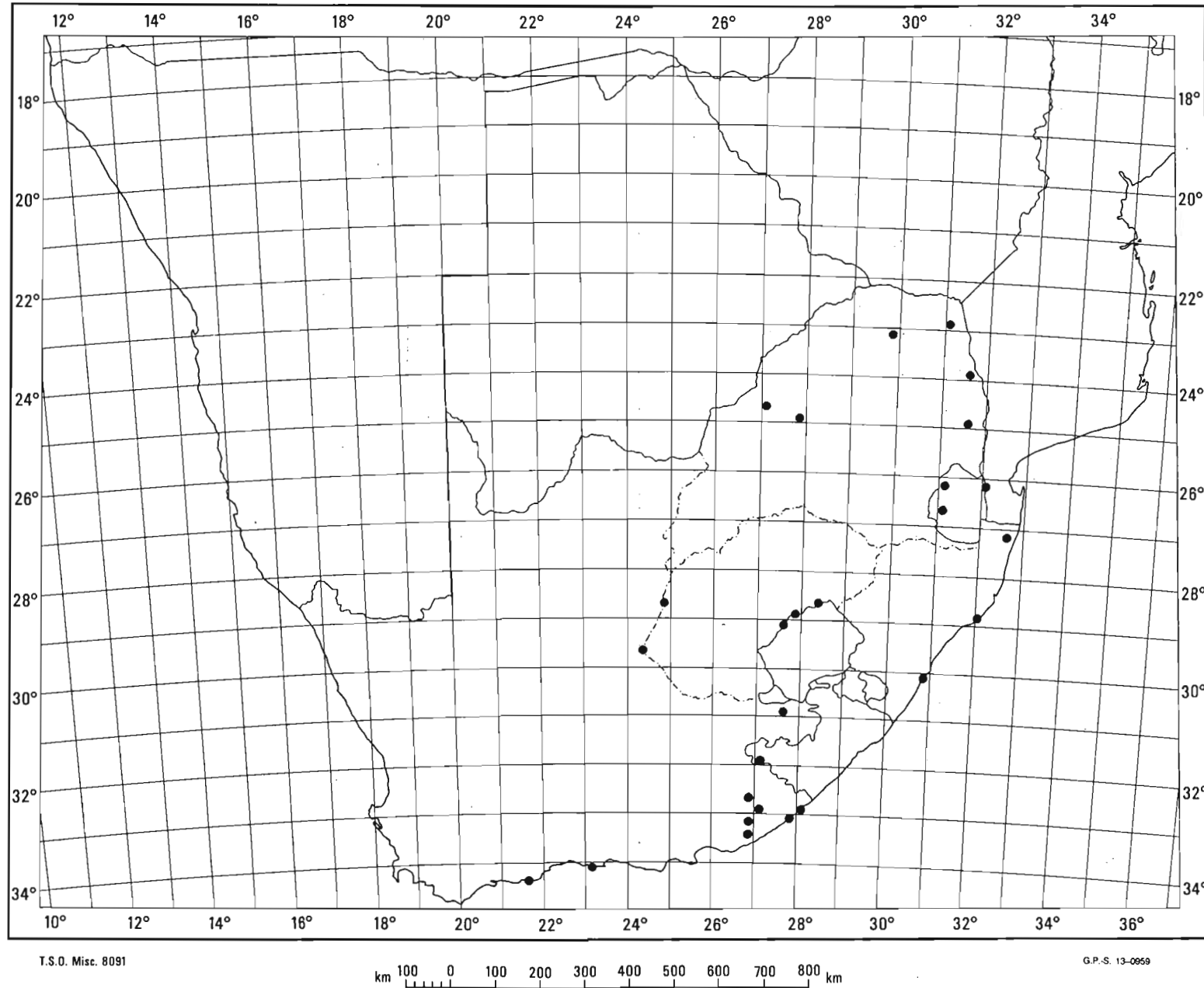
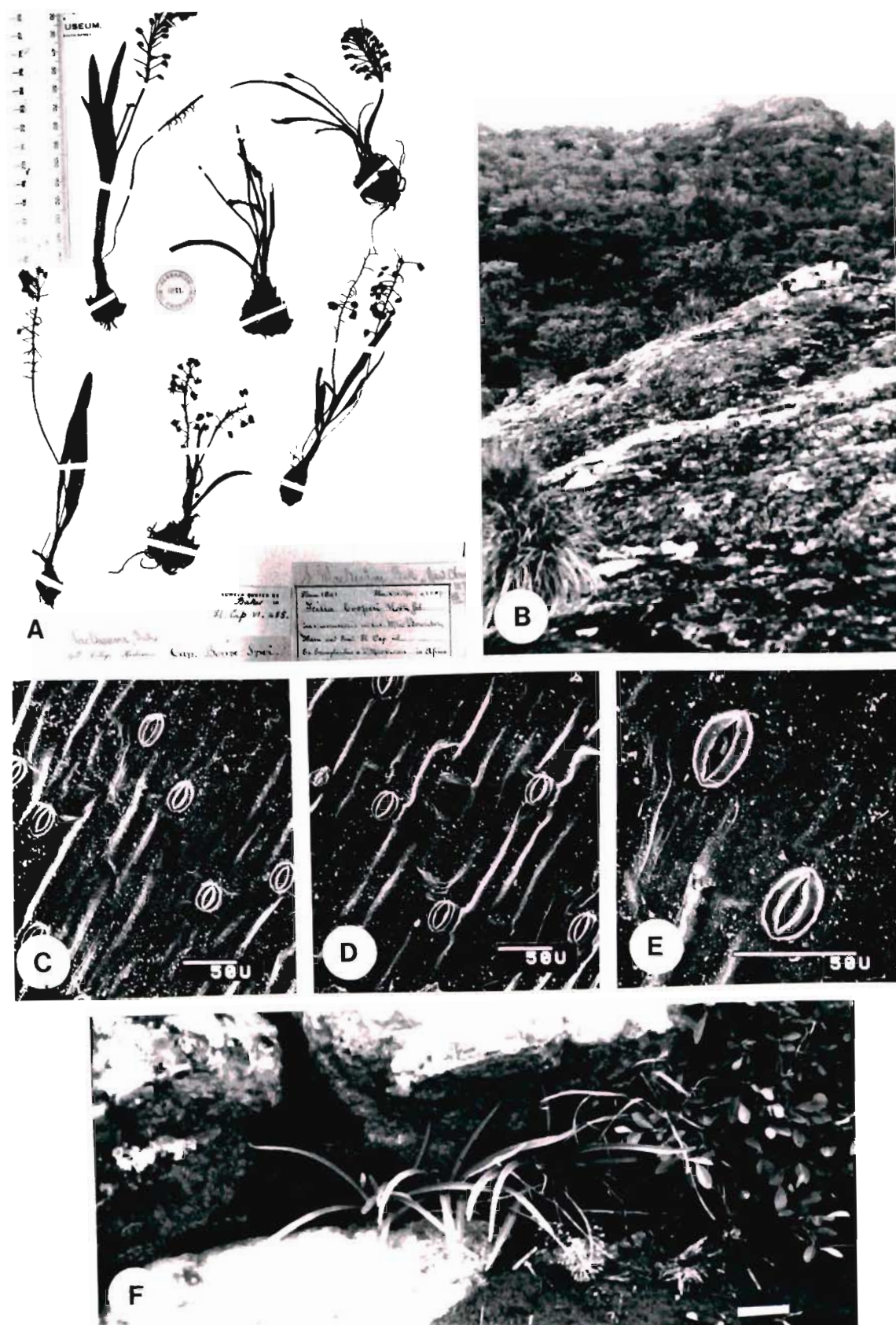


Figure 77. A, lectotype of *L. macowanii* (Bak.) S. Venter (GRA); B, habitat near Pafuri in the Kruger National Park. The vegetation consists of closed deciduous *Terminalia sericea* - *Hymenocardia ulmoides* - *Holarrhena pubescens* woodland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, plants of *L. macowanii* showing the lax racemes. Bar = 50 mm. C - F from Venter s.n..



Specific epithet etymology.

Commemorates Dr. P. MacOwan who collected the type material.

Flowering period

From October to March with a peak from November to December.

Distribution (Map 35).

Widely scattered throughout the eastern half of South Africa mostly in the Transvaal and eastern Cape. This species is mostly associated with mountains.

Habitat

L. macowanii occurs in shallow, 10 - 50 mm deep, humusrich sandy soil derived from quartzite, conglomerate or sandstone. In the western Transvaal, southern Cape and on the Natal Coast this species grows on damp cliff ledges in semi shade.

Variation.

Plants from dry lowland areas of Kimberley and the Kruger National Park tend to be small. The neck of the bulbs are usually above ground level except in some populations in the Waterberg (*Venter 13,413*). Plants from the Cape are prominently marked with purple, whereas the plants from the northern populations are immaculate.

Historical background

Jessop (1970) regarded *Scilla macowanii* as a synonym of *Ledebouria cooperi* without giving a reason. He also placed *Scilla nelsonii* as a synonym of *Ledebouria undulata* with a note that it may be nearer to *L. cooperi* than to *L. undulata*.

Specimens examined

TRANSVAAL. - 2231 (Pafuri): Punda Maria, Dzundwini Hill (-CC), *Codd & Dyer 4598* (KNP, PRE). - 2427 (Thabazimbi): Rooiberg (-DD), *Van der Merwe 2044* (PRE). - 2329 (Pietersburg): Louis Trichardt (-BB), *Koker 3* (PRE). - 2331 (Phalaborwa): Letaba Camp (-DC), *Codd 4675* (KNP). - 2431 (Acornhoek): Skukuza (-DC), *Codd & De Winter 5076* (PRE); Mabase (-DC), *Lang s.n.* (PRE). - 2527 (Rustenburg): Rustenburg (-CA), *Van der Merwe 1558* (PRE).

SWAZILAND. - 2631 (Mbabane): Komati Bridge (-AA), *Compton 29,391* (PRE); Usuthu Dam (-CA), *Compton 27,120* (PRE). - 2632 (Bela Vista): Mbuluzi Nature Reserve (-AA), *Culverwell 1389* (PRE).

ORANGE FREE STATE. - 2924 (Fauresmith): Fauresmith, farm Wanda (-CB), *Smook 3045* (PRE). - 2827 (Senekal): Senekal, farm Doornkop (DD), *Goossens 777* (PRE). - 2828 (Bethlehem): Clarence (-CB), *Van Hoepen 18,270* (PRE). - 2927 (Maseru): Clocolan, farm Hillcrest (-BA), *Crosby 420* (PRE).

NATAL. - 2732 (Ubombo): Phelendaba Crossing (-BA), *Germishuizen 3533* (PRE). - 2832 (Mtubatuba): Enseleni Nature Garden (-CC), *Venter 6115* (PRU).

TRANSKEI. - 3027 (Lady Grey): Herbert, Douglas (-DC), *Orpen 57* (BOL). - 3127 (Lady Frere): Glen Grey, Nzebanya Mountain (-CC), *Galpin 1914* (PRE).

CAPE. - 2824 (Kimberley): Riverton Pont (-DB), *Leistner 2016* (PRE).
- 3226 (Fort Beaufort): Katberg Mountain, above Seymour (-DB), *Bayliss 7442* (NBG). - 3227 (Stutterheim): Pirie (-CC), *Taylor 1760* (BOL); King Williams Town (-CD), *Sim 628* (NU); *Sim 1075* (BOL); *de Victoria 15* (BOL). - 3326 (Grahamstown): Blaauw Krantz (-BD), *Daly 1026* (BOL); Peddie, Committee's Drift (-BB), *Van der Merwe 2132* (PRE). - 3327 (Peddie): East London (-BB), *Wood 2817* (BOL); *Rattray s.n.* sub BOL 13,689 (BOL); *Pamphlett 77* (NBG). - 3228 (Butterworth): Kwenqura River (-CC), *Galpin 5814* (PRE). - 3421 (Riversdale): Riversdale (-AD), *Bohnen 7461* (STE); Still Bay (-AD), *Bolus s.n.* sub BOL 19,487 (BOL); *Ferguson s.n.* sub BOL 22,515 (BOL); Albertinia, Ystervarkpunt (-BC), *Willemse 107* (STE). - 3423 (Knysna): Knysna (-AA), *Breyer 23,711* (PRE).

Sectio **Paucifoliae** S. Venter, sect. nov., foliis numquam plus quam quatuor; cataphyllis duo vel tres; ovario depresso ovato.

Species typica: *Ledebouria galpinii* (Bak.) S. Venter.

Lectotypus: Transvaal, Kaapsche Hoop, *Galpin 672* (PRE).

Species: *L. galpinii* (Bak.) Jessop, *L. papillata* S. Venter.

Plants 30 - 70 mm tall. **Bulb** 8 - 25 mm wide; neck 3 - 7 mm long; basal stem present; cataphylls 1 - 3. **Leaves** 2 - 4, adaxial surface unspotted. **Inflorescence** rachis ridged; raceme 10 - 20 mm wide; bracts fleshy. **Tepal** segments slightly cucullate. **Ovary** depressed-ovate, 1.5 mm long. **Seed** 1.5 - 2.0 mm long.

Distribution and habitat.

Transvaal and the eastern Cape, in montane grassland and coastal shrubland.

32. *LEDEBOURIA GALPINII* (Bak.) S. Venter

Ledebouria galpinii (Bak.) S. Venter comb.nov.

Scilla galpinii Bak. in Flora Cap. 6: 487 (1896).

Type: Transvaal, summit of Devil's Kantoer, *Galpin 672* (PRE! lecto; BOL!; GRA!; NH!; PRE!, photo.; SAM!; Z). Designated here as lectotype (Greuter *et al.* 1988).

