A REVISION OF THE GENUS *RAFNIA* THUNB.

(FAM. FABACEAE : SUB-FAM. PAPILIONOIDEAE)

by

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PREFACE

The experimental work described in this thesis was carried out in the Department of Plant Sciences, Rhodes University, Grahamstown, under the supervision of Mrs G.D. Court.

This study represents original work by the author and has not been submitted in any other form to any other University, except for one paper delivered at the Electron Microscopy Society of Southern Africa's (EMSAA) 23rd Annual Conference in December 1984, entitled "Taxonomic features of Rafnia spp. as revealed by Scanning Electron Microscopy" and published as an abstract in the EMSSA's proceedings, volume 14, 1984.

Out of this revision, three new taxa have emerged and these have been described and submitted to the Scientific Editor of the South African Journal of Botany for publication.

This revision of Rafnia forms a small part of work currently being carried out on the sub-family Papilionoideae. It is intended that a shortened version of this revision will be submitted to the Flora of Southern Africa.

ACKNOWLEDGEMENTS

The author wishes to express her sincere thanks to the following:

Mrs G.D. Court of Rhodes University for assistance and supervision of this revision.

The Directors and staff of the following institutions for the loan of herbarium specimens including types:

BLFU University of the Orange Free State, Bloemfontein

BM British Museum, London

BOL Bolus Herbarium, Cape Town

C Botanical Museum and Herbarium, Copenhagen, Denmark

DBN National Botanic Gardens, Dublin

G Conservatoire et Jardin botaniques, Geneva

GRA Herbarium of the Albany Museum, Grahamstown

J University of the Witwatersrand, Johannesburg

JF Jonkershoek Forestry Research Station, Stellenbosch

K Royal Botanic Gardens, Kew, London

NBG Compton Herbarium, Kirstenbosch

NH Natal Herbarium, Durban

NU University of Natal, Pietermaritzburg

P Museum National d' Histoire Naturelle, Paris

PEU University of Port Elizabeth, Port Elizabeth

PRE Botanical Research Institute, Pretoria

PRU University of Pretoria, Pretoria

PUC Potchefstroom University for C.H.E., Potchefstroom

RUH Rhodes University, Grahamstown

S Herbarium, Swedish Museum of Natural History, Stockholm, Sweden

SAAS Saasveld, Herbarium, George

SAM South African Museum Herbarium, Kirstenbosch, Cape Town

SBT Herbarium, Bergius Foundation, Stockholm, Sweden

SRGH National Herbarium and Botanic Garden, Harare, Zimbabwe

STE Government Herbarium, Botanical Research Institute, Stellenbosch

UPS Thunberg Herbarium, University of Uppsala, Uppsala.

UWC University of the Western Cape Herbarium, Bellville.

Mr E.G.H. Oliver of the Botanical Research Unit, Stellenbosch for location of the R. ericifolia population and for arranging field trips.

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LIST OF FIGURES

ABSTRACT

A taxonomic revision of Rafnia Thunb. (Fam. Fabaceae, Subfam. Papilionoideae) is presented in which 21 species are recognised. The relative value of the taxonomic characters is discussed. An electron microscopy study of the seed surface, pollen grains and several sexual characters has been undertaken. Two keys are included, one using vegetative and floral characters and the other using ultrastructure of the testa. Each species description is accompanied by illustrations and a distribution map. Historical and ecological notes on the genus are given.

INTRODUCTION

The genus Rafnia Thunb. belongs to the large family Fabaceae, comprising 600 genera and about 12000 species (R.A. Dyer, 1975). This genus, which belongs to the sub-family Papilionoideae, comprises 21 species which are concentrated in the south-western Cape extending northwards to Clanwilliam with only one species, R. elliptica Thunb. spreading eastwards into Natal. The genus was last revised by Schinz in Bull. Herb. Boissier (1894). Dahlgren (1970), in his article "Parallelism, Convergence and Analogy in some South African genera of the Leguminosae" suggested that the genus Rafnia needed to be revised.

In this revision of the genus Rafnia, the species concepts are revised and a history of the taxonomy of the genus is provided. In addition, three new species are described, R. vlokii Richardson, R. swartbergensis Richardson, and R. glaucophylla Stirton ex Richardson and two species, R. humilis Eckl. & Zeyh. and R. affinis Harv., are reduced to synonymy. An account of doubtful species is given.

The results of a micromorphological study of the testas of the seeds using scanning electron microscopy (SEM) are presented and discussed and a key based on these results is provided.

In addition, various morphological characters are evaluated for their usefulness or otherwise in distinguishing species, and an artificial key to the species is included.

Where applicable, problems commonly encountered when attempting to identify the species are mentioned and attention is drawn to those characters which will distinguish the species. Each species is illustrated by diagrams of flowering branches, dissected floral parts and pods as well as photographs of the type specimen, where possible. Some details of the species biology are mentioned.

A distribution map of each species is provided using the one-degree square reference system (Leistner and Morris 1976) and all the specimens examined by the author are listed after each species description.

Future avenues of research are discussed. These involve SEM of hila shapes and exine of the pollen grain to help establish phylogenetic relationships between the various taxa. In addition the necessity of further field investigation is discussed as the occurrence of further new species must not be excluded.

CHAPTER ONE

TAXONOMIC HISTORY OF THE GENUS RAFNIA THUNB.

The genus Rafnia was formally circumscribed by Carl Peter Thunberg on the 3rd June 1800, when thirteen species were published in Nova Genera Plantarum, p. 144-149. The account included the following new species:

R. angulata Thunb. *

R. angustifolia Thunb.

R. axillaris Thunb.

R. diffusa Thunb. *

R. elliptica Thunb. *

R. erecta Thunb.

R. filifolia Thunb.

R. retroflexa Thunb.

R. spicata Thunb. *

Of the above species, only four (marked *) have stood the test of time and are accepted specific epithets in this revision. Both R. angustifolia and R. filifolia are synonyms of R. angulata. R. axillaris Thunb. is a synonym of R. elliptica. R. retroflexa sensu Harvey in F.C. ii p. 37, based on Thunberg's material in Uppsala, called R. retrofracta, is in fact a synonym of Cyclopia brachypoda Benth. R. erecta Thunb. is a doubtful species, (F.C. ii p. 38). All that remains is a battered fragment which cannot be reliably identified. In the same account Thunberg makes two new combinations: Crotalaria triflora L. and C. amplexicaulis L. became Rafnia triflora (L.) Thunb. and R. amplexicaulis (L.) Thunb., respectively and both of these species are upheld.

Thunberg cites Spartium ovatum Berg. as a synonym under R. cuneifolia. This was corrected in 1894 by Schinz (Bull. Herb. Boissier ii p. 199) who upheld R. ovata (Berg.) Schinz with the following synonymy: Spartium ovatum Berg. Flor. Cap. (1763) p. 197; C. cuneiformis Lam. Dict. ii (1786-88) p. 195; R. cuneifolia Thunb., Prodr. (1800) p. 123. This indicates that the widely used epithet, R. cuneifolia Thunb. falls away. A similar situation arises with Cytisus capensis Berg. (1767) which Thunberg places in synonymy under R. opposita L. In 1894 this was rectified by Schinz, who using the earlier epithet, set up the correct combination of R. capensis (L.) Schinz with Cytisus capensis in synonymy. This correct combination was not used until 1913 when Druce published the same combination in Rep. Bot. Soc. Exch. Club Br. Isl.

The remaining species in Thunberg's list, R. opposita Thunb. Liparia opposita L. and Crotalaria opposita (L.) L.f. are homotypic. L. opposita L. was published in 1774 and appeared in the new combination Crotalaria opposita (L.) L.f. in 1782. L. opposita L. is an illegitimate name because Linnaeus based it on material of Spartium capense L. (1774) and the earlier name takes priority. For the same reason Crotalaria opposita (L.) L.f. is also illegitimate.

At an earlier date (1799), Thunberg had described Oedmannia lancea (Act. Holm. p. 281 tab 4). In preparing his outline of Rafnia he upheld O. lancea. In 1825 De Candolle recorded (DC. Prodr. ii p. 119) that the only character separating Oedmannia from Rafnia is the almost connate condition of the posterior and lateral sepals, and that in all other respects the genera are alike. He therefore united the only

species of Oedmannia, O. lancea Thunb. with Rafnia, the new combination being R. lancea (Thunb.) DC.

The synonymy of Borbonia L. and Vascoa DC. under Rafnia is quite complex. In Prodr. (1800) Thunberg described Borbonia perfoliata but in 1826 De Candolle (Mém. Leg.) introduced the new combination R. perfoliata (Thunb.) DC. In the same publication he described the genus Vascoa, including in it Crotalaria amplexicaulis of Linnaeus. Much earlier, in 1786, Lamarck had described 12 Crotalaria species. One of these was C. reniforme which De Candolle realised was the same as his Vascoa amplexicaulis (another of Lamarck's species was Crotalaria cuneiformis which became a synonym of R. ovata (Berg.) Schinz. De Candolle's second species was Vascoa perfoliata. In 1832, E. Meyer described V. acuminata thereby increasing Vascoa to three species. In 1836 Vascoa was united with Rafnia by E. Meyer in Comm. Pl. Afr.* while Borbonia cordata Andrews (Bot. Rep. T. 31) was discounted because it was based on a Linnaean description of a villous plant and illustrated from material grown from seed in England. The illustration appears to be of R. triflora material (Fig. 1). In 1963 Dahlgren revised the genus Aspalathus and placed Borbonia L. into synonymy under Aspalathus. In 1816 Martius described R. cordata from Eckl. & Zeyh. 1180, and this entered in synonymy of Rafnia meyeri Schinz (Harvey in F.C.). Thunberg had described R. cuneifolia based on material of Spartium ovatum Berg. thereby making the former an illegitimate name. Meyer independently described his R. ovata based on the Drege type. In 1894 Schinz noticed Thunberg's error and correctly renamed R. cuneifolia as R. ovata. In the same publication

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* E. Mey. Comm. Pl. Afr. : now abbreviated as follows:
E. Mey. Comm. (Botanical Research Institute Technical Note Tax 6/1, March 1972).

Figure 1: Illustration of Borbonia cordata taken from Andrews (1797). The Botanists Repository Vol. 1, T31.

he corrected Meyer's then illegitimate homonym by renaming it R. meyeri Schinz.

In 1836 Meyer also described several new taxa as well as describing the genus Pelecynthis. The type material of the new species, R. virens E. Mey. (Fig. 2) is without doubt R. amplexicaulis (L.) Thunb. and so becomes a synonym of the latter. The other new species, R. ecklonis E. Mey. is untraceable and is discussed under doubtful species. His new combination, R. perfoliata (Thunb.) E. Mey. takes Borbonia perfoliata Thunb. (omitted in F.C.) and Vascoa perfoliata into synonymy. Lastly, Meyer reduced Thunberg's R. angustifolia and R. filifolia to varieties of R. angulata Thunb.

In Meyer's publication of the genus Pelecynthis he grouped eight species of Rafnia into three sections. Three of these species, P. rhomboidea; P. corymbosa (which takes R. spicata into synonymy!) and P. gibba were species novae, while the rest were new combinations. (P. rhomboidea and P. gibba are R. ovata (Berg.) Schinz and R. dichotoma respectively). His listing of R. spicata under P. corymbosa is unexplainable since his Drege type of P. corymbosa is material of R. ovata (Berg.) Schinz, a shrubby plant 600-900 mm tall while the real R. spicata has a small procumbent habit.

In 1839 Walpers in Linnaea XIII united Pelecynthis and Rafnia thereby reinstating the earlier combinations:

Pelecynthis rhomboidea E. Mey. = R. rhomboidea (E. Mey.) Walp.

P. corymbosa E. Mey. = R. corymbosa (E. Mey.) Walp.

P. opposita (Thunb.) E. Mey. = R. opposita Thunb.

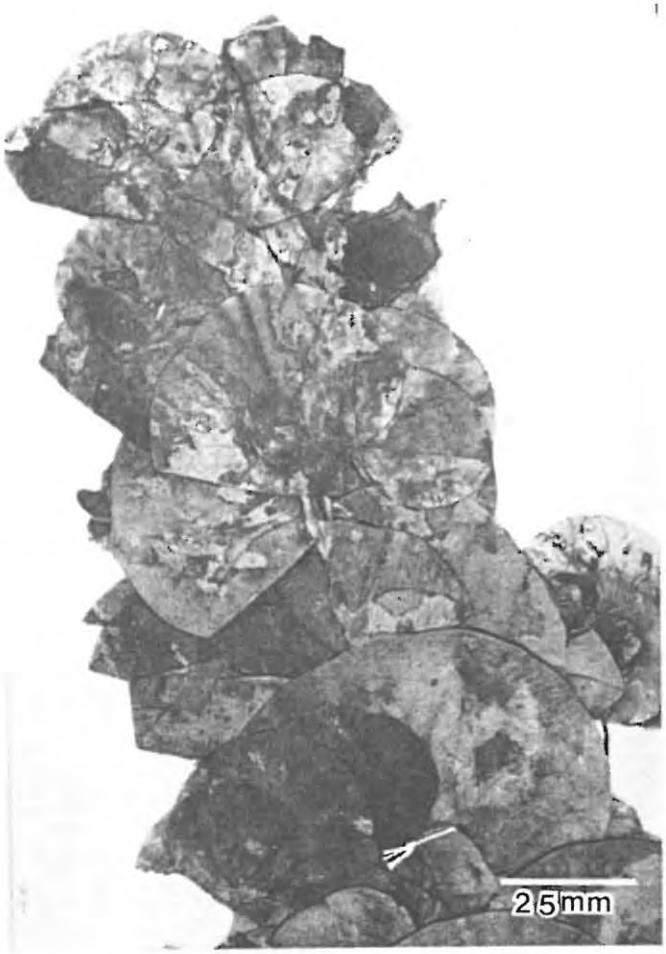


Figure 2: Photograph of type of R. virens E. Mey. (Drege, du Toits Kloof (P)).

P. axillaris (Thunb.) E. Mey. = R. axillaris Thunb.

P. retroflexa (Thunb.) E. Mey. = R. retroflexa Thunb.

P. diffusa (Thunb.) E. Mey. = R. diffusa Thunb.

The problem attending P. dichotoma and P. gibba is complex, and concerns three names and four specimens. Meyer's Pelecynthis dichotoma was based on a Drege specimen from Drakensteen, whereas the R. dichotoma of Walpers was based on Eckl. & Zeyh. 1190 from Genadendal, Caledon (Type of R. dichotoma in NBG). Further, Walpers also saw the Drege specimen and placed it in synonymy under R. pauciflora (Eckl. & Zeyh. 1195) which species is not listed by Meyer. Pelecynthis gibba E. Mey. was based on a Drege specimen from the Cedarberg. Walpers synonymised this under his R. dichotoma (Eckl. & Zeyh. 1190). This problem was noted by Bentham in Ann. Mus. Vind. 11: 142, and recorded by Presl in Bot. Bemerk. 1844, who stated that: R. pauciflora Eckl. & Zeyh. = Pelecynthis dichotoma E. Mey., and R. dichotoma Eckl. & Zeyh. = Pelecynthis gibba E. Mey. In 1916 Druce listed the new combination of R. gibba with Pelecynthis gibba E. Mey. and R. dichotoma Eckl. & Zeyh. as synonyms. In this revision, R. dichotoma Eckl. & Zeyh. is upheld with R. gibba and Pelecynthis gibba as synonyms. R. pauciflora Eckl. & Zeyh. was correctly placed as a synonym of R. capensis by Schinz in 1894 (Bull. Herb. Boissier ii). In the same publication Schinz named Pelecynthis dichotoma as a synonym of R. angulata Thunb., thus supporting Bentham's decision (Hooker, Lond. J. Bot. 1843). However, on examination of the Drege specimen (Drege s.n. collected 5/10 1833 in the "Draakensteenberge", (P)), the author finds it to be R. capensis.

In 1836, R. racemosa was described by Eckl. & Zeyh. and is upheld in this revision. The Eckl. & Zeyh. collection, 1183 was misidentified by the collectors as R. diffusa. Although not traced by the author, this specimen is apparently R. triflora (Walpers in Linnaea, Vol. XIII, 1839). Eckl. & Zeyh. collection 1184 is labelled and described as R. alpina. Also untraced, this specimen is allied to R. triflora by Walpers. R. humilis was described by Eckl. & Zeyh. from their collection 1198. There is much confusion between the concept of R. humilis and R. angulata, the author therefore has relegated the former species to synonymy under R. angulata. Although R. humilis has smaller and fewer flowers, distinguishing characters are not substantial enough to separate the two entities.

R. fastigiata was described in 1836 by Eckl. & Zeyh. from their collection 1182. In 1862 Harvey in F.C. ii p. 33 noted that R. fastigiata was very similar to R. triflora but retained the species with reservation. In 1864, Schinz placed it in synonymy with R. triflora and the writer approves this action. It should be noted that in Eckl. & Zeyh's Enum., the name used for this species is R. fastigata. This is obviously an error as on the type sheet Eckl. & Zeyh. no. 1182, the name R. fastigiata appears in the author's writing and this name must stand.

In 1839 R. intermedia Vogel ex Walpers was published in Linnaea XIII. Several authors have commented on its likeness to R. triflora and to R. elliptica. On examination of the relevant types, this author has found that its calyx structure places it in synonymy with R. elliptica.

In 1843 a useful survey of the genus by Bentham appeared in the London Journal of Botany. In this we are reminded that the rafnias are entirely glabrous, blacken on drying, and are closest to the genus Crotalaria, distinguished mainly by the inflated pod of the latter. He used divisions made earlier by De Candolle and Meyer, producing the four sections:

1. Vascoa DC. Carina rostrate and leaves amplexicaul.
2. Eurafnia E. Mey. Carina rostrate, leaves never amplexicaul.
3. Pelecynthis E. Mey. Carina arched or truncate, sometimes emarginate.
4. Carminotropis E. Mey. Carina truncate, never emarginate.

In his work Bentham does not describe any new species, but it should be noted that his entry on R. lancea is only partly correct, for his allusion to Burke's Albany Specimen (seen by the writer) is actually R. elliptica. R. lancea is a very distinct species which is limited to the South Western Cape. Secondly, in his note on R. retroflexa, he questions Thunberg's authorship but places Meyer's Pelecynthis retroflexa in synonymy; the explanation here is apparently the following: the name R. retroflexa appeared in Thunberg's Nov. Gen. Pl. but the specimens morphologically nearest to this description are all labelled retrofracta, and, according to Schinz (and the writer) at least one of them is Cyclopia brachypoda. The rest have been seen by the writer and represent a small form of R. capensis. This leaves us with Bentham's synonym, Pelecynthis retroflexa E. Mey., which refers to the Drege specimen from the Bokkeveld. On examination, this material has proved to be R. diffusa Thunb.

In 1844, Karl Presl published a list of Rafnia species (with comments) in Bot. Bemerk. This list has proved to be extremely useful in solving some of the problems related to the often confused nomenclature. It is noted, however, that his mention of R. myrtifolia Presl, Rafnia meyeriana Presl and R. lancifolia Presl are not validly published here or elsewhere and therefore each is a nomen nudum.

Between 1859 and 1861 Harvey described three new species; the well marked R. crassifolia, R. thunbergii and R. affinis. Of these, the first two are upheld while R. affinis is reduced to synonymy under R. capensis in this revision. The identification of R. capensis is sometimes confused because of the smaller-leaved montane or upland form (further complicated by coppicing after fire) (Fig. 3a) and the larger-leaved lowland form (Fig. 3b). This indicates the unreliability of leaf character which was used by Harvey in distinguishing R. affinis from R. opposita, which itself is a proved synonym of R. capensis (see page 2).

In 1894, Schinz published a revision of Rafnia and a description of a new species, R. schlechteriana in Bull. Herb. Boissier. ii p. 199. R. schlechteriana is upheld in this revision but not for the same diagnostic characters used by Schinz. Although Schinz described this species almost one hundred years ago, it has never been correctly identified by any collector. The specimens seen by the author are labelled either R. affinis Harv., R. capensis (L.) Schinz or what is now called R. meyeri Schinz. These specimens, however, fit Schinz's concept of the species. In addition, in his revision of the genus he retains the four sections, viz. Vascoa, Eu-Rafnia, Pelecynthis and

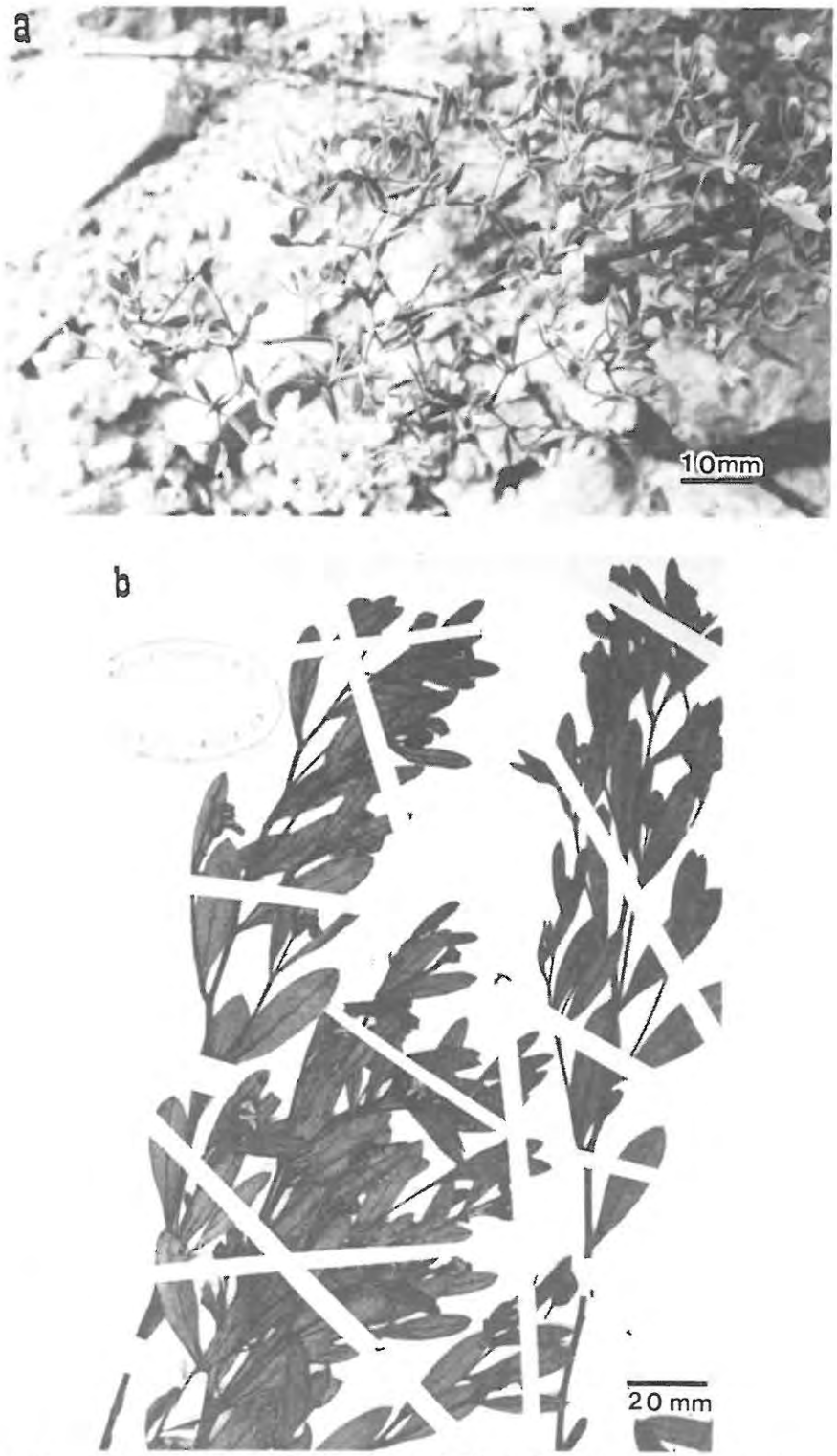


Figure 3: (a) Photograph of R. capensis (L.) Schinz. coppicing after fire (small leaved montane form - taken at Saasveld on side of Outeniqua mountains).

(b) Photograph of R. capensis (L.) Schinz (large leaved lowland form - Barker 3260 in NBG).

Carminotropis which are used in Harvey's account in Flora Capensis. In section Vascoa, Schinz places R. virens E. Mey. into synonymy under R. amplexicaulis (L.) Thunb., on grounds of a correct assessment that two species cannot be reliably distinguished. In section Eu-Rafnia, Schinz makes R. fastigiata Eckl. & Zeyh. a synonym of R. triflora (L.) Thunb. and R. axillaris Thunb. a synonym of R. elliptica Thunb. These latter two species says Schinz are so similar that he is unable to find any character to separate them. It should be noted here that Ecklon and Zeyher's R. axillaris (illegit.) is actually R. crassifolia Harv. Under R. angulata, Schinz places R. angustifolia in synonymy and does not accept any of the infra-specific taxa under these as described by Thunberg, Meyer and Harvey. In this account, no varieties are accepted as intermediates show that there is no definite dividing line to separate the species into varietal taxa.

In section Pelecynthis, Schinz upholds R. affinis and R. capensis with reservation. In this revision, R. affinis is not upheld. In addition, and as mentioned earlier, Schinz sorted out the confusion surrounding the name of R. cuneifolia Thunb. The fourth section, Carminotropis, which consists of R. dichotoma Eckl. & Zeyh., R. retroflexa Thunb. R. diffusa Thunb. and R. spicata Thunb., remain unchanged in Schinz's work. An explanation regarding R. retroflexa is required here. The sheets related to this epithet are labelled (in Thunberg's hand) R. retrofracta, therefore there is no such species as R. retroflexa Thunb. The specimens, however, are undoubtedly R. capensis. There is a validly described Pelecynthis retroflexa E. Mey. (Fig. 4) (1835) based on a Drege specimen which has proved to be R.

Figure 4: Photograph of Pelecynthis retroflexa E. Mey. (Drege s.n. K).

diffusa and so also falls away. This highlights an error in Walpers account (1839) (p.5) in which he includes R. retroflexa Thunb. in his list of new combinations (Ecklon and Zeyher's specimen 1187 - actually R. elliptica - is also wrongly labelled R. retroflexa Thunb.)

No further work was done on this genus until 1916 when Druce in his report for that year made the new combination Rafnia gibba from Pelecynthis gibba E. Mey. Meyer's description based on a Drege specimen from the Cedarberg has proved to be R. dichotoma, thus this epithet falls into synonymy.

In 1946, Salter described the distinctive R. ericifolia which is today an endangered species.

In 1970 Dahlgren examined the kinship of Rafnia and related genera in a detailed article (Bot. Notiser v. 123, p. 551-568). He concluded that Hutchinson's tribe consisting of Borbonia, Euchlora and Rafnia was artificial, and that the apparent leaf similarities had arisen by convergence. Dahlgren associates Lebeckia, Wiborgia, Rafnia and Aspalathus (including Borbonia) because of floral similarities, absent or poorly developed stipules and their prevailing chromosome number 2n = 16 or 18. This natural group of genera is centred in south-western South Africa.

In 1982 Stirton discovered a few specimens of Rafnia near Worcester which possessed an irregular margin unlike the smooth margin present in all other species. This, he named R. crispa on the basis of its crispate margin. Although this species is upheld, it must be noted

that close examination of the type material held at PRE, has revealed the margin to be decidedly undulate and not crispate as stated.

Three new species have been described by the author during the current revision:

R. vlokii, a large woody shrub from a northern face of the Outeniqua was discovered by Jan Vlok of the Saasveld Forestry Research Station.
R. swartbergensis, again montane but much smaller, was for a long while mis-identified as R. elliptica. The author discovered that this distinct species has a well-marked winged calyx which separates it from all other rafnias.
R. glaucophylla was first noted and named (but not published) by Stirton. The author found that this species has, in addition to its glaucous-grey leaves, a diadelphous staminal arrangement, while all other rafnias are monodelphous.

It can be seen from the above history that 41 species of Rafnia have been described since the inception of the genus. In this revision, 18 of these are upheld, and three new species are described.

CHAPTER TWO

MATERIALS AND METHODS

MORPHOLOGICAL STUDIES

To conduct this investigation it was necessary to obtain as much herbarium material as possible. Loans were obtained from the following herbaria (abbreviated according to Holmgren et al. 1981). BLFU; BM; BOL; C; DBN; G; GRA; J; JF; K; NBG; NH; NU; P; PEU; PRE; PRU; PUC; RUH; S; SAAS; SAM; SBT; SRGH; STE; UPS; UWC. In addition, many field trips to Saasveld Forestry Research Station, Kleinmond, Betty's Bay, Cape Town and environs; Worcester, Darling, Rawsonville, Cape Point Nature Reserve, Piquetberg, Kluitjieskraal, Stellenbosch, Jonkershoek, Cedarburg and Klipheuwel were undertaken. Unfortunately, the environment of many of the collection areas listed on herbarium sheets have changed as they are now built-up areas or farmland and the author had to find alternative localities in order to collect specimens.

Of the taxa described in this study, collections were made of the following: R. perfoliata, R. amplexicaulis, R. capensis, R. schlechteriana, R. ovata, R. meyeri, R. racemosa, R. elliptica, R. triflora and R. vlokii. Fresh material and seeds were also obtained from several other collectors in the south-western Cape.

Once the material was received, each specimen was thoroughly examined. Flowers were boiled and dissected and these, together with leaves and pods were thoroughly scrutinised to detect morphological similarities and differences between the various taxa.

A detailed map of each species is presented using the 1^{o} grid square system and within each species the specimens seen are organised by grid number taken from west to east and then from north to south. Within each 1^{o} grid square, the specimens are organised by $1/4^{o}$ squares, first A, then B, C and D squares. The localities are as per "South African Place Names" in the Annals of the Cape Provincial Museums Vol. 12 (Leistner and Morris 1976).

Micromorphological Studies

Scanning electron microscopy (SEM) was carried out on the testas of the seeds of 18 of the 21 taxa in order to establish whether testa pattern would provide a useful taxonomic feature as previous work (Brisson et al. 1976, La Sota et al. 1979, Lersten 1981, Bragg 1983, Bridges et al. 1983, Richardson et al. 1984, Baker et al. 1985) suggested this may be the case. As most of the existing reference material used had been air dried in the traditional manner for herbarium collections, SEM of the seed coats was carried out on air dried material. Where possible, results from old dried material were correlated with results obtained from freshly dried seeds. In addition, using R. elliptica seeds, a comparison was made between seeds which had been critical-point dried and seeds which had been air dried to ascertain whether surface morphology of critical-point dried seeds differed markedly from air dried seeds. As no distinct differences were observed, air dried material was used.

Seeds were examined for surface damage, mounted on brass stubs with glue and sputter-coated with gold using a Polaron E5100 Sputter Coater, observed and photographed in a Joel JSM U3 and Joel JSM 840 Scanning electron microscope.

The hila of a few species were also examined using SEM as Bragg (1983) suggested that this may be a useful taxonomic feature.

SEM was carried out on wing petals with lunulae and wing petals without lunulae in conjunction with an SEM examination of the stigmas of these flowers to assess whether size and hairiness of stigma could be correlated to presence or absence of lunulae.

CHAPTER THREE

TAXONOMIC CHARACTERS AND THEIR RELATIVE VALUE

Leaves

Although the leaves of *Rafnia* are notoriously variable, they provide sound taxonomic characters in several instances. The leaves are always alternate near the base of the stem but are often opposite and smaller near the flowering stem apices. This indicates the importance of examining the whole plant and not just a flowering branch before making decisions. Many mistaken identifications are made because either the flowering branch only is collected, or a coppicing stem is examined - in both instances the normal leaf variation described above is absent.

The leaves are always simple, sessile, exstipulate and with an entirely glabrous surface (Fig. 5a & b). The leaf lamina varies greatly in size and shape. The margin is always smooth with the exception of *R. crispa* Stirton (Fig. 44). An amplexicaul leaf character is met with in two species (*R. amplexicaulis* (L.) Thunb. and *R. perfoliata* (Thunb.) E. Mey. and these are delimited from the remaining species on the basis of this character. Leaf shape is also used to distinguish *R. ericifolia* Salter, this being the only species which possesses distinctly ericoid leaves. The extensive variation in size and shape of the leaves of *R. capensis* (L.) Schinz has accounted for its extensive synonymy, yet once this variation is recognised, this species is not easily confused with other species. The main problem here is that often only the flowering branches or coppicing

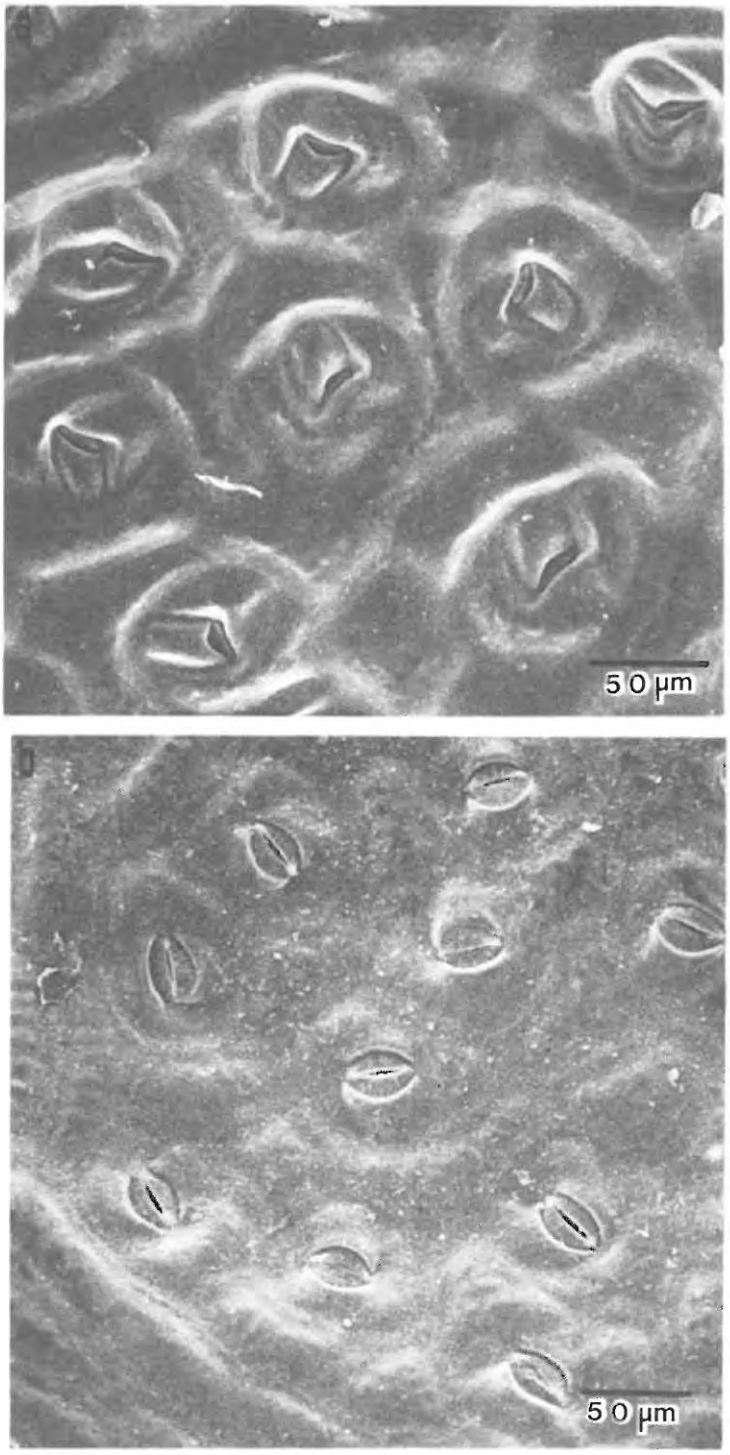


Figure 5: (a) Scanning electron microscope (SEM) photograph of leaf surface of R. perfoliata E. Mey. collected on edge of road next to tortoise reserve near Worcester.

(b) SEM photograph of leaf surface of R. schlechteriana Schinz collected in the Versveld Pass (Piquetberg).

branches are collected and, as previously mentioned, the normal leaf variation is then absent (Figs. 6a & b).

Inflorescence

The flowers are usually solitary or in short axilliary or terminal racemes or sometimes capitate. R. triflora (L.) Thunb. is the only species which has flowers borne in a three-flowered cyme. The flowers of R. racemosa Eckl. & Zeyh. are always in a very distinctive leafless, terminal raceme (Fig. 83), making this species easily distinguishable. Other species which have distinctive inflorescences are: R. spicata Thunb. in which the flowers are axilliary and arranged in long pseudo-racemes (Fig. 7), R. thunbergii Harv. which has forked flowering branches arranged in a long pseudo-thyrsus (Fig. 8) and R. ovata (Berg.) Schinz which has several leafless peduncles at the ends of branches in a sub-corymbose arrangement (Fig.9).

Flowers, fruits and seeds

Calyx characters are constant within a species and therefore interspecific variation of these characters is reliable. Only one species, R. lancea DC., possesses a calyx which appears to be three-lobed because the upper and lateral calyx lobes are almost completely connate in two opposite pairs (Fig. 10). Confusion appears to arise in the identification of R. amplexicaulis (L.) Thunb. and R. perfoliata (Thunb.) E. Mey. This is easily cleared up if the calyx is examined. The calyx of R. amplexicaulis has wide rounded sinuses between the upper and lateral calyx lobes while that of R. perfoliata has sharp, narrow sinuses between the upper and lateral lobes (Fig. 11). R. crassifolia Harv. also has a very distinctive calyx in that the calyx

Figure 6: (a) Photograph of coppicing branch of R. capensis (L.) Schinz (Stirton 10289, STE).

Figure 6: (b) Photograph of normal branch of R. capensis (L.) Schinz - typical broad-leaved form (Herb. Maire, P).

Figure 7: Photograph of herbarium specimen of R. spicata Thunb. showing long pseudo-raceme (Levyns in SAM 31650, SAM).

Figure 8: Photograph of herbarium specimen of R. thunbergii Harv. showing pseudo-thyrsus (Thunberg in UPS 16434).

Figure 9: Photograph of herbarium specimen of R. ovata (Berg) Schinz (Compton 23688, UWC).

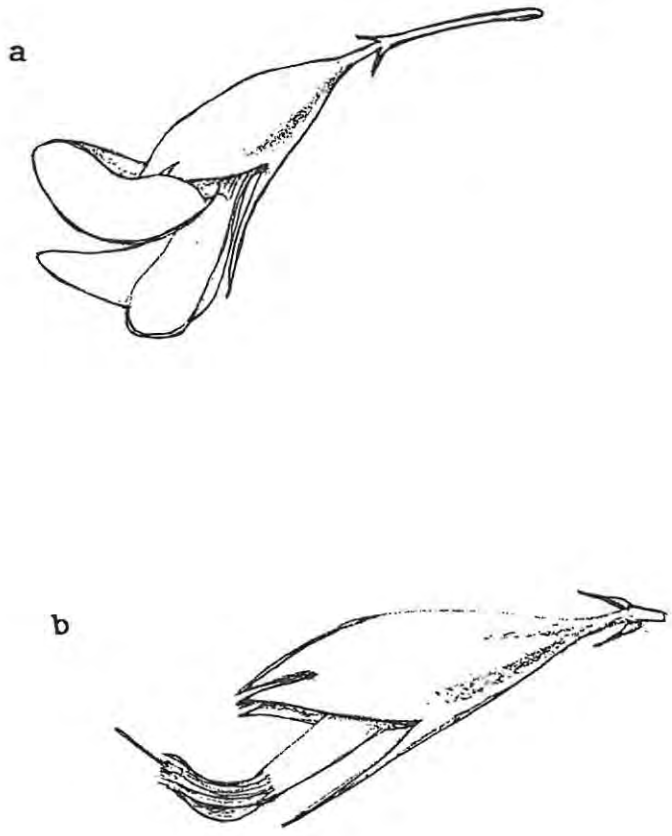


Figure 10: Illustration of Rafnia lancea DC. from Thesaurus Capensis, William H. Harvey, Vol. 1 (Pl. LXXII 1859)to show connate condition of calyx. (a) whole flower x4, (b) calyx only x6.

Figure 11: Light microscope photograph of the calyx of (a) R. perfoliata E. Mey. and (b) the calyx of R. amplexicaulis Thunb. to show difference in calyx structure.

lobes are divergent and two to three times as long as the tube (Fig. 12). The calyx provides a key character in R. swartbergensis Richardson sp. nov. (Fig. 116b&c) in which five prominent wings, formed by the fusion of the margins of adjacent sepals, exist. This feature allies this new species with both R. elliptica Thunb. and R. vlokii Richardson sp. nov. both of which possess a single dorsal keel between the upper lobes of the calyx. No other rafnias possess a winged calyx.

Corolla

Standard

The standard petal shows little variation except in size and length of claw and even these characters vary within the same species. The only exception is R. lancea (Thunb.) DC. where the standard (vexillum) is strongly revolute.

Wings

The wing petals are obovate in all species. The presence or absence of the pockets, called lunulae (Figs. 13a & b & 14) on the wings is a useful character. In addition, those species which do possess lunulae have stigmas which appear capitate under the light microscope, while those without lunulae have stigmas which appear to be hairy. On Scanning Electron Microscopy (SEM) examination of the stigmas, it was noted that both types of stigmas are in fact hairy but the hairs on the stigmas of the species which possess lunulae are much smaller than those on the stigmas of the species which do not possess lunulae (Figs. 15a & b).

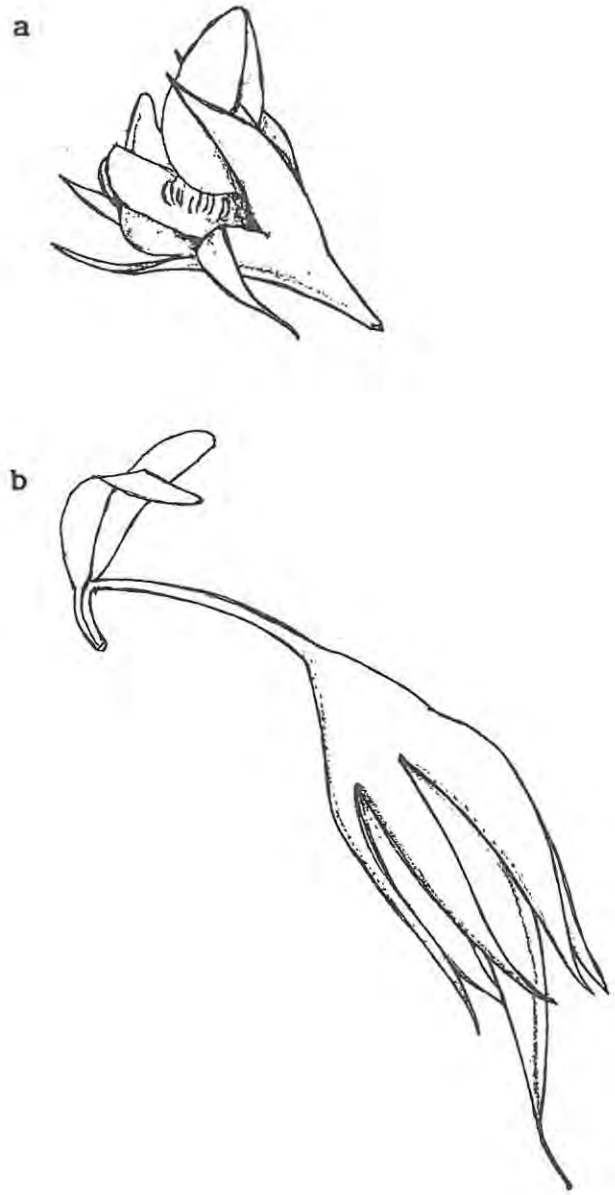


Figure 12: Illustration of R. crassifolia Harv. from Thesauris Capensis, William H. Harvey Vol. 1, (Pl. LXXI, 1859) to show divergent character of calyx. (a) whole flower x3, (b) calyx with partly enlarged ovary x4.

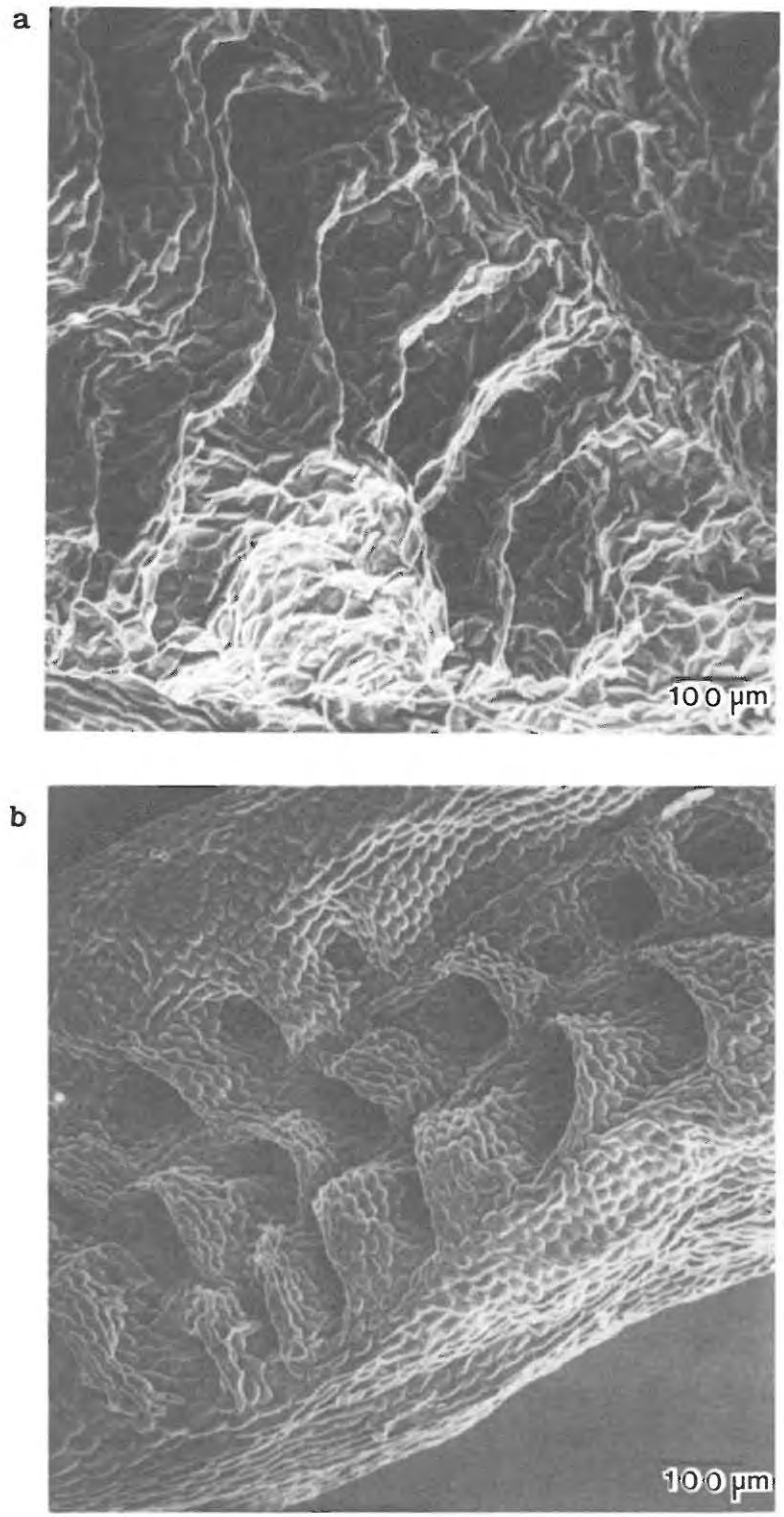


Figure 13: (a) SEM photograph of wing petal with lunulae from old dried material of R. elliptica Thunb. (Urton 599, PEU).
(b) SEM photograph of wing petal with lunulae from recently dried material of R. diffusa Thunb. (Taylor 11145, STE; RUH).

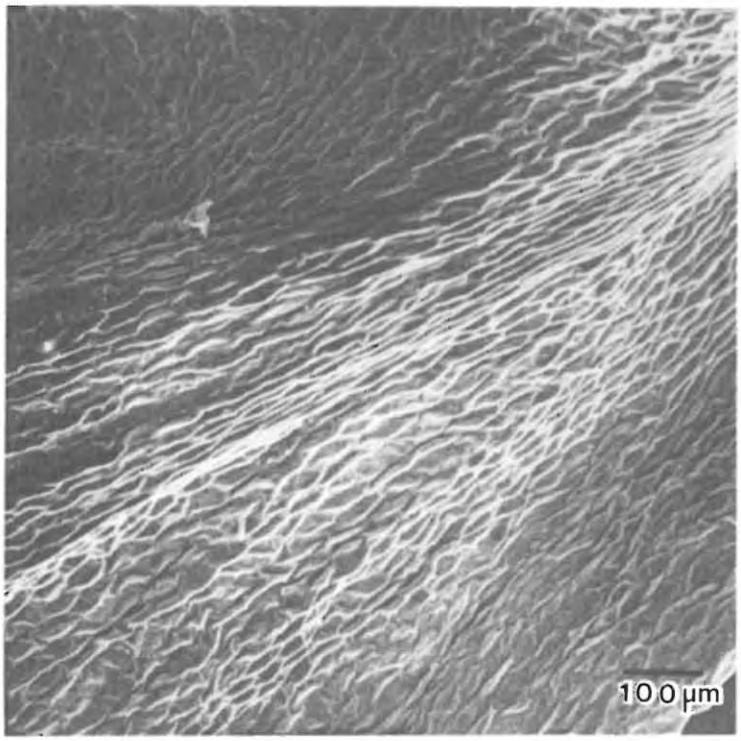


Figure 14: SEM photograph of wing petal without lunulae from *R. capensis* (L.) Schinz (Compton 22839, UWC).

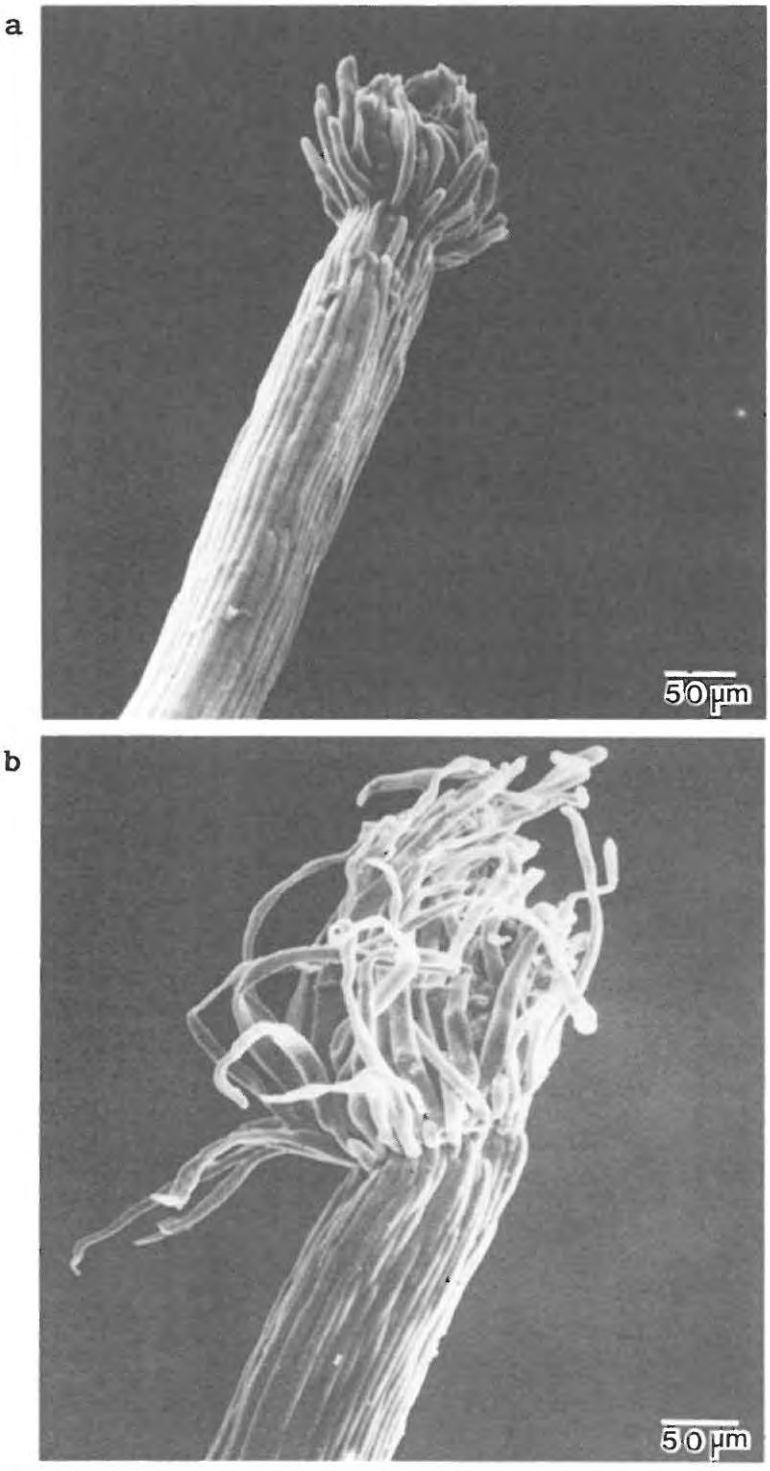


Figure 15: (a) SEM photograph of stigma of R. diffusa Thunb. (Taylor 11145, RUH).

