TAXONOMIC STUDIES ON LEUCOSPERMUM R.BR.

BY

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CONTENTS

SUMMARY

A brief historical review of previous taxonomic studies on Leucospermum is given. The principal diagnostic characters used in the present revision are evaluated. A complete taxonomic revision of the genus has been undertaken. All the relevant names have been typified and all the type specimens have been personally examined, except in a few cases where no type material could be traced. For each species the synonymy is given, the diagnostic characters are enumerated, brief historical comments are made where relevant and short ecological observations are provided. The distribution ranges of all taxa recognized have been mapped. In the present study, 47 species are upheld, arranged in 9 sections. 8 new species, L. innovans, L. pluridens, L. praecox, L. fulgens, L. erubescens, L. utriculosum, L. profugum and L. secundifolium are described. A key to the species is provided.

Mass gatherings have been used in several cases to investigate the variation ranges in complex groups. All but 3 taxa have been studied in the field. Although much of the variation in the polymorphic species L. cuneiforme appears to be random, a topocline in respect of leaf width was observed. Leaf width was found to increase from east to west over the distribution range of L. cuneiforme. A reappraisal of the taxonomic status of several complex vicarious populations was made, particularly those now upheld as L. profugum and L. spathulatum, L. praecox and L. fulgens L. catherinae and L. formosum, L. calligerum and L. wittebergense and L. alpinum and L. obtusatum. An ecocline in the species here delimited as L. oleaefolium is described. To demonstrate the cline, samples were obtained along a transect, over an altitudinal (and also ecological) gradient. When mass gatherings, made at intervals along the transect, were evaluated, continuous variation in respect of growth habit, leaf pubescence and in the length and pubescence of the involucral bracts, was observed.

Chromosome counts for 16 species of Leucospermum are listed, 13 of which were made by the present author. The somatic number is $2n = 24$.

Observations on the reaction of certain species to burning are discussed. The majority of species of Leucospermum have no special adaptation to burning, regeneration taking place from the seeds. A few species are able to regenerate from the aerial stems but their survival rate is rather low and depends on the severity of the fire. The most effective adaptation to burning is the persistent rootstock or lignotuber. Development of the lignotuber was

found to commence in the seedling stage, a few months after germination.

Studies on the pollination biology of the genus led the author to conclude that Promerops cafer (the Cape Sugarbird) and three species of sunbird, Anthobaphes violacea, Nectarina famosa and Cinnyris chalybeus were the most important pollen vectors. Certain Scarab beetles, particularly Anisonyx ursus and Trichostetha spp. were found to play a significant but less important role in pollen transfer due to their short seasonal activity.

Phytogeographic studies showed that although the distribution range of Leucospermum extends as far north as Rhodesia, the greatest species density is found in a narrow belt along the southern Cape coastal flats where 30% of the known species occur. A high proportion of geographical and edaphic vicariads occur within this coastal belt, the surface of which has been disturbed by marine regressions and invasions since the Tertiary. It is suggested that this zone has been an important area of speciation since the Pleistocene.

The isolation and subsequent differentiation of certain montane populations such as L. spathulatum and L. profugum, L. calligerum and L. wittebergense, L. alpinum and L. obtusatum, is thought to have been caused by climatic fluctuations resulting from the hypothermal and hyperthermal phases during the Pleistocene.

In the light of available paleoclimatological evidence, the distribution of certain species of the section Crassicaudex occuring in the summer rainfall regions of southern Africa, suggests that these taxa have been in existence since the Early Tertiary. It is suggested that the species occuring in the south western Cape could have been derived from forms such as presently survive in south central Africa.

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AIM AND SCOPE OF WORK

The principal reason for undertaking the present research was to provide a modern taxonomic revision of the genus Leucospermum. Since the publication of the last complete revision, by Phillips and Stapf in 1912, a further thirteen species have been described. Moreover, large areas of South Africa have been opened up since that date and consequently have become more readily accessible to collectors, which has resulted in the accumulation of much Leucospermum material in local herbaria. As our knowledge of distribution ranges is extended, taxa previously considered to have been distinct have often been found to grade into each other. On the other hand, exploration has revealed the presence of several remarkable new species. The incorporation of this scattered information in a complete and critical revision of the whole genus has become an urgent necessity, particularly in view of the current horticultural popularity of many of the larger species. Consideration has also been given to observations on the cytology, biology and phytogeography of the genus.

ACKNOWLEDGEMENTS

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In 1968, the award of the Smuts Memorial Fellowship by the University of Cape Town, made it possible for the author to visit several of the major herbaria in Europe. I am extremely grateful to the University for this assistance and also to the Board of Trustees of the National Botanic Gardens, Kirstenbosch, for granting me 3½ months study leave.

The directors of the following institutes are sincerely thanked for the loan of material and, in many cases, for their hospitality when personal visits were possible: BOL, CT, STE, PRE, GRA, NH, NU, SRGH, K, BM, S, UPS, B, M, BR, Z, G, P, PH, FI, LY (abbreviated according to Lanjouw and Stafleau, 1964).

Finally, I would like to record my gratitude to Mr. Ion Williams, with whom I have travelled many thousands of miles in search of *Leucadendron* and *Leucospermum*, not only for his hospitality but also his splendid companionship on so many expeditions.

HISTORICAL BACKGROUND

In 1689 Paul Herman's Paradisi Batavi Prodromus was published, containing the earliest known published description of a Leucospermum. Herman, who visited the Cape in 1672, described L. conocarpodendron (Salix conophora Africana ....), which he had observed on the lower slopes of Table Mountain. During the ensuing fifty years, numerous other descriptions were published by such writers as Plukenet, Petiver, Ray and Boerhaave, and when, in 1753, the first edition of Linnaeus' Species Plantarum appeared, two species of Leucospermum were recognized. Between the publication of the Species Plantarum and the appearance of Thunberg's Dissertatio De Protea in 1781, an additional four species were described, by Linnaeus, Bergius and N.L. Burman. Thunberg's enumeration listed nine species which at this stage were still grouped under Protea. The few additions to the genus that were published after this date were mainly in a review of Protea (sens. lat.) by Lamark and in the Botanists Repository and Paradisus Londinensis.

The appearance of the rival publications of Salisbury (1809) and Brown (1810) saw the first use of the recently established generic divisions Leucadendrum and Leucospermum. The latter name of Brown was later to be conserved against Leucadendrum Salisb. The revisions of Salisbury and Brown listed twenty four and eighteen species respectively. These studies were to a large extent based on the collections of Masson, Niven and Roxburgh as well as living material from several of the great private collections of Cape Proteaceae which were fashionable in cultivation at that time.

Meisner's careful and lucid account of the genus for De Candolle's Prodromus in 1856, recognized twenty three species, four of which were newly described. Although this work purported to be a synthesis of all available information, it lacks the completeness it should have had for Salisbury's publications were not quoted at all.

In the last revision of the whole genus by Phillips and Stapf (1912), thirty one species were upheld, arranged in four sections. Despite its shortcomings, one hesitates to criticise this work, considering the hopelessly inadequate material available at the time.

CHARACTERS OF TAXONOMIC VALUE

Growth Habit

Most species of Leucospermum are erect shrubs or small trees, usually with a single main stem, but a number of species have a prostrate growth form which is particularly characteristic of these taxa. In addition, certain species may be distinguished by having multiple stems at ground level, arising from a persistent rootstock, instead of a single main stem.

For example, while it is very difficult to separate L. pedunculatum and L. prostratum on herbarium material only, both these prostrate species have different growth habits. L. pedunculatum has a short stout trunk up to 30 cm in height from which numerous horizantally spreading stems arise, whereas in L. prostratum the stems develop from a subterranean lignotuber. Characters concerned with the biology of higher plants are seldom taken into account when classifications are proposed. The presence of a subterranean rootstock or lignotuber has been overlooked in the past but in the present study it is regarded as a very significant morphological and biological feature.

Leaves

Leaf characters have been greatly emphasised in previous classifications but usually without regard to their plasticity. The form, dimensions, pubescence and the number of teeth at the apex of the leaf are very useful characters. A fairly clear division can be made into species in which the leaves are entire with a single apical thickening, and those species in which the leaf apex is incised, bearing up to seventeen teeth.

It has been found that population studies are necessary to evaluate the range of variation in each taxon, for, while foliar characters may be very plastic in some species (e.g. L. cuneiforme L. cordifolium and L. oleaefolium), they may be surprisingly constant in others.

The presence or absence of pubescence on the leaves is generally a reliable diagnostic character. The type of pubescence found on the stems and leaves is so distinctive that it might even be regarded as a generic character. A fine matted indumentum of varying density is formed by numerous, short, crisped or coiled unicellular trichomes which may or may not have a few long straight unicellular trichomes interspersed among them. (fig. 1).

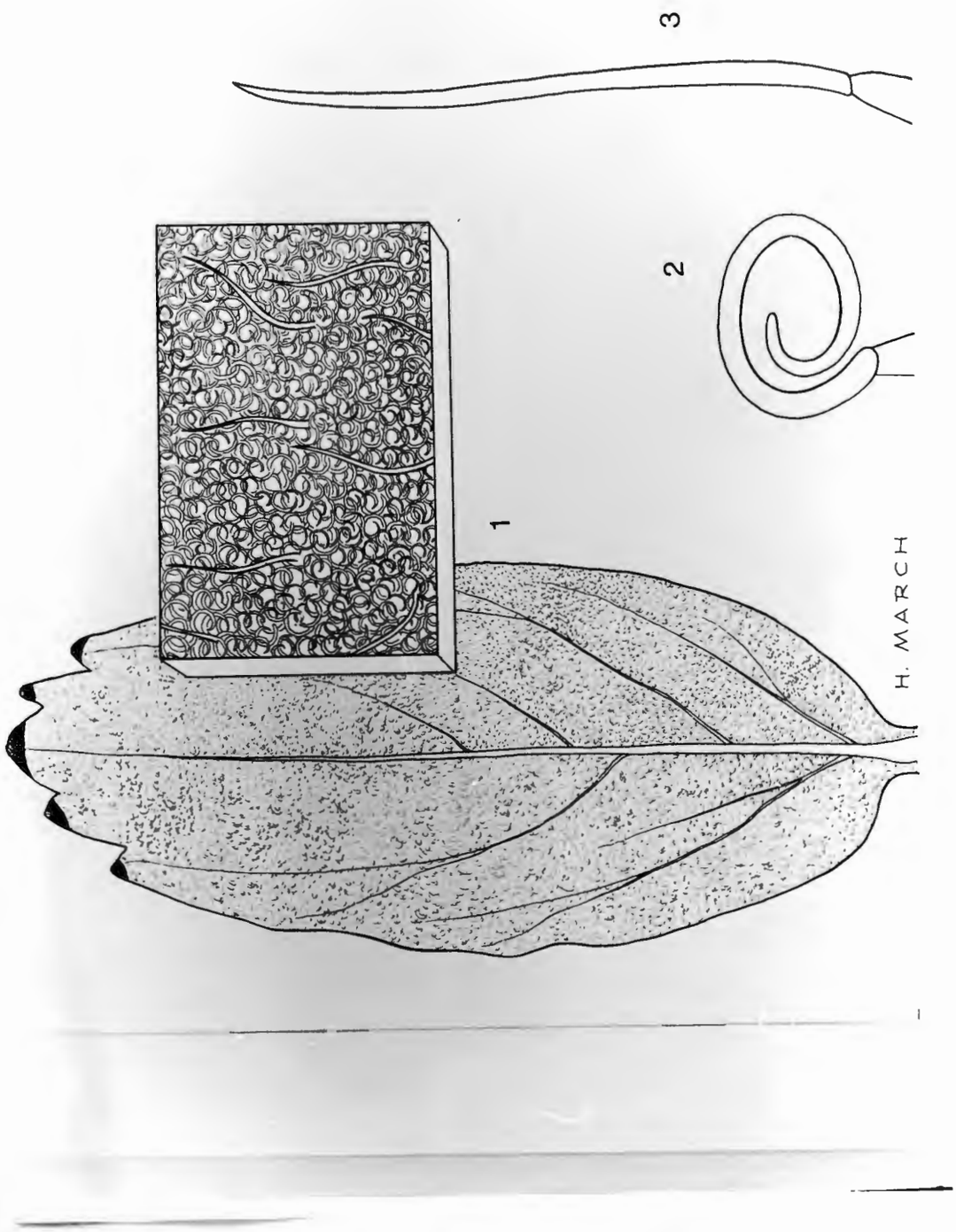


Fig. 1. Leaf pubescence in Leucospermum. The stylized leaf with an inset (1) shows the short dense indumentum of crisped hairs (2) interspersed with straight erect trichomes (3).

The Inflorescence

In Leucospermum the inflorescence is a capitulum borne in an axillary position towards the apex of a flowering shoot. This is a diagnostic generic character. Generally, a single axillary bud develops into an inflorescence in the species having large inflorescences but in species having small inflorescences, nearly all the buds in the axils of the uppermost leaves on a flowering shoot may develop into inflorescences. Although the number of inflorescences per flowering shoot is not specifically diagnostic, it is usually characteristic of certain sections in the genus.

Involucral Bracts

There is comparatively little variation in the morphology of the involucral bracts but differences in their texture provide significant characters. A tough, cartilaginous texture characterises the involucral bracts in the majority of species. In these cases, the involucral bracts are tightly adpressed imbricate and are usually pubescent. On the other hand, species such as L. tottum, L. vestitum and L. parile may be distinguished by their glabrous bracts which are thin and papyraceous in texture.

The Involucral Receptacle

One of the most useful characters that has been largely overlooked by previous workers, is the form of the involucral receptacle. When the inflorescence is cut longitudinally into two equal halves the involucral receptacle can be seen in median section. The form of the involucral receptacle as seen in median section provides very reliable characters for grouping species. The basic shapes of the involucral receptacle are cylindric obtuse, narrowly conic acute, conic acute, broadly conic depressed and flattened (fig. 2).

Perianth

Perianth characters have also been overlooked by monographers in the past. The most obvious character of taxonomic value is the structure of the perianth tube. Although the perianth tube in most species is cylindric and of uniform diameter, there are several species forming a distinct group in which the perianth tube is narrowed proximally and inflated distally. L. utriculosum is the most extreme example of this type. Unfortunately this character is not easily observed in dried material but is quite obvious in fresh material.

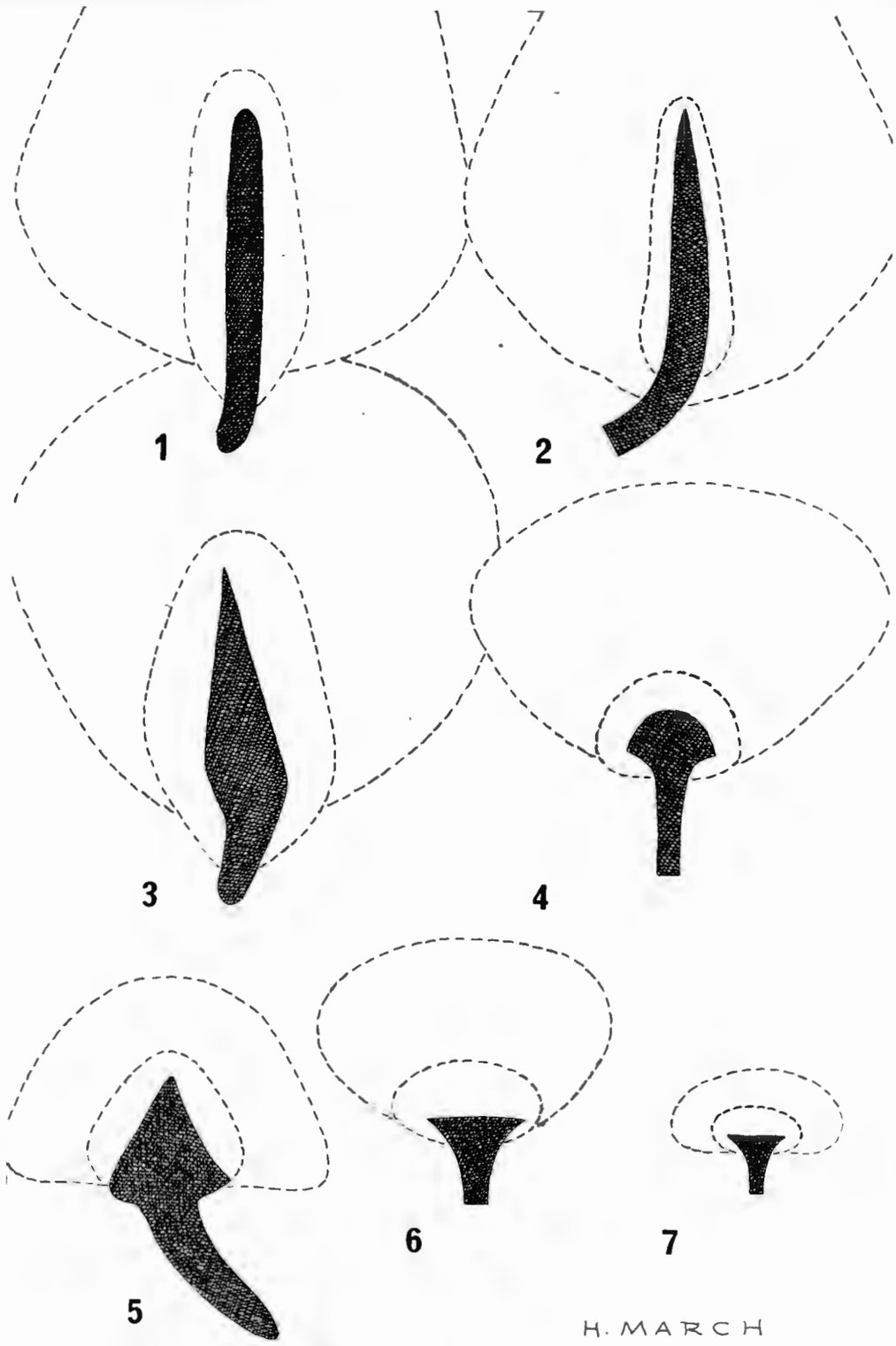


Fig. 2. The principal types of involucral receptacle in Leucospermum, as seen in longitudinal half section. The outermost broken line represents the position of the expanded styles; the innermost broken line represents the position of the bracteoles and the involucral receptacle is darkly hatched.
(1)Cylindric obtuse; (2) narrowly conic acute(3) conic acute; (4)spheroidal; (5) broadly conic depressed ;(6&7) flattened.

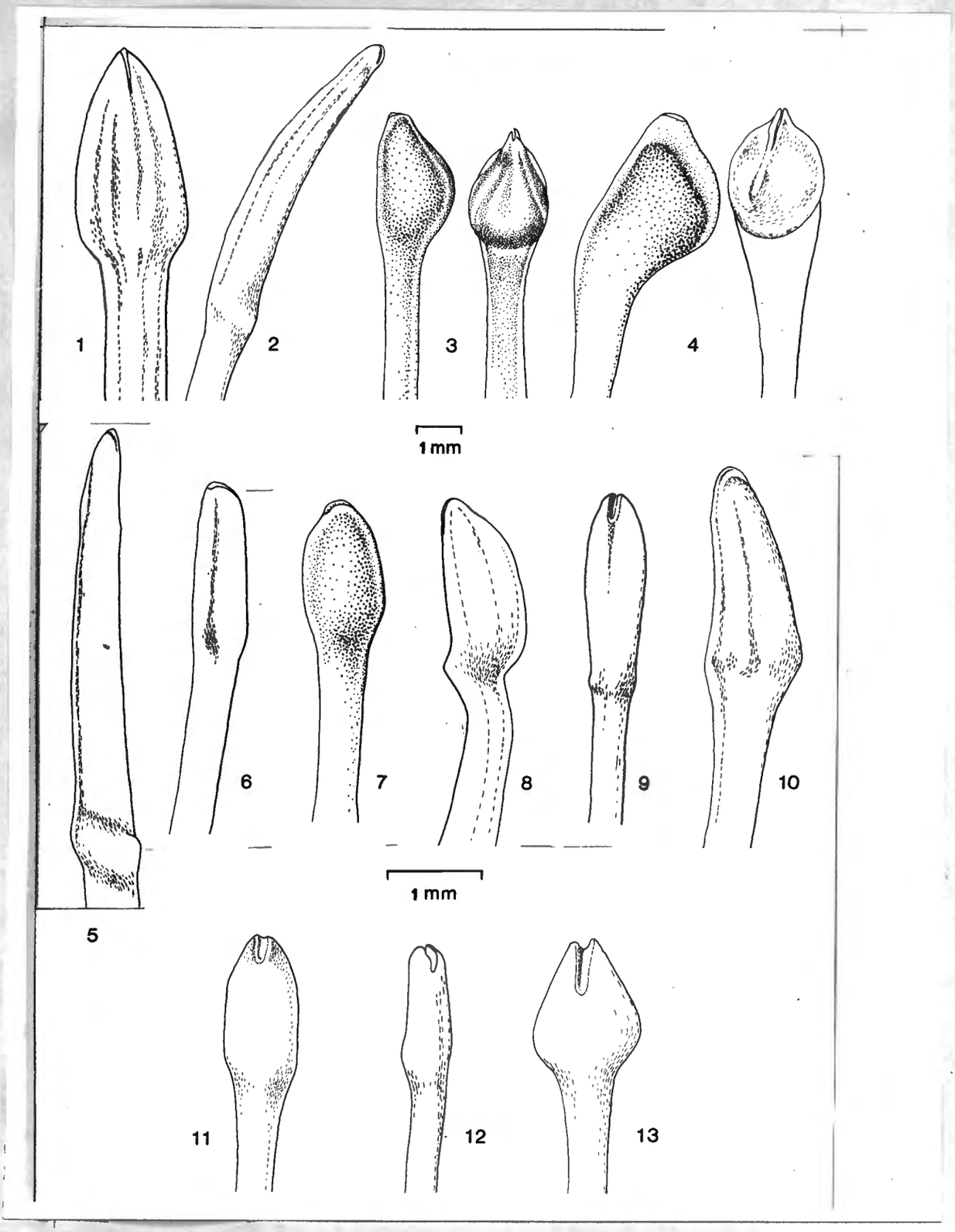


Fig. 3. The principal types of pollen presenter in Leucospermum. (1) L. conocarpodendron; (2) L. grandiflorum; (3) L. vestitum; lateral and abaxial view; (4) L. patersonii, lateral and abaxial view; (5) L. reflexum; (6) L. saxosum; (7) L. utriculosum; (8) L. cordatum; (9) L. rodolentum; (10) L. praecox; (11) L. royenifolium; (12) L. mundii; (13) L. calligerum.

Anthers

While the anthers are morphologically uniform throughout the genus and are normally sessile, certain species are described as having subsessile anthers. In the latter species, a short rudimentary filament 1.0 - 1.5 mm long connects the anther to the perianth limb. Those taxa, grouped together in the section Brevifilamentum on overall morphological similarity, are also characterised by having subsessile anthers.

Pollen Presenter

The considerable range of variation in the morphology of the pollen presenter provides characters of great taxonomic value at specific level. In a previous paper the definition and use of this term were discussed as well as the taxonomic importance of this character in other genera of the Proteaceae (Rourke, 1969). Since no adequate language exists to describe in full the morphology of this organ, the principal types have been illustrated (fig. 3).

Fruits

Little importance can be attached to the fruits as a taxonomic character for species delimitation. Differences in the dimensions are slight while the morphology is surprisingly uniform, varying only from ovoid to cylindric. (fig. 4).

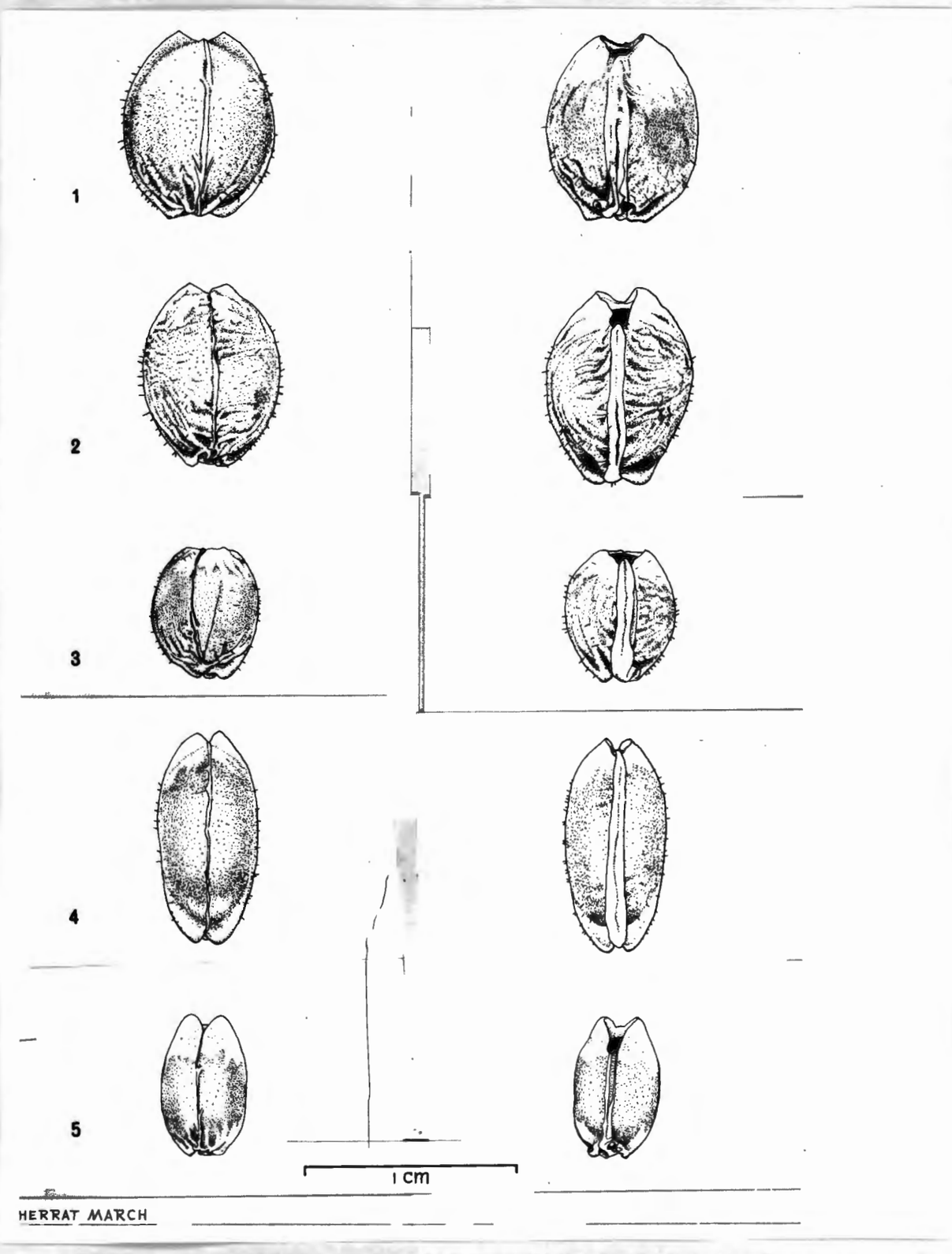


Fig. 4. The small variation range in the fruits of Leucospermum showing the abaxial (left) and adaxial (right) views of the most extreme types in the genus. (1) L. patersonii; (2) L. glabrum; (3) L. praecox; (4) L. praemorsum; (5) L. mundii.

TAXONOMY

Criteria used for delimitation of Species.

In the preparation of this revision, the author has attempted to produce a classification of naturally occuring populations. Differences and similarities between living populations have been sought, while great stress has been laid on the determination of their exact distributional limits. Where populations have been found to be variable or where careful comparison of two or more populations has been necessary, mass gatherings throughout their range have been made in order to assess the extent and significance of the variation. Here, I have followed the methods prescribed by Anderson (1941) which have enabled me to make a more complete and objective evaluation of variability than the range of available herbarium material would normally have permitted.

The phenomenon of vicarism was found to be very widespread. In this connection it is worth quoting Cain's clear definition of vicarious species : "Vicarious species are closely related allopatric species which have descended from a common ancestral population and attained at least spatial isolation" (Cain, 1944 : 265). Although as far as Leucospermum is concerned, it is at this stage impossible to prove that two vicarious taxa are descended from a common ancestral population, it can at least be inferred by their morphological similarity.

The assignation of rank to vicarious taxa even when separated by significant geographical intervals, is not always easy and although every effort has been made to evaluate the distinctness of these taxa objectively, the decision as to whether they should be accorded specific or subspecific rank is often unavoidably subjective. Nevertheless, some morphological criteria must be followed and for this purpose the suggestions of Hedberg have been adopted. Thus, populations separated by discontinuous variation in at least two (preferably more) independent characters, are distinguished at the level of species while distinct discontinuity in a single character together with geographical isolation, is used as the basis for recognising subspecies (Hedberg, 1958 : 193).

The genus has been divided into nine sections, each containing morphologically similar taxa. Complex groups within each section are discussed directly after the sectional diagnosis. All specimens (including types) quoted in this work have been examined by the present author except where the contrary is stated.

Due to the advanced stage this work had reached by the time the one degree grid system was generally adopted in South Africa, specimens are still cited according to the magisterial districts as defined in 1964.

Leucospermum R. Br. in Trans. Linn. Soc. Lond. 10 : 95 (1810), - nom. cons.; Roem. & Schult. Syst. Veg. 3 : 356 (1818); Sprengel, Syst. Veg. 1 : 464 (1825); Roem. & Schult., Mant. Syst. Veg. 3 : 266 (1827); Endlicher, Gen. Pl. fasc. 5 : 337 (1837); Harv., Gen. S. Afr. Pl., : 291 (1838); Meisn. in DC., Prodr. 14 : 253 (1856); Benth. & Hook., Gen. Pl. 3 : 170 (1883); Engler in Nat. Pfl. Fam. 3 (1) : 137 (1888); Phillips & Stapf in Fl. Cap. 5 : 610 (1912); Thonner, Fl. Pl. Afr. : 171, t. 33 (1915); Phillips, Gen. S. Afr. Fl. Pl. ed 2, : 257 (1951); Hutch., Gen. Fl. Pl. 2 : 292 (1967). Type: L. hypophyllocarpodendron (L.) Druce.

Conocarpus Adanson, Famil. de Plant. 2 : 284 (1763), partly, as to citation of Boerh. t. 196 & t. 198; - non L. (1753).

Lepidocarpus Adanson, Famil. de Plant. 2 : 284 (1763), partly, as to citation of Pluk. Phyt. t. 200 f. 2.

Leucadendrum Salisb., Parad. Lond. sub. t. 67 (1807); Knight, Cult. Prot. : 52 (1809).

Leucadendron O. Kuntze, Rev. Gen. Pl. 2 : 578 (1891); - non L. (1753).

Small trees or shrubs, single or with multiple stems at base, 1.0 - 5.0 m in height, or sprawling prostrate shrubs with decumbent stems, often forming low mats, 1.0 - 5.0 m in diam. Leaves alternate, loosely ascending or imbricate, sessile or petiolate 1.5 - 14.0 cm long; linear, elliptic, oblanceolate, oval, obovate or spathulate; entire or with up to 17 teeth at apex; glabrous or pubescent, often covered with a short indumentum of fine crisped hairs interspersed with erect silky trichomes. Inflorescences axillary capitula, sessile to pedunculate, solitary or in groups of up to 10 per flowering shoot; globose to depressed globose, ovoid or turbinate, 2.0 - 15.0 cm in diam. Involucral receptacle cylindric, conic, conic depressed, globose or flat. Involucral bracts linear or ovate, acute, acuminate or recurved; tightly imbricate to subsquarrose; cartilaginous or membranaceous; glabrous or pubescent; small, inconspicuous and greenish when fresh. Bracteoles lanate proximally, puberulous or glabrous distally; occasionally enlarging and becoming woody in post pollination phase. Perianth 1.5 - 5.5 cm long, tubular-cylindric in bud; straight or adaxially curved; white, pink, yellow, orange or crimson; the three adaxial perianth claws fused to form a sheath, the abaxial perianth

claw increasing in length and becoming separated from the adaxial sheath for 3/4 of its length but remaining fused at the base; Perianth tube 0.3 - 1.0 cm long, cylindric or narrowed proximally and inflated distally; perianth limbs ovate or lanceolate, acute. Anthers sessile or subsessile, the connective produced into a pointed or rounded apical boss. Style straight or adaxially curved, 1.0 - 8.0 cm long, elongating rapidly and arching up between the adaxial perianth sheath and the partially free abaxial perianth claw; often tapering subterminally; 1.0 - 2.0 mm in diam., or filiform. Pollen presenter cylindric, clavate, ovoid, conic or obliquely turbinate; stigmatic groove terminal or oblique. Ovary 1.0 - 2.0 mm long, puberulous, scarcely differentiated from the base of the style; one chambered, ovule single, pendulous. Hypogynous scales 4; 1.0 - 3.0 mm long, linear or deltoid-subulate. Fruit an ovoid to cylindric nut 4.0 - 8.0 mm long, broadly emarginate at base, glabrous or minutely puberulous.

Diagnostic Characters: The genus is distinguished by having axillary capitula with small insignificant involucral bracts; by the three adaxial perianth segments being fused into a sheath, with the abaxial perianth segment elongating and separating for the greater part of its length but remaining fused proximally to form a distinct perianth tube; by the prominent, exerted, coloured styles, straight or adaxially arcuate, and the nut-like fruits broadly emarginate at the base.

Distribution: 47 species, ranging from Namaqualand throughout the south western, southern and eastern Cape to Natal, the eastern Transvaal, Swaziland and the Chimanimani mountains, Rhodesia.

KEY TO THE SPECIES OF LEUCOSPERMUM

1	Styles 10 - 30 mm long, usually not exceeding 28 mm in length	2
1'	Styles 31 mm or more long, usually exceeding 35 mm in length	25
2	Leaves with 2 or more teeth at apex	3
2'	Leaves entire, with a single apical thickening	14
3	Involucral receptacle flat	4
3'	Involucral receptacle conic, acute	7

4 Leaves 5 - 7 mm wide 5

4' Leaves 10 - 85 mm wide 6

5 Leaves very narrowly oblanceolate, attenuate at base, bracteoles acute 47. saxatile

5' Leaves linear, obtuse at base, bracteoles abruptly acuminate 46. gracile

6 Leaves ovate, lanceolate or oblong, usually entire, rarely with 2 - 5 teeth at apex 44. oleaefolium

6' Leaves oblanceolate to broadly obovate, with 7 - 17 teeth at apex 45. mundii

7 Leaves canescent, with a dense, greyish, crisped indumentum 8

7' Leaves glabrous or glabrescent 11

8 Stems erect, leaves ascending loosely imbricate, very rarely subsecund 9

8' Stems prostrate, leaves secund 28. hypophyllocarpodendron

9 Leaves linear, broadly canaliculate 10

9' Leaves oblong to oblanceolate, plane 30. rodolentum

10 Involucral bracts glabrous, membranaceous, subsquarrose 31. parile

10' Involucral bracts tomentose, cartilaginous, tightly adpressed imbricate 29. tomentosum

11 Stems erect, leaves ascending, loosely imbricate 13

11' Stems prostrate, leaves usually secund or at least some of them secund 12

12 Pollen presenter cylindric obtuse to clavate 28. hypophyllocarpodendron

12' Pollen presenter conic ovoid 36. heterophyllum

13 Perianth puberulous, leaves 4 - 10 mm wide 11. muirii

13' Perianth villous, leaves 8 - 15 mm wide 10. truncatum

14	Styles very strongly adaxially arcuate	21. cordatum	
14'	Styles straight or very slightly adaxially arcuate		15
15	Pollen presenter conic-ovoid		16
15'	Pollen presenter cylindric-clavate		18
16	Involucral bracts membranaceous, forming a distinct, multiseriate involucre		17
16'	Involucral bracts cartilaginous, involucre indistinct	33. calligerum	
17	Leaves pubescent, oval or oblong	37. truncatulum	
17'	Leaves glabrous, elliptic to ovate	38. bolusii	
18	Leaves secund		19
18'	Leaves ascending, loosely imbricate		20
19	Leaves 1 - 2.5 cm long	42. obtusatum	
19'	Leaves 5 - 8 cm long	43. secundifolium	
20	Stems erect		21
20'	Stems trailing		24
21	Leaves glabrous or glabrescent		22
21'	Leaves pubescent with a fine crisped indumentum	34. wittebergense	
22	Leaf apices obtuse		23
22'	Leaf apices acute	35. royenifolium	
23	Leaves obovate to spathulate-elliptic, 8.5 - 13.0 mm wide	41. alpinum	
23'	Leaves linear-spathulate, 1.5 - 6.0 mm wide	42. obtusatum	
24	Acaulescent shrubs, with stems arising from a subterranean rootstock; perianth and style deep yellow at anthesis becoming orange or red with age	39. prostratum	

24'	Caulescent shrubs, with stems arising from the crown of a stout main trunk up to 30 cm in height; perianth and style creamy white at anthesis becoming pinkish carmine with age	40. pedunculatum	
25	Styles 3.0 - 3.5 cm long	32. arenarium	
25'	Styles exceeding 3.5 cm in length		26
26	Involucral bracts loosely arranged, linear-lanceolate	26. praemorsum	
26'	Involucral bracts adpressed imbricate, (not loosely arranged), lanceolate to ovate		27
27	Involucral receptacle narrowly cylindric, obtuse		28
27'	Involucral receptacle narrowly conic acute, conic acute, or conic depressed		32
28	Styles 7.0 - 7.5 cm long, leaves grey, canescent, with a dense, permanent crisped indumentum	27. reflexum	
28'	Styles less than 7.0 cm long, leaves glabrous or glabrescent		29
29	Pollen presenter very narrowly conic acute, scarcely differentiated from the style; recorded from Rhodesia, Transvaal, Swaziland and Natal		30
29'	Pollen presenter conic acute; recorded from the Cape and Natal		31
30	Leaves linear to oblanceolate, slightly falcate, with prominently raised reticulate and parallel veins on surface	4. gerrardii	
30'	Leaves elliptic, smooth, lacking prominently raised veins on surface	1. saxosum	
31	Leaves oblanceolate 0.6 - 3.0 cm wide	2. cuneiforme	
31'	Leaves very broadly oblanceolate to obovate, 3.0 - 5.0 cm wide	3. innovans	

32	Style 7.0 - 8.0 cm long, pollen presenter set almost at right angles to the style	33
32'	Style less than 7.0 cm long, pollen presenter in line with the style	36
33	Involucral bracts of immature inflorescences tightly adpressed imbricate, glabrous to glabrescent, margins and apex minutely ciliate	35
33'	Involucral bracts of immature inflorescences squarrose, margins with dense long cilia, apices crinite	34
34	Leaves pubescent with a greyish canescent indumentum of fine crisped hairs; apex with 2 - 4 teeth; perianth and style yellow at anthesis	24. grandiflorum
34'	Leaves glabrous, deep green in fresh state; leaves usually entire or rarely with 2 - 4 teeth; perianth and style bright orange at anthesis	25. gueinzii
35	Leaves permanently pubescent, covered with a dense indumentum of fine crisped hairs, sessile	22. formosum
35'	Leaves glabrous, petiolate with a prominently attenuate base	23. catherinae
36	Perianth tube inflated distally, narrowed proximally	37
36'	Perianth tube cylindric, of uniform diameter	42
37	Stems decumbent, trailing	38
37'	Stems erect	39
38	Style 4.5 - 6.2 cm long; leaves glabrous or glabrescent, usually with 2 or 3 teeth at apex	15. profugum

38'	Style 3.0 - 4.0 cm long; leaves beset with a fine indumentum of short crisped hairs; usually entire, rarely with 2 or 3 teeth at apex	14. spathulatum	
39	Pollen presenter conic, acute		40
39'	Pollen presenter ovoid, clavate or cylindric, obtuse		41
40	Leaves oblanceolate to oblong, with up to 4 teeth at apex; perianth villous	9. fulgens	
40'	Leaves obovate to broadly obovate, with 6 - 11 teeth at apex; perianth puberulous	8. praecox	
41	Inflorescences in groups of 2 - 8, slightly assymetrical; perianth velutinous; styles almost straight	12. erubescens	
41'	Inflorescences solitary or in groups of up to 2; perianth beset with long, spreading, silky trichomes; styles adaxially curved	13. utriculosum	
42	Pollen presenter obliquely turbinate (hoof shaped)		43
42'	Pollen presenter ovoid or conic, acute		44
43	Perianth claws lanate; leaves broadly oblong, always with 3 - 8 teeth at apex	20. patersonii	
43'	Perianth claws puberulous; leaves ovate to oblong, entire or with up to 6 teeth at apex	19. cordifolium	
44	Pollen presenter conic, acute		45
44'	Pollen presenter ovoid or obliquely ovoid, acute		47
45	Involucral bracts with long, acuminate recurved apices		46

45'	Involucral bracts acute to acuminate apices imbricate, not recurved	5. conocarpodendron
46	Stems with a villous to arachnoid, cinereous indumentum	7. pluridens
46'	Stems glabrous	6. glabrum
47	Involucral bracts membranaceous, glabrous	48
47'	Involucral bracts cartilaginous, tomentose	18. lineare
48	Styles straight at maturity, the lowermost horizantally patent; perianth pink	17. tottum
48'	Styles adaxially arcuate at maturity; perianth orange or red	16. vestitum

Sect. 1. CRASSICAUDEX Rourke, sect. Nov.

Frutices erecti, caulibus plurimis, a caudice suhterraneo lignoso persistenti exorientibus. Folia oblanceolata cuneata vel late cuneatissima, 2 - 10 dentata. Receptaculum involucrale cylindricum.

Erect shrubs with numerous stems arising from a woody, subterranean, persistent rootstock. Leaves oblanceolate cuneate to very broady cuneate. Involucral receptacle cylindric.

Type: L. cuneiforme (Burm. f.) Rourke

L. gerrardii is the only sharply delimited species in the section. L. saxosum and L. innovans are sufficiently distinct morphologically and sufficiently isolated geographically, to be accorded specific rank.

The remaining variable complex extending from the Caledon district eastwards to Qolora Mouth in the Transkei, has been subdivided into several species in the past. Differences in growth habit can be very marked, particularly as the type of habitat occupied may vary from stabilised coastal sand dunes to the margins of temperate evergreen forest, or arid fynbos fringing the Karoo. Consequently, the variety of growth habits assumed is considerable, ranging from low, stunted, almost prostrate shrubs, to arborescent shrubs reaching 3 m or more in height. Climatic and edaphic factors as well as the frequency of burning have a very significant effect on the modification of growth habits within this complex.

Variation in the size of the inflorescence is also evident but cannot be correlated with any other character. The considerable range in the form and dimensions of the leaves together with differences in the degree of toothing of the leaf apex, have been the major causes for subdivision by previous authors. However, a topocline in respect of leaf width was found.

To demonstrate this cline, the entire distribution range of the complex was divided into 3 approximately equal divisions : Caledon - Mossel Bay (19°- 22°E); Mossel Bay - Gamtoos River mouth (22°- 25°E); Gamtoos River mouth - Qolora mouth 25°- 29°E). The leaf width of 30 collections occuring within each of these divisions was measured (from specimens in NBG, SAM, BOL, PRE) and plotted as a series of histograms. A clear trend from narrow leaves in the east to broader leaves in the west is observable (Fig. 5). The arrangement of the leaves illustrated

in Fig. 6 to show variation in apical toothing and in overal dimensions, more or less follows the direction of the cline.

While local races may appear quite distinct, continuous variation in all characters throughout the complex suggests that only one variable species, L. cuneiforme, should be recognised.

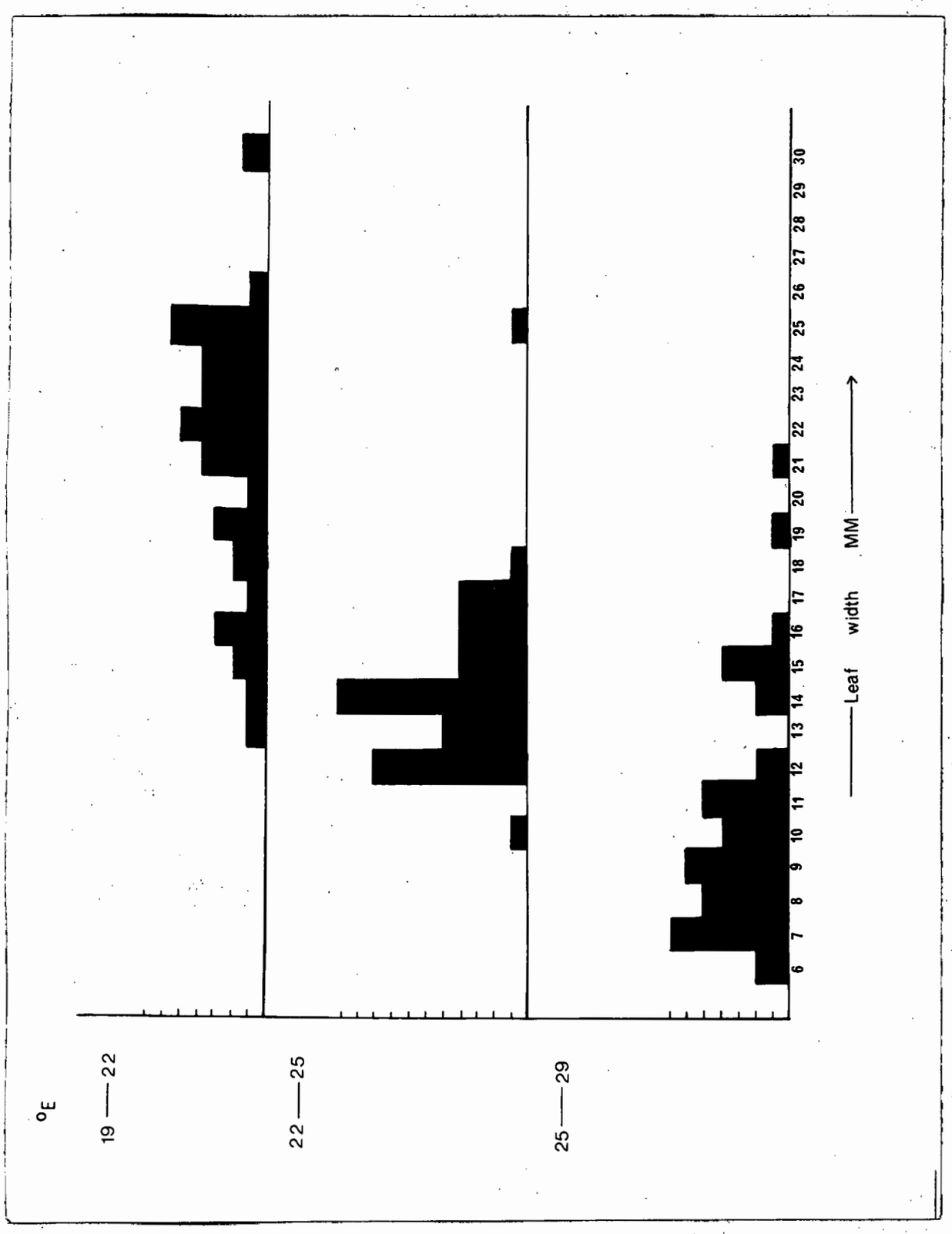


Fig. 5. Histograms showing the topocline in leaf width in Leucospermum cuneiforme(Burm.f.)Rourke. The leaf width increases from east to west.

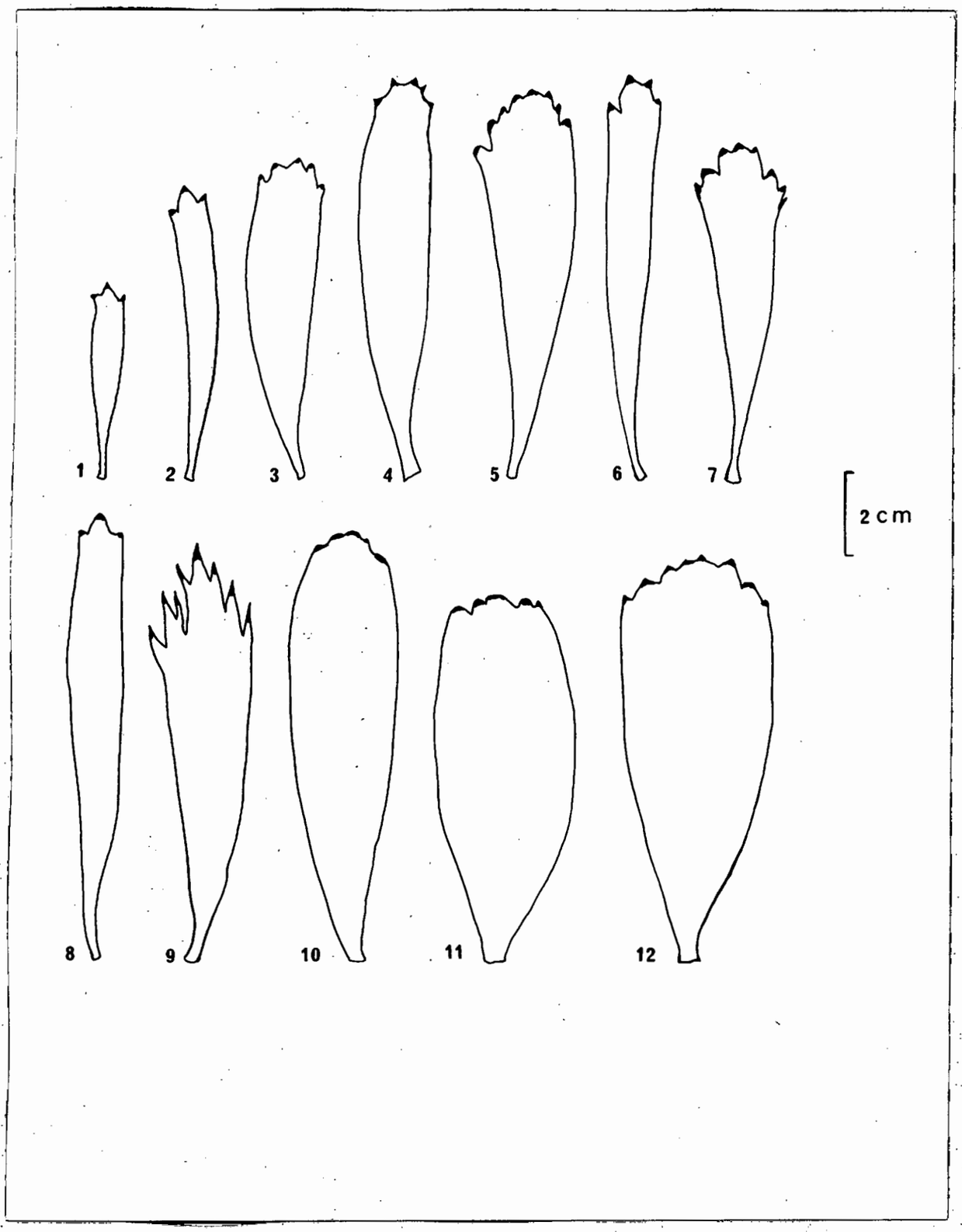


Fig. 6. Variation in the leaves of Leucospermum cuneiforme (Burm. f.) Rourke : (1) Compton 20290; (2) Rycroft 2502; (3) Barker 10497; (4) Rourke 616; (5) Barker 10500; (6) Middlemost 2053; (7) Denman 21; (8) Compton 7546; (9) Lewis 5337; (10) Williams 1056; (11) Rourke 950; (12) Rourke 279.

(1) Leucospermum saxosum S. Moore in J. Linn. Soc. (Bot) 40 : 185 (1911). Type : Crags of Chimanimani mts., Swynnerton 652 (Holotype BM; isotypes K, B).

An erect shrub to 2.0m in height with numerous stems arising from a woody underground rootstock. Stems erect, 3.0 - 8.0 mm in diam., covered with a dense indumentum of fine crisped hairs, sparsely interspersed with long (2.0 - 3.0 mm), erect trichomes. Leaves oblanceolate cuneate to elliptic to almost linear, 5.5 - 11.5 cm long, 0.6 - 2.5 cm wide, attenuate to petiolate at base; apex usually 3 - 6 toothed, occasionally entire. Inflorescences solitary, occasionally 2-nate; ovoid, 4.0 - 6.0 cm in diam., pedunculate, peduncle 1.0 - 1.5 cm long. Involucral receptacle narrowly cylindric 2.5 - 3.0 cm long, 0.5 cm wide. Involucral bracts ovate, 6.0 - 8.0 mm long, 2 - 3 seriate, imbricate, tomentose, cartilaginous; apex abruptly acute. Bracteoles very broadly obovate, apex acute; tightly clasping the perianth. Perianth 3.0 - 3.5 cm long, yellow-orange becoming crimson with age. Perianth tube 6.0 mm long, infundibuliform, inflated and minutely puberulous distally, narrowed and glabrous proximally. Perianth claws villous. Perianth limbs linear 3.0 mm long, sparsely villous. Anthers sessile, 2.0 mm long, elliptic. Style 4.5 - 5.5 cm long, slightly abaxially arcuate, orange, becoming reddish with age. Pollen presenter very narrowly conic acute, scarcely differentiated from style, 2.0 - 3.0 mm long; stigmatic groove terminal. Hypogynous scales linear subulate, 2.0 mm long.

Diagnostic Characters: The infundibuliform perianth tube, the very narrowly conic-acute pollen presenter (scarcely differentiated from the style) and the oblanceolate-elliptic leaves very attenuate to petiolate at the base, serve to distinguish L. saxosum from related taxa.

Distribution, Ecology and Biology: L. saxosum was originally discovered in 1906 by Swynnerton in the Chimanimani mountains (eastern highlands of Rhodesia) and has subsequently been recorded at several points along this range on both the Rhodesian and Portuguese sides of the border. Outlying populations have recently been discovered at the northern end of the eastern Transvaal Drakensberg.

L. saxosum is a fire resistent species able to regenerate after burning from a persistent rootstock. No personal field observations on this species have been made but collectors records indicate that it occurs between 4,000 and 7,000 ft. in montane

grassland or associated with Proteaceous scrub and sclerophyll. In the Chimanimani range it is apparently confined to rocky, well drained slopes and craggy outcrops of Frontier Quartzite while the population in the eastern Transvaal Drakensberg occurs on Wolkberg Quartzite. A fairly high summer rainfall of 45 - 60" p.a. is recorded in addition to frequent mists.

Inflorescences are produced erratically throughout the year but the peak of the flowering period is from September to December.

Specimens Examined:

SOUTH AFRICA

TRANSVAAL.

LETABA: On the Drakensberg escarpment overlooking Sekororos location (near The Downs) along a stream on slopes facing Penge, May, L.C. Thompson s.n. (PRE, K).

PILGRIMS REST: Western Hebronsberg north east of Mac's Mine, in south facing kloof, Aug., P. Vorster s.n. sub. PRE 30775 (PRE).

BARBERTON: Barberton, Transvaal, 3100 ft F.A. Rogers 30038 (K, G) (This may be a dubious record).

RHODESIA

MELSETTER: Chimanimani mts., Sept., Swynnerton 652 (BM, K, B); Martin forest reserve, Nov., Mavi 663 (SRGH, NBG); Chimanimani mts., July, Beard 817 (NU); Stonehenge, Chimanimani mts., June, Hall 235 (BOL, SRGH); Chimanimani mts., near streams, Oct., Plowes 1212 (SRGH); June, Munch 128 (SRGH, K); June, Wild 2958 (SRGH, K); Stonehenge, Chimanimani mts., May, Chase 6914, (SRGH, PRE, K); Martin forest reserve, Jan., Rail (SRGH, PRE, K); Small rocky valleys between Uncontoured Peak and Turret Towers, Feb., Goodier 188 (SRGH, PRE, K); South of Ben Nevis, Sept., H.C. Taylor 1756 (SRGH); Chimanimani mts., near mountain club hut, Nov., Parke 3175 (SRGH, NBG); Upper Chimanimani mts., Aug., Watermeyer s.n. (SRGH 174716); Mount Mahoendgi, among rocky outcrops, Aug., Palgrave CH 61 (SRGH); Mount Peza, Oct., Munch 290 (SRGH); Martin falls, Sept., H.C. Taylor 1792 (SRGH); Melsetter, Chimanimani, Sept., Loveridge A70 (SRGH, PRE); Gwasha, on first range, Sept., Rutherford-Smith 164 (SRGH); Plateau in the Chimanimani, May, Leach 9034 (SRGH); Stonehenge Plateau, Chimanimani mts., Feb., Phipps 355 (SRGH, BR); Chimanimani mts., July, Thompson 5 (SRGH, PRE); Mountain hut, Chimanimani, May, Noel 2115 (SRGH).

MOZAMBIQUE

Manica and Sofala, Manica Chimanimani, River Inhanadri, July, Pedro and Pedrogão 7207 (PRE); Manica and Sofala, Manica Chimanimani, River Mevumosi, July, Pedro and Pedrogão 7267 (PRE).

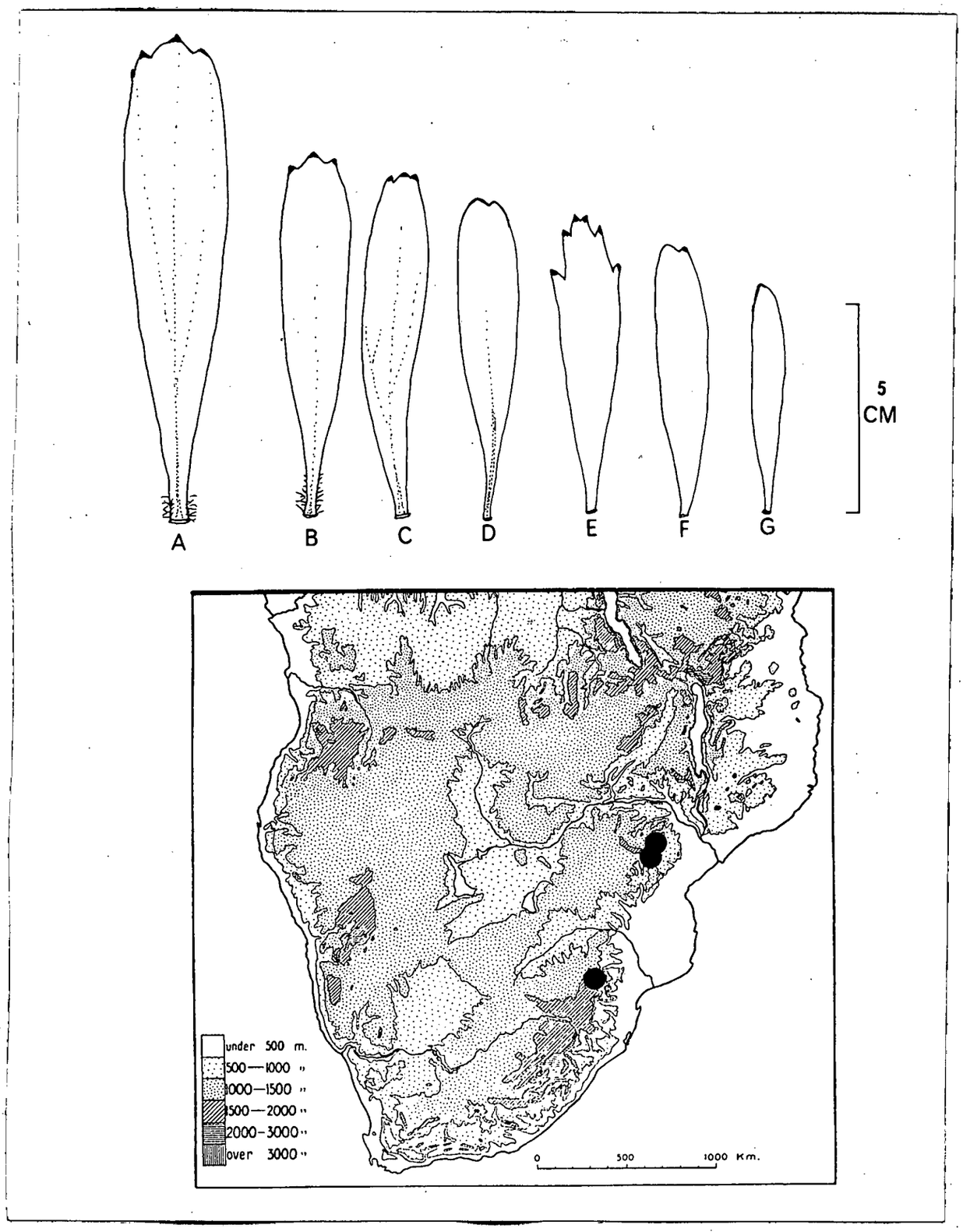


Fig. 7. Leucospermum saxosum S. Moore, showing distribution and leaf variation. (A) Watermeyer s.n. (SRGH 174716); (B) Rutherford-Smith 164; (C) Leach 9034; (D) Loveridge A70; (E) Parke 3175; (F) Thompson 5; (G) Taylor 1792.

(2) Leucospermum cuneiforme (Burm. f.) Rourke in Jl S. Afr. Bot. 33 : 263 (1967).

Leucadendron cuneiforme Burm. f., Fl. Cap. Prodr. : 4 (1768). Type: Oldenland in herb. Burman (G), isotype in herb. Schreber (M).

Protea elliptica Thunb., Diss. Prot. : 22 (1781). Type: Thunberg, Cap. b. spei, sheet 2915 in herb. Thunberg (UPS).

Leucadendrum ellipticum (Thunb.) Salisb. ex Knight in Knight, Cult. Prot. : 53 (1809).

Leucospermum ellipticum (Thunb.) R.Br. in Trans. Linn. Soc. Lond. 10 : 98 (1810); Dandy and Taylor in J. Bot., Lond. 71 : 157 (1933)

Leucodendron ellipticum (Thunb.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Leucadendrum phyllanthifolium Salisb. ex Knight in Knight, Cult. Prot. : 55 (1809). Type: "3 ft high, elevated dry places, Zwellendam, Niven 49", holotype in herb. Salisbury (K).

Leucospermum phyllanthifolium (Salisb. ex Knight) Fourcade in Trans. R. Soc. S. Afr. 21 : 97 (1932).

Leucadendrum cervinum Salisb. ex Knight in Knight, Cult. Prot. : 55 (1809). Type: "4 - 5 ft. high, rocky elevated places" Niven s.n. in herb. Salisbury (K).

Leucospermum attenuatum R. Br. in Trans. Linn. Soc. Lond. 10 : 96 (1810). Type: Specimen at British Museum labelled "2 Leucospermum attenuatum" in Brown's hand, taken as type. (BM).

Protea attenuata (R. Br.) Poir. in Lam., Encycl. Meth. Bot. Suppl. 4 : 566 (1816).

Leucospermum zeyheri Meisn. in DC. Prodr. 14 : 255 (1856). Types: Stony hills, Buffelsjachts river, Swellendam, Zeyher 3682, syntype in herb. Meisner (NY); On hills near Port Elizabeth, Zeyher 3680, type number (SAM, PRE).

Leucospermum septemdentatum Gandoger and Schinz in Bull. Soc. bot. Fr. 60 : 53 (1913). Type: Port Elizabeth, Laidley 185 in herb. Schinz (Z).

Shrubs to 3.0 m in height, with many stems arising from a stout subterranean rootstock, occasionally with a single main stem if unburnt; basal branches pustulate. Flowering stems erect, 0.3 - 0.7 cm in diam., covered with a dense cinereous indumentum of short crisped hairs. Leaves linear cuneate to broadly oblanceolate cuneate, 4.5 - 11.0 cm long, 0.6 - 3.0 cm wide, apex 3 - 10 toothed, margins horny, glabrous. Inflorescences ovoid, 5.0 - 9.0 cm in diam.; usually solitary, occasionally in groups

of 2 or 3; pedunculate, peduncle to 1.5 cm long. Involucral receptacle narrowly cylindric obtuse, 2.5 - 4.5 cm long, 0.6 cm wide. Involucral bracts ovate to broadly ovate acute, 0.8 - 1.0 cm long, 0.6 cm wide, tightly imbricate, cartilaginous, tomentose cinereous. Bracteoles ovate acute to acuminate 1.0 - 1.2 cm long, 0.7 cm wide, cartilaginous, clasping perianth, densely lanate proximally, sericeous distally, margins ciliate. Perianth 2.5 - 4.0 cm long, adaxially curved in bud; yellow aging to orange. Perianth tube 0.6 - 1.0 cm long, slightly laterally compressed, glabrous proximally, puberulous distally. Perianth claws becoming adaxially coiled on opening, covered with a fine indumentum of short crisped hairs interspersed with long, patent to erect, silky trichomes. Style 3.8 - 5.5 cm long, slightly adaxially curved, yellow aging to orange. Pollen presenter broadly conic to conic acute 1.5 - 4.0 mm long, up to 2.0 mm broad, stigmatic groove terminal. Hypogynous scales deltoid-subulate, 1.0 mm long.

Diagnostic Characters: In the field, L. cuneiforme may be recognised as a shrub, with numerous stems arising from a large woody, persistent rootstock; the basal stems being covered with warts and pustules. The narrowly cylindric involucral receptacle, glabrous to glabrescent cuneate leaves and the conic acute pollen presenter, are further distinguishing characters.

There can be no certainty as to when L. cuneiforme was first encountered by the early explorers, but it is highly probable that the first recorded collection was made by Oldenland, the Dutch East India Company's master gardener at the Cape. In 1689 Isaq Schryver journeyed eastwards from Cape Town on an expedition to barter with the Inqua Hottentots. The expedition crossed the Outeniqua mountains in the vicinity of Attaqua's Kloof (near the present day Robinson Pass). Schryver records the event thus :

"Friday 28th January 1689. At sunrise we left the said river and took a most troublesome way amongst high mountains, the krantzes of which were covered with dense brushwood. Amongst this a "Kreupleboom" here and there showed itself".

The name Kreupleboom, although usually reserved for L. cononocarpodendron, would have been applied to any large, yellow or orange flowered Leucospermum, but here Schryver is clearly referring to L. cuneiforme which is still common at this locality today. The special significance of this expedition and the above quotation is that Schryver was accompanied

by "den botanicus Oldenland". Even if Oldenland did not collect L. cuneiforme on this occasion, he could have obtained material at many places along the Langeberg. N.L. Burman acknowledges Oldenland as the collector of the plants described in his Florae Capensis Prodromus although his name does not appear on the type specimen at Geneva. (Rourke, 1967 : 263). Of considerable interest is an apparent duplicate in Schreber's herbarium at Munich, labelled "Oldenland". Since this specimen is morphologically very similar to the Geneva specimen and apparently mounted on the same type of paper, I conclude that it is an isotype.

During the past two hundred years a number of taxonomically superfluous species have been established on variable characters such as leaf length, the toothing of the leaf apex and the size of the inflorescences. These must now be reduced to synonymy.

Distribution, Ecology and Biology: The most widespread species in the genus, L. cuneiforme extends from Greyton in the Caledon district along the southern and eastern Cape coastal belt and adjacent mountain ranges, to just beyond Qolora mouth in the Kentani district, Transkei.

No other species in the genus has such a wide ecological amplitude as L. cuneiforme. The range of climatic types within which it occurs varies from the winter rainfall area to the summer rainfall area and to areas where precipitation is evenly spread throughout the year. Its distribution range encompasses a broad spectrum of veld types ranging from climax sclerophyll on the south slopes of Langeberg composed mainly of Restionaceae, Ericaceae, Rutaceae and Proteaceae, to grassveld and the subtropical coastal dune forest of the eastern Cape (Acocks, 1953 : 27-29) where I have observed it growing in association with Phoenix reclinata and Stangeria eriopus. It is also found in such diverse veld types as Arid Fynbos, in marginal areas fringing the Little Karroo and in the moist climax sclerophyll on the margins of the cool temperate evergreen forests in the Knysna - Tsitsikama area.

Despite this diversity, personal field observations and the records of others, indicate that L. cuneiforme is restricted to soils derived from Table Mountain Sandstone, Witteberg Quartzite or stabilised coastal sand of Tertiary origin. Populations are found from sea level to 3,500 ft.

L. cuneiforme is probably the most fire resistent species in the genus. Frequent burning keeps the shrubs low (0.5 - 1.0 M) and with multiple stems sprouting from a massive woody root-stock. If left unburnt for a number of years, a single main stem becomes dominant and an arborescent growth habit to 3.0 M is developed, but this is seldom observed due to the frequency of veld burning in its habitats.

Flowering can take place at any time of the year but mainly occurs between August and February.

SPECIMENS EXAMINED:

CAPE

CALEDON: Tygerhoek, Dec., H.C. Taylor 4486 (PRE, STE); South foot of Riversonderend mts., near Greyton, Nov., Esterhuysen 20810 (BOL); The Oaks, Genadendal, Oct., 1846, Alexander Prior s.n. (K); Tygerhoek, Feb., Vogts 66 (PRE, STE); Riversonderend, Oct., Schlechter 5645 (Z); In montibus Riversonderend, Zeyher 3681 (SAM, BOL, Z).

BREDASDORP: Cape Infanta, San Sebastian estate, west of Breede River mouth, Oct., Rourke 18 (BOL); Hamerkop, Potteberg range, Oct., Levyns 8422 (CT); In monte Potteberg, Oct., Ecklon and Zeyher s.n. sub. SAM 13375 (SAM); Potteberg, middle south slope, Oct., Pillans 9340 (BOL, PRE, K); Potteberg farm, north end of Potteberg Range, Oct., Rourke 950 (NBG); Potteberg flats, Nov., Barker 8453 (NBG); Grasrug, Cape Infante, Dec., Rourke 279 (NBG).

ROBERTSON: Langeberg at Cogman's Kloof, east side, Oct., Esterhuysen 32037 (BOL).

SWELLENDAM: On a mountain peak near Swellendam, Jan. 16th. 1815, Burchell 7376 (K); Elevated dry places, Niven 49 (K); Tradouwsberg, Bowie s.n. (BM); At base of the Crown mountain, Aug., Wurts 278 (NBG); Marloth reserve, Sept. Wurts 369, 370 (NBG); Grootvadersbosch, Dec., Lewis 5337 (NBG); Rocky, Kloof between Stormsvlei and Bonnievale, Sept., Acock 1738 (S); Mountain at Voormansbosch, Oct., Pappe s.n. sub. SAM 19648 (SAM); Stormsvlei Kloof, Oct., Rourke 643 (NBG); Bontebok Park, Sept., Liebenberg 6475 (PRE, STE); Stoney hills, Buffelsjachts river, Zeyher 3682 (NY, PRE, B, SAM, K); Common everywhere, Swellendam, Niven s.n. (PH); Tradouw Pass, Sept., Williams 515 (BOL); In montibus Swellendam, Oct., Pappe s.n. sub. SAM 19642 (SAM); Tradouw Pass, Sept., Compton 3406 (BOL); Open veld near Swellendam, Oct., Levyns 720 (CT); Rocky, elevated places, Swellendam, Niven s.n. (K).

RIVERSDALE: In colle saxoso ad viam inter Garcia's Pass et Muiskraal, Oct., Bolus 11365 (BOL, NH, BR, PRE, Z); South of Herbertsdale, Feb., Barker 8526 (NBG); Garcia's Pass, Sept., Phillips 500 (SAM, PRE); Between Gouritz river and Waterval, April, Middlemost 2023 (NBG); Garcia's Pass, north slopes, Jan., Rourke 251 (NBG); Albertinia, Oct., Compton 7621 (NBG); At farm Wateval, Jan., Rourke 249 (NBG); Paardeberg, Dec., Muir 5308 (PRE); Rietvlei, beyond Waterval, Sept., Williams 1056 (NBG).

OUDTSHOORN: Swartberg, lower slopes, May, Pocock S 165 (STE, PRE); Cango East, Oct., Deas s.n. sub SAM 5143 (SAM); North side of Outeniqua mountains near Moeras River, Dec., Esterhuysen 19484 (BOL); Swartberg Pass, May, Compton 7150 (NBG); Prince Albert, Quartzite mts., Oct., Schimper s.n. (Z); Swartberg Pass, Nov., Hutchinson 1151 (BOL, BM, K).

MOSSEL BAY: In arenoso prope Mossel Bay, Oct., Schlechter 5724 (Z); Pinegrove, Oct., McDonald 272 (BOL); South end of Robinson Pass, Sept., Garside 4799 (K); Between Herbertsdale and Langeberg, Dec., Hall 859 (NBG); Robinson Pass, Dec., Compton 23064 (NBG).

GEORGE: Goukamma, Dec., Martin 24 (BOL, NBG); Hills in Langkloof, George, Nov. 1847, Alexander Prior s.n. (K); Outeniqua Pass, Nov., Werdermann and Oberdieck 856 (PRE); Jonkersberg, Nov., Compton 21802 (NBG); Mountains in the district of George, Bowie s.n. (BM); Duivels Kop Pass, north slopes of Outeniqua mts., June, Rourke 466 (NBG).

KNYSNA: Between Knysna River forest and Goukamma River, Aug., Burchell 5563 (K); Tzitzikamma, Jan., Liebenberg 7811 (PRE); Witte Els Bos, July, Fourcade 790 (PRE); Phantom Pass, Nov., Oldevig-Roberts 209 (S); Road to Reenendal, Dec., Middlemost 2053 (NBG); Noetzie, Sept., Middlemost 1969 (NBG); Brenton on Sea, Aug., Denman 21 (NBG); Natures Valley, near Bloukrans Pass, Sept., Rourke 850 (NBG); Paardekop, Nov., Steyn 718 (NBG); Goukamma, Oct., Compton 7546 (NBG); Belvidere, Knysna, Jan., A.V. Duthie s.n. sub. STE 10377 (STE); Top of Prince Alfred's Pass, Schonland 3415 (GRA); Assegai Bos on slope towards Kromme River, Schonland 3073 (GRA, PRE); Hills north of Ruigte Vlei, July, Levyns 7806 (CT); Sedgefield, July, Levyns 10315 (CT); Coldstream, Sept., Rodin 1296 (BOL, PRE, K); Plettenberg bay Sept., Rogers 15437 (Z).

UNIONDALE: Kamanassie mountains, Jan., Stokoe s.n. sub. SAM 54381 (SAM); Kouga mts., at Braam River near Joubertina, Oct., Esterhuysen 16338 (BOL); Louterwater, dry hills, south slopes,

Dec., Compton 4495 (BOL); De Hoek, north foot of Tzitzikamma mts. near Joubertina, March, Esterhuysen 22794 (BOL); Prince Alfred's Pass, Nov., Acocks 19950 (K, PRE); Four miles North by West of Joubertina mountain, Nov., Acocks 20018 (K, PRE); Helpmekaar Peak, Jan., Esterhuysen 4596 (BOL); Kareedouw, Nov., Gillet 2034 (K); Harlem, April, Thode A 2457 (PRE); Half a mile beyond the farm Bo Kouga, Sept., Rourke 891 (NBG).

WILLOWMORE: Baviaanskloof, Jan., Gill 22 (BOL); Baviaanskloof, Oct., Esterhuysen 25007 (BOL); Top of mountains at Baviaanskloof, Dec., Theron 1809 (K, PRE); Towards the south end of Baviaanskloof, Jan., Gill 1 (NBG).

STEYTLERVILLE: Mountains in the Steytlerville district, Oct., Malherbe 1159 (PRE).

HUMANSDORP: Guerna Kop, Oct., Rourke 616 (NBG); Zuuranys, Oct., Rycroft 2330 (NBG); Pisgoedvlakte, Sept., H.C. Taylor 913 (NBG); Near Assegaibos, May, Wurts 2082 (NBG); Between Humansdorp and Clarkson, Nov., Middlemost 1789 (NBG); West of Humansdorp, Nov., Barker 6888 (NBG); Loerie Plantation, Oct., Dix 62 (GRA); Longmore forest, Sept., Long 1044 (GRA, K, PRE); West of Humansdorp, Sept., Sidey 1721 (S); 17½ miles west of Humansdorp, Oct., Acocks 15379 (PRE); Kromme River, 4 miles west of Company's drift, Aug., Fourcade 2321 (K).

PORT ELIZABETH: Between Port Elizabeth and Bethelsdorp, Oct., Zeyher 748 (STE, SAM); Flats near van Stadens River mts., Zeyher 380 (PRE, STE, SAM, BOL, NH); Mountainside at Elands River, June, Urton 288 (GRA); On the hills near Port Elizabeth, Oct. and Dec., Zeyher 3680 (SAM, PRE, Z, S); Near Port Elizabeth on road to Sea View, Aug., Rodin 1000 (BOL, PRE, K); Port Elizabeth, Nov. - March, Laidley 185 (Z); Between Uitenhage and Algoa Bay, Burchell 4275 (K); Round Krakamamana, 2nd Feb. 1814, Burchell 4529 (K); Algoa Bay, Cooper 1583 (K); Thescomb station, 8 miles west of Walmer, Sept., Story 2731 (PRE); Common in veld at Port Elizabeth, Jan., Theron 572 (PRE); Vaal vlei estate, May, Mogg 4720 (PRE); Van Stadensberg, 28/12/1829, Drège s.n. (P).

UITENHAGE: Winterhoek mts., Jan., Beard 765 (NU); Great Winterhoek, Cockscomb mts., March, Esterhuysen 27158 (BOL, PRE); Galgebosch, Uitenhage Dr. Pappe s.n. (K); Enon, Nov., Thode A 1123 (NH, PRE, K); Uitenhage, 13 Dec. 1847, Alexander Prior s.n. (K).

ALEXANDRIA: Near Alexandria, Jan., Leighton 3143 (BOL); Between Alexandria and Alex Forest, Dec., Johnson 841 (PRE, K, G); Alexandria,dominant in valley south of village, April, Galpin 10639 (PRE).

ALBANY: Howison's Poort, MacOwan 62 (NY, NH, Z); Near Heatherton Towers, April, Dyer 1393 (PRE, GRA); Mountain side near Grahamstown, Sept., Galpin 54 (GRA, PRE); In clivis montis prope Howison's Poort, June, MacOwan 778 (BOL, BM, PRE, G, K); Highlands, Grahamstown, Sept., Rogers 27360 (K); Howison's Poort, Nov., Hutchinson 1522 (BOL, BM, PRE); On the Grahamstown-Port Elizabeth rd., Dec., Barker 599 (NBG); Highlands near Grahamstown, Oct., Sidey 1236 (S); Albany, Feb. 1848, Alexander Prior s.n. (K).

BATHURST: Coastal flats, Bathurst, Jan., Sidey 3409 (NY); near juncture of Kop and Fish River mouth near Clumbers, Jan., Dyer 3392 (PRE); Elephant Park, Trappes Valley, Oct., Sidey 1915 (PRE, S); Bathurst, Aug., Tyson 19228 (PRE); Rocky slopes near Bathurst, Oct., Tyson 2959 (PRE); Delamere Farm, Dec., Barker 10500 (NBG); Sea View farm, Kleinemonde, Dec., Barker 10497 (NBG).

SOMERSET EAST: Zuurberg above Ann's Villa, Oct., Acocks 12024 (PRE, NBG); Komma dagga, Aug., Bayliss 1590 (Z, PRE); Top of Zuurberg Pass, Nov., Rycroft 2979 (NBG); Zuurberg Pass, Nov., Compton 20290 (NBG); Zuurbergen, 30/10/1829, Drège s.n. (P).

KOMGA: Grassy flats near Kei mouth, Jan., Flanagan 488 (GRA, Z, PRE, SAM).

KENTANI: Veld above Qolora river, Dec., Alice Pegler 714 (NU, GRA, BOL, PRE); Qolora, open veld on golf course, Feb., Chippendall 337 (PRE); Seagulls, Qolora mouth, on golf course, Sept., Rourke 845 (NBG).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, Verreaux s.n. (NY, FI, G); E. cap b. spei, Thunberg s.n. in herb Bergius (SBT); Thunberg s.n. no 2915 in herb. Thunberg (UPS); Thunberg s.n. in herb Montinii (S).

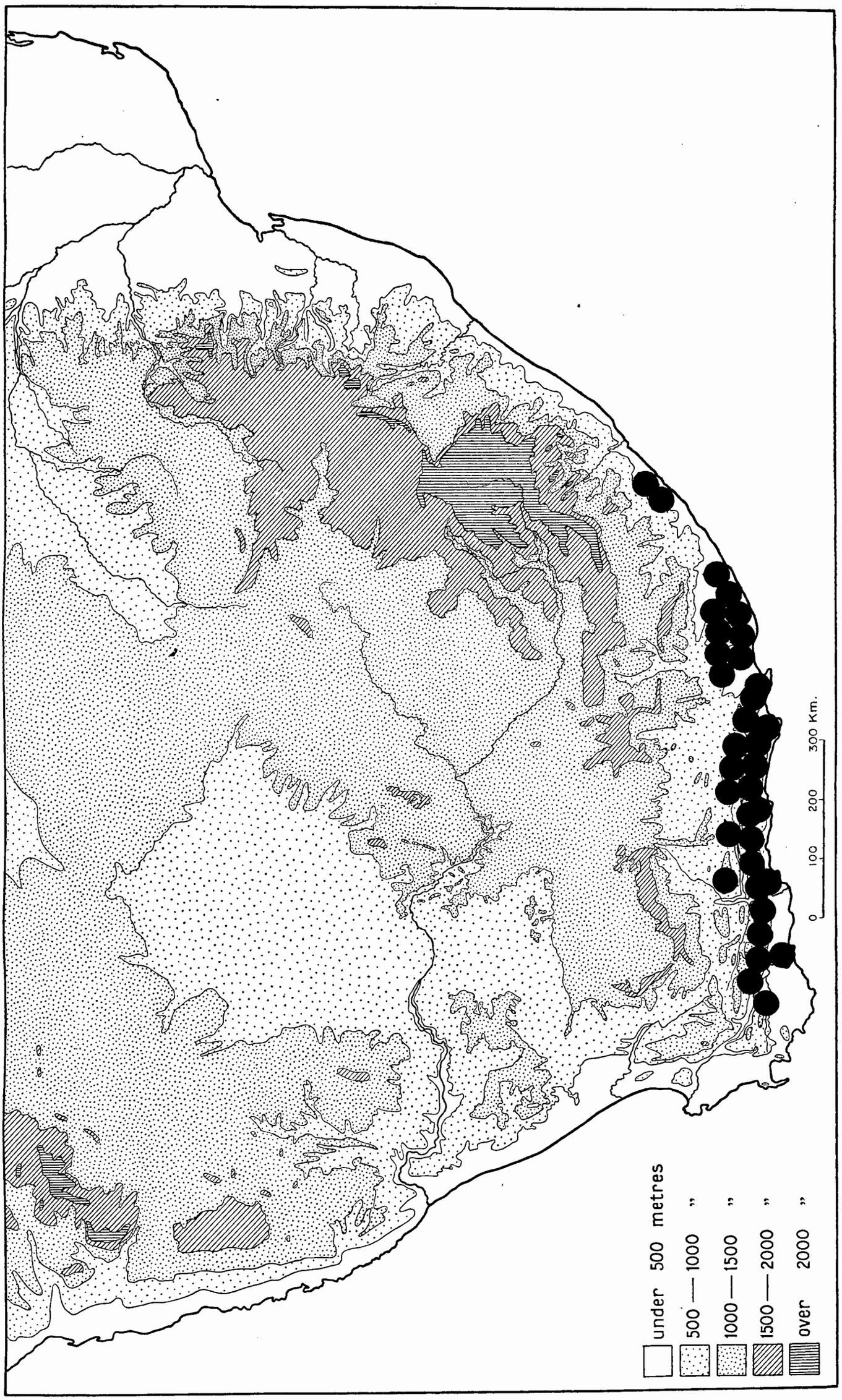


Fig. 8. Distribution of Leucospermum cuneiforme(Burm.f.) Rourke

(3) Leucospermum innovans Rourke, sp. nov.

L. cuneiforme (Burm. f.) Rourke affinis propter caudice persistenti et receptaculo involucralis cylindraceo. Frutex caulibus rectis gracilibus, foliis perlate obovatis, multidentatis, et tubo perianthii distali ventricoso. Crescit in graminosis collibus, plerumque inter rupes saxum arenaceum montis tabularis

Frutex erectus, rotundatus, ad 1 m in diam. Caules plurimi, recti et graciles, a caudice lignoso persistenti exorienti. Folia glabri, perlate obovati a latissime cuneati (3.0 - 5.0 cm lati, 7.0 - 10 cm longi). Lamina basi in petiolum puberulum distinguibem gradatim decrescens. Apex folii subtruncatus ad rotundatus, 5 - 10 dentatus. Inflorescentia globosa (8.0 - 9.0 cm in diam.), plerumque singulare. Receptaculum involucrali cylindraceum, 3 cm longum, 1 cm latum. Bracteae late ovatae acutae, imbricatae, cartilaginiae, velutinae. Tubus perianthii 10.0 - 12.0 mm longus, ventricosus in dimidium distale. Segmentum perianthii dense villosum sed trichomatibus longis (3.0 - 5.0 mm) rectis interspersum. Limbi perianthii peranguste elliptici (5.0 mm longi). Limbus adaxialis minus pilosus. Limbi tres abaxiale pilosi. Stylus 5.0 cm longus arcuatus, ad apicem versus decrescens. Stigma conica acuta, 1 mm longa.