Plants sometimes solitary, usually gregarious. **Bulb** hypogeal, 20 - 30 x 20 - 25 mm, ovoid to subglobose; dead bulb scales brown, apices truncate, live bulb scales fleshy, loosely arranged, white with numerous purplish spots in upper part, with occasional threads when torn, neck 1 - 2 x 3 - 5 mm; bulblets on basal stem; cataphylls 1 - 3, exerted above ground level. **Leaves** fully developed at anthesis, 3 - 4, humifuse, oblong to ovate-spathulate, 50 - 80 x 20 - 25 mm, without threads when torn, thickly fleshy, glossy purple to purplish-green, adaxial surface distinctly lacunose, venation obscure; margins smooth; leaf base canaliculate; apex acuminate to mucronate. **Inflorescences** 1 -

3, dense, sub-globose, 10 - 20 x 10 - 20 mm, flaccid, 20 - 30 -flowered, as long or longer than the leaves, lengthening when in fruit; scape winged at base, purple; rachis ridged, 40 - 50 mm long. **Bracts** fleshy, 1 x 0.5 mm, linear-lanceolate, pink to purple with bracteoles present. **Pedicels** spreading, 3.0 - 4.2 mm long, purple. **Perianth** 4.0 - 4.2 mm long, stellate, tepals equal, oblong, 4 - 5 x 2 mm, apex obtuse, cucullate, pink to purple sometimes with a dull green keel. **Stamens** spreading, 3.8 - 4.0 mm long; filaments maroon, epitepalous; anthers 0.5 mm long, violet. **Ovary** globose, 3 -lobed, 1.5 x 1 mm, lobes obtusely depressed-ovate. **Style** 3 mm long, triangular, glabrous, purple; stigma equalling anthers; stipe 0.25 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base truncate. **Seed** drop-shaped, 1.5 - 2.0 mm long, surface strongly wrinkled, reddish-brown. (Figure 78).

This species is closely related to *L. papillata* but differs in having humifuse leaves with prominent corrugations (lacunae) on the adaxial surface (Figure 79B) and flaccid inflorescence.

Specific epithet etymology.

Commemorates E.E. Galpin who collected the type material.

Flowering period

From October to November.

Distribution (Map 36).

L. galpinii is known only from Kaapsche Hoop in the eastern Transvaal.

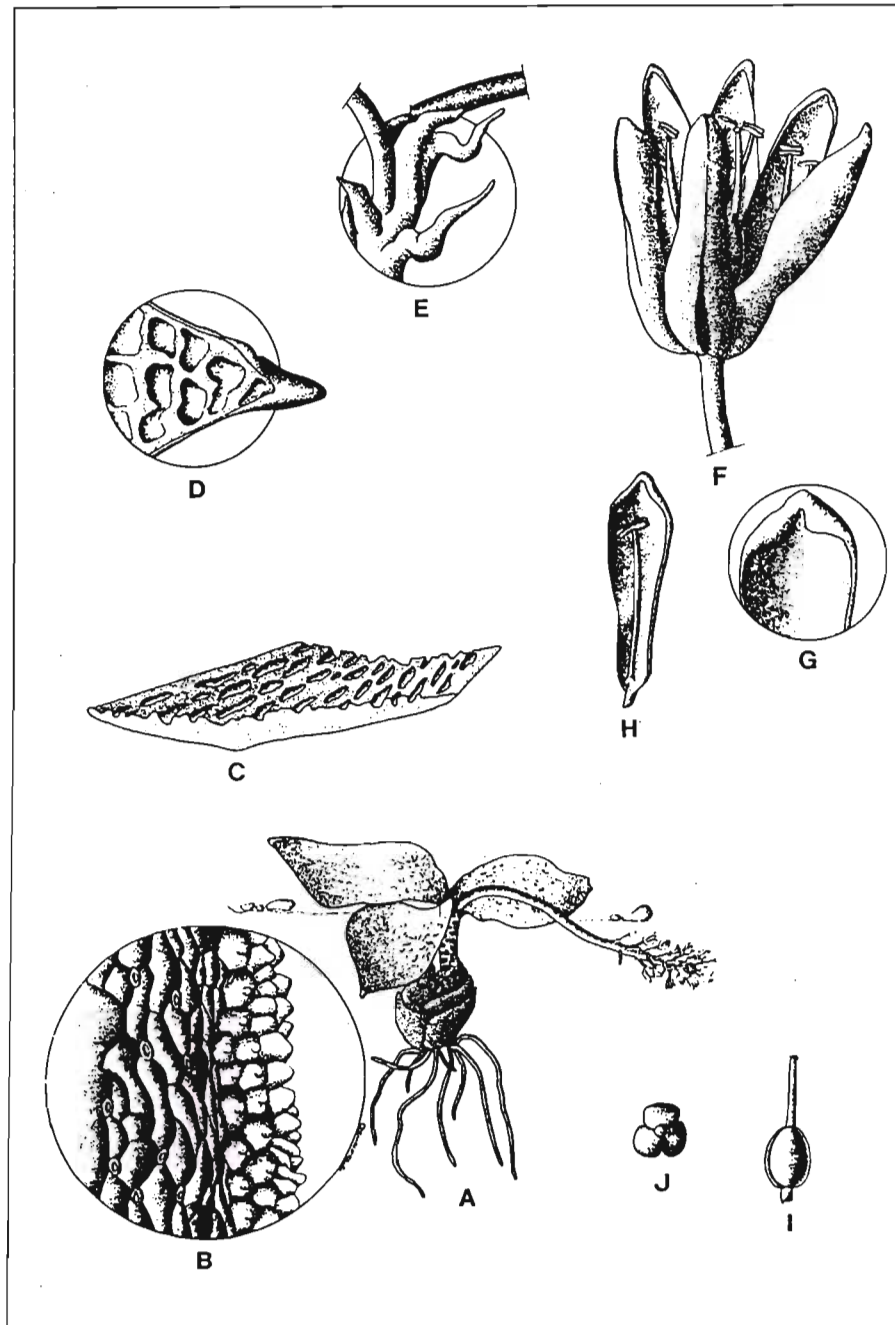
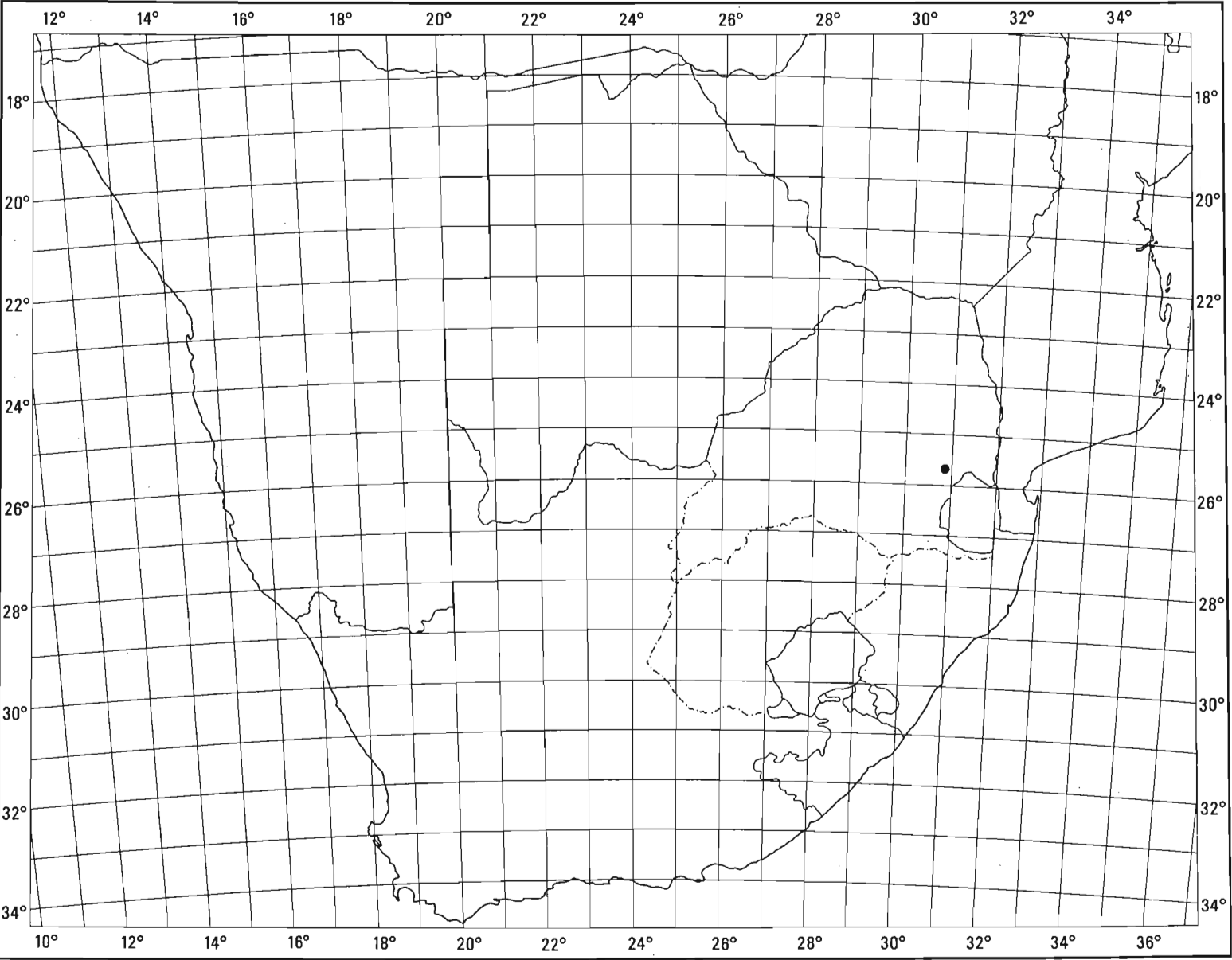


Figure 78. Illustration of *L. galpinii* (Bak.) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, apex of lamina X 20; E, bracts X 10; F, flower X 10; G, apex of tepal X 20; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from Venter 13,389.

Map 36. Known distribution of *L. galpinii* (Bak.) S. Venter

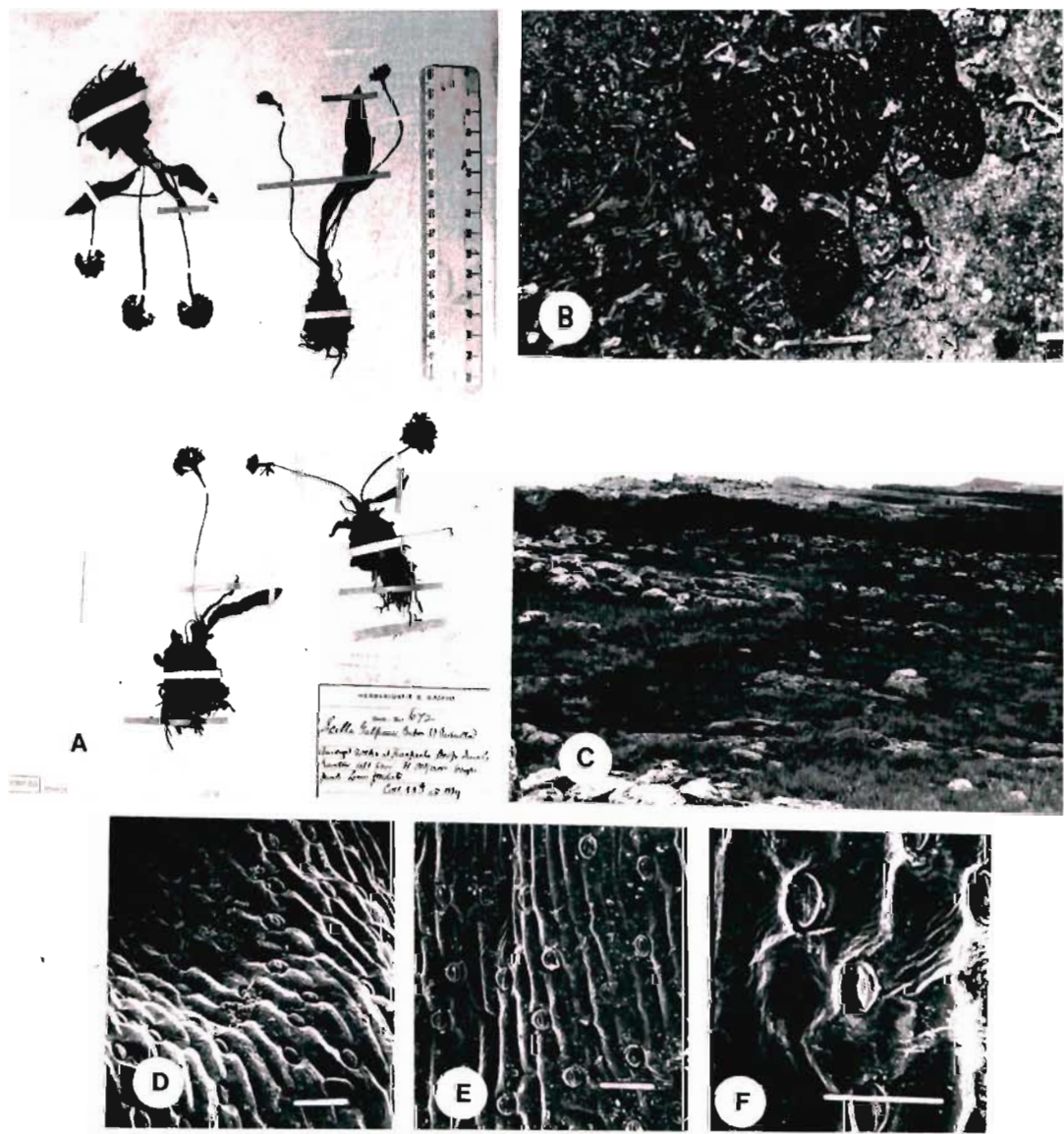


T.S.O. Misc. 8091

km 100 0 100 200 300 400 500 600 700 800 km

G.P.-S. 13-0959

Figure 79. A, lectotype of *L. galpinii* (Bak.) S. Venter (PRE); B, plants with prominent lacunae on the leaves. Bar = 10 mm; C, habitat at Kaapsche Hoop, eastern Transvaal. The vegetation consists of closed short *Panicum natalense* - *Eragrostis racemosa* - *Scabiosa columbaria* montane grassland; D, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; F, SEM micrograph of stomata. Bar = 50 μ m. B and D - F from Venter 13,389.