(b) SEM photograph of stigma of R. capensis (L.) Schinz. (Compton 22839, UWC).

Keel

Keel shape is a very useful taxonomic feature. The occurrence of naviculate, rostrate and truncate keels divides the genus into three natural groups. This character provides an instant means of field identification of flowering material which is traditionally easily muddled, for example, R. diffusa Thunb. and R. capensis (L.) Schinz in which the former possesses a naviculate keel and the latter a truncate keel.

Fruits

The fruits can often be used taxonomically for identification. Pods can be sessile or stipitate, linear, trapezoid or wide with either a broad or narrow wing. The pods are often boot-shaped especially in those species which have truncate keels.

A new species, R. vlokii from the Outeniqua Mountains near George has been consistently misidentified as R. elliptica Thunb. The flower structure is very similar and these two species are obviously allied. On examination of the pod, the confusion between these two species is cleared up as R. vlokii has stipitate broad pods which have a fairly narrow dorsal wing while the pods of R. elliptica are sessile and decidedly trapezoid in shape (Figs. 16a & b). On this feature alone it is thus possible to separate these two species.

Seeds

Although flowering plants provide a large number of pods, most of these are heavily infested with insects which destroy the seeds. However, herbarium sheets of some species have proved to be a useful

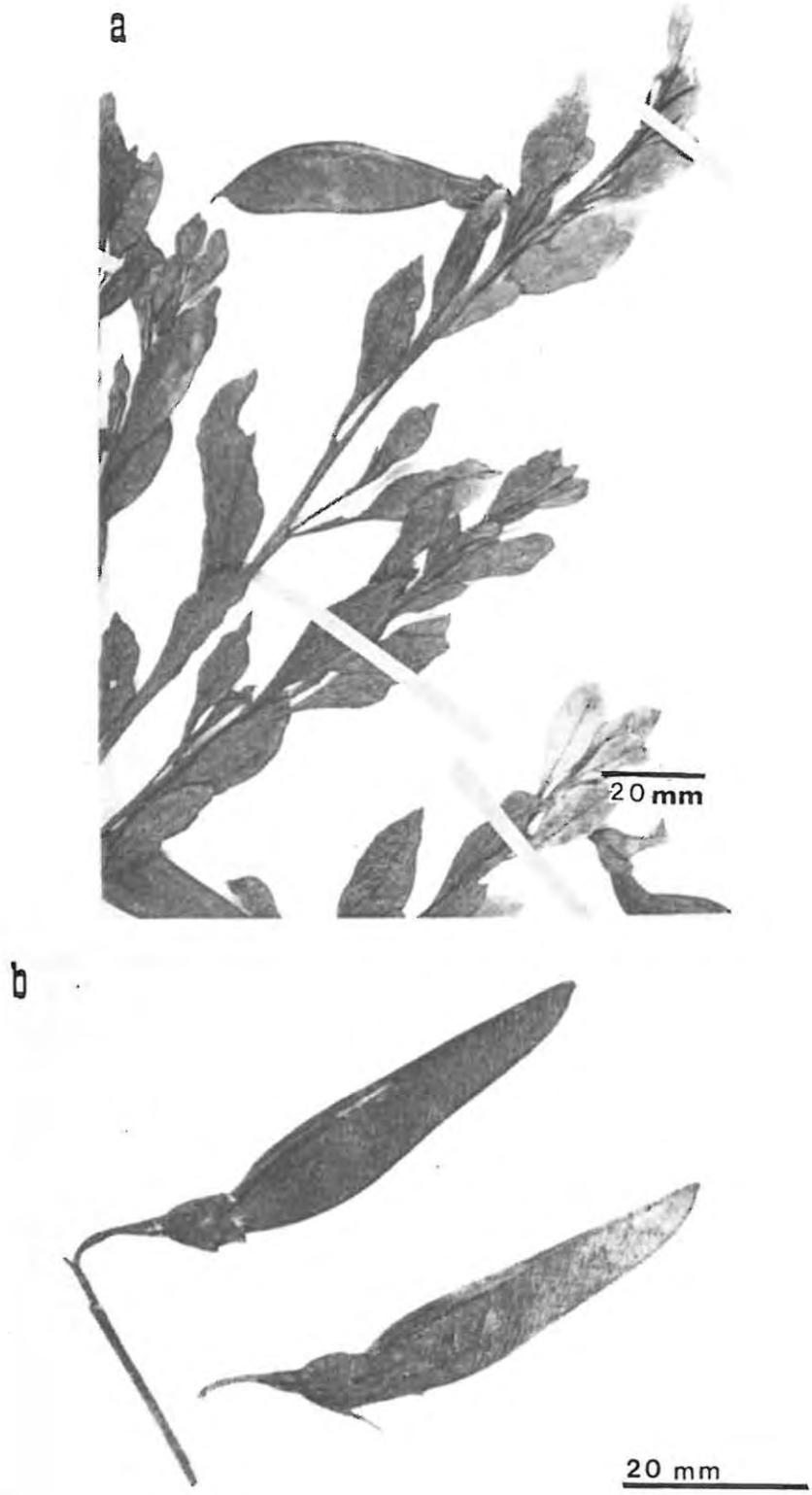


Figure 16a: Photograph to show shape of pod of R. vlokii (Richardson 154, RUH).

(b) Photograph to show shape of pod of R. elliptica Thunb. (N. Grobbelaar 306, PRU).

source of whole fruiting material, while some good seed material has been collected in the field. While surface differences are not discernable in the field or under the light microscope, the SEM investigation has produced some interesting results which are discussed in Chapter 4, entitled "Testa morphology".

Pollen

Pollen shape of various species was examined using SEM. No distinct differences could be found between the pollen of the twelve species examined. In all cases the pollen was found to be tri-colporate (Fig. 17). The search for useful characters in this field was therefore abandoned largely because of the high cost of the procedure.

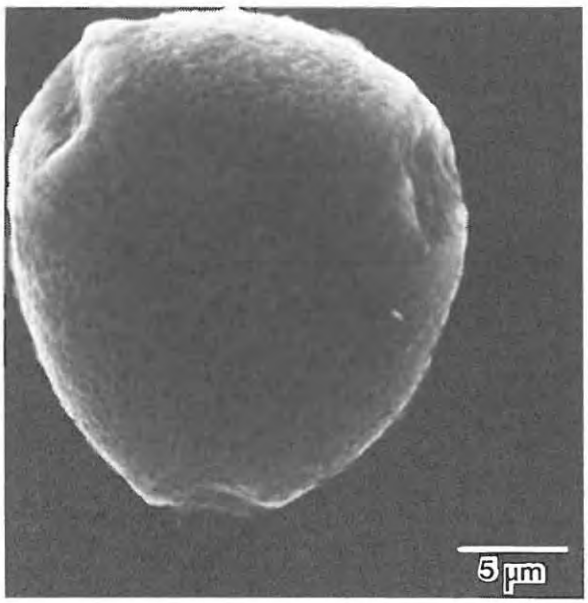


Figure 17: SEM photographs to show tri-colporate shape of pollen grains. R. elliptica Thunb. (Richardson 155, RUH).

CHAPTER FOUR

TESTA MORPHOLOGY

Heywood (1969) predicted that scanning electron microscopy (SEM) of seeds would become a routine technique in the study of seed coat morphology and in the last two decades SEM has indeed been widely used to study testa surface patterns (Brisson and Peterson 1976; La Sota, Link and Gunn 1979; Lersten 1981; Bridges and Bragg 1983; Bragg 1983; Richardson, Hartley and Cross 1984; Baker, Bridges and Bragg 1985). Most of these studies have been carried out on the seeds of the sub-family Papilionoidae where the testa has been generally described from light microscope observations as smooth and featureless (Lersten 1981); one exception being descriptions of testa surfaces of seeds of the Cruciferae by Murley (1951 in Stearn 1966) where she proposed a terminology of these features. The use of SEM has revealed new information of taxonomic significance. Initially only testa surface patterns were examined for their taxonomic usefulness although Bridges and Bragg (1983) also examined the hilum shape and found it to be different for each of the examined species. In addition, Baker, Bridges and Bragg (1985) examined the pleurogram (testa groove) shapes of the seeds of twenty species of eight mimosoid genera and found that the pleurogram was a more useful character than the surface patterns.

Despite the extent of these investigations, no standard terminology of testa surface features has yet been agreed upon and no standards established for the suggested site of SEM observation. Lersten (1981) carried out extensive surface observations on 30 different Papilionoid families. He has proposed nine categories of testa surface patterns, eight of which are employed by Baker, Bridges and Bragg (1985) in

their description of testa surface patterns of North American Legumes. The nine categories are as follows:

1. Levigate - appears smooth even at 1000 x.
2. Rugulate - irregularly roughened.
3. Substriate - short parallel ridges.
4. Simple-reticulate - meshwork of ridges enclosing single cells.
5. Multi-reticulate - primary plus secondary ridges (ridges enclose a multicellular area).
6. Simple foveolate - single cell ends isolated by grooves.
7. Multi-foveolate - unit of several cells surrounded by grooves.
8. Lophate - short ridges with irregular sides.
9. Papillose - single protruding epidermal cells.

The seeds of Rafnia have been examined electromicroscopically by the writer for two reasons:

(a) Rafnia seeds have not been studied by this method before, and

(b) The question as to whether their surface characters are of taxonomic significance had to be answered.

SEM was carried out on reference material selected from air-dried herbarium specimens. Where possible results from old dried material were correlated with results obtained from fresh dried seeds.

Of the nine categories proposed by Lersten (1981) four were identified on examination of seeds of eighteen species of Rafnia. All examinations were done at a magnification of 1000 x, near the hilum, as Lersten (1981) states that patterns are usually most conspicuous here.

R. ovata, R. schlechteriana, R. capensis and R. diffusa all exhibited a reticulate pattern. (Fig. 18).

The testa pattern on the seeds of R. ovata (Fig. 18a) and R. schlechteriana (Fig. 18b) is described as reticulate with heavy walls.

R. capensis (Fig. 18c) has a reticulate pattern with narrow walls while that of R. diffusa (Fig. 18d) is described as scrambled-reticulate.

Many of the seeds examined showed a generally rugulate pattern and it is thus difficult to distinguish one from the other. This applies to R. racemosa (Fig. 19a), R. swartbergensis (Fig. 19b), R. meyeri (Fig. 19c), R. lancea (Fig. 19d) and R. angulata (Fig. 19e). R. thunbergii (Fig. 20a) has a puddled-rugulate and R. dichotoma (Fig. 20b) a striate-rugulate pattern. R. vlokii (Fig. 21a), R. amplexicaulis (Fig. 21b), and R. perfoliata (Fig. 21c) all have little mounds (tubercles) and the pattern is described as tuberculate. They are differentiated from each other by the occurrence and shape of these tubercles. R. vlokii has tubercles which appear to be continuous and the pattern is described as confluent. In R. amplexicaulis and R. perfoliata the tubercles are separate and their shape distinguishes one from the other.

The remaining four species exhibit very distinct testa patterns. R. elliptica (Figs. 22a & b) has an ocellate pattern being composed of cells with central depressions and raised circular borders. The pattern on the testa of R. crassifolia (Fig. 22c) is papillose and no central depressions are observed.

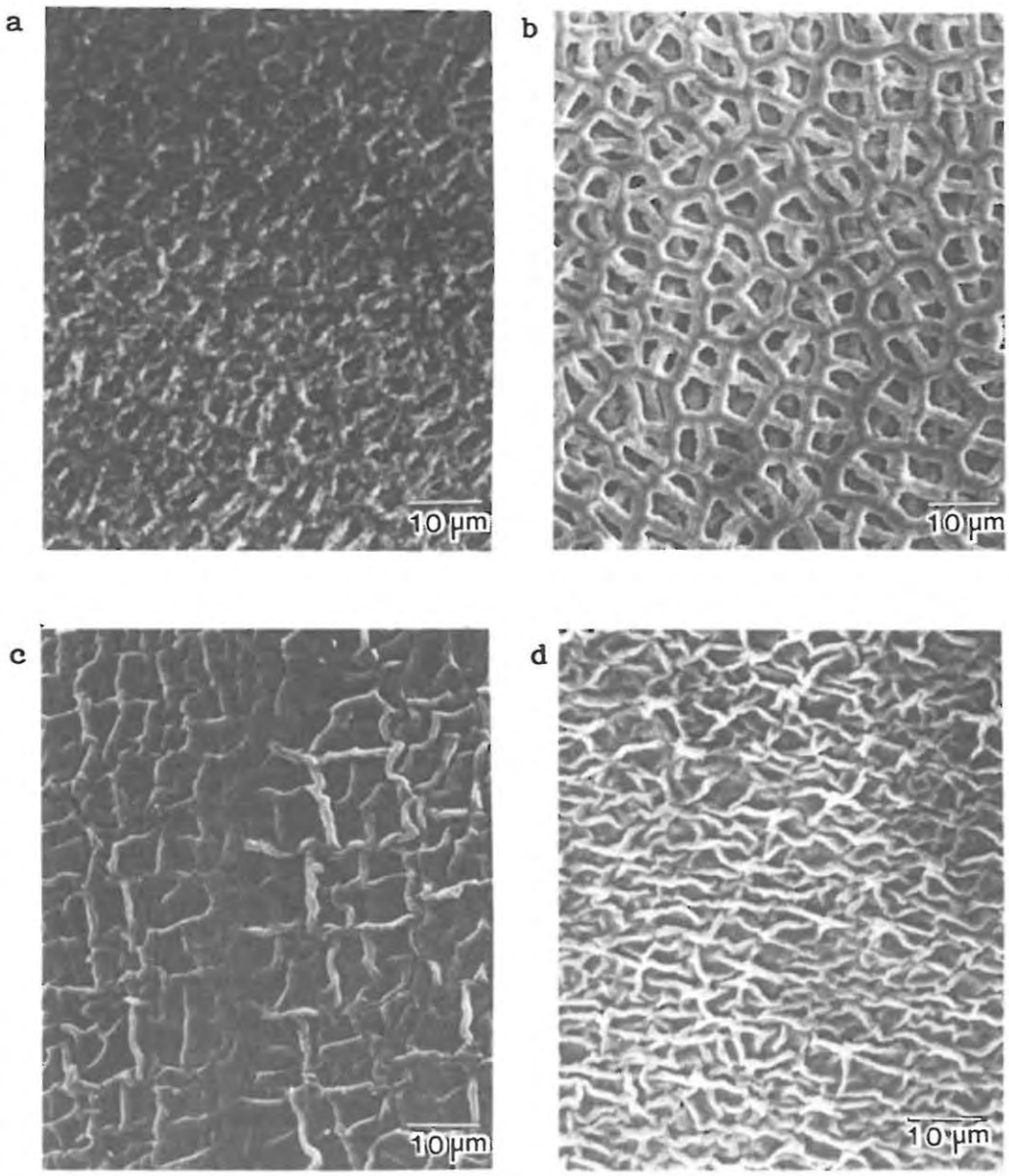


Figure 18: SEM patterns of testa surfaces. (a) R. ovata (Mrs O. Barret s.n. RUH); reticulate with heavy walls, (b) R. schlechteriana (Esterhuysen 17875 BOL); reticulate with heavy walls, (c) R. capensis (Compton 4847, NBG) reticulate with narrow walls, (d) R. diffusa Hanekom 2541, PRE) scrambled-reticulate.

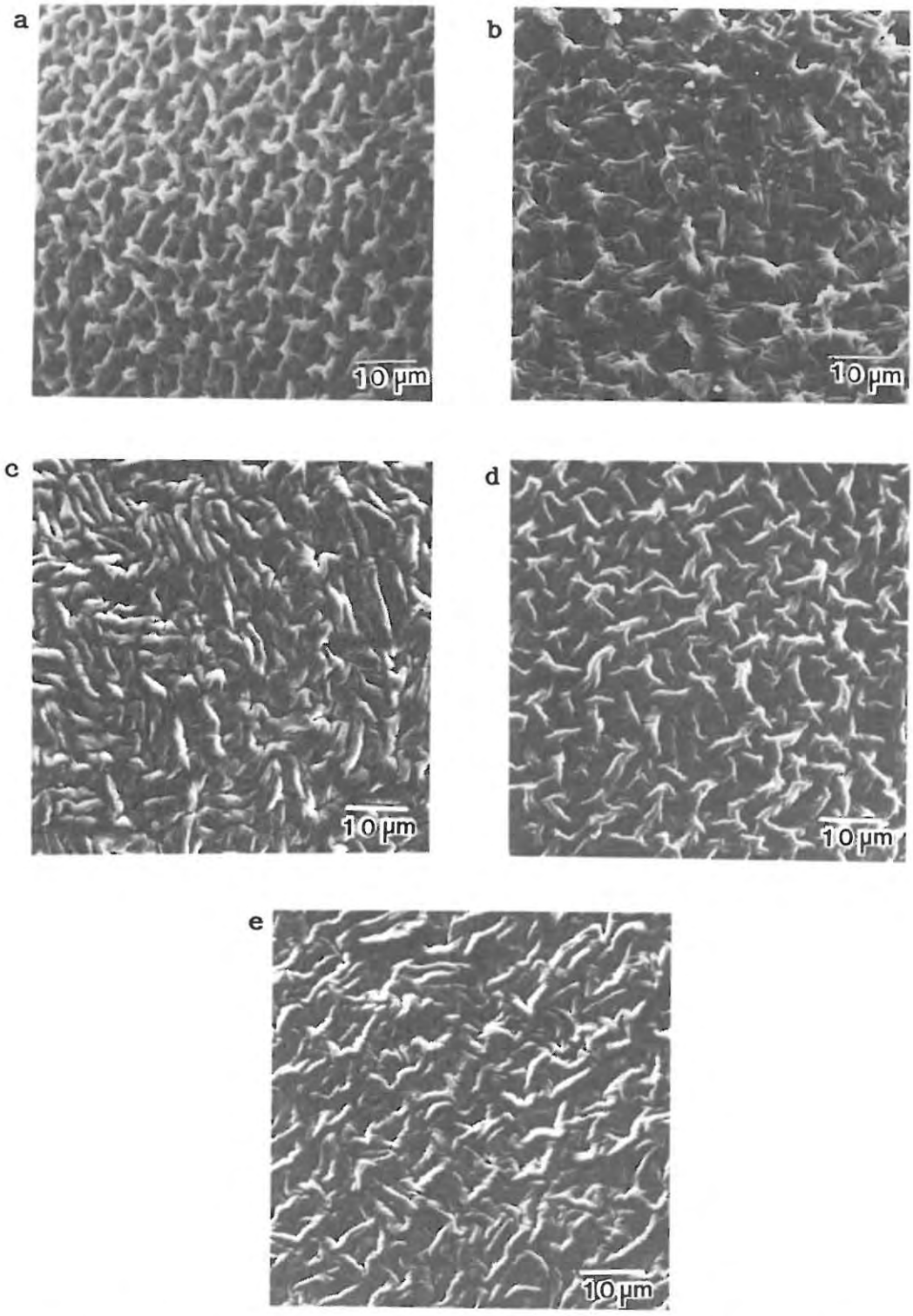


Figure 19: SEM patterns of testa surfaces. (a) R. racemosa (Thorne in SAM 50193, SAM) simple rugulate, (b) R. swartbergensis (Esterhuysen 28822, BOL) simple rugulate, (c) R. meyeri (Von Breda 1401, PRE) simple rugulate, (d) R. lancea (Salter 7669, BM) simple rugulate, (e) R. angulata (Esterhuysen 20807, NBG) simple rugulate.

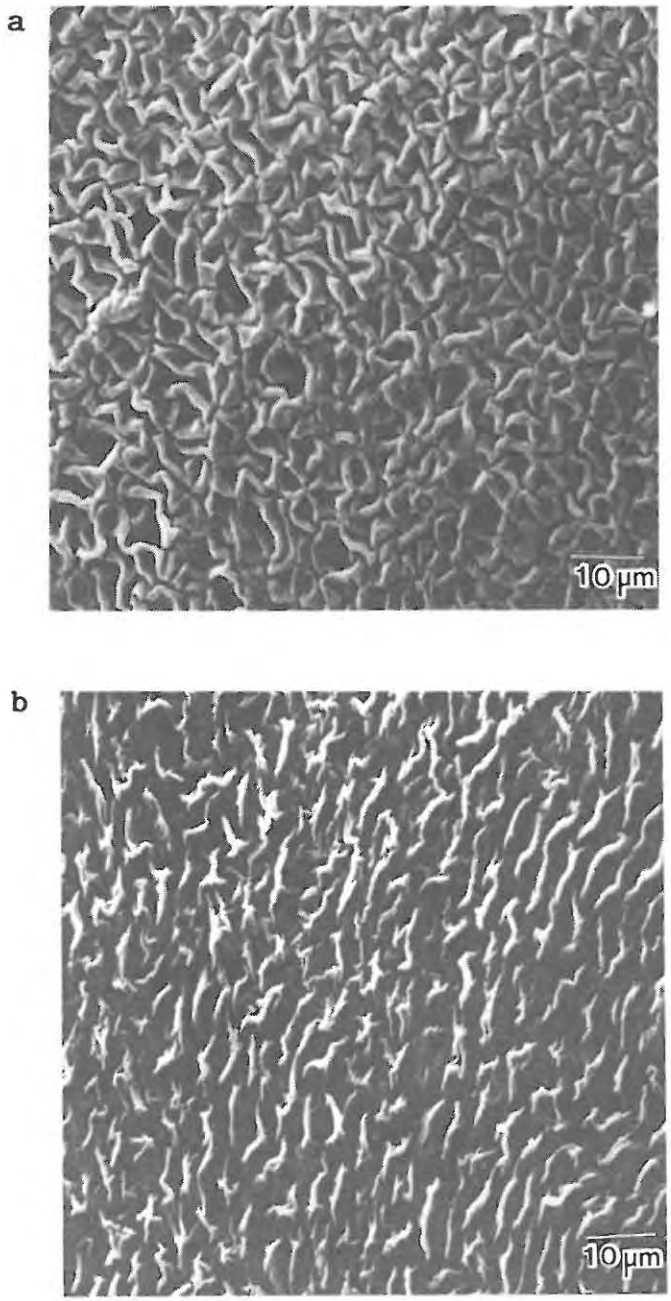


Figure 20: SEM patterns of testa surfaces. (a) R. thunbergii (Lewis 3503, SAM) puddled-rugulate, (b) R. dichotoma (Bolus 372, BOL) striate-rugulate.

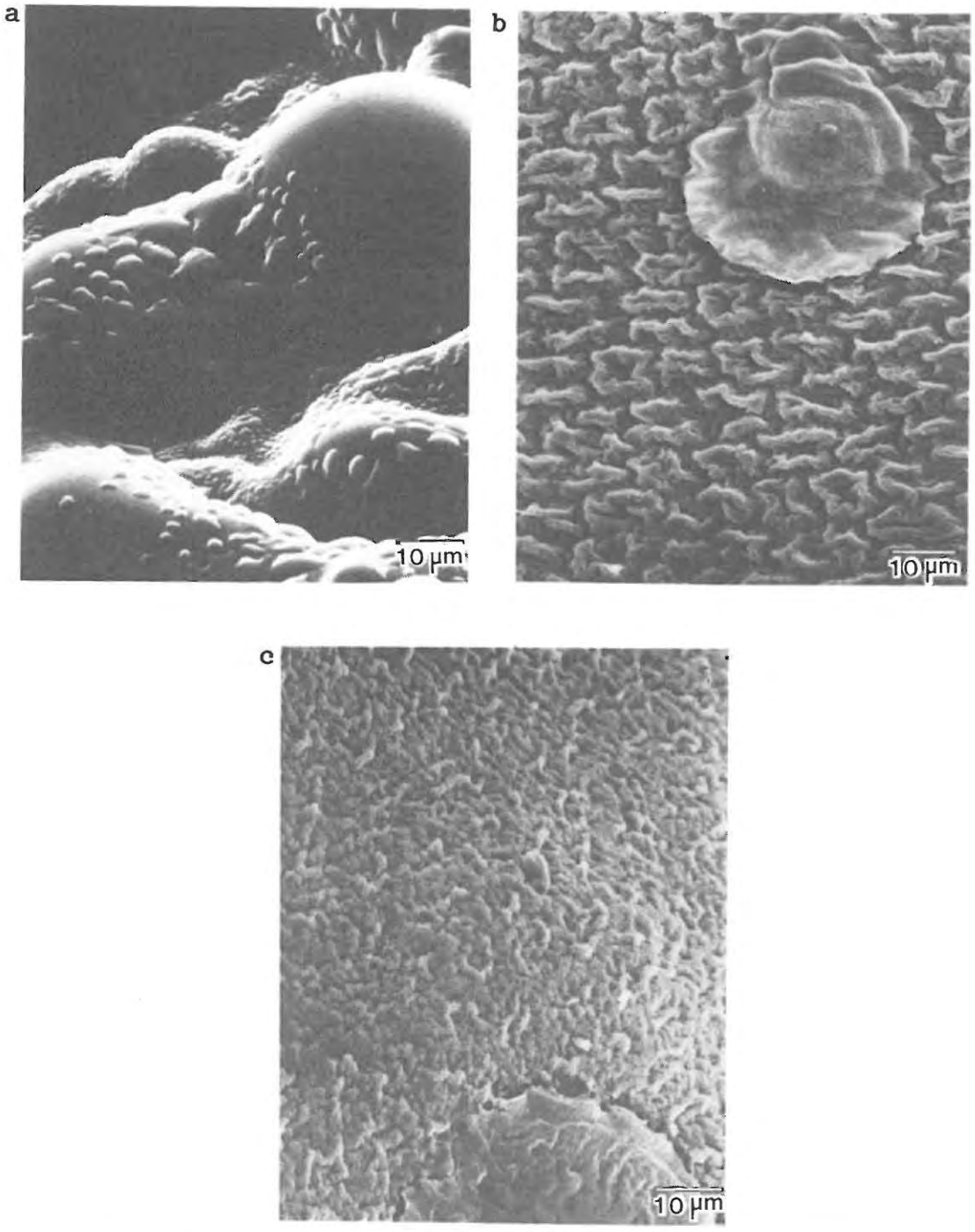


Figure 21: SEM patterns of testa surfaces. (a) R. vlokii (Richardson 155, RUH) tubercles confluent, (b) R. amplexicaulis (Compton 10351, NBG) tubercle limpet-shaped, (c) R. perfoliata (Grobbelaar 1079, PRU) tubercle humped.

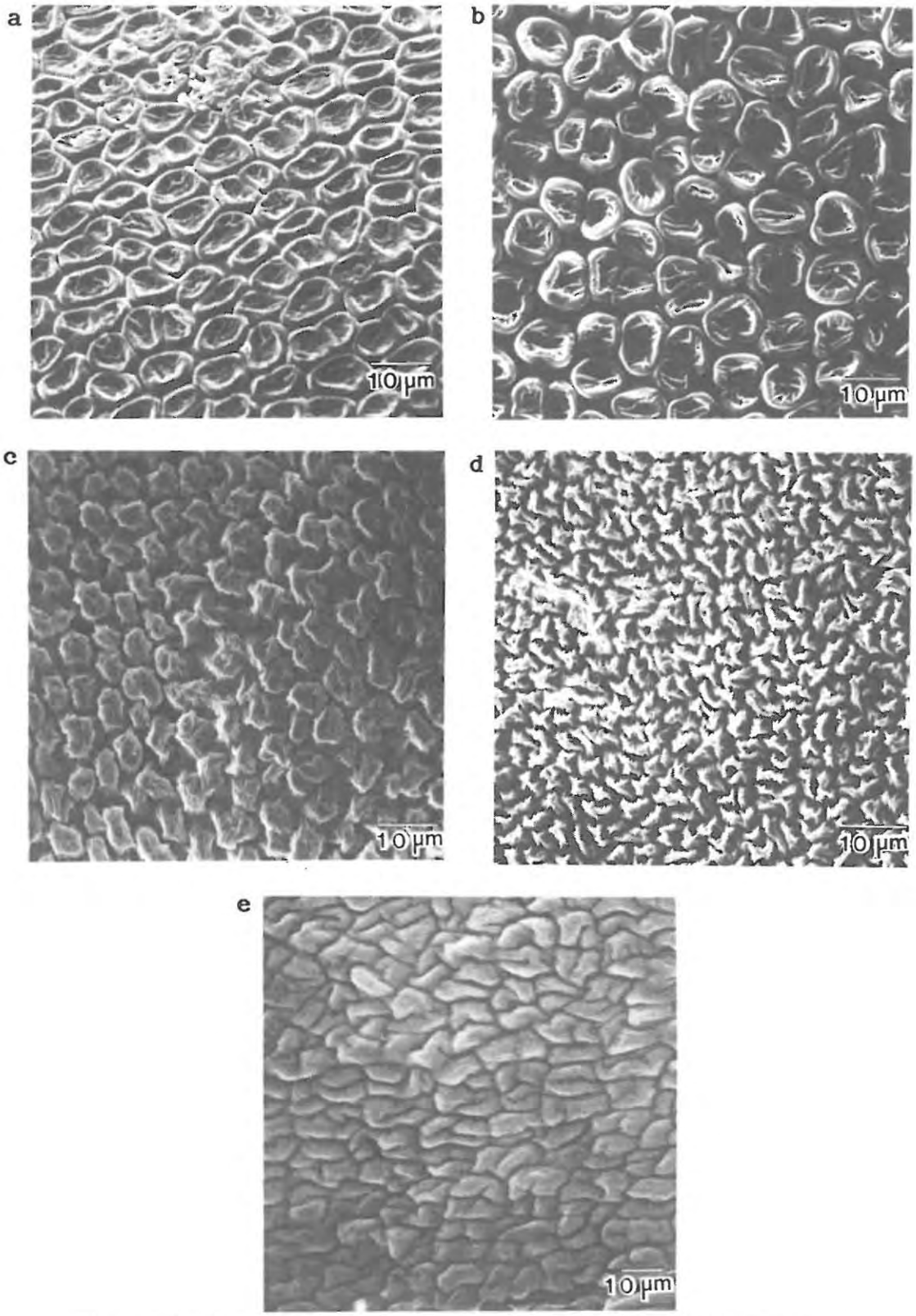


Figure 22: SEM patterns of testa surfaces. (a) R. elliptica - old dried material (Gillet 1581, STE), (b) R. elliptica - recently collected dried material (Richardson 172, RUH) ocellate, (c) R. crassifolia (Taylor 6751, STE) papillose, (d) R. triflora (Salter 7869, BOL) lophate, (e) R. ericifolia (Salter 6567, BM) involute pattern.

R. triflora (Fig. 22d) has a lophate pattern composed of short ridges with irregular sides.

A closely involute pattern is observed on the testa of R. ericifolia (Fig. 22e).

It can be seen that testa surfaces exhibit different patterns which facilitate differentiation between some of the species examined. In some cases the differences are very clear cut and can be of utmost importance in distinguishing one species from another. Much confusion has existed in the identification of R. vlokii and R. elliptica but as can be seen in Figs. 21a and 22a & b, the testa patterns of these two species are so different that there can be no doubt as to the fact that they are indeed two different species. A similar situation arises with R. amplexicaulis (Fig. 21b) and R. perfoliata (Fig. 21c). While the testa surfaces of both species appear tuberculate, the tubercle of R. amplexicaulis (Fig. 23a) is flat and limpet-shaped, whereas in R. perfoliata (Fig. 23b) it is humped.

Specimen age seems to have little effect on the testa pattern as can be seen from Fig. 22a, the testa pattern of a seed of R. elliptica taken from an old herbarium sheet and Fig. 22b which shows the testa pattern of a recently dried R. elliptica seed.

The testa patterns of seeds from the same species from different areas are also similar. The only species of Rafnia which has a wide distribution is R. elliptica. Taking this as an example, therefore, Figs. 22a and 22b show the surfaces of seed material collected in the Cape, and Grahamstown districts respectively and show no structural differences.

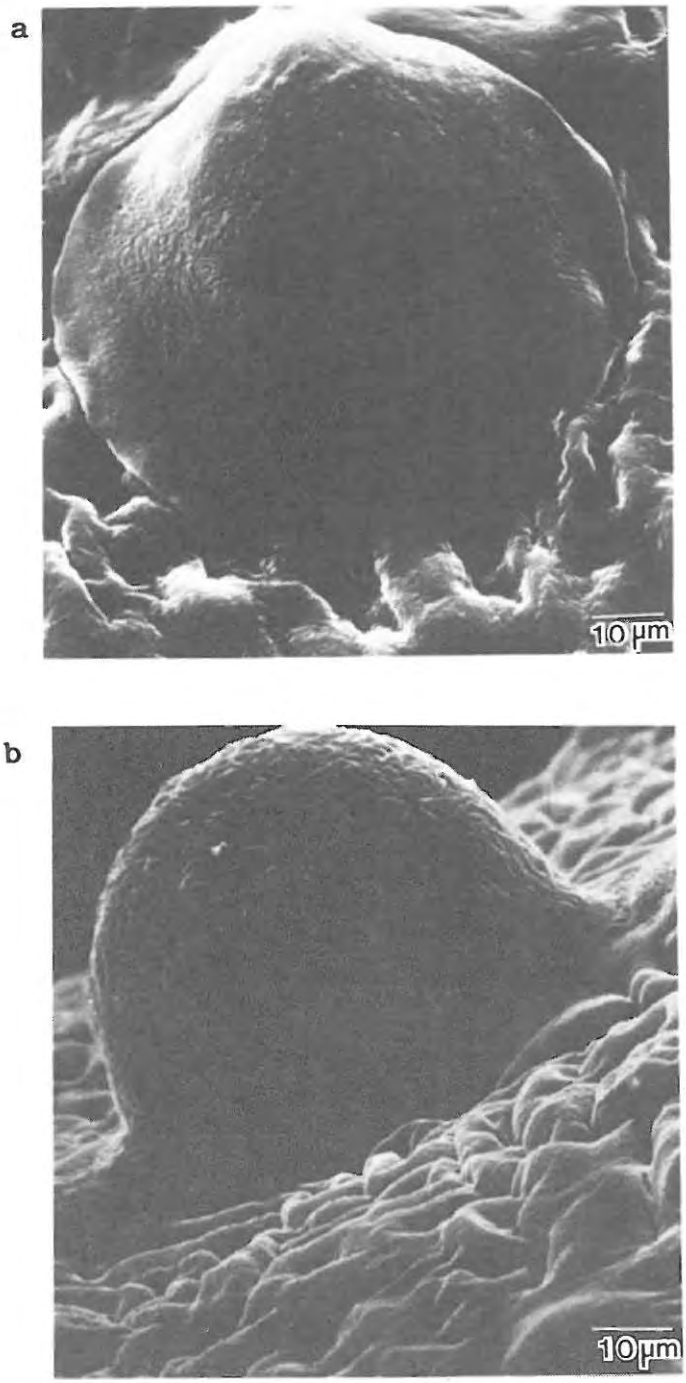


Figure 23: SEM patterns of testa surfaces. (a) R. amplexicaulis - tubercle (Compton 10351, NBG) limpet-shaped, (b) R. perfoliata tubercle (Grobbelaar 1079, PRU) humped.

SEM of the hila of R. perfoliata (Fig. 24a) and R. amplexicaulis (Fig. 24b) also show distinct differences in shape - the hilum of R. perfoliata being much more acute than that of R. amplexicaulis. The hilum of R. vlokii (Fig. 24c) is again different from the former two. The high cost of the SEM technique necessitated concentration on testa patterns and (with the exception of the hilum photographs) to the exclusion of other seed features.

CONCLUSIONS

External environmental conditions appear to have little or no effect on surface morphology.

Age of the dried seeds does lead to some further shrivelling of the testa but does not change the pattern or structure of the seed surface.

Taxonomic significance is related to:

(i) Identification of at least thirteen of the eighteen species examined is enabled by a SEM key of testa surface. The other five can be identified by closer comparison of SEM photographs.

(ii) Delimitation between closely related species, e.g. R. amplexicaulis and R. perfoliata; R. capensis and R. diffusa; R. elliptica and R. vlokii. This character is, however, substantiated in the foregoing pairs by other floral characters.

(iii) This study does not suggest that testa surface characters can aid the grouping of allied species and therefore it is unlikely to assist in any evolutionary surmise.

It is felt that the above study combined with a full SEM study of hilum shape would be productive.

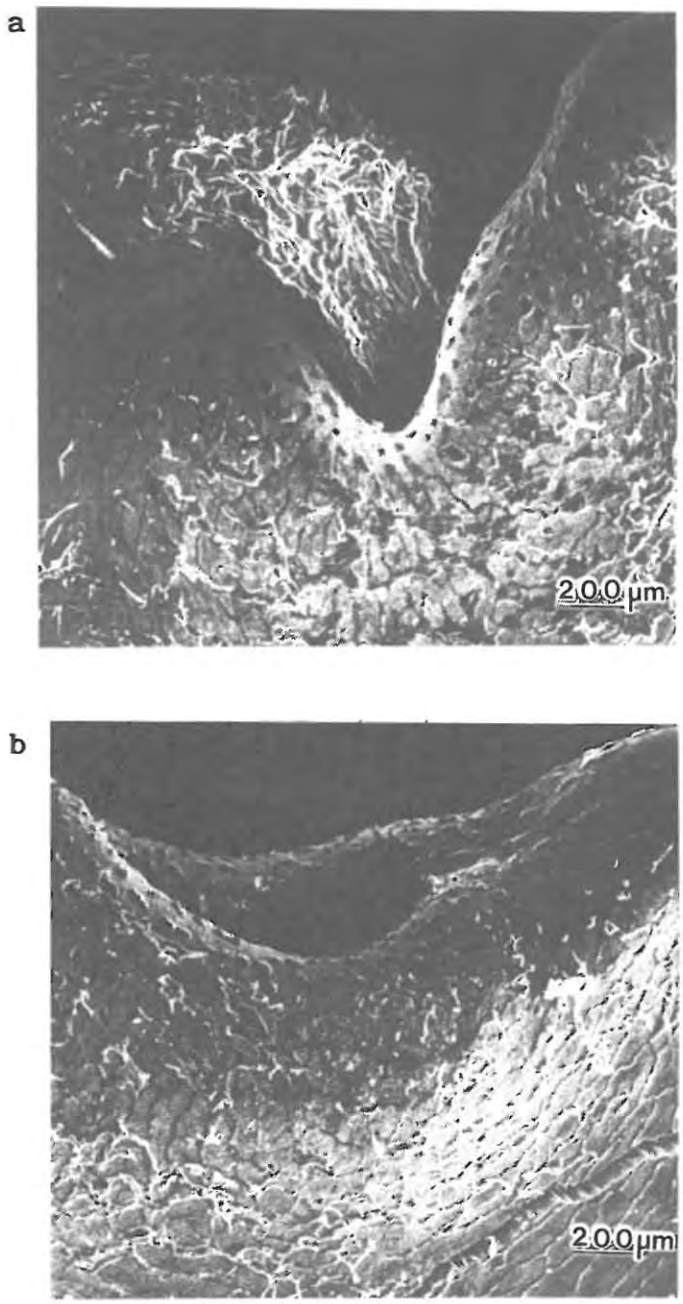


Figure 24: SEM of the hilum. (a) R. perfoliata (Grobbelaar 1079, PRU) acute shape, (b) R. amplexicaulis (Compton 10351, NBG) wide and shallow.

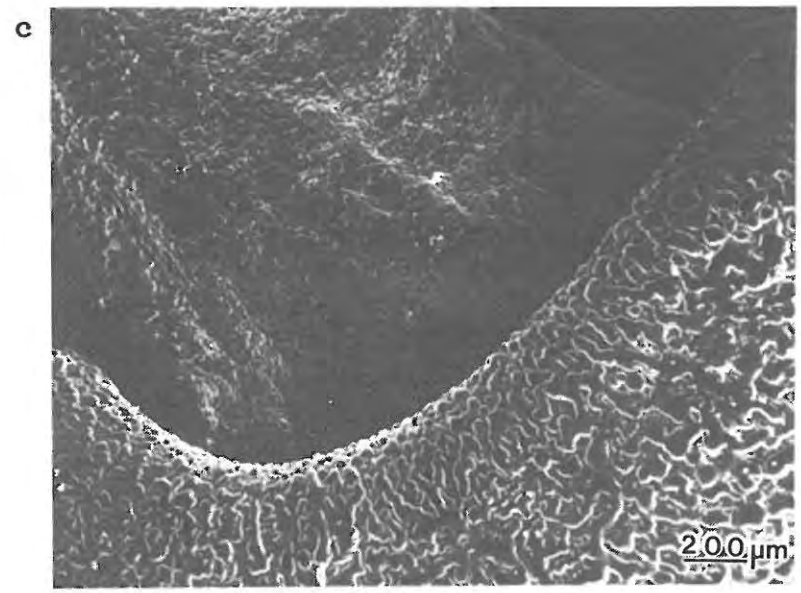


Figure 24: (c) R. vlokii (Richardson 155, RUH) intermediate between other two.

Key to the species using Testa Morphology

Many species can be separated by differences in testa morphology. The following SEM key is based on surface differences. The terminology is adapted from Murley (1951 in Stearn 1966) ånd Lersten (1981).

1.	Testa reticulate	2
	Testa not as above	4
2.	Testa reticulate with heavy walls	R. ovata
		R. schlechteriana
	Testa not as above	3
3.	Testa reticulate with narrow walls	R. capensis
	Testa scrambled-reticulate	R. diffusa
4.	Testa rugulate	5
	Testa not as above	7
5.	Testa simple rugulate	R. racemosa
		R. swartbergensis
		R. meyeri
		R. lancea
		R. angulata
	Testa not as above	6
6.	Testa puddled-rugulate	R. thunbergii
	Testa striate-rugulate	R. dichotoma
7.	Testa tuberculate	8
	Testa not as above	10
8.	Tubercles discrete bodies	9
	Tubercles confluent	R. vlokii

9.	Tubercle limpet-shaped	*R. amplexicaulis*
	Tubercle humped	*R. perfoliata*
10.	Testa ocellate	*R. elliptica*
	Testa not as above	11
11.	Testa papillose	*R. crassifolia*
	Testa not as above	12
12.	Testa lophate	*R. triflora*
	Testa densely involute	*R. ericifolia*

Key to names

1.	reticulate	-	net-shaped
2.	rugulate	-	wrinkled
3.	ocellate	-	separate cells with concavities (raised circular borders)
4.	papillose	-	single cells, protruding without concavities
5.	lophate	-	short ridges with irregular sides
6.	involute	-	rolled inwards.

CHAPTER FIVE

TAXONOMIC TREATMENT OF THE SPECIES OF RAFNIA

Abbreviations

All abbreviations of authors or plant names, books and periodicals are according to the following lists of the Botanical Research Institute:

1. Authors of Plant Names : Technical Note Tax 2, May 1980.
2. Literature abbreviations : (a) Books - Technical Note Tax 6/1, March 1972; (b) Periodicals - Technical Note Tax 6, March 1981.

The Genus Rafnia Thunb.

Rafnia Thunb. Nov. Gen. Pl. 10: 144 (1800); Prodr. 23 (1800) Harvey in F.C. ii: 31 (1862) Schinz Bull. Herb. Boissier 11: 199 (1894).

Oedmannia Thunb. Nov. Gen. Pl. 136 (1800)

Vascoa DC. Mem. Leg. 186 (1825); Prodr. ii: 119 (1825)

Pelecynthis E. Mey. Comm. 13 (1836)

Hybotropis E. Mey. ex Steud. Nom. Bot. ed. II: i, 780 (1840).

Shrubs or shrublets, multistemmed or single stemmed from perennial root-stocks, always glaucous. Leaves simple, entire, alternate and exstipulate. Flowers yellow, solitary or in short axilliary or terminal racemes or occasionally a three-flowered cyme. Bracts foliaceous, setaceous or absent. Calyx with a campanulate tube, usually the lowest lobe is much narrower than the others. Standard obovate, sometimes bilobed and always clawed; wings falcate-oblong or oblong, clawed; sometimes possessing lunulae; keel incurved, clawed, either rostrate, naviculate or truncate, sometimes gibbous. The keel

petals are always fused. Stamens 10, monadelphous or very occasionally diadelphous, unequal, tube usually long, anthers unequal, alternately globose and linear, the latter sterile. Ovary sessile or stalked, two to many ovuled, always glabrous; style incurved with either a small capitate finely fringed or a larger more hairy stigma. Legume linear, lanceolate or linear-oblong, compressed, the upper suture sharp or winged, either with a very narrow or with a broad wing. The pod may be sessile or stipitate and is dehiscent.

Species 21, mostly south-western Cape, extending northwards to Wuppertal and eastwards into Natal.

Key to the Species

1 Leaves amplexicaul.

2 Habit erect, calyx lobes shorter than the tube with a wide rounded sinus between upper and lateral lobes .....R. amplexicaulis

2 Habit prostrate, calyx lobes same length as tube with an acute, narrow sinus separating upper and lateral calyx lobes .....R. perfoliata

1. Leaves not amplexicaul.

3 Calyx lobes: dorsal and lateral lobes connate in opposite pairs, basal free ..... R. lancea

4 Calyx tube winged with wings between adjacent sepals .....R. swartbergensis

4 Calyx tube keeled, with keel between two vexillar calyx lobes.

5 Calyx: posterior sepals divided to less than halfway. Pod sessile within the calyx, trapezoid .....R. elliptica

5 Calyx: posterior sepals deeply divided. Pod stalked within the calyx, broadly linear .....R. vlokii

3 Calyx lobes not connate in opposite pairs.

6 Lobes of calyx two or three times as long as the tube ..... R. crassifolia

6 Lobes of calyx equal in length or shorter than the tube.

7 Lunulae absent, carina truncate.

8 Flowering branches ending in sub-corymbose, leafless peduncles ..... R. ovata

8 Flowering branches once or twice forked with a flower in each fork subtended by a pair of opposite foliaceous bracts.

9 Wing of pod very broad, pod sessile .....
..... R. schlechteriana

9 Wing of pod very narrow, pods stipitate.

10 Leaves broad, never more than twice as long as wide; bracts rounded at base ..... R. dichotoma

10 Leaves narrow, at least three times as long as wide; bracts foliaceous, linear ..... R. capensis

7 Lunulae present, carina naviculate or rostrate.

11 Leaves ericoid ..... R. ericifolia

11 Leaves not ericoid.

12 Leaves glaucous-grey. Filament of carinal anther free ..... R. glaucophylla

12 Leaves green. Filaments fused.

13 Flowers terminal, solitary. Slender twigs almost entirely without opposing leaves .....
..... R. diffusa

13 Flowers axilliary, in long pseudo-racemes .....
..... R. spicata

14 Leaf margin undulate .....
..... R. crispa

14 Leaf margin smooth.

15 Flowers in a three-flowered cyme with tiny setaceous bracts at the articulation of the calyx ..... R. triflora

15 Flowers solitary, subtended by awl-shaped bracts ..... R. meyeri

16 Leaves elliptic: flowers arranged in a short, terminal leafless raceme .....
.....R. racemosa

16 Leaves linear to narrowly obovate.

17 Peduncles axilliary, forked and bracts leafy. Branches virgate .....
..... R. thunbergii

17 Peduncles axilliary, flowers usually solitary or in pairs with small setaceous bracts. Branches angular.....
.....R. angulata

Species Descriptions

1. Rafnia amplexicaulis (L.) Thunb. in Nov. Gen. Pl. 10: 144 (1800); Thunb. Fl. Cap: 563 (1825); DC. Prodr. ii: 119 (1825); Harvey in Harv. & Sond. F.C. ii: 31 (1862); Schinz Bull. Herb. Boissier ii: 200 (1894). Type: Cape of Good Hope, Burman s.n. (G. Holo!) (Fig. 25). Syntypes: Cape Tulbaghskloof : Ecklon & Zeyher, 1200 (P! NBG!); Witzenberg Mountains: Ecklon & Zeyher 361 non 36 F.C. (NBG! P! GRA! BM!).

Vascoa amplexicaulis DC. Mem. Leg. 187 (1825); DC. Prodr. ii: 119 (1825). Type: Cape, Tulbaghskloof, Ecklon s.n. (P holo!).

Rafnia virens E. Mey. Comm. ii (1836). Type: Cape, Dutoitskloof, Drege s.n. (P holo!) (Fig. 2).

Crotalaria amplexicaulis L. Syst. Veg. per Gmelin. 1094 (1792); L. Sp. Pl. ed. 2: 1003 (1763); Linn. Pl. Afr. Rar: 16 (1760); Amoen Acad. 6: 94 (1763).

Woody, much-branched, densely leafy, perennial shrub, 1 - 1,5m high **Leaves** cordato-amplexicaul, very obtuse with entire margin and varying in size from 13 to 65 mm broad and 10 to 45 mm long. The upper foliage leaves are yellow green while the lower ones are dark green. **Flowers** on short pedicels, larger than 10 mm in length, borne between a pair of foliaceous bracts. **Calyx** about 2 mm long with the four upper calyx lobes deltoid-acute and shorter than the tube. The lowest calyx lobe is setaceous. There is a wide rounded sinus between the upper and lateral teeth. **Corolla** yellow, the carina is beaked and paler than the other petals. **Standard** wide ovate, emarginate and clawed. **Wings** obovate, lunulate, each possessing 5-6 rows comprising

Figure 25: The type of R. amplexicaulis Burman s.n.

15-25 intercostal lunulae, clawed. **Keel** blades fused, 13 mm long, 6 mm wide at maximum, claw 4 mm long, apex rostrate, sharply upcurved, height of curvature 4,5 mm. **Staminal sheath** 12 mm long with 4 short, basifixed anthers alternating with 6 long, dorsifixed anthers. **Gynoecium** 10 mm long, style filiform, sharply upcurving, height of curvature 9 mm high, stigma capitate, finely fringed. **Pods** winged, 18-25 mm long, 8-10 mm wide at widest part. Pods are sessile (Fig. 26).

Diagnostic features

1. Amplexicaul leaves.
2. Erect bush.
3. The sinus between the upper and lateral segments of the calyx is wide (Fig. 11).
4. Calyx lobes shorter than the tube.

Distribution

Widely distributed in the S.W. Cape, south of 31°S but mainly north of 34°S, stretching from the Gifberg in the north to the Elim district in the south (Fig. 27).

Normal Flowering Period: September to February.