An erect, rounded shrub to 1.0 M in diam. Stems arising from a woody persistent rootstock, up to 30.0 cm in diam. Flowering stems very straight, erect and slender, 5.0 mm in diam., covered with a dense indumentum of fine crisped hairs, interspersed with numerous long (3.0 - 4.0 mm) straight hairs. Leaves obovate, very broadly cuneate to cuneate, 7.0 - 10.0 cm long, 3.0 - 5.0 cm broad, narrowing to a distinct petiolar region; apex rounded to truncate, with 5 to 10 teeth, occasionally deeply incised; glabrous but with a dense crisped indumentum in the petiolar region. Inflorescences globose, 8.0 - 9.0 cm in diam., sessile or pedunculate, peduncle to 1.5 cm long. Involucral receptacle cylindric 3.0 cm long, 1.0 cm wide. Involucral bracts broadly ovate acute, imbricate, cartilaginous 1.0 cm long, 0.8 cm wide; outer surface densely velutinous, apex cinereous. Bracteoles ovate - obtrullate, acute, very densely lanate proximally, velutinous distally, softly cartilaginous; 7.0 mm long, 5.0 mm wide. Perianth tube 10.0 - 12.0 mm long, ventricose distally, becoming narrowed proximally, laterally compressed; 5.0 mm in diam. distally, 2.0 mm in diam. proximally; glabrous proximally becoming sparsely villous distally.

Perianth claws covered with a dense villous indumentum interspersed with long (3.0 - 5.0 mm), straight hairs. Perianth limbs very narrowly lanceolate elliptic, 5.0 mm long, 1.5 mm wide, with a short, dense, villous indumentum, interspersed with long straight trichomes. The adaxial limb less densely pubescent than the 3 abaxial limbs. Style 5.0 cm long, slightly adaxially arcuate, tapering subterminally. Pollen presenter narrowly conic acute, 2.0 mm long, 1.0 mm wide; stigmatic groove terminal.

Diagnostic Characters: L. innovans is distinguished from L. cuneiforme by its very broadly cuneate to obovate leaves, with 7 - 10 teeth at the apex, and by the perianth tube, ventricose distally but becoming narrowed proximally. The erect, very slender (5.0 mm in diam.) stems are particularly characteristic of this species.

Type Material: Transkei, Lusikisiki district, between Fraser's Falls and Picnic Falls, about ½ a mile east of the Ntsubane forest station, 4th Sept. 1967, Rourke 841 (holotype NBG).

Mr. William Tyson made the first recorded collection of this species as early as October 1885. His material was determined as L. attenuatum R.Br. as were most subsequent collections of L. innovans.

Distribution, Ecology and Biology: According to our present information, L. innovans is confined to the subtropical coastal belt of the Eastern Cape and Natal, between Lusikisiki and Port Shepstone.

The entire distribution range falls within a veld type described as Pondoland Coastal Plateau Sourveld (Acocks, 1953), and receives a fairly high summer rainfall of 45 - 50" p.a. Most of the populations occur in close proximity to the sea, usually within about 3 miles of the coast. Small clumps of plants occur in open grassveld on the plateaux above the escarpment, always among the rocky outcrops of Table Mountain Sandstone. The close association between L. innovans and the rocks of the Table Mountain Sandstone series is one of its most marked ecological features.

L. innovans is a very fire resistent species. New shoots sprout rapidly from the woody underground rootstock soon after the aerial stems have been burnt off. Due to the repeated burning of the grassveld in which this species grows, some plants

seldom reach more than 45.0 cm in height, but under favourable conditions the plants develop into rounded shrubs up to 1.0 m in height.

Inflorescences are produced rather erratically between July and December with the peak of the flowering season being in September and October.

Specimens Examined:

CAPE

LUSIKISIKI: Ntsubane forest station, Aug., O.B. Miller s.n. (PRE 2595, K); Midway between Umsikaba river and site of Grosvenor wreck ½ mile from sea shore, July 1965, W.L. Chiazzari s.n. (NBG 80, 632; PRE 30375); Lusikisiki, Pondoland, Nov. 1934, H.C. Bellew s.n. (BOL); On stony koppie near mouth of the Msikaba river, north Pondoland, Sept. 1937, H.C. Bellew s.n. (PRE 30374, K); Egossa, Pondoland, Aug. 1899, Sim 2513 (BOL, PRE); Picnic falls near Fraser's falls, Nov., Williams 565 (BOL); Rocky outcrop in grassland at Mkambati Leper Institution, Aug., Story 4249 (PRE); Between Fraser's falls and Picnic falls, about ½ a mile east of Ntsubane forest station, Sept., Rourke 841 (NBG); Pondoland, Oct. 1885, W. Tyson 2612 (BOL).

NATAL

PORT SHEPSTONE: On the farm Excelsior, Paddock, mountain krantzes, Dec., Strey 6201 (NU, NH, PRE).

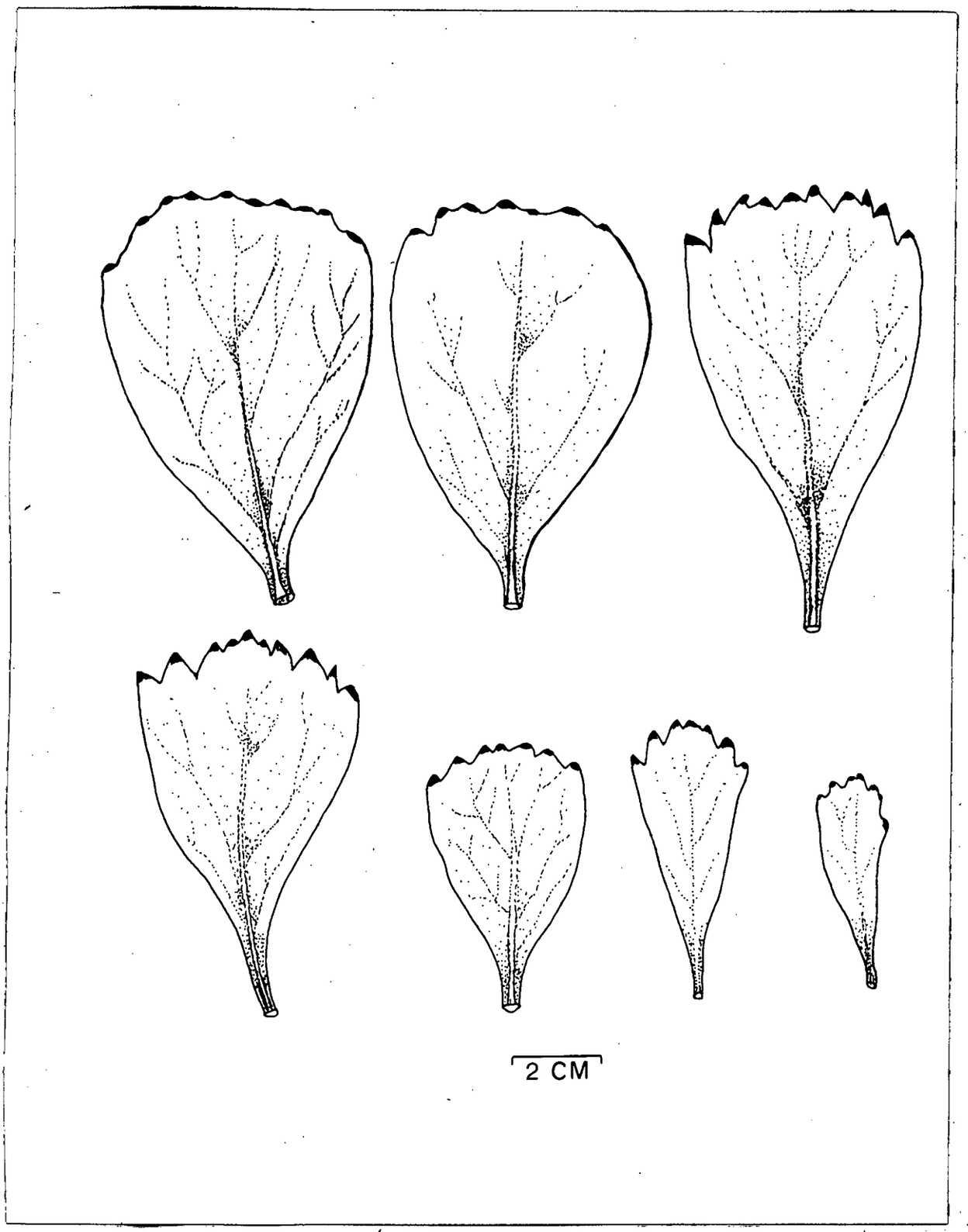


Fig. 9. Leucospermum innovans Rourke, showing variation in the leaves from the type collection, Rourke 841.

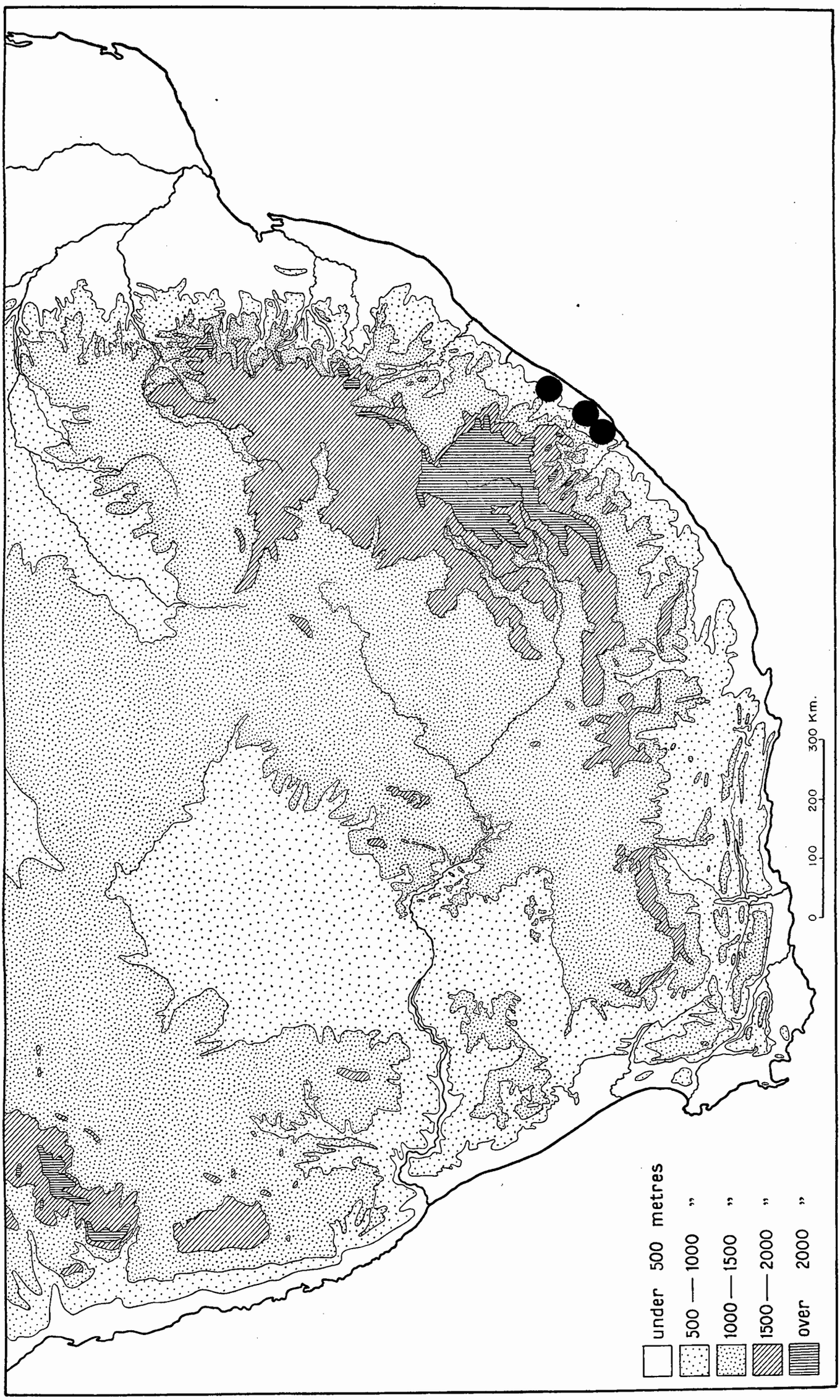


Fig. 10. Distribution of Leucospermum innovans Rourke

(4) Leucospermum gerrardii Stapf in Fl. Cap. 5 : 619 (1912); Burtt Davy, Fl. Transv. Pt. 1 : 211 (1926); Flower Pl. S. Afr. 17 : 668 (1937); Letty, Wild Flow. Transv. : 117-119 (1962); Compton in Jl S. Afr. Bot. Suppl. vol. 6 : 18, 20, 41, 106 (1966). Type : Natal, received July 1865, W.T. Gerrard 1664 (holotype, K).

A dwarf soboliferous shrub 20.0 - 40.0 cm in height, multiple stemmed at the base, with a subterranean rootstock from which arise numerous short, erect branches; forming dense mats up to 1.0 m in diam. Flowering stems slender, erect, 2.0 - 3.0 mm in diam., arachnoid at first becoming glabrous later. Leaves linear to oblanceolate, occasionally falcate, 5.0 - 9.0 cm long, 0.8 - 2.0 cm wide, narrowed to a distinct petiole at base; usually entire with an apiculate callous tip, occasionally 3 or 4 toothed; puberulous at first, soon glabrous; the veins very prominently raised on the leaf surface, reticulate to parallel. Inflorescences ovoid, 4.0 - 7.0 cm in diam.; pedunculate, peduncle 1.0 - 2.0 cm long; inflorescences usually single, occasionally with up to 3 per flowering shoot. Involucral receptacle cylindric 1.5 - 2.5 cm long, 3.0 - 4.0 mm wide. Involucral bracts ovate-acuminate, 10.0 mm long, 5.0 mm wide, very densely tomentose, cartilaginous, 2 - 3 seriate. Bracteoles ovate-acuminate, 10.0 mm long, 3.0 mm wide, clasping the perianth; thickly lanate proximally, villous distally cartilaginous. Perianth 3.0 - 3.5 cm long, yellow on opening becoming orange to scarlet. Perianth claws coiled subterminally on opening; th e median adaxial claw puberulous, the lateral and abaxial claws thickly villous. Perianth limbs lanceolate-acute, 5.0 mm long, densely beset with long straight trichomes. Anthers sessile, 3.0 mm long, lanceolate acute. Style 5.0 cm long, tapering subterminally, slightly adaxially arcuate. Pollen presenter narrowly conical acute, 2.0 - 2.5 mm long, stigmatic groove terminal. Hypogynous scales subulate, 2.0 mm long.

Diagnostic Characters: The dwarf soboliferous growth habit and the distinctive linear to oblanceolate, slightly falcate leaves with prominently raised venation, distinguish L. gerrardii from all other species with cylindric involucral receptacles.

W.T. Gerrard made the first recorded collection of this species, probably in 1865. He appears to have made two separate collections both of which are mounted on the type sheet. One specimen labelled "Natal" has leaves typical of material from Swaziland. The other, labelled "Natal - Zululand" has leaves typical of

specimens from central Natal. As the measurements given by Stapf cover the entire range of this material it is clear that both specimens were used in the original description.

Distribution, Ecology and Biology: The main distribution area is in the high mountainous country of the Barberton and Carolina districts in the eastern Transvaal and the highlands of north-west Swaziland. Isolated and rather scattered populations occur in central Natal.

L. gerrardii possesses a stout, woody rootstock bearing numerous, spreading, rhizome-like underground stems. Stiff, erect shoots, seldom exceeding 30 cm in height, develop from these stems, which causes the mature plants to have a dense cushion-like appearance. Grass fires regularly burn off the short aerial stems but new shoots regenerate from the underground stems and rootstock. L. gerrardii is one of the most fire resistent species in the genus.

In north-west Swaziland and in the Barberton area L. gerrardii occurs in open grassveld or in short montane grassveld among rocky outcrops of granite or quartzite at elevations varying from 4,000 - 6,000 ft. Mists are frequent in summer. Collections from Natal have been made at lower altitudes, generally 1,500 - 3,500 ft. in grassland on Ecca sandstone or Table Mountain sandstone. The summer rainfall in these areas may be up to 40" p.a. and up to 60" p.a. in higher lying regions. Flowering takes place erratically throughout the year but chiefly from September to November.

Variation: Material from the two main areas of distribution differs only in the dimensions of the leaves. Collections from Natal have mostly broader leaves than material from Swaziland and the Barberton area. As there is a complete gradation between the two extreme forms however, the recognition of sub-specific taxa is not considered advisable. (Fig. 11)

Specimens Examined:

NATAL

NDWEDWE: Zwati, on Table Mountain Sandstone in grassland, June, Strey 7530 (NH).

MAPUMULO: Fort Cross on road between Mapumulo and Kranskop, Sept., Hilliard 874 (NU).

NEW HANOVER/LIONS RIVER: On the farm Branxholme, Karkloof, Nov., Beard 987 (NU); Road from York to Rietvlei on the farm Branxholme, Karkloof, April, Beard 789 (PRE).

SWAZILAND

MBABANE: Waverly mine, Oct., Compton 26103 (NBG, K, PRE); Forbes Reef, Oct., Thorncroft 726 (NH).

PIGGS PEAK: Mountain tops at Havelock concession, Sept., Saltemarshe s.n., no 1045 in herb Galpin (SAM, BOL, PRE, GRA, NH, Z); Havelock mine Sept., Miller 4519 (K, PRE, BR); Sept., Miller 2997 (PRE); Havelock, Oct. Dhlamini s.n. (NBG 28567).

TRANSVAAL

BARBERTON: Saddleback mountains, Nov., Thorncroft 1001 (BOL); Barberton, Rogers 24829 (STE, BOL, PRE, K); Mountains 20 miles N.E. of Barberton, Sept., de Wet s.n. (NBG 81915); Moodie near Barberton, Sept., Thorncroft 12 (NH); Nelshoogte, Nov., Hamilton s.n. no 986 in herb. Beard (NU); Nelshoogte, Botha's Nek, March, Meeuse 10091 (PRE); 7 miles west of Barberton, Nov., Reynolds 3935 (PRE).

CAROLINA/BARBERTON: Nelsberg, Feb., van der Merwe 1643 (PRE); Summit of Nelsberg, Oct., Reynolds 2145 (PRE, K)

NELSPRUIT: Duivels Kantoor, Oct., Thode A1644 (NY, K, PRE, NH); Kaapsche Hoop, Oct., Thode s.n. (NH 20060); Near Kaapsche Hoop, Oct., Schlieben 8446 (PRE, K); Kaapsche Hoop, Oct., Prosser 1271 (K); Kaapsche Hoop, Dec., Gilmore 2338 (PRE, G)

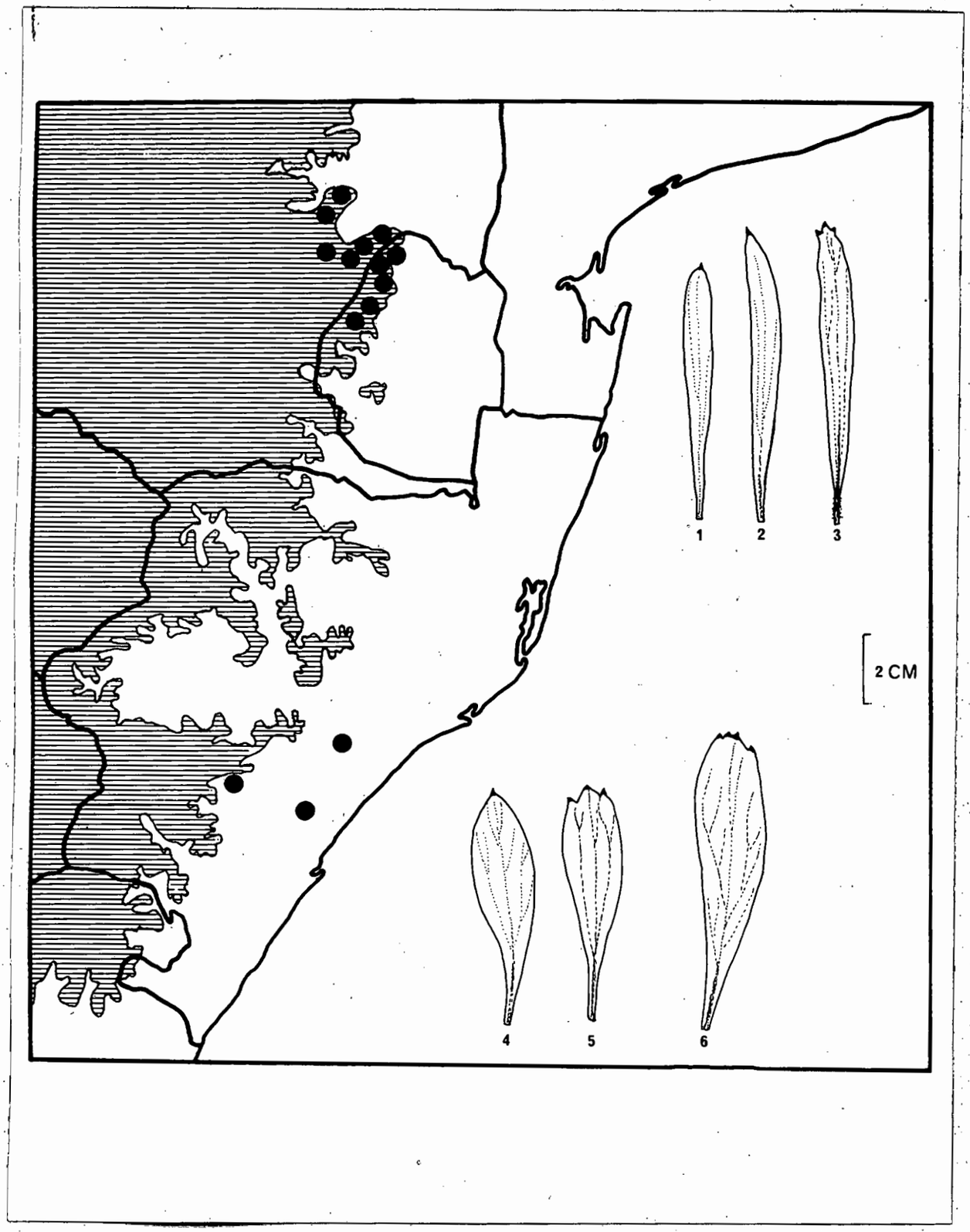


Fig. 11. Distribution of Leucospermum gerrardii Stapf. Variation in the leaf dimensions of specimens from the two disjunct areas of distribution is shown. The hatched area represents land above 4,000 ft. (1) Compton 26103; (2) Hamilton s.n. no. 986 in herb. Beard; (3) Dhlamini s.n. NBG 28567; (4 & 5) Hilliard 874; (6) Strey 7530. 1, 2, and 3 are representative of the narrow leaved form from Swaziland and the eastern Transvaal; 4, 5 and 6 are representative of the generally broader leaved Natal form.

Sect. 2 CONOCARPODENDRON Buek ex Endl.

Large shrubs or small trees to 4.0 m in height, with a single stout main trunk. Involucral receptacle conic to narrowly conic acute. Involucral bracts acuminate or acuminate recurved. Style 5.0 - 6.0 cm long, stout, 1.5 - 2.0 mm in diam. Pollen Presenter conic acute.

Type: L. conocarpodendron (L.) Buek

There is considerable variation in the form and dimensions of the leaves in L. conocarpodendron and also in the number of teeth at the leaf apex (Fig. 12). The majority of populations throughout its range have dark green, glabrous or glabrescent leaves. On the Cape Peninsula however, a series of populations occurs from the eastern slopes of Devils Peak along the western and northern slopes of Table Mountain, Lion's Head and the Twelve Apostles, to Llandudno. They are characterised by having canescent leaves covered with a dense indumentum of fine crisped hairs. Apart from being clearly delimited geographically, these populations grow mainly on decomposed Cape Granite in dry, exposed N.W. facing positions. The usual form with glabrous leaves occurs as far north as Kirstenbosch on the south eastern slopes of Table Mountain, but its range is not contiguous with that of the canescent leaved form due to the ecological barrier formed by the evergreen forests at Kirstenbosch and Newlands. The most southerly population of the form with canescent leaves is on Little Lion's Head, above Llandudno and is almost contiguous with the glabrous leaved form on the adjacent Karbonkelberg. A hybrid swarm between these forms occurs on the eastern slopes of Little Lion's Head above Mt. Rhodes. While the two parent populations are completely uniform as regards leaf pubescence, every intermediate can be found in the hybrid swarm.

Plants raised from seeds collected at Oudekraal (near Llandudno) and on the Karbonkelberg, have remained true to type after four years in cultivation, suggesting that the presence or absence of a crisped canescent indumentum is a genetically stabilised character. As the presence of a crisped canescent indumentum on the leaves is associated with populations from a geographically circumscribed area, it is proposed that two subspecific taxa in L. conocarpodendron be recognized, based on the presence or absence of this character.

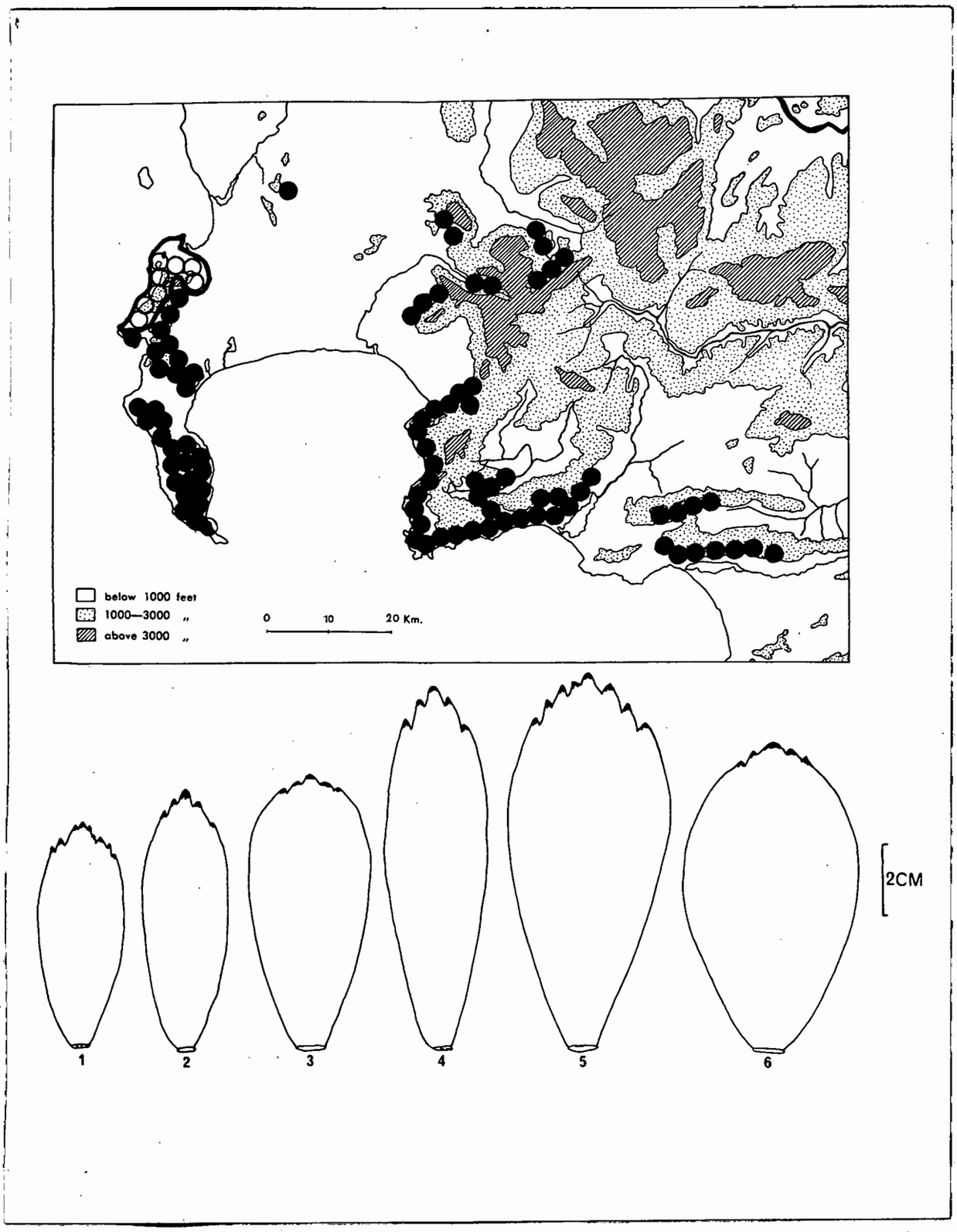


Fig. 12. Distribution of L. conocarpodendron (L.) Buek ssp. conocarpodendron (open circles) and ssp. viridum Rourke (solid circles). The leaf outlines show the range of variation in the leaves (1) Rourke 939; (2) Rourke 1096 (3) Rourke 1021; (4) Rourke 57; (5) Rourke 926; (6) Rourke 684

(5) Leucospermum conocarpodendron (L.) Buek, Ind. Gen. et Spec. ad DC. Prodr. 4 : 203 (1874).

A large, rounded shrub or tree 3.0 - 5.0 m in height, 3.0 - 6.0 m in diam.; crown rounded, rigid due to the very divaricate interlocking branchlets; trunk stout, 15.0 - 40.0 cm in diam., covered with thick (3.0 - 5.0 cm) bark, greyish, reddish or black with reticulate, horizontal or longitudinal fissures. Flowering stems stout and rigid, 1.0 - 1.5 cm in diam., covered with a short, dense, whitish to cinereous indumentum of crisped hairs or with a shaggy, villous indumentum of patent, silky trichomes. Leaves sessile, oblong, oblanceolate, broadly elliptic or obovate, 6.0 - 11.5 cm long, 2.5 - 5.0 cm wide; apex rounded or acute, obtusely or deeply incised with 3 - 10 teeth; glabrous, or pubescent with a fine greyish indumentum of short, crisped hairs, margins occasionally fimbriate. Inflorescences globose to ovoid, 7.0 - 9.0 cm in diam.; pedunculate, peduncle to 1.5 cm long; occasionally solitary but usually in groups of up to 3; often partly enclosed by the uppermost leaves on the shoot. Involucral receptacle conic acute, 2.5 - 3.0 cm long, 1.0 - 1.5 cm wide. Involucral bracts ovate acuminate, 1.2 - 1.5 cm long, 1.0 cm wide, tightly imbricate, cartilaginous, villous to tomentose. Bracteoles obtrullate, apex sharply acuminate, 2.0 cm long, 1.0 cm wide, cartilaginous, clasping perianth; lanate proximally, sericeous distally. Perianth 3.5 - 5.0 cm long, yellow. Perianth tube 1.0 cm long, cylindric, glabrous. Perianth claws recurved at anthesis, beset with an erect sericeous to very densely sericeous indumentum, except the median adaxial claw which is puberulous to shortly villous. Perianth limbs lanceolate acute, 6.0 - 8.0 mm long; outer surface closely adpressed sericeous, the median adaxial limb puberulous. Style stout, 1.0 - 1.5 mm in diam., 4.5 - 5.5 cm long, adaxially curved at first, later straightening. Pollen presenter broadly conic acute, 4.0 - 5.0 mm long, 2.0 mm wide. Hypogynous scales lanceolate acute, 2.0 mm long.

Diagnostic Characters: L. conocarpodendron is distinguished from related taxa by its arborescent growth habit, conic acute involucral receptacle, ovate acuminate involucral bracts and the broadly conic pollen presenter.

Key to the subspecies

Leaves canescent, with a dense indumentum of fine crisped hairs

..... ssp. conocarpodendron

Leaves deep green, glabrous or glabrescent (margins occasionally fimbriate).

..... ssp. viridum

ssp. conocarpodendron

Leucadendron conocarpodendron L., Sp. Pl. ed 1 : 93 (1753). Lectotype : Boerh., Ind. Plant. Hort. Lugd. Bat. (2) : 196 t. 196 (1720).

Protea conocarpodendron (L.) Reichard, Syst. Plant. 1 : 271 (1779).

Protea conocarpa Thunb., Diss. Prot. : 22, 47, 48 (1781), - nom. supfl.

Leucospermum conocarpum (Thunb.) R.Br. in Trans. Linn. Soc. Lond. 10 : 99 (1810); Phillips & Stapf in Fl. Cap. 5 : 616 (1912); Adamson and Salter, Fl. Cape Penins. : 326 (1950)

Protea tortuosa Salisb., Prod. Stirp. Hort. Chapel Allerton : 48 (1796), - nom. supfl.

Leucadendrum crassicaule Salisb. ex Knight in Knight, Cult. Prot. : 55 (1809), - nom. supfl.

Leucospermum macowanii Gandoger in Bull. Soc. bot. Fr. 48 : 94 (1901). Type: In rupestribus ad latera Montis Diaboli, Oct., MacOwan 774, holotype in herb. Gandoger (LY); isotypes (BOL, K, BM, G).

Pre Linnaean Citations.

Salix conophora Africana lato obtuso crenato folio lanuginoso. Herm., Parad. Bat. Prodr. : 372 (1689).

Leucadendro similis Africana arbor argentea folio summo crenaturis florida. Pluk., Phyt. (Pars 3) t. 200 f.2 (1692).

Conophorus Cap. B. S. folio in summo dentato. Petiver, Musei Petiveriani : 22 (1695).

Leucadendros Africana arbor argentea, summo folio crenato - a Promontor. Bon. Spei sibi allatum ad me missit Vir D. Patricus Adair. Pluk., Opera 2 (Almagest.) : 212 (1696).

Scolymocephalus Africanus, latifolius, lanuginosus, foliis in summitate crenatis, coma sericea. D. Sherrard. Pinus africana latifolia, lanuginosa foliis in summo crenatis. D. Herman. In Ray, Hist. Plant. tom. 3 Dendr. : 9 (1704).

Conocarpodendron; folio crasso, nervoso, lanuginoso, supra crenato, ibique limbo rubro; flore aureo cono facile deciduo. Boerh., Ind. Plant. Hort. Lugd. Bat. (2) : t. 196 (1720)

Protea foliis oblongo - ovatis, apice quinque-dentato callosis. Royen, Fl. Leyd. Prod. Plant. Hort. Acad. Lugd. Bat. : 184 (1740).

Flowering stems pubescent, with a shaggy villous indumentum of patent trichomes. Leaves canescent, beset with a dense indumentum of fine crisped hairs, only becoming glabrescent after several years.

Only two of the six polynomials cited by Linnaeus in his original description of L. conocarpodendron are accompanied by illustrations. As he had no herbarium material of this species, the description was evidently based on one of these illustrations. Plukenet depicts a single detached leaf with nine teeth at the apex while in Boerhaave's plate, a complete flowering branch is illustrated in which the leaves generally have five teeth at the apex. The latter plate is therefore most likely to have been the source of the word "quinquedentatis" used by Linnaeus in the phrase name of L. conocarpodendron. Consequently, it is suggested that Boerhaave's plate serve as the lectotype of this name. It is also clear that since Boerhaave uses the phrase "folio....lanuginoso", he was referring to the form from Table Mountain with canescent leaves.

Distribution and Ecology: The typical subspecies is endemic to the Cape Peninsula where it occurs over a limited area, ranging from the eastern slopes of Devils Peak along the northern and western slopes of Table Mountain and the Twelve Apostles, to Llandudno.

It occurs mainly on heavy clay derived from decomposed Cape Granite but also grows on Table Mountain Sandstone at a few places. Well drained, north or west facing slopes are the most favoured habitat. The mature plants are fairly fire resistent probably due to the thick bark (3.0 - 5.0 cm) on the trunk and main stems. Regeneration takes place from the apical branchlets, while the lowermost stems are burnt off. Frequent burning causes the adult trees to develop an umbrella shaped growth habit. (Luckhoff, 1951 : t.68) Flowering takes place from August to December.

Specimens Examined:
CAPE
CAPE: Camps Bay, Jan., Young s.n. sub. 26603 in herb. Tvl. Mus. (PRE); Table Mtn., Sept., Muir 727 (PRE); Cape, Verreaux s.n. (G); Cape, Sonnerat s.n. cat. no. 4100 in herb. Jussieu (P-JU); Table Mtn. 13/10/1827, Drège 187a (P); Bakoven, Sept., Hafstrom & Lindeberg s.n. (S); Salt River, Wahlberg s.n. (S); Table Mtn., Jan., Rogers 3001 (GRA); Devils Peak, Jan., Wolley Dod 570 (BM); Lower parts of Table Mtn., Bowie s.n. (BM); Devils Peak, Oct., MacOwan no. 774 in Herb. Norm. (BOL, LY, K, BM, G); Lions Head, 12/1/1894, O. Kuntze s.n. (NY, Z, K); Table Mtn., Oct., Bolus 2909 (K); Lions Head, Sept., Ecklon s.n. (K, B, G, M); Lions Head, Pappe s.n. (SAM); Table Mtn., near Mowbray, 10/1/1894, O. Kuntze s.n. (NY, K); Cape Town, Rehmann 2072, 2073 (Z); Table Mtn., MacGillivray 640 (K, PRE); Rondebosch, Oct. Slade s.n. (PRE); Little Lions Head above Llandudno, Oct., Rourke 924 (NBG); Devils Peak forest station, Sept., Rourke 1121 (NBG); Oudekraal, Oct., Rourke 923 (NBG); U.C.T. grounds, Nov., Esterhuysen 26469 (BOL).

ssp. viridum Rourke, ssp. nov.

A subspecie typica differt, foliis glabris atrovirentibus, destitutis indumentis crispis canescentibus.

Flowering stems generally pubescent with a dense indumentum of fine crisped hairs, rarely with shaggy, villous, patent trichomes. Leaves glabrous bright green in live state, very rarely with a few scattered, straight trichomes but never with a fine crisped indumentum.

ICON: Flower. Pl. S. Afr. 17 : 667 (1937).

Type Material: Between Sunny Seas and De Wet's Bay, near mouth of Palmiet River, 19th Nov. 1968, Rourke 1168 (holotype NBG).

Distribution and Ecology: L. conocarpodendron ssp. viridum occurs on the Cape Peninsula between Kirstenbosch and Karbonkelberg in the north, and Cape Point. Off the Cape Peninsula it occurs in th e upper Berg River Valley, at French Hoek, Jonkershoek, Sir Lowry's Pass and southwards to Cape Hangklip and Hermanus, extending along Shaws Mountain and along the Klein River Mountains as far as Stanford. Relict populations still survive in the foothills of the Helderberg and Simonsberg and on Kanonberg at Durbanville.

It grows in a wide variety of habitats: stabilised sand dunes near the sea, permanently moist peaty sponges, stony Table Mountain Sandstone slopes, Malmesbury gravel and in a few places on decomposed Cape Granite. Most populations are found at relatively low altitudes, from sea level to 500 ft. and very rarely occur above 1,000 ft. At some localities it becomes dominant with very dense stands developing. Like the typical subspecies it is fairly fire resistent. Flowering takes place from August to January.

Specimens Examined:
CAPE
WYNBERG: Castle Buttress, Sept., Rourke 588 (NBG); Karbonkelberg, Oct., Rourke 926 (NBG); Wynberg, Wallich s.n. (BM); Wynberg Hill, Aug., Salter 9253 (BM); Wynberg Hill, Aug., Bolus 2909 (BOL, K); S.E. of Table Mtn., Sept., Werdermann & Oberdieck 121 (PRE); Wynberg Hill, July, Gamble 22101 (K); Hillside at Kirstenbosch, Oct., Forbes 158 (NH).

SIMONSTOWN: Muizenberg Mtn., Dec., Noel 426 (GRA); Simon's Bay Oct., 1801, R. Brown s.n. (BM); Simonstown, Nov., Meebold 12419 (NY); Silvermine, Sept., Werdermann & Oberdieck 127 (K); Fish Hoek, Dec., Young 250 (PRE); Muizenberg mts., Oct., Lansdell s.n. (PRE); Silvermine Valley, Aug., Rourke 1088 (NBG); Klaasjagersberg, Nov., Rourke 684 (NBG); Between Rooikrans and Cape of Good Hope, Sept., Rourke 1122 (NBG).

BELLVILLE: Kanonberg, 2 miles n.w. of Durbanville, Oct., Rourke 939 (NBG).

STELLENBOSCH: Bloem Erf, Stanford s.n. (BOL); Klapmuts, Dec., van der Bijl s.n. sub NH 16165 (NH); Jonkershoek, above Swartrug,

Dec., Kruger 787 (NBG); Stellenboschberg, Sept., Strey 484 (PRE); Jonkershoek, Oct., Garside 202 (K).

PAARL: Roadside near French Hoek, Nov., Letty 55 (PRE); French Hoek, Oct., Phillips 1267 (SAM); Slopes above French Hoek, Sept., Rourke 585 (NBG).

SOMERSET WEST: Gordon's Bay mtns., Nov., Nel s.n. sub STE 13105 (STE); Sir Lowry's Pass, Dec., Rourke 59 (BOL); Sir Lowry's Pass Oct., Schlechter 5367 (Z); Helderberg, lower N.W. slopes, Sept., Rourke 1096 (NBG); Foot of Sir Lowry's Pass, Barker 8806 (NBG); Summit of Sir Lowry's Pass, Nov., Rourke 962 (NBG).

CALEDON: Ridge above Zandfontein, Oct., Galpin 4462 (K, PRE); Between Gordon's Bay and Betty's Bay, Oct., Dyer 5762 (PRE); Between Bot River and Kleinmond, June, Cheadle 826 (PRE); Caledon, Oct., Marloth 8923 (PRE); At Hangklip, Jan., Rodin 3140 (BOL, K); Hermanus, Jan., Burtt Davy 18494 (BOL); Between Aries Kraal & Louws River drift, Kogelberg Reserve, Dec., Rourke 1001 (NBG); Ysterklip, between Bot River and Kleinmond, Sept., Rourke 917 (NBG); Mossel River, Nov., Barker 8504 (NBG); N. of Rooi Els, Jan., Gill 7 (NBG); Between Sunny Seas and De Wet's Bay, Nov., Rourke 1168 (NBG); Stoff Vlei, above Hermanus Yacht Club, Oct., Rourke 1144 (NBG); Between Betty's Bay and Palmiet River mouth, Dec., Rourke 1021 (NBG); Pringle Bay, near Cape Hangklip, Jan., Rourke 1023 (NBG).

WITHOUT PRECISE LOCALITY: Comm. Mrs. Phillips, Letty 377, figured for Flower. Pl. S. Afr. (PRE).

HYBRIDS: Little Lions Head, S.E. of Mt. Rhodes, Cape Peninsula, Oct., Rourke 925 (NBG). This collection is a representative sample of the hybrid swarm between the two subspecies, occuring on Little Lions Head.

(6) Leucospermum glabrum Phillips in Kew Bull. 1910 : 331 (1910); in Fl. Cap. 5 : 617 (1912); in Flower. Pl. S. Afr. 8 : t. 311 (1928). Type: Forest near Touw River, George, 20th Aug. 1814, Burchell 5726 (Lectotype, K; BOL, NY, B, M).

An erect, rounded shrub to 2.5 m in height, with a single main stem at base, trunk to 10.0 cm in diam., bark reddish brown. Flowering stems erect, woody, 5.0 - 10.0 cm in diam., pilose at first, soon glabrous. Leaves subsessile, loosely ascending obovate to very broadly obovate, cuneate at base 8.0 - 12.0 cm long, 3.0 - 5.0 cm broad; glabrous, bright green in live state, with 7 - 14 teeth at apex. Inflorescences ovoid, 7.0 - 9.0 cm in diam., subsessile, usually solitary, occasionally 2 - 3 nate. Involucral receptacle conic, 4.5 cm long, 1.3 cm wide. Involucral bracts ovate, 9.0 mm long, 6.0 mm wide, with a recurved acuminate apex; tightly adpressed imbricate, cartilaginous, tomentose. Bracteoles obtrullate 1.5 cm long, 1.0 cm wide, apex caudate-acuminate, strongly recurved, margins ciliate, adaxial surface deep carmine in fresh state; cartilaginous, densely lanate proximally tomentose distally. Perianth 3.5 cm long, bright orange to carmine. Perianth tube 10.0 mm long, glabrous. Perianth claws bright crimson on inner surface; the abaxial claw sparsely villous, the three adaxial claws set with a dense, short indumentum of crisped hairs. Perianth limbs narrowly elliptic, acute, abaxial limb densely villous, the 3 adaxial claws sparsely villous. Style 5.0 - 6.0 cm long, stout, (2.0 - 3.0 mm in diam.), slightly arcuate adaxially. Pollen presenter conic, acute 6.0 mm long, 3.0 mm wide, stigmatic groove terminal. Hypogynous scales deltoid 1.5 mm long, ivory to cream.

Diagnostic Characters: L. glabrum is distinguished by its large (8.0 - 12.0 X 3.0 - 5.0 cm) obovate, bright green, glabrous leaves with 7 - 14 teeth at the apex, the glabrous mature stems and th e acuminate-recurved involucral bracts.

Distribution and Ecology Populations of L. glabrum occur sporadically along the southern foothills of the Outeniqua mountains, from Cradockberg above George, eastwards to the Plettenberg Bay - Prince Alfred's Pass area.

This species appears to be restricted to cool, sheltered, south facing slopes at elevations of 500 to 1500 ft. The mean annual rainfall of 30 - 40" p.a. is distributed more or less evenly throughout the year. L. glabrum grows on permanently moist

peaty soils in a very tall, dense type of fynbos termed "hygrophilous macchia" (Phillips, 1931 : 112), generally in association with Berzelia spp., Leucadendron sp., Erica sp. and Laurophyllus capensis. Flowering takes place from August to October.

Specimens Examined:

CAPE

GEORGE: Forest near the Touw River, 20th Aug. 1814, Burchell 5726 (K, M, B, BOL, NY); George mountain, Aug., Gie s.n. sub. STE 16872 (STE); Woods near George Town, Sept. 1847, Alexander Prior s.n. (K, PRE); Touw River, Sept., Fourcade s.n. (K); Between Cape Town & George Town, Moyle Rogers s.n. (BM); Near the Touw River, 21st Aug. 1814, Burchell 5754 (K); Strangeways, George, Aug., Egerton-Bird s.n. sub. NBG 52718 (NBG); Kaymans Gat, 800 ft., 5/9/1831, Drège 187c (P).

KNYSNA: On the rocky edges of Plettenberg Bay glens, Bowie s.n. (BM); Springfield and edge of forest near the Poort, Bowie s.n. (BM); In fynbos on plateau above ridge at van der Watts Hoek, Knysna, Oct., Keet 1013 (PRE), sub 13106 in STE; Between Knysna and Avontuur, Aug., Salter s.n. (BOL); Millwood, slopes south of Streepbosch creek, Sept., Fourcade 5294 (BOL); Petrus Brandt, Sept., Phillips 99 (BOL, GRA); Concordia, Knysna, July, Kapp 94 (PRE, K, Z); Plettenberg Bay, Sept., Smart s.n. sub PRE 15524 (PRE, K); Plateau above van der Watts Bos, Oct., Keet 1073 (GRA); Plettenberg Bay, Oct., Rogers 27663 (K, G).

WITHOUT PRECISE LOCALITY: South Africa, Mund s.n. (K, PRE).

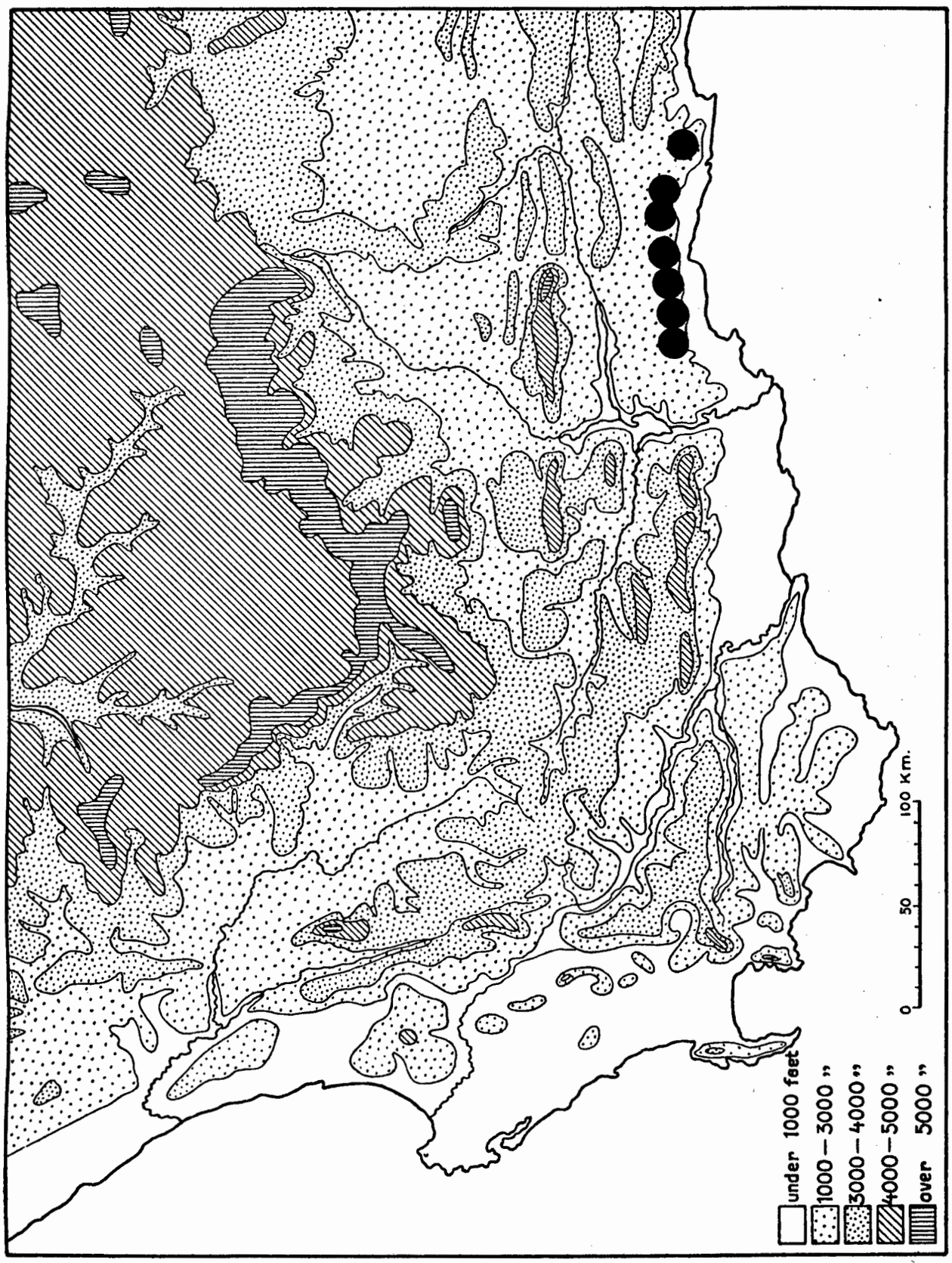


Fig. 13. Distribution of Leucospermum glabrum Phillips

(7) Leucospermum pluridens Rourke, sp. nov.

L. pluridens a caulium indumentiis spisse arachnoidiis cinerascenti, bracteis longissima (2.0 cm) recurvatis marginibus ciliatis, et folio apice inciso 7 - 10 dente obtuso, distinguitur.

Frutex rigide erectus, 2.0 - 3.0 m altus, arborescens. Caules crassi 8.0 - 10.0 mm in diam. Indumentum spisse arachnoideum, cinereum. Folia oblonga-oblanceolata, 5.5 - 10.0 cm longa, 2.0 - 3.5 cm lata, glabri, coriacea; apices 7 - 10 dentes rotundatos incisos, gerentes. Inflorescentiae ovoideae, 8.0 cm longae, 6.0 cm latae, solitariae vel usque ad quartae fasiculatae. Receptaculum involucrali anguste conicum, acutum, 3.5 - 4.0 cm longum, 1.0 cm latum. Bracteae ovatae, cartilagineae, 2.0 cm longae, ad apicem versus acuminatae et recurvatae. Margines ciliati, paginam adaxialem nitentem carmineum. Perianthium rectum ad leviter arcuatum, anthesis initio 3.5 - 4.0 cm longum, flavidum, rubescens, sparsum hirsutum. Stylus rectus ad leviter arcuatus, crassus, 5.0 - 6.0 cm longus, 1.5 mm in diam. Stigma conicum acutum.

An erect, rigid, tree-like shrub to 3.0 m in diam., with a stout woody trunk to 20.0 cm in diam. Bark on basal branches and trunk smooth, grey. Young plants rather sparsely branched with stiffly erect stem, older plants becoming more divaricate. Flowering stems stout, woody, 8.0 - 10.0 mm in diam., with a thick villous to arachnoid cinereous indumentum of short crisped hairs. Leaves glabrous and coriaceous, subimbricate, oblong to broadly oblanceolate-cuneate, 5.5 - 10.0 cm long, 2.0 - 3.5 cm wide. Leaf apex rounded, bearing 7 to 10 very prominent, rounded teeth, frequently deeply incised. Inflorescences sessile to subsessile, ovoid, 8.0 cm long 6.0 cm wide, usually borne singally but occasionally with up to 4 inflorescences per flowering shoot. Involucral receptacle narrowly conical, acute, 3.5 - 4.0 cm long, 1.0 cm broad. Involucral bracts ovate, carinate on adaxial surface; the apex caudate, very long acuminate, recurved, up to 2.0 cm long, margins fringed with long cilia, the adaxial surface shiny and carmine in live state. Bracteoles cartilaginous, obtrullate, carinate on adaxial surface, 1.0 cm long, 0.6 cm broad, apex long acuminate, somewhat incurved, margins ciliate. Perianth tube 10.0 mm long, cylindric, somewhat laterally compressed, glabrous but slightly puberulous distally on the abaxial surface. Perianth claws yellow when fresh, becoming bright carmine with age, particularly on the inner surface;

hirsute, with long straight trichomes interspersed between a dense, shortly villous indumentum. Median adaxial claw glabrous proximally. Perianth limbs broadly lanceolate, acute, 5.0 mm long, 2.0 mm wide, covered with a dense indumentum of short crisped hairs, the three abaxial limbs beset with long silky trichomes. Style 5.5 - 6.0 cm long, 1.5 mm in diam., straight to slightly arcuate, tapering in the subterminal region. Pollen presenter conic acute, orange, upper half yellow; stigmatic groove terminal, green when fresh. Hypogynous scales subulate, 2.0 mm long, white.

Diagnostic Characters: L. pluridens is distinguished from the related L. glabrum by the villous to arachnoid, cinereous indumentum on the flowering stems, the narrowly conic acute involucral receptacle, the exceptionally long (up to 2.0 cm) recurved, acuminate bracteoles with ciliate margins and the deeply incised leaf apices bearing 7 to 10 blunt teeth.

Type Material: Oudtshoorn district, between Saffraan Rivier and Kruis Pad, north side of the Robinson Pass, 17th Oct. 1966, Rourke 621, holotype in Compton Herbarium, Kirstenbosch, (NBG).

Dr. M.R. Levyns made the first recorded collection of this species on the Rooiberg Pass, near Calitzdorp in 1938. It is quite astonishing that such a prominent shrub should have been overlooked for so long, especially since L. pluridens also grows on the north slopes of the Outeniqua Range near the old Attaquas Kloof pass, which was crossed by Thunberg, Masson and many other early collectors.

Distribution and Ecology: To date, L. pluridens has been recorded from the northern foothills of the Outeniqua mountains in the vicinity of Kruis Pad, Saffraan Rivier and "Klein Moeras Rivier Spruiten", between 1600 ft. and 2000 ft. and also along the south eastern ridges of the Rooiberg between 2,500 ft. and 3,500 ft.

At both these localities the populations occur in Arid Fynbos transitional between Fynbos and Karroid vegetation. This is particularly evident at Kruis Pad where the plants are scattered on hot, dry, north facing hills, growing in association with various Restionaceae, Elytropappus sp., Aloe ferox and Cotyledon sp. Throughout its known distribution range, L. pluridens is confined to a zone receiving 10 - 15" of rainfall p.a. The ecological requirements of L. pluridens are thus very different from the related species, L. glabrum. Flowering takes

place from September to December.

Specimens Examined:

CAPE

LADISMITH/CALITZDORP: Rooiberg, at the top of the pass, Sept., Levyns 6629 (CT); Along the crest of the Rooiberg, west of the Rooiberg Pass, Nov., Wurts 1628 (NBG); Rooiberg Pass, south east side, Sept., Rourke 855 (NBG).

OUDTSHOORN: Klein Moeras Rivier spruiten, Dec., Compton 23149 (NBG, BOL); North side of Outeniqua mountains, near Moeras Rivier, Dec., Esterhuysen 19485 (BOL); Kruis Pad, Nov., Compton 21746 (NBG); Between Saffraan Rivier and Kruis Pad, north side of Robinson Pass, Oct., Rourke 621 (NBG); Kruis Pad, north slopes of the Outeniqua's, Sept., Rourke 851 (NBG).

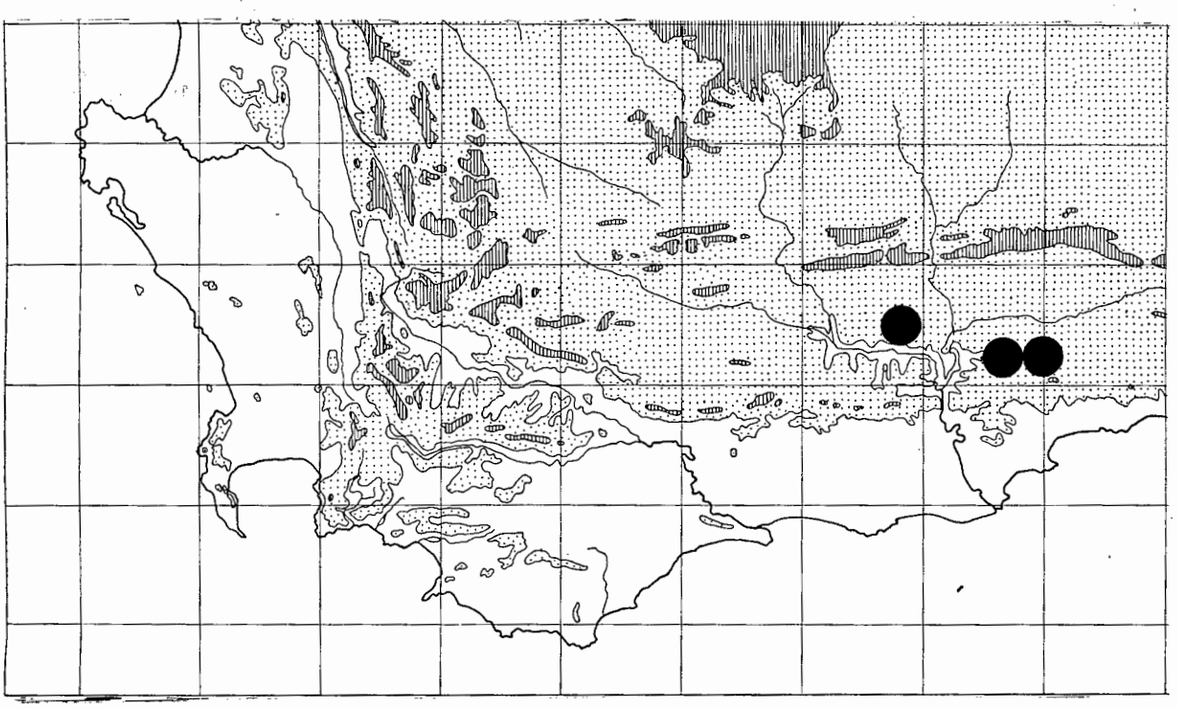


Fig. 14. Distribution of Leucospermum pluridens Rourke

Fig. 15. Leucospermum pluridens Rourke, a flowering shoot (natural size) and ▬ immature inflorescence buds (▬) showing the characteristic acuminate and recurved involucral bracts; from the type collection, Rourke 621

Sect. 3 TUMIDITUBUS Rourke, sect. nov.

Frutices erecti vel decumbentes, caule singularis principalis. Receptaculum involucrale conicum vel conicum depressum. Tubus perianthii contractus proximalis, inflatus distalis.

Erect or sprawling shrubs with a single main stem. Involucral receptacle conic or conic depressed. Perianth tube narrowed proximally, inflated distally.

Type: L. praecox Rourke.

Two rather complex pairs of vicarious taxa are discussed in this section.

(A) The L. praecox/L. fulgens group.

Some of the principal differences between two vicarious populations of Leucospermum occuring on the southern Cape coastal flats in this section, are illustrated in fig. 16. The larger of the two populations extends from Albertinia to Mossel Bay while the smaller is confined to the farm Cupido's Kraal, south of the Potteberg. An obvious difference between them is the colour of the perianth and style which is yellow becoming orange in the Albertinia-Mossel Bay population and deep pink or orange becoming brilliant crimson in the Cupido's Kraal population. The Albertinia-Mossel Bay population commences flowering in April and reaches a peak in May and June after which the inflorescences persist until September. At Cupido's Kraal, flowering commences in August and reaches a peak during September and October with the inflorescences persisting until December and January. Even if these two populations were sympatric, interbreeding would therefore be unlikely.

Morphological differences are less obvious. Style length fails to provide an absolute distinction between the two populations although it is perfectly clear that the Cupido's Kraal population has [redacted] longer styles. (Fig. 16). The form of the leaves and the toothing of the leaf apex provide the most reliable characters for separating the populations. At Cupido's Kraal the leaves are oblanceolate to oblong with 2 - 4 (usually 3) blunt, rounded teeth. Specimens from the Albertinia-Mossel Bay area have obovate leaves with 5 - 11 (usually 6 or 7) rather acute teeth at the apex. A further character to be considered is the pubescence of the perianth, which is puberulous in the Albertinia-Mossel Bay material and villous in the Cupido's Kraal material.

Taking into account the biological and morphological differences between these two populations, it is considered that they

should be treated as closely related species. The Albertinia-Mossel Bay population is described as L. praecox and the material from Cupido's Kraal as L. fulgens.

(B) The L. spathulatum/L. profugum group.

Along the main chain of mountains running in a north-south direction from the Cedarberg through the Cold Bokkeveld to Worcester, there is a series of variable populations of a prostrate species of Leucospermum, isolated on the higher peaks, to which the name L. spathulatum R.Br. (= L. cereris Compton) has been applied. Material collected on the Piketberg has been included in L. spathulatum. A decumbent growth habit, conic involucral receptacle, incurved, arcuate style and an infundibuliform perianth tube characterise these populations.

Mature plants of the Piketberg population produce a few long, trailing or looping, main stems which are almost entirely unbranched and are devoid of leaves for the greater part of their length except on the terminal growths. Moreover, the populations on the Piketberg appeared larger than the Cedarberg-Cold Bokkeveld forms, in several morphological characters, notably flower and leaf size. In addition, the leaves are consistently glabrous with 3 or 4 teeth at the apex (Fig. 18).

A dense matted growth habit is typical of material from the Cedarberg and Cold Bokkeveld. This is due to development of short lateral branchlets on the flowering stems. This material is further characterised by the grey, crisped pubescence on the leaves, although nearly glabrous forms do arise at random within this geographical range. The leaves are nearly always entire (rarely with teeth at apex) and are perceptibly smaller than those of the Piketberg population.

Style length was taken as an easily and accurately measurable parameter of flower size. A sharp distinction may be drawn between the two populations with regard to style length. (Fig. 19). Variation in the leaf dimensions is almost continuous but although no clear cut distinction can be drawn it is evident that the leaves of the Piketberg population are significantly larger than those of the Cedarberg-Cold Bokkeveld material. (Fig. 19). Material from an outlying population on Sawedge Peak, Worcester, falls into this latter group, for, while the leaves from this population are rather larger than normal, the style length is well within the range of the Cedarberg-Cold Bokkeveld material.

Taking into account also the fairly consistent differences in

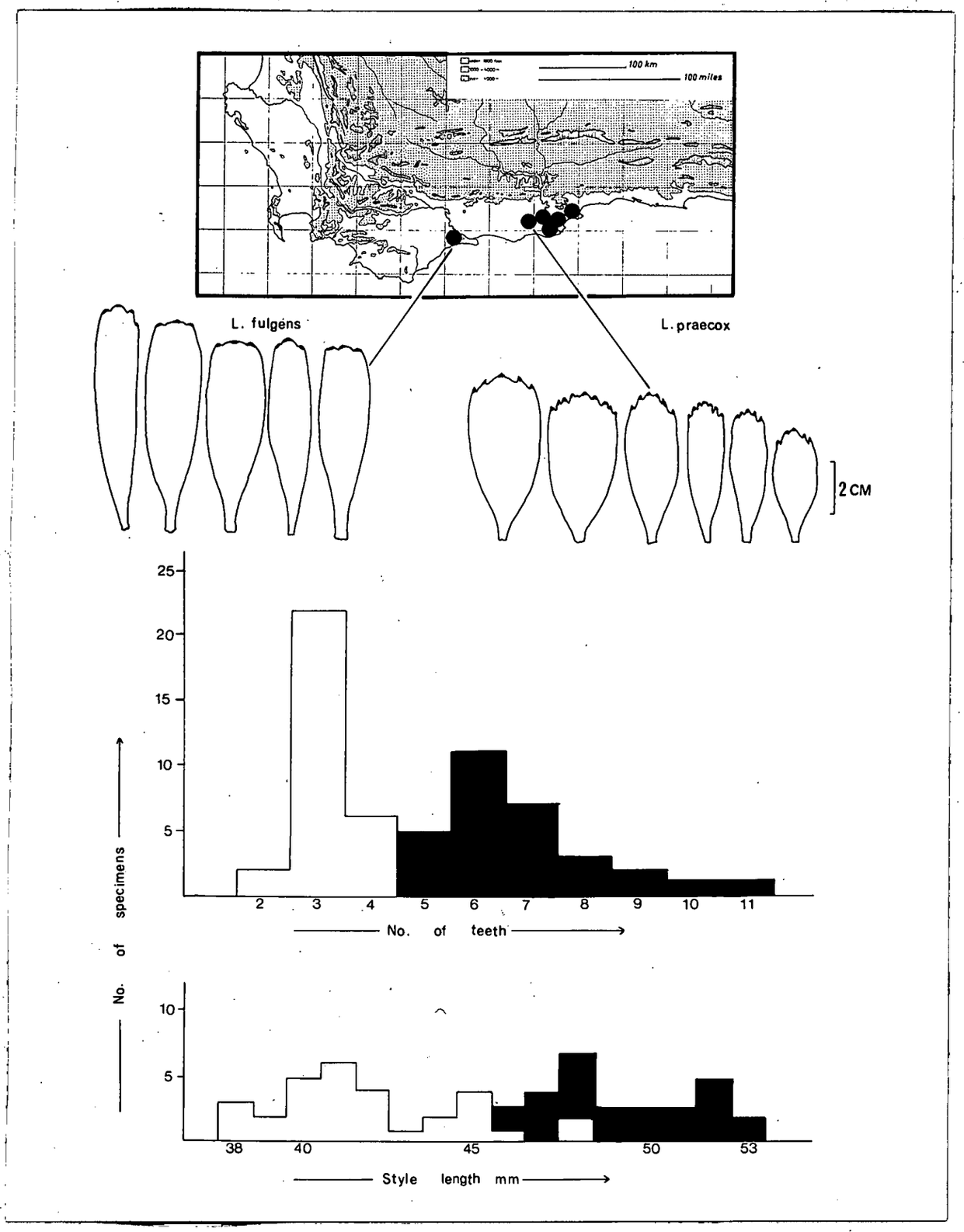


Fig. 16. Distribution of Leucospermum praecox Rourke and L. fulgens Rourke, showing the range of variation in the leaves, the number of apical teeth on the leaves and variation in the style length. In the histograms showing variation in the number of teeth on the leaf apex, the blackened histogram represents L. praecox. In the histograms showing variation in style length the blackened histogram represents L. fulgens.

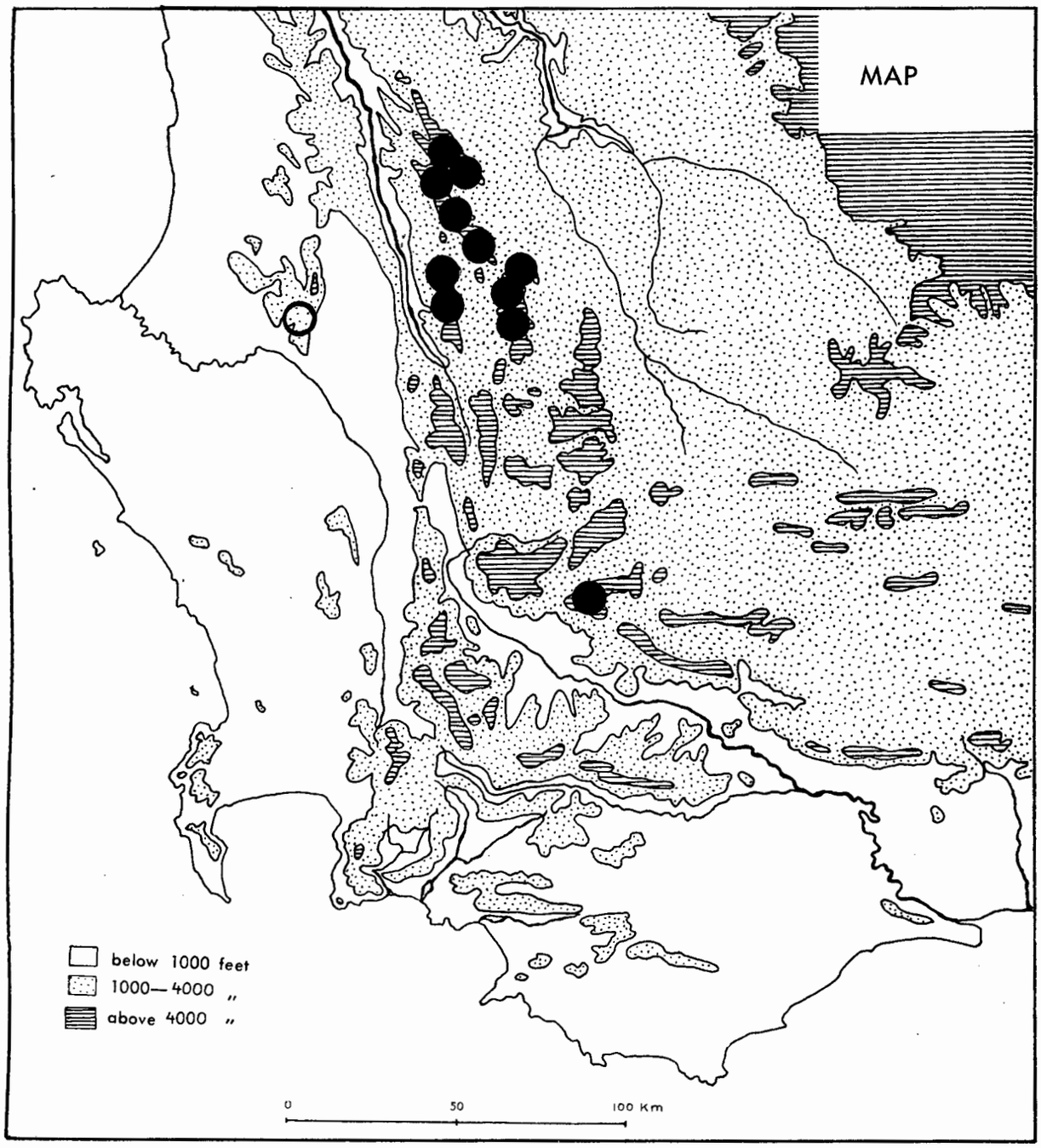


Fig. 17. Distribution of Leucospermum spathulatum R.Br. (solid circles) and Leucospermum profugum Rourke (open circle)

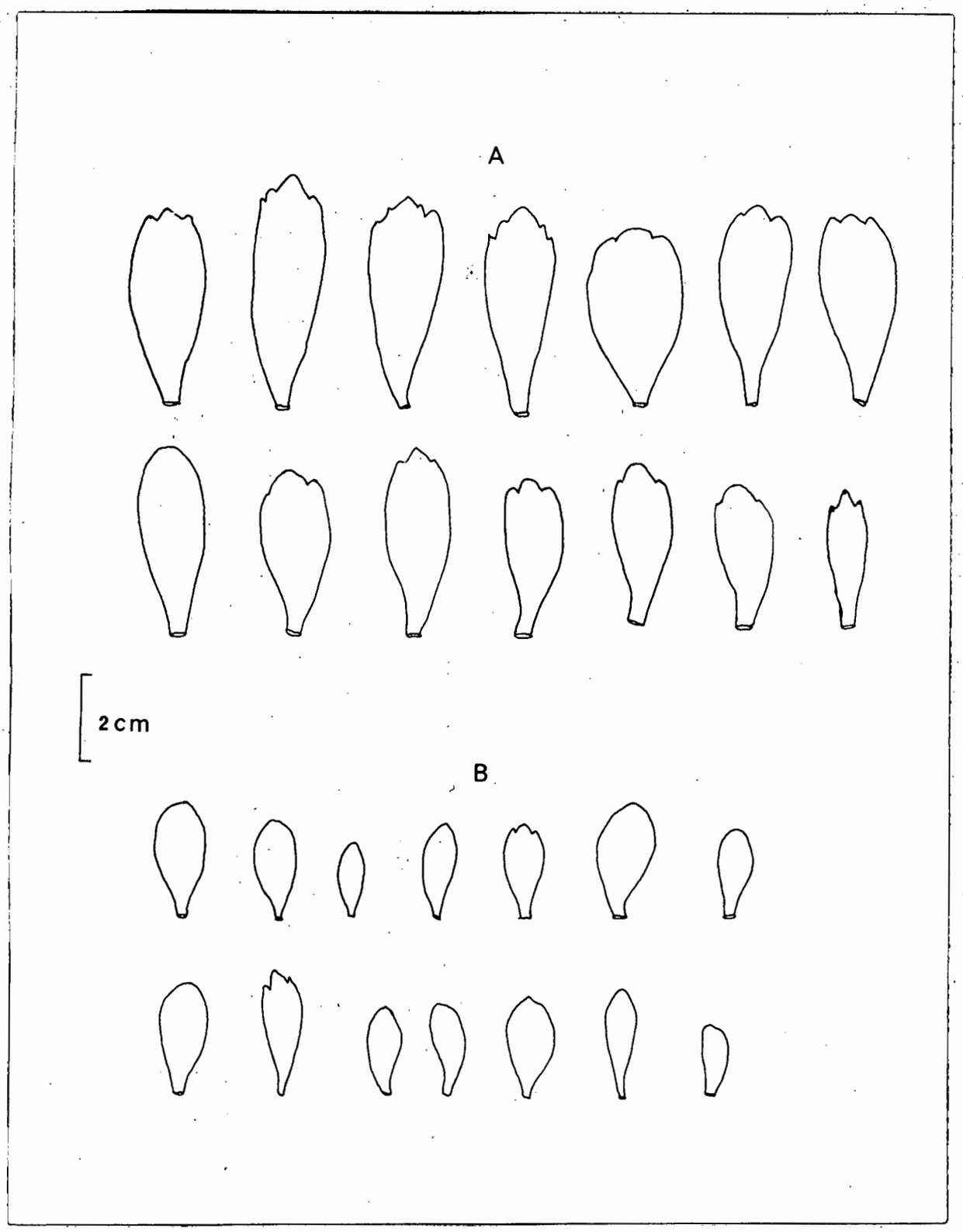


Fig. 18. Differences in the leaf dimensions and the number of teeth at the leaf apex in Leucospermum profugum Rourke (A) and L. spathulatum R. Br. (B).

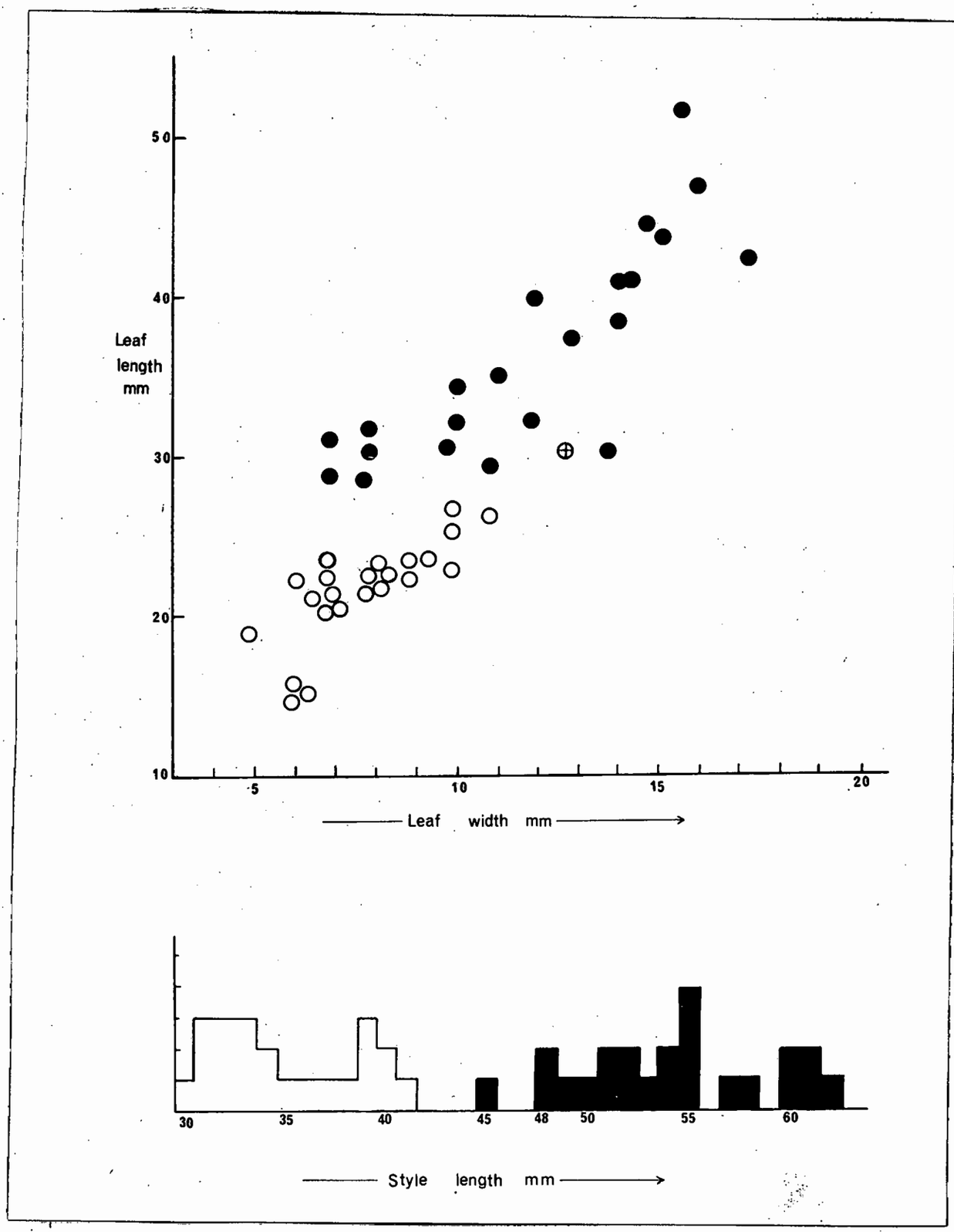


Fig. 19. Variation in the leaf dimensions and style length in Leucospermum spathulatum R. Br. and L. profugum Rourke. In the scatter diagram the open circles represent the Cedarberg-Cold Bokkeveld population (L. spathulatum) with the outlying population on Sawedge Peak marked with a cross. The solid circles represent the Piketberg population (L. profugum). In the histogram showing variation in style length, the solid graph represents the Piketberg population and the open graph the Cedarberg-Cold Bokkeveld population.

leaf pubescence and the number of teeth on the leaf apex, already mentioned, it is considered advisable to recognize the isolated population on the Piketberg as a distinct species, L. profugum.

(8) Leucospermum praecox Rourke, sp. nov.

L. praecox speciebus aliis caule principali singulo distinguitur, a foliis obovatis vel late cuneatis, apicibus 6 - 10 dentatis, receptaculo involucrali late conico, perianthio puberulo, tubo distali inflato, stylo 3.8 - 4.8 cm longo, stigmate angusto conico acuto.

Frutex erectus, 2.0 - 3.0 m altus, 4.0 m in diam., caule principali singulo. Caules 0.5 - 1.0 cm in diam. Indumentum dense, laxe, crispum, cinerascens. Folia laxe imbricata, ascendentia; glabra; obovata vel late cuneata, 3.5 - 7.0 cm longa, 1.5 - 3.0 cm lata, 6 - 11 dentata. Inflorescentiae sessiles, globosae, 6.0 cm in diam. Receptaculum involucrale late conicum, acutum, 2.0 cm longum, 1.5 cm latum. Bracteae involucrales arcte adpressae imbricatae, ovatae acute, 8.0 mm longae, 5.0 mm latae, cartilagineae, dense tomentosae, cinerascentes. Perianthium 3.0 cm longum, puberulum, luteum per anthesin. Tubus perianthii 6.0 - 8.0 mm longus, glaber et angustus proximalis, inflatus et puberulus distalis. Stylus 3.8 - 4.8 cm longus, arcuatus adaxilis. Stigma anguste conicum, acutum, 3.0 mm longum.

An erect, rounded shrub, 2.0 - 3.0 m in height, up to 4.0 m in diam., with a single, stout main stem to 8.0 cm in diam. Basal branches smooth, bark grey. Flowering stems terete, 0.5 - 1.0 cm in diam., covered with a dense, cinereous indumentum of short crisped hairs interspersed with long, patent, silky trichomes. Leaves glabrous, obovate to broadly cuneate 3.5 - 7.0 cm long, 1.5 - 3.0 cm broad, 6 - 11 toothed at the apex; loosely ascending imbricate. Inflorescences sessile, axillary, globose, 6.0 cm in diam.; up to 4 inflorescences produced on each branch. Involucral receptacle broadly conic, acute, 2.0 cm long, 1.5 cm wide. Involucral bracts tightly adpressed imbricate, ovate acute, 8.0 mm long, 5.0 mm wide, cartilaginous, densely tomentose, cinereous. Bracteoles obovate, abruptly acuminate, 10.0 mm long, 5.0 mm wide, very thickly lanate proximally, cartilaginous. Perianth 3.0 cm long, yellow on opening, becoming orange with age. Perianth tube 6.0 - 8.0 mm long, glabrous and narrow proximally, becoming minutely puberulous and inflated distally, constricted at junction with perianth claws. Perianth claws pale yellow; becoming recurved subterminally, puberulous.

Perianth limbs narrowly lanceolate, 5.0 mm long, beset with long, straight, sericeous trichomes. Anthers subsessile, lanceolate. Style 3.8 - 4.8 cm long, adaxially arcuate, tapering subterminally, pale yellow becoming orange with age. Pollen presenter narrowly conical, acute, 3.0 mm long. Hypogynous scales 3.0 mm long subulate, hyaline.

Diagnostic Characters: L. praecox is distinguished by the broadly conic involucral receptacle, the obovate to broadly cuneate leaves, 6 - 11 toothed at the apex, the puberulous perianth, the inflated perianth tube, the style, 3.8 - 4.8 cm long and the narrowly conic acute pollen presenter.

Type Material: Riversdale district, on the sandy flats south of Aasvogelberg, a few miles east of Albertinia, 29th May 1967, Rourke 771 (holotype NBG).

Mr. R.C. Alexander Prior made the first recorded collection of this species on the 2nd of August 1847, at Mossel Bay. It is a curious fact that this large and conspicuous shrub was by-passed, apparently unobserved by 18th and early 19th century collectors. This anomaly can only be explained by assuming that they closely followed the main waggon track to the east which skirted the southern foothills of the Langeberg and did not cross the Albertinia plateau.

Distribution, Ecology and Biology: L. praecox has a comparatively small area of distribution extending from Mossel Bay westwards, to a few miles west of Albertinia and thence southwards to coast between these two points.

Throughout this region L. praecox is locally common and several very dense communities can still be seen despite the aggressive advance of Australian wattles. Agricultural encroachment has also destroyed large tracts of this species near Albertinia. Except at Mossel Bay where L. praecox grows on soils derived from Table Mountain Sandstone, all other populations occur on deep white stabilised sand which is late Tertiary to recent in origin. It is a fairly large species eventually attaining a height of 3 metres and a diameter of up to 4 metres. L. praecox is remarkable in that it commences flowering in April and May. By September, the yellow perianths have faded but the styles persist, becoming bright orange in colour.

Specimens Examined:

RIVERSDALE: Between Albertinia and the Gouritz River mouth, April, Rycroft 1888 (BOL, NBG); Half a mile east of Albertinia, July, Rourke 11 (BOL, NBG); Albertinia commonage, Aug., Muir 639 (PRE); One mile along the Albertinia-Mossel Bay road, Oct., van Breda 736 (PRE); Riversdale flats Feb., Marloth 3611 (PRE); Gouritz River mouth, Nov., Levyns 9526 (CT); Albertinia, Sept., Levyns 9161 (CT); One mile east of Albertinia, Sept., Salter 6361 (BOL, BM, K); Sandy flats south of Aasvogelberg, Albertinia, May, Rourke 771 (NBG); Albertinia, Aug., Compton 15752 (NBG); Parker 4431 (NBG, K); Albertinia commonage, 1 mile east of Albertinia Sept., Garside 4808 (SAM, K); Riversdale, Muir s.n. no. 5641 in herb. Marloth (PRE); Between Albertinia and Mossel Bay, Dec., Noel 1345 (GRA); Four miles from Gouritz River mouth, Sept., Middlemost 2115 (NBG); On the road to the Fisheries, near Albertinia, Aug., Hall 539 (NBG).

MOSSEL BAY: 5 miles from Mossel Bay on the Albertinia road, Dec., Marais 583 (PRE, GRA, K); 4 miles w. of Mossel Bay, Oct., Lewis 3677 (SAM); In collibus pone Mossel Bay, Jan., Bolus s.n. (BOL); Mossel Bay, Feb., Walgate 209 (NBG); Sept., Walters 104 (NBG); Oct., Martin 253 (NBG); Jan., Guthrie 4377 (NBG); Vicinity of Mossel Bay, Sept., Rodin 1347 (PRE, K); 6 to 8 miles w. of Mossel Bay, Jan., Gentry and Barclay 19123 (PRE); Mossel Bay, Aug., Alexander Prior s.n. (K).