Habitat

Kaapsche Hoop is situated on quartzites and conglomerates of the Black Reef Quartzite Formation of the Wolkberg Group (SACS 1980). Soil derived from these quartzites is a shallow grey sandy soil with the grains 0,25 - 1.0 mm diameter. Wherever *L. galpinii* occurs, the soil has a high humus content.

L. galpinii grows in protected soil pockets between and in openings under stones and boulders. It grows in association with various moss species and *Streptocarpus galpinii* J.D. Hooker (Hilliard & Burt 1971). Plants receive direct sunlight in the mornings and are frequently subjected to mist (Figure 79C).

Population structure

The 19 populations surveyed extend over $\pm 1\text{km}^2$ and usually number 5 - 20 individuals but one population that occurs in a vleis consists of 1000+ individuals.

Variation

Plants growing in dense shade tend to have long, green leaves which are not appressed to the ground. Plants have pure pink to purple flowers and shaded individuals develop a prominent dull green keel on the tepals.

Specimens examined

TRANSVAAL. - 2530 (Lydenburg): Kaapsche Hoop, Devil's Kantoer (-DB), *Galpin* 672 (BOL, GRA, NBG, NH, PRE); *Van der Merwe* 2047 (PRE); *Codd* 9789 (PRE); *Venter* 13,389 (UNIN).

33. *LEDEBOURIA PAPILLATA* S. Venter

Ledebouria papillata S. Venter, sp.nov., ad *L. cooperi* (Hook.f.) Jessop affinis sed squamis ad apicem truncatis; petiolo purpureo fasciato; inflorescentiis erectis, pedunculo pappilato; ovario stipitato, stipite 0.5 mm longo; ovario dorsaliter lobato differt.

Type: Transvaal, Pietersburg, *Venter 13,186* (PRE!, holo.; NU,!; UNIN!).

Plants solitary. **Bulb** hypogeal, 15 - 30 x 8 - 20 mm, obovoid; dead bulb scales light brown, membranous, apices truncate, live bulb scales fleshy, without threads when torn, white inside, neck 3 - 27 x 3 - 7 mm; basal stem 5 - 15 mm long. **Cataphylls** 2, reaching ground level. **Leaves** fully developed at anthesis, 2 - 4, spreading, linear-lanceolate to oblanceolate, 30 - 90 x 4 - 10 mm, with few threads when torn, fleshy, adaxial surface glossy dark green, abaxial surface dull purplish green with rows of longitudinal papillae, prominent dark purple cross bars at base, venation prominent; margins papillate; leaf base petiolate, canaliculate; apex acute to acuminate. **Inflorescences** 1 - 2, dense, cylindric, 20 - 60 x 10 - 20 mm, erect, 14 - 45 -flowered, longer than the leaves; scape terete at base, green, spotted and striped purple, longitudinally papillate, rachis ridged, 50 - 120 mm long. **Bracts** fleshy, 0.5 x 0.25 mm, oblong to bifurcate, pink, white or green without bracteoles. **Pedicels** spreading horizontally, 2.5 - 5.0 mm long, pink. **Perianth** 2.0 - 3.5 mm long, tepals reflexed, equal, oblong, 3.0 - 3.5 x 1.0 - 1.5 mm, apex obtuse, thinly cucullate, pink to purple with a green keel. **Stamens** erect, 3 mm long, filaments maroon, epitepalous; anthers 0.5 mm long, violet. **Ovary** globose, 6 -lobed, 1.5 x 2.5 mm, lobes depressed ovate, apex shoulders raised, distal lobes present. **Style** 3.5 mm long, terete, glabrous, purple; stigma equal height to anthers; stipe 0.5 x 0.5 mm. **Capsule** three-lobed, symmetrical, globose; base tapering. **Seed** globse, 2 mm long, surface strongly wrinkled, brown. (Figure 80).

L. papillata is closely related to *L. galpinii* and together they constitute the section *Paucifoliae*. It differs from *L. galpinii* in having longitudinal rows of papillae on the adaxial leaf surface, purple cross bars on the petiole, erect inflorescences and papillate peduncles.

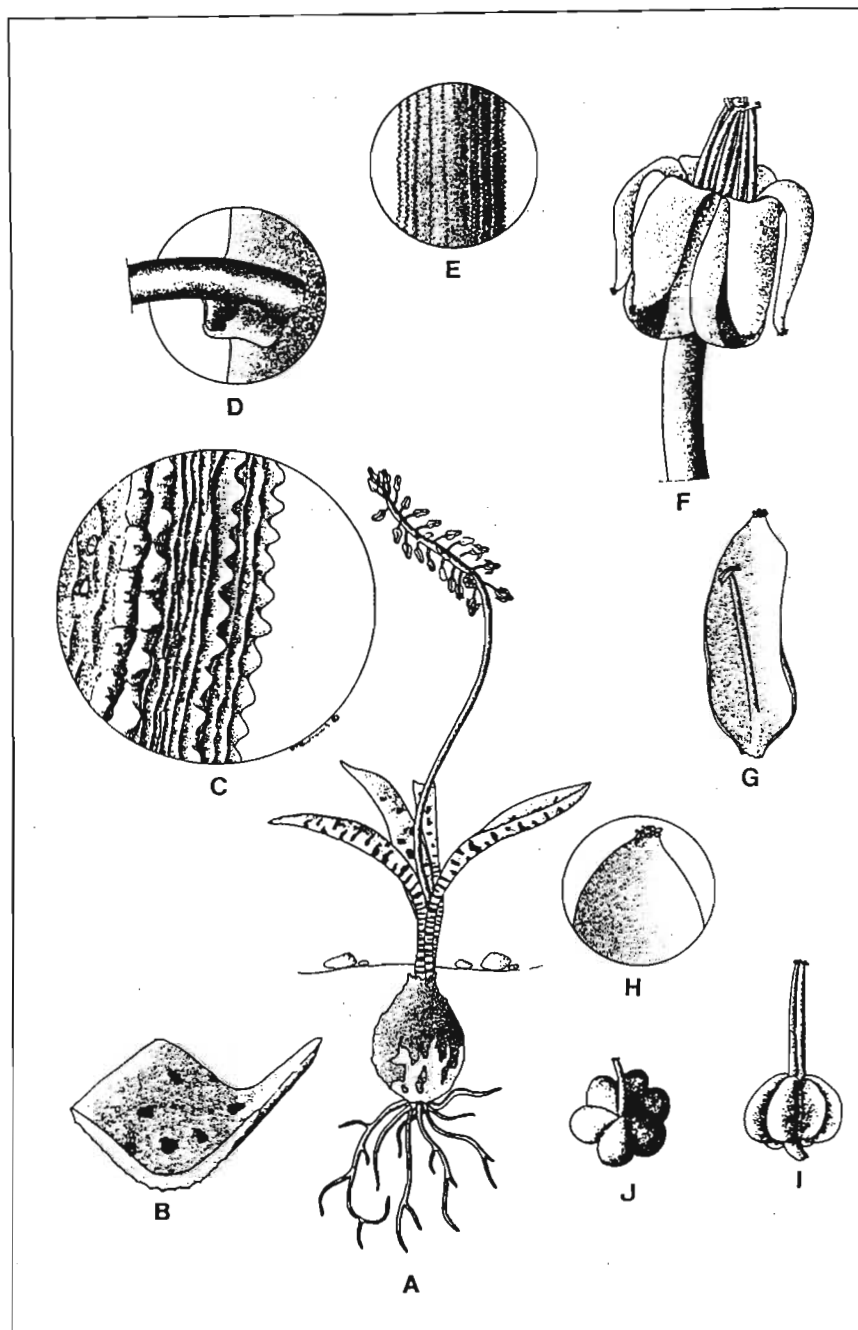


Figure 80. Illustration of *L. papillata* S. Venter. A, habit X 2; B, section through leaf X 5; C, lamina margin X 300; D, bract X 10; E, papillae on peduncle X 10; F, flower X 10; G, tepal with stamen X 10; H, apex of tepal X 20; I, ovary lateral view X 10; J, ovary dorsal view X 10. All from Venter 13,008.

Map 37. Known distribution of *L. papillata* S. Venter

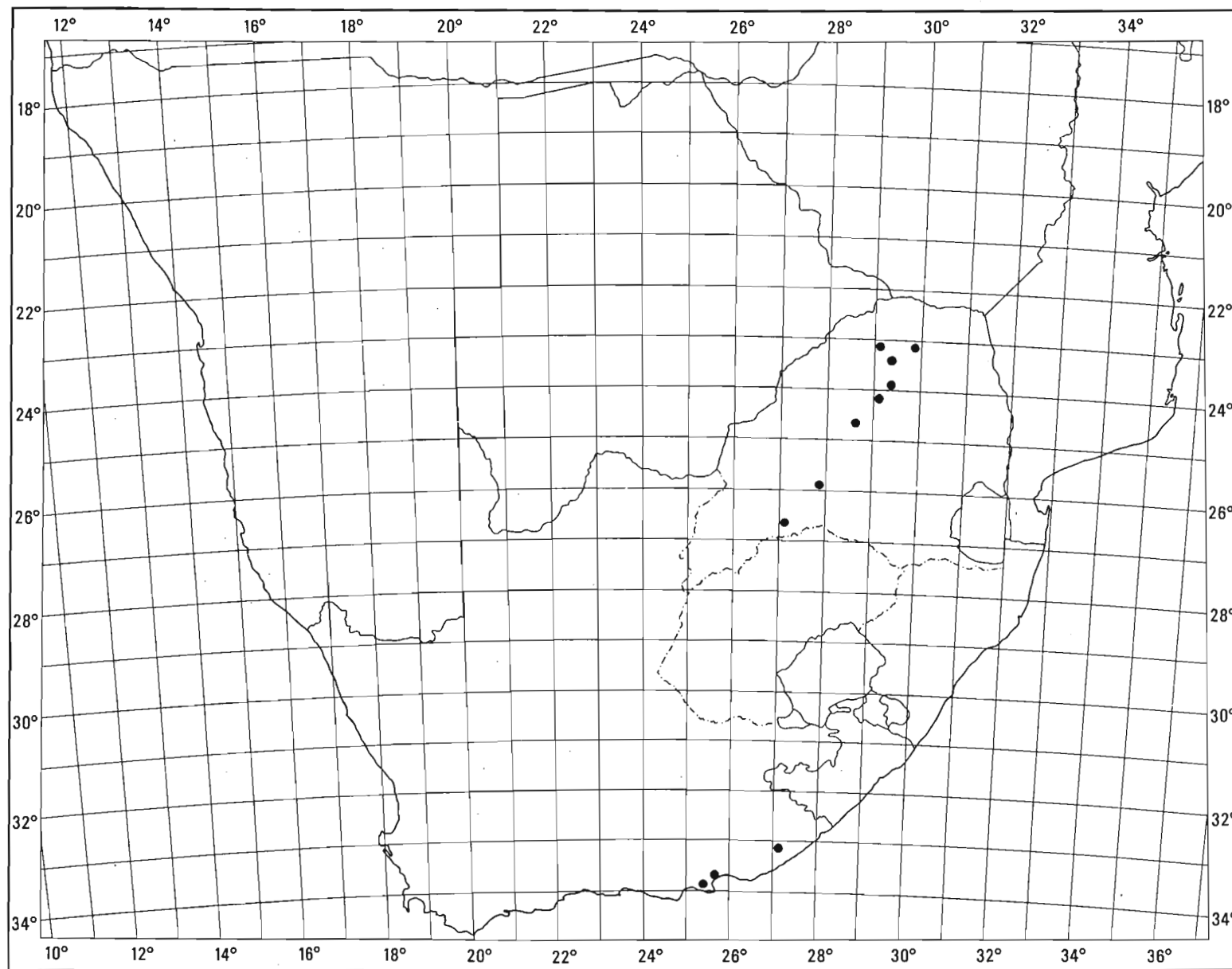
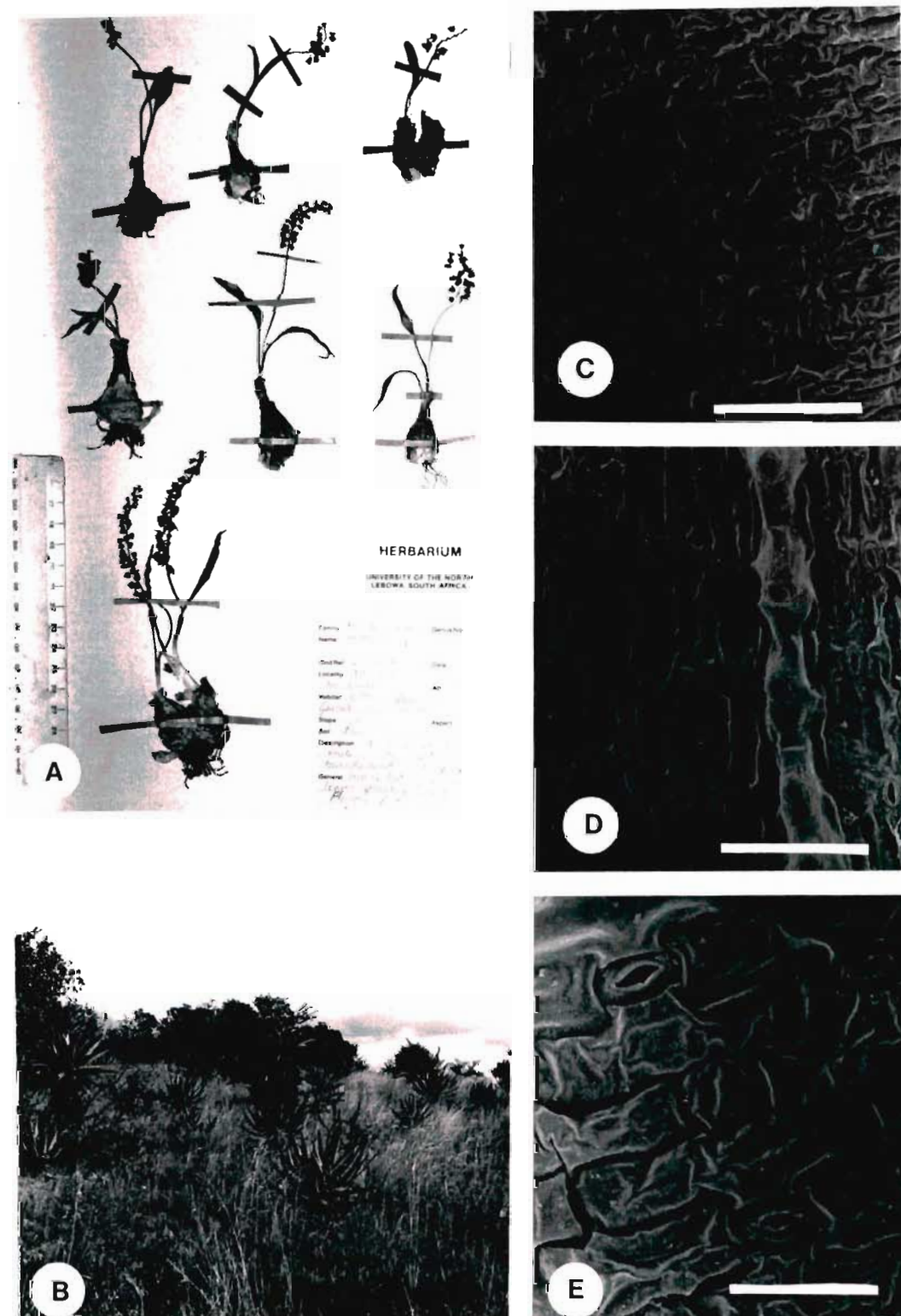