Collections

3118 (Vanrhynsdorp) Gifberg (-BC) Esterhuysen 11273 (BOL); Matsikama Mountains (-DB) Stirton 5954 (PRE);

3119 (Calvinia) Nieuwoudville (-AC) Story 4352 (GRA); Michell's pass (-AD) MacOwan & Bolus 53 (BM); Calvinia (-BD) Story 4353 (PRE);

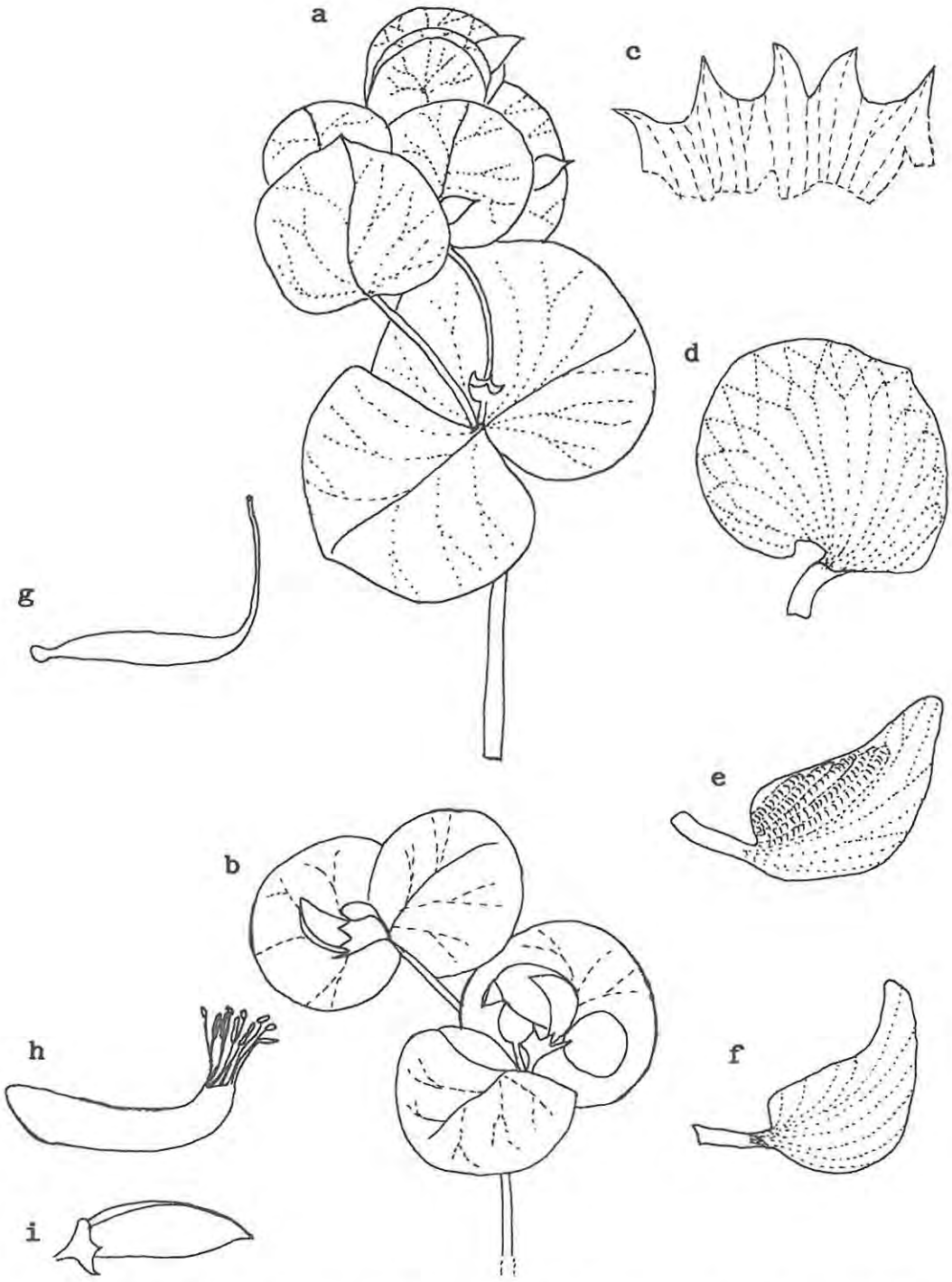


Figure 26: R. amplexicaulis (a) branch x1 (Schlechter 9194, BOL), (b) terminal inflorescence x1 (MacOwan 2903, SAM), (c) calyx opened out x3, (d) standard opened out x3, (e) wing petal showing intercostal lunulae x3, (f) keel petal x3, (g) gynoecium x3, (h) staminal sheath x3, (Compton 9632, NBG), (i) pod x1 (Bolus 2749, BOL).

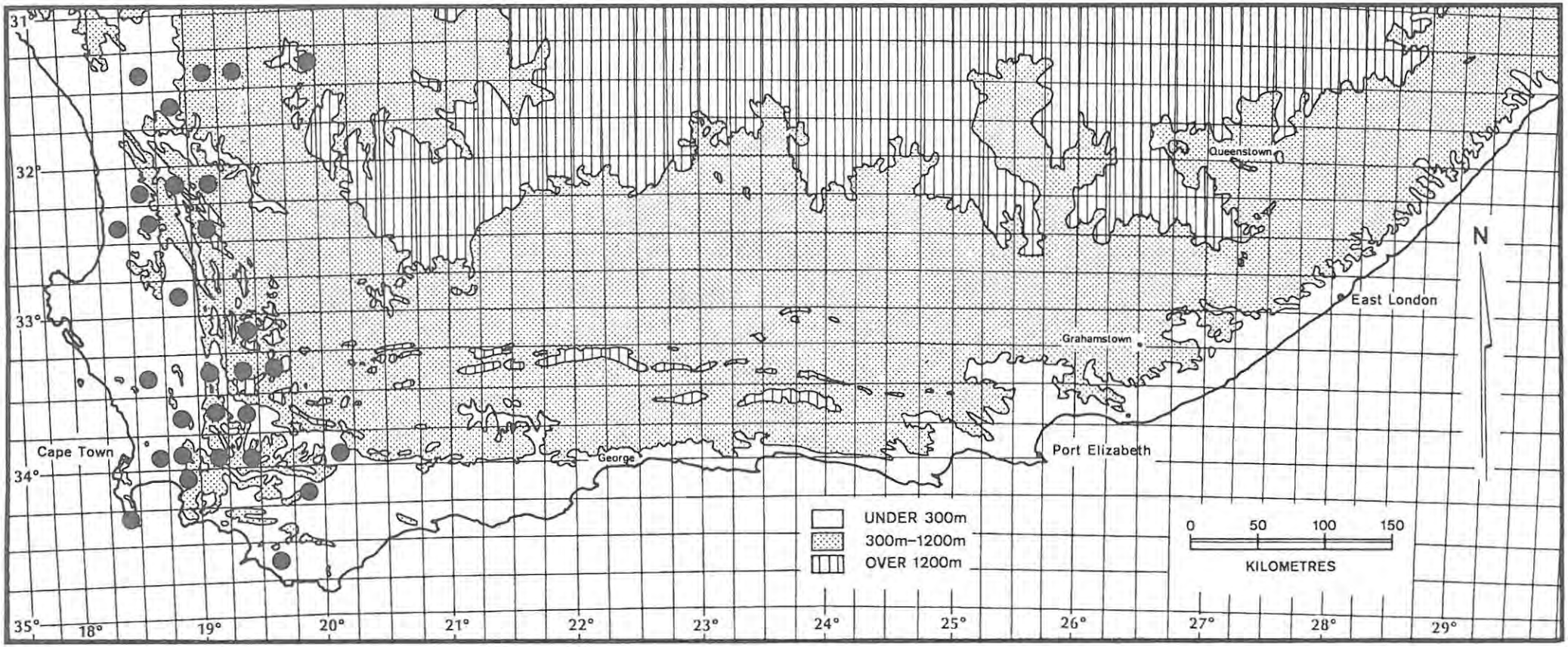


Figure 27: Geographical distribution of R. amplexicaulis (L.) Thunb.

3218 (Clanwilliam) 24 km from Elandsbay to Redelinghuys (-AD) Stirton 6119 (SRGH); Bloufontein kop (-BA) Boucher 3635 (PRE; STE); Pakhuis pass (-BB) Grobbelaar Ø1282 (PRE); Compton 9632 (NBG); Compton 4758 (NBG); Galpin 11Ø92 (PRE); Grobbelaar 2182 (PRU); Schlieben & Von Breda 99Ø7 (STE); Slater 276Ø (BM; BOL); Esterhuysen 34ØØ (BOL); Slater 5Ø58 (BM); Between Clanwilliam and Graafwater (-BB) Bolus 23248 (BOL); Boekenberg (-BC) Leighton 21599 (BOL); Piketberg Mountains (-DD) Jones Comp. no 28505 (NBG);

3219 (Wuppertal) Wuppertal (-AC) Thode A1983 (NH); Hex River Valley (-AC) Tyson 764 (PRE); Clanwilliam Road (-AC) Grobbelaar 2674 (PRE); Middelburg (-AC) Hubbard 354 (STE);

3318 (Cape Town) Malmesbury District (-BC) Goldblatt 3132 (PRE); Paarlberg (-DB) Bolus 2749 (BOL); West 145 (GRA); Jordaan J1275 (STE, SRGH); Kruger M18Ø (PRE); Compton 22943 (NBG, UWC); Drege s.n. (BM); Drege 1433 (P); MacOwan 53 (SAM); Drege 24381 (SAM); Paradise Wellington (-DB) Britten 3152 (GRA; PRE); Zypherfontein (-DC) Oliver 3814 (STE); Cape Town (-DD) Rycroft 33Ø7 (NBG); Banhoek (-DD) Compton 1Ø351 (NBG); Stokoe Sam no 56856 (SAM); Jonkershoek 1st Waterfall (-DD) Wicht 622 (JF);

3319 (Worcester) Riviersonderend (-AB) Schlechter 9194 (BOL); Witzenberg Mountains (-AC) Ecklon & Zeyher 361 (NBG; P; GRA; BM); Tulbaghskloof (-AC) Ecklon & Zeyher 12ØØ (P; NBG); Tulbagh Waterfall (-AC) Isaac in BOL Ø32555 (BOL); Compton 12433 (NBG; UWC); Herre in STE 8914 (STE); Grant 2473 (BM); Tulbagh (-AC) Marloth 4239 (PRE); Mountains near Tulbaghkloof (-AC) Ecklon s.n. (P); Davis 657Ø4 (NBG); Ceres (-AD) Guthrie 2141 (NBG); Horrocks 122 (NBG, UWC); Adamson D45 (PRE); Michell's Pass (-AD) Walters in Compton 7Ø457 (NBG); Grobbelaar 1187 (PRE; PRU); Bolus 2749 (BM; BOL); Bolus in BOL Ø32554 (BOL);

Matroosberg (-BC) Phillips 1928 (NBG); Bolus in NBG 14170 (NBG); Sneeukop mountains (-CA) Thorne 4649 (SAM); Bainskloof (-CA) Schlechter 1630 (PRE); Schlechter 7194 (GRA; BM); Hex River Valley (-CB) Tyson 677 (NBG); Bolus in PRE 53084 (PRE); Worcester Mountains (-CB) Rehmann 2434 (BM); duToits Kloof (-CC) Johnson 263 (BOL; NBG); Stokoe 61417 (SAM); Drege 6417 (P); Berg River Hoek (-CC) Compton 8330 (BOL); Compton 21906 (NBG); Wemmershoek (-CC) Esterhuysen 11273 (BOL); French Hoek Pass (-CC) Phillips 8301 (SAM); Thode A2192 (NH); Franschhoek Mountains (-CC) MacOwan 2903 (SAM; NH); Drakenstein Mountains (-CC) Wood 3357 (NH); Stettynsberg (-CD) Esterhuysen 11052 (BOL); Louwshoek (-CD) Stokoe 56856 (SAM); Stokoe 59609 (SAM);

3320 (Montagu) Montagu (-CC) Lewis 5700 (NBG); Richter 3223 (UWC);

3418 (Simonstown) Cape of Good Hope (-AD) Banks & Solander s.n. (BM); Verreaux s.n. (P); Boisvin s.n. (P); Bonplant s.n. (P); Sir Lowry's Pass (-BB) Compton 14224 (NBG);

3419 (Caledon) Middelberg (-BB) Hill s.n. (RUH); Elim (-DA) Bolus in NH 13620 (NH).

Ecology

This species is found mainly in the sandveld and on sandy, stony mountain slopes.

Notes

Bond & Goldblatt (1984) list *R. virens* E. Mey. but question its authenticity. In fact, *R. virens* was placed in synonymy under *R. amplexicaulis* (L.) Thunb. by Schinz in his revision of this genus in 1894 as apart from the different proportions of the calyx-lobes there

are no distinguishing characters to separate the two taxa. The author approves this action as it is identical to the more luxuriant forms of R. amplexicaulis.

This species is commonly named the soethoutbossie.

2. Rafnia perfoliata (Thunb.) E. Mey. in Comm. 12 (1836); Harvey in Harv. & Sond. F.C. ii: 31 (1862); Schinz, Bull. Herb. Boissier ii: 200 (1894). Type ex Cape of Good Hope, Thunberg in UPS 16330 (UPS holo!) (Fig. 28a).

Crotalaria amplexicaulis L. Lam. Dict. v: 194 (1786-88). Type: Cape of Good Hope, Burman s.n. (G. holo!) (Fig. 28b).

Borbonia perfoliata Thunb. Prodr. 122 (1800).

Vascoa acuminata E. Mey. Linnaea vii: 148 (1832). Type: Cape, Hottentots Holland. Eckl. & Zeyh. 1201 (P. holo! K) (fig. 29).

Rafnia perfoliata var. acuminata Walp. in Linnaea xiii: 463 (1839).

Vascoa perfoliata DC. Mém. Leg. 186 (1825), DC., Prodr. ii: 119 (1825).

Baptisia perfoliata Willd. Sp. Pl. iii: 949.

Woody perennial shrub between 150 and 300 mm in height arising from a long fleshy tap root with root nodules. Branches ascending then spreading and becoming decumbent. **Leaves** simple, alternate but opposite on flowering branch, cordate or amplexicaul, mucronate, 15 to 25 mm long and 10-20 mm broad. Internodes 28-35 mm long. **Flowers** on short pedicels, small, never more than 10 mm long and yellow turning red with age, borne between a pair of foliaceous bracts. The two upper **calyx** lobes are broadly falcato-cultrate, broader than the triangular lateral ones, all nearly equaling the tube in length. The sinus separating the upper from the lateral calyx lobes is sharp and narrow and the lateral lobes are narrow and triangular. The **standard** is wide ovate, emarginate and clawed. **Wings** obovate, lunulate, each of 4-5 rows comprising 10 to 15 intercostal lunulae, clawed. **Keel** blades are fused 8,5 mm long, 5 mm wide at maximum, claw 2 mm long,

Figure 28: (a) The type of R. perfoliata Thunb. in UPS 16330.

b

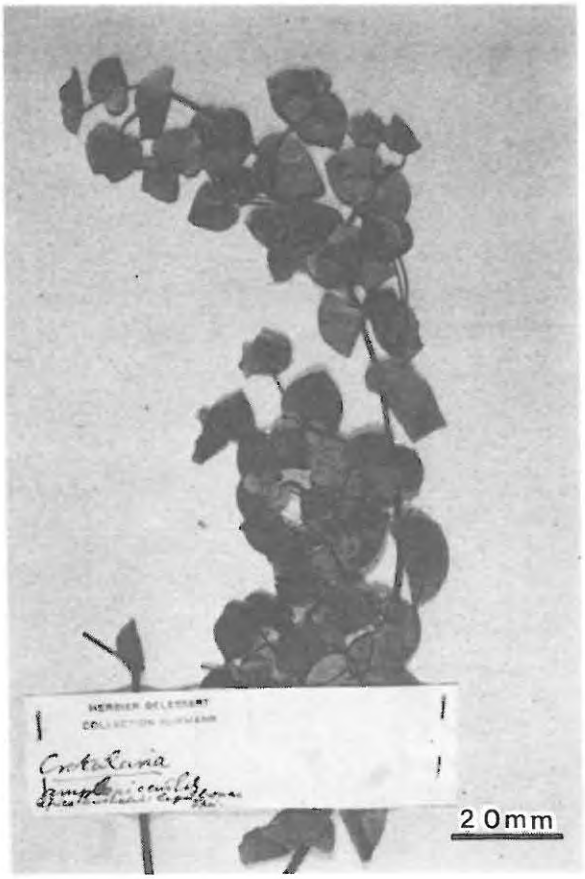


Figure 28: (b) The type of Crotalaria amplexicaulis L. Burman s.n.

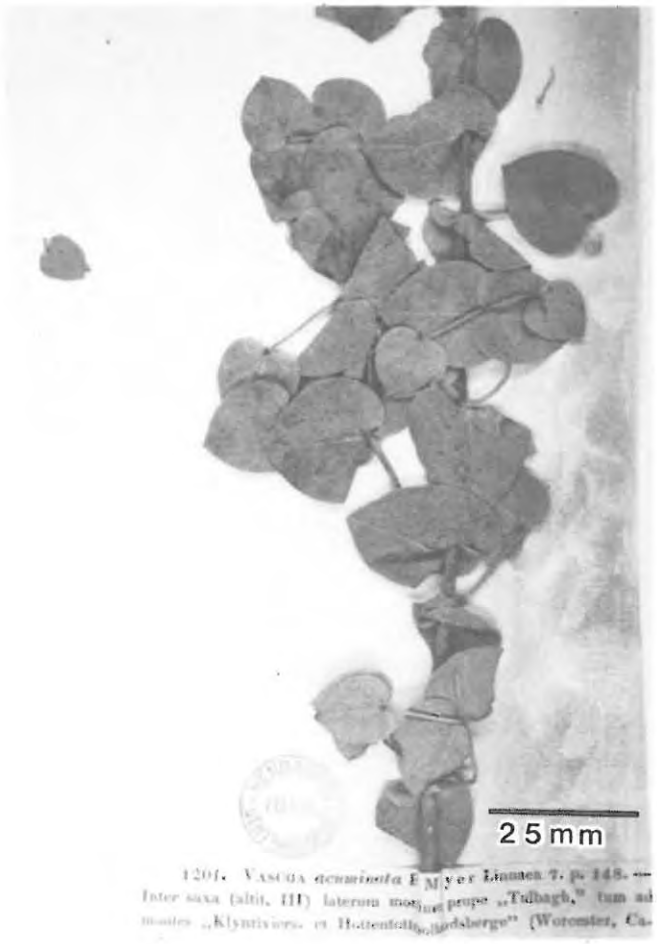


Figure 29: The type of Vascoa acuminata E. Mey. Eckl. & Zeyh. 1201.

apex rostrate, upcurved, height of curvature 3 mm. **Staminal sheath** 8mm long with 4 short basifixed anthers alternating with 6 long dorsifixed anthers. **Gynoecium** 6 mm long, style filiform sharply upcurving, height of curvature 6 mm long, stigma capitate, finely fringed. Pods are stalked, 7-21 mm long and 4-6 mm wide at maximum (Fig. 30).

Diagnostic features

1. Amplexicaul leaves.
2. Decumbent habit.
3. The sinus between the upper and lateral calyx lobes is sharp and narrow (Fig. 11).
4. Calyx lobes equal the tube in length.

Distribution

Widely distributed in the S-W Cape occurring mainly south of 32°S; stretching from the Olifants River Valley near Clanwilliam in the north, to Kleinmond in the south and eastwards along the coast to the Riversdale district (Fig. 31).

Normal Flowering Period: September to December but isolated ones have been collected in January.

Collections

3218 (Clanwilliam) Olifants River Valley (-DB) Esterhuysen 17909 (BOL); Piketberg (-DD) Loubser 799 (BOL); Pillans 7355 (BOL);

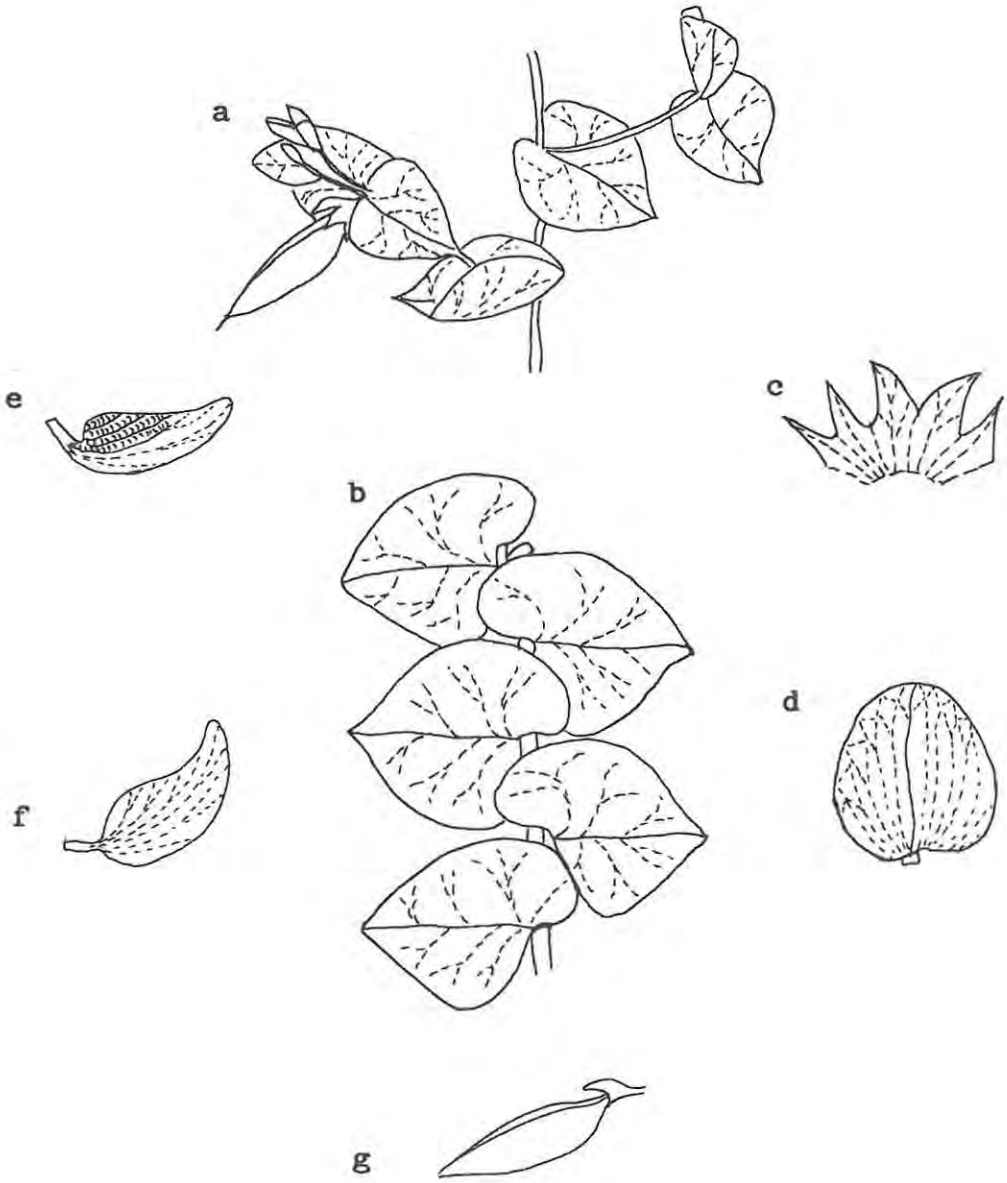


Figure 30: R. perfoliata (a) flowering branch x1, (Zeyher in SAM, 15201), (b) branch from near base of plant showing larger leaves x1 (Rycroft 3355, NBG), (c) calyx opened out x3, (d) standard opened out x3, (e) wing petal showing intercostal lunulae x3, (f) keel petal x3 (Compton 18690, NBG), (g) pod x1 (Compton 6091, NBG).

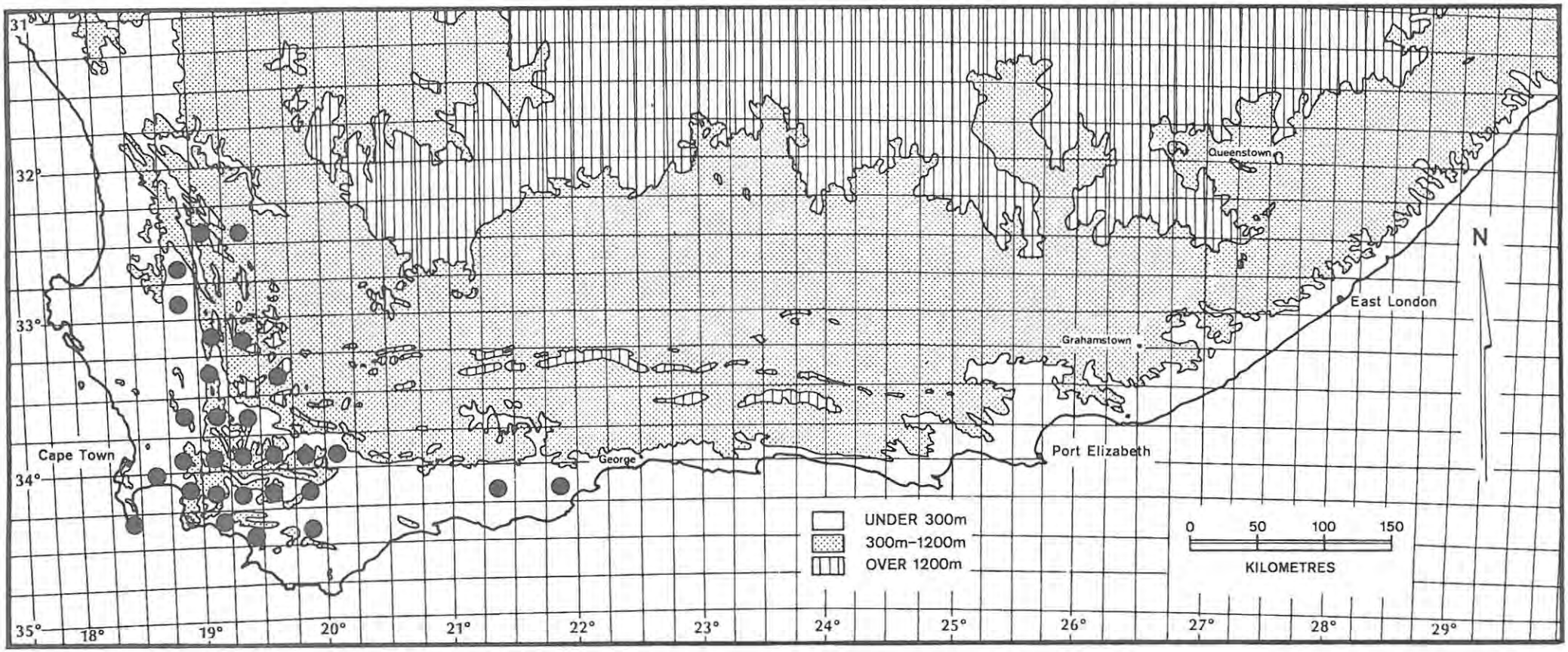


Figure 31: Geographical distribution of R. perfoliata (Thunb.) E. Mey.

3219 (Wuppertal) Cedarberg (-AC) Compton 4786 (NBG); Nieuwoudt's Pass (-AC) Salter 5065 (BM); Tierkloof (-AD) Gray s.n. (BOL);

3318 (Cape Town) Paarlberg (-DB) Kruger M180 (STE); Wellington (-DB) Esterhuysen 13730 (BOL); Anonymous in RUH 5271 (RUH); Jonkershoek State Forest (-DD) Compton 15309 (NBG); Kruger 11 (PRE; STE; JF); Rycroft 1074 (JF); Floyd s.n. (JF); Gouws 1018 (UWC);

3319 (Worcester) Winterhoekberge (-AA) Zeyher in SAM 15201 (SAM); Elandsfontein (-AB) Von Breda 341 (PRE); Skurfteberge (-AB) Bolus 7570 (BOL); Roodesandberg (-AC) Compton 6498 (NBG); Elandskloof Mountains (-AC) Stokoe 69768 (SAM); Witzenberg Mountains (-AC) Stokoe 7408 (BOL); De Doorns (-BC) Schlieben & Von Breda 9935 (STE; PRE); du Toits kloof (-CA) Lewis 3584 (SAM); Compton 22309 (NBG; UWC); Drege s.n. (P); Tulbaghkloof (-CA) Ecklon s.n. (P); Worcester (-CB) Compton 18690 (NBG); Richardson 201 (RUH) Waaihoek (-CB) Drege 6428 (P); Wemmershoek (-CC) Esterhuysen 4034 (BOL); Esterhuysen 17674 (BOL); Franschhoek Pass (-CC) Grobbelaar 1079 (PRU); Boucher 23362 (STE; JF); Barker 4164 (NBG); Compton 8171 (NBG); Compton 20204 (NBG; UWC); Phillips 1100 (SAM); Slater 1923 (BM); Rodin 3087 (BOL); Drakenstein Mountains (-CC) Rogers 17956 (J); Tyson s.n. (BOL); Pillans 8419 (BOL; PRE); Klein Drakenstein Mountains (-CC) Kruger KR761 (JF); Zachariashoek State forest (-CC) Thorne 46497 (SAM); Jonaskop (-CD) Bayliss 1396 (PRE); Stettynsberg (-CD) Esterhuysen 11113 (BOL); Worcester (-DC) Negin 5 (NBG); Riviersonderend (-DD) Robbertse & studente 995 (PRU; PUC); Robertson (-DD) Compton 11849 (NBG);

3320 (Montagu) Montagu Baths (-CC) Page in PRE 53093 (PRE);

3418 (Simonstown) Cape of Good Hope (-AD) Zeyher 333 (P); Zeyher 2283 (P); Dr Pappe s.n. (UPS); Drege s.n. (UPS); Thunberg s.n. (UPS); Drege s.n. (UPS); Thunberg s.n. (UPS); Burchell 7550 (K), Vergelegen (-BA)

Esterhuysen 34015 (BOL); Sir Lowry's Pass (-BB) Guthrie 2210 (NBG); Grobbelaar 225 (PRE); Smith 4780 (PRE); Gouws 3222 (UWC); Rogers 23426 (PRE); Schlechter 7288 (BOL; GRA; BM); Compton 14224 (NBG); Gordon's Bay (-BB) Richter 1294 (UWC); Marloth 10012 (PRE); Marloth 10112 (PRE; STE); de Villiers in STE 31483 (STE); Goldblatt 2975 (NBG); Van der Stel (-BB) Smith 4885 (PRE); Hottentots Holland (-BB) Prior in PRE 53087 (PRE); Phillips s.n. (BM); Ecklon & Zeyher 1202 (P; SAM); Ecklon & Zeyher 1201 (P; SAM); Helderberg (-BB) Parker 3741 (NBG; BOL); Hangklip Mountains (-BD) Boucher 759 (SRGH; STE); Taylor 5868 (NBG);

3419 (Caledon) Palmiet River (-AA) Zeyher 2283 (SAM); Bolus 2719 (GRA); Compton 3453 (BOL); Houwhoek (-AA) Guthrie 2241 (NBG); Bolus s.n. (BOL); Bolus 5007 (BOL); S of Greytown (-AB) Acocks 24423 (PRE); Salmonsdam Nature Reserve (-AB) Matthews 102 (PRE); Kleinmondberg (-AB) de Vos 358 (STE); Bowie s.n. (BM); Kleinmond (-AC) Stokoe in PRE 53097 (PRE); Hawston Mountains (-AC) Compton 10185 (NBG); Hermanus (-AC) Barker 1628 (NBG); Compton 14263 (NBG); Rogers 26533 (P); Hemel en Aarde (-AC) Barker 7619 (NBG; UWC); Berghang (-AD) Van Wyk 2090 (PRU); Kleinrivierberg (-AD) Ecklon s.n. (P); Fernkloof Nature Reserve (-AD) Orchard 292 (STE); Greyton Nature Reserve (-BA) Rycroft 3355 (NBG); Riviersonderend (-BB) Stokoe 61414 (NBG); Pringle Bay (-BD) Compton 6091 (NBG); Palmiet River Mouth (-BD) Compton 12354 (NBG; UWC); Stokoe 61413 (NBG); Napier (-BD) Jordaan 510 (STE);

3421 (Riversdale) Brandfontein (-AB) Smith 5001 (PRE); Honingklip (-BB) Taylor 5868 (NBG); Taylor 5860 (STE); Taylor 4082 (STE).

Ecology

This species is found mainly on sandy shale soils and on shallow sandy soils of the Table Mountain Group (TMG) usually on mountain slopes and also near the coast. It is fairly frequent after a burn.

Notes

This species has often been confused with *R. amplexicaulis* probably because both species have amplexicaul leaves. They are, however, distinct from one another, *R. perfoliata* having smaller leaves and longer internodes. In addition, *R. perfoliata* is a much more delicate plant, being a small decumbent bush in contrast to the larger, more luxuriant *R. amplexicaulis*. *R. perfoliata* is however, also commonly called the soethoutbossie.

The material obtained from Geneva which was collected by Oldenland and lent to Linnaeus by Burman contained several herbarium sheets labelled *Crotalaria amplexicaulis* L. Although some of these sheets, on examination, prove to be *R. amplexicaulis* Thunb., there is one sheet which is definitely *R. perfoliata* E. Mey., and this is most probably the specimen of *Crotalaria amplexicaulis* L. which Lamarck cites as a synonym of *R. perfoliata* E. Mey. (Fig. 28b).

3. Rafnia crassifolia Harvey in Harv. Thes. Cap. Vol. 1: 71 (1859) Harv. and Sond., F.C. ii: 34 (1862); Schinz Bull. Herb. Boissier ii: 201 (1894). Type: Cape, Hottentots Holland Mountains. Eckl. & Zeyh. 1192 (non., Thunb.) (SAM holo!) (Fig. 32).
R. axillaris Eckl. & Zeyh. Enum. 161 (1836). nom. illegit.

A low, woody perennial shrublet 300-600 mm high with narrowly winged, curved and ascending unbranched stems. **Leaves** alternate, about 25 mm apart, 25 to 55 mm long, 5 to 10 mm wide, narrow oblong or cuneate oblong, obtuse, mucronate, thick and somewhat fleshy in substance with immersed veins, glaucous, cartilaginous-margined, the margin often reddened. **Peduncles** axillary, shorter than the leaves, jointed a little above the base and there furnished with a pair of linear oblong or linear bracts which are sometimes small; sometimes as long as the upper half of the peduncle. Usually one flowered, after flowering the peduncles are deflexed at the joint. **Calyx** tube conical, much shorter than the limb, whose 4 upper segments are broadly lanceolate-acuminate, and more or less falcate, at all times standing apart from each other, the sinuses are very acute. The calyx lobes are twice or thrice as long as the tube and as long as the carina. The **corolla** is scarcely longer than the calyx. The **standard** is about 18 mm long, the blade widest about the middle, tapering cuneately to the base. The **wings** are obovate, lunulate, each of 4-5 rows comprising 15-20 intercostal lunulae, clawed. The **keel** blades are fused, 11 mm long, 6 mm wide at maximum, claw 5 mm long, apex rostrate. **Staminal sheath** 8mm long, split on upper side with four 1,75 mm long basifixed anthers alternating with five 0,25 mm long dorsifixed anthers, carinal anther intermediate, 0,75 mm long. **Style** filiform, sharply upcurving, height

Figure 32: Type of R. crassifolia Eckl. & Zeyh. 1192 (non Thunb.).

of curvature 9 mm high, stigma capitate, finely fringed. The ovary is 3-ovuled. The pod is minutely stipitate, cultrate, cuneate at base 25-40 mm long, pendulous. Pods have twisted walls when open (Figs. 33 & 34).

Diagnostic features

1. Calyx lobes twice or thrice as long as the tube.
2. Leaves cartilaginous margined, the margin often reddened.

Distribution

From Patrysvlei eastwards along the coast as far as George. (Fig. 35).

Normal Flowering Period: November to February.

Collections

3318 (Cape Town) Highlands (-DC) Bond 1525 (NBG); Patrysvlei (-DC) Wolley Dod 769 (BM); Martin 4303 (RUH);

3322 (Oudtshoorn) Mountains of George (-CD) Bowie 4 (BM);

3418 (Simonstown) Simonstown (-AB) Minicki 51791 (SAM); Taylor 6751 (STE); Klaver Valley (-AB) Salter s.n. (BM); Moss 7734 (BM; J); Smitswinkelbaai (-AD) Baker 1175 (NBG); Barker 3953 (NBG); Cape Point (-AD) Compton 16664 (NBG); Salter 7830 (NBG); Compton 20240 (NBG); Compton 12516 (NBG); Schlechter 7303 (BM; P); Moss 6102 (J); Cape of Good Hope (-AD); Nelson s.n. (BM); Bowie 17 (BM); Thunberg in UPS 16427 (UPS); Cape Point (-AD) Schlechter 7303 (BOL); Smith's Farm (-AD) Acocks & Hafstron 711 (PRE); Houtrivier (-AD) Grobbelaar 1052 (PRU; PRE); Paulsberg (-AD) Hall in SRGH 15179 (SRGH); Brightwater

Figure 33: R. crassifolia flowering branch x1 (from Thesaurus Capensis, William H. Harvey Vol. 1, Pl. LXXI, 1859).

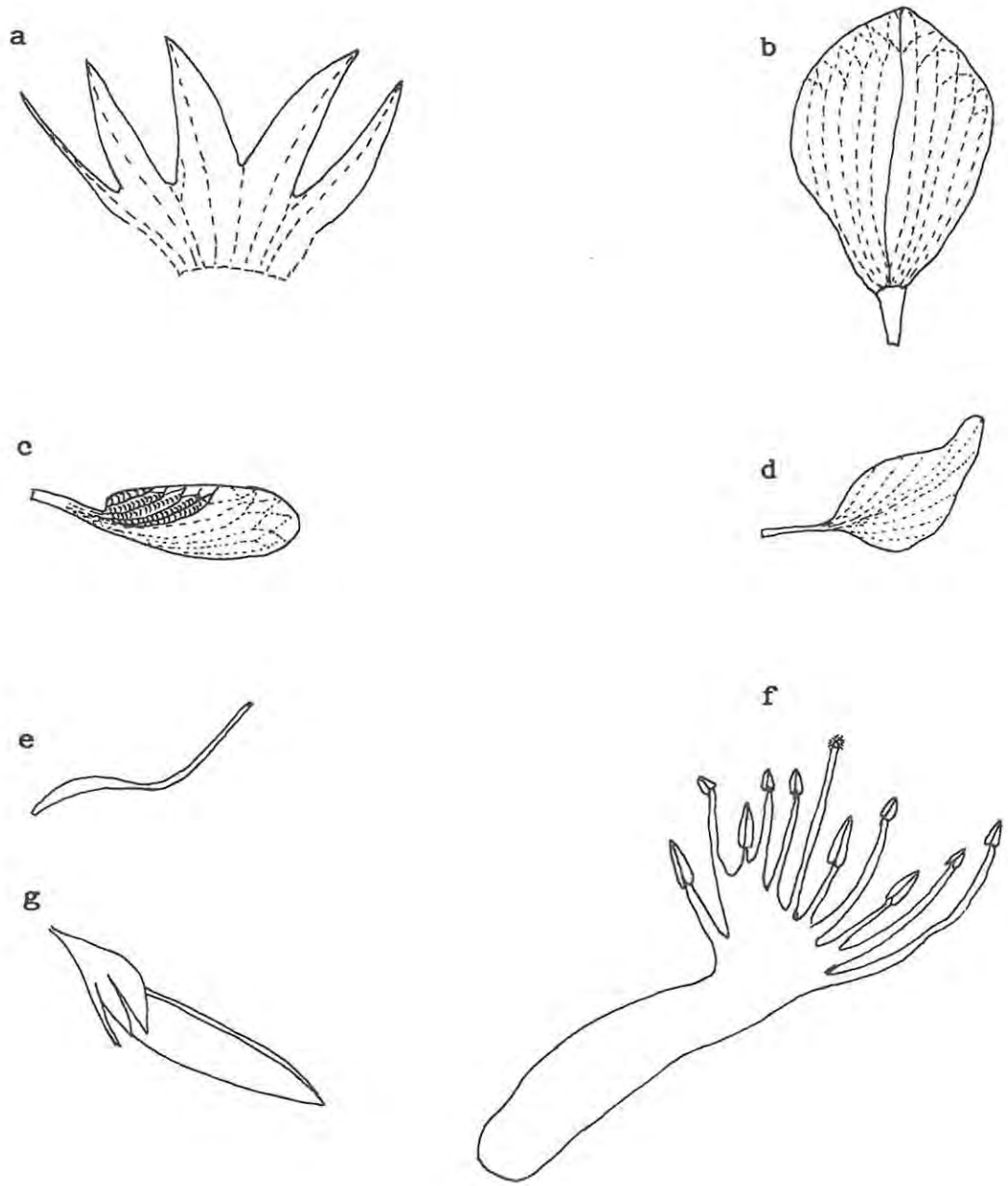


Figure 34: R. crassifolia (a) calyx opened out x3, (b) standard opened out x3, (c) wing petal showing intercostal lunulae x 3, (d) keel petal x3, (e) gynoecium x3, (f) staminal sheath x5,4 (g) pod x1 (Barker 3953, NBG).

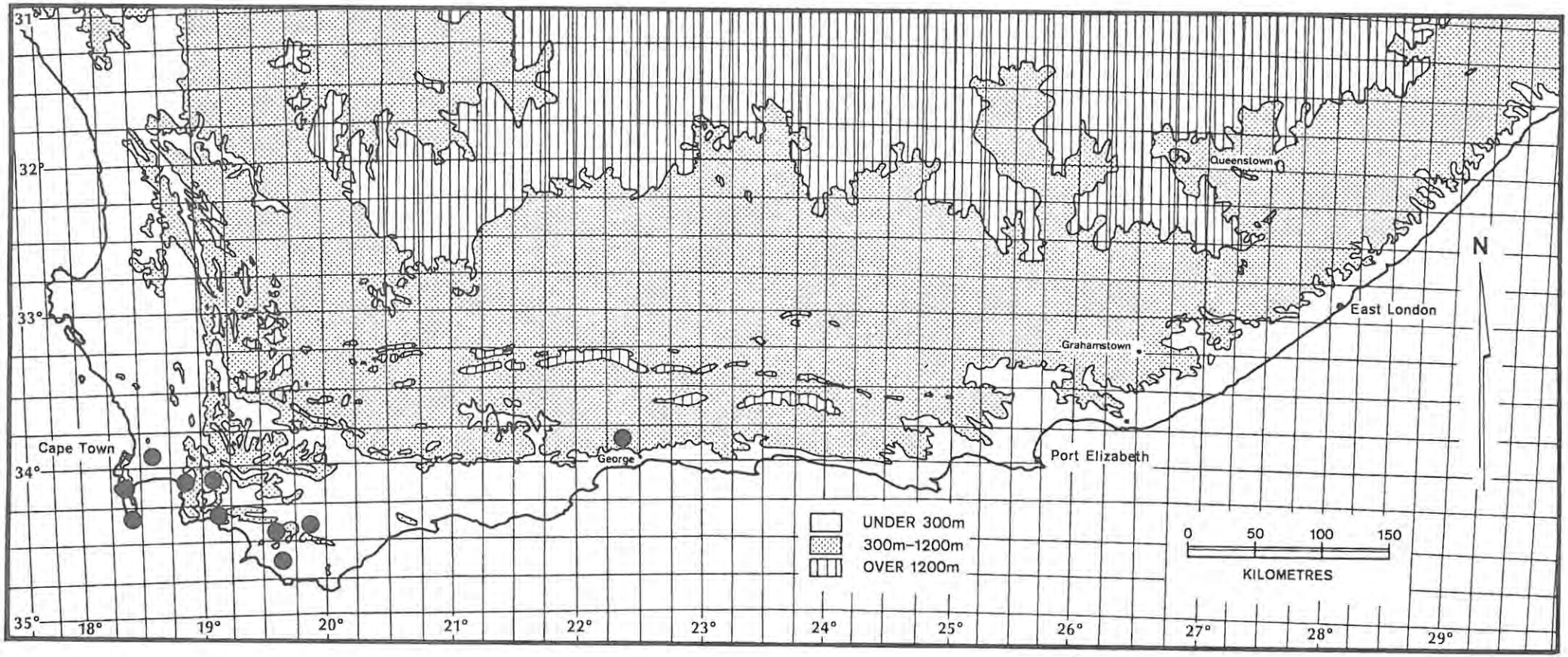


Figure 35: Geographical distribution of R. crassifolia Harv.

(-AD) Grobbelaar 2659 (PRE); Hottentots Holland Mountains (-BB) Ecklon & Zeyher 1192 (NBG);

3419 (Caledon) Palmiet River (-AA) Stokoe 61406 (SAM); Stokoe 65710 (SAM); Esterhuysen s.n. (BOL); Esterhuysen 13702 (BOL); Stokoe in SAM 53120 (PRE); Klein Houwhoek (-AA) Zeyher 2281 (SAM; PRE); Hermanus (-AC) Compton 23224 (NBG); Elandskloof (-BC) Schlechter 9710 (BM; P; PRE); Rooi Els (-BD) Grobbelaar 303 (PRU; PRE); Cape Hangklip (-BD) Pillans 8246 (BOL); Lavranos 12059 (PRE); Compton 6089 (NBG); Bettysbaai (-BD) Van Wyk 229 (PRE; PUC); Elim (-DA) Bolus 3773 (NBG); Bolus 8535 (NBG; PRE; NH; BOL).

Ecology

Usually grows on sandflats and on plateaux in very sandy, eroded soil.

Notes

This appears to be a very well-marked species easily distinguished from other Rafnia species by its very distinctive calyx. The Eckl. & Zeyh. sheet 1192 (Enum. p.161) labelled R. axillaris is a misidentification and is actually R. crassifolia Harv.

4. Rafnia lancea (Thunb.) DC. in Prodr. ii: 119 (1825); Harvey in Harv. and Sond. F.C. ii: 34 (1862); Schinz Bull. Herb. Boissier ii: 200 (1894). Type: ex Cape of Good Hope, Thunberg in UPS 16348 (UPS holo!) (Fig. 36).

Oedmannia lancea Thunb. Prodr. 122 (1800); Act Holmens : 281 (1799).

A small shrub, 150 to 300 mm high, erect or ascending, simple or branched from the base. **Leaves** 25 to 50 mm long, 6 to 12 mm wide, varying in shape from linear-oblong to oblong-lanceolate and mucronate with an obvious midrib. **Peduncles** axilliary in the axils of the uppermost leaves, crowded toward the ends of the branches, one-flowered, 25 to 30 mm long, jointed near the summit and there furnished with a pair of minute setaceous bracts. **Calyx** tube conical, its upper segments connate in opposite pairs for half their length or more, each pair of segments forming a deeply bifid, triangular lobe of a trifid calyx. The lowest lobe is setaceous. The **corolla** is nearly twice as long as the calyx and bright yellow. The **standard** is 10-12mm long, 10 mm wide and is clawed, claw 6 mm long. The **wings** are 11 mm long, 4 mm wide, obovate, lunulate, each of 6-8 rows comprising 15-25 intercostal lunulae. **Keel** blades fused, 12 mm long, 6 mm wide at maximum, claw 6 mm long, apex rostrate, sharply upcurved, height of curvature 6 mm. **Staminal sheath** 8 mm long, split on the upper side with 5 large basifixed anthers on short filaments alternating with 5 small dorsifixed anthers on longer filaments. **Gynoecium** 10 mm long, style filiform, sharply upcurving, height of curvature 9 mm high, stigma capitate, finely fringed. The **legume** is deflexed, narrow, tapering much at the base into a short stipe (Figs. 37 & 38).

Figure 36: The type of R. lancea Thunberg in UPS, 16348.

Figure 37: R. lancea flowering branch x1 (from Thesaurus Capensis, William H. Harvey Vol. 1, Pl. LXXII, 1859).

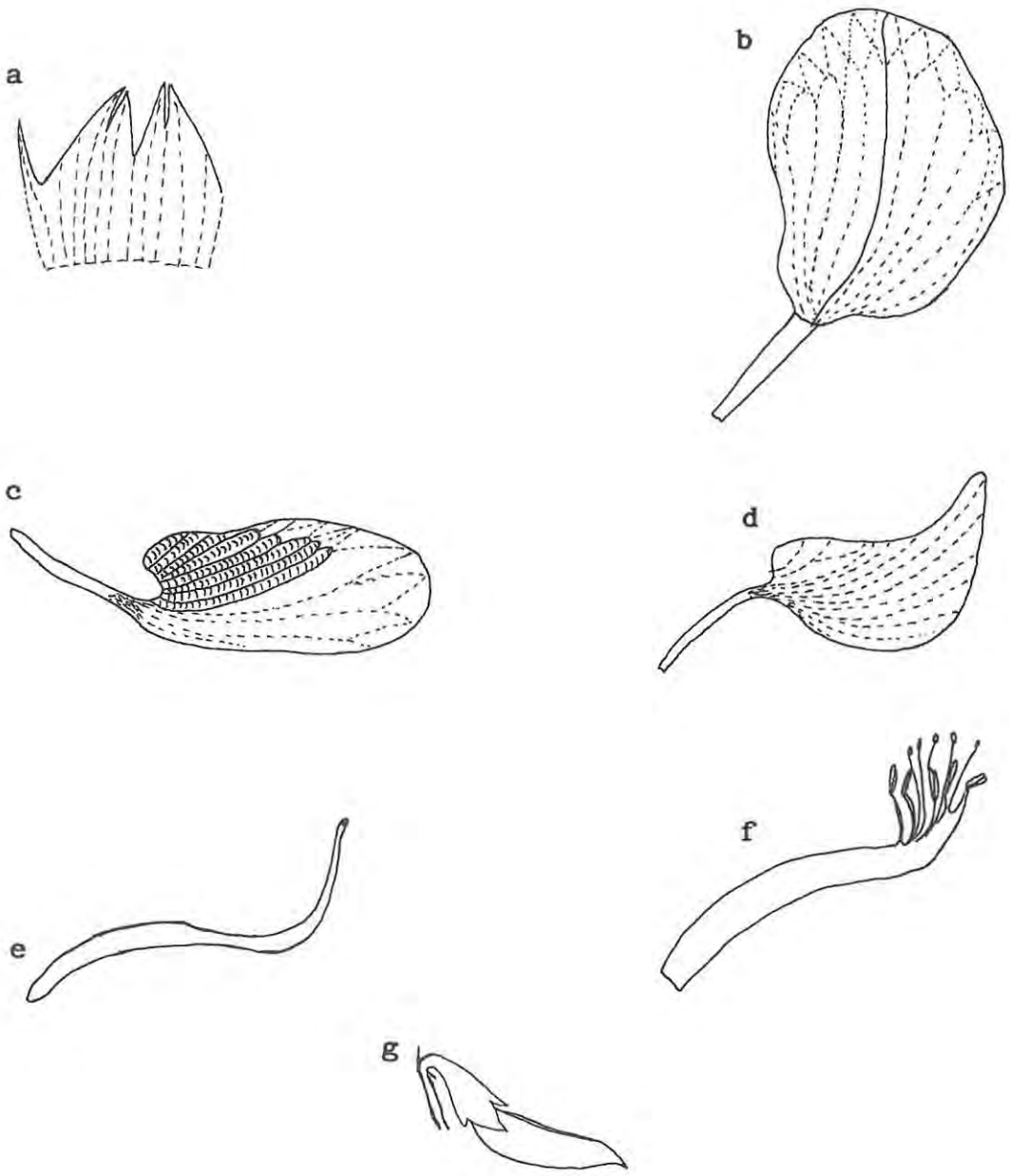


Figure 38: R. lancea (a) calyx opened out x3, (b) standard opened out x3, (c) wing petal showing intercostal lunulae x3, (d) keel petal x3, (e) gynoecium x3, (f) staminal sheath x3 (Johnson 1674, UWC) (g) mature pod x1 (Salter 7669, BOL).

Diagnostic features

1. Peduncles axillary in the axils of the uppermost leaves, crowded towards the ends of the branches.
2. Upper lobes of calyx, connate in opposite pairs.

Distribution

Widely scattered in the S.W. Cape from Wuppertal in the north to Caledon in the south. (Fig. 39).

Normal Flowering Period: September to January.

Collections

3219 (Wuppertal) Wuppertal (-AC) Leipoldt 3401 (SAM);

3318 (Cape Town) Malmesbury (-BC) Barker 1002 (NBG); Paardeberg (-DB); Salter 7669 (BM); Tygerberg (-DC) Ecklon & Zeyher 1194 (NBG; P); Drege 6415 (P); Drege s.n. (BM); Joostenberg (-DD) Pillans 9259 (NBG);

3319 (Worcester) Tulbaghkloof (-AC) Zeyher in SAM 15207 (SAM); Roman's River (-AC) Lewis 3587 (SAM); Johnson 481 (NBG; UWC); Tulbagh (-AC) Lewis 5739 (NBG); Michells Pass (-AD) MacOwan 1601 (SAM; BM; UPS); Ceres (-AD) Guthrie 3382 (NBG); Doorn River (-BB) Walters 203 (NBG);

3320 (Montagu) Smitswinkel (AB) Compton 15515 (NBG); Compton 12576 (NBG);

3418 (Simonstown) Fish Hoek Mountains (-AB) Barker 1665 (UWC); Cape of Good Hope (-AD) Thunberg in UPS 16348 (UPS).

