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**STUDIES OF THE SOUTH AFRICAN SPECIES OF EULOPHIA**

**R.BR. EX LINDL. (ORCHIDACEAE).**

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**Being a thesis in fulfilment of the regulations  
for the Degree of Doctor of Philosophy at the  
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## SUMMARY

The present work was undertaken to provide a much-needed taxonomic revision of the South African members of the genus Eulophia R.Br. ex Lindl. (Orchidaceae).

To obtain data for delimiting and giving rank to taxa, studies were made of morphological variation, geographical distribution, cytology and ecology. In the morphological studies use was made of biometric methods, to aid the evaluation of differences between similar groups. It was found possible to uphold thirty-six species of Eulophia in South Africa, with a small number of subspecies and varieties. Two new species are described: E.leachii Greatrex ex Hall, and E.coddii Hall.

As a result of these studies, forty-nine previously recognised taxa have to be reduced to synonymy. A considerable number of nomenclatural changes have also arisen from studies of type material in South African, British and European herbaria; these are discussed in detail for each taxon. Two new combinations are made: E.fridericii (Reichb.f.) Hall, and E.parviflora (Lindl.) Hall. A new key to the species is given.

Owing to a lack of correlated characters among many of the species, it was found difficult to make significantly large groupings within the genus. Chromosome numbers ranging from  $n = 20$  to  $n = 60$  were obtained for twenty-one taxa. The numbers showed little correl-

ation with the groupings of species, and it was not possible to deduce the basic chromosome number of the genus. No species was found to have a chromosome number as low as  $n = 16$ , the only previous published count for Eulophia. Putative aneuploids were found in three taxa.

Distribution studies indicated that 47% of the taxa are endemic to South Africa; previously about 84% were considered to be endemic. Four are found chiefly along the South Cape coast, while the remainder occur in the Eastern half of South Africa. Two species have distributions centered in the Eastern Cape and Western Transvaal, with a conspicuous disjunction in the intervening area.

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A. V. H.

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## INTRODUCTION

The majority of species of Eulophia occur in Central and Southern Africa. There are several species in India, a few in South-East Asia, and a single species is common to Central America and West Africa. The present work is chiefly concerned with the species of Eulophia occurring within the boundaries of South Africa, taken to include Swaziland and Basutoland. Studies have also been made of material from other territories, in a search for the earliest valid names of certain taxa that have distributions extending beyond the borders of South Africa.

The earliest descriptions of members of this genus were based on plants from South Africa. They were published in the late 18th century by the younger Linnaeus, and were placed in the genus Satyrina. The generic name Lissochilus was published by Robert Brown in 1821, and in the same article the generic name Eulophus was suggested for an allied series of species, without a description or any formal transfer of epithets. This name was validly published in the form Eulophia two years later by Lindley.

Lissochilus R.Br. and Eulophia R.Br. ex Lindl. have been considered distinct up to relatively recent times. J. D. Hooker, Oliver and N. E. Brown were the first to propose that the genera should be merged (Bolus 1888). This view was adopted by Bolus and by Schlechter in his earlier publications on South African orchids (e.g. Schlechter 1895). Later however, Schlechter came to the conclusion that Lissochilus and Eulophia should be retained as distinct

genera, in spite of the difficulty of assigning some of the species to one or the other genus (e.g. Schlechter 1915, 1924, 1927). Rolfe treated the two genera separately in his important accounts of the Orchidaceae in the Flora of Tropical Africa (1897) and the Flora Capensis (1912). The current view that only a single genus can be upheld (Summerhayes 1936) is followed in the present work.

The name Eulophia R.Br. ex Lindl. has been conserved against the less widely used but earlier epithet Liss-ochilus R.Br., together with certain other names. The present author found that the lectotype on which the conservation of Eulophia had been based actually belonged to a different genus, Acrolophia Pfitz. A proposal for a different lectotype and certain amendments and additions to the schedule for conservation are given elsewhere (Summerhayes and Hall 1962).

Numerous problems have arisen in the infra-generic taxonomy of Eulophia. Many of the species are rather variable and it seems that the earlier workers did not have an adequate enough range of material to reflect this variation. Consequently many superfluous species were described. Taxa were seldom given varietal status, and it is only recently, with the work of Summerhayes, that subspecies have been recognised in the genus (e.g. Summerhayes 1953g).

Some superfluous names may have arisen as a result of the stipulation of H.G.Reichenbach that his important herbarium should be kept sealed until twenty - five years

after his death (K. H. Rechinger, V. S. Summerhayes, priv. comm.). This herbarium contained many of Reichenbach's types which are essential for understanding some of his more brief type descriptions. It was unfortunate that the period in which this material was not available (1889 to 1914) coincided with one of the more eventful phases in the history of African orchidology, when valuable contributions were being made by Schlechter, Rolfe, Bolus and Kränzlin.

The present author's work on Eulophia began in 1957 with a preliminary investigation of six species in South Africa, together with studies of cytology and biometric aids to taxonomy. Two expeditions were carried out to obtain material for this work, which was written up in the form of an M.Sc. thesis in 1959. A programme of work leading to the present thesis was started in 1960 with a year spent studying types and other specimens at British and European herbaria. On returning from overseas a short expedition was made to the Eastern Cape Province to study spring-flowering species; later a much longer expedition was carried out to study summer-flowering species in the Eastern Cape, Natal and the Transvaal.

PART 1: DELIMITATION OF TAXA IN CRITICAL GROUPS

## 1. TAXONOMIC CATEGORIES

Preliminary studies in the genus Eulophia showed that while some groups could be distinguished from one another without difficulty, others showed complex intergrading series, with or without higher frequencies of one or more forms. Complex variation patterns of this sort have been recorded before in the genus Eulophia, chiefly among the tropical African taxa (e.g. de Wildeman 1919, Summerhayes 1953, 1958<sup>9</sup>).

To obtain a conventional and consistent treatment of these complexes, the concepts of species, subspecies and variety must be considered in detail. A comparison of some recent monographs of African plants shows that there is variation in the use of these categories.

### (1) Taxonomic categories in a sample of monographs:

Weimarek (1940), in a monograph of the genus Aristea (Iridaceae), makes no comment about the definition of taxonomic categories. However, it is clear from the treatment that variety is used for slightly differing forms that are sympatric with one another, and subspecies when these forms are allopatric.

Norlindh (1943), in spite of an unusually high proportion of polymorphic species, delimited few subspecies and varieties in the difficult South African Calenduleae (Compositae). Norlindh considered that it was more appropriate to discuss and describe the infra-

specific variation patterns, rather than to try and fit them into the rigid framework of taxonomic categories. On the occasions when infra-specific taxa were used, the principles and definitions of Du Riets (1930) were followed as far as possible. Du Riets' definitions are as follows: Subspecies: a population of several biotypes forming a more or less distinct regional facies of a species. Variety: a population of one or several biotypes, forming a more or less distinct local facies of a species. Nerlindh makes no attempt to define a species concept, but notes that the species he delimits "may be considered to be larger and more polymorphous than species usually are".

Levyns (1954) in a monograph of the genus Muraltia (Polygalaceae), gives no definition of taxonomic categories. In a small number of cases, species are divided into varieties which are more or less sympatric with one another: where intervals occur between them they do not exceed 20 to 30 miles. No subspecies are upheld in this work, nor indeed in earlier publications (e.g. Levyns 1934, 1935, 1936 and 1937).

In a monograph of Afro-alpine vascular plants, which includes many detailed analyses of difficult groups, Hedberg (1957) gives a short review of the infra-generic concepts of various authors. After a discussion of genetically based classifications, Hedberg arrives at an essentially morphological definition that species should be distinguished from their nearest allies by discontinuous variation in not less than two independent structural

characters. Hedberg concedes that this rule may be difficult to apply in borderline cases.

Hedberg regards the subspecies as a "regional subdivision of a species", which is essentially the same as the concept of Du Rietz (1930), whose definition of variety is followed without alteration. As a working scheme for distinguishing subspecies Hedberg uses "a rather completely discontinuous variation in one feature, preferably reinforced by partial discontinuities in other features". It is pointed out that this concept differs from other definitions in requiring a greater degree of distinctness. Stebbins (1950) for example states that subspecies should be "connected by a series of intergrading forms". Hedberg considers that such forms are rare in the Afro-alpine flora because of the great isolation of taxa on distant mountains. Perhaps in the ordinary way these subspecies might be regarded as closely related species, and it seems an unfortunate step to use an adjusted definition for a situation where less rigorous isolation might theoretically lead to conventional subspecies with intergrading forms.

A number of subspecies and varieties are upheld by Gillett (1958) in a monograph of the numerous tropical African species of Indigofera, Cyamopsis and Rhynchotrophia (Leguminosae). Although there is no special reference to taxonomic categories, it can be seen from the treatment that the subspecies are regionally allopatric forms slightly differing from one another, and that the varieties differ in a similar way, but are sympatric.

In Part I of Dahlgren's revision of the genus Aspalathus (Leguminosae), a chapter is devoted to a discussion

of taxonomic concepts (Dahlgren 1960). The principles are essentially those of Du Rietz (1930), but the definitions of that author have been expanded to be a more direct guide to users of the monograph:

**"Species:** A species is represented by one or many populations, the individuals of which are morphologically separated from all other forms by a marked discontinuity in several characters; the species may or may not occupy the same area as other closely related species.

**"Subspecies:** A subspecies represents one or more populations which occupy different areas or habitats from the other forms of the same species, and they are separated morphologically from these by a more or less distinct discontinuity in quantitative characters.

**"Variety:** More or less locally restricted populations, separated from the other populations of the same species or subspecies by discontinuity in a few characters of minor significance". A slightly different definition of variety is also given: "a form series, which is separated from other forms of the same species or subspecies by less distinct intervals (than subspecies) in morphologic characters. It may, then, have a wide or small distribution".

It appears from subsequent discussion that Dahlgren's concept of variety lies rather more with the second definition. The idea that varieties should be morphologically less distinct than subspecies is seldom stated or implied by other workers.

In pointing out the difficulties of deciding between subspecific and varietal rank, Dahlgren indicates

that there are intermediate cases of geographical and morphological distinctness that cannot be classified with confidence. The difficulties increase when the distributions extend through poorly collected areas. Dahlgren states that "mostly for the sake of simplicity in taxonomy", he has avoided the rank of variety. No varieties are upheld in this work, and contrary to definition some of the subspecies are quite clearly sympatric with one another in many parts of their geographical ranges. (e.g. Aspalathus radiata Dahlg. ssp. radiata, and A. radiata ssp. sericea Dahlg.).

In the Orchidaceae, extensive work on African species has been carried out by Summerhayes (e.g. 1948, 1949, 1953, 1960). Summerhayes uses variety for slightly differing forms that are sympatric with one another, and subspecies when these forms are allopatric.

It is clear that there is a good deal of divergence in the use of the categories species, subspecies and variety. In some monographs both subspecies and varieties are used, in others either subspecies or varieties are used alone. The subspecies is generally considered to be an allopatric segregate of a species, but when no varieties are used, some subspecies are sympatric with one another. Subspecies may or may not be considered more distinct from one another than varieties. There is agreement that species should be clearly distinguished from one another, but there is variation in the precise nature of the distinction. Owing to the lack of consistency in

these examples, it is necessary to review some of the principles found in them, in the light of the theory and practice of taxonomy.

(ii) Taxonomic theory and practice: The majority of taxa in classical Angiosperm taxonomy are formed on the basis of similarities and dissimilarities in gross morphology. In contrast, experimental taxonomy aims at special classifications based on biological properties, interbreeding and isolation.

In Angiosperm taxonomy, increasing use is being made of studies other than gross morphology as aids in deciding the relationships and sometimes the rank of groups; these groups are generally delimited in the first place by morphological criteria. Turrill (1950) classifies these sources broadly as anatomy, plant biochemistry, cytology, ecology, genetics, morphogenesis, paleobotany and plant geography. In occasional cases, these studies may also reveal the presence of groups for which morphological distinctions may be found later (Heywood 1960b).

Some of these ancillary studies provide evidence of the isolating mechanisms between breeding populations. Internal isolation barriers (Stebbins 1950) have been used on occasion to delimit taxa. While the isolation criterion is a *sine qua non* of experimental taxonomy, its use in classical taxonomy gives rise to many difficulties.

The setting up of an isolation barrier does not immediately give rise to differences in morphology and

other kinds of characters. Indeed in the early part of the history of the isolated races the differences might be nearly confined to the isolating factor alone. For example many cases are known of races that are isolated by having different chromosome numbers, but which cannot otherwise be distinguished from one another. Wilkinson (1944) found that the diploid and tetraploid races of Salix caprea L. were quite indistinguishable. Cryptic polyploid races are also known in Galium verum and G. mollugo (Heywood 1960b); those of Lathyrus pratensis L. have rather different geographical distributions (Larsen 1957). Slight differences, insufficient for taxonomic recognition, are found between the diploid and tetraploid races of Galium sternerii (Heywood 1960b). In the present work, a plant of the rather variable taxon Eulophia clavicornis var. nutans was found to have a different chromosome number from morphologically indistinguishable plants collected elsewhere.

In an example from entomological taxonomy, Dobzhansky (1946) found that in spite of a "virtual lack of morphological differences" between two races of Drosophila willistonii, the races could not be crossed with one another. Nevertheless, Dobzhansky decided that as the races were biologically distinct, they should be regarded as different species, and recognised in the classical system as D. willistonii and D. equinoxialis.

Having no means of identification by gross morphology, the recognition of cryptic races as distinct taxa would be of little value to the field biologist. It is

indeed doubtful whether the properties of these races are more significantly distinct than those of geographically widely isolated populations.

Löve (1960) gives interesting suggestions for the treatment of this kind of problem for polyploids in the *Flora Europaea*. Löve proposes that where polyploids cannot be distinguished morphologically, they should not be delimited as separate taxa, but their separate chromosome numbers should be given in the description of the structurally-delimited taxon of which they form a part.

Löve considers that there are at least slight differences between the members of the majority of polyploid series. At times these differences may be so slight that "non-specialists may have difficulty in separating ... (them) ... in the field". In such cases he proposes that the polyploid races be regarded as "species" forming part of an "aggregate species", which "ought to be regarded as a collective name of a higher category".

This is an unusual step to take, both in the setting up of the category 'aggregate species' and in the lack of clear morphological distinction between the species. Löve rejects the possibility of using subspecies for these morphologically poorly-defined races: he gives as a reason that introgression may take place between subspecies but not between polyploid races. His further objection, that subspecies should be kept for major geographical races alone, must be discounted on the grounds that he should have rather considered varietal

status. Indeed, where the races are sympatric, there is much to be said for the use of varietal status. Without cytological aid, the forms might well be classified as varieties, and the subsequent discovery of differences in ploidy would not alter their status or involve the setting up of 'aggregate species'. Recognition at species level might carry the implication that there were a greater number of distinct properties than there actually are. Use of the variety would further fall into line with the decision not to recognise taxonomically the cryptic polyploid races. Not taking a purist view on cryptic races implies that it would be inconsistent to let the isolation factor play too great a part in the classification of the slightly differentiated groups, to the extent of calling them species.

Morphologically - based definitions of categories centre round the concept that species should be separated from one another by distinct discontinuities in structure, whereas infra-specific taxa should have a low proportion of intergrading forms between them (e.g. Du Rietz 1930, Stebbins 1950). This scheme is easily applied in the majority of cases, but difficulties have been encountered in several complexes in the present work. To simplify discussion of these complexes, it is desirable to define the various kinds of distinguishing characters.

White (1962), in a preamble to a study of the difficult African species of Diospyros (Ebenaceae), distinguishes two kinds of characters. Those that are present

in every individual of the taxon in question and in no individuals of the taxa with which it is being compared, are termed diagnostic characters. A perfectly clear-cut distinction is implied here, and the present author considers that a more suitable term embodying this idea of preciseness would be 'absolute character'. Species may be delimited by absolute characters.

Under the term 'differential character', White includes cases where the characters can be measured and the measurements "overlap", and also where presence or absence characters are found mostly in one taxon and seldom in the group from which it is being distinguished. Inclusion of presence or absence characters with those that intergrade makes White's definition of little value in the present discussion. Further, the use of the word overlap excludes an intergrading character which itself delimits an infra-specific taxon: overlap does not occur in such a case. It is better to keep the definition to the character alone than to try and incorporate details of its correlation with other characters as well.

A simpler approach to non-absolute characters is to use the statistical term bimodal for characters that show a low frequency of intermediates between two high-frequency modes.

White's "clear-cut presence or absence characters" are in a sense absolute, and their inconsistent presence in the one taxon and rare presence in the other shows that

they are only partly correlated with a more significant character-set. It seems that they can be more logically regarded as 'partly correlated absolute characters'.

The problem of character correlation is a very great one indeed, and next to the difficulties arising from insufficient material, this can be the greatest source of differences of opinion in taxonomy.

The most difficult cases are when several partly correlated bimodal characters are present. In some cases there may be a good chance that no individuals fully intermediate in all characters may be found: this is when there are several clearly bimodal characters, each with a low proportion of intermediates. The within-group correlation should be poor, so that if one character happens to be intermediate, the others should not be intermediate as well. Species may be readily delimited by character combinations of this sort. However, the case for using infra-specific taxa becomes greater as the characters become less clearly bimodal, fewer in number, or better correlated with one another.

An objective assessment of this kind of variation can be obtained by using Fisher's discriminant analysis for several variables. Briefly, this consists of calculating weightings for each measured character. The weightings vary according to the contribution of each character to the discrimination between the groups. The weighting  $\times$  measurement multiples are then added together to give a value of the discriminant function

for each specimen. The frequency distribution of these values shows how the characters in combination distinguish between the groups. A full description of the method (Fisher 1936) is given in Appendix 1.

Deciding whether a distinction is bimodal or absolute is difficult in marginal cases. The decision may be aided by a statistical comparison of variance ranges, where the characters are measurable. These methods are a little elaborate, but they at least give an objective presentation of the data on which decisions of specific or infra-specific status are based. They can materially reduce what Heywood (1960a) calls "the agonies of appraisal" some taxonomists go through in deciding status.

Most taxonomists use the subspecies as well as the variety. It is unconventional to exclude either or both from the set of available categories.

In the survey of criteria used in a sample of monographs, one author considered that subspecies should be morphologically more distinct from one another than are varieties (Dahlgren 1960). This author also includes the commonly accepted view that subspecies should be allopatric and varieties sympatric. This second idea conflicts with the first: there is no general principle that allopatric segregates should be more distinct than sympatric ones, and Dahlgren is not able to demonstrate this in his monograph.

The concept of the subspecies as a morphological

equivalent of the variety, but with an allopatric distribution, is a conventional view in Angiosperm taxonomy. While it is not proposed to adopt a different attitude to this concept, it should be pointed out that it is inconsistent not to use other partial isolating mechanisms as equivalent criteria to geographical separation. Factors such as wide differences in habitat and flowering time may produce the same results as regional isolation, and it is a little arbitrary to exclude them. Perhaps their inclusion would ultimately, with a great deal of research, lead to a serious depletion in the number of varieties! This problem will become more obvious as studies progress in these ancillary fields.

(iii) Conclusions: The criteria for delimiting species and infra-specific taxa should be morphological. Species should be clearly distinguishable from one another, either by one or more absolute characters or by several bimodal characters that show poor within-group correlation. One or very few bimodal characters, giving a low proportion of intermediate individuals, should indicate infra-specific status. If related infra-specific taxa are regionally allopatric, they should be regarded as subspecies, if sympatric, then as varieties.

Other kinds of characters, such as chromosome number, flowering time and ecology may assist the taxonomist in showing the presence of groups for which structural distinctions may be found later. Conversely, their constancy in a taxon may substantiate a view that it cannot be subdivided.

## 2. PRESENTATION AND ANALYSIS OF DATA

(i) Nomenclature: Nomenclatural problems are in general excluded from this section. For ease of reference, names are given to the taxa once they are distinguished from other members of a complex; these names result from the nomenclatural studies given in Part 3. The names of the complexes (e.g. 'Eulophia ovalis complex') are based on the name of the earliest included South African species.

Prior to the discussion and analysis of a complex, the characters distinguishing it from other species of Eulophia are first given, together with its chief variable features and geographical range. This was found to be a more precise way of defining the complex than giving a list of the included species of other authors, whose names in any case strictly refer only to their nomenclatural Type specimens.

(ii) Analysis of the complexes: The complexes are made up of groups which at first sight are doubtfully distinct from one another. In analysing the complexes, the distinctions between the more well-defined groups were tested first, and those between the more obscure groups, later. In this way the most distinct taxa are separated off first, and do not interfere with the more difficult analyses of the 'obscure' groups.

In many cases, the distinguishing characters could be expressed in terms of measurements, so that the

differences could be demonstrated graphically. Single sets of measurements were plotted as histograms, and pairs as scatter diagrams. Ratios were not as a rule used, as they can obscure disjunctions in linear distributions. Gaps in a ratio distribution would in any case be shown in a scatter diagram of its two components.

Where the distinction might be improved by the inclusion of more than two sets of measurements, discriminant functions were calculated and the resulting values given as a histogram. Four sets at a time proved to be as much as could be used in a discriminant analysis without electronic computation.

The measurements of very small floral parts were made using an eyepiece graticule in a low-power microscope. They were taken to the nearest graticule division (1 mm. = 4.852 graticule divisions). For convenience, the scales of these measurements are given in the diagrams in millimeters.

The statistical evidence aided considerably the decision between making no distinction, or separating the groups at species or infra-specific level. If infra-specific status was indicated, the geographical relationships of the groups were then examined. In more difficult cases, geographical distribution and structural variation were examined together in a regional variation diagram. This consists of a map with scatter diagrams in each of the squares formed by the lines of latitude and longitude. Each scatter diagram shows the variation of the specimens

collected in the area bounded by the lines. With the numbers of specimens available, reasonable samples could be obtained in each area by the use of one degree square units for distributions in South Africa, and five degrees square for ranges extending into Tropical Africa.

The standard abbreviations of Lanjou and Stafleau (1959) are used for the names of herbaria. The majority of specimens used in the analyses were from South African institutions. In some cases, analyses of forms extending into Tropical Africa were confined to material in the herbaria at Kew (K), the British Museum (BM) and Brussels (BR). This was to avoid possible distortion of the results that might appear if a large amount of material from South African herbaria were included.

### 3. EULOPHIA ODONTOGLOSSA COMPLEX

This complex may be distinguished from other species of Eulophia by the following features: scape and leaves very slender, the sheaths long and closely amplexicaul; petals barely narrower than the sepals; mentum prominent, with the lip attached only to the distal end; the lateral margins of the lip mid lobe undulate to dentate; the lip crests of two prominent lamellae basally, passing into several elongate papillae on the mid lobe. The chief variable features in the complex are flower size and the relative sizes of the lip mid lobe, side lobes and spur; there is also some variation in flower colour. The complex has a wide distribution extending from Sierra Leone in West Africa, across to Kenya and down to South Africa.

A range of material of the complex was studied in detail by Summerhayes (1953: E. shupangae). Summerhayes came to the conclusion that "three main groups can be recognised, these three groups having more or less distinct geographical ranges". Summerhayes found that the differences between the three sets were not sufficiently clear-cut to treat them as subspecies, so they were provisionally named Groups A, B and C.

A greater number of specimens were available to the present author. Inspection of the complex with this additional material indicated that it was no longer possible to uphold geographical distinctions between the sets; morphological distinctions also seemed to break down.

To demonstrate this, measurements of the chief variable characters, spur length, odd sepal length, lip side lobe length, and mid lobe length and width, were taken from 105 specimens in the herbaria at Kew (K), the British Museum (BM), Zürich (Z) and Vienna (W). The measurements are plotted in diagrams 1-3, coded according to the affinity of the specimens to one of the three groups proposed by Summerhayes. No gaps or bimodalities are evident in these diagrams, and the three forms clearly merge into one another.

The geographical relationships of the three sets are given in diagrams 4 and 5. The form with small lip mid lobes (Group B, shown by crosses) is more or less the only representative of the complex in northern and western parts of the range; elsewhere, the other two groups are generally sympatric with one another. In passing, it is interesting to note the much greater range of variation of plants in a belt lying south of the Equator.

Examination of specimens and the scatter diagrams showed that there might be a slight chance of distinguishing group B with a combination of characters; groups A and C seem virtually inseparable. To test this possibility, a discriminant analysis was carried out using the characters lip mid lobe width and length, and odd sepal length. The results are given in diagram 6. A slight bimodality is evident between group B and the rest of the complex, but not large enough to warrant taxonomic recognition.

It seems, therefore, that the complex should be regarded as a single variable species. It is referred to in Part 3 as Eulophia odontoglossa Reichb.f.

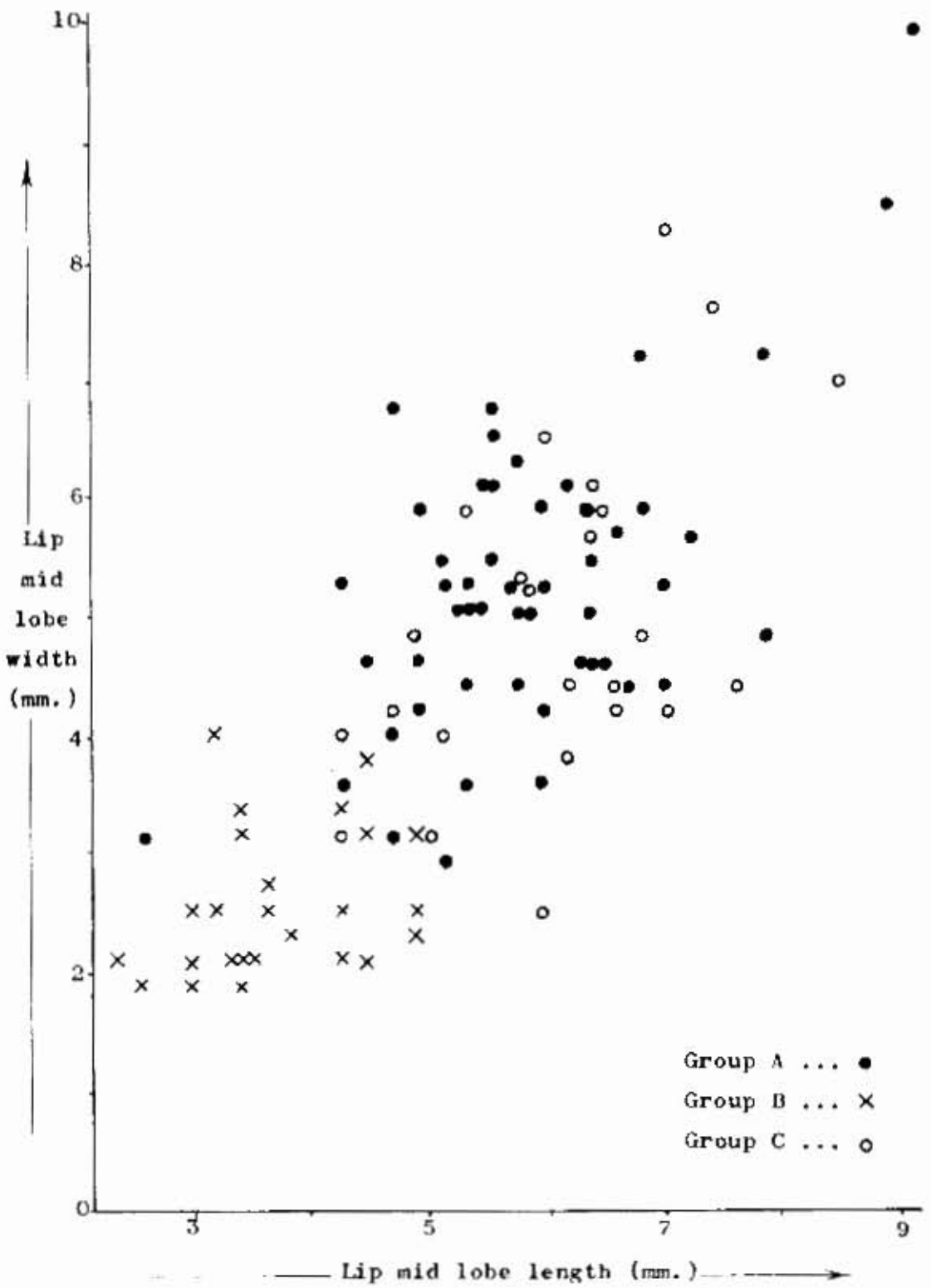


Diagram 1. Eulophia odontoglossa complex:  
 scatter diagram showing the variation in  
 lip mid lobe width and length in herbarium  
 specimens.

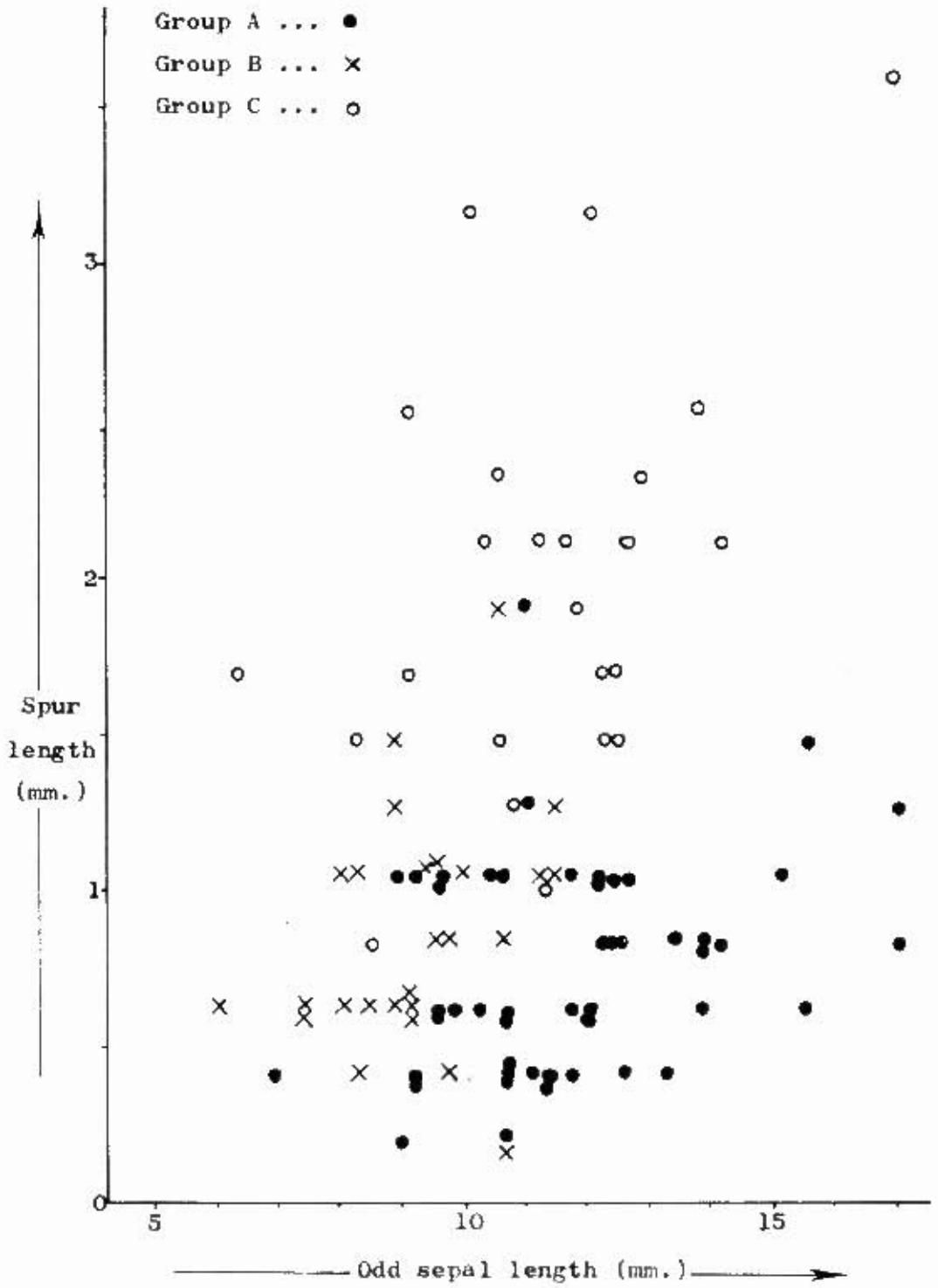


Diagram 2. Eulophia odontoglossa complex:  
 scatter diagram showing the variation in  
 spur length and odd sepal length in herbarium specimens.

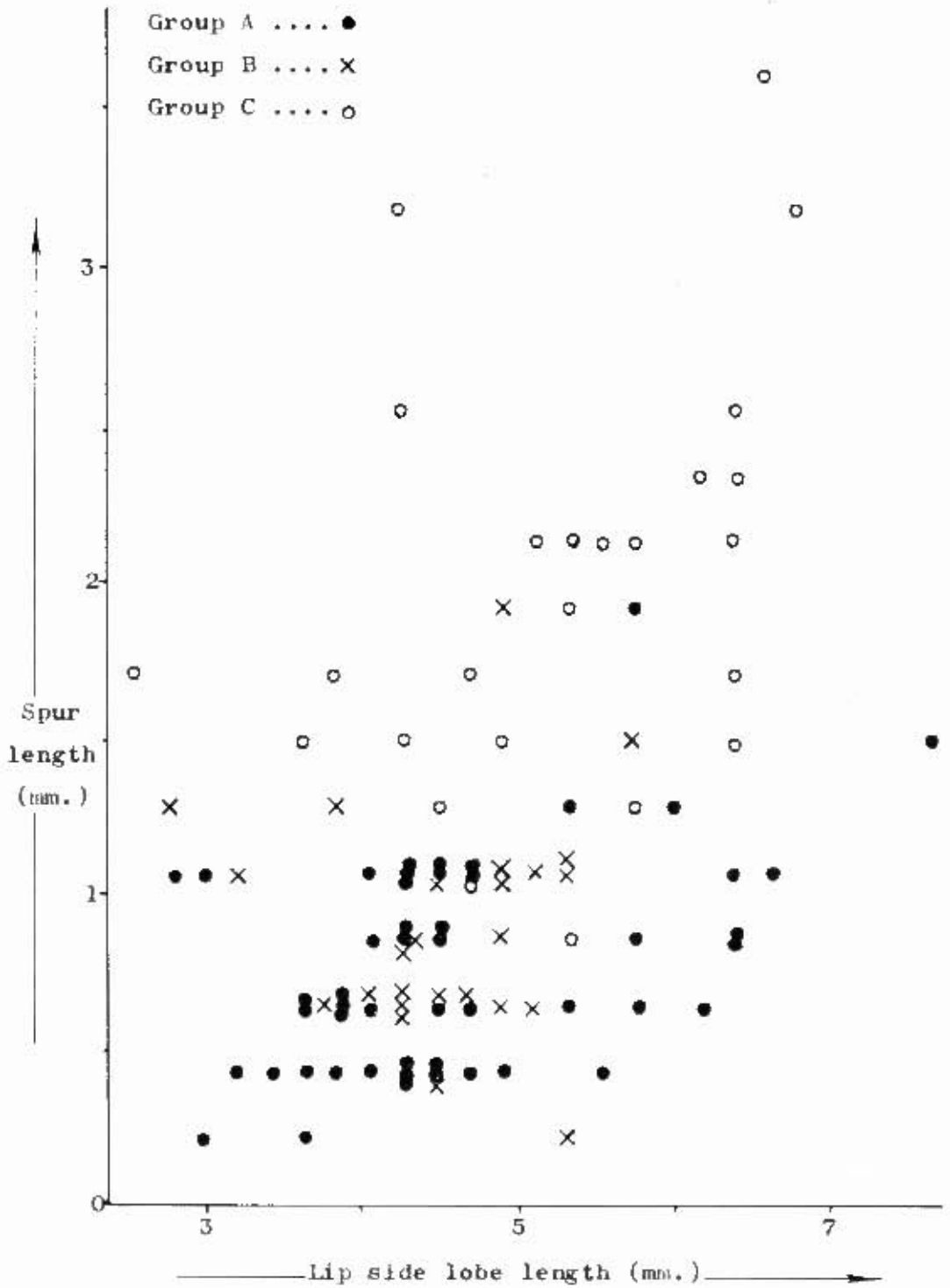


Diagram 3. Eulophia odontoglossa complex: scatter diagram showing the variation in spur length and lip side lobe length, in herbarium specimens.

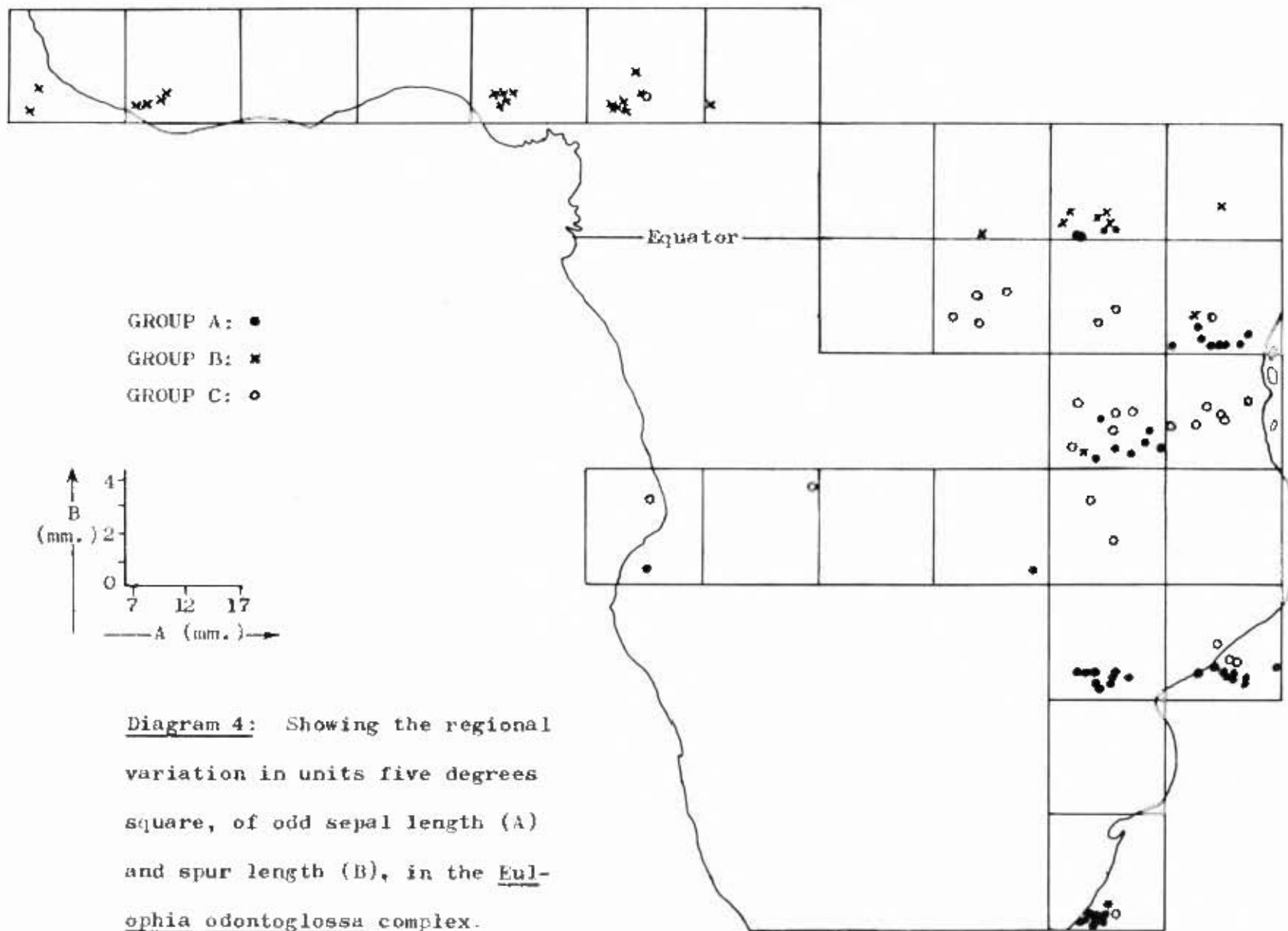


Diagram 4: Showing the regional variation in units five degrees square, of odd sepal length (A) and spur length (B), in the Eulophia odontoglossa complex.

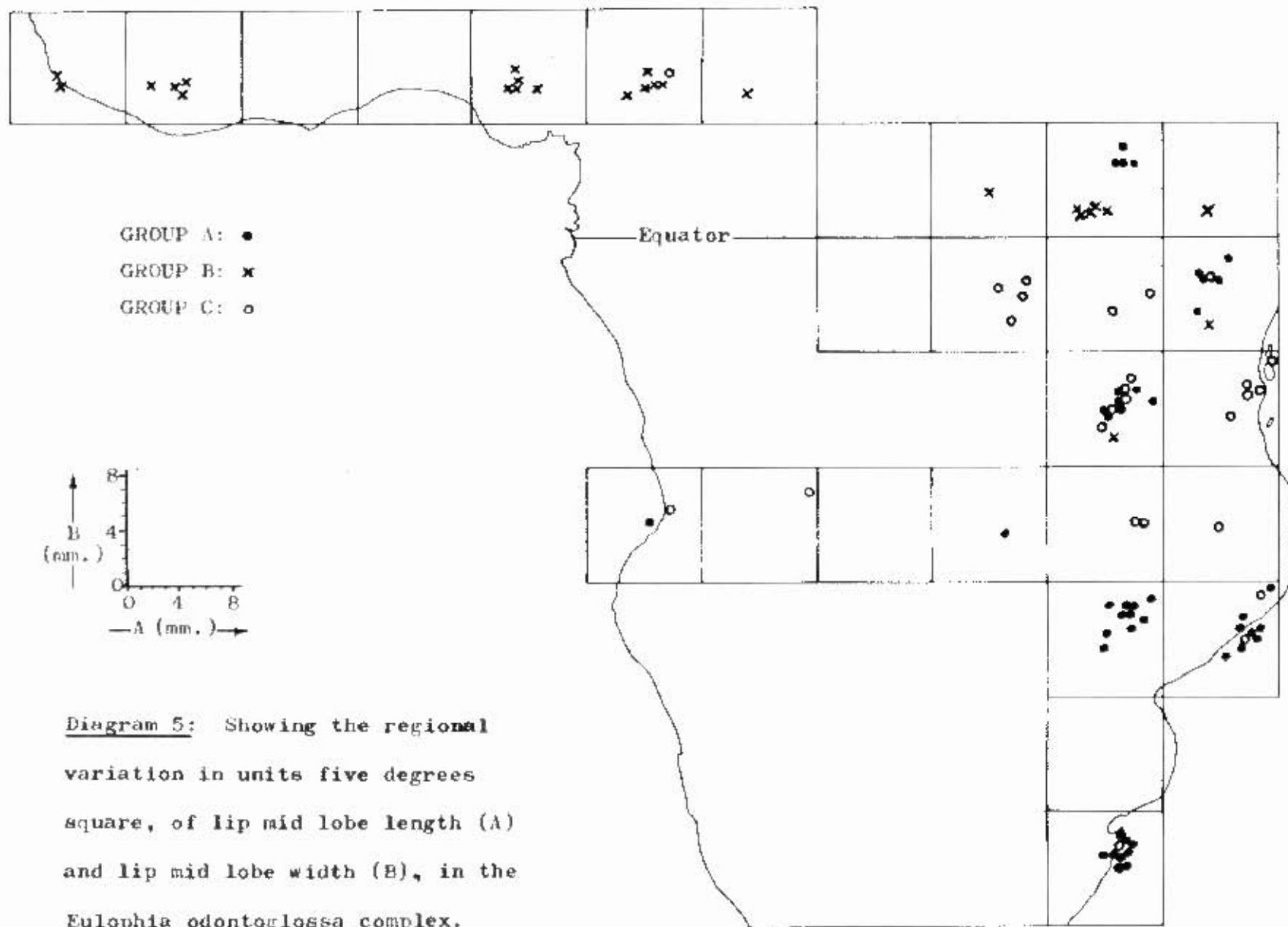


Diagram 5: Showing the regional variation in units five degrees square, of lip mid lobe length (A) and lip mid lobe width (B), in the Eulophia odontoglossa complex.

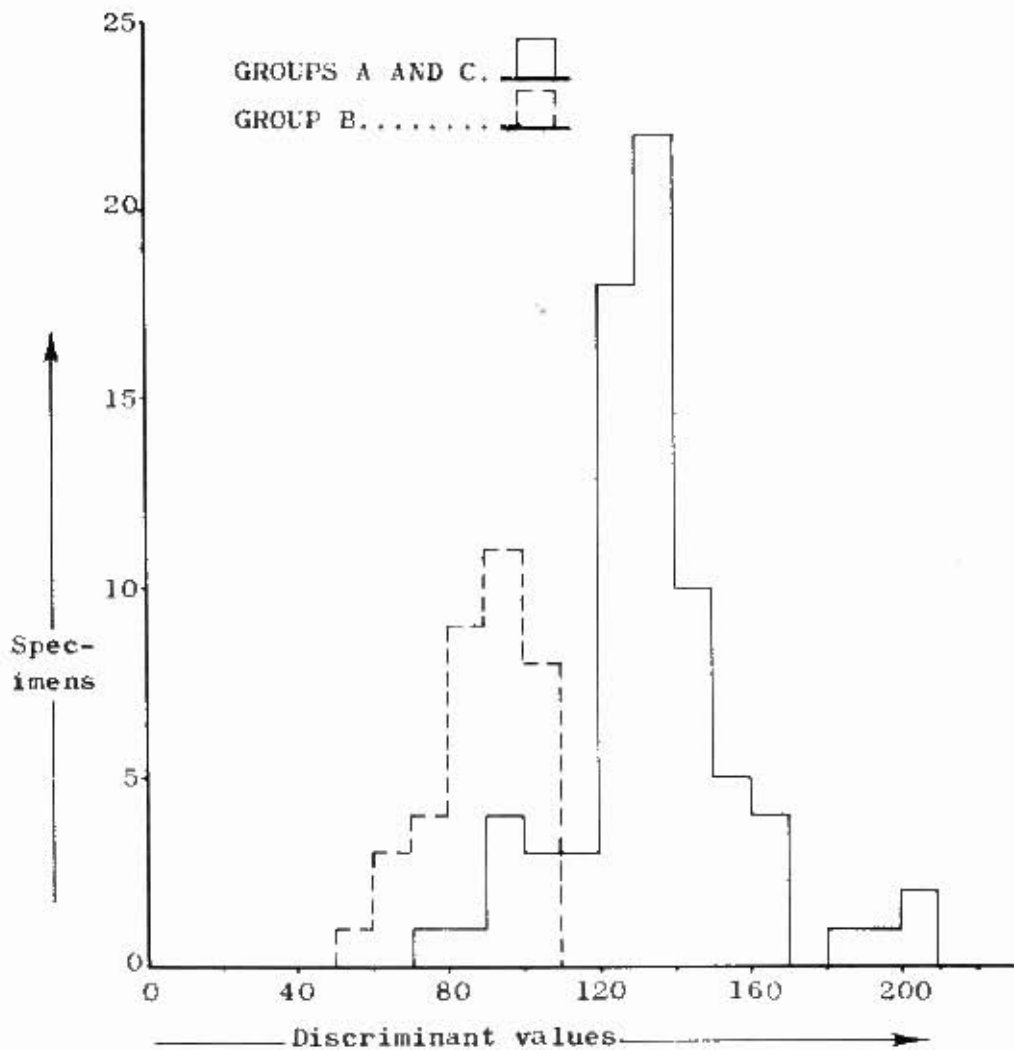


Diagram 6: Showing the discrimination between Group B and Groups A and C combined, using the characters odd sepal length, lip mid lobe width and length, in the Eulophia odontoglossa complex.