Figure 81. A, holotype of *L. papillata* S. Venter (PRE); B, habitat near Pietersburg. The vegetation consists of deciduous open low *Aloe marlothii* var. *marlothii* - *Ormocarpum trichocarpum* - *Themeda triandra* woodland; C, SEM micrograph of the adaxial lamina surface. Bar = 100 μm ; D, SEM micrograph of the abaxial lamina surface. Bar = 100 μm ; E, SEM micrograph of stomata. Bar = 43 μm . A and C - E from Venter 13,186.



Specific epithet etymology.

Describes the papillate surface of the plant.

Flowering time

From October to January with a peak in November.

Distribution (Map 37).

The distribution is mainly in the Transvaal with a strangely disjunct extension in the eastern Cape near Port Elizabeth and Peddie.

Habitat

Plants of *L. papillata* grow in shallow (10 - 35 mm deep), medium grained (0.25 - 1.0 mm ϕ) to fine grained (0.025 - 0.25 mm ϕ), sandy to sandy loam. Plants grow in small populations in woodland.

In the eastern Cape, near Grahamstown, populations occur on Dwyka Tillite of the Karoo Sequence (SACS 1980). The vegetation consists of grassland with scattered bushclumps. At 'The Aloes' near Port Elizabeth, *L. papillata* occurs on limestone and sand of the Alexandria Formation in the Kalahari Group (SACS 1980). The vegetation is a closed evergreen tall shrubland.

Variation

The neck of the bulb is usually short (3 - 5 mm) in plants growing in shallow soil in exposed situations. Plants from the Blouberg grow in deeper soil resulting in a longer neck (10 - 27 mm). Plants from Port Elizabeth (*Venter 13,308*) exhibit long linear-lanceolate leaves compared to the short oblanceolate leaves of the Transvaal populations.

Historical background

Leendertz (from the Transvaal Museum) collected the first specimen, subsequently only a few collections have been made mainly in the Transvaal.

Jessop (1970) regarded *L. papillata* merely as a form of *L. cooperi* but did not mention the papillate nature of the epidermis.

Specimens examined

TRANSVAAL. - 2329 (Pietersburg): Louis Trichardt (-BB), *Breyer* 22,714 (PRE); Pietersburg (-CD), *Van der Merwe* 2244 (PRE); farm Bloedrivier, *Venter* 12,216 (UNIN); Flora Park, *Venter s.n.* (UNIN). - 2428 (Nylstroom): Naboomspruit, farm Mosdene (-DA), *Galpin* M362 (PRE). - 2429 (Zebediela): Potgietersrus (-AA), *Leendertz* 6627 (PRE); Potgietersrus, farm Riebeeck West, *Van der Merwe* 1744 (PRE). - 2527 (Rustenburg): Witwatersberg, Nefdt (-DD), *Prosser* P1109 (PRE). - 2627 (Potchefstroom): Potchefstroom (-CA), *Ubbink* 332 (PUC); Potchefstroom Dam, *Ubbink* 742 (PUC).

CAPE. - 3325 (Port Elizabeth): Uitenhage (-CD), *Van Jaarsveld* 9115 (NBG); The Aloes (-DC), *Venter* 13,308 (UNIN). - 3327 (Peddie): Peddie (-AA), *Van der Merwe* 2129 (PRE).

13.0. NOMINA DUBIA AND NOMINA EXCLUSA.**Nomina dubia**

Drimia angustifolia Kunth in Enum. Pl. 4: 340 (1843).

Type: Cap. b. Spei, *Drège 8618b*. Not located and description inadequate.

Drimia dregeana Kunth in Enum. Pl. 4: 340 (1843).

Type: Cap. b. Spei, *Drège 1616c*. Not located and description inadequate.

Drimia nitida Eckl. in S. Afr. Quart. Journ. 1: 364 (1830).

Type: Uitenhage, Addo, *Drège 8616b*. Not located and description inadequate.

Drimia viridiflora Eckl. in Topogr. Verzeichn. von Chr. Fr. Ecklon (1827).

Type: No locality, *Zeyher s.n.* Specimen not found and there is no description.

Drimia viridiflora Kunze in Linnaea 20: 10 (1847).

Type not located and description inadequate.

Scilla leichtlenii Bak. in Flora Cap. 6: 486 (1896).

Type: Without locality, cultivated specimen. (K!, holo.).

Described from a living plant that flowered with Max Leichtlin, at Baden-Baden in June 1878. Baker's description does not fit that of any *Ledebouria* species and the type specimen consists of a single inflorescence.

Scilla sphaerocephala Bak. in Flora Cap. 6: 484 (1896).

Type: Little Namaqualand, *Bolus s.n.* Type not found and the description inadequate.

Scilla viridiflora (Kunze) Bak. in J. Linn. Soc. (Bot.) 13: 255 (1873).

Nomina exclusiva

Hyacinthus flexuosus Thunb. in Prodr. Fl. Cap. :64 (1794).

Type: Cape, *Thunberg s.n.* = *Ornithogalum* sp.

Scilla flexuosa (Thunb.) Bak. in J. Linn. Soc. (Bot.) 13: 245 (1873).

14.0. HYBRIDS.

Only one putative hybrid in the genus *Ledebouria* is known. On Settlers Hill at Grahamstown, plants were found that looked superficially like *L. revoluta*. On closer inspection these plants showed characters of both *L. hypoxidioides* and *L. revoluta* both of which occur at this locality.

15.0. CULTURAL USES.

15.1. Food.

Some species of *Ledebouria* are a popular food source for various animals. *L. ovatifolia* bulbs are dug up and eaten by Chacma Baboon, [*Papio ursinus* (Kerr, 1792)] in the Rustenburg Nature Reserve in the north-western Transvaal (pers. obs.). Notes to this effect are made on the label of a specimen collected at the same locality (Jacobsen 1031).

Ledebouria bulbs are utilized by the Bushman in Namibia, the Kalahari and Botswana. In the central Kalahari, in the Kweneng District, Botswana, the bulbs of *L. apertiflora* are baked in warm ashes before eating and are called "Dinojane" (Barnard 219). Bushmen in the Sandfontein area, Namibia, eat the baked bulbs of *L. revoluta* (Bleek s.n. sub PRE 26,143).

15.2. Medicine.

Many *Ledebouria* species are used medicinally by local tribes throughout the distribution range (Watt & Breyer-Brandwijk 1962).

L. apertiflora - Bulbs are used by the Bakone Sotho of Sekhukhuniland for chest problems (pers. obs.).

L. concolor - Diviners wash their bodies in water with pieces of the bulb so that the patients will not mind paying a fee for the consultation (pers. obs.).

L. cooperi - A preparation is given to a woman in the fourth month of pregnancy to ease her discomfort. A decoction is given to cows to ensure a succession of calves of one sex (Jacot Guillarmod 1971).

L. hypoxidioides - Xhosa herbalists use bulbs of this species in and around Grahamstown as a remedy for stomach problems (pers. obs.).

L. luteola - At Melville Koppies area near Johannesburg, Sotho and Tswana people use crushed bulbs as an enema for children with meningitis (Notes on label of *Macnae 1166*).

L. marginata - In the Melville Koppies area near Johannesburg bulbs are cooked and the infusion used as enema for children with 'meningitis' (*Macnae 1166*). Also used in treating lumbago (Jacot Guillarmod 1971). Meat of sheep cooked with the bulbs can be used as a remedy against insanity (diviner pers. comm.)

L. revoluta - The Tswana use a decoction of the bulb as a cure for sadness. If the heart beats too fast, the patient must eat bulbs boiled with chicken. To prevent mishaps, bulbs are mixed with *Craterostigma plantagineum* Hochst., *Pittosporum viridiflorum* Sims and *Brunsvigia radulosa* (Jacq.) Aitk. A plant of this species in a village gives protection and a person who speaks badly of the village will become ill at his house. *L. revoluta* is used as muti to assure a bumper harvest. In Lesotho the natives cultivate this plant outside houses as a good luck charm and to drive away lightning (Jacot Guillarmod 1971).

Ledebouria sp. - Used by the Nanga of Zimbabwe as Fontanelle - "chipande" (Gelfand *et al* 1985).

15.3. Poisoning.

Some species of *Ledebouria* are toxic. The following species contain cardiac poisons: *L. inquinata*, *L. revoluta*, *L. ovatifolia* and *L. cooperi*.

L. cooperi - This plant has the typical action of the digitalis group. It was shown that the minimal one-hour systolic doses per gram for a frog was 0.0055 - 0.02 cc (Gunn *et al.* 1924). Toxic to sheep but seldom eaten in quantity (Galpin 5814).

L. ovatifolia - The results of toxicity tests done at Onderstepoort Research Station during December 1957 are given in table 10.

Table 10. Toxicity tests with *L. ovatifolia*.

Animal	Weight (Kg)	Dosage	Period	Result
Rabbit	2.5	20g	3 days	Died
Rabbit	2.75	20g	3 days	Recovered
Sheep	27.21	30g	5 days	No effect
Sheep	26.3	50g	2 days	Died
Sheep	25.8	50g	5 days	Very sick

The level where this plant is toxic is 2g per Kg live mass. The bulbs used were sent from Horse Shoe Farm, Port Shepstone.

L. revoluta - The bulb contains a combination of alkaloids (Willaman & Schubert 1958). A decoction of these bulbs is used to treat gall-sickness (Smith 1895). Bulbs are inedible and toxic according to the !kun Bushmen (Story 1958). Produces ill effects if eaten by sheep but not usually fatal (Gane 202).

15.4. Vernacular names.

L. apertiflora - (Afrikaans) Kaffir Ui; (Sotho) Mokxetlepyane.

L. concolor - (Xhosa) iDumu.

L. cooperi - (Sotho) beokho, bookhoe, phetola (Jacot-Guillarmod 1971).

L. luteola - (Tswana) Untlokwana.

L. marginata - (Tswana) Untlokwana, Bogokwe, Bogokgwe, Mositakgomo.

L. ovalifolia - (English) Reflex-flowered Lachenalia (Andrews 1803).

L. revoluta - (!kun Bushman) !o/ni, //nanna, //khabhe; (English) Wave-leaved Hyacinth (Aiton 1789), Spotted Copperas-leaved Lachenalia (Aiton 1811); (German) Lanzenblattrige Lachenalie (Willdenow 1799), Gebogene Hyacinthe (Willdenow 1799); (Shona) chitupatupa (Gelfand *et al.* 1985); (Sotho) boakhoe, boekhoe, bookhoe; (Tswana) Sejabaleki, Mositakgomo, Bogokgwe; (Xhosa) ubuHlungu; (Zulu) iCubudwane.

L. undulata - (German) Wellenblattrige Giftlilie (Willdenow 1799).

16.0. CAPTIONS TO ILLUSTRATIONS AND TABLES

Figure 1 - 6. 1. The bulbs of A, *Ledebouria revoluta* (L.f.) Jessop (Venter 13,209); B, *Drimiopsis* sp. nov. [Venter 13,459 (UNIN)] and C, *Scilla dracomontana* Hilliard [Edwards s.n. (UNIN)] to show the differences in the bulb scales. Bar = 50 mm.

Figure 2. Leaves of the genera A, *Scilla natalensis* Planch. [Venter s.n. (UNIN)]; B, *Ledebouria revoluta* (Venter 13,209) and *Drimiopsis burkei* Bak. [Venter s.n. (UNIN)] to show the differences in the leaves. Bar = 100 mm.

Figure 3. Three different types of root in the genus *Ledebouria*. A, contractile roots of *L. revoluta* (Venter 13,207); B, fusiform roots of *L. apertiflora* (Bak.) Jessop (Venter 12,686) and C, fleshy roots of *L. cooperi* (Hook.f.) Jessop (Glen 2295). Bar = 50 mm.