3419 (Caledon) Klein River Mountains (-AD) Stokoe in SAM 68746 (SAM);

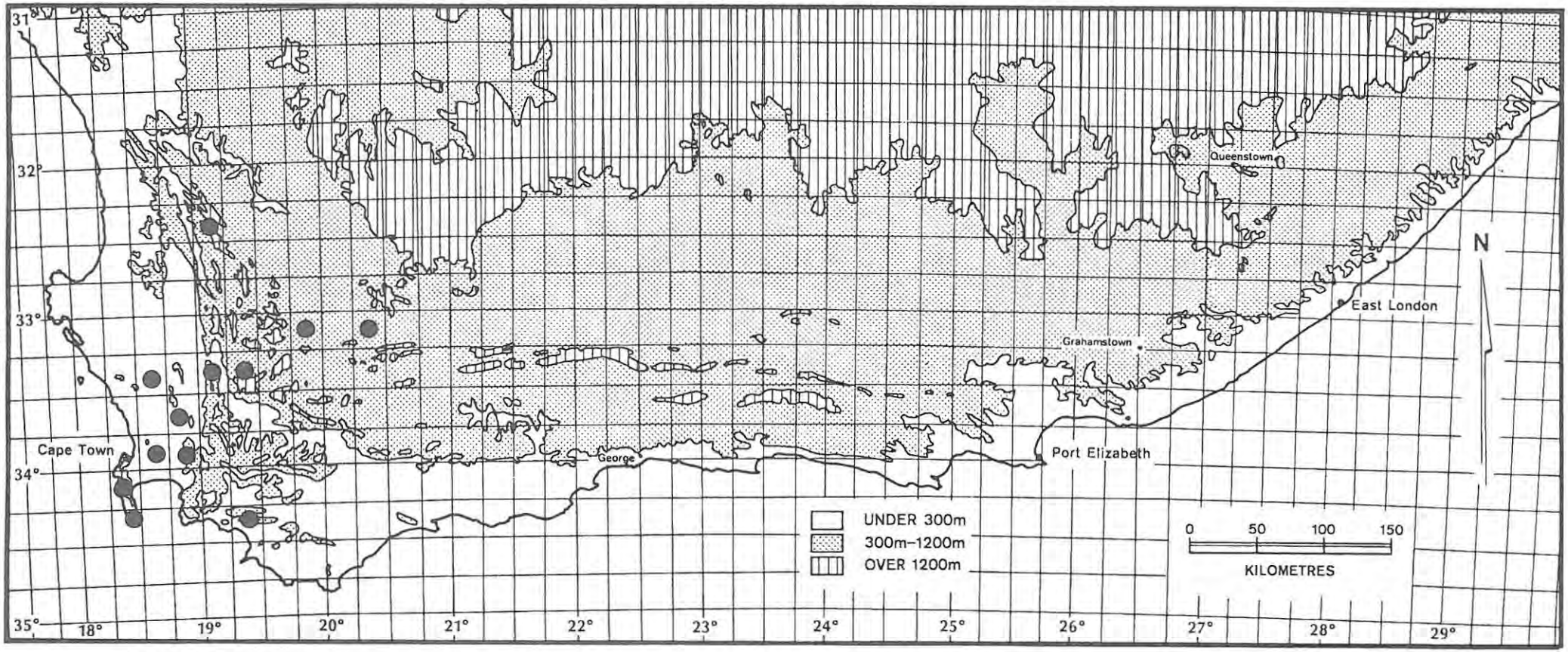


Figure 39: Geographical distribution of R. lancea (Thunb.) DC.

Ecology

Usually grows in dry sandy clay or in shallow sandy ground.

Notes

This is readily known from all the other species of Rafnia by the arrangement and connation of the calyx segments. The divisions between the two posterior segments and between the lateral and anterior are deeply cut, but those between the posterior and lateral are twice as shallow; consequently, these appear to be connate for half their length. It was on this character that Thunberg proposed his "Oedmannia" but as there is nothing else to separate Oedmannia from Rafnia, with which the habit agrees perfectly, De Candolle united Oedmannia lancea, the only species, to Rafnia.

5. Rafnia meyeri Schinz in Bull. Herb. Boissier ii: 201 (1894).

R. ovata E. Mey. in Comm. : 12 (1836); Harvey in Harv. and Sond. F.C. ii: 32 (1862). Type: Cape, Cedarberg, Drege (P, holo!).

R. cordata Eckl. & Zeyh. Enum : 159 (1836). Type: Cape, Klapmuts, Eckl. & Zeyh. 1180 (NBG holo!) (Fig. 40).

Woody, caespitose shrub with annual stems about 1 to 1,5 m high arising from a long, fleshy tap root with root nodules. **Leaves** broadly elliptic-ovate, sharply acuminate. The upper leaves are more lanceolate. The leaves vary greatly in size from 16 to 80 mm broad and 35 to 100 mm long. **Peduncles** axilliary, usually with a solitary flower subtended by a pair of small awl-shaped bracts, occasionally the peduncle bears more than one flower. **Flowers** fairly large, about 20 mm in length. The four upper **calyx** lobes are triangular-acuminate, as long as the tube while the lowest is narrow-subulate and of equal length to the rest. The **standard** is narrowly ovate and clawed. The **wings** are obovate, lunulate each of 5-6 rows comprising 15-25 intercostal lunulae, clawed. The **keel** blades are fused, 12 mm long, 6 mm wide at maximum, claw 6 mm long, apex rostrate. **Staminal sheath** 14 mm long with 4 short basifixed anthers, alternating with 6 long dorsifixed anthers. **Gynoecium** 15 mm long, style filiform, sharply upcurving, height of curvature 10 mm high, stigma capitate, finely fringed. **Pods** are stipitate with a broad wing on the upper side, 35-40 mm long and about 10 mm wide at maximum (Figs. 41 & 42).

Figure 40: The type of R. cordata Eckl. & Zeyh. 1180.

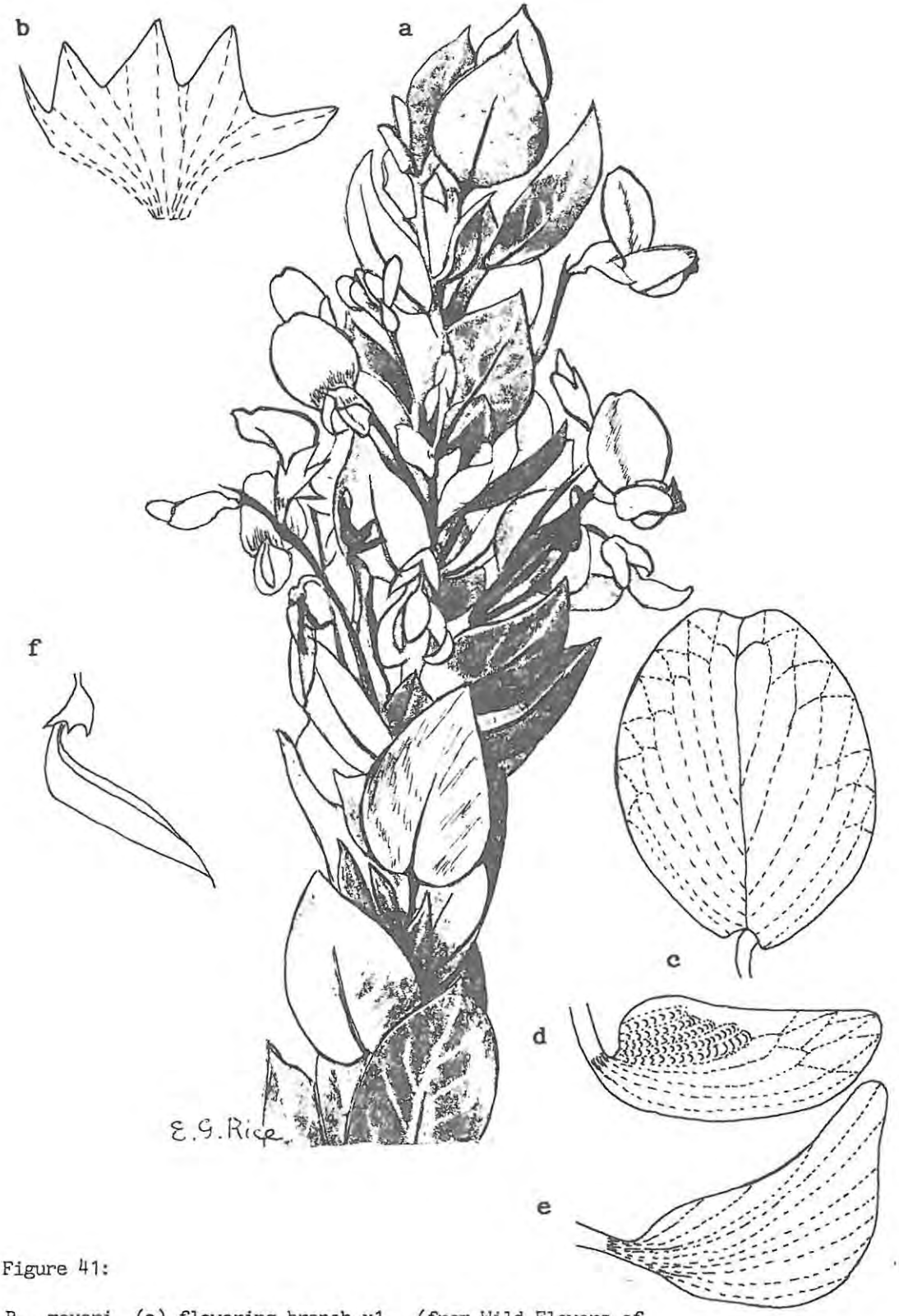


Figure 41:

R. meyeri (a) flowering branch x1, (from Wild Flowers of the Cape of Good Hope, E.G. Rice and R.H. Compton, 1950), (b) calyx opened out x3, (c) standard open out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3, (f) pod x1 (Parker 3868, NBG).

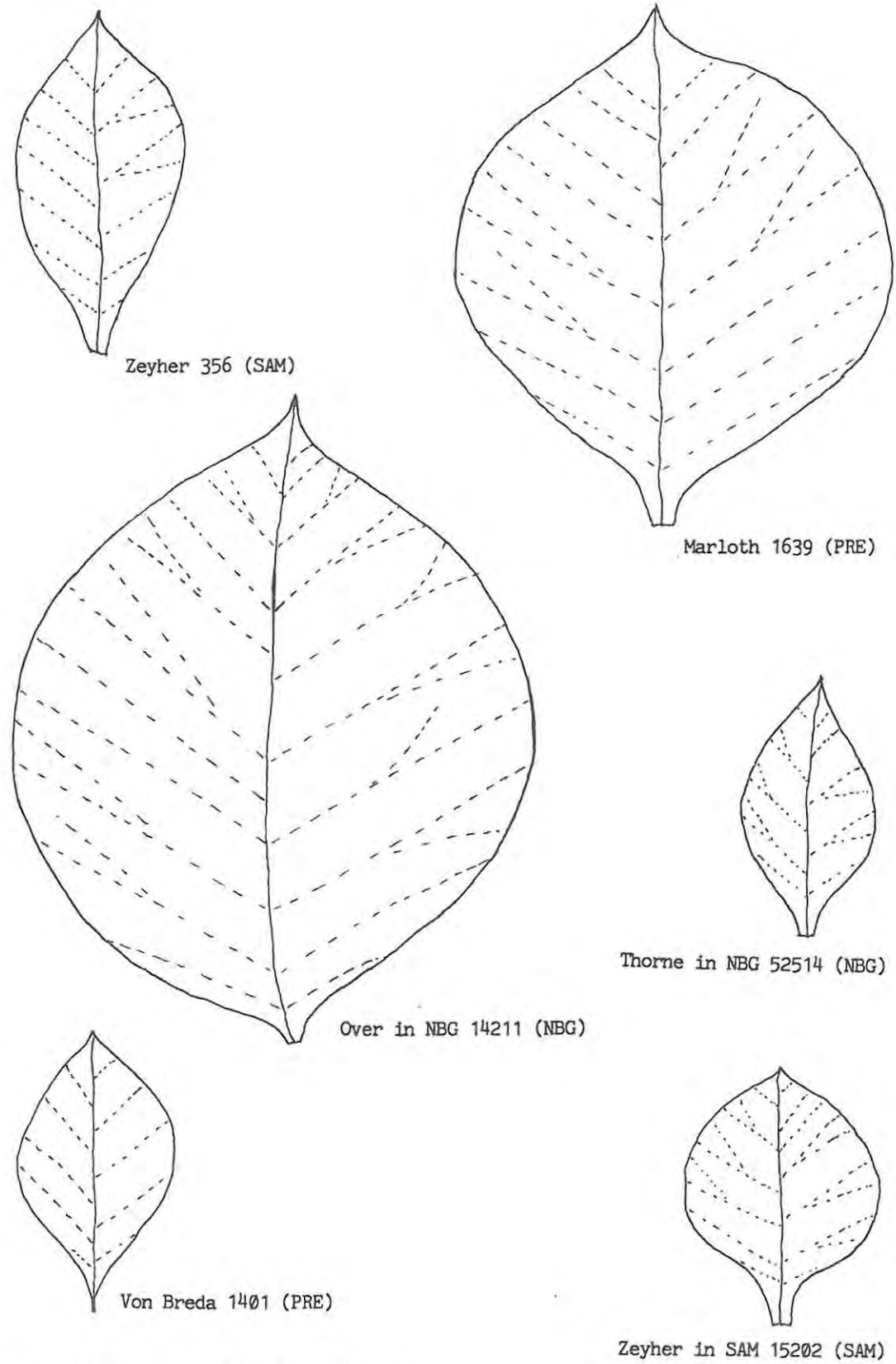


Figure 42: R. meyeri leaf variation x1.

Diagnostic features

1. No foliaceous bracts on inflorescence. Solitary flower subtended by a pair of small awl-shaped bracts.
2. Large woody, caespitose shrub.
3. Leaves broadly elliptic-ovate, sharply acuminate.

Distribution

On sandy flats from the Hottentots Holland Mountains in the south extending northwards in a straight line to the Vanrhynspas with one outlier near Laingsberg (Fig. 43).

Normal Flowering Period: (August) September to December.

Collections

3119 (Calvinia) Vanrhynspas (-AC) Von Breda 1401 (PRE); Nieuwoudtville (-AC) Barker 9212 (NBG); Barker 9568 (NBG);

3218 (Clanwilliam) Clanwilliam (-BB) Pillans 9093 (BOL); Taylor 5931 (PRE); Piketberg (-DD) Loubser 1027 (BOL);

3219 (Wuppertal) Heuningvlei (-AA) Kruger 1691 (STE; JF); Stokoe in SAM 55791 (SAM); Krakadouw Pass (-AA) Thorne in SAM 52514 (SAM); Stokoe in SAM 55792 (SAM); Cedarberg (-AC) Esterhuysen 12130 (BOL); Salter 7565 (BOL); Andrag 86 (JF); Schelpe 285 (BOL); Sneeuberg (-CA) Barnard in NBG 44109 (NBG);

3318 (Cape Town) Klapmuts (-DD) Ecklon & Zeyher 1180 (NBG); Jonkershoek (-DD) Borchardt 629 (JF); Wicht 628 (JF); Stellenbosch (-DD) Over in NBG 14211 (NBG);

3319 (Worcester) Great Winterberg Mountains (-AA) Zeyher s.n. (SAM); Phillips 1735 (SAM); Marloth 1639 (PRE); Phillips in PRE 58735 (PRE);

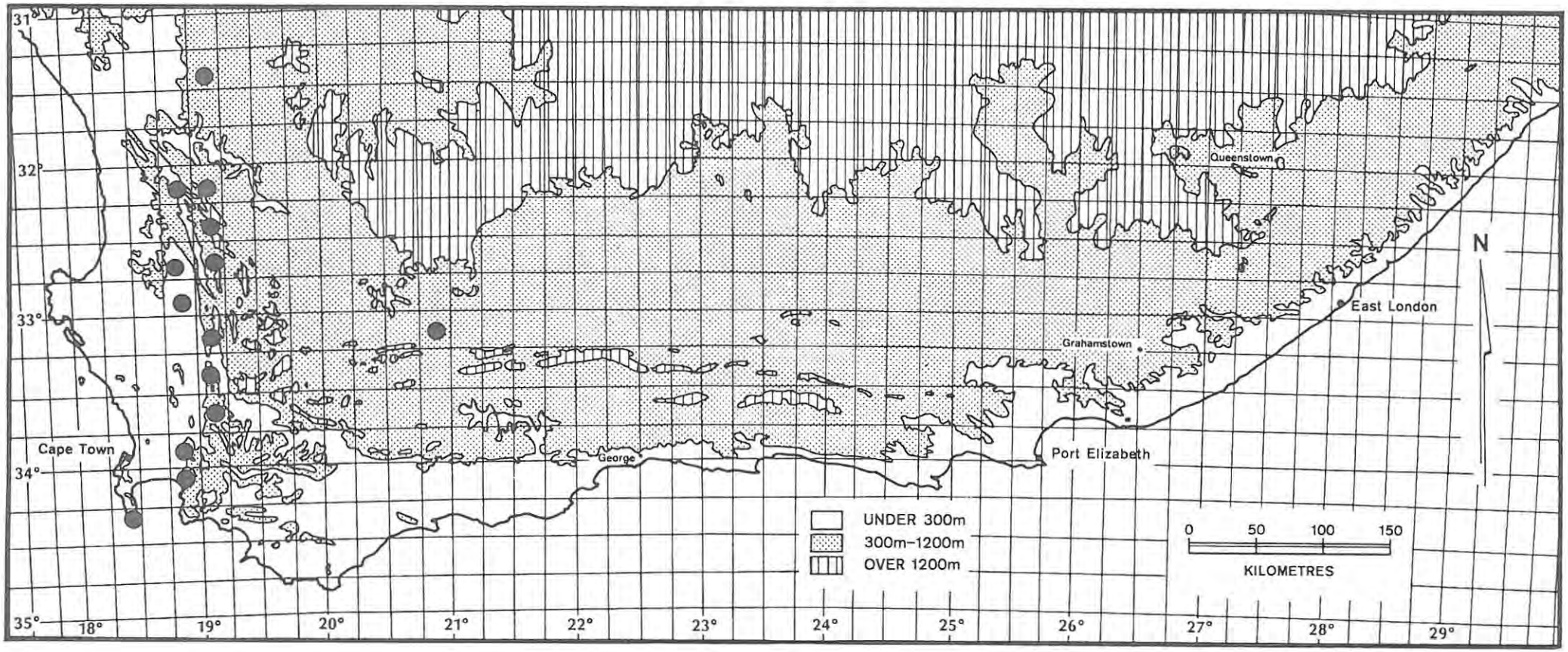


Figure 43: Geographical distribution of R. meyeri Schinz.

Witzenberg (-AC) Zeyher 356 (SAM; PRE); Andreae 146 (STE); Compton 18813 (NBG); Keerom Hills (-CA) Esterhuysen 17875 (BOL; NBG);

3320 (Montagu) Laingsberg (-BB) Compton 3038 (BOL);

3418 (Simonstown) Cape of Good Hope (-AD) Wallich s.n. (BM); Waterkloof (-BB) Parker 3868 (BOL; NBG); Sir Lowry's Pass (-BB) Grey s.n. (STE); Hottentots Holland Mountains (-BB) Zeyher s.n. (NBG); Vergelegen (-BB) Valpy in NBG 14208 (NBG).

Ecology

This species grows mainly on rocky slopes usually composed of soils of the Table Mountain Group.

Notes

Thunberg described R. cuneifolia in 1800 having based his description on material of Spartium ovatum Berg., thereby making the former an illegitimate name. In 1830 Meyer independently described his R. ovata based on a Drege type. In 1894 Schinz noticed Thunberg's error and renamed R. cuneifolia as R. ovata. In the same publication he corrected Meyer's then illegitimate homonym by renaming it R. meyeri Schinz. Although this correction was made nearly a hundred years ago, the name R. meyeri has never been used and the taxa which fit this description have consistently been named R. ovata E. Mey.

6. Rafnia crispa Stirton in Bothalia Vol. 14, No. 1: 74-76 (1982). Type: Cape, Kluitjieskraal, Stirton 8439 (PRE, holo!) (Fig. 44).

Erect herbaceous perennial up to 400 mm high, glabrous, arising from a woody rootstock. **Leaves** simple, alternate, sessile, exstipulate, 50-65 mm long, 15-17 mm wide, becoming smaller and eventually almost bractlike at the flowering apices, elliptic, apex attenuate, base decurrent, margin undulate, cartilaginous. **Inflorescences** axillary, single flowered, clustered terminally on long shoots. **Flowers** 13-15 mm long, bright yellow, each subtended by small bracts; bracteoles 2 mm long. **Pedicel** 1-2 mm long. **Peduncle** 13-15 mm long. **Calyx** 12 mm long, teeth shorter than the 7 mm long tube, keel tooth shortest, setaceous, vexillar and lateral teeth triangular-acuminate and more united. **Standard** 14-15 mm long, 14 mm wide, very wide ovate, emarginate, shortly clawed, auricles and appendages absent. **Wings** 15 mm long, 8 mm wide, obovate, exceeding the keel; sculpturing present, upper basal and left central, lunulate, each of 5-6 rows comprising 15-25 intercostal lunulae. **Keel** blades fused, 14 mm long, 7 mm wide at maximum, claw 5 mm long, apex rostrate, sharply upcurved, height of curvature 7 mm. **Staminal sheath** 14 mm long, split on upper side with five small 1 mm long dorsifixed anthers alternating with four 2,25 mm long basifixed anthers, carinal anther intermediate. **Gynoecium** 13 mm long, style filiform, sharply upcurving, height of curvature 9 mm high, stigma capitate, finely fringed. Mature **pods** not seen (one ovary contained two ovules) (Fig. 45).

Figure 44: The type of R. crispa Stirton 8539.

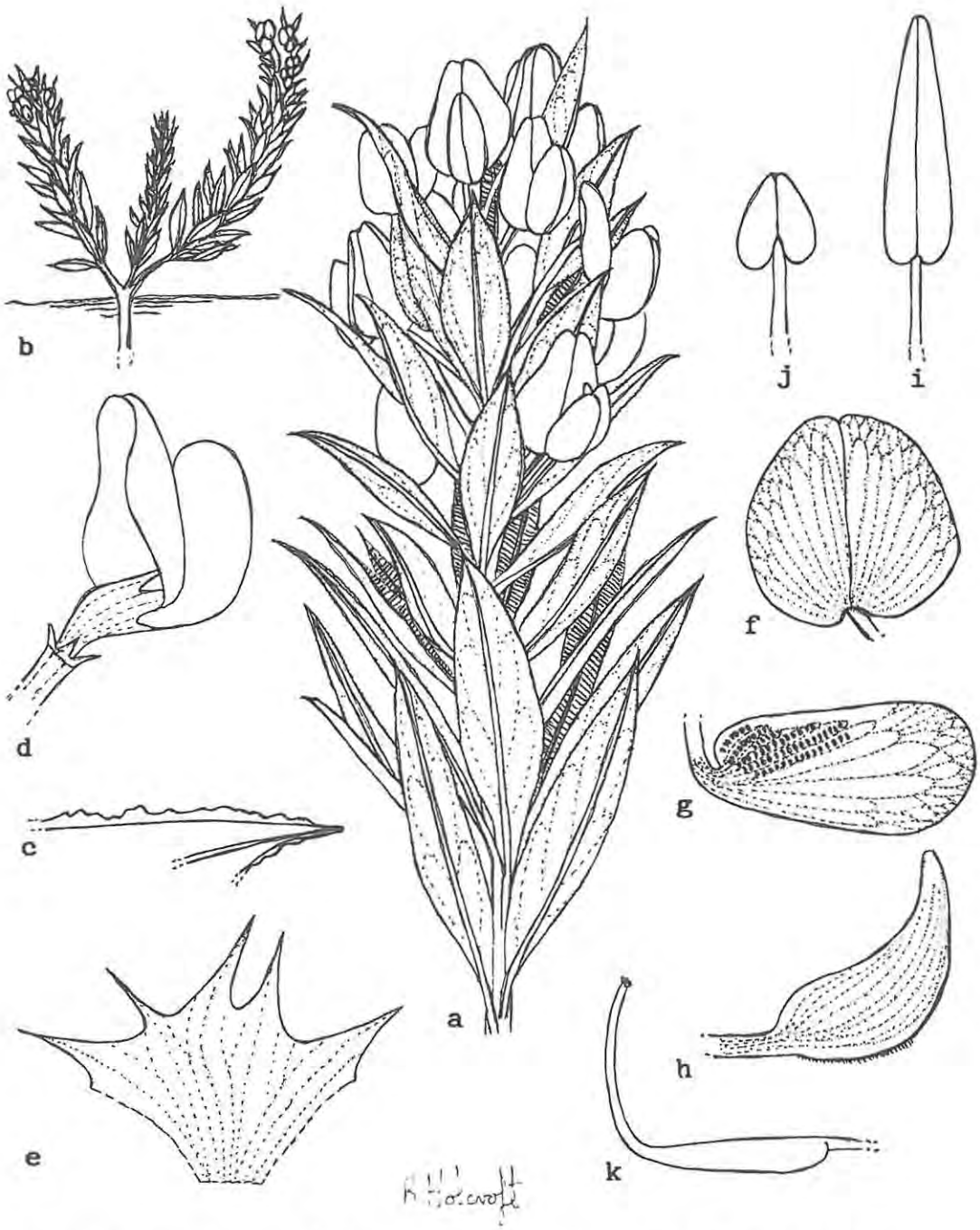


Figure 45: R. crispa (a) terminal inflorescence x1, (b) habitat, (c) leaf margin x2, (d) flower x2, (e) calyx opened out x3), (f) standard opened out x2, (g) wing petal showing intercostal lunulae x3, (h) keel petal x3, (i) basifixed anther on longer filament x18, (j) dorsifixed (versatile) anther on shorter filament x18, (k) gynoecium x3 (from Stirton in Bothalia Vol. 14: 1 p. 75, June 1982).

Diagnostic features

1. Leaves have an undulate margin.
2. Keel rostrate.
3. Wings lunulate.

Distribution

Kluitjeskraal Forestry area (Fig. 46).

Normal Flowering Period: December.

Collections

3319 (Worcester): Kluitjeskraal (-AC) Stirton 8439 (PRE).

Ecology

A rare species that grows on open flat well-drained sandy soil.

Notes

R. crispa is related to R. lancea (Thunb.) DC which also grows in this region but among sandy-rocky areas in the mountains to the west of the Tulbagh flats. Stirton based his name on the incorrect assumption that this species had crisped leaf margins. Close examination shows that the margin is not crisped but undulate.

The author has not rediscovered this species and the fact that it was founded on one collection makes its existence suspect but it has been upheld pending further investigation.

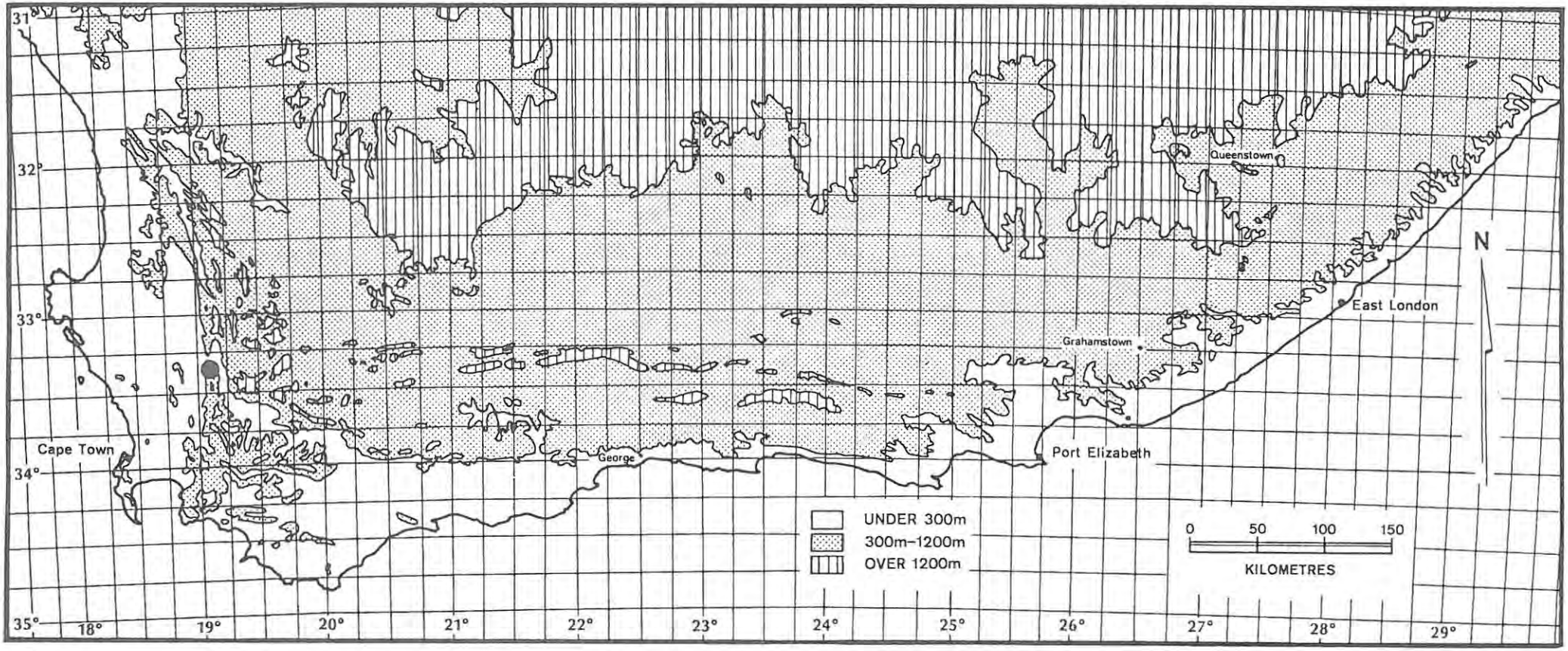


Figure 46: Geographical distribution of R. crispa Stirton.

7. R. dichotoma Eckl. & Zeyh. Enum. 161 (1835); Harvey in Harv. & Sond. F.C. ii : 34 (1862); Schinz in Bull. Herb. Boissier ii; 200 (1894). Type: Cape of Good Hope, in the mountains at Genadendal, Caledon. Eckl. & Zeyh. 1190 (SAM Holo!) (Fig. 47).

P. gibba E. Mey. Comm 14 (1836). Type: Cape of Good Hope, Cedarbergen. Drege (P. Holo!).

R. gibba Druce. Rep. Botl. Soc. Exch. Club. Br. Isl. (1916).

A small, bushy, many stemmed undershrub, 400 to 600 mm tall. **Leaves** are blue-green, somewhat fleshy, glaucous, broadly ovate or elliptic-oblong, mucronate, 12 to 24 mm long, 8 to 12 mm wide. The flowering branches are borne towards the summit of the stems and are 100 to 120 mm long and repeatedly branched or dichotomous with a pair of roundish bracts at each fork. The **flowers**, 5 to 8 mm long, are solitary, and are borne on the ends of branches between a pair of opposite, leafy bracts which are somewhat rounded at the base. The upper and lateral lobes of the **calyx** are triangular and acute whilst the lowest is broadly subulate. The **corolla** is yellow, the **standard** is ovate and clawed, 7 mm long, 9 mm wide, claw 3 mm. The involute edges of the standard are strongly bent. **Wings** 8 mm long, 4 mm wide, obovate and clawed, claw 4 mm long. Lunulae are absent. **Keel** is truncate and clawed, 7 mm long, 4,5 mm wide at maximum, claw 4 mm long. Keel petals are united to the very point. **Staminal sheath** 6 mm long, split on the upper side with four 1 mm long basifixed anthers alternating with six 0,25 mm long dorsifixed anthers. **Gynoecium** 7 mm long, style filiform, upcurved, height of curvature 4 mm high, stigma finely fringed. **Legume** ovate-oblong with a narrow wing on the upper side, on a long stipe (Fig. 48).

Figure 47: Type of R. dichotoma Eckl. & Zeyh. 1190.

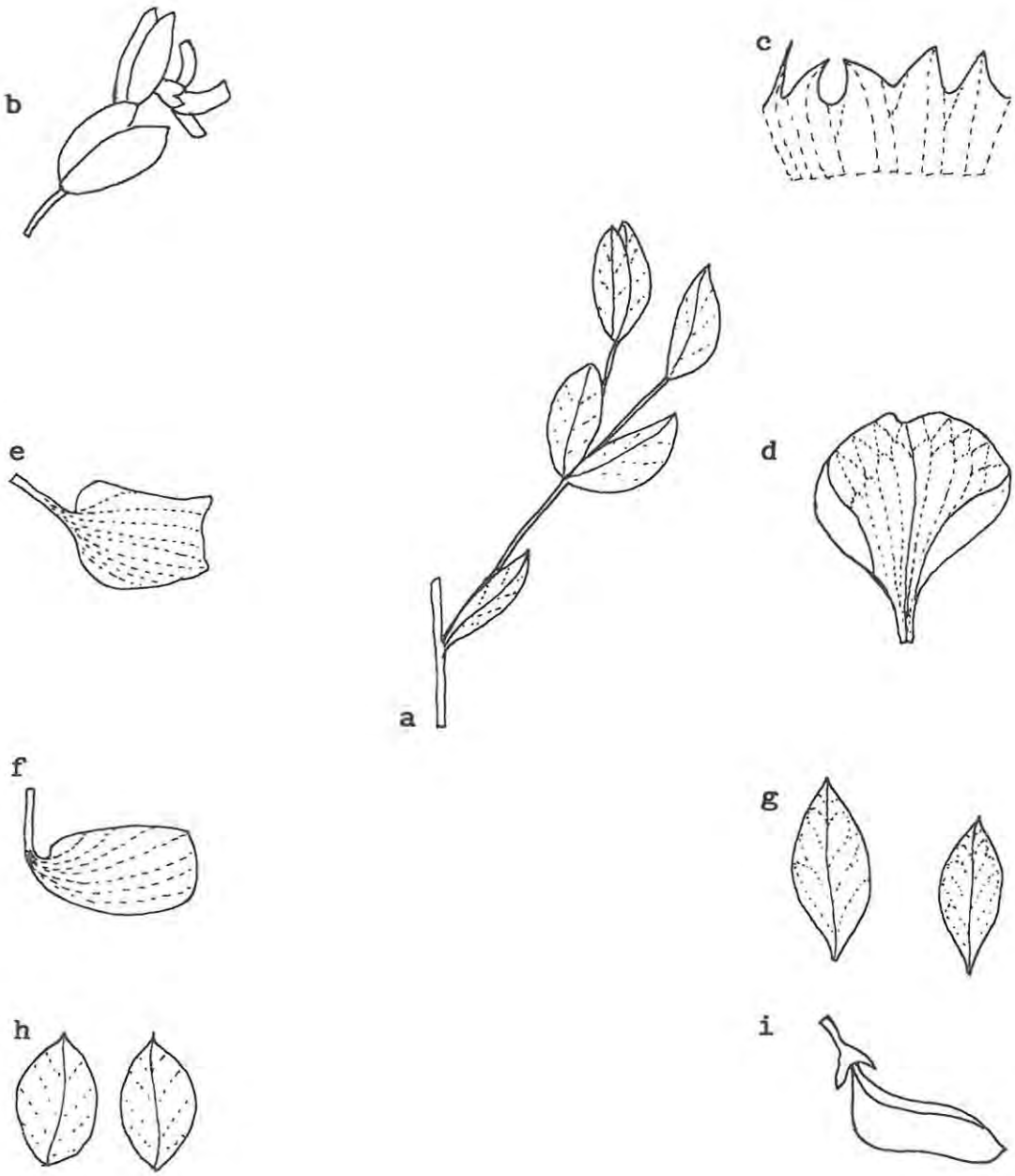


Figure 48: R. dichotoma (a) flowering branch x1, (b) flower x1, (c) calyx opened out x3, (d) standard opened out x3, (e) wing petal x3, (f) keel petal x3, (g) leaves x1, (h) bracts x1, (i) pod x1 (Ecklon & Zeyher 1190, SAM).

Diagnostic features

1. Flowers borne between foliaceaus bracts which are rounded at base.
2. Keel is truncate.
3. Lunulae are absent.

Distribution

On slopes composed of Table Mountain Group soils and sandy flats from Piketberg in the north, stretching southwards as far as Elandskloof in the district of Caledon and eastwards as far as Garcia's Pass in the Langeberg Mountains near Riversdale. (Fig. 49).

Normal Flowering Period: September to November (January).

Collections

3218 (Clanwilliam) Piketberg (-AD) Compton 22963 (UWC; NBG); Maquire 1178 (NBG; BOL); Bolus 8428 (BOL; PRE); Edwards 254 (PRE); Bockenberg (-BC) Leighton in BOL 32557 (BOL); Elandskloof Waterfall (-BD) Rabinowitz s.n. (PRE; STE); Stokoe in SAM 68749 (SAM); Olifants River Mountains (-DB) Esterhuysen 17867 (BOL); Esterhuysen 13467 (BOL); Olifants River Valley (-DB) Esterhuysen 14297 (BOL);

3219 (Wuppertal) Cedarbergen (-AC) Drege s.n. (P); Citrusdal (-CA) Hanekom 1251 (PRE);

3319 (Worcester) Drakensteenberge (-CC) Drege s.n. (P); Jonas Kop (-CD) Rourke 1751 (PRE; STE; NBG); Dassieshoek Peak (-DB) Esterhuysen 29129 (BOL);

3320 (Montagu) Tradouw Pass (-DC) Adamson in SAM 38999 (SAM); Levyns 635 (STE); Barrydale Mountains (-DC) Barnard in SAM 28982 (SAM);

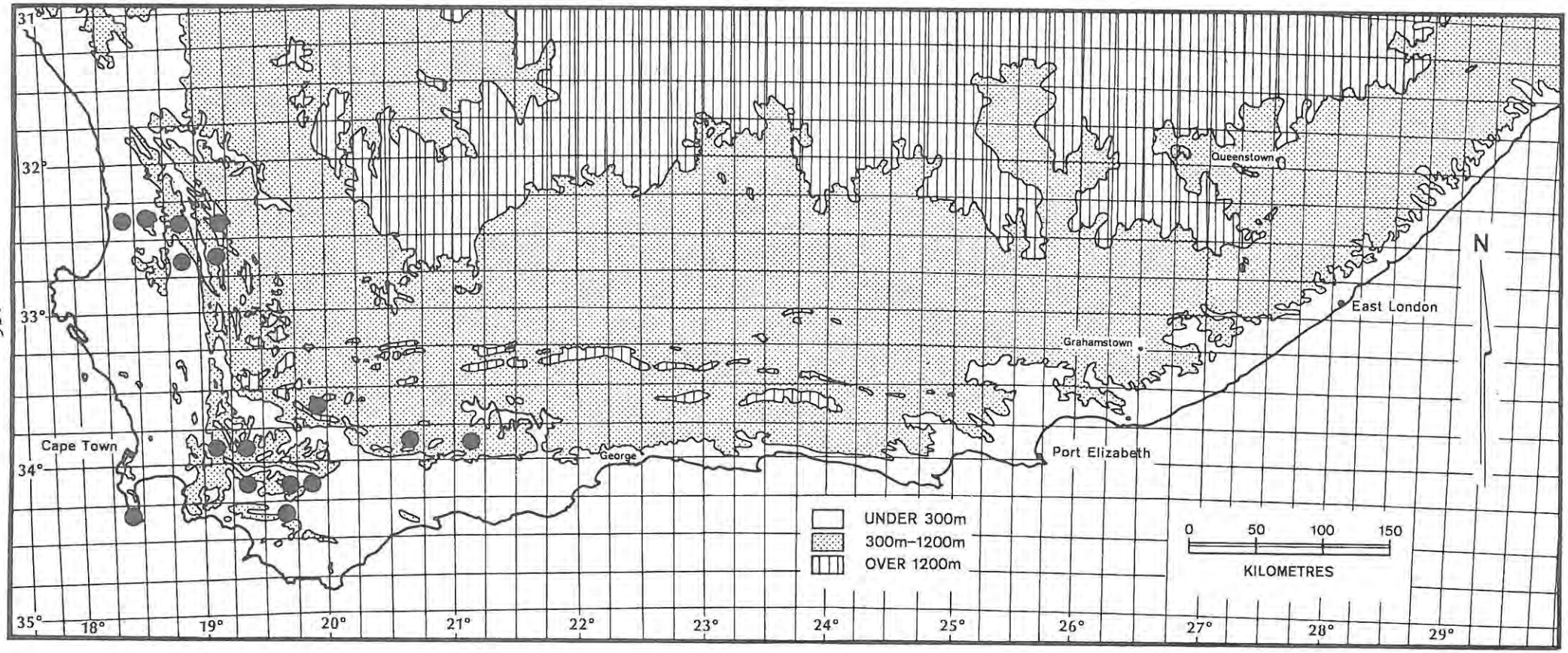


Figure 49: Geographical distribution of R. dichotoma Eckl. & Zeyh.

3321 (Ladismith) Garcia's Pass (-CC) Phillips 325 (PRE; SAM); Galpin 3917 (PRE); Muir 2959 (PRE); Thorne in SAM 43130 (SAM); Thorne in SAM 38932 (SAM); Esterhuysen 28791 (BOL);

3418 (Simonstown) Cape of Good Hope (-AD) Masson s.n. (BM); Thom s.n. (K);

3419 (Caledon) Zwartberg (-AB) Zeyher in SAM 15211 (SAM); Caledon (-AB) Bolus s.n. (BOL); Burchell 7742 (K); Riviersonderend Mountains (-BA) Stokoe in SAM 57819 (SAM; STE); Genadendal Mountains (-BA) Ecklon & Zeyher 1190 (NBG); Bolus 372 (NH; SAM; BM; BOL); Greyton (-BA) Rycroft 3221 (NBG); Dasberg (-BB) Stokoe in SAM 62240 (SAM).

Ecology

Usually found growing on slopes composed of soils of the Table Mountain Group or on plains in gravely places or sandy vlaktes.

Notes

The problem attending Pelecynthis dichotoma and P. gibba is complex as it concerns three names and four specimens. Meyer's Pelecynthis dichotoma was based on a Drege specimen from Drakensteen, whereas Walpers's Rafnia dichotoma was based on Eckl. & Zeyh. 1190 from Genadendal, Caledon (Type of R. dichotoma in NBG). Further, Walper's also saw the Drege specimen and placed it in synonomy under R. pauciflora (Eckl. & Zeyh. 1195) which species is not listed by Meyer. Pelecynthis gibba E. Mey was based on a Drege specimen from the Cedarberg. Walpers placed this species as a synonym under his Rafnia dichotoma (Eckl. & Zeyh. 1190). This problem was noted by Bentham in Ann. Mus. Vind 11: 142 and recorded by Presl. in Bot. Bemerk. 1844,

who states that: "R. pauciflora Eckl. & Zeyh. = P. dichotoma E. Mey. and R. dichotoma Eckl. & Zeyh. = P. gibba E. Mey." In 1916 Druce listed this new combination of P. gibba with Meyer's P. dichotoma and R. dichotoma Eckl. & Zeyh. as synonyms. In this revision, R. dichotoma Eckl. & Zeyh. is upheld with R. gibba and P. gibba as synonyms.

8. Rafnia spicata Thunb. in Nov. Gen. Pl. 10: 147 (1800); Thunb. Fl. Cap.: 564 (1825), DC. Prodr. ii: 119 (1825); Harvey in Harv. & Sond. F.C. ii: 38 (1862). Type: Cape of Good Hope, Thunberg in UPS 16441 (UPS Holo!) (Fig. 50).

A small many-stemmed, procumbent shrub with slender stems. **Leaves** blue-green, scattered 15-30 mm long, 3-6 mm wide, linear-lanceolate, acuminate, veinless. **Flowers** small, 4-5 mm long in a densely racemose arrangement. **Peduncles** axillary, one-flowered, nearly as long as the subtending leaf, with a pair of linear leafy bracts near the summit. The upper and lateral **calyx** lobes are triangular, acute and the lowest is subulate, shorter than the tube. The **corolla** is yellow. The **standard** is 6 mm long, 6 mm wide, with a long claw, 4 mm long. **Wings** 6 mm long, 3 mm wide, obovate, lunulate, clawed. **Keel** is naviculate, keel blades are fused, 5 mm long, 3 mm wide at maximum, clawed. **Staminal sheath** 6 mm long, split on upper side with four large, basifixed anthers on short filaments alternating with six small dorsifixed anthers on longer filaments. **Gynoecium** 6 mm long, style filiform, upcurving, height of curvature 2,5 mm high, stigma capitate, finely fringed. **Legume** stipitate, 2 seeded (Fig. 51).

Diagnostic features

1. Many stemmed procumbent shrub.
2. Flowers in a densely racemose arrangement.
3. Naviculate keel
4. Wings have lunulae.

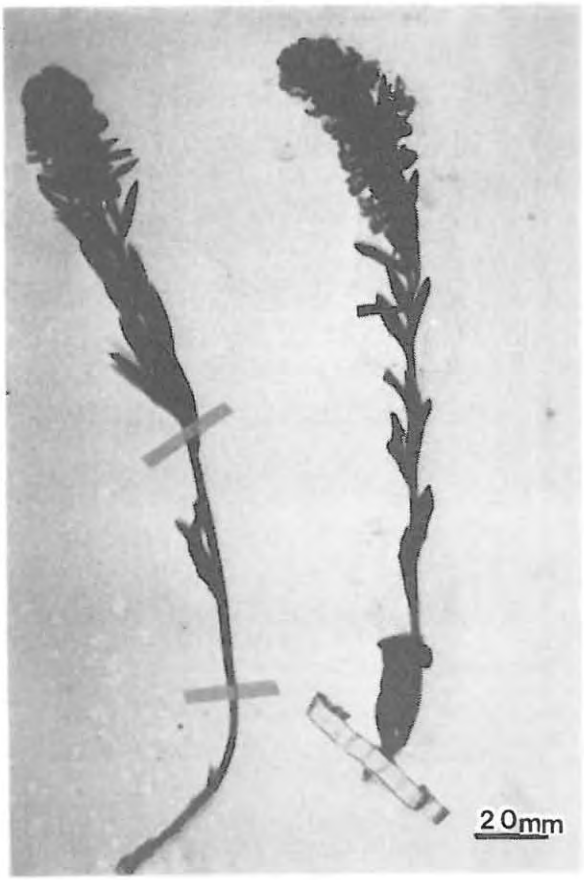


Figure 50: Type of R. spicata Thunberg in UPS, 16441.

Figure 51: R. spicata (a) flowering branch x1, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3, (f) leaf x1 (Bolus 7337, BOL), (g) pod x1 (Hanekom 2541, PRE).

Distribution

In level sandy ground, on shalebands and on stony sandy mountain slopes from Wuppertal in the north stretching southwards in a narrow belt as far as Bot River on the coast with the main concentration in the Ceres and Worcester districts. (Fig. 52).

Normal Flowering Time: (September) October (December).

Collections

3218 (Clanwilliam) Olifants River (-BB) Esterhuysen 13468 (BOL);

3219 (Calvinia) Cedarberg (-AC) Taylor 745 (STE); Viviers 13 (JH); Emdon 203 (STE; PRE); Kruger KR971 (JH); Niewhoudpas (-AC) Pocock 794 (STE); Wuppertal (-AC) Thode A1984 (NH; PRE); Waboomsrivier (-AC) Hanekom 2541 (PRE);

3319 (Worcester) Twenty Four Rivers Mountains (-AA) Esterhuysen 16105 (BOL); Ceres (-AD) Guthrie in BOL 32559 (BOL); Kolbe s.n. (BOL); Bolus 7337 (BOL); Stokoe in SAM 63834 (SAM); Hanekom 1259 (PRE); Levyns in SAM 31650 (SAM);

3418 (Simonstown) Cape of Good Hope (-AD) Burman (G).

3419 (Caledon) Bot River (-AC) Taylor 4068A (NBG);

Ecology

This plant is usually found growing in very sandy areas in Restionaceae and Proteaceae veld.

Notes

R. spicata Thunb. differs from the prostrate form of R. capensis (L.) Schinz by having a naviculate rather than a truncate keel and

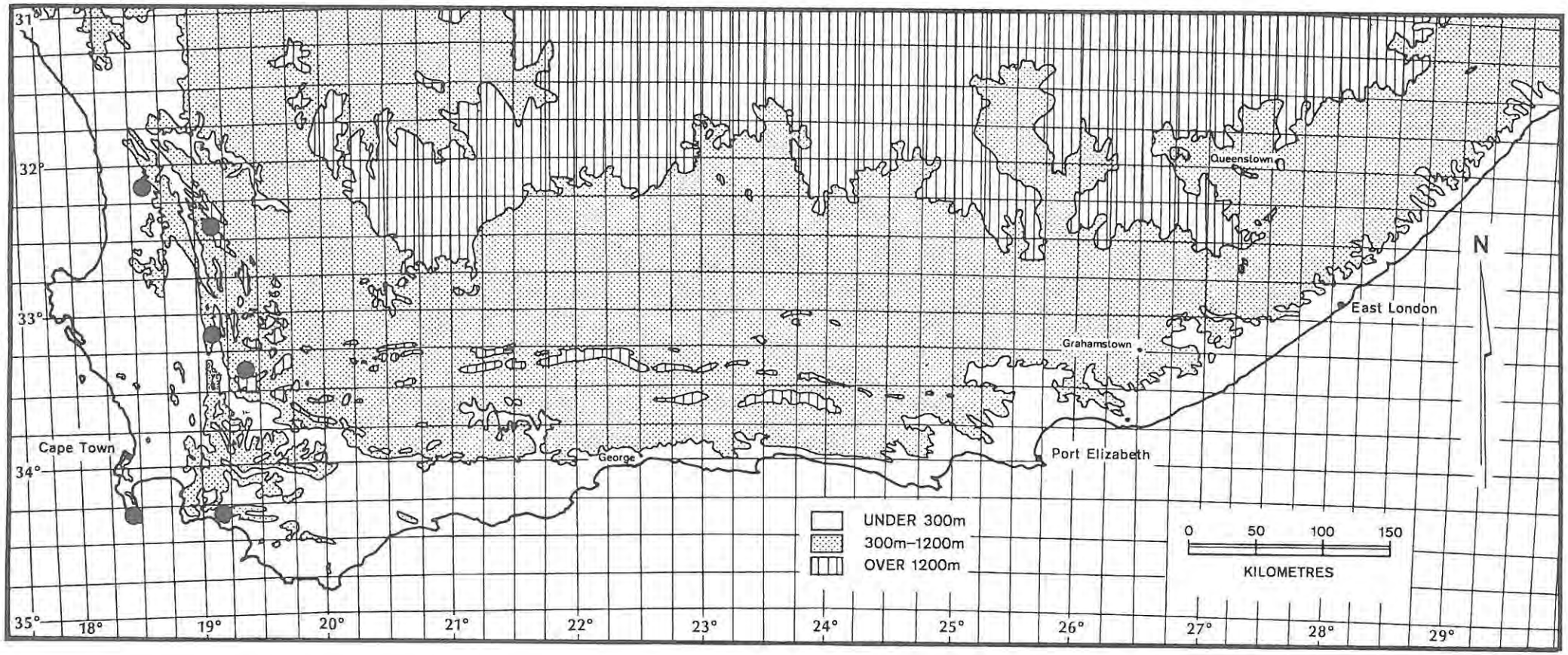


Figure 52: Geographical distribution of R. spicata Thunb.

by possessing lunulae. In addition R. spicata has a densely racemose arrangement totally unlike the inflorescence of R. capensis which has solitary flowers or peduncles which are once or twice forked.

9. Rafnia triflora (L.) Thunb. in Nov. Gen. Pl.: 145 (1800); Thunb Prodr. 123 (1800); Thunb. Fl. Cap. (ed. Schult) 563 (1800); DC. Prodr. ii 119 (1825); Harvey in Harv. & Sond. F.C. ii: 33 (1862); Schinz Bull. Herb. Boissier ii: 200 (1894). Type: Cape Constantia. Eckl. & Zeyh. 1181 (NBG Neotype!) (Fig. 53a).

Crotolaria triflora L. Sp. Pl. ed. 1: 715 (1753).

Rafnia alpina Eckl. & Zeyh. Enum. 160 (1836). Type: Cape, Table Mountain Eckl.& Zeyh. 1184 (not seen).

R. fastigiata Eckl. & Zeyh. Enum. 160: (1836). Type: Cape Puspasvalley (Swellendam) Eckl. & Zeyh. 1182 (P Holo! SAM isotype!) (Fig. 54).