(9) Leucospermum fulgens Rourke, sp. nov.

L. fulgens ab speciebus cognatis distat, foliis oblanceolatis vel oblongis, 1 - 3 dentati, stylo 4.6 - 5.3 cm longo, leviter arcuato, perianthio villoso.

Frutex procerus, erectus, rotundatus, ad 3.0 m altus, 4.0 m in diam.; caule principali singulare. Caules erecti, rigidi, 5.0 - 7.0 mm in diam. Folia oblanceolata vel oblonga, 6.0 - 9.0 cm longa, 1.5 - 2.0 cm lata, plerumque 3 dentata, glabra, coriacea, laxe assurgentia. Inflorescentiae globosae vel ovoideae, 6.0 - 8.0 cm in diam., plerumque singulares. Receptaculum involucrale conicum acutum, 2.0 - 4.0 cm longum, 1.5 cm latum. Bracteae involucrales ovatae acute, 10.0 mm longae, 7.0 - 8.0 mm latae, arcte adpressae imbricatae, cartilagineae, cinerascentes. Perianthium 3.5 - 4.0 cm longum, carneum vel aurantiacum, rubescens. Tubus perianthii 8.0 - 10.0 mm longus, angustus et glaber proximalis, tumidus et puberulus distalis. Segmentum perianthii circinatum subterminale, villosum. Stylus 4.6 - 5.3 cm longus, leviter arcuatus. Stigma conicum anguste acutum, 4.0 mm longum.

An erect, rounded shrub to 3.0 m in height, up to 4.0 m in diam.; with a single stout main stem up to 10.0 cm in diam.; bark smooth, grey. Flowering stems fairly stout, rigid, 5.0. - 7.0 mm in diam., covered with a sparse indument of fine crisped hairs; soon becoming glabrous. Leaves oblanceolate to oblong, 6.0 - 9.0 cm long, 1.5 - 2.0 cm broad with 2 - 4 teeth, usually 3, at the apex; glabrous, coriaceous. Inflorescences sessile to subsessile, peduncle up to 1.0 cm long; globose to ovoid, 6.0 - 8.0 cm in diam., usually single but occasionally in groups of 2. Involucral receptacle conic acute, 2.0 - 4.0 cm long, 1.5 cm broad. Involucral bracts tightly adpressed imbricate, ovate, acute, 10.0 mm long, 7.0 - 8.0 mm wide, densely tomentose, cartilaginous, cinereous. Bracteoles ovate cuspidate, 6.0 mm long, 4.0 mm broad, very densely lanate. Perianth 3.5 - 4.0 cm long, pink to orange becoming brilliant crimson with age. Perianth tube 8.0 - 10.0 mm long, narrow and glabrous proximally, inflated and puberulous distally, becoming constricted at the junction with the perianth claws. Perianth claws villous, the margins beset with long straight, spreading trichomes; becoming strongly coiled subterminally at anthesis. Perianth limbs lanceolate acute, 5.0 mm long, villous. Anthers sessile, elliptic, 4.5 - 5.0 mm long, apical boss rounded, yellow. Style 4.6 - 5.3 cm long, almost straight to slightly adaxially arcuate. Pollen presenter narrowly conic acute, 4.0

mm long, stigmatic groove terminal. Hypogynous scales 2.0 mm long, subulate.

Diagnostic Characters: L. fulgens is distinguished by the oblanceolate to oblong glabrous leaves usually with 3 teeth at the apex, the villous perianth, the style, 4.6 - 5.3 cm long, the conic involucral receptacle and the inflated perianth tube.

Type Material: Bredasdorp district, between Hamerkop Hill and Elands Pad, Potteberg, 15th Oct., 1967, Rourke 948 (holotype NBG).

Distribution, Ecology and Biology: A single population of L. fulgens is known. This is situated in the Bredasdorp district, on the south side of the Potteberg on the farm Cupido's Kraal, more or less midway between Potteberg farm and Eland's Pad farm.

Ecologically, L. fulgens is a very specialised species. The only population known occurs exclusively on partially stabilized sandy hillocks which have accumulated in the trough formed between the Potteberg range (Table Mountain Sandstone) and the ridge of limestone hills (Alexandria beds), which run parallel to the coast. These hillocks, at an elevation of 500 ft., form a narrow zone and are composed of deep white sand, Tertiary to recent in origin. Despite the fact that this belt is only a few hundred yards wide, no colonization of the adjacent limestone or rocky Table Mountain Sandstone slopes by L. fulgens, has been observed. This leads one to conclude that the ecological amplitude of this species is restricted. Apart from tall, tufted Restionaceae and species of Passerina and Metalasia, L. fulgens constitutes the major component of the vegetation cover. The very dense but local stands cover several acres. A winter rainfall of 15 - 20" p.a. is experienced. The bright pink to deep orange inflorescences are produced from August to November, becoming brilliant crimson with age and persisting until January.

Specimens Examined:

CAPE

BREDASDORP: Cupido's Kraal, south slopes of Potteberg, Dec., Rourke 276 (NBG); Two miles south of Potteberg farm, Sept., Rourke 603 (NBG); Between Potteberg and Cape Infanta, Nov., Rycroft 1748 (NBG); Between Hamerkop Hill and Eland's Pad, Oct., Rourke 948 (NBG)

(10) Leucospermum truncatum (Buek ex Meisn.) Rourke in Jl S. Afr. Bot. 33 : 266 (1967).

Leucospermum truncatum Buek in Drège, Zwei Pfl. Geog. Docum. : 123, 199 (1843) - nom. nud.

Leucospermum zeyheri Meisn. var. truncatum Buek ex Meisn. in DC., Prodr. 14 : 256 (1856). Syntypes: Cape of Good Hope, Ludwig 21 in herb. Meisn. (NY); Between Potberg and Cape Agulhas, 3/8/1831, Drège 8057, (P, K, G; fragment in herb. Meisner, NY, lectotype).

Leucadendron truncatum (Buek ex Meisn.) O. Kuntze, Rev. Gen. Pl. 2 : 578 (1891).

Erect, rounded, well branched shrubs to 2.0 m in height, with a single main stem. Flowering stems, stiffly erect, 5.0 mm in diam., covered with a dense indumentum of fine crisped hairs. Leaves oblanceolate to narrowly cuneate, glabrous, 4.5 - 9.0 cm long, 0.8 - 1.5 cm wide, apex truncate, usually tridentate. Inflorescences globose, 3.0 - 4.0 cm in diam., 2 or 3 nate, rarely solitary; pedunculate, peduncle to 2.0 cm long. Involucral receptacle conic acute, 0.8 - 1.5 cm long, 0.8 - 1.0 cm wide. Involucral bracts broadly ovate acuminate, 0.8 - 1.0 cm long 0.6 cm wide, cartilaginous, imbricate, densely tomentose to lanate. Bracteoles broadly obovate, cuspidate 7.0 mm long, 5.0 mm wide, densely lanate. Perianth 1.2 - 1.8 cm long, golden-yellow. Perianth tube 5.0 mm long puberulous distally becoming glabrous proximally and narrowing to half the distal diameter. Perianth claws thickly villous to densely lanate. Perianth limbs elliptic 2.5 mm long, villous. Style 1.8 - 3.5 mm long, straight or somewhat adaxially incurved. Pollen presenter 1.0 - 2.0 mm long, cylindric obtuse to clavate; stigmatic groove terminal. Hypogynous scales linear, 1.0 mm long.

Diagnostic Characters: L. truncatum may be distinguished by its oblanceolate cuneate leaves, 0.8 - 1.5 cm wide, the style, 1.8 - 3.8 cm long, the cylindric obtuse to clavate pollen presenter, the villous to lanate perianth claws and the perianth tube which is sharply narrowed proximally. It is confined to limestone formations.

The name Leucospermum truncatum was first proposed by Buek who applied it to a collection made by Drège in August 1831 on the limestone hills between Cape Agulhas and the Potteberg but as no description was published L. truncatum Buek is a nomen nudum.

Several years later Meisner adopted the epithet "truncatum" for a variety of Leucospermum zeyheri Meisn., citing Buek's nomen nudum and giving a complete latin description. Two collections were cited by Meisner, namely, Drège 8057 (quoted incorrectly as 8957) and Ludwig 21. Both are represented by small fragments in Meisner's personal herbarium. Meisner's description appears to have been based on both elements but as the Drège collection is more widely distributed it has been chosen as the lectotype.

Distribution, Ecology and Biology: The range of L. truncatum extends from the Soetanysberg, in the west, eastwards, through the Bredasdorp district along the ridge of limestone hills adjacent to the coast, to Vermaaklikheid, near the mouth of the Duivenhoks River.

L. truncatum occurs exclusively on deposits of the Alexandria formation. This association with limestone or limestone derived soils is very intimate as in most cases the roots penetrate the crevices in outcrops of pure limestone. Dense stands are formed generally in association with Leucadendron muirii, L. meridianum and Protea obtusifolia. All populations are found in close proximity to the coast at elevations varying from sea level to 800 ft. A mean annual rainfall of 15 - 20" p.a. is experienced, mainly falling in winter. Flowering takes place from August to December. On opening, the perianths and styles are bright yellow but become orange with age.

Variation: Several local variants occur within the species here delimited as L. truncatum particularly at the western and eastern extremities of its range. The most westerly populations at the western end of the Soetanysberg (on the farms Hangnes and Rietfontein) are characterised by exceptionally long leaves (to 9.0 cm), large inflorescences and large, very densely lanate involucral bracts. The most easterly populations occuring between the Breede River mouth and Vermaaklikheid have leaves which are more obovate than oblanceolate, suggesting an affinity with L. praecox.

Specimens Examined:

CAPE

BREDASDORP: Rietfontein Poort, Dec., Schlechter 9696 (PRE, S, G, BM, K, Z, PH); The Poort, Bredasdorp Sept., Compton 4381 (BOL); Flats between Elandspad and Noetze Oct., Pillans 9425 (BOL); Limestone hills near the Potteberg, Sept., Esterhuysen

23350 (BOL); De Hoop, April, Barker 8678 (NBG); Near Potteberg, Nov., Rycroft 1744 (NBG); St. Mungo Bay near Cape Agulhas Sept., Garside 4680 (K); 7 miles west of Bredasdorp, Nov., Salter 4083 (BM, K); Kliprug, along limestone hills, Nov., van Breda 1048 (PRE); De Hoop, Sept., van Breda 1721 (PRE); Bredasdorp Poortjie, Oct., van Breda 714 (PRE, NBG, K); Sand Hoogte, Nov., C.A. Smith 4926 (PRE, K); Northumberland Point, Aug., Acocks 22627 (PRE); 6 miles west of Bredasdorp, Nov., Gentry and Barclay 18845 (PRE); The Poort, Bredasdorp, Sept., Acocks 1530 (S); Between Potteberg and Cape Agulhas, 3/8/1831, Drège 8057 (P,G,K, NY); Summit of Soetanysberg, Oct., Rourke 1126 (NBG); Springfied, Soetanysberg, Nov., Williams 49 (NBG); Springfield, Jun., Rycroft 1827 (NBG, BOL); The Poort, Sept., Compton 4381 (NBG); De Hoop, Sept., Middlemost 2206 (NBG); Limestone hills between De Hoop and Bredasdorp, Sept., Rourke 599 (NBG); Arniston, Nov., Topper 505 (NBG); The Poort, Aug., Dec., Compton 9077, 23197 (NBG); 10 miles east of Gansbaai, Nov., L.E. Taylor 4889A (NBG); Struisbaai, Sept., Williams 884 (NBG); Springfontein, Dec., Rourke 1178 (NBG) Hill 1/4 mile west of Cape Agulhas, Dec., Pillans 8149 (BOL, K); Zoetwater valley, Dec., Krauss s.n. (FI); Nachtwacht - Marthas Gat borderline, Nov., C.A. Smith 4911 (BM, PRE); Plain south of mountain range on Elim rd., Dec., Galpin 11203 (PRE); Limestone hills at Cape Agulhas, Dec., Acocks & Hafstrom 2107 (PRE, S); The Poort, Bredasdorp, Nov., H.C. Taylor 4318 (STE, PRE).

SWELLENDAM: San Sebastian, near Cape Infante, Nov., Esterhuysen 29360 (BOL); 2 miles south east of Potteberg farm, Sept., Rourke 597 (NBG); Between Hamerkop Hill and Eland's Pad, Oct., Rourke 949 (NBG); Grasrug, Cape Infante, Rourke 278 (NBG); 2 miles south east of Potteberg farm, Sept., Rourke 605 (NBG); San Sebastian estate, Breede River mouth, Oct., Rourke 19 (BOL).

HEIDELBERG: Vermaaklikheid, Oct., Williams 548 (BOL, NBG); 11 miles south of Riversdale, Sept., Richmond 9 (NBG); Vermaaklikheid hills, near village, Oct., Rourke 626 (NBG); Puntjie hills, at mouth of Duivenhoks River, Oct., Rourke 625 (NBG).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, Ludwig 21 in herb. Meisner (NY); Cape of Good Hope anno 1831, Jules Verreaux s.n. (G).

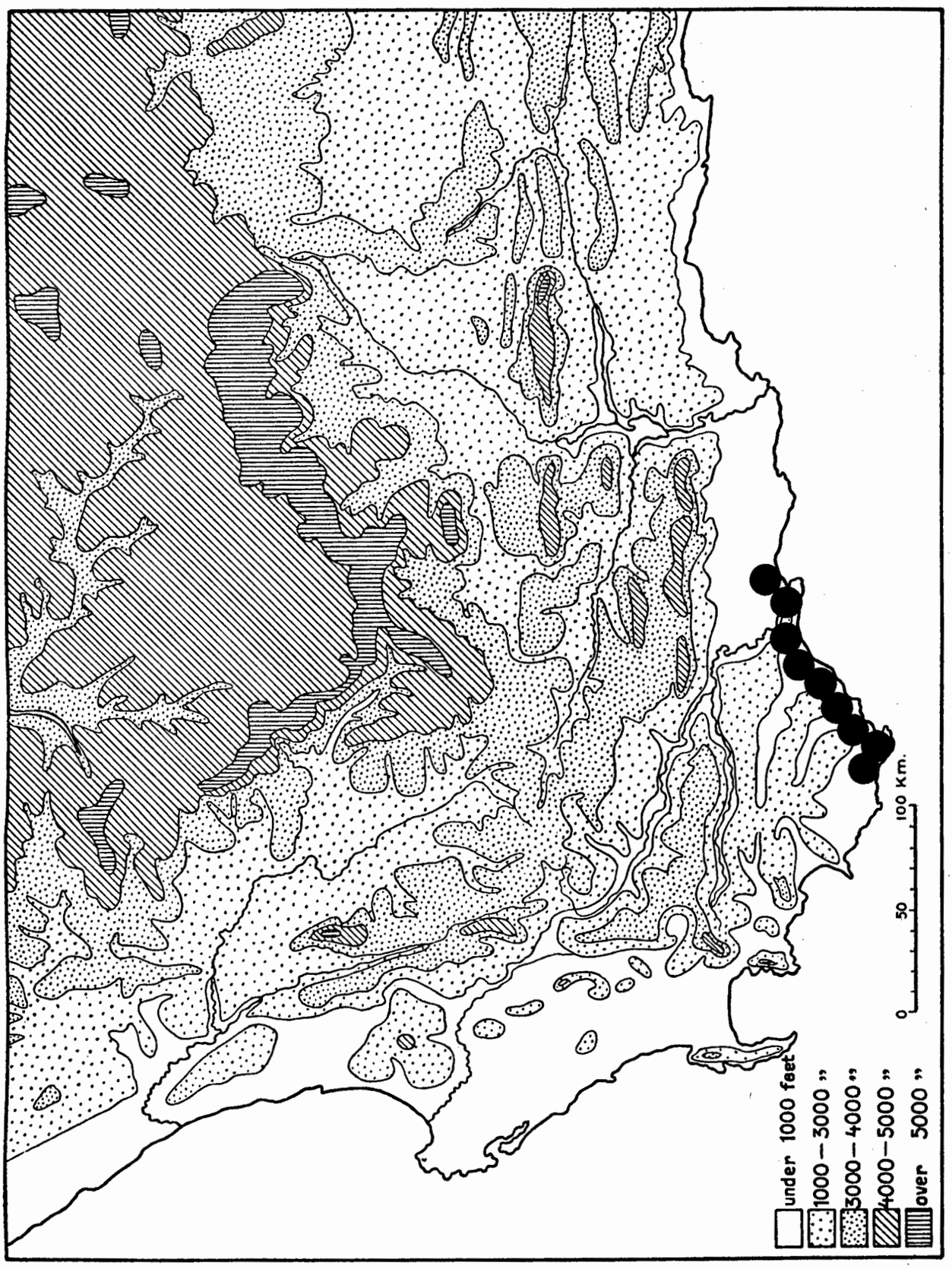


Fig. 20. Distribution of Leucospermum truncatum(Buek exMeisn.) Rourke

(11) Leucospermum muirii Phillips in Kew Bull. 1910 : 332 (1910); Phillips & Stapf in Fl. Cap. 5 : 627 (1912). Syntypes: Milkwoodfontein, Galpin 4457 (GRA, PRE, K); Zandhoogte, Muir s.n. no. 5309 in herb. Galpin (Lectotype, PRE).

An erect, rounded, much branched shrub to 1.5 m in height, with a single main stem. Flowering stems slender, 2.0 - 3.0 mm in diam., covered with a short, crisped, cinereous indumentum at first, soon glabrous. Leaves very narrowly cuneate to cuneate-linear, 4.0 - 6.0 cm long, 4.0 - 10.0 mm wide, with 3 - 7 teeth at apex; pubescent at first, with a short, crisped indumentum, soon glabrous. Inflorescences solitary, 2, 3, or 4 nate; globose, 2.0 - 3.0 cm in diam.; pedunculate, peduncle 1.0 - 2.0 cm long. Involucral receptacle conic depressed, 1.0 cm long, 0.8 cm wide. Involucral bracts ovate acuminate, 7.0 - 8.0 mm long, 4.0 mm wide, tightly imbricate, cartilaginous, villous, apex acuminate, cinereous. Bracteoles broadly obtrullate - acuminate, 7.0 mm long, 5.0 mm wide, densely lanate proximally, cartilaginous. Perianth 12.0 - 15.0 mm long, pale yellow to yellowish green. Perianth tube 5.0 mm long, cylindric to slightly compressed laterally; glabrous proximally, minutely puberulous distally. Perianth claws puberulous to sparsely villous. Perianth limbs narrowly lanceolate, 2.0 mm long; outer surface of the 3 adaxial limbs sericeous, abaxial limb sparsely sericeous. Style 1.3 - 2.2 cm long, straight. Pollen presenter clavate-cylindric, 1.0 mm long, indistinctly differentiated from the style. Hypogynous scales 1.0 mm long, subulate, pale yellow.

Diagnostic Characters: L. muirii is distinguished by its small globose inflorescences, 2.0 - 3.0 cm in diam., the narrowly cuneate leaves 4.0 - 10.0 mm wide, the short style 13.0 - 22.0 mm long and the puberulous to sparsely villous perianth claws.

Two syntypes were cited by Phillips in the original description of L. muirii and of these, the collection by Muir from Zandhoogte (Muir s.n. no. 5309 in herb. Galpin, PRE), has been chosen as the lectotype. The material bears a determinavit label signed by Phillips and also his drawing of the floral parts, which seems to indicate that this specimen was used for the original description. Specimens gathered by Dr. John Muir in 1909 appear to be the first recorded collection of L. Muirii.

Distribution, Ecology and Biology: Rather restricted in its range, L. muirii is confined to the Albertinia plateau where it occurs a few miles west and east of the town and southwards towards the coast, chiefly in the vicinity of Melkhoutfontein and Still Bay.

In contrast to L. truncatum which grows on limestone formations in the same region, L. muirii is found only on deep, white sand of Late Tertiary or Recent origin. Small dense communities are frequent on sandy flats, growing in association with tall Restionaceae, Leucadendron galpinii, Protea repens, Leucospermum praecox and various Ericaceae. Flowering takes place between July and October.

Specimens Examined:

CAPE

RIVERSDALE: 7 miles from Albertinia on Riversdale Rd., Dec., Marais 587 (PRE, GRA, NBG); Melkhoutfontein, Oct., Muir 4796 (PRE, NH); Zandhoogte, Riversdale dist., June, Muir s.n. no. 5309 in herb. Galpin (PRE); Near Albertinia, June, Muir 612 (PRE); Riversdale, Muir 17 (GRA); Milkwoodfontein, Oct., Galpin 4457 (GRA, K); One mile west of Albertinia, Sept., Salter 6365 (BOL, K); Zandhoogte, Muir 737 (BOL, SAM, PRE); Still Bay hills, Aug., Barker 5544 (BOL, NBG); 1 mile from Albertinia, Garside 4810 (K); ½ mile east of Albertinia, July, Rourke 10 (BOL, NBG); Albertinia, Oct., Esterhuysen 25012 (BOL); Towards Albertinia, Sept., Rodin 1346 (BOL, PRE, K); On road to Still Bay, Nov., Levyns 9517 (CT); Soetbotters Vlakte north of Still Bay hills, Aug., Johnson 126 (NBG); De Kriet, 10 miles west of Albertinia, Oct., Rourke 612 (NBG); 15 miles from Riversdale to Still Bay, Jan., Marsh 1172 (STE).

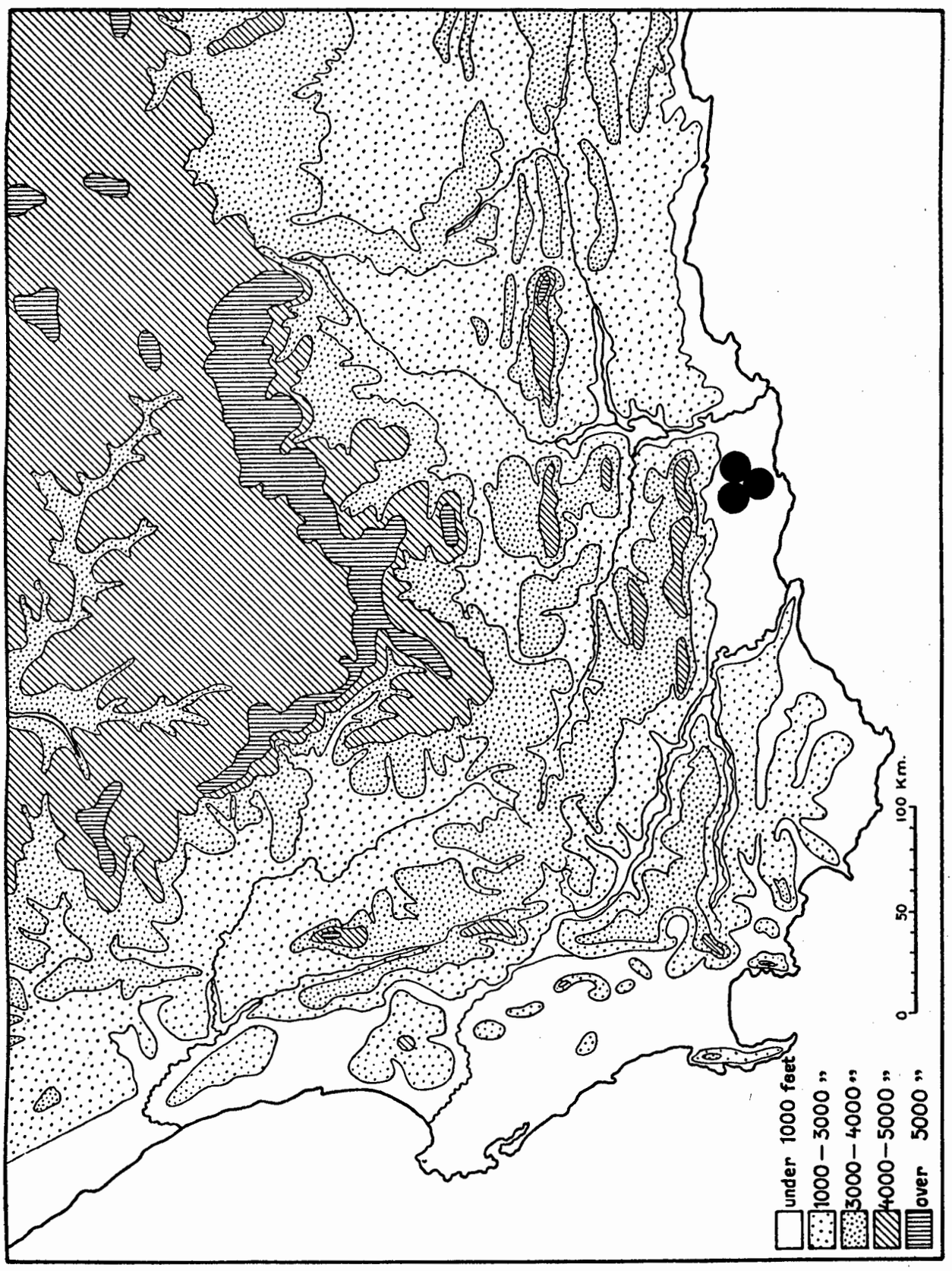


Fig. 21. Distribution of Leucospermum muirii Phillips

(12) Leucospermum erubescens Rourke, sp. nov.

Inter species generis tubo perianthio tumido distali, L. erubescens inflorescentiae leviter asymmetricae manifeste et oblique pedunculatae, receptaculo involucrali oblique sphaerico vel conico depresso, perianthio uniformiter velutino, distinguitur.

Frutex erectus 2.0 m altus. Caules erecti, 0.5 - 1.0 cm in diam., trichomatibus densis crispis obsitis. Folia erecto-patentia, oblanceolata elliptica vel oblonga, 7.0 - 8.5 cm longa, 1.0 - 2.0 cm lata, glabra. Apex plerumque truncatus et tridentatus, aliquando rotundatus usque ad septem dentatum. Inflorescentia singulare vel plurimae, plerumque 4 - 8 aggregatae, leviter asymmetricae, ovoideae, 5.0 - 6.5 cm in diam., manifeste et oblique pedunculatae. Pedunculus 2.0 - 3.0 cm longus. Receptaculum involucrale conicum depressum vel oblique sphaericum, 1.3 cm in diam. Bracteae involucrales late ovatae, 6.0 - 8.0 mm longae, 6.0 mm latae, arcte imbricatae, tomentosae, cartilagineae; apices abrupte acuminati. Perianthum rectum, 3.0 - 3.5 cm longum, uniformiter velutinum; luteum, erubescens post anthesin. Tubus perianthii 1.0 - 1.2 mm longus, angustatus et glaber proximalis, tumidus et puberulus distalis. Stylus 4.0 - 5.5 longus, leviter arcuatus adaxialis. Stigma clavatum vel cylindricum-obtusum, 3.0 mm longum.

An erect shrub to 2.0 m in height, with a single main stem; bark smooth, grey. Flowering stems erect, 0.5 - 1.0 cm in diam., covered with a dense indumentum of fine crisped hairs. Leaves oblanceolate-elliptic to oblong, 7.0 - 8.5 cm long, 1.0 - 2.0 cm wide, usually truncate and with 3 teeth, occasionally rounded and with up to 7 teeth at apex; erect, loosely ascending imbricate, glabrous. Inflorescences numerous, generally 4 - 8 , clustered at the apex of a flowering shoot, slightly asymmetrical, the styles generally displaced adaxially; ovoid, 5.0 - 6.5 cm in diam.; prominently pedunculate, peduncle 2.0 - 3.0 cm long. Involucral receptacle obliquely conic-depressed to obliquely spheroidal, 1.3 cm in diam., very clearly differentiated from the peduncle. Involucral bracts very broadly ovate, 6.0 - 8.0 mm long, 6.0 mm wide, tightly imbricate, cartilaginous, apices abruptly acuminate, outer surface tomentose. Bracteoles obtrullate, 1.0 cm long, 0.7 cm wide, cartilaginous, apices abruptly acuminate; thickly lanate proximally. Perianth straight in bud, 3.0 - 3.5 cm long, uniformly velutinous; yellow on opening becoming deep crimson with age. Perianth tube 1.0 - 1.2 cm long, slightly laterally compressed, glabrous proximally, swollen

and puberulous distally. Perianth claws straight, velutinous becoming tightly coiled subterminally. Perianth limbs 3.0 mm long, narrowly ovate, tomentose, beset with stiff erect trichomes. Style 4.0 - 5.5 cm long, very slightly adaxially arcuate; yellow, becoming crimson with age. Pollen presenter clavate to cylindric-obtuse, 3.0 mm long. Hypogynous scales hyaline, 2.0 mm long, subulate.

Diagnostic Characters: Among the species of Leucospermum characterised by a distally inflated perianth tube, L. erubescens is distinguished by the prominently pedunculate slightly asymmetrical inflorescences, the obliquely spheroidal to conical-depressed involucral receptacle sharply differentiated from the peduncle and the uniformly velutinous perianth.

This species has already been described at varietal level as L. attenuatum R. Br. var. ambiguum Meisn. in DC. Prodr. 14 : 256 (1856). Meisner's fragmentary type consists of a single detached inflorescence and a few leaves in a capsule. The material is in the Sonder herbarium (S) and is annotated in Meisner's hand.

Type Material: Riversdale district, at Muiskraal, north slopes of the Langeberg, 18th Oct 1966, Rourke 624, (holotype NBG)

Distribution, Ecology and Biology: The range of L. erubescens is very limited, extending along the north slopes of the Langeberg from Muiskraal to Brandrivier with an isolated population at Warmbad on the Warmwaterberg.

Scattered populations occur sporadically along the hot northern foothills of the Langeberg in a narrow zone of Arid Fynbos, on the margin of the Little Karroo. The plants are found on rocky hills or gravel flats of Table Mountain Sandstone from 1500 - 2,000 ft. A low winter rainfall of 10 - 15" p.a. is experienced. Flowering takes place from August to January. On opening, the styles and perianths are pale yellow but as the flower ages both style and perianth become brilliant crimson. Up to eight inflorescences per flowering shoot are produced which persist for about two months.

Specimens Examined:

CAPE

SWELLENDAM: Near Warmbad, 30 miles from Ladismith, Nov., Hutchinson 1135 (K, BOL);

RIVERSDALE: Garcias Pass, on Ladismith side, Oct., van Breda

744 (PRE, K); Muiskraal near Garcias Pass, Oct., Galpin 4461 (PRE); At Muiskraal, Oct., Williams 544 (BOL); Slopes north of Garcias Pass, Oct., Thorne s.n. (SAM 38939); Top of Garcias Pass, Sept., Garside 4915 (K); 37 miles from Barrydale to Garcias Pass, Jan., Marsh 1154 (STE); Riversdale, Muir s.n. (SAM 3765); Muiskraal, north slopes of the Langeberg, Oct., Rourke 624 (NBG); North side of Garcias Pass, Aug., Middlemost 1706 (NBG); Garcias Pass, Dec., Hall 114 (NBG); Thorns 25 (NBG); Aug., Barker 5529 (NBG); Sept. Compton 7623 (NBG); Hills around Muiskraal, Jan., Rourke 246 (NBG); Brandrivier, Aug., Williams 1053 (NBG).

WITHOUT PRECISE LOCALITY: Africa australis, Ecklon & Zeyher 7, in herb. Sonder (S).

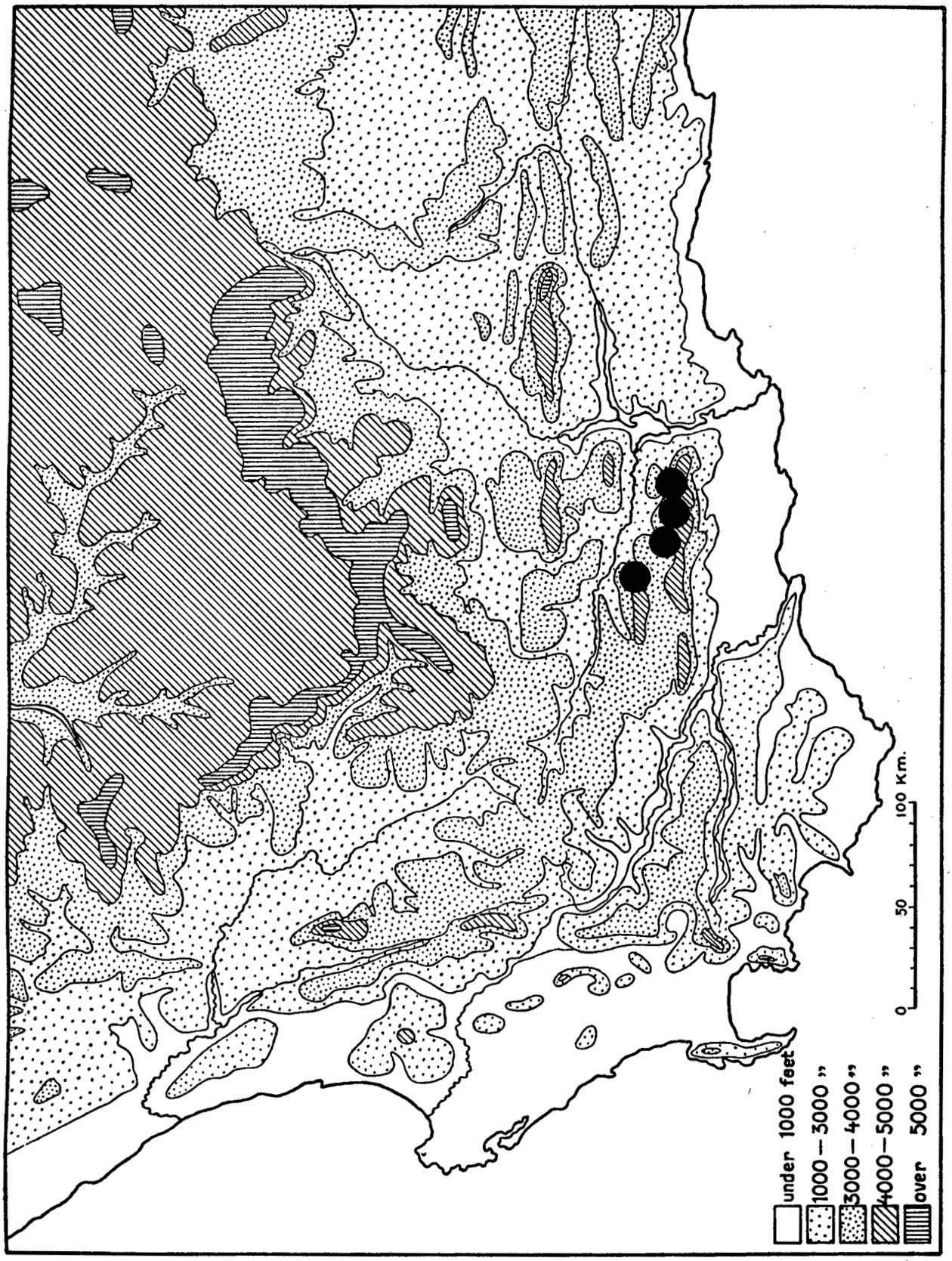


Fig. 22. Distribution of Leucospermum erubescens Rourke

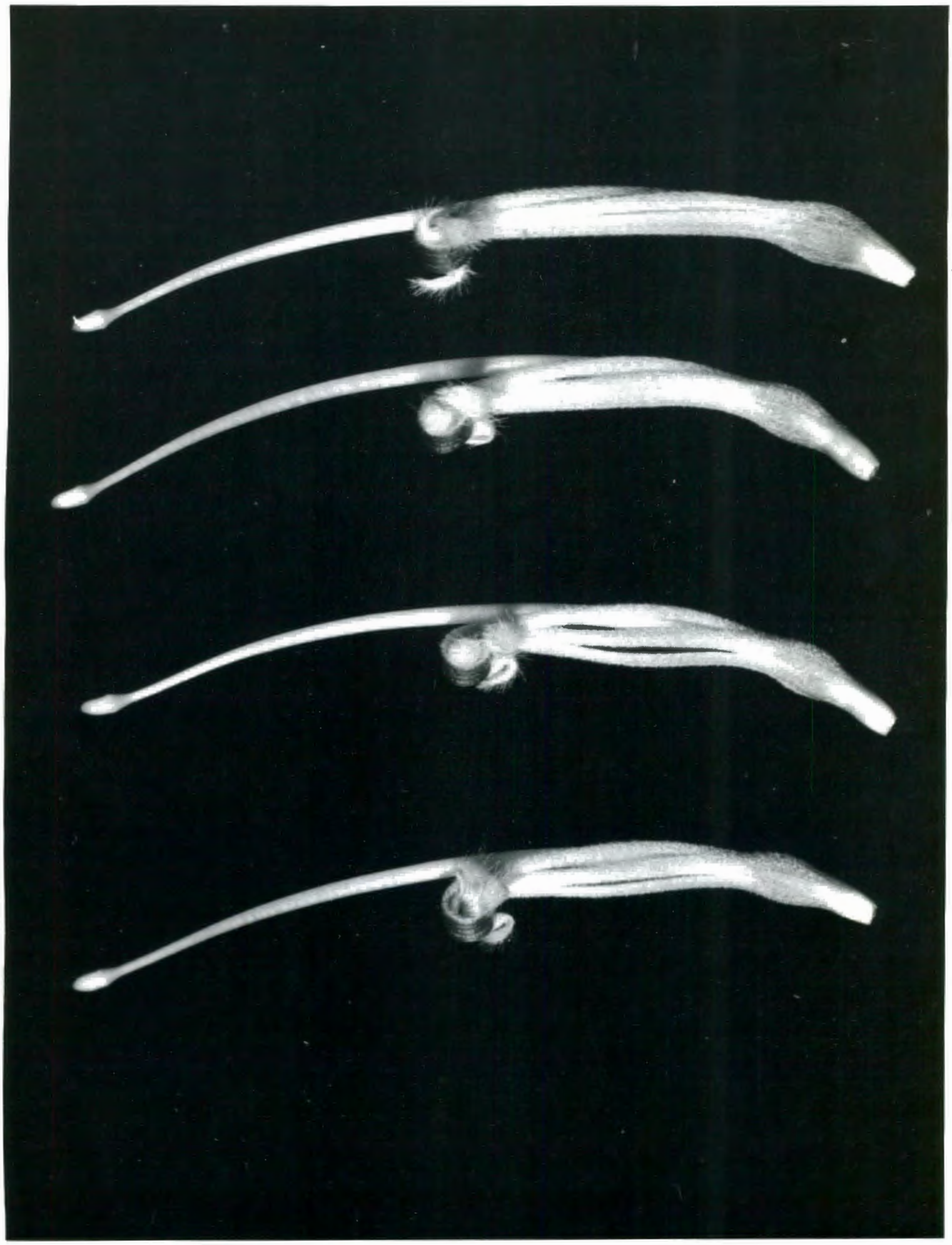


Fig. 23. The perianth in Leucospermum erubescens Rourke, x 3.

(13) Leucospermum utriculosum Rourke, sp. nov.

Species ramos laxos, horizantaliter patentes, emittens; receptaculo involucrali conico depresso, stigmate ovoideo, tubo perianthii infundibuliformi constrictione distali, pubescentia sericeo patulo, praecipue distinguitur.

Frutex 1.0 - 2.0 m altus, 2.0 - 3.0 m latus. Caules ascendentes vel horizantaliter patentes. Folia glabra, oblanceolata-cuneata, 4.5 - 7.0 cm longa, 1.0 - 2.0 cm lata. Apices foliorum truncati, 3 - 5 dentati. Inflorescentia subglobosa depressa, 5.0 - 8.0 cm in diam. Receptaculum involucrale conicum depressum, 1.0 cm longum, 0.75 cm latum. Bracteae involucrales ovatae acutae, cartilagineae, adpressae imbricatae, cinereae sericeae, 8.0 mm longae, 5.0 mm latae. Segmentum perianthii obsitus trichomatibus bombycinis patulis. Tubus perianthii 7.0 mm longus, infundibuliformis, sed abrupte constrictus ad extremum superum; attenuatus et glaber proximalis, vesiculatus et puberulus distalis. Stylus 3.5 - 5.0 cm longus, recavus, decrescens ad apicem versus. Stigma conicum, ovoideum.

An erect to spreading shrub, 1.0 - 2.0 m tall, 2.0 - 3.0 m in diam., with a lax growth habit. Branches somewhat laterally to horizontally spreading, often drooping onto the ground. Single main stem, stout, branching near base; bark smooth, grey. Flowering stems 3.5 mm in diam. covered with a thin indumentum of fine crisped hairs, interspersed with long erect sericeous trichomes. Leaves glabrous, oblanceolate-cuneate, 1.0 - 2.0 cm wide, 4.5 - 7.0 cm long, tapering to a distinct petiolar region; apex truncate with 3 - 5 teeth. Inflorescence somewhat depressed globose to flattened, 5.0 - 8.0 cm in diam.; usually single but occasionally with up to 3 inflorescences per flowering stem; pedunculate, peduncle 1.0 cm long. Involucral receptacle conic-depressed, 1.0 cm long, 0.75 cm wide. Involucral bracts cartilaginous, closely adpressed imbricate, ovate acute, 5.0 mm wide by 8.0 mm long, sericeous, cinereous. Bracteoles obtrullate-cuspidate, 5.0 mm wide, 10.0 mm long, very densely lanate proximally, sericeous distally. Perianth tube 7.0 mm long, infundibuliform, narrowed proximally (1.0 mm in diam.), becoming swollen and inflated distally (4.0 mm in diam.), then becoming sharply constricted; glabrous proximally, puberulus distally. Perianth claws 2.0 cm long, beset with long, erect to spreading silky trichomes. Perianth limbs elliptic, 2.0 mm long, densely sericeous with long, straight, white or ferruginous trichomes. Anthers sessile, elliptic. Style 3.5 - 5.0 cm long, tapering and becoming somewhat incurved in the distal third. Pollen presenter

conic ovoid 1.5 - 2.0 mm long, stigmatic groove terminal. Hypogynous scales 1.0 mm long, linear subulate.

Diagnostic Characters: L. utriculosum may be distinguished by its lax, growth habit; the horizontally spreading branches; the short, conic-depressed involucral receptacle; the perianth tube, narrow proximally, becoming inflated distally and then sharply constricted; the silky spreading pubescence on the perianth claws and the ovoid pollen presenter.

Type Material: Swellendam district, at Diepkloof farm, hills on the north slopes of the Potteberg, 400 ft., 24th Sept. 1966, Rourke 600 (holotype NBG).

Thunberg made the first recorded collection of this species but he did not describe it. This specimen is in Thunberg's herbarium labelled "Protea conocarpa β" in his own handwriting. Although no locality was given it seems likely that Thunberg made this collection when he passed through Storms Vlei while en route for the Company's cattle post at Tyger Hoek in the early summer of 1772. Thereafter it was apparently overlooked until 1924 when Prof. R.H. Compton made a collection at McGregor.

Distribution, Ecology and Biology: The principal populations of L. utriculosum occur in the Robertson, McGregor, Storms Vlei area, and along the north slopes of the Potteberg, extending as far south as the Breede River mouth.

Throughout its entire distribution range, L. utriculosum is restricted to dry, very rocky north facing slopes in areas receiving a winter rainfall of 10 - 15" p.a., at altitudes of 200 - 2,000 ft. From the mouth of the Breede river along the northern slopes of the Potteberg, communities are nearly always found growing on a hard Table Mountain Sandstone-Quartzite conglomerate, often forming quite dense local stands. In the Storms Vlei - Robertson area the plants are more scattered on rocky slopes of Witteberg Quartzite as well as Table Mountain Sandstone. Some of the hills are so arid and stony and the vegetation cover so sparse that frequent veld burning has not been possible. Consequently, numerous old specimens can still be found, their main stems tightly wedged between the crevices of the boulders.

Although the peak of the flowering period is between September and November, inflorescences are produced rather erratically from May until as late as March. The style and perianth of the

of the Potteberg populations is usually pale yellow with a green pollen presenter, while material from Storms Vlei and Robertson has orange to copper coloured perianths and styles, crimson pollen presenters and ferruginous pubescence on the perianth limbs.

Specimens Examined:

CAPE

ROBERTSON: Schurfdeberg near Robertson, Nov., Levyns 9801 (CT); McGregor, Sept., Compton 3405 (BOL, K); Robertson, sandstone kopie Oct., Levyns 2844 (CT); Storms Vlei, Sept., Leighton s.n. (BOL 21178); Schurfdeberg, Robertson, on top of ridge, July, Levyns 11307(CT); Storms Vlei Kloof, Sept., Compton 5798 (BOL); On the farm Eilandia, 21 miles east of Worcester, 1 mile from main road, Nov., Littlewood s.n. (NBG 70451); Storms Vlei Kloof, Oct., Rourke 644 (NBG); Sandstone hills at McGregor, May, Galpin 9941 (PRE); Rocky kloof between Storms Vlei and Bonnievale, Sept., Acock 1741 (S).

SWELLENDAM: Potteberg,north side, western end, July, H.C. Taylor 3656 (PRE, STE); Hamerkop, Potteberg, Oct., Levyns 8421 (CT); East slopes of Potteberg, April, Levyns 8181 (CT); Lower slopes of Potteberg, March, Levyns 11552 (CT); Potteberg, Jan., Lewis 2596 (SAM); Diepkloof farm, north slopes of Potteberg, Sept., Rourke 600 (NBG); Diepkloof farm, Dec., Rourke 281 (NBG); Albertsdal farm, Potteberg, May, Barker 4562 (NBG); North side of Potteberg July, Acocks 22506 (PRE); Grasrug, at mouth of Breede river, Oct., Rourke 951 (NBG).

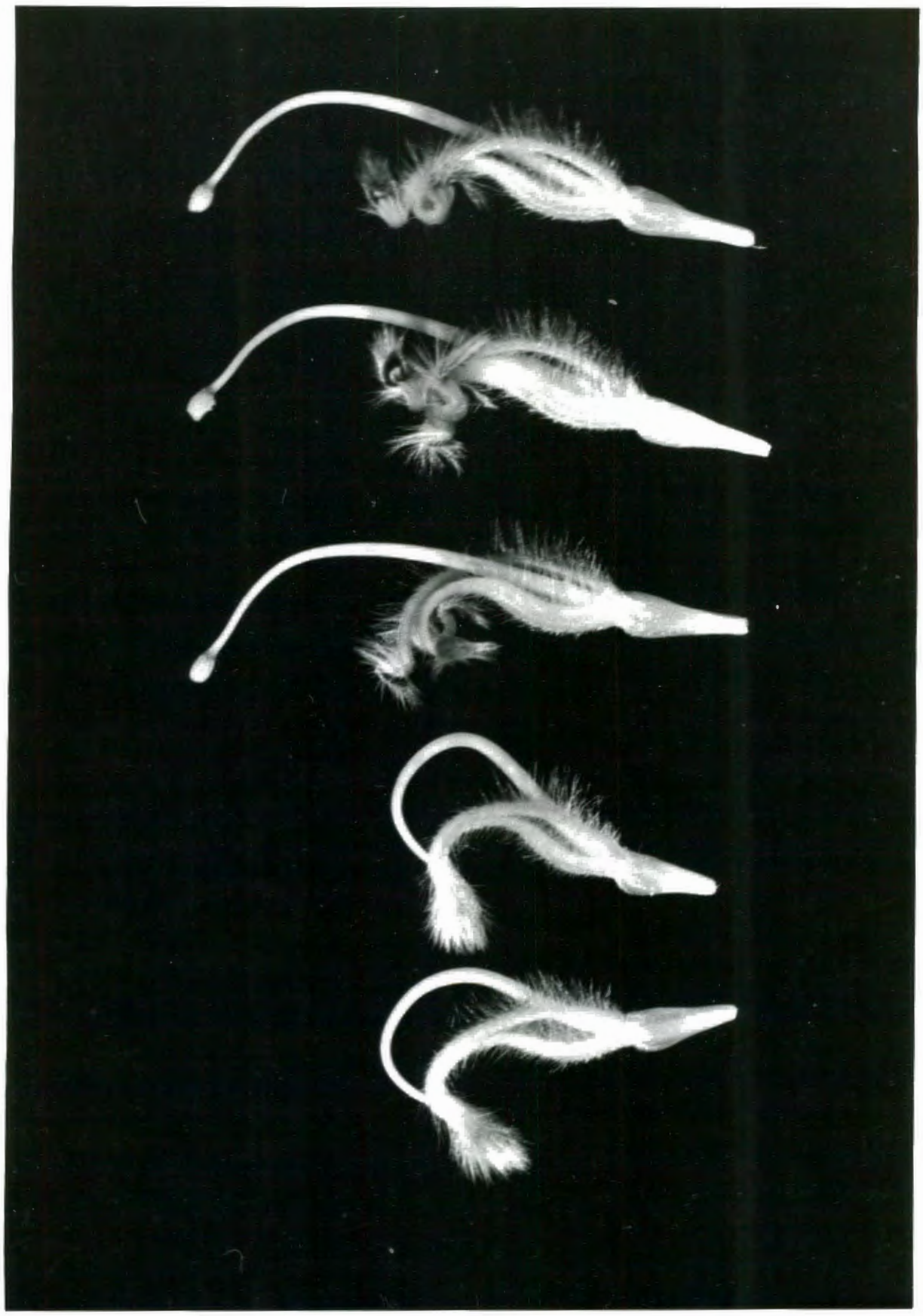


Fig. 24. The perianth of Leucospermum utriculosum Rourke

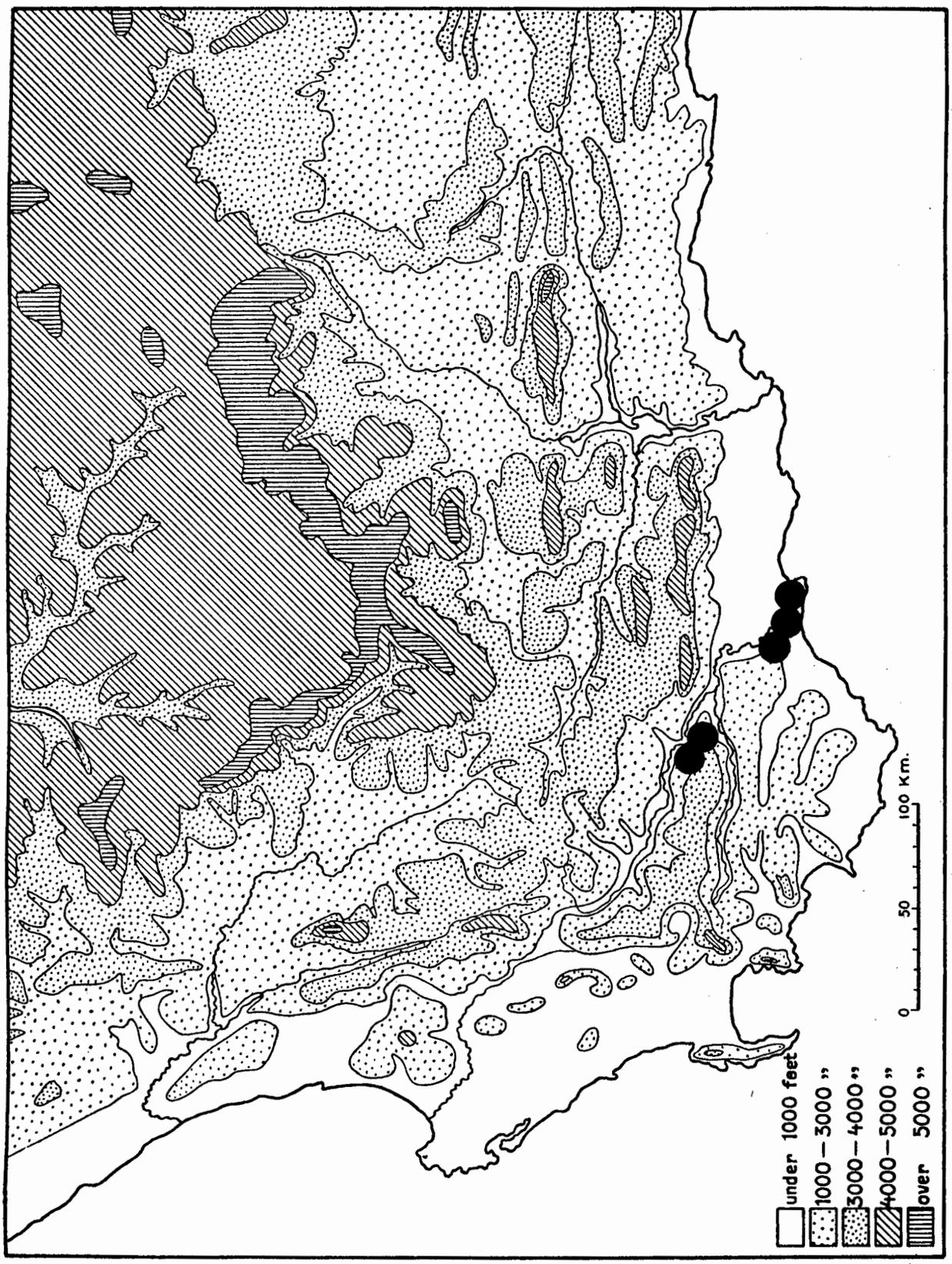


Fig. 25. Distribution of Leucospermum utriculosum Rourke

(14) Leucospermum spathulatum R. Br. in Trans. Linn. Soc. Lond. 10 : 101 (1810); Phillip & Stapf in Fl. Cap. 5 : 638 (1912). Type: Africa australis, Niven s.n., labelled "12 Leucospermum spathulatum" in Brown's hand, holotype (BM).

Protea spathulata (R.Br.) Poir. in Lam., Encycl. Meth. Bot. Suppl. 4 : 567 (1816).

Leucadendron spathulatum (R.Br.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Leucospermum cereris Compton in J. Bot., Lond. 71 : 69 (1933). Syntypes: Without coll., Wild Fl. Show, Cape Town, Oct. 1919, sub. BOL 16283 (BOL, K); Ceres Wild Fl. show, Oct. 1927, Compton 3824 (BOL); Oct. 1930, Compton 3694 (BOL).

A prostrate, sprawling shrub with trailing stems, forming dense mats to 3.0 m in diam., seldom exceeding 30.0 cm in height. Flowering stems decumbent, trailing, 2.0 - 4.0 mm in diam., covered with a dense, short, crisped indumentum interspersed with straight, patent, trichomes; often bearing short side branches. Leaves obovate to spathulate, patent to subsecund, 1.4 - 3.0 cm long, 7.0 - 17.0 mm wide, apex entire, occasionally with 2 - 3 teeth; canescent to glabrescent, usually beset with a fine indumentum of short crisped hairs. Inflorescences depressed globose, 5.0 - 7.0 cm in diam., solitary or in groups of 2, subsessile to pedunculate, peduncle to 1.0 cm long. Involucral receptacle conic acute, 0.7 - 1.0 cm long, 5.0 - 7.0 mm wide. Involucral bracts ovate acute-acuminate, tightly imbricate, cartilaginous, tomentose, 7.0 mm long, 4.0 mm wide. Bracteoles ovate acuminate, thickly lanate proximally, 7.0 mm long, 4.0 mm wide, clasping the perianth. Perianth strongly adaxially arcuate, deep orange to crimson. Perianth tube 8.0 mm long, narrowed proximally, becoming ventricose and strongly inflated distally on the adaxial surface. Perianth claws strongly recurved subterminally, sericeous to villous. Perianth limbs ovate acute 3.0 mm long, sericeous. Style 3.0 - 4.0 cm long, tapering subterminally, upper third bent adaxially, almost at right angles. Pollen presenter cylindric obtuse, 2.0 mm long, stigmatic groove slightly adaxial. Hypogynous scales 3.0 - 4.0 mm long, linear subulate.

Diagnostic Characters: L. spathulatum is distinguished from those related species having a prostrate growth habit, conic involucral receptacle and inflated perianth tube by its

usually entire, oblong to spathulate leaves, 1.4 - 3.0 cm long, beset with a short crisped indumentum (of varying density), and the strongly arcuate style, 3.0 - 4.0 cm long.

An unlocalised collection made by Niven is the earliest record of this species and serves as the type of L. spathulatum R.Br. Leucadendrum bellidifolium Salisb. ex Knight, published a year earlier, was considered by Phillips and Stapf to be synonymous with L. spathulatum R.Br. However, the type description was based on plants flowering in the conservatory of the Marquis of Blandford which had been raised from seed collected by Niven. As Niven's seed was unlocalised and no type material appears to have been preserved, the name L. bellidifolium cannot be typified with any certainty as the description could equally apply to this or several other decumbent species. For the present, L. bellidifolium is best regarded as a species insufficiently known.

Distribution, Ecology and Biology: The range of L. spathulatum extends from the Middelberg Plateau in the Cedarberg, southwards to the Cold Bokkeveld mountains, with an outlying population on Sawedge Peak near Worcester.

This species is most abundant in the Cedarberg where populations occur in dry, rocky exposed positions between 4,500 and 5,500 ft. A winter rainfall of up to 35" p.a. is experienced with occasional snowfalls in winter. The stout main stems are rooted in rock crevices and produce horizontally spreading branches which sprawl over the adjacent ledges or large slabs of Table Mountain Sandstone. Mature plants may develop into mats up to 3.0 m in diam. The matted growth habit is due to the development of short interlocking side branchlets on the flowering stems. In this respect L. spathulatum differs from the related L. profugum in which the flowering stems are straight or looped and are rarely branched. The scarlet to crimson inflorescences are produced between September and January but mainly towards the end of October.

Specimens Examined:

CAPE

CLANWILLIAM: Archberg, Cedarberg, Dec., Esterhuysen 18122 (BOL, NBG, PRE); Wolfberg, Dec., Vogts 84 (STE, PRE); Wolfberg, Cedarberg Plateau, Dec., Esterhuysen 22457 (BOL, K, PRE); Cedarberg, Nov., Stokoe 8060 (BOL); Middelberg Plateau,

Dec., Levyns 10819 (CT); South slopes of Sneeuwberg, Oct. White s.n. sub SAM 20949 (SAM); Square Peak, above De Riff Jan., Rycroft 2676 (NBG); Matjies River, Oct. & Jan., Wagener 266 (NBG); Gabriel'sPass, rocky s.w. slopes, Nov., Kruger 934 (NBG).

CERES: Gideon's Kop, Oct., Esterhuysen 31623 (BOL); Gideon's Kop, April, Esterhuysen 27219 (BOL); On the farm Rosendal, east of Bokkeveld Sneeuwkop, March, White s.n. sub. SAM 45892 (SAM); Blaauwkop, Cold Bokkeveld, Oct., Esterhuysen 27904 (BOL); Gideon's Kop, Oct., Rourke 668 (NBG).

WORCESTER: Sawedge Peak, east of Keeromsberg, along summit of a rugged east ridge, Sept., Esterhuysen 31163 (BOL).

(15) Leucospermum profugum Rourke, sp. nov.

Inter Leucospermum species caulibus decumbentibus, receptaculis involucralibus conicis, et perianthiis infundibuliformibus, L. profugum a stylo 4.5 - 6.2 cm longo, foliis obovatis vel oblanceolatis, 2.9 - 5.2 cm longis, glabris vel glabratis 3 - 4 dentibus apicalibus, distinguitur.

Frutex decumbens. Caules pauci, serpentes, 2.0 - 4.0 m longi; caudicem nodosum expositum exorientes. Folia oblanceolata vel obovata, 2.9 - 5.5 cm longa, 0.6 - 1.8 cm lata, glabra vel glabrata, apicem 3 - 4 dentatum. Folia plerumque secunda vel subsecunda, saepe retrorsa apicem versus caulium. Inflorescentia solitariae, depressae ovoideae, 9.0 - 12.0 cm in diam.; pedunculus 3.0 - 3.5 cm longus, a caule ad angulum 90° portatus. Receptaculum involucrale conicum acutum, 2.0 - 2.5 cm longum, 1.0 - 1.3 cm latum. Bracteolae late obovatae, abrupte acuminatae, 8.0 - 9.0 mm latae, 11 mm longae, cartilagineae, dense lanatae proximales. Perianthium 3.5 - 4.0 cm longum, salmoneum. Tubus perianthii infundibuliformis, 1.5 cm longus, glaber proximalis, puberulus distalis; adaxialis carinatus. Stylus adaxialis arcuatus, 4.5 - 6.5 cm longus. Stigma anguste ovoideum vel conicum acutum.

A decumbent shrub with a stout, exposed, woody rootstock, 4.0 - 12.0 cm in diam., from which arise several stout, unbranched, trailing stems, 2.0 - 4.0 m in length. Basal branches stout and woody, 2.0 - 3.0 cm in diam., usually bare or covered with corky bark. Flowering stems often looped or bowed with the inflorescences arising at right angles to the stem. Leaves oblanceolate to obovate, 2.9 - 5.5 cm long, 0.6 - 1.8 cm wide, glabrous to glabrescent, the young leaves with a sparse indumentum of short crisped hairs, soon becoming glabrous; apex rounded to subtruncate with 3 - 4 teeth; leaves usually secundly arranged, often reflexed and bent backwards. Inflorescences solitary, depressed ovoid, 9.0 - 12.0 cm in diam; peduncle 3.0 - 3.5 cm long, arising at right angles to the stem. Involucral receptacle conic acute, 2.0 - 2.5 cm long, 1.0 - 1.3 cm wide. Involucral bracts lanceolate acute, 5.0 - 7.0 mm long, cartilaginous, softly tomentose. Bracteoles broadly obovate to cordate, 8.0 - 9.0 mm wide, 11 mm long, cartilaginous, thickly lanate proximally; apex abruptly acuminate, 4.0 - 5 mm long. Perianth 3.5 - 4.0 cm long, yellowish orange, becoming deep reddish orange to salmon pink with age. Perianth tube infundibuliform, 1.5 cm long, tapering and glabrous proximally, becoming greatly inflated and puberulus distally, 1.0 - 1.5 mm in

diam. proximally, 3.5 - 4.0 mm in diam. distally; abaxial surface keeled. Perianth limbs lanceolate acute, 4.0 mm long, 1.5 mm wide beset with a hispid ferruginous indumentum. Style curved adaxially, 4.5 - 6.2 cm long, tapering towards the apex. Pollen presenter, narrowly ovoid to conic acute, 1.0 mm long. Stigmatic groove oblique, adaxially placed. Hypogynous scales linear subulate, orange, 4.0 - 5.0 mm long.

Diagnostic Characters: Among the prostrate species of Leucospermum with a conic involucral receptacle and infundibuliform perianth tube, L. profugum is distinguished by its long style, 4.5 - 6.2 cm in length and the large (2.9 - 5.2 cm long) glabrous to glabrescent, obovate to oblanceolate leaves, usually with 3 or 4 teeth at the apex.

Type Material: Piketberg, half a mile south of the summit of Versveld's Pass, 20th Oct., 1968, Rourke 1141, (holotype NBG).

Distribution, Ecology and Biology: This species is confined to the southern extension of the Piketberg, where it has been recorded between Versveld's Pass and Aasvoelkop, along the south eastern escarpment, between 1200 ft. and 2500 ft. Miss G. Edwards made the first recorded collection of L. profugum in 1914 on the Piketberg.

L. profugum has a distinctive growth habit unlike most other decumbent species in the genus. The plants produce only a few main stems, up to 4 m in length which trail over the rocks and surrounding vegetation. These stems arise from a gnarled, woody rootstock, usually exposed and wedged between the cracks of large boulders. The rootstocks and basal stems develop a tough corky bark which results in the plants being fairly fire resistent. For the greater part of their length the main stems are devoid of leaves and tend to develop adventitious roots where they are in close contact with the soil.

All the observed populations were found to occur in well drained situations, on rocky outcrops or on small koppies of Table Mountain Sandstone. The associated vegetation consists mainly of low Restionaceae, Leucadendron glaberrimum, Rhus africana and Diosma vulgaris. Flowering occurs from late September until December.

Specimens Examined:

PIKETBERG: Top of Piketberg mountain, Sept., Barker 10347 (NBG); Piketberg, 1200 ft., Sept., J. Krige s.n. (STE 10546); Piketberg Nov., Edwards s.n. (BOL 14444); Top of Piketberg mountain, Sept., Martin 883 (NBG); Piketberg mountain, Aug. (in bud), Rourke 541 (NBG); Piketberg mountain, Nov., Martin 900 (NBG); Half a mile south of the summit of Versveld's Pass, Oct., Rourke 1141 (NBG); Piketberg mtn. top, Oct., Barker 10347 (NBG)

Sect. BREVIFILAMENTUM Rourke, sect. nov.

Folia linearia-oblonga vel elliptica-ovata, saepe basaliter cordata. Receptaculum involucrale conicum vel peranguste conicum acutum. Stigma ovoidea vel oblique ovoidea vel unguliforme. Antherae subsessiles; filamentum 1.0 - 2.0 mm longum.

Leaves linear-oblong to elliptic-ovate, often cordate at base. Involucral receptacle very narrowly conic acute. Pollen presenter ovoid, obliquely ovoid or obliquely turbinate (hoof shaped). Anthers subsessile; filament 1.0 - 2.0 mm long.

Type: L. vestitum (Lam.) Rourke

(16) Leucospermum vestitum (Lam.) Rourke in Jl S. Af. Bot. 33 : 266 (1967).

Protea vestita Lam., Encycl. Meth. Bot. Illustr. 1 : 239 (1792). Type: Cap. b. Spei, Joseph Martin s.n., holotype in herb. Lamarck (P - LA).

Leucadendrum ellipticum Salisb. ex Knight in Knight, Cult. Prot. : 53 (1809). Type: "Jackall Flyberg", Niven 53, holotype in herb. Salisbury (K), isotype in herb. J.E. Smith (LINN).

Leucospermum medium R.Br. in Trans. Linn. Soc. Lond. 10 : 97 (1810). Type: Specimen labelled "4 Leucospermum medium africa australis Oldenland" in Brown's hand, taken as type (BM).

Protea media (R.Br.) Poir. in Lam., Encycl. Meth. Bot. Suppl. 4 : 566 (1816).

Leucospermum incisum Phillips in Kew Bull. 1910 : 332 (1910). Type: Breede river valley near Darling Bridge, Bolus 5235, holotype (K), isotype (BOL); Phillips in Fl. Cap. 5 : 620 (1912).

A stiffly erect to spreading shrub to 2.5 m in height, up to 3.0 m in diam., with a single stout main stem; bark smooth, grey. Flowering stems 0.5 - 0.8 cm in diam., stiffly erect to horizontally spreading, thinly puberulous. Leaves oblong to elliptic to narrowly ovate, 5.0 - 7.5 cm long, 1.0 - 3.0 cm wide, glabrous, sessile, truncate or cordate at base, apex entire or with 2 - 4 teeth; loosely imbricate. Inflorescences ovoid to globose, 7.0 - 9.0 cm in diam., usually borne singly. Involucral receptacle very narrowly conical-acute, 4.0 - 5.0 cm long 0.75 - 1.0 cm wide. Involucral bracts broadly ovate-acute to acuminate 1.0 - 1.5 cm long, 0.5 - 1.0 cm broad, loosely patent, membranous, glabrous, pale green and shiny in fresh state, margins ciliate. Bracteoles ovate acuminate, membranous, clasping the perianth tube, 1.5 cm long, 0.5 - 0.7 cm broad, glabrous, or minutely puberulous, margins ciliate. Perianth 3.5 cm long, orange on opening becoming brilliant carmine with age. Perianth tube 6.0 mm long, glabrous, cylindric becoming slightly compressed laterally. Perianth claws sigmoid after anthesis, coiled subterminally, median adaxial claw glabrous margins of the two

lateral adaxial claws beset with erect, straight silky trichomes, the abaxial claw densely beset with straight silky trichomes. Perianth limbs ovate, 4.0 - 5.0 mm long, 1.0 mm wide, beset with long, straight silky trichomes. Anthers ovate 3.0 mm long, subsessile, filament 1.0 mm long. Style 5.0 - 6.0 cm long, the upper third adaxially arcuate. Pollen presenter obliquely ovoid acute, 3.0 mm long, stigmatic groove in a raised terminal papilla. Hypogynous scales 1.5 - 2.0 mm long, linear, obtuse, cream.

Diagnostic Characters: The glabrous, membranous, loosely patent involucral bracts, the very narrowly conic acute involucral receptacle, the glabrous oblong leaves and obliquely ovoid pollen presenter distinguish L. vestitum from related species.

The type of Protea vestita Lam. is a specimen collected at the Cape by Joseph Martin, probably in 1788. Martin studied at the Paris Botanic Garden and was later sent to Mauritius by the French government. He proceeded to Mahe and Malabar and was eventually posted to Cayenne in French Guiana as government botanist and director of the botanic garden. There is apparently no published record of his visit to the Cape which probably took place in 1788 while en route for Mauritius. Nevertheless, it is evident from the collection of Cape Proteaceae which he sent to Lamarck that he penetrated at least as far as the upper Breede river valley between the Worcester - Hex river area and Tulbagh.

Distribution and Ecology: The present range of L. vestitum extends from Heerenlogementberg in the north, southwards through the districts of Clanwilliam, Ceres, Piketberg and Tulbagh to the northern end of the Breede river valley, a few miles north of Worcester.

Three collections of this species have been made on the Cape Peninsula but it has not been observed growing wild there since 1886. A specimen was collected by Marloth on Table Mountain at 500 ft. in November 1884. Material was also collected by C.A. Fairbridge on the eastern slopes of Lion's Head at 200 ft. in October 1886 and by Zeyher above Judge Menzies' estate at Green-point although this latter collection is undated. (Mr. Justice William Menzies purchased 18 morgan of land at Sea Point on which he built his home, Sea Point House. The site of this house was subsequently occupied by the Queens Hotel and more recently, the Hotel President.)

In the light of present day distribution records these collections appear spurious. Nevertheless, the fact that all three were made

by reliable collectors and in fairly close proximity to each other, suggests that L. vestitum actually did occur naturally near Cape Town but has since been exterminated there due to urban expansion. It is also extinct now on Paarl mountain.

L. vestitum appears to have no special ecological requirements apart from a dry, well drained position on a rocky slope of Table Mountain Sandstone, between 200 and 4,000 ft., usually in north or west facing situations. This species is very tolerant of dry conditions as it frequently occurs associated with arid fynbos in regions receiving a winter rainfall as low as 10" pa.

Plants from the Tulbagh valley often tend to have a stiff upright growth habit with erect stems while those from more northerly localities develop into rather sprawling shrubs. Flowering commences as early as July in warm localities and continues until January, with a peak in October and November.

Specimens Examined:

CAPE

VAN RHYNSDORP: Heerenlogementsberg, N.E. aspect, Sept., H.C. Taylor 3944 (STE, PRE, NBG); West slope of Torenberg, Heerenlogement, July, Barker 9887 (NBG); Heerenlogementsberg, July, Compton 10981 (NBG).

CLANWILLIAM: Lambertshoekberg, Sept., Maguire 421 (NBG); Middelberg, Cedarberg, Dec., Kerfoot 6146 (NBG); Algeria, Cedarberg, Sept., Siaens s.n. (NBG 81913); Ridge S.E. of Uitkyk peak, Jan., H.C. Taylor 2307 (NBG); Uitkyk Pass, Sept., Compton 8477, 7009 (NBG); Grey's Pass, Oct., Acocks 19823 (PRE, NBG, K); Uitkyk Pass, Dec., Salter 5092 (BM); Groot Kliphuis 8 miles S. of Clanwilliam, Dec., Leipoldt 3514 (PRE); Pakhuis Pass, Nov., Galpin 11086 (PRE, K); Mountains at Jackals Vlei, Niven 53 (K), Upper slopes of Pickeniers Pass, Nov., Pearson 5137 (K); Krakadouw heights, Cedarberg, Oct., Pocock 577 (STE); Grey's Pass, Oct., Levyns 1375 (CT, K); Lambertshoekberg Aug., Compton 5495 (NBG, BOL); North side of the Cedarberg at Heuning Vlei, Jan., Esterhuysen 21131 (BOL, PRE); Clanwilliam, hills S.E. of Keerem, Nov., Pillans 8820 (BOL); Blaauwberg 3500 - 4,000 ft., 24/11/1828, Drège 8056 (P, G, K, BM); Blaauwberg 3500 - 5,000 ft., 4/1/1831 Drège s.n. (P); Pikeniers Kloof Pass, Aug., Rourke 544 (NBG)

PIKETBERG: In sumo monte Piketberg, Oct., A. Bolus 13636 (BOL); Western of Cardouw Pass near Porterville, Sept., Lewis 3676 (SAM); Mountain at "The Rest", Piketberg, Sept., Gillet 3727 (BOL);

Hills N.W. of Moutons Vlei, Nov., Pillans 7471 (BOL); Piketberg mountain, Nov., Martin 1165 (NBG); Cardouw Pass, Nov., Compton 23032 (NBG); Kapiteins Kloof, Piketberg, Sept., Pillans 7670 (BOL); Top of mts. at back of "The Rest", Sept., Howes 201 (PRE, BR), Bosch Kloof, Piketberg, Sept., Compton 9500 (NBG); Heuningberg, Piketberg, Nov., Acocks 23429 (PRE), H.C. Taylor 5558 (PRE); Piketberg, Jan., Theiler 9 (PRE).

CERES: Ceres Rd., Oct., Marloth 1982 (PRE); Ceres, Nov., Meebold 12421 (NY).

TULBAGH: Tulbagh Rd., Sept., Schlechter 8997 (PH, GRA, NH, S, G, K, BM, PRE); Roodezand mts., Oct., Andreae 614 (PRE, STE); Breede river valley near Darling Bridge, Nov., Bolus 5235 (BOL, K); Between Tulbagh and Wolsely, Feb., Rourke 9 (BOL); Mountains around the Tulbagh Waterfall, Oct., MacOwan 904 (BOL, SAM, G, BM, K); In ericetis prope Tulbagh, Nov., Bolus 5236 (BOL, K); In the Winterhoek mts., Tulbagh, Nov., Pappe s.n. (SAM 19620); Tulbagh Rd., Sept., Schlechter 8992 (BR, Z); Roodesandberg, Sept., Compton 6670 (NBG); Michells Pass, Jan., Wasserfall 780 (NBG); Ceres Rd., below Michells Pass, Guthrie 3404 (NBG); Leeuriver, Tulbagh valley, Sept., Rourke 1120 (NBG); On the road to Goedgevonden, Dec., Vogts 60 (PRE, STE); Below homestead of "The Waterfalls", Tulbagh, Phillips 524 (PRE, K); Gravelly places between Tulbagh & Michells Pass, Dec., Acocks & Hafstrom 2104 (PRE).

WORCESTER: Near Breede River, Worcester, Jan., Mund s.n. (B); Hex River, 1,000 - 1,5000 ft. 12/9/1826, Drège s.n. (P); Die Eike near Breede River station, Oct., van Breda 997 (PRE); Botha station, between Wolsely and Worcester, Oct., Rourke 1140 (NBG).

PAARL: Paarl mountain, Tyson s.n. (SAM 19618).

CAPE TOWN: On the eastern hills of Lion's Head, 200 ft., Oct. 1886, C. Fairbridge 7036 (BOL); In clivis montis Tabularis, Nov. 1884, Marloth 341 (PRE); Stony area at Greenpoint above Menzies estate, Oct., Zeyher s.n. (BOL).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, Verreaux s.n. (NY, FI); C.B.S., Thunberg in herb. Bergius (SBT) Prom. Bona Spei J. Roxburgh s.n. (G).

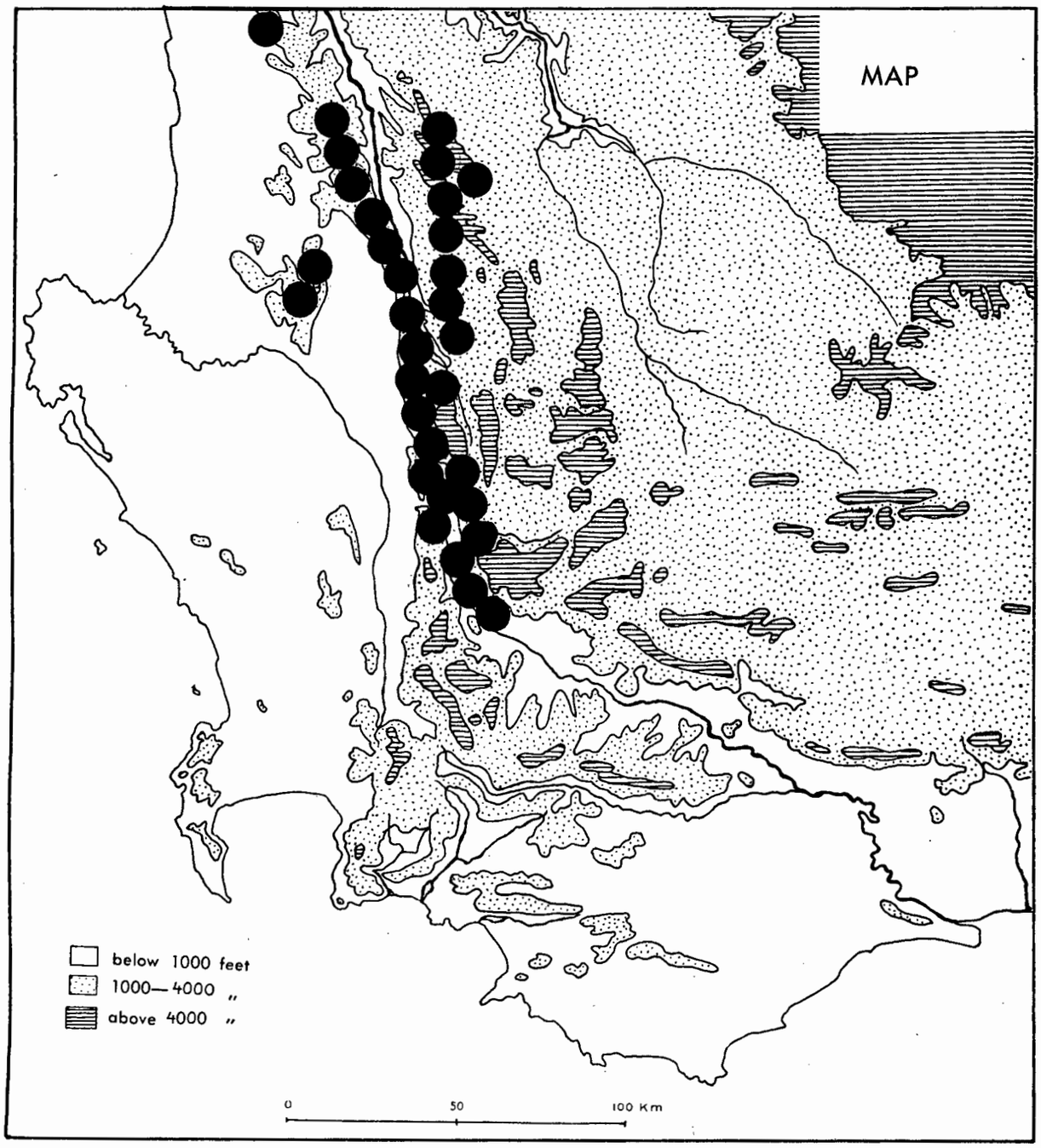


Fig. 26. Present distribution of Leucospermum vestitum(Lam.) Rourke

(17) Leucospermum tottum (L.) R.Br. in Trans. Linn. Soc. Lond. 10 : 97 (1810); Phillips & Stapf in Fl. Cap. 5 : 621 (1912); Vogts in Flower. Pl. S. Afr. 35 : t. 1380 (1962).

Protea totta L., Mant. Alt. : 191 (1771). Type: "Roode Zand mountains, 3 ft., whole thickets, fl. August", Tulbagh s.n. sheet no. 116 35 (LINN).

Protea lotta L., Poir. in Lam., Encycl. Meth. Bot. 5 : 644 (1804), "totta".

Leucadendron tottum (L.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Leucadendrum horizantale Salisb. ex Knight in Knight, Cult. Prot. : 53 (1809), - nom. superfl.

An erect, much branched shrub 1.0 - 2.0 m in diam., with a single main stem and somewhat horizantally spreading branches. Flowering stems held horizantally, 5.0 - 7.0 mm in diam., thinly pilose to glabrescent, reddish tinted. Leaves sessile, glabrous, lanceolate acute to oblong linear, occasionally cordate at base, 0.5 - 1.5 cm wide, 2.5 - 6.0 cm long; apex usually entire, occasionally with 2 or 3 teeth; leaves widely spaced, patent. Inflorescences usually solitary, broadly depressed conic, becoming discoidal on opening, 9.0 - 15.0 cm in diam.; pedunculate, peduncle 2.0 - 3.0 cm long. Involucral receptacle narrowly conic, 3.0 - 4.0 cm long, 4.0 mm broad. Involucral bracts broadly ovate to ovate acuminate 4.0 - 7.0 mm wide, 1.0 - 1.5 cm long, expanded into 2 membranaceous wings in the proximal half; glabrous but with ciliate margins, patent to very loosely imbricate. Bracteoles broadly ovate, 15.0 mm long, 8.0 mm wide, softly membranaceous, lanate proximally, puberulous to glabrous distally, apices acuminate. Perianth 4.0 - 4.5 cm long, pale pink. Perianth tube 7.0 mm long, glabrous to very sparsely pilose, slightly laterally compressed. Perianth claws 1.0 mm wide, thinly pilose, the 3 adaxial claws fused into a sheath; becoming very tightly coiled on opening in the subterminal region. Perianth limbs ovate, 3.0 mm long 1.5 mm wide dull carmine to brownish, sparsely tomentose. Anthers subsessile, ovate to lanceolate, 2.0 mm long. Style 5.0 cm long, slightly adaxially curved, straightening as the inflorescence ages, eventually projecting at right angles to the receptacle. Pollen presenter ovoid acute,

1.0 - 1.5 mm in diam., adaxial surface oblique, stigmatic groove terminal. Hypogynous scales subulate linear, 2.0 mm long, hyaline.

Diagnostic Characters: L. tottum is distinguished by its narrowly lanceolate to linear-oblong, usually entire leaves, the glabrous, loosely imbricate involucral bracts, the ovoid pollen presenters and the nearly straight styles which become patent to horizantally spreading at maturity.

It is probable that the first collection of L. tottum was made by Auge. Specimens from this collection were sent to Linnaeus in about 1769 by Tulbagh, then Governor of the Cape, who reported that it occured in the Roodezand mountains in "whole thickets".

Although there has been some uncertainty regarding the precise meaning of the epithet "tottum", Houttuyn's suggestion that it had been derived from the word Hottentot, thereby implying that it was a native of the Cape, is the most logical explanation. [Houttuyn, Nat. Hist Deel 2, 4 : 108 (1775)]

L. tottum (L.) R.Br. var. glabrum Phillips is regarded by the present author as a putative hybrid between L. tottum and L. vestitum and is discussed in the chapter on hybrids.

Distribution and Ecology: The range of L. tottum extends from as far north in the Cedarberg as Ezelbank, southwards through the Cold Bokkeveld, Ceres, Tulbagh, Worcester and Paarl mountains to Villiersdorp.

Apart from a few dense stands on the Zuurvlakte near Tulbagh and near Villiersdorp, L. tottum tends to be a rather solitary species. Scattered individuals or small groups are widely dispersed in rugged mountainous country at elevations of 1,000 to 6,000 ft. The range of habitats occupied may vary from hot, dry north facing positions in the Cedarberg, receiving 15 - 20" p.a. to cool, moist south facing slopes where the annual rainfall may be up to 60" p.a. Flowering takes place from September to January.

Specimens Examined:

CAPE

CLANWILLIAM: Grootberg, south west slopes, Dec., Esterhuysen 4173 (BOL, PRE); Duivelskop, Cedarberg, Jan., Stokoe s.n. sub. SAM 56567 (SAM); Top of Middelberg Pass, Oct., Acocks 19855 (PRE, K); Top of Oliphants River mountains behind Warm Baths, Nov., Stephens 6862 (K); Ezelbank, Oct., Thode 2063 (PRE);

Kleinfontein, Clanwilliam, Dec., Gentry 19018 (PRE).

PIKETBERG: Piketberg mountain, Sept., Kriege s.n. sub STE 10548 (STE).

CERES: Matroosberg, Dec., Marloth 2271 (STE); Kleyn vlei, Koue Bokkeveld, Jan., Schlechter 10206 (PH, B, BR, Z, BM, K, PRE, S); Koue Bokkeveld, in saxosis prope sandrivier, Jan., Schlechter 10116 (GRA, BOL); Elands Kloof, Dec., Levyns 8131 (CT); West base of the Schurfteberg, Nov., Pillans 9705 (BOL); South slopes of Castle Rocks, Dec., Esterhuysen 14697 (BOL, PRE); Near Laaken vlei, Matroosberg, Nov., Phillips 2130 (SAM); Ceres mountains, Dec., Marloth 13363 (PRE); Matroosberg, Sand drift kloof, Jan., A. Bolus 6369 (BOL).

TULBAGH: Tulbagh, Zuurvlakte, Nov., Kling s.n. sub STE 9013 (STE); Witsenberg, summit of eastern slopes, Dec., Andreae 147 (STE); In montibus juxta Tulbagh waterfall, MacOwan 2505 (NH, PRE, K, Z); In monte Witsenberg, Dec., Zeyher 1462 (PRE, G, S); Witsenberg Oct., Marloth 10704 (PRE).