Figure 4. Plants of *L. crispa* S. Venter showing the gregarious habit (Venter 11,202). Bar = 10 mm.

Figure 5. Basal stems of *L. glauca* S. Venter (Venter 13,368). Bar = 50 mm.

Figure 6. SEM micrograph of the spiral threads in the leaves of *L. crispa* (Venter 13,209a). Bar = 5 μ m.

Figure 7. Different leafshapes in *Ledebouria*. A, *L. cooperi* (Venter 13,342); B, *L. revoluta* (Venter 13,207); C, *L. revoluta* (Venter 13,203); D, *L. luteola* (Venter 13,217); E, *L. revoluta* (Venter 13,362); F, *L. revoluta* (Venter 13,363); G, *L. marginata* (Venter 13,358); H, *L. asperifolia* (Venter 13,382); I, *L. revoluta* (Scott-Shaw s.n.); J, *L. cooperi* (Venter 13,334); K, *L. floribunda* (Venter 13,315); L, *L. zebrina* (Cunningham s.n.); M, *L. revoluta* (Venter 13,322); N, *L. cooperi* (Venter 13,388); O, *L. asperifolia* (Venter 13,382); P, *L. cooperi* (Venter 13,383); Q, *L. revoluta* (Venter 13,257); R, *L. inquinata* (Venter 13,335) and S, *L. ovatifolia* (Venter 13,337). Bar = 100 mm.

Figure 8. Flower bracts. A, *L. concolor*, vestigial bract (Venter s.n.); B, *L. floribunda* (Venter 13,315); C, *L. apertiflora* (Mauve et al. 179); D, *L. atro-brunnea* (Venter 13,483); E, *L. ovatifolia* (Venter 13,376) and F, *L. zebrina* (Venter 13,395). Bar = 500 μ m. Bracteoles indicated with an arrow.

Figure 9. *L. revoluta* flower. A, lateral view. B, distal view. Both from Venter 13,007 (X 8).

Figure 10. Tepal apices of A, *Drimiopsis burkei* Bak. (Venter 13,341) and B, *Ledebouria apertiflora* (Bak.) Jessop (Mauve et al. 179) (X 16).

Figure 11. Various parts of the ovary (X16).

Figure 12. SEM micrographs of A, tepal apex in *L. zebrina* (Bak.) S. Venter (Venter 13,395). Bar = 50 μ m. B, anther of *L. ensifolia* (Eckl.) S. Venter (Venter 13,521). Bar = 0.38 mm. C, pollen grain of *L. revoluta* (L.f.) Jessop (Venter 13,207). Bar = 12.6 μ m. D, reticulate exine of *L. revoluta* (Venter 13,207). Bar = 5 μ m. E, stigma of *L. revoluta* (Venter 13,257). Bar = 86 μ m. F, nectaries on the base of the ovary lobes in *L. sandersonii* (Bak.) S. Venter (Venter 13,465). Bar = 200 μ m. G, seed surface of *L. glauca* S. Venter (Venter 13,386). Bar = 1.2 mm. H, detail texture of the testa of *L. luteola* Jessop. Bar = 43 μ m.

Figure 13. SEM micrographs of the different ovary shapes. A, *L. undulata* (Jacq.) Jessop (Müller-Doblies 89129). Bar = 500 μ m. B, *L. papillata* S. Venter (Venter 13,186). Bar = 1 mm. C, *L. parvifolia* S. Venter (Venter s.n.). Bar = 1 mm. D, *L. ensifolia* (Eckl.) S. Venter (Venter 13,278). Bar = 500 μ m. E, *L. apertiflora* (Bak.) Jessop (Mauve et al. 179). Bar = 500 μ m. F, *L. leptophylla* (Bak.) S. Venter (Venter 13,251). Bar = 500 μ m. G, *L. asperifolia* (Van der Merwe) S. Venter (Venter 13,382). Bar = 0.86 mm. H, *L. zebrina* (Bak.) S. Venter. Bar = 500 μ m. and I, *L. hypoxidioides* (Schönl.) Jessop (Venter 13,311). Bar = 500 μ m.

Figure 14. Meiotic chromosomes (metaphase I) *L. apertiflora*: $2n = 26$. A - C from Venter *s.n.* and *L. ensifolia*: $2n = 30$. D - F from Venter 13,278. A, C and E X 1000; B, X 600 and F X 400.

Figure 15a. Graphic guide for sandy soil textural classification with A, the different types of sandy soil for *Ledebouria* (shaded portion) and B, soil textures of the habitats (shaded portion).

Figure 15b. Phenogram generated with the program 'NTSYS-pc'. ape = *L. apertiflora*; ens = *L. ensifolia*; san = *L. sandersonii*; dol = *L. dolomiticola*; atr = *L. atro-brunnea*; vis = *L. viscosa*; lpt = *L. leptophylla*; lep = *L. lepida*; min = *L. minima*; rup = *L. rupestris*; cor = *L. coriacea*; flo = *L. floribunda*; hyp = *L. hypoxidioides*; rev = *L. revoluta*; zeb = *L. zebrina*; lut = *L. luteola*; ovt = *L. ovatifolia*; mon = *L. monophylla*; coo = *L. cooperi*; par = *L. parvifolia*; asp = *L. asperifolia*; gla = *L. glauca*; inq = *L. inquinata*; mar = *L. marginata*; con = *L. concolor*; cri = *L. crispa*; und = *L. undulata*; ovl = *L. ovalifolia*; pet = *petiolata*; soc = *L. socialis*; mac = *L. macowanii*; gal = *L. galpinii* and pap = *L. papillata*.

Figure 16. Illustration of *L. apertiflora* (Bak.) Jessop. A, habit X 1. B, lamina margin X 300. C, bract X 10. D, tepal with stamen X 10. E, apex of tepal X 20. F, section through lamina X 5. G, flower X 10. H, lateral view of ovary X 10 and I, distal view of ovary X 10. All from Venter *s.n.*

Figure 17. A, lectotype of *L. apertiflora* (Bak.) Jessop under *Drimia apertiflora* Bak. in Saunders Refugium Botanicum 1 : t. 19 (1868); B, SEM micrograph of the adaxial lamina surface. C, SEM micrograph of the abaxial lamina surface. D, habitat near Phalaborwa, north-eastern Transvaal. The vegetation consists of closed deciduous tall *Combretum apiculatum* - *C. imberbe* - *Acacia nigrescens* woodland; E, SEM micrograph of stomata and F, SEM micrograph of the fine texture of the testa. B - C and E - F from Venter *s.n.*

Figure 18. Illustration of *L. ensifolia* (Eckl.) S. Venter. A, habit X 1; B, lamina margin X 300; C, lamina apex X 10; D, bract X 10; E, section through lamina X 5; F, tepal apex X 20; G, tepal with stamen X 10; H, flower X 10; I, ovary distal view X 10; J, ovary lateral view X 10. All from *Smith 155*.

Figure 19. A, lectotype of *L. ensifolia* (K); B, habitat at the Zwartkops River estuary. The vegetation consists of tall, closed, evergreen shrubland; C, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; D, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of stomata. Bar = 50 μ m; F, inflorescence. Bar = 10 mm. C - F from *Venter 13,278*.

Figure 20. Illustration of *L. sandersonii* (Bak.) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 2; D, bract X 10; E, tepal with stamen X 10; F, flower X 10; G, section through lamina depicted in H, X 2; H, lamina, shade form X 1; I, tepal apex X 20; J, ovary lateral view X 10; K, ovary distal view X 10. A - F from *Crouch 7* and H to K from *Venter 13,464*.

Figure 21. A, type of *L. sandersonii* (Bak.) S. Venter (K); B, plants of the spotted-leaf form, near Dullstroom, eastern Transvaal. Bar = 25 mm; C, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; D, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of stomata. Bar = 50 μ m; F, habitat in the basalts at Cathedral Peak. The vegetation consists of short montane grassland. C - E from *Crouch 7*.

Figure 22. Illustration of *L. dolomiticola* S. Venter. A, habit X 1; B, lamina margin X 300; C, lamina apex X 20; D, bract and bracteole X 10; E, section through lamina X 5; F, tepal apex X 20; G, flower X 10; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary distal view X 10. All from *Venter 13,208a*.

Figure 23. A, holotype of *L. dolomiticola* S. Venter (PRE); B, habitat at Donkerkloof, the type locality. The vegetation consists of closed deciduous low *Kirkia wilmsii* - *Dombeya autumnalis* - *Obetia tenax* woodland on dolomite; C, plants of *L. dolomiticola* growing in rock cracks showing the epigeal bulbs. Bar = 100 mm; D, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; E, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; F, SEM micrograph of stomata. Bar = 43 μ m. D - F from *Venter 13,089a*.

Figure 24. Illustration of *L. atro-brunnea* S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, bract X 20; E, tepal with stamen X 10; F, flower X 10; G, tepal apex X 20; H, ovary lateral view X 10; I, ovary distal view X 10. All from Venter 13,460.

Figure 25. A, holotype of *L. atro-brunnea* S. Venter (PRE); B, habitat near Kroondal, north-western Transvaal. The vegetation consists of closed deciduous tall *Protea caffra* subsp. *caffra* - *Xerophyta retinervis* - *Parinari capensis* woodland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of wax platelets forming the cuticle; F, plants of *L. atro-brunnea* showing the colonial growth and the erect, twisted leaves. Bar = 30 mm. C - F from Venter 13,460.

Figure 26. Illustration of *L. viscosa* Jessop. A, habit X 1; B, lamina margin X 300; C, section through lamina X 2; D, bract X 10; E, flower X 10; F, tepal with stamen X 10; G, tepal apex X 20; H, ovary lateral view X 10; I, ovary distal view X 10. All from Venter 13,455.

Figure 27. A, holotype of *L. viscosa* Jessop (PRE); B, habitat near Thabazimbi. The vegetation consists of closed deciduous low *Terminalia sericea* - *Acacia tortilis* subsp. *heteracantha* - *Grewia flava* - *Digitaria eriantha* woodland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, leaves of *L. viscosa* with sand particles adhering to the surfaces. Bar = 10 mm. F, SEM micrograph of the stomata; G, SEM micrograph showing the thick resinous covering of the lamina; H, leaf unrolling, a unique character in *Ledebouria*. Bar = 20 mm. C - H from Venter 13,455.

Figure 28. Illustration of *L. leptophylla* (Bak.) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 10; D, tepal apex X 20; E, tepal with stamen X 10; F, bract with bracteole X 10; G, flower X 10; H, habit of nonspiral-leaved form X 1; I, ovary lateral view X 10; J, ovary distal view X 10. All from Venter 13,214 except H from Venter 13,251.

Figure 29. A, holotype of *L. leptophylla* (Bak.) S. Venter (K); B, miniature form resembling *L. minima* (Bak.) S. Venter. Bar = 20 mm; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, habitat at Angle Station, between Barberton and Havelock. The vegetation consists of open low *Protea roupelliae* var. *roupelliae* - *Helichrysum splendidum* - *Xerophyta retinervis* woodland; G, plants with nonspiral leaves. Bar = 20 mm. B and G from Venter 13,251 and C - E from Venter 13,214.

Figure 30. Illustration of *L. lepida* (N.E. Br.) S. Venter. A, habit X 1; B, lamina margin X 300; C, bract X 10; D, hairs on peduncle X 10; E, section through lamina X 2; F, flower X 10; G, tepal with stamen X 10; H, tepal apex X 10; I, ovary lateral view X 10; J, ovary distal view X 10. All from Venter 13,415.

Figure 31. A, holotype of *L. lepida* (N.E. Br.) S. Venter (K); B, habitat near Palala, Waterberg. The vegetation consists of closed deciduous low *Combretum zeyheri* - *Mimusops zeyheri* - *Freylinia tropica* woodland; C, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata. Bar = 43 μ m; F, abaxial surface of the lamina showing the prominent purple zebra stripes on the petiole. Bar = 10 mm. C - F from Venter 13,415.

Figure 32. Illustration of *L. minima* (Bak.) S. Venter. A, habit X 1; B, section through lamina X 5; C, lamina margin X 300; D, bract X 10; E, tepal apex X 20; F, flower X 10; G, tepal with stamen X 10; H, ovary lateral view X 10; I, ovary distal view X 10. All from Venter 13,404.

Figure 33. A, holotype of *L. minima* (Bak.) S. Venter (K); B, habitat on "The Downs" near Trichardtsdal, north-eastern Transvaal. The vegetation consists of *Tristachya leucothrix* - *Panicum natalense* - *Scilla natalensis* montane sour grassland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, plants showing filiform leaves. Bar = 20 mm. C - F from Venter 13,404.

Figure 34. Illustration of *L. rupestris* (Van der Merwe) S. Venter. A, habit X 2; B, lamina margin X 300; C, section of the peduncle X 10; D, section through lamina X 5; E, bract with bracteole X 10; F, tepal with stamen X 10; G, tepal apex X 20; H, flower X 10; I, ovary lateral view X 10; J, ovary distal view X 10. All from Venter 13,250.

Figure 35. A, holotype of *L. rupestris* (Van der Merwe) S. Venter (PRE); B, habitat near Mac Mac Falls, eastern Transvaal. The vegetation consists of open short *Pteridium aquilinum* - *Parinari capensis* - *Digitaria eriantha* montane grassland; C, plants showing globose inflorescences with stellate flowers. Bar = 20 mm; D, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; E, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; F, SEM micrograph of a stomata. Bar = 43 μ m. C - F from Venter 13,250.

Figure 36. Illustration of *L. coriacea* S. Venter. A, habit X 2; B, lamina margin X 300; C, section through lamina X 5; D, lamina apex X 20; E, bract X 10; F, flower X 10; G, tepal apex X 10; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary distal view X 10. All from Venter 13,307.