An erect, bushy, perennial shrub, 1-2 m tall, with ascending angular branches. **Leaves** roundish-obovate, elliptical or ovato-lanceolate, mucronate, obtuse at base measuring 37,5 to 75 mm long and 12,5 to 62,5 mm wide. **Flowers** axilliary, about 20 mm long in a three-flowered cymose arrangement, the central flower more advanced than the lateral ones with a pair of foliaceous bracts at the base of the very short peduncle. The flower is articulated on a long pedicel 12-15 mm long. Four tiny setaceous awl-shaped bracts are found at the base of the calyx at the point of articulation. The **calyx** is nearly 10 mm long. The upper calyx teeth are broadly falcato-cultrate, lateral acutely triangular, lowest narrow subulate, as long as the rest. The **corolla** is yellow. The **standard** is broadly ovate and clawed, about 18 mm long and 22 mm wide. The **wings** are obovate, clawed, lunulate, each of 5-6 rows comprising 15-25 intercostal lunulae. The **keel** is broadly rostrate and clawed, the blades are fused, 12-15 mm long and 10-12 mm wide at maximum, claw 5 mm long. **Stamens** monodelphous, **staminal**

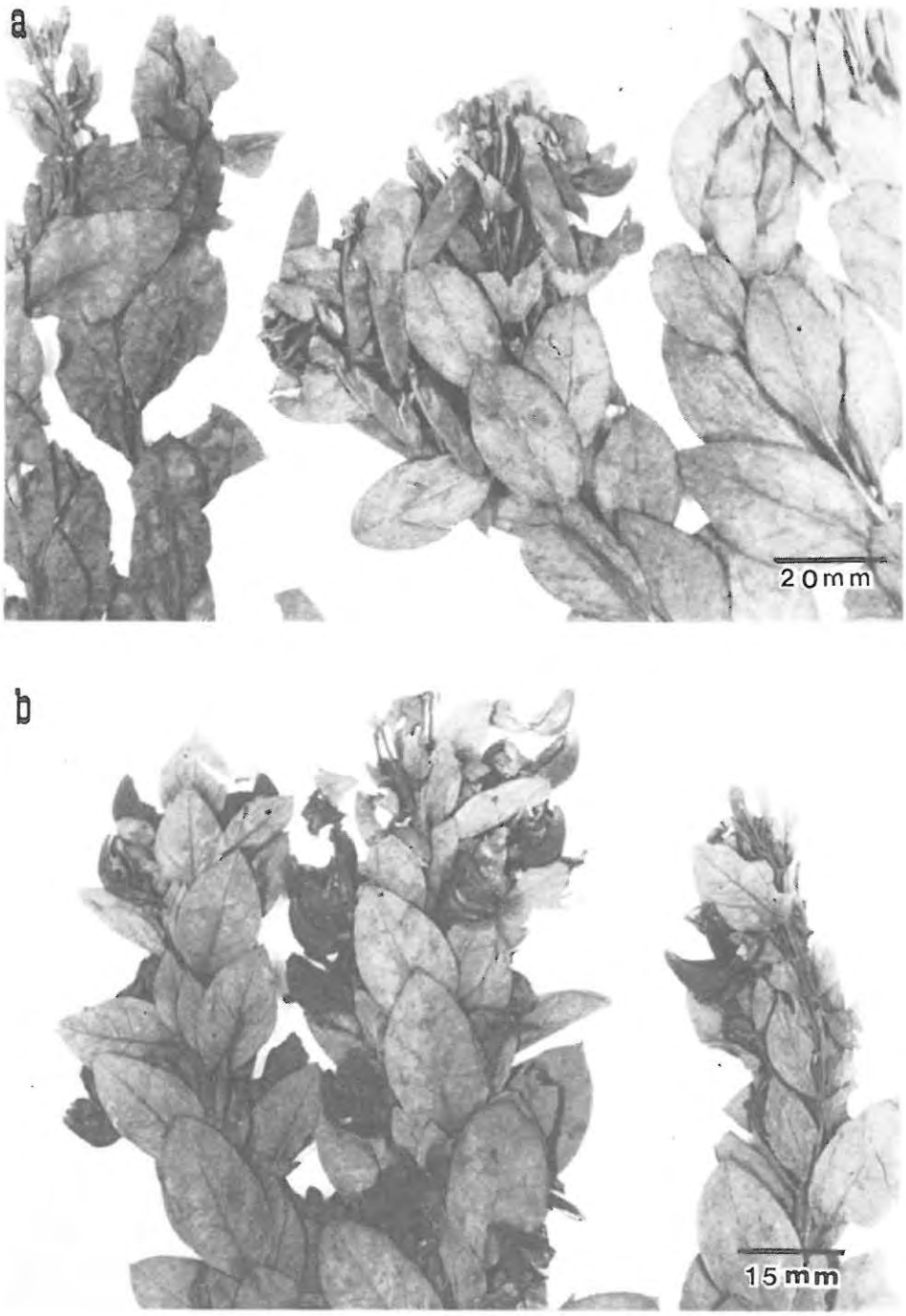


Figure 53: (a) Neotype of R. triflora Eckl. & Zeyh. 1181.

(b) Photograph of R. triflora Thunb. in UPS 16437.

Figure 54: Type of R. fastigiata Eckl. & Zeyh. 1182.

sheath 15 mm long with four 2,25 mm long basifixed anthers alternating with five 1 mm long dorsifixed anthers. The carinal anther is 1,25 mm long. **Gynoecium** 18 mm long, style filiform, sharply upcurving, height of curvature 10 mm high, stigma capitate, finely fringed. **Pods** are pendulous and reflexed and have a very narrow wing on the upper side, 25-30 mm long, 5 mm wide (Figs. 53b, 55, 56 & 57).

Diagnostic features

1. Flowers in a three-flowered cymose arrangement.
2. Flower is articulated on a long pedicel.
3. Four awl-shaped bracts are found at the point of articulation.
4. Keel rostrate.
5. Wings lunulate.

Distribution

Stretches from Clanwilliam southwards to Camps Bay and eastwards along the coast as far as Storms River. The main concentration is around Camps Bay with fewer collections from the Oudtshoorn-George area (Fig. 58).

Normal Flowering Period: September to January.

Collections

3218 (Clanwilliam) Clanwilliam (-BB) Pillans (BOL);

3318 (Cape Town) Camps Bay (-CD) Grobbelaar 1200 (PRE; PRU); Kirstenbosch (-CD) Young 209 (PRE); Henderson 1403 (NBG); Pearson in BOL 32552 (BOL); Devils Peak (-CD) Penfold 193 (NBG); Table Mountain (-CD) MacOwan 2696 (NH); Ellis 45 (NBG); Gillet 3496 (STE); Thode 6073

Figure 55: R. triflora. Photocopy of drawing by W. Curtis.

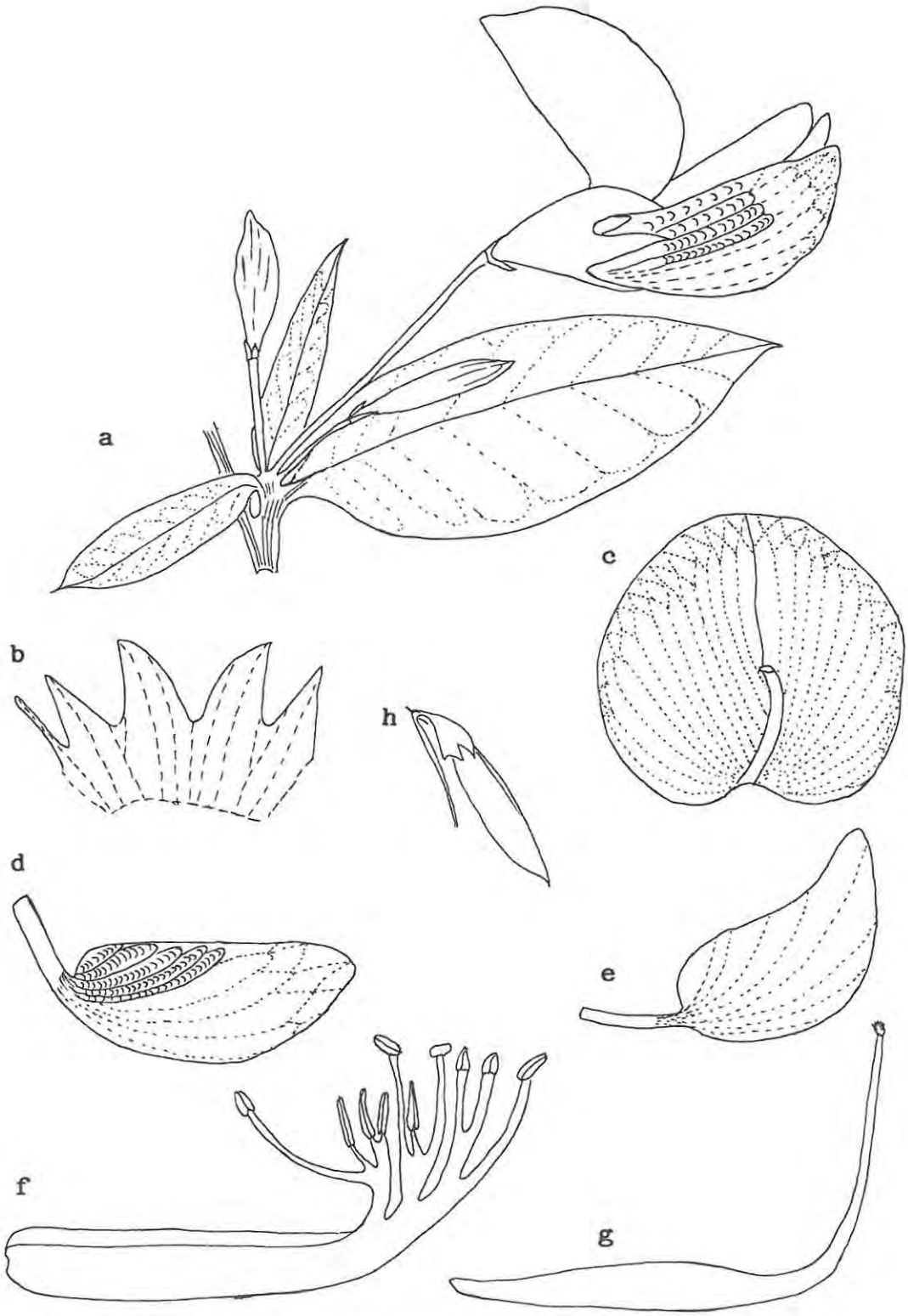


Figure 56: R. triflora (a) flowering branch x3, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae, (e) keel petal x3, (f) staminal sheath x4, (g) gynoecium x4, (h) pod x1 (Purcell s.n. SAM).

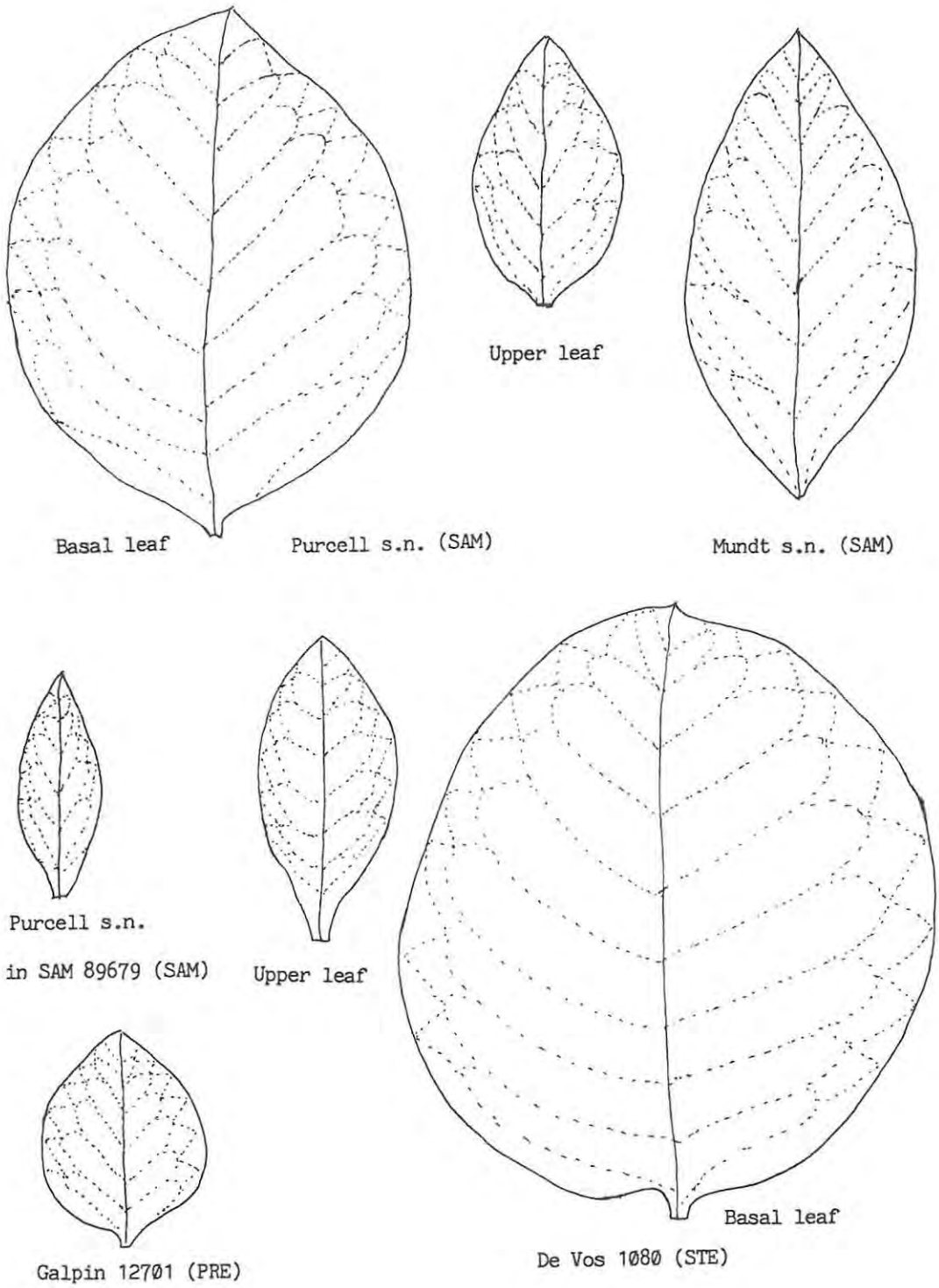


Figure 57: R. triflora. Leaf variation x1.

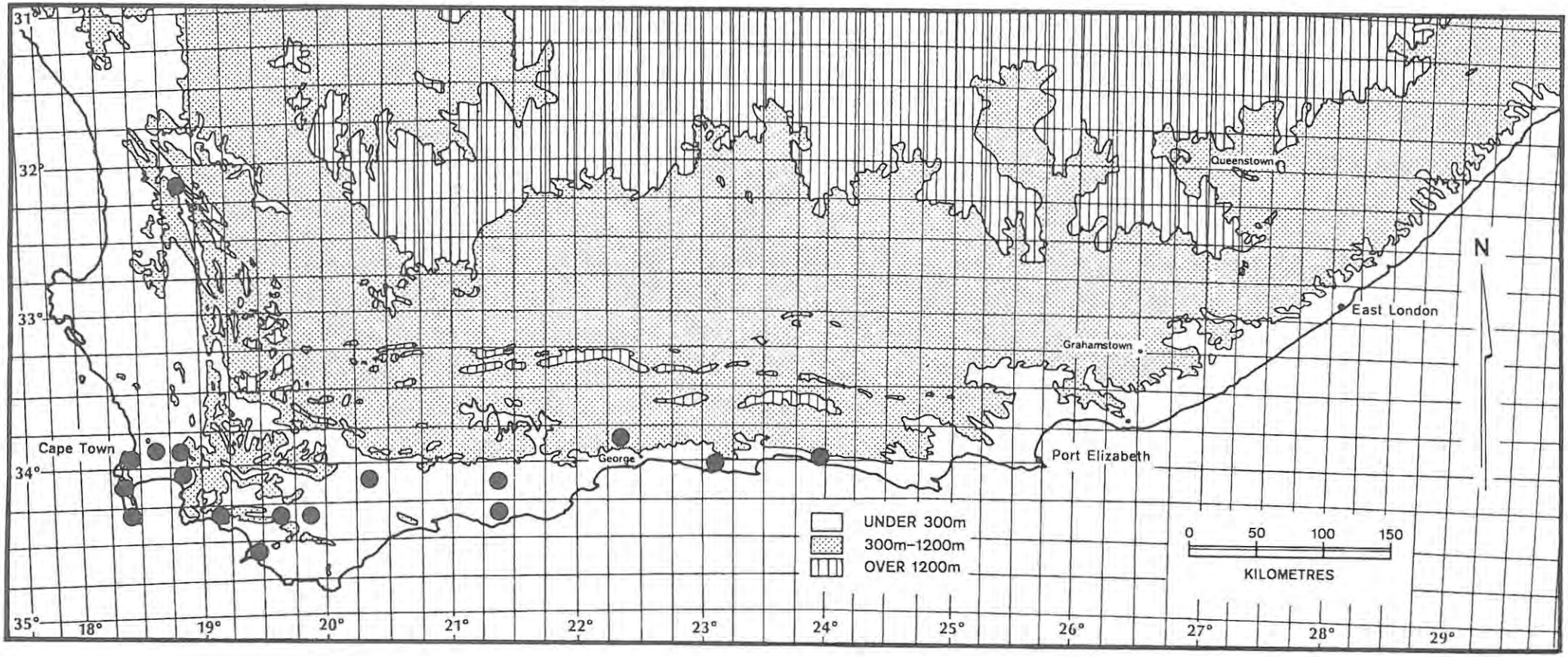


Figure 58: Geographical distribution of R. triflora Thunb.

(STE); Treleaven 142 (STE); MacOwan 812 (UPS; BOL; P; NBG; BM); Cape Neck (-CD) Moss 7474 (J); Behind Groot Schuur (-CD) Woolley Dod 467 (BOL); Constantia (-DC) Zeyher 1181 (NBG); Ecklon 675 (BM); Newlands (-DC) Marloth 1622 (PRE); Stellenbosch (-DD) Gillet 564 (STE);

3322 (Oudtshoorn) George (-CD) Guthrie 4301 (NBG); Bowie s.n. (BM);

3418 (Simonstown) Constantia Nek (-AB) Grobbelaar 351 (PRU; PRE); Simonstown (-AB) Taylor 6057 (STE); Chapman's Peak (-AB) Whellan 1784 (PRE); Barker 3284 (NBG); Kalk Bay Mountain (-AB) Goldblatt 5101 (PRE); Salter s.n. (P; BM); Red Hill (-AB) Grobbelaar 2202 (PRE); Karbonkelberg (-AB) Compton 15389 (NBG); Leighton 668 (BOL); Bergvliet Farm (-AB) Purcell 259 (SAM); Purcell in SAM 89679 (SAM); Purcell in SAM 89677 (SAM); Wynberg Mountains (-AB) Zeyher in SAM 31305 (SAM); Hall s.n. (SRGH); Drege 27 (P); Marloth 553 (PRE); Drege s.n. (BM); Wallich s.n. (P); Bolus 4611 (P; BOL; BM); Salter 9352 (BM); Orange Kloof (-AB) Stokoe in SAM 59607 (SAM); Wolley Dod 1701 (P; BM); Boyes Drive (-AB) Salter 7869 (BOL); False Bay (-AB) Bolus 3065 (BOL); Cape of Good Hope (-AD) Thunberg s.n. (UPS); MacOwan 2696 (NH); Ecklon s.n. (P); Drege s.n. (P; UPS); Lehman s.n. (P); Masson s.n. (BM); Oldenburg s.n. (BM); Nelson s.n. (BM); Rehmann 1079 (P; BM); Wallich s.n. (UPS; BM); Sieber 51 (P); Cape Peninsula (-AD) Galpin 12701 (PRE); Barber 5345 (UWC; NBG); Cape of Good Hope Nature Reserve (-AD) Richardson 205 (RUH); Kogel Bay (-BB) Boucher 2050 (STE); Leighton 2472 (BOL); Hottentots Holland Mountains (-BB) Stokoe 6142 (BOL);

3419 (Caledon) Kleinmond (-AC) de Vos 1080 (STE); Stokoe in STE 31485 (STE); Hangklip Estates (-BC) Stokoe in SAM 62242 (SAM); Kogelberg (-BD) Compton 18958 (NBG; UWC); Palmiet River (-BD) Stokoe in SAM 61416 (SAM); Stanford (-CB) Chambers in NBG 85107 (NBG);

3420 (Bredasdorp) Swellendam (-AB) Mundt in SAM 15204 (SAM);
3421 (Riversdale) Corente River Farm (-AB) Muir 61 (PRE); Riversdale (-AB) Muir 618 (PRE); Puspasvalley Swellendam (-AD) Eckl. & Zeyh. 1182 (P; SAM);
3423 (Knysna) Knysna (-AA) MacOwan 1602 (UPS; NBG; BM); Pocock 414 (STE); Storms River (-BB) Taylor 3730 (NBG); Tsitsikamma (-BB) Schlechter 5967 (BOL).

Ecology

Usually found in exposed shallow soils of the Table Mountain Group as well as in loam.

Notes

It has not been possible to trace the type material of Crotalaria triflora L. In Sp. pl. 2: 715 (1753) Linnaeus has a new diagnosis, not taken from any earlier work, and states: "Habitat in Asia. D. Royen". This implies that Linnaeus either saw material with Royen when Linnaeus was in the Netherlands in 1737-38 or that Royen sent him material later. Unfortunately Dr C.E. Jarvis from the British Museum has been unable to trace the material as the only material (Sheet 908, 122-50) at Leiden appears to be rather later and certainly the material at LINN. seems not to have been acquired by Linnaeus until after 1753 (895 16-18 LINN) (Pers. comm.).
The form named R. fastigiata by Ecklon & Zeyher differs from this species in the proportion of the calyx lobes having more isosceles-triangled upper calyx lobes and more lance-shaped leaves. As these are very trivial characters they do not justify upholding R. fastigiata as a separate taxon thus Shinz in 1894 correctly placed

this species in synonymy with R. triflora. It should be noted, however, that in Eckl. & Zeyh's Enum. the name used is R. fastigata. This is obviously a printing error as on the Eckl. & Zeyh. sheet no. 1182 the name is R. fastigiata. R. fastigata is thus an illegitimate name.

10. Rafnia ericifolia Salter in Jl S.Afr. Bot. XII: 39 (1946). Type: 3318 (Cape Town) Belville near Hercules Pillar (-DC) Salter 6567 (BOL; Holo! PRE isotype!) (Fig. 59).

A small, rather compact glabrous shrublet, dome shaped in habit, up to about 200 mm high, with numerous ascending or spreading branches. **Leaves** ascending to erect, imbricate, sessile, linear, obtuse, mostly 5-8 mm long, about 0,6 mm broad, the median vein prominent above; margins sometimes slightly revolute. **Flowers** few, lateral, mostly near apex of branchlets. **Peduncles** 1-flowered, semi-reflexed, swollen at the apex. Bract filiform, scarcely 1 mm long; bracteoles minute, 0,4 mm long, near the base of the peduncle. **Calyx** about 7 mm long, the tube subobconic; lobes as long as the tube, more or less lanceolate, the posterior narrower than the remainder. **Petals** yellow, subequal in length. **Standard** about 10 mm long, ovate, acute, keeled, 5 times as long as the curved claw. **Wings** 7,5 mm long, 2,5 mm wide, obovate, lunulate. **Keel** blades fused 8 mm long, 3 mm wide at maximum, rostrate. **Staminal sheath** 6 mm long, split on upper side. Anthers alternately globose and lanceolate, the latter sterile. **Ovary** about 5mm long, 1 mm broad, 4 ovuled, style filiform, 6,5 mm long, inflexed, the stigma minute and finely fringed. **Pod** about 2,3 cm long, 4,5 mm broad, flat, reflexed, somewhat glabrous (Fig. 60).

Diagnostic Features

1. Dwarf habit
2. Leaves ericoid
3. Keel rostrate
4. Wings lunulate

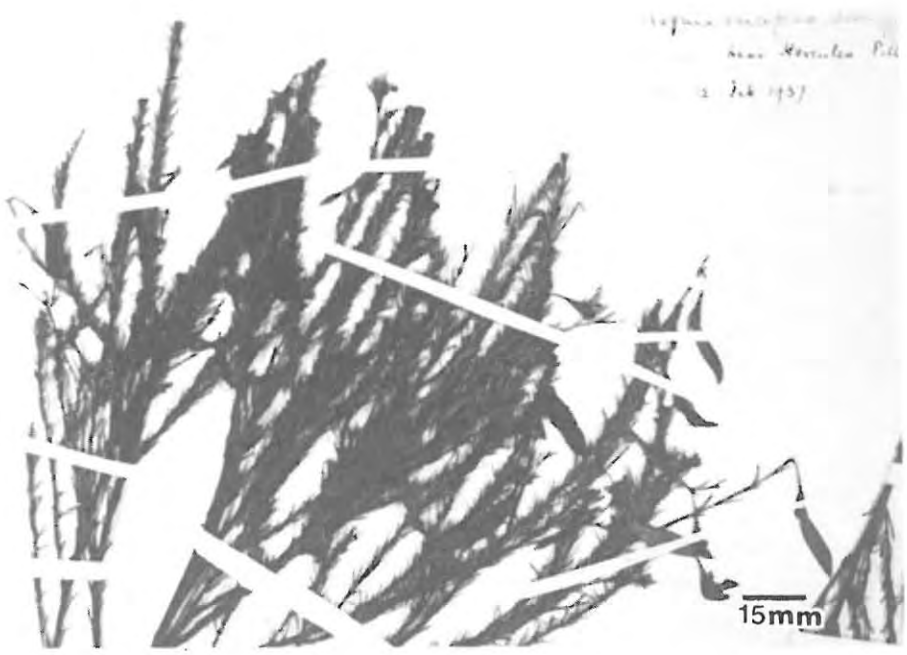


Figure 59: Type of R. ericifolia Salter.

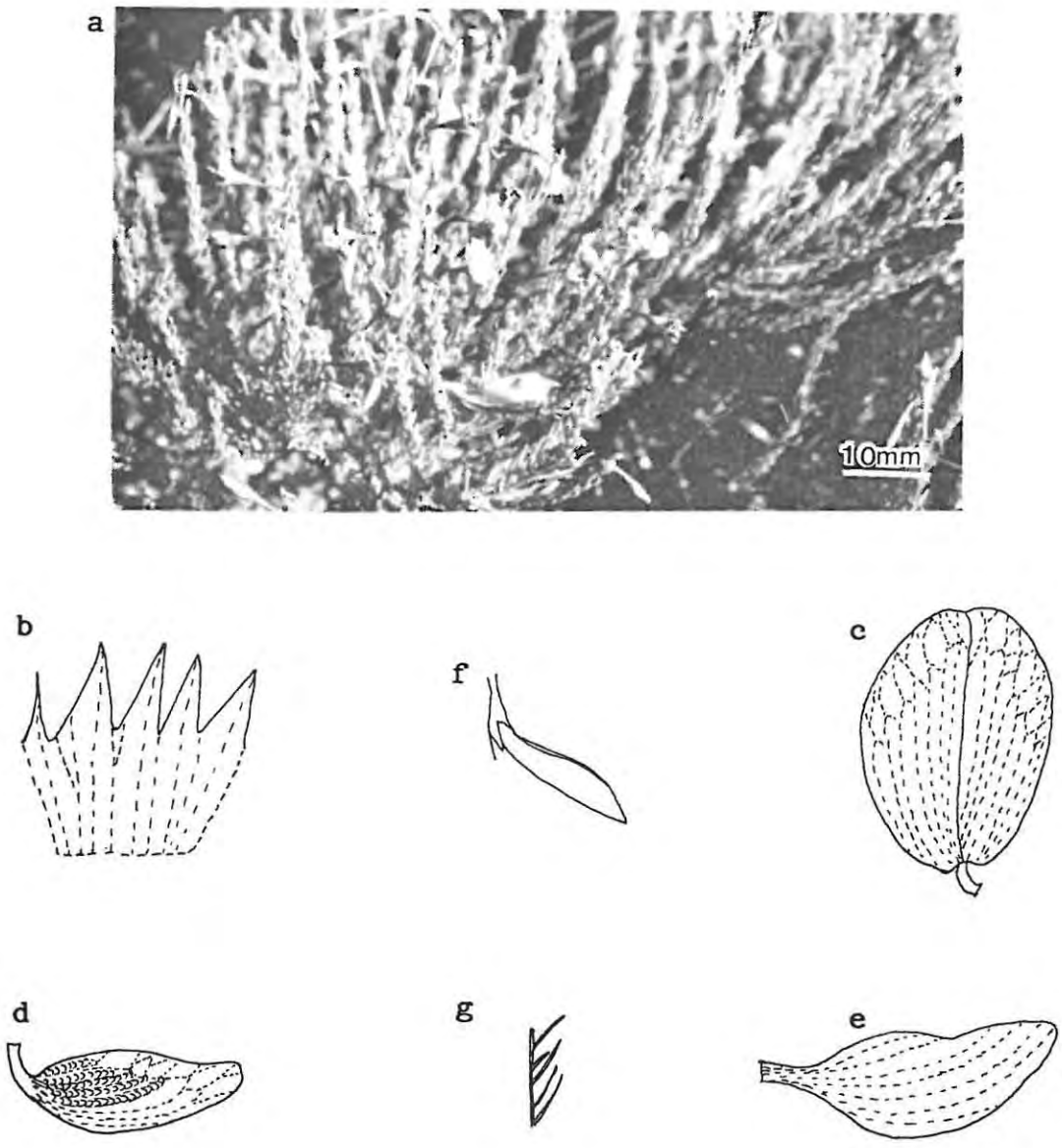


Figure 60: R. ericifolia (a) flowering plant, (b) calyx opened out x 3, (c) standard opened out x 3, (d) wing petal showing intercostal lunulae x 3, (e) keel petal x 3, (f) pod x 1, (g) leaves x 1 (Salter 6567 BM).

Distribution

Found only at Klipheuwel and south of Paarl Berg near Cape Town (Fig. 61).

Normal Flowering Period: January to March.

Collections

3318 (Cape Town) Klipheuwel Radio Mast (-DA) Boucher 3535 (PRE); Oliver 8665 (STE); Richardson 208 (RUH); Moss 8750 (BM); Belville District near Hercules Pillar (-DC) Salter 6567 (BM; P; BOL; PRE); Salter 6568 (BM).

Ecology

Found scattered along a quartzite outcrop in Klipheuwel formation in a remnant fynbos patch.

Notes

This species can be at once distinguished by its dwarf habit and small ericoid leaves. Apparently it never flowers very profusely. It differs from the narrow-leaved R. angulata by having shorter leaves, smaller flowers and a decidedly dwarf habit. Only one population of R. ericifolia has been located. This population is at Klipheuwel near Stellenbosch where about 20 plants scattered along the quartzite outcrops were seen. These plants were all reasonably old with no signs of seedlings. There were scattered flowers and young fruits seen at the end of January. Although the plants had many pods, most of them contained no seeds. It appears that the seeds are eaten by insects.

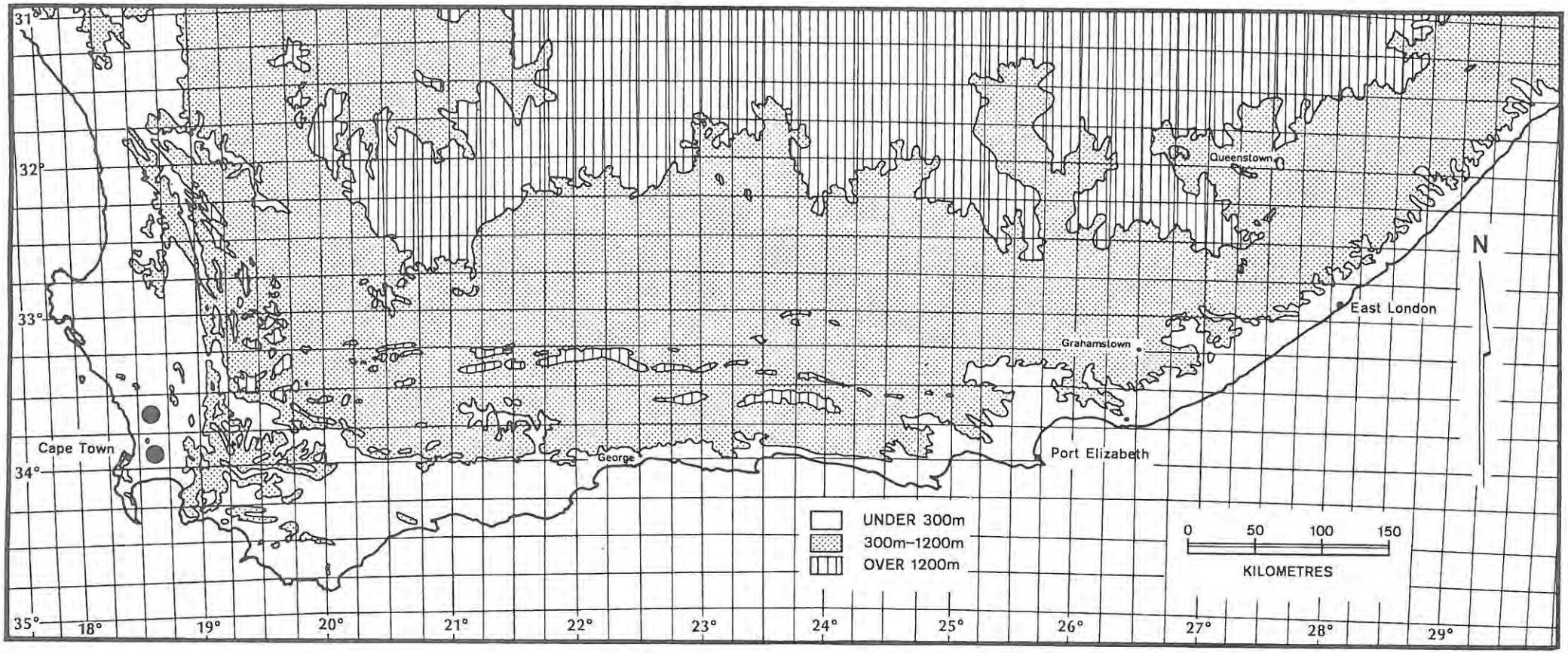


Figure 61: Geographical distribution of R. ericifolia Salter.

11. Rafnia thunbergii Harvey in Harv. & Sond. F.C. ii 36 (1862). Type: ex Cape of Good Hope Thunberg in UPS 16434 (UPS holo!) (Fig. 8). Isotype: in S (Fig. 62).

An erect woody shrub up to 1,5 m high with virgate branches. The lower half of the branch is densely leafy while the upper half, for about 35 cm is converted into a dense thyrsoid inflorescence. The **leaves** are linear, attenuate, 1 to 3 mm wide and 25 to 30 mm long. The individual flowering branches are axillary, 4 to 6 cm long, bearing 1 to 3 flowers and one or two pairs of leaves. The upper and lateral calyx teeth are deltoid-acuminate, not half as long as the tube, with rounded interspaces. The lowest calyx tooth is setaceous and shorter than the rest. The **corolla** is yellow. **Flowers** are 10 - 15 mm long. The **standard** is ovate and clawed, 13 mm wide and 14 mm long. The claw is 4 mm long. **Wings** 12 mm long, 5,5 mm wide, obovate, lunulate, each of 6-8 rows comprising 15-25 intercostal lunulae. The **keel** blades are fused and the keel is sharply upcurved and much longer than the standard. It is 16 mm long, 7 mm wide at maximum, claw 5 mm long and the apex is rostrate. **Staminal sheath** 12 mm long, split on upper side, with five 2 mm long basifixed anthers alternating with six 0,5 mm long dorsifixed anthers. **Gynoecium** 10 mm long, style filiform, sharply upcurving, height of curvature 10 mm high, stigma capitate, finely fringed. **Pods** small 10 mm long and 2 mm wide tapering at base into a stipe. (Fig. 63).

Diagnostic features

1. Flowers in a dense thyrsoid inflorescence.
2. Keel rostrate, sharply upcurved.
3. Pods small, tapering at base into a stipe.

Figure 62: Isotype of R. thunbergii Harv.

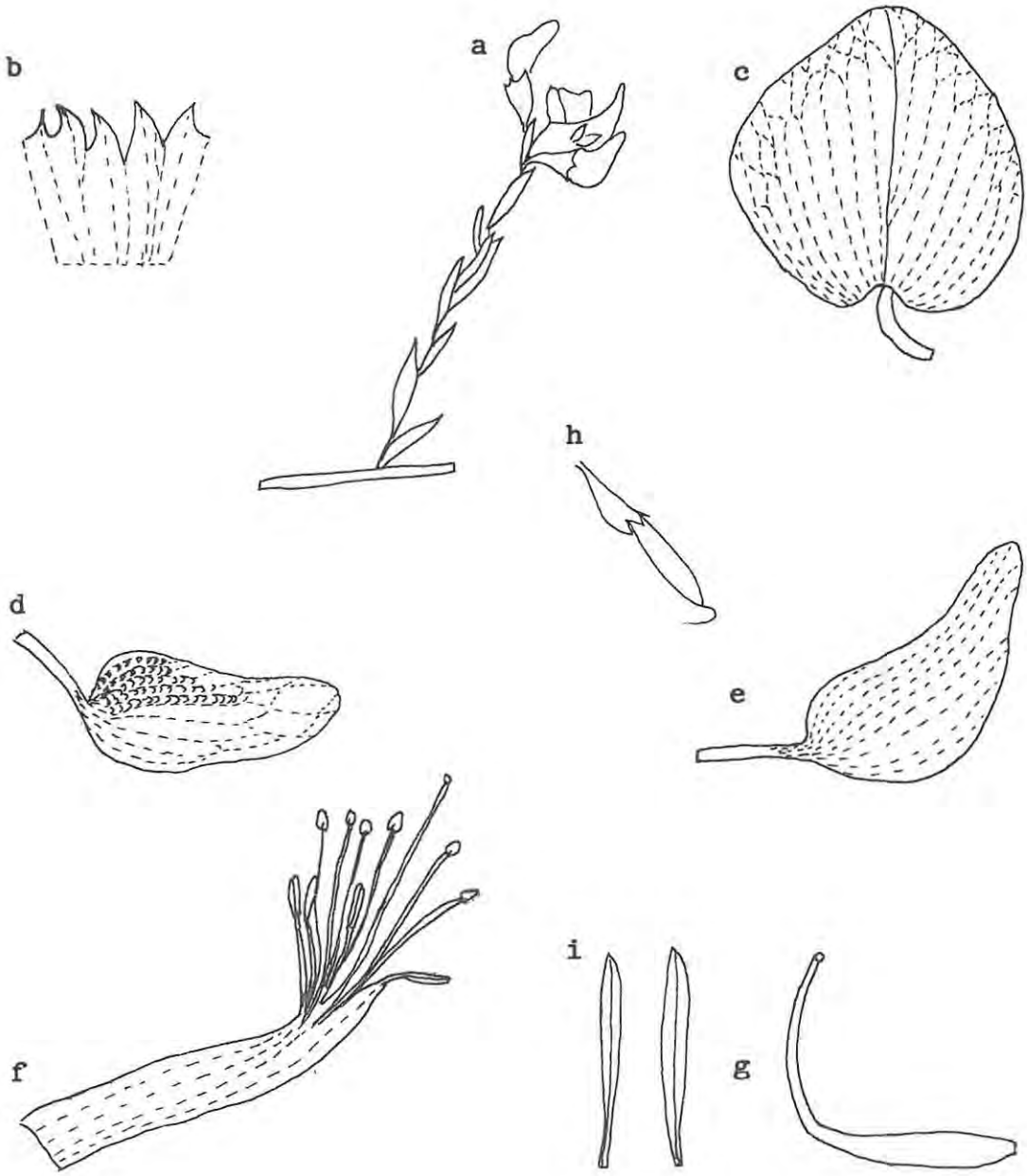


Figure 63: R. thunbergii (a) flowering branch x1, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (ed) keel petal x3, (f) staminal sheath x4, (g) gynoecium x3, (h) pod x1, (i) leaves x1 (Rycroft 2094, NBG).

Distribution

In sand in the Worcester district from Rawsonville in the north to the Breede River in the south and westwards to Stellenbosch. (Fig. 64).

Normal Flowering Period: November.

Collections

3318 (Cape Town) Stellenbosch (-DD) Parker 3957 (BOL; NBG);

3319 (Worcester) Worcester (-CB) Lewis 3583 (SAM); Rawsonville (-CB) Walters 147 (NBG); De Doorns (-CD) Thorns in NBG 14263 (NBG); Eliovson in J 26984 (J); Schlieben & Von Breda 9933 (PRE); Breede River (-DC) Rycroft 2094 (UWC; NBG); Compton 24446 (NBG).

Ecology

This species grows in black or white sandy soil mainly at roadsides.

Notes

This species is founded on one of the sheets marked R. filifolia in Thunberg's Herbarium. The thyrsoid habit is so peculiar and the calyx so completely different to that of any other of the rostrate keel rafnias that this is a very clearly marked taxon.

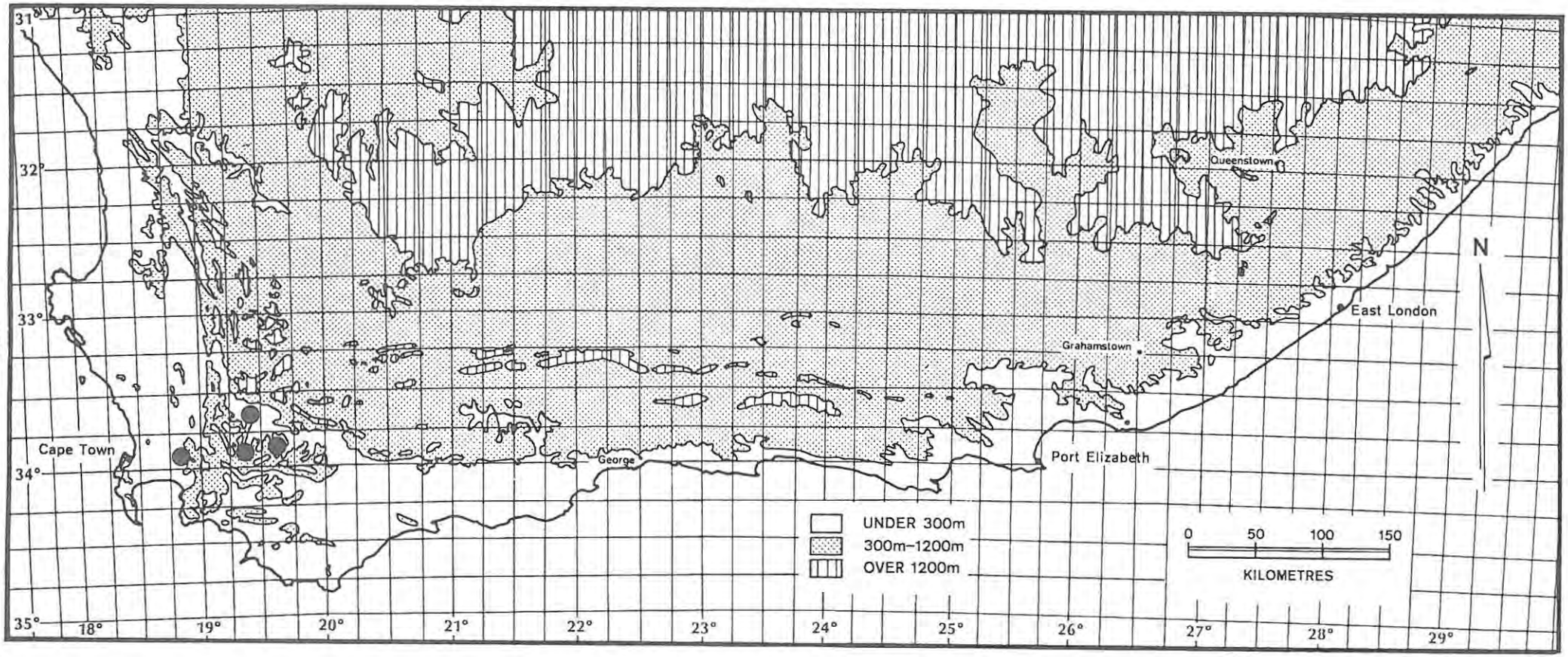


Figure 64: Geographical distribution of R. thunbergii Harv.

12. Rafnia diffusa Thunb. in Nov. Gen. Pl. 149 (1800); Thunb.,Prodr. 123 (1800) et Fl. Cap. (ed. Schult) 564 (1825); DC. Prodr. ii: 119 (1825); Harvey in Harv. & Sond. F.C. ii: 38 (1862); Schinz in Bull. Herb. Boissier ii: 199 (1894). Type: Cape of Good Hope, Thunberg in UPS 16432 (UPS holo!). (Fig. 65).

Pelecynthis diffusa E. Mey. Comm. 14 (1835). Type: Cape of Good Hope, Drege s.n. (P. holo!).

P. retroflexa E. Mey. Comm. 14 (1835). Type: Onderbokkeveld, Drege s.n. (K holo! P).

Small spreading procumbent shrub, 200 to 300 mm in height with a thick, woody, deeply descending root. Glaucous, lax and spreading with many trailing or diffusely sub-ascending, slender, terete and much branched stems. The lowest **leaves** are broadly cuneate-obovate 10-20 mm long and 8-15 mm wide. The upper leaves are much smaller and lanceolate 5-9 mm long, 2-4 mm wide. The slender twigs are almost entirely without opposing leaves. **Flowers** at the ends of branchlets on short pedicels are small, about 5 mm long and solitary. **Calyx** oblique, the upper and lateral segments are triangular and acuminate while the lowest is subulate and as long as the tube. The **standard** is ovate and shortly clawed, 7 mm long, 6,5 mm wide, claw 1 mm long. **Wings** 6 mm long, 2,5 mm wide, obovate, lunulate each of 4-5 rows comprising 5-11 intercostal lunulae. The **keel** blades are fused and the keel is naviculate, 6 mm long, 2,5 mm wide at maximum, claw 1,5 mm long. **Staminal sheath** 5 mm long, split on the upper side with four 1 mm long basifixed anthers alternating with six 0,25 mm long dorsifixed anthers. **Gynoecium** 6 mm long, style filiform, sharply upcurving, height of curvature 3 mm high, stigma capitate, finely fringed.

Figure 65: Type of R. diffusa Thunb.

Legume broadly oblong on a long stipe. (Fig. 66).

Diagnostic features

1. Lowest leaves broadly cuneate-obovate, upper leaves much smaller and lanceolate.
2. Slender twigs are almost entirely without opposing leaves.
3. Keel is naviculate.
4. Lunulae are present on the wing petals.

Distribution

Stretches from the Vanrhynsdorp district in the north, southwards as far as the Riviersonderend mountains. (Fig. 67).

Normal flowering period: September to November.

Collections

3118 (Vanrhynsdorp) Gift Berg (-BC) Phillips 3235 (SAM); Phillips 7483 (BOL); Gifberg (-DC) Stirton 5962 (PRE); Near Klaver (-DC) Grobbelaar 1128 (PRU; PRE); Nardouw Pass, Clanwilliam (-DD) Stokoe in SAM 61409 (SAM);

3119 (Calvinia) Nieuwoudtville (-AC) Barker 9776 (NBG); Theiler 76 (PRE); Calvinia (-BD) Drege s.n. (K); Lokenberg (-CA) Story 4333 (PRE); Acocks 117276 (PRE);

3218 (Clanwilliam) Piketberg (-DA) Acocks 19805 (PRE); Acocks 24444 (PRE; SRGH); Olifants River Valley (-DB) Barker 10332 (NBG);

3219 (Wuppertal) Pakhuis Pass (-AA) Emdon 123 (STE; PRE); Bond 606 (NBG); Stirton 10181 (PRE; STE); Bolus 3269 (NBG); Bolus in BOL 23842 (BOL); Leipoldt in BOL 32560 (BOL); Heuningvlei (-AA) Pocock 585

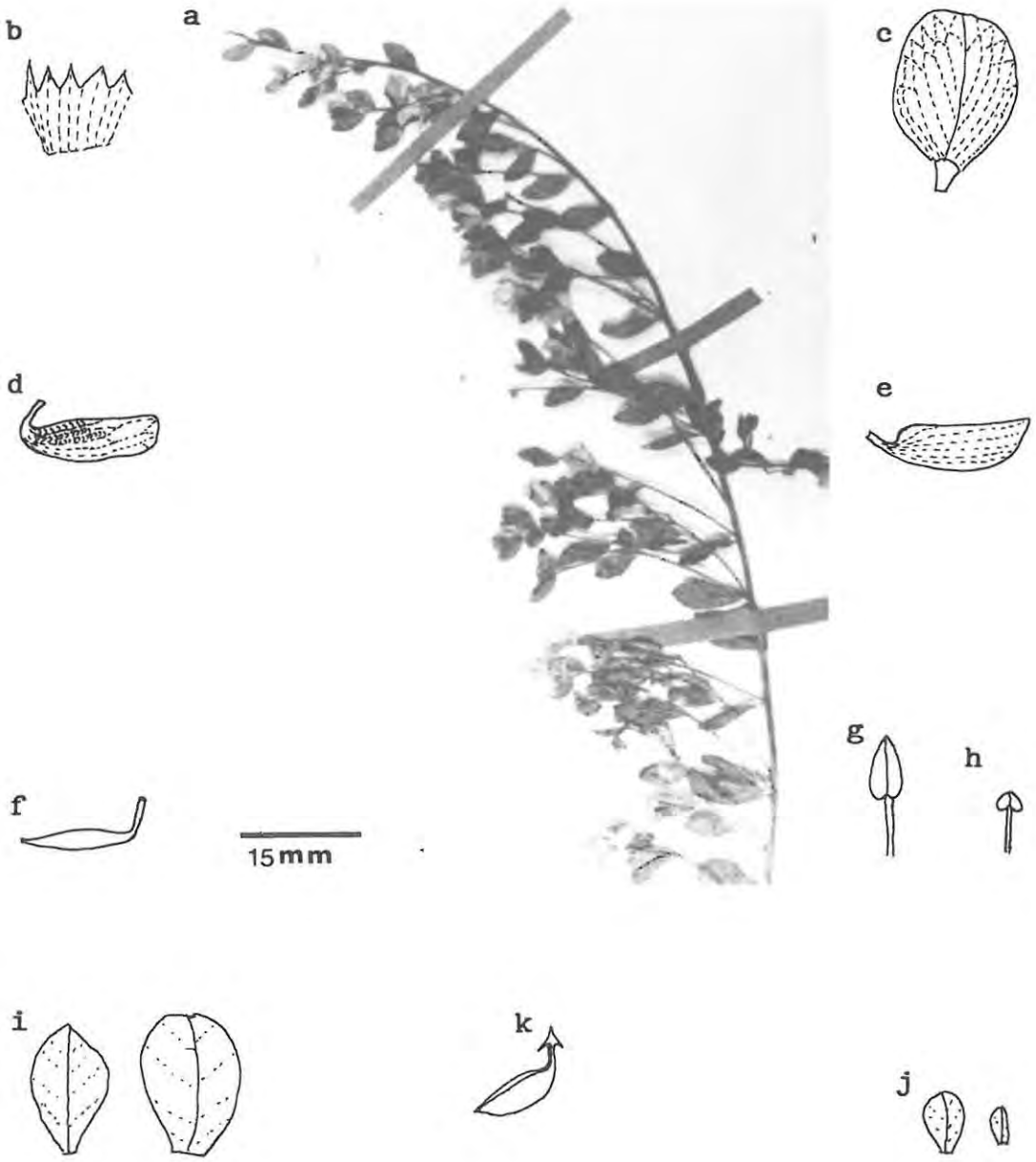


Figure 66: R. diffusa (a) flowering branch, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3, (f) gynoecium x3, (g) basifixed anther x8, (h) dorsifixed anther x8 (Taylor 11145 RUH), (i) basal leaves x1, (j) upper leaves x1 (k) pod x1 (Drege 1836 K).

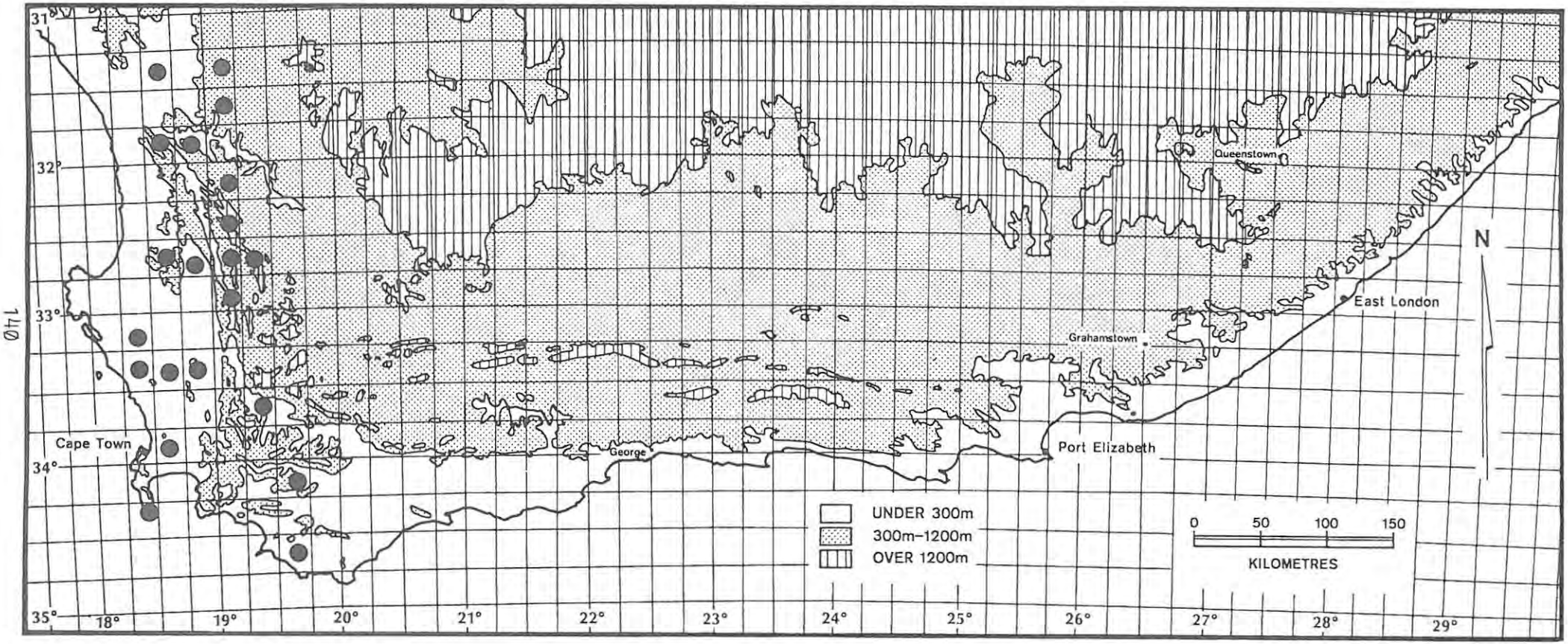


Figure 67: Geographical distribution of R. diffusa Thunb.