PAARL: Bain's Kloof, Oct., Hastig s.n. sub. STE 30015 (STE); Lower slopes of Seven Sisters mountains, Jan., Esterhuysen 18325 (BOL); Bailey's Peak, Jan., Esterhuysen 8530 (BOL); Bottom of Du Toits Kloof, Dec., Rourke 56 (BOL, NBG); Paarl side of Du Toits Kloof, Dec., Gill 26 (NBG); Du Toits Kloof, Nov., Walters 143 (NBG); Du Toits Kloof Pass near Paarl, Werdermann & Oberdieck 735 (K, PRE); Bain's Kloof, Nov., Thorne s.n. sub SAM 46537 (SAM); Du Toits Kloof mountains, between Dal Josephat and Wagenmakers vallei, 18/1/1828, Drège s.n. (P, S, SAM); Du Toitskloof Berg, 30/11/1827, Drège 1467 (P).

WORCESTER: Louwshoek mountain, Nov., Stokoe s.n. sub SAM 58934 (SAM); Ad latera montium Drakensteen prope Du Toits Kloof, Oct., MacOwan no 776 in Herb. Norm. Austro. Afric. (BOL, SAM, GRA, NH, K, BM, BR, G); Worcester, Sept., T. Cooper 1397 (K, BM, NY, Z, BOL, NH, PRE); Worcester, Oct., Fine 996 (PRE).

CALEDON: Stettynsberg, lower south west slopes, Dec., Esterhuysen 11160 (BOL); Villiersdorp, Middlemost s.n. (GRA); On the farm Bo Radyn, 2 miles N.W. of Villiersdorp, Littlewood s.n. sub NBG 77988 (NBG); Villiersdorp, summit of Elands Kloof, Nov., M.G. Gillet 725 (K); Caledon, Nov., anno 1837, Verreaux s.n. (G).

WITHOUT PRECISE LOCALITY: Prom. bon. spei, 1773, Oldenburg s.n. (BM); (. b. sp., Wanmann s.n. in herb. Bergius (SBT); (ap. b. sp., Thunberg s.n. in herb. Bergius (SBT).

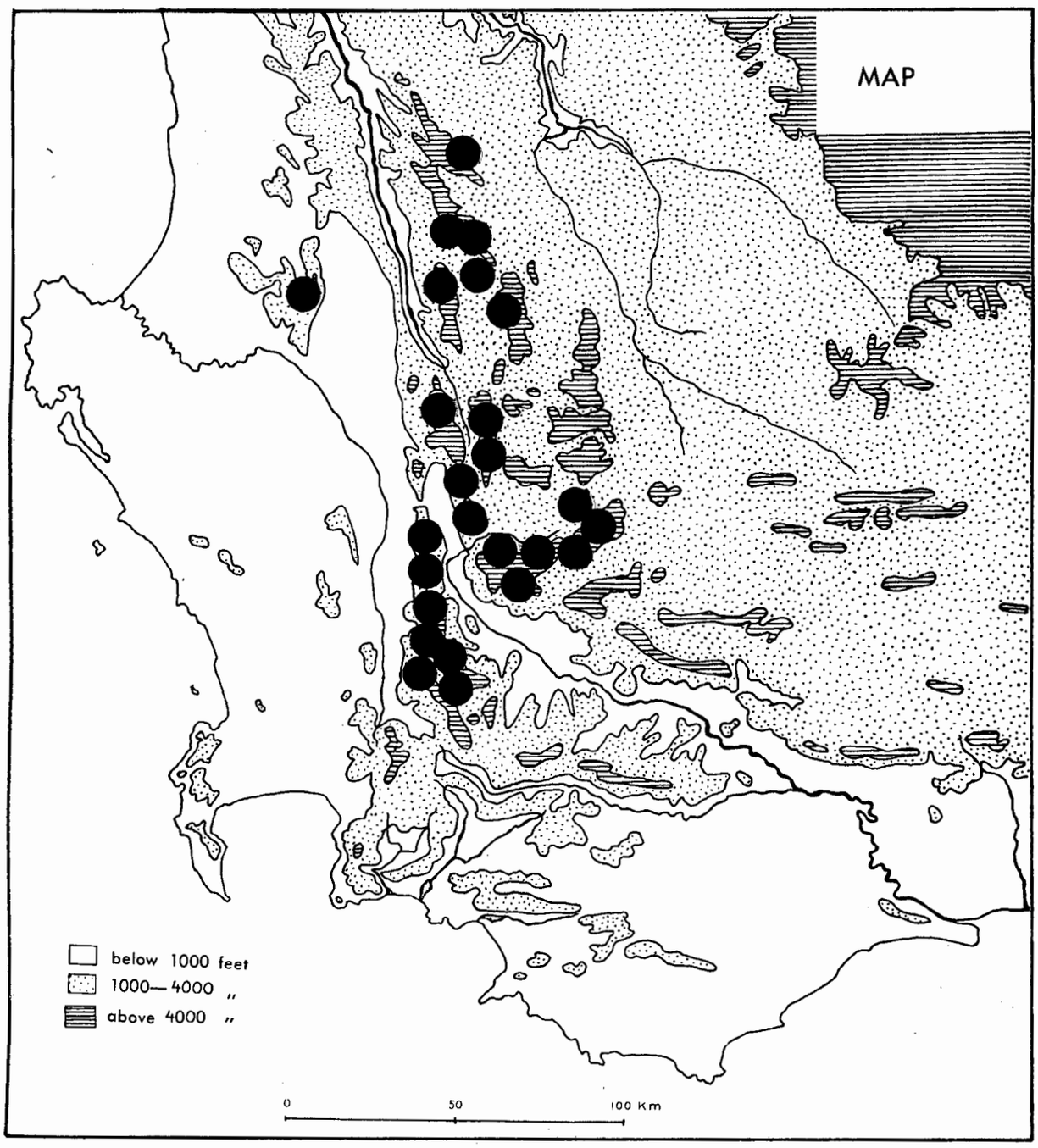


Fig. 27. Distribution of Leucospermum tottum(L.)R.Br.

(18) Leucospermum lineare R. Br. in Trans. Linn. Soc. Lond. 10 : 96 (1810); Phillips & Stapf in Fl. Cap. 5 : 622 1912; Phillips in Flower, Pl. S. Afr. 15 : t. 572 (1935). Lectotype: Cape of Good Hope, Masson s.n. (BM).

Leucadendron lineare Burm. f., Fl. Cap. Prodr. : 4 (1768). Type: Cape of Good Hope, Oldenland in herb. Burman (G).

Protea linearis Thunb., Diss. Prot. : 33, t. 4 (1781), - non P. linearis Houtt., Nat Hist. Deel 2, 4 : 116 t 19 f. 2 (1775). Type: Cape of Good Hope, Thunberg s.n. sheet 2938 in herb. Thunberg (UPS).

Leucadendrum fallax Salisb. ex Knight in Knight, Cult. Prot. : 52 (1809), - nom. supfl.

Leucospermum lineare R. Br. var. calocephalum Gandoger in Bull. Soc. bot. Fr. 48 : 94 (1901). Type: In lapidosis ad Mostertsberg prope Mitchells Pass, MacOwan 2839, Herb. Norm. Austro. Afric. no 777, holotype in herb. Gandoger (LY).

Leucospermum calocephalum (Gandoger) Gandoger & Schinz in Bull. Soc. bot. Fr. 60 : 53 (1913). Type: As above.

An erect to sprawling shrub to 2.0 m in height, 3.0 - 4.0 m in diam. if sprawling. Flowering stems erect or horizantally spreading, glabrous, 2.0 - 5.0 mm in diam. Leaves linear, flat or very broadly canaliculate with involute margins; 4.0 - 10.0 cm long, 2.0 - 7.0 mm wide, glabrous; loosely ascending or occasionally subsecund; apex entire or 2 - 3 dentate. Inflorescences depressed ovoid, 6.0 - 9.0 cm in diam., usually solitary but occasionally in groups of 2 or 3; pedunculate, peduncle 1.0 - 4.0 cm long. Involucral receptacle very narrowly conic acute, 2.0 - 3.0 cm long, 3.0 - 5.0 mm wide. Involucral bracts ovate acute, 1.5 cm long, 1.0 cm wide, imbricate, cartilaginous, tomentose on outer surface, margins densely ciliate. Bracteoles ovate acute 1.0 cm long, 5.0 - 6.0 mm wide, cartilaginous, thickly lanate proximally. Perianth 3.0 cm long, sigmoid on opening, pale yellow to orange. Perianth tube 7.0 - 8.0 mm long, slightly ventricose; glabrous distally. Perianth claws coiled subterminally, villous. Perianth limbs lanceolate, 3.0 mm long, sparsely hispid. Anthers subsessile. Style 5.0 - 5.5. cm long strongly adaxially arcuate distally. Pollen presenter

obliquely ovoid, acute, 1.5 mm long, stigmatic groove terminally oblique. Hypogynous scales linear subulate, 2.0 mm long.

Diagnostic Characters: L. lineare is distinguished from all other species of Leucospermum with subsessile anthers by its glabrous linear leaves, either flattened or with involute margins.

N.L. Burman's name Leucadendron lineare is the earliest validly published name to have been applied to this species but his epithet "lineare" cannot be taken up as Brown had already used the binomial Leucospermum lineare in 1810, citing Protea linearis Thunb. but not Leucadendron lineare Burm. f. Thunberg's name P. linearis is, however, illegitimate as it is a later homonym of P. linearis Houtt. Therefore, a Masson specimen which was examined and annotated by Brown in the Banks collection (BM), upon which his L. lineare was probably based, has been chosen as the lectotype of Leucospermum lineare R. Br.

Distribution and Ecology: The range of L. lineare extends from Bain's Kloof in the north, southwards to the Paarl, Klein Drakenstein and French Hoek mountains, and to Jonkershoek. Two forms are known of which the horizantally sprawling form with golden yellow perianths and styles is the most widespread. At Assegaaibos Kloof, French Hoek, a more erect form occurs locally with an upright growth habit and deep orange perianths and styles.

Most populations of L. lineare occur in mountainous country between 1,000 and 3,000 ft. above sea level where a winter rainfall of 30 - 50" p.a. is experienced. Particularly notable is the fact that this species grows almost exclusively on soils derived from weathered Cape Granite. This breaks down to form a heavy gravelly clay. At a few places where L. lineare occurs on Table Mountain Sandstone, it is generally underlain by weathered granite. Flowering takes place erratically from July to January but chiefly during September and October.

Specimens Examined:

CAPE

PAARL: Bain's Kloof, Nov., Schlechter 9202 (S, PH, BM, K, PRE, GRA, BOL, BR, Z, G); Mountains at Paarl, April, MacOwan no. 777 in Herb. Norm. Austro. Afr. (SAM, GRA, BOL, Z, G, BM, K); Bushman's Castle, French Hoek, Oct., Scholtz s.n. sub SAM 59630 (SAM); Assegaaiboskloof, Aug., van der Merwe 1196 (STE); Groot Drakenstein, Jan., Marloth 9437 (STE); Du Toit's Kloof, Sept., Thode 8505 (STE); French Hoek, Ludwig s.n. in herb. Meisner (NY);

Dal Josaphat, near Wellington, Jan., Tyson 935 (BOL, NH); Between Wellington and Bain's Kloof, Oct., Levyns 2389 (CT); French Hoek, Oct., Phillips 1268 (SAM); Du Toit's Kloof, 28/12/1827, Drège 1473b (P); On Paarlberg, 12/1/1828, Drège 1473 a a (P); Paarlberg, 31/8/1827, Drège 1473 a (P, SAM, S); French Hoek, Oct., Barker 4180 (NBG); Wemmershoek, Dec., Compton 10140 (NBG); Du Toit's Kloof, July, Compton 24100 (NBG); In clivis montosis French Hoek Pass, Nov., Bolus 5234 (BOL, Z); Berg River Hoek, Dec., Esterhuysen 12409 (BOL); Wemmershoek valley, Nov., Esterhuysen 17731 (BOL); Felixberg, lower slopes, April, Esterhuysen 7740 (BOL); Klein Drakenstein mts., between Wemmershoek and Paarl, Dec., Rourke 57 (BOL, NBG); Du Toit's Kloof, Aug., Esterhuysen 20302 (BOL, PRE); Bains Kloof, Rehmann 2327 (Z); Paarl Hills, anno 1799, Dr. Roxburgh 38 (G); Roberts vallei, French Hoek, Sept., Rycroft 2519 (NBG); Du Toits Kloof, Oct., Acocks 20641 (PRE, K); Groen Berg, Wellington, Sept., Lewis Grant 2417 (PRE); French Hoek, May, Oct., Marloth 4856, 8854 (PRE); French Hoek Pass, Oct., van Breda 696 (PRE, K); Upper West slopes of Hawequas mts., Acocks & Hafstrom 2110 (PRE); Mountains above French Hoek, Dec., Galpin 12422 (PRE, K); Roadside near French Hoek, Letty 51 (PRE); French Hoek mountains, towards Villiersdorp, Jan., Marloth 8169 (PRE); Paarl, Nov. 1846, Alexander Prior (K, SAM, PRE); Sandy plains, Paarl - Drakenstein, Oct., Niven 48 (K); Olyvenbosch farm near Wellington Nov., Salter 1783 (BM).

STELLENBOSCH: Jonkershoek, Swartbas Kloof, Sept., van Rensburg 2121 (STE, PRE, K); Biesiesvlei, Jonkershoek, Nov., Levyns 7501 (CT); Jonkershoek, July, Parker 4583 (NBG, PRE, K); Between Hells Hoogte and Pniel, Sept., Stanford s.n. (BOL); Jonkershoek, Swartbas Kloof, van der Merwe 2041 (STE, PRE); Jakalsvlei, Jonkershoek, Nov., H.C. Taylor 6920 (PRE).

WITHOUT PRECISE LOCALITY: Prom. bon. spei, J. Roxburgh (G); Masson (BM); Oldenburg 501 (anno 1773) (BM); Without collector in herb. Lamark; without collector, cat. no 4099 in herb. Jussieu.

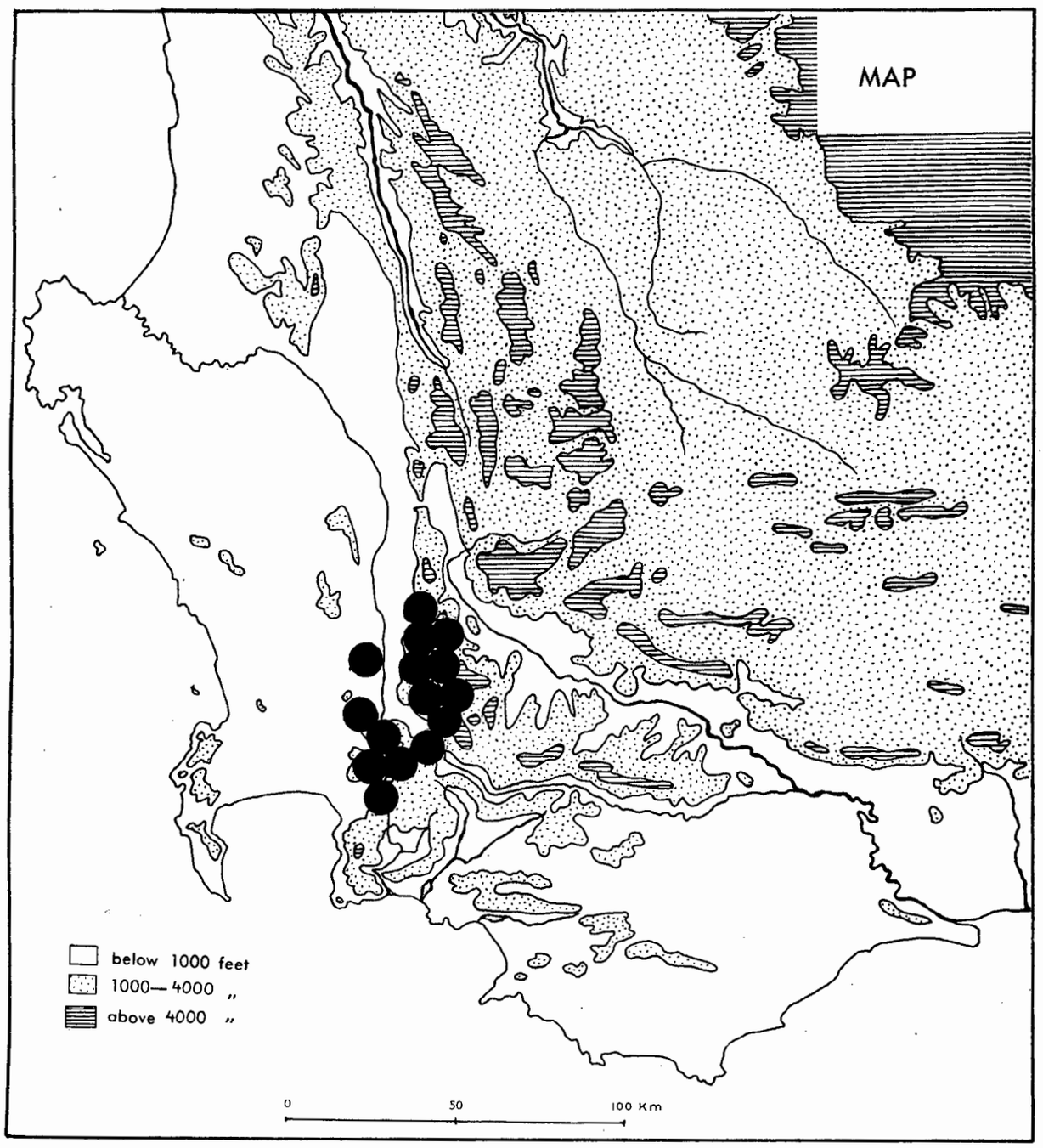


Fig. 28. Distribution of Leucospermum lineare R. Br.

(19) Leucospermum cordifolium (Salisb. ex Knight) Fourcade in Trans. R. Soc. S. Afr. 21 : 97 (1932); Rourke in Jl S. Afr. Bot. 33 : 268 (1967).

Leucadendrum cordifolium Salisb. ex Knight in Knight, Cult. Prot. : 54 (1809). Type: Groot Hout Hoek, Niven 48, in herb. J.E. Smith, lectotype (LINN), isotype in herb. Martii (BR), fragm. in Salisb. mss. vol. 5 : 523 (BM).

Leucospermum nutans R. Br. in Trans. Linn. Soc. Lond. 10 : 98 (1810); Phillips and Stapf in Fl. Cap. 5 : 614 (1912). Type "6 Leucospermum nutans, Africa australis, Mr. Masson" (BM).

Protea nutans (R. Br.) Poir. ex Steudel, Nomencl. Bot. ed 2, 2 : 400 (1841).

Leucadendron nutans (R. Br.) O. Kuntze, Rev. Pl. 2 : 579 (1891).

Leucospermum bolusii Phillips in Kew Bull. 1910 : 330 (1910), non Gandoger 1901; Phillips and Stapf in Fl. Cap. 5 : 615 (1912); Rourke in Jl S. Afr. Bot. 33 : 268 (1967). Type: In collibus prope Elim, 9/12/1896, Bolus 8586, holotype (K), isotype (BOL).

Leucospermum mixtum Phillips in Kew Bull. 1910 : 332 (1910); Phillips and Stapf in Fl. Cap. 5 : 615 (1912). Type: Cape, without locality or collector, (K).

Leucospermum integrifolium Gandoger and Schinz in Bull. Soc. bot. Fr. 60 : 53 (1913). Type: Klynriviersкloof, Zeyher 3678, holotype in herb. Gandoger (LY).

Leucospermum meisneri Gandoger in Bull. Soc. bot. Fr. 60 : 54 (1913). Type: Zwartberg, Zeyher 3678b, holotype in herb. Gandoger (LY).

A rounded spreading shrub to 2.0 m in diam., 1.5 m in height, with a single main stem and horizantally spreading stems often drooping onto the ground. Flowering stems suberect or horizantally spreading, 5.0 - 8.0 mm in diam., beset with a short indumentum of fine crisped hairs, becoming glabrescent. Leaves patent to

suberect, ovate, cordate and entire to oblong obtuse and with up to 6 teeth at apex; 2.0 - 4.5 cm wide, 2.0 - 8.0 cm long; pubescent at first, soon glabrous; oblong obtuse at lower end of stem becoming ovate cordate and entire below inflorescence. Inflorescences depressed globose, 10.0 - 12.0 cm in diam., solitary, or in groups of 2 or 3; usually borne at right angles to flowering stem; pedunculate, peduncle to 1.5 cm long. Involucral receptacle narrowly conic acute, 3.0 - 3.5 cm long, 8.0 mm wide. Involucral bracts ovate acuminate, 4.0 - 5.0 mm wide, 8.0 mm long, closely adpressed imbricate, cartilaginous, thinly tomentose. Bracteoles obtrullate acuminate, concave, apex incurved; 7.0 mm wide 8.0 - 10.0 mm long; cartilaginous, thickly lanate proximally. Perianth 3.0 - 3.5 cm long, yellow orange or crimson. Perianth tube 8.0 - 10.0 mm long, cylindric, glabrous. Perianth claws crimson to hyaline. The 3 adaxial claws united into a sigmoidly curved sheath, glabrous, but slightly hispid on margins of the 2 lateral adaxial claws, strong coiled subterminally in an adaxial direction. Abaxial claw sparsely puberulous. Perianth limbs ovate acute, 3.0 mm long, 2.0 mm wide, hispid. Anthers subsessile, ovate, filament 1.0 mm long, swelling into 2 fleshy protuberances at the base. Style 4.5 - 6.0 cm long, held horizantally but curved adaxially in subterminal region. Pollen presenter obliquely turbinate, apex truncate with an obliquely placed stigmatic groove. Hypogynous scales subulate, 2.0 mm long.

Diagnostic Characters: L. cordifolium is distinguished from related species having an obliquely turbinate pollen presenter, by its spreading growth habit, the horizantally spreading stems, the characteristic leaf spectrum ranging from oblong and toothed to ovate entire below the inflorescences and the sparsely pubescent perianth claws. The inflorescences are normally borne at right angles to the stem.

No type material of L. cordifolium has been traced among Salisbury's specimens at Kew but a duplicate specimen in Smith's herbarium has been chosen as the lectotype. This was almost certainly examined by Salisbury when he and Smith were still on good terms. Of particular importance is a pencil drawing by Salisbury of the perianth, style and fruit, labelled "Leucadendrum cordifolium" in his own handwriting, and now preserved in the British Museum (Natural History). (Salisbury mss. vol 5 fl. 523). This drawing together with a single complete flower attached to it and which may be assumed to have been removed from the type, help to

clarify the typification of the name Leucadendrum cordifolium Salisb. ex Knight.

Distribution and Ecology: The most northerly population of L. cordifolium is at Aries Kraal in the south eastern foothills of Kogelberg. From this point its range extends southwards through Bot River, Onrust, Shaw's Pass, Caledon and Stanford to Napier, Bredasdorp and Elim. The most southerly populations occur at the south end of the Soetanysberg.

Whereas L. patersonii is confined to limestone outcrops or alkaline soil, L. cordifolium occurs only on acid soils derived from weathered Table Mountain Sandstone. Scattered individuals or fairly dense stands of up to several hundred plants are found in open hilly country between 100 and 1500 ft. The associated vegetation consists of fairly dense Fynbos composed mainly of Restionaceae, Ericaceae and Proteaceae. A winter rainfall of 25 - 45" p.a. is experienced. Flowering commences in August and continues until January. Although the style and perianth may vary from yellow to crimson, deep orange is the most frequently encountered colour.

Variation: A young, vigorously growing shoot of L. cordifolium has its leaves arranged along the stem in a characteristic spectrum. This leaf spectrum differs slightly from individual to individual but usually follows the pattern described here. The initial leaves on each new flowering shoot are oblong with several teeth at the apex and are normally obtuse at the base. Towards the apex of the shoot the leaves become progressively smaller, entire, lanceolate to broadly ovate in form, usually with cordate bases. Directly below the inflorescences the leaves may be almost scale like (Fig. 30).

Although this pattern is normally found in young, vigorous shoots, older shrubs tend to produce short shoots with oblong toothed leaves only. Taxonomically superfluous species have been founded on incomplete herbarium material, without having taken into account the great range of leaf form found on a single shrub at different phases of its development.

Specimens Examined:

CAPE

CALEDON: Houw Hoek Pass, Nov., Salter 4050 (K); Shaw's Mountain, Dec., Salter 5160 (K); Houw Hoek, Mund 16 (K); Houw Hoek, Feb., Schlechter 7332 (BM, PH, BOL, GRA, B, G, Z); Caledon, Sept.,

Marloth 8817 (STE, PRE); Kleyn River Kloof, Aug., Zeyher 3678 (SAM, Z); Top of Shaw's Pass, Lewis 3678 (SAM); HouwHoek, Oct., Pappe s.n. sub. SAM 19639 (SAM); In saxosis Houw Hoek, Oct., Schlechter 5441 (Z, PRE); Hermanus, Dec., Compton 14251 (NBG); Aries Kraal, Kogelberg Forest Reserve, Dec., Rourke 1000 (NBG); Shaw's Mountain, Jan., Barker 7204 (NBG); Swartberg, Dr Pappe (S); Hartebeest River, Caledon, Jan., Elbrecht 19019 in herb. Tvl. Mus. (PRE); Ridge above Sandfontein, Caledon, Oct., Galpin 4459 (PRE); Shaw's mountain, Dec., Acocks & Hafstrom 2101 (PRE); Houw Hoek, Sept., Werdermann & Oberdieck 188 (PRE); Between Houw Hoek and Palmiet River, Nov., Bolus 5237 (BOL); Houw Hoek, Nov., Thode 8095 (STE).

BREDASDORP: Near Gansbaai, Oct., Baker 1149 (BM); Nine miles west of Elim, Nov., Salter 4082 (BM, K); Koude River, Dec., Schlechter 9595 (Z, BM); In collibus prope Elim, Dec., Bolus 8586 (K, BOL); Bredasdorp mountain, Dec., Galpin 10469 (PRE, K) Mountain slopes at Napier, Oct., van Breda 1428 (STE); Baard-scheerdersbosch, Leighton 2585 (BOL, NY); Springfield, hills among T.M.S. boulders, Jan., Rycroft 1824 (BOL, NBG); Between Caledon and Elim, Oct., Bolus 7858 (BOL); In collibus prope Elim Dec., Krauss s.n. (FI, M, Z); Brandfontein, Oct., Esterhuysen 19119 (BOL); Hagelkraal, between Gansbaai and Quoin Point, Lewis 2594 (SAM); Viljoenshof, Oct., van Breda 1419 (PRE); South slopes of Bredasdorp mts., Dec., Acocks & Hafstrom 2106 (PRE); South of Napier, Feb., Compton 22664 (NBG); On the Pearly Beach Rd., Sept., Richmond 33 (NBG); Uitkomst River, Dec., Compton 10243 (NBG); Ratel River, Sept., Compton 14769 (NBG); Hagel Kraal, Jan., Barker 5281 (NBG); Mountains between Stanford and Elim, Sept., Middlemost 2205 (NBG); Elands Kloof mts., Koudeberg area, Sept., Rourke 596 (NBG); Springfontein Dec., Rourke 1177 (NBG); Geelrug, north of Soetanysberg, Dec., Rourke 1177 (NBG).

WITHOUT PRECISE LOCALITY: Africa australis, Masson (BM); Cape, Gueinzius (NY, S); Cape, Jules Verreaux (G); Prom b. spei. Dr. Roxburgh (G).

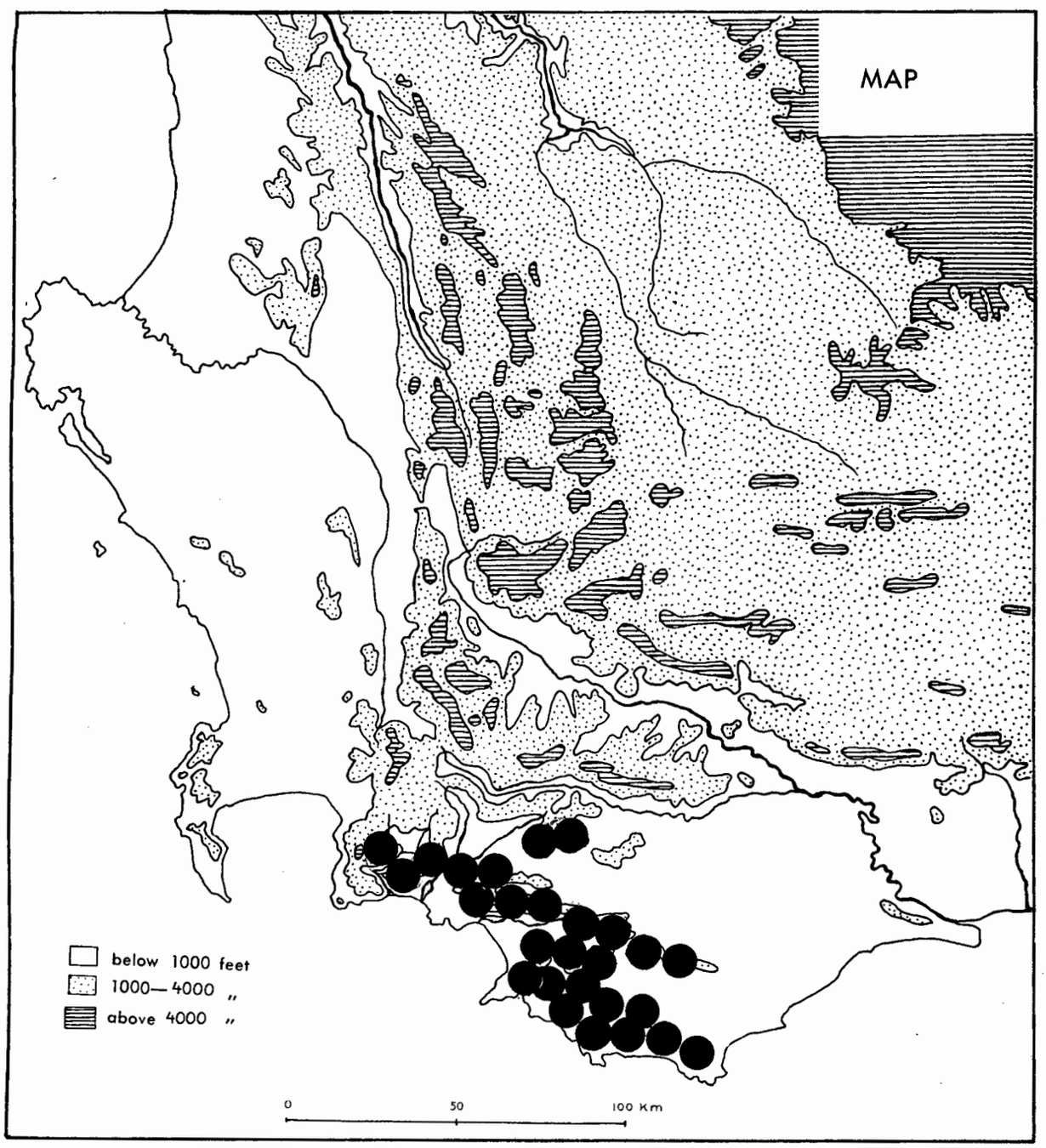


Fig. 29. Distribution of

Leucospermum cordifolium(Salisb. ex Knight)Fourcade

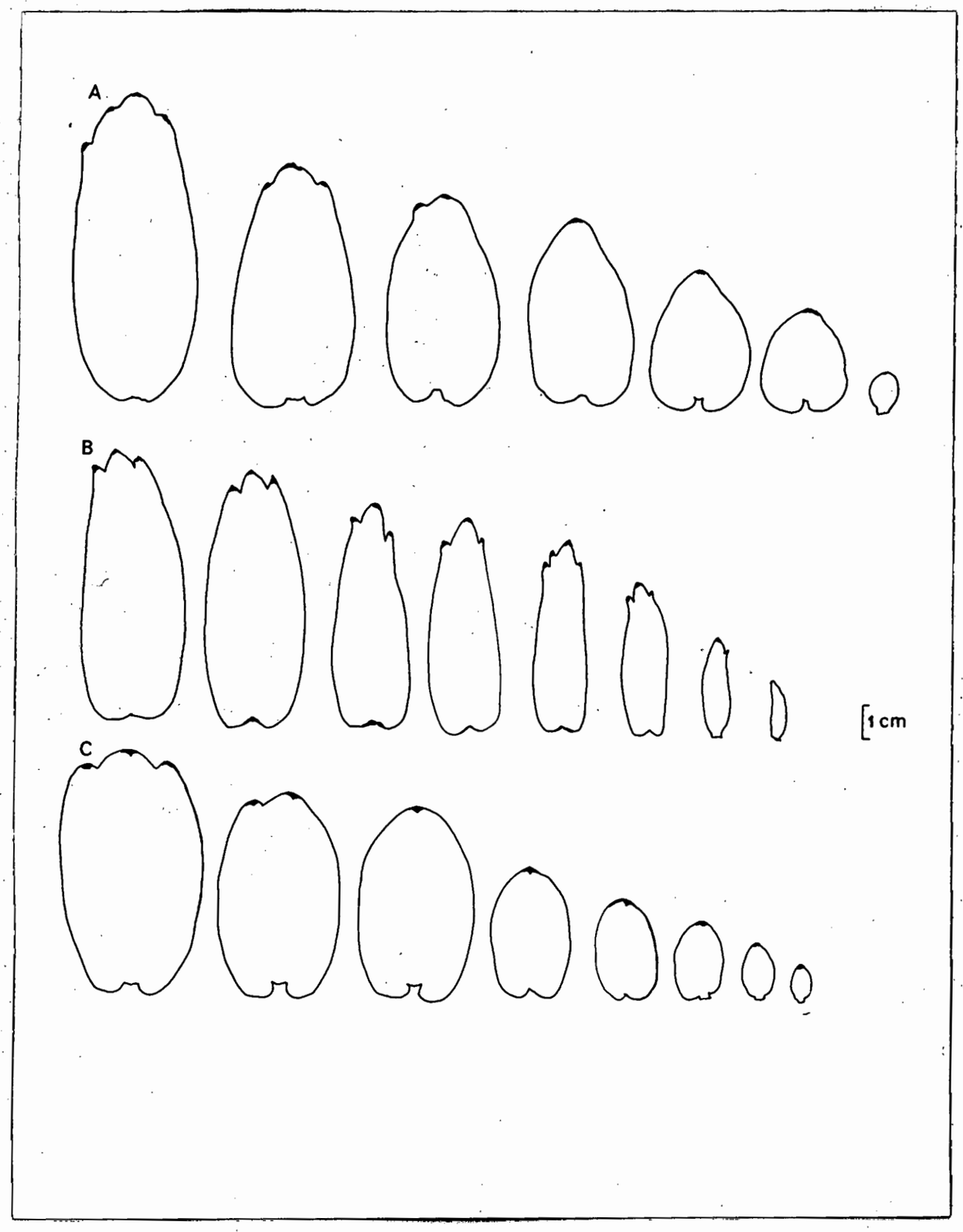


Fig. 30. Leucospermum cordifolium (Salisb. ex Knight) Fourcade, showing the leaf spectra of three collections from the Bredasdorp district; (A) Rourke 1130; (B) Rourke 1177; (C) Rourke 596.

(20) Leucospermum patersonii Phillips in Bothalia 2 : 474 (1928). Syntypes: Hermanus mts., Oct. 1922, Paterson s.n. (11453 in herb. Marloth, PRE); Mountains of Hermanus Oct. 1928 Paterson s.n. (PRE 7797, lectotype).

A large rounded shrub or small tree to 4.0 m in height; trunk stout, 10.0 - 20.0 cm in diam. Flowering stems erect, woody, 8.0 - 10.0 mm in diam., beset with a short dense indumentum of fine crisped hairs interspersed with straight, spreading trichomes. Leaves very broadly oblong to oblong, 5.0 - 9.0 cm long, 3.0 - 5.0 cm wide; cordate to auriculate at base; apex rounded with 3 - 8 teeth; leaves imbricate, glabrous. Inflorescences ovoid to globose, 8.0 - 9.0 cm in diam., usually solitary, occasionally in groups of 2 or 3; pedunculate, peduncle 1.0 - 2.0 cm long. Involucral receptacle narrowly conic acute, 4.0 - 5.0 cm long, 0.7 - 1.0 cm wide. Involucral bracts ovate-acuminate, 1.0 cm long, 0.7 cm wide, tightly adpressed imbricate, cartilaginous, minutely puberulous to glabrous. Bracteoles obovate-cymbiform, apex acuminate; densely lanate proximally, 10.0 mm long, 8.0 mm wide. Perianth 2.5 - 3.0 cm long, very strongly adaxially curved in bud, orange to crimson. Perianth tube 5.0 mm long, cylindric, glabrous. Perianth claws becoming sigmoidly curved at anthesis, tapering and becoming strongly recurved subterminally; densely lanate. Perianth limbs ovate, 4.0 mm long, strongly recurved, glabrous to hispid. Style 4.5 - 5.5 cm long, strongly adaxially arcuate subterminally. Pollen presenter obliquely turbinate, 3.0 - 4.0 mm long, 2.0 mm in diam., stigmatic groove oblique. Hypogynous scales 4.0 mm long, subulate, pale orange.

Diagnostic Characters: L. patersonii may be distinguished by its arborescent growth habit, the large, broadly oblong leaves with 3 - 8 teeth, the lanate perianth claws and the obliquely turbinate pollen presenter. The inflorescences are usually held erect.

L. patersonii was not unknown to the earliest botanical collectors for there are excellent specimens preserved in the herbaria of Burman (G) and Schreber (M), that were collected by Oldenland, the Dutch East India Company's master gardener at the Cape until 1697. These collections were filed under L. conocarpodendron and were apparently overlooked by 18th and 19th century monographers. About 230 years passed before it was collected again, this time by H.W. Paterson of Hermanus, after whom it was named.

Distribution and Ecology: The present range of L. patersonii extends from Cape Agulhas westwards along the coastal belt to Stanford, with an outlying population at Heuningklip Kloof, Kleinmond. This species previously occured at Hermanus but has since been exterminated there.

L. patersonii is a coastal species, restricted to the ridges of limestone hills lying adjacent to the sea, between Cape Agulhas and Stanford, at elevations of 150 - 800 ft. Limestone, or a limestone derived soil appears to be one of the most important ecological requirements of this species. Apart from a small aberrant population at Heuningklip Kloof, Kleinmond, all other populations are confined to limestone deposits of the Alexandria formation. In most cases the plants root system is intimately associated with the soft subsurface layers of limestone.

This species is one of the largest in the genus becoming an erect upright shrub of almost tree-like form, reaching 15 ft. in height. L. patersonii usually occurs in fairly dense stands in association with other calciphilous Proteaceae such as Leucadendron meridianum, Protea obtusifolia and Mimetes saxatilis. It appears to have a certain degree of fire resistance as mature plants are capable of regenerating from the stem apices if the intensity of the fire is not too great. Flowering commences in August and continues until December.

Specimens Examined:
CAPE:
CALEDON: Hermanus mts., Oct. 1922, Paterson s.n. sub 11453 in herb. Marloth (PRE); Hermanus mts., Marloth 8818 (STE); Mountains of Hermanus, Oct. 1928, Paterson s.n. sub PRE 7797 (PRE); Mossel River Hermanus, Sept., L. Guthrie 171 (BOL); Mountains above Kleinmond in Heuning Klip Kloof, Nov., Cloete s.n. sub. SAM 60941 (SAM); Heuning Klip Kloof, Kleinmond, Jan., Cloete s.n. (NBG).

BREDASDORP: Uintjieskraal, June, van Breda & Admiraal 1857 (PRE); Near Gansbaai, July, Linley s.n. sub SAM 60386 (SAM); Uilkraal May, Jordaan 918 (STE); Hill one quarter mile east of Agulhas, Dec., Pillans 8146 (BOL); Hagelkraal River, Dec., Leighton 2557 (BOL); Baardscheerdersbosch, Jan., Barker 5291 (NBG); Hagelkraal, Dec., Compton 19052 (NBG); Limestone hills near Danger Point, Jan., Lewis 2082 (SAM); Limestone hills between Waterford and Hagelkraal, Aug., Rourke 521 (NBG); Heidehof, Uilenkraal River, Aug., Rourke 531 (NBG); Hills above Pearly Beach, Aug., Rourke

511 (NBG); Hills above De Kelders, Aug., Rourke 505 (NBG); Soetanysberg, on the farm Hangnes, Oct., Rourke 1129 (NBG).

WITHOUT PRECISE LOCALITY: Oldenland in herb. Burman (G), and in herb. Schreber (M).

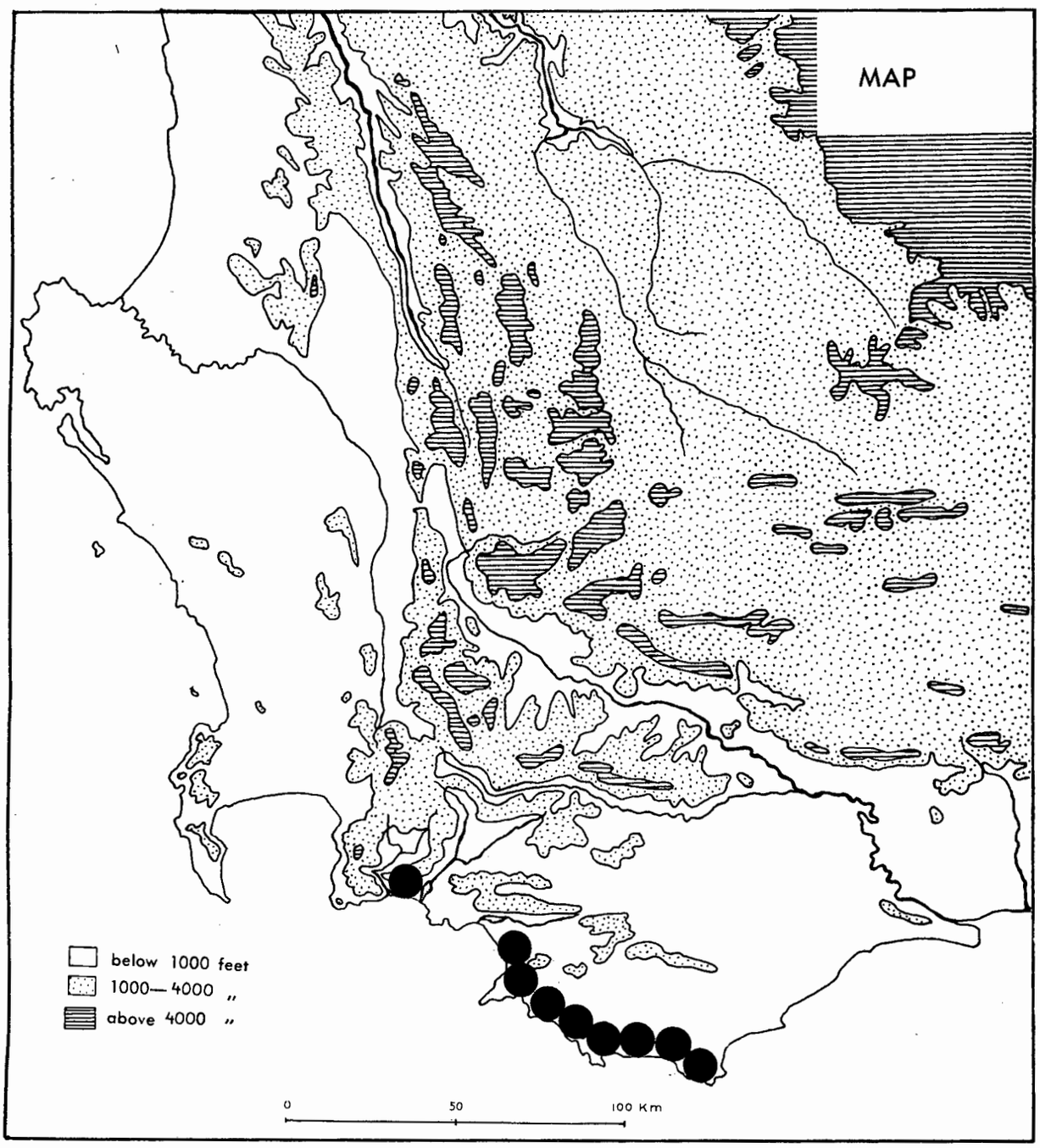


Fig. 31. Distribution of Leucospermum patersonii Phillips

(21) Leucospermum cordatum Phillips in Flower. Pl. S. Afr. 3 t. 95 (April 1923); in Kew Bull. 1923 : 185 (May 1923). Type: Hottentots-Holland mts., near Kogelbay, Oct. & Nov. 1922, Stokoe s.n., holotype (PRE 2607), isotypes (K, BM, G, Z, BR).

A low trailing shrub 15.0 - 25.0 cm in height, forming loose diffuse mats 1.0 - 2.0 m in diam., with a single main stem at base, trunk to 3.0 cm in diam., bark smooth, grey. Flowering stems slender, sprawling horizantally or trailing, 3.0 - 4.0 mm in diam., sparsely puberulous with soft, erect, spreading trichomes. Leaves ovate, cordate to auriculate at base, 3.0 - 5.5 cm long, 1.0 - 2.5 cm broad, apex entire; leaves patent, widely spaced, puberulous at first with a dense, short indumentum of fine crisped hairs, soon glabrous. Inflorescences depressed globose, 3.0 - 4.0 cm in diam.; pedunculate, peduncle 2.0 - 5.0 cm long, 2.0 - 3.0 mm in diam. Involucral receptacle conic depressed, 7.0 mm long, 7.0 mm wide. Involucral bracts ovate acute to abruptly acute, 5.0 mm broad, 7.0 - 10.0 mm long, imbricate, cartilaginous, softly tomentose, margins densely ciliate. Bracteoles obovate, 8.0 - 10.0 mm long, 5.0 - 6.0 mm wide, apex abruptly acuminate; cartilaginous, lanate proximally, margins thickly ciliate. Perianth 1.5 - 1.8 cm long, pale cream to hyaline, strongly adaxially curved in bud. Perianth tube cylindric, 5.0 mm long, glabrous. Perianth claws hyaline, beset with long, straight spreading trichomes (2.0 - 3.0 mm), the median adaxial claw glabrous to glabrescent; claws narrowing distally to half their proximal width. Perianth limbs elliptic, 4.0 mm long, 1.5 mm wide, very strongly recurved, villous. Style strongly adaxially arcuate, tapering subterminally, 2.0 - 2.5 mm long; white or tinged pale pink. Pollen presenter narrowly conic acute geniculate, 2.5 mm long, pink fading to white. Hypogynous scales linear obtuse, 3.0 mm long.

Diagnostic Characters: L. cordatum is distinguished by its prostrate growth habit, the entire, ovate acute leaves with prominently cordate to auriculate bases, the short, strongly incurved style (2.0 - 2.5 cm long) and the conic acute pollen presenter, geniculate at its junction with the style.

Distribution and Ecology: The only known population of L. cordatum occurs midway between Kogel Bay and Rooi Els on the lower western slopes of Rooi Els Berg near the disused Manganese mine.

The plants observed grow on steep west facing slopes between 50 and 250 ft. above sea level growing in association with low, tufted Restionaceae. The substratum consists of coarse Table Mountain Sandstone gravel with an admixture of clay and is situated just above the lower T.M.S. shaleband. A fairly high winter rainfall of 30 - 40" p.a. is experienced here. The mature plants have a low diffuse growth habit with stems trailing over the ground and eventually develop into loose mats up to 2.0 m in diam., but not exceeding 25.0 cm in height. The pale cream inflorescences with pink flushed styles are produced between July and December but the peak of the flowering period is from September to November.

Specimens Examined:

CAPE

CALEDON: Hottentots-Holland mts., near Kogel bay, Oct. & Nov., Stokoe s.n. (PRE 2607, K, BM, G, Z, BR); Hottentots-Holland mts. near Kogelbay, Nov., Stokoe 540 (STE, PRE); Hottentots Holland mts., between Steenbras and Rooi Els, Oct., Stokoe s.n. (BOL 17376); Slopes between Gordon's bay and Rooi Els, Dec., Stokoe s.n. (SAM 25292); Kogel bay area, July, Macpherson s.n. (NBG 88741); Below the old mine, Kogel bay, Sept., Boucher 563 (STE, NBG); Lower north west slopes of Rooi Els Berg, 100 yds. from disused Manganese mine, Nov., Rourke 1227 (NBG).

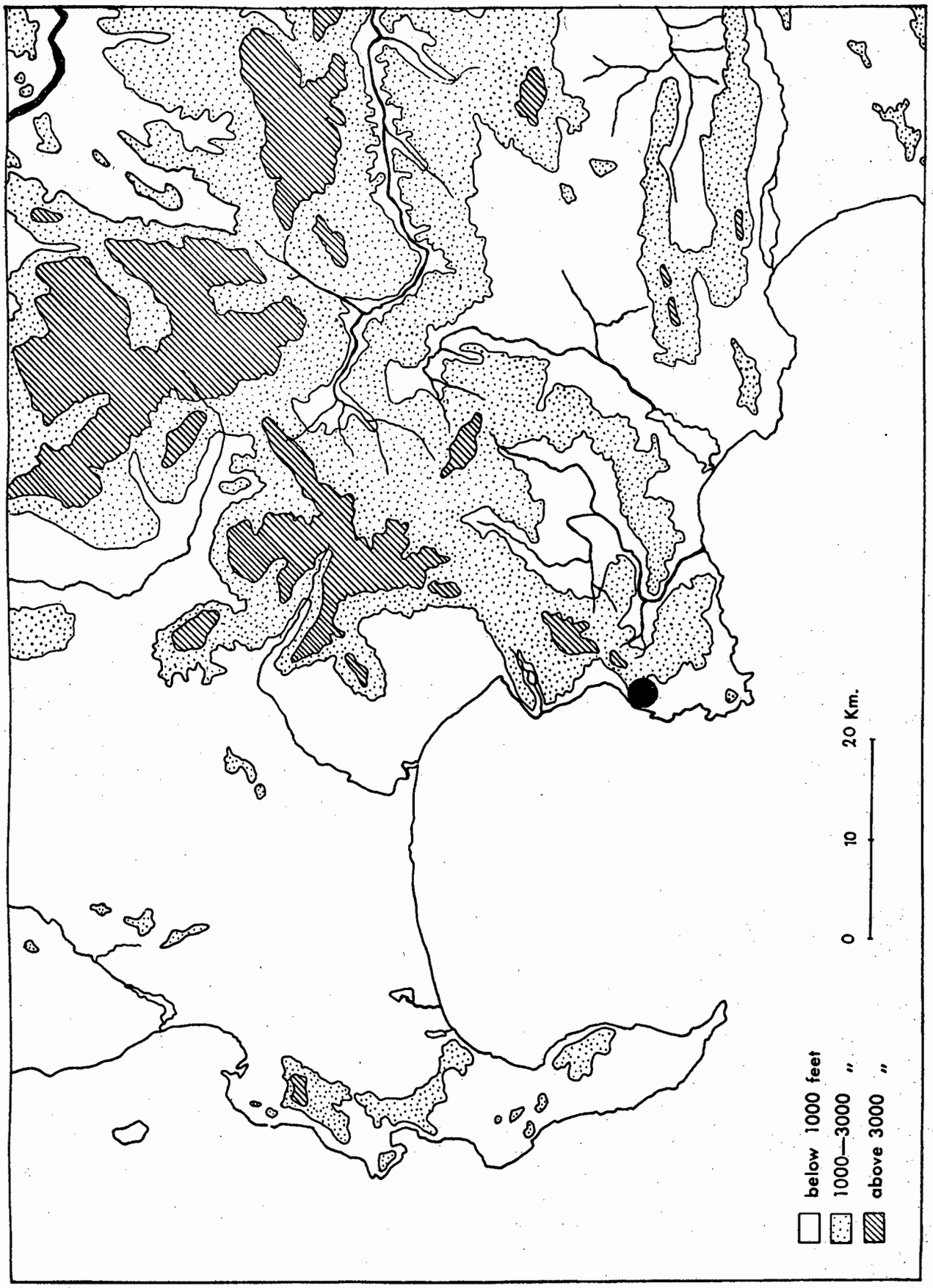


Fig. 32. Distribution of Leucospermum cordatum Phillips

Sect. CARDINISTYLUS Rourke, sect. nov.

Frutices grandes, 2.0 - 3.0 m alti. Receptaculum involucrale perangustum conicum acutum. Styli 5.5 - 8.0 cm longi, torquent per 90° per anthesin moventes. Stigma anguste cylindraceum, acutum.

Large shrubs 2.0 - 3.0 m in height. Involucral receptacle narrowly conic acute. Style 5.5 - 8.0 cm long, hinged, moving through 90° during flowering. Pollen presenter narrowly cylindric, acute.

Type: L. formosum (Andr.) Sweet

Apart from the very distinct L. praemorsum and L. reflexum, the remaining taxa of this section can be referred to two groups based on the morphology and pubescence of the immature inflorescences. Those species in which the bracts of the immature inflorescence are squarrose with acuminate recurved involucral bracts, prominently crinite at the apex, form a distinct group comprising L. grandiflorum and L. gueinzii. A second group in which the bracts of the inflorescence buds are tightly adpressed imbricate and glabrous, contains a less easily distinguishable pair of vicarious taxa.

Within this latter group, populations occuring on the Langeberg are characterised by sessile, permanently pubescent leaves beset with a fine, dense, greyish indumentum of short crisped hairs. Material from the Cedarberg, Piketberg and Cold Bokkeveld is characterised by having prominently petiolate leaves which are quite glabrous. There is also an obvious trend towards shorter leaves in the Langeberg population and longer leaves in the Cedarberg, Piketberg and Cold Bokkeveld population, but no absolute distinction can be made on leaf length. (Fig. 33).

However, as the populations differ in two characters, they should be accorded specific rank. In the Flora Capensis material from the Langeberg population was incorrectly cited under L. grandiflorum while the name L. formosum which should have been applied to it was quoted as a synonym of L. ellipticum. Despite this confusion it is now clear that the Langeberg material should be referred to L. formosum and the material from the Cedarberg, Piketberg and Cold Bokkeveld, as L. catherinae.

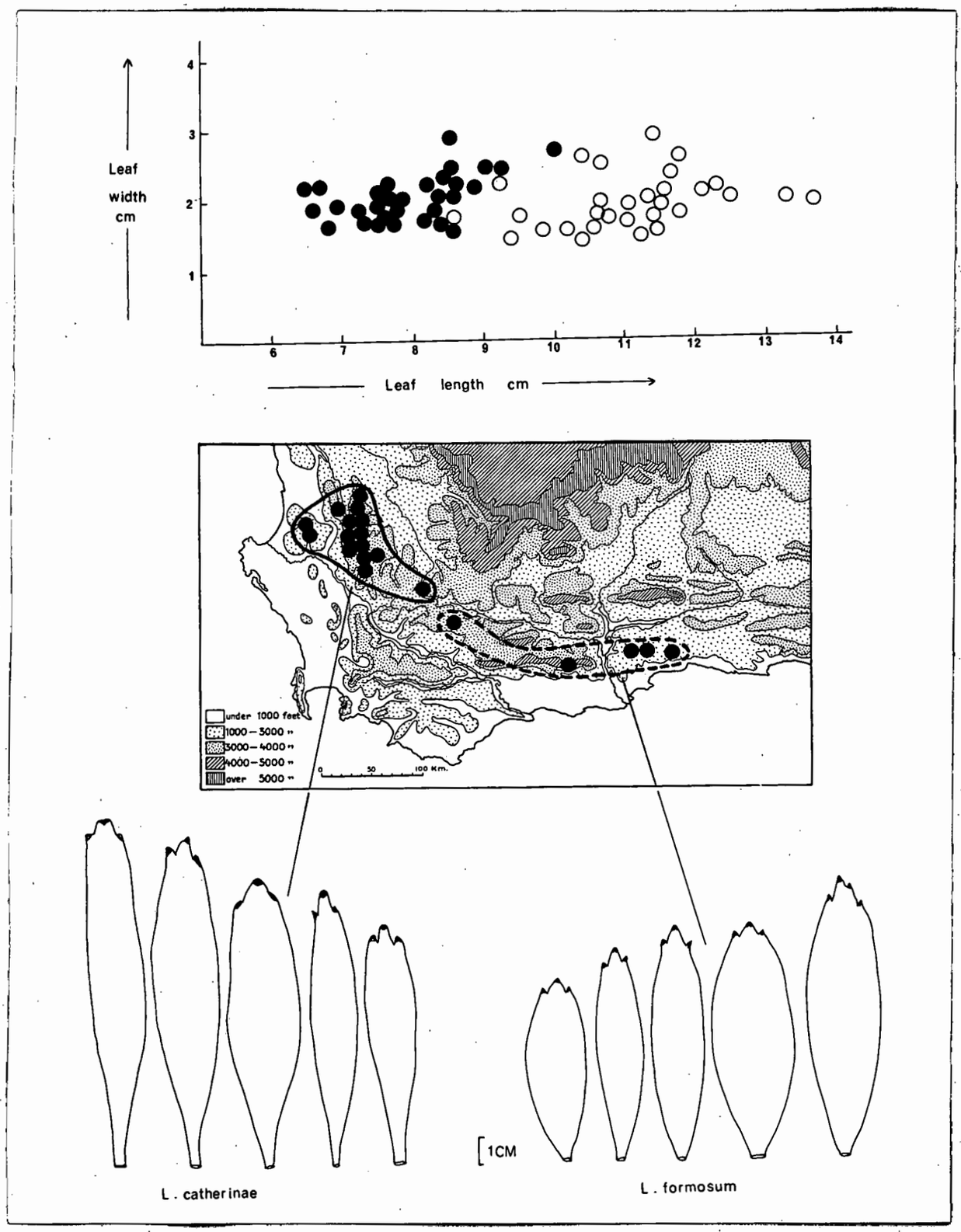


Fig. 33. Distribution of Leucospermum formosum (Andr.) Sweet and L. catherinae Compton, showing variation in the form and dimensions of the leaves. In the scatter diagram the solid circles represent L. formosum and the open circles L. catherinae.

(22) Leucospermum formosum (Andr.) Sweet, Hort. Suburb. Lond. : 21 (1818); - non L. formosum (Salisb. ex Knight) Loud., Encycl. Pl. : 82 (1829).

Protea formosa Andr., Bot. Repos. t. 17 (1798).

Leucadendrum formosum (Andr.) Salisb. ex Knight in Knight, Cult. Prot. : 54 (1809).

Leucodendron formosum (Andr.) O. Kuntze, Rev. Gen. Pl. 2 : 578 (1891).

A large erect shrub to 3.0 m in height, with a single main stem at base. Flowering stems erect, to 8.0 mm in diam., covered with a short, dense indumentum of fine crisped hairs interspersed with long erect trichomes, 5.0 - 7.0 mm long. Leaves lanceolate elliptic, 6.5 - 10.0 cm long, 1.4 - 2.0 cm wide, sessile to subsessile, loosely ascending imbricate, softly velutinous in texture, covered with a dense grey indumentum of fine crisped hairs; apex sharply trifid, rarely entire. Inflorescences turbinate to depressed discoid, 15.0 cm in diam.; pedunculate, peduncle 1.0 - 2.0 cm long; usually solitary rarely in groups of 2 or 3. On opening, the styles elongate rapidly and curve abaxially as the inflorescence develops. Involucral receptacle narrowly conic acute, 5.0 - 5.5 cm long, 1.0 - 1.5 cm broad. Involucral bracts ovate acute, 1.0 - 1.5 cm long, 0.7 cm wide, tightly adpressed imbricate, thin and papyraceous in texture, outer surface puberulous, soon glabrescent; margins ciliate. Bracteoles lanceolate acute to acuminate; cymbiform, margins involute; 2.0 cm long 0.8 - 1.0 cm wide, thickly lanate proximally, margins ciliate, apex crinite. Perianth 5.0 cm long golden yellow. Perianth tube 1.0 cm long, slightly laterally compressed, glabrous proximally, puberulous distally. Perianth claws filiform, but broadening proximally; becoming tightly coiled on opening; beset with long spreading trichomes on outer surface. Perianth limbs very narrowly lanceolate acuminate, 7.0 mm long, 1.0 mm wide, outer surface beset with long, erect trichomes; apex minutely crinite. Style 7.0 - 8.0 cm long, elongating rapidly, tapering and twisting clockwise subterminally, pale yellow becoming amber flushed with bronze. Pollen presenter narrowly cylindric acute, 0.7 cm long, slightly geniculate, curved clockwise almost at right angles to style; white, aging to pink; stigmatic groove terminal. Hypogynous scales subulate 3.0 mm long.

Diagnostic Characters: L. formosum is distinguished from related taxa by its sessile to subsessile lanceolate-elliptic leaves, 6.5 - 10.0 cm long, covered with a soft, permanent, greyish indumentum of fine crisped hairs.

The earliest validly published description of this species is that of Andrews in 1798 under the name Protea formosa Andr. The description was accompanied by an excellent colour plate, clearly depicting the diagnostic characters of the species. Later authors failed to identify any further collections with P. formosa Andr. except Salisbury who had seen specimens in the Chapel Allerton collection where it had flowered and even "ripened seeds" (Knight, : 54 (1809)). Drawings of a leaf, style and perianth as well as descriptive notes by Salisbury are preserved in the collection of Salisbury's manuscripts, vol. 5 fl. 520 at the British Museum (BM).

Considerable confusion was caused by Brown who tentatively cited P. formosa Andr. as a synonym of Leucospermum medium R. Br., while at the same time describing an additional species, P. formosa R. Br. Apart from being a later homonym of P. formosa Andr., P. formosa R. Br. is synonymous with P. compacta R. Br. Subsequent monographers all followed Brown despite the fact that P. formosa Andr. bears not the slightest resemblance to L. medium R. Br.

Andrews' plate was painted from a plant which had flowered in the nursery of Messrs. Lee & Kennedy in August 1796. He notes that it had been introduced by Masson without giving any further details regarding its locality. Although the precise locality at which Masson collected the seeds will never be known, it is very likely to have been on the south slopes of the Langeberg near the Ruitersbos Forest Reserve. On the 19th of November, 1773, Masson and Thunberg crossed the Langeberg by way of Attaquas Kloof, (near the present day Robinson Pass at Ruitersbos). At precisely this time ripe seeds of L. formosum would have been available for collection. Masson could therefore have easily gathered seeds on this occasion.

Specimens collected at Ruitersbos match Andrews' plate in every detail, particularly the leaves which he described as "lance shaped, downy". Young plants flowering for the first time tend to produce entire leaves as illustrated by Andrews, but tridentate leaves are produced by mature plants.

Distribution and Ecology: Only a few scattered populations of L. formosum are known. These occur on the southern slopes of the Langeberg Range between Dassieshoek Peak, Robertson and Duivels Kop near George. The population at Garcia's Pass where Galpin collected specimens in 1897 now appears to have been exterminated while at Ruitersbos where the largest and most vigorous stands occur, the species is being threatened by afforestation.

L. formosum grows only in cool, south facing situations between 600 and 3,000 ft., in moist peaty soils. The mean annual rainfall of 25 - 40" p.a. is evenly distributed throughout the year. The associated vegetation consists of tall dense sclerophyll, mainly Ericaceae, Restionaceae and Proteaceae. Flowering takes place from September to October.

Specimens Examined:
CAPE
ROBERTSON: Dassieshoek Peak, south slopes, Sept., Esterhuysen 29135 (NBG).

RIVERSDALE: Mountains at Garcia's Pass, Sept., Galpin 4458 (PRE, K).

GEORGE: At Pacaltsdorp, Oct., Zeyher s.n. sub SAM 19625 (SAM); Ruitersbos Forest Reserve, Vogts 311 (BOL); Pacaltsdorp, 6th Oct., 1847, Alexander Prior s.n. (K, PRE); Ruitersbos Forest Reserve, June (in bud), Rourke 467 (NBG); Duivels Kop, in loamy soil, Bowie s.n. (BM); South slopes of Outeniqua mts. at Ruitersbos Forest Reserve, Oct., Rourke 620 (NBG).

(23) Leucospermum catherinae Compton in J. Bot., Lond. 71 : 69 (1933). Type: Ceres Wild Flower Show, 5th Oct. 1931, Compton 3958 (sub BOL 20079), lectotype (BOL), isotype (K).

An erect shrub to 3.0 m in height, becoming spreading with age; with a single main stem at base. Flowering stems erect, 5.0 - 8.0 mm in diam., puberulous. Leaves oblanceolate-elliptic, 9.0 - 13.5 cm long, 1.0 - 2.5 cm wide, attenuate to petiolate at base, apex deeply and obtusely 3 or 4 toothed; glabrous; loosely ascending imbricate. Inflorescences depressed globose on opening, flattening to discoid later, 15.0 cm in diam.; pedunculate, peduncle 1.0 cm long; usually solitary. Involucral receptacle narrowly conic acute, 3.5 cm long, 1.0 cm wide. Involucral bracts ovate acute 1.0 - 1.5 cm long, 0.5 - 0.8 cm wide, closely adpressed imbricate, membranaceous, margins ciliate. Bracteoles lanceolate acuminate, 1.8 cm long, 0.5 cm wide, densely lanate proximally, membranaceous and puberulous distally on the outer surface. Perianth 4.0 - 5.0 cm long, pale orange when fresh. Perianth tube 6.0 - 7.0 mm long, ventricose adaxially, keeled and puberulous distally, glabrous proximally. Perianth claws filiform, becoming tightly coiled on opening; outer surface pilose; the three adaxial claws thickened and fleshy at base. Perianth limbs very narrowly lanceolate acute, 6.0 mm long, 1.5 mm wide, outer surface thickly sericeous. Style 7.0 - 8.0 cm long, tapering subterminally; elongating rapidly on opening and arching abaxially, the upper third being bent clockwise at rightangles to the proximal two thirds; orange at anthesis, becoming coppery bronze with age. Pollen presenter 6.0 mm long, narrowly cylindric acute, stigmatic groove terminal; magenta when fresh. Hypogynous scales 3.0 mm long, subulate, hyaline.

Diagnostic Characters: L. catherinae may be distinguished by its glabrous, oblanceolate elliptic, distinctly petiolate leaves, 9.0 - 13.0 cm long, 1.0 - 2.5 cm wide, with obtusely 3 or 4 dentate apices.

The earliest recorded collection of this species was made by Masson but without a precise locality being given. When Compton described L. catherinae in 1933, its exact locality was still uncertain for the type material was obtained from the Ceres wild flower show. The only localised collection available was a specimen collected in 1897 by Bodkin on the Krakadouw Pass in the Cedarberg but this was apparently not known to Compton at the time. The specific epithet "catherinae" was chosen partly because of the

wheel-like appearance of the inflorescence seen in apical view and partly to commemorate the name of Mrs. Catherine van der Byl who provided Prof. Compton with information regarding the location of wild populations of this species (R.H. Compton, private communication).

Distribution and Ecology: The range of L. catherinae extends from Middelberg in the Cedarberg, southwards, to the Cold Bokkeveld and Ceres mountains with outlying populations on the Piketberg and at Bokkerivier.

L. catherinae grows almost exclusively in moist situations and is generally found along the margins of perennial streams, at elevations varying from 2,000 to 4,000 ft. Level sandy flats along stream banks or seepage areas where the substratum is composed of coarse grit derived from weathered Table Mountain Sandstone, are the most favoured habitats. Very occasionally small groups are found on drier rocky slopes. Large stands are seldom encountered as most populations are small, consisting only of a few individuals, while solitary widely dispersed plants are not unusual. Flowering takes place from September to December.

Specimens Examined:

CAPE

CLANWILLIAM: Cedarberg mountains at Krakadouw Pass, Oct. 1897, A. Bodkin s.n. (BOL); Driehoek, Cedarberg, Vogts 330 (BOL); Warmbaths, Oliphants River valley, Oct., Engels s.n. sub. BOL 13330 (BOL); Eland's Kloof, Sept., Levyns 5814 (CT); Elands Kloof, Sept., Compton 16145, 20964, 6444 (NBG); Oct., Compton 9659 (NBG); Middelberg, upper Jan Dissels river valley, Oct., Gill 46 (NBG); Duivels Kloof, Jan., Sept., Stokoe s.n. sub SAM 56568 and SAM 65164 (SAM); Cedarberg Pass, Dec., Kruger 950 (NBG); Driehoek valley, Cedarberg, Pocock 417 (PRE); Elands Kloof Pass, Sept., Acocks & Hafstrom 390 (PRE, S); Between Witte Els Kloof and Lambertshoek Berg, Oct., Pillans 9149 (BOL).

PIKETBERG: Top of Piketberg, Oct., Middelmann 3 (NBG); Piketberg mountain, Oct., Krige s.n. sub STE 10547 (STE); Piketberg mountain, Sept., Martin 252 (NBG); Piketberg mountain, Nov., Compton 23001 (NBG); Hills N.W. of Moutons Vlei, Nov., Pillans 7431 (BOL).

CERES: Road between Rosendalfontein and Visgat, Nov., Pillans 9750 (BOL); Ceres Wild Flower Show, Oct., Compton 4112 & 3958 sub BOL 20079), (BOL); Waboomsriver, Dec., Lewis 1207 (SAM);

Visgat between Schurfteberg and Great Winterhoek, Stokoe s.n. sub SAM 63178 (SAM); Bokkeriver Farms, Nov., Middlemost 2271 (NBG); Waboomsriver flats, Aug. (in bud), Rourke 558 (NBG); Onderboskloof, Cold Bokkeveld, Oct., Rourke 679 (NBG).

WITHOUT PRECISE LOCALITY: Prom. bonae Spei, F. Masson s.n. (G).

(24) Leucospermum grandiflorum (Salisb.) R. Br. in Trans. Linn. Soc. Lond. 10 : 100 (1810); Phillips & Stapf in Fl. Cap. 5 : 623 (1912).

Leucadendrum grandiflorum Salisb., Parad. Lond. t. 116 (1808); in Knight, Cult. Prot. 54 (1809). Iconotype: Parad. Lond. t. 116.

Protea villosiuscula Banks ex R. Br. in Trans. Linn. Soc. Lond. 10 : 100 (1810), - nom. nud.

Protea villosa Poir. in Lam., Encycl. Meth. Bot. Suppl. 4 : 566 (1816), - nom. supfl.

Protea erosa Licht. ex Spreng., Syst. Veg. 1 : 464 (1825), - nom. nud.

An erect shrub to 2.5 m in height with a single stout main stem. Flowering stems erect or slightly sprawling, beset with a sparse indumentum of short crisped hairs, interspersed with straight, patent, silky trichomes 5.0 mm long. Leaves broadly elliptic to elliptic-oblong, 5.0 - 8.0 cm long, 2.0 - 3.0 cm wide, apex obtuse, usually tridentate, very rarely entire; pubescent, with a fine greyish indumentum of short crisped hairs. Inflorescences ovoid on opening becoming depressed-ovoid, 10.0 - 12.0 cm in diam., subsessile to pedunculate, peduncle to 1.5 cm long. Involucral receptacle narrowly conic acute, 4.0 cm long, 1.0 cm wide. Involucral bracts ovate acute, 1.0 - 1.5 cm long, 0.5 - 0.8 cm wide, cartillaginous proximally becoming brown and membranaceous distally; margins densely ciliate, apices crinite. Bracteoles 2.0 cm long, 0.5 cm wide, lanceolate acuminate, apices slightly recurved; very thickly lanate proximally, sericeous distally. Perianth 4.5 - 5.0 cm long, pale greenish yellow. Perianth tube 7.0 mm long, glabrous; narrowed proximally, adaxially ventricose distally. Perianth claws becoming sigmoidly curved at anthesis; beset with a few slender, spreading trichomes. Perianth limbs 8.0 mm long, narrowly lanceolate linear, acute; sericeous. Style 7.0 - 7.5 cm long, tapering subterminally, slightly obliquely deflected in a clockwise direction; yellow at anthesis becoming crimson with age. Pollen presenter cylindric acute, 6.0 - 8.0 mm long, pink becoming carmine; stigmatic groove terminal. Hypogynous scales subulate, 3.0 mm long.

Diagnostic Characters: The broadly elliptic to elliptic oblong leaves, 5.0 - 8.0 cm long, usually tridentate at the apex, permanently pubescent with a fine grey crisped indumentum and the perianth 4.5 - 5.0 cm long, distinguish L. grandiflorum from related taxa. The style and perianth are bright yellow at anthesis.

Collections of L. grandiflorum were made at Paarl as early as 1799, by Roxburgh and Niven. Moreover, it was raised from seed collected by Niven and successfully cultivated in Hibbert's conservatory where it "flowered, and ripened seeds, for several years" according to Salisbury. Salisbury's description in the Paradisus Londinensis (t. 116, 1808), was accompanied by an excellent colour plate which must serve as the lectotype of L. grandiflorum since no herbarium material appears to have been preserved.

Distribution and Ecology: Apart from a few isolated localities in the Berg River valley where it is now almost extinct, L. grandiflorum still occurs on Paarl mountain, on the hills around Durbanville and on the Paardeberg at Malmesbury.

Throughout its range, L. grandiflorum grows mainly on clayey soils derived from weathered Cape Granite but is occasionally found on Tertiary sand underlain with Malmesbury gravel. It occurs in hot, dry, exposed habitats, often in a north facing position, in association with low scrub composed mainly of Elytropappus rhinocerotis, Eriocephalus africanus and various Rhus spp. A rather low winter rainfall of 15-25" p.a. is experienced in these areas. Flowering takes place from July to November.

Specimens Examined:

CAPE

MALMESBURY: Upper N.E. slopes of Paardeberg, Aug., Pillans 7643 (BOL); Lammershoek, Paardeberg, Sept., Garside 5042 (BOL, NBG); Near reservoir, Paardeberg, Sept., Martin 1186 (NBG).

BELLVILLE: Between Paarl Rd. and railway at Muldersvlei, June, Acock 4652 (S); N.W. of Hercules Pillar, July, Acock 4804 (S); Phisantekraal, July, Barker 10247 (NBG); Between Volmoed and Hercules Pillar, Oct., Rourke 941A (NBG); Phisantekraal, Oct., Rourke (938 (NBG).

PAARL: Near Paarl, Nov., Schlechter 9211 (PH, PRE, K, BM, G, NH, GRA, BOL, BR, Z, S); Berg River valley, Jan., Marloth 10058

(PRE, STE); French Hoek, Ludwig s.n. (NY); Near Wellington, Sept. Zeyher s.n. (GRA, BOL); Paarl mountain, Jan., Bolus 5570 (BOL, BM); Foot of Paarlberg, Sept., Hutchinson 461 (BOL, BM, PRE, K); Between Durbanville and Paarl, July, L. Guthrie 172 (BOL); Mountains round French Hoek, Oct., MacOwan 2905 (SAM, K); Paarlberg, 16/10/1828, Drège s.n. (P); Paarlberg, 17/8/1827, Drège s.n. (P); Pearl hills, Oct., Dr. Roxburgh 37 (G); Paarl mtn., Oct., Henderson 1194 (NBG); Oct., Compton 22942 (NBG); Dal Josaphat, Aug., Lewis Grant 2335 (PRE); Paarl, Aug., Marloth 5218 (PRE); In montibus Paarl, Oct., Pappe s.n. (PRE); Wellington, Pappe s.n. (PRE); Olyvenbosch Farm, Wellington, Nov., Salter 1782 (BM, K).

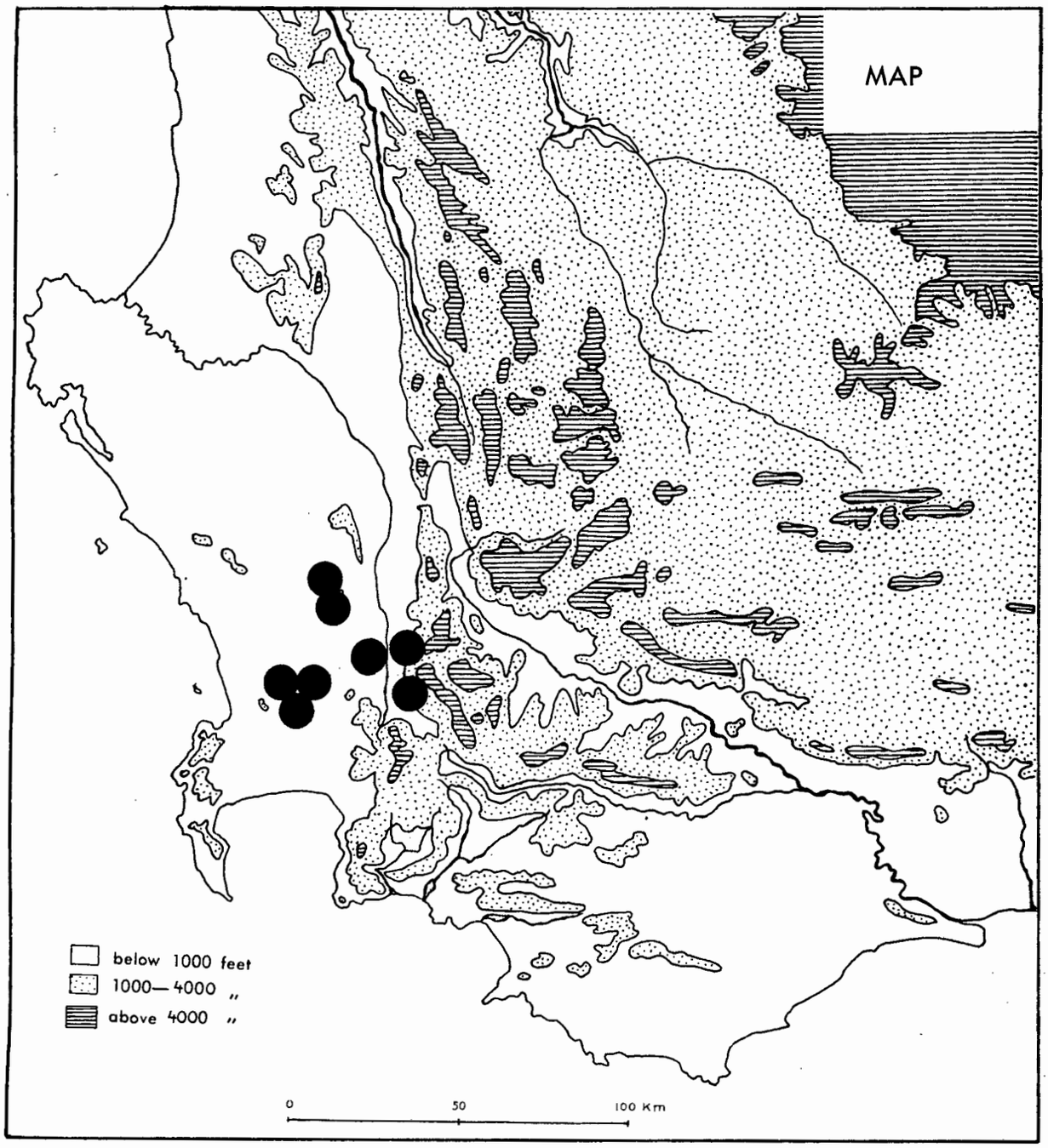


Fig. 34. Distribution of Leucospermum grandiflorum(Salisb.)R.Br.

(25) Leucospermum gueinzii Meisn. in DC., Prodr. 14 : 254 (1856). Type: In Africa Capensi, Gueinzius, lectotype in herb. Meisner (NY), isotype (S).

Stout erect shrub 2.0 - 3.0 m in height, with a single main stem; branches erect, ascending. Flowering stems 6.0 - 9.0 mm in diam., covered with a dense indumentum of fine crisped hairs interspersed with long erect trichomes. Leaves lanceolate acute, 7.5 - 10.0 cm long, 2.0 - 3.0 cm wide; usually entire, rarely with 2, 3 or 4 teeth at apex; glabrous but occasionally minutely puberulous at first; sessile, ascending imbricate; bright green when fresh. Inflorescences ovoid on opening, depressed ovoid when mature, 10.0 - 14.0 cm in diam., usually solitary, occasionally in groups of up to 3; pedunculate, peduncle to 1.0 cm long. Involucral receptacle narrowly conic acute, 4.0 - 4.5 cm long, 1.0 - 1.2 cm wide. Involucral bracts broadly ovate acute, the innermost whorl becoming acuminate; 1.5 - 2.4 cm long, 0.5 - 0.8 cm wide; cartilaginous proximally becoming brown and membranaceous distally, margins densely ciliate, apices usually crinite. Bracteoles lanceolate acuminate 2.5 - 3.0 cm long, 0.5 - 0.9 cm wide, cartilaginous, thickly lanate proximally, apex minutely crinite, margins ciliate. Perianth 5.5 - 6.0 cm long, greenish yellow proximally, amber distally. Perianth tube 7.0 mm long, glabrous, narrowed proximally, adaxially ventricose distally. Perianth claws sparsely sericeous with a few straight erect trichomes; becoming sigmoidly recurved subterminally. Perianth limbs very narrowly lanceolate acute, 1.0 cm long 0.2 cm wide, beset with a shaggy indumentum interspersed with long, slender trichomes; apex crinite. Style 7.0 - 7.5 cm long, tapering and becoming sharply curved abaxially in the subterminal region; deep orange. Pollen presenter 0.8 - 1.0 cm long, cylindric acute, pointing abaxially; stigmatic groove terminal. Hypogynous scales subulate, 3.0 mm long, ivory.

Diagnostic Characters: L. gueinzii is distinguished from L. grandiflorum by its glabrous, lanceolate acute to elliptic leaves, 7.5 - 10.0 cm long, usually entire, very rarely with up to 3 teeth at the apex and the perianth 5.5 - 6.0 cm long. The style and perianth are deep orange at anthesis.

A specimen in Meisner's herbarium (NY) annotated in his own hand is proposed as the lectotype of L. gueinzii. The species was named after Wilhelm Gueinzius who collected at the Cape between 1839 and 1841.

Distribution and Ecology: This species is confined to the Hottentots Holland mountains where it occurs at Jonkershoek, Bushmans Castle, on the Helderberg and near Sir Lowry's Pass. Collections of this species were made at Houw Hoek by Zeyher but it now appears to be extinct there.

L. gueinzii requires a very much moister environment than L. grandiflorum as its entire distribution range falls within a region receiving 30 - 45" p.a. Sheltered kloofs near stream banks at elevations varying from 1,000 - 3,000 ft. in dense sclerophyll are particularly favoured habitats. It is restricted to haavy clayey soils derived from weathered Cape Granite. Flowering takes place from August to December. On opening, the perianth and style are deep orange but become bright crimson with age.

Specimens Examined:

CAPE

STELLENBOSCH: Helderberg, Oct., Herre 2191 (STE); Guardian Peak Oct., Esterhuysen 12005 (BOL); Helderberg, Nov., Parker 3876 (BOL, NBG, K); Abdol's Kloof, Jonkershoek, Oct., Levyns 7376 (CT); Helderberg, Oct., Parker 4527 (SAM, K, PH); French Hoek mts., Bushmans Castle, Oct., Scholtz s.n. sub SAM 60931 (SAM); Langrivier, Jonkershoek, Aug., Kerfoot 5478 & 5507 (NBG); Langrivier, Jonkershoek, Aug., Rourke 1092 (NBG); Abdol's Kloof, Jonkershoek, Aug., Rourke 831 (NBG); Swartboskloof, Sept., van der Merwe 26/12 (PRE).

SOMERSET WEST: Sir Lowry's Pass, Sept., Levyns 3920 (CT); Western foot of Hottentots Holland mts. below Kaatjies Kloof, Aug., Esterhuysen 17384 (BOL, PRE).

CALEDON: Houwhoek, Sept., Zeyher s.n. sub SAM 19630 (SAM, G).

WITHOUT PRECISE LOCALITY: C.B.S., Masson (G); C.B.S., Brehm (M); In Africa Capensi, Gueinzius (NY, S).

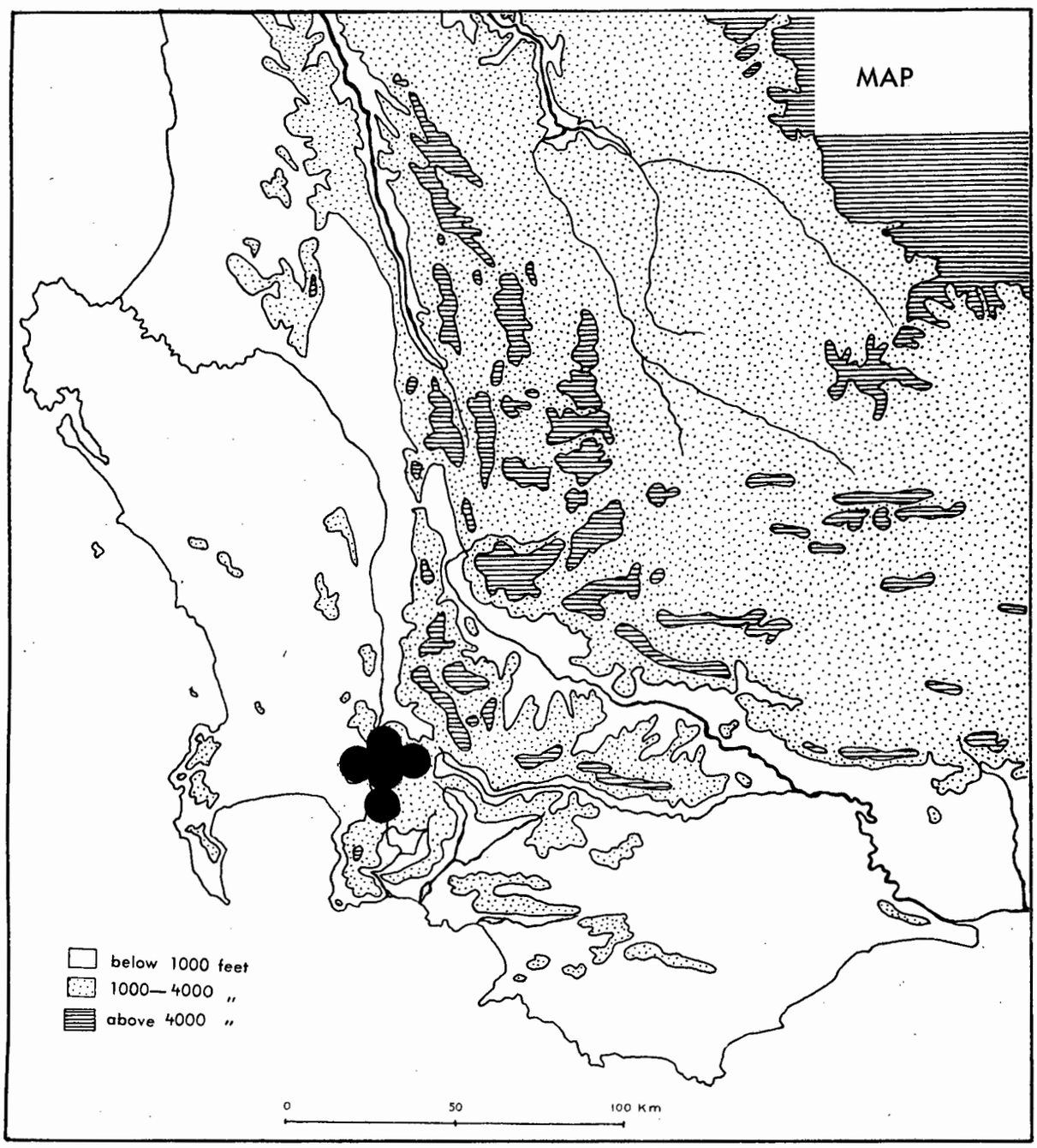


Fig. 35. Distribution of Leucospermum gueinzii Meisn.