#### 4. EULOPHIA ACULEATA COMPLEX

This complex can be distinguished from other species of Eulophia by the following features: Inflorescence a short dense spike; petals and sepals subequal, obovate and sub-obtuse; mentum prominent, with the lip attached only to the distal end; spur quite absent; lip mid-lobe subquadrate, sometimes a little crenulate, crested with elongate papillae. The variable features of the complex are the height and stoutness of the vegetative parts, and the flower size. The complex has a distribution extending from the South-West Cape through Natal to the Eastern Transvaal.

Inspection showed that the complex could be divided into two groups on the basis of flower size. Many specimens of the group with larger flowers have slightly stouter vegetative parts than in the small-flowered group; however, this is noticeable only after examination of a large number of specimens. The only useful character for discrimination seems to be flower size.

A small proportion of near-intermediates in flower size were apparent. To demonstrate the frequency of these intermediates, a scatter diagram was plotted of measurements of the two best parameters of flower size, petal length and mentum length. This is given in diagram 7. The measurements were made from 132 specimens from the herbaria at Pretoria (PRE), Cape Town (BOT), Durban (NH) and Grahamstown (GRA). The gap between the two sets in diagram 7 is very small indeed, possibly smaller than errors of

measurement. This seems to be a good case of a binodal character, and the two groups should therefore be distinguished at infra-specific level.

The geographical relationships of the two groups were investigated by means of a regional variation diagram (see Diagram 8). The distribution range of the small flowered form overlaps that of the other. However, the localities of the small-flowered form in the area of overlap are much more widely dispersed than elsewhere (see Map 4, page 130). There appears to be a general tendency for each form to be restricted to a certain area. It therefore seems that there is a reasonable case for regarding the two groups as subspecies.

In Part 3, the small-flowered form is referred to as Eulophia aculeata (L.f.) Spreng. ssp. aculeata, and the other as E.aculeata ssp. huttonii (Rolfe) Hall stat. nov.

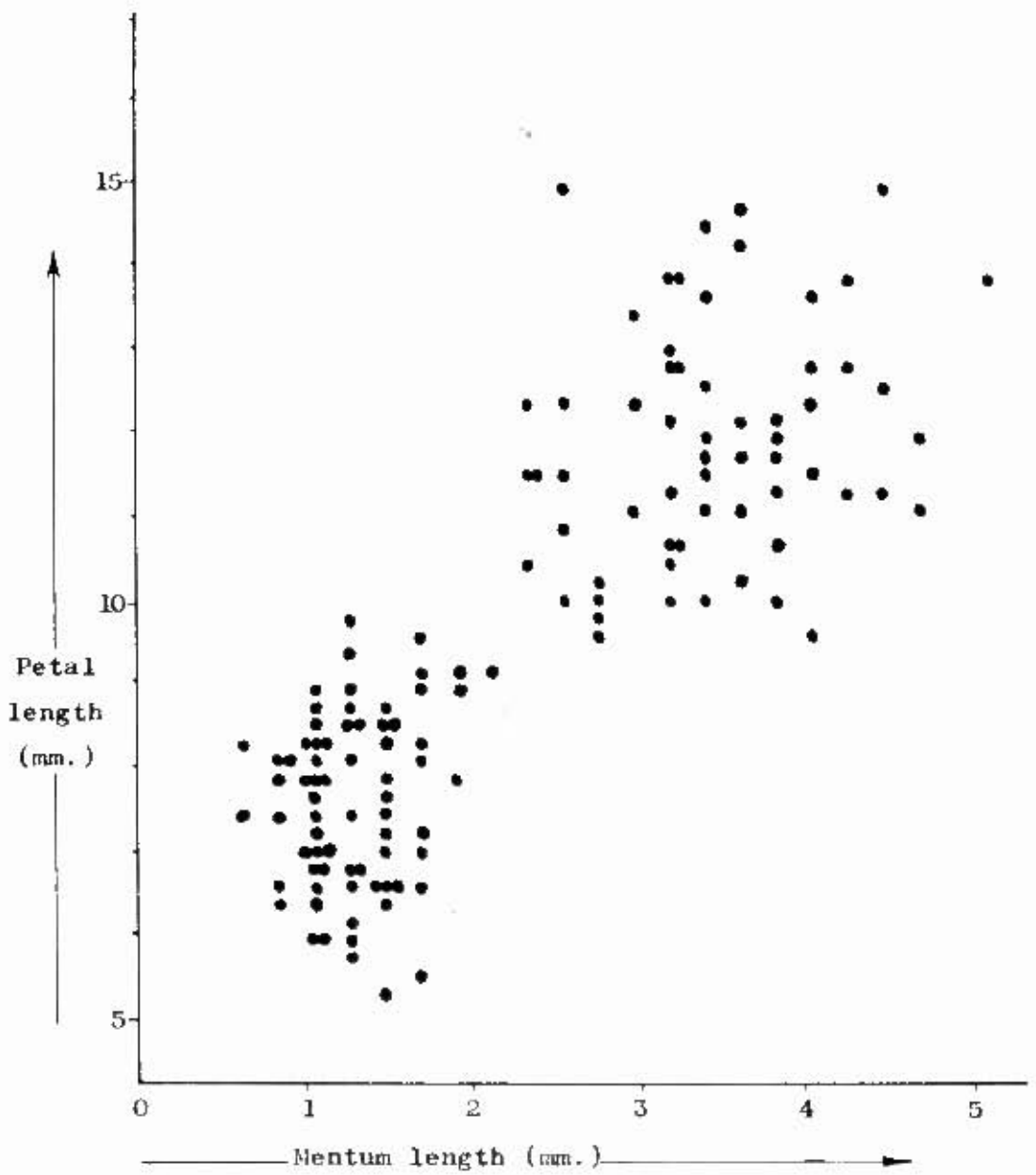
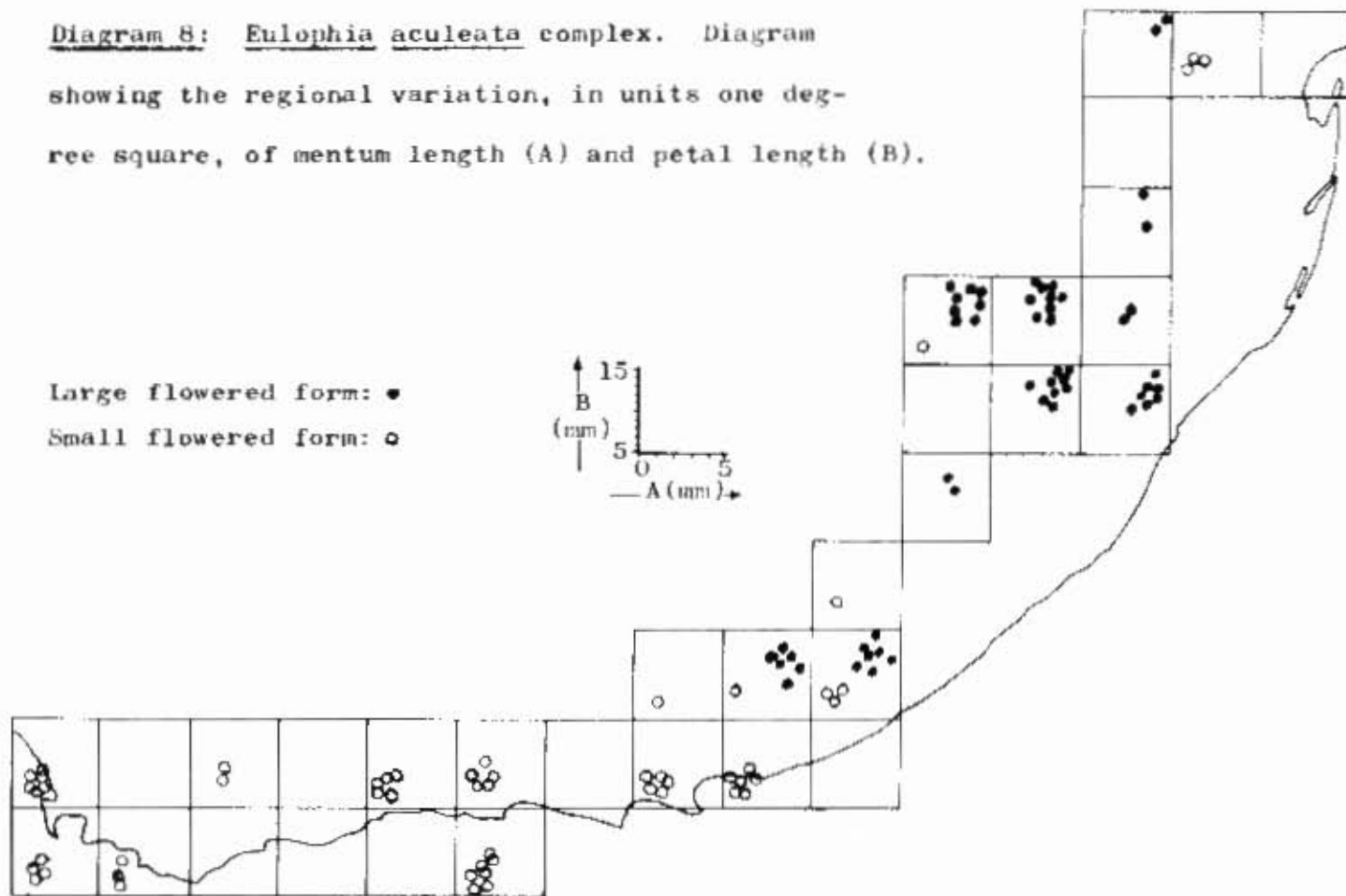
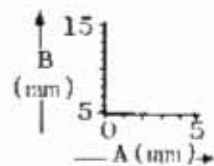


Diagram 7: Scatter diagram of measurements of mentum length plotted against petal length. (Eulophia aculeata complex).

Diagram 8: *Eulophia aculeata* complex. Diagram showing the regional variation, in units one degree square, of mentum length (A) and petal length (B).

Large flowered form: ●  
 Small flowered form: ○



#### 5. EULOPHIA STENIOPHYLLA COMPLEX

This complex can be distinguished from other species of Eulophia by the following features: petals relatively large, subrhomboid; sepals usually as long as the petals but narrower; anther as long as the column, attached to most of the length of the side lobes of the lip, which stand erect; lip crests of ridges, tallest near the base of the mid lobe; leaves thin-tissued, with emergent veins. The complex has an essentially Eastern distribution in Africa, extending from South Africa north across the Equator to Eritrea. It has also been collected in Angola.

Inspection showed that the complex could be divided into two groups on the basis of leaf morphology. In one group an abscission layer was present, and the leaves showed a continuous gradation on each plant, from short broad blades to long and more slender laminae. In the other group, the leaves were all long and did not have an abscission layer; also the flowers tended to be a little smaller. The abscission layer takes the form of a narrow band of thickened tissue, linking the veins near the base of the leaf. (c.f. Plates 1 and 2). Leaf loss by abscission was observed on plants in cultivation at Kew and the National Botanic Gardens of South Africa at Kirstenbosch.

It is clear that the presence or absence of the abscission layer and the shorter leaves are both absolute

characters. The two groups should therefore be treated as distinct at species level. The non-abscising group cannot be subdivided, and forms a single species. No valid epithet can be found for it however, although it includes much of the material, as well as the nomenclatural type, of *Eulophia palvazana* ssp. borealis Summerhayes.

Distinction at species level is substantiated by a rather interesting biological feature. The groups have characteristic geographical distributions: the one lacking an abscission layer is confined to a belt near the Equator, while the other has a much wider distribution. (See diagram 9).

It is possible that the abscission layer might be of adaptive value in areas away from the equator, where long dry spells may be encountered. At the onset of dry weather, leaf loss by abscission is probably quicker and thus more efficient in reducing water loss than the gradual withering of leaves.

This would account for the restriction of the 'withering' form to the equatorial belt, and the wider distribution of the 'abscising' group, which indeed also occurs near the equator: here the abscission layer would be no disadvantage.

In diagram 9, the regional variation of odd sepal length (parameter of flower size), and leaf width is given. The measurements were taken from 120 specimens in the herbaria at Kew (K) and the British Museum (BM). The diagram shows a possible subdivision of the abscising

form. At the southern end of the distribution there is a sudden appearance of a narrow leaved form with both large and small flowers. Elsewhere the leaves are generally wide and the flowers large.

However, it was suspected that this apparently abrupt change was actually a short range cline, extending over too small an area to be resolved in the diagram. To test this, a large number of measurements were taken from field populations. The measurements are given in diagrams 10 and 11. It is clear that there is a clinal change in both petal length (parameter of flower size), and leaf width. It is therefore not possible to give taxonomic recognition to the southern form.

No other subdivisions of the abscising form are possible, so that it must be regarded as a single species. It is referred to in Part 3 as Eulophia streptopetala Lindl.

'Abscissing' form ... ●

'Withering' form .... ○

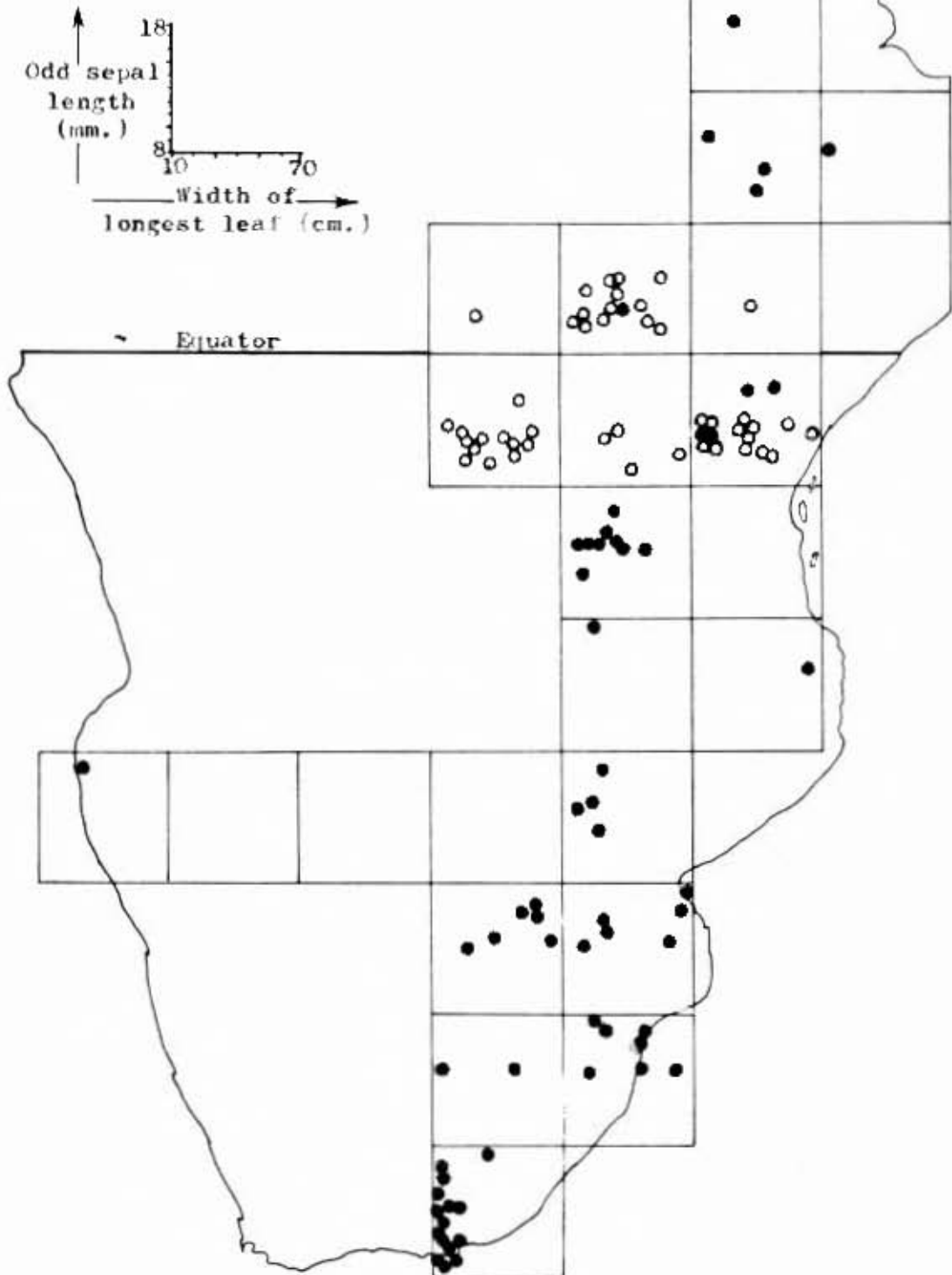


Diagram 9. Eulophia streptopetala complex: diagram showing the regional variation, in units five degrees square, of width of the longest leaf and odd sepal length.

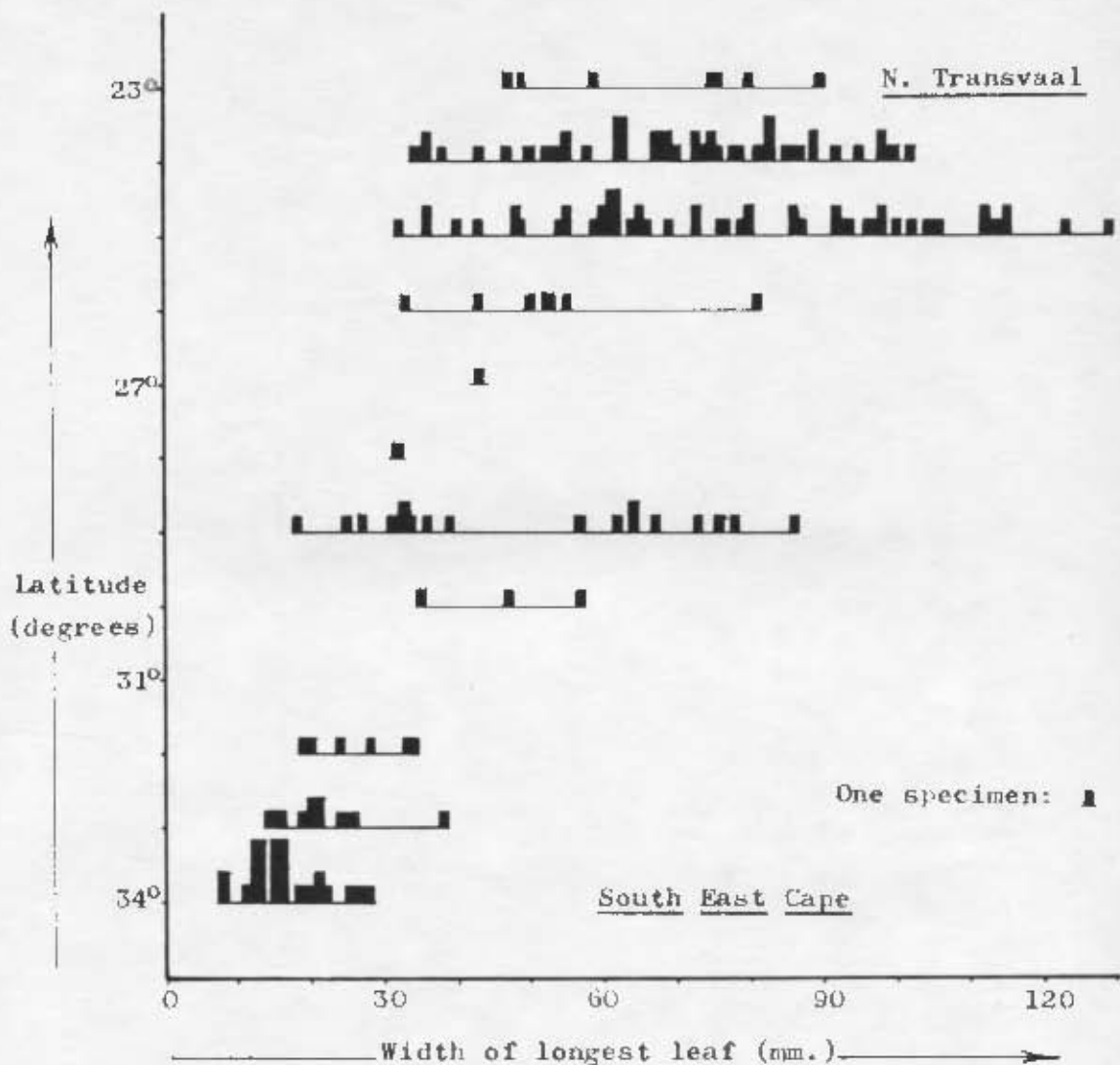


Diagram 10. Eulophia streptopetala complex:  
 diagram showing the variation in the width of  
 the longest leaf, in each degree of latitude  
 of the South African part of the distribution  
 range.



Plate 1. E.streptopetala complex: lower part of leaf fascicle of form with an abscission layer (Sander s.n. in Hort. Kew. 385 - 53, s.loc.). About half natural size.



Plate 2. E.streptopetala complex: lower part of leaf fascicle of form lacking an abscission layer (Grumbley s.n. in Hort. Kew. 399 - 58, Kenya). About 1.5 times natural size.

## 6. EULOPHIA OVALIS COMPLEX

This complex can be distinguished from other species of Eulophia by the following features: petals wider than the sepals, usually ovate or ovate-elliptic, subconnivent with the lip; lip cresting of thin lamellae basally, passing into fine papillae that generally terminate about half-way along the mid lobe; mentum present, passing into a sub-cylindrical spur. The complex has been collected mostly in eastern South Africa, and in scattered places in Southern Rhodesia and Nyasaland.

Features for subdividing the complex are mostly confined to flower structure. Vegetative features vary too widely in most parts of the complex to be of much taxonomic value.

The most distinctive group in the complex is one with practically unresupinate flowers and long spurs. Unresupinate flowers are sometimes found in other parts of the complex, where however the spurs are always very short. Absence of resupination was checked in a large field population of over three hundred plants near Umata in the Eastern Cape. Flowers of the majority of plants showed no sign of resupination; in some however, a slight twisting of the ovary was evident, never more than about 20°.

The 'unresupinate' group also has some less well-defined features. The petals are usually obovate-elliptic, very rarely ovate as in the rest of the complex. The

lamellae on the lip are also generally taller in this group. Unresupinate flowers and long spurs together form an absolute character-combination, and with two evidently bimodal features they form a fairly secure basis for regarding the 'unresupinate' group as a distinct species. This view is substantiated by biological distinctions. A member of the species was found to have a different chromosome number from the rest of the complex ( $n = 28$ , c.f. Table 1). The species is only found in the southern part of the geographical range of the complex. In Part 3, the species is referred to as Eulophia macowanii Rolfe.

A less easily distinguishable group in the complex has very short spurs and hysteranthous leaves (partly developed at time of flowering, fully developed sometime later). To show the amount of discrimination given by these two characters in combination, measurements of spur length and longest leaf length were plotted together in a scatter diagram. (See diagram 12). The measurements were taken from 141 specimens at the National Herbarium, Pretoria (PRE) and the Bolus Herbarium (BOL). A small gap is evident between the group in question and the rest of the complex. Some forms have leaves about as long as in the group, and spurs only slightly longer (points lying to the right of the group in the diagram). However, these forms do not have hysteranthous leaves: the tallest leaf is generally about as long as the scape. On present evidence it seems best to regard this character combination

as being absolute, although further work may show it to be marginally bimodal. The group has other features that are much less distinctive. Compared with the rest of the complex, the scape sheaths are often shorter and broader; the lip crests are lower and the papillae fewer in number; also the sepal apices tend to be more acute.

With an absolute character-combination and several evident bimodal features, it seems that this group can be given the status of a distinct species. Biological distinctions lend weight to the validity of this conclusion. There are many records of the species being fragrant, but none for the rest of the complex; it flowers earlier (see diagram 13), and has only been recorded from the central part of the geographical range of the complex. The species is referred to in Part 3 as Eulophia cooperi Reichb.f.

The remainder of the complex is far less easy to resolve into satisfactory groups. Chromosome numbers, population morphology and flower colours were used as aids in setting up hypothetical groups. Four groups were proposed, and given code letters Ap, Ay, B and C. Their essential characteristics are summarised in Table 1 (page 39), together with the chromosome numbers found in some representative field populations. The results in Table 1 show that it is fairly certain, in the populations studied, that Ap, B, C and possibly Ay differ from one another in chromosome number. Small populations of Ap and C were found growing within yards of each other

**Table 1. *Eulophia ovalis* complex: table showing the chief characteristics and cytological data for groups Ap, Ay, B and C.**

Group	Characteristics			Gametic chromo- some No.	Number of counts*	A.V. Hall No.
	Petal colour	Flower size	Spur length			
Ap	purple	small	long	21	6	760
	"	"	"	21	3(1)	853
	pale purple	medium	"	21	2(1)	854
Ay	yellow	small	long	20?	0(6)	773
B	pale purple	large	long	40	5(4)	833
C	yellow	large	short	42	7(2)	867

\*The number of accurate counts is given first; the figure in brackets shows the number of approximate counts.

without any obvious evidence of hybridisation, such as the presence of intermediates (Hall 852 and 854). Although at least three of the groups therefore seem to be biologically distinct, it is difficult to find a set of morphological characters to separate them.

Biometric studies were first made of the ranges of form of field populations. It was considered better to start with this material than with herbarium specimens, as flower colours and three-dimensional shapes made it easier to be sure of the common identity of the plants in each sample. Common identity is also more likely if the plants come from the same local population. Detailed comparison

of four populations, each representing one of the forms (Ap, Hall 760; Ay, Hall 652, 653, 773; B, Hall 833; C, Hall 867), showed that only the following characters might be of value in distinguishing the groups: lateral sepal length (as a parameter of flower size), spur length, lip mid and side lobe lengths, and the distance between the lip mid lobe apex and the nearest crest papilla. Scatter diagrams of measurements of these characters are given in diagrams 14, 15 and 16. Although the variation ranges are sometimes remarkably limited (e.g. form Ap in diagram 14), there are no gaps large enough to suggest an absolute difference.

The separation given by more than two characters at a time was determined by discriminant analysis. Two analyses were carried out, one showing the distinctness of form Ap, the other, that of form C. The best characters for separating Ap from the rest of the complex were shown to be lateral sepal length, and lip mid and side lobe lengths; for C, lateral sepal length, spur length and lip mid lobe length. The distributions of discriminant values are given in diagrams 17 and 18. It is clear from these diagrams that the discrimination is scarcely better than for pairs of characters. It seems unlikely that comparison of any other sets would give better separation.

While no absolute characters were evident between the populations, it seemed likely that some of the characters might be found to be bimodal when larger samples of specimens are compared. To test this, measurements of the same five characters were taken from 129 specimens at

the National herbarium, Pretoria (PRE), the Bolus Herbarium (BOL), and the Albany Museum (GRA). It was found difficult to allocate specimens to one of the three groups Ap, Ay and B. The best distinguishing feature of Ay, yellow flower colour, is not often given by collectors, and no consistent structural character could be found to distinguish it from Ap. Also, the population-based concepts Ap and B seemed to intergrade with one another. In the scatter diagrams, Ap and Ay are given the same symbol, and not all B and Ap/Ay specimens may be accurately classified. (See diagrams 19, 20 and 21).

The most distinctive group in these diagrams is form C. Bimodal distributions are evident between C and the rest of the complex in lateral sepal length (parameter of flower size), spur length and to a lesser extent in other characters. There is only occasional difficulty in recognising members of this group, so it seems that it could well be regarded as a distinct infra-specific taxon. No clear bimodalities are evident between forms B and Ap/Ay, so that for taxonomic purposes this set can be treated as one group.

Geographical distributions of groups C and B/Ap/Ay are given on maps and respectively. There is a good deal of overlap in the area occupied by C, but C is absent from a proportionately much larger area of the other set. In the area of overlap it is only seldom that the populations are actually intermingled. It seems that the sets are more allopatric than sympatric,

so that they should qualify for subspecies rank. In Part 3, group B/Ap/Ay is named Eulophia ovalis ssp. ovalis, and form C as E.ovalis ssp. bainesii.

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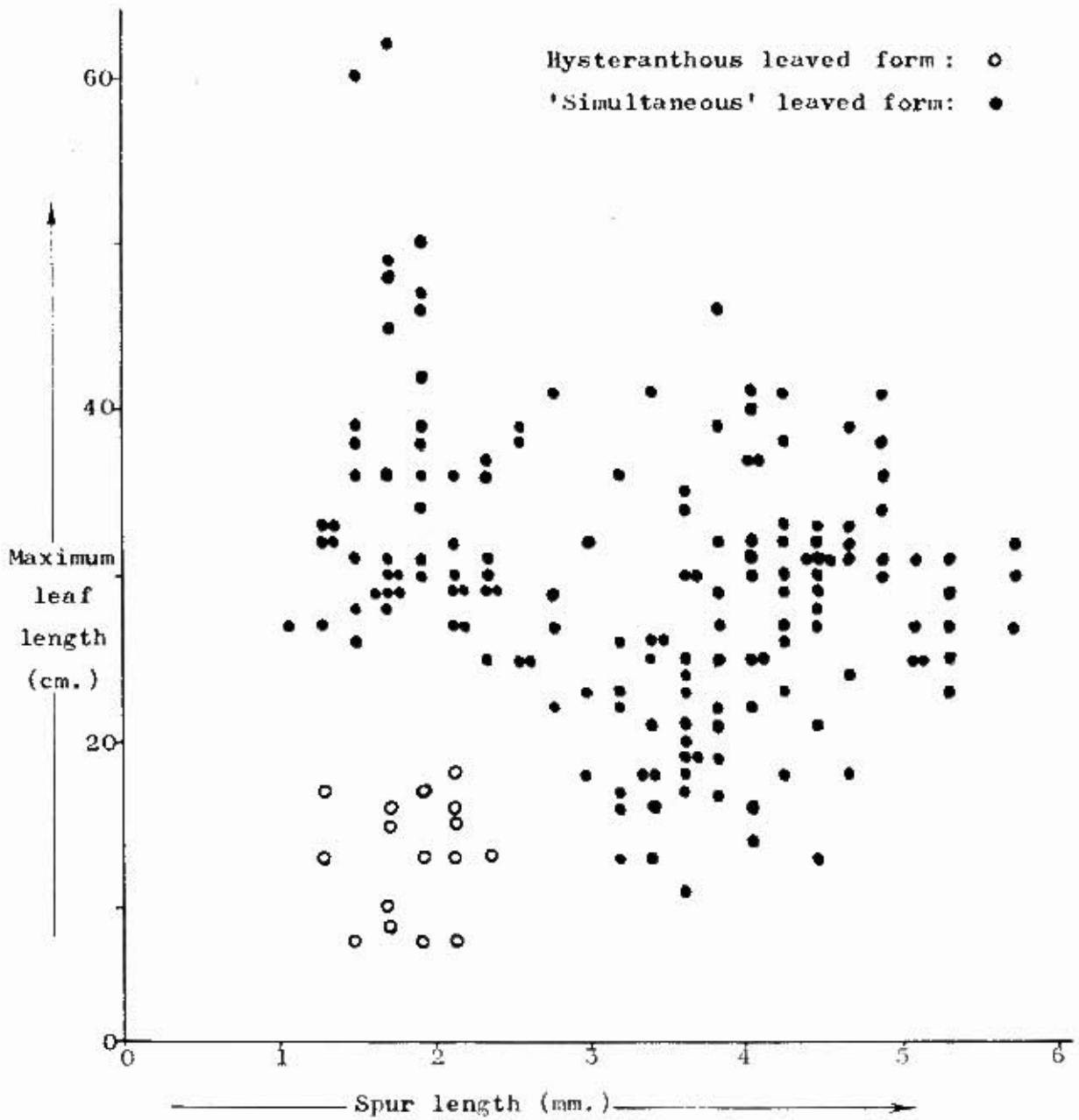


Diagram 12. Eulophia ovalis complex:  
scatter diagram of measurements of spur  
length plotted against leaf length.

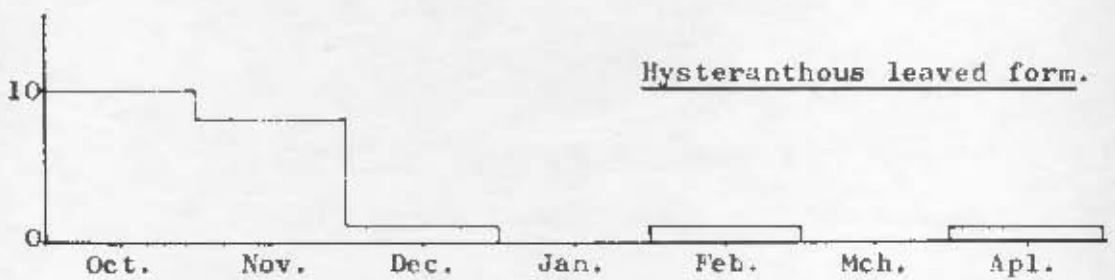
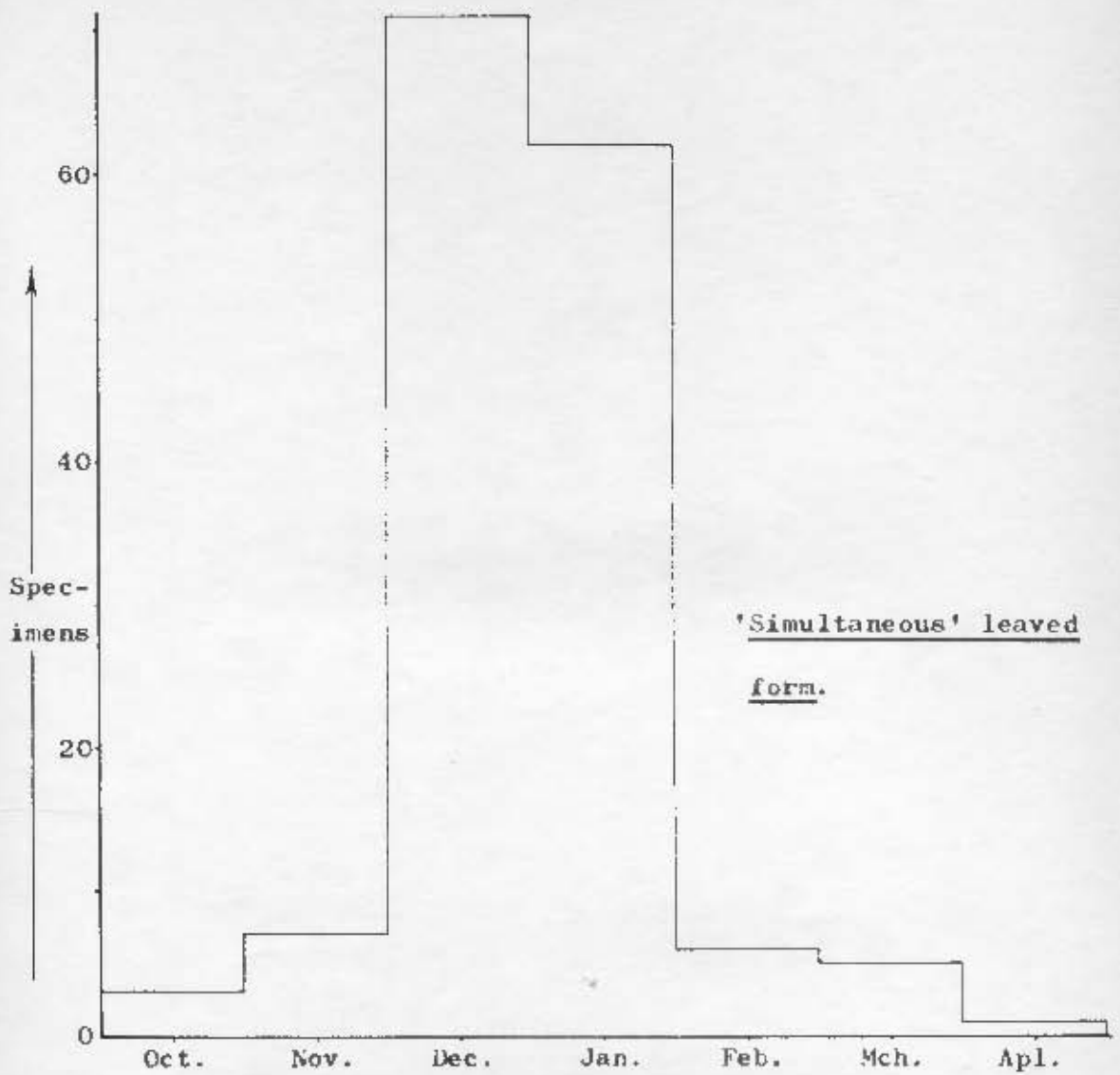


Diagram 13. Eulophia ovalis complex: diagram showing the frequency distribution of collector's records of flowering times, for the hysteranthous leaved form and the 'simultaneous' leaved form.

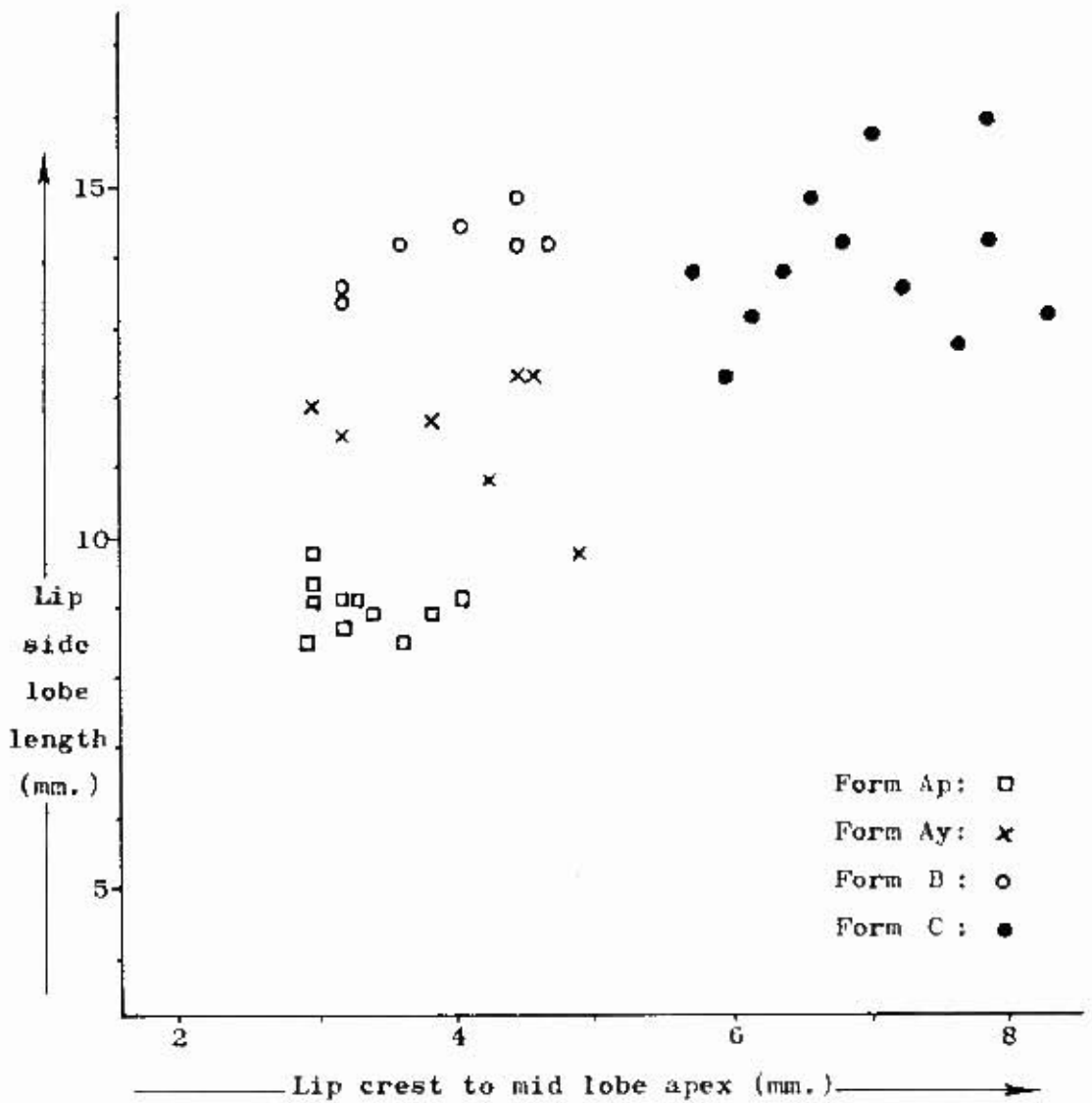


Diagram 14. Eulophia ovalis complex ('simultaneous' leaved forms): scatter diagram showing the variation in the distance from the lip crest to the lip mid lobe apex, and the lip side lobe length, in field populations each representing one of the forms Ap, Ay, B and C.

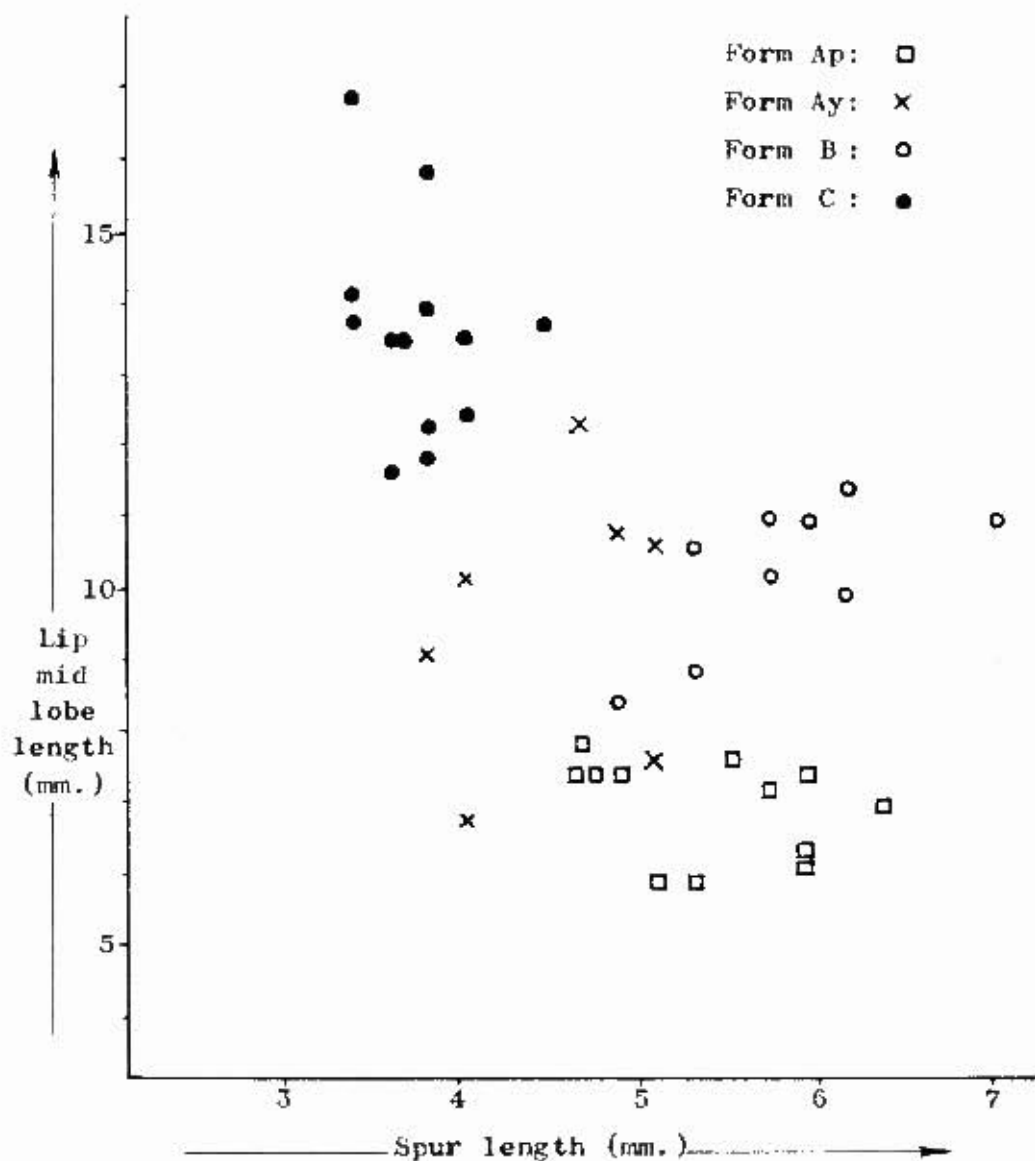


Diagram 15. Eulophia ovalis complex (simultaneous' leaved forms): scatter diagram showing the variation in spur length and lip mid lobe length, in four field populations, each representing one of the forms Ap, Ay, B and C.

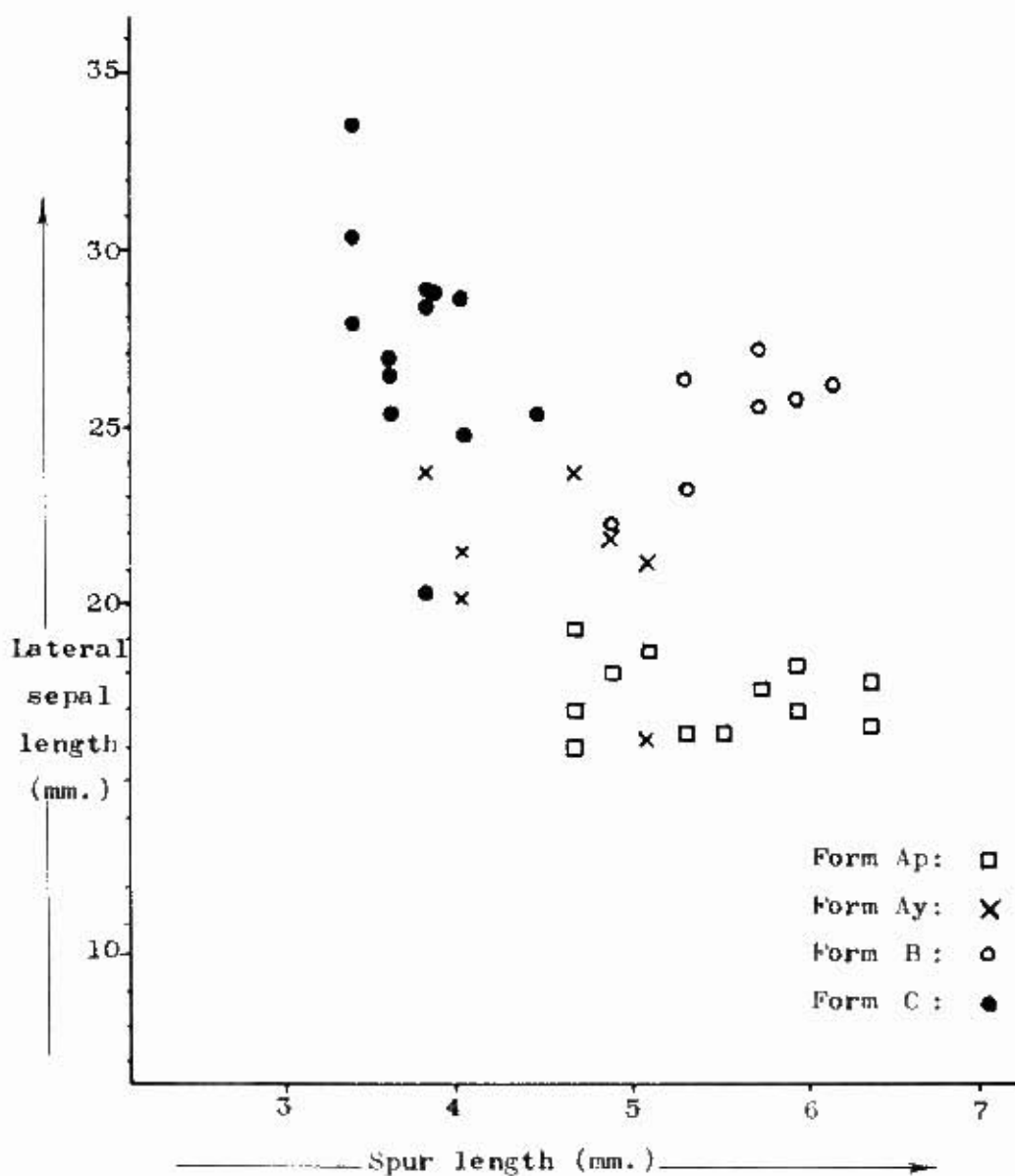


Diagram 16. Eulophia ovalis complex ('simultaneous' leaved group): scatter diagram showing the variation in spur length and lateral sepal length, in four field populations, each representing one of the forms Ap, Ay, B and C.