(STE); S of Heiveld (-AA) Taylor 11145 (RUH); Krakadouw Mountain (-AA) Leipoldt 537 (PRE; NBG; BOL); Stokoe in SAM 55913 (SAM); Bodkin s.n. (PRE; NH); Cedarberg (-AC) Taylor 7451 (STE); Kruger 971 (STE); Viviers 13 (STE); Bolus s.n. (NBG); Waboomsrivier (-AC) Hanekom 2451 (PRE); Elandskloof (-CA) Stokoe in SAM 55790 (PRE; STE; SAM); Waterfalls between Citrusdal and Elandskloof (-CA) Stokoe 7830 (PRE; NBG); Sneeuberg (-CB) Pocock 350 (STE); Gideons Kop (-CB) Stokoe in SAM 54501 (SAM); Grasruggens Mountain (-CC) Pillans 8726 (PRE);

3318 (Cape Town) Darling Flora Reserve (-AB) Winkler 169 (NBG); Between Mamre and Darling (-AC) Salter 1755 (BM); Hopefield (-AB) Bachmann in BOL 5976 (BOL); Malmesbury (-BC) Goldblatt 5111 (PRE); Zwartland (-BD) Pappe 21 (NBG); Pappe s.n. (NBG); Visserhok (-DC) Compton 16367 (NBG);

3319 (Worcester) Onderbokkeveld (-CB) Drege 3298 (P);

3418 (Simonstown) Cape of Good Hope (-AC) Zeyher 357 (PRE; SAM; BM; P; K);

3419 (Caledon) Riviersonderend Mountains (-BA) Stokoe 7371 (BOL); Koudeberg (-DA) Thode A1985 (PRE; NH).

Ecology

Grows among tall fynbos in loose sandy soil and among rocks as well as in sandy restioid veld.

Notes

R. diffusa is distinguished from the prostrate form of R. capensis (L.) Schinz by having a naviculate rather than a truncate keel. In addition, the wings are lunulate. The fact that the slender twigs are almost entirely without opposing leaves helps to make it easily recognizable.

It should be noted here that the Eckl. & Zeyh. specimen no. 1183 is not *R. diffusa* but *R. triflora* Thunb.

13. Rafnia schlechteriana Schinz in Bull. Herb. Boissier ii: 197 (1894). Type: Cape, Table Mountain, Schlechter 73 (P. holo!). (Fig. 68).

Somewhat woody, erect perennial 500 to 900 mm tall. **Leaves** simple, alternate, sessile, exstipulate, glabrous, broadly lanceolate, attenuate at base, mucronate, 25-70 mm long, 11-30 mm wide. **Inflorescences** axilliary, single flowered or dichasially branched. **Flowers** are about 10 mm long and are enclosed by foliaceous bracts. Immediately preceding the flower is a tiny setaceous bract, just above the insertion of the foliaceous bracts. **Calyx** 5 mm long, upper and lateral calyx lobes triangular shorter than the lowest subulate lobe. **Standard** is broadly oval and clawed, 10 mm long, 8 mm wide. **Wings** 12 mm long, 5 mm wide, obovate, clawed and without lunulae. **Keel** blades fused, 11 mm long, 5 mm wide at maximum, claw 4 mm long, apex truncate. **Staminal sheath** 9 mm long, split on upper side with six small 0,25 mm long dorsifixed anthers, alternating with four 1,25 mm long basifixed anthers. **Gynoecium** 9 mm long, style filiform, sharply upcurving, height of curvature 4,5 mm high, stigma capitate, finely fringed. The mature **pod** is trapezoid in shape, attenuated at base with a broad wing on the upper side, approximately 35 mm long and 15 mm wide. (Figs. 69 & 70).

Diagnostic features

1. Leaves broadly lanceolate, attenuate at base, mucronate.
2. Truncate keel.
3. No lunulae on wings.
4. Pod is trapezoid, broadly winged.

Figure 68: Type of R. schlechteriana Schinz.

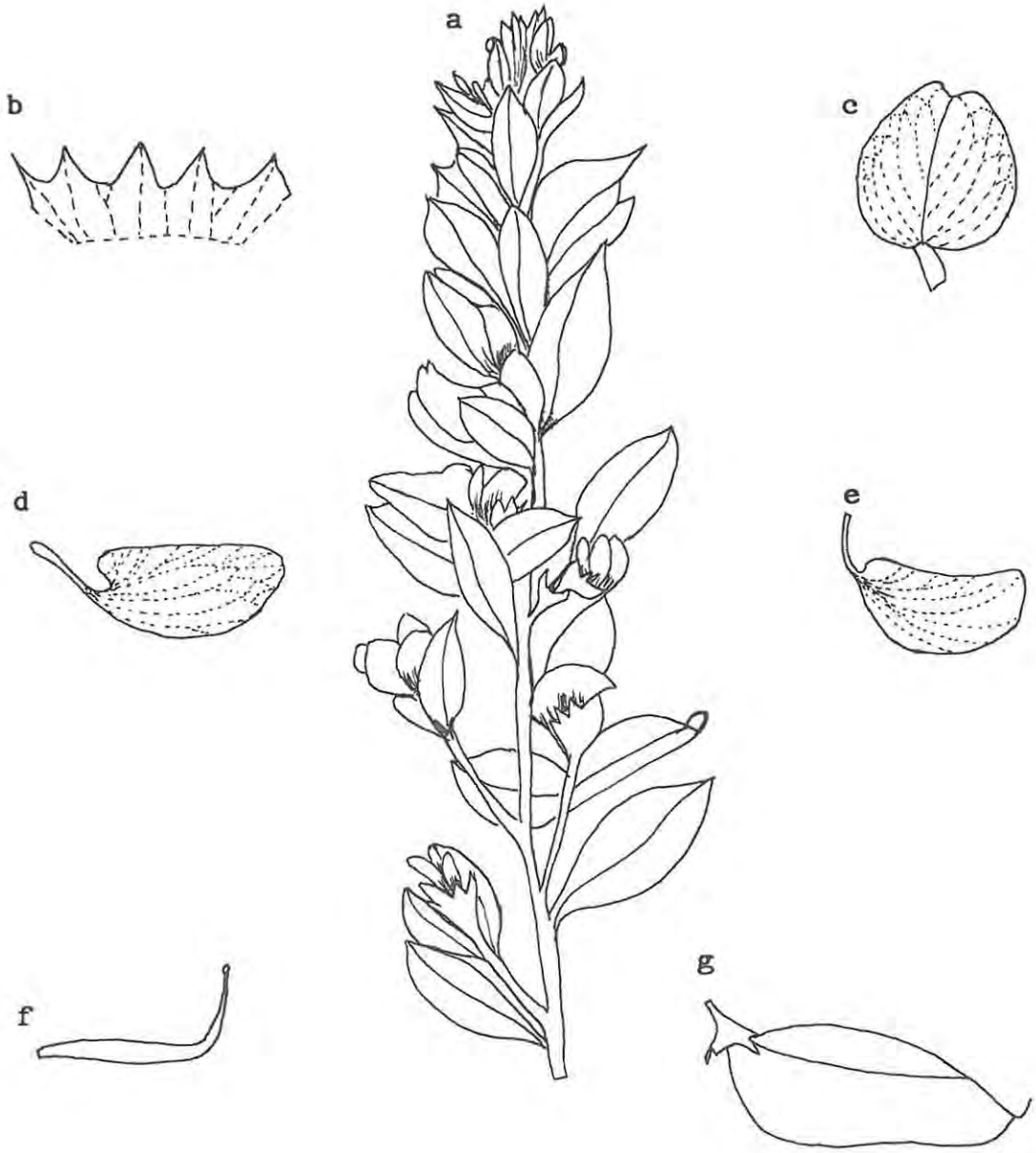


Figure 69: R. schlechteriana (a) flowering branch x1, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal x3, (e) keel petal x3, (f) gynoecium x3 (Schlechter 73 P.), (g) pod x1 (Esterhuysen 17875 BOL).

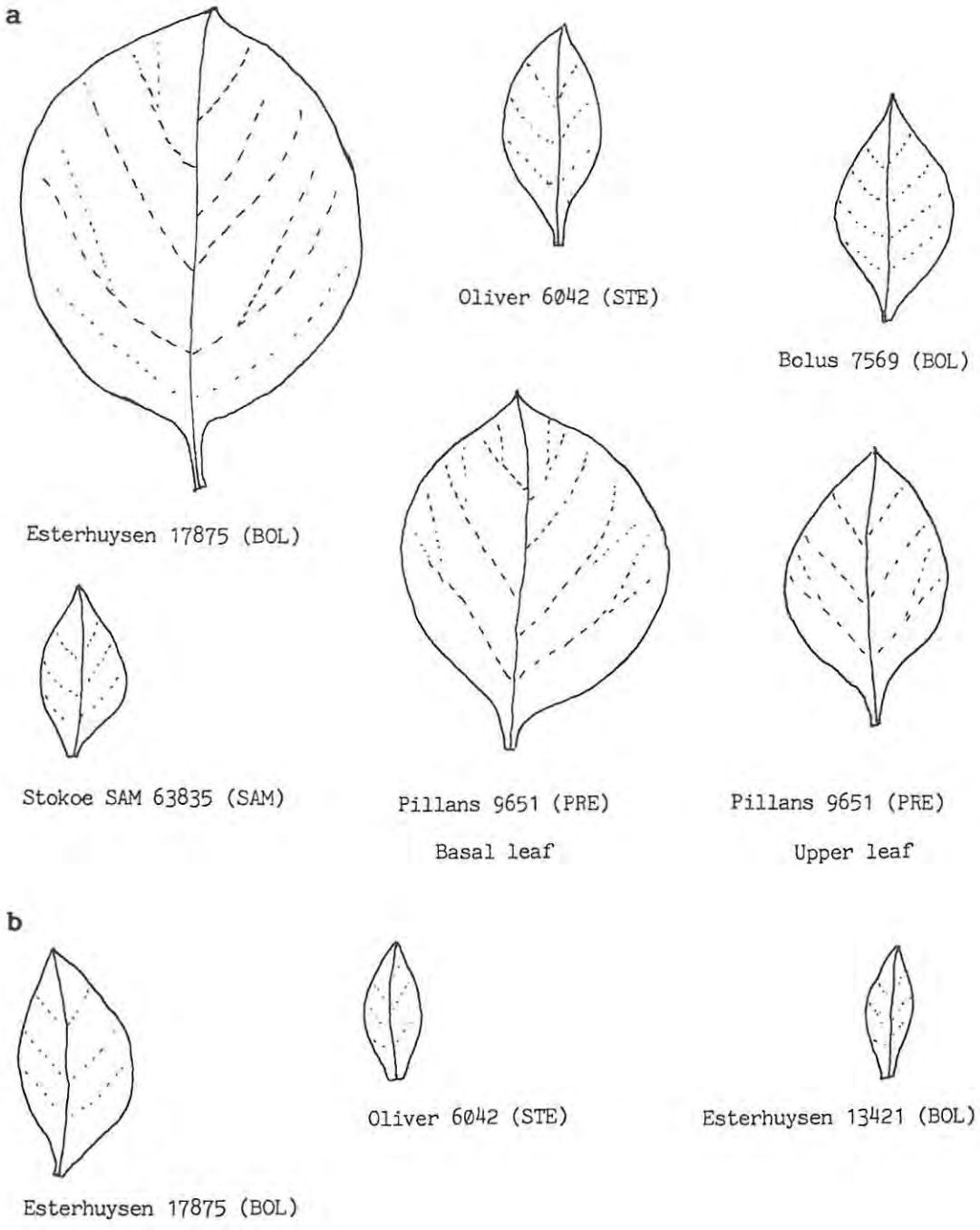


Figure 70: R. schlecteriana (a) leaf variation x1, (b) bracts x1.

Distribution

On mountain slopes, in soils of the Table Mountain Group, from Piketberg in the north, stretching southwards through Ceres to Table Mountain in the extreme south. (Fig. 71)

Normal Flowering Period: September - December

Collections

3218 (Clanwilliam) Cardouw Pass (-BB) Baker 8125 (NBG); Piketberg (-DA) Bolus 13535 (BOL); Goldblatt s.n. (NBG); Guthrie 2577 (NBG); Compton 22961 (NBG); Lewis 3585 (SAM); Versveldpas (-DD) Richardson 210 (RUH);

3219 (Wuppertal) Twenty Four River Mountains (-CC) Esterhuysen 17875 (BOL); Olifantsrivierberge (-CC) Van Zyl 3095 (STE);

3318 (Cape Town) Table Mountain (-CD) Schlechter 73 (P);

3319 (Worcester) Ceres (-AB) Esterhuysen 13421 (BOL); Skurfteberg (-AB) Stokoe in SAM 63835 (SAM); Lewis 906 (SAM); Bolus 7569 (BOL); Pillans 9651 (BOL; PRE); Hansiesberg (-AB) Compton 16672 (NBG); Oliver 6042 (STE; PRE); Michell's Pass (-AD) Thorne in SAM 51227 (SAM).

Ecology

Grows with short fynbos. Always found growing on disturbed ground, usually where a burn has taken place.

Notes

R. schlechteriana was first described by Schinz in 1894, but has never been correctly identified by any collector which is surprising as the pod is so different to any of the other species which have truncate keels.

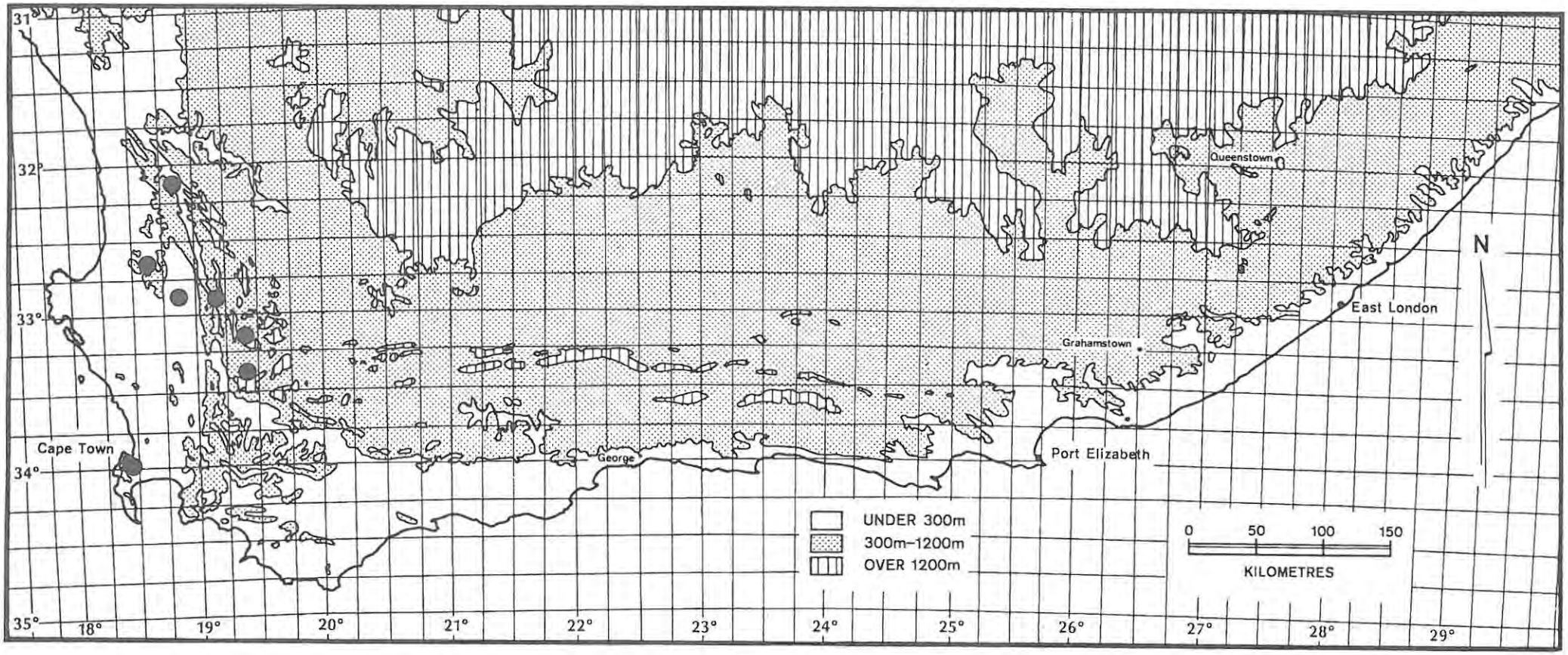


Figure 71: Geographical distribution of R. schlechteriana Schinz.

14. Rafnia angulata Thunb. in Nov. Gen. Pl. 147 (1800); Thunb. Fl. Cap. 564 (1825); DC. Prodr. ii: 119 (1825); E. Mey. Comm. 13 (1836); Harvey in Harv. and Sond. F.C. ii: 35 (1862); Schinz in Bull. Herb. Boissier ii: 201. Type: Cape of Good Hope. Thunberg in UPS 16426 (UPS, Holo!).

Rafnia angustifolia Thunb. in Nov. Gen. Pl. 147 (1800). Type: Cape of Good Hope, Thunberg in UPS 16428 (UPS holo!). (Fig. 72).

Rafnia filifolia Thunb. in Nov. Gen. Pl. 148 (1800). Type: Cape of Good Hope, Thunberg in UPS 16435 (UPS holo!). (Fig. 73).

Rafnia angulata var. filifolia E. Mey. Comm. 13 (1836). Type: Cape, Bergrivier. Drege s.n. (P. holo!). (Fig. 74).

R. angulata var. α latifolia Harvey in Harv. & Sond. F.C. ii: 35 (1862).

R. angulata var. β angustifolia Harvey in Harv. & Sond. F.C. ii: 35 (1862). Type: Cape of Good Hope, Table Mountain, Eckl. & Zeyh. 1196 (SAM). (Fig. 75).

R. humilis Eckl. & Zeyh. Enum. (1836). Type: Cape, Cape Flats, Eckl. & Zeyh. 1198 (SAM isotype!). (Fig. 76).

Much branched perennial shrubs, 300 to 1200 mm high, the branches angular, **leaves** oblong, cuneate, oblong, lanceolate, linear-lanceolate or linear-filiform, somewhat glaucous, 15 to 30 mm long, varying from 1 to 10 mm wide. **Peduncles** axilliary with flowers usually solitary or in pairs, varying in size from 6 to 15 mm on short pedicels 4-8 mm long with a pair of setaceous bracts at the base. **Calyx** 5-14 mm long; the upper and lateral calyx lobes lanceolate or falcate, subequal nearly as long as the calyx tube or slightly longer, the lowest setaceous-subulate. The **corolla** is yellow, the **standard** is ovate and clawed, 8-12 mm long, 6-10 mm wide, claw 2-3 mm long. **Wings** obovate,

Figure 72: Type of R. angustifolia Thunb.

Figure 73: Type of R. filifolia Thunb.

Figure 74: Type of R. angulata var filifolia E. Mey.

Figure 75: Type of R. angulata var angustifolia Harv.

Figure 76: Type of R. humilis Eckl. & Zeyh.

clawed and lunulate each of 5-6 rows comprising 15-25 intercostal lunulae, 7-11 mm long, 3-4 mm wide, claw 3-4 mm long. **Keel** is rostrate and clawed 5-9 mm long, 2-5 mm wide at maximum, claw 4-5 mm long. **Staminal sheath** 6-8 mm long, split on upper side with four 2,25 mm long basifixed anthers on short filaments, alternating with six Ø,75 mm long dorsifixed anthers on longer filaments. The dorsifixed anthers are lanceolate and sterile while the basifixed anthers are globose. **Gynoecium** 6-9 mm long, style filiform, upcurved, height of curvature 6-9 mm high, stigma capitate, finely fringed. **Legume** narrowed at base into a stipe and very narrowly winged on upper side. (Figs. 77 & 78).

Diagnostic features

1. Rostrate keel.
2. Lunulae on wings.
3. Legume stipitate with a very narrow wing on the dorsal side.

Distribution

On sandy flats and hilltops from the Vanrhynsdorp district in the north, stretching southwards as far as Genadendal near Caledon with outliers in the Montagu and George districts. The main concentration is in the peninsula area but this could be due to the fact that this area was more intensively collected. (Fig. 79).

Normal Flowering Period: (September) October - March (April).

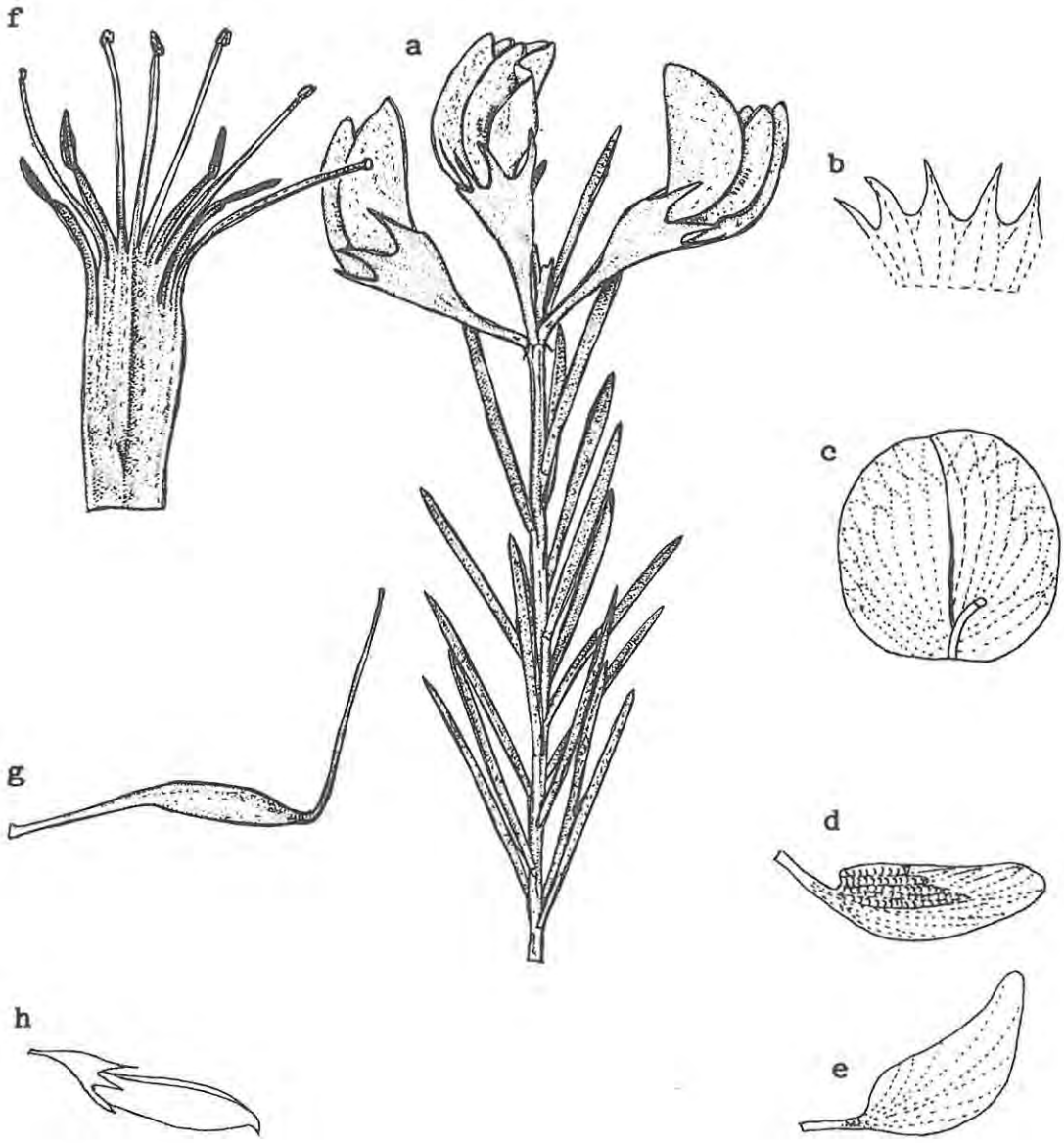


Figure 77: R. angulata (a) flowering branch x2,5 (from Dahlgren, 1963), (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3 (Esterhuysen s.n. PRE), (f) staminal sheath x5, (g) gynoecium x5 (from Dahlgren, 1963), (h) pod x1 (Compton 14191 PRE).

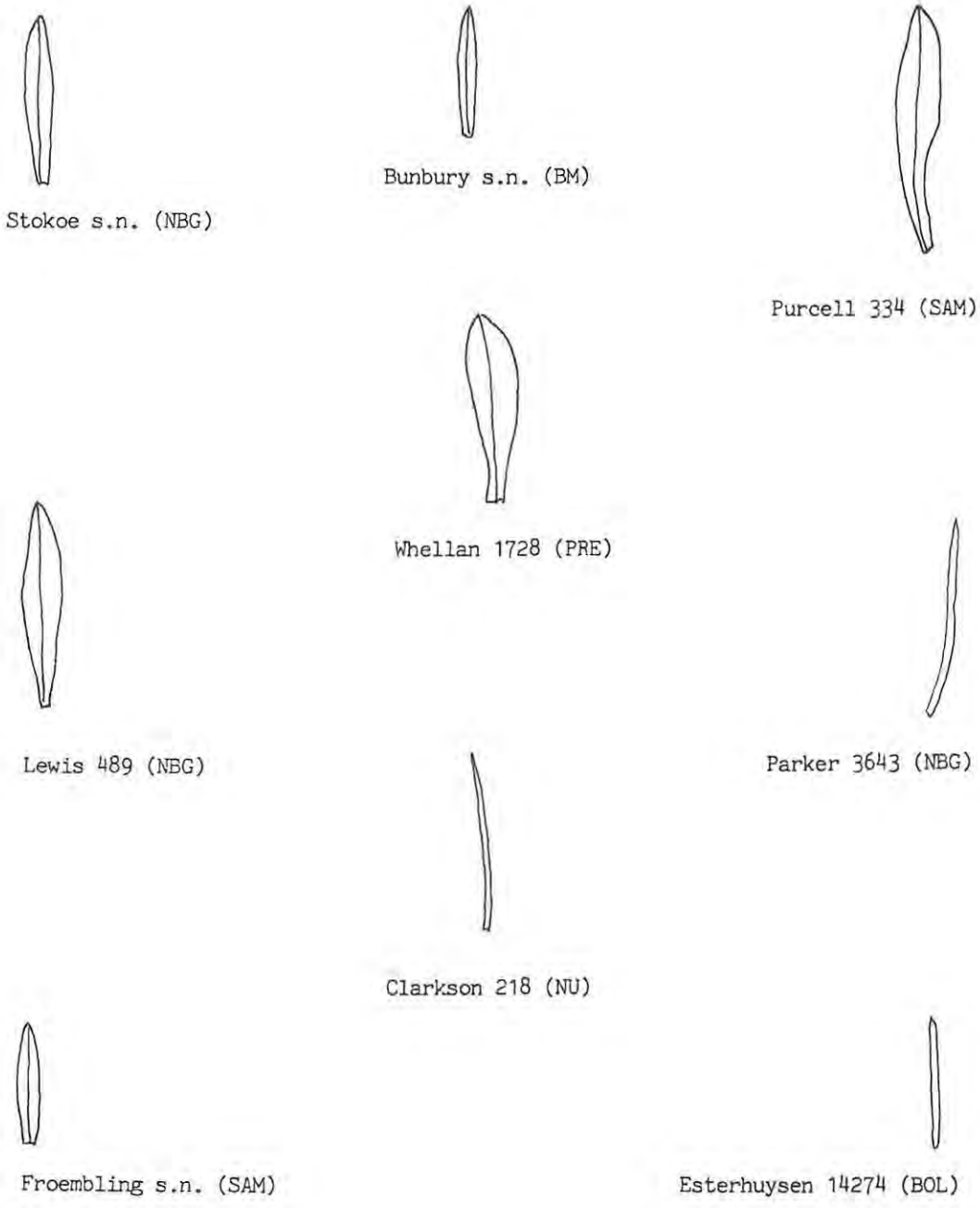


Figure 78: R. angulata leaf variation x1.

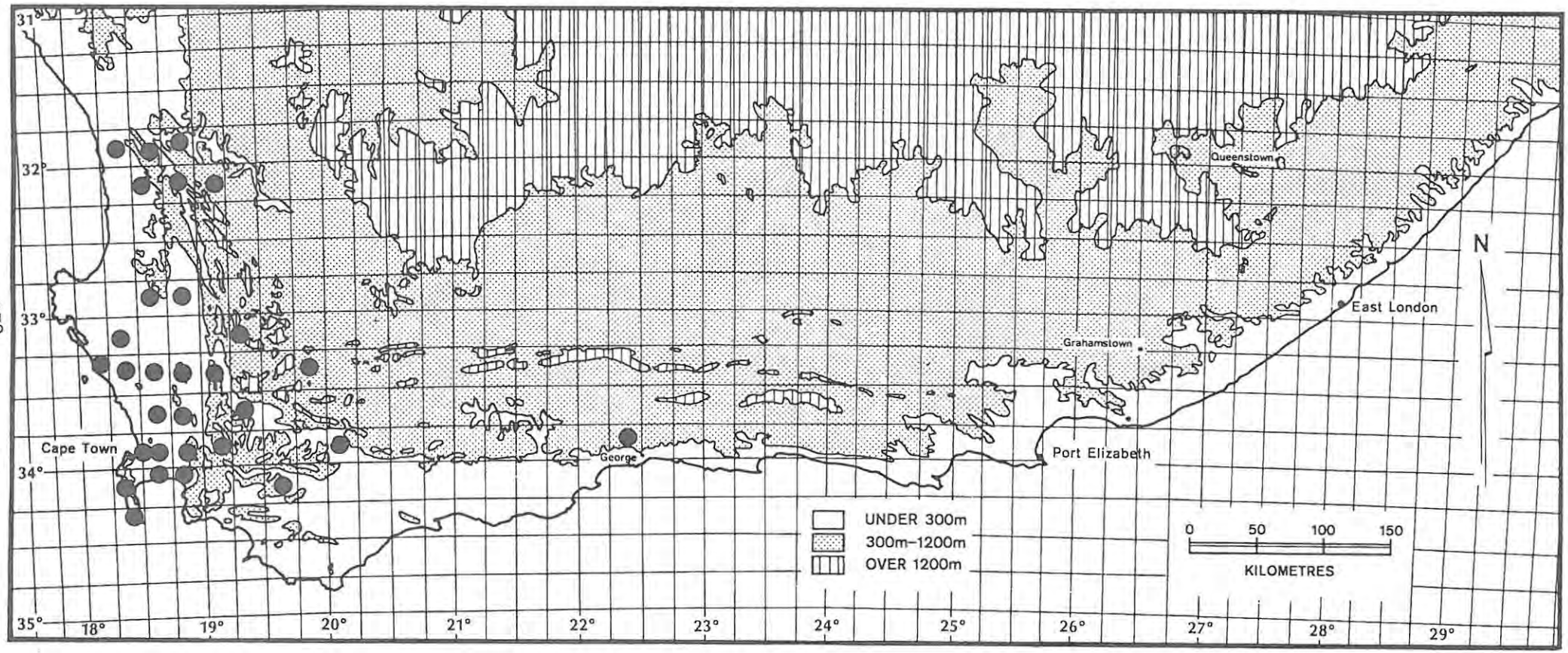


Figure 79: Geographical distribution of R. angulata Thunb.

Collections

3118 (Vanrhynsdorp) between Vredenburg and Hopefield (-CD) Grobbelaar 02913 (PRE); Klawer Road (-DC) Grobbelaar 1139 (PRE; PRU);

3218 (Clanwilliam) Langberg (-BA) Bond 1385 (NBG); N. of Clanwilliam (-BB) Barker 10333 (NBG); Piketberg (-DC) Esterhuysen 7134 (BOL); Grobbelaar 2667 (PRU; PRE); Compton 12669 (NBG);

3318 (Cape Town) Hopefield, Malmesbury (-AB) Acocks 24470 (PRE); Compton 18918 (BOL; NBG); Leighton 2447 (BOL); Clarkson 371 (BOL; NU); Leighton 2453 (BOL); Grobbelaar 2194 (PRU); Bolus 16749 (BOL); Compton 227 (UWC); Compton 227a (UWC); Compton 18920 (NBG); Thompson 3604 (STE); South of Darling (-AC) Grobbelaar 290 (PRU; PRE); Between Darling and Ysterfontein (-AD) Rycroft 1810 (NBG); Boucher 58 (STE); Flats S. of Mamre (-BC) Salter 2291 (BOL; BM); Middlemost 1838 (UWC; NBG); Penfold 240 (NBG); Riebekkasteel (-BD) Zin in SAM 54233 (SAM); Camps Bay (-CD) Salter s.n. (BM); Drege 108 (P); Thode A7 (PRE); Table Mountain (-CD) Galpin 3919 (PRE); Ecklon s.n. (P); Eckl. & Zeyh. 1197 (SAM); Andreae 268 (STE); Moss 3267 (J; BM); Moss 7800 (J); MacOwan 52 (BM; UPS; SAM; NH); Eckl. & Zeyh. 1196 (SAM); Grobbelaar 119 (PRE); Penfold in SAM 52756 (SAM); Froembling in SAM 65269 (SAM); Bolus 2750 (SAM); Devils Peak (-CD) Esterhuysen 20829 (BOL); Thode 6072 (STE); Tyson 2427 (NH); Wolley-Dod 555 (BM); Wilms 3135 (BM); Penfold 186 (NBG); Cape Town (-CD) Wood 3356 (NH); Bolus 4673 (BM); Bolus 2750 (PRE; BOL); Sweefspoorpad (-CD) Grobbelaar 2196 (PRU); Platklip (-CD) Marloth 1804 (PRE); Zeyher 4895 (SAM); Pella (-DA) Boucher/Shepherd 4288 (STE; PRE); Strauss 5 (NBG); Paardeberg (-DB) Van Niekerk 356 (BOL); Paarl (-DB) Drege s.n. (P; K); Vygerkraal (-DC) Wolley-Dod 724 (BOL; BM); between Uitvlugt and Vygerkraal (-DC) Wolley-Dod 2091 (BM; BOL); Constantia (-DC) Lamb 1364 (SAM); Kraaifontein (-DC) Salter 3988

(BOL); Young 176 (BOL); Springfontein (-DC) Axelson 378 (NBG); Modderdam (-DC) Leighton 1474 (BOL); Bottelary (-DC) Esterhuysen 7680 (PRE; BOL); Compton 12931 (NBG); Stellenbosch (-DD) Taylor 7038 (STE); between Firgrove and Stellenbosch (-DD) Pillans 6722 (BOL);

3319 (Worcester) Gydo Pass (-AB) Compton 18728 (NBG); Glenridge Nieuwoudtville (-AC) Barker 9648 (NBG; UWC); Tulbagh Waterfall (-AC) Ecklon & Zeyher 1195 (SAM); Snijman 44 (NBG); Hex River Valley (-BD) Esterhuysen 1537 (PRE; BOL); Bolus 13080 (NH; PRE; BOL); Esterhuysen 14274 (BOL); Compton 8366 (NBG); Near Worcester (-CB) Bayliss 1240 (PRE); Von Breda 1552 (PRE); Bergrivier (-CC) Drege s.n. (P; BM); Tafelberg, Ceres (-CC) Compton 10078 (NBG); Wemmershoek (-CC) Compton 10142 (NBG);

3320 (Montagu) Slopes of Langeberg (-CC) Stokoe s.n. (NBG);

3322 (Oudtshoorn) George (-CD) Bowie 7 (BM); Bowie 6 (BM);

3418 (Simonstown) Wynberg Hill (-AB) Salter 9008 (BOL; SAM); Salter 8916 (PRE); Bolus 7954 (BOL); Kloofneck (-AB) Wolley-Dod 2335 (BOL); Constantiaberg (-AB) Salter 7959 (BOL); Schlechter 540 (BM; P); Viviers 164 (STE); Chapman's Peak (-AB) Goulimis s.n. (BOL); Compton 8487 (NBG); Van Niekerk 470 (NBG); Noord Hoek (-AB) Salter s.n. (BM); Miller's Point (-AB) Whellan 1728 (PRE; SRGH); Gillet 3425 (STE); Simonsberg (-AB) Salter s.n. (BM); Wolley-Dod 290 (BM; BOL); Compton 14191 (PRE; NBG); Bergvliet Farm (-AB) Purcell 3909 (SAM); Purcell s.n. (SAM); Purcell 334 (SAM); Bergvliet, Cape Peninsula (-AB) Salter 7984 (BOL); Cape of Good Hope (-AD) Zeyher s.n. (P); Burman s.n. (G); Harvey s.n. (BM); Wallich 1043 (BM); Wallich s.n. (UPS); Hance 10282 (BM); Harvey 762 (BM; K); Niven s.n. (BM); Miers 8595 (BM); Rehmann 1081 (BM); Masson s.n. (BM); Bowie s.n. (K); Drege s.n. (P; K); Harvey

s.n. (DBN); Cumming s.n. (BM); Boupland s.n. (P); Cape Peninsula (-AD) Salter 8721 (BOL); Zeyher 358 (BM; P); Salter 2875 (BM); Cape Point Game Reserve (-AD) Whellan 1768 (SRGH); Smitswinkel (-AD) Gillet 1497 (BOL); Salter 8004 (BOL); Compton 16937 (NBG); Compton 16658 (NBG); Compton 12576 (NBG) Compton 15515 (NBG); Cape Flats (-BA) Eckl. & Zeyh. 1198 (SAM); Near Faure (-BB) Compton 10371 (NBG); Sir Lowry's Pass (-BB) Clarkson 218 (NU); Somerset West (-BB) Parker 3643 (BOL; NBG); Johnson in NBG 14245 (NBG);

3419 (Caledon) Happy Valley (-BA) Esterhuysen 20807 (PRE; BOL; NBG); Genadendal (-BA) Schlechter 10283 (PRE; BOL; BM; P); Schlechter 135 (PRE).

Ecology

R. angulata is a very variable species as was noted by Salter in Adamson's Flora of the Cape Peninsula. The leaf-shape varies from narrowly linear-lanceolate to oblong. There are a number of intermediates between these two extreme shapes. This species is often found growing with Restionaceae and Ericaceae. A solitary flowered form is found on Wynberg Hill (Figs. 80 & 81), but is in danger of extermination.

Notes

In 1800 in Nov. Gen. Thunberg described R. angulata, R. angustifolia and R. filifolia. E. Meyer in 1836 in Comm. 13 recognised two varieties, variety angustifolia and variety filifolia. However, in 1839 Willdenow (ex Walpers) stated, in Linnaea, that apart from the broader leaves no difference between the three Thunberg specimens could be found. He made R. angustifolia and R. filifolia synonyms of R. angulata.

Figure 80: R. angulata - solitary flowered form from Wynberg Hill (Salter 9008 NBG).

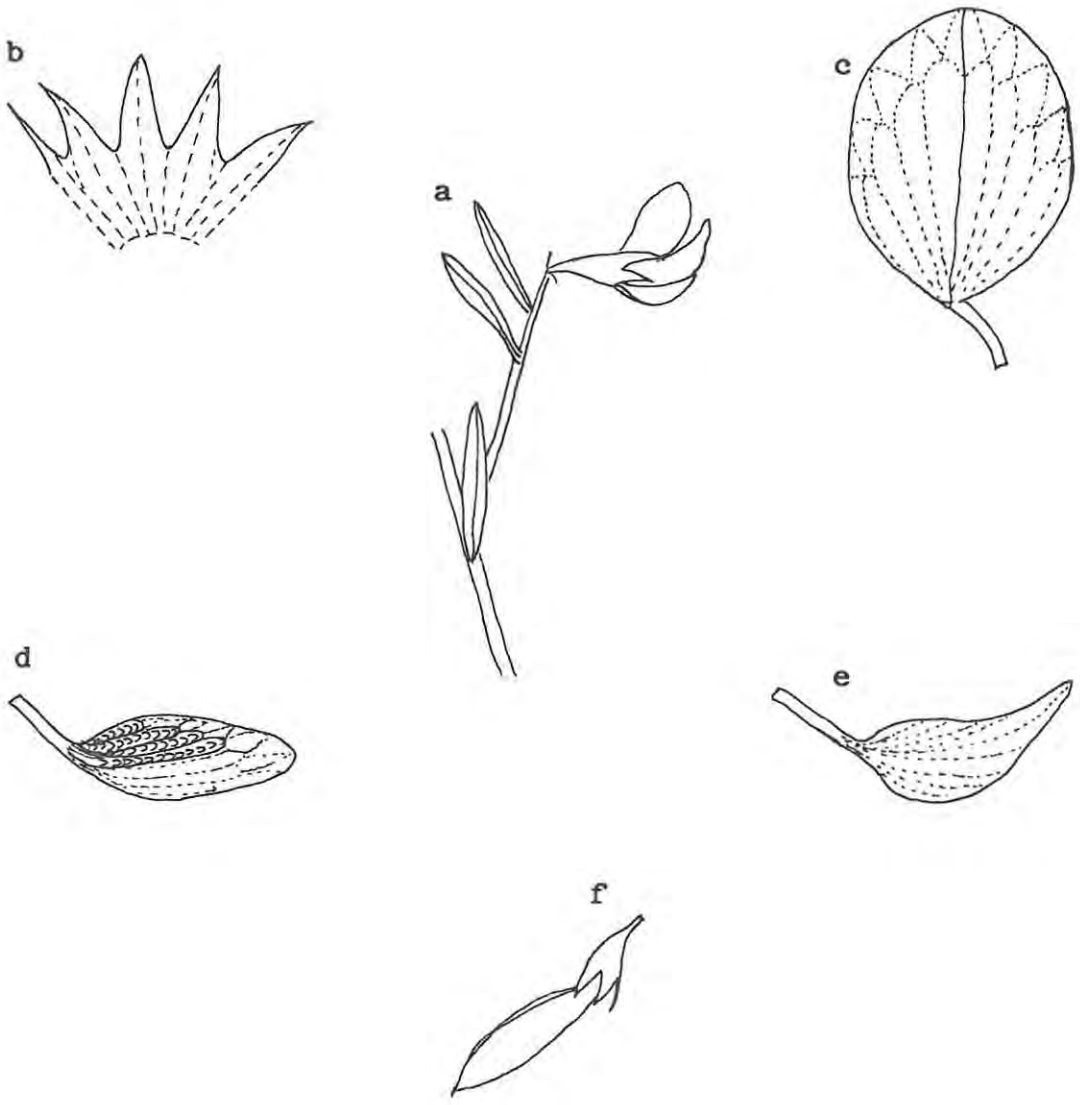


Figure 81: R. angulata - solitary flowered form (a) solitary flower x1, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3, (f) pod x1 (Salter 9008 BOL).

In 1862 Harvey in F.C. ii: 35 recognised two varieties of R. angulata namely var. α latifolia Harv. with cuneate-oblong or lanceolate leaves and calyx lobes shorter than the tube, and var. β angustifolia E. Mey. with leaves linear-lanceolate or filiform and calyx lobes shorter than in var. α. However, examination of many specimens has shown that no real difference in length of calyx lobes occurs in the two varieties.

In Flora of the Cape Peninsula (1950), Ed. R.S. Adamson and T.M. Salter, Salter states that although Harvey has distinguished a broad leaved latifolia and a narrow-leaved angustifolia, intermediates show that there is no definite dividing line to separate the species into varietal taxa. The author, after examination of many herbarium sheets, has, in fact, found this to be the case and as distinguishing characters are not substantial enough to separate this species into two entities it has been decided to uphold only Rafnia angulata Thunb. with no varietal taxa.

15. Rafnia racemosa Eckl. & Zeyh. Enum. 161 (1835); Harvey in Harv. & Sond. F.C. ii: 34 (1862); Schinz in Bull. Herb. Boissier ii: 200 (1894); Type: Cape of Good Hope. In the rocks between the Breede River and Attaquaskloof. Eckl. & Zeyh. 1188 (SAM). (Fig. 82).
R. cuneifolia Willd. Hb. no. 13191 (non Thunb.) (not traced).

A strong growing bush 0,5 to 2 m high. **Leaves** elliptical or oblong, mucronate somewhat cuneate at base with a very distinct midrib and quite leathery, 15-45 mm long, 6-26 mm wide. The **flowers** about 10 mm long are borne in a short terminal raceme usually having three to six flowers in the raceme. Each flower has a pair of tiny setaceous bracts at its base. The **calyx** lobes are the same length as the calyx tube. The upper calyx lobes are broadly cultrate whilst the lateral lobes are lanceolate. The lowest is setaceo-subulate. The **corolla** is yellow. The **standard** is ovate and clawed, 13 mm long, 12 mm wide, claw 5 mm long. **Wings** 13 mm long, 6 mm wide, obovate and clawed, claw 5 mm long, lunulate, each of 5-6 rows comprising 15-25 intercostal lunulae. **Keel** blades are fused, 12 mm long, 5 mm wide at maximum, claw 6 mm long. The keel is shortly rostrate. **Staminal sheath** 11 mm long, split on upper side with four 2,5 mm long, linear, basifixed anthers alternating with five 1 mm long, globose, dorsifixed anthers, carinal anther 1,5 mm long. The linear anthers are sterile. **Gynoecium** 12 mm long, style filiform, upcurving, height of curvature 8 mm high, stigma capitate, finely fringed. **Legume** linear, sessile, with a very narrow wing on the upper side. Most legumes contained six ovules. (Fig. 83).

Figure 82: Type of R. racemosa Eckl. & Zeyh.

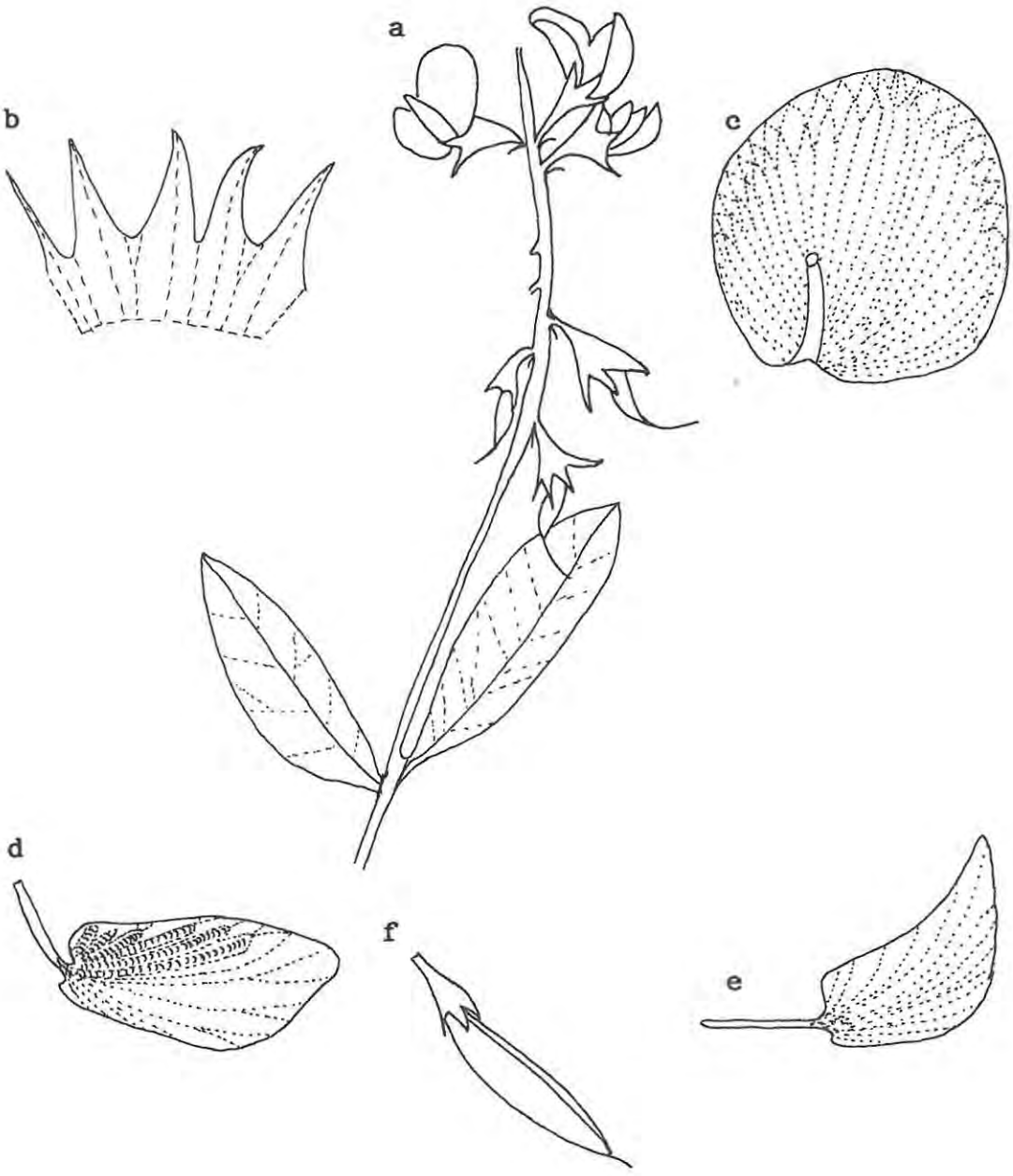


Figure 83: R. racemosa (a) flowering branch x1, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3 (Wurts 1641 NBG) (f) pod x1 (Olivier 5550 STE).

Diagnostic features

1. Flowers borne in a short terminal raceme.
2. Setaceous bracts present at the base of each flower.
3. Carina shortly rostrate.
4. Lunulae present on wings.
5. Calyx lobes equal in length to calyx tube.

Distribution

Stretching from Montagu in the west, eastwards as far as Uniondale in the Willowmore district with the main concentration on the Swartberg Mountains in the Ladismith area. (Fig. 84).

Normal Flowering Period: September - March (April).