(26) Leucospermum praemorsum (Meisn.) Phillips in Fl. Cap. 5 : 623 (1912).

Leucospermum attenuatum R. Br. var. praemorsum Meisn. in DC., Prodr. 14 : 257 (1856). Type: Sandy flats at Biedouw, 13/12/1830, Drège 2416 (lectotype B, isotypes P, K).

Leucospermum praemorsum Buek, in Drège Zwei Pfl. Docum. : 73, 199 (1844). Nom. nud.

Large shrubs or small trees to 5.0 m in height, 7.0 m in diam., with a single stout trunk to 30.0 cm in diam., branching at 30.0 cm from ground level. Bark smooth, grey. Flowering stems rigid, erect, 50 - 70 mm in diam., villous-cinereous at first, soon glabrous. Leaves oblong-oblanceolate, 7.0 - 8.0 cm long, 1.5 - 2.0 cm broad, glabrous; tapering to a distinct petiole up to 2.0 cm long, villous-arachnoid at base; apex truncate, praemorse, with 3 - 5 teeth, slightly undulate. Inflorescence broadly obconical depressed on opening, 7.0 cm in diam., becoming narrowly obconical after pollination; pedunculate, peduncle 0.75 - 1.0 cm long. Involucral receptacle depressed conic, acute 2.0 cm long, 1.5 cm wide. Involucral bracts loosely arranged, narrowly lanceolate-linear, drawn out into a long acuminate apex, up to 2.0 cm in length, somewhat incurved; cinereous, beset with long spreading, silky trichomes; pinkish-grey in live state. Bracteoles oblanceolate, abruptly acuminate, outer surface of proximal half densely lanate; apex cinereous, beset with long spreading silky trichomes. Perianth 2.5 - 3.0 cm long, uniformly villous, pale carmine when fresh; strongly incurved in bud. Perianth tube 8.0 mm long, glabrous and narrowing proximally, puberulous distally. Perianth limbs narrowly lanceolate acute, shortly villous with long silky trichomes sparsely interspersed. Style 50.0 - 60.0 mm long, almost straight, but curved adaxially in the distal region on opening; orange at anthesis, becoming deep crimson with age. Pollen presenter ellipsoid-cylindric, 2.5 mm long, 0.75 mm wide, greenish; stigmatic groove terminal. Hypogynous scales 3.0 mm long subulate, pale yellow.

Diagnostic Characters: The pubescent, loosely arranged, narrowly lanceolate linear involucral bracts distinguish L. praemorsum from all other species in the genus. Further distinguishing characters are the oblong-oblanceolate, petiolate leaves, truncate and praemorse at the apex and the ellipsoid-cylindric pollen presenter.

On the 13th of December 1830, Drège collected this species for the first time on record, growing on the sandy flats near Biedouw. The material of this collection on which Meisner based his description of L. attenuatum var. praemorsum, appears to have consisted of a few leaves only since he described his type as "fragm. steril. in herb. Sonder". Despite a careful search through the Sonder material in Stockholm, much of which is annotated in Meisner's hand, the present author was unable to trace this collection. As it was the only collection of L. praemorsum made by Drège, the duplicates can be regarded as isotypes. The complete specimen in E. Meyer's herbarium in Berlin that was examined at some stage by Meisner has therefore been selected as the lectotype.

Distribution and Ecology: The distribution range of L. praemorsum extends from near Lokenberg in the Calvinia district, southwards to the Gifberg and the Nardouwberg plateau with the most southerly population in the Biedouw - Wuppethal area of the Clanwilliam district.

At all these localities the populations occur in dry situations at elevations of 1,000 - 2,500 ft., in deep sandy soil derived from weathered Table Mountain Sandstone. L. praemorsum is essentially a species peculiar to arid regions receiving a low winter rainfall of 10 - 15" p.a. but by virtue of their elevation, these populations probably obtain the benefits of the frequent mists in this area. On the Nardouwberg plateau, large stands occur, consisting of many thousands of plants growing on level sandy flats scattered amongst clumps of Willdenowia lucaeana and an occasional shrub of Leucadendron procerum, which apart from small annuals and geophytes, comprise the only vegetation cover. It would appear that veld fires are unable to burn very fiercely (if at all) due to the extensive bare sandy areas between the shrubs and tufts of Willdenowia. Consequently, most of the specimens of L. praemorsum are of considerable age and stature and have developed into small trees. Many specimens attain a height of more than 15 ft. (5 m) and a diameter of more than 20 ft. (7 m) with a trunk diameter of up to 1 ft. (30 cm). After counting the annual growth increments on several specimens, the present author estimates their age to be between 50 and 80 years.

Inflorescences are produced erratically throughout the year (particularly on old senescent plants), although the peak of the flowering period appears to be from July to December.

Specimens Examined:

CAPE

CALVINIA: On the road to Dobbelaars Kop beyond Paalkraal near Lokenberg, Aug., Williams 1022 (NBG).

VAN RHYNSDORP: Klaver, Nov., Austin Roberts 25092 (PRE); Gifberg, July, van Lutzenberg s.n. (NBG 80662).

CLANWILLIAM: Nardouw Pass, Aug., Salter 3525 (BOL, SAM, PRE, BM, K); Nardouw, Sept., H.C. Taylor 5933; Nardouwberg Pass, July, van Breda 1600 (PRE, STE, K); Clanwilliam mountains, Sept., Garside 4469 (STE, K); Nardouw Pass, Nov., Middlemost 1898 (NBG); Vondelingsberg, north of Nardouw, Dec., Williams 1140 (NBG); Nardouwsberg, May., Rycroft 2239 (NBG); Sept., Compton 20,000 (NBG); Towards the summit of the Nardouwberg Pass, July, Williams 823 (NBG); Sandy flats at Biedouw, 2500 - 3000 ft., 13/12/1830 Drège 2416 (P, B, K); Nardouw Plateau, between Vondelingsberg and Syferkop, Aug., Rourke 1070 (NBG).

LOCALITY DOUBTFULL: Between Leipoldtville and Graafwater, July, Leipoldt 3513 (BOL).

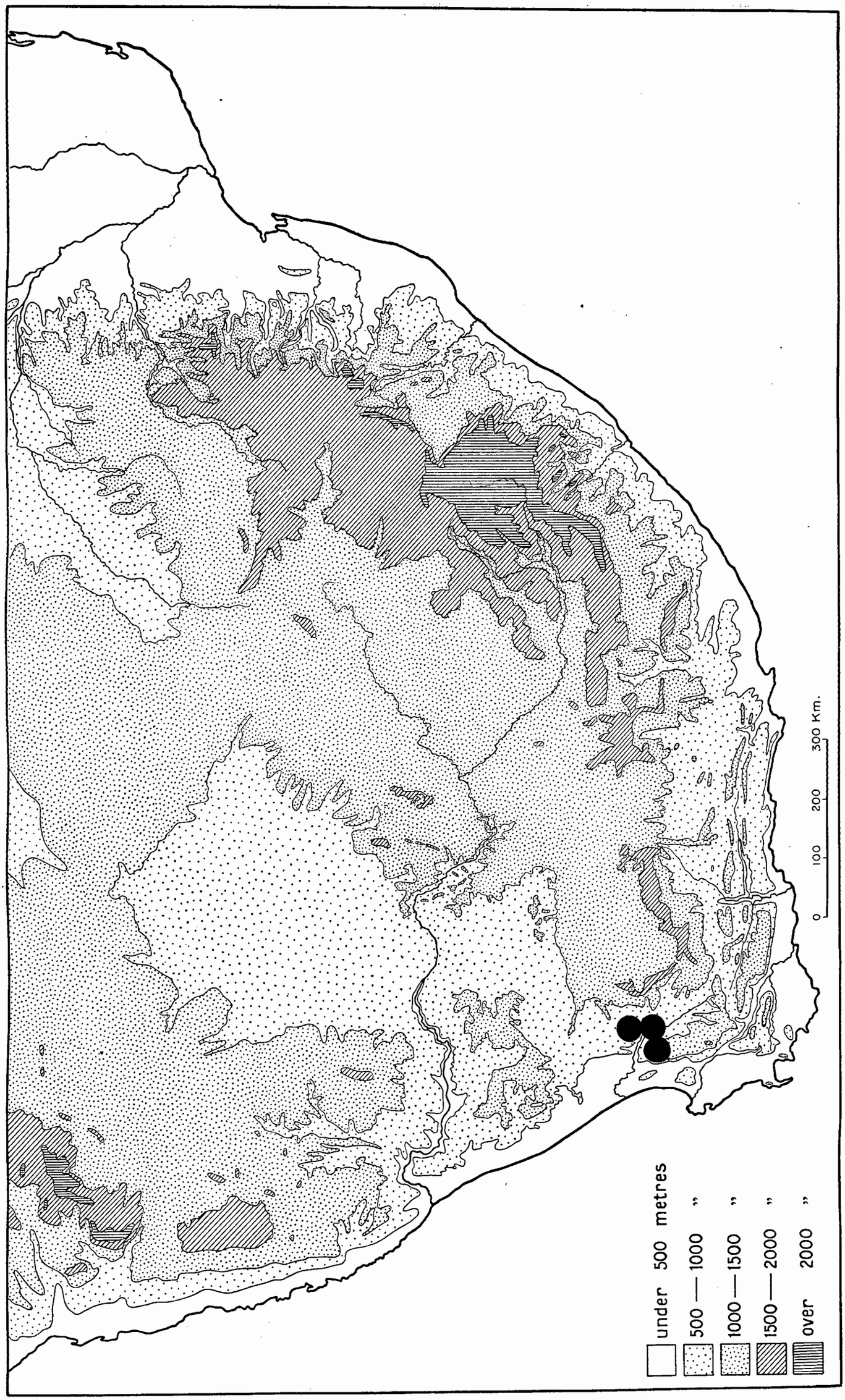


Fig. 36. Distribution of Leucospermum praemorsum(Meisn.)Phillips

(27) Leucospermum reflexum Buek ex Meisn. in DC., Prodr. 14 : 254 (1856); Phillips in Fl. Cap. 5 : 624 (1912). Type: Africa australis, J.F. Drege, Lectotype in herb. Meisner (NY).

Leucadendron reflexum (Buek ex Meisn.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

ICONES
Flower. Pl. S. Afr. 35 t. 1361 (1962).
S. Eliovson, Proteas for Pleasure : 148 (1965).
M. Vogts, Proteas, Know them and Grow them : 112-116 (1959).
J. bot. Soc. S. Afr. pt. 24 : 28 t. 7(1939).

A large rounded shrub to 4.0 m in diam., with a single main stem at base; bark smooth, grey. Flowering stems stiffly erect, 3.0 - 6.0 mm in diam., covered with a dense indumentum of fine crisped hairs, sparsely interspersed with straight, erect trichomes. Leaves ascending imbricate; elliptic to oblanceolate-oblong, 2.0 - 5.5 cm long, 0.5 - 1.3 cm wide, grey, covered with a dense matted indumentum of fine crisped hairs; apex usually bifid or trifid, occasionally entire. Inflorescences solitary, ovoid to globose in young stages, 8.0 - 10.0. cm in diam.; pedunculate, peduncle 3.0 - 6.0 cm long. Involucral receptacle narrowly cylindric, 2.0 - 3.5 cm long, 0.5 - 0.7 cm wide. Involucral bracts narrowly deltate, acuminate, 1.0 - 1.2 cm long, 4.0 mm wide at base; cartilaginous; sparsely sericeous, margins ciliate, apex minutely crinite. Bracteoles broadly obtrullate, tightly clasping the perianth, 1.0 cm long, 0.6 - 0.8 cm wide; apex acuminate, patent to recurved; thickly lanate proximally, thinly sericeous distally. Perianth 4.0 - 5.0 cm long, deep orange to crimson. Perianth tube 1.0 cm long, glabrous and narrow proximally, puberulous and inflated distally. Perianth claws uniformly villous, becoming recurved subterminally. Perianth limbs very narrowly lanceolate linear, acute, 5.0 - 6.0 mm long, 1.5 mm wide, villous. Anthers linear subulate 4.0 - 5.0 long; apical boss sharply subulate, 1.0 mm long. Style 7.0 - 7.5 cm long; orange becoming deep crimson. Pollen presenter cylindric to subulate, sharply acute, 5.0 - 6.0 mm long, minutely geniculate at junction with style. Hypogynous scales subulate, hyaline, 3.0 mm long.

Diagnostic Characters: The small (2.0 - 5.0 mm long) elliptic to oblanceolate leaves covered with a dense, crisped, grey indumentum, the cylindric involucral receptacle and the perianth tube,

curved at right angles at anthesis, serve to distinguish L. reflexum from related species.

On the 11th of December, 1830, J.F. Drège made the first recorded collection of L. reflexum at Heuning Vlei in the eastern Cedarberg. This material was given the manuscript name of L. reflexum by Buek, a name that was later adopted and validly published by Meisner. As Meisner does not state the location of his type, I propose that the excellent specimen in his personal herbarium labelled "Africa australis J.F. Drège acc. 1840" in his own hand, serve as the lectotype.

Distribution and Ecology: L. reflexum is confined to the eastern part of the Cedarberg between Pakhuis in the north and the Koudeberg - Wupperthal area in the south.

Throughout its range, L. reflexum is found only between 3,000 and 6,000 ft. Its range falls within a region of low winter rainfall (10 - 15" p.a.) which supports a sparse and rather arid type of fynbos. Nevertheless, at the various localities where the present author has observed L. reflexum, the plants have always been growing in comparatively moist situations such as near stream banks or on wet seepage areas, often in association with Cannamois virgata and Pteridium aqualinum. Information on collectors labels confirms the view that an adequate supply of moisture is an important requirement of this species despite the aridity of its environment in general. Flowering commences at the end of August and continues into December. Two colour forms are known. Apart from the usual form with styles and perianths brilliant scarlet, a pale yellow form has been recorded from Heuning Vlei.

The Mechanism of Reflexion: In L. reflexum the hinged perianth is developed to its fullest extent. Reflexing is brought about by the bending of the perianth tube. In the young bud stage before the elongating style has protruded through the perianth claws, the perianth tube is straight and very slightly inflated distally. By the time the style has protruded through the perianth claws and has arched abaxially, the adaxial surface of the perianth tube has begun to enlarge. The rapid elongation of the cells on the adaxial surface of the perianth tube causes the entire perianth to bend abaxially (i.e. downwards). When reflexing is complete, the upper half of the perianth tube is bent at right angles to the lower half. Concomitantly with the bending of the perianth tube, the style (which is constricted within the tube), is bent at right

angles, 6.0 mm above the ovary. The style is forced into this position by the bending of the turgid perianth tube. At this stage the flower is fully reflexed with the styles adpressed to the peduncle. As the perianth dries, becomes papery, and loses its turgidity in the fruiting stage, the styles are released and become erect again, spreading at right angles to the inflorescence axis instead of being closely adpressed to the peduncle.

Specimens Examined:

CAPE

CLANWILLIAM: Cedarberg, Krakadouw Heights, Oct., Pocock 493 (STE); Pakhuis Pass, Oct., Schroeder s.n. (STE 19375); Koudeberg, Aug., Schlechter 8755 (PRE, GRA, BOL, PH, BM, K, G, S, Z, BR); Pakhuis Pass, Oct., Bolus 9079 (BOL, NBG, PRE, NH, K); Koudeberg above Wupperthal, Nov., Thode A2134 (PRE, NH, K); Near Crystal Pool, Cedarberg, Sept., Levyns 2946 (CT); East of Cedarberg in a vlei July, Wurts 2146 (NBG); Cedarbergen, Oct., Marloth 2676 (PRE); Mountains at Kranz Kloof near Wupperthal, Sept., Leipoldt s.n. (SAM 43639); In the hills near Pakhuis Oct., Macowan 1946 (SAM, G, BM, K, Z); Krakadouw Heights, Sept., Barnard 738 (SAM); Above the forestry hut at Heuning Vlei, Aug., Rourke 1077 (NBG); At Heuning Vlei, between Koudeberg and Wupperthal, 3,000 - 3,500 ft., 11/12/1830 Drège 2415 (P, S, B, K, BM, SAM, PRE); At Heuning Vlei, 17/12/1830, Drège 2415 (P); Heuning Vlei, Dec., Kruger 974 (NBG) yellow form, & Kruger 984 (NBG)

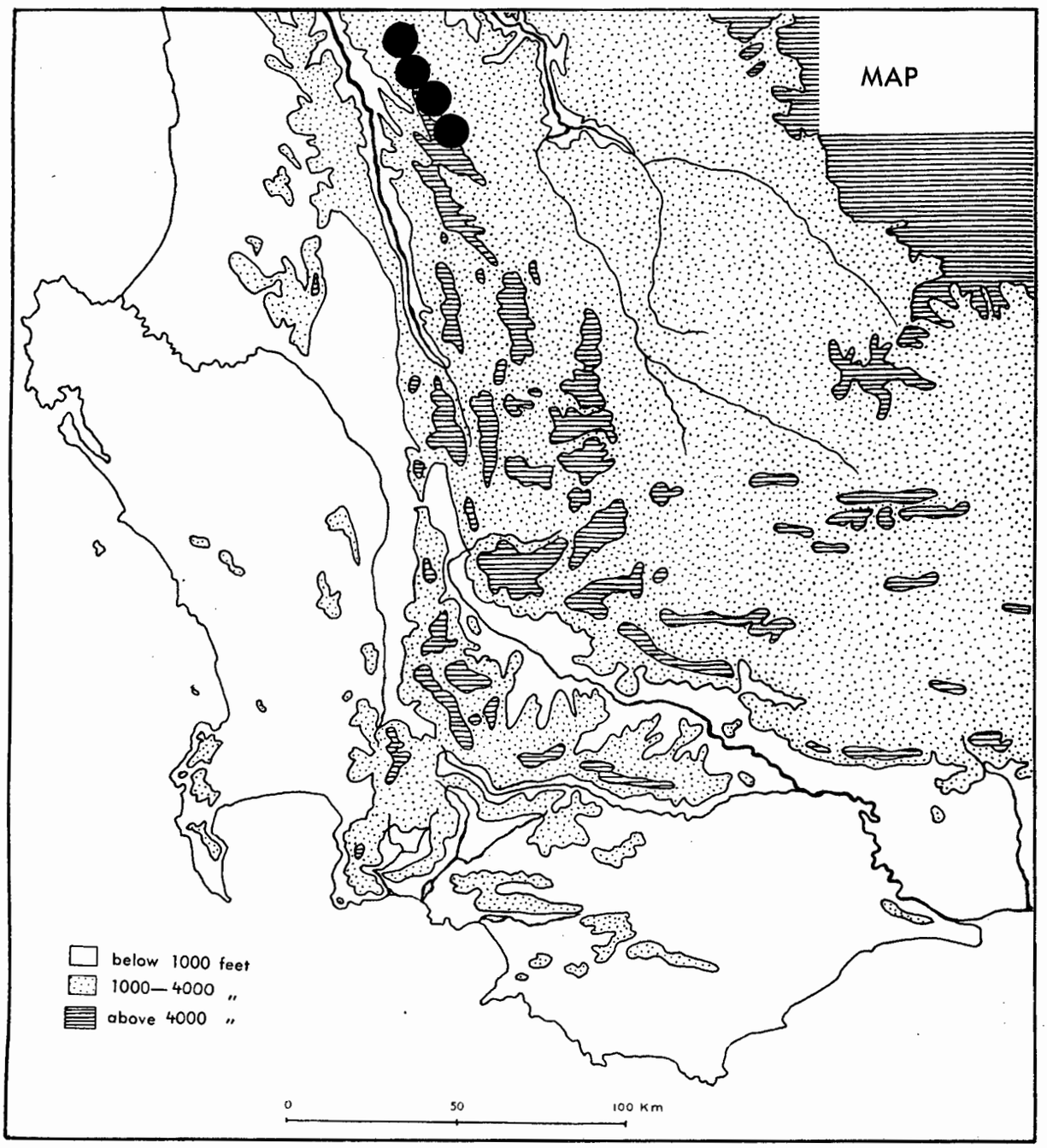


Fig. 37. Distribution of Leucospermum reflexum Buek ex Meisn.

Sect. 6. LEUCOSPERMUM

Hypophylloidea Phillips, Fl. Cap. 5 : 612 (1912).

Erect, sprawling or decumbent shrubs. Leaves ascending imbricate or secund, oblanceolate cuneate or linear, beset with a dense permanent greyish indumentum of fine crisped hairs. Perianth straight in bud, bright yellow; very sweetly scented. Pollen presenter clavate or cylindric.

Type: L. hypophyllocarpodendron (L.) Druce

Good characters can be found to separate all the vicarious species within this section but the extent of the variation in the species here delimited as L. hypophyllocarpodendron requires further discussion.

Although L. hypophyllocarpodendron is a very clearly defined species which may be recognised by its persistent rootstock, trailing stems, secund leaves and very broad involucral bracts, numerous widely divergent forms are grouped under this species. Four principal forms can be recognised:

(1) Glabrous stems and bright green oblanceolate to narrowly cuneate, glabrous leaves;

(2) pubescent stems with grey, pubescent, linear canaliculate leaves;

(3) pubescent stems becoming glabrous with glabrescent linear canaliculate leaves;

(4) pubescent stems with pubescent, oblanceolate to very narrowly cuneate leaves.

Only the form with glabrous stems and bright green, glabrous oblanceolate leaves (1) could readily be distinguished within the species. Moreover, it was found to be remarkably uniform throughout its range, showing very little variation. It occurs on the Cape Peninsula and adjacent flats with a few relict populations on the flats at Faure, Stellenbosch and the upper Berg River valley, with an outlying population along the Bredasdorp coast.

However, in the remaining three groups (2, 3 & 4), a wide range of variation was observed. Field studies showed that while small local populations can often be uniform, these do merge into each other indistinguishably. All are characterised by a fine, greyish crisped pubescence on the stems and leaves which, although normally permanent, tends to rub off with age in form (3) with canaliculate leaves. In such cases the pubescence remains only

in the channel formed between the involute leaf margins. On the southern and western slopes of Katzenberg all three forms were found growing in close proximity (Fig. 38).

Thus it is only possible to divide L. hypophyllocarpodendron into two taxa based on leaf and stem pubescence, which are well demarcated geographically and do not overlap. It is suggested that the first group with glabrous stems and glabrous, consistently oblanceolate leaves, be recognised as ssp. hypophyllocarpodendron and those forms with pubescent stems and pubescent leaves (at least at some stage of their development) which may be linear canaliculate to oblanceolate, be recognised as ssp. canaliculatum

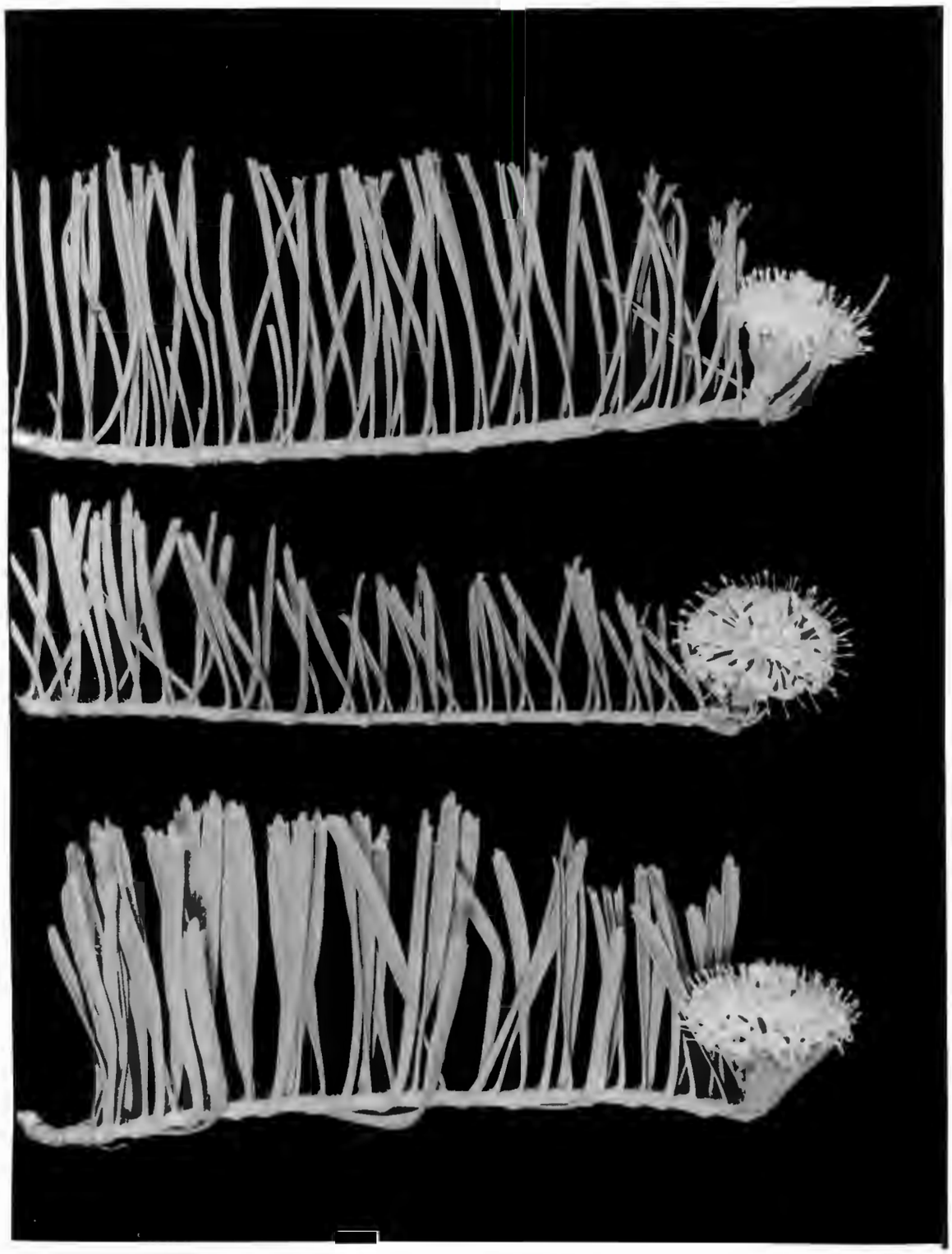


Fig. 38. The three principal forms of Leucospermum hypophyllocarpodendron (L.) Druce ssp. canaliculatum (Meisn.) Rourke. All three forms were found growing in close proximity to each other on the southern and western slopes of Katzenberg, near Pella (Malmesbury district). Top: the form with glabrous, linear canaliculate leaves (Rourke 1195); Middle: the form with pubescent, linear canaliculate leaves (Rourke 1194); Bottom: the form with narrowly oblanceolate pubescent leaves (Rourke 1193). (All x $\frac{3}{4}$)

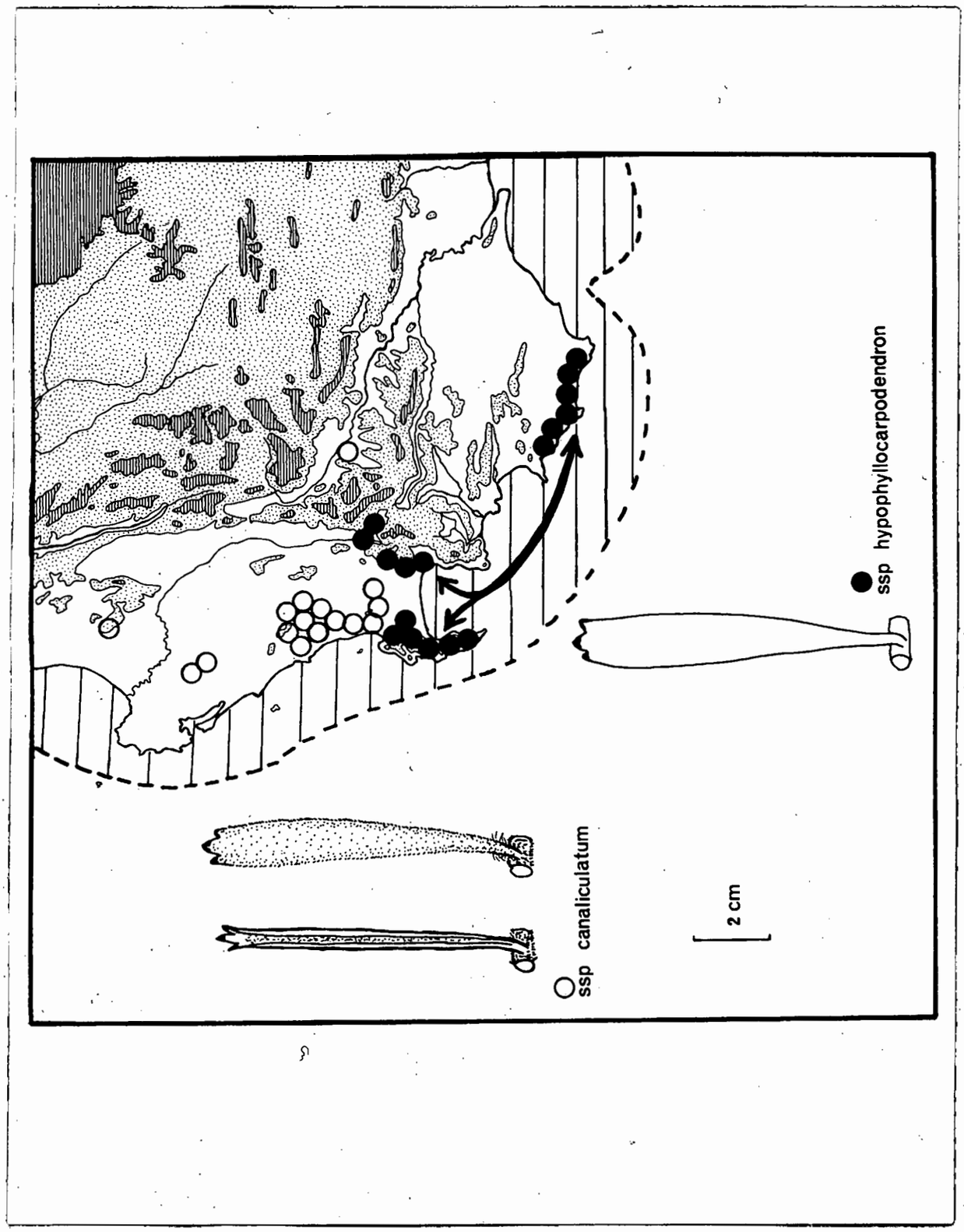


Fig. 39. Distribution of Leucospermum hypophyllocarpodendron (L.) Druce. The range of ssp. canaliculatum (Meisn.) Rourke is indicated with open circles and the range of ssp. hypophyllocarpodendron with solid circles. The dotted line enclosing the widely hatched area along the coast represents the position of the coastline during the Middle Pleistocene (adapted from Hamilton and Cooke, 1965 : 336). The arrows indicate a hypothetical migration route between the Cape Flats and the Bredasdorp Flats during Middle Pleistocene times.

(28) Leucospermum hypophyllocarpodendron (L.) Druce in Rep. botl Soc. Exch. Club Br. Isl. 3 (4) : 120 (1914)

A prostrate or rarely suberect shrub to 20.0 cm in height, stems trailing along the ground and forming mats 0.5 - 1.5 m in diam.; stems arising from a stout, underground, persistent rootstock. Flowering stems 2.0 - 4.0 mm in diam., pubescent with a fine grey crisped indumentum, glabrescent or glabrous. Leaves secund; linear canaliculate to narrowly oblanceolate or narrowly cuneate, 4.0 - 13.0 cm long, 0.2 - 1.5 cm wide, apex with 2 - 4 reddish teeth, occasionally entire; pubescent with a short grey indumentum of fine crisped hairs, occasionally becoming glabrescent to glabrous, or bright green and quite glabrous. Inflorescences depressed globose, 3.0 - 4.0 cm in diam.; pedunculate, peduncle 3.0 - 5.0 cm long; arising in groups of up to 4, generally at right angles to stem. Involucral receptacle conic acute, 1.5 cm long, 0.7 - 1.0 cm wide. Involucral bracts very broadly ovate acute, 4.0 - 6.0 mm long, 5.0 - 7.0 mm wide, closely adpressed imbricate, cartilaginous, glabrescent to softly tomentose. Bracteoles broadly obtrullate to ovate, acute, 7.0 mm long, 5.0 mm wide, cartilaginous, very thickly lanate proximally, pilose distally. Perianth 2.0 - 2.2 cm long, tubular, slightly adaxially curved in bud; bright yellow. Perianth tube 1.0 cm long, minutely pilose but glabrous adaxially. Perianth claws strongly coiled at anthesis; the 3 adaxial claws united into a sheath, glabrous, but pilose along sheath margins; abaxial claw pilose. Perianth limbs narrowly lanceolate acute, 3.0 mm long, the 3 abaxial limbs villous, adaxial limb glabrescent. Style 2.0 - 2.6 cm long, slender, straight or very slightly adaxially curved; yellow. Pollen presenter clavate obtuse 1.5 - 2.0 mm long, stigmatic groove terminal. Hypogynous scales subulate linear, 1.0 mm long, or absent.

Diagnostic Characters: In the section Leucospermum, L. hypophyllocarpodendron is distinguished by its prostrate growth habit, the trailing stems with secundly arranged linear canaliculate to narrowly oblanceolate leaves which may be pubescent or glabrous and by the broadly ovate involucral bracts, 5.0 - 7.0 mm wide.

Key to subspecies

Stems and leaves glabrous, leaves always narrowly oblanceolate to narrowly cuneate

ssp. hypophyllocarpodendron

Stems and leaves pubescent with a fine grey crisped indumentum occasionally lost with age. Leaves linear canaliculate or narrowly oblanceolate to narrowly cuneate

ssp. canaliculatum

a. ssp. hypophyllocarpodendron

Leucadendron hypophyllocarpodendron L., Sp. Pl. ed 1 : 93 (1753). Lectotype: Boerhaave, Ind. Hort. Lugd. Bat (2) t. 198 (1720).

Protea hypophyllocarpodendron (L.) L., Mant. Alt. : 191 (1771).

Protea hypophylla Thunb., Diss. Prot. : 23, 49 (1781), - nom. superfl.

Leucadendrum hypophyllum (Thunb.) Salisb. ex Knight, Cult. Prot. : 56 (1809)

Leucospermum hypophyllum (Thunb.) R. Br. in Trans. Linn. Soc. Lond. 10 : 102 (1810); Roem. & Schult., Syst. Veg. 3 : 361 (1818); Meisn. in DC., Prodr. 14 : 257 (1856) excluding var. β and var. γ ; Phillips and Stapf in Fl. Cap. 5 : 625 (1912); Adamson & Salter, Fl. Cape Penins. : 326 (1950).

Pre Linnaean Citations.

Leucadendros Africana sive Scolymocephalus, angustiori folio, apicibus tridentatis. Pluk., Opera 2 (Almagest.) : 212 (1696).

Thymelaea capitata Rapunculoides Nerii crassioribus foliis, summo apice tridentatis, Aetheopia, coniformi calyce squamata. Pluk., Opera 3 (Mant.) : 181 (1700). Tab. 440 fig 3. in Pluk., Opera 4 (Amal. Bot.) 1705.

Scolymocephalus foliis angustis in summitate tridentatis. Ray, Hist. Plant. tome 3, Dendr. : 9 (1704).

Conocarpodendron; folio rigido, angusto, apice tridentato, rubro; flore aureo. Boerh., Ind. Hort. Lugd. Bat. (2) t. 198 (1720).

Protea foliis lanceolato-linearibus, apice tridentato-callosis. L., Hort. Cliff. : 29 (1737).

Protea foliis lanceolatis linearibus, apice tridentato callosis; capitulis aphyllis. Roy., Prod. Lugd. Bat. : 184 (1740); Wach., Hort. Ultra. (1747).

Scolymocephalus seu Conocarpodendron folio angusto. Weinm., Phyt. 4 : 294 t. 902 fig a (1745).

Stems glabrous to glabrescent, often tinted reddish in the live state. Leaves flat, narrowly oblanceolate to narrowly cuneate, glabrous, bright green when fresh. Hypogynous scales minute, 0.2 mm long, or absent.

Linnaeus cited four different polynomials when he described L. hypophyllocarpodendron, including a reference to a specimen in Clifford's herbarium. Of the four elements in the protologue, only the Boerhaave plate has any significant bearing on the typification of the name since it is only from this plate that Linnaeus could have obtained the information "calycibus turbinatis nudis" quoted in his original description. The small sterile twig in the Hortus Siccus Cliffortianus was obviously taken from a plant in Clifford's garden but there is no evidence that it ever flowered. Likewise, the other polynomials refer to vegetative parts only. Consequently Boerhaave's plate appears to be the only acceptable lectotype. This plate depicts a specimen with glabrous oblanceolate leaves and glabrous stems and was said to have occured on sandy fields at Steenberg, thus clearly identifying the type with a plant from the Cape Peninsula.

Distribution and Ecology: The typical subspecies still occurs on the Cape Peninsula, but only in the southern half as it is now extinct on the flats between Cape Town and Retreat due to urban expansion. Small relict populations survive near Faure, Stellenbosch and in the upper Berg River valley but the most extensive

populations occur along the Bredasdorp coast between Franskraal and Brandfontein.

Most populations occur on sandy flats of Tertiary age, at elevations ranging from sea level to 500 ft. but are occasionally found at elevations up to 1000 ft. on weathered Table Mountain Sandstone. The mature plants are very fire resistent and are able to regenerate new stems from a large subterranean rootstock. The bright yellow, sweetly scented inflorescences are produced between August and January.

Specimens Examined:

CAPE

CAPE: Raapenberg, Cape Flats, F. Guthrie 1889 (CT); Cape Flats, Wallich 160 (BM); Near Durban Rd., Nov., MacOwan 2504 (no. 775 in Herb. Norm.) (SAM, Z, K, G); Cape Flats, Ecklon s.n. (M); Cape Flats near Rondebosch, 31/1/1811, Burchell 710 (K); Cape Town, Flats Rehmann 2086 (BR, Z).

WYNBERG: Near Wynberg, Nov., MacOwan 2504 (no 775 in Herb. Norm.) (GRA, NH, Z, G, BM, K); Flats between Claremont and Kenilworth, Dec., Schlechter 59 (Z); Retreat, Nov., Rogers (BM, Z, K); Flats west of Zeekoe Vlei, Nov., Salter 3999 (BM); Tokai-Westlake Rd., Sept., Esterhuysen 31106 (BOL).

SIMONSTOWN: Between Buffels Bay and Cape Point, Oct., Salter 3881 (BM); Near Kommetjie, Dec., Phillips s.n. (PRE); Kommetjie Nov., Galpin 4467 (PRE, K); Imfoffs Gift, Aug., Kies 136 (NBG); Bonteberg, Sept., Compton 9349 (NBG); Smitswinkel, Feb., Middlemost 1671 (NBG); Olifants Bos, Aug., Compton 15843 (NBG); Kommetjie Hills, Sept., Barker 5899 (NBG); Cape Point, Nov., Compton 12533 (NBG); Between Smith's Farm and Vasco da Gama, Dec., Salter 8515 (CT); Fish Hoek, Aug., Page s.n. herb. Guthrie (CT); Kalk Bay, Sept. 1886, Alexander Prior s.n. (K); Between Smith's Farm and Cape Point, Phillips 3762 (SAM); Modderdam, Oct., Barker 3884 (NBG, BOL); Smiths Farm, Oct., Hutchinson 658 (K, BOL, BM, PRE); Mountains around Simonstown, Oct., Bolus 4688 (BOL, K); Fish Hoek, Jan., Rogers 16068 (G); Cape Point, Phillips 521 (PRE, K); Fish Hoek, Aug., Thode 8429 (STE).

STELLENBOSCH: Between Sir Lowry's Pass and Jonkershoek, Burchell 8302 (K); Stellenbosch flats, Aug., Strey 460 (PRE); Zeekoe Vlei Farm, near Faure, Nov., Rourke 995 (NBG).

PAARL: Berg River, near Paarl, 5/1/1829, Drège 1469 (P, SAM); Belgravia, Paarl Rd., de Villiers s.n. (BOL); French Hoek, Oct., Roberts s.n. sub STE 16841 (STE); French Hoek, Oct., Phillips 1269 (SAM); Wemmershoek, Nov., Baker 311 (NBG)

BREDASDORP: Soetanysberg, Nov., Smith 5034 (PRE); Brandfontein, Sept., Smith 3127 (PRE); Rietfontein Poort, Dec., Schlechter 9684 (GRA, Z, PRE); Near Elim, Dec., Bolus 8584 (BOL, K); Springfield estate, Stokoe s.n. (SAM); Groenkloof, above Pearly Beach, Aug., Rourke 1085 (NBG); Soetanysberg, Dec., Rourke 1008 (NBG); Flats above Pearly Beach, Aug., Rourke 536 (NBG); Heidehof, near Uilenkraal River, Oct., Rourke 1012 (NBG).

b ssp. canaliculatum (Buek ex Meisn.) Rourke, comb. nov. et stat. nov.

Leucospermum canaliculatum Buek in Drège, Zwei Pfl. Geog. Docum. 112, 113, 199 (1843), - nom. nud.

Leucospermum hypophyllum (Thunb.) R. Br. var. canaliculatum Buek ex Meisn. in DC., Prodr. 14 : 257 (1856). Type: Between Dassenberg and Paardeberg, 18/2/1829, Drège 1470b (Lectotype in herb. Meisn. NY; isotypes G, B, P, SAM).

Leucospermum hypophyllum (Thunb.) R. Br. var angustifolium Klotzsch in Krauss, Flora 28 : 76 (1845), - nom. nud.

Leucospermum hypophyllum (Thunb.) R. Br. var stenophyllum Meisn. in DC., Prodr. 14 : 257 (1856). Type: In herb. DC., comm. ex herb. Delessert (not found.).

Stems pubescent, beset with a fine greyish crisped indumentum. Leaves linear canaliculate, to narrowly oblanceolate cuneate, pubescent, with a greyish indumentum of fine crisped hairs; usually permanently pubescent but occasionally with the indumentum rubbing off causing leaves to become glabrous or glabrescent later.

Distribution and Ecology: Apart from an outlying population near Brandvlei, Worcester, this subspecies is confined to the "sandveld" of the Western Cape coast, ranging from Milnerton, Kuils River and Kraaifontein in the south to Mamre, Darling, Hopefield and Piketberg in the north.

The ssp. canaliculatum occurs in habitats very similar to those of

the typical subspecies, that is, always on deep white sandy soils of partly stabilised Tertiary or Recent deposits. However, the environment is slightly drier, with a mean annual rainfall of 15 - 20" p.a. As with the typical subspecies, it is very fire resistent and flowers from August to January.

Specimens Examined:

CAPE

PIKETBERG: Piketberg mountain, Krige s.n. sub STE 10528 (STE); Mountain above Aurora, Aug., Rourke 1059 (NBG).

HOPEFIELD: Field near Hopefield, Sept., Letty 6 (PRE); Hopefield, Oct., Compton 15117 (NBG).

MALMESBURY: Southern part of Dassenberg, Sept., Pillans 6871 (BOL); Kalabaskraal, Feb., Grobler 883 (STE); Buffelsrivier, Oct., H.C. Taylor 4153 (STE); Kalabaskraal, April, van der Merwe 7 (STE); Near Darling, Sept., Parker 4641 (PH, PRE, K); In arenosis Groenkloof, Oct., Zeyher s.n. (NH). Sandy places, Groenkloof, Oct., Bolus 4325 (BOL); Mamre Rd., Leighton 1847 (PRE); Between Darling and Malmesbury, Oct., van Breda 1052 (PRE); Between Malmesbury and Mamre Rd. station, Garside 4580 (K); Pella turn off, Oct., Barker 10355 (NBG); Near Darling, Aug., Compton 7508 (NBG); Melkbos Rd., Aug., Compton 15869 (NBG); Blaauwberg Rd., July, Barker 390 (NBG); Melkbosstrand Rd., Sept., Acocks 2536 (S); Between Groenkloof & Dassenberg, Sept., Drège s.n. (S) Between Dassenberg and Paardeberg, 18/2/1829, Drège 1470b (G, P, B, SAM, NY); At Dassenberg, 19/9/1828, Drège s.n. (P, S); Darling, Sept., Bayliss 1662 (Z); Zwartland, Nov., Pappe s.n. sub SAM 19635 (SAM); Mamre Flats, Oct., Compton 13877 (NBG, PRE); Near Melkbos Strand, Sept., Compton 9340 (NBG); Flats east of Melkbos, Aug., Salter 3549 (BM, K); Mamre dunes, Sept., Garside 4651 (K); Klein Springfontein, Sept., Rourke 1095 (NBG); Burghers Post, E. slopes of Dassenberg, Aug., Rourke 502 (NBG); S. slopes of Katzenberg, Aug., Rourke 1193 and 1194 (NBG); West of Pella, Aug., Rourke 1195 (NBG).

BELLVILLE: Rietvlei, Sept., MacOwan s.n. sub SAM 13584 (SAM); 4 miles north of Milnerton, Nov., L. Bolus s.n. sub BOL 18317 (BOL); Rietvlei, Nov., Ecklon & Zeyher 1465 (SAM, K, G); Along Koeberg Rd., Nov., Forbes 228 (NH); Between Tygerberg and Simonsberg, 7/10/1829, Drège s.n. (P); Mulder's Vlei, Jan., Pillans 10400 (BR); Near Kraaifontein, Nov., Salter 3987 (BM, K);

Kraaifontein, Nov., Wilman 950 (BOL); Kuils River, Sept., Garside 35 (K); Kraaifontein, Dec., Young 162 (PRE); Kuils River, Sept., Lewis Grant 2532 (PRE); Halfway House on Rd. to Stellenbosch, 20/8/1846 Alexander Prior s.n. (PRE).

WORCESTER: Brandvlei winery, Oct., van der Merwe 25 - 64 (STE, K, PRE); Near Brandvlei, Oct., Williams 512 (BOL); De Grip, Worcester, Walters 1015 (PRE, K); Kweek Kraal, S.W. of Worcester, Oct., Hardy & Bayliss 1016 (PRE, K).

(29) Leucospermum tomentosum (Thunb.) R. Br. in Trans. Linn. Soc. Lond. 10 : 101 (1810); Phillips in Fl. Cap. 5 : 626 (1912).

Protea tomentosa Thunb., Diss. Prot. : 24 (1781). Lectotype: Cap. b. spei, Thunberg s.n., sheet no. 2992 in herb. Thunberg (UPS).

Leucadendrum tomentosum (Thunb.) Salisb. ex Knight in Knight, Cult. Prot. : 57 (1809).

Leucadendron tomentosum (Thunb.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Leucospermum ecklonii Buek, in Drège Zwei Pfl. Docum. : 113, 199 (1844) - nom. nud.

An erect to semi-erect shrub 0.5 - 1.0 m in diam., 40.0 cm to 1.0 m in height. Basal branches stout and woody, 2.0 - 5.0 cm in diam., tending to spread horizantally. Flowering stems erect to horizantally spreading, 4.0 - 6.0 mm in diam., covered with a dense indumentum of short crisped hairs interspersed with long, slender, erect trichomes. Leaves linear to linear-spathulate, 4.5 - 6.0 cm long, 3.0 - 5.0 mm wide; margins involute causing leaves to be broadly canaliculate; loosely ascending imbricate on upper branches, occasionally subsecund on lowermost trailing branches; apex entire or with up to 3 teeth. Leaves covered with a dense canescent indumentum of short, closely adpressed crisped hairs. Inflorescences sessile, globose, 3.0 - 3.5 cm in diam., solitary, or with 3 to 4 inflorescences per flowering shoot. Involucral receptacle conic-depressed, 1.3 cm long, 1.0 cm wide. Involucral bracts lanceolate-acute 5.0 mm long, 3.0 mm wide, cartilaginous, very closely adpressed imbricate; shortly tomentose, the apex crinite, cinereous. Bracteoles linear-obtrullate, 5.0 - 7.0 mm long, 1.0 - 2.0 mm wide, apex acute to acuminate, margins ciliate, outer surface tomentose. Perianth 2.0 cm long, straight in bud, tubular, deep yellow throughout; the abaxial and 2 lateral perianth claws sparsely pilose, the adaxial claw glabrous. Perianth tube 4.0 - 5.0 mm long, glabrous, slightly laterally compressed. Perianth limbs lanceolate acute, 2.0 - 3.0 mm long, barely differentiated from the perianth claws, outer surface sparsely hirsute to glabrescent. Style straight, slender, 1.7 - 2.0 cm long, yellow. Pollen presenter cylindric to narrowly ellipsoid 1.5 - 2.0 mm long; stigmatic groove terminal.

Hypogynous scales linear-subulate, 1.0 mm long, hyaline.

Diagnostic Characters: L. tomentosum is the only erect species in the section Leucospermum which has a persistent rootstock. Its small, cartilaginous, tightly imbricate involucral bracts, shortly tomentose on the outer surface, and linear canaliculate leaves distinguish it from other related species.

Thunberg was apparently the first to observe, collect and describe this species, probably on his first journey northwards. On the 7th of September 1772, after having left Jan Besis Kraal (the present day Milnerton, a suburb of Cape Town) he notes that :

> "all over the sandy fields the protea hypophylla was seen creeping and procumbent, with its leaves standing erect on each side of it. Near Eland's Fontain a plant of this species was standing upright like a bush, much resembling the former, but with broader leaves".

The upright plant which Thunberg refers to is clearly L. tomentosum. Thunberg describes the leaves of Protea tomentosa as "linearia". For this reason, the material mounted on the sheet labelled Protea tomentosa β in Thunberg's herbarium has been selected as the lectotype since it has linear leaves and matches his description perfectly. Sheet no. 2991 labelled Protea tomentosa α in Thunberg's handwriting cannot possibly be the type as it has oval -oblong leaves.

Distribution and Ecology: The most southerly populations of L. tomentosum occur at Bok Bay and the most northerly on the sandy flats between Hopefield and Vredenburg.

L. tomentosum is a species characteristic of the "sandveld" along the Atlantic coastline. Apart from an exceptionally isolated population at Mud River ($\pm$ 6 miles from the coast), this species seldom occurs further inland than 3 miles from the coast. The entire area receives a rather low winter rainfall of 10 - 15" p.a. The plants tend to be widely scattered on bare sandy areas in between large clumps of Restionaceae, Passerina and Metalasia. An erect to suberect growth habit is developed but as the plants age they usually form low spreading mats 1 - 3 metres in diam. and 0.75 metres tall. L. tomentosum is a fairly fire resistent species. Regeneration takes place from underground stems. The lowermost branches of the adult plants droop onto the soil and soon become buried in the sand, several inches below the surface with the terminal leafy shoots projecting above the soil. From these stout

underground stems covered with corky bark, new roots regenerate when the aerial parts of the plant have been burnt off. Flowering takes place between June and November. The bright yellow inflorescences are very sweetly scented.

Specimens Examined:

CAPE

MALMESBURY: 2 miles from the coast at Ysterfontein on Darling Road, Aug., Garside 4773 (K); In arenosis Groenkloof, Oct., Pappe s.n. (SAM 19607); 1 mile east of Ysterfontein, Aug., H. Hall 944 (NBG); Darling, Dec., Pole Evans s.n. (SAM 51334); Groenkloof, 500 ft. 23/9/1827, Drège 1468 (P); Zonquasfontein 12.5 miles from Darling, June, Boucher 77 (STE); 4 miles east of Ysterfontein, Aug., Salter 6227 (BOL, BM, NY); Sandy flats near Ysterfontein, Feb., Acocks and Hafstrom 2112 (PRE); Mamre, June, Acocks 14521 (PRE); Ysterfontein, Dec., Pole Evans 4384 (PRE, NBG, K); Aug., Marloth 4035 (PRE); Aug., Gillet 3120 (BOL); Sandy flats between Darling and Ysterfontein near Versveld reserve Sept., Rourke 15 (BOL, NBG); Sandy flats near the farm Geelbek, Sept., Rourke 16 (BOL, NBG); Half a mile along the Donkergat road from Ysterfontein, Aug., Williams 837 (NBG); Blombosfontein, north of Ysterfontein, Sept., Rourke 586 (NBG); On the farm Jacobus Kraal, 14 miles south of Darling, Aug., Rourke 1054 (NBG); Near Leerbaai, about 2 miles north of Bokbaai, Sept., Rourke 1113 (NBG); Geelbek, Aug., Compton 19888 (NBG); Geelbek road, Sept., Compton 24386 (NBG); Between Pampoen Vlei and Mud River near Darling, Sept., Rourke 1093 (NBG); Between Ysterfontein and Darling, Aug., Barker 389 (NBG); Buffelsrivier, strandveld near Bokbaai, Oct., H.C. Taylor 4153 (PRE); Bokbaai, coastal macchia, H.C. Taylor 5012 (PRE); Bok Point, Sept., Compton 9383 (NBG); Bok Bay, Sept., Compton 6775 (NBG); Swartwater farm, 8 miles N.W. of Darling, Sept., Rourke 1205 (NBG).

HOPEFIELD: In arenosis prope Hopefield, Sept., Schlechter 5300 (Z); Hopefield, Oct., Marloth 11540 (STE, PRE); Between Vredenburg and Hopefield, Sept., Hutchinson 304 (PRE, K, BM, BOL, GRA); Sandy flats between Hopefield and Vredenburg, Oct., Pillans 6993 (BOL); Between Hopefield and fossil site, Oct., Middelmann 1 (NBG); 3 miles west of Hopefield, Nov., H. Hall 857 (NBG); Sandy flats at Saldanha Bay, 200 ft., 26/9/1828, Drège 1470c (P); Grootfontein, vicinity of Hopefield, Sept., 1886, Bachmann 1298 (Z); Near Theefontein, vicinity of Hopefield, Sept. 1887, Bachmann 2132 (Z).

WITHOUT PRECISE LOCALITY: Cap. b. spei, Niven 50 in herb. J.E. Smith (LINN); "Erect shrub 4 or 5 feet high, sandy plains everywhere" Niven s.n. (K); Cap. b. spei, Thunberg s.n., sheet no. 2992 in herb. Thunberg (UPS); Cap. b. spei Ekeberg s.n. in herb. Bergius (SBT).

LOCALITY DOUBTFUL: Swellendam, Oct., Pappe s.n. (SAM 19634); H. Holland, Oct., Nov., Verreaux anno 1831, (G).

Fig. 40. Part of the rootstock of Leucospermum tomentosum (Thunb.) R. Br. showing the development of new shoots (from Rourke 1113).

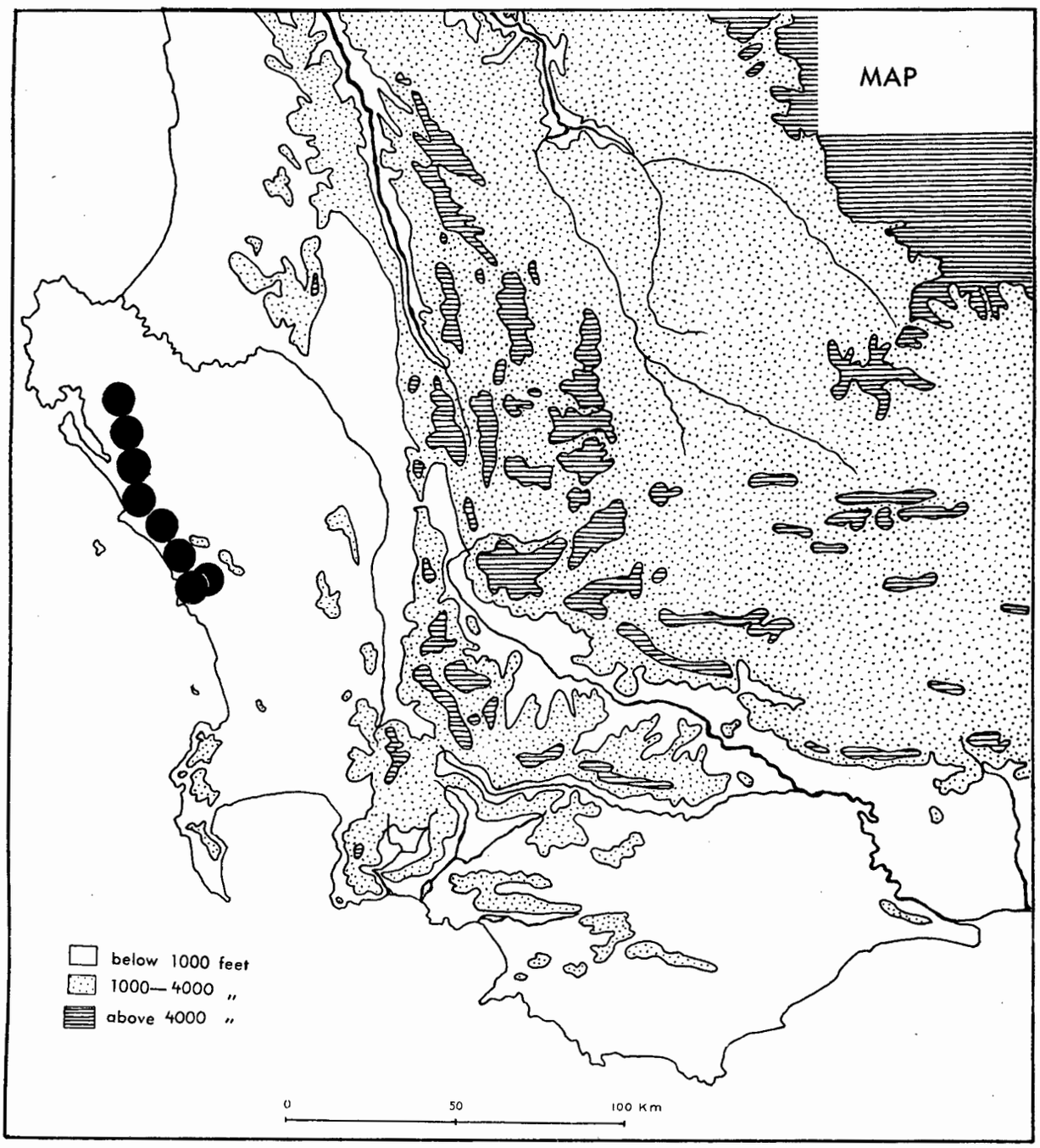


Fig. 41. Distribution of Leucospermum tomentosum(Thunb.)R.Br.

(30) Leucospermum rodolentum (Salisb. ex Knight) Rourke in Jl S. Afr. Bot. 35 : 323 (1969).

Leucadendron rodolentum Salisb. ex Knight in Knight, Cult. Prot. : 58 (1809). Iconotype: Andr., Bot. Repos. : t 294 (1803).

Protea candicans Andr., Bot. Repos. : t. 294 (1803), - non Thunb. (1800).

Leucospermum candicans (Andr.) Sweet in Sweet, Hort. Suburb. Lond. : 21 (1818); Loudon, Encycl. of Plants ed 1 : 82 (1829); Phillips and Stapf in Fl. Cap. 5 628 (1912).

Erect to spreading shrubs, to 3.0 m in height, 4.0 m in diam.; with a single main stem at base; trunk 8.0 - 14.0 cm in diam., bark smooth, grey. Flowering stems erect, ascending 5.0 - 7.0 mm in diam., covered with a dense grey indumentum of fine crisped hairs. Leaves elliptic to cuneate 0.7 - 1.5 cm wide, 4.0 - 6.5 cm long, obtuse or attenuate at base; canescent, covered with a fine, dense indumentum of short, crisped hairs; apex 3 - 6 dentate, truncate or rounded. Inflorescences globose, 3.0 - 3.5 cm in diam.; sessile to pedunculate, peduncle 5.0 mm long; 2, 3 or 4 nate, seldom solitary. Involucral receptacle broadly conic depressed, 1.0 cm long 0.7 cm wide. Involucral bracts ovate acute 5.0 - 7.0 mm long, 2.0 - 3.0 mm wide, tightly imbricate, cartilaginous, cinereous. Bracteoles narrowly lanceolate acuminate, 2.0 cm long, 2.0 mm wide, clasping the perianth, thickly lanate proximally, apex puberulous, carmine, margins ciliate. Perianth straight and cylindric in bud, 1.5 - 2.5 cm long, deep yellow, limbs tinged with green in bud. Perianth tube 5.0 mm long, hyaline, cylindric, glabrous. Perianth claws recurved in the upper half, the 3 adaxial claws glabrescent, margins thinly sericeous; abaxial claw thinly sericeous. Perianth limbs lanceolate acute, 3.0 mm long 1.0 mm wide, very sparsely sericeous. Style straight, 1.5 - 2.5 cm long, tapering subterminally, occasionally very slightly abaxially arcuate. Pollen presenter clavate to cylindric-obtuse, 2.0 mm long, stigmatic groove terminal. Hypogynous scales subulate, 1.0 mm long, hyaline.

Diagnostic Characters: L. rodolentum may be distinguished from related taxa by its tall, erect growth habit (to 3.0 m) and its

very densely canescent, elliptic to cuneate leaves 0.7 - 1.5 cm broad.

The earliest known account of this species was published by Andrews. This was based on living specimens that had flowered in Hibbert's conservatory at Clapham, in 1802 and had probably been raised from seeds gathered by Masson. As the name Protea candicans Andr. is a later homonym of P. candicans Thunb., the new name "rodolentum" proposed by Salisbury has been adopted.

Distribution and Ecology: Apart from an outlying population south of Brandvlei, the main area of distribution extends from Darling, Northwards, through the districts of Hopefield, Piketberg, and Clanwilliam. The most northerly populations are found on the Heerenlogementberg and the Nardouw Pass. In 1966 Mrs. E. Powrie discovered a single plant surviving on a relict area of veld between Brakenfell and Kraaifontein, about 12 miles east of Cape Town and in August 1884, Marloth collected specimens near Salt River, even closer to Cape Town. However, this species must now be considered extinct in both these localities due to urban expansion.

L. rodolentum is a prominent species in Western Cape coastal "sandveld." It is frequent on level sandy flats, usually growing in association with Leucadendron pubescens, Willendowia sp., and other Restionaceae. Most populations are found between sea level and 800 ft., very few having been recorded above 1,000 ft. The edaphic requirements of this species are very specific in that it occurs only on loose surface deposits of sand (very often stabilised drift sand), that are of Tertiary or recent origin. The entire distribution range falls closely within the 15 - 20" isohyet, although at most localities the mean annual rainfall seldom exceeds 15" p.a. Flowering takes place from August to November when the bright yellow, very sweetly scented inflorescences are produced.

Specimens Examined:

CAPE

VAN RHYNSDORP: Among hills south of Heerenlogementberg, Aug., Rourke 1064 (NBG).

CLANWILLIAM: Zeekoe vlei, Sept., Schlechter 8579 (NBG, S, G, GRA, BOL, Z, BR, PRE, PH, K, BM); Grey's Pass, Sept., Marloth 2736 (PRE); Nardouw Pass, Sept., Salter 3616 (BOL, K, BM); Oliphants

river valley, opposite warm baths, Sept., Stephens 6920 (BOL, K); Between Citrusdal and Keerom, Dec., Esterhuysen 17944 (BOL); Zeekoe vlei, Aug., Compton 4343 (BOL, NBG); One mile north of Keerom, Nov., Pillans 8695 (BOL); Zeekoe vlei, Oct., Levyns 1203 (CT); Near Modderfontein, Aug., Schlechter 4973 (Z); Five miles west of Clanwilliam on Lamberts bay road, July, Lewis 2592 (SAM); Nardouw Pass, Sept., Lewis 2593 (SAM); Zandberg, Langvlei, 500 ft., 17/7/1830 Drège 1468c (P); Sandy flats at Oliphants river, 27/11/1828, Drège 1468a (P); Four miles north of Paleisheuvel, Sept., Hall 1009 (NBG); Eight miles south of Clanwilliam, July, Booysen 28 (NBG); Ten miles N.E. of Clanwilliam, April, Booysen 4 (NBG); Boekenberg north of Paleisheuvel, July, Williams 812 (NBG); Nardouw Pass, Aug. Rourke 1074 (NBG); Between Paleisheuvel & Leipoldtville, Oct., Werdermann & Oberdieck 480 (K, PRE); Along the Clanwilliam-Citrusdal Rd., July, van Breda 1626 (PRE, K).

PIKETBERG: A few miles west of Sauer, Sept., Wilman 866 (PRE); Three miles west by north of Sauer, Acocks 14530 (PRE); Sandy soil east of the base of Bokloof, Oct., Pillans 7821 (BOL); Between Sauer and Velddrif, June, Horrocks 178 (NBG); Mountains above Aurora, Nov., Williams 1361 (NBG); Het Kruis, Sept., Compton 15024 (NBG); Between Aurora and Velddrif, Aug., Rycroft 2127 (NBG); Near Aurora, Aug., Rourke 1058 (NBG); Het Kruis, Dec., Grobler 48 (STE).

HOPEFIELD: Elandsfontein, Hopefield, Jordaan T 1254 (STE); In arenosis prope Hopefield, Sept., Bolus 12816 (PRE, BOL, GRA, NH); One mile from Hopefield, Clarkson 373 (NU); In arenosis Hopefield, Nov., Schlechter 5313 (GRA, BOL, Z); Between Darling and Hopefield, Sept., Hutchinson 256 (K, BOL, PRE); Road to Saldanha bay near Hopefield, Oct. 1885, Bachmann 1299 (Z); Vicinity of Hopefield, Matjiesfontein and Hazenkraal, Sept. 1886, Bachmann 1300 (Z); Hopefield, Aug., Hall 748 (NBG); Hopefield, Sept., Compton 15968 (NBG); Veld near Hopefield, Oct., Garside 1605 (K).

MALMESBURY: Darling, sandy flats, Sept., H.C. Taylor 1544 (NBG, BOL); Near Darling, Sept., Levyns 3258 (CT); Between Darling and Hopefield, July, Gill 37 (NBG); Near Darling, Aug., Compton 7794 (NBG); Near Groen River, about 7 miles N.W. of Darling, Aug., Rourke 1056 (NBG).

WORCESTER: De Grip, Sept., Walters 1016 (PRE); Moordkuil, April,

van Rensburg 176 (STE); Kweek Kraal, S.W. of Worcester, Oct., Hardy & Bayliss 1017 (PRE, STE, K); Brandvlei, Jan., Schlechter 9921 (K, BM, PRE, PH, BOL, BR, Z, G, S); Near Brandvlei, Stokoe 1196 (PRE); Spes Bona, between Worcester & Villiersdorp, Jan., Compton 1665 (BOL, NBG); Between Worcester and Stettyn, Sept., Rycroft 1731 (NBG); Moordkuil, a few miles south of Brandvlei, Sept., Rourke 1119 (NBG).

BELVILLE: South of old national rd., between Brakenfell and Kraaifontein, Aug., & June, Powrie 16, 26 (NBG); Cape flats near Salt River, Aug., Marloth 157 (SAM, PRE).

WITHOUT PRECISE LOCALITY: Cape, "Sandy places everywhere", Niven 50 (PH); Cape of Good Hope, Thunberg s.n. in herb. Bergius (SBT); Cape of Good Hope, Thunberg s.n., sheet 2991 in herb. Thunberg (UPS).

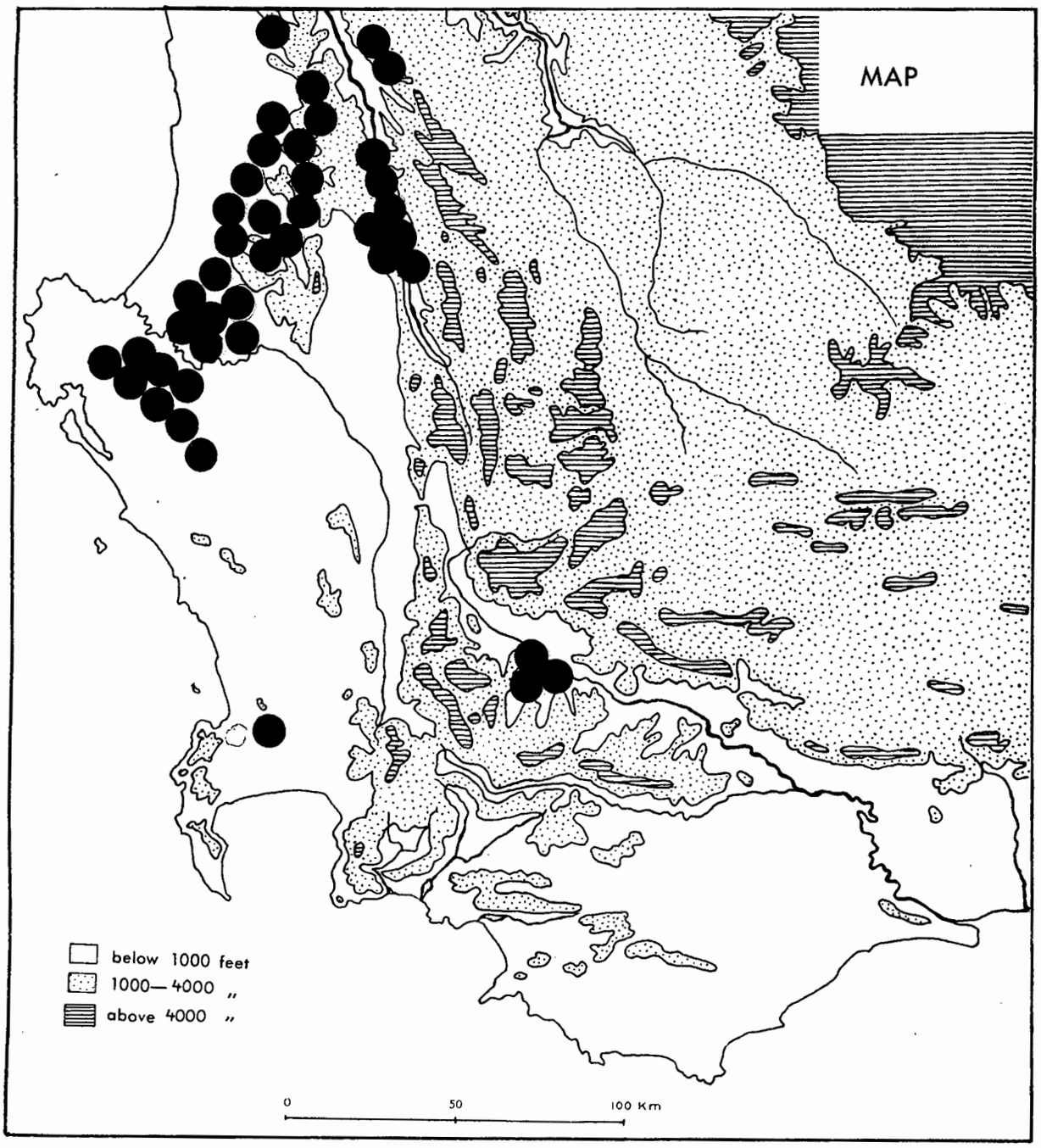


Fig. 42. Distribution of

Leucospermum rodolentum(Salisb. ex Knight)Rourke

(31) Leucospermum parile (Salisb. ex Knight) Sweet in Sweet, Hortus Suburbanus Londinensis : 21 (1818); Phillips in Fl. Cap. 5 : 628 (1912)

Leucadendrum parile Salisb. ex Knight in Knight, Cult. Prot. : 57 (1809). Type: "Sandy plains near Paardeberg. Hibbert's garden Parile m.s. June 1805", Niven s.n., holotype in herb. R.A. Salisbury (K).

Leucospermum dregei Phillips in Kew Bull. 1910 : 331 (1910) - nom superfl.

An erect to semi-erect rounded shrub, to 1.5 m in height, with a single stout main stem; lower branches often spreading along the ground. Flowering stems erect, terete, villous. Leaves loosely ascending-imbricate; linear to oblong-linear, 4.0 - 6.0 cm long, 6.0 - 8.0 mm broad; covered with a [illegible], dense, canescent indumentum of short crisped hairs; apex entire or up to 3 toothed. Inflorescences globose to depressed globose, 3.0 - 3.5 cm in diam. sessile to subsessile; occasionally solitary, usually with two to six inflorescences clustered in the axils of the uppermost leaves of the flowering stem. Involucral receptacle broadly conical to conical-depressed, acute, 1.4 cm long, 1.0 cm wide. Involucral bracts glabrous to glabrescent, ovate-acuminate, the acuminate apex patent to subsquarrose; paleaceous to papyraceous in texture, margins occasionally ciliate and the apex shortly crinite. Bracts 1.0 cm long, 0.5 cm wide. Bracteoles lanceolate-acuminate, 1.0 cm long, 0.3 cm wide, lanate proximally on outer surface, glabrous distally, apex crinite. Perianth straight at anthesis 1.5 - 2.0 cm long, yellow. Perianth tube glabrous, cylindric, slightly compressed laterally 4.0 mm long. Perianth claws 0.9 - 1.2 cm long, the median posticous claw glabrous, the anticous claw and margins of the two lateral posticous claws pubescent. Perianth limbs narrowly-lanceolate, 4.0 mm long; the posticous limb glabrous the three anticous limbs sparsely sericeous. Style straight 1.5 - 2.0 cm long. Hypogynous scales 1.5 mm long, hyaline, subulate.

Diagnostic Characters: Among the species of the section Leucospermum with linear-oblong leaves and an erect growth habit, L. parile is distinguished by its slightly patent to subsquarrose paleaceaous to papyraceous involucral bracts, reddish brown in colour and glabrous to glabrescent on the outer surface.

A specimen in the British Museum collected by Francis Masson is probably the first recorded collection of L. parile. There is a strong possibility that Masson dispatched seeds as well as herbarium material to England since both Sweet (1818 : 21) and Loudon (1829 : 82) in their horticultural textbooks record that this species was introduced into England in 1789. Further evidence that it was cultivated in England comes from a note in R.A. Salisbury's handwriting on the type specimen at Kew, reading: "Hibbert's garden Parile ms June 1805". It was raised from seed collected by Niven on the "sandy plains near Paardeberg" (Malmesbury) at which locality it may still be found growing today.

Distribution and Ecology: L. parile is endemic to the Malmesbury district where it occurs within a relatively small area bounded by Mamre Road station (Klipfontein farm) and Abbotsdale in the north, Kalabaskraal in the south and Dassenberg in the west.

This species grows on sandy flats in the Malmesbury "sandveld" at elevations of 100 - 500 ft., in an area receiving a winter rainfall of 15 - 20" p.a. It grows exclusively on white, fairly fine grained sandy soils which are almost completely devoid of organic matter. This soil type is Tertiary to recent in age and supports a typical "sandveld" vegetation cover consisting mainly of low, tufted Restionaceae, Passerina sp., Serruria sp., Cryptadenia sp. and various Ericaceae. At Katzenberg and Burgher's Post, large dense colonies of L. parile still survive but at most other places the populations have been destroyed by agricultural development and the species only survives on uncultivated road verges. The rich yellow, highly perfumed inflorescences are produced between July and November.

Specimens Examined:

CAPE

MALMESBURY: In arenosis depressis prope Groenekloof, Oct., Bolus 4324 (BOL, BM, K); N.E. base of Dassenberg, Sept., Pillans 6872 & 6873 (BOL); Flats south of Mamre, Aug., Salter 3572 (BM); Dassenberg, 400 ft., 19/9/1828, Drège 1468a (P); Groenekloof, Klipberg, 500 ft., 23/9/1827, Drège 1468b (P); Between Groenekloof and Kalabaskraal, 500 ft., 28/7/1827, Drège 1468c (P); Green river near Malmesbury, Aug., Levyns 2644 (CT); Mamre road, Oct., Wasserfall 1012 (PRE, K); Kalabaskraal, Oct., Herre s.n. (STE 26757); Between Groenekloof and Dassenberg, Drège s.n. (NY, PRE, SAM, K); Burghers Post farm, Aug., Rourke 503 (NBG); Sandy flats between Katzenberg and Dassenberg, Oct., Rourke 934 (NBG); A few miles west of Kalabaskraal, Aug., Rourke 1055 (NBG);

Abbotsdale, about 2 miles S.W. of Malmesbury, Aug., Rourke 1078 (NBG); Mamre Road, July, Barker 5373 (NBG, BOL); Mamre Road, Aug., Compton 19866 (NBG); At the roadside between Mamre Road station and Malmesbury, Sept., Gill 12 (NBG); Roadside near Mamre, Aug., Garside 4439 (K); Sandy plains near Paardeberg, Hibbert's garden, June, Niven s.n. (K); Mamre, Dec., Pole Evans 4383 (PRE); 30 miles from Cape Town on the Darling Road, Dec., Acocks & Hafstrom 2111(PRE).

WITHOUT PRECISE LOCALITY: Cape of Good Hope anno 1831, Jules Verreaux s.n. (G); Prom. bon. spei, Masson s.n. (BM).

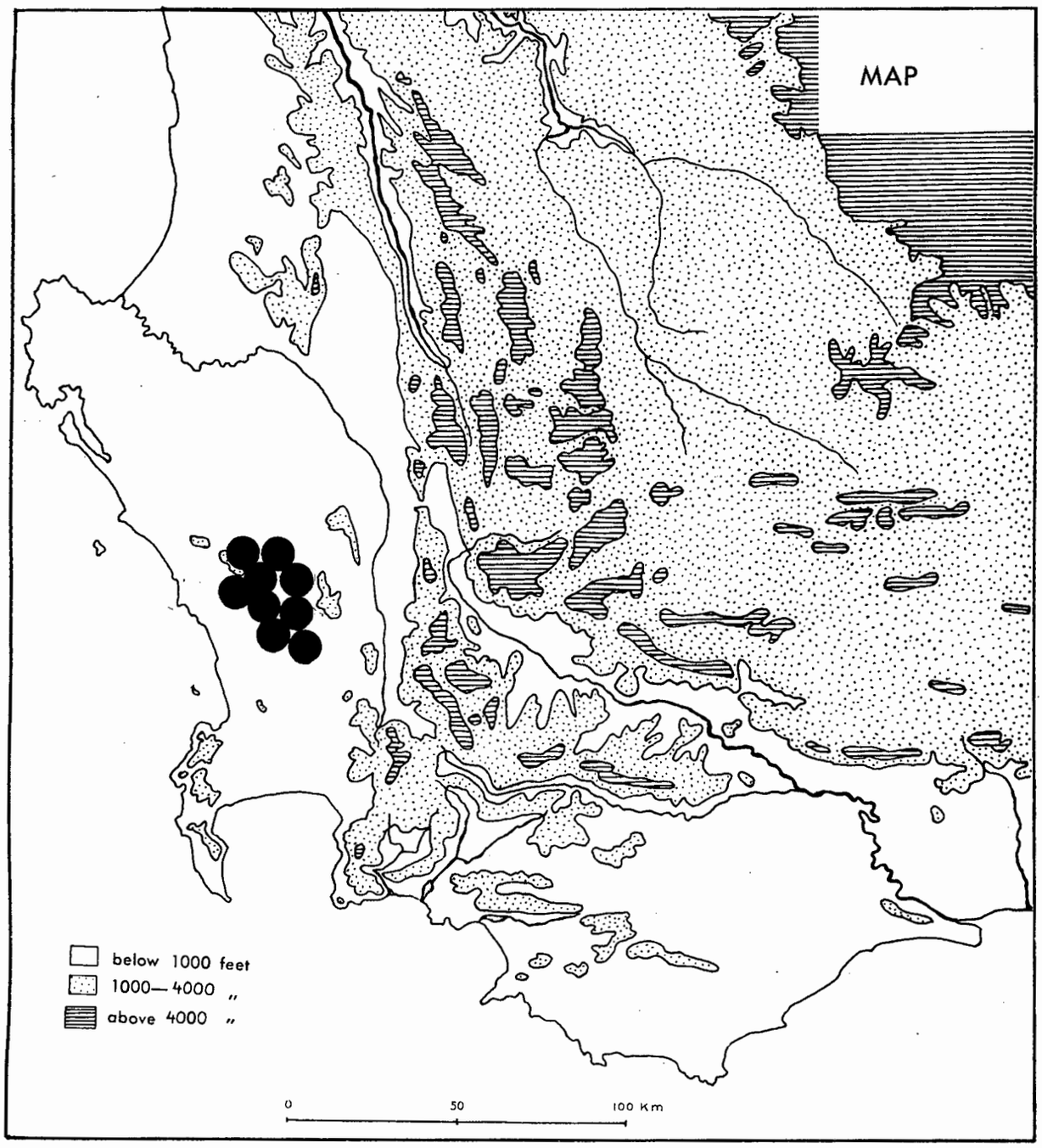


Fig. 43. Distribution of

Leucospermum parile(Salisb. ex Knight)Sweet

(32) Leucospermum arenarium Rycroft in Jl. S. Afr. Bot. 25 : 247 (1959). Type: Between Redelinghuis and Aurora, Rycroft 2125 (Holotype NBG, isotypes PRE, K).

A low spreading shrub to 0.75 m in height, 1.0 - 1.5 m in diam., with a single main stem at base, trunk 4.0 - 5.0 cm in diam., bark smooth, grey. Flowering stems lax, drooping, or arching onto the ground, sometimes trailing. Leaves secund on flowering stems; narrowly oblong-linear, 6.0 - 8.0 cm long, 0.7 cm wide, rather loosely spaced, usually entire, rarely with 2 or 3 teeth, slightly attenuated and twisted towards base; covered with a dense grey indumentum of fine crisped hairs. Inflorescences depressed globose, 5.0 - 7.0 cm in diam., pedunculate to sub-sessile, usually solitary, occasionally in pairs; peduncle when present 1.0 - 4.0 cm long. Involucral receptacle broadly conic depressed, 1.5 cm long, 1.5 cm broad. Involucral bracts ovate acuminate, 8.0 - 10.0 mm long, 6.0 mm broad, membranous, minutely puberulous to glabrescent; apices somewhat recurved, margins minutely ciliate; bracts reddish-carmine when fresh. Bracteoles oblanceolate, abruptly acuminate, 12.0 mm long, 4.0 mm broad, cartilaginous; base very densely lanate, the apex acuminate, shortly sericeous. Perianth 2.0 - 2.5 cm long, very strongly adaxially curved in bud. Perianth tube 7.0 mm long, cylindric, glabrous proximally becoming pilose distally. Perianth claws puberulous to sparsely villous, the median adaxial claw glabrous; the adaxial claws becoming strongly coiled in a sigmoid manner. Perianth limbs linear to narrowly lanceolate, acute, 4.0 mm long, villous. Anthers sessile, narrowly lanceolate linear, acute, apical boss, pointed, yellow. Style 3.0 - 3.5 cm long, strongly incurved, tapering towards the apex; pale ivory to yellowish green. Pollen presenter 2.5 mm long, 0.5 mm in diam., cylindric acute, greenish towards apex; stigmatic groove terminal. Hypogynous scales subulate, hyaline.

Diagnostic Characters: The long, incurved, sigmoid styles (3.0 - 3.5 cm), the large inflorescences (5.0 - 7.0 cm in diam.), the membranous involucral bracts with recurved acuminate apices and the sprawling, sub-erect growth habit, distinguish L. arenarium from the other species in the section Leucospermum.

Mrs. M.L. Thomas made the first recorded collection of L. arenarium in August 1958. Few subsequent collections have been made, probably on account of its inconspicuousness and the rather isolated locality in which this species grows.

Distribution, Ecology and Biology: L. arenarium is restricted to the Piketberg district where it occurs on a sandy, level plain between Klein Tafelberg and Mierberg (situated more or less midway between the towns of Aurora and Redelinghuis), and appears to be confined to the farms Langefontein and Driefontein.

The entire area is at an elevation of between 400 and 500 ft. above sea level. The plants occur as rather widely scattered individuals in deep white sandy soil, Tertiary in age. They are seen interspersed among large tufts of Willdenowia lucaeana, Rhus rosmarinifolia, Griesebachia sp., Leucadendron pubescens and Serruria fucifolia, which comprise the associated vegetation. A rather low winter rainfall of 10 - 15" p.a. is experienced throughout this area.

The growth habit of L. arenarium is very unusual in that two main branch systems can be distinguished. There is an erect system with stiff short shoots covered with loosely imbricate ascending leaves. From these branches, long looping stems arise which droop onto the ground and bear secundly arranged leaves. The inflorescences are borne at the ends of these drooping branches and are often half buried in the sandy soil.

Although all the collections of flowering material that are known were made in August, it is clear from the faded inflorescences and new buds on living plants that flowering commences in July and probably continues until October. A pale ivory-cream shade is the normal colour of the style and perianth but a form with a deep golden yellow perianth has been observed. In both forms the style becomes tinted pinkish-carmine during the fruiting stage.