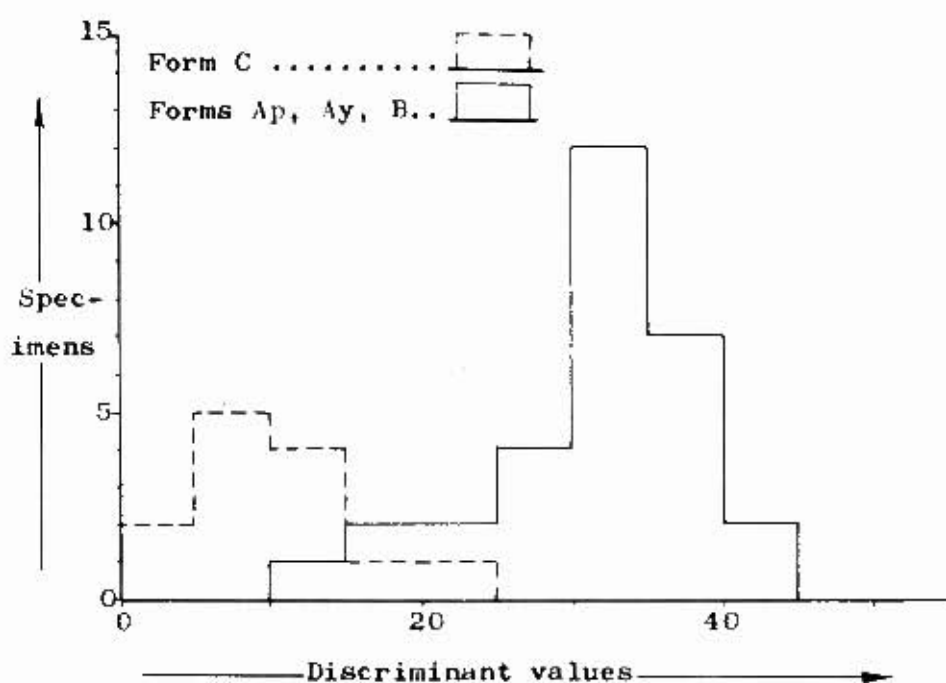


Diagram 17. Eulophia ovalis complex ('simultaneous' leaved group): histogram showing the discrimination between populations of Form C and Forms Ap, Ay and B, using the characters lip mid lobe length, spur length and lateral sepal length.

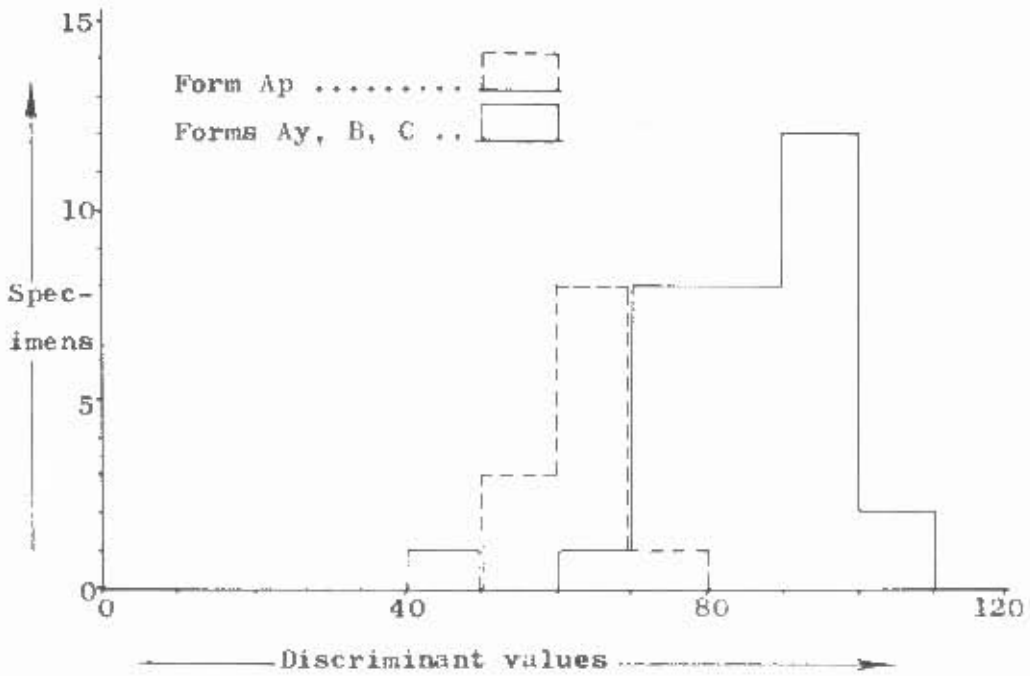


Diagram 18. Eulophia ovalis complex ('simultaneous' leaved group): histogram showing the discrimination between populations of Form Ap and Forms Ay, B and C, using the characters lateral sepal length and lip mid- and side-lobe length.

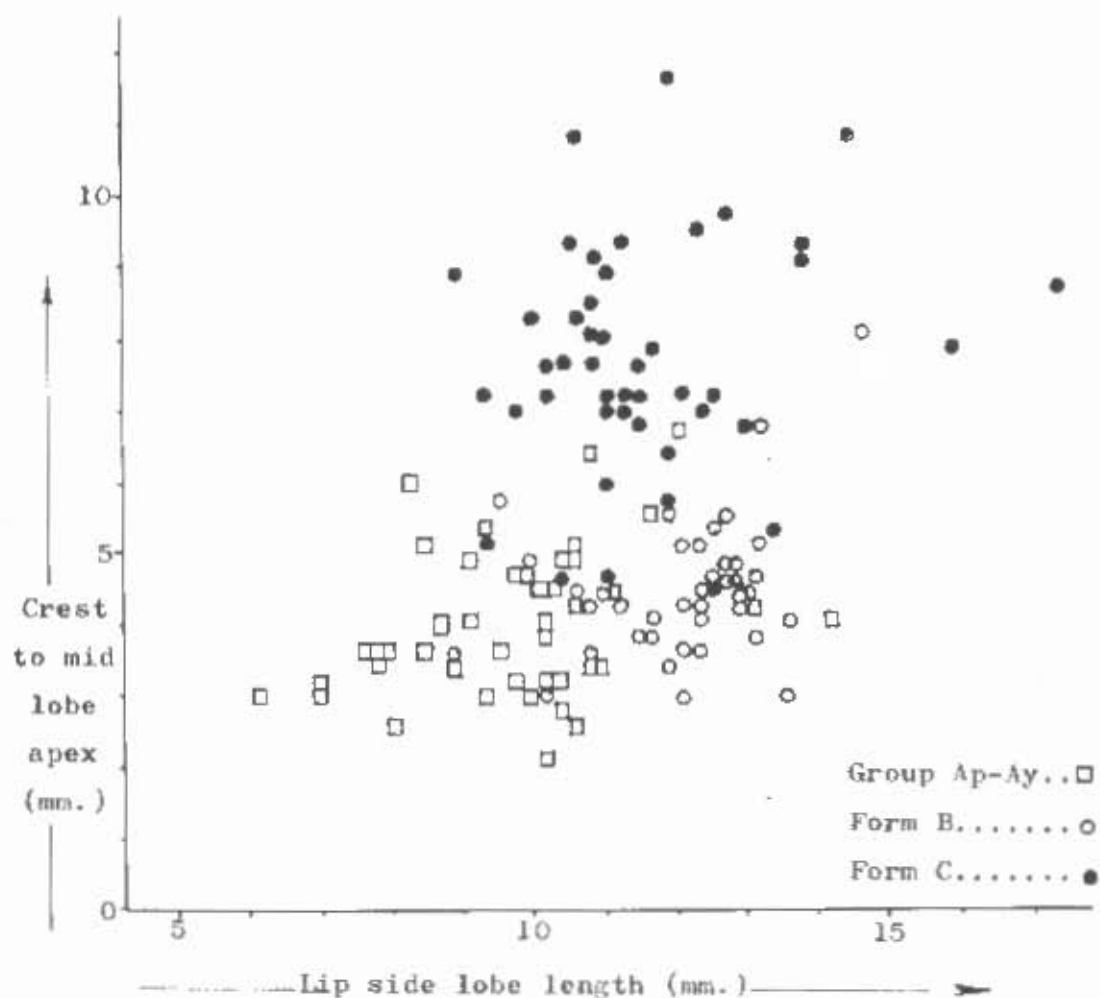


Diagram 19. Eulophia ovalis complex ('simultaneous' leaved group): scatter diagram showing the variation in lip side lobe length and the distance from the crest to the mid lobe apex, in herbarium specimens.

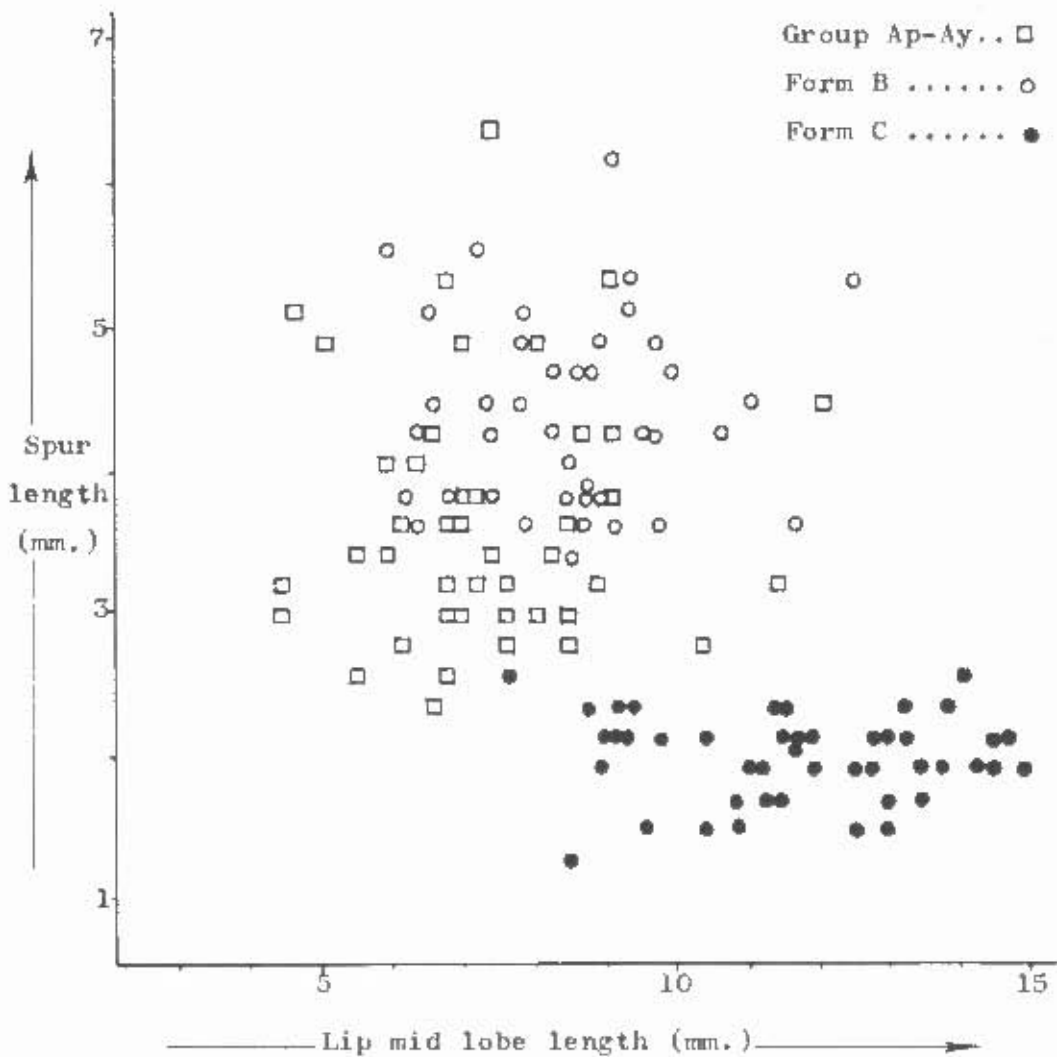


Diagram 20. Eulophia ovalis complex ('simultaneous' leaved group): scatter diagram showing the variation in spur length and lip mid lobe length in herbarium specimens.

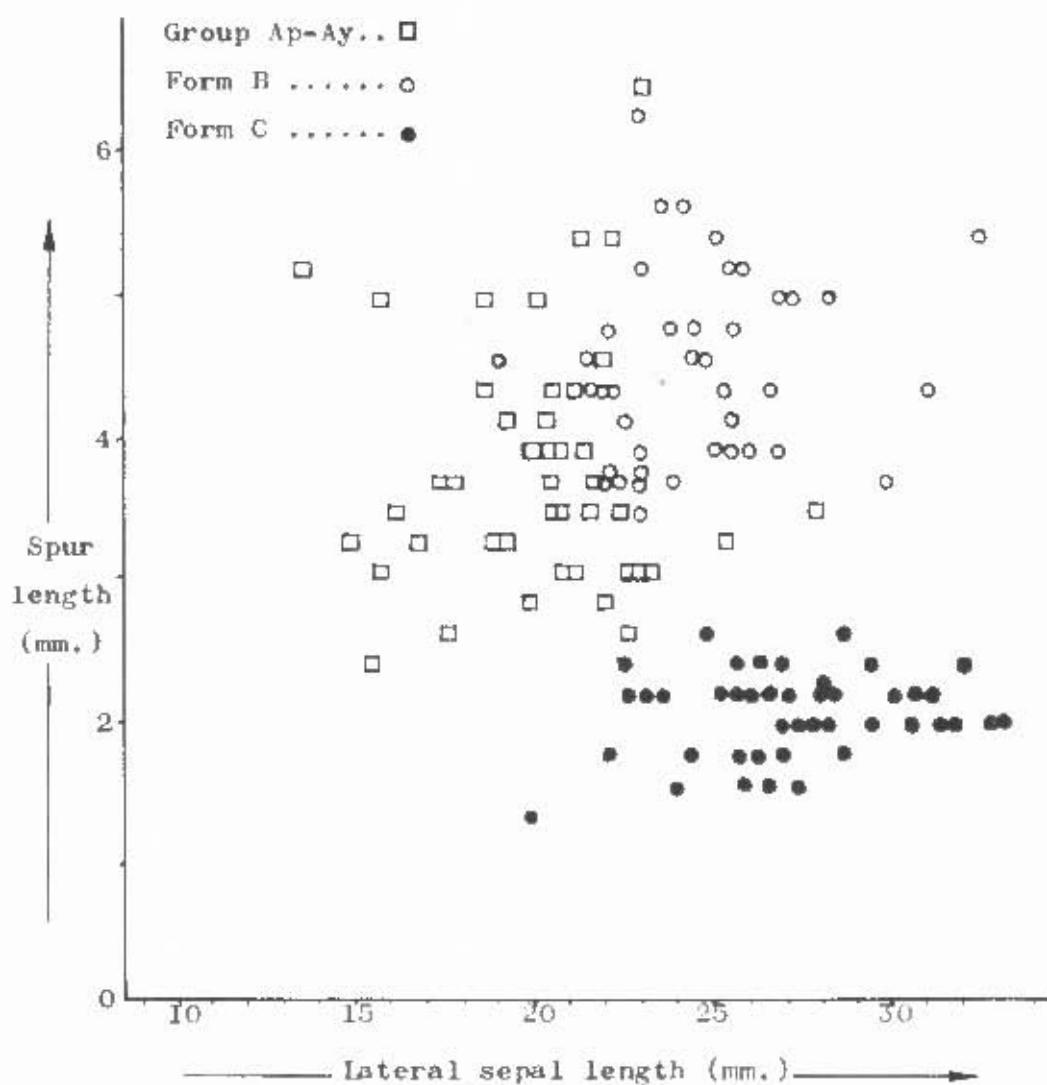


Diagram 21. Eulophia ovalis complex ('simultaneous' leaved group): scatter diagram showing the variation in spur length and lateral sepal length, in herbarium specimens.

## 7. EULOPHIA LONGISEPALA COMPLEX

This complex can be distinguished from other species of Eulophia by the following features: leaves narrow, short at time of flowering; scape slender, few-flowered, with one or two very small sheaths not more than 12mm. long; sepals narrower and rather longer than the petals, and more widely spreading; spur and mentum well developed. The complex has been collected in scattered localities from north-east Natal to Tanganyika and the Congo.

The chief features for subdividing the complex are found in the structure of the lip. A major division can be made on the nature of the side lobe venation, which is of two kinds. In one, the side lobe nerves are first directed laterally from the central lip veins, and then branch widely. In the other, they are directed diagonally and their subsequent branches remain close together. (See diagram 22). No intermediates have been found, so that this can qualify as an absolute character. Inspection showed that it was not possible to subdivide the group with 'lateral' venation.

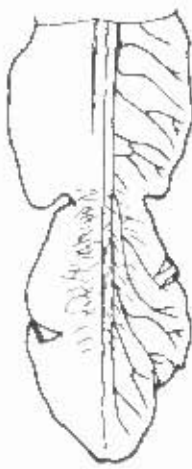
Other features distinguish this group less clearly from the complex. The mid lobe of the lip tends to be longer than in other forms. To illustrate this, measurements were taken from 55 specimens in the herbaria at Kew (K), the British Museum (BM), Brussels (BR), Zürich (Z), Pretoria (PRE) and Cape Town (BOL). They are plotted together with measurements of the lip side lobe length (for

subdividing the rest of the complex), in diagram 25.

It can be seen from this diagram that plants with 'lateral' venation all have at least slightly longer lip mid lobes than those with 'diagonal' venation. Inspection also indicated that the 'lateral' venation group had longer and more numerous crest papillae, and side lobe apices tapering more gradually into the mid lobe. There seems to be a reasonably sound basis for regarding this group as a distinct species. The earliest available name for it is Eriophia venulosa Benth.f.

In the remainder of the complex, there is a slight bimodal distribution of side lobe lengths. This is shown in diagram 25 (closed circles). Several minor variants are found, particularly in the group with smaller side lobes. Some have acuminate apices to the petals and lip, others have denser creasing than usual, or have shorter sepals. Most of these variants are represented in herbaria by only one or two specimens, and their status (at present as species) must remain tentative until more material is available for checking the constancy of their characteristics.

The nomenclatural Type of the earliest name in the 'diagonal' venation group lies in the set with long lip side lobes. It matches all the South African material, which also lies in this set. The name given to this nomenclatural Type, Eriophia longicaepala Rendle, is therefore used in referring to the South African representatives of the complex in Part 5.



Stolz  
1051  
(x4)



Stolz  
2575  
(x4)

'Diagonal' venation  
in side lobes

'Lateral' side lobe venation.

Diagram 22. Eulophia longisepala complex: drawings of labella to show the two kinds of side lobe venation.

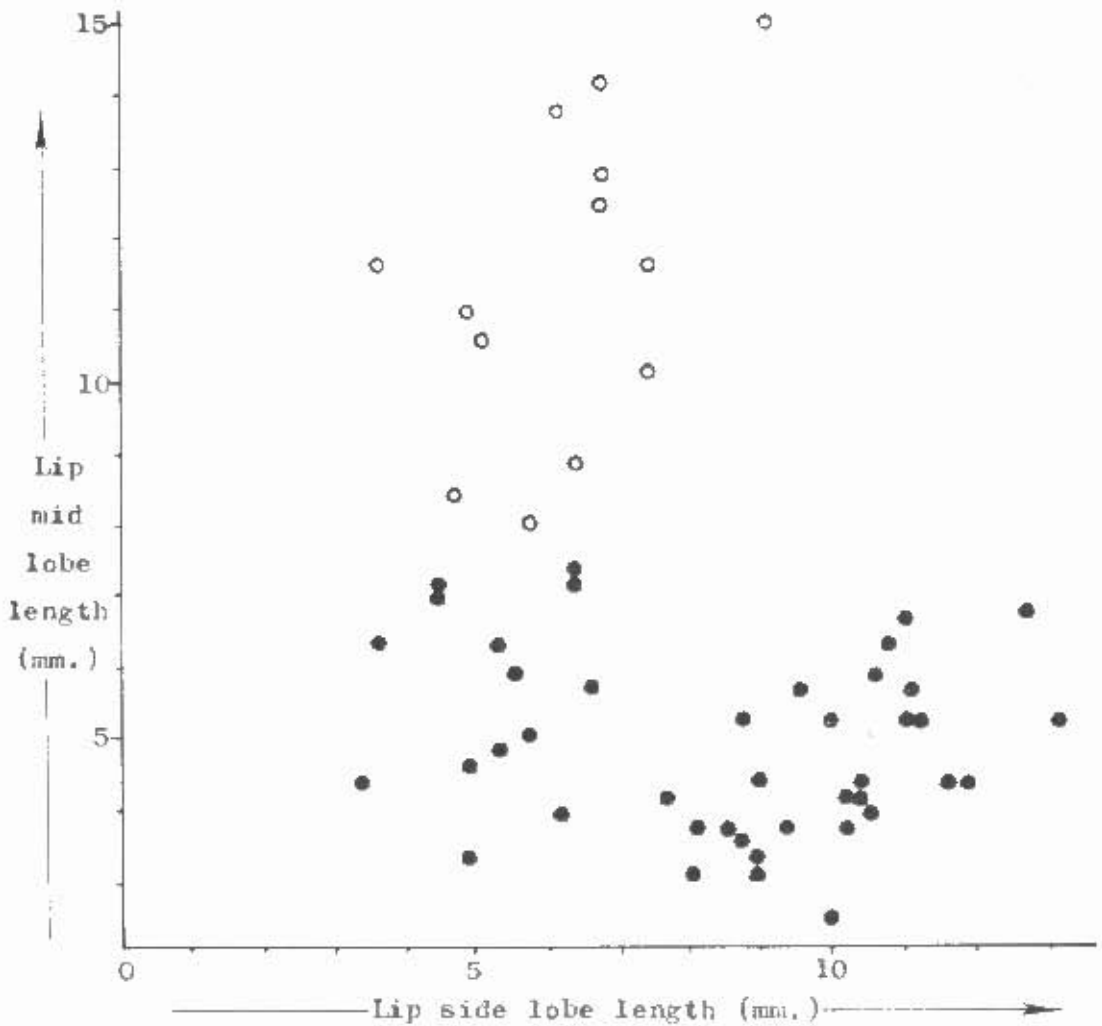


Diagram 23. Eulophia longisepala complex: scatter diagram showing the variation in lip mid- and side-lobe lengths in the forms with 'lateral' side lobe venation (open circles), and those with 'diagonal' veins (closed circles).

### 8. EULOPHIA PETERSII COMPLEX

This complex can be distinguished from other species of Eulophia by the following features: pseudobulbs sub-aerial, bearing two to four stiff serrulate leaves near the apex; petals usually circinnate, slightly wider than the spreading sepals; lip crests lamellate, tall distally; spur cylindrical, often curved away from the ovary. The complex has a wide distribution, extending from Natal northwards across the Equator to Eritrea, with a few scattered western localities in Angola and the Congo.

Inspection showed considerable variation in flower structure, particularly in spur and mentum length, petal length, and the relative lengths of the mid and side lobes of the lip. To evaluate the taxonomic significance of this variation, measurements were taken from specimens in the herbaria at Kew (K), the British Museum (BM), Brussels (BR), Vienna (W), Zürich (Z), Pretertia (PRE), Cape Town (BOL), Grahamstown (GRA) and Durban (NH). The data is given in diagrams 24 and 25.

The only separation evident from these diagrams is that of a form with small petals and a short spur and mentum. The geographical relationships of this form are given in diagram 26. The small petalled form is confined to south-western Angola, slightly less than 1000 miles from any other known locality. There is no evidence to indicate an east-west cline in the variable characters; however, there is no doubt that material from an intermediate

area would be of the greatest interest. Both petal length, and spur and mentum length can be taken here as parameters of flower size, as can the mid and side lobe lengths. The difference in flower size is large enough to be regarded as an absolute character. The Angolan group also has less distinctive features. All the available specimens of the group have scapes with second order branching, and rectangular apices to the side lobes of the lip; both these features are uncommon in the rest of the complex. Although many other features are very similar to the rest of the complex, it seems that there are sufficient grounds for regarding the Angolan group as a separate species. The earliest name for it is Eulophia aloifolia Reichb.f.

The remainder of the complex cannot be subdivided, although evidence is given in Part 3 of modal differences between local populations. It is referred to in Part 3 as Eulophia petersii Reichb.f.

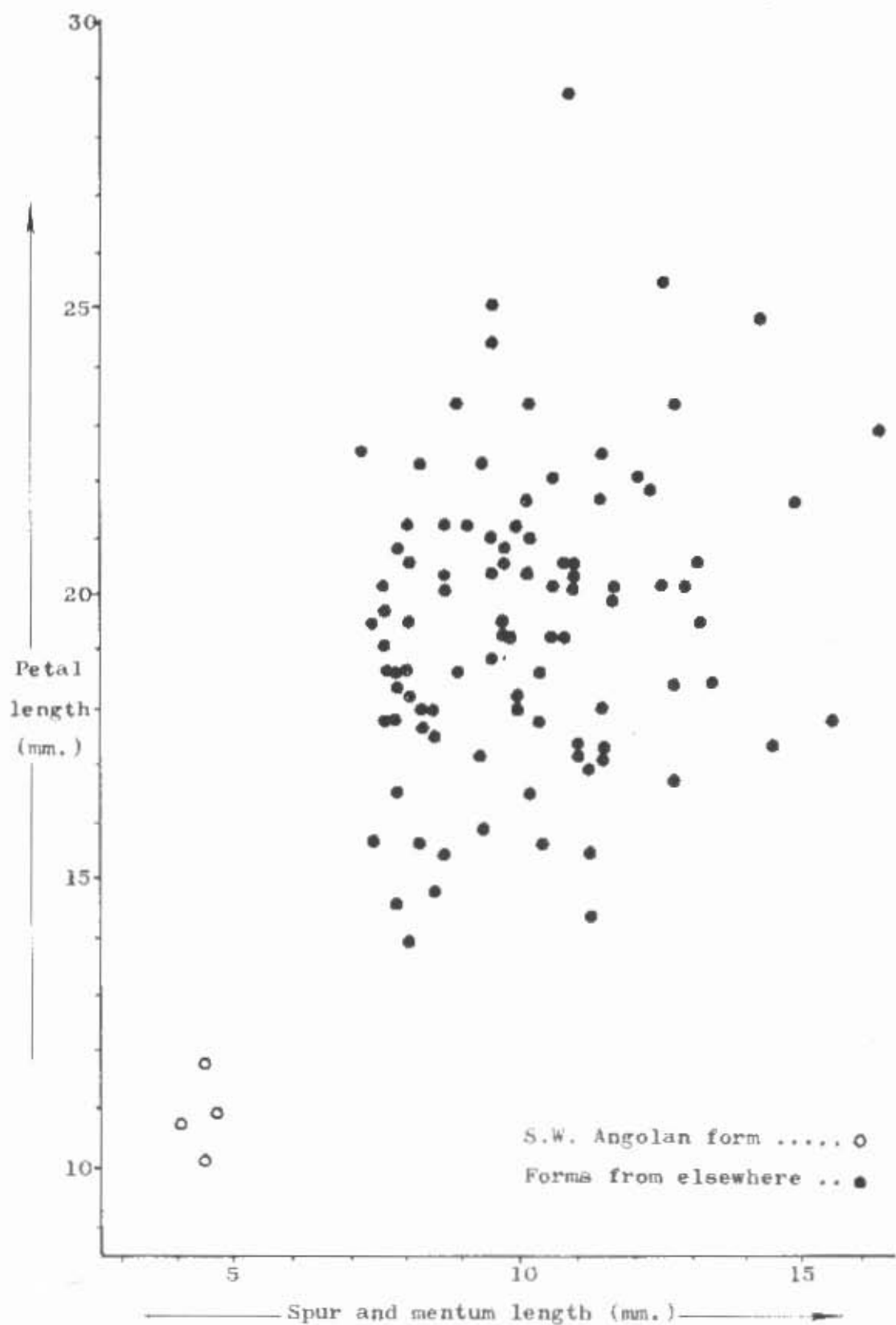


Diagram 24. *Eulophia petersii* complex: scatter diagram showing the variation in petal length and spur and mentum length in herbarium specimens.

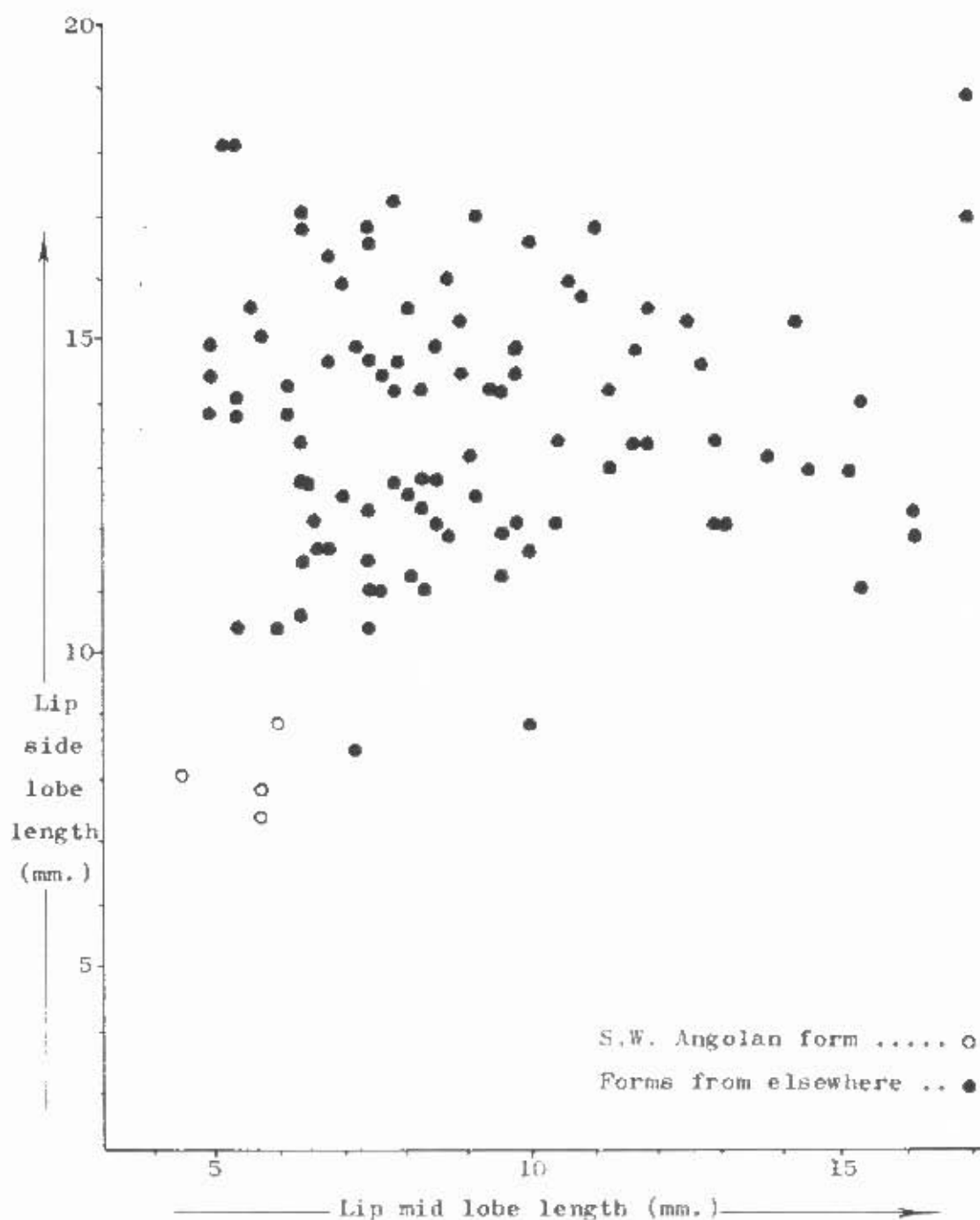
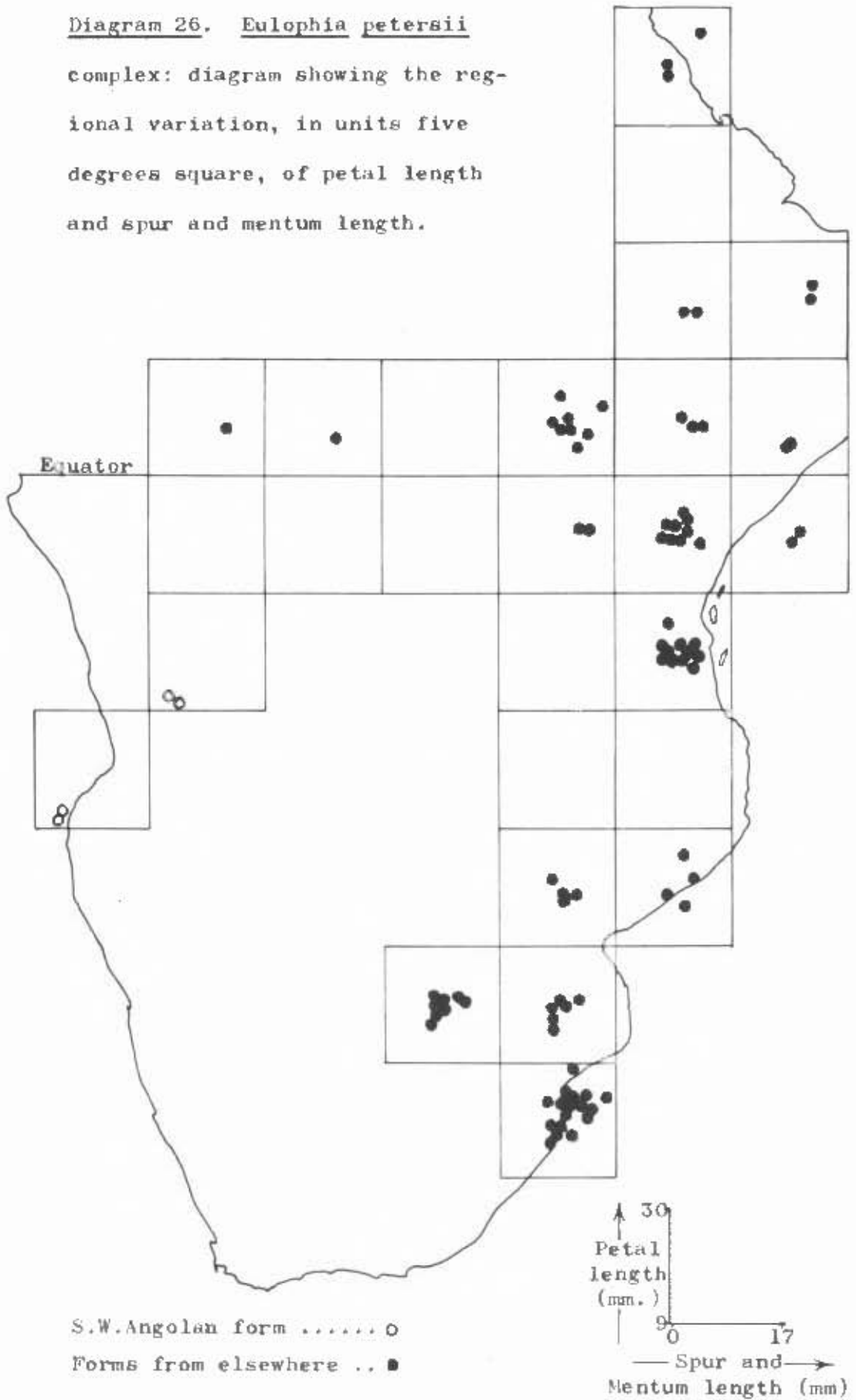


Diagram 25. Eulophia petersii complex: scatter diagram showing the variation in lip mid- and side-lobe lengths in herbarium specimens.

Diagram 26. *Eulophia petersii*  
 complex: diagram showing the regional  
 variation, in units five  
 degrees square, of petal length  
 and spur and mentum length.



### 9. EULOPHIA CLAVICORNIS COMPLEX

Members of this complex may be distinguished from other species of Eulophia by the following features: leaves narrowly linear; petals slightly broader than the sepals, usually oblong to elliptic-oblong, rarely slightly ovate or obovate; flowers small to medium-sized, the perianth about 8 to 18mm. long; spur and sometimes the mentum well developed; crested of dissected lamellae or numerous papillae, dense near the mid-lobe apex. The complex has been mostly collected in the eastern parts of South Africa, and there are scattered records of some forms as far north as Tanganyika.

Inspection indicated that it might be possible to recognize at least three groups in the complex. It appeared that two of these groups could be distinguished from the rest of the complex by having longer spurs and hysteranthous leaves. To test this, measurements of spur length and longest leaf length were taken from 326 plants in the herbaria at Preterria (PRE), Cape Town (BOL, SAM, NBS), Grahamstown (GRA) and Durban (NH). The measurements are given in diagram 27, symbolized according to the affinity of the specimens with one of the three proposed groups. The distribution is bimodal with a reasonably large number of intermediates.

The length of the penultimate sheath on the scape was also measured, and the results are plotted with leaf length in diagram 28. Scarcely any bimodality is evident

in diagram 26, although the two sets tend to occupy different ranges. Other possible distinctions in the flowers may be blurred by the frequent abnormalities in the long-spurred set (upper right of diagram 27). Normal flowers of this set tend to have slightly shorter and broader petals, but the difference is too indefinite to warrant biometric investigation.

It seems that abnormality in flower structure can itself be used as a taxonomic character in this complex. The abnormalities are often conspicuous. They take the form of cohesion of the petals and sometimes the lip, to the column, together with various distortions and reductions of these segments. Occasionally the sepals may be abnormal as well. In field populations of the long-spurred set, the frequencies of plants with abnormal flowers may vary from 25 to 80 per cent. Only one or two abnormal flowers have been found in the other set. This is therefore best regarded as a partly correlated absolute character (c.f. page 11).

There are not enough separate characters to exclude the possibility of intermediates between the two sets; indeed a small number of intermediate forms were actually found. Distinction must therefore be made at infra-specific level. As the sets are regionally sympatric, they should be given varietal status.

In the long-spurred set there is a form with different side lobe venation and yellow petals, in contrast to the more common purple petals. The veins, instead of

curving away from the median axis of the lip, remain straight for most of their length. This is not clearly shown in some plants, and the character must be regarded as bimodal. Rather less distinctive features of this group are the relatively short lip and the prominent mentum shown in some specimens, this being nearly absent in the rest of the set. The small number of bimodal characters, and sympatric distributions point to a distinction at varietal level. In Part 3, the yellow-flowered variety is called Eulophia clavicornis var. inaequalis, and the remainder of the long-spurred set E.clavicornis var. clavicornis.

There is great difficulty in subdividing the short spurred, long leaved set (diagram 26, lower right). Specimens representing the various developments in this part of the complex were chosen, and an attempt was made to set up groups around them. A large proportion of intermediates seen showed that this was impossible. However, it was interesting to find that characters are usually quite constant among the members of a local population (e.g. Hall 654, 810, 828, 871). For taxonomic purposes this set must be regarded as a single group. It was distinguished at varietal level on page 62, and in Part 3 it is named Eulophia clavicornis var. nutans.

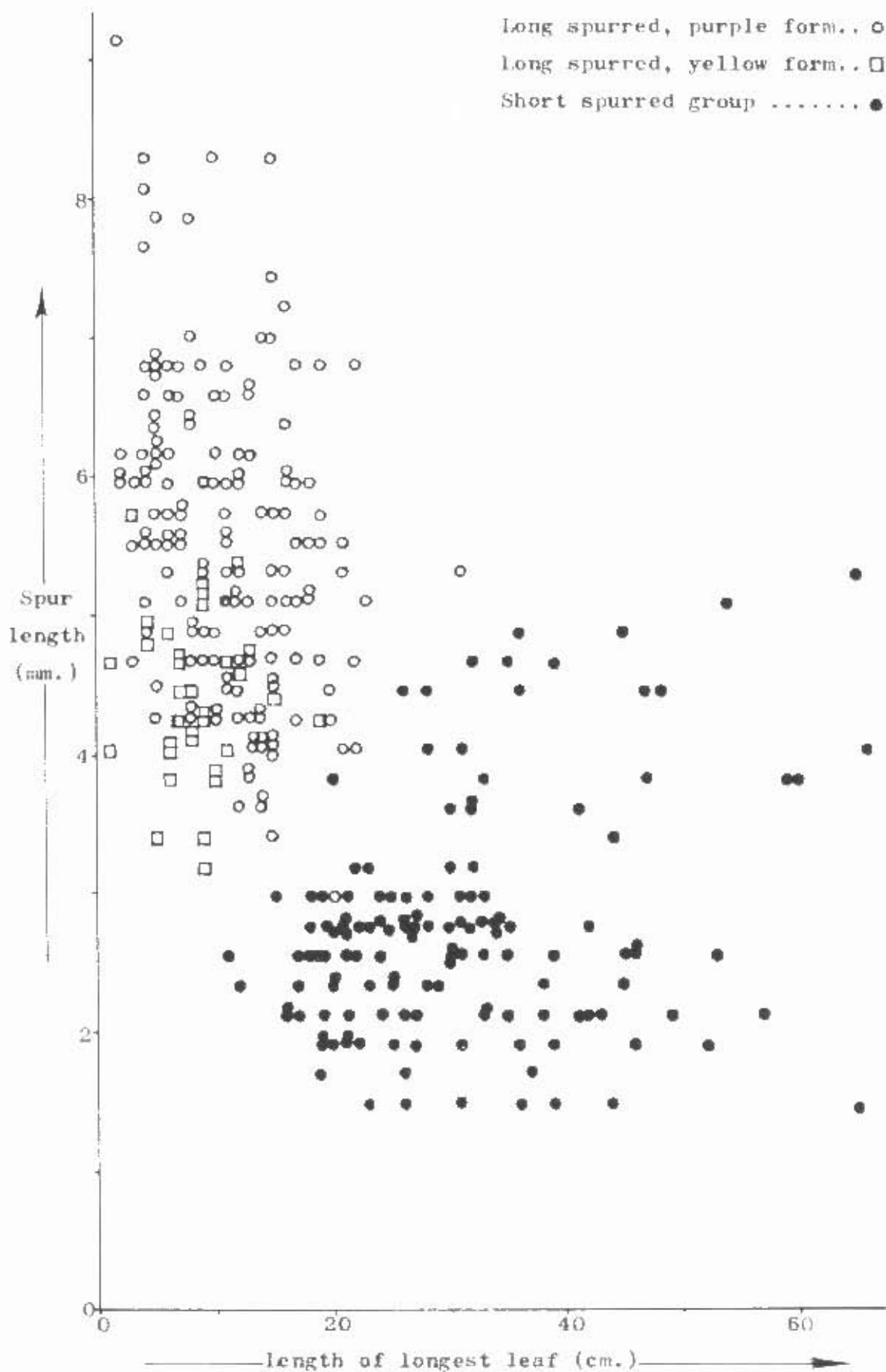


Diagram 27. *Eulophia clavicornis* complex: Scatter diagram showing the variation in spur length and the length of the longest leaf.

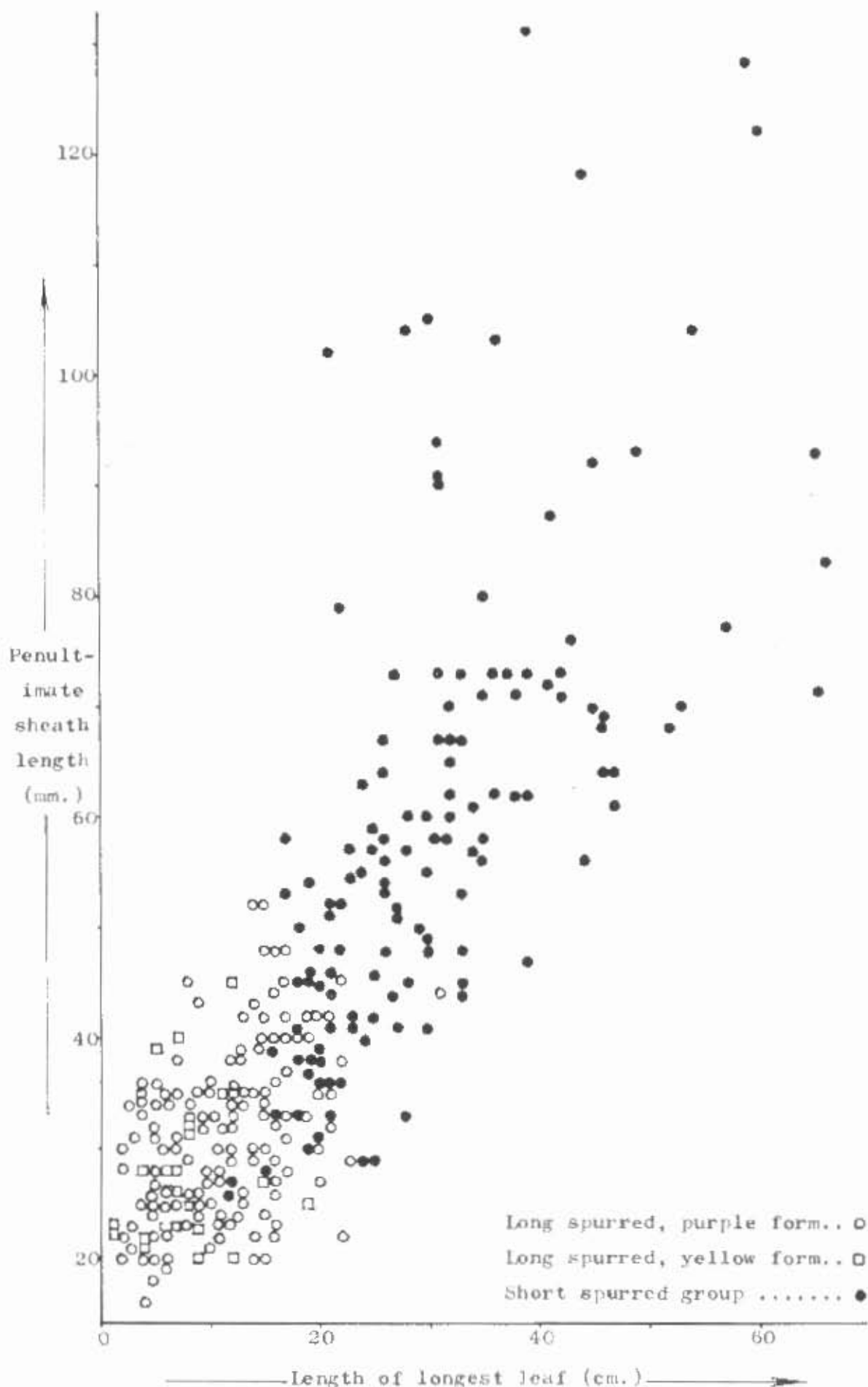


Diagram 28. *Eulophia clavicornis* complex: scatter diagram showing the variation in penultimate sheath length, and the length of the longest leaf.