Figure 37. A, holotype of *L. coriacea* S. Venter (PRE); B, habitat at 'The Aloes' near Port Elizabeth. The vegetation consists of evergreen tall *Euclea undulata* - *Ficus burtt-davyi* - *Brachylaena floribunda* shrubland with open patches covered in *Pteronia incana* (Burm.) DC. *L. coriacea* occurs under the *Pteronia* shrublets; C, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; D, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; E, SEM micrograph of stomata. Bar = 43 μ m. A and C - E from Venter 13,307.

Figure 38. Illustration of *L. floribunda* (Bak.) Jessop. A, habit X 0.5; B, lamina margin X 300; C, lamina apex X 5; D, bract with bracteole X 10; E, section through lamina X 1; F, flower X 10; G, tepal with stamen X 10; H, tepal apex X 20; I, ovary lateral view X 10; J, ovary distal view X 10. All from Venter 13,475.

Figure 39. A, type of *L. floribunda* (Bak.) Jessop (K); B, habitat at Thabina Falls in the Wolkberg Wilderness Area near Tzaneen. The vegetation consists of evergreen low *Cliffortia linearifolia* - *Agapanthus inapertus* subsp. *pendulus* - *Helichrysum splendidum* shrubland in a seepage area next to a waterfall; C, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; D, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of stomata. Bar = 50 μ m. C - E from *Venter 13,475*.

Figure 40. Illustration of *L. hypoxidioides* (Schönl.) Jessop. A, habit X 0.25; B, lamina margin X 110; C, section through lamina X 2; D, bract X 10; E, tepal with stamen X 10; F, flower X 8; G, tepal apex X 20; H, ovary lateral view X 10; I, ovary distal view X 10. All from *Venter 13,311*.

Figure 41. A, holotype of *L. hypoxidioides* (Schönl.) Jessop (GRA); B, habitat at Grahamstown. The vegetation consists of False Fynbos with *Passerina rigida* - *Ficus burtt-davyi* - *Euphorbia tetragona* shrubveld; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, plants from the type locality. Note the hairy leaves. Bar = 10 mm; G, SEM micrograph of the leaf surface to show the hairs. C - G from *Venter 13,311*.

Figure 42. Illustration of *L. revoluta* (L.f.) Jessop. A, habit X 0.5; B, lamina margin X 300; C, section through lamina X 2; D, apex of tepal X 20; E, bract with bracteole X 10; F, tepal with stamen X 10; G, flower X 10; H, ovary lateral view X 10; I, ovary distal view X 10. All from *Venter 13,430*.

Figure 43. A, type of *L. revoluta* (L.f.) Jessop under *Lachenalia lanceaefolia* Jacq. in *Icones Plantarum Rariorum* 2: t.402 (1794); B, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; C, habitat near Thabazimbi in the Waterberg, north-western Transvaal. The vegetation consists of closed deciduous low *Albizia tanganyicensis* var. *tanganyicensis* - *Croton gratissimus* var. *subgratissimus* - *Myriothamnus flabellifolia* woodland; D, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; E, SEM micrograph of stomata. Bar = 43 μ m; F, plant of *L. revoluta* with thickly packed dry bulb scales for protection against fire. Bar = 30 mm. B and D - E from *Venter 13,009*.

Figure 44. Illustration of *L. zebrina* (Bak.) S. Venter. A, habit X 0.25; B, section through lamina X 0.5; C, lamina margin X 300; D, bract with bracteole X 5; E, tepal with stamen X 5; F, apex of tepal X 10; G, flower X 5; H, ovary lateral view X 10; I, ovary distal view X 10. All from *Venter 13,395*.

Figure 45. A, type of *L. zebrina* (Bak.) S. Venter under *Scilla zebrina* Bak. in Saunders Refugium Botanicum 3: t.185 (1870); B, plant with leaves 1000 mm long showing growth habit. Bar = 60 mm; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of a stomatum; F, habitat near Barberton. The vegetation consists of closed evergreen low *Acacia sieberana* var. *woodii* - *Pavetta edentula* - *Schotia brachypetala* woodland; G, plant from Noodsberg near Greytown showing the prominent purple zebra stripes on the leaves. Bar = 60 mm. B - E from *Venter 13,395* and G from *Smith 115*.

Figure 46. Illustration of *L. luteola* Jessop. A, habit X 1; B, lamina margin X 300; C, apex of lamina X 20; D, section through lamina X 5; E, bract with bracteole X 10; F, flower X 20; G, tepal with stamen X 20; H, apex of tepal X 10; I, ovary lateral view X 10; J, ovary distal view X 10. All from *Venter 13,458*.

Figure 47. A, holotype of *L. luteola* Jessop (PRE); B, habitat at Potchefstroom. The vegetation consists of open deciduous low *Acacia caffra* - *Aloe greatheadii* var. *davyana* - *Themeda triandra* woodland; C, plant with the previous years leaves still on the plant. Bar = 10 mm; D, SEM micrograph of the adaxial lamina surface; E, SEM micrograph of the abaxial lamina surface; F, SEM micrograph of stomata. C - F from *Venter 13,217*.

Figure 48. Illustration of *L. ovatifolia* (Bak.) Jessop. A, habit X 0.5; B, lamina margin X 300; C, section through lamina X 2; D, apex of lamina X 20; E, bract with bracteole X 10; F, apex of tepal X 20; G, flower X 5; H, tepal with stamen X 5; I, ovary lateral view X 10; J, ovary distal view X 10. All from *Stirton 11,180*.

Figure 49. A, holotype of *L. ovatifolia* (Bak.) Jessop (distal left) (K); B, plant of *L. ovatifolia* showing the truncate apices of the bulb scales; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of a stomatum; F, habitat near Trichardtsdal, north-eastern Transvaal. The vegetation consists of open low evergreen *Protea roupelliae* var. *roupelliae* - *Themeda triandra* woodland. B from Van der Merwe 2172 and C - E from Venter 13,349.

Figure 50. Illustration of *L. monophylla* S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, bract with bracteole X 10; E, flower X 10; F, tepal with stamen X 10; G, apex of tepal X 20; H, ovary lateral view X 10; I, ovary distal view X 10. All from Venter 13,235.

Figure 51. A, holotype of *L. monophylla* S. Venter (PRE); B, plants showing the solitary humifuse leaf. Bar = 20 mm; C, plant in habitat near Graskop, showing the solitary leaf and erect globose inflorescence. Bar = 10 mm; D, SEM micrograph of the adaxial lamina surface; E, SEM micrograph of the abaxial lamina surface; F, SEM micrograph of stomata; G, habitat at the type locality near Graskop. The vegetation consists of closed evergreen low *Erica leucopelta* - *Passerina montana* - *Pteridium aquilinum* shrubland. A - F from Venter 13,235.

Figure 52. Illustration of *L. cooperi* (Hook.f.) Jessop. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, flower X 10; E, bract with bracteole X 10; F, apex of lamina X 20; G, tepal with stamen X 10; H, ovary lateral view X 10; I, Ovary distal view X 10. All from Crouch 97.

Figure 53. A, holotype of *L. cooperi* (Hook.f.) Jessop (distal specimen) (K); B, habitat on slopes of Mount Currie near Kokstad with montane grassland and swampy areas; C, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; D, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; E, SEM micrograph of a stomatum. Bar = 43 μ m; F, plants of *L. cooperi* showing parallel purple markings on the lamina. Bar = 20 mm. C - F from Venter 13,194.

Figure 54. Illustration of *L. parvifolia* S. Venter. A, habit X 2; B, lamina margin X 300; C, section through lamina X 3; D, bract X 10; E, flower X 15; F, tepal with stamen X 15; G, tepal apex X 20; H, ovary lateral view X 10; I, ovary distal view X 10. All from *Venter s.n.*

Figure 55. A, holotype of *L. parvifolia* S. Venter (PRE); B, plant showing the bulbils, small leaves and the solitary inflorescence. Bar = 20 mm; C, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, habitat near Pilgrim's Rest, eastern Transvaal. The vegetation consists of closed deciduous low *Dombeya rotundifolia* subsp. *rotundifolia* - *Acacia ataxacantha* - *Scilla natalensis* woodland; G, SEM micrograph of the rows of hairs on the adaxial lamina surface; A - F from *Venter s.n.*.

Figure 56. Illustration of *L. asperifolia* (Van der Merwe) S. Venter. A, habit X 1; B, lamina margin X 300; C, leaf apex X 10; D, section through lamina X 4; E, bract X 10; F, tepal apex X 20; G, flower X 10; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary distal view X 10. All from *Venter 13,249*.

Figure 57. A, holotype of *L. asperifolia* (Van der Merwe) S. Venter (PRE); B, habitat on the the Makonjwa Mountain between Barberton and Havelock. Plants were collected (*Venter 13,382*) on the cliffs in the foreground; C, plants of *L. asperifolia* after a recent veld fire, Lisbon Falls, Graskop. Bar = 100 mm; D, plant from Barberton showing the rows of asperities on the leaves. Bar = 10 mm; E, SEM micrograph of the adaxial lamina surface. Bar = 100 μ m; F, SEM micrograph of the abaxial lamina surface. Bar = 100 μ m; G, SEM micrograph of stomata. Bar = 43 μ m. C from *Venter 13,249* and D - G from *Venter 13,382*.

Figure 58. Illustration of *L. glauca* S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, bract with bracteole X 10; E, apex of tepal X 20; F, tepal with stamen X 10; G, flower X 10; H, ovary lateral view X 10; I, ovary distal view X 10. All from *Venter 13,368*.

Figure 59. A, holotype of *L. glauca* S. Venter (PRE); B, habitat in the Kalahari near Vanzylsrus. The vegetation consists of open low *Acacia erioloba* - *A. haematoxylon* - *Stipagrostis uniplumis* woodland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata. A and C - E from *Venter 13,368*.

Figure 60. Illustration of *L. inquinata* (C.A. Sm.) Jessop. A, habit X 1; B, lamina margin X 300; C, apex of lamina X 10; D, section through lamina X 5; E, bract with bracteole X 10; F, tepal with stamen X 10; G, flower X 10; H, apex of tepal X 20; I, ovary lateral view X 10; J, ovary distal view X 10. All from *Venter 13,343*.

Figure 61. A, lectotype of *L. inquinata* (C.A. Sm.) Jessop (K); B, isotype of *L. inquinata* designated by Smith as co-type (K); C, habitat at Linksfield Ridge, Bedfordview, with open evergreen *Protea caffra* subsp. *caffra* - *Aloe greatheadii* var. *davyana* - *Digitaria eriantha* woodland; D, plant showing the diagnostic mottling on the live bulb scales. Bar = 25 mm; E, SEM micrograph of the adaxial lamina surface; F, SEM micrograph of the abaxial lamina surface; G, SEM micrograph of stomata. D - G from *Venter 13,343*.

Figure 62. Illustration of *L. marginata* (Bak.) Jessop. A, habit X 0.5; B, lamina margin X 300; C, section through lamina X 1; D, bract with bracteole X 10; E, tepal with stamen X 10; F, flower X 10; G, apex of tepal X 20; H, lamina of the narrow leaved form from Vryheid X 0.5; I, section through lamina of H. X 2; J, ovary lateral view X 10; K, ovary distal view X 10. A - G and J - K from *Venter 13,327* and H - I from *Venter 13,364*.

Figure 63. A, lectotype of *L. marginata* (Bak.) Jessop (GRAZ); B, SEM micrograph of the adaxial lamina surface; C, SEM micrograph of the abaxial lamina surface; D, SEM micrograph of a stomatum; E, plant showing diagnostic twisted leaves. Bar = 30 mm; F, plants of the narrow-leaved form from near Vryheid. Bar = 40 mm. B - E from *Venter 13,230* and F from *Venter 13,358*.

Figure 64. Illustration of *L. concolor* (Bak.) Jessop. A, habit X 1; B, lamina margin X 300; C, vestigial bract X 10; D, section through lamina X 2; E, flower X 10; F, tepal with stamen X 10; G, apex of tepal X 20; H, ovary lateral view X 10; I, ovary distal view X 10. All from *Stirton 12,474*.

Figure 65. A, holotype of *L. concolor* (Bak.) Jessop (lower specimen) (K); B, habitat at the mouth of the Zwartkops River near Port Elizabeth. The vegetation consists of closed evergreen tall *Sideroxylon inerme* - *Aloe ferox* - *Euphorbia ledonii* shrubland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata. C - E from *Van Jaarsveld 9060*.

Figure 66. Illustration of *L. crispa* S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5. D, bract with bracteole X 10; E, tepal with stamen X 10; F, flower X 10; G, apex of tepal X 10; H, ovary lateral view X 10; I, ovary distal view X 10. All from *Venter 11,202*.

Figure 67. A, holotype of *L. crispa* S. Venter (PRE); B, colony of plants showing the typical colonial growth. Bar = 20 mm; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of a stomatum. All from *Venter 11,202*.

Figure 68. Illustration of *L. undulata* (Jacq.) Jessop. A, habit, leafing period X 1; B, habit, flowering period X 1; C, lamina margin X 300; D, bracts with bracteoles X 10; E, section through lamina X 4; F, flower X 10; G, apex of tepal X 20; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary distal view X 10. A and C - J from *Müller-Doblies 89129* and B from *Hall 3200*.

Figure 69. A, type of *L. undulata* (Jacq.) Jessop under *Drimia undulata* Jacq. in *Icones Plantarum Rariorum* 2: t.376 (1794); B, habitat on the Gamsberg Flats, Bushmenland. The vegetation consists of closed *Euphorbia mauritanica* - *Euclea undulata* shrubland; C, plant of *L. undulata* with semi-fleshy leaves and the inflorescence absent. Bar = 10 mm; D, SEM micrograph of the adaxial lamina surface; E, SEM micrograph of the abaxial lamina surface; F, SEM micrograph of stomata. C - F from *Müller-Doblies 89129*.