Specimens Examined:

CAPE

PIKETBERG: Between Redelinghuis and Aurora, Aug., Rycroft 2125 (NBG, PRE, K); Between Redelinghuis and Aurora, Aug., M.L. Thomas s.n. (NBG, PRE, K); Six miles south of Redelinghuis on the road to Aurora, Aug., Barker 9724 (NBG); Between Aurora and Redelinghuis, Aug., Williams 839 (NBG); On the farm Driefontein 3 miles south of Redelinghuis, Aug., Rourke 1080 (NBG); Aurora road, 39 miles from Piketberg, Aug., Thompson 788 (STE, NBG).

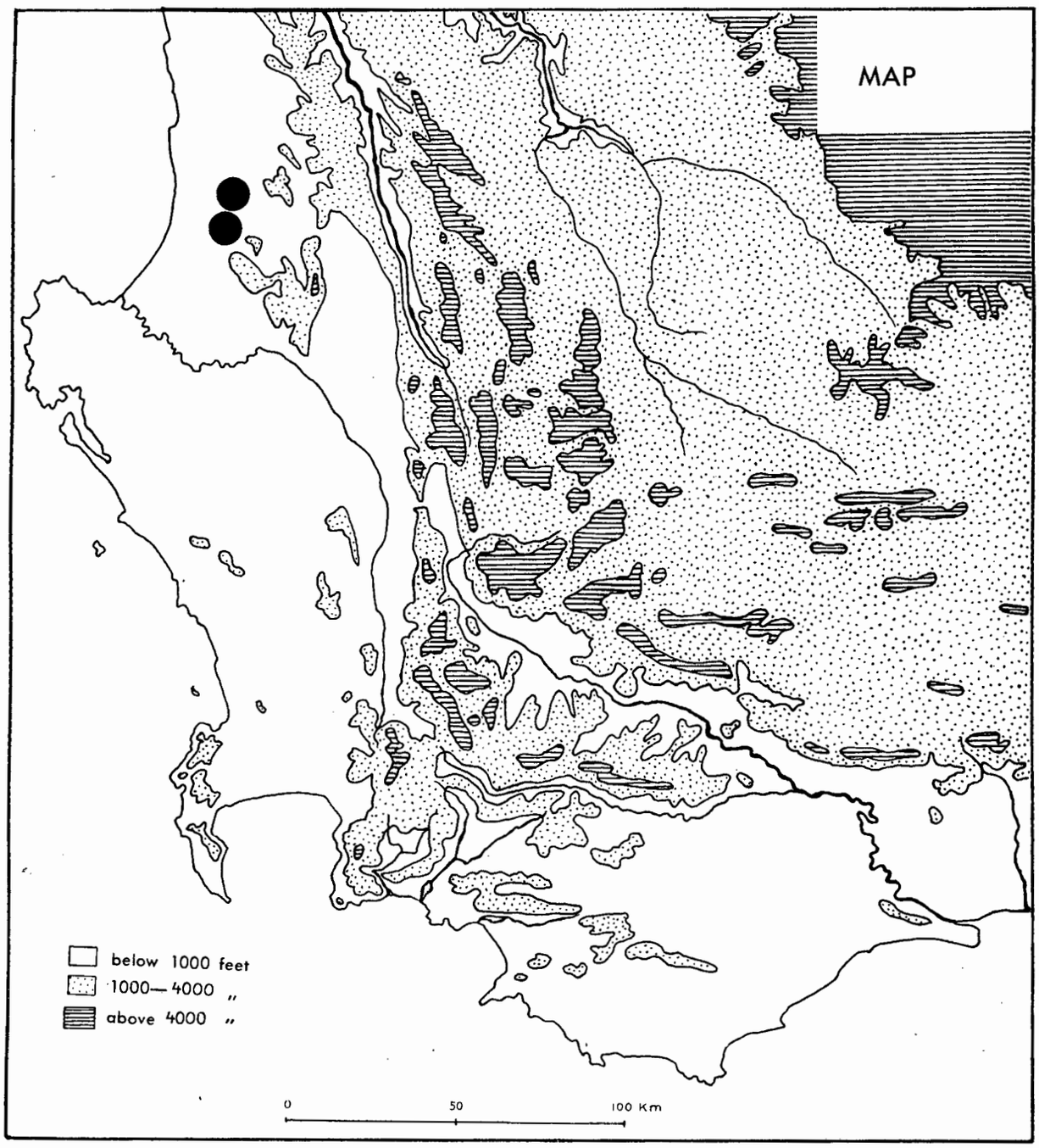


Fig. 44. Distribution of Leucospermum arenarium Rycroft

Sect. DIASTELLOIDEA Phillips

Erect, sprawling or decumbent shrubs. Leaves entire, very rarely with teeth at apex. Inflorescences small, globose, 1.0 - 3.0 cm in diam., in groups of 2 - 6. Style 1.0 - 2.5 cm long. Pollen presenter conic-ovoid, cylindric, or clavate. Perianth colour varying with age, creamy white to pink, or yellow to orange.

Lectotype: L. calligerum (Salisb. ex Knight) Rourke

Difficulty has been experienced in distinguishing certain species within this section, particularly between L. calligerum and L. wittebergense. Compton (1931) separated L. wittebergense from L. calligerum because of its smaller leaves and inflorescences and cylindric pollen presenter. It was thought to be endemic to the Witteberg. L. calligerum however, is a widespread and very variable species in which the pollen presenter is conic-ovoid. Thus the only significant morphological character separating the two species is the form of the pollen presenter.

Style length (as a measure of inflorescence size) correlated with the form of the pollen presenter appeared to provide a reliable method of evaluating the distinctness of the two species. The style lengths in 40 herbarium specimens with conic pollen presenters and 40 specimens with cylindric pollen presenters were measured on specimens in BOL, NBG, SAM, K and CT, and were plotted as histograms (Fig. 45). In specimens with a cylindric pollen presenter there is a fairly wide range in style length while the range is considerably less in material with conic-ovoid pollen presenters but there is no overlap between the two ranges. Therefore, style length when correlated with the form of the pollen presenter suggests that L. wittebergense is specifically distinct. Moreover it was found that L. wittebergense is not confined to the Witteberg but that the populations which occur along the Swartberg and adjacent mountain peaks in the Little Karoo should be referred to L. wittebergense and not L. calligerum as they are characterised by cylindric pollen presenters and significantly shorter styles.

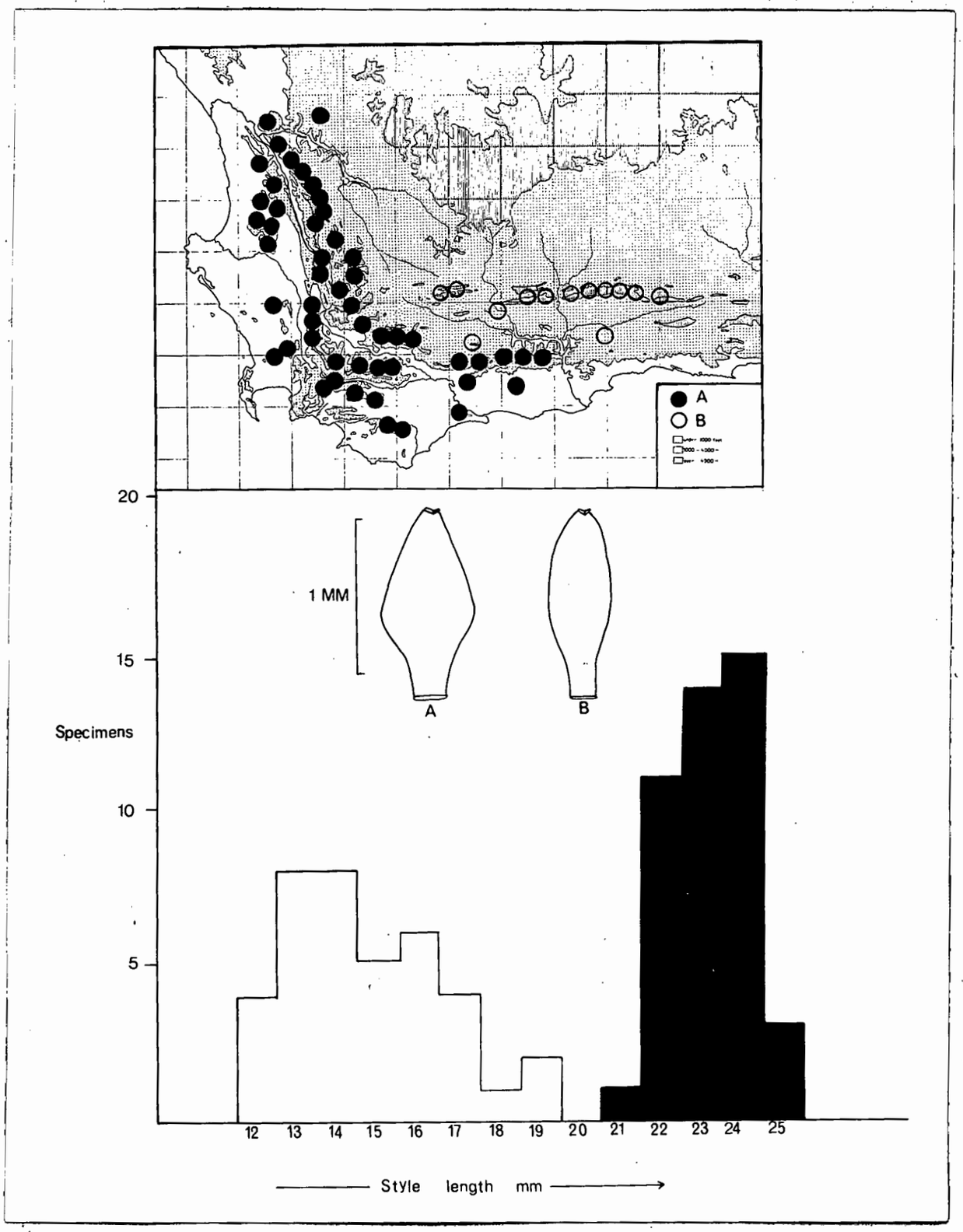


Fig. 45. Distribution of Leucospermum calligerum (Salisb. ex Knight) Rourke and L. wittebergense Compton, showing variation in style length and differences in the form of the pollen presenters. The solid circles and pollen presenter outline (A) represent L. calligerum and the open circles and pollen presenter outline (B) represent L. wittebergense. The unshaded histogram (left) shows variation in the style length of L. wittebergense while the shaded histogram (right) shows variation in style length in L. calligerum.

(33) Leucospermum calligerum (Salisb. ex Knight) Rourke in Jl S. Afr. Bot. 35 : 323 (1969).

Leucadendrum calligerum Salisb. ex Knight in Knight, Cult. Prot. : 60 (1809). Type: Dry Places, Twenty-four Rivers, Niven 41, holotype in herb. Salisbury (K), isotype in herb. J.E. Smith (LINN).

Protea pubera L., Mant. Alt. : 192 (1771), - nom. supfl. Type: Sheet no. 116 37 (LINN).

Leucadendrum puberum (L.) Salisb. ex Knight in Knight, Cult. Prot. : 61 (1809).

Leucospermum puberum (L.) R. Br. in Trans. Linn. Soc. Lond. 10 : 100 (1810); Phillips & Stapf in Fl. Cap. 5 : 634 (1912).

Leucodendron puberum (L.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Leucadendrum xeranthemifolium Salisb. ex Knight in Knight, Cult. Prot. : 60 (1809); Phillips & Stapf in Fl. Cap. 5 : 639 (1912) Type: Elevated places at Jackall Flyberg, Niven s.n., not traced. (i.e. Jackalsvlei mts., Clanwilliam.)

Leucadendrum gnaphaliifolium Salisb. ex Knight in Knight, Cult. Prot. : 60 (1809); Phillips & Stapf in Fl. Cap. 5 : 638 (1912). Type: "Low dry situations" without collector or locality, not traced.

An erect to suberect shrub to 2.0 m in height, 3.0 m in diam., the lowermost branches often sprawling; with a single main stem at base. Flowering stems erect 3.0 - 5.0 mm in diam., covered with a dense indumentum of fine crisped hairs interspersed with straight patent trichomes. Leaves sessile, lanceolate to elliptic, acute, 1.2 - 3.6 cm long 4.0 - 8.0 mm wide, apex entire very rarely 2 or 3 dentate; loosely ascending imbricate; dull grey to olivaceous, occasionally canescent, permanently villous. Inflorescences globose, 2.0 - 3.5 cm in diam., rarely solitary, usually 2 - 6 nate; subsessile to pedunculate, peduncle to 3.0 cm long. Involucral receptacle shortly conic-depressed, 3.0 mm long, 3.0 mm wide. Involucral bracts lanceolate, acute to acuminate, 5.0 - 7.0 mm long, 2.0 - 3.0 mm wide, cartilaginous,

imbricate; apices recurved, crinite and cinereous; outer surface tomentose. Bracteoles oblanceolate acuminate, 5.0 - 7.0 mm long, cartilaginous, apex crinite, outer surface densely lanate. Perianth 1.5 - 1.7 cm long, straight in bud, pale cream, flushed with dull carmine. Perianth tube 5.0 mm long, very slightly quadrangular, glabrous. Perianth claws villous, equally recurved subterminally on opening. Perianth limbs lanceolate acute, 1.5 mm long, beset with long, straight, silky trichomes. Style 2.1 - 2.5 cm long, tapering subterminally, slightly adaxially arcuate on opening, straightening at maturity; yellow at first becoming dull carmine. Pollen presenter conic-ovoid, 1.0 mm long, yellow stigmatic groove terminal. Hypogynous scales 2.0 mm long, subulate.

Diagnostic Characters: L. calligerum is distinguished from related taxa by its erect growth habit, permanently pubescent entire leaves; the style, 2.1 - 2.5 cm long, and the conic ovoid pollen presenter.

Material of L. calligerum reached Europe at a comparatively early stage for there are specimens in Burman's herbarium (G) collected by Oldenland, but it was not until 1771 that the species was described. Unfortunately, when Linnaeus published the original description in the Mantissa Altera, he cited Leucadendron oleaefolium Berg. as a synonym, thus rendering Protea pubera L. a superfluous name. Despite the recent relaxation of Article 63 of the International Code it is impossible to uphold Linnaeus' familiar epithet "pubera" since he neither excluded explicitly, nor by implication, the type of the name he ought to have adopted. (Stafleau, 1970 : 41-42). Of the three binomials, Leucadendrum calligerum, L. xeranthemifolium and L. gnaphaliifolium published simultaneously by Knight, only the type of L. calligerum has been traced, although it is quite evident from the descriptions of L. gnaphaliifolium and L. xeranthemifolium that all three are conspecific.

Distribution and Ecology: One of the most widely dispersed species in the genus, L. calligerum occurs throughout the South Western Cape from Lokenberg and the Gifberg in the north as far as Riversdale and Albertinia in the south east.

L. calligerum favours hot, dry, very well drained situations receiving a rather low winter rainfall of 10 - 20" p.a. Particularly noteworthy is the fact that this species never occurs where

the mean annual rainfall exceeds 30". Apart from these conditions it appears to have no special ecological requirements. The habitats may vary from level sandy flats near the coast at elevations of about 500 ft. to steep rocky mountain slopes on inland ranges at 4,000 ft. Although most populations are found on Table Mountain Sandstone, they grow equally as well on weathered Cape Granite and Malmesbury Shale conglomerate at a few localities. Flowering takes place from July to January. On opening, the perianths and styles are creamy yellow but become flushed with dull carmine as they age. The inflorescences are generally sweetly scented.

Specimens Examined:

CAPE

CALVINIA: Lokenberg, 21 miles S. of Niewoudtville, Oct., Story 4354 (GRA); Lokenberg, Sept., Leistner 335 (PRE, NBG, K); Lokenberg, arid Fynbos, Aug., Acocks 17096 (PRE).

VAN RHYNSDORP: Heerenloggementsberg, Sept., H.C. Taylor 3924 (STE, PRE, NBG); Gifberg, Sept., Phillips 7386, 7416 (BOL); Gifberg, Oct., Esterhuysen 21986 (BOL, PRE); Gifberg, Sept., Compton 20781 (NBG); Tigerberg above Kobee Pass, Aug., Williams 1018 (NBG); Klaver, Nov., Austin Roberts s.n. sub PRE 25656 (PRE); Sandkraal, along western edge of Gifberg, July, van Breda 1612 (PRE); Gifberg, halfway up pass, Aug., Rourke 1063 (NBG).

CLANWILLIAM: Oliphants River valley near Modderfontein, Sept., Stephens 6936 (BOL, K); One mile S.E. of Keerom, Nov., Pillans 8753 (BOL, NBG); Western end of Elands Kloof, Lewis 3674 (SAM); Klein Kliphuis, Pakhuis Sept., Hardy 810 (PRE, BM, K); Foothills of Cedarberg near Algeria, Oct., Galpin 10522 (PRE, K); Berg fly Niven 42 (PH, BM, & in herb. Smith, LINN); Niewoudts Pass, Dec., Salter 5061 (K); Pakhuis Pass, Oct., Acocks 15042 (PRE, K); Biedouw at Pakhuis, 10/1/1831, Drège 476c (P); Bergvalei, at Zwartbastkraal, 10/7/1830, Drège 476 bb (P); Bergvlei, at Langvlei, 18/11/1828, Drège 476 b (P); At Uitkomst above Graafwater Sept., Acock 3019 (S); Hill behind homestead at Krommerivier, Cedarberg, Sept., Acock 3137 (S); Langvlei, July, Williams 818 (NBG); 4 miles north of Paleisheuvel, Sept., H. Hall 1007 (NBG); Biedouw, upper plateau, Middlemost 1893 (NBG); 6 miles south of Wuppertal, Aug., Rycroft 2256 (NBG); Pilaarsberg, north of Pakhuis Pass, Sept., Kerfoot 5914 (NBG); Matjiesrivier, Cedarberg Oct., Wagener 265 (NBG); Elands Kloof, Sept., Johnson 527 (NBG); Kromme River, Sept., Compton 5032 (NBG); Lambertshoekberg, Aug.,

Compton 5498 (BOL, NBG); Modderfontein, Clanwilliam, Sept., Compton 4286 (BOL, NBG); Krakadouw Heights, Oct., Pocock s.n. (BOL); Biedouw mts., near Pakhuis Pass, Nov., Thode A2135 (NH, K); Ezelbank, Oct., Thode A2065 (NH); Mountain Pass to Algeria, Sept., Story 2959 (GRA); Heuning Vlei, Oct., Pocock 571 (STE); Kardouw Pass, Oct., Hubbard 252 (STE); Blauwberg, Aug., Schlechter 8463 (BOL, Z, PRE, S, PH); Alexandershoek, Sept., Schlechter 5128 (STE, GRA, BOL, SAM, PRE, BR, S, K, BM, Z).

PIKETBERG: Kapiteins Kloof, Sept., Pillans 7705 (BOL, NBG); Summit and west edge of Sandberg, Piketberg, Oct., Pillans 8578 (BOL); Dry places Twenty-four rivers district, Niven 41 (K) and in herb. Smith (LINN); Bosch Kloof, Sept., Bond 539 (NBG); Between Redelinghuis and Aurora, Aug., Rycroft 2124 (NBG)

CERES: Michells Pass, Jan., Barnard s.n. sub SAM 44124 (SAM); Matroosberg near Laaken Vlei, Nov., Phillips 2129 (SAM); Visgat between the Schurfteberg and Great Winterhoek, Oct., Stokoe s.n. sub. SAM 63180 (SAM); Bokkeriver farms, Nov., Horrocks 137 (NBG); Zoo Ridge on Grootrivier rd., from Koue Bokkeveld to Cedarberg, Dec., H.C. Taylor 6127 (PRE); Katbakkies, Swartruggens range, Oct., Rourke 955 (NBG).

TULBAGH: Tulbagh Kloof, Oct., Andreae 660 (STE); Saron, Jan., Thode 4751 (STE); Tulbagh Kloof, Nov., Zeyher 1463 (SAM, PRE, STE, K, FI, NH, S); In lapidosis clivis, Nieuwekloof, Oct., MacOwan no. 779 in Herb. Norm. Austro. Afr. (BOL, SAM, Z, BM, K, G); Mountains around Tulbagh Kloof, Nov., Bolus 5233 (NH, BOL, BM, Z, K); Nieuwekloof, 18/10/1828, Drège 476a (P); On the Witzenberg near Tulbagh, 17th April 1811, Burchell 8726 (K).

WORCESTER: Bosjeveld mts., April, Andreae 337 (STE); Audensberg, Oct., Marloth 2437 (STE); Keeromsberg, Oct., H.C. Taylor 6453 (STE, PRE); Bonteberg, Eikenbosch Hoek, Nov., Esterhuysen 3704 (BOL); Keeromsberg, Nov., Esterhuysen 9240 (BOL); Bokkeriver, Sept., Levyns 942 (CT); Goudini Rd., Oct., Levyns 2826 (CT); Slanghoek, Oct., Rycroft 2355 (NBG); Bonteberg, Nov., Compton 9930 (NBG); Lower N. slopes of Jonaskop, Sept., Rycroft 2873 (NBG); Wildepaardeberg mts., top of Baviaanskloof, Stokoe 6567 (PRE); Vaalkloof, north slopes of Bonteberg, Aug., Marloth 9095 (PRE, NBG).

PAARL: Elands Kloof mts., north of Wellington, Oct., Stokoe s.n. sub. SAM 70038 (SAM); Olyvenbosch farm, near Wellington, Nov.,

Salter 1781 (BM, K).

BELLVILLE: Hercules Pillar, Oct., Compton 20152 (NBG); Joostenberg, Oct., Lewis 5904 (NBG); Between Volmoed and Hercules Pillar, Oct., Rourke 940 (NBG); Phisantekraal, Oct., Rourke 937 (NBG).

MALMESBURY: Kleinhoop, 2 miles S.W. of Malmesbury, Oct., Rourke 929 (NBG).

CALEDON: Zwartberg, Oct., Schlechter 5558 (PRE, STE, SAM, BR, Z, S, G, K, BM); Ezeljacht, Dec., van Breda 1657 (STE, K); Caledon, Jan. 1894 Otto Kuntze s.n. (NY, K); Mountains at Houwhoek, Oct., Zeyher 1463 (GRA); Rocky situations of Houwhoek, Bowie s.n. (BM); Zwartberg, Nov., Pappe s.n. sub SAM 19603 (SAM); Caledon, July, Garside 201 (K); Mountains of Baviaanskloof near Genadendal, 27th Feb. 1815, Burchell 7822 (K); On Donkerhoek mountain, 9th March 1815, Burchell 7939 (K); Driefontein, east end of Caledon mts., June, Williams 17 (NBG), Ezeljacht, July, Walters 3 (NBG); Between Caledon & Villiersdorp, Sept., Rycroft 1725 (NBG).

BREDASDORP: Potteberg, Sept., Esterhuysen 23190 (BOL); Entrance to Boschkloof, Potteberg, Oct., Pillans 9438 (BOL); Potteberg, Dec., Codd 9946 (K); 2 miles S.E. of Potteberg farm, Sept., Rourke 598 (NBG).

ROBERTSON: Boesmans Kloof Pass at McGregor, Oct., Esterhuysen 59091 (BOL); Boesmanskloof Pass, Esterhuysen 7649 (BOL); Sandberg, Oct., Pearson 3430 (SAM).

MONTAGU: Patatsfontein, Waboomsberg, July, Rycroft 2084 (NBG); Montagu Baths, Dec., Bolus sub. Guthrie 2768 (NBG); Top of mountain near Montagu Baths, Oct., Michell 153 (PRE).

SWELLENDAM: Bontebok Park, Sept., Liebenberg 4425 (STE); Zuurbrak peak, Oct., Barnard s.n. sub SAM 28972 (SAM); Tradouw Pass, Oct., Adamson s.n. sub. SAM 39005 (SAM); Bergsig farm near Barrydale, Sept., Williams 1062 (NBG); Lifford farm near Barrydale, Sept., Williams 1045 (NBG); Bontebok Park, Aug., Grobler 487 (PRE).

RIVERSDALE: Garcia's Pass, Muiskraal, Oct., Bolus 11364 (BOL, PRE, NH); Crystal Kloof, Oct., Williams 542 (BOL); Garcia's Pass, Aug.

Morris 248 (BOL, NBG); Waterfall, on the Muiskraal/Gouritsriver road, July, Levyns 11281 (CT); Tygerfontein, near Albertinia, May, Muir s.n. sub SAM 2714 (SAM); Garcia's Pass, Sept., Phillips 516 (SAM, K); Albertinia commonage, Oct., Muir 607 (Z); Muiskraal, hills on N. slopes of Langeberg, Jan., Rourke 247 (NBG); Brandrivier, Barrydale to Muiskraal rd., Sept., Williams 1051 (NBG); Between Muiskraal and Cloete's Pass, April, Horrocks 4 (NBG); Albertinia Plateau 10 miles east of Riversdale, Sept., Rourke 912 (NBG).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, Masson s.n. (BM); Without collector, cat. no 4101 in herb. Jussieu (P - JU); C.B.S. Oldenland in herb. Burman (G); C.B.S., Wanmann in herb. Bergius (SBT); C.B.S., Thunberg s.n., sheets 2964 & 2965 in herb. Thunberg (UPS).

(34) Leucospermum wittebergense Compton in Trans. R. Soc. S. Afr. 19 : 280 (1931). Types: Top of Witteberg, Compton 2822, lectotype (BOL); Witteberg summit, Compton 3563, syntype (K).

An erect, much branched shrub 0.5 - 1.5 m. in height. Flowering stems erect, terete, 3.0 mm in diam., often covered with prominent leaf scars. Leaves elliptic-lanceolate, entire, 1.5 - 2.5 cm long 3.0 - 6.0 mm wide; covered with a short, dense indumentum of fine crisped hairs, greyish to silvery; ascending imbricate. Inflorescences globose, sessile, 2.0 cm in diam., usually solitary. Involucral receptacle obconic truncate, 4.0 mm wide. Involucral bracts broadly laceolate, acute-acuminate, 4.0 mm long, 2.0 mm wide; densely villous, cartilaginous, tightly imbricate. Bracteoles oblanceolate-cuspidate, 6.0 - 7.0 mm long, 1.0 - 2.0 mm wide, densely lanate; carmine coloured when fresh. Perianth 1.5 cm long,straight in bud, pale cream becoming pinkish. Perianth tube 3.0 mm long, puberulous distally, glabrous proximally. Perianth claws 1.0 cm long, thickly villous; pinkish carmine, inner surface creamy yellow. Perianth limbs elliptic 1.5 mm long, thickly villous, scarcely differentiated from claws, recurved on opening. Style 1.2 - 1.9 cm long, filiform, straight to very slightly arcuate, pink to carmine when fresh. Pollen presenter clavate to cylindric-obtuse, 1.0 mm long, yellow when fresh. Hypogynous scales filiform, 0.5 - 0.7 mm long, hyaline.

Diagnostic Characters: L. wittebergense is distinguished by the short style, 12 - 19 mm long, the clavate to cylindric-obtuse pollen presenter and the crowded ascending imbricate leaves beset with a short, dense greyish-silvery indumentum.

Drège made the first recorded collection of L. wittbergense in July 1829, on the Swartberg. Nearly all subsequent gatherings were made after the publication of the Proteaceae in the Flora Capensis where it was confused with L. puberum R. Br.

Two syntypes were cited by Compton. Of these, the specimen at the Bolus herbarium labelled "type" in Compton's handwriting (Compton 2822) has been chosen as the lectotype.

Distribution and Ecology: L. wittebergense occurs from the Witteberg, eastwards along the Swartberg to a few miles east of Meirings Poort. It has also been recorded on Touwsberg and the Warmwaterberg in the Little Karroo and at Klein Moeras River on the north slopes of the Outeniqua range near Oudtshoorn.

This species is found on arid rocky slopes of either Table Mountain Sandstone or Witteberg Quartzite, between 2,500 and 6,000 ft., in north or south facing situations. Arid Fynbos constitutes the associated vegetation. On the Swartberg, specimens up to 1.5 m in height are not unusual while plants on the Witteberg are more stunted and seldom exceed 0.5 m. The differences in the vigour of these plants appears to be correlated with mean annual rainfall which is about 10" p.a. on the Witteberg and up to 25" p.a. on the Swartberg. Flowering takes place from August to January.

Specimens Examined:

CAPE

LAINGSBURG: Top of the Witteberg, Nov., Compton 2822 (BOL); Witteberg, Oct., Leighton 237 (BOL); Witteberg summit, Oct., Compton 3563 (K); Witteberg, Oct., Compton 15189 (NBG); Witteberg, Whitehill, Oct., Compton 7951 & 13942 (NBG).

SWELLENDAM: Warmwaterberg, Little Karroo, on the top, July, Levyns 6181 (CT).

LADISMITH: Touwsberg, June, Esterhuysen 25954 (BOL); Seven Weeks Poort, Sept., Levyns 2444 (CT); Towerkop, Sept., Esterhuysen 13954 (BOL); Touwsberg, on the top, July, Levyns 6110 (CT); Seven Weeks Poort, Sept., Phillips 1507 (SAM); Seven Weeks Poort Berg, Dec., Barnard s.n. (SAM 46291); Seven Weeks Poort mountains below 2nd peak, Dec., Andreae 1261 (PRE); Seven Weeks Poort mountains, north slopes, Dec., Stokoe 1818 (PRE); Primos 83 (PRE); Western slopes of Seven Weeks Poort, Dec., Stokoe 1917 (STE).

CALITZDORP: Sandberg, west of Calitzdorp, June, Wurtts 1364 (NBG).

OUDTSHOORN/PRINCE ALBERT: Swartberg Pass, Sept., Sidey 1901 (PRE, S); Swartberg Pass, June, Deas 12 (GRA); In saxosis in summo monte Zwartberg Pass, Dec., Bolus 11628 (BOL, PRE, NH, BR); Upper peaks of the Swartberg, May, Pocock S248 (BOL, STE); Cango East, Oct., Deas s.n. (SAM 5142); Swartberg Pass, Nov., Barnard s.n. (SAM 48189); Swartberg mountains, Oct., Stokoe s.n. (SAM 62124); Higher slopes of Spitzkop, 5 miles east of Meiring's Poort, Feb., Thorne s.n. (SAM 50195); Swartberg, 2500 - 3000 ft., 27/7/1829, Drège 476h (P); Swartberg, Nov., E. Wall s.n. (S); Swartberg Pass, Jan., Compton 10427 (NBG); Swartberg Pass, on the road to the east at top of pass, Nov., Williams 963 (NBG); Quartzite mountains near Prince Albert, Oct. 1898, Schimper s.n. (Z); North side of Outeniqua mountains near Moeras River, Dec., Esterhuysen 19475 (BOL);

Klein Moeras River Spruiten, Dec., Barker 7710 (NBG).

GEORGE: Paarde Poort, George dist., Aug., Thorne s.n. (SAM 51644).

(35) Leucospermum royenifolium (Salisb. ex Knight) Stapf in Fl. Cap. 5 : 635 (1912).

Leucadendrum royenaefolium Salisb. ex Knight in Knight, Cult. Prot. : 59 (1809). Type: Duivelskop Pass, rocky elevated places, decumbent, alpine, Niven 43, holotype in herb. Salisbury (K), isotypes in herb. J.E. Smith (LINN), (PH).

Leucospermum puberum (L.) R. Br. var dubium Meisn. in DC., Prodr. 14 : 259 (1856). Type: Drege "f" in herb. DC. (not found). Klip River, Longkloof, 13/11/1831, Drege 476 f (P) - presumed isotype.

A sprawling, semi-erect to prostrate shrub, developing into a dense mat 1.0 - 3.0 m in diam., 0.5 m in height. Basal branches stout and woody, spreading horizontally, 3.0 - 6.0 cm in diam., covered with a tough layer of bark 3.0 - 5.0 mm thick. Flowering stems semi-erect to trailing, 2.0 - 3.0 mm in diam., puberulous at first soon glabrous. Leaves elliptic, attenuate at base, apex acute, entire, very rarely bifid or trifid; leaves 1.5 - 2.2 cm long, 0.4 - 0.6 cm wide, loosely patent, usually glabrous, or puberulous at first soon becoming glabrous. Inflorescences globose, 1.0 - 2.0 cm in diam., sessile to pedunculate, peduncle 1.0 cm long; solitary, but usually with 3 - 5 inflorescences per shoot; on vigorous young shoots, multiple inflorescences (20 - 30), develop in uppermost leaf axils. Involucral receptacle broadly conic-depressed, 5.0 mm long, 4.0 mm wide. Involucral bracts ovate-acute, 5.0 mm long, 3.0 mm wide, cartilaginous, softly tomentose; apices of the uppermost series slightly acuminate and recurved. Perianth 1.0 - 1.5 cm long, straight in bud, slightly laterally compressed, shortly tomentose, the perianth claws becoming equally deflexed subterminally; cream to greenish at anthesis becoming pale carmine with age. Perianth tube 4.0 mm long, glabrous and narrowed proximally, puberulous distally. Perianth limbs lanceolate acute, 1.5 mm long, the outer surface beset with stiff erect trichomes. Style straight, 1.3 - 1.6 cm long, tapering towards the apex; pale greenish-cream at anthesis becoming pinkish carmine with age. Pollen presenter cylindric obtuse, 1.0 mm long, stigmatic groove terminal. Hypogynous scales linear, 2.0 mm long, hyaline.

Diagnostic Characters: Among the species of the Sect. Diastelloidea with styles 1.2 - 1.9 cm long and clavate to cylindric-obtuse

pollen presenters, L. royenifolium is distinguished by its procumbent growth habit and the glabrous to glabrescent, patent leaves. Although nearly always glabrous, the bright green leaves are very occasionally sparsely hirsute but soon become glabrous.

Niven's collection from Duivel's Kop on the north side of the Outeniqua range appears to be the first on record and was probably made between 1799 and 1803. Although most early 19th century horticultural textbooks make no mention of L. royenifolium Knight (1809 : 59) notes that it is "hardy", which seems to indicate he had sucessfully cultivated it in Hibbert's collection.

Distribution and Ecology: This species is found throughout the length of the Longkloof on the northern foothills of the Outeniqua range as far as Misgund; from the Meiring's Poort area on the Swartberg it extends eastwards to the Kamanassie, Kouga and Baviaanskloof mountains reaching Scholtzberg at the most easterly point of its range.

In comparison with most other members of the genus, L. royenifolium endures fairly rigorous climatic conditions, tolerating a dry environment which experiences great heat in summer and frost in winter. The low winter rainfall of 10 - 15" p.a. is distributed more or less evenly throughout the year with a slight winter maximum. Most populations occur between 2,000 and 4,000 ft., always on Table Mountain Sandstone or Witteberg Quartzite, in hot, exposed, north facing positions. In most places it occurs in Arid Fynbos but occasionally even grows on the fringes of Rhenosterbosveld.

The growth habit of the mature plant is sprawling and untidy and it seldom attains a height of more than 0.5 m. A layer of tough corky bark on the horizontally spreading basal branches gives the adult plant a certain measure of protection against fire. New shoots are able to regenerate from these main branches after the remainder of the plant has been burnt off.

Under optimum conditions the young flowering shoots produce multiple inflorescences. Between 20 and 40 inflorescences on a single flowering shoot have been counted. On opening, the perianth and styles are pale cream to ivory in colour, later changing to deep pink. The sweetly scented inflorescences are produced between July and December.

Specimens Examined:

CAPE

GEORGE: Duivel's Kop, rocky elevated places, Niven 43 (K, LINN, PH); Between Cape Town and Georgetown, 1859-62, W. Moyle-Rogers s.n. (BM); Duivel's Kop, Oct., Fourcade 1615 (BOL, K); Longkloof, in district of George, Nov. 1847, Alexander Prior s.n. (K); Ganskraal, Longkloof, Oct., Rourke 613 (NBG); Molen River, Longkloof, Sept., Rourke 907 (NBG).

UNIONDALE: On a rocky hill near Haarlem, 14th March, 1814, Burchell 4993 (K); Haarlem, Sept., Schonland 3115 (STE); South side of the mountain between Uniondale and Avontuur, Dec., Schonland 3352 (GRA, PRE, K); Uniondale, Nov., Paterson 3026 (GRA, Z); Haarlem, July, Markotter s.n. (STE 20211); Hoopsberg, Nov., Esterhuysen 6605 (BOL); Kouga mountains, peak east of Smutsberg, Nov., Esterhuysen 6993 (BOL); Kamanassie mountains at Laudina, Nov., Esterhuysen 16462 (BOL); Mannetjiesberg, south slopes, Nov., Esterhuysen 6603 (BOL, K); Potjiesriverhoogte, July, Rourke 12 (BOL, NBG); Kamanassie mts., Jan., Stokoe s.n. (SAM 54380); Klipriver in the Longkloof, 2500 - 3500 ft., 13/11/1831, Drège 476f (P, K); Kamanassie mts., April, Rycroft 1901 (NBG); Avontuur, Longkloof, Oct., Bayliss 3690 (NBG, Z); Slypsteenberg, south slopes, Nov., Esterhuysen 6348 (BOL, PRE); Avontuur, Nov., Marloth 10949 (PRE); Mountains near Uniondale, Bolus 2453 (PRE); Longkloof, 30 miles from Uniondale, Sept., Middlemost 2105 (NBG); Lower slopes of Hoopsberg, Dec., Williams 1376 (NBG); Half a mile beyond the farm Bo Kouga, Sept., Rourke 892 (NBG); Mannetjiesberg, south slopes, Sept., Rourke 861 (NBG).

JOUBERTINA: Ouplaas, in the Kouga mountains, June, van Breda 1178 (PRE, K); Between Misgund and Ongelegen, May, Rycroft 2281 (NBG); One mile west of Misgund Oos, Sept., Rourke 875 (NBG).

WILLOWMORE: Kierfonteinberg, Vondeling, between Klaarstroom & Willowmore, Oct., Thorne s.n. (SAM 53368); Swartberg, Dec., Stokoe s.n. (SAM 56308); Scholtzberg, Baviaanskloof range, Sept., Urton 432 (GRA).

WITHOUT PRECISE LOCALITY: Prom. bon. spei, J. Roxburgh s.n. (G).

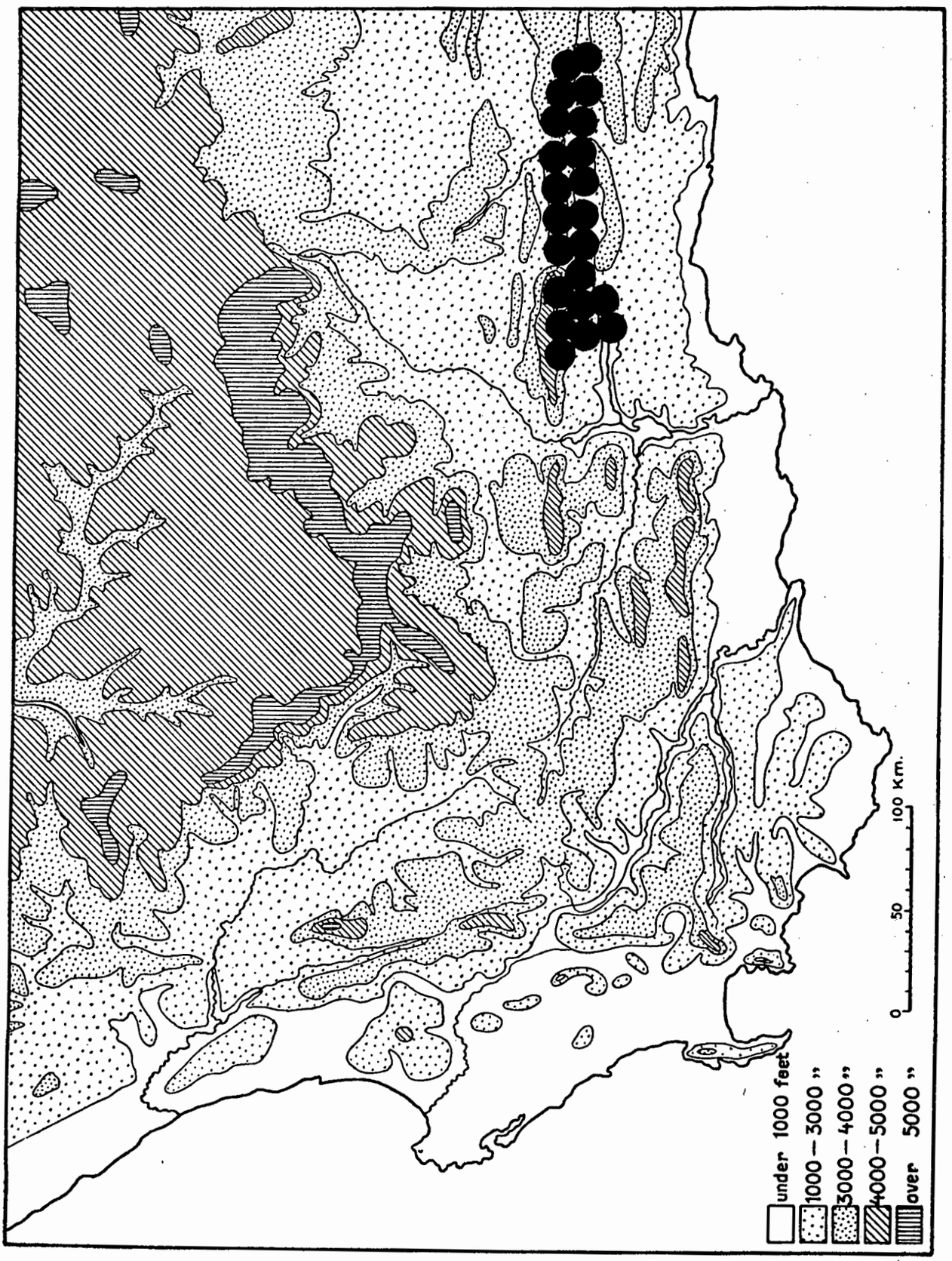


Fig. 46. Distribution of

Leucospermum royenifolium(Salisb. ex Knight)Stapf

(36) Leucospermum heterophyllum (Thunb.) Rourke in Jl S. Afr. Bot. 33 : 266 (1967).

Protea heterophylla Thunb., Diss. Prot. : 24 (1781). Lectotype: Cap. b. spei, Thunberg s.n., sheet no 2921 in herb. Thunberg (UPS).

Leucadendron heterophyllum (Thunb.) Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Leucospermum patulum R. Br. in Trans. Linn. Soc. Lond. 10 : 100 (1810). Type: Africa australis, Prom. bon. spei Masson s.n. (BM).

Protea patens Poir. in Lam., Encycl. Meth. Bot. Suppl. 4 : 567 (1816) - nom. supfl., et non P. patens R. Br. (1810).

Leucospermum lemmerzianum Schltr. in Bot. Jahrb. 27 : 111 (1900). Type: Hills near Elim, Schlechter 9663 (Holotype B, isotypes K, Z, G, S, BR, BM, BOL, PRE).

A prostrate shrub forming large, flat, dense mats, 1.0 - 6.0 m in diam., 10.0 - 15.0 cm in height. Basal branches stout and woody 5.0 cm in diam., arising from a large woody rootstock 5.0 - 10.0 cm in diam., and then spreading horizontally along the ground. Flowering stems arising at perimeter of mat; slender, terete, 1.0 - 2.0 mm in diam., trailing along the ground, often bearing short lateral flowering branchlets. Leaves oblanceolate to linear-spathulate, 20.0 - 30.0 mm long, 3.0 - 6.0 mm wide; apex usually truncate and trifid, occasionally entire and acute; glabrescent to glabrous, usually sparsely covered with short crisped hairs at first, soon becoming glabrous; sessile, arising from stems in a subsecund to secund manner, slightly twisted at base. Inflorescence globose, 2.0 - 3.0 cm in diam.; pedunculate, peduncle 1.0 - 2.0 cm long. Involucral receptacle depressed ovoid, 2.0 - 3.0 mm in diam. Involucral bracts ovate acute, 3.0 - 4.0 mm long, 1.0 - 2.0 mm wide, imbricate, cartilaginous, shortly tomentose, the apices somewhat recurved and minutely crinite. Bracteoles broadly ovate acute 3.0 mm long, 2.0 mm wide, lanate. Perianth 15.0 mm long. Perianth tube 4.0 mm long, glabrous but slightly villous distally; narrowing proximally. Perianth claws pale yellow-green, villous; becoming equally recurved in the subterminal region. Perianth limbs narrowly lanceolate acute, 1.0 mm long, tomentose, dark brown when fresh. Anthers sessile, narrowly lanceolate, 0.75 mm long, apical

boss pointed, yellow. Style 18.0 - 21.0 mm long, straight, tapering in the upper third; pale yellow becoming dull carmine with age. Pollen presenter conic ovoid, yellow; stigmatic groove terminal. Hypogynous scales linear, filiform, hyaline, 2.0 mm long.

Diagnostic Characters: The glabrous to glabrescent leaves, oblanceolate-cuneate and slightly twisted at the base, usually tridentate at the apex and the prostrate growth habit, distinguish L. heterophyllum from the other species in the section.

Despite the very restricted range of this species, material was collected fairly early in the 18th century, for there is a very complete specimen in N.L. Burman's herbarium in Geneva which was probably collected by Oldenland or Auge. At Uppsala and the British Museum there are specimens of L. heterophyllum that are attributed to Thunberg and Masson respectively. When and where they collected this material remains a mystery for the route which they followed when travelling together in 1773-1774 bypasses the Elim-Bredasdorp area by 20 miles. Indeed, on no occasion did either Thunberg or Masson ever pass through the Bredasdorp district, according to published records. Masson's specimen is the type of L. patulum R. Br. and Thunberg's is the type of P. heterophylla Thunb. Three sheets in Thunberg's herbarium are labelled Protea heterophylla. One of these (no 2921) is labelled Protea heterophylla a, the remaining two (2922, 2923) are both labelled P. heterophylla β . The material on these latter two sheets has entire leaves. The only specimen which can possibly be the type is mounted on sheet 2921, since it matches Thunberg's description perfectly in that it has glabrous tridentate leaves.

Distribution and Ecology: This very localised species is confined to a few square miles in the Bredasdorp district, within an area bounded by Elim in the west, Bredasdorp in the north-east and Soetendals Vlei in the south.

A notable feature of the ecology of L. heterophyllum is that it tends to be found mainly on a curious sandstone and quartzite conglomerate of the Table Mountain series which outcrops at several places in the Bredasdorp district (Spies et al. 1963 : 11-12). In a few places it also grows on soils derived from fine grained graywacke, also a conglomerate but belonging to the Malmesbury series. Very occasionally plants are found on sandy soils belonging to Tertiary deposits, but this is exceptional. The asscciated vegetation is low and sparse consisting mainly of Ericaceae, Thymelaeaceae and

Restionaceae. A winter rainfall of 15 - 20" p.a. is experienced.

When mature, L. heterophyllum becomes a dense, low, spreading mat up to 6 m in diam., never more than 20 cm in height. Stout main branches 4 - 10 cm in diam. radiate from a single main stem and spread horizontally along the soil surface. This species has a certain degree of fire resistence. Most of the more slender peripheral branches are destroyed during a bush fire but new shoots frequently sprout from the stout basal branches which are covered with a fairly thick layer of bark.

Flowering takes place from August to January with a peak during September and October. The inflorescences are pale yellow to green, fading to carmine and are produced in great profusion at the height of the flowering season.

Specimens Examined:

CAPE

BREDASDORP: In collibus prope Elim, Dec., Schlechter 9663 (B, Z, G, S, BR, BM, K, BOL, PRE); Bredasdorp, Dec., Galpin 11281 (PRE, K); 2 miles south of Bredasdorp, Sept., Salter 4809 (BOL, SAM, PRE, BM, K); In collibus prope Elim, Dec., Bolus 8585 (BOL, NBG, NH, K); Near Bredasdorp, Oct., L. Guthrie 182 (BOL); On the Nachtwacht-Martha's gat borderline, Nov., Smith 4910 (PRE); Bredasdorp, July, van Niekerk 420 (BOL); The Poort, Bredasdorp, Sept., Leighton 21112 (BOL, K); Bredasdorp, slopes behind the town, Sept., Levyns 2146 (CT); Between Bredasdorp and Elim, Sept., Levyns 4530 (CT); 5 miles S.W. of Bredasdorp, Dec., Codd 9955 (PRE); In collibus prope Elim, Oct., Bolus 7873 (PRE, K); Springfield estate, Sept., Stokoe s.n. (SAM 62125); Bredasdorp, Oct., Breach s.n. (SAM 51339); Flats between Bredasdorp and Elim, Dec., Acocks & Hafstrom 2109 (PRE, S); 10 miles S.W. of Bredasdorp, Sept. Sidey 1819 (PRE, S); On the farm Rietfontein, Bredasdorp, Oct., van Breda 2052 (PRE); Sandhoogte, below dunes, Sept., C.A. Smith 3005 (PRE); Flats at Soetendals Vlei, Dec. 1838, Krauss 1064 (M); Mierekraal at Elim, Dec., E. Wall s.n. (S); The Poort, Bredasdorp, Sept., Acock 1777(S); 1 mile from Bredasdorp on the Agulhas road, Sept., Richmond 14 (NBG); Near Elim, Aug., Barker 5574 (NBG); Between Bredasdorp and Elim, Oct., Compton 22132 (NBG); 9 miles S.W. of Bredasdorp, Sept., Rycroft 2520 (NBG); Springfield Jan., Rycroft 1825 (NBG); Between Bredasdorp and Elim, Sept., Rourke 275 (NBG); Hills 1 mile north of the Soetanysberg, Nov., Rourke 1016 (NBG); Voelvlei, a few miles east of Elim, Oct., Rourke 945 (NBG); At the farm Jacobsdam north of the Soetanysberg Oct., Rourke 1125 (NBG); Near Soetendalsvlei, west side, Dec., Rourke 1169 (NBG); Springfontein, between homestead and saltpan

Dec., Rourke 1171 (NBG).

WITHOUT PRECISE LOCALITY: Prom. bon. spei, Mund s.n. (B); Prom bon. spei, Masson s.n. (BM); Prom. bon. spei, Nelson s.n. (BM); Cap. b. spei, Thunberg s.n. in herb. Bergius (SBT); Cap. b. spei, Thunberg s.n., no 2921 (UPS); Cap. b. spei, without collector in herb. Burmann (G); Without collector or locality in herb. Lamarck (P-LA).

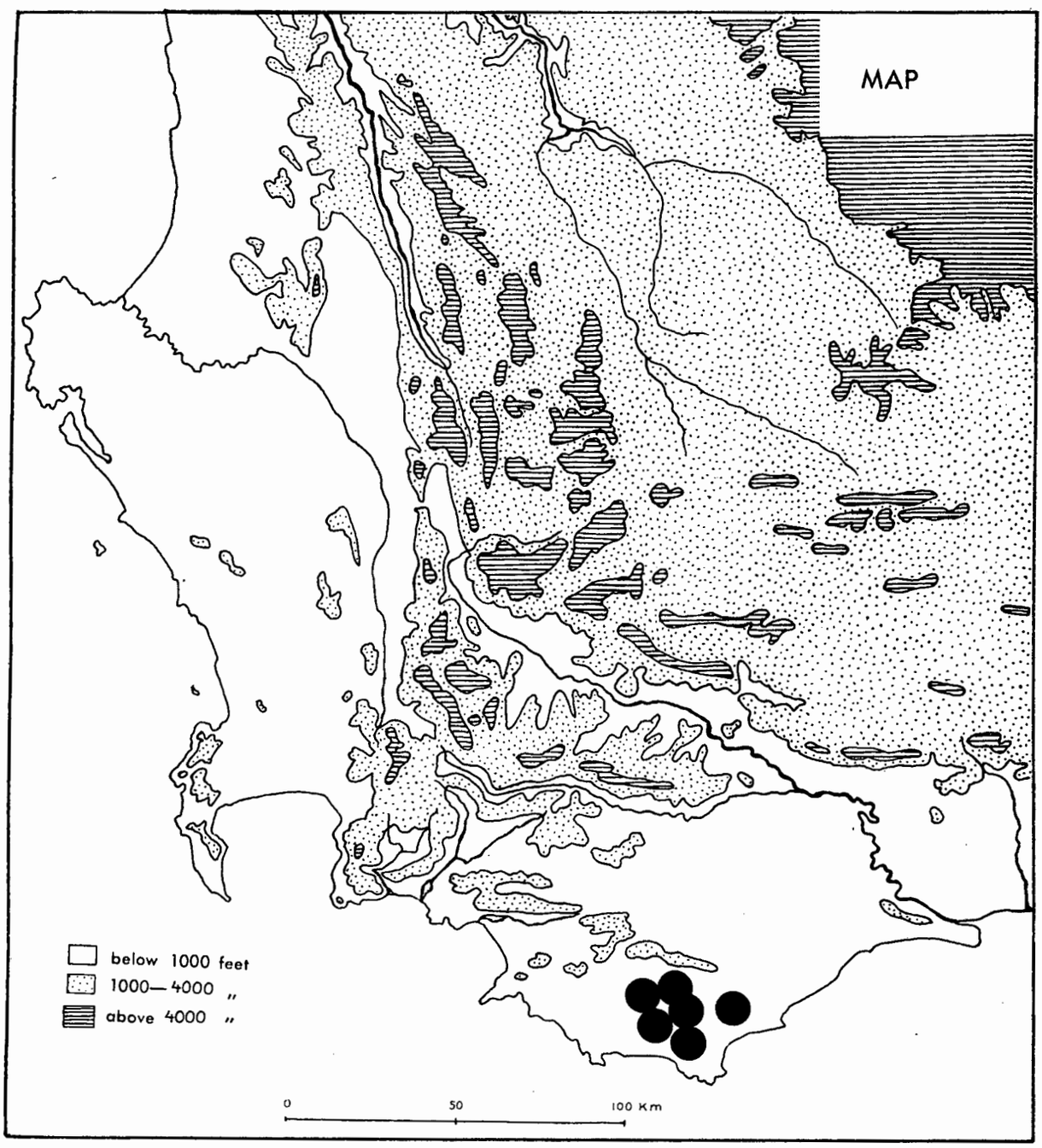


Fig. 47. Distribution of Leucospermum heterophyllum(Thunb.)Rourke

(37) Leucospermum truncatulum (Salisb. ex Knight) Rourke in Jl S. Afr. Bot. 33 : 266 (1967).

Leucadendrum truncatulum Salisb. ex Knight in Knight, Cult. Prot. : 61 (1809). Type: "Klein Hout Hoek, Niven 200", holotype in herb. Salisbury (K).

Leucospermum buxifolium R. Br. in Trans. Linn. Soc. Lond. 10 : 100 (1810); Phillips & Stapf in Fl. Cap. 5 : 633 (1912). Type: Africa australis, Masson s.n. (BM).

Protea buxifolia (R. Br.) Poir in Lam., Encycl. Meth. Bot. Suppl. 4 : 566 (1816).

Leucadendron buxifolium (R. Br.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Protea villosa Willd in Spreng., Syst. Veg. 1 : 464 (1825) - nom. nud.

Leucospermum buxifolium R. Br. forma epacridea Gandoger in Bull. Soc. bot. Fr. 48 : 94 (1901). Type: Mountains at Babylonstower near Ecksteen's , Aug., Zeyher 3685 holotype in herb. Gandoger (LY).

Leucospermum epacrideum (Gandoger) Gandoger and Schinz in Bull. Soc. bot. Fr. 60 : 53 (1913). Type: As above.

ICONES
R. Marloth, Fl. S. Afr. 1 : t 31c (1913).
M. Vogts, Proteas, Know them & Grow them : 130 (1959).

A slender erect shrub to 2.0 m in height, very sparsely branched, stiffly erect, with a single main stem at base. Flowering stems slender, 3.0 - 4.0 mm in diam., densely tomentose. Leaves obovate-orbicular, occasionally elliptic, 1.0 - 2.5 cm long, 0.5 - 1.0 cm wide, entire; densely imbricate, covered with a softly villous adpressed indumentum. Inflorescences globose, 1.5 - 2.0 cm in diam., sessile, seldom solitary, usually 2 - 8 nate. Involucral receptacle flat, 4.0 - 5.0 mm wide. Involucral bracts broadly lanceolate to ovate, acute to obtuse 5.0 - 7.0 mm long, 2.0 - 5.0 mm wide, scarious to papyraceous, slightly sericeous towards the apex, otherwise glabrous, margins densely ciliate; arranged in 3 to 4 rows forming a distinct involucre. Bracteoles lanceolate

acuminate, 6.0 mm long, 2.0 mm wide, densely lanate. Perianth yellow when fresh, becoming pinkish with age, 8.0 - 10.0 mm long Perianth tube 4.0 mm long, glabrous, slightly quadrangular. Perianth claws equally reflexed subterminally, thickly villous. Perianth limbs elliptic 2.0 mm long very sparsely hirsute. Style 1.4 - 1.6 cm long, straight to very slightly incurved, tapering subterminally, yellow at first aging to crimson. Pollen presenter abruptly conic-ovoid, acute, 1.0 mm long, stigmatic groove terminal. Hypogynous scales filiform, obtuse, 1.5 mm long, hyaline.

Diagnostic Characters: The small, entire, densely imbricate, orbicular leaves, 1.0 - 2.5 cm long, the papyraceous involucral bracts which form a distinct involucre and the conic ovoid pollen presenter, distinguish L. truncatulum from related taxa.

Distribution and Ecology: L. truncatulum extends from the eastern foothills of Kogelberg Peak, southwards, to Bot River, Caledon, Hermanus and Bredasdorp, reaching the farm Springfontein (just north of Cape Agulhas) at the most southerly point of its range.

Solitary specimens or small stands are rarely encountered as this species tends to be gregarious, usually forming extensive communities. Most populations are found only in regions receiving a mean annual rainfall of 25 - 40" p.a., mainly in winter. L. truncatulum favours south and east facing slopes at elevations ranging from sea level to 1,200 ft., where the associated vegetation consists of dense sclerophyll composed mainly of Restionaceae Ericaceae and Proteaceae. Flowering takes place from August to December.

Specimens Examined:

CAPE

CALEDON: Elgin, along Highlands forest rd., Nov., Esterhuysen 20730 (BOL, PRE); Viljoens Pass; Nov., Salter 4035 (BOL, BM, K); Palmiet River, Elgin, Dec., Stokoe 8376 (BOL); Shaw's Pass, Aug., Stokoe s.n. sub. SAM 65935 (SAM); Swartberg, Caledon Oct., Pappe s.n. sub SAM 43646 (SAM); Prope Hangklip, Nov., Krauss s.n. (B); Between Bot River and Kleinmond, Dec., Wall s.n. (S); Hottentots Holland Kloof, Auge s.n. in herb. Bergius (SBT); Highlands, Aug., Compton 7890 (NBG); Sandbaai, July, Walters 2 (NBG); Sondagskloof, Dec., Bond 771 (NBG); Honingklip, Sept., L.E. Taylor 4085 (NBG); Foot of Onrust River mts., Feb., Esterhuysen 4956 (NBG); Between Aries Kraal and Louwsriver drift, Kogelberg, Dec., Rourke 1002 (NBG);

Mountain at Onrust, April, Brink 71 (STE); Houw Hoek mountains Oct., Schlechter 5495 (S, PRE, G, BM, SAM, K, BR, STE, Z); Fairfield, summit of Sondags Kloof Pass, H.C. Taylor 3627 (STE, PRE); In monte Houwhoek, Krauss s.n. (FI, M, Z); Swartberg, Caledon, MacOwan s.n. (GRA); Swartberg, Caledon, Zeyher 3685 (BOL, SAM); Kleyn river Kloof, Aug., Zeyher 3685 (BOL, PRE, K, S); Onrust, Dec., van Niekerk 347 (BOL, PRE); Hemel en Aarde, Dec., Barker 7616 (NBG); Hermanus, Oct., Galpin 4466 (PRE); Caledon, Marloth 4849 (PRE); Shaw's mountain, Dec., Salter 5163 (K); Flats at Grabouw, Aug., Garside 4454 (K); "Alpine places near Klein River" Niven s.n. (K); On the Howw Hoek mountain, Bowie s.n. (BM); Between Somersfontein and Aries Kraal, below Kogelberg, Jan., Rourke 1180 (NBG);

BREDASDORP: Haasvlakte forest reserve, Nov., Hubbard 179 (STE); Koude River, Dec., Schlechter 9603 (K, BM, PRE, G, BOL, BR, Z, S, PH); In collibus prope Elim, Dec., Bolus 8588 (BOL, NBG, K); Elands Kloof, Aug., Esterhuysen 5092 (BOL); Brandfontein, Oct., Esterhuysen 19065 (BOL); Ratel River, Sept., Levyns 8593 (CT); Between Elim and Hagedisberg Pass, Oct., Levyns 8436 (CT); Bredasdorp mountain, Dec., Acock & Hafstrom 2105 (S); Baardscheerdersbosch, Dec., Compton 19020 (NBG); Near Elim on road to Pearly Beach, Nov., Gill 25 (NBG); Fairfield hills, Aug., Barker 8785 (NBG); Hills near Waterford, Aug., Rourke 520 (NBG); Eland's Kloof mts., above Papies vlei, Sept., Rourke 565 (NBG); Hills above Groenkloof, Kleyn Hagelkraal, Aug., Rourke 1084 (NBG); Hills above Avoca on Witelskloof farm, Sept., Williams 1236 (NBG); Bredasdorp mountain, Galpin 10507 (PRE, K); Sandrif near Napier, Oct., van Breda 1070 (PRE, K); Between Stanford and Elim, Nov., Pole Evans 4381 (PRE, K); Brandfontein, Nov., Smith 4987 (PRE, K); Springfontein, Sandy flats, Dec., Rourke 1172 (NBG).

WITHOUT PRECISE LOCALITY: Cape of Good Hope, Ludwig s.n. (NY, B); Prom. b. spei, Masson 16 (G); Cap. Bon. Spei, Thunberg in herb. Montini (S).

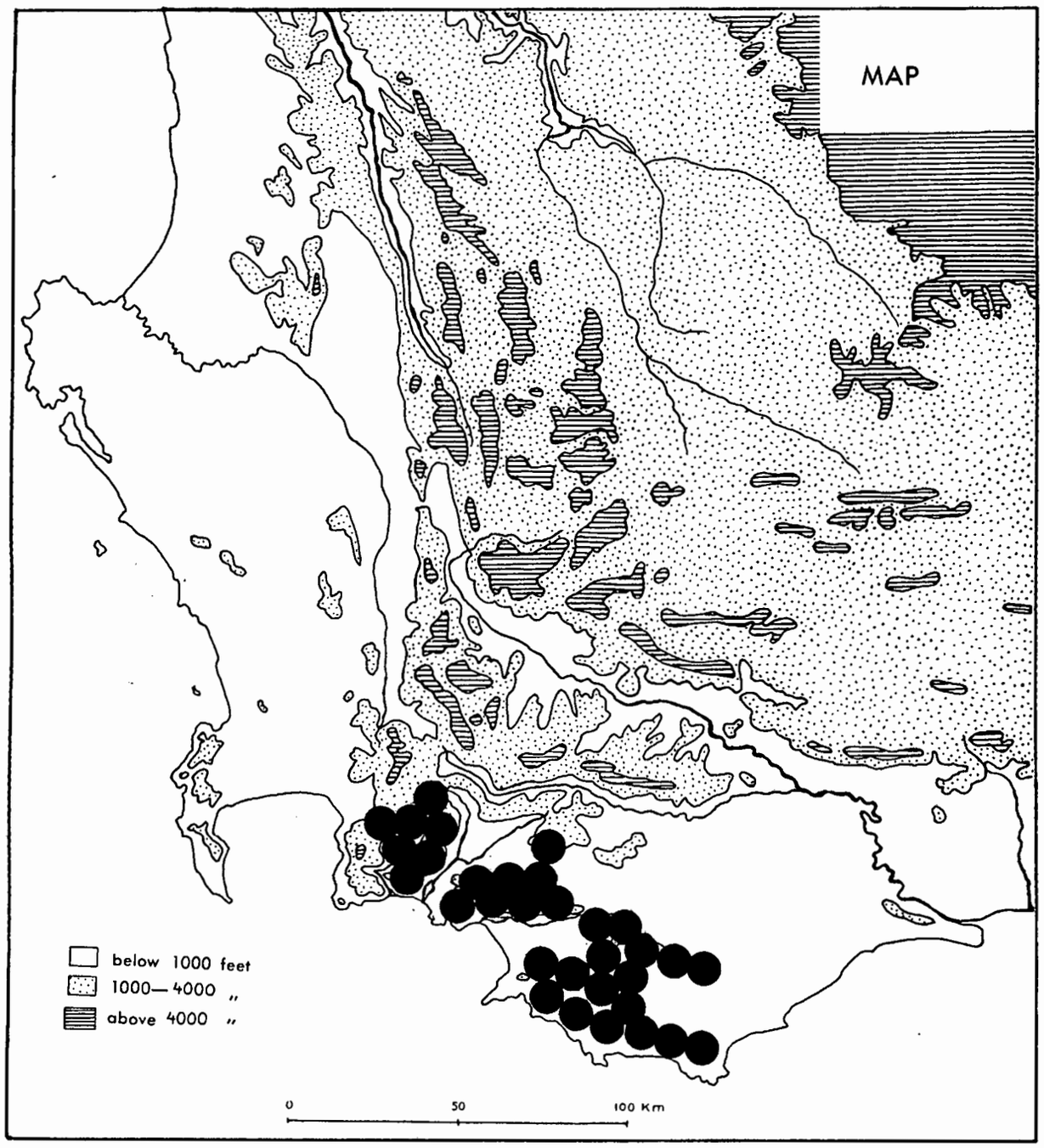


Fig. 48. Distribution of

Leucospermum truncatulum(Salisb. ex Knight)Rourke

(38) Leucospermum bolusii Gandoger in Bull. Soc. bot. Fr. 48 : 95 (1901); Rourke in Jl S. Afr. Bot. 33 : 268 (1967). Type: In collibus prope Gordon's Bay, False Bay, Oct., Bolus 8077, (Lectotype BOL, isotype PRE).

Leucospermum oleaefolium (Berg.) R. Br. var. brownii Meisn. in DC., Prodr. 14 : 261 (1856). Type: In Africa Capensi, Gueinzius s.n. in herb. Meisner (NY).

Leucospermum album Bond in Jl S. Afr. Bot. 7 : 200 - 202 (1941). Type: Gordon's Bay, Mathews s.n. (NBG 1327/29), (holotype NBG, isotype BOL).

ICONES
Bond in Jl S. Afr. Bot. 7 : 201 (1941)
Vogts, Proteas, Know them and grow them : 127 (1959)
Eliovson, Proteas for Pleasure : 172 - 173 (1965)
Rice & Compton, Wild Flowers of the Cape of Good Hope, tab 146 (1951).

An erect to spreading, rounded shrub, to 1.5 m in diam., with a single main stem. Flowering stems erect, slender, 3.0 - 5.0 mm in diam., villous. Leaves sessile, subimbricate erect-ascending, ovate elliptic 2.5 - 4.5 cm long, 0.75 - 1.5 mm wide; apex acute to obtuse usually entire, rarely bifid or trifid; glabrous, occasionally puberulous when young. Inflorescences numerous, up to 8 inflorescences per flowering shoot; depressed globose 2.0 cm in diam., pedunculate, peduncle 1.0 cm long 2.0 mm in diam., lanate. Involucral receptacle flat, 5.0 - 7.0 mm wide. Involucral bracts ovate-acute, 4.0 - 5.0 mm long, 2.0 mm wide, glabrescent with ciliate margins, reddish carmine in fresh state, texture soft and membranous; imbricate, aggregated to form a distinct cup-shaped involucre of about 3 whorls. Bracteoles lanceolate-acuminate, 7.0 mm long, 1.5 mm wide, densely villous to lanate, medianly canaliculate on inner surface. Perianth straight in bud, 12.0 mm long, creamy white, becoming very pale pink with age. Perianth tube 5.0 mm long, glabrous proximally, puberulous distally, slightly quadrangular. Perianth claws densely villous, deflexed, subterminally. Perianth limbs broadly lanceolate, 1.0 mm long, villous, reddish on outer surface when fresh. Style 1.5 - 2.0 cm long, straight, tapering subterminally. Pollen presenter conic ovoid, 0.75 - 1.0 mm long, pale greenish-yellow. Hypogynous scales hyaline, filiform, 1.0 mm long.

Diagnostic Characters: The conic ovoid pollen presenter, ovate glabrous leaves 2.5 - 4.5 cm long, the prominant involucre of imbricate, membranous, glabrous bracts with ciliate margins, and the creamy-white perianth, distinguish L. bolusii from related species.

Wilhelm Gueinzius made the first recorded collection of L. bolusii sometime between 1839 and 1841 during his period of residence at the Cape. This collection is the type of L. oleaefolium (Berg.) R. Br. var. brownii Meisn. The type of L. bolusii should be in Gandoger's herbarium at Lyon but the present author has been unable to trace it there, nor is it among the sheets of Cape Proteaceae at Zurich which were annotated by Gandoger and Schinz. Therefore, the duplicate at the Bolus herbarium has been designated the lectotype.

Distribution, Ecology and Biology: The range of L. bolusii extends from above Gordon's Bay to Kogelbay, a distance of about 7 miles. Throughout this very limited range the fairly dense populations grow in a narrow belt within a quarter of a mile of the sea and seldom above the 500 ft. contour. They occur on steep rocky slopes, on coarse Table Mountain Sandstone gravel, in a west facing position receiving a winter rainfall of 30 - 45" p.a. The creamy white, sweetly scented inflorescences are produced from September to December. As the flower ages the white perianth becomes tinted with a pale pinkish hue.

Specimens Examined:

CAPE

SOMERSET WEST: Gordon's Bay, Sept., Markotter s.n. (STE 26116); Feb., Markotter s.n. (STE 8164); In collibus prope Gordon's Bay, Oct., Bolus 8077 (BOL, PRE); Gordon's Bay, Nov., Mathews s.n. NBG 1327/29 (BOL, NBG); Between 1st & 2nd streams, Gordon's Bay, Sept., Lavis s.n. (BOL 18536); Steenbras, Dec., Middlemost s.n. (BOL 18536, K); Steenbras Dam, Oct., Middlemost s.n. NBG 2010/26 (BOL); Between Gordon's Bay and Steenbras Oct., Levyns 10783 (CT); Steenbras river mouth, Dec., Lewis 1646 (SAM); Slopes to the Steenbras river, Dec., Acock 3945 (S); Steenbras river, Dec., Hafstrom & Lindeberg s.n. (S); Over Gordon's Bay, Dec., Wall 21 (S); Gordon's Bay, Sept., Werdermann & Oberdieck 131 (K); Gordon's Bay, Nov., Parker 4304 (NBG, K); Gordon's Bay cliffs, Oct., Garside 1311 (K); Steenbras river mouth, Oct., Parker 4002 (NBG, PRE, K); Between Steenbras mouth and Kogel Bay, Nov., Gill 13 (NBG)

Roman Point between Gordon's Bay and Steenbras river mouth, Sept., Rourke 918 (NBG); Hills south of Gordon's Bay, Nov., Marloth 10014 (PRE); Heuning Kloof at Kogelbay, Nov., Rourke 1166 (NBG).

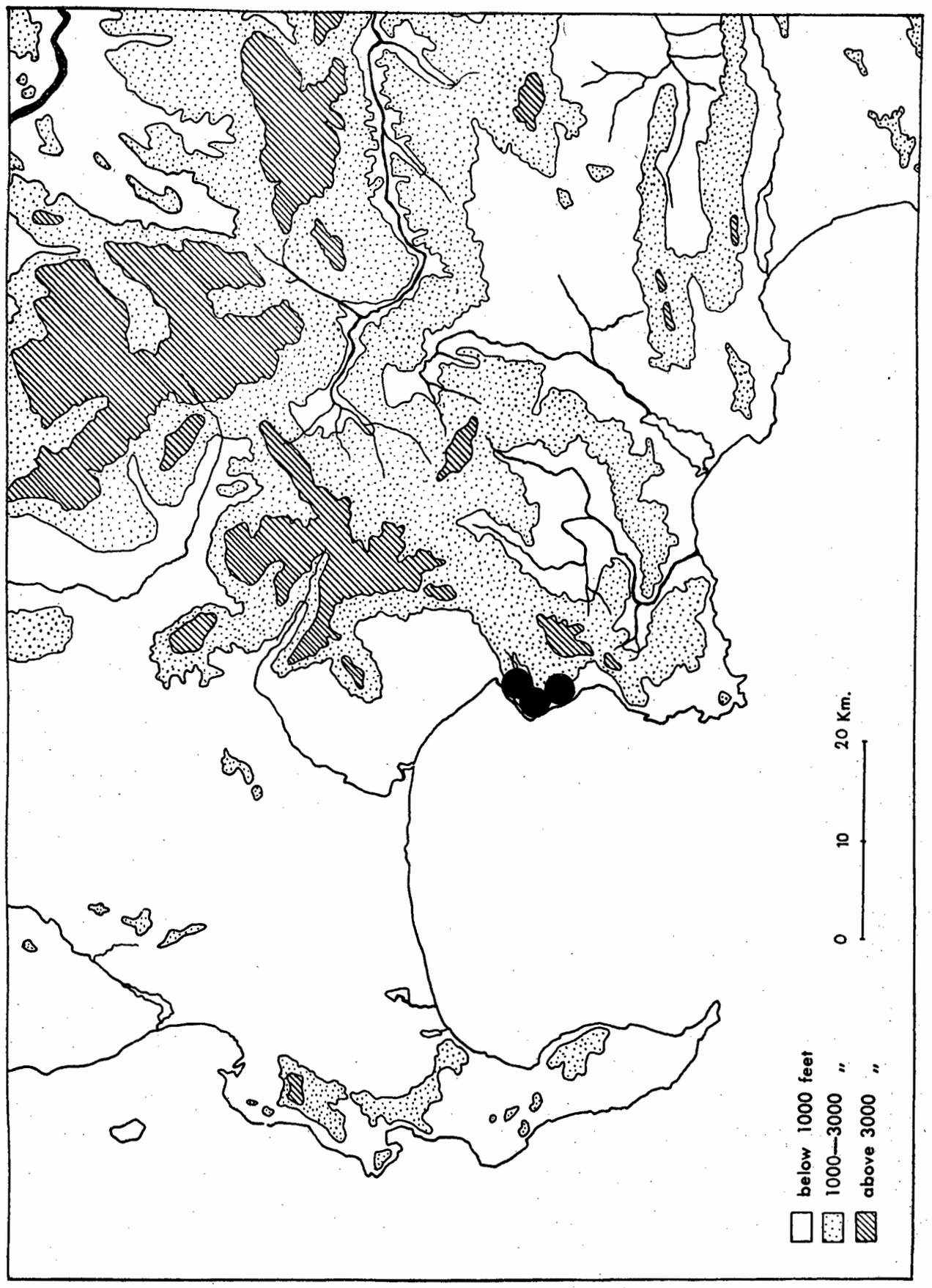


Fig. 49. Distribution of Leucospermum bolusii Gandoger.

(39) Leucospermum prostratum (Thunb.) Stapf in Fl. Cap. 5 : 636 (1912).

Protea prostrata Thunb., Prodr. Pl. Cap. pars 1 : 27 (1794); Thunb., Fl. Cap. ed Schult. : 133 (1823); Roem & Schult. Syst. Veg. 3 : 355 (1818), R. Br. in Trans. Linn. Soc. Lond. 10 : 221 (1810). Type: E cap. b. spei, Thunberg s.n., sheet 2962 in herb. Thunberg (UPS).

Leucadendron prostratum (Thunb.) Meisn. in DC., Prodr. 14 : 227 (1856).

Leucadendron glomiflorum Salisb. ex Knight in Knight Cult. Prot. : 59 (1809); Phillips & Stapf in Fl. Cap. 5 : 551 (1912). Type: Not traced. "Sandy hillocks near Groot Hout Hoek", Niven.

Leucospermum diffusum R. Br. (Sensu Meisner), in DC. Prodr. 14 : 259 (1856), according to specimens quoted and seen in herb. Meisner (NY).

Prostrate plants with long trailing stems to 2.0 m in length; with numerous stems arising from an underground, persistent rootstock. Flowering stems trailing, slender, 1.0 - 2.0 mm in diam., softly puberulous, usually unbranched. Leaves linear to oblong acute, rarely obtuse,entire, sessile, 2.0 - 4.0 cm long, 2.0 - 6.0 mm wide, sparsely villous to glabrescent, dull olivaceous, patent to subsecund. Inflorescences globose, 2.0 - 2.5 cm in diam., pedunculate; peduncle 1.0 - 3.0 cm long; usually solitary, occasionally 2 or 3 nate. Involucral receptacle flat, 6.0 mm wide. Involucral bracts lanceolate acute, 5.0 - 7.0 mm long, 1.0 - 1.5 mm wide, imbricate, cartilaginous, outer surface tomentose; apex crinite, cinereous. Bracteoles lanceolate acuminate 7.0 mm long, 2.0 mm wide, lanate, margins involute, clasping the perianth. Perianth 8.0 - 10.0 mm long, straight in bud, bright yellow at anthesis becoming deep orange with age. Perianth tube cylindric, 3.0 mm long, glabrous. Perianth claws sparsely villous, equally recurved subterminally. Perianth limbs narrowly lanceolate acute, scarcely differentiated from the claws; sparsely hispid. Style 1.2 - 1.5 cm long, straight, pale yellow at first, aging to orange. Pollen presenter cylindric obtuse, 1.0 mm long, stigmatic groove terminal. Hypogynous scales subulate 1.0 mm long.

Diagnostic Characters: L. prostratum is distinguished from L. pedunculatum by its diffuse prostrate growth habit, the slender, rarely branched trailing stems which arise from a stout subterranean rootstock, the small globose inflorescences 2.0 - 2.5 cm in diam., the cylindric obtuse to clavate styles and the perianth colour, bright yellow on opening, becoming deep orange with age.

Leucadendrum glomiflorum Salisb. ex Knight is included in the synonymy although no type material has yet been traced. However, Knight's very explicit description together with the information regarding its locality, leaves one in little doubt as to the identity of L. glomiflorum.

Distribution and Ecology: L. prostratum occurs from Kogelberg southwards along the coast to Betty's Bay, Houw Hoek, Hermanus, Stanford and Hagelkraal, extending inland to the Gansbaai, Papies Vlei and Elim hills.

This species grows mainly on sandy coastal flats. Populations occuring in hilly country appear to be confined to small areas of loose, sandy soil derived from weathered Table Mountain Sandstone. A winter rainfall of 25 - 40" p.a. is experienced throughout its distribution area. L. prostratum is a very fire resistant species able to withstand repeated burning. Regeneration of the aerial stems takes place from the crown of the subterranean rootstock. The sweetly scented inflorescences are produced from July to December.

Specimens Examined:

CAPE

CALEDON: Klein River mts., Sept., Esterhuysen 2909 (BOL); Palmiet River mts., Stokoe s.n. sub BOL 17520 (BOL); West base of Hangklip, Jan., Pillans 8202 (BOL); Kleinmond, near Palmiet River mouth, Jan., M.C. Gillet 596 (BOL); Kleinmond, Oct., Levyns 7750 (CT); Palmiet River mouth, April, Levyns 6340 (CT); South of Pringle Bay Peak, Sept., Boucher 625 (NBG); Kleinmond near harbour, Nov., Rourke 984 (NBG); Highlands, Sept., Henderson 1101 (NBG); Hills above Gansbaai, Aug., Rourke 506 (NBG); Fisherhaven near Hawston, July (in bud), Williams 786 (NBG); Betty's Bay, June Rourke 485 (NBG); Hermanus rd. near Kleinmond, Sept., Compton 5878 (NBG); Klein river Vlei near Hermanus, Oct., Williams 48 (NBG); Cascades, Betty's Bay, L.E. Taylor 4394 (NBG); Three miles west of Stanford, July, Williams 807 (NBG); 15 miles south of Bot River Nov. Salter 4060 (BM, K); Kogel Bay, Oct., Werdermann & Oberdieck

714 (PRE); Voelklip near Hermanus, June, Bruyn 187 (PRE); Hawston, Sept., Marloth 9205 (PRE); Diep Gat, Oct., Galpin 4465 (PRE, K); 2 miles west by north of Paviesvlei, July, Acocks 22453 (PRE, K); Plains between Kleinmond and Bot River, April, Galpin 12853 (PRE); Pringle Bay, Sept., M.C. Gillet 4210 (PRE); Houw Hoek & Swartberg, Bowie s.n. (K); Klein River, Stokoe 6563 (PRE, K); In arenosis ad Bot River, pone Hemel en Aarde, Aug., Zeyher 3686 (SAM, B, K, Z, BOL, PRE); In montibus Zwartbergen, pone Caledon, Oct., Templemann s.n. sub. 1641 in Herb. Norm. Aust. Afric. (SAM, K, Z); In monte Zwartberg, Caledon, Oct., Pappe s.n. sub SAM 19605 (SAM); Houw Hoek, Aug., Compton 7898 (NBG); Vogel Klip, Sept., Barker 1849 (NBG, PRE); Hangklip, Sept., Compton 13576 (NBG); Afdaks River near Hawston, Sept., Rourke 915 (NBG); Onrust River, Dec., van Niekerk 311 (BOL, PRE); Kleinmond, Sept., Compton 3403 (BOL, K); Road to Kogelberg Forest Reserve from Highlands Oct., Williams 533 (BOL); Palmiet River, April, Stokoe 410 (STE); Papies vlei, July, H.C. Taylor 3612 (STE); Houw Hoek, Oct., Schlechter 5513 (GRA, BOL, BM, STE, SAM, PRE, BR, Z, K).

BREDASDORP: Eland's Kloof mts., above Papies Vlei, Sept., Rourke 570 (NBG); Stanford-Elim rd., Oct., Baker 1140 (BM); Strandkloof Aug., Compton 21973 (NBG); 10 miles from Gansbaai on Elim rd., Sept., Richmond 27 (NBG); Baardscheerdersbos, Jan., Barker 5299 (NBG); Fransch Kraal, Nov., Rycroft 1753 (NBG); Frikkies Bay, Aug., Compton 18210 (NBG); Uilenkraal, Oct., H.C. Taylor 1600 (NBG); Between Waterford and Wolwegat, Sept., Rourke 569 (NBG); Kleyn Hagel Kraal, above Pearly Beach, Oct., Rourke 943 (NBG); Elim hills Aug., Compton 9112 (NBG); Eland's Kloof, Aug., Esterhuysen 5093 (BOL); Sandy flats near Elim, Sept., Levyns 2156 (CT); Elim, April, Schlechter 7640 (GRA, K).

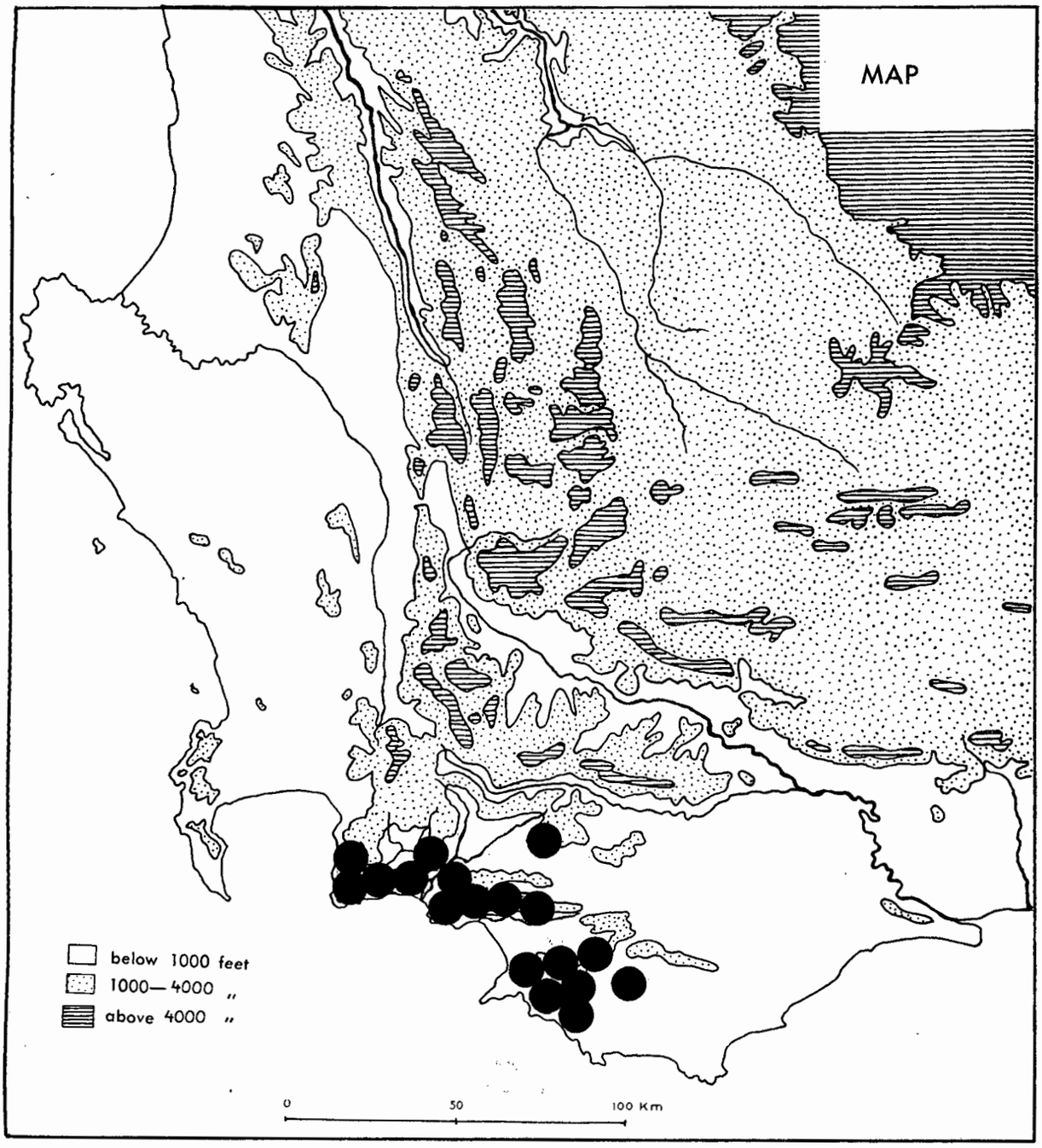


Fig. 50. Distribution of Leucospermum prostratum(Thunb.)Stapf

(40) Leucospermum pedunculatum Klotzsch in Krauss, Flora 28 : 76 (1845); Krauss, Beiträge Fl. Cap. und Natal. : 140 (1846). Type: "In arenosis planitiei Zoetendalsvalley, Dec., 38", Krauss s.n. lectotype (M), isotypes (Z, FI).