#### 10. EULOPHIA NIGRICANS COMPLEX

This complex is distinguished from other species of Eulophia by the following features: leaves short at the time of flowering; scape sheaths generally broad and often longer than their internodes; petals linear-oblong, slightly narrower than the sepals; spur short, directed away from the ovary; column over 9mm. long with the operculum rostrate; crests thin below, passing into a few dentate lamellae on the mid lobe. The complex has been collected on remarkably few occasions in a very large distribution range, extending from South Africa to Kenya, and thence, with a 1500-mile gap, to Nigeria.

Inspection showed that all specimens from Nigeria had different side lobes. They tapered gradually towards the base, in contrast to the rounded, almost rectangular outlines shown in plants from Kenya to South Africa. The distinction is sharp enough to be regarded as an absolute character.

Perhaps associated with the same morphogenetic system is the tendency for the mentum and spur to be smaller and the mid lobe to be larger in the Nigerian material. In a sense, both these features and the tapered side lobe bases are parameters of a displacement of growth, involving contraction at the base of the lip and an enlargement of distal parts. The only other feature of the Nigerian plants showing distinctive tendencies is the narrowness of the sepals. Other features,

including cresting, flower colour, column shape and vegetative structures are remarkably similar in the two groups.

To demonstrate the variation in lateral sepal width, and mentum and spur length, measurements were taken in 26 specimens in the herbaria at Kew (K), the British Museum (BM), Zurich (Z) and Cape Town (DOL). The results are given in diagram 29. Although the sets tend to occupy different ranges, they merge into one another with scarcely any sign of a bimodality. The regional variation of these two characters is given in diagram 30. There is no sign of a north-south clinal change in the Eastern form, although the number of specimens available is scarcely sufficient to show this.

The species is rare over most of its range, and its apparent absence in the Kenya - Nigeria 'gap' may be due to less intensive collecting in the area. Specimens from this area would be of the greatest interest. Such material might well prove to be intermediate in the few characters which at present separate the forms.

Being distinguished by an absolute character (shape of the lip side lobe) the two forms must be regarded as distinct species. In Part 3 the South African and eastern material is named *Eulophia nigricans* Schltr. The name for the Nigerian species, *E. adenoglossa* Lindl., was published earlier than this. If the forms are later shown to be conspecific, the South African material will have to be renamed.

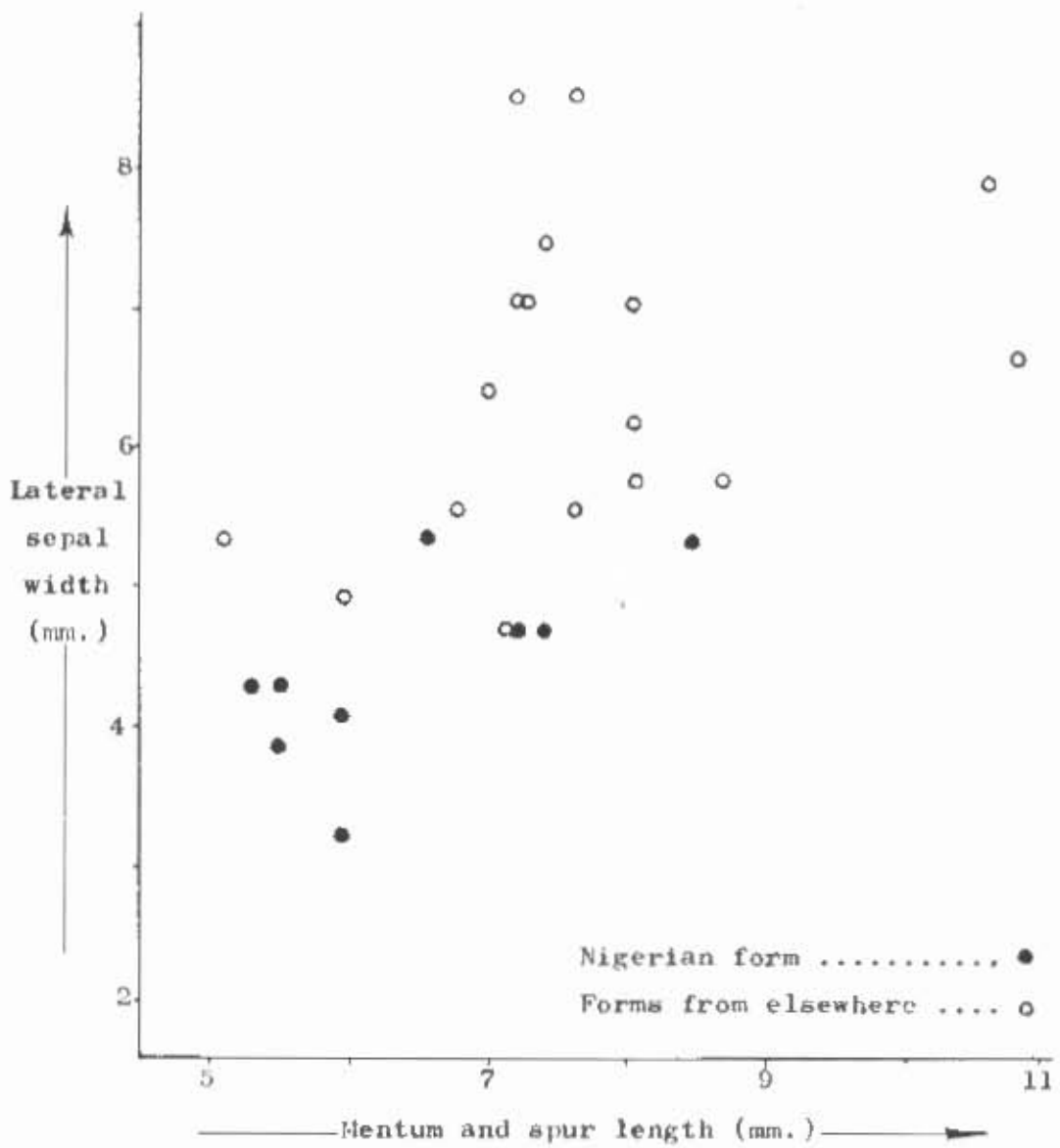


Diagram 29. Eulophia nigricans complex: scatter diagram showing the variation in lateral sepal width, and mentum and spur length.

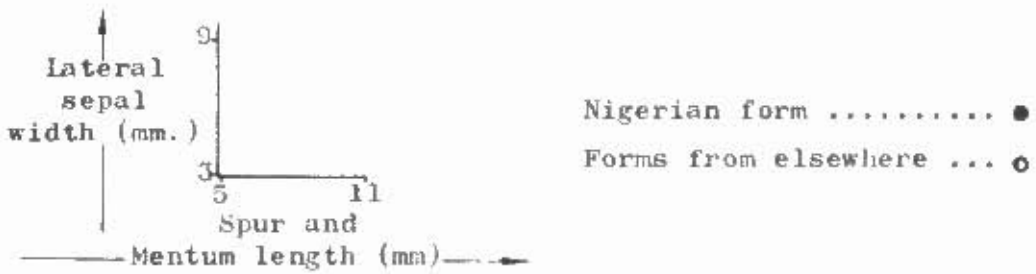
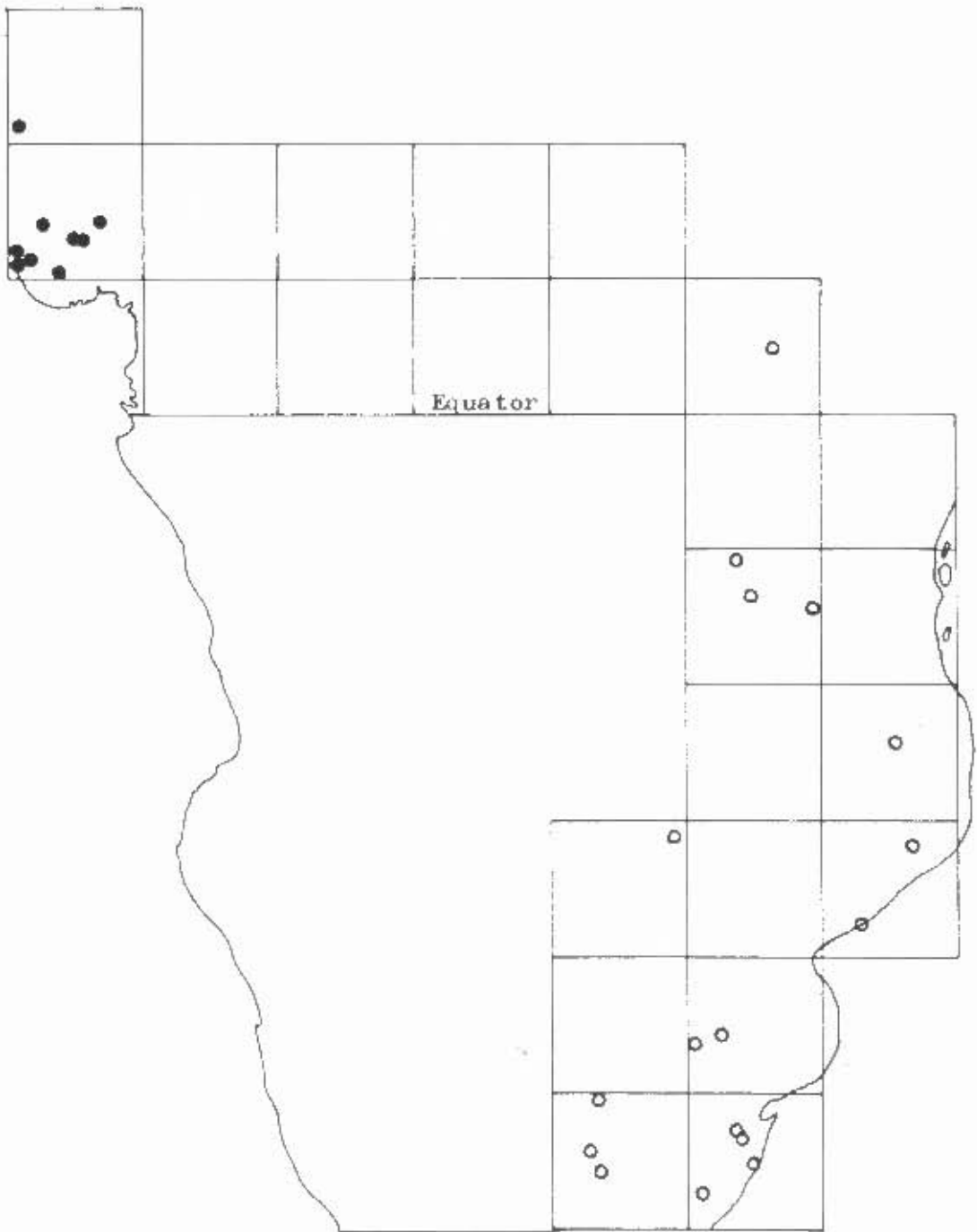


Diagram 30. *Eulophia nigricans* complex: diagram showing the regional variation, in units five degrees square, of lateral sepal width, and spur and mentum length.

## 11. EULOPHIA WELWITSCHII COMPLEX

This complex is distinguished from other species of Eulophia by the following features: leaves plicate and rather stiffly erect; petals slightly narrower than the lateral sepals; perianth large, with the lateral sepals 15 - 45mm. long; column relatively short, about half the length of the side lobes; of the lip; crest papillae very slender, usually confined to the basal half of the mid lobe. The complex has a wide distribution, extending from South Africa to Uganda in the north and Angola in the west.

The most distinctive group in the complex has very short spurs, and tends to have large flowers. To evaluate these differences, measurements of spur length and lateral sepal length were taken from 109 specimens of the complex in the herbaria at Kew (K) and the British Museum (BM). The results are given in diagram 31. A small gap is evident between the short-spurred group and the rest of the complex, mostly due to discrimination by spur length. The distinction is perhaps more absolute than bimodal.

The short-spurred group has some less distinctive properties. The mentum is often a little longer than in the rest of the complex, and the crest papillae are generally longer and more numerous. Members of this group can always be clearly distinguished and no intermediates have been found in the material examined. It seems

reasonable to recognise this as a distinct species. The earliest name for it is Eulophia aurantiaca Rolfe.

The rest of the complex is much more difficult to subdivide. Each possibly useful character seems to vary through a wide range with no gaps or bimodalities. Hypothetical groupings based on combination of characters appear to merge into one another; indeed, it seems that only three such groups have the slightest chance of recognition. One of these is proposed chiefly on the grounds of auxiliary, non-morphological characters. It has orange-red flowers (in contrast to yellow or yellow and purple in the rest of the complex), and a distinct geographical distribution in Angola. Several morphological trends are associated with this, such as broad lateral sepals and a relatively long lip. The other two groups are proposed mostly because of differences in flower size and colour. The smaller flowered form usually lacks purple tinges, and tends to occur, more or less exclusively, in the northern parts of the geographical range of the complex.

To evaluate the distinctness of these groups, measurements were taken of the chief variable characters in specimens at the herbaria at Kew (K) and the British Museum (BM). These are plotted in their most discriminative combinations in diagrams 31 - 34, coded according to the affinity of the specimens to one of the three groups. This coding is also given in diagram 31. The diagrams show that the variation ranges of the groups merge into each other. This is particularly evident between the 'Angolan' form (squares) and the large -

flowered group (closed circles). The small-flowered group (open circles) is the most distinct of the three, and there seemed to be a possibility that a combination of characters might at least partly distinguish it from the rest of the complex.

To test this, a discriminant analysis was carried out using the four best characters, spur length, lateral sepal width and length, and lip length. The frequency distribution of discriminant function values is given in diagram 35. Values of the two sets overlap a great deal, precluding any recognition of a taxonomic distinction.

As there are no other structural distinctions in this part of the complex, it seems that it should be regarded as a single variable species. In Part 3 it is referred to as Eulophia welwitschii (Reichb.f.) Rolfe.

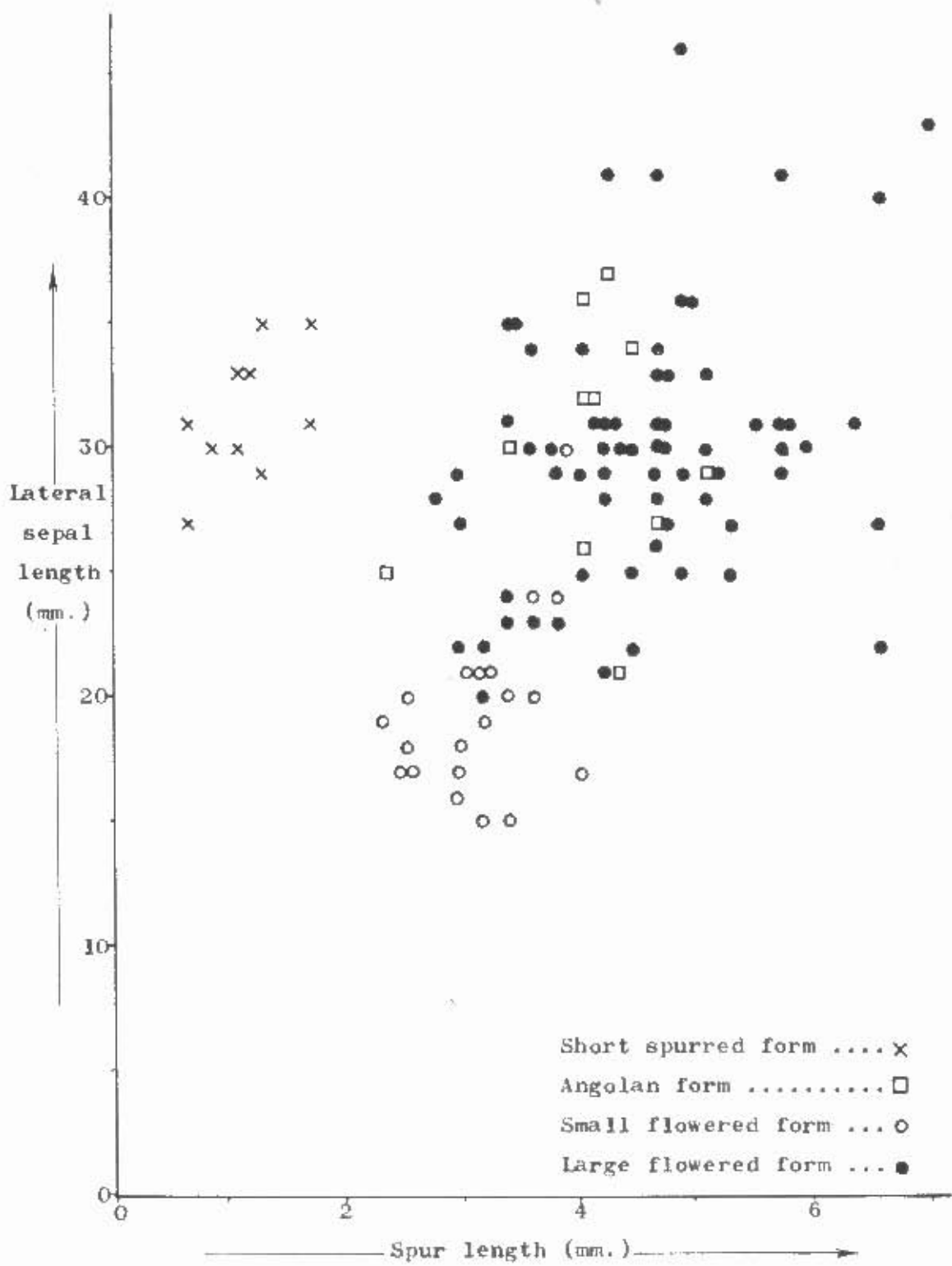


Diagram 31. *Eulophia welwitschii* complex:  
 scatter diagram showing the variation in  
 spur length and lateral sepal length.

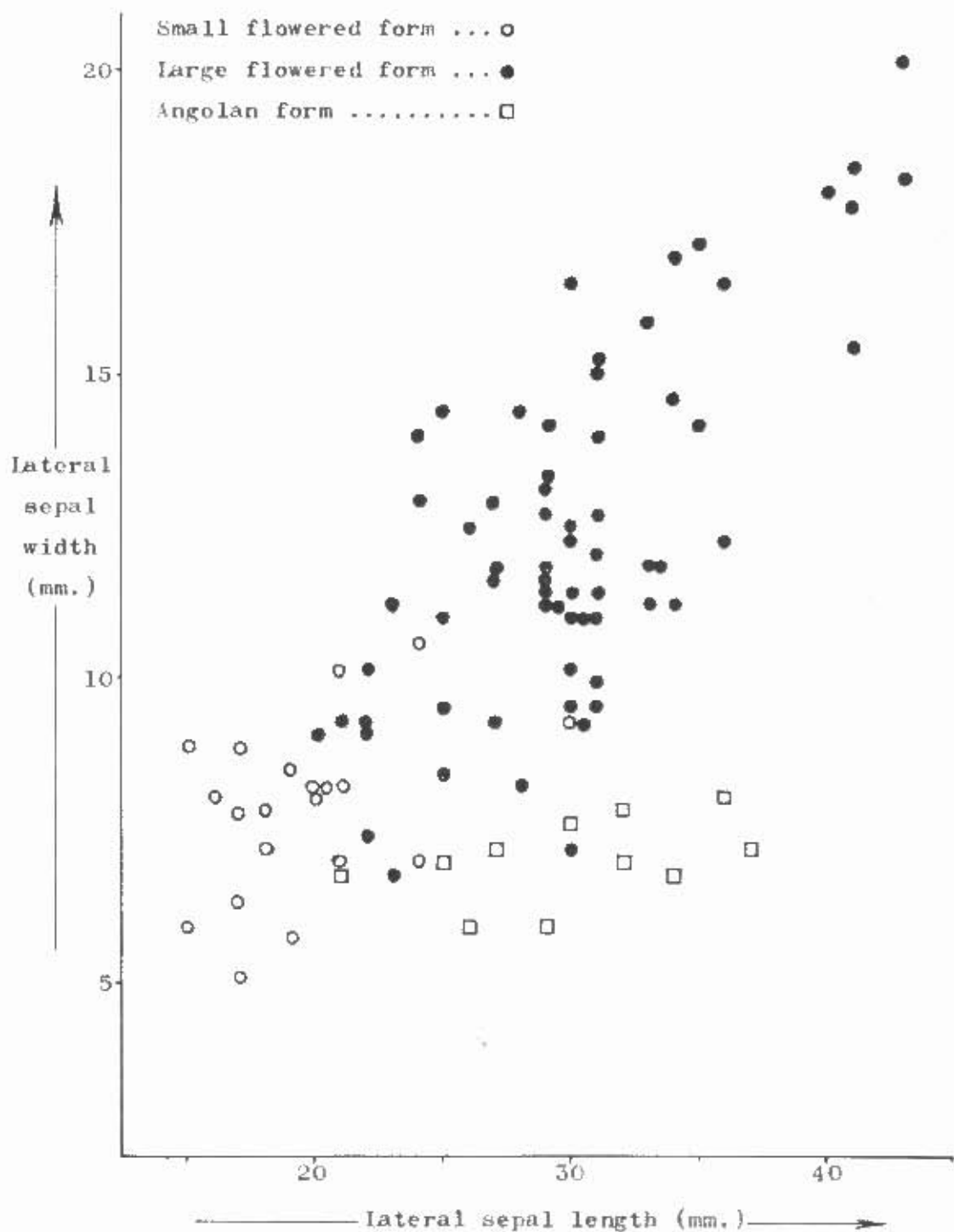


Diagram 32. Eulophia welwitschii complex (long spurred group): scatter diagram showing the variation in lateral sepal length and width.

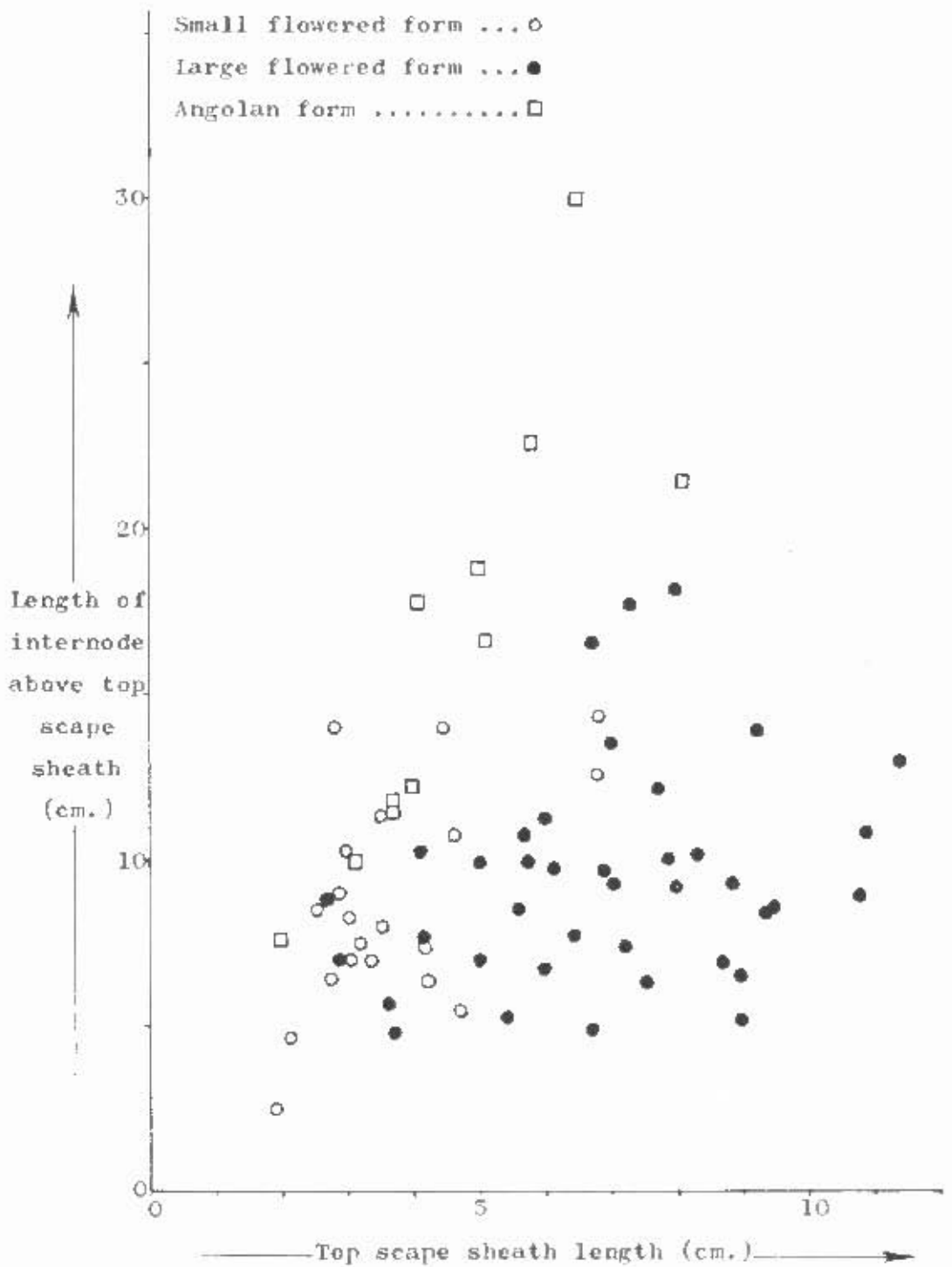


Diagram 33. Eulophia welwitschii complex (long spurred group): scatter diagram showing the variation in the length of the uppermost scape sheath, and the length of the internode above it.

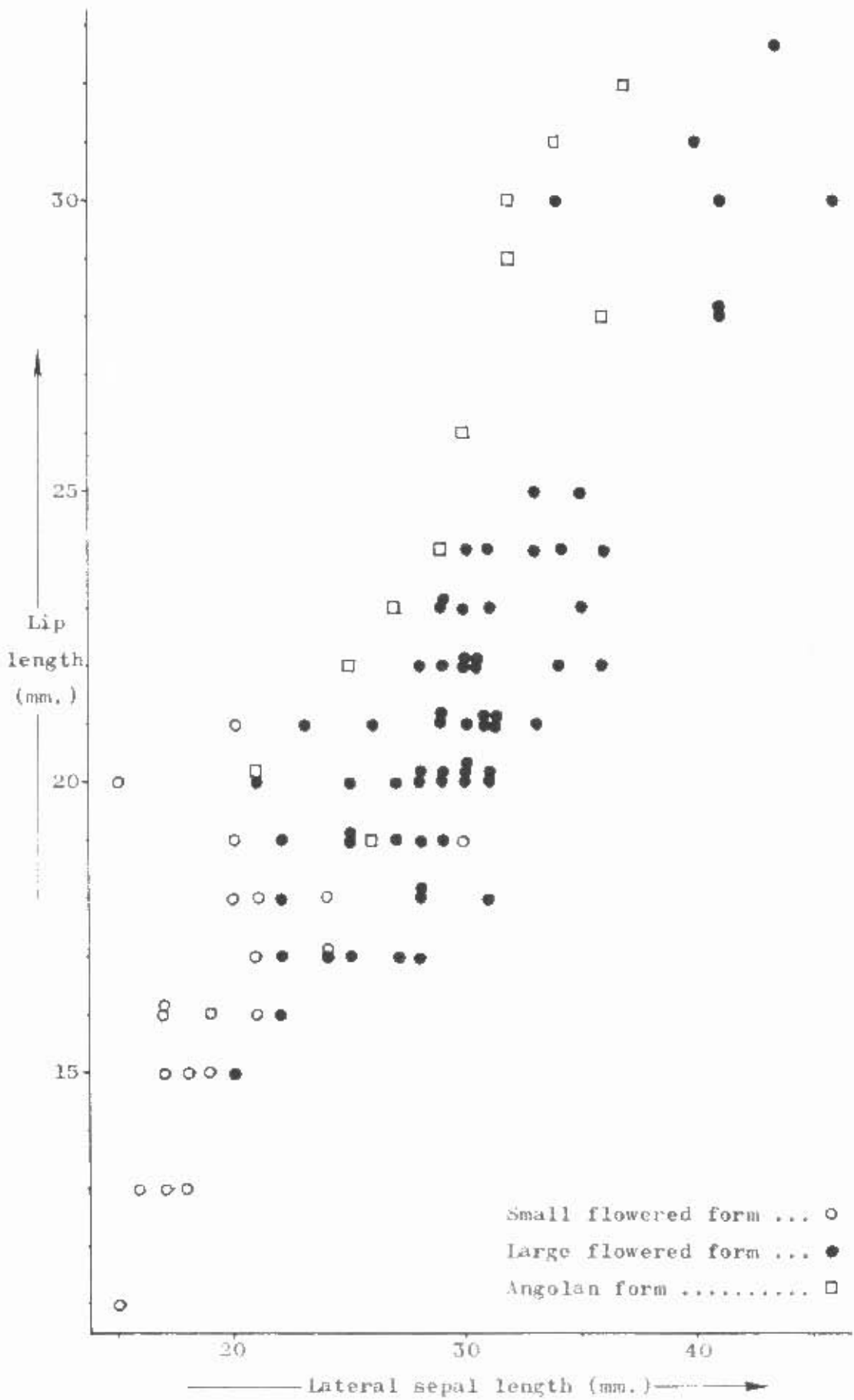


Diagram 34. *Eulophia welwitschii* complex (long spurred group): scatter diagram showing the variation in lip length and lateral sepal length.

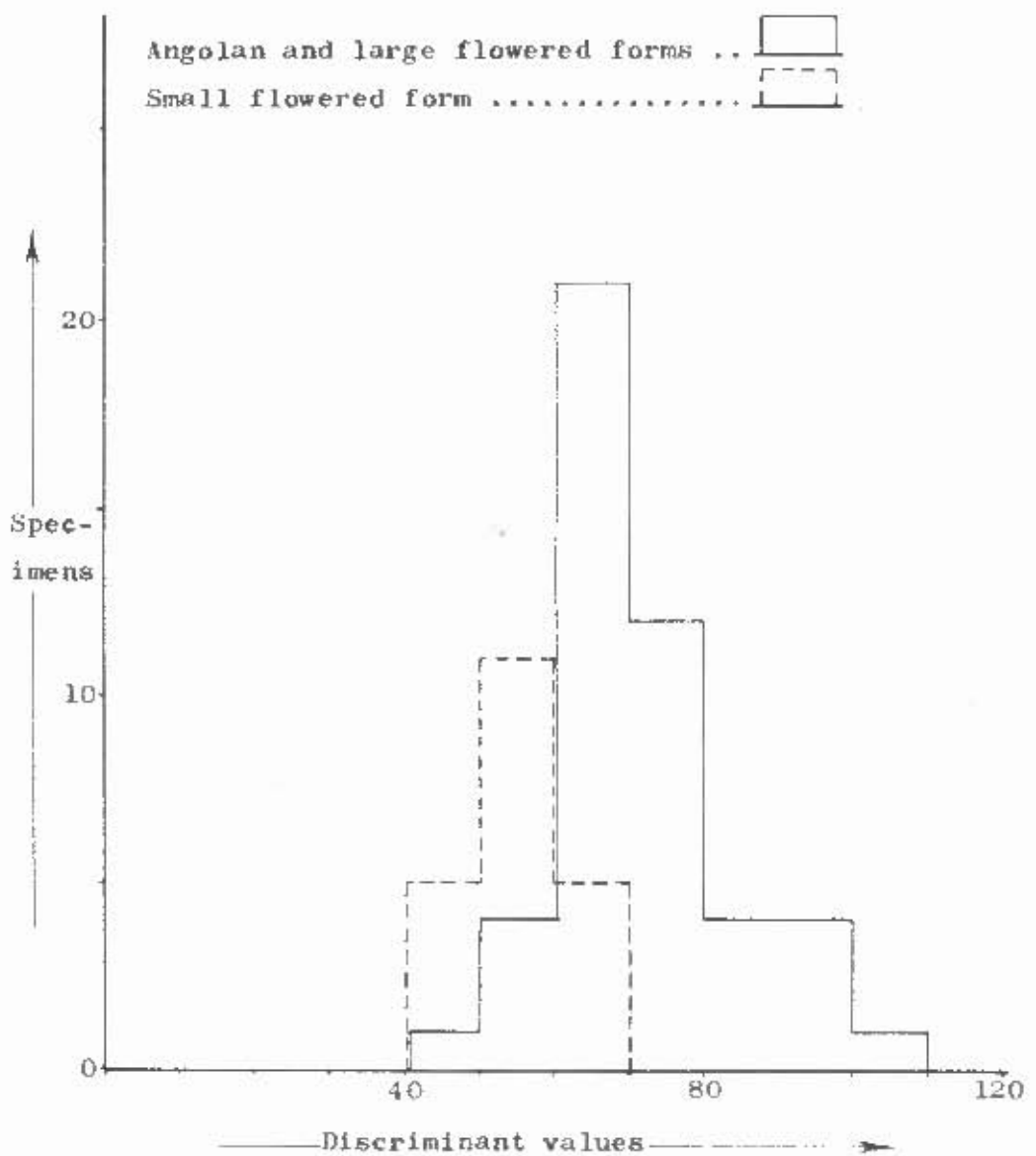


Diagram 35. Eulophia welwitschii complex (long spurred group): histogram showing the discrimination between the small flowered form, and the Angolan and large flowered forms. Characters used in the analysis were spur length, lateral sepal width and length, and lip length.

PART 2: KEY TO THE SPECIES, SUBSPECIES AND VARIETIES

OF EULOPHIA IN SOUTH AFRICA

KEY TO THE SPECIES, SUBSPECIES AND VARIETIES

OF EULOPHIA IN SOUTH AFRICA

The first key to the South African species of Eulophia was published by Rolfe (1912). Thirteen allied species were considered to belong to a different genus, Lissochilus R.Br., which was said to differ from Eulophia in having more clearly differentiated sepals and petals.

The petals in Lissochilus were considered to be larger and more brightly coloured than the "generally strongly reflexed" sepals. Eulophia was said to differ in having "sepals and petals equal or subequal, subconnivent or the sepals seldom reflexed; petals usually very similar to the sepals in colour or paler".

In practice, however, these distinctions seem to be difficult to uphold (c.f. Summerhayes 1936). The colour characters are not always correlated with the morphological distinctions. In some species the sepals and petals may be subequal and subconnivent like a Eulophia, but very different in colour (e.g. E.parviflora). In others, the sepals and petals may be structurally quite different, but have almost the same colouring (e.g. E.angolensis).

In morphological features, a continuous series can be traced from species with petals smaller than the sepals, through to very large petalled forms (e.g. E.melagris - E.ensata - E.litoralis - E.tenella - E.clavicornis).

- E.ovalis - E.macowanii - E.fridericii - E.tuberculata - E.cucullata). In most species of Eulophia, the sepals are partly spreading, lying at an angle of about 40° - 80° to the axis of the column in the mature flower. Again there is a continuous series, from partly spreading forms to a minority of species with reflexed sepals (E.milnei - E.ovalis - E.longisepala - E.angolensis - E.cucullata - E.tuberculata). There is a general trend for the more 'reflexed' forms to have more clearly differentiated sepals and petals. However, as the two characters taken together show no sign of a discontinuity, there is no basis for upholding a generic distinction.

Relfe's key to the species of Eulophia would need to be changed extensively to accommodate the species transferred from Lissochilus. Furthermore, it is found that continuity between some of the main divisions makes the key difficult to use.

For example, two main groups are distinguished by the spur being "distinctly conical" in contrast to "slender, oblong, clavate or somewhat elongated". This difference is difficult to assess in practice, as most elongate spurs are conical for at least part of their length. Also, the spur may vary from conical to slender-elongate in a single species (e.g. E.parviflora). The large set of slender-spurred species was further subdivided using differences in flower size and inflorescence density. However, flower size is particularly variable in Eulophia (see measurements of odd sepal length in the descriptions in Part 3), and in

several species of this group the inflorescence becomes much less dense as more flowers open (e.g. E.ovalis, E.cooperi, E.macowanii).

In view of these difficulties, it became necessary to construct a new key. This new key makes no claim to show the groupings of species with similar overall structure: there appeared to be too many groups of this sort, and their character combinations were too complex for this to be a suitable basis for setting up the key. In the sense of some authors, this is an "artificial" and not a "natural" key. However, the author prefers to avoid these terms as they carry the implication of some knowledge of the patterns of ancestral origin of the species. It is considered that much more information is needed to decide this in Eulophia, than is at present available.

The distorted-flowered varieties of E.clavicornis were first separated off in the key. This was followed by the separation of a small and characteristic group of species with obsolete spurs and the side lobes of the lip free from the mentum. Characters for making subdivisions of the remaining large group of species were very difficult to find.

Apart from flower colour, the best single character for distinguishing between these species is the nature of the creasing on the lip. There is some inconvenience in determining crest structure in dried material, as the flowers must be boiled in water for a short period

to reconstitute the original shapes. However, it seemed that this difficulty was far outweighed by the advantage of rapid identification.

Nearly all species could be classified without difficulty into three groups, based on crest type. The few 'borderline' species were included in more than one group as necessary. Briefly, the groups are characterized as follows: crests of broad fleshy ridges, gradually becoming lower distally; crests lamellate, terminating abruptly; crests papillose. The slightly larger papillose-crested group was further subdivided using the relative widths of the petals and sepals.

- 
- 1 One or both petals, and sometimes the lip, fused to the column and variously distorted; spur elongate. . . 39
  - 1' Neither petals nor the lip fused to the column, or very rarely, if so, then the spur absent. . . . . 2
  - 2 Spur usually lacking, if present then less than 1.8 mm. long; lip attached only to the apex of a prominent mentum; petals usually oblanceolate or broadly elliptic. 3
  - 2' Spur generally present; if obsolete, then either the lip attached to more than 1/3 of the length of the mentum, or the mentum absent; petals variously shaped. . . . . 8

Obsolete - spurred species

- 3 Lip crest a single ridge for most of its length, sometimes three-lobed at its apex; odd sepal 17 - 25 mm. long. . . . . E.tabularis (1).
- 3' Lip crests of two ridges or lamellae, passing distally into several rows of papillae or lamellae; odd sepal 5-18 mm. long. . . . . 4
- 4 Papillae wart-like and very sparse on the distal half of the mid-lobe of the lip; raceme generally dense and elongate. . . . . E. foliosa (2)
- 4' Papillae or lamellae elongate, usually numerous on the distal half of the mid-lobe of the lip; raceme seldom both elongate and dense. . . . . 5
- 5 Mid-lobe usually slightly more than half the length of the lip, with denticulate margins. . E.odontoglossa (3).
- 5' Mid-lobe rather less than half the total length of the lip, with smooth to finely undulate margins. . . . . 6
- 6 Mentum passing into a distinct spur 1.2 - 1.8 mm. long; raceme somewhat lax and elongate; sepals acute. . . . . E.chlorantha (34).
- 6' Spur absent; raceme rather dense and short; sepals sub-obtuse to subacute. . . . . 7

- 7 Flowers small: mentum (0.6) - 1.2 - (2.1) mm. long; petals (5.2) - 7.5 - (9.5) mm. long. . . . .  
. . . . . E.aculeata ssp. aculeata (4).
- 7' Flowers large: mentum (2.3) - 3.5 - (5.0) mm. long; petals (9.3) - 12.0 - (14.5) mm. long. . . . .  
. . . . . E.aculeata ssp. huttonii (4).

Broad ridge - crested species

- 8 Crests on the distal 2/3 of the lip composed of broad, smooth or verrucose ridges, that gradually become lower to vestigial near the lip apex. . . . . 9
- 8' Crests on the distal 2/3 of the lip composed of papillae or lamellae, generally rather abruptly terminated, or the lip without crests in the distal 2/3. . . . . 16
- 9 Lip with a fringed lamella 2 - 4 mm. high, lying transversely near the base. . . . . E.fridericii (5).
- 9' lip lacking a transverse lamella near the base. . . . . 10
- 10 Margin of the side lobe of the lip adjoining the middle lobe 5 - 9 mm. long; leaves with a transverse line near the base marking an abscission layer. . . . .  
. . . . . E.streptopetala (6).
- 10' Margin of the side lobe of the lip adjoining the middle

- lobe 3 mm. long; leaves without a transverse line near the base. . . . . 11
- 11 Column 2 - 4 mm. long; margin of the mid-lobe of the lip undulate; odd sepal 4-9 mm. long. . . . .  
. . . . . E.clitellifera (7).
- 11' Column usually rather more than 5 mm. long; rarely, if less, then the margin of the mid-lobe of the lip entire. Odd sepal 7 - 30 mm. long. . . . . 12
- 12 Lip margin rounded in a smooth curve at the junction of the side and mid-lobes; lateral sepals reflexed in the mature flower. . . . . 13
- 12' Lip margin with an acute incision at the junction of the side and mid-lobes; lateral sepals not reflexed in the mature flower. . . . . 14
- 13 Subcylindrical part of the spur about 3 mm. long; mid-lobe of the lip incurved so that the central convexity lies close to the column. . . . E.schweinfurthii (8).
- 13' Subcylindrical part of the spur less than 1 mm. long; mid-lobe of the lip scarcely incurved, so that the central convexity lies distant from the column. . . . .  
. . . . . E.speciosa (9).
- 14 Petals often shortly clawed, obovate-elliptic; column

- 4-8 mm. long; side lobes of the lip obliquely truncate. . . . . E. parviflora (10).
- 14' Petals never clawed, lanceolate-elliptic to ovate-oblong; column 7-9 mm. long; side lobe apices rounded. . . . . 15
- 15 Odd sepal 12-15 mm. long; mid-lobe of the lip irregularly denticulate; leaves 5mm. wide. . E. coddii (16)
- 15' Odd sepal 16-29 mm. long; mid-lobe of the lip entire; leaves 7-16 mm. wide. . . . . E. cooperi (27).

Papilla and lamella crested species

- 16 Sepals linear, about twice as long as the petals. . . . . E. longisepala (11).
- 16' Sepals not linear; if twice as long as the petals then elliptic to oblong. . . . . 17
- 17 Crests composed of lamellae, either confined to the base or extending onto the mid-lobe; the lamellae continuous or with a few incisions to the lip surface, smooth to crenulate. . . . . 18
- 17' Crests composed of lamellae basally, passing into slender papillae in the distal parts of the lip; the papillae numerous and elongate, or (rarely) few and short. . . . . 32

Lamella - crested species

- 18 Petals half the length of the odd sepal, and retund-ovate. . . . . E.meleagris (12).
- 18' Petals more than 2/3 the length of the odd sepal; if retund-ovate then longer than the odd sepal. . . . 19
- 19 Crests confined to the distal rim of a broad sac at the base of the lip. . . . . E.cucullata (13).
- 19' Crests usually extending along the greater length of the variously spurred lip; if the crests confined to the base then the spur slender and cylindrical. . . 20
- 20 Lip with a broadly rounded sac beneath the end of the column. . . . . E.calanthoides (14).
- 20' Lip without a broadly rounded sac beneath the end of the column. . . . . 21
- 21 Flower scarcely resupinate at anthesis; crests confined to the basal 2/5 of the lip. . . E.parvilabris (15).
- 21' Flowers fully resupinate at anthesis; crests extending beyond the basal 1/2 of the lip. . . . . 22
- 22 Mentum usually more than 4 mm. long; if less (2 mm. long), then either the petals 19 - 30 mm. long, or the spur vestigial. . . . . 23

- 22' Mentum usually absent; rarely, if up to 2 mm. long, then the petals 8-15 mm. long; spur always elongate, 2-9 mm. long. . . . . 29
- 23 Crests of low crenulate ridges less than 0.5 mm. high. . . . . E.coddii (16).
- 23' Crests of stout lamellae standing 1.3-5 mm. high. . . . . 24
- 24 Spur lacking, or present as a small boss on the mentum; odd sepal less than 9 mm. long. . . . . E.tuberculata (17).
- 24' Spur present, usually cylindrical to conical; if shortly conical then the odd sepal more than 12 mm. long. . . . . 25
- 25 Margins near the base of the mid-lobe of the lip crispate-undulate; the operculum bilobed. . . . . 26
- 25' Margins near the base of the mid-lobe of the lip nearly smooth; the operculum not bilobed. . . . . 28
- 26 Leaves with serrulate margins; petals acuminate, narrowly oblong, with the apices often circinnate. . . . .  
. . . . . E.petersii (18).
- 26' Leaves with entire margins; petals obtuse, or if sub-acuminate then rotund to elliptic-oblong, the apices never circinnate. . . . . 27

- 27 Sepals obtuse, slightly longer than the suboblong petals. . . . . E.angolensis (19).
- 27' Sepals acute to apiculate, slightly shorter than the subrotund petals. . . . . E.horsfallii (20).
- 28 Mid-lobe of lip subdeltoid; crest lamellae on the main side lobe nerves. . . . . E.hereroensis (21).
- 28' Mid-lobe of lip broadly obovate; crests lacking on the side lobes. . . . . E.platypetala (22).
- 29 Odd sepal 5-10 mm. long; crests of low, stout lamellae; spur 2-3 mm. long. . . . . 30
- 29' Odd sepal usually more than 12 mm. long; when less (8-5 mm. long) then the crests of tall thin lamellae; spur 3-9 mm. long. . . . . 31
- 30 Side lobes of the lip subelliptic, not overlapping the mid-lobe margins, widely divergent from the median axis of the lip. . . . . E.zeyheriana (23).
- 30' Side lobes of the lip subrhomboid, overlapping part of the base of the mid-lobe, with only the apex slightly divergent. . . . . E.tenella (24).
- 31 Spur conical from the base to near the apex. . . . .  
. . . . . E.platypetala (22).
- 31' Spur cylindrical and slender for most of its length. . 39

Papilla - crested species

- 32 Petals nearly always a little narrower than the lateral sepals and oblanceolate to narrowly oblong; if slightly wider, then clearly oblanceolate. . . . . 40
- 32' Petals 1.3 - 2.6 times as wide as the lateral sepals, and usually ovate to oblong; if suboblanceolate, then clearly much wider. . . . . 33

Papillose, broad-petalled species

- 33 Rostellum with a fine papilla 1.2 mm. long on either side; margins of mid-lobe of the lip crispate-dentate. . . . . E.leachii (25).
- 33' Papillae lacking on either side of the rostellum; margins of the mid-lobe of the lip smooth to slightly undulate. . . . . 34
- 34 Flowers not or very slightly resupinate at anthesis, and the spurs 5 - 8 mm. long. . . . E.macowanii (26).
- 34' Flowers either resupinate at anthesis, or if not, then the spurs less than 3 mm. long. . . . . 35
- 35 Leaves less than half the length of the scape at anthesis; spur 1.2 - 2.2 mm. long; crest papillae few, confined to the basal third of the mid-lobe of the lip. . . . . E.cooperi (27).

- 35' Leaves usually more than  $\frac{2}{3}$ rds the length of the scape at anthesis; if less then the spur more than 3 mm. long and the crest papillae numerous over most of the mid-lobe of the lip. . . . . 36
- 36 Petals ovate, tapering to a subacute apex. . . . . 37
- 36' Petals oblong to elliptic-oblong or slightly obovate-oblong, acute or obtuse; if slightly ovate-oblong, then very obtuse. . . . . 38
- 37 Spur 1.0 - 2.9 mm. long; odd sepal 18 - 32 mm. long; mid lobe of the lip 9 - 18 mm. long. . . . .  
. . . . . E.ovalis ssp. bainesii (28).
- 37' Spur 2.5 - 5.6 mm. long; odd sepal 13 - 26 mm. long; mid lobe of the lip 5 - 15 mm. long. . . . .  
. . . . . E.ovalis ssp. ovalis (28).
- 38 Spur 1.4 - 5.2 mm. long; leaves fully developed at time of flowering, 10 - 65 cm. long; mid-lobe crests of numerous papillae, often united at the base. . . . .  
. . . . . E.clavicornis var. nutans (29).
- 38' Spur 2.9 - 8.9 mm. long; leaves partly developed at the time of flowering, 2 - 30 cm. long; mid-lobe crests of dentate to crenulate lamellae. . . . . 39
- 39 Side lobe nerves gradually curving away from the central axis of the lip; mentum absent or vestigial; lip

lamina about as long as the odd sepal. . . . .  
. . . . . E.clavicornis var. clavicornis (29).