Figure 70. Illustration of *L. ovalifolia* (Schrad.) Jessop. A, habit X 1; B, lamina margin X 300; C, apex of lamina X 20; D, apex of tepal X 20; E, section through lamina X 5; F, bract X 10; G, flower X 10; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary distal view X 10. All from Venter 13,263.

Figure 71. A, type of *L. ovalifolia* (Schrad.) Jessop under *Drimia lanceaefolia* Lodd. in Loddiges Botanical Cabinet 3: t.278 (1818); B, plant of *L. ovalifolia* with flatly spreading leaves. Bar = 20 mm; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of stomata. Bar = 20 μ m; F, SEM micrograph of the parallel rows of papillae on the abaxial lamina surface; G, habitat at Baakens River, Port Elizabeth. The vegetation consists of *Protea* - *Watsonia* - *Leucospermum* Fynbos. B - F from Venter 13,263.

Figure 72. Illustration of *L. petiolata* (Van der Merwe) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, apex of tepal X 20; E, bract with bracteole X 10; F, tepal with stamen X 10; G, flower X 10; H, ovary lateral view X 10; I, ovary distal view X 10. All from Middleton s.n..

Figure 73. A, holotype of *L. petiolata* (Van der Merwe) S. Venter (PRE); B, habitat near Graskop. The vegetation consists of open short *Passerina montana* - *Ischyrolepis schoenoides* - *Panicum natalense* grassland. C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, plants of *L. petiolata* typically growing in moss filled rock cracks. Bar = 20 mm. C - F from Venter s.n.

Figure 74. Illustration of *L. socialis* (Bak.) Jessop. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, bract X 10; E, flower X 10; F, tepal with stamen X 10; G, ovary lateral view X 10; H, ovary distal view X 10. All from Venter 13,272.

Figure 75. A, holotype of *L. socialis* (Bak.) Jessop (K); B, plant showing the gregarious habit. Plant growing in deep shade. Bar = 40 mm; C, plants showing the pendulous flowers. Bar = 20 mm; D, SEM micrograph of the adaxial lamina surface; E, SEM micrograph of the abaxial lamina surface; F, SEM micrograph of stomata. B - F from Venter 13,272.

Figure 76. Illustration of *L. macowannii* (Bak.) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 2.5; D, bract X 10; E, apex of tepal X 10; F, flower X 5; G, tepal with stamen X 10; H, ovary lateral view X 10; I, ovary dosal view X 10. All from *Venter 13,413*.

Figure 77. A, lectotype of *L. macowanii* (Bak.) S. Venter (GRA); B, habitat near Pafuri in the Kruger National Park. The vegetation consists of closed deciduous *Terminalia sericea* - *Hymenocardia ulmoides* - *Holarrhena pubescens* woodland; C, SEM micrograph of the adaxial lamina surface; D, SEM micrograph of the abaxial lamina surface; E, SEM micrograph of stomata; F, plants of *L. macowanii* showing the lax racemes. Bar = 50 mm. C - F from *Venter s.n.*.

Figure 78. Illustration of *L. galpinii* (Bak.) S. Venter. A, habit X 1; B, lamina margin X 300; C, section through lamina X 5; D, apex of lamina X 20; E, bracts X 10; F, flower X 10; G, apex of tepal X 20; H, tepal with stamen X 10; I, ovary lateral view X 10; J, ovary distal view X 10. All from *Venter 13,389*.

Figure 79. A, lectotype of *L. galpinii* (Bak.) S. Venter (PRE); B, plants with prominent lacunae on the leaves. Bar = 10 mm; C, habitat at Kaapsche Hoop, eastern Transvaal. The vegetation consists of closed short *Panicum natalense* - *Eragrostis racemosa* - *Scabiosa columbaria* montane grassland; D, SEM micrograph of the adaxial lamina surface. Bar = 50 μ m; E, SEM micrograph of the abaxial lamina surface. Bar = 50 μ m; F, SEM micrograph of stomata. Bar = 50 μ m. B and D - F from *Venter 13,389*.

Figure 80. Illustration of *L. papillata* S. Venter. A, habit X 2; B, section through leaf X 5; C, lamina margin X 300; D, bract X 10; E, papillae on peduncle X 10; F, flower X 10; G, tepal with stamen X 10; H, apex of tepal X 20; I, ovary lateral view X 10; J, ovary distal view X 10. All from *Venter 13,008*.

Figure 81. A, holotype of *L. papillata* S. Venter (PRE); B, habitat near Pietersburg. The vegetation consists of deciduous open low *Aloe marlothii* var. *marlothii* - *Ormocarpum trichocarpum* - *Themeda triandra* woodland; C, SEM micrograph of the adaxial lamina surface. Bar = 100 μm ; D, SEM micrograph of the abaxial lamina surface. Bar = 100 μm ; E, SEM micrograph of stomata. Bar = 43 μm . A and C - E from Venter 13,186.

Table 1. Summary of the taxonomic treatments of *Ledebouria* by the various authors.

Table 2. Differences between the genera *Ledebouria*, *Drimiopsis* and *Scilla*.

Table 3. Leaf characters for the genus *Ledebouria* in South Africa.

Table 4. Phenology of the genus *Ledebouria* in South Africa.

Table 5. Microsculpturing of the leaf surfaces.

Table 6. Ovary and fruit characters.

Table 7. Results of Jessop's chromosome studies (1972).

Table 8. Flowering period (+) for the genus *Ledebouria* in South Africa.

Table 9. The major soil types (Buckman & Brady 1969).

Table 10. The sectional, subsectional and species groupings of *Ledebouria*.

Table 11. Distribution and status of the genus *Ledebouria* in South Africa.

Table 12. Toxicity tests with *L. ovatifolia*.

-
- Map 1. Pictorialized map showing the variation in leaf shape, in *L. marginata* (Bak.) Jessop. A, Venter 13,487. B, Venter 13,246. C, Venter 13,358 and Venter s.n.
- Map 2. Known distribution of the genus *Ledebouria* Roth.
- Map 3. Known distribution of the genus *Ledebouria* Roth in South Africa.
- Map 4. Concentration of species of *Ledebouria* in geographical degree squares.
- Map 5. Pictorialized map of *L. apertiflora* with the known distribution of the tapered and truncate bulb scaled plants.
- Map 6. Known distribution of *L. ensifolia* (Eckl.) S. Venter
- Map 7. Known distribution of *L. sandersonii* (Bak.) S. Venter
- Map 8. Known distribution of *L. dolomiticola* S. Venter
- Map 9. Known distribution of *L. atro-brunnea* S. Venter
- Map 10. Known distribution of *L. viscosa* Jessop
- Map 11. Known distribution of *L. leptophylla* (Bak.) S. Venter
- Map 12. Known distribution of *L. lepida* (N.E. Br.) S. Venter
- Map 13. Known distribution of *L. minima* (Bak.) S. Venter
- Map 14. Known distribution of *L. rupestris* (Van der Merwe) S. Venter
- Map 15. Known distribution of *L. coriacea* S. Venter
-

-
- Map 16. Known distribution of *L. floribunda* (Bak.) Jessop
- Map 17. Known distribution of *L. hypoxidioides* (Schönl.) Jessop
- Map 18. Known distribution of *L. revoluta* (L.f.) Jessop
- Map 19. Known distribution of *L. zebrina* (Bak.) S. Venter
- Map 20. Known distribution of *L. luteola* Jessop
- Map 21. Known distribution of *L. ovatifolia* (Bak.) Jessop
- Map 22. Known distribution of *L. monophylla* S. Venter
- Map 23. Known distribution of *L. cooperi* (Hook.f.) Jessop
- Map 24. Known distribution of *L. parvifolia* S. Venter.
- Map 25. Known distribution of *L. asperifolia* (Van der Merwe)
S. Venter
- Map 26. Known distribution of *L. glauca* S. Venter
- Map 27. Known distribution of *L. inquinata* (C.A. Sm.) Jessop
- Map 28. Known distribution of *L. marginata* (Bak.) Jessop
- Map 29. Known distribution of *L. concolor* (Bak.) Jessop
- Map 30. Known distribution of *L. crispa* S. Venter
- Map 31. Known distribution of *L. undulata* (Jacq.) Jessop
- Map 32. Known distribution of *L. ovalifolia* (Schrad.) Jessop
-

Map 33. Known distribution of *L. petiolata* (Van der Merwe)
S. Venter

Map 34. Known distribution of *L. socialis* (Bak.) Jessop

Map 35. Known distribution of *L. macowannii* (Bak.) S. Venter

Map 36. Known distribution of *L. galpinii* (Bak.) S. Venter

Map 37. Known distribution of *L. papillata* S. Venter

ACKNOWLEDGEMENTS

"Commit your work to the Lord, and your plans will be established" Proverbs 16:3.

I wish to thank the following persons and institutions who offered encouragement, assistance, advice and cooperation in the preparation of this thesis:

Mr. T.J. Edwards, my supervisor, for his advice and constructive comments on the thesis.

Prof. J. van Staden, head of the Department of Botany, Natal University, for encouragement and permission to use the Department in my studies.

The Foundation for Research Development and Mr. M. Dix for financing part of the thesis.

The staff of the National Herbarium (PRE) of the National Botanical Institute and the following herbaria B, BLFU, BM, BOL, CPF, GRA, GRAZ, J, K, KEI, KNP, LYD, NBG, NH, NU, PEU, PRE, SAM, PRU, PUC, SRGH, STE, UNIN, UWC, Z, for assistance and permission to examine material.

Mrs. Sandy Burrows, the artist, for preparing the ink drawings.

The staff of the Mary Gunn Library for their assistance in the search for literature.

Messrs. R. Archer, J. Burrows, I. & N. Croach, G.J. du Toit, T.J. Edwards, D.S. Hardy, A. le Roux, T. Middleton, G.F. Smith, C. Stirton, E. van Jaarsveld, J.A. Venter and W.T. Vos for the collecting of plant material.

The directors and staff of the Electron Microscope Units, Natal University, Pietermaritzburg and University of the North, Sovenga for constructive assistance and the use of their facilities.

My wife Julye-Ann Venter for her patience and support in the veld and at home.

REFERENCES

- Acocks, J.P.H. 1988. Veld Types of South Africa. *Memoirs of the Botanical Survey of South Africa* No. 57.
- Aiton, W.T. 1789. *Hortus Kewensis, or a catalogue of the plants cultivated in the Royal Botanic Gardens at Kew*. 1., London.
- Aiton, W.T. 1811. *Hortus Kewensis, or a catalogue of the plants cultivated in the Royal Botanic Gardens at Kew*. Ed.2. Richard Taylor & Co., London.
- Andrews, G. 1803. *Botanical Repository* 5: t.299.
- Axelrod, D.I. 1972. Edaphic aridity as a means of Angiosperm evolution. *The American Naturalist* 106: 311-320.
- Badenhuizen, N.P. 1954. Some observations on removable spirals in *Scilla ovatifolia* Bak. *Protoplasma* 63(4): 429-440.
- Baker, J.G. 1868. *Saunders Refugium Botanicum* 1: t.18-19.
- Baker, J.G. 1870a. *Saunders Refugium Botanicum* 3: t.180-t.184.
- Baker, J.G. 1870b. *Saunders Refugium Botanicum* 3: t.185-189.
- Baker, J.G. 1870c. Monograph of *Scilla*: Sections *Ledebouria* and *Drimiopsis*. *Saunders Refugium Botanicum* 3(Append.): 1-18.
- Baker, J.G. 1870d. A revision of the Genera and Species of Herbaceous Capsular Gamophyllous Liliaceae. *Journal of the Linnean Society* 11(54): 228-253.
- Baker, J.G. 1870e. *Saunders Refugium Botanicum* 4: 235.

-
- Baker, J.G. 1873. *Journal of the Linnean Society* 13: 245-255.
- Baker, J.G. 1874. *Journal of Botany (London)* 3: 365.
- Baker, J.G. 1875. New Garden Plants. *Gardener's Chronicle* 3: 748.
- Baker, J.G. 1876. New Bulbous Plants from the Cape. *Journal of Botany (London)* 5: 183.
- Baker, J.G. 1878. New Garden Plants. *Gardener's Chronicle* 9: 104.
- Baker, J.G. 1880. New Garden Plants. *Gardener's Chronicle* 14: 230.
- Baker, J.G. 1881. New Garden Plants. *Gardener's Chronicle* 16: 38-102.
- Baker, J.G. 1883. New Garden Plants. *Gardener's Chronicle* 20: 166.
- Baker, J.G. 1891a. New Garden Plants. *Gardener's Chronicle* 9(3): 521.
- Baker, J.G. 1891b. new garden plants. *Gardener's Chronicle* 9(3): 668.
- Baker, J.G. 1892. *Botanische Jahrbücher* 15(35): 7.
- Baker, J.G. 1896. *Flora Capensis* 6: 478-494.
- Baker, J.G. 1901. *Bulletin de L'Herbier Boissier* ser. 2(1): 853.
- Baker, J.G. 1904. *Bulletin de L'Herbier Boissier* ser. 2(4): 1001-1002.
- Barnard, W.S. et al. 1972. *Suid - Afrika - Die land en sy streke*. Nationale Opvoedkundige Uitgewery Bpk., Kaapstad.
- Bentley, B & Thomas, E. 1983. *The Biology of Nectaries*. Columbia University Press, New York.
- Blatt, H., Middleton, G. and Murray, R. 1972. *Origin of Sedimentary Rocks*. Prentice Hall, Inc., Englewood Cliffs, New Jersey.
-