Leucadendron pedunculatum (Klotzsch in Krauss) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

A low, prostrate shrub 15.0 - 30.0 cm in height, forming dense mats up to 3.0 m in diam., with a single stout erect main stem, to 30.0 cm in height, 1.0 - 15.0 cm in diam., from which arise stout, horizontally spreading branches. Flowering stems produced at the perimeter of the mat, trailing along the ground, usually bearing short lateral branchlets each terminating in an inflorescence; stems slender 2.0 - 3.0 mm in diam., puberulous. Leaves linear, occasionally slightly falcate 3.0 - 6.0 cm long, 2.0 - 5.0 mm wide, glabrous to minutely puberulous, distant, occasionally subsecund on trailing stems. Inflorescences globose, 2.5 - 3.0 cm in diam., usually solitary; prominently pedunculate, peduncle 2.0 - 4.0 cm long. Involucral receptacle very depressed-conic, almost flat, 4.0 mm high, 7.0 mm wide. Involucral bracts lanceolate acuminate, 6.0 mm long, 1.5 mm wide, cartilaginous, villous, rather loosely imbricate, the apices slightly recurved. Bracteoles oblanceolate, 7.0 mm long, 2.0 mm broad, apex mucronate, margins involute, outer surface thickly lanate. Perianth straight, cylindric in bud, pale cream to white becoming carmine with age. Perianth tube 7.0 mm long, glabrous proximally, villous distally, narrowed at base. Perianth claws equally recurved in the subterminal region, villous. Perianth limbs recurved, narrowly lanceolate acute, 2.0 mm long, hispid. Style straight, 1.7 - 2.0 cm long, pale cream becoming carmine with age. Pollen presenter clavate cylindric, acute, 1.5 mm long, stigmatic groove terminal. Hypogynous scales linear, 1.0 mm long, hyaline.

Diagnostic Characters: L. pedunculatum may be distinguished from L. prostratum with which it has been confused, by its stout, erect main stem, up to 30.0 cm in height and up to 15.0 cm in diam. The horizontally spreading branches terminate in flowering stems which usually bear short lateral branchlets, each branchlet producing an inflorescence. Living material may be distinguished by the creamy-white inflorescences, which become carmine with age, and the bright green colour (R.H.S. 144 B) of the foliage.

The name L. pedunculatum Klotzsch has been consistently misapplied since its publication in 1845. Both Meisner and Phillips assumed it to be a synonym of L. saxatile (Salisb. ex Knight) Rourke (= L. diffusum R. Br.). The original collection was made by Krauss in Dec. 1838 "In arenosis planitei zoetendalsvalley". Krauss described his visit to Soetendalsvlei as follows : "Round the salt pans the ground is covered with Samolus campanuloides R. Br. ..... and the hills of marine lime were beautified by the lovely Leucospermum pedunculatum Klotzsch n. sp., and other plants". (Krauss, 1846)

When the type material was examined it appeared to resemble a slender depauperate twig of L. prostratum (Thunb.) Stapf, but as L. prostratum does not occur near Soetendalsvlei nor on the adjacent limestone hills of the Soetanysberg, it is unlikely to be this species. Unfortunately, no information regarding the colour of the perianth is provided which would at once have established its identity.

The type locality was therefore visited in December 1968. A collection was made a quarter of a mile south east of the homestead Springfontein which lies on the sandy flats between Soetendalsvlei and the foothills of the limestone Soetanysberg. Several flowering stems from this collection match the type material very closely. Thus, despite the fact that L. pedunculatum was described from rather atypical material obtained at the extreme eastern end of its range, a careful search of the type locality for material matching the type specimen, has made it possible to apply this name to living populations with a fair degree of certainty.

Distribution and Ecology: L. pedunculatum is confined to a narrow strip of the Southern Cape coast between Franskraal near Danger Point and Springfontein near Cape Agulhas.

All known populations are found in fairly close proximity to the sea, generally within 2 miles of the coast and never occuring more than 4 miles inland from the coast. The altitudinal range is also small, being from sea level to 600 ft. Most populations grow on the flats skirting the ridge of limestone hills which lie adjacent to the coast, on deep white sandy soils of Tertiary or recent origin. Occasionally plants are found on small areas of wind blown sand that have accumulated between the limestone hills but they are never found growing on limestone. At higher elevations L. pedunculatum occurs on weathered Table Mountain Sandstone. A rather low winter rainfall of 15 - 25" p.a. is experienced throughout its distribution range.

L. pedunculatum has a certain degree of fire resistance. If the peripheral branches are burnt off, regeneration frequently takes place from the crown of the trunk, but recovery seems to depend on the intensity of the fire.

Between August and January, the very sweetly scented inflorescences are produced, the peak of the flowering season being in September. On opening the perianth is creamy-white, changing to pink and later to carmine.

Plants from the western end of the distribution range form large dense mats. They are further characterised by the bright green foliage and the numerous axillary branchlets produced by the flowering stems. This form gradually grades into less vigorous plants towards the eastern end of the distribution range which are more diffuse, produce few axillary branchlets (or none at all) on the flowering stems and have rather more olivaceous foliage, but develop a taller and more prominent main stem.

At Kleyn Hagel Kraal, L. pedunculatum and L. prostratum occur sympatrically (within 5 metres of each other) but no hybridization has ever been observed between these two species.

Specimens Examined:

CAPE

BREDASDORP: Danger Point mountain, Jan., Leighton 1596 (BOL, PRE); Hagelkraal River, Dec., Leighton 2536 (BOL); Ratel River, Jan., Rycroft 1852 (NBG, BOL); Zoetanysberg, Oct., H.C. Taylor 145 (BOL); Franskraal, Aug., Leighton 1883 (BOL); Brandfontein, sandy flats, Oct., Esterhuysen 19065 (BOL); Pearly Beach, Jan., Lewis 2595 (SAM); Frikkies Bay, Aug., Compton 18180 (NBG); Near Vogelvlei between Elim & Bredasdorp, Aug., Williams 478 (BOL); In ericetis prope Elim, Dec., Bolus 8587 (BOL); In montibus prope Elim, Oct., Bolus 7872 (BOL, PRE); Between Gansbaai and Baardscheerdersbos, Oct., Levyns 10879 (CT); Springfield estate, Sept., Stokoe s.n. sub SAM 62121 (SAM); In arenosis planitei Zoetendalsvalley, Dec., Krauss s.n. (M, FI, Z); Gansbaai, Sept., Gillet 4328 (PRE); Dirk Uys Kraal, Aug., van Breda 835 (PRE); Ratel River estate, Oct., van Breda 1467 (PRE); Sandy hills above Hagelkraal, Sept., Rourke 530 (NBG); Kleyn Hagelkraal above Pearly Beach, Oct., Rourke 942 (NBG); Groenkloof, Kleyn Hagel Kraal, Sept., Rourke 1086 (NBG); Heidehof near Uilenkraal River, Dec., Rourke 1011 (NBG); Springfontein, 1/4 mile south of homestead, Dec., Rourke 1174 (NBG); Hagelkraal, Jan., Compton 20435 (NBG); Springfield, Jan., Rycroft 1826 (NBG); Franskraal, Nov., Rycroft 1754 (NBG); Hills one mile north of the Soetanysberg, Dec., Rourke 1015 (NBG); Soetanysberg,

north slopes, Dec., Rourke 1018 (NBG); One mile inland from Die Dam, Sept., Esterhuysen 32019 (NBG); Bo Vogelvlei, road to Soetanysberg, Oct., Williams 1321 (NBG); Soetanysberg, east of Rietfontein, Oct., Rourke 1128 (NBG); Between Jacobsdam and Geelrug, north of Soetanysberg, Oct., Rourke 1123 (NBG); Waterford, between Viljoen's Hof and Hagelkraal, Oct., Rourke 1134 (NBG); Brandfontein, Nov., Smith 5001 (PRE); Brandfontein, at foot of Soetanysberg, Nov., Smith 5012 (PRE); Bredasdorp mountains, Nov., Galpin 10502 (PRE).

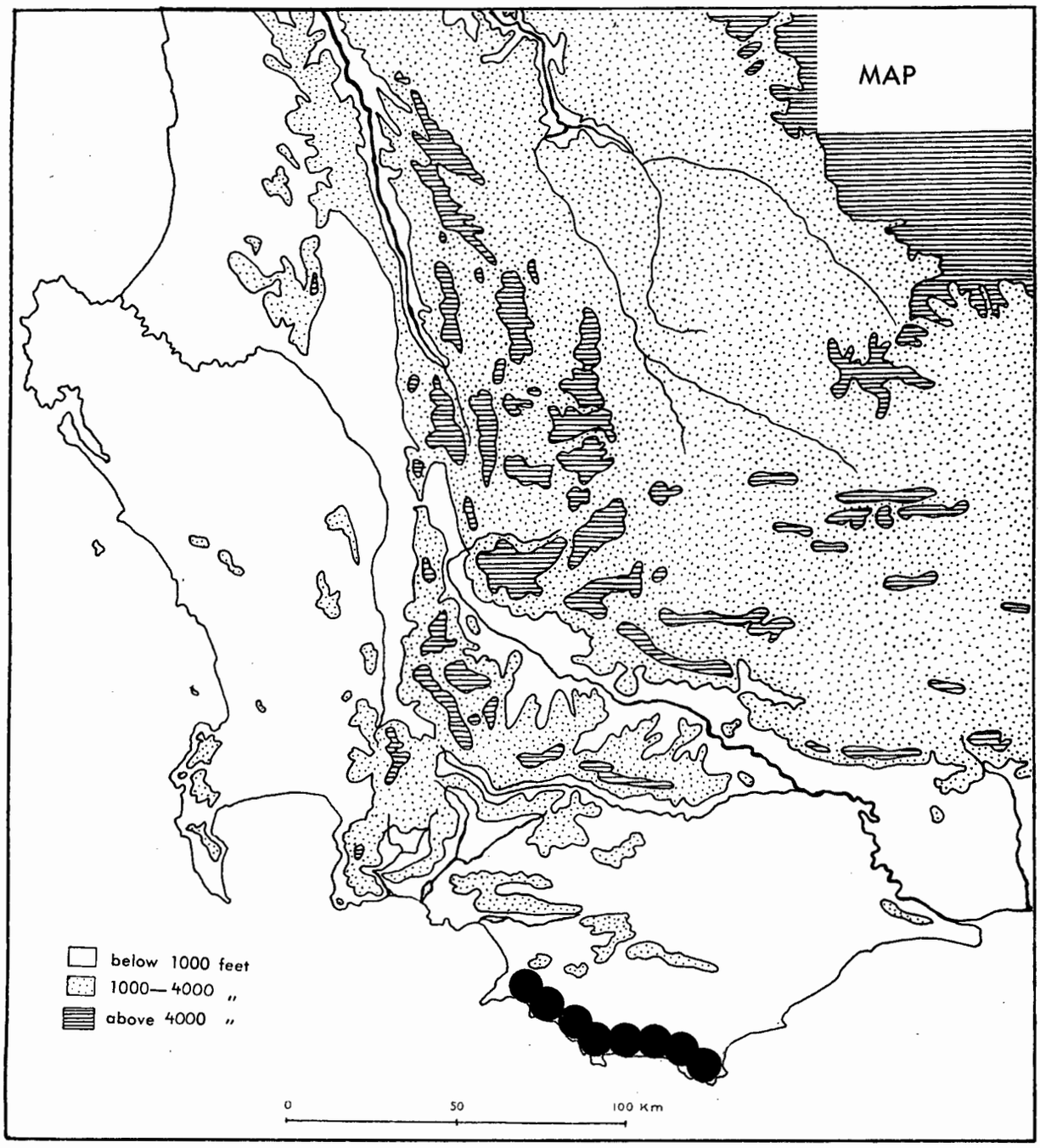


Fig. 51. Distribution of Leucospermum pedunculatum Klotzsch

Seot. 8. XERICOLA Rourke, sect. nov.

Foliis integris, glabris, glaucis, ovatis-ellipticis vel linearis spathulatis, cartilagineis, crassis. Inflorescentiae globosae, 1.0 - 2.5 cm in diam. Perianthium roseum. Stigmate clavata. Bracteolae demum accrescentes, lignescentes.

Type: L. alpinum (Salisb. ex Knight) Rourke

The section Xericola is a very natural group characterised by the small rather few flowered globose inflorescences the thick, glaucous, entire leaves, the pink perianth and the bracteoles which enlarge and become woody in the post pollination phase. Apart from the very distinct L. secundifolium, the remaining material which had been assigned to L. alpinum and L. obtusatum, appeared to belong to a single variable complex. Leaf length appeared to be the only significant variable character as the floral parts except for differences in style length were very similar in all the material. In material referred to L. alpinum the range in style length is 1.2 - 1.7 cm while in L. obtusatum it is 1.0 - 1.3 cm. Initially, an inspection of all available material suggested that there was an even gradation from linear-spathulate to obovate-spathulate leaves. However, closer inspection revealed that the broader leaved forms were from northerly localities while the narrower leaved forms were from southerly localities. Moreover, in the narrower leaved forms a fine indumentum of short, crisped hairs persists on the foliage for several months while the broader leaved forms are quite glabrous.

In order to investigate the significance of leaf dimensions in relation to locality, the lengths and widths of accurately localised specimens in BOL, SAM, NBG, CT, PRE and K were plotted as a scatter diagram. Each measurement was scored to indicate locality. (fig 52). A gap separating the complex into two main groups is apparent while two less clearly defined sub groups may be distinguished within each of the main groups. These four groups represent four isolated montane populations occuring in areas bordering the Karroo, above 3,000 ft. and growing in arid Fynbos. Effective reproductive isolation is achieved by the presence of intervening karroid areas. (fig 53).

The gap between the two main groups is regarded as being sufficiently marked to recognise them at specific level as L. obtusatum and L. alpinum respectively. (fig 52). No absolute disjunctions between the subgroups are discernible in the diagram although it

is clear that each species is composed of two local races.

Field observations revealed that in the case of L. obtusatum the shorter leaved form was consistently decumbent with trailing stems and secund leaves. The Witteberg population is composed entirely of upright plants with erect stems and considerably longer leaves. For these reasons this latter population is here described as a distinct subspecies of L. obtusatum.

In L. alpinum, apart from the considerable geographical disjunction between the two populations as well as differences in the leaf length, the Cold Bokkeveld-Swartruggens material is characterised by the presence of prominent involucral bracts. The typical population from the Kamiesberg is characterised by a poorly developed, indistinct involucre.

Consequently, it is now proposed that the Cold Bokkeveld-Swartruggens populations be recognised as a hitherto undescribed subspecies of L. alpinum.

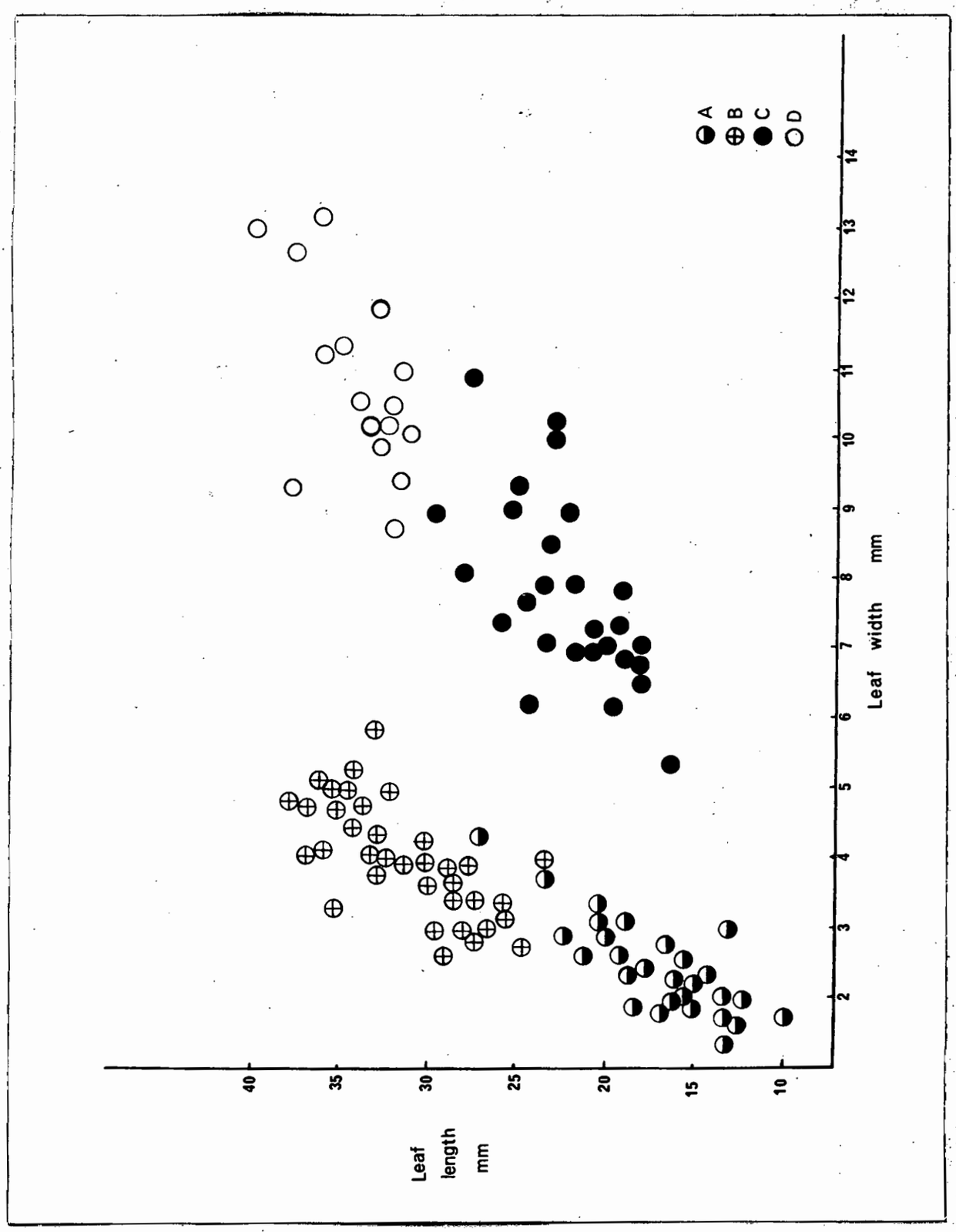


Fig. 52. Scatter diagram showing variation in the leaf dimensions of Leucospermum obtusatum (Thunb.) Phillips ssp. obtusatum (A), L. obtusatum (Thunb.) Phillips ssp. albomontanum Rourke (B), L. alpinum (Salisb. ex Knight) Rourke ssp. alpinum (D) and L. alpinum (Salisb. ex Knight) Rourke ssp. amoenum Rourke (C).

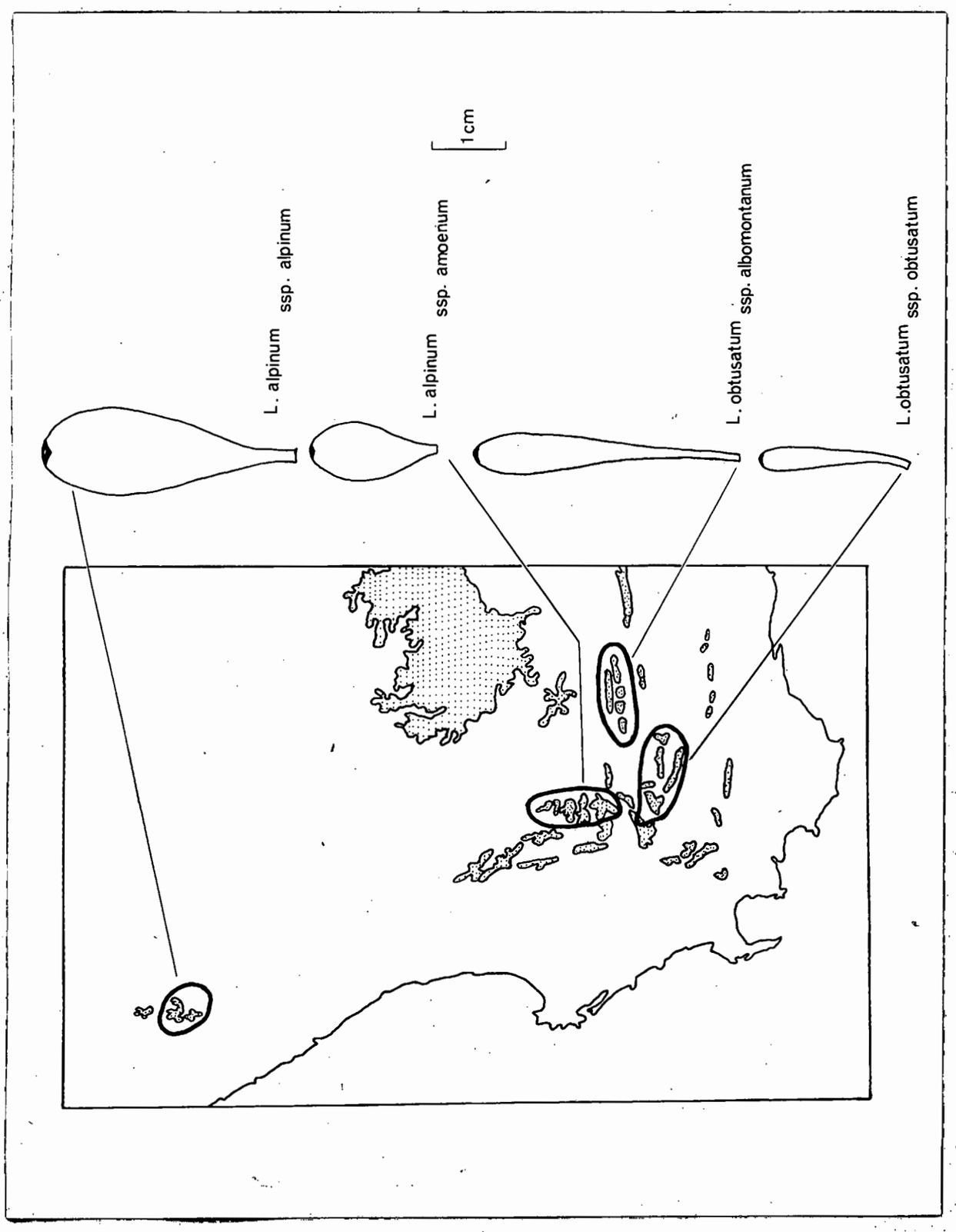


Fig. 53. Distribution of Leucospermum alpinum (Salisb. ex Knight) Rourke and L. obtusatum (Thunb.) Phillips showing the ranges of their subspecies. Outlines of leaves regarded as being representative of each subspecies are shown.

(41) Leucospermum alpinum (Salisb. ex Knight) Rourke in Jl S. Afr. Bot. 33 : 266 (1967).

An erect to suberect shrub to 1.5 m in height; with a single main stem at base, trunk to 5.0 cm in diam., lowermost branches tending to sprawl along the ground. Flowering stems erect or slightly spreading; terete, 3.0 mm in diam., puberulous, soon becoming glabrous. Leaves obovate to spathulate-elliptic, 1.5 - 4.0 cm long, 0.5 - 1.3 cm wide; usually distinctly petiolate, entire, glabrous, thick and coriaceous with a prominent margin and a yellowish callous at apex; subimbricate to slightly patent. Inflorescences solitary, globose, 1.5 - 2.0 cm in diam., sessile or pedunculate, peduncle up to 1.5 cm long; inflorescences occasionally terminal. Involucral receptacle ovoid to spherical, 5.0 mm in diam. Involucral bracts lanceolate, acute to acuminate densely lanate, apex hardened and glabrous; 6.0 mm long, 1.5 mm wide, uniseriate or 3 - 4 seriate. Bracteoles ovate-lanceolate, acute, very densely lanate, 5.0 mm long, 2.0 mm wide. Perianth 1.3 - 1.8 cm long, straight in bud, pale pink when fresh, limbs deep claret. Perianth tube 2.0 - 2.5 mm long, glabrous. Perianth claws villous to densely villous, becoming coiled at anthesis. All 4 claws of equal length, free, spreading at right angles. Perianth limbs elliptic 2.0 mm long, tomentose-villous. Style straight, 1.2 - 1.7 cm long, pale pink to carmine at anthesis becoming deep claret with age. Pollen presenter clavate 1.5 mm long, brownish at first, becoming deep purple to black. Ovary ellipsoid-ovoid 1.0 mm long, pubescent, clearly differentiated from style. Hypogynous scales 1.0 mm long, subulate, yellow.

Diagnostic Characters: The thick,glabrous, slightly glaucous entire obovate to spathulate-elliptic leaves which are 1.5 - 4.0 cm long and 0.5 - 1.3 cm wide, distinguish L. alpinum from related species.

Key to the subspecies

Leaves 3.0 - 4.5 cm long, involucre indistinct, uniseriate, puberulous; confined to Kamiesberg.

..... ssp. alpinum

Leaves 1.5 - 3.0 cm long, involucre prominent, 3 - 4 seriate, lanate; confined to Cold Bokkeveld & Swartruggens.

..... ssp. amoenum

a Leucospermum alpinum (Salisb. ex Knight) Rourke ssp. alpinum

Protea alpina Salisb. ex Knight in Knight, Cult. Prot. : 27 (1809). Lectotype: "On the high peak of Khamiesbergh, Niven 47 (PH), isotype in herb J.E. Smith (LINN).

Leucadendron cartilagineum R. Br. in Trans. Linn. Soc. Lond. 10 : 67 (1810). Presumed type: Niven 47 in herb J.E. Smith (LINN).

Protea cartilaginea (R. Br.) Poir. in Lam., Encycl. Meth. Bot. Suppl. 4 : 557 (1816).

Leucospermum cartilagineum (R. Br.) Phillips in Fl. Cap. 5 : 636 (1912).

An erect shrub to 1.5 m in height. Leaves obovate to spathulate-elliptic, 3.0 - 4.5 cm long, 8.5 - 13.0 mm wide, distinctly petiolate. Inflorescences globose, 2.0 cm in diam.; involucre indistinct, involucral bracts uniseriate, puberulous.

No type material of Protea alpina could be traced in Salisbury's herbarium at Kew, but the Academy of Natural Sciences, Philadelphia (PH) possesses a considerable number of specimens of Cape Proteaceae collected by Niven, including two duplicates of his original collection of Protea alpina. One of these sheets bears a ticket in Niven's hand which reads "Protea 3 or 4 ft high on the high peak of Khamiesbergh". As Knight uses this phrase verbatim in the type description, this sheet has been designated the lectotype of P. alpina. A duplicate of this collection is in Smith's herbarium (LINN) and is annotated "Cap b. spei - Hibbert 1801" in Smith's handwriting. I consider that this sheet is the type of Leucadendron cartilagineum R. Br. since Brown merely remarks "v.s. in Herb. Soc. Linn. et D. Hibbert.", without mentioning any collector.

Distribution, Ecology and Biology: The only Leucospermum found in Namaqualand, L. alpinum ssp. alpinum, is confined to the Kamiesberg Range where it occurs on the higher peaks between 4,500 ft. and 5,500 ft. at Leliefontein, on Ezelskop, Welcomekop and Roodeberg.

Archaean granite and soils derived from it make up the substratum throughout this area. Most populations are apparently confined to the upper slopes of the peaks in both north and south facing positions. The average annual rainfall at Leliefontein (4,700 ft) is 12.7". Eighty per cent of the precipitation falls in winter and the figure quoted is probably fairly representative of the Kamiesberg complex, although during this period a maximum of 20.6" and a minimum of 7.4" p.a. was recorded (Adamson, 1938 : 5). The associated vegetation is composed mainly of hardy outliers of genera such as Passerina, Cliffortia and Metalasia. Flowering takes place from September to November.

Specimens Examined:
CAPE
NAMAQUALAND: Leliefontein, Roodeberg, Ezelkop, Nov., Drège s.n. (M, NY, B, SAM, S, G, PRE, K, BM); Leliefontein, 4500 ft, 3/11/1830, Drège s.n. (P); Roodeberg, 4,000 - 5,000 ft, 10/11/1830, Drège 2417 (P, B); Kamiesbergen, May, Marloth 4865 (PRE); Leliefontein Kamiesbergen, Marloth 8758 (PRE); Ezelkop, near summit, Kamiesberg, Oct., Adamson 1466 (CT, PRE); Leliefontein, Kamiesberg, Feb. (in fruit), George s.n. (STE 19567); Beacon Hill, north west of Leliefontein, Jan. (in fruit), Pearson 6330 (BOL, SAM, K); Near Leliefontein, Sept., Levyns 4003 (CT); Welcome, Kamiesberg, Oct., Esterhuysen 23735 (BOL); "On the high peak of Khamiesbergh", Niven 47 (PH, LINN),

WITHOUT PRECISE LOCALITY: Africa australis, Roxburgh s.n. (BM); Prom bon. spei, Roxburgh s.n. (G).

b Leucospermum alpinum (Salisb. ex Knight) Rourke ssp. amoenum Rourke, ssp. nov.

Distinguitur a subspecie typica, foliis brevioribus (1.5 - 3.0 cm longis), involucro distincto, 3 - 4 seriato bracteis dense lanatis.

An erect to suberect shrub, to 1.0 m, the lowermost branches tending to trail along the ground. Leaves obovate, entire, apex rounded,

1.5 - 3.0 cm long, 5.0 - 11.0 mm wide. Involucre prominent, 3.- 4 seriate, involucral bracts thickly lanate.

Type Material: Ceres district, at Katbakkies, Swartruggens Range between Cold Bokkeveld and Ceres Karoo, 22nd Oct. 1967, Rourke 958, (holotype NBG).

Distribution and Ecology: L. alpinum ssp. amoenum is confined to the south Cold Bokkeveld and the southern end of the adjacent Swartruggens range.

Unlike the typical subspecies which occurs exclusively on Archaean granite, L. alpinum ssp. amoenum grows only on Table Mountain Sandstone. This environment is slightly more moist than the Kamiesberg, experiencing 10 - 20 " of rain p.a. Hot, dry, very rocky north facing slopes are the favoured habitat. The associated vegetation is Arid Fynbos, composed mainly of low, sparse Restionaceae, Ericaceae and Proteaceae. Flowering takes place between September and November.

Specimens Examined:

CAPE

CERES: Near Zandberg, south Cold Bokkeveld, Oct., Esterhuysen 3449 (BOL, PRE, K); Ertjiesland Kloof, Nov., Leighton 2260 (BOL, PRE); Baviaansberg, Jan., Stokoe 4547 (BOL); Ceres, Nov., Tijmens 14 (STE); Dwarsberg, Ceres, Cold Bokkeveld, Sept., Levyns 1942 (CT, K); Baviaansberg, Jan., Stokoe s.n. (SAM 68375); Gydo, Nov., Compton 18712 (NBG); Road to the Ceres Karroo beyond Houdenbek, Sept., Williams 891 (NBG); Baviaansberg, Nov., Esterhuysen 29842 (NBG); South Cold Bokkeveld, Oct., Bond 647 (NBG); Katbakkies, Swartruggens Range, between Cold Bokkeveld and Ceres Karroo, Oct., Rourke 958 (NBG).

WITHOUT PRECISE LOCALITY: C.B.S., Mund s.n. (K).

(42) Leucospermum obtusatum (Thunb.) Phillips in Fl. Cap. 5 : 637 (1912).

An erect to suberect or sprawling to decumbent shrub 20.0 cm - 1.0 m in height, 1.0 - 2.0 m in diam. Flowering stems erect or trailing, 1.0 - 2.0 mm in diam., thinly puberulous with fine crisped hairs, soon glabrous. Leaves linear-spathulate, entire 0.9 - 3.8 cm long, 1.5 - 6.0 mm wide, apex rounded, obtuse. Leaves dull grey - glaucous, puberulous at first becoming glabrous; stiffly erect-ascending or secund. Inflorescences terminal, globose, 1.5 - 2.0 cm in diam. Involucral receptacle depressed globose 3.0 - 4.0 mm in diam. Involucral bracts ovate acute, 6.0 - 8.0 mm long, 2.0 - 4.0 mm broad, outer surface thickly tomentose to lanate; bracts imbricate, cartilaginous, uniseriate. Bracteoles ovate-acute, 5.0 - 7.0 mm long, 2.5 - 3.0 mm wide, thickly lanate, tightly clasping the perianth. Perianth 1.0 - 1.5 cm long, straight, the 4 perianth claws becoming equally recurved at anthesis; cream or pink in fresh state. Perianth tube 2.0 - 3.0 mm long, slightly quadrangular, glabrous. Perianth claws filiform, the outer surface beset with a fine crisped indumentum. Perianth limbs lanceolate-acute, 3.0 mm long, outer surface very shortly villous. Anthers sessile, elliptic, 2.5 mm long, apical boss pointed, black. Style 1.0 - 1.3 cm long, straight, pale yellowish-green at first becoming deep claret coloured with age. Pollen presenter clavate-obtuse, 1.5 - 2.0 mm long, greenish when fresh becoming amber with age. Stigmatic pore terminal, minute. Ovary ovoid, 1.0 mm long very clearly differentiated from style, pubescent. Hypogynous scales subulate, hyaline, 1.0 mm long.

Diagnostic Characters: The entire, puberulous linear-spathulate, leaves, 1.5 - 6.0 mm wide, attenuate to petiolate at the base, distinguish L. obtusatum from all other species in the genus.

Key to the subspecies

Stems decumbent or trailing, leaves secund, 10 - 25 mm long.

.....ssp. obtusatum.

Stems erect, leaves loosely ascending imbricate, 22 - 38 mm long.

..... ssp. albomontanum.

a Leucospermum obtusatum (Thunb.) Phillips ssp. obtusatum.

Protea obtusata Thunb. in Phytogr. Blätt. 1 : 15 (1803). Type: Cap. b. spei, Thunberg s.n., sheet no. 2946 in herb. Thunberg, holotype (UPS).

Protea obtusa Thunb. in Nova Acta Acad. Sci. Imp. Petrop. Hist. Acad. 15 : 461, tab. 3 fig. 2 (1806). Type: As for P. obtusata.

Leucadendron obtusatum (Thunb.) Meisn. in DC., Prodr. 14 : 227 (1856).

A sprawling decumbent shrub with stems trailing along the ground; forming dense mats 1.0 - 2.0 m in diam. Leaves secund to subsecund linear-spathulate, 1.0 - 2.5 cm long, 0.5 - 4.5 mm wide.

Apart from the vague "Cap. b. spei", Thunberg, who first collected and described this species provides no further information concerning its exact locality. Nevertheless, from the trailing stems with secundly arranged leaves on the type specimen, one may deduce that Thunberg made this collection in the Koo-Montagu-Waboomberg area. The only occasion on which he passed close to this area was in mid October 1772. This clue is provided in Thunberg's "Travels" where we learn that the party proceeded "to Riet Fontein and further over Clas Vogts Rivier to a farm which at this time belonged to one Le Roux". From the vicinity of Klaas Voogds it would not have been impossible for Thunberg to make an excursion into the surrounding Langeberg where he would have encountered L. obtusatum ssp. obtusatum.

Distribution and Ecology: Although L. obtusatum ssp. obtusatum is mainly centred around the Waboomsberg and Koo mountains in the Montagu district, its range extends westwards to the Worcester district where it has been recorded on the Keeromsberg, Matroosberg and at Bokkeriver.

This subspecies inhabits dry rocky slopes of Table Mountain Sandstone in an area receiving a winter rainfall of 10 - 15" p.a. Most populations occur above 3,000 ft. The veld type in which they occur is Arid fynbos and the associated vegetation consists mainly of low Restionaceae and Cliffortia ruscifolia with Protea repens, P. lorifolia and P. sulphurea being the more significant larger shrubs. The mature shrub seldom exceeds 20.0 cm in height

but develops into a dense spreading mat up to 2.0 m in diam., with stems radiating from a stout trunk and trailing over the ground. From September to December the sweetly scented cream to pink inflorescences are produced, usually on the young shoots at the perimeter of the old plants.

Specimens Examined:

CAPE

MONTAGU: Top of pass between Concordia and Eendracht, Oct., Michell 305 (PRE, CT); Wagenboomsbergen, Dec., Compton 10286 (NBG, BOL); Eendracht, Wagenboomsbergen, Sept., Compton 18388 (NBG, BOL); Eendracht, Sept., Lewis 1645 (SAM); Concordia and Triangle, Oct., Barnard 683 (SAM); Waboomsberg, April, Williams 727 (NBG); Koo Mountains, Nov., Oliver s.n. (NBG 40111); On the Waboomsberg at Brakkefontein, Oct., Rourke 1163 (NBG); Waboomsberg, at Highlands, Oct., Rourke 1164 (NBG).

WORCESTER: Keeromsberg, shale band S.W. side, Nov., Esterhuysen 9286 (BOL); Keeromsberg, shale band below Ben Heatlie, March, Esterhuysen s.n. (BOL); Keeromsberg, Koo valley side, April, Esterhuysen 22895 (BOL); Matroosberg, K.L. Davidson15 (K), 37 (SAM).

CERES: Bokkeriver Farms, Nov., Horrocks 127 (NBG).

b Leucospermum obtusatum (Thunb.) Phillips ssp. albomontanum Rourke, ssp. nov.

L. obtusatum ssp. albomontanum a habitu erecto, foliis linearibus spathulatis integris, laxe imbricatis assurgentibus, 2.2 - 3.8 cm longis, distinguitur. Folia longiora quam subspecie typica sunt.

An erect to rather spreading shrub, to 1.0 m in height, 1.0 m in diam., single stemmed at base. Flowering stems erect with leaves loosely ascending imbricate. Leaves entire, linear-spathulate, glabrous, 2.2 - 3.8 cm long, 2.5 - 5.5 mm wide.

Type Material: Summit of the Witteberg at Bantams, 29th Oct. 1968, Rourke 1161, (holotype NBG).

Distribution, Ecology and Biology: L. obtusatum ssp. albomontanum is distributed along the entire length of the Witteberg and also occurs on the adjacent Bonteberg.

Throughout its range, this subspecies grows exclusively on soils derived from quartzites of the Witteberg series. This is in contrast to the typical subspecies which occurs only on Table Mountain Sandstone. At most places on the Witteberg it is very common particularly along the summit ridge and on the upper south slopes, even extending down the hot north facing slopes in sheltered kloofs. The plants grow wedged between sharp angular quartzite fragments on very rocky scree-like slopes, between 4,000 and 5,000 ft. The associated vegetation consists mainly of sparsely scattered tufts of Restionaceae, Erica spectabilis, Protea lorifolia, P. harmeri and Leucadendron cadens. A very low winter rainfall is experienced. No exact rainfall figures are available for the summit of the Witteberg but it is unlikely to be more than 10" p.a., since the mean annual rainfall of Matjiesfontein is 6" and that of Whitehill is 5", (Compton, 1931 : 269). Both these villages are situated at the foot of the Witteberg, 2,000 ft below the summit ridge. The very arid nature of this environment cannot be over emphasised as the average annual rainfall experienced here is barely sufficient to maintain a cover of Cape Flora or "Fynbos". Levyns (1938 : 414) considered that a mean annual rainfall of 10" or more is necessary to support Cape Flora.

If left unburnt, plants of L. obtusatum ssp. albomontanum will reach a height of 1.0 m or more. The pink to carmine coloured inflorescences are sweetly scented and are produced between August and November.

Specimens Examined:

CAPE

LAINGSBURG: Witteberg near Matjiesfontein, Nov., J.D. Logan s.n. no. 11555 in herb. Marloth (PRE); Witteberg, Oct. Leighton 209 (BOL); Witteberg near Whitehill, Nov., L.E. Taylor 1248 (BOL); Witteberg near Matjiesfontein, Oct., Marloth 4539 (BOL); Tweedside, Witteberg Ridge, Oct., Compton 3265 (BOL, BM, NBG, K); Witteberg, Jan., Esterhuysen 28884 (BOL, NBG); Summit of the Witteberg, June, Compton 2556 (BOL); Witteberg, Matjiesfontein, Sept., Thoday s.n. (SAM 25281); Witteberg, Nov., Compton 2823 (BM, K); Top of Witteberg, Oct, Compton 39169 (BM); Witteberg, Whitehill, south slope, Aug., Compton 2514 (BM); Witteberg at Whitehill, Oct., Compton 13933, 7952 (NBG); Witteberg, Bantams, Oct., Compton 12180 (NBG); Summit of the Witteberg at Bantams, Oct., Rourke 1161 (NBG).

CERES: Bonteberg, Nov., Compton 9924 (NBG); Eikenbosch hoek, Bonteberg, summit of ridge, Nov., Esterhuysen 3700 (BOL, K, PRE).

(43) Leucospermum secundifolium Rourke, sp. nov.

Species insignis, a speciebus omnis nanis prostratis mihi notis bene distincta propter caules graciles serpentes, folia petiolata secunda distantes, angusta elliptica, obtusa, et inflorescentias parvalas floribus paucis.

Frutex humilis, diffusus. Caules graciles, serpentes, 1.5 - 2.0 mm in diam. Folia glabra, petiolata, elliptica, secunda, 5.0 - 8.0 cm longa, 0.7 - 1.6 cm lata. Petiolus 1.0 - 2.0 cm longus. Apex obtusus, integrus, raro tridentatus. Inflorescentia globosa, 1.0 - 1.5 cm in diam. Bracteae involucrali, uniseriatae, lanceolatae acuminatae, 6 mm longae, 2 mm latae. Perianthium 1.6 cm longum, rectum. Stylus filiformis, 1.4 cm longus, rectus. Stigma 1.0 mm longa, clavata.

A low, prostrate, decumbent shrub, with slender rather diffuse stems, trailing over the ground. Stems very slender, 1.5 - 2.0 cm in diam., new growths villous to lanate, but soon quite glabrous. Leaves glabrous, petiolate (petiole 1.0 - 2.0 cm long) elliptic,obtuse, 5.0 - 8.0 cm long, 0.7 - 1.6 cm wide; apex obtuse with a single callus tooth, or occasionally 3 toothed; margins horny, occasionally involute on upper surface. Leaves secund, arising at right angles to the stems, young leaves thickly villous to lanate, soon glabrous. Inflorescences axillary, borne at the apices of the flowering shoots, usually solitary. Inflorescence globose, 1.0 - 1.5 cm in diam.; pedunculate, peduncle 0.5 - 1.5 cm long, very thickly villous to lanate, 1.5 mm in diam. Inflorescences 12 - 30 flowered. Involucral receptacle depressed globose, 2.0 mm in diam., very much reduced. Involucral bracts lanceolate acuminate, 6.0 mm long, 1.5 - 2.0 mm broad; in a single series. Bracteoles lanceolate to broadly ovate, apex acuminate, somewhat cartilaginous, very thickly villous, becoming considerably enlarged (to 1.0 cm long) and woody after pollination. Perianth 1.6 cm long, straight. Perianth tube 4.0 - 5.0 mm long, cylindric, glabrous proximally, villous distally. Perianth claws slender, 0.75 mm wide, villous; all 4 perianth claws becoming equally reflexed in the subterminal region at anthesis. Perianth limbs lanceolate elliptic, 2.0 mm long, 1.0 mm broad, sparsely villous to tomentose. Style filiform 1.4 cm long, tapering very slightly in the subterminal region. Pollen presenter clavate obtuse 1.0 mm long, stigmatic groove terminal. Hypogynous scales subulate 0.5 mm long, hyaline.

Fig. 54. Part of the type of Leucospermum secundifolium Rourke life size. (From E. Esterhuysen 26835).

Diagnostic Characters: L. secundifolium is unlike any other species in the genus and may readily be distinguished by the glabrous, distinctly petiolate, narrowly elliptic, obtuse leaves secundly arranged and the very small (1.0 - 1.5 cm in diam.) few flowered inflorescences.

Type Material: Ladismith district, Swartberg, Towerkop, steep rocky slopes below shale band, 4,000 ft., 17th Dec. 1956, Esterhuysen 26835, holotype BOL, isotype NBG.

Distribution and Ecology: As only two collection of L. secundifolium have ever been made, its exact range is uncertain, but according to these records the species appears to be localised on the south side of the Klein Swartberg range, between Towerkop and Seven Weeks Poort.

Both collections have been made at an altitude of 4,000 ft. on rocky, south facing slopes of Table Mountain Sandstone, in a region experiencing a winter rainfall of 10 - 15" p.a. Flowering takes place in early December.

Specimens Examined:
LADISMITH: Towerkop, Swartberg, steep rocky slopes below shale band, Dec., Esterhuysen 26835 (BOL, NBG); Seven Weeks Poort, slopes, 4,000 ft., Sept. 1928, Pocock s.n. (Levyns 2480 CT) - in fruit.

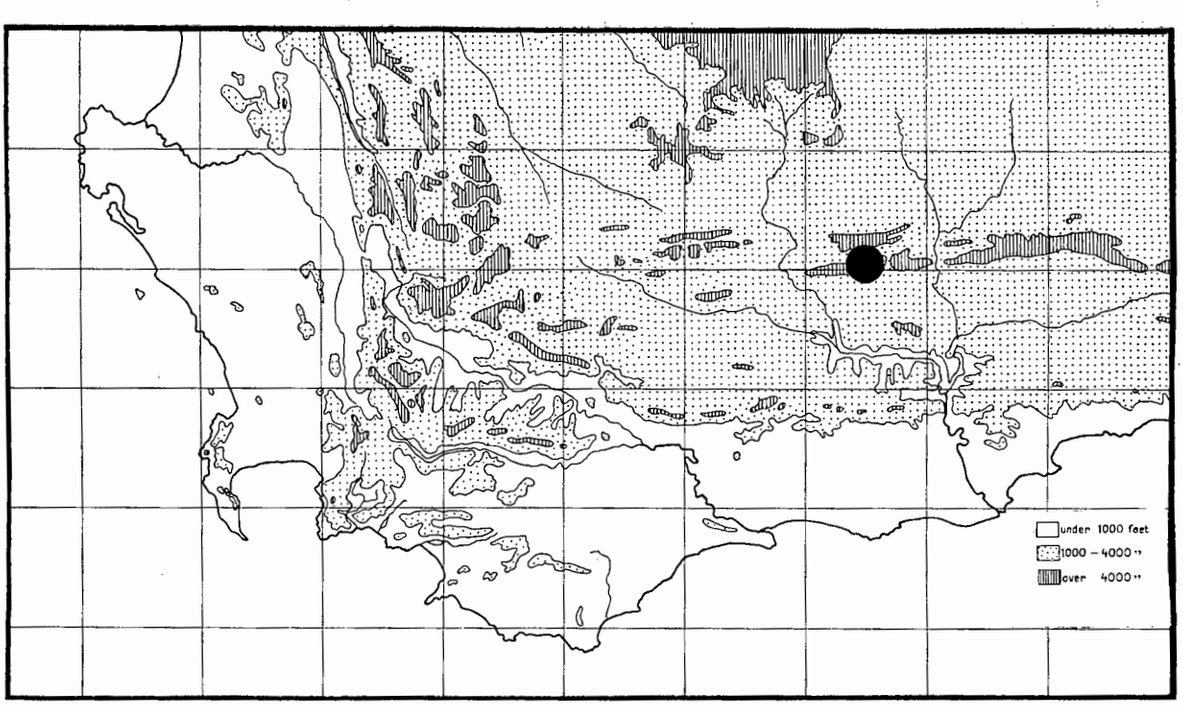


Fig. 55. Distribution of Leucospermum secundifolium Rourke

Sect. 9 CRINITAE Phillips

Sect. Diastella sensu Meisn, non Diastella (Salisb.) Endl.

Erect or sprawling shrubs. Inflorescences turbinate, 2.0 - 4.0 cm in diam. Styles filiform, 2.5 - 3.0 cm long. Perianth colour varying with age, greenish-yellow to orange or crimson.

Lectotype: L. oleaefolium (Berg.) R. Br.

Within the very natural section Crinitae, characterised by flat involucral receptacles and filiform styles, the prostrate species L. gracile and L. saxatile are very distinct. Likewise, erect forms having oblanceolate leaves, with 7 - 17 teeth at the apex, are referred to the L. mundii group. However, specimens having an erect growth habit, lanceolate to ovate, usually entire leaves (seldom 2, 3 4 or 5 dentate), and membranaceous involucral bracts, belong to a complex group wherein eight different specific names have been applied in the past. It is here referred to as the L. oleaefolium group for convenience.

(A) The L. oleaefolium group.

After extensive field investigations it became evident that much of the variation within this group was associated with differences in the ecological conditions under which the plants were growing, particularly with regard to the elevation of the populations above sea level. It was suspected that the variation might be clinal. In order to study this phenomenon, an area near the Palmiet River mouth, between Betty's Bay and Kleinmond, was selected as the most suitable site for a transect since there is a marked altitudinal range over a short distance in undisturbed virgin veld. Three sampling stations were chosen at intervals along a 6 mile transect, covering an altitudinal range from sea level to 1,800 ft (fig. 56)

The first station, A, at 50 ft. was situated along the coast at Sunny Seas, between De Wet's Bay and Betty's Bay, approximately 50 yards from the high water mark. The second station, B, at 500 ft. was on the lower south slopes of Voorberg, directly above De Wet's Bay and Sunny Seas. Similarly, station C at 1,800 ft. was situated along the Paardeberg plateau above Kleinmond. At each station 50 samples were taken at regular intervals over a distance of at least one mile on the contour line of the particular station.

Observations:

The most significant variable characters in the complex under study are growth habit, leaf pubescence and the length, form and pubescence of the involucral bracts.

The population at 50 ft. is exposed to the full force of the salt laden south easterly winds. Here, a compact rounded growth habit, with short interlocking branches, is developed. The leaves are permanently pubescent with a dense villous indumentum.

Plants at 500 ft. are characterised by a more open growth habit than the extreme maritime form at station A. Much of the pubescence on the leaves is shed at an early stage, leaving the mature leaves partly glabrous and partly pubescent.

A loose, sparsely branched, rather straggly growth habit characterises specimens from station C. The leaves are always completely glabrous.

The appearance of the inflorescence is most radically altered by differences in the length and pubescence of the involucral bracts. At each station the lengths of the involucral bracts were measured and then plotted as a series of histograms. (The bract length was measured from the innermost whorl of involucral bracts in an inflorescence). This revealed a very distinct cline with regard to bract length which was found to increase with increasing altitude. It was found that the higher the population above sea level, the longer the involucral bracts became, (fig. 57). Thus the involucral bracts of plants from the population at 1800 ft. may be 3 or 4 times the length of those from plants at 50 ft. above sea level. Moreover, the short, acute involucral bracts of populations at an elevation of 50 ft. generally had ciliate margins, while the acuminate bracts typical of material from 1800 ft. were found to be prominently crinite at the apex. A complete gradation of intermediate forms links the two extremes (fig 58).

Continuous variation is evident in respect of growth habit, leaf pubescence and particularly in the length and pubescence of the involucral bracts. The variation may be described as ecoclinal since it takes place along an ecological gradient ranging from an exposed rocky maritime habitat to a moist montane habitat subjected to frequent summer mists.

Seed was collected at each station during December 1964 and was planted in March 1965. In September 1969 the shrubs flowered for the first time in the author's garden. In every case they retained the characters of the wild population from which the seed was collected, clearly indicating that the various ecotypes making up

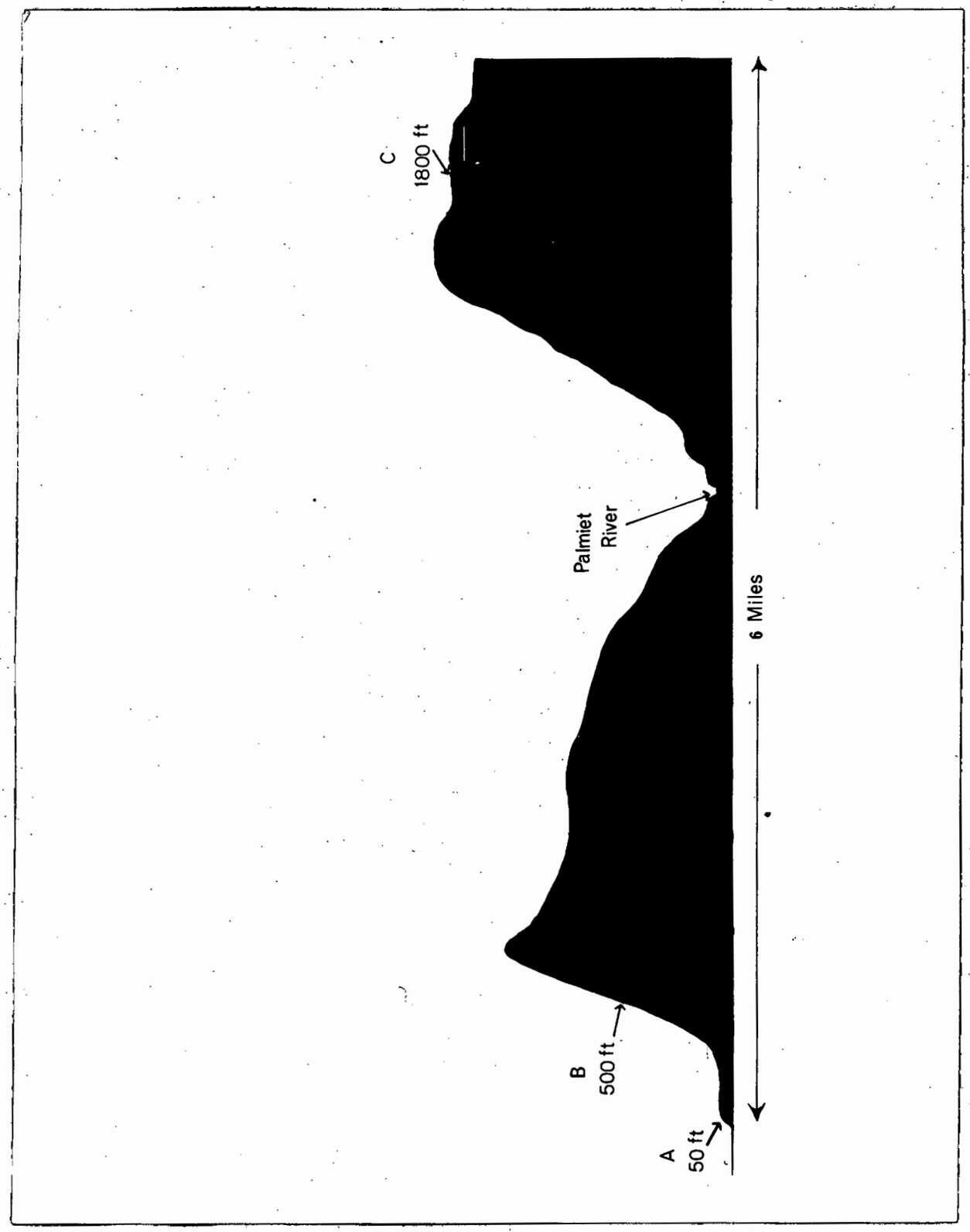


Fig. 56. Profile of the Betty's Bay and Kleinmond mountains showing the positions of the stations along an altitudinal transect, at which the Leucospermum oleaefolium group was sampled. Station A (50 ft.) is at Sunny Seas, between De Wet's Bay and Betty's Bay; Station B (500 ft.) is on the south slopes of Voorberg, above Sunny Seas; Station C (1800 ft.) is on the Paardeberg plateau, above Kleinmond.

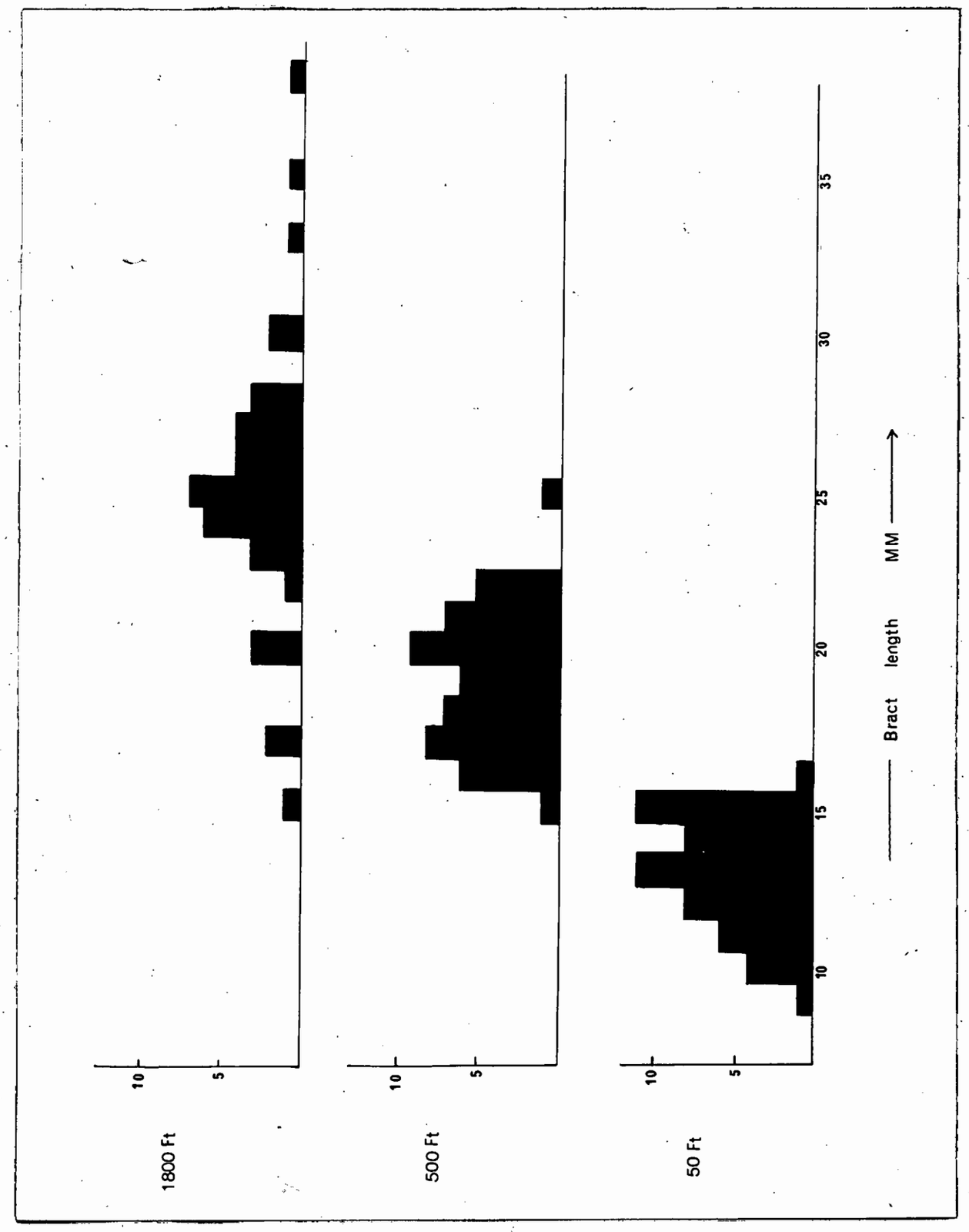


Fig. 57.
Cline in the involucral bract length of Leucospermum oleaefolium (Berg.) R. Br. showing an increase in bract length with increasing altitude. Each of the three histograms is based on 50 samples from the stations at 50, 500 and 1800 ft. above sea level indicated in fig. 56.

Fig. 58. Detached inflorescences of Leucospermum oleaefolium from populations at different elevations above sea level, showing the gradual increase in bract length with increasing altitude. Life size.

the L. oleaefolium group are genetically stabilised.

As continuous variation is exhibited within the complex described above, it is considered that only one variable species, L. oleaefolium (Berg.) R. Br. can be recognised. Likewise, no infraspecific taxa can be clearly defined.

(B) The L. mundii group.

Material classified as L. mundii in herbaria appeared to be referrable to two broad groups. Firstly, a rather narrow leaved group with greyish, pubescent, narrowly cuneate leaves ranging from (15)20-35(40) mm wide, and secondly a group with broadly cuneate to obovate, glabrous, bright green leaves, ranging from (30)35 - 55(60) mm wide. Field observations revealed that the large glabrous leaved race was restricted to the Tradouw and Barrydale mountains while the race with narrower pubescent leaves was found to be confined to the Riversdale mountains around Garcias's Pass.

Thirty samples from each population were taken and the dimensions of their leaves plotted as a scatter diagram (fig. 59). It is evident that although the foliar differences between the two populations are fairly pronounced, their variation ranges merge into each other. The presence or absence of pubescence on the leaves thus appeared to be the only absolute character by which the populations could be distinguished. Plants raised from seed collected from both populations have remained true to type in cultivation for 4 years. However, the large glabrous leaved form from Tradouw passes through a juvenile stage with pubescent leaves before the large glabrous adult leaves are produced. For these reasons, the recognition of subspecific or varietal taxa cannot be justified.

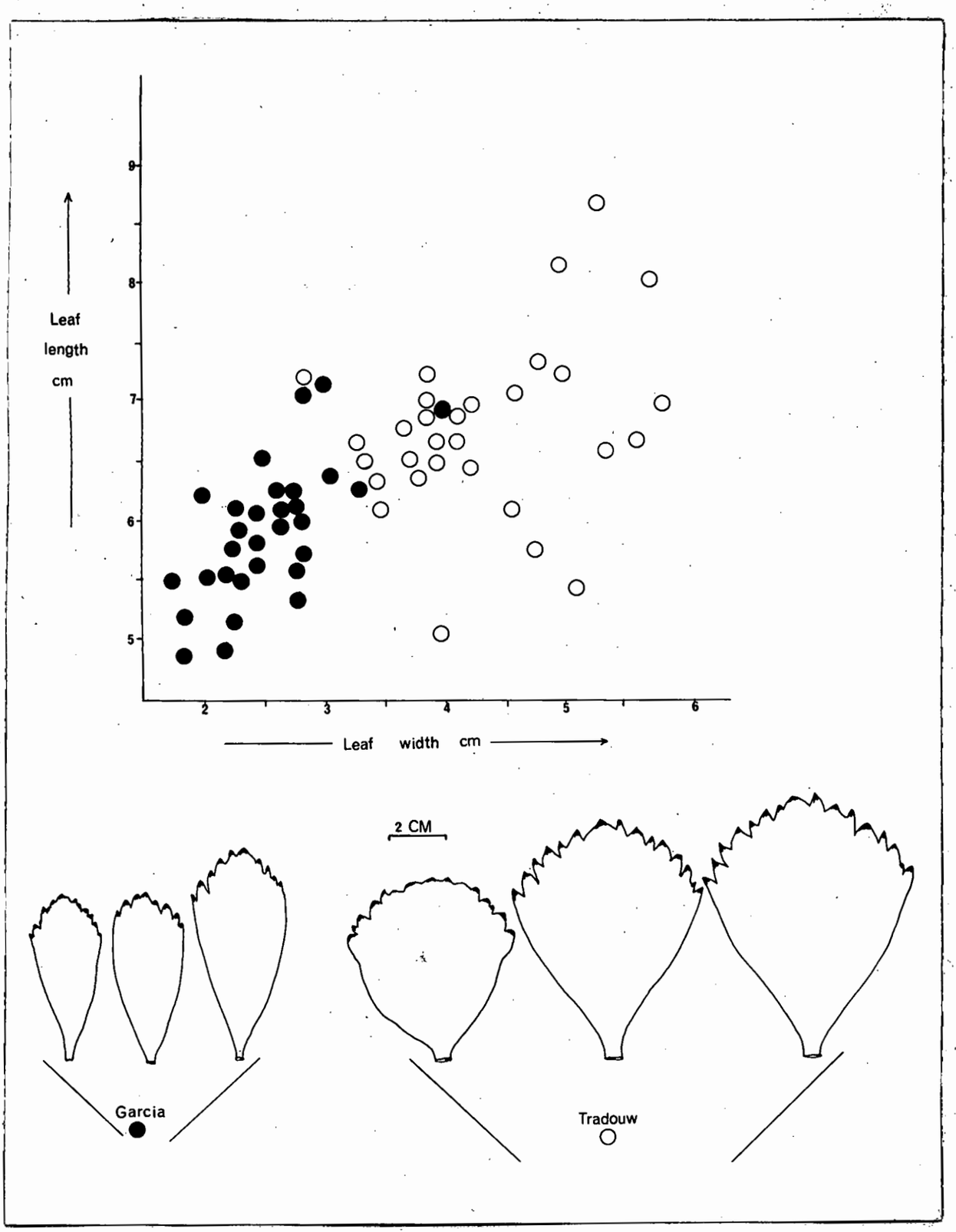


Fig. 59. Variation in the leaf dimensions of Leucospermum mundii Meisn. In the scatter diagram the solid circles represent the Garcia's Pass populations with pubescent leaves and the open circles the populations from the Tradouw area, with glabrous leaves.

(44) Leucospermum oleaefolium (Berg.) R. Br. in Trans. Linn. Soc. Lond. 10 : 104 (1810); Phillips & Stapf in Fl. Cap. 5 : 630 (1912).

Leucadendron oleaefolium Berg. in Kongl. Vetensk. Acad. Handl. 27 : 320 (1766); Berg., Descript. Plant. Cap. : 15 (1767). Type: Cap. b. sp., Grubb s.n. in herb. Bergius (SBT).

Protea crinita Thunb., Diss. Prot. : 27, 47 (1781), - nom. superfl. Type: Cap. b. spei, Thunberg s.n., sheet 2906 in herb. Thunberg (UPS).

Leucospermum crinitum (Thunb.) R. Br. in Trans. Linn. Soc. Lond. 10 : 103 (1810); Phillips & Stapf in Fl. Cap. 5 : 629 (1912).

Leucadendron crinitum (Thunb.) Steudel, Nomencl. Bot. ed. 2 Pars 2 : 399 (1841); O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Protea criniflora L.f., Suppl. : 117 (1781). Type: Not traced, but based on a Thunberg specimen.

Leucadendrum criniflorum (L.f.) Salisb. ex Knight in Knight, Cult. Prot. : 58 (1809).

Protea venosa Lam., Encycl. Meth. Bot. 1 : 234 (1792). Type: Without locality or collector in herb. Lamarck (P-LA).

Leucospermum molle R. Br. in Trans. Linn. Soc. Lond. 10 : 103 (1810). Type: "Africa australis, Leucospermum molle", sheet labelled in Brown's hand (BM).

Protea mollis (R. Br.) Poir. in Lam., Encycl. Meth. Bot. Suppl. 4 : 567 (1816).

Leucadendron molle (R. Br.) O. Kuntze, Rev. Gen. Pl. 2 579 (1891).

Leucospermum penicillatum Buek in Drège, Zwei Pfl. Geog. Docum. : 85, 199 (1843), - nom. nud.

Leucospermum penicillatum Buek ex Meisn. in DC., Prodr. 14 : 260 (1856). Type: Klein Hout Hoek, Zeyher 3683 (NY, S).

Leucadendron penicillatum (Buek ex Meisn.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891).

Leucospermum cryptanthum Buek in Drège, Zwei Pfl. Geog. Docum. : 82, 199 (1843), - nom nud.

Leucospermum schinzianum Gandoger in Bull. Soc. bot. Fr. 60 : 53 (1913). Type: Cape, Zeyher 3684c, holotype in herb. Gandoger (LY).

An erect, rounded shrub to 1.0 m in height; with a single main stem at base; compact and rigid or loosely branched with sub-erect stems. Flowering stems 3.0 - 6.0 mm in diam., villous to tomentose when young, becoming glabrous later. Leaves lanceolate acute to oblong, or ovate obtuse, sessile, glabrous to villous, 4.0 - 6.0 cm long, 8.0 - 25.0 mm wide; entire or 2 - 5 toothed; margin occasionally undulate. Inflorescences turbinate, 2.5 - 4.0 cm in diam., subsessile; 2 - 5 nate, rarely solitary. Involucral receptacle flat, 12.0 mm wide. Involucral bracts ovate acute to lanceolate acuminate, 9.0 - 36.0 mm long, 5.0 - 7.0 mm wide; densely to loosely imbricate; villous to glabrous, with or without a distinctly crinite apex; membranaceous to papyraceous in texture. Bracteoles very narrowly lanceolate to linear, 1.0 - 3.0 cm long; membranaceous, lanate proximally, pilose distally. Perianth 2.0 cm long, straight; hyaline to pale yellowish green, becoming crimson with age. Perianth tube 8.0 mm long, glabrous, tubular cylindric, inflated distally, narrowing proximally. Perianth claws filiform, becoming equally and strongly reflexed on opening. Perianth limbs elliptic 1.5 mm long, 1.0 mm wide, very sparsely tomentose to glabrous, scarcely differentiated from claws. Style strongly arched and cygneous when developing, elongating and straightening rapidly, 2.5 - 3.0 cm long, filiform; pale yellow at first becoming crimson with age. Pollen presenter filiform, cylindric, 1.0 mm long, slightly thickened basally; stigmatic groove terminal. Hypogynous scales filiform obtuse, hyaline 2.0 mm long.

Diagnostic Characters: In the section Crinitae characterised by

a flat involucral receptacle and filiform styles, L. oleaefolium is distinguished by its lanceolate acute to acuminate membranaceous involucral bracts and the lanceolate to ovate leaves, generally entire and rarely 2 - 5 toothed at the apex.

All the synonyms quoted were typified without serious difficulty except Protea criniflora L. f. No type material of this name has been traced either in London or Stockholm but as it was based on a Thunberg collection it is likely to have been a duplicate of the specimen on sheet 2906 in Thunberg's Herbarium.

Distribution and Ecology: The range of L. oleaefolium extends from Cape Hangklip and Betty's Bay in the south, northwards through the Kogel Berg Reserve, Hottentots Holland, French Hoek, Villiersdorp and Stettynskloof mountains, and eastwards along the River Sonder End Range as far as Tyger Hoek. Outlying populations occur in the Bain's Kloof mountains.

The habitats occupied by this species range from rather dry rocky coastal margins 50 yards from the high water mark, to cool peaty south-facing mountain slopes at 3,000 ft. A fairly copious supply of moisture appears to be a significant factor in determining the distribution of L. oleaefolium since its entire range falls within a zone receiving a mean annual rainfall of 30 - 70". It has not been recorded from localities where the mean annual rainfall is less than 30". L. oleaefolium occurs exclusively on weathered Table Mountain Sandstone in association with dense sclerophyll composed mainly of Restionaceae, Ericaceae and Proteaceae. Local stands of many hundreds of individuals growing in close association are often encountered, particularly in the south but towards the eastern and northern margins of the distribution range the plants become more widely dispersed and are frequently seen as solitary specimens. Flowering takes place from August to January with a peak in September and October. On opening, the perianth and style are bright yellow but become brilliant crimson with age, in which state they persist for up to eight weeks.

Specimens Examined:

CAPE

PAARL: Bains Kloof, Nov., Schlechter 9095 (PRE, BOL, Z, BR, G, K, BM, S, PH); French Hoek, Oct., Marloth 8378 (PRE); Roadside near French Hoek, Letty 50 (PRE); Du Toit's Kloof, 30/9/1828, Drège s.n. (P); Asegaaiboskloof, Oct., C. Banks s.n. sub. STE 30016 (STE); French Hoek, Assegaaibos, Oct., van Breda 694 (PRE, BOL,

G); Bain's Kloof, Oct., Strey s.n. (M).

STELLENBOSCH: Jonkershoek forest reserve, Nov., Rycroft 1434 (BOL, NBG); Hottentots Holland, Feb.-March 1827, Verreaux s.n. (G).

WORCESTER: Wildepaardeberg mts., top of Baviaanskloof, Stokoe 6568 (BOL); Omklaarberg, Dec., Stokoe s.n. (PRE); Stettyn's Kloof, Oct., W.E. Powrie s.n. (NBG); Aasvogelberg near Villiersdorp, Oct., Marloth 13334 (PRE).

SOMERSET WEST: Lourensford estate, Sept. Williams 516 (BOL); Lourensford, Oct. Mackay s.n. sub SAM 23616 (SAM).

CALEDON: Genadendal, Dec., Schlechter 9839 (PH, BOL, BR, Z, S, G, K, BM, PRE); Hangklip near Kleinmond, Dec., Noel 1344 (GRA); Sir Lowry's Pass, Aug., Parker 4601 (PRE, NBG, K, PH); Klein Houw Hoek, Oct., Zeyher 3683 (NY, BOL, SAM, K, S); Appels Kraal, River Sonder End, Oct., Zeyher 3684 (PRE, SAM, K, NY, S); Between Palmiet River and Cape Hangklip, April, Andreae 891 (STE, PRE); Betty's Bay, Nov., van Rensburg 2156 (STE, PRE, BM); Highlands forest reserve, Aug., Hubbard 468 (STE); Palmiet River bridge, Oct., van Breda 1438 (STE, PRE); Kogelberg Reserve, Aug., van der Merwe 1244 (STE, PRE); Elgin, mountain slopes, Sept., Levyns 3370 (CT); Kleinmond, Oct., Levyns 7745 (CT); Palmiet River, March, Levyns 2661 (CT); Pringle Peak, Oct., Esterhuysen 23916 (BOL); Along coast at Hangklip, Jan., Rodin 3176 (BOL, PRE, K); Upper east slope of Hangklip, Jan., Pillans 8276 (BOL); Kleinmond, Sept., Compton 3404 (BOL, K); Houw Hoek, July, MacOwan 910 in Herb. Norm. Aust. Afr. (SAM, BOL, G, BM, K, BR); Hottentots Holland mts., near Sir Lowry's Pass, May, Bolus 5331 (BOL); Oliphants River valley, River Sonder End, June, Williams 754 (NBG); Betty's Bay, lower slopes of Voorberg, Oct., Rourke 608 (NBG); Palmiet River mouth, Nov., Compton 12367 (NBG); Hangklip, Sept., Compton 13527 (NBG); Mountains at Hangklip, Nov. 1838, Krauss s.n. (M); Houw Hoek, Lichtenstein 15 (B); Lowry's Pass, 16/12/1828, Drège s.n. (P); Summit of Swartberg, Caledon, Nov., Pappe s.n. sub SAM 19612 (SAM); Genadendal, 28/10/1828, Drège s.n. (SAM, P); Platteberg, Palmiet River valley, Oct., Stokoe s.n. sub SAM 65938 (SAM); Lebanon forest reserve, Sept., Martin 1039 and 1041 (NBG); Highlands, Aug., Compton 7891 (NBG); Mountain slope near Pringle Bay, Sept., Rycroft 1224 (NBG); Caledon, Baths, Dec., F. Guthrie 3587 (NBG); Voorberg near Betty's Bay, Sept., H.C. Taylor 1549 (NBG);

Between Sunny Seas and Palmiet River bridge, Dec., Gill 29 (NBG); Villiersdorp, Sept., M. Cloete s.n. sub NBG 19430 (NBG); Kogelberg Peak, on N.W. slopes Aug., Rourke 819 (NBG); Nuweberg forest reserve, Aug., Rourke 829 (NBG); Paardeberg, above Kleinmond, Nov., Rourke 979 (NBG); Sunny Seas, lower south slopes of mountain near Die Blomhuis, Nov., Rourke 994 (NBG); Sunny seas, on ridge 50 yds. from sea, Nov., Rourke 993 (NBG); Between Buffels River mouth and Rooi Els, Dec., Rourke 1004 (NBG).

WITHOUT PRECISE LOCALITY: Without collector or locality in herb. Burman (G); Cap. b. spei, Thunberg in herb. Swartz (S); Cap. b. spei, Grubb in herb. Bergius (SBT); Cap. b. spei, Wanmann in herb. Bergius (SBT); Cap. b. spei, Thunberg s.n. sheet 2906 (UPS).

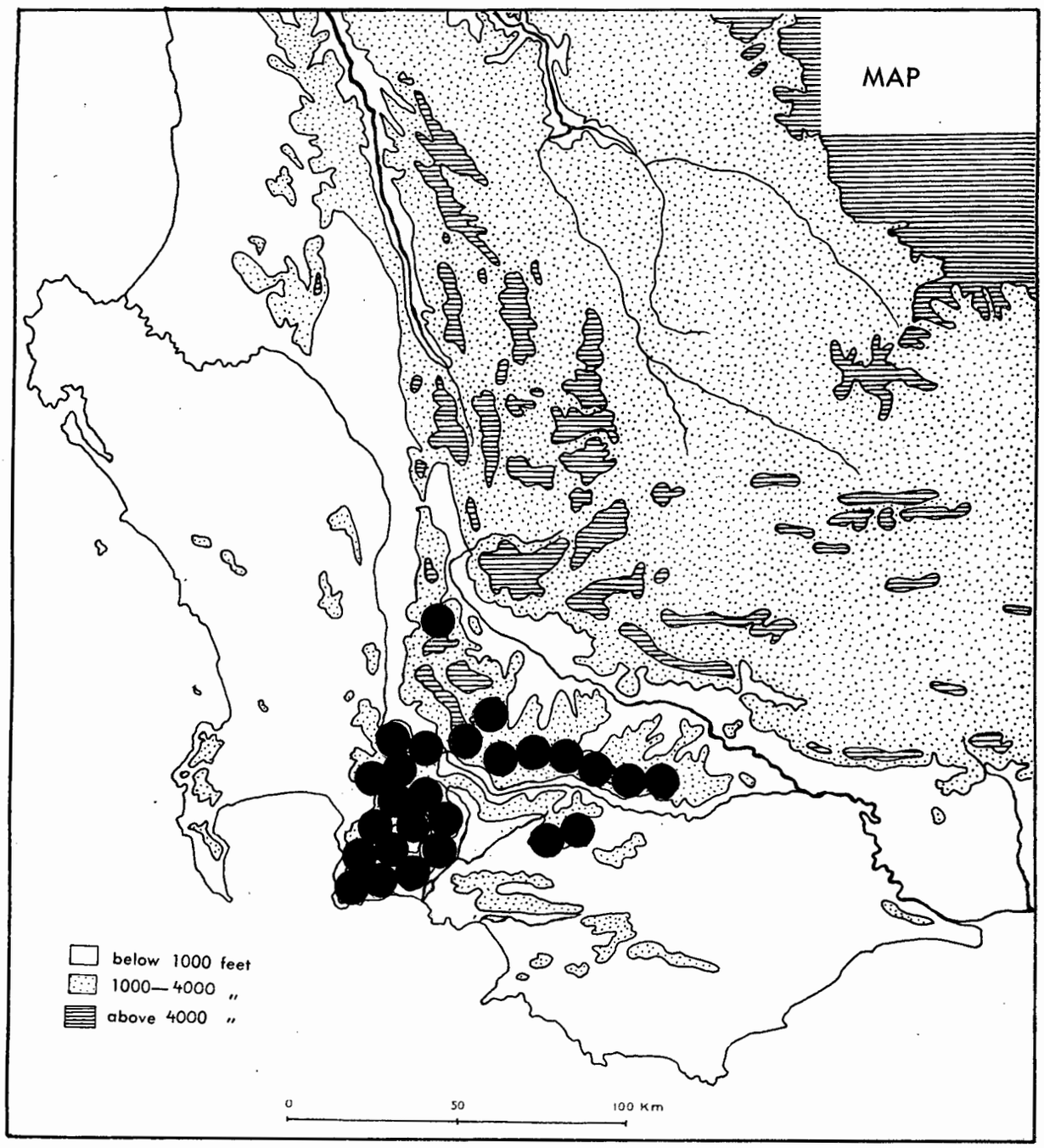


Fig. 60. Distribution of Leucospermum oleaefolium(Berg.)R.Br.

(45) Leucospermum mundii Meisn. in DC., Prodr. 14 : 261 (1856); Phillips and Stapf in Fl. Cap. 5 : 623 (1912). Type: In montibus prope Tradouw, Feb. 19th, Mund s.n. holotype (B), fragm. of holotype in herb. Meisn. (NY); isotypes (SAM, K).

Leucadendron mundtii (Meisn.) O. Kuntze, Rev. Gen. Pl. 2 : 579 (1891), err. orthog.

Leucospermum purpureum Mund ex Meisn. in DC. Prodr. 14 : 261 (1856), - nom. nud.

An erect, rounded, much branched shrub, 0.5 - 1.0 m in height, with a single main stem at base. Flowering stems 5.0 - 6.0 mm in diam., covered with a densely villous cinereous indumentum. Leaves broadly cuneate to very broadly obovate, 5.0 - 8.5 cm long 2.0 - 6.5 cm wide, subsessile to scarcely petiolate; glabrous, or canescent with a dense indumentum of fine crisped hairs; margin incised at apex with 7 - 17 teeth. Inflorescences turbinate, 2.0 - 4.0 cm long, 1.0 - 2.0 cm wide; in clusters, 3 - 10 nate; pedunculate, peduncle 1.0 - 1.5 cm long. Involucral receptacle flattened, 6.0 - 7.0 mm wide. Involucral bracts lanceolate acute to ovate acute, 5.0 - 7.0 mm long, 3.0 - 5.0 mm wide, imbricate, cartilaginous, densely velutinous, the apex slightly recurved and thickened. Bracteoles rectangular-obtrullate, 5.0 mm long, 2.0 mm wide, cartilaginous, thickly tomentose, apex recurved. Perianth 16.0 - 18.0 mm long, yellow at anthesis, tube dull carmine. Perianth tube 8.0 - 10.0 mm long, cylindric, inflated and puberulous distally, narrowed and glabrous proximally. Perianth claws filiform, hispidulous, equally recurved subterminally, pale yellow aging to orange. Perianth limbs elliptic to lanceolate acute, 1.5 mm long, pale green. Style filiform, straight, 2.5 - 2.8 cm long, pale yellow. Pollen presenter filiform, cylindric-obtuse, 0.5 - 1.0 mm long, scarcely differentiated from the style; stigmatic groove terminal. Hypogynous scales filiform, obtuse, 2.0 - 2.5 mm long, hyaline.

Diagnostic Characters: The cuneate to very broadly obovate leaves, 7 - 17 toothed at the apex, distinguish L. mundii from all other species in the section Crinitae.

Leopold Mund made the original collection of this species in the mountains near Tradouw on Feb. 19th (no year given), according to his field notes on the type in Berlin (B). The fact that the

inflorescences were old and faded when collected probably explains why Mund proposed the manuscript name, L. purpureum for this species. Since only this collection was cited by Meisner and is annotated in his handwriting, it may be regarded as the holotype. A few leaves and perianths in a capsule in Meisner's personal herbarium (NY), were evidently removed from the main sheet in Berlin by Meisner.

Distribution and Ecology: L. mundii is confined to the Langeberg range where it has been recorded from a few localities only, between Goedgeloof Peak, Swellendam and Garcia's Pass, Riversdale.

This species appears to be restricted to the northern slopes of cool, south west facing kloofs at elevations of 1,000 - 3,000 ft. Although a mean annual rainfall of 25 - 40" is experienced, well drained slopes on Table Mountain sandstone are preferred. The small, very local populations usually grow in association with dense fynbos, consisting mainly of Restionaceae, Leucadendron eucalyptifolium, Protea eximia and P. neriifolia. Flowering takes place from July to November.

Specimens Examined:

CAPE

SWELLENDAM: Goedgeloof Peak, north slopes of Langeberg, Sept., Esterhuysen 24512 (BOL); Barrydale mountains Oct., Barnard s.n. sub. SAM 29023 & 28973 (SAM);

HEIDELBERG: Mountains round Tradouw Pass, Oct., Adamson s.n. sub. SAM 39006 (SAM); In the mountains near Tradouw, Feb., Mund s.n. (B, NY, K, SAM); Tradouw Pass, Oct., Neethling s.n. sub STE 19371 (STE); Tradouw Pass, slopes with south aspect, Sept., Esterhuysen 24609a (BOL); Tradouw Pass, Sept., Williams 514 (BOL); Oct., Levyns 657 (CT); Along mountain slopes at Tradouw Pass, van Breda 2154 (PRE, K); Lower slopes of Tradouw Peak, Sept., Rourke 854 (NBG).

RIVERSDALE: Garcia's Pass, mountain slopes, Sept., Muir 517 (SAM); Garcia's Pass, Sept., Compton 7544 (NBG); Oct., Marloth 8855 (PRE, STE); July, Acocks 15424 (PRE, K); Oct., Pillans 2900 (PRE); Mozambique Kop, south slopes, Oct., Thorne s.n. sub SAM 38941 (SAM); Top of Garcia's Pass, Oct., Hubbard 225 (STE); Garcia's Pass, Sept., Phillips 517 (PRE, K); In declivibus saxosis Garcia's Pass, Bolus 11366 (BOL, PRE, NH, K); Garcia's Pass, Oct., Galpin 4478 (PRE, K); Langeberg, Riversdale, Sept., Muir 1117 (PRE); Riversdale, Feb., Marloth 3597 (PRE); Near Crystal Pool,

Garcia's Pass, Williams 539 (BOL, NBG); Garcia's Pass, June, van Breda 1097 (PRE, K); Crystal Kloof, north slopes of Kampscheberg, Oct., Rourke 623 (NBG).