39' Side lobe nerves not curving away from the central axis of the lip; mentum 1-2 mm. long; lip lamina often rather shorter than the odd sepal. . . . .  
. . . . . E.clavicornis var. inaequalis (29).

Papillose, narrow-petalled species

40 Odd sepal 3-8 mm. long; raceme elongate; mentum absent; spur apex nearly always lying against the ovary. . . . .  
. . . . . E.milnei (30).

40' Odd sepal 7-46 mm. long; when 7-10 mm. long, either the raceme a globose head, or a mentum present and the spur apex lying away from the ovary. . . . . 41

41 Column 10-13 mm. long; side lobes of the lip with acute apices; mid-lobe with stout erect papillae. . . . .  
. . . . . E.litoralis (31).

41' Column usually 3-8 mm. long; if 9-12 mm. long, then the side lobes of the lip with broadly rounded apices; mid-lobe with slender flexuose papillae. . . . . 42

42 Cylindrical portion of the spur shorter than the mentum; column 9-12 mm. long. . . . . E.nigricans (32).

- 42' Cylindrical portion of the spur usually much longer than the mentum; if nearly as long then the column 3-4 mm. long. . . . . 43
- 43 Crest papillae very few on the distal half of the mid-lobe of the lip; mid-lobe 9-20 mm. long. . . . .  
. . . . . E.welwitschii (33).
- 43' Crest papillae usually numerous on the distal half of the mid-lobe of the lip; if few, then the mid-lobe 2-4 mm. long. . . . . 44
- 44 Crest papillae few (about 5 - 15); raceme rather lax; column 3-4 mm. long. . . . . E.chlorantha (34).
- 44' Crest papillae numerous (40-80 or more); raceme dense; column 4-8 mm. long. . . . . 45
- 45 Mid-lobe half the length of the lip, excluding the spur; apices of the side lobes of the lip obtuse; scape about 30-100 cm. tall. . . . . E.ensata (35).
- 45' Mid-lobe 1/3 the length of the lip, excluding the spur; apices of the side lobes of the lip acute; scape about 6-30 cm. tall. . . . . E.leontoglossa (36).
-

PART 3: DESCRIPTIONS, NOMENCLATURE AND BIOLOGICAL

FEATURES OF TAXA

## DESCRIPTIONS, NOMENCLATURE AND BIOLOGICAL

### FEATURES OF TAXA

In this part, the characteristics of each taxon are discussed separately; comparative studies are mostly confined to Part 4. The taxa are arranged more or less in the order in which they appear in the key in Part 2. It is shown in Part 4 that the largely uncorrelated expressions of characters among the South African species of Eulophia makes it extremely difficult to find a basis for forming a linear sequence of taxa (c.f. Summerhayes 1936). However, it has been possible to group a small proportion of species, and these are placed near one another in the sequence.

The name of the species is followed by a description, given in Latin in the case of new taxa. As orchid terminology has varied somewhat in the past, the terms used for the various parts of the plant are illustrated diagrammatically in Appendix 2. These terms are based on current practice (e.g. Summerhayes 1951). Terms describing the shape and texture of parts are based on the glossary in the Flora Zambesiaca (ed. Exell and Wild, 1960). The definitions of plane shapes given in this glossary agree with the recent proposals for an international terminology (Systematics Association, 1962).

Detailed measurements are given to show the often large ranges of flower size. The parameter odd sepal length was found to be best for showing this variation.

Besides the normal range, the largest and smallest measurements are given in parenthesis. The flower colours are given approximately, as no accurate colour charts were available for field use. As an addendum to the description, there is a short account of the distinctions of the species most often mis-identified with the taxon in question.

This is followed by a discussion of the nomenclature and typification of the taxon and its synonyms. Putative later synonyms based on material from outside South Africa were not studied in detail; nevertheless where the resemblances are obvious, the names are noted in the nomenclatural discussion. Following the discussion is a chronological list of the names previously applied to the taxon, with relevant taxonomic literature and citations of nomenclatural types. Placing these references away from the description is somewhat unorthodox; however, as they essentially summarise the nomenclatural discussion, they are logically best placed after it.

The herbaria in which the nomenclatural types were found are abbreviated according to the standard list of Lanjouw and Stafleu (1959). Some types could not be found, and to facilitate future work, the herbaria in which searches have already been carried out by the author are given below. The following herbaria were actually visited by the author, enabling the searches to be extended to other genera that might have contained misplaced types:

Linnaean Herbarium (LINN).

Herbarium of the Royal Botanic Gardens, Kew (K).

The British Museum (Natural History) (BM).

Naturhistorisches Museum, Wien (W).

Muséum National d'Histoire Naturelle, Laboratoire  
de Phanerogamie, Paris (P).

Botanische Staatssammlung, München (M).

Botanischer Garten und Museum der Universität  
Zürich (Z).

Jardin Botanique de l'Etat, Bruxelles (BR).

Bolus Herbarium, Cape Town (BOL).

Botanical Department Herbarium, University of  
Cape Town (CT).

Material of Eulophia and Lissochilus was sent for  
study by the author from the following herbaria:

Trinity College School of Botany, Dublin (TCD).

National Herbarium, Pretoria (PRE).

Natal Herbarium, Durban (NH).

Albany Museum Herbarium, Grahamstown (GRA).

McGregor Memorial Museum Herbarium, Kimberley (KMG).

South African Museum Herbarium, Cape Town (SAM).

Compton Herbarium, Cape Town (NBG).

Requests for some of the missing specimens were  
circulated to certain other herbaria (S, UPS, LIV, G);  
these are noted individually in the nomenclatural dis-  
cussions. The section on nomenclature is followed by  
an account of the general biological features of the taxon.

This includes geographical distribution, flowering period, cytology and ecology. Distributions in South Africa are given on topographical maps prepared from the Atlas of the Union of South Africa (Talbot and Talbot, 1960). The reliability of these distribution maps was to some extent confirmed by the author's expeditions (see Appendix 3).

Transparent overlays, showing the distribution of vegetation and soil types, total annual precipitation, and the average number of days with frost per year, were prepared from the above atlas. Used in conjunction with the distribution maps, the overlays gave general ecological data to supplement the author's and other collector's field notes.

Cytological observations are recorded briefly in this Part. Full details of cytological methods and results may be found in Appendix 4. Finally, it should be mentioned that the citations of herbarium specimens of each taxon examined by the author are given in Appendix 5.

1. EULOPHIA TABULARIS (L.F.) BOL.

(i) Description: Rhizome subterranean, moniliform. Leaves absent to partly developed at anthesis, reaching about 15 cm. long and 7 mm. wide, erect and plicate, lacking emergent nerves. Scape slightly stout, about 10 - 40 cm. tall. Scape sheaths about half the length of their internodes, loosely clasping, obtuse to apiculate. Bracts usually a little shorter than the ovary, generally narrowly lanceolate. Raceme short and dense; flowers 2 - 12, sometimes not fully resupinate, the perianth partly spreading.

Odd sepal (17) - 20 - 22 - (25) mm. long, narrowly elliptic, subobtuse. Lateral sepals similar, generally slightly broader. Petals oblanceolate, obtuse, often a little falcate, slightly narrower and a little shorter than the odd sepal. Column 8 - 10 mm. long, slender. Mentum 2 - 3 mm. long, with the apex alone joined to the lip. Spur absent. Side lobes of the lip broadening near the narrow base and remaining this width for most of their length, the free distal portion elongate, sometimes as long as the suborbicular mid-lobe. Lip crests consisting of a single, minutely pubescent ridge for most of the length of the lip, dividing into two ridges at the base, and 2 - 3 lobed distally.

Sepals, petals and lip pale lemon yellow. Crests bright orange-yellow. Flowers with a faint sweet scent.

(ii) Distinctions from similar taxa: This species, with its large spurless flowers and peculiar lip crest, which consists of a single ridge for most of its length, is very distinctive. Other species are seldom mis-identified with it in herbaria.

(iii) Nomenclature: The earliest description matching this taxon was published by the younger Linnaeus in 1781, with the name Satyrrium tabulare. This description is very brief and by no means distinctive. The type is given as a Thunberg specimen from the summit of Table Mountain.

Thunberg in 1823 published a quite unambiguous description of the present taxon, with the name Serapias tabularis. He quotes the younger Linnaeus' synoptic description and the name Satyrrium tabulare, so that it can be inferred that he considered he was describing the same species. Furthermore, Thunberg states that only a single specimen of the species was known. If this is so, then he and the younger Linnaeus were actually describing the same specimen, so that Thunberg's account may be taken as an emended type description.

In the Thunberg herbarium at Uppsala (UPS), there is a single specimen of the present concept, labelled 'Satyrrium tabulare L.f.', 'Serapias tabularis' and 'Cymbidium tabulare' (a new combination proposed by Swartz in 1800). This specimen lacks the 'rounded bulbs' mentioned

in both the younger Linnaeus' and Thunberg's descriptions. No collector is given, although the fact that the specimen is in Thunberg's herbarium shows that it was probably collected by him. The locality is recorded imprecisely as 'Cap. b. Spei'; none of the other field data given in the Thunberg description are recorded on this sheet. Thunberg's description appeared 42 years after the younger Linnaeus', so it is rather unlikely that he relied on memory for the details he gives about the plant. He may have rather used notes made at the time of collection; perhaps the younger Linnaeus also used them. It seems that there is only a general indication that the Uppsala specimen might be the holotype.

The epithet tabularis was transferred from Satyrium to Serapias by Thunberg in 1794, to Cymbidium by Swartz in 1800, and finally to Eulophia by Bolus in 1888.

Rolfe published a description matching the taxon in 1912, with the name Eulophia peglerae. The type specimen agrees with the present concept without reservation, so that E.peglerae may be reduced to the synonymy of E.tabularis (L.f.) Bol. The collector and locality of the type are possibly erroneous. The collector is given as 'Pegler?', followed by a Bolus Herbarium number. The characteristic printed label nearly always given with Pegler specimens is lacking. Most Pegler material came from Kentani, a district seldom visited by other collectors. If it is not a Pegler specimen, it

may not have come from Kentani. No other specimens of E. tabularis have been recorded from surrounding areas (see Map 1).

(iv) Nomenclatural references and types:

Satyrium tabulare L.f. Suppl. Pl. 402 (1781).

Holotype: Thunberg, summit of Table Mountain (probably at UPS!). Descr. emend.?: Thunb. Fl. Cap. 27 (1823).

Serapias tabularis (L.f.) Thunb. Prodr. Fl. Cap. 3 (1794).

Cymbidium tabulare (L.f.) Sw. Schrad. Journ. 2: 224 (1800).

Eulophia tabularis (L.f.) Bolus Trans. S. Afr. Phil. Soc. 5: 108 (1888).

Eulophia peglerae Rolfe Fl. Cap. 5(3): 49 (1912).

Holotype: Pegler? in Herb. Bolus. 10677, Kentani (BOL! Collector and locality possibly erroneous).

(v) General biology: Eulophia tabularis is largely confined to the South-West Cape, which is distinct climatically from the rest of South Africa in having winter rainfall (see Map 1). There is a single record from the Knysna district which receives both winter and summer rainfall, and a doubtful locality (Kentani, referred to above) in the summer rainfall area.

All accurately recorded localities are in mountainous areas with a rather high annual precipitation, ranging from about 30" to 75" per annum. Such places

may receive up to 20 days with frost per year. The species is found almost exclusively on sandy soils derived from Table Mountain Sandstone, sometimes in marshy places with a large admixture of black humus. It grows in sclerophyllous bush vegetation.

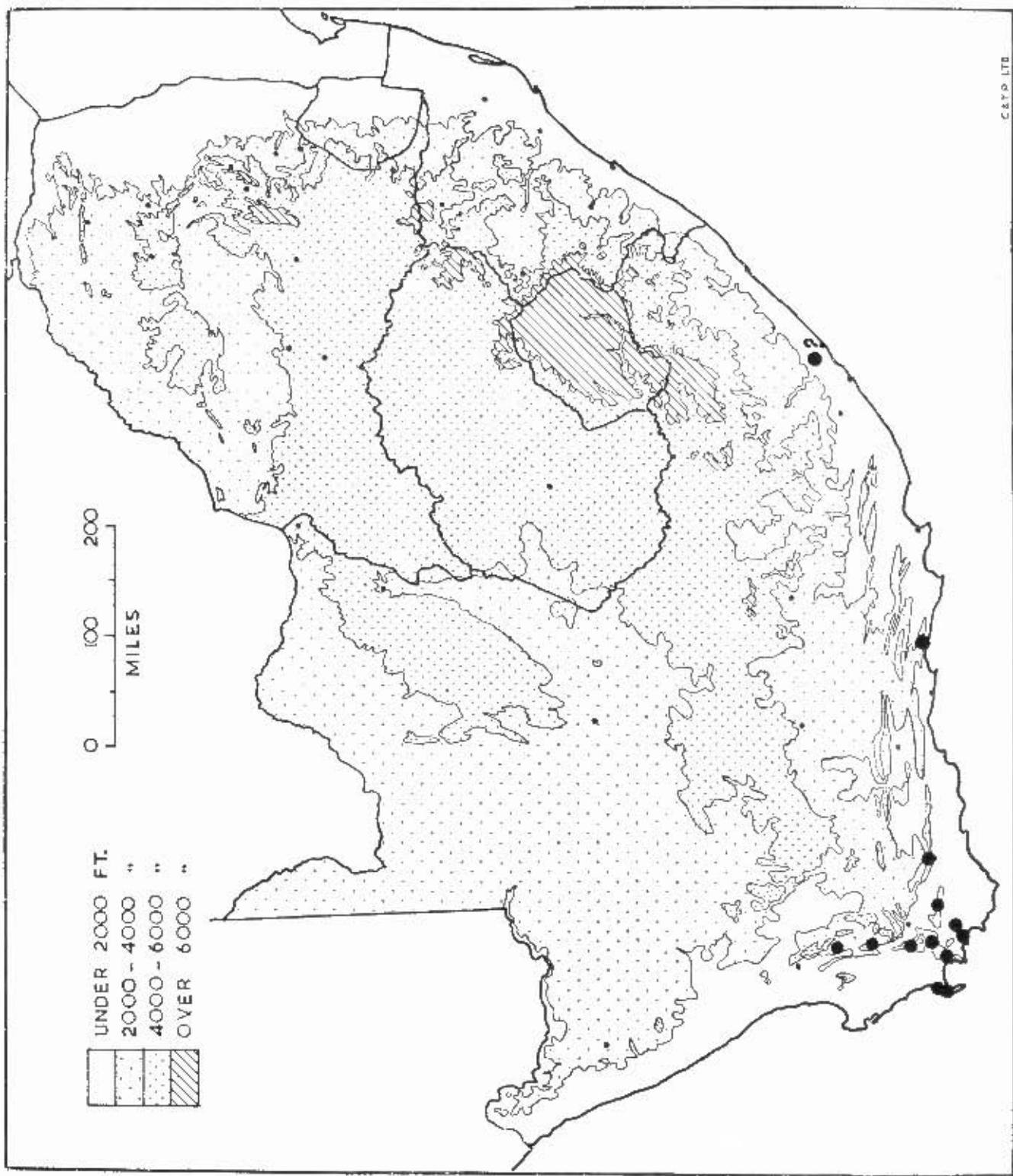
The species has not often been seen or collected, and it is rare to find more than one or two plants at the same locality. Herbarium records show that flowering takes place during the dry summer months November, December and January (see Table 2). Flowering may be more profuse after a previous season's veld fire (Hall 1959).

Table 2: Records in herbaria of the dates of collection of flowering specimens of Eulophia tabularis (L.f.) Bol.

---

<u>Month</u>						<u>No. of records</u>
November	..	..	..	..	..	2
December	..	..	..	..	..	12
January	..	..	..	..	..	8

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Map 1: Distribution of *Eulophia tabularis* (L.f.) Bol. in South Africa. The question mark indicates a doubtful locality.

2. EULOPHIA FOLIOSA (LINDL.) BOL.

(1) Description: Rhizome subterranean, moniliform. Leaves partly to fully developed at anthesis, about 20-60 cm. long, up to 2.5 cm. wide, rather stiffly erect, plicate, with several veins emergent on the abaxial surface. Scape usually stout, sometimes a little slender, 15 - 45 cm. tall. Scape sheaths usually rather longer than their internodes, loosely clasping. Bracts subulate, usually longer than the ovary. Raceme dense, generally elongate; flowers about 6-40, the perianth rather fleshy, sub-campanulate.

Odd sepal (9) - 10 - 13 - (16) mm. long, lanceolate to narrowly elliptic, acute to acuminate. Lateral sepals similar, a little broader. Petals as long as the odd sepal, variable in shape but usually lanceolate oblong, obtuse. Column 3.5 - 5.0 mm. long, rather stout. Mentum 2 - 3 mm. long, with the lip attached only to its apex. Spur absent. Side lobes of the lip broadening mostly near the narrow base, the short free apex rounded. Mid-lobe suborbicular, concave. Crests of 2 - 3 broad ridges in the basal half of the lip, passing into a number of very short stout papillae confined to the basal part of the mid-lobe.

Sepals, petals and most of the lip dull lime green. Distal parts of the lip variously tinged with dark purple, or rarely, pale purple to white.

(ii) Distinctions from similar taxa: Some material of this species resembles E.chlorantha Schltr., which differs in having the mentum passing into a cylindrical spur, and lamellate papillae produced over most of the surface of the mid-lobe. Specimens of E.aculeata (L.f.) Spreng. ssp. aculeata have been occasionally mis-identified as E.foliosa, but differ in having a short capitate raceme, slender leaves (about 3 - 11 mm. wide), and lip crests consisting of lamellate papillae.

(iii) Nomenclature: The earliest description matching this species was published by Lindley in 1837, with the name Cyrtopera foliosa.

No type specimen could be found in the herbaria consulted (see page 96). However, a sheet of drawings was found, labelled as in the type description, in the Lindley orchid herbarium at Kew (K). A rough outline is given of a scape with a dense elongate raceme, resembling the present species. Next to the scape is a detailed drawing of a single flower opened out to show the lip, which was clearly made from material of the present taxon. The drawings are identified as Cyrtopera foliosa in Lindley's handwriting. Until dried material is found, this sheet of drawings may be regarded as the lectotype. (See Art.69, Note 1, Int. Code 1961).

In 1881 a rather short description matching this species was published by Reichenbach, with the name Cymbidium buehanani. Two of the three syntypes are clearly

identifiable with the present taxon. The third syntype, a Krebs specimen, has not yet been found, and may have been in the orchid collections at Berlin (B), which were destroyed during World War II. As the type description shows little disagreement with the concept, there is little reason to suspect that the Krebs specimen might have been different.

In 1882, Bolus transferred the epithet foliosa from Cyrtopera to Eulophia. Six years later he erroneously regarded Cymbidium buchanani Reichb.f. (see above) as a synonym of Eulophia aculeata (L.f.) Spreng. The following year he corrected this, and returned it to the status of a separate species, placing it in the genus Eulophia. He rightly did not use the combination Eulophia buchanani, as this had already been used for another species with a different basionym (Lissochilus buchanani Reichb.f.); instead, he used a new epithet, calling the species Eulophia reichenbachiana Bol.

Durand and Schinz in 1892 erroneously made the combination Eulophia buchanani, using the basionym Cymbidium buchanani Reichb.f.

In 1912, Rolfe published a full description of a species with the name Eulophia boltoni. This description and two of the four syntypes available match the present concept in all respects, so that it may be regarded as a later synonym. Another description, which like its holotype, matches small-flowered members of the taxon, was published by Kränzlin in 1915. This name should also be reduced to synonymy.

(iv) Nomenclatural references and types:

Cyrtopera foliosa Lindl. Hook. Comp. Bot. Mag.  
2: 203 (1837). Holotype: Drège s.n., inter Basche et  
Omtala in graminosis (K, icon!).

Cymbidium buchanani Reichb.f. Flora 64: 329  
(1881). Syntypes: Buchanan s.n., E. South Africa (W!  
K, isosyntype!); Cooper s.n., E. South Africa (W!  
K, isosyntype!); Krebs s.n., E. South Africa.

Eulophia foliosa (Lindl.) Bolus J. Linn. Soc.  
19: 337 (1882).

Eulophia azuleata (L.f.) Bolus Trans. S. Afr. Phil.  
Sec. 5: 109 (1888), pro syn. tantum Cymbidium buchanani  
Reichb.f.

Eulophia reichenbachiana Bolus J. Linn. Soc. 25:  
185 (1889), nom. nov. pro syn. Cymbidium buchanani  
Reichb.f.

Eulophia buchanani Dur. et Sch. Consp. Fl. Afr.  
5: 19 (1892), nom. illegit., non E. buchanani (Reichb.f.)  
Bolus J. Linn. Soc. 25: 185 (1889).

Eulophia boltoni Harv. ex Rolfe Fl. Cap. 5(3):  
53 (1912). Syntypes: MacOwan 681 (K!  
BM, isosyntype!);  
Reade in Herb. Bolus. 1281, Fullers near Grahamstown  
(BOL!); Bolton s.n.; Hutton s.n., Katberg.

Eulophia inamoena Kraenzl. Vjschr. Naturf. Ges.  
Zur. 60: 394 (1915). Holotype: Junod 2587, Shilouvane  
(Z!).

(v) General biology: In the Eastern Cape and Natal, Eulophia foliosa is found at a wide range of altitudes, from near sea level to 6000 ft. In the Transvaal it is restricted to an easterly belt lying above about 3000 ft. (see Map 2).

Rainfall at accurately recorded localities is usually high, ranging from 30" to 60" per annum, and occurs chiefly in summer. Such places may receive up to 80 days with frost per year. The species grows on a variety of lateritic and podsol soil types. It is found mostly in sour grassveld, occasionally in grassy places in coastal thornveld. There may be several to many (100 or more) plants at a given locality. The species is particularly frequent in railway enclosures, where the veld is burnt in winter and protected from grazing in summer, when the plants are flowering.

Wide continuous variation in flower size and in the intensity of the purple colouration on the lip was found in plants growing in the North-Eastern Transvaal. In a population studied in detail (Hall 928, Entabeni, Zoutpansberg District), the two characters were found to vary independantly. Plants with small flowers (odd sepal 10 mm. long) appeared very different from plants with large flowers (odd sepal 15 mm. long). The population consisted of 22 plants, 3 lacking purple on the lip, 12 with various shades of pale purple and 7 with the usual dark purple encountered elsewhere in this

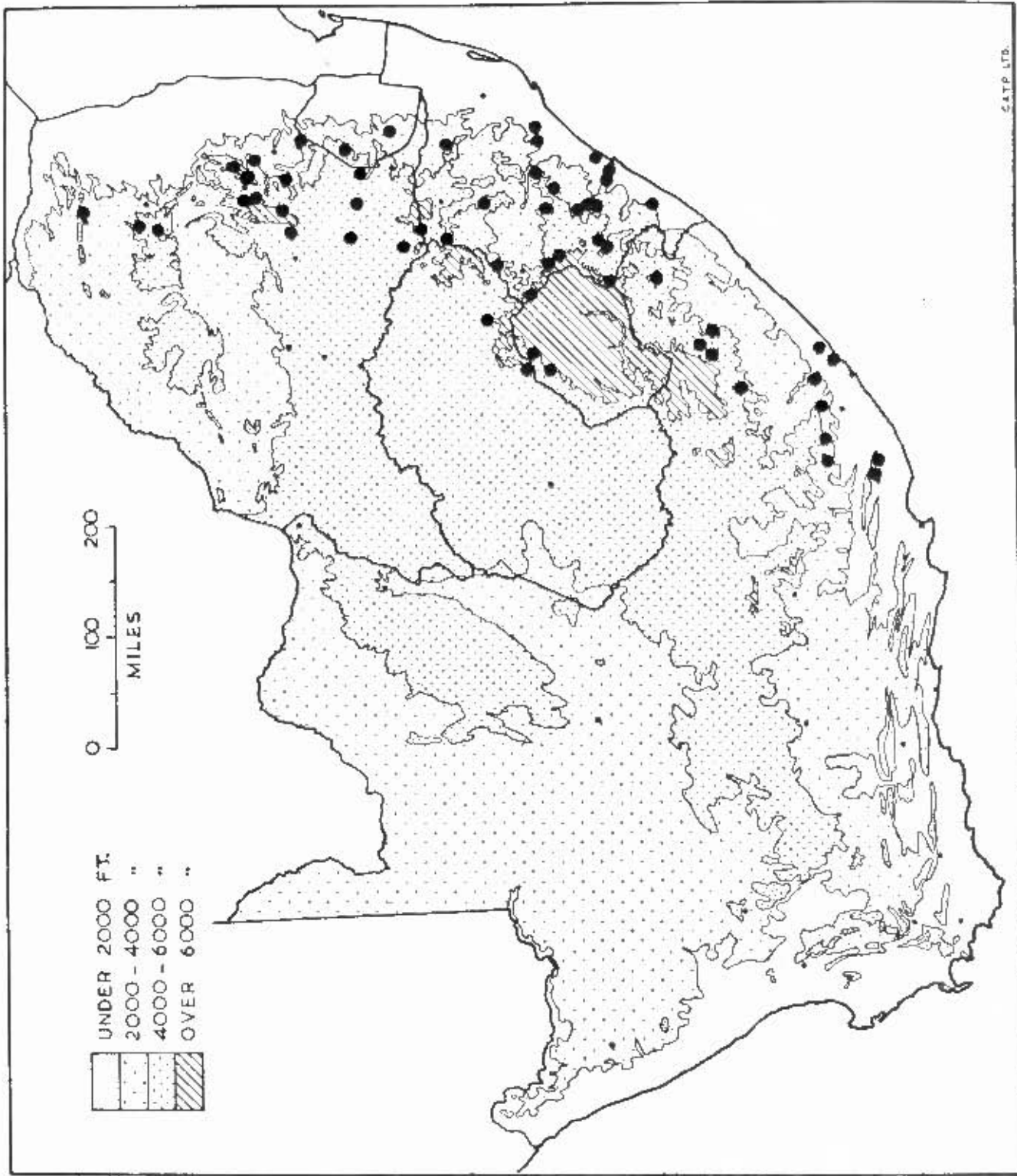
species. The chromosome number of material from the Eastern Cape (Hall 755) and Central Natal (Hall 801) was found to be  $n = 27$ . The chromosomes were slightly smaller than usual. The species flowers mostly in the warm, wet summer months, occasionally in late Spring and early Autumn (see Table 3).

Table 3: Records in herbaria of the dates of collection of flowering specimens of Eulophia feliosa (Lindl.) Bol.

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<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	4
November	..	..	..	..	..	9
December	..	..	..	..	..	27
January	..	..	..	..	..	15
February	..	..	..	..	..	1
March	..	..	..	..	..	0
April	..	..	..	..	..	1

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Map 2: Distribution of *Eulophia foliosa*  
(Lindl.) Bol. in South Africa.

### 3. EULOPHIA ODONTOGLOSSA REICHE.F.

(i) Description: Rhizome subterranean, moniliform. Leaves partly to fully developed at anthesis, plicate and stiffly erect, with several veins emergent on the abaxial surface, up to 100 cm. long and 9 mm. wide. Scape rather slender, 50 - 90 cm. high. Sheaths on the scape generally rather longer than their internodes, tightly clasping. Bracts usually a little shorter than the ovary, narrowly elliptic, acuminate. Raceme somewhat dense; flowers about 10 - 30, the perianth spreading.

Odd sepal (5.8) - 8 - 12 - (16.5) mm. long, ovate to narrowly ovate, acute to subacuminate; lateral sepals similar. Petals a little shorter and narrower than the odd sepal, broadly elliptic to broadly elliptic-oblong, oblique at the base. Column 3.5 - 6.5 mm. long. Mentum 2 - 4 mm. long, only the apex attached to the lip. Spur at the base of the lip vestigial, rarely reaching 0.8 mm. long. Side lobes of the lip broadening near the narrow base, subrhomboid. Mid-lobe large, about half the total length of the lip, very broadly oblong to oblate or very broadly obovate, the lateral margins denticulate, the apex rounded to emarginate. Crests on the lip consisting of two lamellae in the basal half, with numerous slender papillae on the mid-lobe.

Sepals and petals pale yellow. Lip slightly orange-yellow, with the bases of the crest papillae sometimes reddish-brown. Much of the lip may be tinged brown in Tropical African material.

(ii) Distinctions from similar taxa: This species is very seldom mis-identified with other South African taxa, from which it is clearly distinguished by its tall slender habit, the vestigial spur, less than 0.8 mm. long, and the densely papillose denticulate mid-lobe, which is often a little more than half the total length of the lip.

(iii) Nomenclature: The earliest description matching this species was published by Reichenbach in 1846, with the name Eulophia odontoglossa. The type is cited as a Gueinzus specimen in the Römer herbarium. This herbarium was destroyed at Leipzig during World War II, and the only remaining material appears to be two flowers in a capsule in the Reichenbach herbarium in Vienna (W). This capsule is labelled "Eul. odontoglossa mihi Natal Gueinzus Rehb.f." in Reichenbach's handwriting, showing that it is almost certainly part of the holotype. The flowers match the concept in all respects.

In 1881, Reichenbach published another description matching the present taxon, with the name Cyrtopera shupangae. The holotype at Vienna (W) clearly belongs to the present species.

In 1883, Reichenbach erroneously regarded Eulophia odontoglossa as a synonym of Cyrtopera pedicellata (L.f.) Lindl., whose type (a tall form of E. aculeata (L.f.) Spreng. ssp. aculeata) it superficially resembles. In 1891, Kuntze transferred the epithet odontoglossa from Eulophia

to Graphorchis, a generic name against which Eulophia has been conserved (Summerhayes and Hall, 1952).

Subsequently, numerous names were published with descriptions and types matching the present species: Cyrtopera papillosa Rolfe, Eulophia papillosa (Rolfe) Schltr., E.chrysantha Schltr., E.shupangae (Reichb.f.) Kraenzl., E.missionis Rendle, E.holstiana Kraenzl. ex Gilg, E.aurea Kraenzl., E.graciliscapa Schltr., E.johnstoni Rolfe, E.lata Rolfe, E.panganiana Kraenzl., E.flammea Kraenzl., E.ochracea Schltr., E.brunneo-rubra Schltr., E.durbanensis Rolfe, E.baoulensis A.Chev. and E.propinqua Hutch.

Summerhayes (1953 $\frac{1}{2}$ ) reduced these names to the synonymy of E.shupangae (Reichb.f.) Kraenzl. After checking the descriptions and types, the present author is in agreement with this view, with the added qualification that the earlier name E.odontoglossa Reichb.f. should be used for the species.

(iv) Nomenclatural references and types:

Eulophia odontoglossa Reichb.f. Linnaea 19: 373

(1846). Holotype: Gueinzus s.n., Port Natal (W!).

Cyrtopera shupangae Reichb.f. Otia Bot. Hamb.

2: 116 (1881). Holotype: J.Kirk s.n., Shupanga, 14 - 19<sup>o</sup> S. Lat., Jan. 59 (W!; K, isotype!).

Graphorchis odontoglossa Kuntze, Rev. Gen. 662

(1891).

Cyrtopera papillosa Rolfe, Kew Bull. 1893: 336 (1894).

Syntypes: Comm. O'Brien s.n., ex hort. Sir Trevor Lawrence, Natal (K!); Sanderson s.n., Natal (K!); Fannin 130, Dargle (K!); Wood 785, Inanda (K!).

Eulophia papillosa (Rolfe) Schltr. Bot. Jahrb. 20; Beibl. 50: 25 (1895).

E.chrysantha Schltr. Bot. Jahrb. 20, Beibl. 50: 2 (1895). Syntypes: Sanderson 829 nr. Maritzburg (NH, isotype!); Wood 785, Verulam (NH, isotype!); Wood 785, Inanda (K, isotype!).

E.shupangae (Reichb.f.) Kraenzl. ex Gilg Pflanzenw. Ost. Afr. C: 157 (1895).

E.holstiana Kraenzl. ex Gilg Pflanzenw. Ost. Afr. C: 157 (1895). Holotype: s.leg., Usagara - Usambara (Simbili) (K, isotype!).

E.missionis Rendle J. Bot. 33: 168 (1895). Holotype: Scott-Elliot 8618, Mt. Milanji, Dec. 1894 (BM!; K, type number!).

E.aurea Kraenzl. Bull. Herb. Boiss. Ser. 1, 5: 635 (1897). Holotype: Junod 187, Delagoa Bay (BR!).

E.graciliscapa Schltr. Bot. Jahrb. 24: 418 (1897). Holotype: Buchanan s.n., Nyasaland 1894 (K, isotype!).

E.johnstoni Rolfe Fl. Trop. Afr. 7: 66 (1897). Holotype: Johnston s.n., Nile Land, Maungu (K!).

E.lata Rolfe Fl. Trop. Afr. 7: 67 (1897). Holotype: Carson 13, Fwambo (K!).

E.panganiana Kraenzl. Bot. Jahrb. 28: 169 (1900).

Holotype: Buchwald 763, Usambara (K, isotype!).

E.flammea Kraenzl. Bot. Jahrb. 48: 395 (1912).

Holotype: Münzner 94, Urungu (K, isotype!).

E.ochracea Schltr. Bot. Jahrb. 53: 583 (1915).

Holotype: Stolz 1054, Mbaka (K, type number!).

E.brunneo-rubra Schltr. Bot. Jahrb. 53: 583

(1915). Holotype: Stolz 2383, Kibira River (K, type number!).

E.durbanensis Rolfe Kew Bull. 1917: 83 (1917).

Holotype: Wood 11775, Durban (K!).

E.baoulensis A. Chev. Expl. Bot. Afr. Occ. Fr.

1: 613 (1920), nomen nudum.

E.propinqua Hutch. Kew Bull. 1921: 401 (1921).

Holotype: Lely 353, Hephem and Ropp (K!).

(v) General biology: Eulophia odontoglossa has a wide distribution in Africa. From South Africa, it extends north to Kenya, westwards to Angola and West Africa, reaching as far as Sierra Leone. In South Africa, the species is found chiefly at low altitudes in the Cape and Natal, and only at higher elevations in Swaziland and the Transvaal (see Map 3).

Precipitation at accurately recorded localities is usually rather high, ranging from 30" to 50" per annum. It is noteworthy that the species has not been

recorded from the high precipitation belt in the Natal Drakensberg. Frost occurs on less than 20 days per year at most localities, although at the highest altitudes in the Eastern Transvaal there may be 60 - 80 days with frost.

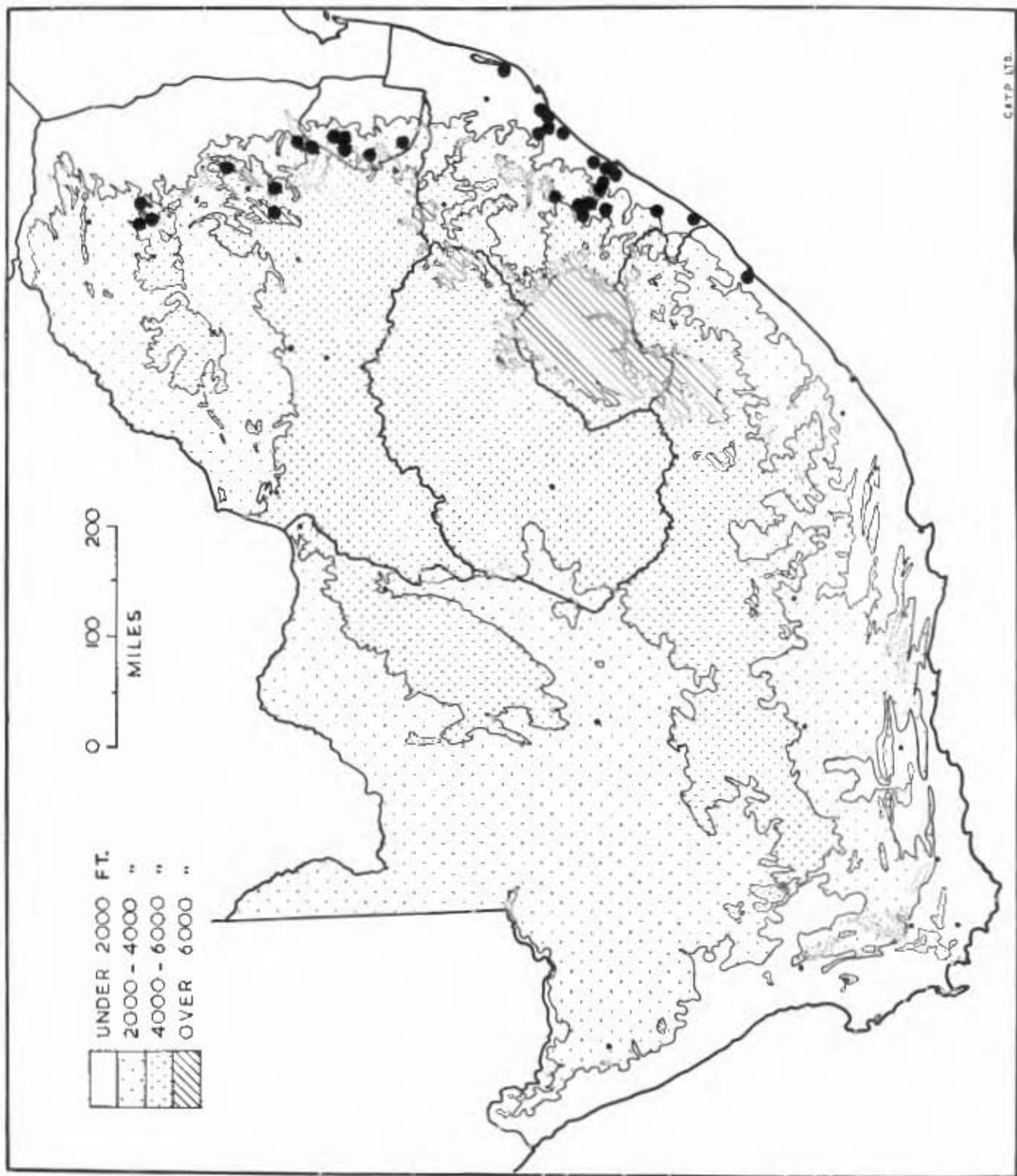
The species is found on various types of lateritic soils, and the podsols of the Natal coast belt, inhabiting both well-drained slopes and marshy places. In Natal, it is found chiefly in coastal thornveld; further north the species grows in sour grassveld. Flowering takes place in South Africa during the warm, wet summer months (see Table 4).

Table 4: Records in herbaria of the dates of collection of flowering specimens of Eulophia odontoglossa Reichb.f.

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<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	2
November	..	..	..	..	..	4
December	..	..	..	..	..	14
January	..	..	..	..	..	35
February	..	..	..	..	..	3

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Map 3: Distribution of *Eulophia odontoglossa*

Reichb.f. in South Africa.

#### 4. EULOPHIA ACULEATA (L.F.) SPRENG.

##### (i) Descriptions:

(a). Eulophia aculeata (L.f.) Spreng. ssp. aculeata:  
Rhizome subterranean, moniliform. Leaves partly to fully developed at anthesis, stiffly erect, plicate, with about 3 veins emergent on the abaxial surface, up to about 60 cm. long and 11 mm. wide. Scape (6) - 10 - 25 - (63) cm. tall, very slender to rather stout. Scape sheaths generally rather longer than their internodes, loosely clasping, the free portion of the distal sheath sometimes extending beyond the raceme. Bracts subulate, usually longer than the ovary. Raceme short and rather dense; flowers 3 - 27, the perianth scarcely spreading.

Odd sepal (5.4) - 6 - 8 - (9.5) mm. long, oblong to elliptic-oblong, subobtuse; lateral sepals slightly broader and longer. Petals oblanceolate, about as long and as wide as the odd sepal, obtuse. Column 3.5 - 5.0 mm. long. Mentum 0.6 - 2.1 mm. long, the spurless lip attached only to the apex. Side lobes of the lip broadening gradually from a narrow base to a short obtuse free apex. Mid-lobe subquadrate to slightly tapering distally, truncate to retuse, the lateral margins undulate to finely crenulate. Lip crests of two ridges in the basal half, passing into slender lamellate papillae on the mid-lobe.

Sepals, petals and lip dull ivory to white or

or greenish white. Lip sometimes tinged pale purple near the basal margins of the mid-lobe, and on some of the crest papillae. Flowers faintly sweet-scented.

(b). E.aculeata (L.f.) Spreng. ssp. huttonii (Rolfe)

Hall, stat. nov. Basionym: Eulophia huttonii Rolfe

Fl. Cap. 5(3): 52 (1912). Differs from ssp. aculeata

as follows: Leaves up to 17 mm. broad. The uppermost scape sheath very rarely extending beyond the raceme.

Flowers larger: mentum 2.3 - 5.0 mm. long, petals 9.3

- 14.5 mm. long and the odd sepal (9.3) - 12 - 16 - (17.5) mm. long.

Perianth nearly concolorous, varying from greenish white, to pink tinged with green to give a 'smoky pink' appearance, to dark reddish purple. Lip crests generally yellowish green to white. Flowers with a faint soapy-sweet scent.

(ii) Distinctions from similar taxa: Both subspecies, particularly ssp. huttonii, have been mis-identified in herbaria with the superficially similar species Eulophia leontoglossa Reichb.f., which differs chiefly in having a cylindrical spur 3 - 5 mm. long at the base of the lip. Ssp. aculeata has also been mis-identified with E.odontoglossa Reichb.f., which differs conspicuously in having a large mid-lobe about half the total length of the lip, with denticulate margins.

(iii) Nomenclature: The two subspecies given here were previously regarded as separate species. There are several 18th and early 19th Century descriptions which appear to match the small-flowered subspecies (ssp. aculeata). The other form was described much later, in the present century, evidently due to its absence in the areas explored by the early collectors.

The earliest name has often been regarded as Satyrium capense, which was published with a detailed description by Linnaeus in 1760 (e.g. Bolus 1918, Adamson and Salter 1950). However, the description disagrees with the concept in referring to a 'lax raceme' and a 'very short obtuse spur at the base of the lip'. In neither subspecies may the raceme be regarded as lax, and no evidence has been found of a spur. If these two characters had been mis-interpreted, the description could also match Eulophia tabularis (L.f.) Bol.

No type was quoted by Linnaeus for Satyrium capense. However, Houttyn (1780) gives an accurate illustration of a plant, with the name Satyrium capense, a translation of Linnaeus' description into Dutch, and accurate bibliographic references. The plant figured by Houttyn is clearly either Acrolophia lamellata Schltr. et Bol. or A. tristis Schltr. et Bol., and it matches the description of Linnaeus' Satyrium capense in all details.

Interpreting S. capense L. as one of these two species of Acrolophia is rather more likely than regarding

it as either Eulophia tabularis (L.f.) Bol., or the present taxon. In passing, it may be mentioned that there is a specimen labelled 'Satyrium capense' in the Vienna herbarium (W). Writing on the obverse of this sheet shows that it came from the herbarium of Lars Montin, a pupil of Linnaeus (T. Norlindh, priv. comm.). However, it was collected by Thunberg in 1775, so it could not be the type of Linnaeus' 1760 description, which it only superficially matches: it is a plant of Monadenia cernua (Sw.) Dur. et Sch.

Two synoptic descriptions resembling the concept were published simultaneously by the younger Linnaeus in 1781, with the names Satyrium aculeatum and S. pedicellatum. The types are quoted as Thunberg and Sparrman specimens respectively, both from the 'Cape of Good Hope'. As the descriptions are scarcely distinctive, precise identification rests largely with these types.

There are two sheets of the small-flowered subspecies in the Linnæan herbarium (LINN). One bears two small plants with the inscription 'aculeatum'; the other, a single tall scape with 'Satyrium pedicellatum' written near the base. Both inscriptions were probably made by the younger Linnaeus (Savage 1945). No collectors are cited on the sheets, but the specimens clearly match the salient features of the descriptions. It therefore seems likely that these are indeed the holotypes, so that the two names may be regarded as referring to the

small-flowered form of the present concept. The epithets aculeatum and pedicellatum were transferred from Satyrium to Serapias by Thunberg in 1794, to Cymbidium by Swartz in 1799, and to Eulophia by Sprengel in 1826. The epithet pedicellatum was combined with Cyrtepera by Lindley in 1833. In 1836, Lindley published a very detailed description written by Harvey, with the name Cymbidium plicatum. Both the description and the holotype clearly match the small-flowered subspecies, so that C.plicatum Harv. ex Lindl. may be regarded as synonymous to Satyrium pedicellatum L.f. and S.aculeatum L.f. In 1882, Bolus transferred the epithet plicatum from Cymbidium to Eulophia.

In 1888, Bolus reduced Eulophia pedicellata (L.f.) Spreng. to the synonymy of E.aculeata (L.f.) Spreng. In accordance with Principle III (Int. Code 1961), Bolus' treatment of these two simultaneously published epithets should be followed, so that E.aculeata is used for the taxon in the present work.

In 1924, a detailed description of a species with the name Eulophia culveri was published by Schlechter. The description and all but a single specimen of one of the syntypes agrees with the small-flowered subspecies. The mis-identified specimen belongs to Eulophia chlerantha Schltr., and may be excluded from the type description of E.culveri chiefly on the grounds of having a short cylindrical spur.

The first description matching the large-flowered

subspecies was published by Bolus in 1911 with the name Eulophia oliveriana. This name is illegitimate, as it is the later homonym of E. oliveriana (Reichb.f.) Bolus, given to material of a different species which is now known as Eulophia parviflora (Lindl.) Hall.

In 1912, Rolfe published a full description of the large-flowered form, with the name Eulophia huttonii. Ten of the eleven syntypes have been seen; of these, all except one agree with the type description. The exception, Tyson 1085, belongs to Eulophia feliosa (Lindl.) Bol., and may be excluded by the type description in lacking crests near the apex of the lip.

As this is the earliest epithet for the large-flowered subspecies, it is necessary to select a holotype. Rolfe cited only one specimen, Hutton s.n., collected at Katberg, with a later Latin translation of the original description, which was evidently given to validate the publication of E. huttonii. It seems that this specimen was intended to be the nomenclatural type. However, examination of the specimen at the Kew Herbarium (K) shows that the leaves placed next to the scape probably belong to a member of the Iridaceae: they are equitant and have a very fine acuminate apex quite unlike anything found in Eulophia. No special feature of these leaves is mentioned in the type description, so it is possible to exclude them from the holotype (Art. 70, Int. Code 1961).

As Eulophia huttonii Rolfe is the earliest valid name for the large-flowered subspecies, but was published

later than E. aculeata (L.f.) Spreng., this form is referred to as E. aculeata (L.f.) Spreng. sp. huttonii (Rolfe) Hall. The small-flowered subspecies is called E. aculeata (L.f.) Spreng. sp. aculeata.

(iv) Nomenclatural references and types:

(a). Satyrium aculeatum L.f. Suppl. Pl. 402 (1781).

Holotype: Thunberg, Cap. Bon. Spei (LINN!).

Satyrium pedicellatum L.f. Suppl. Pl. 402 (1781).

Holotype: Sparreman s.n., Cap. Bon. Spei (LINN!).

Serapias aculeata (L.f.) Thunb. Prodr. Pl. Cap. 3 (1794).

Serapias pedicellata (L.f.) Thunb. Prodr. Pl. Cap. 3 (1794).

Cymbidium aculeatum (L.f.) Sw. Schrad. Journ. 2: 225 (1799).

Cymbidium pedicellatum (L.f.) Sw. Schrad. Journ. 2: 224 (1799).