Collections

3320 (Montagu) Rietkloof (-BB) Lewis 760 (SAM); Bond 242 (NBG); Compton 8642 (NBG); Touwsberg (-DB) Wurts 1355 (NBG);
3321 (Ladismith) Klein Swartberg (-AD) Thompson 3176 (STE); Wurts 1498 (NBG); Ladismith (-AD) Wurts 1345 (NBG); Hugo 602 (STE); Seven Weeks Poort (-AD) Barnard in SAM 46319 (SAM); Stokoe 1756 (BOL); Andreae 1294 (PRE); Vleiland (-AD); Van Wyk 531 (STE); Gamka Mountain Reserve (-BC) Boshoff P285 (STE); Kliphuisvlei (-BD) Laughton 139 (BOL); Swartberg (-BD) Vlok 35 (SAAS); Vlok 164 (SAAS); Oliver 5550 (STE); Pocock 575 (PRE); Ridge of Rooiberg (-CB) Wurts 1641 (NBG); Rooiberg (-DA) Oliver 5307 (STE); Cloete's Pass (-DD) Muir 1071 (BOL; PRE); Attakwaskloof (-DD) Thompson 1610 (STE); Vlok 86 (SAAS);
3322 (Oudtshoorn) Swartberg Pass (-AC) Gentry/Barclay 19097 (PRE); Stokoe in SAM 55812 (SAM); Bolus 11464 (NH; BOL); Thompson 2271 (STE);

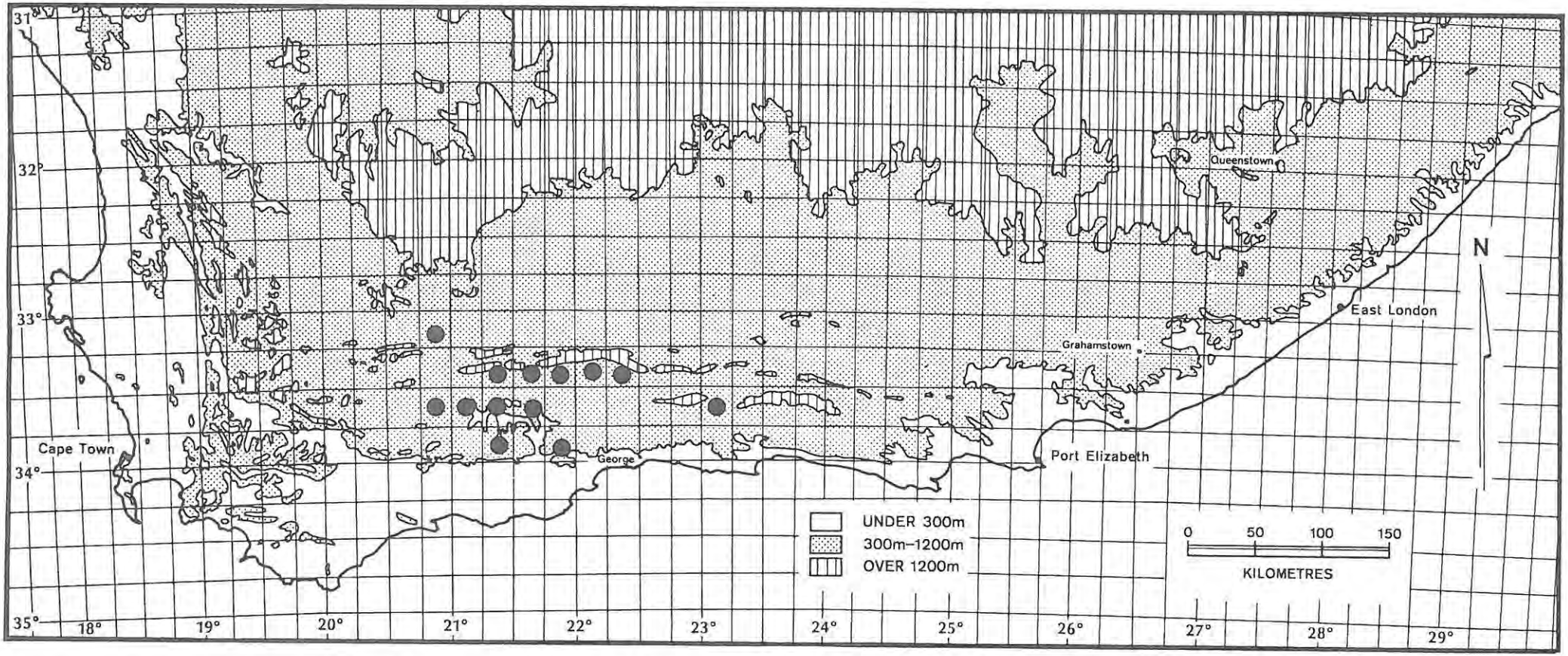


Figure 84: Geographical distribution of R. racemosa Eck. & Zeyh.

Compton 10418 (NBG); Werdermann & Oberdieck 830 (PRE); Thorns s.n. (NBG); Schelpe 92 (BOL); Bond 1551 (NBG); Stirton 10311 (STE); Meiringspoort (-BD) Thorne in SAM 50193 (SAM);
3323 (Willowmore) 74 km from Joubertina to George (-CA) Stirton 6367 (PRE; SRGH); Avontuur (Uniondale) (-CA) Acocks 16036 (BOL).

Ecology

Rafnia racemosa grows mainly on sandy soil in arid fynbos. It is usually associated with Erica speciosa and is also often found with restioid, proteoid shrub. It grows best on recently burnt ground and coppices after fire.

Notes

According to Walpers, there is a specimen in Willdenow's herbarium labelled R. cuneifolia Willd.(non Thunb.) which is actually Rafnia racemosa. Unfortunately this specimen has not been traced.

16. **Rafnia elliptica** Thunb. Nov. Gen. Pl. 145 (1800); Thunb. Prodr. 123 (1800); Thunb. Fl. Cap. (ed. Schult.): 563 (1825) DC. Prodr. ii: 119 (1825); Harvey in Harv. and Sond. F.C. ii: 33 (1862); Schinz Bull. Herb. Boissier ii: 200 (1894). Neotype: Cape, Van Stadensriver, Zeyher 7 (SAM). (Fig. 85).

R. axillaris Thunb. Prodr. 123 (1800). Type: Cape of Good Hope. Thunberg in UPS 16430 (UPS Holo!). (Fig. 86).

Pelecynthis axillaris E. Mey. Comm. Pl. Af. Aust. 14 (1835).

R. cuneifolia E. Mey. Comm. 12 (1836). Type: Cape, Paarl and Dutoitskloof, Drege (not traced).

R. intermedia Vogel ex Walp. in Linn. XIII: 463 (1839). Type: Cape, in mountains at Van Stadensrivier. Zeyher in SAM 15205 (SAM Isotype!). (Fig. 87).

R. elliptica var α erecta Harvey in Harv. and Sond. F.C. ii: 33 (1862). Syntypes: Cape of Good Hope, Thunberg (UPS); Van Stadensrivier Mountains, Eckl. & Zeyh. 11867 (P); (not as in F.C. ii 1168). (Fig. 88).

R. elliptica var β acuminata Harvey in Harv. and Sond. F.C. ii: 33 (1862). Type: Cape, Pickenierskloof, Eckl. & Zeyh. 1185 (P Holo!).

A stout leafy, erect or spreading, much branched shrub of 300 to 900 mm high. Branches angular and alternate. **Leaves** ovate or elliptical, acute, alternate on stem, the upper ones narrow and more lanceolate, all narrowed at base. The leaves, 35-90 mm long and 10-35 mm wide vary much in shape on different parts of the plant. **Peduncles** axilliary, one or two flowered, with a pair of leafy awl-shaped bracts under the flower. **Calyx** segments as long as or longer than the tube,

Figure 85: Neotype of R. elliptica Thunb.

Figure 86: Type of R. axillaris Thunb.

Figure 87: Type of R. intermedia Vogel ex Walp.

Figure 88: Type of R. elliptica var ∝ erecta Harv.

lateral which are broadly subulate, the lowest narrow subulate, longer than the rest. The upper margins of the two vexillar calyx lobes are connate to form a keel. The calyx lobes vary in length, as compared with the tube, rather than in shape. The **standard** is ovate and clawed, 11 mm long and 14 mm wide, claw 5 mm long. **Wings** 10 mm long, 5 mm wide, obovate, lunulate, each of 5-6 rows comprising 7-15 intercostal lunulae. The **keel** blades are fused and the keel is sharply rostrate 10 mm long, 5 mm wide at maximum, claw 4 mm long. **Staminal sheath** 9 mm long, split on the upper side with four 2 mm long, linear, basifixed sterile anthers alternating with six 1 mm long, globose, dorsifixed anthers. **Gynoecium** 10 mm long, style filiform, sharply upcurving, height of curvature 6 mm high, stigma capitate, finely fringed. **Pod** sessile, linear-oblong, broader at base. (Figs. 89 & 90).

Diagnostic features

1. Upper margins of vexillar calyx lobes connate to form a keel.
2. Setaceous calyx lobe longer than the rest.
3. Pod sessile, broader at base.
4. Keel sharply rostrate.
5. Wings lunulate.

Distribution

Stretching from Simonstown in the south-western Cape eastwards to Grahamstown in the east Cape and northwards along the coast as far as Port Shepstone in Natal. (Fig. 91).

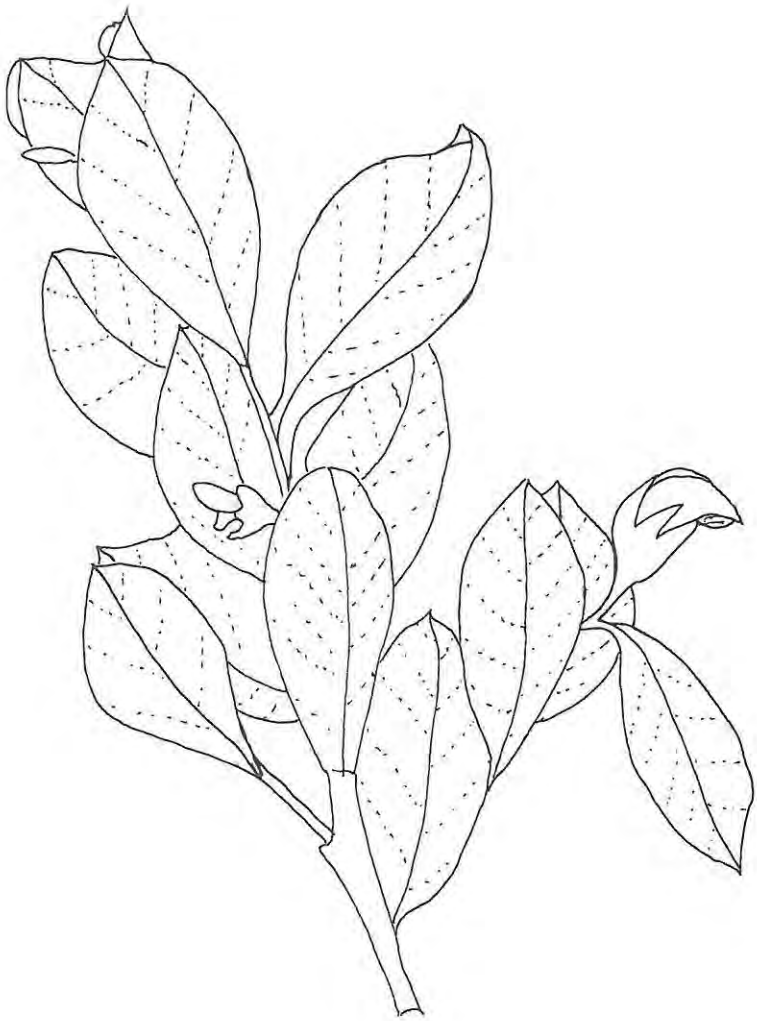


Figure 89: R. elliptica. Flowering branch x1 (Richardson 172 RUH).

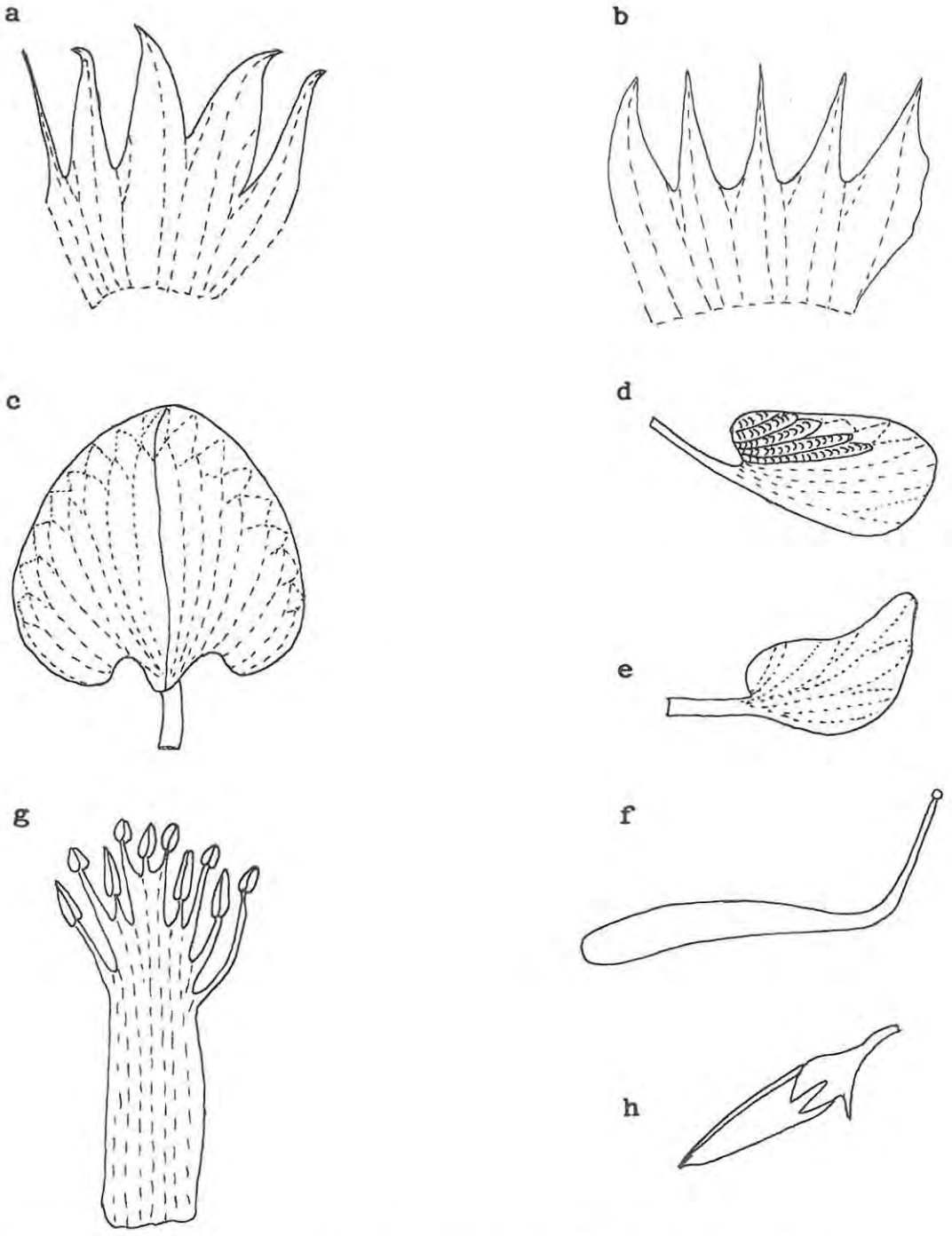


Figure 90: R. elliptica (a) calyx opened out x3, (b) calyx opened out showing keel x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3, (f) staminal sheath x4, (g) gynoecium x4, (h) pod x1 (Richardson 172 RUH).

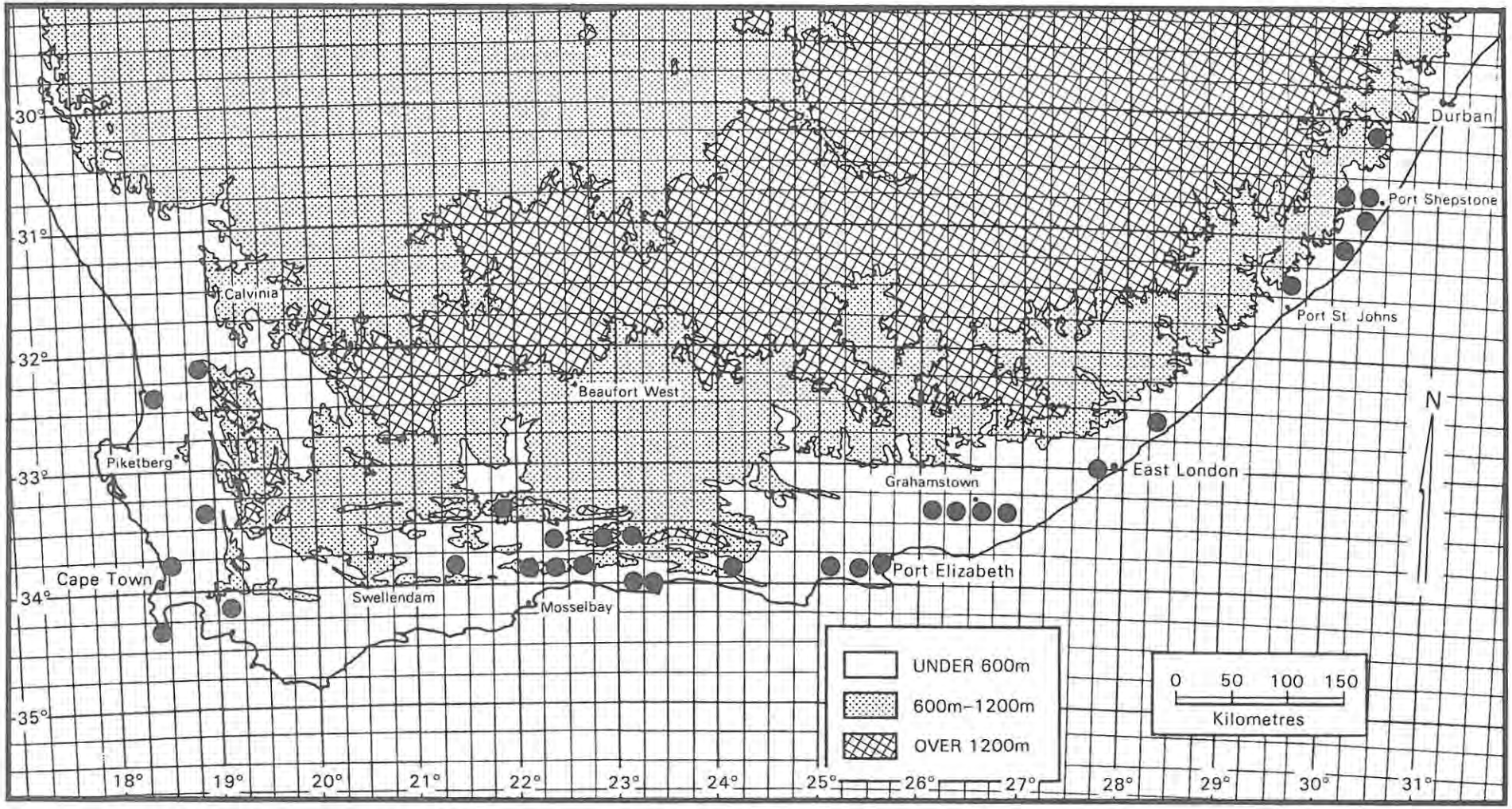


Figure 91: Geographical distribution of R. elliptica Thunb.

Normal Flowering Period: (September) October - February (March).

Collections

3030 (Port Shepstone) St Michael's on Sea (-AB) Nicholson 194 (NH); Oribi Gorge (-CA) Mantell and Vassilatos 46 (PRE; J); Beacon Hill (-CB) Strey 6551 (NH); Black Trail (-CB) Davidson 2589 (J); Glen 498 (J); Umzumbe (-CD) Medley-Wood 12858 (NH); Inyangwine (-CD) Medley-Wood 3008 (SAM; BM; NH); Margate (-CD) Morris 119 (NU); Hilliard 1161 (NU); Uvongo Beach (-CD) Schrire 247 (NH); Stirton 8058 (PRE);

3129 (Port St Johns) Lusikisiki (-BC) Galpin 9428 (PRE); Moss 16138 (J);

3130 (Port Edward) Port Edward (-AA) Huntley 740 (NU); Hilliard 1690 (NU); Van Wyk 5343 (PRE; PRU); Umtamvuna Nature Reserve (-AA) Abbott 612 (NH; PRU); Umtamuvuna (-AA) Hilliard 6760 (PRE);

3218 (Clanwilliam) Piketberg (-AD) Edwards 242 (BOL); Pickenierskloof (-BB) Ecklon & Zeyher 1185 (P);

3228 (Butterworth) Kei Mouth (-CB) Flanagan 1816 (PRE; SAM; NH; BOL);

3318 (Cape Town) Riebekkasteel (-BD) Drege s.n. (P); Cape Town (-CD) de Castelnard 401 (P);

3321 (Ladismith) Waterkloof (-BD) Hutchinson 1106 (BOL; PRE); Gillet 1937 (BOL);

3322 (Oudtshoorn) George (-CB) Guthrie 4300 (NBG); Compton 24419 (NBG; UWC); Bolus 8645 (BOL); Acocks 21531 (PRE); Robinson Pass (-CC) Taylor 10060 (BOL); Langkloof (-CD) Van der Bijl in SAM 52008 (SAM); Outeniqua Pass (-CD) Lewis 3586 (SAM); Kammanassie Mountains (-DB) Zinn in SAM 54414 (SAM); Junction Montagu Pass and Oudtshoorn Road (-DC) Grobbelaar 2279 (PUC);

3323 (Willowmore) Uniondale (-CA) Horn s.n. (PRE); Avontuur (-CA) Court 342 (RUH);

3324 (Steytlerville) Kareedouw (-CC) Stirton 6359 (SRGH; PRE); Compton 4609 (NBG);

3325 (Port Elizabeth) Vanstadensrivier (-CC) Zeyher 7 (SAM); Ecklon & Zeyher 1186 (P); Zeyher in SAM 15205 (SAM); Uitenhage (-CD) Ecklon & Zeyher 1187 (SAM); Baakens River Valley (-DC) Olivier 1263 (NBG; PRE); Lovemore Heights (-DC); Urton 599 (PEU);

3326 (Grahamstown) Sidbury (-AC) Zeyher & Burke (SAM; PRE); Assegaai River (-AD) Bayliss 3632 (NBG); Leighton 2613 (BOL); Coldsprings (-AD) Acocks 12100 (PRE); Lubke 342 (RUH); Britton 5090 (PRE); Brink 306 (PRE); Bayliss 8188 (PRE); Richardson 172 (RUH); Grahamstown (-BC) Bayliss 3078 (NBG); Maguire 653 (NBG); Heeg 164 (RUH); Guthrie 3329 (NBG); Martin 9436a (RUH); Martin 9436b (RUH); Rogers 27467 (SAM; PRE; J); Tyson 6033 (SAM); Bennie 164 (PUC); MacOwan 53 (BM; BOL); Reed 9169 (NH); Grobbelaar 781 (PRE); Round Hill (-BD) Bolus in BOL 032550 (BOL);

3327 (Peddie) Orange Grove, East London (-BB) Rattray 1279 (PRE);

3418 (Simonstown) Cape of Good Hope (-AD) Reynaud s.n. (P); Rogers 2049 (BM); Masson s.n. (BM); Waldegrave s.n. (BM); Zeyher 359 (BM; P);

3419 (Caledon) Palmiet River Mouth (-AA) Compton 6082 (NBG);

3423 (Knysna) Knysna (-AA) Zeyher in SAM 15206 (SAM); Keurbooms River (-AB) Gillet 1581 (STE); Fourcade 4800 (STE).

Ecology

Grows in sandy soil on the slopes of grassy hills or on grassy flats. It is usually found where there is little other vegetation thus it does exceptionally well on burnt areas.

Notes

Harvey in Harv. & Sond. F.C. ii: 33 (1862) recognised three varieties of *R. elliptica*, var. α *erecta*, var. β *intermedia* and var. *acuminata*. These varieties differed from each other only in leaf shape and the trivial character - calyx lobes longer or shorter than the tube. γ Var. *intermedia* appears to be an intermediate form between var. α *erecta* and var. β *accuminata*, thus in this revision these varieties are not upheld but are placed in synonymy with *R. elliptica*.

It should be noted that *R. erecta* Eckl. & Zeyh. 1186 Enum. p.160 (1835) collected at Van Stadens River is misidentified and is actually *R. elliptica* (Fig. 88). In addition, Eckl. & Zeyh's no. 1187 Enum. p.160 (1835) collected at Uitenhage is not *R. retroflexa* Thunb. but is material of *R. elliptica* Thunb. (Fig. 92).

Figure 92: Type of R. retroflexa Eckl. & Zeyh.

17. **Rafnia ovata** (Berg.) Schinz in Berg Fl. Cap: 197 (1763); Thunberg Nov. Gen. Pl. 145 (1800); Schinz in Bull. Herb. Boissier ii: 199 (1894). Type: Cape of Good Hope Grubb s.n. SBT no. 32 (SBT lectotype!) Grubb s.n. SBT no. 31 (SBT syntype!). (Fig. 93).

Spartium ovatum Berg. in Fl. Cap: 197 (1763).

Crotalaria cuneiformis Lam., Encycl. II: 195 (1786). Type: No locality Sonnerat (P. holo!).

R. cuneifolia Thunb. Prodr. 123 (1800); Nov. Gen. Pl. 145 (1800); Fl. Cap. (ed. Schult): 563 (1823). Type: Cape of Good Hope: Thunberg in UPS 16431 (UPS holo!).

Pelecynthis rhomboidea E. Mey. Comm. 14 (1836). Type: Cape, Piketberg Drege (K holo!).

Pelecynthis corymbosa E. Mey. Comm. 14 (1836). Type: Cape, Paarlberg, Drege s.n. (P holo!). (Fig. 94).

Rafnia rhomboidea Walp in Linn XIII: 464 (1839).

R. corymbosa Walp in Linn. XIII: 464 (1839).

Either erect 600 to 900 mm tall or low spreading and procumbent. **Leaves** simple, alternate, sessile, exstipulate, 13-59 mm long and 4-30mm wide becoming smaller near the top of the plant, lanceolate to obovate, rigid, semi-fleshy and coriaceous. The lower leaves are greater and more rounded, the upper are smaller and narrowed. **Peduncles** several at the ends of the branches, sub-corymbose, leafless. Peduncles usually between 10-12 mm long but are only 2-3 mm long on some specimens, e.g. Esterhuysen 6155 (BOL). **Flowers** 8-12 mm long, bright yellow. **Calyx** 5-6 mm long. Upper and lateral calyx lobes broadly triangular, acuminate, shorter than the subulate lowest lobe. **Standard** 7-9 mm long, 7-8 mm wide, obovate, clawed and folded

Figure 93: Syntype of R. ovata (Berg.) Schinz.

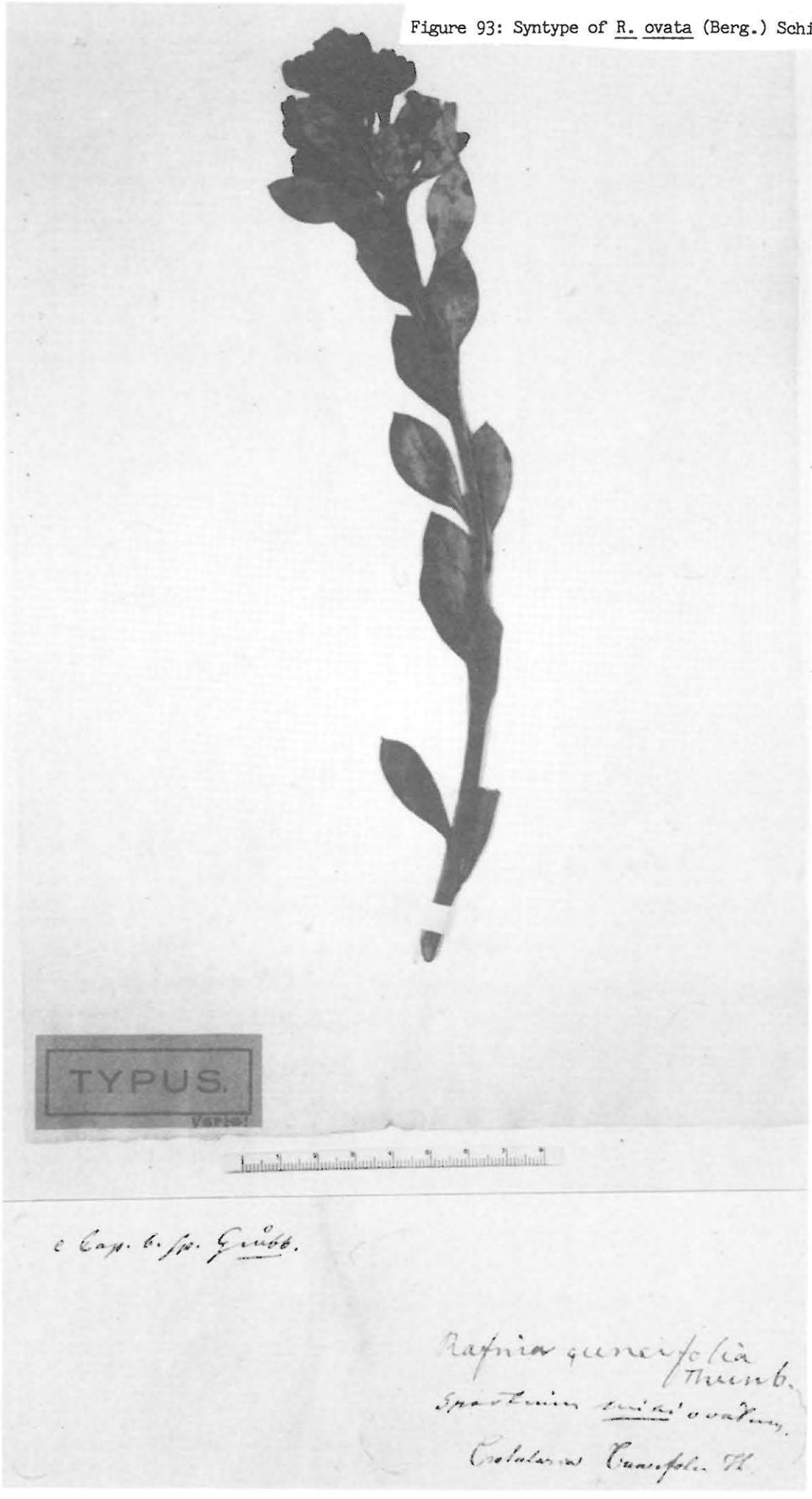


Figure 94: Type of Pelecynthis corymbosa E. Mey.

inwards. **Wings** 8-9 mm long, 4-5 mm wide at maximum, apex truncate. **Staminal sheath** 7 mm long, split on upper side, with six small 0,25 mm dorsifixed anthers alternating with four 1 mm long basifixed anthers. **Gynoecium** 8 mm long, style filiform, sharply upcurving, height of curvature 4,5 mm high, stigma capitate, finely fringed. **Legume** oblong 12-40 mm long, narrowed at base, shortly pedicellate with a narrow wing on the upper side. Ovary consistently 2-ovuled. (Figs. 95, 96 & 97).

Diagnostic features

1. Peduncles sub-corymbose leafless.
2. Keel truncate.
3. Wings without lunulae
4. Legume oblong, shortly pedicellate and narrowly winged.
5. Ovary consistently 2-ovuled.

Distribution

On dry sandy soil, reed flats and stony slopes from Pakhuis pass in the Clanwilliam district in the north, stretching southwards as far as Groot Hagelkraal in the district of Elim with the main concentration in the Ceres, Worcester area and eastwards through Ladismith and Riversdale to sparsely collected in Plettenberg Bay. (Fig. 98).

Normal Flowering Period: September to January (Feb).

Figure 95: R. ovata (Berg.) Schinz - Flowering branch (Dr Pappe s.n. K).

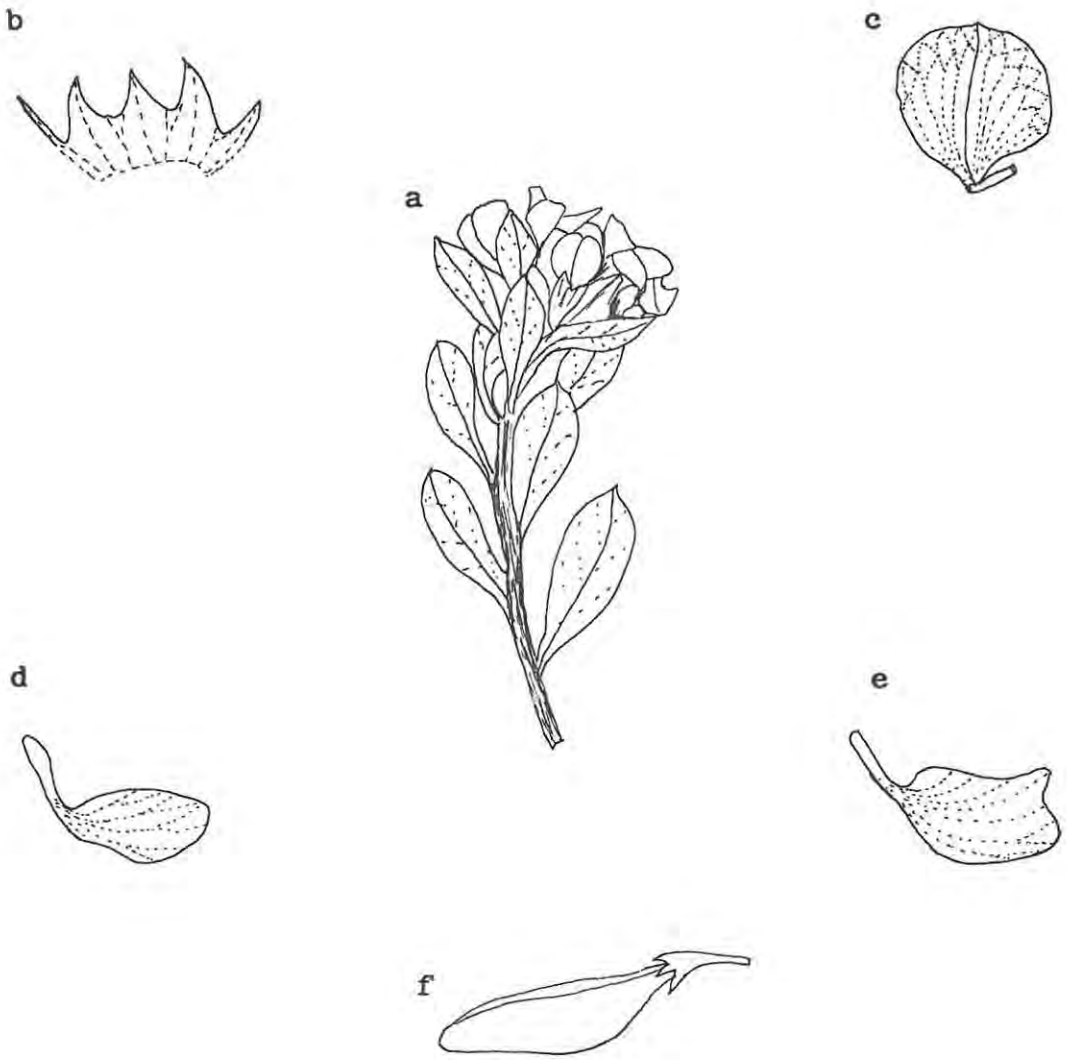


Figure 96: R. ovata (a) flowering branch x1, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal x3, (e) keel petal x3 (Drege s.n. P), (f) pod x1 (Compton 20442 NBG).

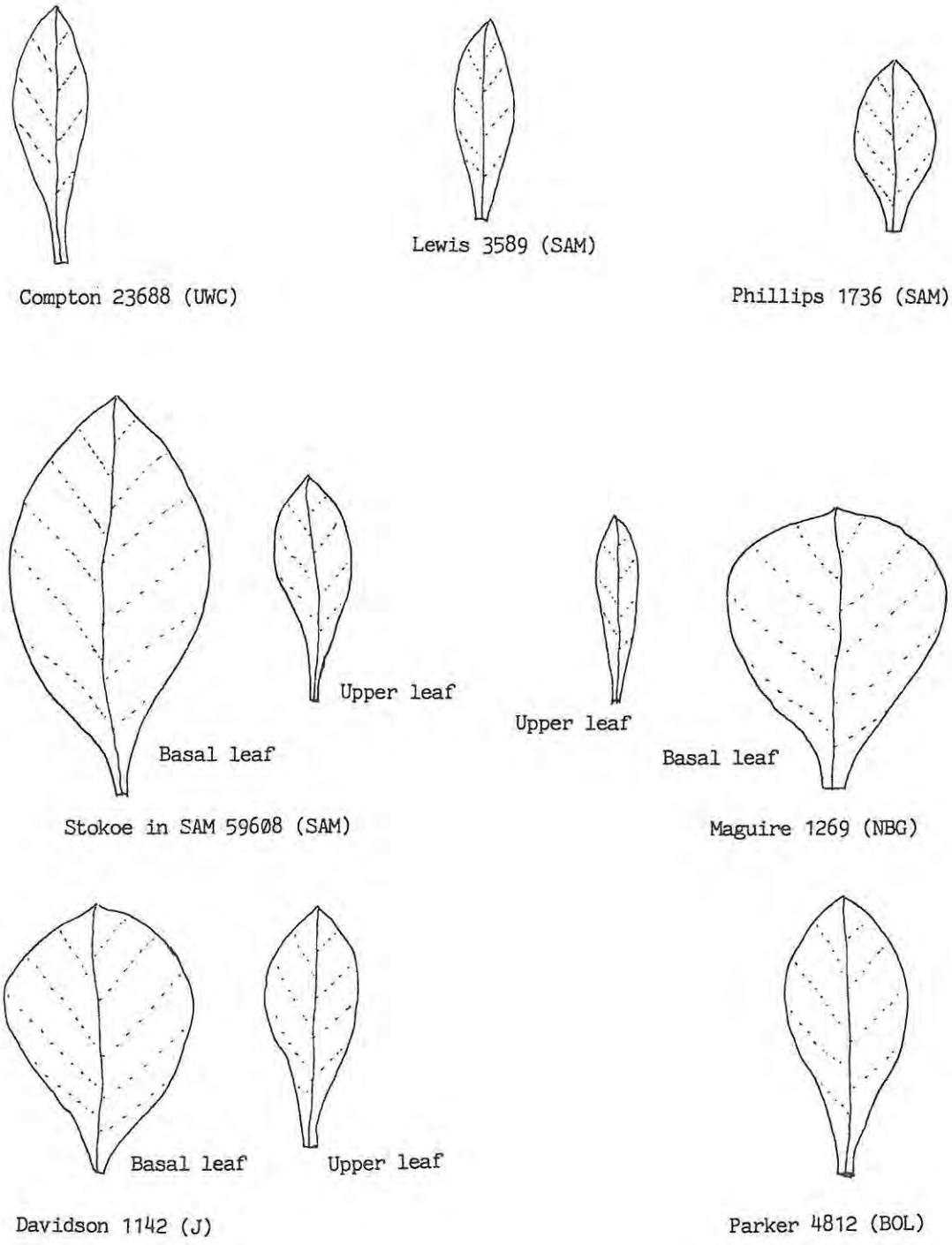


Figure 97: Rafnia ovata leaf variation x1.

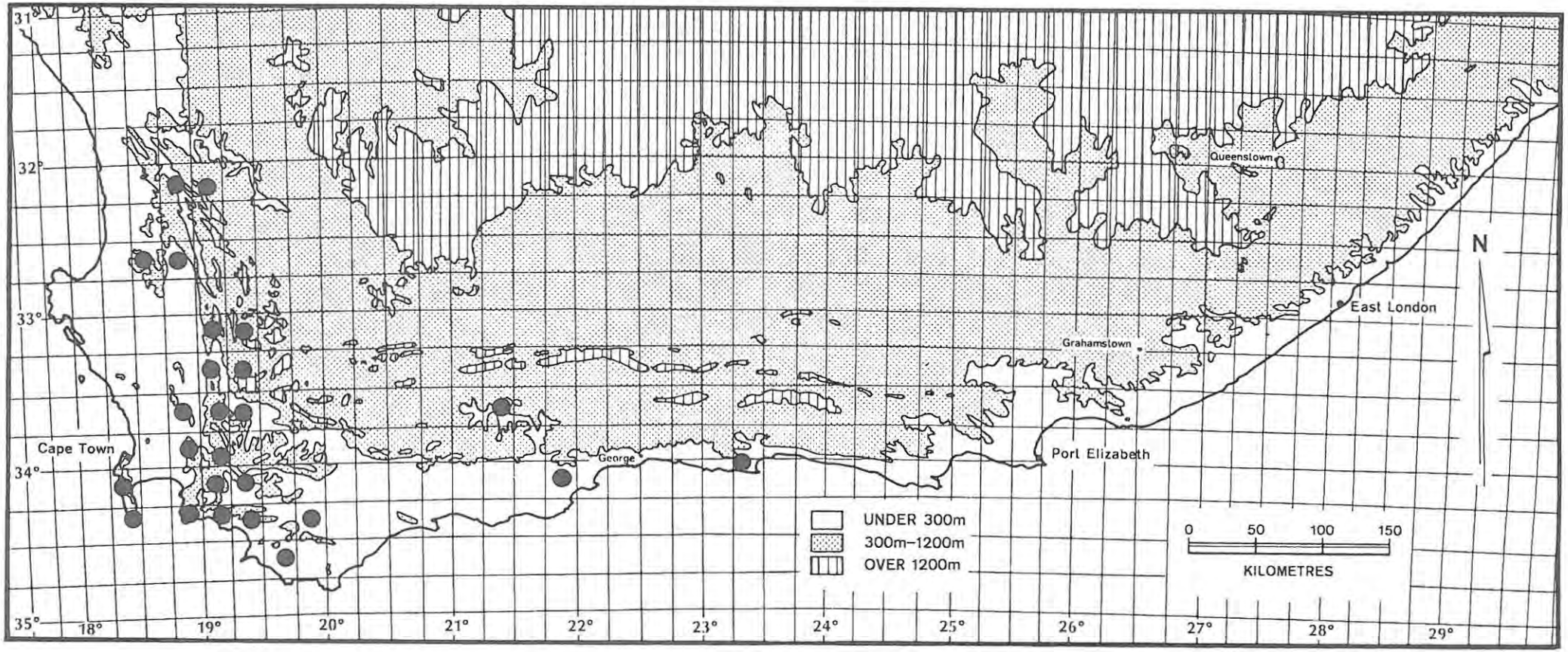


Figure 98: Geographical distribution of R. ovata (Berg.) Schinz.

Collections

3218 (Clanwilliam) Cardouw Pass (-BB) Barker 8121 (NBG); Piketberg Mountains (-DA) Compton 22968 (NBG); Loubser 803 (BOL); Bolus s.n. (BOL); Zinn in SAM 54632 (SAM); Guthrie 2578 (NBG); Martin 784 (NBG); Olifants River Mountains (-DB) Stephens 7031 (BOL); Pillans s.n. (STE); Edwards 93 (BOL); Dasklip Pass (-DB) Baker 10294 (NBG);

3219 (Wuppertal) Pakhuis Pass (-AA) Goldblatt 3083 (NBG);

3318 (Cape Town) Paarl (-DB) Drege s.n. (K); Paarlberg (-DB) Drege s.n. (P); Hangklip (-DB) Gouws 41 (UWC); Cloudskloof Mountains (-DB) Stokoe in PRE 53124 (PRE); Jonkershoek (-DD) Gouws 3054 (UWC); Compton 15340 (NBG);

3319 (Worcester) Winterberg, Tulbagh (-AA) Louw 1079a (STE); Phillips 1736 (SAM); Bolus s.n. (BOL); Twenty Four Rivers Mountains (-AA) Esterhuysen 16109 (BOL); Skurfteberg (-AB) Andreae 201 (STE); Tulbagh (-AC) Dr Pappe s.n. (K); Guthrie s.n. (NBG); Bolus 5009 (BOL); Compton 1240 (NBG); Compton 6499 (NBG); Esterhuysen 34389 (BOL); Bolus 2752B (BOL; BM); Elandskloof Pass (-AC) Compton 22694 (NBG); Winterhoek, Tulbagh (-AC) Zeyher in SAM 15210 (SAM); Waaihoek Peak (-AD) Esterhuysen 28730 (BOL; NBG; PRE); Esterhuysen 9927 (BOL; PRE); Esterhuysen 22658 (BOL); Esterhuysen 8308 (NBG; BOL); Michell's Pass (-AD) Compton 6715 (NBG); Compton 11963 (NBG); Stokoe in SAM 55819 (SAM); Esterhuysen 6755 (BOL); Milner Peak (-AD) Esterhuysen 14858 (BOL; PRE); Rosendal and Visgat (-AD) Pillans 9652 (BOL); Kaaimansgat, Villiersdorp (-BD) Esterhuysen 33367 (BOL); Du Toitskloof (-CA) Barker 7165 (NBG); Grobbelaar 2242 (PRU); Grobbelaar 1179 (PRE); Drege 1431 (P); Stokoe in STE 31486 (STE); Drege s.n. (BM); Lewis 3589 (SAM); Bainskloof (-CA) Schlechter 9100 (BM); Waainek Mountain (-CB) Esterhuysen 8289 (BOL); Frenchhoek (-CC) Schlechter 9318 (BM; P);

Drakenstein (-CC) Tyson 2358 (SAM); Haalsneeukop (-CC) Stokoe in SAM 56281 (SAM); Zachariashoek Experimental Catchment (-CC) Haynes 686 (STE);

3321 (Ladismith) Bailey's Peak (-CB) Stokoe in SAM 55818 (SAM);

3418 (Simonstown) Simonstown (-AB) Bolus 4793 (BOL; K); Cape of Good Hope (-AD) Sidey 4097 (PRE); Nelson s.n. (BM); Banks and Solander s.n. (BM); Niven s.n. (BM); Betty's Bay (-BD) Walters 287 (NBG); Davidson 1142 (J); Jordaan 1242 (STE); Van Rensburg 2154 (STE); Richardson 289 (RUH); Palmiet River Mouth (BD) Compton 6087 (NBG); Martin 783 (NBG); Groot Hangklip (-BD) Boucher 520 (STE; PRE; SRGH);

3419 (Caledon) Palmiet River Valley (-AA) Stokoe in SAM 65715 (SAM); Stokoe in SAM 61407 (SAM; PRE); Gray s.n. (BOL); Stokoe in SAM 59608 (SAM); Palmiet Bergrant (-AA) de Vos 1406 (STE); near Caledon (-AB) Bolus in PRE 53164 (PRE); Hermanus (-AC) Barker 1614 (NBG); Bolus 9833 (K); Kleinmond (-AC) Compton 3452 (BOL); Bot River (-AC) Schlechter 9449 (BOL); Vogelgat, Caledon (-AC) Williams 2605 (PRE); Fernkloof Nature Reserve (-AC) Orchard 133 (STE); Mossel River (-AD) Maguire 1269 (NBG); Compton 23688 (NBG; UWC); Maguire 228 (UWC); Rooi Els (-BD) Parker 4812 (BOL; NBG); Esterhuysen 14119 (BOL); Elim (-DA) Bolus 6789 (NBG; PRE; BOL; NH); Bolus 8534 (BOL; STE); Hagelkraal (-DA) Compton 20442 (NBG);

3421 (Riversdale) Zuurvlakte (-BB) Andreae 654 (STE);

3423 (Knysna) Plettenberg Bay (-AB) Bowie s.n. (BM).

Ecology

These plants are usually found on disturbed ground in firebelts or where fairly recent burns have occurred. They sprout after fire. *R. ovata* (Berg.) Schinz grows on shale band slopes, in dry sandy soil or

on reed flats.

Notes

The nomenclature of this species is rather involved and is explained in the chapter dealing with the history of the species (p. 2).

18. Rafnia capensis (L.) Schinz in Bull. Herb. Boissier ii: 199 (1894); L., Sp. Pl. ed. II: 995 (1763); Berg. Fl. Cap: 217 (1767); L. Suppl: 322 (1781); L. Syst. Veg. ed. XIII: 554 (1781); Thunb. Prodr. 123 (1800); Thunb. Fl. Cap. ed. (Schult): 563 (1823). Type: Cape of Good Hope, Burman (G. Holo!). (Fig. 99).

Spartium capense L. Pl. rar. Afr. 14 (1860), Amoen. Acad. 6: 91 (1763), Sp. Pl. ed. II: 995 (1763).

Cytisus capensis Berg. Fl. Cap: 217 (1767).

Liparia opposita L., Syst. Veg. ed. XIII: 554 (1774) Nom. illegit.

Grotalaria opposita L. Syst. Nat. per. Gmel: 1094 (1792) Nom illegit.

Rafnia opposita (L.) Thunb. Prodr. 123 (1800) et Fl. Cap. (Schult): 564 (1823). Type: Cape of Good Hope, Thunb in UPS 16438 (UPS Holo!). (Fig. 100).

R. pauciflora Eckl. & Zeyh. Enum: 162 (1835). Type: Tulbagh Waterfall, Eckl. & Zeyh. no. 1195 (NBG, Holo!).

Pelecynthis opposita (Thunb.) E. Mey. Comm. 15 (1836). Type: Cape of Good Hope, Zwarteberg, Ecklon 1820 (P Holo!).

Rafnia affinis Harv. in F.C. ii: 36 (1862). Type: Cape of Good Hope, Bowie (K Holo!). (Fig. 101).

Perennial shrubs, very variable, either erect to about 1200 mm or spreading with procumbent stems up to 300 mm, arising from a woody rootstock. **Leaves** simple, alternate, sessile, exstipulate, 8-55 mm long, 3-22 mm wide becoming smaller on the flowering axis, elliptic, lanceolate or ovate elliptical, narrowed at base. **Inflorescences** axilliary, flowers either solitary or peduncle once or twice forked with a pair of opposite bracts at each fork. **Flowers** 6-10 mm long, bright yellow, each subtended by a pair of foliaceous bracts,

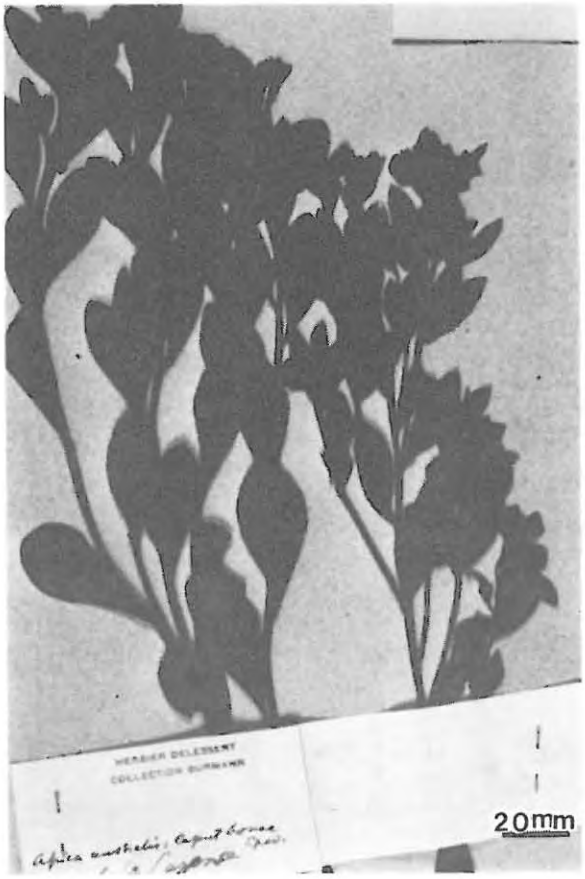


Figure 99: Type of R. capensis (L.) Schinz

Figure 100: Type of R. opposita (L.) Thunb.

Figure 101: Type of R. affinis Harv.

bracteoles 5-25 mm long. **Pedicel** 3-6 mm long. **Peduncle** 20-45 mm long. **Calyx** 4-5 mm long, lobes shorter than the 3-4 mm long tube. Upper and lateral calyx lobes triangular with a wide sinus, lowest subulate, somewhat longer. **Standard** 6-8 mm long, 4-8 mm wide, ovate, shortly clawed. **Wings** 5-8 mm long, 2-4 mm wide, clawed, claw 2-4 mm long, obovate, lunulae absent. **Keel** blades fused, 5-6 mm long, 3-5 mm wide with claw 2-3 mm long with truncate extremity. **Staminal sheath** 6-8 mm long, split on upper side with six small 0,25 mm long dorsifixed anthers, alternating with four 1 mm long basifixed anthers which are sterile. **Gynoecium** 6-8 mm long, style filiform, sharply upcurving, height of curvature 3-4 mm high, stigma capitate and finely fringed. **Legume** boot-shaped, stipitate, 14-20 mm long, with a narrow wing on the dorsal side. (Figs. 102, 103 & 104).

Diagnostic features

1. The absence of lunulae in this species is associated with a fringed, capitate stigma.
2. Keel is truncate.
3. The pod is boot-shaped with a narrow wing on the dorsal side.

Distribution

This species is never found further than 140 km from the coast and extends from the Vanrhynsdorp and Calvinia districts southwards to its main concentration in the Cape mountainous areas of Worcester and south-eastwards to the Kammanasieberge near Oudtshoorn. It also appears to a lesser degree in the Karoo in the Laingsburg and Prince Albert areas. (Fig. 105).

Figure 102: R. capensis (L.) Schinz - Flowering branch (Burchell 6892 K).