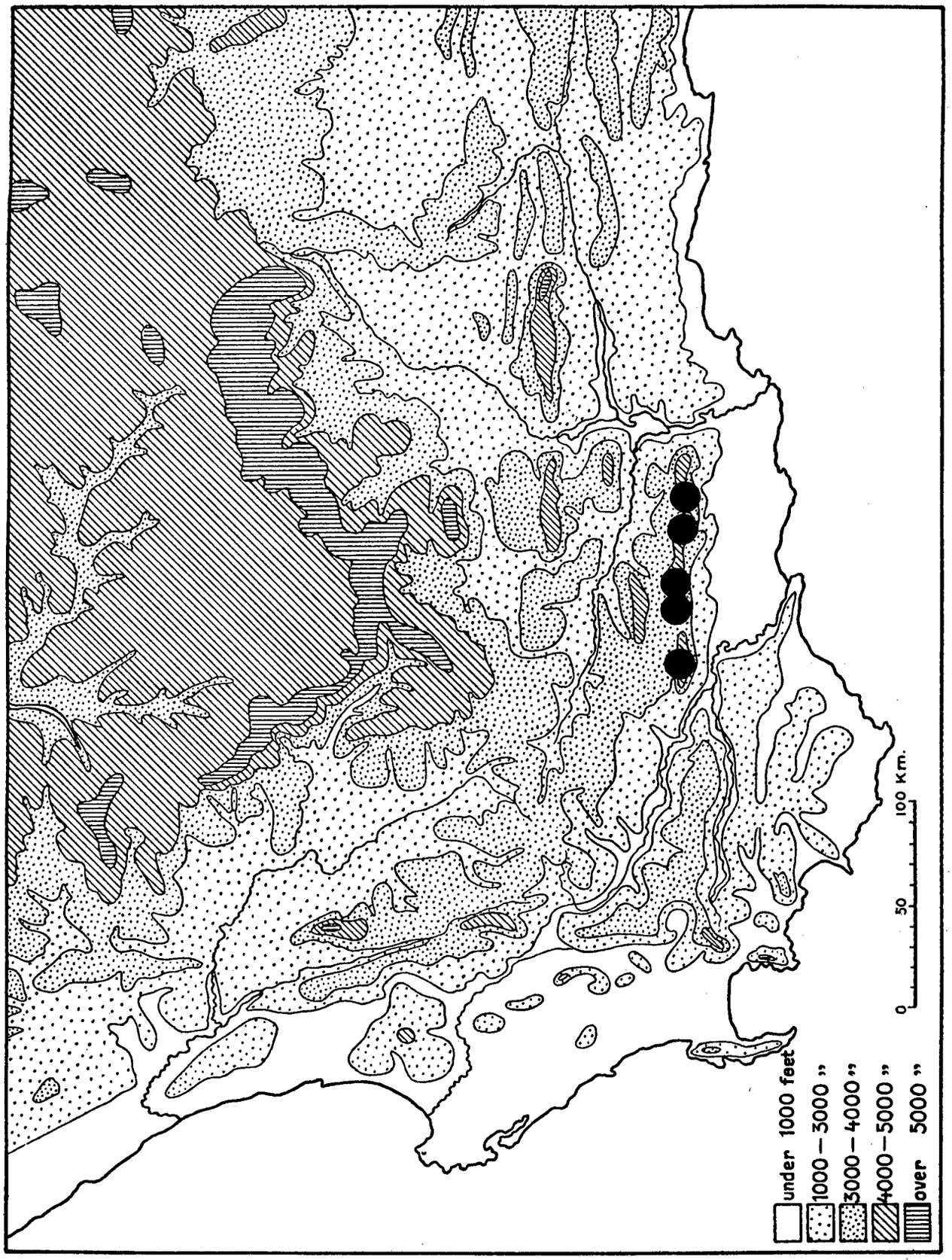


Fig. 61. Distribution of Leucospermum mundii Meisn.

(46) Leucospermum gracile (Salisb. ex Knight) Rourke in Jl S. Afr. Bot. 33 : 226 (1967).

Leucadendrum gracile Salisb. ex Knight in Knight, Cult. Prot. : 59 (1809). Type: "On the mountains near Klein River", Niven (not traced). Neotype: Lower slopes of Klein River mts., at Fernkloof, Hermanus, Sept., Rourke 852 (NBG).

Leucospermum stenanthum Schlechter in Bot. Jb. 27 : 112 (1900); Phillips in Fl. Cap. 5 : 632 (1912). Type: In montibus pone Bot River, Schlechter 9446 (Holotype B; isotypes BOL, BM, PRE, K, Z, G, S, BR).

A low sprawling shrub, 30.0 - 40.0 cm in height, with a single main stem at base, forming rather diffuse mats to 1.5 m in diam. Flowering stems slender, 2.0 - 3.0 mm in diam., villous to glabrescent; trailing along ground. Leaves oblong linear, obtuse, entire or trifid, obtuse to truncate at base, 2.0 - 4.5 cm long, 2.0 - 5.0 mm wide; usually widely spaced and secund, occasionally loosely ascending; sparsely villous to puberulous. Inflorescences turbinate, 2.5 - 3.0 cm in diam.; sessile to pedunculate, peduncle up to 2.0 cm long, usually at right angles to stem. Involucral receptacle flat, 0.5 cm wide. Involucral bracts very narrowly lanceolate linear 0.8 - 1.0 cm long, 1.0 - 1.5 mm wide; apex acuminate to slightly cirrhous and minutely crinite; imbricate, cartilaginous, tomentose. Bracteoles oblanceolate, abruptly acute or acuminate, 5.0 - 6.0 mm long, 1.5 mm wide, cartilaginous, very thickly lanate. Perianth 2.0 - 2.5 cm long, yellow, becoming greenish in the tube region. Perianth tube 8.0 mm long, tubular obconical, glabrous, but minutely puberulous distally. Perianth claws filiform, becoming sharply recurved subterminally, adaxial claw glabrous to glabrescent proximally, the remainder hispidulous. Perianth limbs narrowly lanceolate acute, 1.0 mm long, scarcely differentiated from the perianth claws. Style filiform, 2.5 - 3.0 mm long, straight, tapering towards apex; yellow, becoming pale green with age. Pollen presenter 1.0 mm long, cylindric acute, scarcely differentiated from style, stigmatic groove terminal. Hypogynous scales clavate, hyaline 3.0 mm long.

Diagnostic Characters: L. gracile is distinguished from related species by its prostrate growth habit, the oblong-linear leaves (not exceeding 5.0 mm in width), truncate at the base, the abruptly acute oblanceolate bracteoles and the yellow perianth.

The earliest collections of this species were made by Masson and Niven. Niven noted that he had found L. gracile "on the mountains near Klein River, in great abundance". Unfortunately, no type material of this collection has been traced but Knight's description is so detailed that it can only refer to L. gracile. Material answering to the original description has been gathered by the present author in the Klein River mountains where this species is still abundant today. It is proposed that this collection (Rourke 852) serve as the neotype until material from the original Niven collection comes to light.

Distribution and Ecology: Schlechter's collection from the mountains near Bot River is the most northerly record for L. gracile but it has probably been exterminated here due to agricultural development. It is nevertheless fairly frequent on Shaw's Mountain near Caledon and on the Onrust and Klein River mountains near Hermanus, extending southwards to the hills around Napier.

L. gracile occurs on south facing mountain slopes between 300 and 1,000 ft. elevations, occasionally reaching 3,000 ft. Always in very well drained situations, this species shows a marked preference for well drained sandy soils on rocky slopes where the surface layers of Table Mountain Sandstone are weathering and crumbling. Mature plants grow into diffuse mats up to 1.5 m in diam. from the perimeter of which develop trailing shoots bearing yellow inflorescences. Occasionally inflorescences are developed from the more rigid short shoots near the centre of the plant. Flowering takes place from July to December.

Specimens Examined:

CAPE

CALEDON: In montibus pone Bot River, Nov., Schlechter 9446 (B, BOL, BR, Z, G, S, BM, K, PRE); Shaw's Mountain, Bodkin 9230 (BOL); Klein River mountains between Stanford and Hermanus, Aug., Stokoe 16611 (BOL); Klein River mts., S.E. slopes, Sept., Esterhuysen 2889 (BOL); Mountains behind Mossel River, Oct., Martin 552 (NBG, BOL); Onrust, Sept., Compton 3402 (BOL, K); Voelklip, Sept. Basson s.n. (STE 16836); Onrust River mts., summit, S.E. side, Nov., Esterhuysen 4258; Mossel River, Nov., Maguire 1273 (NBG);

Near Shaw's Pass, Gill 44 (NBG); Voelklip, Sept., Barker 1707 (NBG, PRE); Klein River mountains behind Voelklip, July, Williams 797 (NBG); Klein River mts., east of Rocklands peak, Sept., Stokoe s.n. (SAM 56587, PRE); Stanford mts., July, Stokoe no 9501 in herb Marloth (PRE); Slopes of Babylon's Tower between Hermanus and Caledon, March, Zinn s.n. (SAM 53682); Lower slopes of the Klein River Mountains, Fernkloof, Hermanus, Sept., Rourke 852 (NBG).

BREDASDORP: Sanddrif, Napier, Oct., van Breda 1427 (STE, PRE); Fairfield, Sept., Thomas s.n. (NBG 42557); Sondags Kloof near Napier, Oct., Williams 47 (NBG).

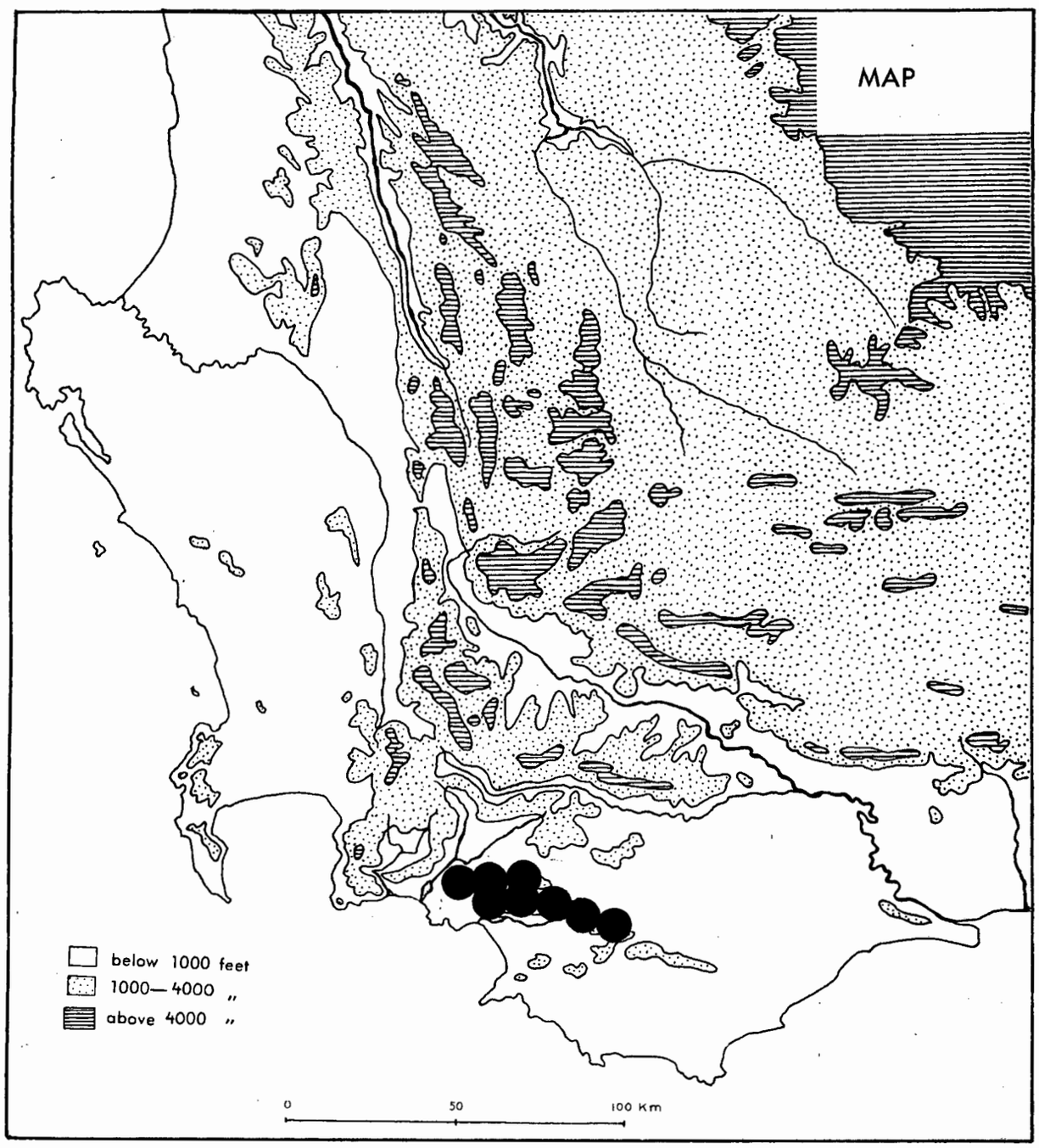


Fig. 62. Distribution of Leucospermum gracile(Salisb. ex Knight) Rourke

(47) Leucospermum saxatile (Salisb. ex Knight) Rourke in Jl S. Afr. Bot. 33 : 266 (1967).

Leucadendrum saxatile Salisb. ex Knight in Knight, Cult. Prot. : 58 (1809). Type: "On dry rocks near Groot Rivier" Niven (not traced). Neotype: Foothills of the north slopes of the Langeberg, at the farm Waterval, 13th, Jan. 1965, Rourke 248 (NBG).

Leucospermum diffusum R. Br. in Trans Linn. Soc. Lond. 10 : 104 (1810); Phillips in Fl. Cap. 5 : 631 (1912), excluding citations of L. pedunculatum Klotzsch. Type: Africa australis, W. Roxburgh s.n. (BM).

A low, suberect to sprawling shrub 0.5 - 0.7 m in height; 1.0 - 1.5 m in diam. Stems suberect to trailing, 2.0 - 4.0 mm in diam., sparsely pubescent, soon becoming glabrous, reddish tinted. Leaves loosely ascending, very rarely subsecund, linear to very narrowly cuneate, narrowing to the base, 2.5 - 5.0 cm long, 2.0 - 5.0 mm wide, puberulous at first, soon glabrous; apex usually entire, occasionally with 2 - 3 teeth; margins frequently involute. Inflorescences turbinate, 2.5 - 3.0 cm in diam., usually single, occasionally 2 - 3 nate; pedunculate, peduncle 0.5 - 1.5 cm long. Involucral receptacle flat, 0.7 cm in diam. Involucral bracts lanceolate acute-acuminate, 4-seriate, imbricate, cartilaginous, tomentose, 0.5 - 1.0 cm long, 2.0 mm wide. Bracteoles lanceolate acute-acuminate, 1.2 - 1.5 cm long, 2.0 - 2.5 mm wide, densely sericeous, margins ciliate. Perianth 2.0 cm long, pale lime green on opening becoming carmine tinted with age. Perianth tube 5.0 - 6.0 mm long, tubular obconical, glabrous. Perianth claws straight, filiform, sericeous, sharply recurved subterminally. Perianth limbs narrowly lanceolate linear, 2.0 mm long, sericeous. Style filiform, 3.0 cm long, tapering subterminally. Pollen presenter cylindric-obtuse, 1.0 mm long, scarcely differentiated from style. Hypogynous scales subulate, hyaline, 1.0 mm long.

Diagnostic Characters: The narrowly cuneate to linear leaves, narrowed towards the base, often with involute margins, the lanceolate acute bracteoles and the pale green colour of the perianth distinguish L. saxatile from related species.

Knight's type of L. saxatile has not been traced, despite a careful search in European and American herbaria. This leads one to

conclude that it has either been lost or destroyed. Nevertheless, his description of this species albeit brief, provides details of the growth habit, morphology and dimensions of the leaves and the structure of the style. The locality is given as "dry rocks near Groot Rivier". The Groot River joins the Gouritz River in the Little Karroo and runs parallel to the northern foothills of the Langeberg. A collection made by the present author at this locality on the farm "Waterval" matches Knight's description in all the details. It is therefore proposed that this collection serve as the neotype of L. saxatile until the original material is traced.

Distribution and Ecology: This very localised species is restricted to a narrow zone of Arid Fynbos which skirts the north slopes of the Langeberg in the Riversdale district, adjacent to and just fringing the Rhenosterveld of the Little Karroo. According to herbarium records and the author's own field observations, the present known distribution range extends from Muiskraal eastwards to Rietvlei, a distance of about 20 miles.

The altitudinal range is very small, being from 1,500 - 2,000 ft. At the farm "Waterval", L. saxatile is locally common with the plants forming quite dense stands, either sprawling on rocky sandstone slopes or scrambling over low shrubs. L. saxatile forms a sub-erect to decumbent shrub 1.0 - 1.5 m in diam., with long trailing branches occasionally being produced. Flowering commences in July and continues until February. The pale lime green perianths and styles which become carmine tinted with age are a very distinctive feature of L. saxatile.

Specimens Examined:

CAPE

RIVERSDALE: Muiskraal, 1,000 ft., Oct., Galpin 4456 (PRE, K); Waterval on the Muiskraal-Gouritz road, dry slopes, July, Levyns 11280 (CT); North side of the Langeberg above Waterval, Oct., Muir 2783 (PRE, BOL); Rietvlei, beyond Waterval, Sept., Williams 1055 (NBG); Behind the Langebergen, Riversdale, Sept., Dekenah s.n. sub 87489 in NBG (NBG); Foothills of the northern slopes of the Langeberg at the farm Waterval, Jan., Rourke 248 (NBG).

WITHOUT PRECISE LOCALITY: Africa australis, W. Roxburgh (BM, G).

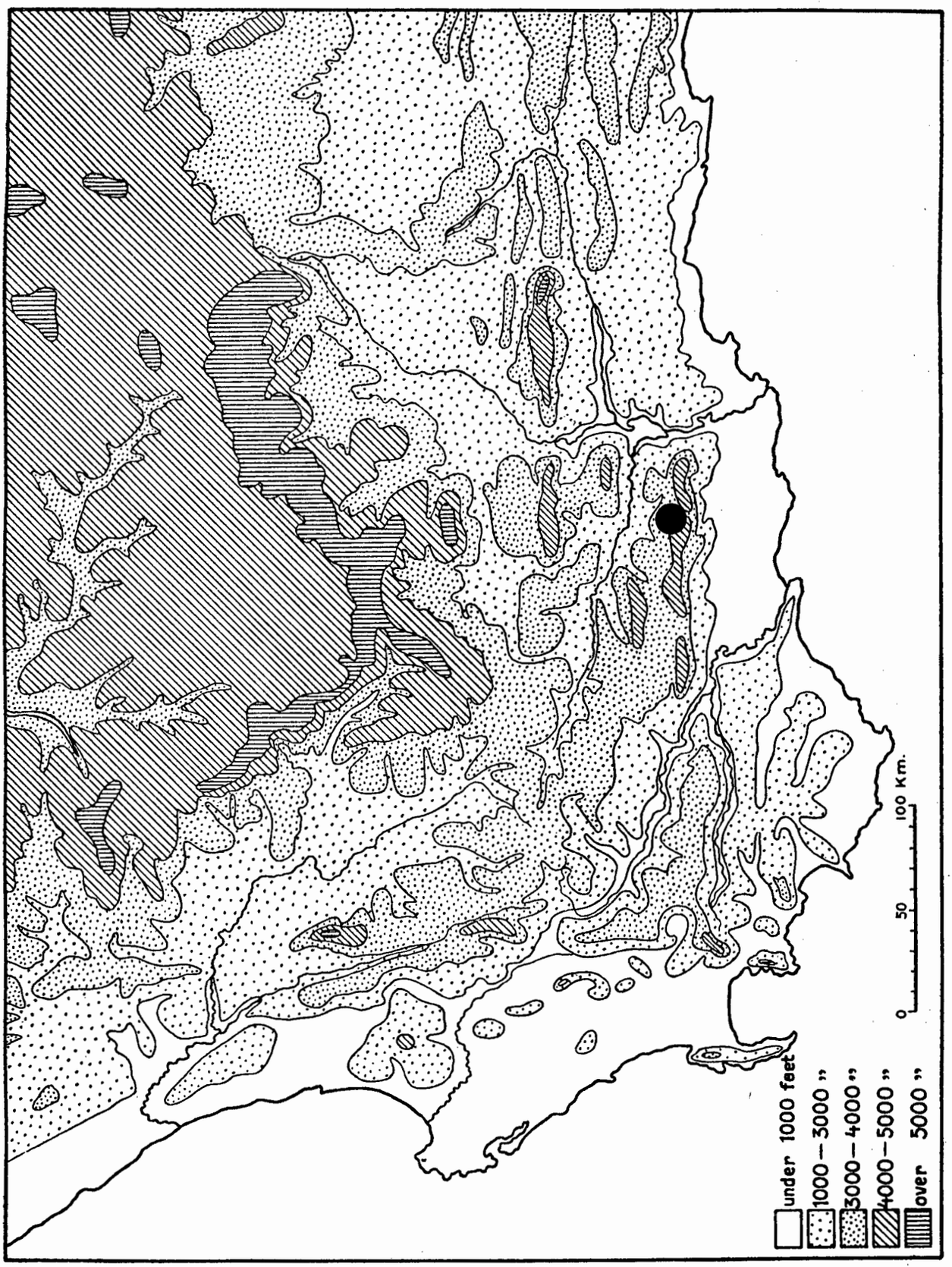


Fig. 63. Distribution of

Leucospermum saxatile(Salisb. ex Knight)Rourke

SPECIES NON SATIS COGNITAE

1) Leucadendron filiamentosum Burm. f., Prodr. Fl. Cap. : 4 (1768). No type could be traced in Burman's herbarium (G). The description could apply to several species of Leucospermum.

2) Leucadendron polifolium Burm. f., Prodr. Fl. Cap. : 4 (1768). No type could be traced in Burman's herbarium (G). The description could apply to several species of Leucospermum.

3) Leucadendrum bellidifolium Salisb. ex Knight in Knight, Cult. Prot. : '56 (1809); Phillips & Stapf in Fl. Cap. 5 : 638 (1912). No type has been found and the description could apply to several species of Leucospermum.

SPECIES EXCLUDED

1) Leucospermum glaberrimum Schlechter in Bot. Jb. 27 : 111 (1900).

This is Leucadendron glaberrimum (Schlechter) Compton in Trans. R. Soc. S. Afr. 19 : 279 (1931).

2) Leucospermum involucratum (Lichtenstein ex Roem. & Schult.) Steud., Nomencl. Bot. ed I 2 : 477 (1824).

Protea involucrata Lichtenstein ex Roem. & Schult. in Roem. & Schult., Syst. Veg. 3 : 363 (1818)

This is Leucadendron salignum Berg.

3) Leucospermum marginatum (Willd.) Spreng., Syst. Veg. 1 : 464 (1825); Roem. & Schult., Mant. Syst. Veg. 3 : 266 (1827).

Protea marginata Willd., Enum. Hort. Berol. suppl. : 7 (1814). Type: Sheet no. 2450 in herb. Willdenow (B), photo. (NBG).

Leucadendron marginatum (Willd.) Link, Enum. Hort. Berol. Altera 1 : 115 (1821).

This is Leucadendron spissifolium (Salisb. ex Knight) Williams.

4) Leucospermum obovatum Marloth, Fl. of S. Af. 1 : 151 (1913) - nom. nud.

5) Leucospermum ovatum (Thunb.) Roem. & Schult., Mant. Syst. Veg. 3 : 266 (1827).

Protea ovata Thunb. in Mem. Acad. Imp. Sci. St. Petersbourg Hist. Acad. 14 : 548, t. 17 (1813). Type: E. cap. b. spei, Sparrman s.n., sheet 2948 in herb. Thunberg (UPS).

This is Protea longiflora Lam.

6) Leucospermum rochetianum A. Rich. in Compt. Rend. Par. 1 : 229 (1851).

This is Faurea rochetiana (A. Rich.) Chiov. ex Pichi Sermoli in Webbia 7 : 327 (1950).

7) Leucospermum spathulatum Drege ex Meisn. in Dc., Prodr. 14 : 299 (1856), non R. Br. (1810).

This is Paranomus reflexus (Phillips & Hutchinson) N.E. Br.

8) Leucospermum zwartbergense Bolus in Trans. S. Afr. phil. Soc. 18 : 399 (1909). Type: Swartberg Pass, Bolus 12267 (BOL).

This is a male specimen of Leucadendron dregei E. Mey. ex Meisn.

PUTATIVE HYBRIDS

A number of putative interspecific hybrids have been recorded. Whenever hybrids have been observed in the field, their identity is usually quite obvious due to the close association of the parents. In such cases only one or two hybrid plants are ever encountered, suggesting that these hybrids are sterile. Putative hybrids observed in gardens are also listed.

1) L. hypophyllocarpodendron x L. pedunculatum.
Klein Hagel Kraal above Pearly beach, Bredasdorp, Aug., Rourke 1087 (NBG).

2) L. hypophyllocarpodendron x L. calligerum.
Mountain behind Aurora, Piketberg, Aug., Rourke 1061 (NBG).

3) L. truncatulum x L. prostratum.
Elands Kloof mts., above Papies Vlei, Bredasdorp, Sept., Rourke 564 (NBG); Highlands, Elgin, Caledon, Nov., Middlemost 1932 (NBG).

4) L. mundii x L. calligerum.
Riversdale wild flower show, Schelpe s.n. (NBG 86306); Mountains in Riversdale area, Oct., Pretorius s.n. (NBG); Riversdale, July, Muir 464 (PRE).

5) L. reflexum x L. catherinae
Ex hort. Rourke s.n. (NBG 86074). Kirstenbosch

6) L. conocarpodendron x L. cordifolium
Ex hort. NBG, June, without collector, (NBG).
This hybrid is very frequent at Kirstenbosch.

7) L. gracile x L. truncatulum.
Onrust River mts., Caledon, Nov., Esterhuysen 4260 (BOL).

8) L. gueinzii x L. lineare.
Upper end of Bosch Kloof, Jonkershoek, Jan., Wicht 649 (BOL).

9) L. tottum x L. vestitum.
L. tottum (L.) R. Br. var. glabrum Phillips in Flower. Pl. S. Afr. 2 : t. 74 (1922) Type: In Jan du Toits Kloof, Chavonnesberg, Oct., 1921, Stokoe s.n. sub PRE 1493 (PRE).

No further material of this variety has ever been collected. As its characters are intermediate between L. tottum and L. vestitum it is suggested that L. tottum var. glabrum is a hybrid between these species.

CYTOLOGY

Methods

Seeds obtained from numbered collections made by the present author and deposited at NBG as voucher specimens were germinated after four to six weeks. Root tips were taken from these seedlings and fixed between 1 and 3 p.m. on warm afternoons in a Chromo-acetic-formalin mixture. (Randolf, 1935). After remaining in the fixative for about 48 hours they were transferred to 70% ethyl alcohol for storage. Later, they were dehydrated through a graded butanol-ethanol series and embedded in paraffin wax. Transverse serial sections were cut at about 12μ. After having been passed through the usual series of alcohols, the sections were hydrolysed for 15 minutes in N HCl at 60° C; then washed in water and stained for about 2 hours in Feulgen reagent, prepared according to Kasten and Burton (1959).

Results

The large rectangular cells of the protoderm were found to contain the most easily observable and most numerous mitoses at metaphase. The chromosomes were found to be small in all cases (1 - 5μ). Consequently, difficulty was sometimes experienced in determining the position of the centromere, which may be median or subterminal. The most significant observation made was that the karyotypes of two vicarious species, L. formosum and L. catherinae, were found to possess a large pair of chromosomes bearing prominent satellites. Satellites were also observed in L. cuneiforme (fig.64).

Discussion

Prior to the present studies, a chromosome number of 2n = 24 had been established in four species of Leucospermum (de Vos, 1943). This number was confirmed by Ramsey (1963) and was found to be the same in 13 additional species counted by the present author (Table 1). The same number was found in several other genera of the Proteaceae in South Africa, namely Paranomus Serruria, Mimetes and Protea (de Vos, 1943; Horn, 1962).

It would seem that little information of any taxonomic value can be gained from any further cytological studies on Leucospermum unless detailed chromosome idiograms of vicarious taxa or local races can be compared. Owing to the small size of the chromosomes this would be a technically difficult and a time consuming procedure.

Species	Authority and Voucher specimen	2 n
L. conocarpodendron	de Vos (1943)	24
L. cordifolium	de Vos (1943) as L. nutans	24
L. reflexum	de Vos (1943)	24
L. cuneiforme	Rourke 279	24
	de Vos (1943) as L. attenuatum	24
L. innovans	Rourke 841	24
L. lineare	" 57	24
L. pluridens	" 621	24
L. glabrum	ex hort. (NBG 84811)	24
L. tottum	Rourke 56	24
L. formosum	" 620	24
L. catherinae	" 679	24
L. gueinzii	" 831	24
L. muirii	" 10	24
L. arenarium	" 1080	24
L. truncatulum	" 941	24
L. pedunculatum	" 942	24

Table 1. Chromosome numbers in Leucospermum

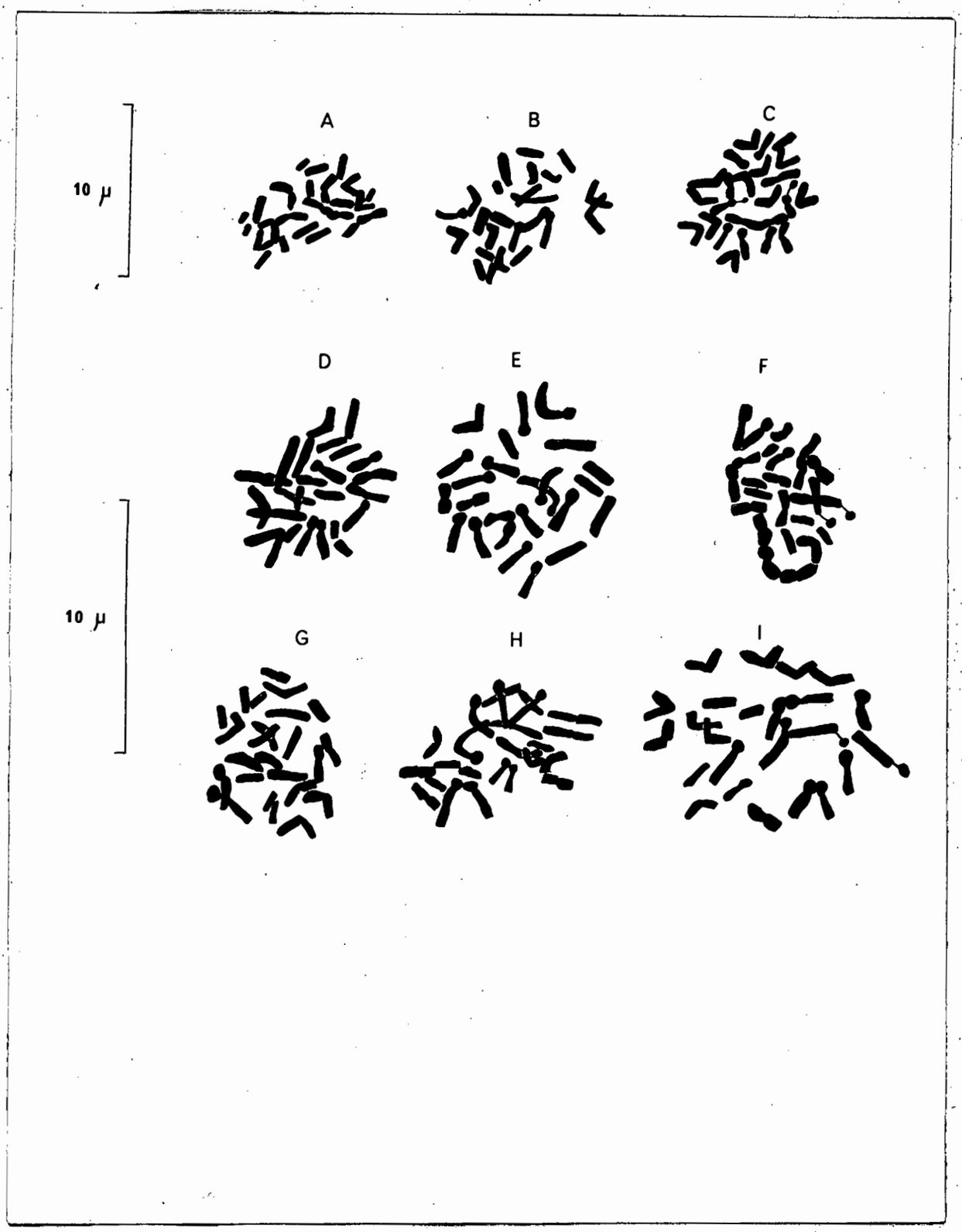


Fig. 64. Karyotypes in Leucospermum. (A) L. innovans; (B) L. pedunculatum; (C) L. cuneiforme; (D) L. arenarium (E) L. truncatulum; (F) L. formosum; (G) L. lineare; (H) L. tottum; (I) L. catherinae.

BIOLOGY

THE EFFECT OF FIRE ON SPECIES OF LEUCOSPERMUM

Fire has probably played a more significant role in the development of different life forms in the vegetation of Southern Africa than is generally acknowledged. It is hardly an exaggeration to say that fire resistence is one of the most important biological attributes any plant species occuring in Southern Africa can possess. The effects of fire on different species of Leucospermum is discussed below.

Species killed by fire.

In the majority of species of Leucospermum, the adult plant is killed outright by a veld fire. These species have a single main stem with a rather thin covering of bark. In a stand of mature plants eight or ten years old, in undisturbed vegetation, all the individuals in the stand are apparently the same age and size. Seedlings or young plants up to two years of age are either rare or completely absent. When such a stand is burnt, however, a dense growth of seedlings is observed the following year. These seedlings will reach the flowering stage in their third or fourth year and may continue to produce seeds annually for many years. Few, if any, of these seeds appear to germinate until the stand is again burnt, after which large numbers of seeds again germinate simultaneously. This cyclical pattern is very noticeable in members of the Proteaceae with hard nut-like fruits.

In all these forms the adult plant reaches a stage of senescence after a certain number of years. This time interval varies from species to species. L. oleaefolium and L. truncatulum become senescent after about 25 - 30 years but large species like L. conocarpodendron and L. praemorsum become senescent in 50 to 80 years. These estimates have been made by counting the annual growth increments on the stems. At this stage, a fire is actually necessary to rejuvenate the population. However, biennial or even triennial veld burning such as now frequently occurs in parts of the south western Cape, usually results in the extermination of these species.

Fire Resistent Species

The thirteen species that are able to resist burning may be roughly grouped into two categories according to their degree of fire resistence (Table 2). In the first group, regeneration takes place from the stems and only 30 - 50% of the individuals in a

population will recover after a fire (fig. 65, B and C). In the second group 95 - 100% of the individuals in a population will recover after a fire. In these species regeneration takes place from a subterranean rootstock or lignotuber (fig. 65, A).

L. heterophyllum, L. royenifolium, L. pedunculatum and L. profugum have a procumbent growth habit with a short main stem from which horizontally spreading branches arise, covered with bark, 3 - 6 mm thick. The peripheral branches in these species are completely destroyed by fire, leaving only the main stem and the stumps of the horizontally spreading branches. Dormant axillary buds beneath the bark are able to sprout and form new stems in many cases (fig. 65, B).

L. conocarpodendron and L. patersonii both develop into large shrubs or small trees. In L. conocarpodendron the main trunk is covered by tough bark, 3 - 5 cm thick. The lowermost branches of both species are destroyed by fire, which causes the adult shrubs that have been frequently burnt to develop an umbrella-shaped growth habit. Regeneration in these cases takes place from the apical shoots of the uppermost branches, which by reason of their elevation above ground level are less severely burnt (fig. 65, C). Regeneration in the species discussed above (Table 2, B & C) takes place from the aerial stems. The extent to which a population will recover after burning appears to be dependent on the intensity of the fire.

A woody, subterranean rootstock or lignotuber from which numerous coppice shoots develop after burning, is considered by many to be a particularly characteristic morphological feature of much of the savannah vegetation in Africa (Bews, 1922; Burtt Davy, 1922; Henkel, 1928; Phillips, 1930; Phillips, 1968). The persistent rootstock is undoubtedly one of the most effective adaptations to surviving repeated burning (fig. 65, A). Seven species of Leucospermum have a persistent rootstock but it is best developed in the four species of the section Crassicaudex which occur mainly in the summer rainfall regions of Southern Africa. Even the seedlings of these species are distinguishable from the seedlings of species with a single main stem. At eight months after germination, shoots have developed in the axils of the lowermost leaves of the seedling, including the cotyledons, while a thickening of the basal part of the stem takes place at the same time. Axillary shoots do not develop on seedlings of species having a single main stem (fig. 66). From six to eight weeks after the aerial stems of the adult plant have been destroyed, new shoots will develop from the rootstock. In most cases 95 - 100% of the individuals

in a population survive burning, irrespective of the intensity of the fire or the frequency of the burning cycles.

Stem regeneration 30 - 50% recovery (fig. 65 , B & C)	Rootstock regeneration 95 - 100% recovery (fig. 65 , A)
L. heterophyllum	L. saxosum
L. royenifolium	L. cuneiforme
L. pedunculatum	L. gerrardii
L. profugum	L. innovans
L. conocarpodendron	L. hypophyllocarpodendron
L. patersonii	L. tomentosum
	L. prostratum

Table 2. The fire resistent species of Leucospermum, indicating the percentage recovery in a population after burning

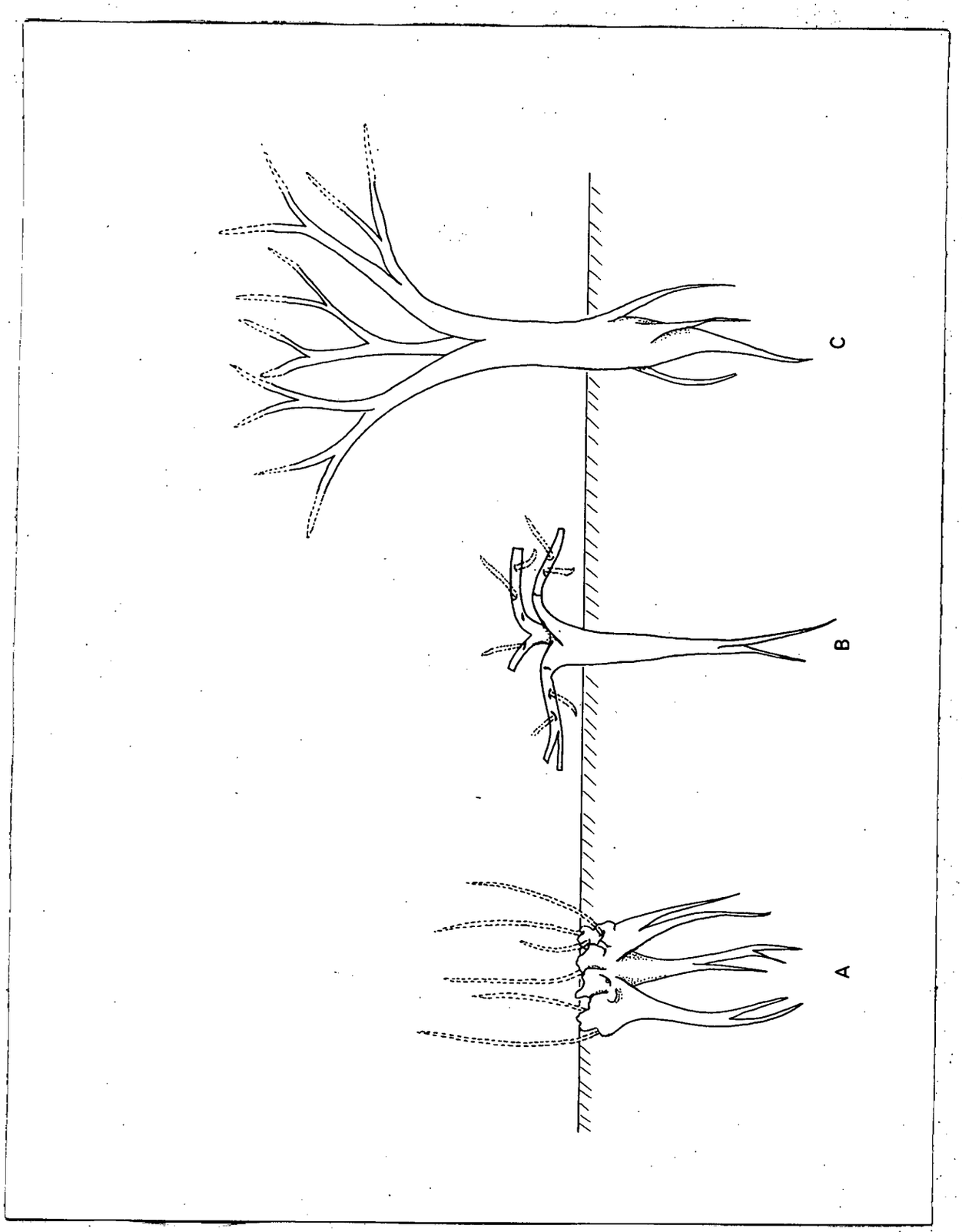


Fig. 65. Stylized diagrams of the growth forms in Leucospermum in which regeneration of the vegetative parts takes place after burning. The new growth is indicated with broken lines. (A) The subterranean rootstock or lignotuber, (B) the form with a short main stem and stout, horizontally spreading branches in which regeneration takes place from axillary buds, (C) the arborescent form in which regeneration takes place from the apical shoots.

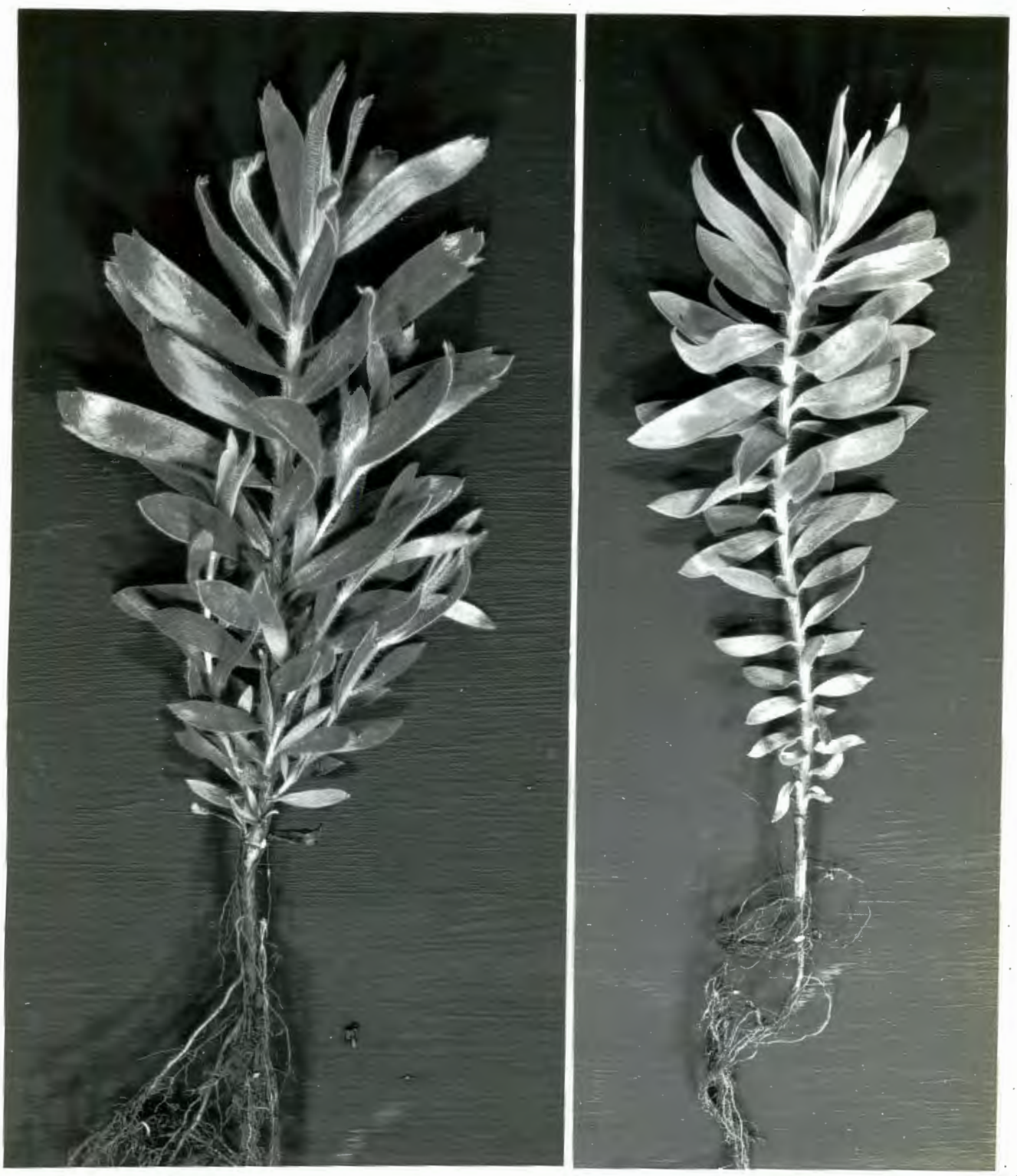


Fig. 66. Leucospermum seedlings, 8 months after germination. Left, L. cuneiforme (Rourke 251) showing the development of shoots in the axils of the lowermost leaves, including the cotyledons. This species is taken as an example of the species of Leucospermum which develop a lignotuber. Right, L. formosum (Rourke 620) taken as an example of a species killed outright by fire and in which there is no development of shoots in the axils of the lowermost leaves in the seedling stage. Life size.

POLLINATION

Introduction

Probably the earliest recorded observations concerning pollination biology in Leucospermum were made by Francis Masson but it was not until 1920 that these notes were published. The first published observations however, were those of Scott-Elliot (1889) and later Marloth (1901, 1908). Apart from these studies, no further original observations have been recorded except for the brief notes of Vogel (1954) and Faergri (1965). Masson's notes are of particular interest for they establish, even at that early date, the importance of Promerops cafer and Anthobaphes violacea in the pollination biology of Leucospermum. Referring to L. conocarpodendron at Constantia, Masson notes that :

"In the time of flowering the trees are plentifully stocked with birds; viz. Certhia formosa violacea and a brown sort with a remarkable long tail, where they feed on the nectar of the flowers which they extract with their long arched bills" (from Karsten, 1960).

The birds mentioned are Anthobaphes violacea and Promerops cafer respectively.

The Inflorescence

Using the terminology of Faegri and van der Pijl (1966), the inflorescence in Leucospermum may be described as the "brush type". At anthesis, the elongating styles burst free of the perianth segments while at the same time the anthers discharge pollen onto the pollen presenters. When fully expanded, the styles project well beyond the level of the coiled perianth segments, bearing the pollen presenters covered with pollen.

Nectar, produced in copious quantities, appears to be the chief attractant. The fairly viscous nectar exudes from the apices of the hypogynous scales filling the perianth tube and even welling up to form a droplet at the mouth of the perianth tube. Numerous small insects which apparently play no direct role in pollen transfer but are attracted by the nectar, serve as an added attractant to bird pollinators which are also known to be insectivorous (Broekhuysen, 1963).

The flowers in Leucospermum are protandrous and it has been proved by controlled pollination experiments that most but not all the species are self incompatible (Horn, 1962). Similar experiments by the author have confirmed that only a few species are self

compatible (e.g. L. mundii, L. oleaefolium) but even these produce only a few viable seeds after selfing. This would result in cross pollination between individuals taking place in the majority of species in the genus.

Bird Pollinators

Observations made in the south western Cape, between Van Rhynsdorp and Port Elizabeth have shown that Promerops cafer (L.) (the Cape Sugarbird), is the most ubiquitous pollinating agent in Leucospermum populations. On numerous occasions as many as 12 birds of this species have been counted feeding on the inflorescences of a single shrub. The life history of Promerops cafer is very closely associated with the family Proteaceae; nesting and the rearing of young taking place during the peak of the flowering season. An indication of its dominance in the above mentioned areas can be seen from the fact that Winterbottom (1966) recorded this species in 84% of the regional check lists of birds inhabiting the vegetation of the south western Cape, including non Proteaceous plant communities. In all the populations of Leucospermum studied in the south western Cape, Promerops cafer was present.

When actively feeding, it perches on the inflorescence, thrusting the head and bill through the styles to the perianth tube. Pollen is then transferred from the pollen presenters to an area on the forehead, between the eyes. The accumulation of pollen on the forehead becomes so great that it can be seen as a distinct yellow spot at a distance of several metres. When the bird alights on another inflorescence, the sharp thrusting motion of the head ensures the forcible transfer of pollen to the small stigmatic groove on the pollen presenter.

Three species of sunbird, Nectarina famosa (L.), Anthobaphes violacea (L.), and Cinnyris chalybeus (L.) are of equal importance as pollinating agents. Although they are distinctly territorial, particularly in the breeding season, the present author has observed all three species feeding simultaneously in a large shrub of L. praemorsum on the Nardouwberg. These species have also been found to be dominant in coastal macchia (Winterbottom, 1968), even increasing in numbers when Ericaceae and Proteaceae are flowering. Pollen spots on the head and sometimes at the base of the bill have been observed in all three species.

The Redwing Starling, Onychognathus morio (L.) and the Cape weaver, Ploceus capensis (L.) have been observed on several of the larger

flowered species of Leucospermum, attempting to obtain nectar by puncturing the perianth tube. However, although pollen has been seen on the heads of both these species, they are only casual visitors and probably do not play a very significant role in pollen transfer.

Insect Pollinators

The inflorescences of Leucospermum attract a large insect fauna (Gess, 1968) but comparatively few of these insects (mainly Diptera, Hymenoptera and Curculionidae) appear to be pollinators. Marloth (1908) reported Trichostetha fascicularis and T. capensis as insect pollinators in Leucospermum. These observations have been confirmed by the present author while several additional Scarab beetles have been found to be important pollinators. Trichostetha albopicta (Gor. Perch) has been observed on several species in the southern Cape, often in association with a smaller even commoner species, Peritrichia capicola (F.). Both these species have been observed in considerable numbers on a single inflorescence. By far the most commonly encountered Scarab beetle is Anisonyx ursus (F.). This species has been found at many places in the south western Cape, on a wide range of species of Leucospermum and is considered the most important insect pollinator of this genus. It is not unusual to find three or four individuals feeding on a single inflorescence.

All the Scarab beetles discussed have a comparatively brief period of pollinating activity which lasts from the end of August until mid October. On warm days in September when the atmospheric humidity is high, many thousands of Anisonyx ursus can be seen in a population of Leucospermum. All the species studied appear to be strong flyers. When alighting on an inflorescence they land on the projecting pollen presenters. Pollen shed from the pollen presenters adheres to the setae on the ventral surface of the head and thorax. They then burrow down through the perianths to feed on nectar in the perianth tubes. Visits to each inflorescence may last up to 30 minutes or more. On leaving the inflorescence the insect clambers through the pollen presenters before taking to flight and again pollen is brushed on the setae

Discussion

The field observations recorded here merely prove that the feeding patterns of certain birds and insects results in the transfer of pollen from one plant to another. Nevertheless, although the receptive stigmatic groove on the pollen presenter is very small,

usually 0.25 - 0.5 mm long, controlled pollination experiments have shown that even the light brushing of pollen onto the stigmatic groove results in fertilization. Thus it is likely that pollination is effected by even the smallest and lightest of the Scarab beetles.

While the insects discussed here are undoubtedly important pollinators for a few weeks during spring, they are rather local in their importance for although they may be abundant in a population at one locality, they may be quite absent from a comparable population of Leucospermum a few miles distant. The bird species mentioned previously are generally ubiquitous, even to the extent of being found on isolated peaks having a capping of Cape Flora in Karroid regions. Moreover, they feed actively on the inflorescences for the full duration of the flowering period. These considerations, together with their greater mechanical efficiency in transferring pollen and the fact that they carry a greater pollen load than any insect, leads one to believe that birds are the more important pollinating agents in Leucospermum.

PHYTOGEOGRAPHY

Introduction

Having completed a taxonomic revision of Leucospermum and having mapped the distribution of each species, it is now possible to discuss the phytogeography of the genus. Problems such as the possible origin and migrations of Leucospermum are discussed in relation to the present day distribution of the genus and also to paleoclimatological and geological evidence. Vicarious taxa and the principal areas of speciation are also discussed.

Several diverse arguments have been proposed to explain the distribution and origin of the Proteaceae in Southern Africa. Largely on the evidence of the fossil record, Levyns (1958) suggested a northern origin for the family. Johnson and Briggs (1963) suggested that African members of the tribe Proteeae were of tropical origin. In the present author's opinion, the arguments of Beard (1959) on the origin of the African Proteaceae, are the most satisfactory. Basing much of his evidence on the distribution and morphology of Protea, Beard maintained that while the Proteaceous flora of the south western Cape appeared to be of southern origin, it was more likely to have been derived from a tropical montane flora that was thought to have originated in Gondwanaland. As regards the distribution of Leucospermum, the present author has found a considerable amount of evidence to support Beard's theory.

Present Distribution

The genus Leucospermum with 47 species, is confined to Southern Africa. Its present range extends from the eastern highlands of Rhodesia through the eastern Transvaal Drakensberg to Swaziland and Natal and from there along the eastern and south eastern Cape coastal belt to the south western Cape, with outlying populations in Namaqualand (fig. 67). Only 3 species (L. saxosum, L. gerrardii and L. innovans) occur beyond the border of the Cape Province while 92% of the known species occur between Port Elizabeth and the Oliphants River mouth (fig 68). The greatest concentration of species, however, is found in a narrow belt along the southern Cape coast, between Stanford and the Breede River mouth, where 30% of the known species occur (figs. 68 & 71). This area will be discussed elsewhere.

The majority of species have rather small geographical ranges, several being confined to an area of about one square mile. Few species have distribution ranges that could be termed "wide",

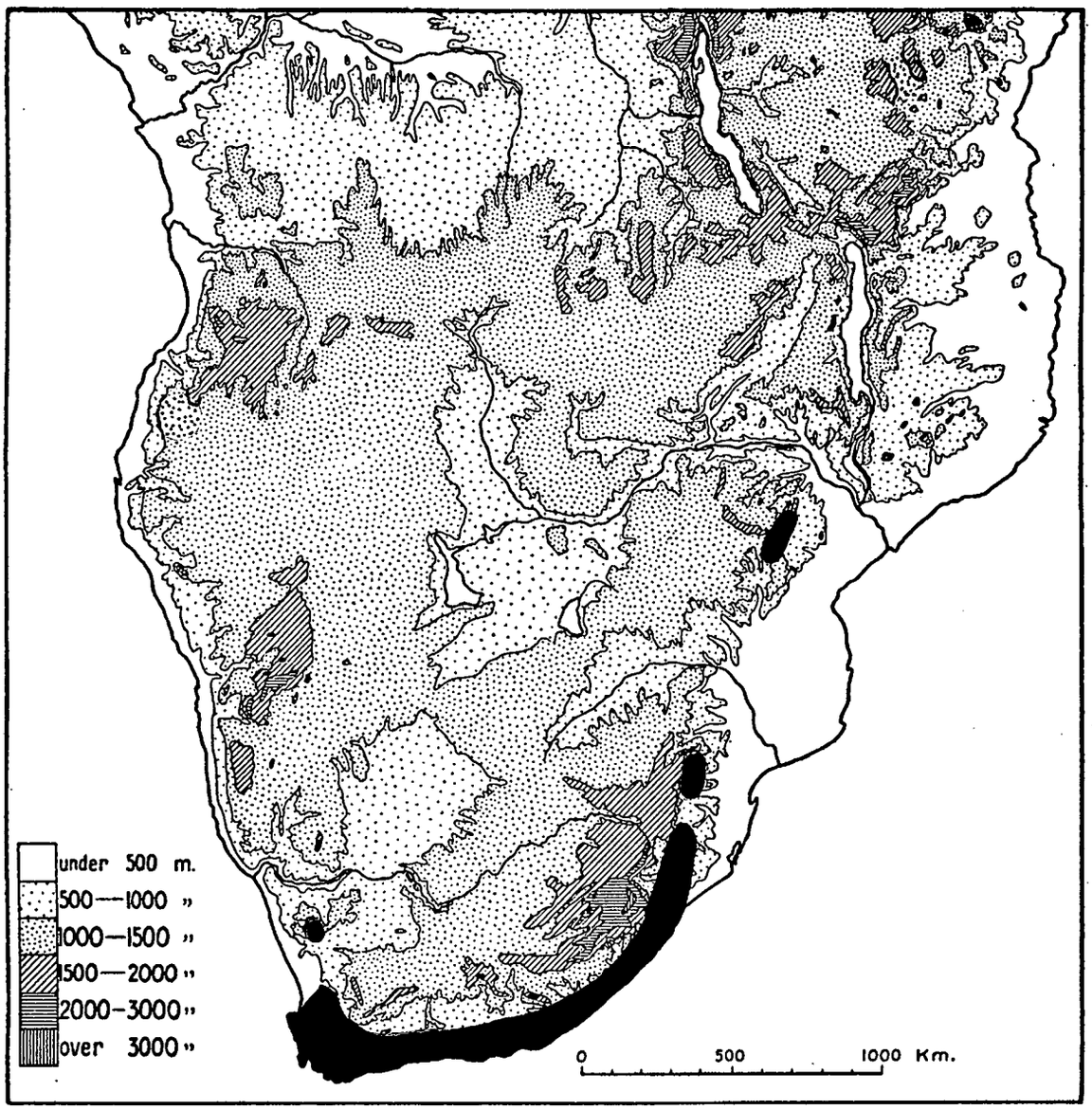


Fig. 67. Distribution range of the genus Leucospermum R.Br.

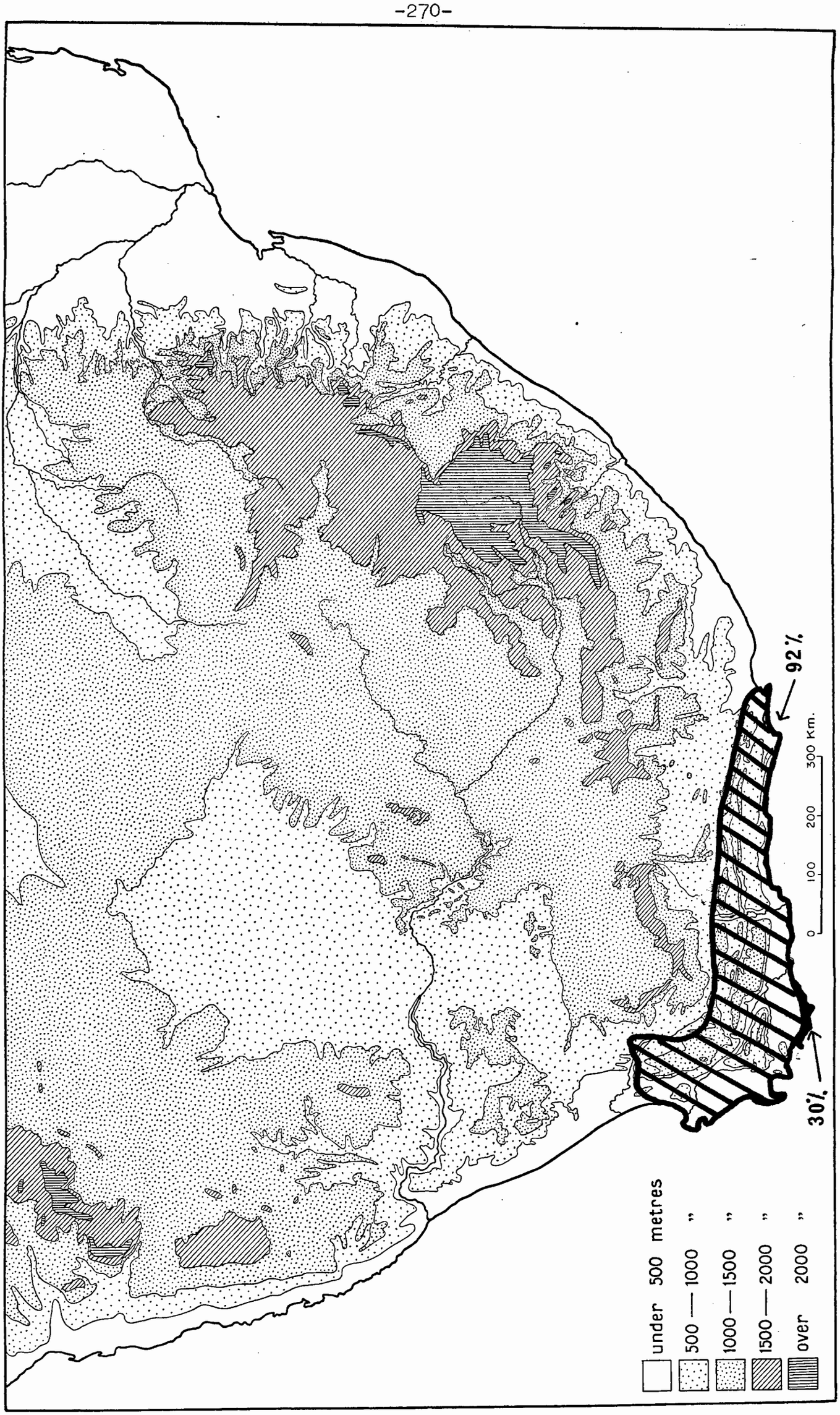


Fig. 68. Species density of Leucospermum in the Cape Province showing the high concentration of species(30%) along the Bredasdorp flats.

even in the narrowest sense of the word. Thus, in many respects the distribution of Leucospermum parallels that of many typically Cape genera such as Phylica (Pillans, 1942), Muraltia (Levyns, 1954), Cliffortia (Weimark, 1934) and Aristea (Weimark, 1940).

Edaphic Factors Affecting The Distribution Of Leucospermum

As a general rule it may be said that the majority of Leucospermum species in the Cape are confined to acid soils derived from Table Mountain Sandstone. A few species occur on Witteberg Quartzite which weathers to form a leached, siliceous substratum that is equally as deficient in minerals. Beyond the borders of the Cape, the genus appears to be found on sandstones and quartzites.

There are, however, several species which occur chiefly on heavy clay soils derived from weathered Cape Granite (e.g. L. gueinzii, L. grandiflorum and L. lineare) while L. calligerum and L. heterophyllum have on occasions been recorded on Malmesbury gravel.

The distribution ranges of L. praecox, L. fulgens, L. muirii, L. tomentosum, L. parile, L. rodolentum, L. arenarium and L. hypophyllocarpodendron appear to be determined by the substratum, which in this case is deep, white,partly stabilized sand of Tertiary or Recent origin.

Likewise, L. truncatum and L. patersonii grow exclusively on limestone deposits of the Alexandria formation. These deposits form a ridge of limestone hills adjacent to the southern Cape coastline, between Danger Point and Still Bay. As no published information is available regarding the alkalinity of this habitat, p.H measurements were made using a transistorised p.H meter, checked against a standard buffer of p.H 7. For example, at a site on the hills above De Hoop in the Bredasdorp district, the surface soil gave a p.H of 8.0 whereas the crushed parent limestone gave a p.H of 8.3. At Grootbos near Gansbaai, the surface soil gave a p.H of 8.3 and the crushed parent limestone a reading of p.H 9.7.

These preliminary observations are indicative of the alkaline nature of this habitat.

It is difficult to estimate the role which different substrata have played regarding the distribution and migration of Leucospermum as several taxa appear to have become adapted to widely divergent edaphic conditions. Nevertheless, it is clear that sandstones, quartzites and occasionally granites are the main

substrata on which species of this genus occur.

Leucospermum In The Summer Rainfall Regions

A persistent, subterranean rootstock and a narrowly cylindric involucral receptacle characterise the very natural section Crassicaudex. This section has the greatest range in the genus, and, with the exception of L. cuneiforme, which also occurs in the southern Cape Province, all the other species are confined to the summer rainfall regions of Southern Africa. (fig. 69). The distribution ranges of the four species making up the section Crassicaudex are all rather wide, and in some cases disjunct, when compared with the ranges of taxa endemic to the south western Cape. L. cuneiforme has the greatest range of all the species, both ecologically and geographically, occuring almost continuously from the Caledon district to the Transkei (fig. 8). In sharp contrast is the very disjunct distribution of its vicarious partner, L. saxosum, which has populations in the eastern highlands of Rhodesia and the eastern Transvaal Drakensberg, separated by the Limpopo interval.

In seeking an explanation for such a distribution one must postulate a connexion between the Drakensberg and Inyangani subcentres at some time in the past. This in turn presupposes favourable climatic conditions which would have permitted the joining of these subcentres. According to Brain and Meester (1964), the sequence of rainfall changes in Southern Africa during the Quaternary followed a cyclical pattern: Plio Pleistocene (1 - 2 million years ago); 1st pluvial; 1st non pluvial; 2nd pluvial; 2nd non pluvial; 3rd pluvial; present. The only quantitative estimates of these variations have been made by Bond (1957) and Brain (1958), working on sites in Rhodesia and the Transvaal respectively. Largely as a result of their work, it is now generally considered that the mean annual rainfall during the Pleistocene varied from 60% of the present rainfall during non pluvials to 140% of the present rainfall during pluvials. Cooke (1964) has even suggested that these values may have been exceeded during certain phases.

Fluctuations in the Pleistocene climates in Africa have been confirmed by palynological research (van Zinderen Bakker, 1964). Moreover, these studies have led van Zinderen Bakker (L.c.) to suggest that during the last major pluvial in east Africa, a decrease in temperature of 5° C occured (equivalent to a decrease in altitude of 500 m).

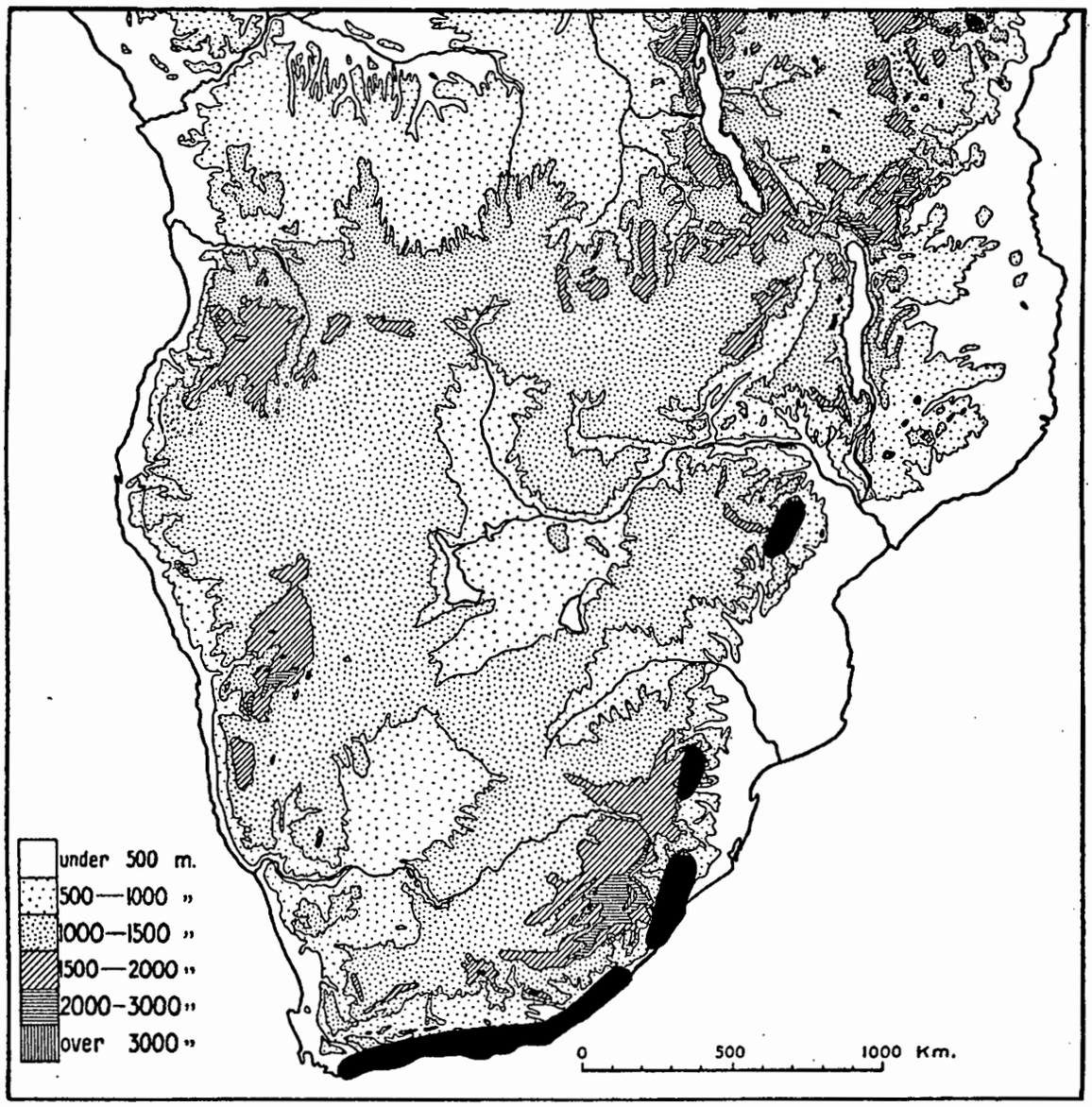


Fig. 69. Distribution range of Leucospermum sect. Crassicaudex

However, as Wild (1964, 1968) has already pointed out, neither the increases in rainfall nor the decreases in temperature currently postulated to have occurred during the Pleistocene are sufficiently great to have resulted in a continuous connexion between Drakensberg and Inyangani subcentres being established. To date, the most satisfactory means of explaining this connexion has been put forward by Wild (1964; 1968), who suggested that the Cape Centre and its subcentres were connected by the Early Tertiary. He points out that in a geomorphological map of Africa (King, 1962) showing the denudational land surfaces, the Cape Centre and its subcentres are shown as continuous during the Early Caenozoic. An even land surface would have allowed the Cape Flora to have covered a large continuous area of the African continent by the Early Tertiary. Folding, which, according to King, took place largely in the Pliocene, would have resulted in the fragmentation of what Wild (1964 : 132) has termed the "Cape Flora or its direct evolutionary precursor" and which would then have only survived in Central Africa in montane areas.

The Western Cape Coastal Sandflats

Another very natural group is the section Leucospermum with five species, distributed almost entirely along the Western Cape coastal sandflats, between Cape Town and Heerenlogementberg. Outlying populations are found in the Breede River valley at Brandvlei and along the Bredasdorp coast (fig. 70).

The distribution of all these species appears to be determined by edaphic factors since they grow only on deep white sandy soils, generally considered to be of Pleistocene origin (Du Toit, 1966 : 441). They are only very rarely found on Table Mountain Sandstone It is probably significant that within the area occupied by these five species (apart from a marginal stand of L. calligerum on an intrusion of Malmesbury gravel) there are no other species of Leucospermum competing in this particular environment. Thus the entire Leucospermum flora of the coastal sandflats habitat is made up of one or other of the vicarious species in the section Leucospermum. It would seem that the species of this section have developed on a substratum that is geologically relatively recent and was moreover subjected to marine regressions and inundations. To suggest that the five species comprising section Leucospermum have probably evolved since the Pleistocene is therefore not unreasonable.

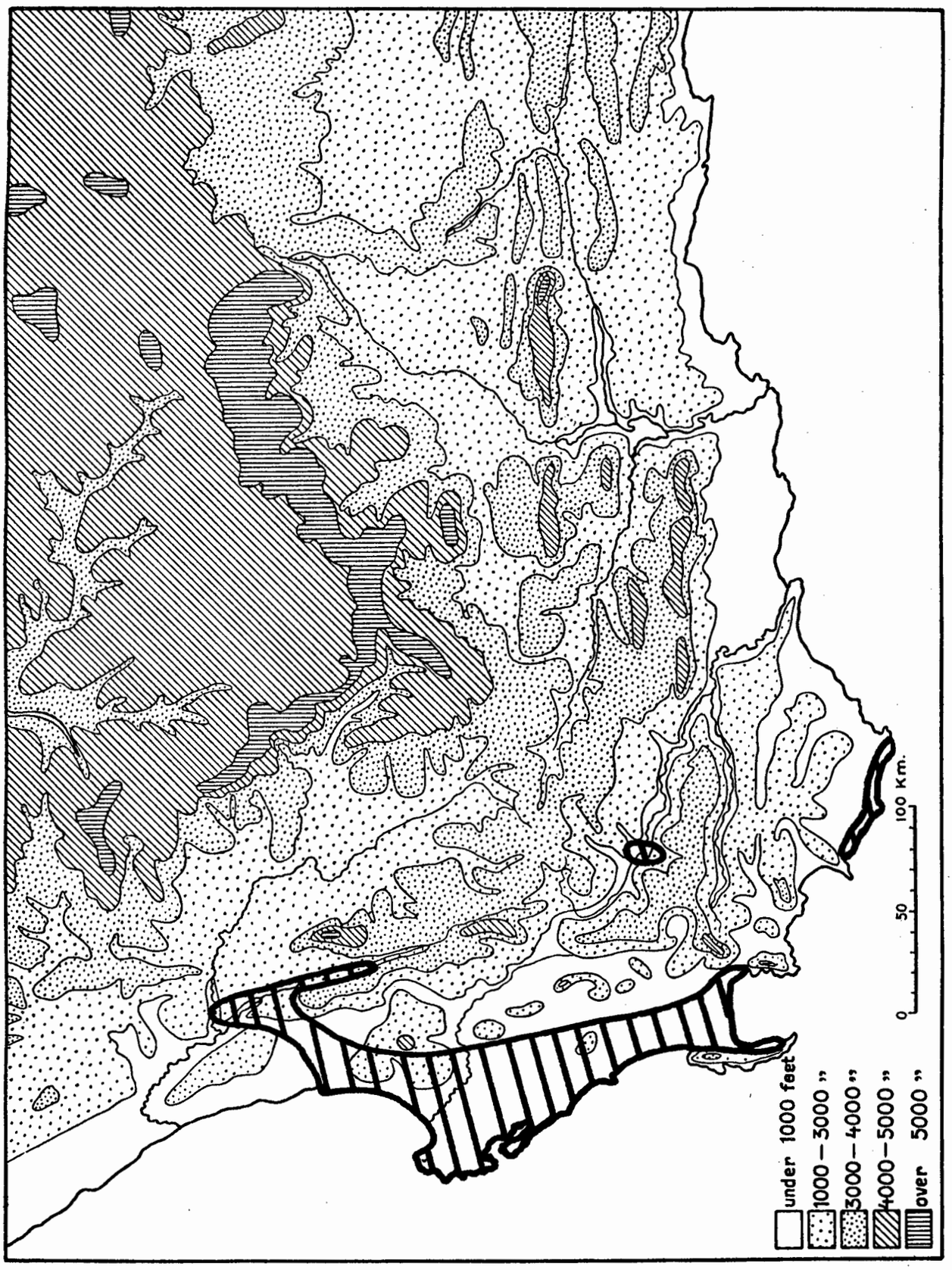


Fig. 70. Distribution range of Leucospermum sect. Leucospermum

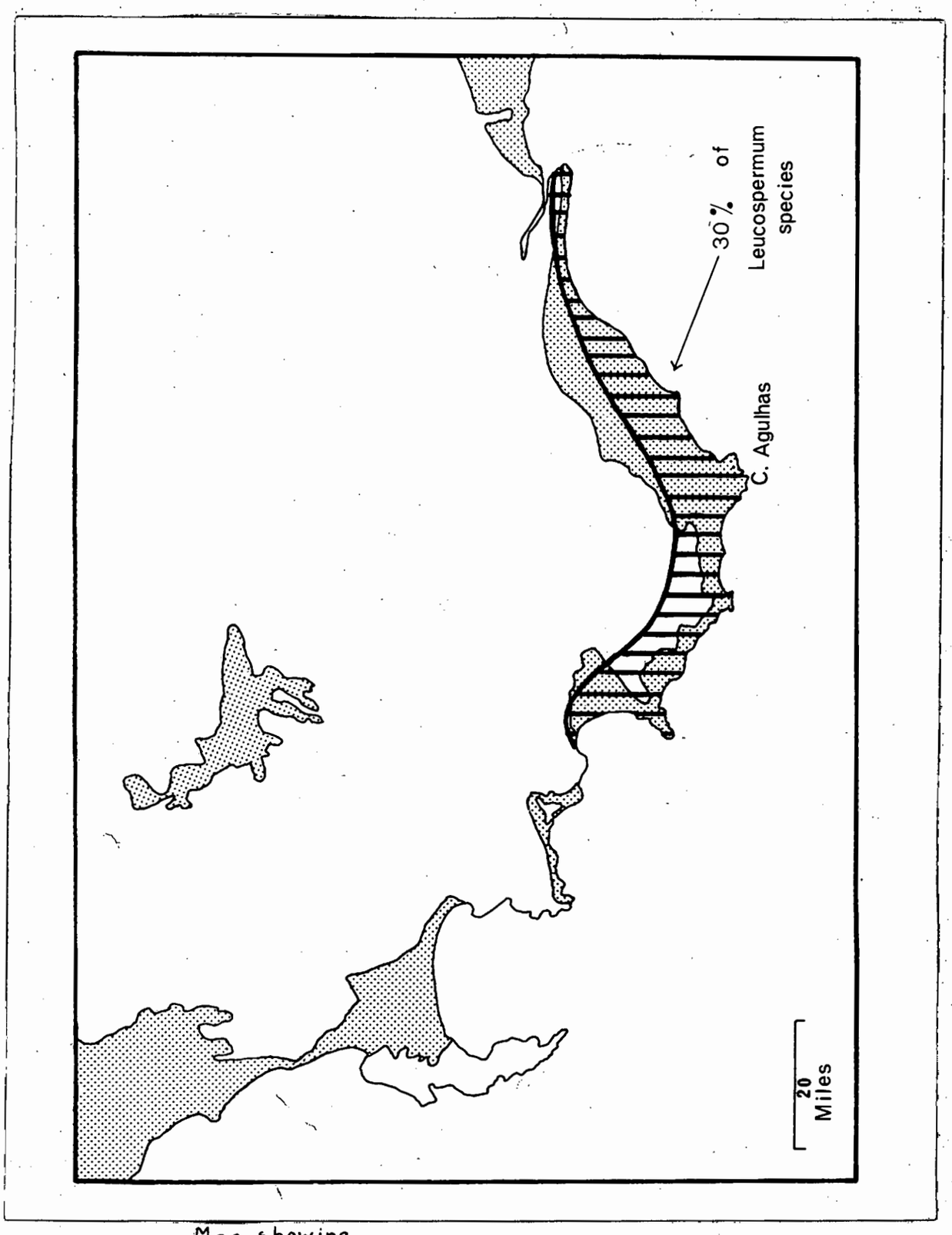
The distribution of L. hypophyllocarpodendron ssp. hypophyllocarpodendron requires some explanation. The populations along the Bredasdorp coastal flats are separated from the populations on the Cape Flats by a formidable ecological barrier, namely the Hottentots Holland mountains. At the present time there are no low lying coastal sandy areas which could link the two above mentioned areas of distribution.

Hamilton & Cooke (1965 : 336) have indicated on their map the position of the coastline between the Cape Peninsula and Cape Agulhas during the marine regression of the Middle Pleistocene. The Middle Pleistocene coastline according to Hamilton & Cooke has been marked on the distribution map of L. hypophyllocarpodendron ssp. hypophyllocarpodendron (fig. 39). Assuming that their interpretation is correct, a land bridge would have linked the Bredasdorp coastal flats and the Cape flats, providing a migration route which is likely to have been ecologically suitable for this species. Subsequently, when the sea returned to its present level, complete isolation between the Bredasdorp coast and the Cape flats would have been achieved.

The Southern Cape Coastal Flats

The greatest concentration of species is found in the Bredasdorp district. Here, 30% of all the known species are confined to a narrow strip along the coast between Stanford and the Breede River mouth and most of these are still further restricted to the Bredasdorp beds which are from two to twelve miles wide (fig. 71).

During the Tertiary and Pleistocene, much of this area was subjected to marine invasions and regressions (du Toit, 1966). Consequently, it may be regarded as a disturbed habitat. In addition, the presence of Table Mountain Sandstone, limestone outcrops of the Alexandria formation, sandy surface deposits of Recent origin and Malmesbury gravels, have afforded a wider range of habitats than is normally available for colonization in such a small area in the south western Cape. Several pairs of ecological vicariads have developed on the different geological formations, each species being very specific in its edaphic requirements. For example, L. cordifolium occurs on Table Mountain Sandstone while its vicarious counterpart L. patersonii grows only on limestone. L. truncatum is confined to limestone while L. fulgens grows only on partly stabilised sand, of Recent origin. Apart from these, several other vicarious pairs (e.g. L. prostratum and L. pedunculatum, L. calligerum and L. heterophyllum) are



Map showing
Fig. 71. The high concentration of species of Leucospermum along the Southern Cape coastal flats where 30 % of the species in the genus occur within the area hatched with dark vertical lines. The stippled area represents unconsolidated superficial deposits of limestone, sand and conglomerate, mainly Tertiary to Recent in age, and also Table Mountain Sandstone. (Adapted from the 1:500,000 geological map by F.C.Truter and P.J.Rossouw, Government Printer, 1955).

prominent in this area.

Thus there are several closely related species growing in adjacent localities in an area which has experienced surface disturbances since Pleistocene times. It is therefore not unduly speculative to suggest that a situation exists in the Bredasdorp coastal flats which can be regarded as being indicative of rapid evolution, if the views of Stebbins (1957 : 549) are held to be correct.

Montane Areas In The South Western Cape

It has been stressed by van Zinderen Bakker (1964 : 33) that we do not know whether the cool-humid periods of the south western Cape Province during the Pleistocene were contemporaneous with those in the Transvaal and Rhodesia. Nevertheless, during a hypothermal minimum, the anticyclones of the middle latitudes to the south of Africa, would have been in a more northerly position than at present. To quote van Zinderen Bakker (1967 : 144), "the consequence of this would have been that the winter rainfall area was much more extensive, as cyclonic rain could penetrate much further inland". Such conditions would have enabled the Cape Flora to spread eastwards and even to reach isolated mountains in the interior. During a hyperthermal period, drier conditions would have prevailed, restricting the winter rainfall area to an even smaller area of the south western Cape than is the case at present.

In a region of dissected topography like the south western Cape, one of the effects of fluctuations in the rainfall would have been to cause the fragmentation and eventual isolation of populations on the higher peaks, during arid periods. This effect would have been most pronounced in marginal areas where the boundry between the Cape and Karroo floras is determined mainly by rainfall.

Noteworthy cases are the isolated populations of L. alpinum on the Kamiesberg and Cold Bokkeveld mountains which have differentiated sufficiently to be regarded as subspecies. Likewise, the isolated populations of L. obtusatum on the Witteberg is considered subspecifically distinct from the main populations on the Worcester and Montagu mountains (fig. 52). Climatic conditions prevailing today are such that migration between the four centres marked in fig. 53 is impossible. It seems reasonable to assume that during a hypothermal period, a single variable complex was distributed over this range. Subsequently, during periods of greater aridity populations survived only on the higher peaks such as the Kamiesberg, Cold Bokkeveld, Witteberg, Worcester and Montagu mountains,

eventually differentiating into two species, each of which can be separated into geographically isolated subspecies.

L. calligerum and L. wittebergense are a similar pair of vicarious species. L. wittebergense probably developed on the dry Witteberg-Swartberg range due to long standing isolation brought about by an increase in the aridity of the region (fig. 45).

Similarly, one can explain the isolation and differentiation of L. profugum and L. spathulatum on the Piketberg and the Cedarberg-Cold Bokkeveld mountains respectively, from a variable continuous population that was probably more widespread in the past.

Discussion

The available phytogeographic and palaeoclimatological evidence points to the likelihood that the four vicarious species of the section Crassicaudex have had a lengthy history in Southern and South Central Africa. The ancestral population from which they could have been derived was probably in existence by the Early Tertiary or even earlier while their survival in these areas may be ascribed to their adaptation to burning by means of the persistent rootstock. The early development of the rootstock or lignotuber in the seedling stages is indicative of the high survival value of this character, which although undoubtedly secondary, is probably a fairly long established adaptation.

Morphologically, the inflorescence might be considered relatively simple in L. saxosum, L. cuneiforme, L. innovans and L. gerrardii as the involucral receptacle in these species is narrowly cylindric suggesting that it is merely a condensed spike. A conic, conic depressed or flattened involucral receptacle is found in the remaining species of the genus. If fusion and reduction can be regarded as being indicative of evolutionary advancement in the inflorescence, it can be argued that the narrowly cylindric involucral receptacle exemplifies the primitive condition.

Conversely, the situation in the south western Cape suggests that speciation has taken place relatively recently. The geographical isolation brought about by climatic fluctuations during the Pleistocene is likely to have been an important factor in promoting speciation in Leucospermum particularly in montane areas. Since the Pleistocene, the availability of new habitats, mainly along the southern and western Cape coastal flats, also appears to have resulted in rapid speciation in Leucospermum as is evidenced by the number of vicariads in these regions. Moreover,

on morphological grounds the inflorescences of these species can be regarded as being advanced.

It is therefore the opinion of the present author that the species density in the south western Cape is largely due to speciation in Pleistocene and post Pleistocene times. These taxa are thought to have been derived from a supposedly more primitive type such as presently occurs in the summer rainfall areas of Southern Africa.

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