Eulophia aculeata (L.f.) Spreng. Syst. Veg. 3: 720 (1826).

Eulophia pedicellata (L.f.) Spreng. Syst. Veg. 3: 720 (1826).

Cyrtopera pedicellata (L.f.) Lindl. Gen. et Sp. Orch. 190 (1833).

Cymbidium plicatum Harv. ex Lindl. Comp. Bot. Mag. 2: 203 (1837). Holotype: Harvey s.n., near Wynberg, Dec. 1835 (K!).

Eulophia culveri Schltr. Ann. Transv. Mus. 10: 238 (1924). Syntypes: Culver 86, Saddleback Mt. (BOL, excl. specim. A 1); Galpin 720, s. loc. (BOL!).

(b). Eulophia oliveriana Bol.  Ic. Orch. Austr. Afr. 2: sub t. 10 (1911), nom. illegit.; non Bolus J. Linn. Soc. 25: 185 (1889).

Eulophia huttonii Rolfe Fl. Cap. 5(3): 52 (1912); Kew Bull. 1920: 128 (1920). Holotype: Hutton s.n., Katberg (K, excl. foliis!). Syntypes: Zeyher? 275 (leg. incert.), Zwartkops R. (K!); Scully in Herb. Bolus. 5917, Chumie Peak, Stockenstroom (K!); Bolus 10293, Dehne Peak, Stockenstroom (K!); Cooper s.n., Orange River Colony (K!); Haygarth in Herb. Wood. 4202, Vaalbank, Mount Currie (K!); Wood 4259, Liddesdale (K!); Wood 11818, Howick (K!); Wood 11819, Howick (K!); Barber 533, Winterberg Range.

Eulophia aculeata (L.f.) Spreng. ssp. huttonii (Rolfe) Hall, stat. nov.

(v) General biology:

(a). E. aculeata (L.f.) Spreng. ssp. aculeata: This subspecies is found chiefly in a belt lying along the South Cape coast, inland in the Eastern Cape, and at outlying localities in the Eastern Transvaal <sup>and Basutoland</sup> (see Map 4).

Precipitation at accurately recorded localities is usually 25" to over 60" per annum, occasionally as low as 15". The proportion of the annual precipitation falling during the summer months, when the species is flowering,

varies from 25% in the South-West Cape to 85% in the Eastern Transvaal (Weather Bureau, 1950). It is remarkable that the flowering time is not perceptibly affected by these differences (see Table 5).

**Table 5:** Month of collection of specimens of Eulophia aculeata ssp. aculeata from various parts of the distribution range, compared with summer precipitation recorded at stations near these localities (Weather Bureau, 1950).

<u>Specimen No.</u>	<u>Locality</u>	<u>Flw. time</u>	<u>Nearest Average summer precipitation</u>		
			<u>Weather Sta.No.</u>	<u>%**</u>	<u>total (in.)</u>
Hall 602	Table Mt., S.W.Cape	Dec. 20/689		25	12
Pillans 4797	Caledon, S.W.Cape	Dec. 6/733		35	7
Bond 784	Bredasdorp, S.W.Cape	Dec. 3/32		42	7
Martin 12	Wilderness, S.C.Cape*	Dec. 28/838		58	19
Fourcade 526	Storms R., S.C.Cape	Nov. 31/688		52	21
Zeyher 300	Van Staadens, SE Cape	Nov. 34/381		55	18
Galpin 387	Grahamstown, SE Cape	Dec. 56/709		62	15
Hall 610	Hogsback, S.E.Cape	Dec. 79/73		69	20
Bolus 10294	Engcobo, E.Cape	Jan. 125/880		78	26
Galpin 720	Barberton, E.Tvl.	Dec. 519/77		83	24
Codd 8228	Lydenburg, E.Tvl.	Dec. 554/175		85	27

\* S.C.Cape = South Central Cape, the coastal belt from Mossel Bay to Uitenhage.

\*\*% = The percentage of the total annual rainfall occurring in the summer months October to March.

A more complete record of flowering times is given in Table 6. Most flowering material has been collected in the months November, December and January. The few specimens collected in the Autumn and early Winter are all from the South-West Cape.

Table 6: Records in herbaria of the dates of collection of flowering specimens of Eulophia aculeata asp. aculeata:

<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	1
November	..	..	..	..	..	13
December	..	..	..	..	..	37
January	..	..	..	..	..	14
February	..	..	..	..	..	1
March	..	..	..	..	..	1
April	..	..	..	..	..	0
May	..	..	..	..	..	1
June	..	..	..	..	..	0
July	..	..	..	..	..	1

Most localities receive up to 20 days with frost per year. Some have up to 40 days with frost, while others have no frost at all. In the Cape, the subspecies is generally found on gray sandy soils derived from Table Mountain Sandstone. It is also found on clay loam and on the Eastern Province coastal Podsoles. In the Transvaal

the two known localities are on lateritic and dark brown sandy soils respectively. The species occurs almost exclusively in Sclerophyll vegetation in the South Cape coastal belt. In the Eastern Cape, from the Amatola Mountains northwards, and in the Transvaal, it is found in sour grassveld.

In moist and sheltered places the plants have tall scapes and leaves; where the habitat is dry and exposed, the plants are very much shorter. Flower size is apparently not affected by these environmental conditions. The chromosome number previously obtained for subspecies aculeata was  $2n = 56$  (Hall, 1959<sup>MS</sup>).

(b). E.aculeata ssp. huttonii: This subspecies is found chiefly in Natal, and occasionally in the Eastern Cape and Transvaal (see Map 5). Precipitation at accurately recorded localities usually ranges from 25" to 40", reaching about 60" per annum in the Natal Drakensberg. Most localities lie at rather high altitudes, in areas which may have 20 to 60 (or rarely 80) days with frost per year.

The subspecies grows on the Podsoils of the Eastern Cape and Natal, and on the lateritic soils of Natal and the Transvaal. It occurs almost exclusively in sour grassveld, rarely in tall grassveld and coastal thornveld. The localities may be sloping and well-drained, or flat and marshy during the rainy season.

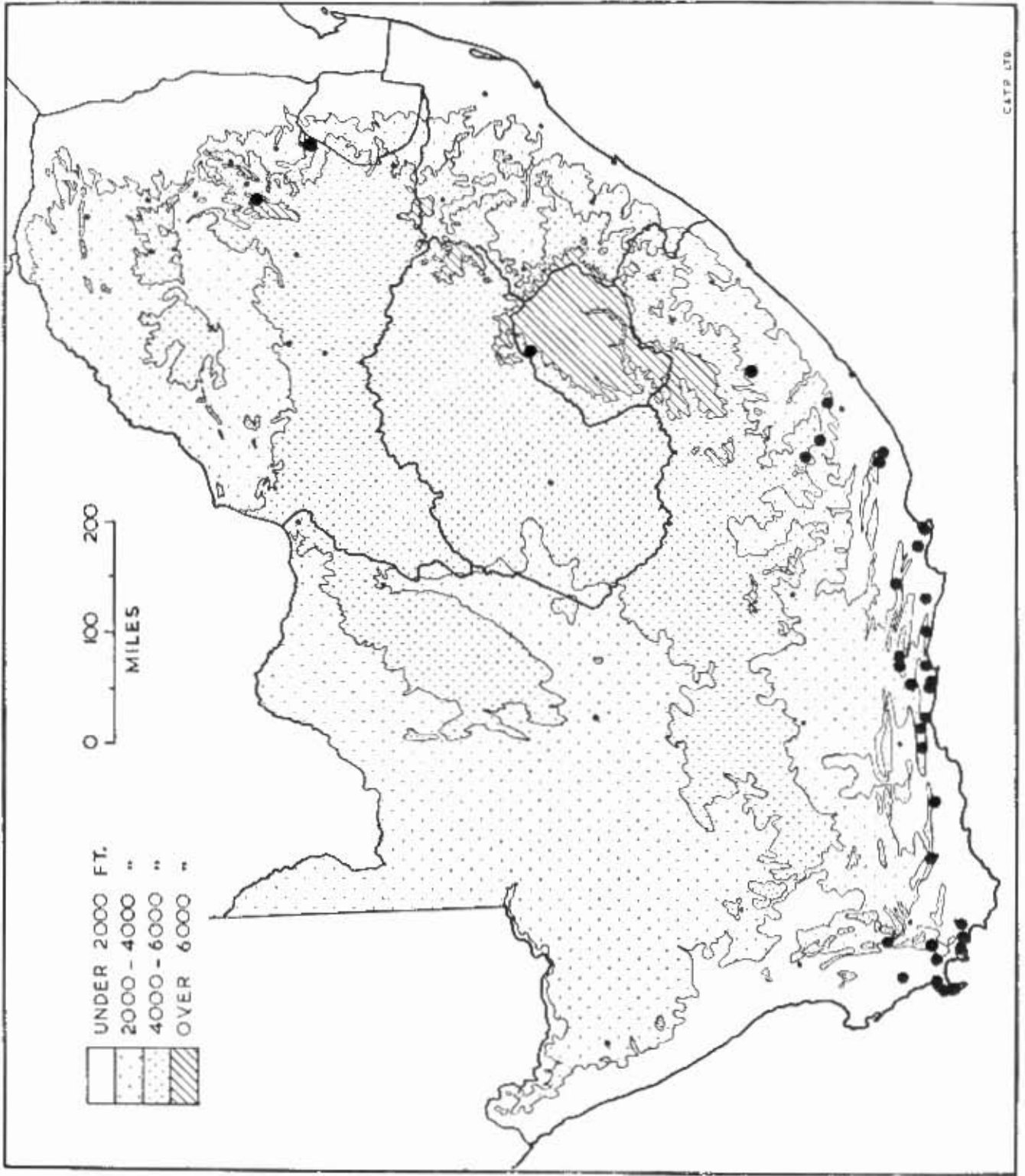
A wide range of flower colours was found in a population studied in Southern Natal (Hall 785, Drakensberg

Garden, Underberg District). The colours varied little on the same plant, but a continuous series was traced from specimens with the perianth greenish-white, lacking pink (3 plants), with a trace of pink (6 plants), purplish pink (62 plants) and deep reddish purple (13 plants). Pale pink and white forms occurred chiefly on a moist flood plain at this locality; those with darker coloured flowers were restricted to the drier slopes nearby, and were generally less robust than the others.

The chromosome number of material from the above locality was found to be  $n = 27$ . The subspecies flowers chiefly during the warm wet summer months (see Table 7).

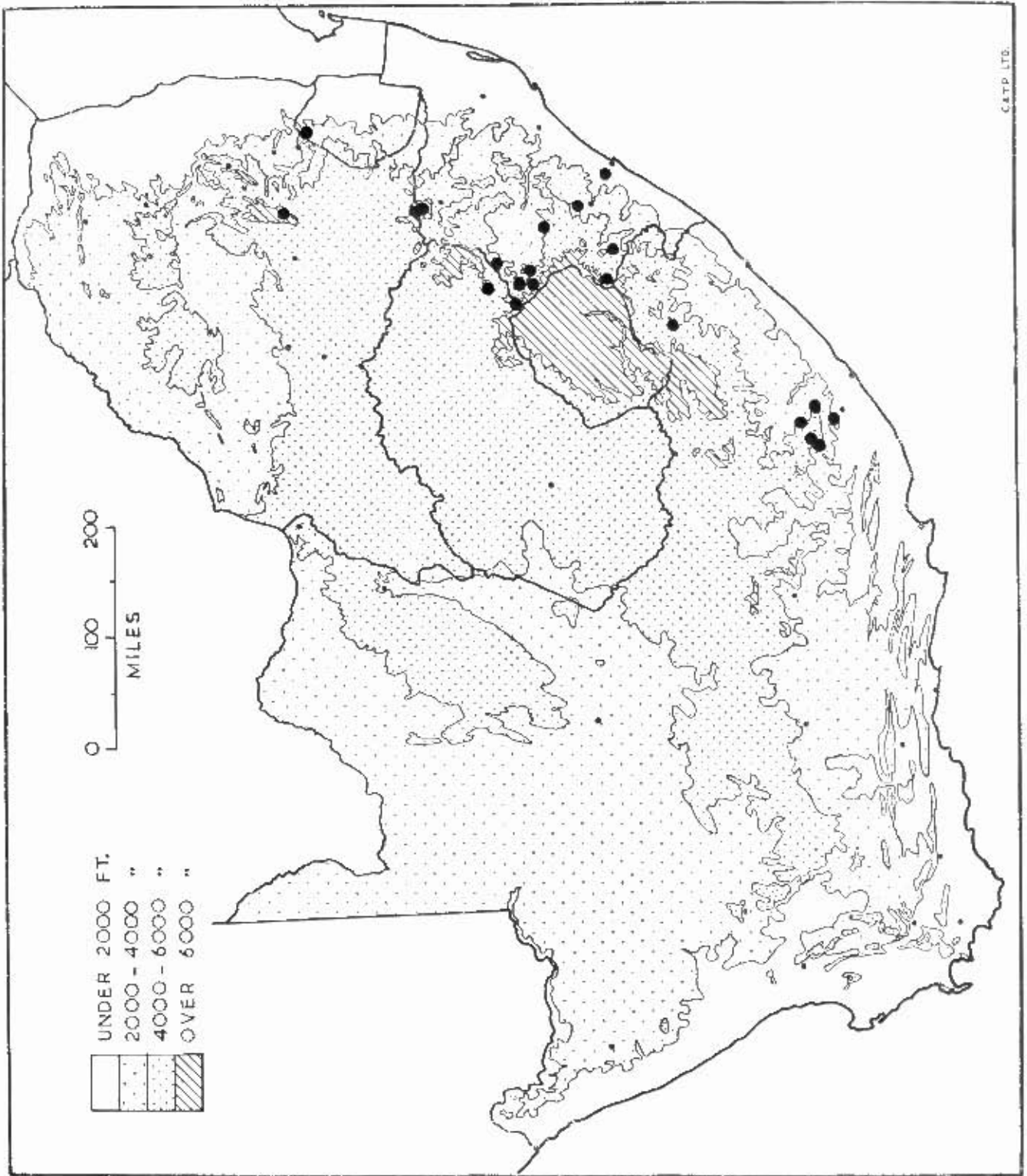
**Table 7:** Records in herbaria of the dates of collection of flowering specimens of *Eulophia sculeata* ssp. *huttonii*:

<u>Month</u>						<u>No. of records</u>
September	..	..	..	..	..	1
October	..	..	..	..	..	1
November	..	..	..	..	..	9
December	..	..	..	..	..	18
January	..	..	..	..	..	4
February	..	..	..	..	..	1
March	..	..	..	..	..	0
April	..	..	..	..	..	1



Map 4: Distribution of *Eulophia aculeata* (L.f.)

Spreng. ssp. *aculeata* in South Africa.



Map 5: Distribution of *Eulophia aculeata* (L. f.)  
Spreng. ssp. *huttonii* (Rolfe) Hall in S. Africa.

5. EULOPHIA FRIDERICII (REICHB.F.) HALL

(1) Description: Rhizome subterranean, moniliform.

Leaves sometimes not fully developed at anthesis, up to 25 cm. long and 6.5 cm. broad, narrowly elliptic, thinnitissued, with slightly crisped margins and a fine line marking an abscission layer near the base. Scape 30 - 60 cm. tall, slender to a little stout near the base. Sheaths on the scape generally less than half as long as their internodes, rather loosely clasping. Bracts subulate, shorter than the ovary. Raceme lax and elongate; flowers 3 - 20, with the perianth spreading.

Odd sepal 9 - 12 mm. long, narrowly obovate and crisped, retuse; lateral sepals similar. Petals twice as broad as the odd sepal, about as long, broadly obovate. Column 5 mm. long, tapering from a broad base. Mentum 5 mm. long, broad and concave inside, with the distal portion of the concavity obscured by a lacerate lamella 2 - 4 mm. high, inserted transversely at the base of the lip lamina. Side lobes of the lip attached to the full length of the mentum, with their longest axis diagonal to it. Mid-lobe of the lip narrowly oblong and ~~very~~ ~~wide~~, incurved with the apex nearly touching the end of the column. Crests consisting of very low fleshy ridges along the central nerves of the mid-lobe.

Sepals dull lime green with dark reddish-brown tinges. Petals bright lemon yellow outside with brownish

red lines on pale yellow inside. Crests and the central area of the lip bright lemon yellow; the side lobes and margins of the mid-lobe yellow with reddish-brown lines. No flower scent detectable.

(ii) Distinctions from similar taxa: Eulophia fridericii may be distinguished from all other South African species of Eulophia in having a transverse lamella at the base of the lip. The species bears a superficial resemblance to E.tuberculata Bolus, which differs in having thick-tissued leaves lacking an abscission layer, tall lamellae on the mid-lobe of the lip, and the sepals never crispate.

(iii) Nomenclature: It appears that the earliest description matching this species was published by Reichenbach in 1867, with the name Lissochilus friderici. The many details given in this description agree with the present concept in every respect. A sheet bearing a specimen matching the concept at the British Museum (BM) is labelled with the collector's number and locality quoted in the type description, but there is no evidence that it was actually seen by Reichenbach. There are also notes and sketches in the herbarium at Vienna (W), evidently made by Reichenbach from type material; the details recorded here also match the concept. It therefore seems very probable that L.friderici Reichb.f. refers to the present taxon. In 1916, Schlechter published

a description of a species matching the present concept, with the name Lissochilus latifolius. Detailed notes and drawings made from isotype material at the Kew Herbarium (K) show that it quite clearly belongs to the present taxon. L.latifolius should therefore be regarded as a synonym of L.friderici Reichb.f.

The earliest epithet applied to this species (Reichenbach's 'friderici') has not been previously used in Eulophia. It therefore becomes necessary to make a new combination Eulophia fridericii (Reichb.f.) Hall, with Lissochilus friderici Reichb.f. as the basionym. Reichenbach's spelling of the epithet is amended according to Art. 73, Note 3 (Int. Code 1961).

(iv) Nomenclatural references and types:

Lissochilus fridericii ('friderici', ex err.)

Reichb.f. Flora 50: 113 (1867). Holotype: Welwitsch 676, nr. Zamba, Ambaca District, Angola (BM, type number!; W, icon!).

Lissochilus latifolius Schltr. Schwed. Rhod.-

Konge Exped. 1: 246 (1916). Holotype: Fries 1341, Kalambo, N.E. Rhodesia (UPS; K, isotype!).

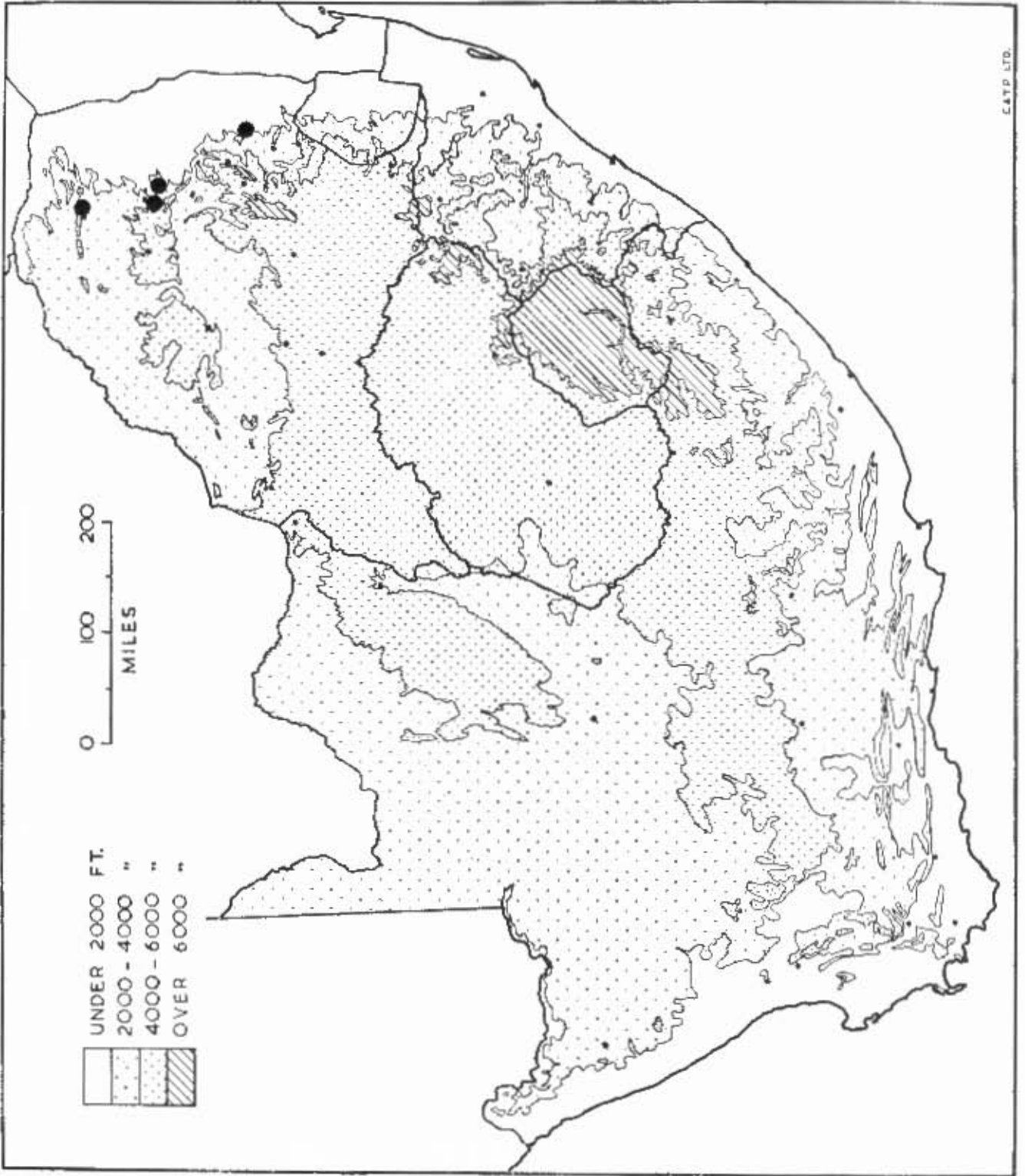
(v) General Biology: This species appears to be rare, so that relatively little is known about its distribution and ecology. It has been collected in Angola, the Caprivi Strip, north-eastern Northern Rhodesia and

in the Transvaal. Precipitation at accurately recorded South African localities (see Map 6) is generally high, varying from 30" to 70" per annum. Frost may be very rarely experienced at these localities. The species appears to grow only in regions with lateritic soils in South Africa; at two of the localities examined by the author there was a large admixture of partly decomposed leaf mould. It appears to be confined to the more shaded parts of riverine forests, where it may be found in small colonies of up to about twenty plants.

The few records available show that flowering takes place in the warm wet summer months, November and December (see Table 8). The chromosome number of material from the Northern Transvaal was found to be  $n = 24$ .

**Table 8:** Records in herbaria of the dates of collection of flowering specimens of E. fridericii (Reichb.f.) Hall.

<u>Month</u>						<u>No. of records</u>
November	..	..	..	..	..	2
December	..	..	..	..	..	4



Map 6: Distribution of *Eulophia fridericii* (Reichb.f.) Hall in South Africa.

6. EULOPHIA STREPTOPETALA LINDL.

**(i) Description:** Rhizome a series of partly aerial pseudobulbs joined at the base. Leaves reaching 75 cm. long and 11 cm. wide, with several progressively shorter leaves below, thin-tissued with several emergent veins on the abaxial surface, and with a fine transverse line marking an abscission layer near the base. Scape 0.4 - 2.3 m. high, rather slender to stout. Sheaths on the scape usually rather shorter than their internodes, tightly clasping. Bracts narrowly elliptic, acuminate, usually shorter than the ovary. Raceme lax and elongate; flowers about 4 - 35, with the perianth widely spreading.

Odd sepal (9.7) - 11 - 18 - (21.0) mm. long, narrowly obovate and mucronate; lateral sepals slightly broader. Petals as long as the odd sepal, rotund and often very slightly clawed at the base. Column 5 - 9 mm. long. Mentum broad, the same length as the column, and passing into a stout subcylindrical spur 1.5 - 2.2 mm. long. Side lobes fused a little more to the mentum than to the lip, their apices rounded. Lip rather convex in between the bases of the side lobes; mid-lobe rotund, obtuse to mucronate, the lateral margins partly to fully deflexed. Crests consisting of low subconfluent ridges on the central nerves of the lip.

Sepals green, variously mottled with dark purplish brown. Petals bright lemon yellow, paler on the inner

surface. Side lobes of the lip dull purple, the mid-lobe yellow with the crests a deeper yellow. No flower scent detectable.

(ii) Distinctions from similar taxa: This species is sometimes mis-identified with Eulophia speciosa (Lindl.) Bolus in herbaria. E.speciosa differs in having thick-tissued leaves with scarcely emergent veins, no convexity between the side lobes of the lip, and the petals nearly always rather longer than the odd sepal.

(iii) Nomenclature: The earliest description matching this species was published by Lindley in 1826, with the name Eulophia streptopetala. No type specimen can be found but a fairly detailed coloured plate is given with the type description. This plate shows nearly all the characteristic features of the taxon, except the abscission layer near the base of the leaf, which could have been overlooked. However, the arrangement of the leaves shows that the plant figured belongs to the present species and not to a closely related, un-named taxon in Central Africa (see page 30): there is a continuous gradation in length from the short outer leaves of the fascicle to the long inner leaves. In the absence of dried material, this illustration may be regarded as the lectotype.

In 1847, Reichenbach published a description agreeing with the present concept, with the name Lissochilus

krebsii. The holotype, a Krebs specimen from the 'Cape of Good Hope' cannot be found: it may have been in the orchid collections of the Berlin Herbarium (B), which were destroyed in World War II. A Gerrard specimen at the Kew Herbarium (K), belonging to the present concept, is labelled "Lissochilus krebsii Rehb.f. mihi videtur" in Reichenbach's handwriting. This specimen agrees with all essential features given in the type description, and may be taken as the lectotype. There seems little doubt that L.krebsii refers to the present taxon; it should therefore be regarded as a synonym of the earlier name Eulophia streptopetala Lindl.

Subsequently a number of names were published with descriptions and types matching the present species: Lissochilus paivaeanus Reichb.f., L.krebsii var. purpuratus Ridl., L.oatesii Rolfe, Eulophia krebsii (Reichb.f.) Bolus, E.krebsii var. purpurata (Ridl.) Bolus, Lissochilus papilionaceus Rendle, L.carsoni Rolfe, L.morrumbalaensis De Wilden., and L.lukingensis Schltr. After checking the descriptions and types, the author agrees with Summerhayes (1953, 1954) that these names can be regarded as synonyms of Lissochilus paivaeanus Reichb.f.; however, the holotype of L.paivaeanus Reichb.f. (a Welwitsch specimen at the Vienna herbarium, W) clearly agrees with the present concept, so that the names should rather be reduced to the synonymy of the earlier name Eulophia streptopetala Lindl. It should be noted that Summerhayes (1953) emended the concept of Lissochilus paivaeanus Reichb.f.

(which he re-named Eulophia paivaeana), by adding a new subspecies, E. paivaeana (Reichb.f.) Summ. ssp. borealis Summ., based on material that the present author considers to belong to a different species (see page 30). This subspecies must therefore be excluded from the synonymy of the present taxon.

It seems very likely that further research may show that two other names, Lissochilus rueppelii Reichb.f. and L. erythrae Rolfe, based on specimens from Eritrea, will also have to be regarded as later synonyms of Eulophia streptopetala Lindl.

(iv) Nomenclatural references and types:

Eulophia streptopetala Lindl. Bot. Reg. 12: sub tab. 1002 (1826). Holotype: sine leg., sine loc., ex hort. 'Mr. Colville's Nursery'. Lectotype: icon., Bot. Reg. 12: tab. 1002 (1826)!

Lissochilus streptopetalus (Lindl.) Lindl. Gen. et Sp. Orch. 191 (1833).

Lissochilus krebsii Reichb.f. Linnaea 20: 685 (1847). Holotype: Krebs s.n., Cape of Good Hope. Lectotype: Gerrard s.n., Natal (K!).

Lissochilus paivaeanus Reichb.f. Flora 48: 187 (1865). Holotype: Welwitsch 731, Huilla (W!).

L. krebsii var. purpuratus ('purpurata', ex err.) Ridl. Gard. Chron. 24: 102 (1885). Holotype: ex hort. Beath, Regent's Park (BM!).

Lissochilus oatesii Rolfe Oates Matabeleland 2:  
409 (1889). Holotype: Oates s.n., Matabeleland (K!).

Eulophia krebsii (Reichb.f.) Bolus J. Linn. Soc.  
25: 185 (1889).

E.krebsii (Reichb.f.) Bolus var. purpurata (Ridl.)  
Bolus J. Linn. Soc. 25: 185 (1889).

Lissochilus papilionaceus Rendle J. Bot. 33:  
170 (1895). Holotype: Scott-Elliot 8268, Stevenson  
Road (BM!).

L.carsoni Rolfe Fl. Trop. Afr. 7: 190 (1897).  
Holotype: Carson 123, Fwambo (K!).

L.morrumbalaensis De Wildem. Pl. Nov. Hort. Then.  
1: 61, sub tab. 15 (1904). Holotype: Luja 399, Mozambique  
(BR!).

L.ukingensis Schltr. Bot. Jahrb. 53: 591 (1915).  
Holotype: Stolz 2278, Ukinga (K, isotype!).

Eulophia paivaiana (Reichb.f.) Summerh. Kew Bull.  
1953: 151 (1953), excl. ssp. borealis Summerh.

(v) General Biology: This species has a wide distribution,  
extending from the Eastern Cape northwards through many of  
the East African territories, and across the Equator to  
Eritrea. In western Africa, it has only been recorded  
in Angola. The distribution in South Africa extends in a  
belt along the coastal areas of the Eastern Cape and Natal,  
and to the higher parts of the Eastern and central Transvaal  
(see Map 7). A rather wide range of habitats is found

in South Africa. Precipitation at accurately recorded localities is generally 25" to 40" per annum; in the Eastern Cape and Northern Transvaal it may be as low as 15" - 20", while along the Eastern Transvaal escarpment it may reach 75" per annum. Frost occurs on less than 20 days per year at most places, but in the Natal Drakensberg there may be up to 80 days with frost.

E.streptopetala grows in areas with a wide range of regional soil types: the shallow arid soils and sandy loams of the Eastern Cape, various kinds of podsol and lateritic soils, black clay, and the unleached sandy soils of the Northern Transvaal.

The species is always found growing near bushes, trees or large herbs, but never in open grassland. In the more arid parts of the Eastern Cape it is found in thorny succulent scrub; in more moist areas along the coast to Natal it may be found in thornveld and at the margins of coastal forest. Inland in Natal and the Transvaal it is usually found at the margins of the more moist forest and bush types, rarely in arid thornveld. In both arid and moist localities the species usually forms local colonies of about 10 - 40 plants. It has become particularly frequent in recent years in Eucalyptus plantations in the North - Eastern Transvaal.

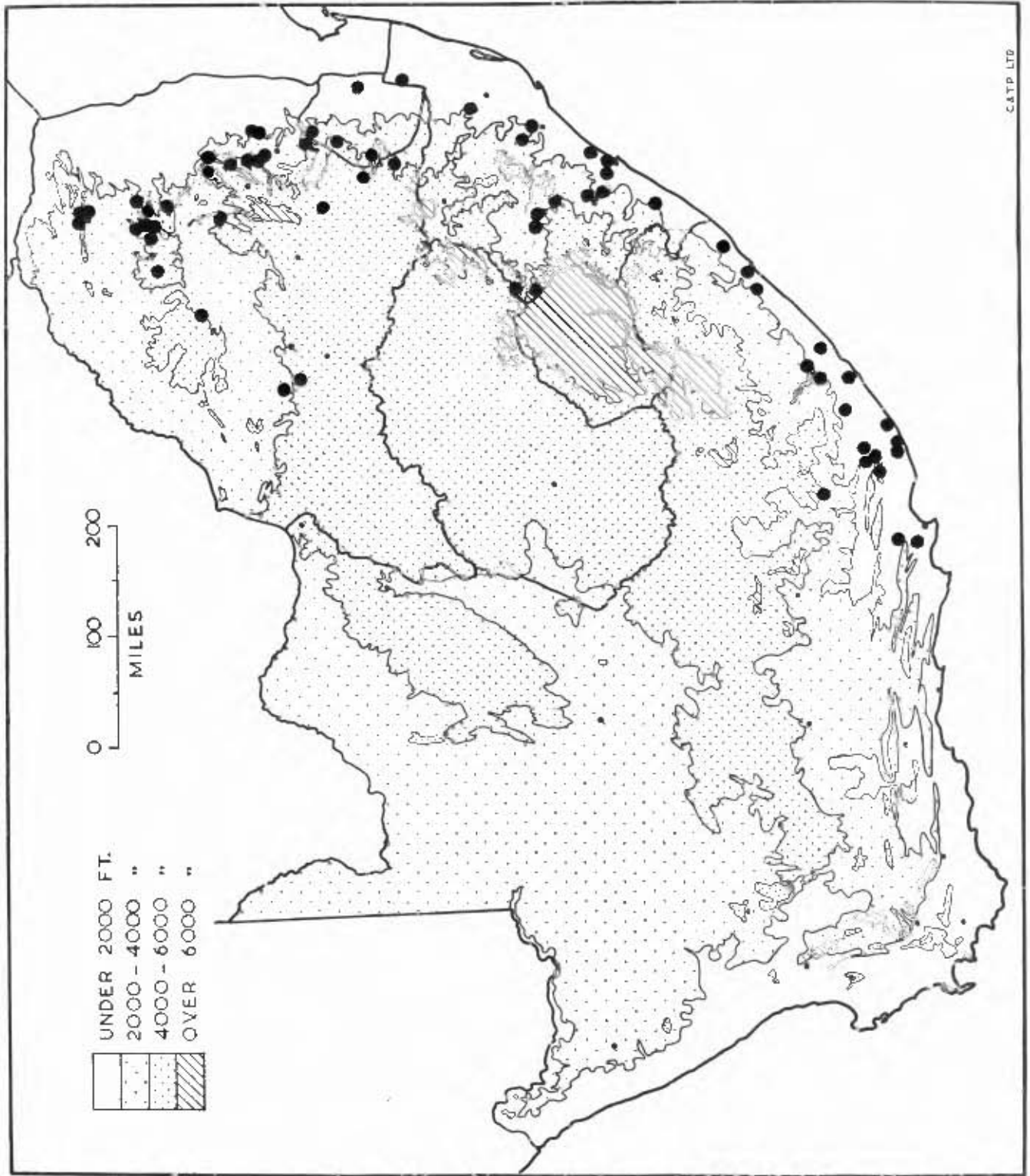
In the Eastern Cape there is a topocline from the usual form of the species to a Southern type with narrower leaves and smaller flowers (see Diagrams 10 and 11).

A plant of this Southern form (Hall 662), cultivated at the National Botanic Gardens, Kirstenbosch for four years, has consistently produced narrow leaves under the same conditions as plants with broad leaves. This shows that the variation in leaf width is more probably due to a genetical change than direct environmental influence. In the South-East Cape, at the southern end of the topoclinal, the species is found at a greater proportion of dry localities than in other parts of the distribution range. This may be due to the development of the narrow-leaved form which with its smaller leaf area could be more able to withstand drought.

The chromosome number of the small-flowered, narrow leaved form was found to be  $n = 20$ ; a count made from somatic tissue of the large-flowered form gave  $2n = 40$ . Flowering takes place chiefly in early summer (see Table 9).

Table 9: Records in herbaria of the dates of collection of flowering specimens of Eulophia streptopetala Lindl.

<u>Month</u>						<u>No. of records</u>
September .. .. .	..	..	..	..	..	2
October .. .. .	..	..	..	..	..	9
November .. .. .	..	..	..	..	..	35
December .. .. .	..	..	..	..	..	25
January .. .. .	..	..	..	..	..	12
February .. .. .	..	..	..	..	..	1



CATP LTD

Map 7: Distribution of *Eulophia streptopetala* Lindl. in South Africa.

7. EULOPHIA CLITELLIFERA (REICHB.F.) BOLUS

(1) Description: Rhizome subterranean, moniliform. Leaves absent to 4 cm. long at anthesis, later up to 24 cm. long and 1-3 cm. wide, thick-tissued, with numerous scarcely emergent veins set closely together. Scape about 20 - 35 cm. tall, slender. Sheaths on the scape generally much shorter than their internodes, loosely clasping. Bracts subulate, shorter than the ovary. Raceme lax, elongate; flowers about 5 - 25, the perianth spreading.

Odd sepal (4.0) - 5 - 8 - (8.9) mm. long, elliptic, subacute; lateral sepals similar. Petals slightly longer to a little shorter than the odd sepal, broadly ovate, obtuse. Column stout, 2 - 4 mm. long. Mentum a little shorter than the column, passing into a cylindrical to slightly conical spur 2.5 - 4.0 mm. long. Side lobes of the lip subquadrate, adnate to the mentum, the apices truncate and finely undulate. Mid-lobe elliptic to broadly obovate, very convex adaxially, the apex obtuse to retuse and the lateral margins irregularly crenulate. Crests consisting of verrucose ridges, produced chiefly on the convex portion of the mid-lobe.

Sepals dull green, tinged with brown and purple. Petals and lip dull white with reddish purple lines on the inner surfaces. Crests on the lip bright yellow. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has been mis-identified occasionally with Eulophia tuberculata Bolus, which differs chiefly in having flowers with a vestigial spur and the crests consisting of tall lamellae extending to near the apex of the mid-lobe.

(iii) Nomenclature: The earliest description matching this taxon was published in 1847 by Reichenbach, with the name Lissochilus clitellifer. The description agrees with the concept in all but two details, one probably a misprint; the sepals are given as 3" long and 2" wide, instead of 2" wide. The other feature, "pollen masses four" is evidently a mis-interpretation of the large cavity in each of the two pollen masses, which are open down one side to give the appearance of four units. Two sheets bearing specimens of the present concept were found in the Reichenbach herbarium at Vienna (W). They are labelled with the collector and locality given in the type description (Gueinzus, Port Natal), together with the identification "Lissochilus clitellifer Reichb.f." in Reichenbach's handwriting.

In 1889, Bolus transferred the epithet clitellifer from Lissochilus to Eulophia. In 1912, Rolfe published a description matching the present concept, with the name Lissochilus rehmannii. The four syntypes at the Kew Herbarium (K) clearly agree with the present species, so that L.rehmannii Rolfe should be regarded as a synonym of

the earlier name Eulophia clitellifera (Reichb.f.) Bolus. Summerhayes (1953) concluded that Lissochilus pulchellus Rendle from Tanganyika should be regarded as a later synonym of E.clitellifera. There appears to be no reason for differing from this view. Lissochilus cochlearis Schltr, based on a type from Northern Rhodesia, may also prove to be a later synonym.

(iii) Nomenclatural references and types:

Lissochilus clitellifer Reichb.f. Linnaea 20: 687 (1847). Holotype: Gueinzius s.n., Port Natal (W!).

Eulophia clitellifera (Reichb.f.) Bolus, J. Linn. Soc. 25: 184 (1889).

Lissochilus pulchellus Rendle J.Bot. Lond. 33: 196 (1895). Holotype: Scott - Elliot 8126, Kibwera (K, type number!).

L.rehmannii Rolfe Fl. Cap. 5(3): 55 (1912). Syn- types: Rehmann 4297, Aapies River (K!); McLea s.n. in Herb. Bolus. 5819a, Pretoria (K!); Tennant 4040, Pretoria (K!); Reck 1004, Koodood Poort (K!).

(v) General biology: Eulophia clitellifera is found in nearly all East African territories to as far north as the borders of the Sudan; it has also been recorded in Madagascar. In South Africa, the species is widely scattered through the Transvaal, the Natal coastal belt and the South East Cape (see Map 8). Precipitation at accurately recorded localities in South Africa is generally about 25"

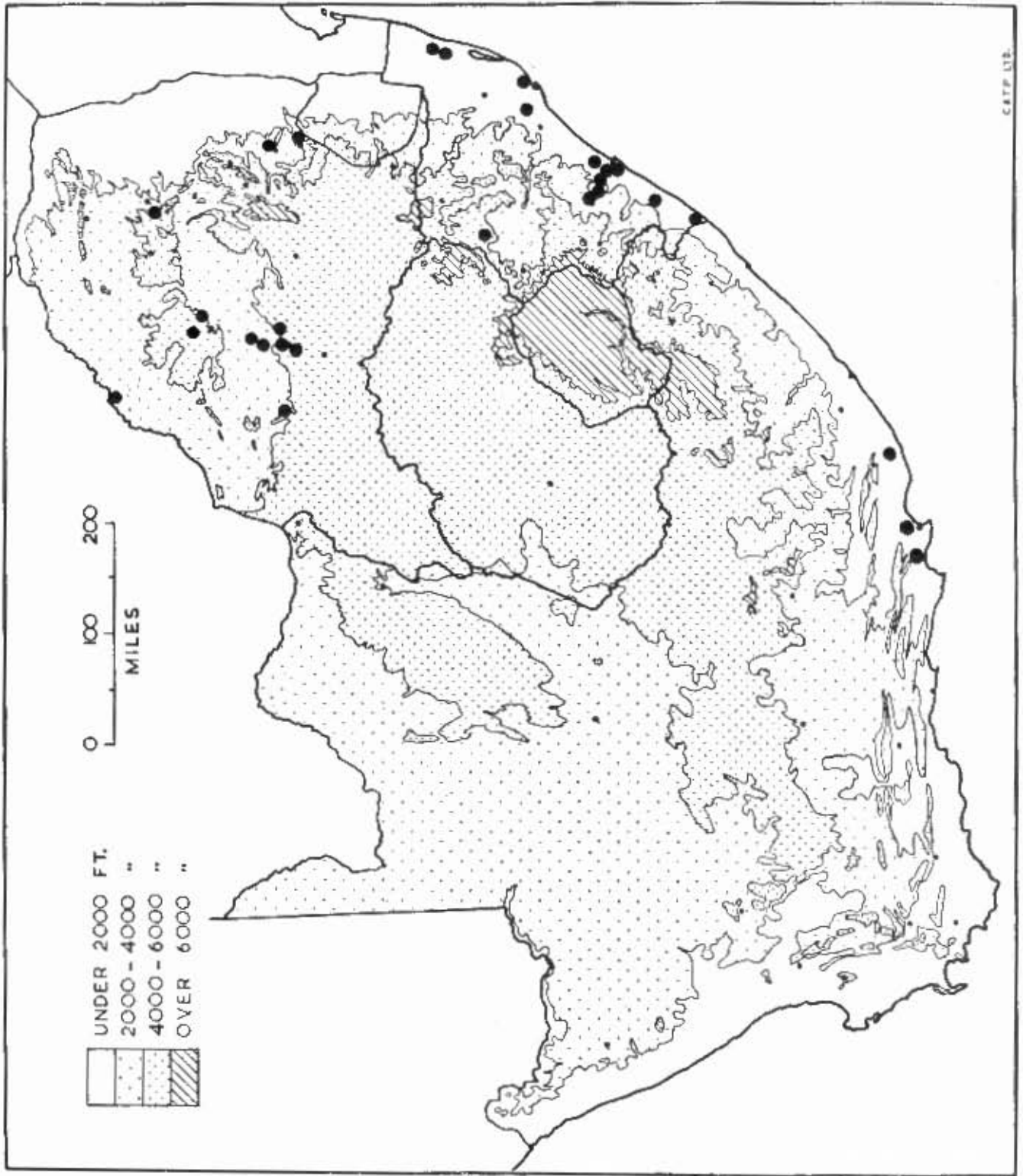
to 40" per annum; in the Eastern Cape and parts of the Western Transvaal it may be as low as 15" - 20", while near the Natal coast it may reach 60". Many localities experience no frost; others may have up to 20 or (rarely) 40 days with frost per year.

The regional soil types at the localities vary widely, from the sandy loams of the Eastern Cape, to podsoils and lateritic soil types, the light brown sandy soils of Northern Zululand, black clay, and soils derived from Kalahari sand. Collectors record stony soils at an appreciable number of localities.

The species appears to favour exposed positions, and occurs in a variety of different vegetation types: the arid succulent scrub of the South-East Cape, the Coastal thornveld of the Eastern Cape and Natal, the tall and sour grassveld types of the Transvaal and Natal, and the bushveld of the north-west Transvaal. Flowering takes place during a period of several months, mostly from Spring to early Summer (see Table 9).

Table 9: Records in herbaria of the dates of collection of flowering specimens of E.clitellifera (Reichb.f.) Bol.

<u>Month</u>						<u>No. of records</u>
June	..	..	..	..	..	1
July	..	..	..	..	..	4
August	..	..	..	..	..	11
September	..	..	..	..	..	11
October	..	..	..	..	..	5
November	..	..	..	..	..	4
December	..	..	..	..	..	1



Map 8: Distribution of *Eulophia clitellifera* (Reichb.f.) Bolus in South Africa.

8. EULOPHIA SCHWEINFURTHII KRAENZL.

(1) Description: Rhizome subterranean, moniliform. Leaves partly developed at anthesis, up to 25 cm. long and 0.9 cm. wide, later reaching up to 35 cm. long, somewhat thick-tissued, with numerous scarcely emergent veins set closely together. Scape up to 80 cm. long, slender to a little stout below. Sheaths on the scape generally much shorter than their internodes, closely clasping. Bracts about half the length of the ovary, subulate. Raceme lax and elongate; flowers about 10 to 20, with spreading petals and reflexed sepals.

Odd sepal 7 - 9 mm. long, narrowly obovate, mucronate, slightly clawed at the base; lateral sepals similar. Petals 12 - 14 mm. long, very broadly ovate, obtuse to retuse. Column about 5 mm. long. Mentum 5 - 6 mm. long, passing into a nearly cylindrical spur about 3 mm. in length. Side lobes of the lip suboblong, adnate to the mentum with their longest axis parallel to it. Mid-lobe abruptly incurved so that its central convexity lies close to the column apex. Crests consisting of verrucose ridges, produced chiefly on the convex portion of the mid-lobe.

Sepals dull brown, paler to greenish yellow on the inner surface. Petals yellow, with the nerves marked with reddish brown inside. Lip bright yellow with reddish brown markings on the side lobes. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has been mis-identified in herbaria with Eulophia speciosa (R.Br. ex Lindl.) Bolus, which differs in having the convexity on the mid-lobe of the lip distant from the column, the spur saccate to shortly conical, and the petals lacking reddish-brown markings.

(iii) Nomenclature: The earliest description resembling this species was published by Kränzlin in 1893 with the name Eulophia schweinfurthii. The description agrees with the concept in all but two details: the petals are said to be broadly ligulate, and the sepals almost orbicular. Examination of a drawing at the Kew Herbarium (K) of a flower from the type shows that the descriptions of the shapes of the petals and sepals had evidently been erroneously interchanged. The drawing agrees with the present concept in every respect.

Notes given with the drawing state that it was made from type material at the Berlin Herbarium (B), which was subsequently destroyed in World War II. As no dried material of the type is available, the drawing may be regarded as the lectotype of the species.

Several names have been reduced to the synonymy of E. schweinfurthii Kraenzl. by Summerhayes (1958<sup>a</sup>): Lissochilus smithii Rolfe, Eulophia pantheri Schltr., Lissochilus elegantulus Schltr., L. descampsi De Wildem., L. vermiculatus De Wildem., Eulophia involuta Summ., and E. compta Summ.

The descriptions and available types of these names were checked and no reason was found for differing from Sumnerhayes' conclusions.

(iv) Nomenclatural references and types:

Eulophia schweinfurthii Kraenzl. Bot. Jahrb. 17: 54 (1893). Holotype: Schweinfurth 2671, Bongoland, Tendj (K, icon.: lectotype!).