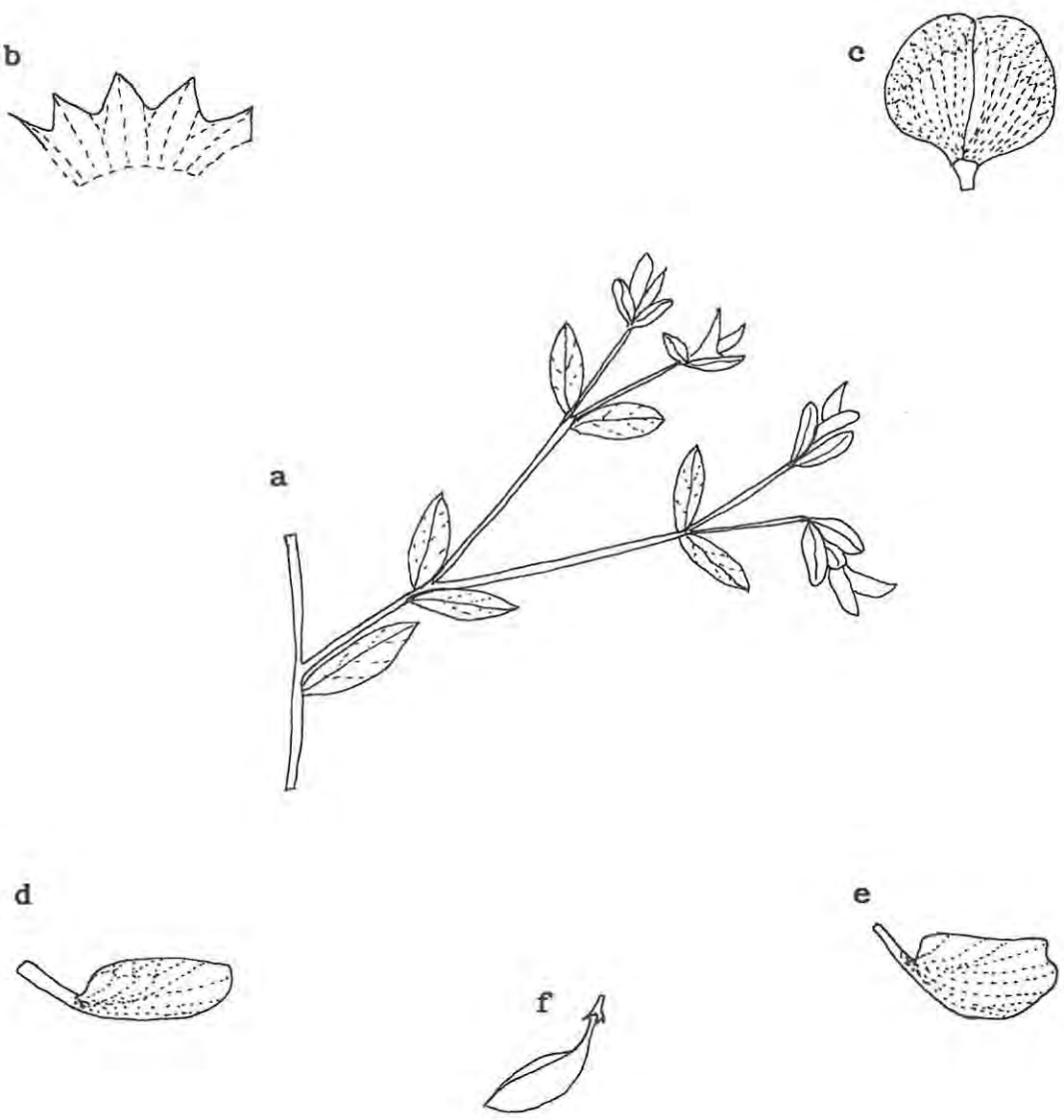


Figure 103: R. capensis (a) flowering branch x1, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal x3, (e) keel petal x3 (Barker 3260 NBG), (f) pod x1 (Hugo 2522 STE).

Goldblatt 5169 (PRE)

Esterhuysen 22458 (BOL)

Wurts 547 (NBG)

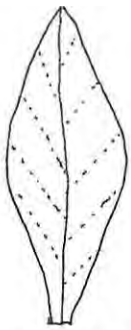
Lewis 5699 (NBG)

Ecklon & Zeyher s.n. (SAM)

Haynes 1235 (STE)

Barker 3260 (NBG)

Salter 4075 (BM)



Compton 17874 (NBG)

Figure 104: R. capensis leaf variation x1.

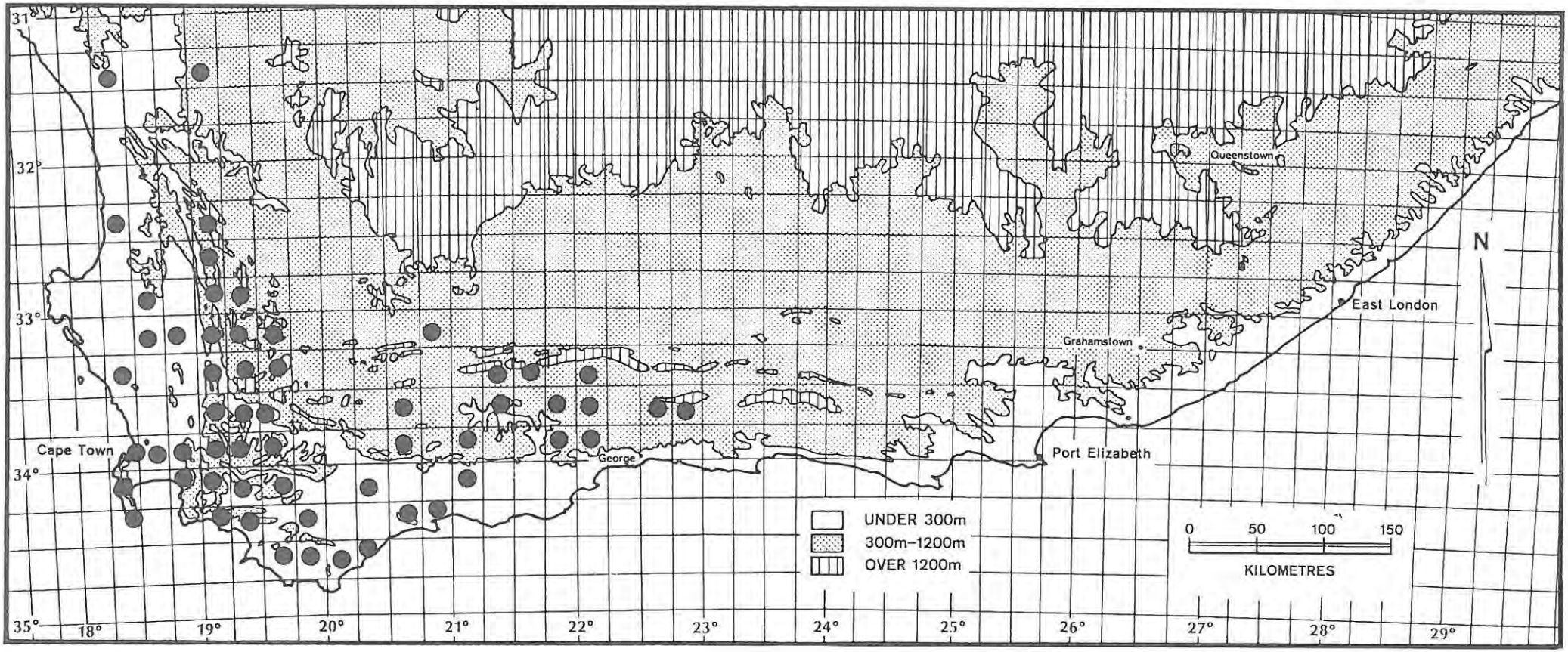


Figure 105: Geographical distribution of R. capensis (L.) Schinz

Normal Flowering Period: September to February.

Collections

3118 (Vanrhynsdorp) Valsgatkop (-AD) Esterhuysen 1555 (BOL);

3119 (Calvinia) Glenridge, Nieuwoudtsville (-AC) Barker 9201 (NBG);

3218 (Clanwilliam) Wolfberg (-AD) Esterhuysen 22458 (BOL); Piketberg (-DC) Guthrie 2577 (NBG); Goldblat s.n. (NBG);

3219 (Wuppertal) Niewhoudpas (-AC) Pocock 794 (STE); Sneeuberg (-AC) Esterhuysen 18035 (BOL); Algeria Nature Reserve (-AC) Taylor 7506 (STE); Viviers 124 (JF); Cedarberg Mountains (-AC) Esterhuysen 7197 (BOL); Haynes 1325 (JF; STE); Gouws 3224 (UWC); Cedarberg State Forest (-CA) Forsyth 157 (STE; JF); Olifants River Mountains (-CC) Esterhuysen 13468 (BOL); Edwards 93 (BOL); Rosendal Valley (-CD) Oliver 6093 (PRE);

3318 (Cape Town) Darling Bridge, Breede River (-AD) Compton 9907 (NBG); Bolus 2751B (BOL); Swartberg (-BA) Vlok 154 (SAAS); Esterhuysen 18546 (BOL); Ecklon s.n. (P); Vlok 37 (SAAS); Pocock 94 (STE); Camps Bay (-CD) Cassidy 97 (NBG); Between Camps Bay and Pipe Track (-CD) Young s.n. (PRE); Table Mountain Twelve Apostles (-CD); Froembling 345 (NBG); Fisantekraal (-DC) Compton 21106 (NBG); Constantia (-DC) Ecklon & Zeyher 1191 (SAM); Kraaifontein (-DC) Compton 4847 (NBG); Jonkershoek State Forest (-DD) Kruger 120 (STE; JF); Borchardt 623 (JF); Taylor 4207 (STE); Kruger KR839 (STE; PRE; JF); Haynes 1118 (STE; JF); Van der Merwe 838 (PRE; STE); Kerfoot 6269 (JF); Klapmuts (-DD) Bolus in BOL 32549 (BOL);

3319 (Worcester) Winterhoek (-AA) Bolus 5010 (BOL); Esterhuysen 19819 (BOL); Skurweberg (-AB) Hugo 2522 (STE); Thorne in SAM 53130 (SAM); Schlechter 10005 (BOL); Hansiesberg (-AB) Compton 16709 (NBG); Compton

16672 (NBG); Tulbagh Waterfall (-AC) Ecklon & Zeyher 1195 (SAM); Witzenberg (-AC) Zeyher in SAM 15203 (SAM); Compton 18807 (NBG; BOL); Waaihoek Peak (-AD) Esterhuysen 28730 (PRE); Esterhuysen 9927 (PRE); Esterhuysen 22658 (BOL); Ceres (-AD) Bolus 8371 (NBG; BOL); Hanekom 1274 (PRE); Story 3590 (PRE); Bolus 3381 (BOL); Baviaansberg (-BA) Compton 12882 (UWC; NBG); Roodeberg (-BC) Compton 8409 (NBG); Hex River Pass (-BC) Compton 22839 (UWC); Bainskloof (-CA) Schlechter 9135 (BOL); Molenaarsberg (-CA) Esterhuysen 14073 (BOL); Compton 20144 (NBG); Waaihoek (-CB) Esterhuysen 9927 (BOL); Esterhuysen 8308 (BOL; NBG); Worcester (-CB) Stokoe 11526 (STE); Klein Drakenstein Mountains (-CC) Kruger KR778 (STE; JF); Zachariashoek Catchment (-CC) le Maitre 48 (STE; JF); Viviers 691 (JF); French Hoek Pass (-CC) Barker 8537 (NBG); Grobbelaar 1028 (PRU); Salter 2970 (BM; BOL); Wemmershoek (-CC) Compton 4832 (NBG); Louwshoek Kloof (-CD) Esterhuysen 17650 (BOL; PRE); Esterhuysen 17600 (BOL); De Doorns (-CD) Acocks 15518 (PRE); Bokkeveld (-CD) Esterhuysen 3922 (BOL); Kroonlandpiek (-CD) Hugo 2454 (STE); Keeromsberg (-DA) Esterhuysen 9257 (BOL); Breede River Valley (-DC) Bolus 2751 (BOL; SAM); Riviersonderend Mountains (-DC) Boucher 4261 (PRE; STE);

3320 (Montagu) Laingsberg (-BB) Barker 6778 (NBG); Anysberg (-DA) Van Wyk 1018 (STE); Zuurbrak (-DC) Schlechter 2139 (P; BM);

3321 (Ladismith) Laingsberg Road (-AD) Stirton 10289 (STE); Seweweekspoort (-AD) Vlok 154 (SAAS); George (-AD) Vlok 4 (SAAS); Bowie s.n. (BM); Swartberg (-BC) Vlok 37 (SAAS); Oliver 5551 (STE); Rooiberg (-CB) Taylor 9801 (STE); Gysmanshoek Pass (-CC) Hugo 2736 (STE; JF); Garcia's Pass (-CC) Van Wyk 686 (STE); Gamka Mountain Slope (-DB) Boshoff P128 (STE); Paardevleiberg (-DD) Bond 1637 (STE; SAAS);

Spitskop and Kamma River Junction (-DD) Matthews 1110 (NBG);

3322 (Oudtshoorn) Swartberg Pass (-AC) Compton 10421 (NBG); Stokoe 8783 (BOL); Esterhuysen 18546 (BOL); Vlok 37 (SAAS); Kammanasie Mountain (-CA) Vlok 371 (STE) Thompson 1389 (STE); Kruispad (-CA) Compton 21765 (NBG); Klein Moerasrivier Spruiten (-CC) Barker 7711 (NBG); Buffelsrivier (-DB) Thompson 1389 (STE);

3418 (Simonstown) Simonstown (-AB) Ecklon s.n. (P); Lynes s.n. (BM); Hout Bay (-AB) Viviers 164 (STE; JF); Noel s.n. (RUH); West of Redhill (-AB) Goldblatt 5169 (PRE); Bergvliet Farm (-AB) Purcell s.n. (SAM); Wynberg (-AB) Eckl. & Zeyh. 1195 (SAM) Steenberg (-AB) Compton 17874 (NBG); Compton 13800 (NBG); Salter 7927 (BOL); Muizenberg Mountains (-AB) Bolus 7012 (BOL); Eckl. & Zeyh. 1191 (SAM; P); Klaver Valley (-AB) Salter 7947 (BOL); Bolus 4678 (BOL); Ecklon s.n. (P); Fish Hoek Flats (-AB) Salter 7790 (BOL); Constantiaberg (-AB) Salter 2913 (BM; BOL); Constantia Nek (-AB) Salter s.n. (BM); Orange Kloof Road (-AB) Wolley-Dod 1696 (BOL; BM); Cape of Good Hope (-AD) Masson s.n. (BM); Nelson s.n. (BM); Lehman s.n. (P); Wallich s.n. (BM); Harvey s.n. (BM); Lourensford Estate (-BB) Parker 3949 (NBG; BOL); Hottentots Holland Mountains (-BB) Eckl. & Zeyh. 1193 (SAM); Ecklon s.n. (BM; P); Palmiet River (-BB) Compton 14094 (NBG); Gordon's Bay (-BB) Marloth 10111 (PRE);

3419 (Caledon) Houwhoek (-AA) Guthrie 2577 (NBG); Palmiet River (-AA) Compton 14094 (NBG); Swartberg (-AB) Ecklon 1828 (P); Bolus 11463 (BOL); Bot River (-AC) Taylor 3797 (NBG); Taylor 4854 (NBG); Hermanus (-AD) Van Wyk 2092 (PRU); Appelskraal (-BA) Stokoe 61412 (SAM); Highlands Forest Reserve (-BD) Stokoe in SAM 68748 (SAM); Kogelberg (-BD) Leighton 779 (BOL); Hagelkraal (-DA) Lewis 3588 (SAM); Riet Fout Poort, Elim (-DB) Bolus s.n. BOL);

3420 (Bredasdorp) Ten o' clock Mountain, Swellendam (-AB) Wurts 547 (NBG); Swellendam Mountains (-AB) Bowie 10 (BM); Potteberg (-BC) Compton 20409 (NBG); Lewis 2461 (SAM); West of Elim (-CA) Salter 4075 (BM; BOL); Strandkloof (-CB) Martin 354 (NBG); Rietfonteinport (-CB) Schlechter 9695 (BOL); Schlechter 9707 (P);

3421 (Riversdale) Riversdale (-AB) Burchell 6892 (K).

Ecology

This species grows mainly on younger Cape granite soil with an overlay of soil of the Table Mountain Group, with restioids in relatively xeric fynbos, often associated with Leucospermum cuneiforme, Protea repens, Leucadendron salignum, Protea arborea and Aspalathus spp.

The identification of R. capensis is sometimes confused because of the smaller-leaved montane forms, (Fig. 106) and this is further complicated if the plants are coppicing after fire (Fig. 107). In both the montane and lowland forms, the leaves and bracts on the flowering branches are small from 5-25 mm in length, and the larger basal leaves are often missing particularly in the coppicing plants. No structural variation presents itself in the flowers.

Notes

Liparia opposita L., first appeared, rather ambiguously, in Mant. Pl. Alt. 269 (1771) but as alternative names appear to be given, the names are regarded as not validly published. However, Murray took up the name in 1774, citing Spartium capense L. in synonymy. As Murray/Linnaeus should have used the earliest epithet, i.e. capense, and did not, Liparia opposita is an illegitimate name, as is

Figure 106: R. capensis - small leaved montane form (Esterhuysen 22458 BOL).

Figure 107: R. capensis coppicing branch (Vlok 4 SAAS).

Crotalaria opposita because it is based on an illegitimate name.

Schinz, in 1894, suggested that R. affinis may well be a synonym of R. capensis, but in his revision he retained it as a separate species. However, in 1950, Salter in Flora of the Cape Peninsula, placed R. affinis in synonymy with R. capensis on the grounds that intermediates exist which make it impossible to separate these species into two entities. The author approves this action.

It should be noted that Eckl. & Zeyh's collections 1193 and 1194 (Enum. p.161 1835) are both R. capensis and not as labelled.

19. Rafnia vlokii Richardson sp. nov. Type: Cape Province 3322 (Oudtshoorn) Northern slope of the Outeniqua Mountains (-DD), April 1984, Richardson 155 (RUH; holotypus; K, PRE, GRA, isotype). (Fig. 108).

Erect herbaceous perennial, 900-1200 mm, glabrous, arising from a woody rootstock. **Leaves** simple, alternate, sessile, exstipulate, 45-50 mm long, 15-20 mm wide, becoming smaller towards the flowering apices, elliptic. Leaves decidedly yellow at apex. **Inflorescences** axilliary, single flowered; **flowers** 16-20 mm long, bright yellow, each subtended by a pair of tiny setaceous bracts at the base of the pedicel; **peduncle** borne between a pair of opposite bracts. **Calyx** 18 mm long, calyx lobes much longer than the tube, keel lobe shortest and setaceous: upper margins of the two vexillar calyx lobes connate to form a keel. **Corolla** yellow, **standard** 16-17 mm long, 16 mm wide, very wide ovate, shortly clawed. **Wings** 16 mm long, 7 mm wide, obovate, exceeding keel, lunulate, each possessing 6-8 rows comprising 12-22 intercostal lunulae. **Keel** blades fused, 14 mm long, 8 mm wide at maximum, claw 5 mm long, apex shortly beaked. **Staminal sheath** 12 mm long, split on upper side with five small 1 mm long dorsifixed anthers alternating with four 3 mm long basifixed anthers, carinal anther 1,5 mm long. The linear, basifixed anthers are sterile. **Gynoecium** 12 mm long, style filiform, sharply upcurving, height of curvature 7 mm high, stigma capitate, finely fringed. **Pods** 40-45 mm long, 10 mm wide, linear, with a fairly broad wing, 2 mm wide. Pods erect at first but becoming pendulous. (Figs. 109, 110 & 111).

Figure 108: Type of R. vlokii Richardson sp. nov.

Figure 109: R. vlokii - whole plant (taken in field on Outeniqua mountain).

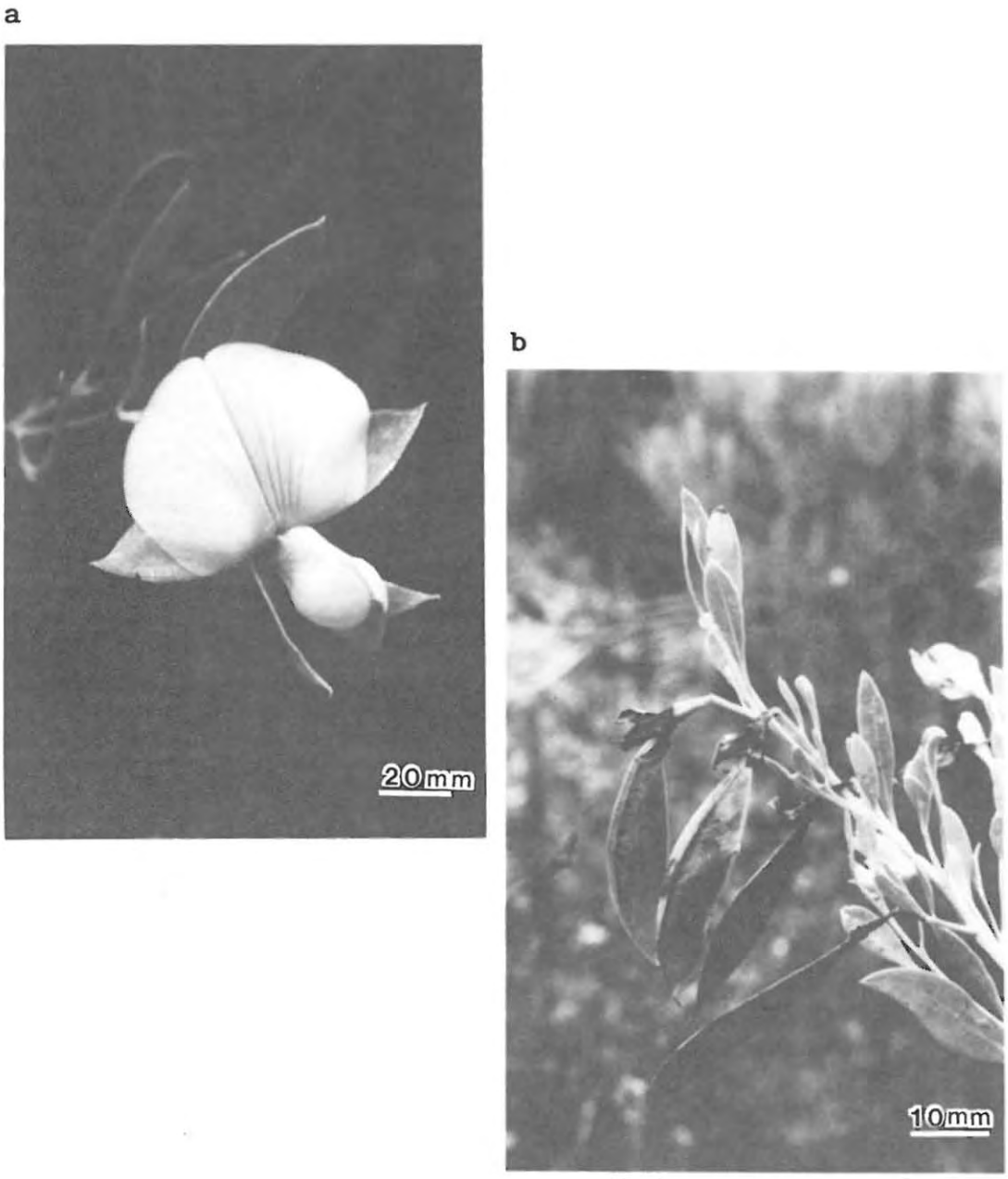


Figure 110: R. vlokii (a) flower, (b) pods.

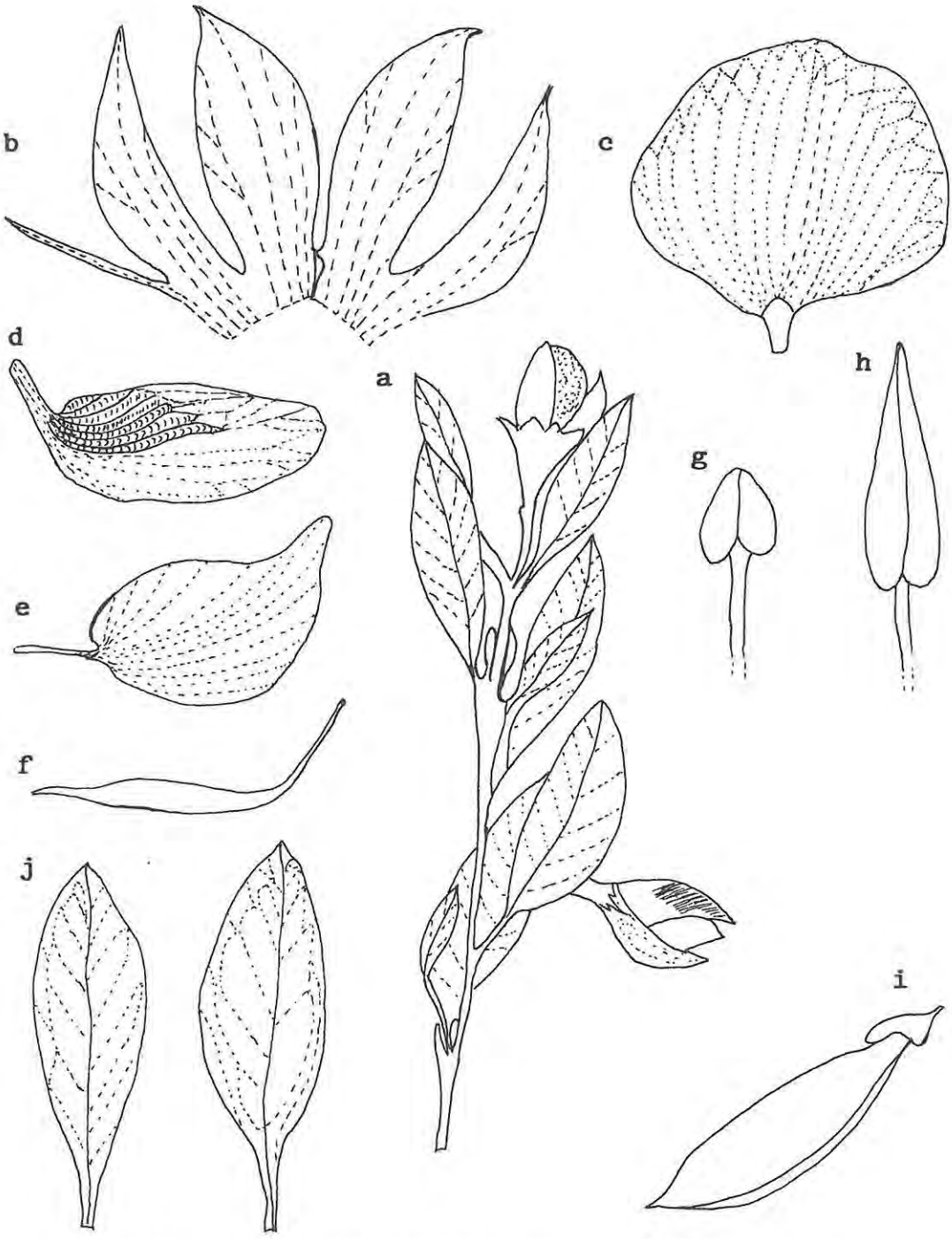


Figure 111: R. vlokii (a) flowering branch x1, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3, (f) gynoecium x3, (g) dorsifixed anther x18, (h) basifixed anther x18, (i) pod x1, (j) leaves x1 (Richardson 155 RUH).

Diagnostic features

1. Erect plant up to 1,2 m tall.
2. The upper margins of the two vexillar calyx lobes are connate to form a keel.
3. The wings are lunulate.
4. Apex of keel shortly beaked.
5. Pods wide, linear with a fairly broad wing.

Distribution

This species is localised on the northern side of the Outeniqua Mountains. (Fig. 112).

Normal Flowering Period: October - March (April)

Collections.

3322 (Oudtshoorn) N. side of Outeniqua mountains (-DD) Richardson 154 (RUH); Richardson 155 (RUH; GRA; PRE; K).

Ecology

R. vlokii grows in soil on the northern slopes of the Outeniqua Mountains.

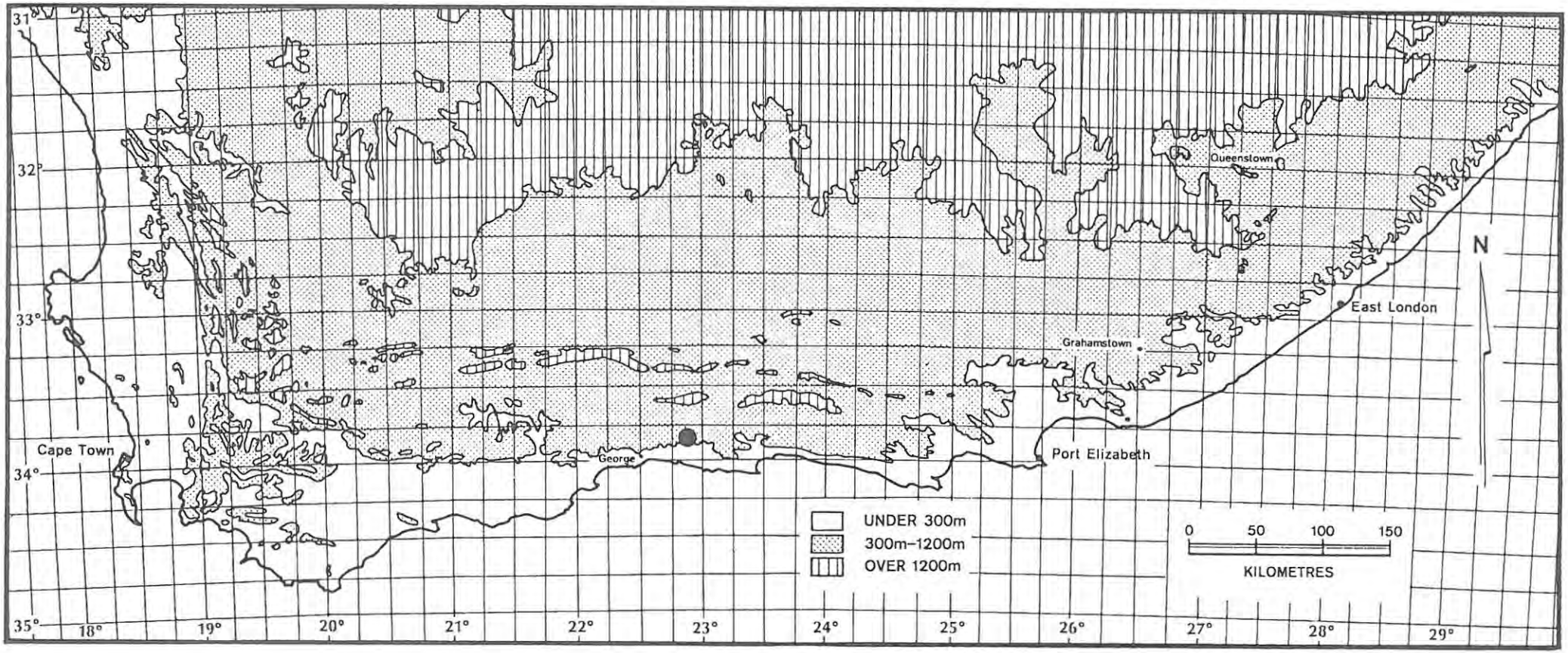


Figure 112: Geographical distribution of R. vlokii Richardson sp. nov.

Notes

This species is not unlike R. elliptica Thunb. in that it also possesses a keel between the two vexillar lobes of the calyx, but differs in having the posterior sepals of the calyx deeply divided whereas R. elliptica only has the posterior sepals of the calyx divided to less than halfway. It is, in addition, a much taller plant and has a completely different pod.

This species is named after Jan Vlok of the Saasveld Forestry Research Station who introduced me to the species.

20. Rafnia swartbergensis Richardson sp. nov. Type: Cape Province 3322 (Oudtshoorn) Swartberg Pass (-AC) Stokoe 8782 (BOL. holotype!). (Fig. 113).

Semi-spreading shrublet up to 300 mm high, glabrous, arising from a woody rootstock. **Leaves** simple, alternate, sessile, exstipulate, 28-33 mm long, 10-25 mm wide, becoming smaller at the flowering apices, elliptic to lanceolate, apex attenuate, base cuneate. **Inflorescence** with forked flowering branches and opposite bracts having a flower in the fork and on each arm. **Flowers** 15-18 mm long, bright yellow, each subtended by a pair of bracts. **Pedicel** very short, 1-2 mm long. **Peduncles** 18-20 mm long. **Calyx** 15 mm long, shallow sinuses associated with wings between each lobe. Each wing is formed by the fusion of the margins of adjacent sepals. This fusion does not extend to the apices. The dorsal wing is more prominent and twice the depth of the other wings. **Standard** 15 mm long, 15 mm wide, very wide-ovate, shortly clawed. **Wings** 11 mm long, 5 mm wide, exceeding the keel, lunulate, each possessing 5-6 rows comprising 15-20 intercostal lunulae. **Keel** blades fused, 9 mm long, 5 mm wide at maximum, claw 5 mm long, apex very shortly beaked. **Staminal sheath** 11 mm long, five 0,75 mm long dorsifixed globose anthers alternating with four 2 mm long linear, basifixed anthers, carinal anther intermediate, 1,25 mm long, the latter five anthers are sterile. **Gynoecium** 11 mm long, style filiform, sharply upcurving, height of curvature 7 mm high, stigma capitate, finely fringed. **Pods** about 20 mm long and 5 mm wide and contain only a single seed. (Figs. 114, 115 & 116).

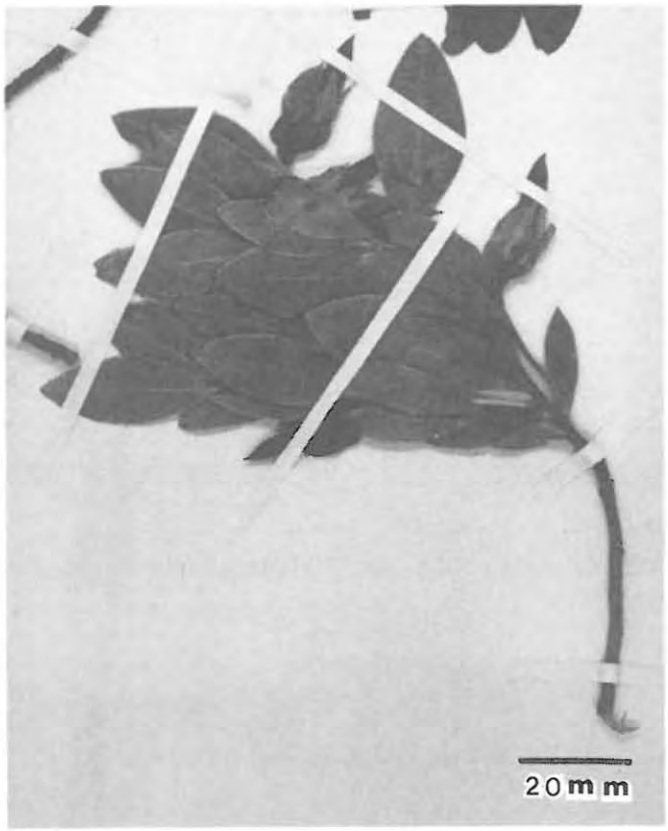


Figure 113: Type of R. swartbergensis Richardson sp. nov.

Figure 114: R. swartbergensis flowering branch (Vlok 108 SAAS).

Figure 115: R. swartbergensis outlier from Potberg (Walgate 899 BOL).

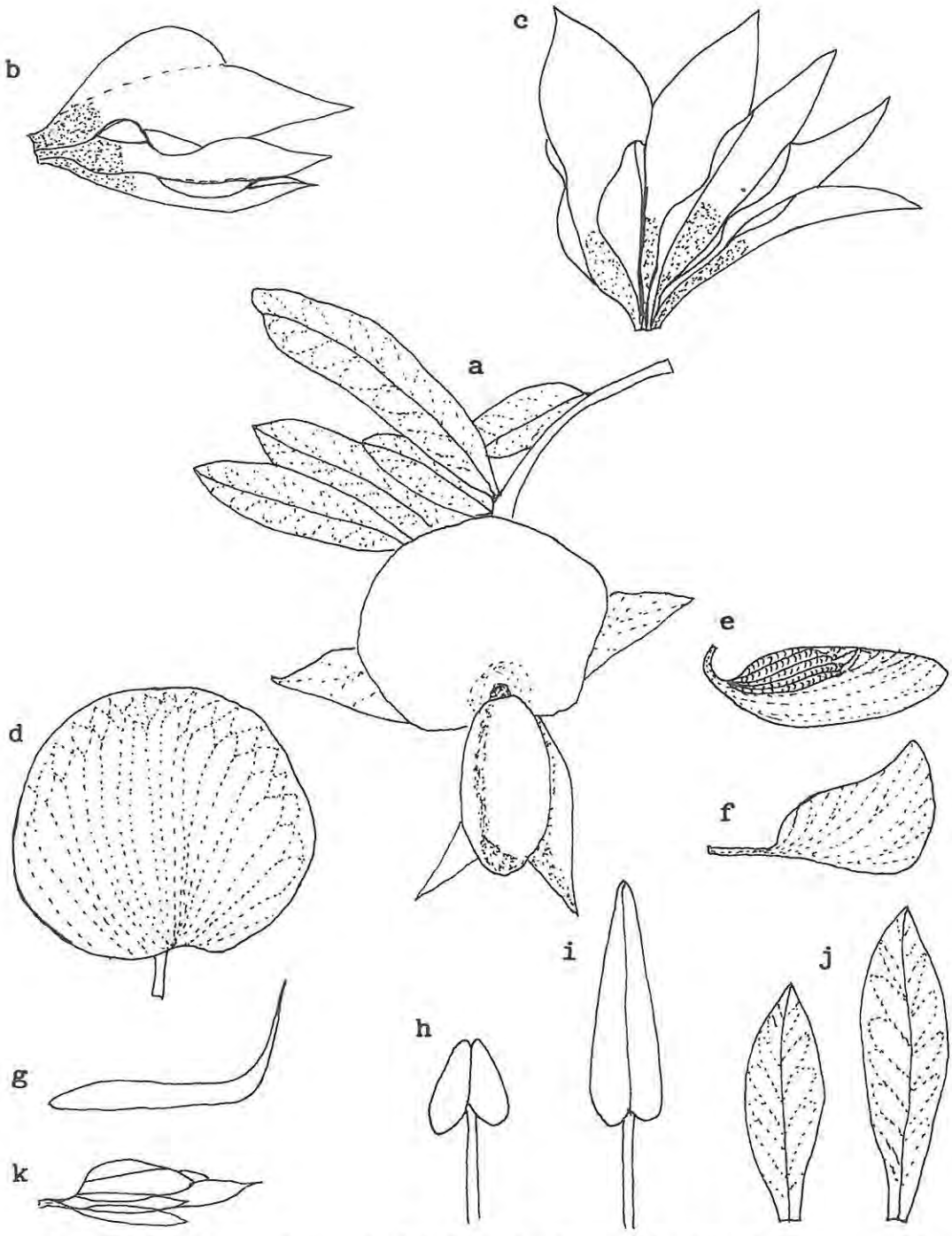


Figure 116: R. swartbergensis (a) flowering branch x3. (b) calyx - longitudinal view x3, (c) calyx opened out x3,5, (d) standard opened out x3, (e) wing petal showing intercostal lunulae x3, (f) keel petal x3, (g) gynoecium x3, (h) versatile anther on shorter filament x18, (i) basifixed anther on longer filament x18, (j) leaves x1 (Stokoe 8782 BOL), (k) pod x1 (Esterhuysen 28822 BOL).

Diagnostic features

1. Winged calyx - a wing being found between each calyx lobe. The dorsal wing is more prominent and twice the depth of the other wings.
2. Wings lunulate.
3. Keel apex very shortly rostrate.
4. Pod has sepals more than half its length.

Distribution

This species is concentrated on the Swartberg except for two outliers from the Potberg. (Fig. 117).

Normal Flowering Period: October - January.

Collections

3321 (Ladismith) Swartberg (-BD) Esterhuysen 28822 (BOL); Vlok 108 (SAAS); Thompson 2266 (STE);

3322 (Oudtshoorn) Swartberg Pass (-AC) Stokoe 8782 (BOL); Stokoe in SAM 68744 (PRE); Stokoe in SAM 44811 (SAM); Bolus s.n. (BOL); Stokoe in SAM 65712 (SAM);

3420 (Bredasdorp) Potteberg (-BC) Walgate 899 (BOL); Potberg Nature Reserve (-BC) Burgers 1404 (STE).

Ecology

R. swartbergensis is found on the slopes of the Swartberg growing mainly in soils of the Table Mountain Group and on rocky slopes among restioids. Two specimens have been collected in the Bredasdorp district on the Potberg. The plants are taller than those from the

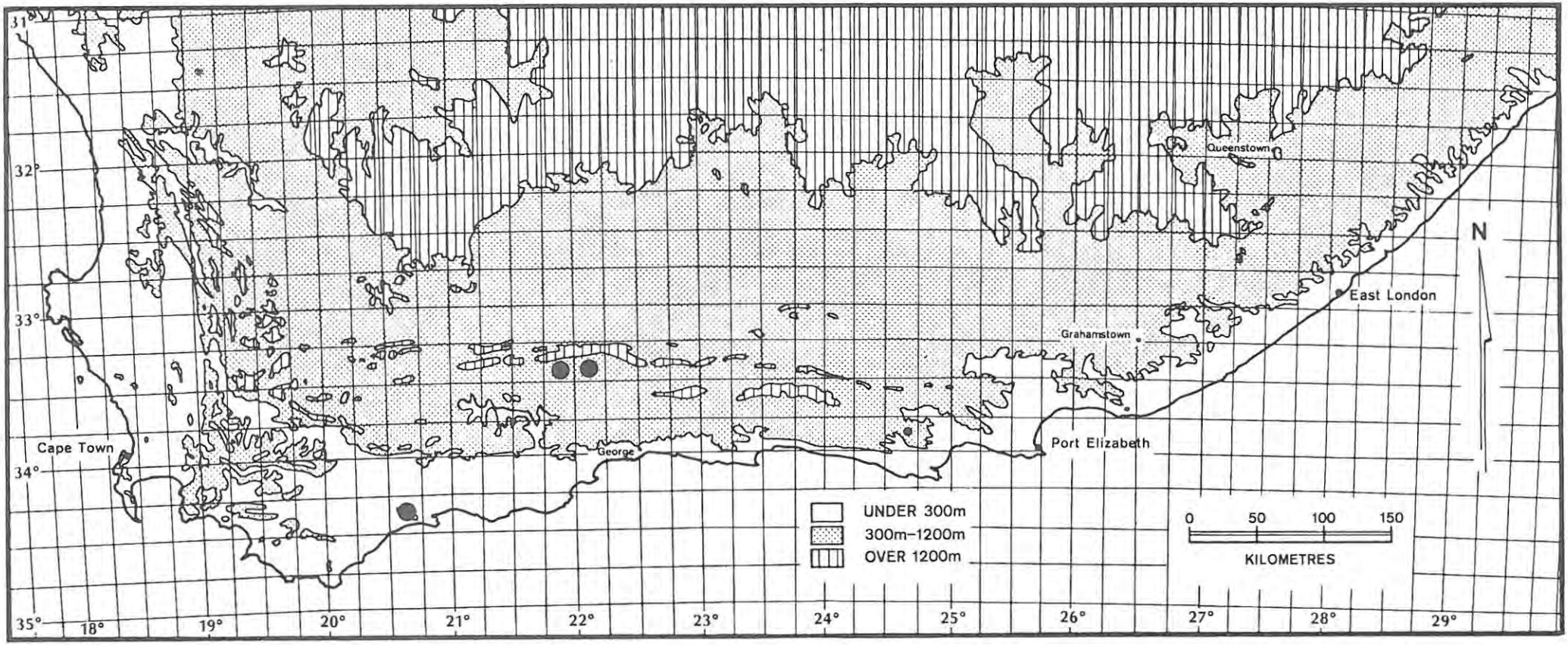


Figure 117: Geographical distribution of R. swartbergensis Richardson sp. nov.

Swartberg but possess the very distinctive winged calyx (Fig. 115). It grows very well in burnt areas and coppices after fire.

Notes

This species is allied to R. elliptica and R. vlokii but it is a much smaller plant with a completely different calyx having wings between each calyx lobe unlike the other two species which only have a keel formed by the connation of the margins of the two vexillar lobes. The pod of the new species is also distinct from the allies in having sepals more than half its length.

This species is so named as it occurs mainly on the Swartberg Mountains.

21. Rafnia glaucophylla Stirton ex Richardson sp. nov. Type: Cape Province 3119 (Calvinia) Lokenburg (-CA) Acocks 17080 (K, holotypus). (Fig. 118).

Decumbent shrub up to 400 mm high arising from a woody rootstock. **Leaves** simple, alternate, sessile, exstipulate, glaucous, 10-15 mm long, 5-10 mm wide, becoming smaller towards the flowering apices. **Inflorescences** axilliary, single flowered sometimes clustered terminally on long shoots. **Flowers** 8-10 mm long, bright yellow, each subtended by a pair of small foliaceaus bracts, bracts about 6 mm long. **Pedicel** 2-3 mm long. **Peduncle** 25-40 mm long. **Calyx** 4 mm long, lobes shorter than tube, keel lobe narrower than vexillar and lateral lobes which are triangular. **Standard** 9-10 mm long, 9 mm wide, wide ovate, shortly clawed. **Wings** 7 mm long, 3,5 mm wide, obovate, exceeding the keel, lunulate, each possessing 5-6 rows comprising 8-20 intercostal lunulae. **Keel** blades fused 7 mm long, 4 mm wide at maximum, claw 2,5 mm long, naviculate. **Staminal sheath** 6 mm long, split on upper side with six small 0,25 mm long globose, dorsifixed anthers alternating with four 1 mm long, linear, basifixed, sterile anthers. The filament of the carinal anther is free. **Gynoecium** 9 mm long, style filiform, upcurving, height of curvature 3mm, stigma capitate, finely fringed, seeds and fruits unknown (Figs. 119 & 120).

Diagnostic features

1. Glaucous, grey leaves.
2. Filament of carinal anther free.
3. Decumbent plant to 400 mm tall
4. Naviculate keel
5. Wings are lunulate

Figure 118: Type of R. glaucophylla Stirton ex Richardson.

Figure 119: R. glaucophylla - flowering branch (Leistner 426 K).

Figure 120: R. glaucophylla (a) part of flowering branch x2, (b) calyx opened out x3, (c) standard opened out x3, (d) wing petal showing intercostal lunulae x3, (e) keel petal x3, (f) gynoecium x3, (g) pod x1, (h) leaves x1 (Acocks 17080 K).

Distribution

This species is found only on the Lokenberg with a single outlier from the southern slopes of the Bontebergen. (Fig. 121).

Normal Flowering Period: September and October.

Collections

3119 (Calvinia) Lokenberg ridges (-CA) Leistner 426 (K); Acocks 17080 (K); Story 4407 (PRE); Acocks 17276 (PRE); Story 4333 (PRE); Acocks 17453 (PRE);

3319 (Worcester) Bontebergen (-BD) Marloth 9092 (STE; PRE).

Ecology

R. glaucophylla is only found in arid fynbos and ridges of the table mountain group.

Notes

This species is closely allied to R. capensis (L.) Schinz but possesses a naviculate keel and lunulae are found on the wing petals whereas in R. capensis the keel is truncate and lunulae are absent. In addition, R. glaucophylla has decidedly glaucous, grey leaves, totally unlike the green leaves of R. capensis (L.) Schinz.

This species was originally named by Charlie Stirton but never described.

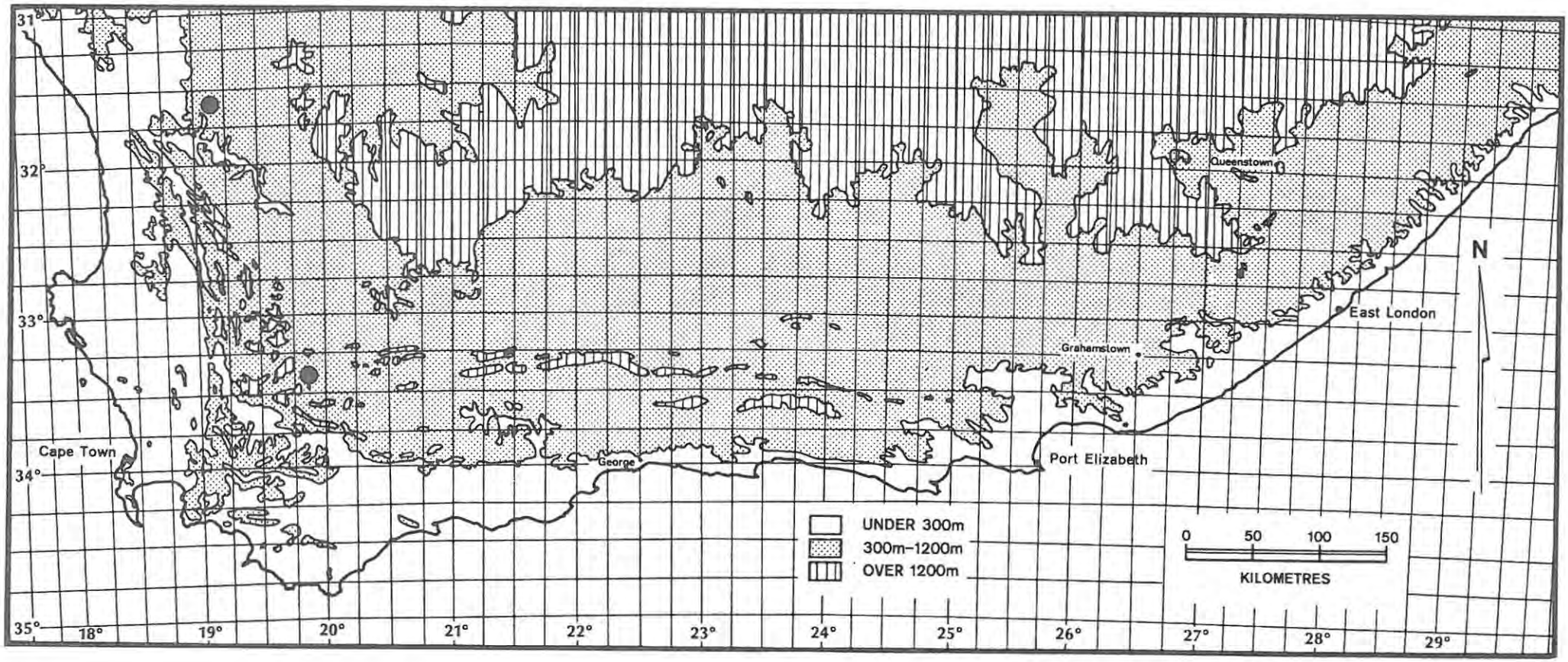


Figure 121: Geographical distribution of R. glaucophylla Stirton ex Richardson sp. nov.

Doubtful Species

R. ecklonis E. Mey. Described as having "linear leaves, four upper calyx lobes dilated, obtuse". No literary reference apart from Harvey's mention (F.C. ii; 36: 1862) that "this can hardly be intended for R. humilis; but nothing like it occurs in Ecklon's (now Sonder's) private herbarium". No material bearing this name has been traced.

R. erecta Thunb. The type of this species was not seen by the author but was seen by Harvey who described it as an unidentifiable "battered fragment" (F.C. ii; 38: 1862).

CHAPTER SIX

CONCLUDING REMARKS

This revision of the genus Rafnia forms a small part of the revision of the sub-family Papilionoideae which is currently being done for Flora of Southern Africa and although it is intended that a shortened version of this work will be submitted to the "Flora of Southern Africa" it must not be considered to be absolutely complete as there are many avenues open for further research, as mentioned below.

Although an intensive study of the testa of the seeds was carried out using scanning electron microscopy (SEM) and the information obtained was found useful, an indepth SEM study of the hila of the various species should be considered in conjunction with testa morphology. Bragg (1983) has shown that the shape of the hilum is distinctive for each of the Lupinus species he studied. He suggested that testa morphology and hilum shape are the most useful characters for separating species. The problem here will be the collection of seeds as although fruiting Rafnia material is often collected, the seeds are usually severely damaged by insects or non-existent, having been predated by insects.

SEM of the exine of the pollen grains should also be undertaken as this could provide useful information as to the phylogenetic relationships between the various species (Muller and Leenhouts 1976; Walker 1976).

The possibility of the existence of further new species must not be overlooked. A specimen (Fig.122) which does not fit the concept of any of the 21 species here described, was collected on Appollo Peak by Mr H.C. Taylor in 1984 (Taylor 11157 RUH; STE). The only other collection of this form was made by Stokoe in 1939 at Gideon's Kop (Stokoe in SAM, 54501). Both these areas are in the Wuppertal district (3219 CB). Unfortunately, neither the author nor Mr H.C., Taylor have managed to locate further material and what is available is insufficient for a full description to be made for as is so often the case, only the flowering branch has been collected.

Figure 122: Photograph of flowering branch of specimen collected by Mr H.C. Taylor on Appollo Peak in 1984 (Taylor 11157 RUH).

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