-
- Bolus, H. 1913. *Icones Orchidearum Austro-Africanarum extratropicarum* 3: t.64. ed. H.M.L. Bolus, Westley & Son, London.
- Britten, J. 1908. *Journal of Botany* 46: 201.
- Brown, N.E. 1921. *Kew Bulletin* :299.
- Buckman, H.O. & Brady, N.C. 1969. *The nature and properties of Soils*. Macmillan Company, London.
- Burchell, W.J. 1822. *Travels into the interior of southern Africa*. 2 volumes. The Patchworth Press, London.
- Cain, A.J. & Harrison, G.A. 1960. Phyletic weighting. *Proceedings of the Zoological Society of London* 135: 1-31.
- Cottrell, C.B. 1978. *Aspects of biogeography of southern African butterflies*. Supplement to Zambezia.
- Cowling, R.M. and Roux, P.W. 1987. The Karoo biome: a preliminary synthesis. Part 2 - vegetation and history. *South African National Scientific Programmes Report No. 142*.
- Dahlgren, R.M.T. & Clifford, H.T. 1982. *The Monocotyledons, a comparative study*. Academic Press, London.
- Dahlgren, R.M.T., Clifford, H.T. & Yeo, P.F. 1985. *The families of the Monocotyledons*. Springer-Verlag, New York.
- Dallwitz, M.J. & Paine, T.A. 1986. User's Guide to the Delta System. *Division of Entomology Report No.13 CSIO, Australia*.
- Desfontaines, R. 1798. *Flora Atlantica* 1: 300, t.88.
- Dickson, C.G.C. and Kroon, D.M. 1978. *Pennington's Butterflies of South Africa*. A.D. Donker Publishers, London.
-

-
- Dinter, K. 1921. *Fedde's Repertorium specierum novarum regni vegetabilis* 17: 189. Berlin.
- Du Toit, A.L. 1956. *The Geology of South Africa*. Oliver & Boyd, Edinburgh.
- Dyer, R.A. 1983. *Genera of Southern African Flowering Plants* Vol. 2. Government Printer, Pretoria.
- Ecklon, C.F. 1827. *Topographisches Verzeichniss der Pflanzensammlung von C.F. Ecklon*. Esslingen.
- Ecklon, C.F. 1830. *South African Quaterly Journal* 1: 364.
- Edwards, D. 1983. A broad-scale structural classification of vegetation for practical purposes. *Bothalia* 13(3 & 4): 705-712.
- Erdtman, G. 1969. *Handbook of Palynology*. Scandinavian University Books. Munksgaard, Copenhagen.
- Faegri, K. and Iversen, J. 1975. *Textbook of Pollen analysis*. Scandinavian University Books. Munksgaard, Copenhagen.
- Faegri, K and Van der Pijl, L. 1966. *The Principles of Pollination Ecology*. Pergamon Press, New York.
- Faegri, K. and van der Pijl, L. 1979. *The principles of pollination biology*. Pergamon Press, Oxford.
- Fernandes, A. & Barros Neves, J. 1962. Sur la caryologie de quelques monocotyledones Africaines. *Comptes Rendus de la Douzieme IVe Reunion AETFAT* : 439-464.
- Gelfand, M. et al. 1985. *The traditional Medical Practitioner in Zimbabwe*. Zimbabwe Government Printer.
-

-
- Gemenez-Martin, G. 1959. Numero cromosmico en especies de *Scilla*. *Genet. Iber.* 11: 97.
- Gibbs Russell, G.E. *et al.* 1985. List of species of southern African plants edn 2, part 1. *Memoirs of the Botanical Survey of South Africa* No. 51.
- Glauert, A.M. 1980. *Practical Methods in Electron Microscopy* 3: 86. North Holland Publishing Company.
- Glen, H.F. & Hardy, D.S. 1990. *Flowering Plants of Africa* 51(1): t.2012.
- Goldblatt, P. 1978. An analysis of the flora of South Africa: its characteristics, relationships and origins. *Annals of the Missouri Botanical Garden* 65: 369-436.
- Grant, V. 1963. *The Origin of Adaptations*. Columbia University Press, United States of America.
- Greuter, W. (Editor) *et al.* 1988. *International Code of Botanical nomenclature*. Published under auspices of the *International association for Plant Taxonomy*. Bohn Scheltema & Holkema, Utrecht.
- Gunn, M. & Codd, L.E. 1981. *Botanical Exploration of Southern Africa*. A.A. Balkema, Cape Town.
- Gunn, J.W.C., Goldberg, M. and Ferguson, J.H. 1924. A note on the pharmacological action of *Scilla cooperi*, *S. rogersii* and *S. lanceaefolia*. *Transactions of the Royal Society of South Africa* 12: 1-4.
- Hilliard, O.M. and Burtt, B.L. 1971. *Streptocarpus. An African Plant Study*. University of Natal Press, Pietermaritzburg.
-

-
- Hooker, J.D. 1866. *Curtis's Botanical Magazine* 92: t.5580.
- Humbert, H. 1935. *Notulae Systematicae* 5(1): 66-68.
- Hutchinson, J. 1932. *Kew Bulletin* :511.
- Hutchinson, J. 1946. *A Botanist in South Africa*. P.R. Gawthorn Ltd. London, W.C.1.
- Jacot-Guillarmod, A.J. 1971. *Flora of Lesotho*.
- Jacquin, N.J. 1794. *Icones Rariorum Plantarum* 2(17): t.402.
- Jessop, J.P. 1970. Studies in the Bulbous Liliaceae in South Africa: 1. *Scilla*, *Schizocarpus* and *Ledebouria*. *Journal of South African Botany* 36(4): 233-266.
- Jessop, J.P. 1972a. Studies in the Bulbous Liliaceae of South Africa: 2. *Drimiopsis* and *Resnova*. *Journal of South African Botany* 38: 151-162.
- Jessop, J.P. 1972b. Studies in the Bulbous Liliaceae in South Africa: 3. The Meiotic chromosomes of *Ledebouria*. *Journal of South African Botany* 38(4): 249-259.
- Jessop, J.P. 1975. Studies in the Bulbous Liliaceae in South Africa: 5. Seed surface characters and generic groupings. *Journal of South African Botany* 41(2): 67-85.
- Ker-Gawler, J.B. 1803. *Curtis's Botanical Magazine* 17: t.643.
- Ker-Gawler, J.B. 1811. *Curtis's Botanical Magazine* 33: t.1380.
- Krause, K. 1914. *Engler's Botanischer Jahrbücher* 51: 445.
- Kunze, O. 1847. *Linnaea* 20: 10.
-

-
- Kunth, C.S. 1843. *Enumeratio Plantarum omnium hucusque cognitarum secundum* 4: 338-681. Colla, Stuttgart.
- Linnaeus, C. fil. 1782, "1781". *Supplementum ad Species Plantarum Systematis Vegetabilium*. Brunsvigae.
- Loddiges, C. 1818. *The Botanical Cabinet* :278.
- Loddiges, C. 1825. *The Botanical Cabinet* :t.1041.
- Markötter, E.I. 1930. *Annale van die Universiteit van Stellenbosch* Reeks A, 8, afl. 1: 13.
- McNeil, J. 1978. Purposeful Phenetics. *Systematic Zoology* 28: 465-482.
- Migdol, I. 1987. *Fieldguide to the Butterflies of South Africa*. C. Struik Publishers, Cape Town.
- Miquel, F.A.W. 1839. *Drimia* in *Mélanges Botaniques. Bulletin des Sciences Physique et Naturelles en Nèerlande* :39.
- Müller - Doblies, D. 1971. *Galanthus* ist doch sympodial gebaut!. *Berichte Deutsche Botanische Gesellschaft* 84(11): 665-682.
- Müller-Doblies, D. & U. 1981. Über Verbreitung und Morphologie der *Ornithogalum* - Arten mit Zebrastreifung (Liliaceae des Südlichen Afrika). *Willdenowia* 11: 45-67.
- Nordenstam, B. 1970. Studies in South African Liliaceae: 3. The genus *Rhadamanthus*. *Botanische Notiser* 123(1): 155-182.
- Obermeyer, A.A. 1980. The genus *Sypharissa* (Liliaceae). *Bothalia* 13: 111-114.
-

-
- Persoon, C.H. 1805. *Synopsis Plantarum seu enchiridium botanicum* 1: 367.
- Phillips, E.P. 1951. *Genera of South African Flowering Plants*. Government Printer, Pretoria.
- Rebelo, A.G. 1987. A preliminary synthesis of pollination biology in the Cape Flora. *South African National Scientific Programmes Report* No. 141.
- Redoutè, P.J. 1807. *Les Liliacées* 1: t.59.
- Richards, A.J. 1986. *Plant Breeding Systems*. George Allen & Unwin, London.
- Rohlf, F.J. 1975. Note on Algorithm 81: Dendrogram plot. *Computer Journal* 18(1): 90-92.
- Rohlf, F.J. 1988. *NTSYS-pc. Numerical Taxonomy and Multivariate Analysis System*. Exeter Publishing. Ltd., New York.
- Rohlf, F.J. & Sokal, R.R. 1981. Comparing numerical taxonomic studies. *Systematic Zoology* 30(4): 459-490.
- Roth, A.W. 1821. *Novae Plantarum Species* : 194. Halberstadt.
- Roth, A.W. 1833. *Curtis's Botanical Magazine* 60: t.3226.
- Rutherford, M.C. and Westfall, R.H. 1986. Biomes - an objective categorization. *Memoirs of the Botanical Survey of South Africa* No.54.
- SACS, South African Committee for Stratigraphy, 1980. Stratigraphy of South Africa. Part 1 (Comp. L.E.Kent). *Handbook of the geological Survey of South Africa*. 8.
- Schrader, H.A. 1827. *Blumenbachia novum eloasearum Familia Genus*. (Dieterichianus, Gottingae) : 28-30.
-

-
- Schönland, S. 1903. On some new and some little-known species of South African plants. *Records of the Albany Museum* 1: 48.
- Schönland, S. 1914. *Records of the Albany Museum* 3: 60-61.
- Skaife, S.H. 1979. *African Insect Life*. C. Struik Publishers, Cape Town.
- Smith, A. 1895. *Contributions to South African Materia Medica* :155.
- Smith, C.A. 1930. *Scilla lanceaefolia* of the Flora Capensis. *Kew Bulletin* : 241-252.
- Smithers, R.H.N. 1983. *The Mammals of the Southern African sub - Region*. University of Pretoria.
- Sneath, P.H.A. and Sokal, R.R. 1973. *Numerical Taxonomy*. W.H. Freeman and Co., San Francisco.
- Stamp, L.D. & Morgan, W.T.W. 1972. *Africa: A study in Tropical Development*. John Wiley and Sons, Inc., New York.
- Stebbins, G.L., 1952. Aridity as a stimulus to plant evolution. *The American Naturalist* 826: 33-44.
- Story, R. 1958. Some plants used by the Bushmen in obtaining Food and Water. *Memoirs of the Botanical Survey of South Africa* No. 30.
- Thornbury, W.D. 1969. *Principles of Geomorphology*. John Wiley & Sons., New York.
- Thunberg, C.P. 1794. *Prodromus Plantarum Capensium quas in promontorio bonae spei Africes, annis 1772-1775 collegit*. Uppsala. :64.
- Tjaden, W.L. 1989. *British Cactus and Succulent Journal* 7(1) :11.
-

-
- Trattinick, L. (1814). *Archiv der Gewächskunde* 2: 132, t.168.
- Truswell, J.F. 1970. *An Introduction to the Historical Geology of South Africa*. Purnell & Sons, Cape Town.
- Valentine, D. 1967. The influence of climatic fluctuations on species diversity in the Tethyan provincial system. In C.G. Adams & D.B. Ager, *Aspects of Tethyan biogeography*. Systematics association publication 7: 153-166.
- Van der Merwe, F.Z. 1941. *Flowering Plants of Southern Africa* 21: t.828 & 832.
- Van der Merwe, F.Z. 1942. *Flowering Plants of Southern Africa* 22: t.865.
- Van der Merwe, F.Z. 1943. *Flowering Plants of Southern Africa* 23: t.904 & 912.
- Van der Merwe, F.Z. 1944a. *Flowering Plants of Southern Africa* 24: t.944
- Van der Merwe, F.Z. 1944b. *Flowering Plants of Southern Africa* 24: t. 947-948.
- Van der Merwe, F.Z. 1944c. *Flowering Plants of Southern Africa* 24: t. 958-959.
- Van der Merwe, F.Z. 1946. *Tydskrif vir Wetenskap en Kuns* 6: 41-46.
- Van der Merwe, C.R. 1962. *Science Bulletin* No. 356. Soil Groups and Sub groups of South Africa.
- Van der Pijl, L. 1969. *Principles of Dispersal in Higher Plants*. Springer-Verlag, Berlin.
-

-
- Van Jaarsveld, E.J. 1989. *A Revision of the genus Gasteria (Asphodelaceae)*. M.Sc. Thesis. University of Natal, Pietermaritzburg.
- Vari, L. and Kroon, D.M. 1986. Southern African Lepidoptera. A series of cross-referenced indices. *Lepidopterist's Society of South Africa and the Transvaal Museum*.
- Viviani, B.J. 1830. *Flora Corsicae Prodromus. Append. Alt. 3*: 1830.
- Von Poellnitz, K. 1944. *Berliner deutsches Gesellschaft* 41: 209.
- Von Poellnitz, K. 1945. *Portugaliae Acta Biologica*, 1 (Sèr. B): 212.
- Von Schrank, F. von P. 1820. *Plantae Rariores Horti Academici Monacensis* 2: 100, t.100.
- Watt, J.M. and Breyer-Brandwijk, M.G. 1962. *The medicinal and poisonous plants of southern and eastern Africa*. E. & S. Livingstone Ltd., London.
- Willaman, J.J. and Schubert, B.G. 1958. Alkaloid-bearing plants and their contained Alkaloids. *Technical Bulletin* No. 1234. U.S. Department of Agriculture : 131.
- Willdenouw, C.L. 1799. *Species Plantarum*. : 166-178.
- Wood, J.M. & Evans, M.S. 1899. New Natal Plants. *Journal of Botany* 37: 251.
- Wood, J.M. & Evans, M.S. 1900. *Natal Plants*. Volumes 1-4.
-