Lissochilus smithii Rolfe Fl. Trop. Afr. 7: 96 (1897). Holotype: Smith s.n., Kilimanjaro (K!).

Eulophia pentheri Schltr. Bot. Jahrb. 26: 339 (1899). Syntypes: Penther s.n., Ligombwe (K!); Schlechter s.n., Komatipoort, Dec. 1897 (K, isosyntype!; BM, isosyntype!; Z, isosyntype!).

Lissochilus elegantulus Schltr. Wiss. Ergebn. Schwed. Rhod.-Kongo Exped. 1: 244 (1916). Holotype: Fries 605, near Fort Roseberry (K, icon.!).

L. descampsi De Wildem. Bull. Jard. Bot. l'Etat 6: 81 (1919). Syntypes: Descamps s.n., Luapula - Lufila (BR!); Verdick s.n., edge of Moero, 1900 (BR!).

L. vermiculatus De Wildem. Bull. Jard. Bot. l'Etat 6: 107 (1919). Holotype: Hock s.n., Elisabethville, 1911 (BR!).

Eulophia involuta Summ. Fl. W. Trop. Afr. 2: 444 (1936), nom. nov. pro syn. Lissochilus smithii Rolfe

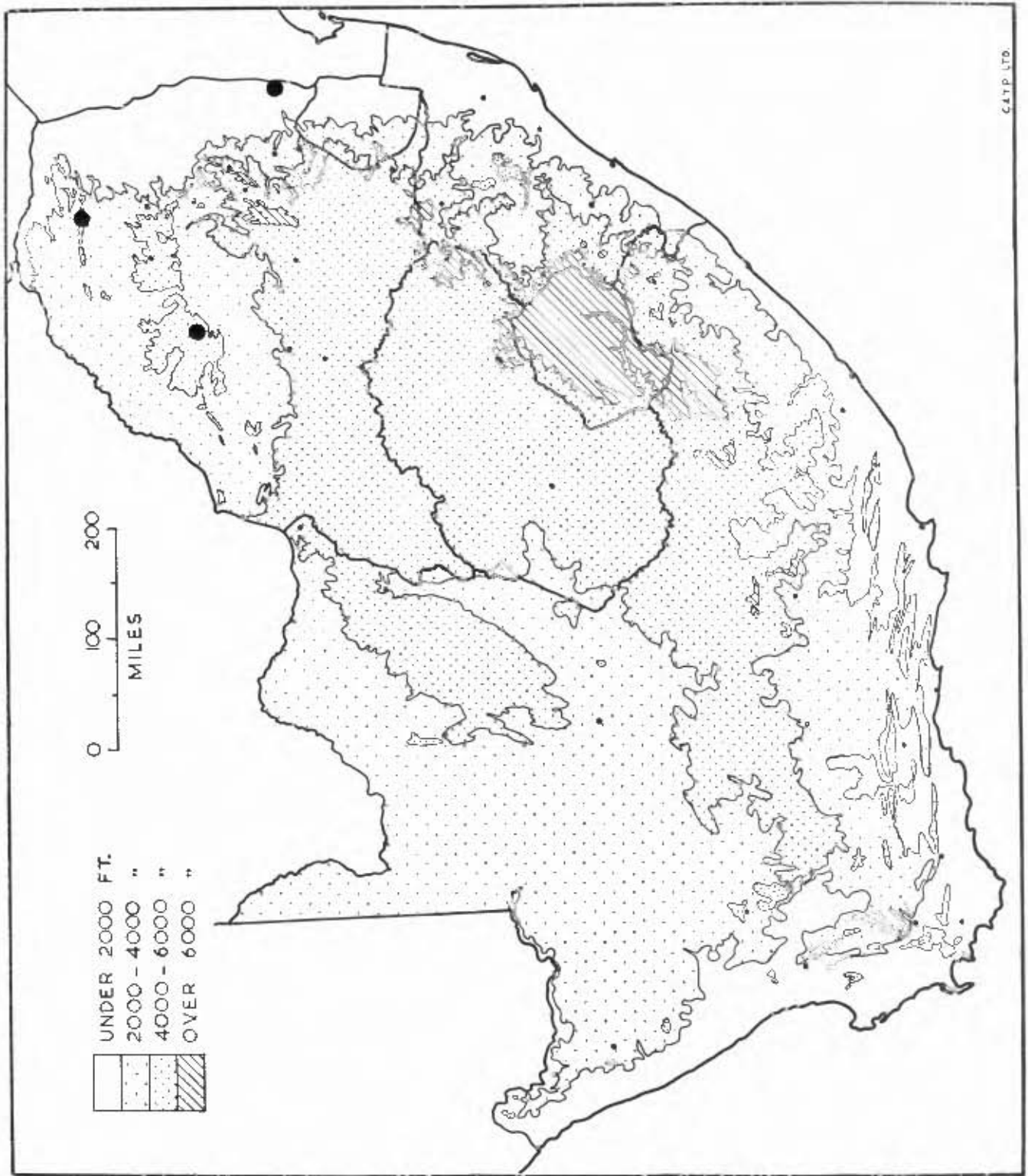
Eulophia compta Summ. Kew Bull. 1951: 472 (1951), nom. nov. pro syn. Lissochilus elegantulus Schltr.

(v) General biology: This species has a large distribution range, extending from the Transvaal northwards through most of the East African territories to the southern borders of the Sudan. The localities in the Transvaal are few in number and widely dispersed (see Map 9).

Precipitation at accurately recorded localities ranges from 25" to 30". Up to 20 days with frost may be experienced. The species grows in regions with unleached subtropical sandy soils. The dominant vegetation type may be lowveld bush or inland mountain grassveld. Flowering takes place in South Africa in the warm wet summer months (see Table 10).

Table 10: Records in herbaria of the dates of collection of flowering specimens of Eulophia schweinfurthii Kraenzl.

<u>Month</u>						<u>No. of records</u>
November	..	..	..	..	..	2
December	..	..	..	..	..	2



Map 9: Distribution of *Eulophia schweinfurthii*

Kraenzl. in South Africa.

9. EULOPHIA SPECIOSA (R. BR. EX LINDL.) BOLUS

(i) Description: Rhizome subterranean or sometimes partly aerial, moniliform. Leaves mature at anthesis, up to 65 cm. long and 2 cm. broad, rather thick-tissued, with numerous scarcely emergent veins. Scape 40 - 60 cm., rarely up to 90 cm. high, rather stout. Sheaths on the scape generally rather less than half the length of their internodes, closely to loosely clasping. Bracts lanceolate acuminate, rather shorter to somewhat longer than the ovary. Raceme becoming elongate and lax during anthesis; flowers about 10 - 30, with reflexed sepals and spreading petals.

Odd sepal (8.0) - 11 - 13 - (20.6) mm. long, elliptic, acuminate to acute, sometimes clawed at the base; lateral sepals similar. Petals usually rotund-obtuse, rarely very broadly ovate and subacute, 9.7 - 22.7 mm. long, nearly always rather longer than the odd sepal. Mentum about two-thirds the length of the 5 - 8 mm. long column, forming with the base of the lip a short laterally compressed sac, rather acute in profile. Side lobes fused to the mentum and the base of the column, suboblong with their longest axis parallel to the mentum and the apices rounded. Mid-lobe subelliptic, obtuse to retuse, with the sides somewhat deflexed, convex adaxially in the middle, and the apex incurved. Crests consisting of broad fleshy ridges thickest on the convex part of the mid-lobe. Sepals pale green; petals yellow; lip

yellow, with the crests a deeper yellow and purple lines on the side lobes. No flower scent detectable.

(ii) Distinctions from similar taxa: This species is sometimes mis-identified in herbaria with Eulophia streptopetala Lindl., which differs in having the lip very convex between the side lobes, the sepals about as long as the petals, and the leaves thin-tissued with emergent veins and an abscission layer near the base.

(iii) Nomenclature: The earliest description attributed to the present species was published by the younger Linnaeus in 1781, with the name Satyrium giganteum. This name cannot be used as the basionym for the present species, owing to the prior existence of Eulophia gigantea (Reichb.f.) N.E.Br., used for a different species resembling E.horsfallii (Batem.) Summ. There are also difficulties in the typification of Satyrium giganteum L.f. There are two sheets in the Herbarium at Uppsala (UPS) labelled Sat. giganteum', probably by the younger Linnaeus, so that they may possibly be regarded as type material. However, besides material of the present concept on these sheets, there are specimens of Eulophia tuberculata Bolus and E.streptopetala Lindl., which cannot be excluded from the synoptic type description. Having discordant elements in the type, the name Satyrium giganteum L.f. should be rejected, according to Art. 70 (Int. Code 1961). The

epithet giganteum was combined with Limodorum by Thunberg in 1794, and with Cymbidium by Swartz in 1800. As these combinations have an unacceptable name as a basionym, they should also be rejected.

In 1821, Lindley published a description written by Robert Brown and matching the present species, with the name Lissochilus speciosus. No dried material of the type can be found, so that the detailed coloured plate given with Lindley's description may be regarded as the lectotype. Bolus transferred the epithet speciosa from Lissochilus to Eulophia in 1889.

In 1895, Schlechter published a description of a variety agreeing with the smaller-flowered forms of the concept, with the name Eulophia speciosa (R.Br. ex Lindl.) Bolus var. culveri Schltr. Isotype material in the Herbaria at Kew (K) and the British Museum (BM) also matches less robust forms of the present species. This variety should therefore be regarded as a synonym of E. speciosa (R.Br. ex Lindl.) Bolus.

Other names based on Tropical African material and published later than Lissochilus speciosus R.Br. ex Lindl. may also prove to be synonymous: Lissochilus wakefieldii Reichb.f. et S.Moore, Eulophia dispersa N.E. Br., Lissochilus brevisepalus Rendle, and L.rendlei Rolfe. The taxonomy of these names was not studied in detail (c.f. page 95).

(iv) Nomenclatural references and types:

Lissochilus speciosus R.Br. Coll. Bot. sub tab. 31 (1821) MSS; Lindl. Bot. Reg. sub tab. 573 (1821). Lecto-type: Bot. Reg. tab. 573 (1821).

Eulophia speciosa (R.Br. ex Lindl.) Bolus J. Linn. Soc. 25: 184 (1895).

Eulophia speciosa var. culveri Schltr. Bot. Jahrb. 20, Beibl. 50: 10 (1895). Holotype: Culver 62, Barberton (K, isotype!; BM, isotype!).

(v) General biology: Forms closely resembling the present species are known from many parts of East Africa as far north as Uganda, also in Northern Bechuanaland and South-West Africa. In South Africa, it has been found at many places along the Eastern Cape and Natal coasts, and inland in Natal, Swaziland and the East and central regions of the Transvaal (see Map 10).

Precipitation at accurately recorded localities along the coast is usually quite high, ranging from 30" to 50" per annum and only rarely as low as 20". Most localities inland receive 25" to 40" per year, except for the central Transvaal where it is 20" - 25". Frost is only encountered at some of the Transvaal localities, occurring on less than 20 days per year.

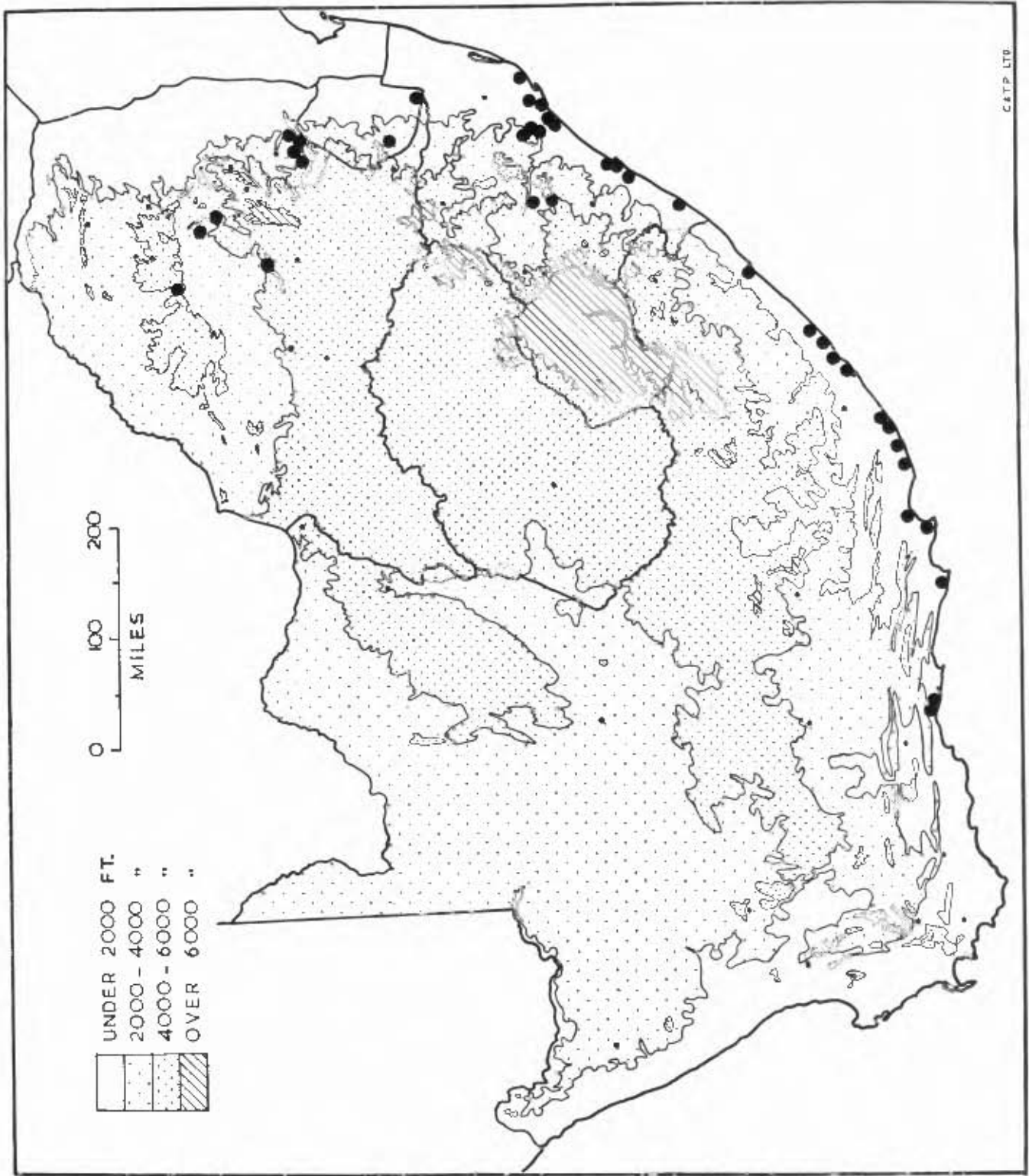
In the South and East Cape, the species appears to be confined to old fixed sand dunes and sandy soils, never more than two or three miles from the coast. In

Natal it is found in regions with coastal podsols and reddish to light brown sandy soils. In the Transvaal it has been recorded from areas with black clay and grey ferruginous lateritic soils.

The species may occupy open to rather sheltered places in bushveld near the coast. In some places it may be less than a hundred yards from the high water mark and exposed to salt spray from the sea (e.g. Port St. Johns, Hall 764). The vegetation at inland localities in the north may vary from valley bushveld to the thorny bush of the lowveld, and inland mountain grassveld types of the Transvaal. Few to many (50 or more) plants may be seen in local colonies at both coastal and inland localities. Flowering takes place mostly in Summer and occasionally at other times of the year (see Table 11). The chromosome number of material from both the Eastern Cape and Natal was found to be  $n = 27$ .

Table 11: Records in herbaria of the dates of collection of flowering specimens of E. speciosa (R.Br. ex Lindl.) Bol.

<u>Month</u>						<u>No. of records</u>
June	..	..	..	..	..	1
July	..	..	..	..	..	2
August	..	..	..	..	..	3
September	..	..	..	..	..	2
October	..	..	..	..	..	7
November	..	..	..	..	..	24
December	..	..	..	..	..	16
January	..	..	..	..	..	14
February	..	..	..	..	..	1
March	..	..	..	..	..	2



Map 10: Distribution of *Eulophia speciosa*  
(R.Br. ex Lindl.) Bolus in South Africa.

10. EULOPHIA PARVIFLORA (LINDL.) HALL

(1) Description: Rhizome subterranean, moniliform.

Leaves partly extended at anthesis, later reaching up to 25 cm. long and 1.6 cm. broad, leathery in texture. Scape about 20 - 50 cm. tall, usually rather stout. Sheaths on the scape equalling to rather shorter than their internodes, loosely clasping. Bracts elliptic acuminate, rather longer to about half the length of the ovary. Raceme rather dense and elongate; flowers 5 - 30, the perianth sub-campanulate.

Odd sepal (7.0) - 10 - 14 - (19.8) mm. long, narrowly obovate to narrowly oblong, obtuse or mucronate; lateral sepals similar. Petals as long to a little shorter than the odd sepal and usually a little wider, obovate-elliptic, shortly clawed at the base. Column 4 - 8 mm. long. Mentum usually a little shorter than the column, passing gradually into the spur; spur varying from sub-cylindrical to shortly conical, 2 - 5 mm. long. Side lobes of the lip subquadrate, fused to part of the mentum, the nerves numerous and parallel near the truncate apex. Mid-lobe broadly oblong to obovate or ovate. Crests consisting of low, broad verrucose ridges on the central nerves of the lip.

Sepals dull brownish green outside, rich orange-brown inside. Petals pale yellow with the nerves marked brownish-red inside. Lip with the side lobes yellow tinged with purple, the mid-lobe bright yellow. No flower scent detectable.

(ii) Distinctions from similar taxa: Eulophia parviflora is a rather variable species, and some forms have been misidentified with E.clavicornis Lindl. and E.ovalis Lindl. Both these species differ in having crests consisting of papillae and thin lamellae.

(iii) Nomenclature: The earliest description matching the present concept was published by Lindley in 1833, with the name Lissochilus parviflorus. In the Herbarium at Kew (K) there is a sheet labelled with the collector and locality given in the type description (Gill s.n., Stony Vale), and bearing the identification Lissochilus parviflorus in Lindley's handwriting. The specimen consists of the upper part of a scape with small flowers, clearly belonging to the present concept and matching the type description without reservation: it may therefore be regarded as the holotype.

In 1837, Lindley published a description of a supposed new species with the name Lissochilus aequalis. The type in the Lindley orchid herbarium at Kew (K) consists of leaves and a scape bearing large flowers, matching the present concept, but superficially rather different from the type of L.parviflorus. Lindley evidently lacked sufficient intermediate material to show that the two forms were in fact conspecific. Lissochilus aequalis Lindl. should be regarded as a synonym of the earlier name L.parviflorus Lindl. In 1847,

Reichenbach published a description based on material belonging to the present taxon, with the name Eulophia rupestris. Lindley had used this name in 1833 for a quite different species from India, now known as Eulophia campestris Wall. ex Lindl. In 1857, Reichenbach recognised this error, and proposed a new name, Eulophia rupincola.

Subsequently, several other names based on South African specimens were published, with descriptions and types agreeing with the present taxon: Cyrtopera oliveriana Reichb.f., Eulophia oliveriana (Reichb.f.) Bolus, E.bilamellata Schltr., E.bilamellata var. euryceras Schltr., E.saundersiae Rolfe, E.inandensis Rolfe, and E.elegantula Rolfe. These names should also be regarded as synonyms of Lissochilus parviflorus Lindl. Further research may show that Eulophia swynnertonii Rendle, based on material from the Eastern Districts of Southern Rhodesia and published much later than the earliest description of the present taxon, may have to be regarded as another synonym of L.parviflorus.

In 1891, Kuntze transferred Reichenbach's epithet rupestris from Eulophia to Graphorchis, a genus against which Eulophia has since been conserved (Summerhayes and Hall, 1962). The earliest epithet applied to this species (Lindley's 'parviflorus') has not been used previously in Eulophia. It therefore becomes necessary to make the new combination Eulophia parviflora (Lindl.) Hall, with Lissochilus parviflorus Lindl. as the basionym.

(iv) Nomenclatural references and types:

Lissochilus parviflorus Lindl. Gen. et Sp. Orch.  
191 (1833). Holotype: Gill s.n., Stony Vale (K!).

L.aequalis Lindl. Comp. Bot. Mag. 2: 204 (1837).  
Holotype: Drège s.n., Zairebergen (K!).

Eulophia rupestris Reichb.f. Linnaea 20: 682  
(1847), nom. illegit; non E.rupestris Wall. Cat. n. 7368,  
ex Lindl. Gen. et Sp. Orch. 185 (1833).

Eulophia rupincola Reichb.f. Bonplandia 5: 38  
(1857), nom. nov. pro syn. E.rupestris Reichb.f. non Wall.  
ex Lindl.

Cyrtopera oliveriana Reichb.f. Flora 64: 329  
(1881). Holotype: Duchanan 13, Port Natal, (K!).

Eulophia aequalis (Lindl.) Bolus J. Linn. Soc.  
25: 184 (1889).

E.oliveriana (Reichb.f.) Bolus J. Linn. Soc. 25:  
185 (1889)

Graphorchis rupestris (Reichb.f.) Kuntze, Rev.  
Gen. 662 (1891).

Eulophia bilamellata Schltr. Bot. Jahrb. 20, Beibl.  
50: 1 (1895). Holotype: Endemann s.n., nr. Johannesburg,  
Dec. 1892.

E.bilamellata var. euryceras Schltr. Bot. Jahrb.  
20, Beibl. 50: 26 (1895). Holotype: Schlechter 3232,  
nr. Emberton.

E.saundersiae Rolfe Kew Bull. 1910: 368 (1910);

Holotype: Saunders 1, Natal (K!).

E.inandensis Rolfe Fl. Cap. 5(3): 47 (1912).

Holotype: Wood 976, Inanda (K!).

E.elegantula Rolfe Kew Bull. 1917: 12 (1917).

Holotype: Wood 11789, Gillitts, Natal (K!).

(v) General biology: Eulophia parviflora has been recorded from the Eastern Cape, Natal, Swaziland, and near the Eastern escarpment in the Transvaal (see Map 11). One specimen is said to have come from Pretoria (McLoughlin in Herb. Transv. Mus. 13193); however, a note on the sheet indicates that it may have been sent from elsewhere and cultivated at Pretoria. Further research may show that the species also occurs in Southern Rhodesia (e.g. Mount Pene, Melsetter District, Swynnerton 75).

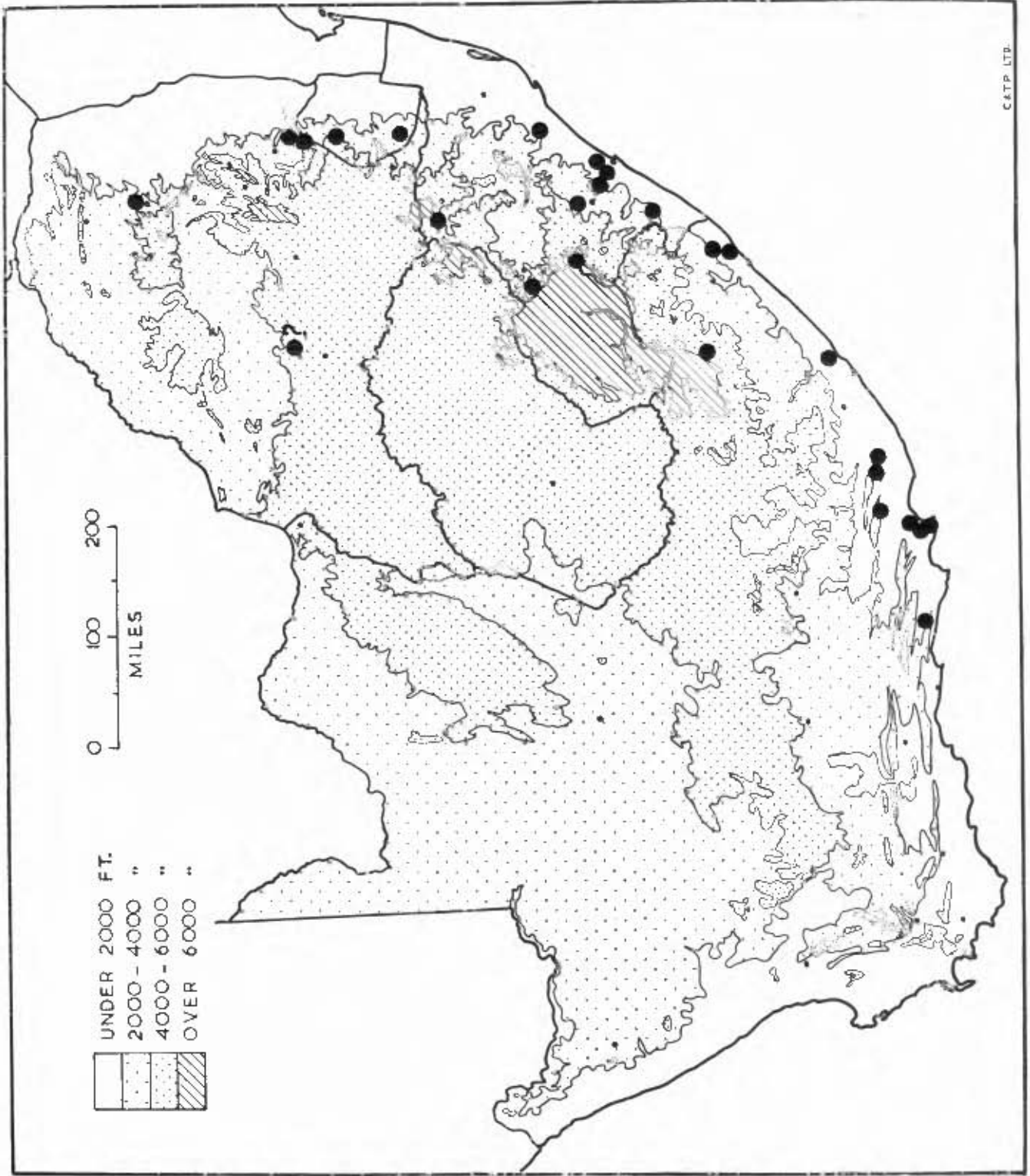
Precipitation at accurately recorded localities in South Africa lies mostly in the range 20" to 40" per annum, occasionally up to 60". Frost generally occurs on less than 20 days per year; however, the species may experience 60 - 80 days with frost in the Cape and Natal Drakensberg.

The species occurs in areas with a variety of regional soil types: the sandy loams and podsols of the Eastern Cape, the highveld and Natal coast belt podsols, and various lateritic soils. The species is generally found in sour grassveld and coastal thornveld, sometimes

growing in dense clumps. Flowering takes place chiefly in Spring (see Table 12). The chromosome number of material from the Eastern Cape was found to be  $n = 25$ .

**Table 12:** Records in herbaria of the dates of collection of flowering specimens of E. parviflora (Lindl.) Hall.

<u>Month</u>						<u>No. of records</u>
August	..	..	..	..	..	4
September	..	..	..	..	..	18
October	..	..	..	..	..	13
November	..	..	..	..	..	11
December	..	..	..	..	..	1



Map 11: Distribution of *Eulophia parviflora* (Lindl.) Hall in South Africa.

## 11. EULOPHIA LONGISEPALA RENDLE

**(i) Description:** Rhizome subterranean, moniliform. Leaves absent to partly developed at anthesis, up to 20 cm. long and 0.6 cm. wide, thin-tissued with 3 fine veins emergent on the abaxial surface. Scape 22 - 63 cm. high, slender. Sheaths on the scape less than 10 mm. long and very much shorter than their internodes. Bracts less than one-third the length of the ovary. Raceme lax; flowers 2 - 10, with widely spreading sepals.

Odd sepal (17) - 21 - 32 - (46) mm. long, narrowly linear-spathulate, acute; lateral sepals similar. Petals 10 - 16 mm. long, about half the length of the sepals, narrowly oblong to elliptic-oblong, acute. Column 6-9 mm. long. Mentum 2 - 5 mm. long, passing into a conical to subcylindrical spur directed away from the ovary and 2 - 4 mm. long. Side lobes of the lip narrowly oblong, fused at the base to the mentum, the distal free apex very short, rounded to slightly undulate. Mid-lobe very broadly obovate, frequently broader than long, obtuse to emarginate, with the lateral margins slightly crispate. Crests consisting of two low ridges passing distally into a few rows of lamellae and papillae.

Sepals green, tinged with brownish purple. Petals green outside and yellow-green within, the nerves marked with dull purple. Side lobes of the lip pale yellow-green; mid-lobe white with the crests pale green. No flower scent has been reported.

(ii) Distinctions from similar taxa: This species may be readily distinguished by its linear-spathulate sepals and very short sheaths on the scape. It has not been mis-identified with other taxa in South Africa.

(iii) Nomenclature: A detailed description matching the present concept was published by Rendle in 1894, with the name Eulophia longisepala. Material from Nyasaland at the British Museum (BM), labelled as the type of Eulophia longisepala by Rendle, agrees with the type description and the present concept without reservation.

Further research may show that certain other names may have to be regarded as later synonyms of Eulophia longisepala Rendle: E. antennata Schltr., E. triceras Schltr. and E. stolzii Schltr. As these were published later than Rendle's description, and are based on specimens from Mozambique and Nyasaland, they were not studied in detail (c.f. page 95).

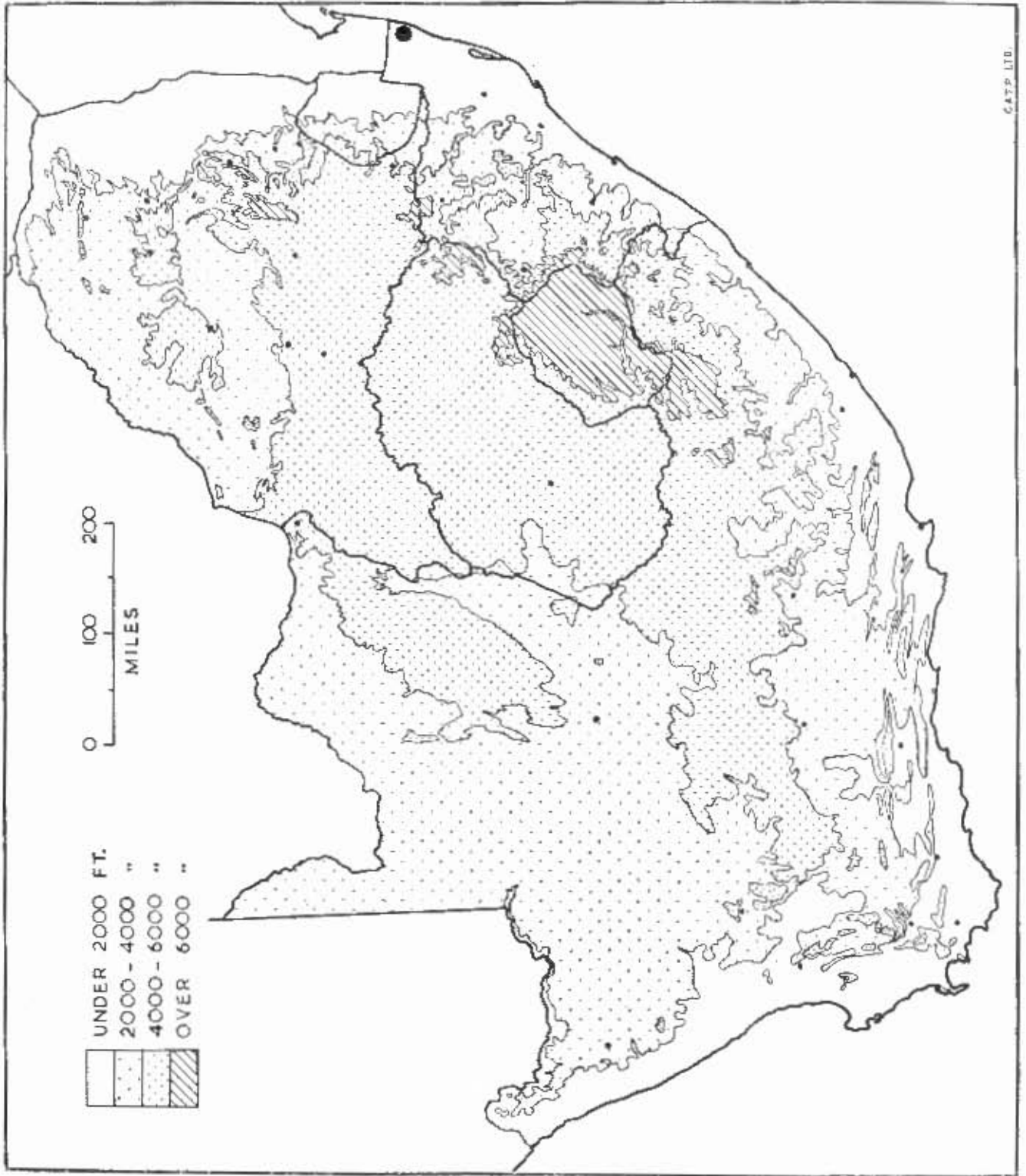
(iv) Nomenclatural reference and types:

Eulophia longisepala Rendle Trans. Linn. Soc. Lond. Ser. 2, 4: 43 (1894). Holotype: Whyte s.n., Milanji, Sept. 1889 (BM!).

(v) General biology: Forms very closely resembling the type of this species, and probably conspecific with it, have been collected in scattered places in Mozambique,

Southern and Northern Rhodesia, Nyasaland and Tanganyika (c.f. pages 53 - 55). In South Africa, only one accurately recorded locality is known, in Northern Zululand (see Map 12). Another locality is given imprecisely as 'Tongaland, N. Zululand'.

Precipitation at the accurately recorded locality is 35" to 40" per annum. Frost is unknown in the area. The regional soil type is a light brown sand, and the vegetation is coastal bushveld. The species was collected in flower in December.



Map 12: Showing the single accurately recorded locality of *Eulophia longisepala* Rendle in South Africa.

12. EULOPHIA MELEAGRIS REICHB.F.

(1) Description: Rhizome subterranean, moniliform. Leaves up to 30 - 60 cm. long and 2.0 - 5.5 cm. broad, thin-tissued with several veins emergent on the abaxial surface. Scape 20 - 80 cm. high, rather slender. Sheaths on the scape usually a little shorter than their internodes, rather tightly clasping. Bracts lanceolate acuminate, generally a little shorter than the ovary. Raceme lax; flowers 3 - 30, with spreading sepals.

Odd sepal (12) - 14 - 17 - (18) mm. long, elliptic to oblong, apiculate; lateral sepals similar. Petals half the length of the odd sepal, very broadly ovate-rotund, obtuse to minutely mucronate. Column 4 - 5 mm. long. Mentum vestigial, broad, passing into a cylindrical spur slightly longer than the column, often abruptly decurved near the apex. Side lobes of the lip broadly oblong, with the free distal portion elongate. Mid-lobe narrowly oblong, forming  $2/3$  -  $3/4$  of the length of the lip excluding the spur, the apex subacute and the margins finely crenulate. Crests consisting of 3 - 5 undulate lamellae, tallest on the central nerves in the distal part of the mid-lobe.

Outer surface of the sepals dark lime green, the inner dark brownish purple with flecks of dull green. Petals and lip purple to white, with dark bluish-purple along the margins and nerves. Crests pale purple basally,

to white and dark purple distally. No flower scent detectable.

(ii) Distinctions from similar taxa: This species is seldom mis-identified with other South African taxa in herbaria. It may be readily distinguished by the petals, which are about half the length of the sepals and very broadly ovate - rotund, and by the narrowly oblong mid-lobe, which forms more two-thirds of the total length of the lip, excluding the spur.

(iii) Nomenclature: A detailed description matching the present concept was published by Reichenbach in 1847, with the name Eulophia meleagris. The type is quoted as a Krebs specimen from the Cape of Good Hope, in the herbarium of 'Prof. Dr. Kunth'. Prof. K. S. Kunth died in Berlin in 1850, and his collections may well have been given to the Berlin Herbarium (B). If the Krebs specimen had been subsequently retained by this Herbarium, it would have been destroyed with other orchid collections during World War II. However, at Kew (K) there is a single flower of the present species, labelled by N.E. Brown with the collector and locality given in the type description, with the note: "Flower from the type specimen! in the Berlin Herbarium, Aug. 5, 1885". This flower probably represents part of the holotype.

There is also a sheet bearing material of the present species at the Vienna Herbarium (W), labelled "Eulophia

meleagris Cap. b. Spei Krebs", in Reichenbach's handwriting. This could either be regarded as an isotype, or rather less likely, the actual holotype: the sheet bears no evidence of having been either in the Kunth or the Berlin Herbaria, or of having been used as the holotype by Reichenbach.

(iv) Nomenclatural reference and types:

Eulophia meleagris Reichb.f. Linnaea 20: 683 (1847). Holotype: Krebs s.n., Cape of Good Hope (K, flor. unic.!: W, isotype!).

(v) General biology: Eulophia meleagris has been recorded in only three small areas in the Eastern Cape and Northern Natal (see Map 13). This is an unusually small number of localities for so large a distribution range, which is a little over 400 miles long.

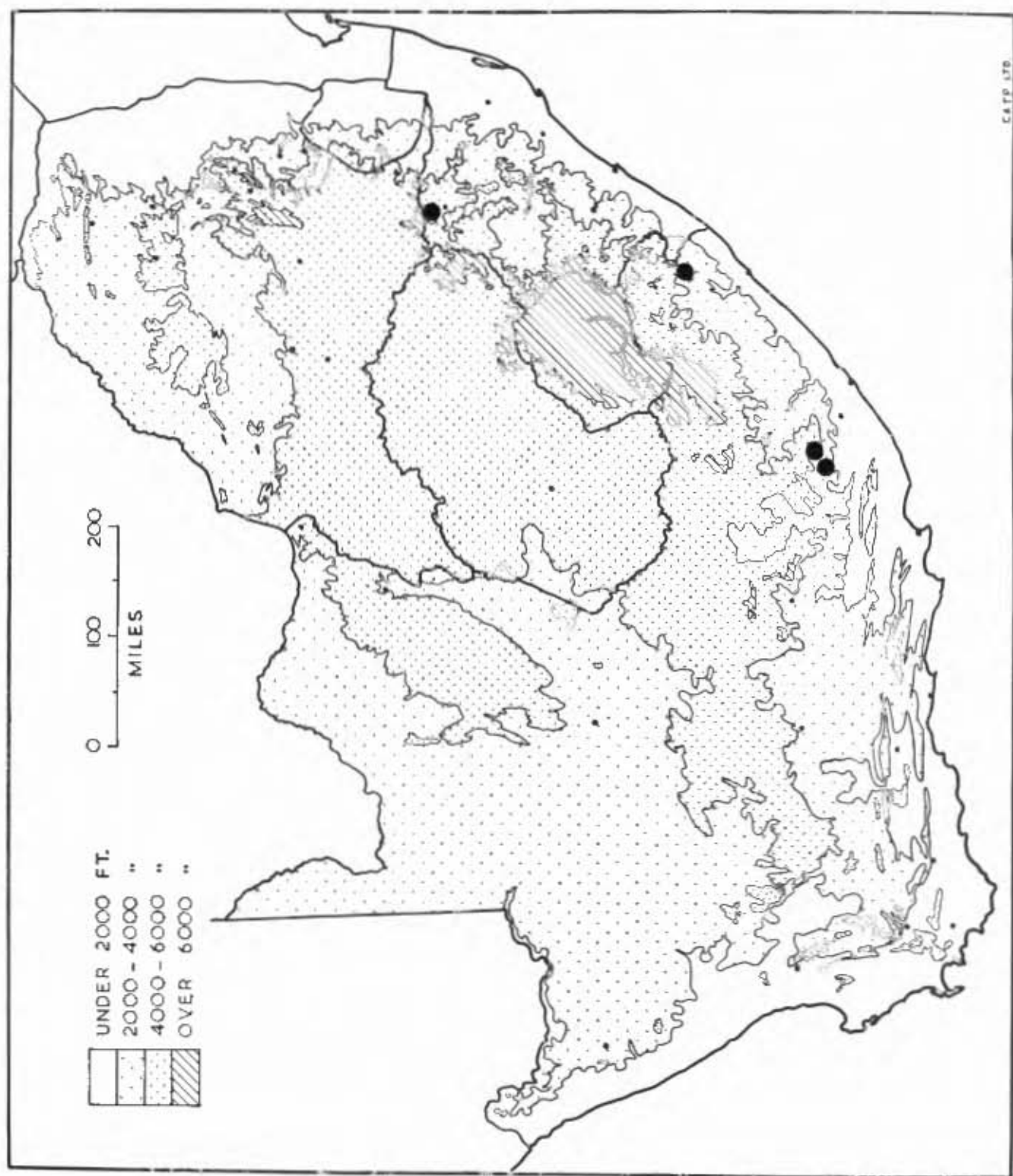
Precipitation at accurately recorded localities is rather high, from 30" to 50" per annum. At a locality in the Eastern Cape (near Fort Donald, Mount Ayliff District, Hall 770) the species was found at a place where mists could be rather common. It was growing on an exposed part of a seaward-facing escarpment, and dense mist was noted at the time of collection. It is possible that other localities, nearly all known to be at higher elevations than their surrounding countryside, may also receive frequent mists. Frost may occur at the localities on 20 - 60 days of the year. The regional soil types in

the areas where the species is found vary from the coastal podsoils of the Eastern Cape to lateritic red earths and brownish-red ferruginous lateritic soils. All available records indicate that the species inhabits the margins of upland forests, often in dense herbaceous vegetation. Only small numbers of plants are recorded in a given area. Available data shows that flowering takes place in the warm wet summer months (see Table 13).

The rarity of localities throughout the distribution range of this species may be in part apparent, due to the plants being inconspicuous and easily overlooked by collectors. The flowers are small and very darkly coloured, and the broad leaves may be obscured by the dense vegetation in which the species grows. The known ecological conditions under which E.meleagris grows are found in many other parts of the Eastern Cape and Natal, some having been frequently visited by collectors (e.g. the Pietermaritzburg District and the Dumisa escarpment, Umzinto District). General ecological conditions (as given above) are evidently not the chief factors limiting the distribution of this species.

Table 13: Records in herbaria of the month of collection of flowering specimens of Eulophia meleagris Reichb.f.

<u>Month</u>						<u>No. of records</u>
December	..	..	..	..	..	4
January	..	..	..	..	..	3



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Map 13: Distribution of *Eulophia meleagris* Reichb.f. in South Africa.

13. EULOPHIA CUCULIATA (AFZEL. EX SW.) STEUD.

(i) Description: Rhizome subterranean, moniliform. Leaves absent to partly developed at anthesis, later up to 30 cm. long and 10 mm. wide, plicate with 3 - 5 veins emergent on the abaxial surface. Scape about 25 - 50 cm. tall, rather slender. Sheaths on the scape usually rather shorter than their internodes, somewhat loosely clasping. Bracts usually a little shorter than the ovary, subulate to lanceolate acuminate. Raceme rather lax; flowers 3 - 15, with reflexed sepals and slightly spreading petals.

Odd sepal (11) - 14 - 16 - (27) mm. long, oblong, obtuse to apiculate; lateral sepals similar, very oblique at the base. Petals as long as the sepals, rotund. Column 9 - 18 mm. long. Mentum slightly longer than the column, fused to the subquadrate side lobes of the lip for most of its length. Mid-lobe of the lip broader than long, truncate to truncate-retuse. Base of the lip forming with the mentum and side lobes a shallow, broadly rounded sac. Crests consisting of two (rarely three) rhomboid-oblong to cuneate subtruncate lamellae near the distal rim of the lip sac, usually with their longest axis set obliquely to the lip surface, rarely also with 2 - 3 very low ridges near the base of the mid-lobe.

Sepals brownish maroon. Petals pale purplish pink. Lip white tinged with pale purplish pink on the mid-lobe and on the margins of the side lobes. Inner

surface of the lip sac yellow with orange and purple spots. Crest lamellae yellow sometimes tinged with purple. No flower scent reported.

(ii) Distinctions from similar taxa: The present concept may be readily distinguished by the large, broadly rounded sac at the base of the lip, the broad truncate mid-lobe, and the crests, which consist of 2 - 3 rhomboid suberect lamellae at the distal rim of the lip sac, sometimes with low ridges distally. The species is seldom mis-identified with other taxa in herbaria.

(iii) Nomenclature: The earliest description resembling the present concept was published by Swartz in 1805, with the name Limodorum cucullatum.

This name had been published as a nomen nudum by Swartz in 1800. In this earlier publication the name was followed by "Afz.", which according to a footnote, signified that the species was to be "communicated by the collector later on" (B. Nordenstam, transl.) No later description ("communication") can be attributed to the collector Afzelius, so that Swartz probably meant that actual specimens were to be sent. If Swartz had not seen any specimens in 1800, then the name he cites, Limodorum cucullatum, which refers to the cucullate lip mentioned in later descriptions, must have been suggested by someone who had examined the material, probably Afzelius.

The correct citation of the name should therefore be Limodorum cucullatum Afzel. ex Sw.

Swartz' description of Limodorum cucullatum is brief, and matches the present concept in all but one character: the lip is said to be erect. This might possibly occur if the flowers were partly open and scarcely resupinate. The type, an Afzelius specimen from Sierra Leone, cannot be found, although it was cited by Rolfe after a description clearly referring to the present concept (Rolfe 1897). As the present taxon is very distinctive, it is most unlikely that Rolfe could have mis-identified the Afzelius specimen. Limodorum cucullatum Afzel. ex Sw. therefore probably refers to the present species.

The process by which the epithet cucullatum came to be transferred to Eulophia is complex. Lindley (1833) included the name Limodorum cucullatum, with a copy of Swartz' description, in a list of species doubtfully belonging to Eulophia. Although Lindley erroneously gives the original description as having been written by Afzelius and published by Persoon (1807), the reference to the original concept of the taxon is reasonably clear (Persoon had given a copy of the original description, correctly attributing it to Swartz). In 1840, Steudel made the combination Eulophia cucullata for the first time, giving only Lindley's reference as the source of the basionym. Steudel inserted a question mark before the epithet, but this in no way invalidates the public-

ation of the combination (Art. 34, Note 1, Int. Code 1961).

In 1862, Lindley published a description matching the present concept, with the name Lissochilus arenarius. A sheet in the Lindley herbarium at Kew (K) is labelled as quoted in the type description (Barter 1488, without precise locality), and bears specimens agreeing with the concept without reservation. Lissochilus arenarius Lindl. should therefore be regarded as a synonym of Eulophia cucullata (Afzel. ex Sw.) Steud. In 1899, Bolus transferred the epithet arenarius from Lissochilus to Eulophia.

In 1924, Schlechter published a full description, agreeing in all details with the present species, with the name Lissochilus amabilis. The description is based on specimens from Natal, and the available iso-syntype material clearly belongs to the present taxon. L.amabilis should therefore also be regarded as a synonym of Eulophia cucullata (Afzel. ex Sw.) Steud. Two other names have been reduced to the synonymy of E.cucullata by Summerhayes (1953 , 1954 ). These are Lissochilus roscheri Reichb.f., based on material from East Africa and L.kassnerianus Kraenzl., described from specimens from N.W. Rhodesia. Descriptions and available types of these species were examined and no reason was found for differing from Summerhayes' conclusions.

Further research may show that certain other names may have to be regarded as later synonyms of

Eulophia cucullata: Lissochilus dilectus Reichb.f.,  
L.stylites Reichb.f., L.monteiroi Rolfe and L.euanthus  
Schltr. As these were published later than Limodorum  
cucullatum Afzel. ex Sw., and are based on specimens  
from Angola, Tanganyika and the Sudan, they were not  
studied in detail (c.f. page 95).

(iv) Nomenclatural references and types:

Limodorum cucullatum Afzel. ex Sw. Vet. Acad. Handl.  
Stockholm 21: 243 (1800), nomen nudum; Sw. Schrad. Journ.  
1: 86 (1805). Holotype: Afzelius s.n., Sierra Leone.

Eulophia cucullata (Sw.) Steud. Nom. Bot. ed. 2,  
1: 605 (1840).

Lissochilus arenarius Lindl. J. Linn. Soc. 6: 133  
(1862). Holotype: Barter 1488, sine loc. (K, holotype!).

Lissochilus roscheri Reichb.f. Otia Bot. Hamb. 62  
(1878). Syntypes: Roscher s.n., Zanzibar; v. Beuglin  
s.n., Bongo, June 1863.

Eulophia arenaria (Lindl.) Bolus J. Linn. Soc. 25:  
185 (1899).

Lissochilus kassnerianus Kraenzl. Bot. Jahrb. 51:  
391 (1914). Holotype: Kassner 2105, N.W. Rhodesia (K,  
isotype!).

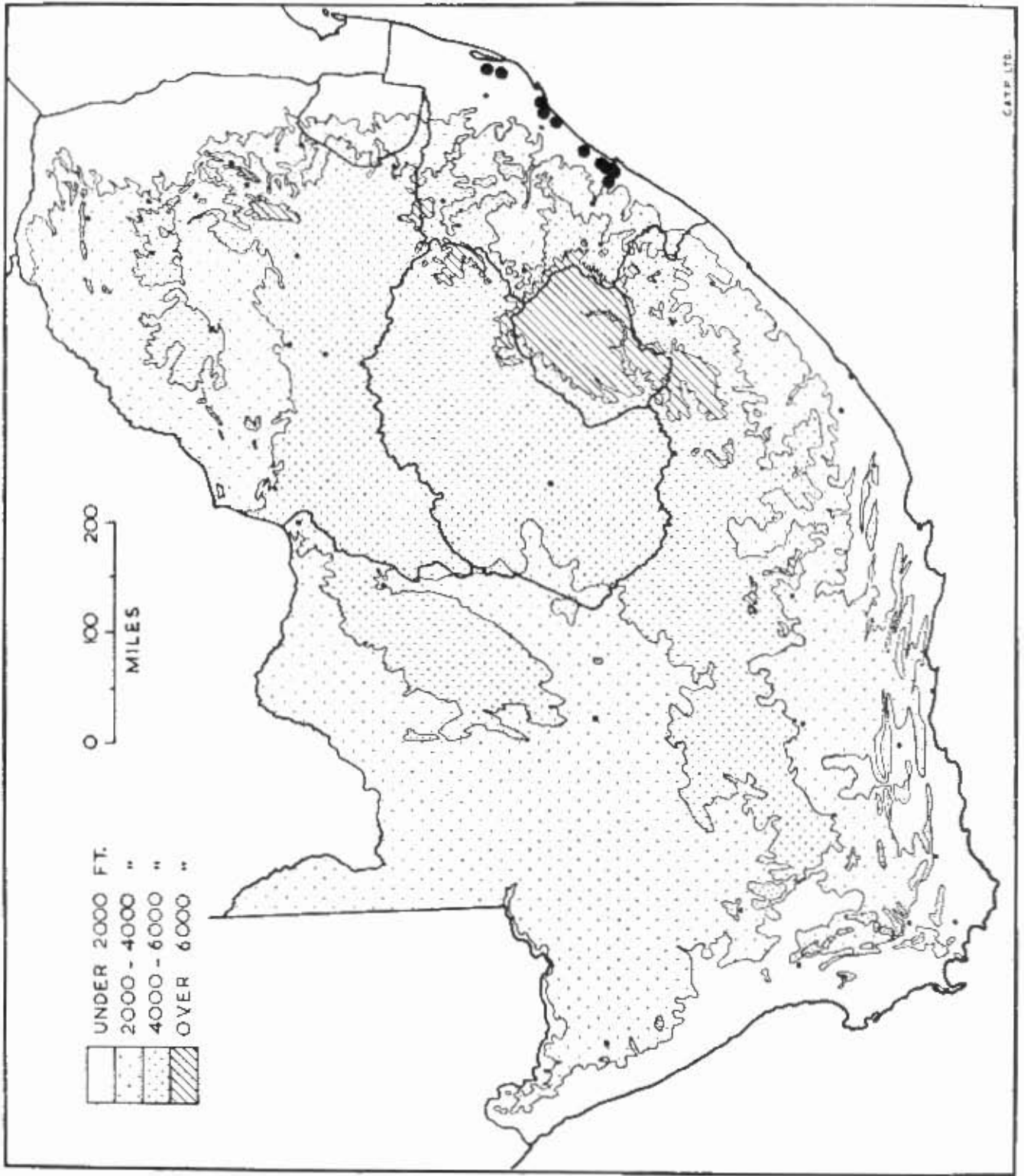
Lissochilus amabilis Schltr. Ann. Transv. Mus. 10:  
240 (1924). Syntypes: Wood s.n., nr. Tongaat River, Nov.  
1887 (BOL, isosytype!; K, isosytype!); Wood 820, Inanda  
(K, isosytype!).

**(v) General biology:** This species has a very wide distribution, extending north from Natal through most of the East African territories to the Sudan and west to Angola and the central Congo Basin; in West Africa it extends from Southern Nigeria along the coast to Gambia. In South Africa, the species is confined to a narrow belt along the Natal coast (see Map 14).

Precipitation at accurately recorded South African localities is rather high, not less than 35" and usually 40" - 60" per annum. Frost is very rarely experienced. The regional soil types vary from the Natal coast belt podsols to light brown sand; collectors record marshy soils at some localities. The species inhabits grassy places in coastal bushveld, and may be frequent to locally abundant at a given locality (E.Harrison, priv. comm.). Flowering takes place in the early summer (see Table 14).

**Table 14:** Records in herbaria of the month of collection of flowering specimens of E.cucullata (Afzel. ex Sw.) Steud. in South Africa.

<u>Month</u>	<u>No. of records</u>
September .. .. .	1
October .. .. .	3
November .. .. .	7



Map 14: Distribution of *Eulophia cucullata*  
(Afzel. ex Sw.) Steud. in South Africa.

14. EULOPHIA CALANTHOIDES SCHLTR.

(i) Description: Rhizome subterranean, moniliform. Leaves apparently fully developed at anthesis, up to 70 cm. long and 6.0 cm. broad, thin-tissued with several emergent veins on the abaxial surface. Scape 30 - 75 cm. tall, rather stout below. Sheaths on the scape longer or equalling their internodes, somewhat loosely clasping. Bracts generally longer than the ovary, lanceolate acuminate. Raceme dense as the first flowers open, later becoming lax and elongate; flowers about 7 - 25, with spreading sepals.

Odd sepal (20) - 26 - 30 - (33) mm. long, narrowly lanceolate to lorate, acuminate to very acute; lateral sepals similar. Petals as long as the sepals, lanceolate to narrowly ovate, rarely ovate-oblong, acute. Column 4 - 5 mm. long. Mentum vestigial to absent. Spur at the base of the lip narrowly cylindrical, 4 - 5 mm. long; lip also with a broadly concave sac 3 mm. deep, beneath the apex of the column. Side lobes of the lip with the free apical portion short and narrow to vestigial; general shape of the basal half of the lip cuneate from a narrow base. Mid-lobe semi-elliptic, obtuse to mucronate. Crests consisting of low, shortly pubescent ridges on the central nerves in the basal  $1/3$  -  $1/4$  of the lip lamina.

Sepals purplish-brown outside, brownish green within. Petals very pale yellow, tinged outside with

purple near the base, the nerves marked with numerous minute blue speckles on the inner surface. Lip very pale yellow, with the central nerves and crested area bright yellow, and minute dark blue speckles along the chief lateral nerves. No flower scent detectable.

(ii) Distinctions from similar taxa: The broadly concave sac in the lip lamina readily distinguishes this taxon from all other South African species of Eulophia. However, it has been mis-identified in herbaria with Eulophia welwitschii (Reichb.f.) Rolfe and E.ovalis Lindl., both of which differ in having papillose crests and the side lobes of the lip well developed, with the free distal apices quite broad.

(iii) Nomenclature: The earliest description matching the present concept was published by Schlechter in 1895, with the name Eulophia calanthoides. The detailed description agrees with the present species in all but one feature: the cylindrical spur at the base of the lip is said to be "very short". A sheet at the Bolus Herbarium (BOL), labelled with the collector's number and locality given in the description (Wood 4626, upper region of Natal) bears the inscription "E.calanthoides RS Type!" in Schlechter's handwriting. The specimen on the sheet agrees with the present concept without reservation, including the elongate spur at the base of the lip, which

being recurved gives the superficial impression of being quite short. Although Schlechter wrote 'Type' on this sheet, it is rather likely that the actual holotype may have been in his private herbarium which was destroyed at Berlin (B) during World War II. The Bolus Herbarium specimen should probably be regarded as an isotype. There is also material of the type number in the Natal Herbarium (NH), but there is no evidence that it was seen by Schlechter; it nevertheless clearly matches the concept.

In 1912, Rolfe simultaneously published three descriptions resembling the present species, with the names Eulophia acuminata, E.allisonii and E.subintegra. While there is no reference to a broadly rounded sac in the lip lamina in these descriptions, most other features given by Rolfe clearly agree with the present concept. The types of all three species from the eastern parts of South Africa were examined in the Herbarium at Kew (K), and were found to be well within the range of variation of the present taxon, except for one of the syntypes of Eulophia allisonii, which belongs to E.macowanii Rolfe. This specimen (Todd s.n., nr. Grahamstown) may be excluded by the type description of E.allisonii in having crests of tall lamellae and papillae (c.f. Art. 70, Int. Code 1961). E.acuminata Rolfe, E.allisonii Rolfe and E.subintegra Rolfe should therefore be regarded as later synonyms of E.calanthoides Schltr.

(iv) Nomenclatural references and types:

Eulophia calanthoides Schltr. Bot. Jahrb. 20, Beibl. 50: 1 (1895). Holotype: Wood 4626, upper region of Natal (BOL, isotype!; NH, type number!).

E.acuminata Rolfe Fl. Cap. 5(3): 39 (1912). Holotype: Wood 3428, Natal, near Estcourt (K, holotype!).

E.allisonii Rolfe Fl. Cap. 5(3): 39 (1912), excl. specim. Todd s.n. Syntype: Allison s.n., South Africa (K, syntype!).

E.subintegra Rolfe Fl. Cap. 5(3): 41 (1912). Holotype: Allison "S", Natal, Oliviershoek (K, holotype!).

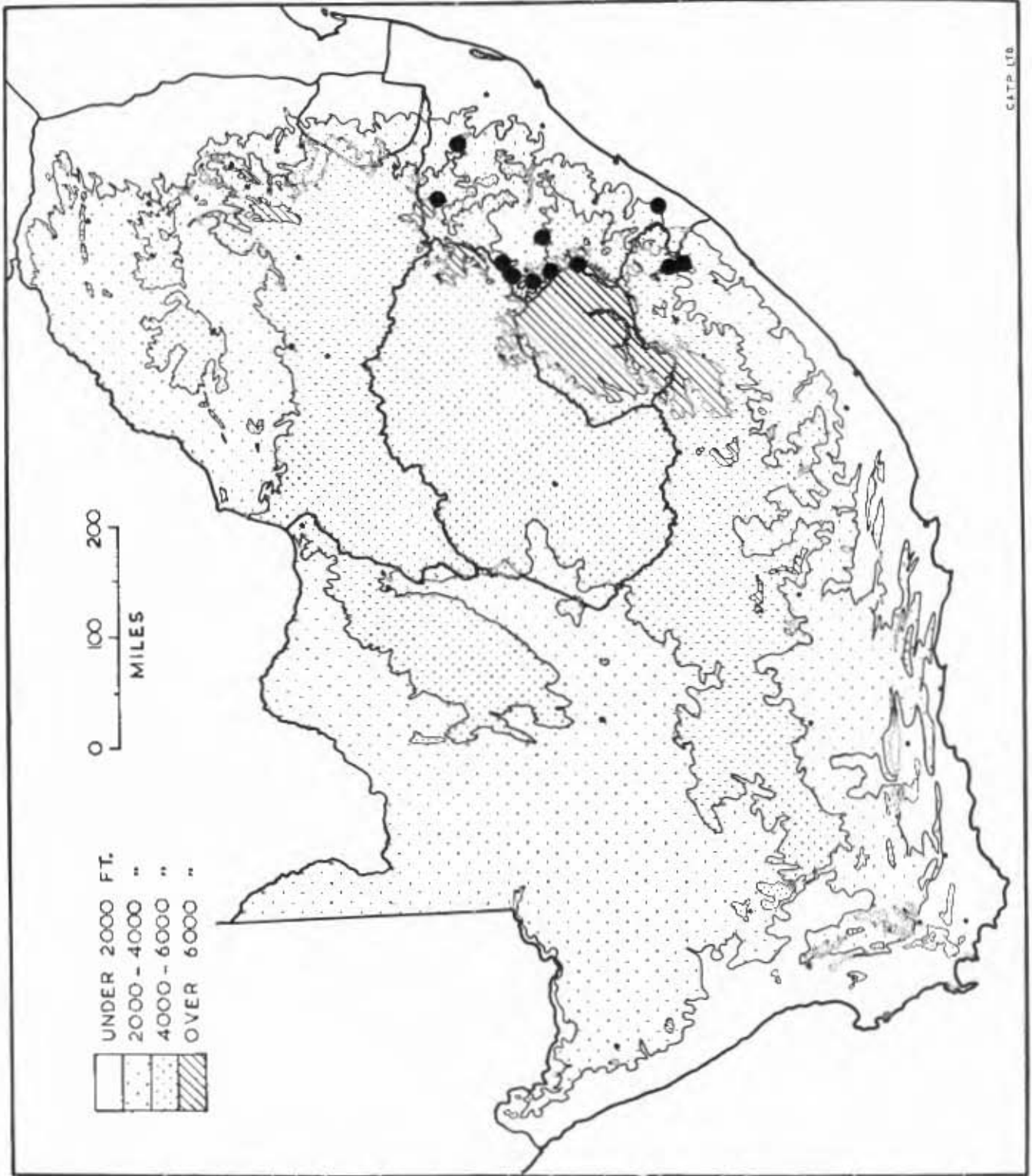
(v) General biology: This species has been recorded mostly at higher altitudes in the north-eastern Cape and Natal (see Map 15).

Precipitation at accurately recorded localities is generally high, mostly ranging from 40" to 60" per annum, rarely as low as 30". Frost may be experienced on 20 - 80 days of the year. The species occurs in areas with several different regional soil types: the Natal coast belt podsols, lateritic red earths, ferruginous lateritic soils, and highveld prairie podsols. The species appears to be confined to bushy and tall herbaceous vegetation at forest margins, where it may be found in colonies of a few scattered individuals. Flowering takes place in the later summer months (see

Table 15). The chromosome number of material from the Natal Drakensberg was found to be approximately  $n = 23$ .

**Table 15:** Records in herbaria of the month of collection of flowering specimens of Eulophia calanthoides Schltr.

<u>Month</u>						<u>No. of records</u>
December	..	..	..	..	..	6
January	..	..	..	..	..	4
February	..	..	..	..	..	4



CATP LTD

Map 15: Distribution of *Eulophia calanthoides* Schltr. in South Africa.

15. EULOPHIA PARVILABRIS LINDL.

(1) Description: Rhizome subterranean, moniliform.

Leaves fully developed at anthesis, the outer short and broad, the inner up to 60 cm. long and 5.5 cm. broad, thin-tissued with several veins emergent on the abaxial surface. Scape 30 - 85 cm. tall, rather stout basally. Sheaths on the scape generally longer than their internodes, loosely clasping, the lower sheaths with long spreading apices. Bracts lanceolate, acuminate, rather longer than the ovaries. Raceme dense as the first flowers open, becoming lax and elongate later; flowers 6 - 18, with the perianth spreading and the ovary only slightly twisted.

Odd sepal (24) - 27 - 31 - (35) mm. long, narrowly oblong to slightly elliptic; lateral sepals similar. Petals broadly elliptic, as long as the odd sepal, obtuse. Column 5 - 6 mm. long. Mentum vestigial to 1 mm. long, passing into a cylindrical spur 5 - 6 mm. long. Lip often a little shorter than the petals, cuneate basally with the side lobe apices vestigial to irregular or broad and rounded. Mid-lobe generally semi-elliptic, obtuse, the margins entire to finely undulate. Crests consisting of 2 - 7 laterally subconfluent ridges on the basal third of the lip, sometimes terminating in a short tooth.

Sepals pale purplish brown. Petals pale straw yellow with the base pale purple. Lip with the basal third dark maroon, distally pale yellow. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has occasionally been mis-identified with Eulophia macowanii Rolfe, which it resembles in many respects. E. macowanii differs in having numerous slender papillae on the central third of the lip, generally narrower leaves (1 - 3 cm. broad) and the lip white with only the main lateral nerves purple near the base.

(iii) Nomenclature: The earliest description resembling this species was published by Lindley in 1837, with the name Eulophia parvilabris. The description is sufficiently detailed to exclude similar taxa (e.g. E. macowanii Rolfe) and agrees with the concept in all but one feature: the petals are described as oblong. A sheet in the Lindley orchid herbarium at Kew (K) is labelled with the collector and locality cited in the type description (Drège s.n., inter Omsamwubo et Omsamcaba), and bears the identification "Eul. parvilabris" in Lindley's handwriting. The specimen on the sheet agrees with the present concept and the type description, but for having elliptic and not "oblong" petals. This specimen should be regarded as the holotype of Eulophia parvilabris Lindl., which may be taken as the earliest name referring to the present taxon.

In 1912, Rolfe published simultaneously two descriptions resembling the present species, with the names Eulophia latipetala and E. rehmannii, and another in 1916

with the name E.stewartiae. While the type specimens from Swaziland and the Transvaal clearly match the present concept in all respects, there are minor discrepancies in two of the type descriptions: E.latipetala is said to have a very short subconical spur and broadly ovate petals, and the flowers of E.stewartiae are described as having "brown centres". As the types belong to the present species, it is necessary to regard Eulophia latipetala Rolfe, E.rehmannii Rolfe and E.stewartiae Rolfe as later synonyms of E.parvilabris Lindl.

In 1924, Schlechter published a full description matching the present concept in nearly all details, with the name Eulophia amplipetala. The petals are described as broadly oblong, but in fact the petals are broadly elliptic in isotype material at the Pretoria Herbarium (PRE: Scheepers in Herb. Transv. Mus. 15023, Ermelo); this material agrees in all other respects with the present species. It is very probable that E.amplipetala Schltr. should be regarded as a later synonym of E.parvilabris Lindl.

(iv) Nomenclatural references and types:

Eulophia parvilabris Lindl. Comp. Bot. Mag. 2: 201 (1837). Holotype: Drège s.n., inter Omsamwubo et Omsamcaba (K, holotype!).

E.latipetala Rolfe Fl. Cap. 5(3): 41 (1912).  
Holotype: Bolus 10975, Houtbosch Mountain, Pietersburg

District (BOL, Holotype!).

Eulophia rehmannii Rolfe Fl. Cap. 5(3): 41 (1912).

Holotype: Rehmann 5845, Houtbosch (K, holotype!).

E.stewartiae Rolfe Kew Bull. 1916: 78 (1916). Hol-

otype: Stewart 41, Hlatikulu ("Hlalikulu") Swaziland (K, holotype!).

E.amplipetala Schltr. Ann. Transv. Mus. 10: 238

(1924). Holotype: Scheepers s.n. in Herb. Transv. Mus. 15023, Spitskop, Ermelo District (PRE, isotype!).

(v) General biology: Eulophia parvilabris occurs in a belt passing from the Eastern Cape through Natal to Swaziland and the higher parts of the Eastern Transvaal. It is found at lower altitudes in the south and at higher places in the north (see Map 16). There appear to be no records of the species occurring in Tropical Africa.

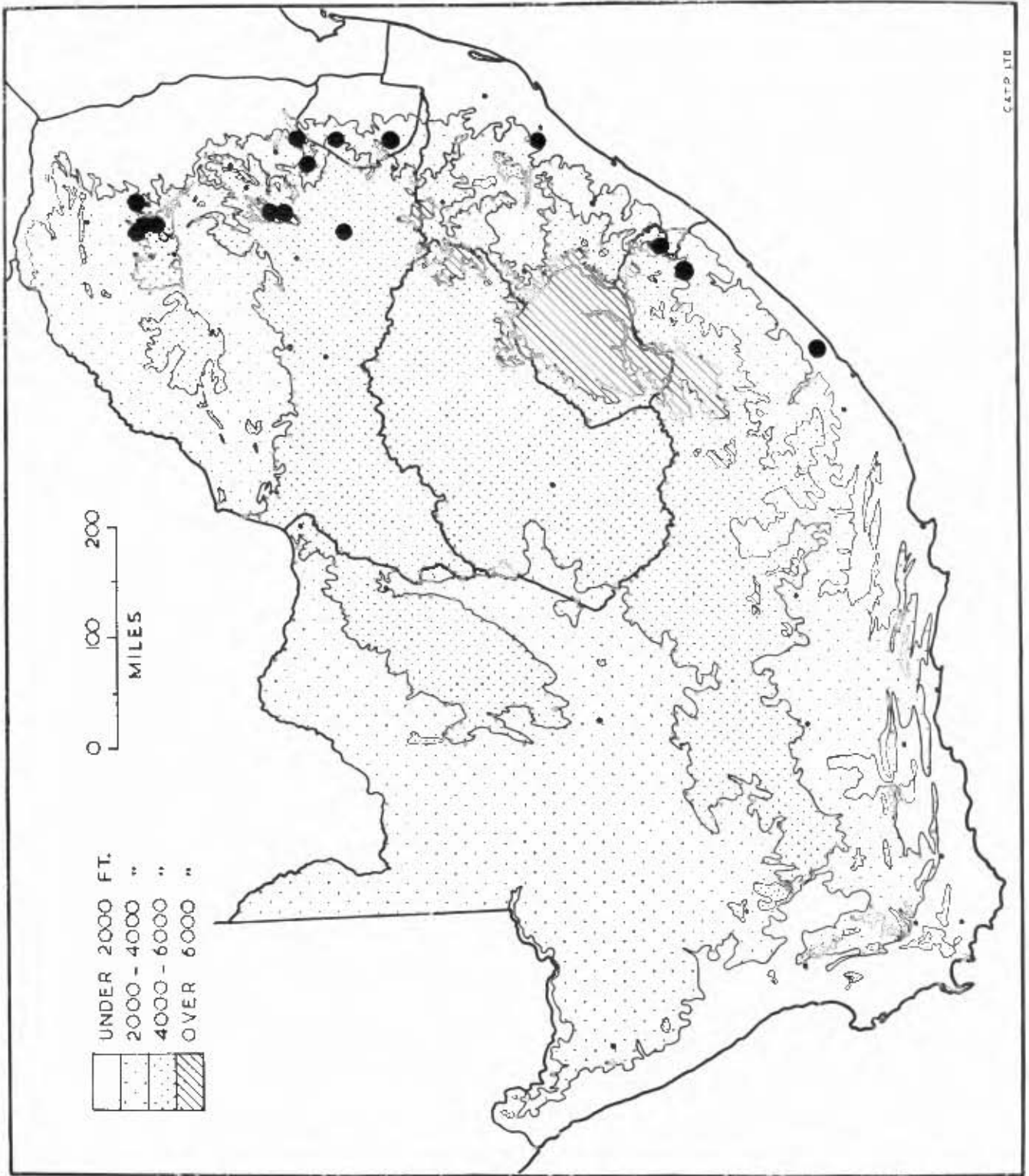
Precipitation at accurately recorded localities usually lies in the range 40" - 60", rarely as low as 30" - 35". Frost may be absent, or there may be up to 80 days with frost per year. The regional soil types where the species is found vary from podsoils to lateritic and ferruginous lateritic soils, and dark brown unleached sandy soils.

The species may be found in open grassland, on moist steep slopes and flats. The plants tend to be rather widely dispersed. Flowering takes place in the

warm wet summer months (see Table 16). The chromosome number of material from the Eastern Transvaal was found to be approximately  $2n = 56$  (Hall, 1959).

**Table 16:** Records in herbaria of the month of collection of flowering specimens of Eulophia parvilabris Lindl.

<u>Month</u>						<u>No. of records</u>
December	..	..	..	..	..	3
January	..	..	..	..	..	11
February	..	..	..	..	..	6



Map 16: Distribution of *Lulophia parvilabris* Lindl. in South Africa.

16. EULOPHIA CODDII HALL, SP. NOV.

(i) Description: Folia anguste linearia acuminata, canaliculata, ad 20 - 25 cm. longa et 5 mm. lata. Scaapus 28 - 42 cm. longus, tenuis, vaginis arcte amplexicaulis internodiis paulo minoribus vestitis. Bracteae ovarii fere aequantes, anguste lanceolatae, acuminatae. Racemus paulo densus; flores 6 - 15.

Sepalum anterius 12 - 15 mm. longum, oblongum, apiculatum; sepala lateralia similia, paulo falcata. Petala elliptico-ovata, longitudo sepala aequantes, obtusa vel subtiliter mucronata. Columna 8 mm. longa. Mentum 4 - 5 mm. longum baso labelli calcar obtusum breviter conicum formans. Labellum manifesto 3-lobatum, lobis lateralis dimidio longitudo menti adnatis, apicis libris irregulariter rotundis et tertiis partibus longitudo lorum lateralium. Lobum intermedium late oblongum obtusum, marginis paulo irregulariter denticulatis. Labellum nervis mediis carinis verrucosis paene ad apicem cristatis.

Leaves narrowly linear, up to 25 cm. long and 5 mm. wide, more than half the length of the scape, channeled adaxially, with fine emergent veins on both surfaces. Scape 28 - 42 cm. long, slender. Sheaths on the scape rather shorter than their internodes, closely clasping. Bracts about as long as the ovary, narrowly lanceolate, acuminate. Raceme rather lax, with 6 - 15 flowers.

Odd sepal 12 - 15 mm. long, oblong, apiculate; lateral sepals similar, slightly falcate. Petals elliptic-ovate, obtuse to finely mucronate, as long as the odd sepal. Column 8 mm. long. Mentum 4 - 5 mm. long, forming with the base of the lip an obtuse shortly conical spur. Side lobes adnate to the distal half of the mentum, the apical free portion one third of the total length of the side lobe, irregularly rounded. Mid-lobe broadly oblong to slightly expanded distally, obtuse, irregularly denticulate. Crests consisting of low verrucose ridges on all central nerves of the lip, extending to near the mid-lobe apex.

Sepals brown. Petals cream coloured. No flower scent reported.

(ii) Distinctions from similar taxa: This species is rather similar to Eulophia cooperi Reichb.f., which differs in having the sheaths on the scape loosely clasping, the distal free portion of the side lobes of the lip short, distinct papillae on the lip and a nearly concolorous perianth. It also resembles smaller flowered forms of E.platypetala Lindl., which differ chiefly in having the crests consisting of tall lamellae, the mid-lobe with entire margins, the bracts less than 3/4 the length of the ovary and the sheaths loosely clasping the scape.

Eulophia parviflora (Lindl.) Hall differs in having the side lobes of the lip truncate and subquadrate, the

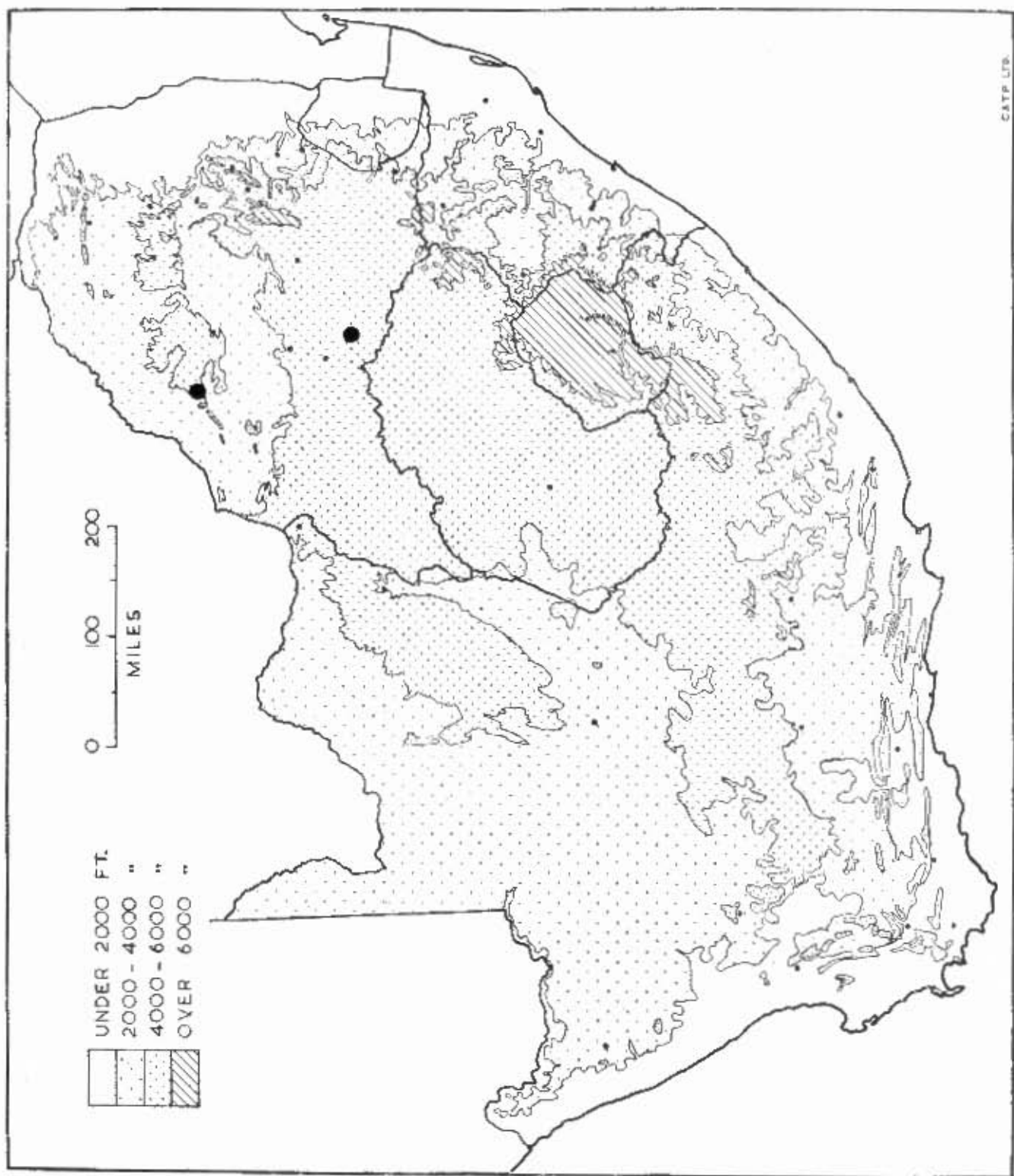
petals obovate - elliptic, shortly clawed at the base, and the sepals and petals coloured orange to reddish brown on the inner surface. The forms of E.clavicornis Lindl. and E.ovalis Lindl. that superficially resemble the present species in colour and morphology, differ in having the distal crests made up of slender papillae or tall lamellae, and the margins of the mid-lobe entire.

(iii) Nomenclature: This species is described here for the first time, and in accordance with Art. 36 (Int. Code 1961) a Latin description has been included to validate its publication should the present work be printed. The species is named after the collector of the type material, Dr.L.E. Codd.

(iv) Type material: Holotype: Codd 4811, Groothoek farm, Krantzberg Mt., Waterberg District, Transvaal (PRE!).

(v) General biology: Eulophia coddii is known to occur at two localities in the Transvaal (see Map 17). Both places receive a slightly low rainfall, 25" - 30" per annum. The northern locality may experience up to 20 days with frost each year; that in the southern Transvaal may get 40 - 60 days with frost per annum.

At both localities the species was found on a steep hillside on soil derived from sandstone. It was growing in "grassy places" in the north, and in "mixed bush" in the south. At both places the species was flowering in early December.



Map 17: Distribution of Eulophia coddii

Hall sp. nov.

17. EULOPHIA TUBERCULATA BOLUS

(1) Description: Rhizome subterranean, moniliform.

Leaves absent to partly developed at anthesis, up to 24 cm. long and 18 mm. broad, widely spreading, thick-tissued with numerous scarcely emergent veins. Scape about 15 to 40 cm. high, slender. Sheaths on the scape generally much shorter than their internodes, closely clasping. Bracts less than half the length of the ovary, lanceolate acuminate. Raceme rather lax, elongate; flowers about 10 - 30, with reflexed sepals and spreading petals.

Odd sepal (5.5) - 6 - 7 - (8.3) mm. long, broadly elliptic to suboblong, mucronate to obtuse; lateral sepals similar. Petals 1.3 - 1.5 times as long as the odd sepal, very broadly ovate, obtuse to minutely mucronate. Column 3 - 4 mm. long, stout. Mentum a little shorter than the column, bearing two calli on the inner surface distally, pressed together and forming with the base of the lip a short passage to a vestigial spur. Side lobes of the lip attached to the full length of the mentum, suboblong with their longest axis almost perpendicular to the column. Mid-lobe subelliptic, obtuse to acute, the sides deflexed and the apex incurved. Crests in the basal half of the lip consisting of low fleshy ridges on the central nerves, rising distally to crenulate fleshy lamellae terminating abruptly near the apex of the mid-lobe.

Sepals yellowish green tinged with purple outside, purple with darker nerves inside. Petals dull white,

tinged with maroon, and the nerves marked reddish - purple inside. Side lobes and basal margins of the mid-lobe of the lip white tinged with reddish purple, the crests and the calli on the mentum yellow.

(ii) Distinctions from similar taxa: This species has frequently been mis-identified with Eulophia clitellifera (Reichb.f.) Bolus, which differs in having a cylindrical spur 2.5 - 4.0 mm. long, crests consisting of low verrucose ridges produced chiefly on a convexity on the mid-lobe, and no calli on the inner surface of the mentum.

(iii) Nomenclature: The earliest description matching this species was published by Lindley in 1837, with the name Lissochilus platypetalus. Both syntypes in the Lindley orchid herbarium at Kew (K) were examined and found to agree with the original description and the present concept in all details. However, it is not possible to use the epithet platypetalus in combination with Eulophia when referring to this species, as the name Eulophia platypetala Lindl. was applied to a different taxon (see Part II, Section 22) in the same publication. In 1889, Bolus proposed Eulophia tuberculata as a new name for Lindley's Lissochilus platypetalus, which was correctly cited as a synonym.

In 1924, Schlechter published a description resembling the present species, with the name Lissochilus

leendertziae. Material of the type number at the herbaria at Kew (K) and Pretoria (PRE) agrees with the present concept and Schlechter's description in all respects. Although it is uncertain whether Schlechter actually saw these specimens, it is rather probable that the name Lissochilus leendertziae Schltr. refers to the present concept, and should therefore be regarded as a synonym of E.tuberculata Bolus.

It is likely that further research will show that Lissochilus verrucosus Rolfe, published in 1897 with a description based on material from Nyasaland, should also be regarded as a synonym of E.tuberculata Bolus. Being based on Tropical African material and published later than Lissochilus platypetalus Lindl., this taxon was not studied in detail (see page 95).

(iv) Nomenclatural references and types:

Lissochilus platypetalus Lindl. Comp. Bot. Mag. 2: 204 (1837). Syntypes: Drège s.n., C. B. S., chalky hills, kopje (K, syntype!); Drège s.n., C.B.S., Zuureberg among stones (K, isotype!).

Eulophia tuberculata Bolus J. Linn. Soc. 25: 184 (1889), nom. nov. pro syn. Lissochilus platypetalus Lindl., non Eulophia platypetala Lindl.

Lissochilus leendertziae Schltr. Ann. Transv. Mus. 10: 239 (1924). Holotype: Leendertz 281a,

Pretoria (K, type number!; PRE, type number!).

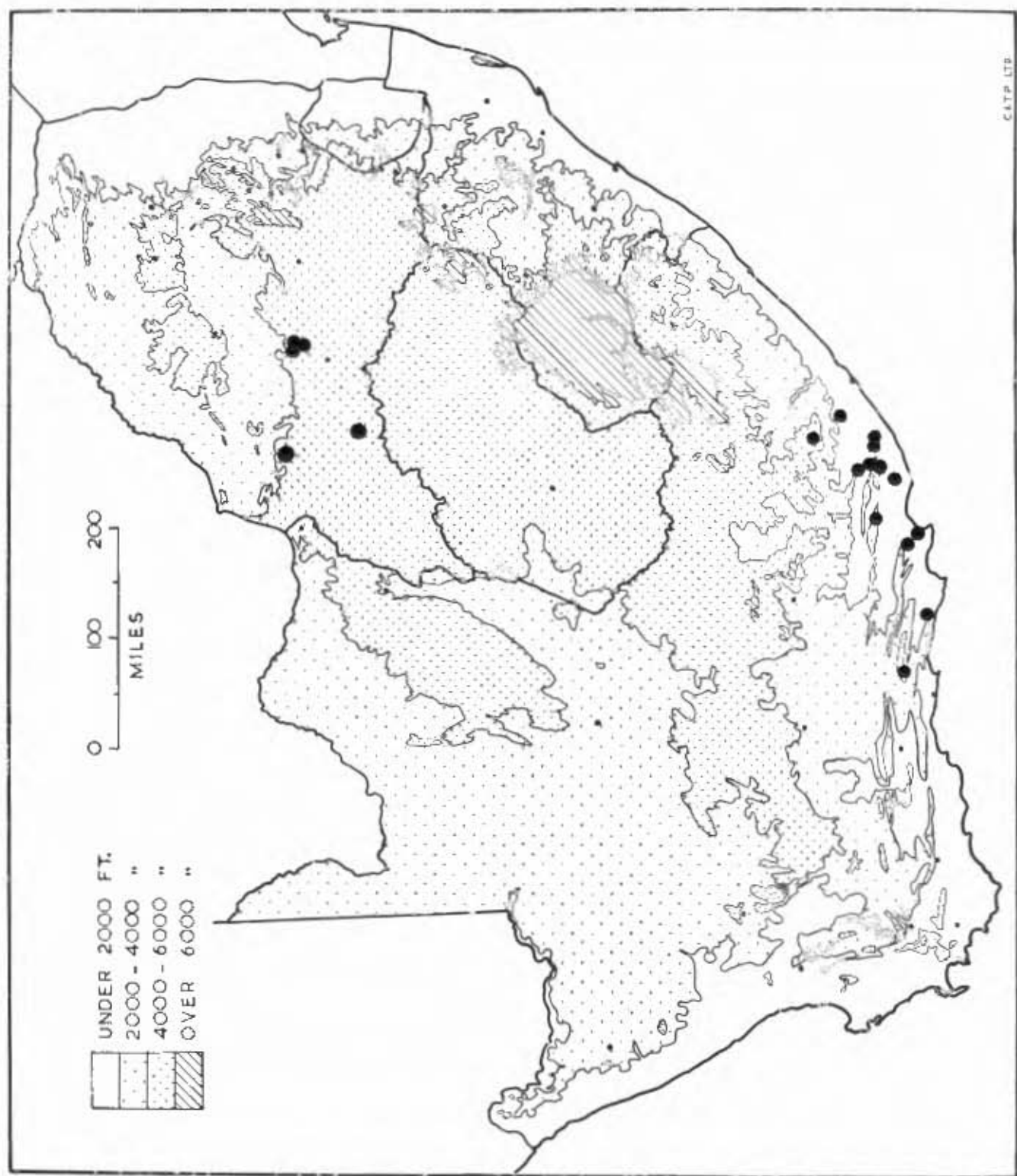
(v) General biology: Forms closely resembling the present species, and probably conspecific with it, are known from Angola, Northern and Southern Rhodesia, Nyasaland and south-western Tanganyika. In South Africa, the species is only known to occur in the south-eastern Cape and the Transvaal, the two areas being separated by an interval of about 400 miles (see Map 18).

Precipitation at accurately recorded localities in South Africa is generally rather low, lying in the range 15" - 25" per annum, rarely up to 30". There may be 20 - 40 days with frost per year. Many collectors record stony and sandy soils at the localities; the species has also been found in a red greasy loam. It appears to inhabit only exposed places, in rather dry grassland, Karroid scrub or savannah. The species may be rare to numerous (40 or more plants) at a given locality. The rarity of records of this species throughout its distribution range may be more apparent than real, as the plants are inconspicuous and could easily be overlooked by collectors.

Flowering takes place chiefly in the Spring, occasionally at other times of the year (see Table 17). The chromosome number of material from the central Transvaal was found to be  $n = 50$ .

Table 17: Records in herbaria of the month of collection of flowering specimens of Eulophia tuberculata Bolus.

<u>Month</u>					<u>No. of records</u>
July	..	..	..	..	1
August	..	..	..	..	3
September	..	..	..	..	8
October	..	..	..	..	13
November	..	..	..	..	16
December	..	..	..	..	3
January	..	..	..	..	1
February	..	..	..	..	0
March	..	..	..	..	1



Map 18: Distribution of *Eulophia tuberculata*  
Bolus in South Africa.

18. EULOPHIA PETERSII REICHB.F.

(1) Description: Rhizome consisting of largely aerial pseudobulbs, linked below soil level by short cylindrical portions 5 - 10 mm. in diameter. Pseudobulbs ovoid to narrowly ellipsoid, about 6 - 15 cm. tall, bearing leaves near the apex and broad caducous sheaths below. Leaves 2 - 4 (rarely 5), up to 40 cm. long and 4-4 cm. broad, stiffly erect to arcuate - spreading, rather thick - tissue with a deep channel adaxially, the margins with scabrous irregular enations about 0.3 - 0.5 mm. high.

Scape unbranched or with first or (rarely) second order branching, 0.9 - 2.0 m. tall, stout below. Sheaths on the scape generally 2 - 4 cm. long and much shorter than their internodes, closely clasping. Bracts less than half the length of the ovary, subulate to lanceolate acuminate. Flowers very laxly arranged on the inflorescence; petals slightly spreading with circinnate apices; sepals widely diverging with their apices often circinnate.

Odd sepal (19) - 23 - 28 - (33) mm. long, lorate to narrowly oblanceolate, apiculate; lateral sepals similar, very oblique at the base. Petals slightly shorter than the odd sepal, narrowly oblong, acute. Column 10 - 13 mm. long, with the operculum bilobed. Mentum 2 - 8 mm. long, terminating in a cylindrical spur 2 - 8 mm. in length and curved away from the ovary. Side lobes of the lip fused to the greater length of the mentum, distally varying

from narrow and curving gradually into the mid-lobe, to broad and with a very short, subtruncate free distal portion. Mid-lobe narrowly obovate to transversely oblong with the margins crispate and the apex obtuse. Crests consisting of lamellae on the central nerves of the lip, low basally and rising to more than 1.5 mm. tall on the mid-lobe, often somewhat dissected; main nerves elsewhere on the lip with very low broad ridges.

Sepals dark green, lined and often much tinged with dark purple. Petals green, the nerves marked with purplish brown on the inner surface. Mid-lobe of the lip white, variously tinged with pink; side lobes green, the main nerves marked with purplish brown. Crests bright purplish red, becoming pinkish white distally. Flowers with a musky, rather sweet scent.

(ii) Distinctions from similar taxa: This is one of the most distinctive species of *Eulophia* in South Africa, and is rarely mis-identified with other taxa. It can be recognised by the tall elongate pseudobulbs bearing leaves at the apex, the tall stout inflorescence which is often branched, the narrowly oblong circinnate petals, and the tall somewhat dissected lamellae on the lip.

(iii) Nomenclature: The earliest description matching this species was published by Reichenbach in 1847, with the name *Galeandra petersii*. The numerous details given

by Reichenbach all agree with the present concept. The type is quoted as a Peters specimen from Mozambique, and said to be in the Berlin Herbarium (B). It may therefore have been destroyed with other orchid collections at this herbarium during World War II. However, there are two flowers matching the present concept in the herbarium at Vienna (W), labelled "Galeandra petersii Mossambique Peters", in Reichenbach's handwriting. These flowers may have been removed from the Berlin specimen by Reichenbach, and might be regarded as part of the holotype.

In 1865, Reichenbach transferred the epithet petersii from Galeandra to Eulophia. At the same time, Reichenbach published another description matching the species, with the name Eulophia caffra. The description was made from living material grown at Chelmsford in England, originally from "Zulu territory". No herbarium material labelled with these details can be found. It is probably significant that a specimen in the Kew Herbarium (K: Sanderson 1015, Natal) bears the identification Eulophia caffra in Reichenbach's handwriting; however, this specimen was not mentioned in the original description and may not be regarded as a type. Many characteristics are given in the description, so that it is reasonably clear that the name Eulophia caffra Reichb.f. refers to the present concept, and should therefore be regarded as a later synonym of Galeandra petersii Reichb.f.

In 1910, Rolfe published a full description matching the present concept, with the name Eulophia circinnata. Material annotated as the type by Rolfe in the Kew Herbarium

(K) agrees with the present concept in every respect, so that E.circinnata Rolfe should be regarded as a later synonym of Eulophia petersii Reichb.f.

Further research may show that certain other names may also have to be regarded as synonyms of E.petersii Reichb.f.: Eulophia schimperiana A.Rich., E.baginsensis Reichb.f., E.longepedunculata Rendle, E.coleae Rolfe, E.phillipsiae Rolfe, E.smithii Rolfe and E.gumbariensis De Wildem. As these names were published later than Galeandra petersii and are based on material from Tropical Africa (Congo, East Africa, Sudan, Ethiopia and Eritrea) they were not studied in detail (c.f. page 95). Available material indicates that Eulophia alaifolia Welw. ex Reichb.f. may belong to a distinct but closely related species (see pages 56 - 60).

(iv) Nomenclatural references and types:

Galeandra petersii Reichb.f. Linnaea 20: 679 (1847).

Holotype: Peters s.n., Mozambique, 1843 (W, flores!).

Eulophia petersii Reichb.f. Flora 48: 186 (1865).

Basionym: Galeandra petersii Reichb.f.

Eulophia caffra Reichb.f. Flora 48: 186 (1865).

Type: s.leg., ex hort. Warner, Chelmsford.

Eulophia circinnata Rolfe Kew Bull. 1910: 280

(1910). Holotype: Kirk 64, Komati Poort, Transvaal (K, holotype!).

**(v) General biology:** Forms closely resembling Eulophia petersii and probably conspecific with it, are known in many parts of East Africa to as far north as Eritrea, and in the Congo basin in central Africa. In South Africa, the species is found in Central Natal and the higher parts of the eastern, northern and western Transvaal (see Map 19).

Precipitation at accurately recorded localities in South Africa is usually a little low (25" - 30" per annum), sometimes as low as 15" - 20" and rarely as high as 40" - 45". Frost is unknown at many localities, especially in Natal; at other places it may occur on up to 20 days of the year. The species is frequently found among granite rocks and outcrops, where the soils would be acid. It inhabits sheltered to quite exposed places in valley bushveld and thorn savannah. The species often forms large clumps, made up mostly of the persistent pseudobulbs of former season's growth. Such clumps and isolated individuals may be rare to numerous (30 or more) at a given locality. The plants are most conspicuous in the field, so that the collector's records probably reflect the true distribution pattern reasonably accurately.

Flowering takes place chiefly in the warm wet summer months (see Table 18). The chromosome number of material from Natal was found to be  $n = 24$ , the chromosomes being rather larger than usual.

**Table 18:** Records in herbaria of the month of collection of flowering specimens of Eulophia petersii Reichb.f. in South Africa.

<u>Month</u>						<u>No. of records</u>
November	..	..	..	..	..	8
December	..	..	..	..	..	14
January	..	..	..	..	..	9
February	..	..	..	..	..	3
March	..	..	..	..	..	1
April	..	..	..	..	..	1

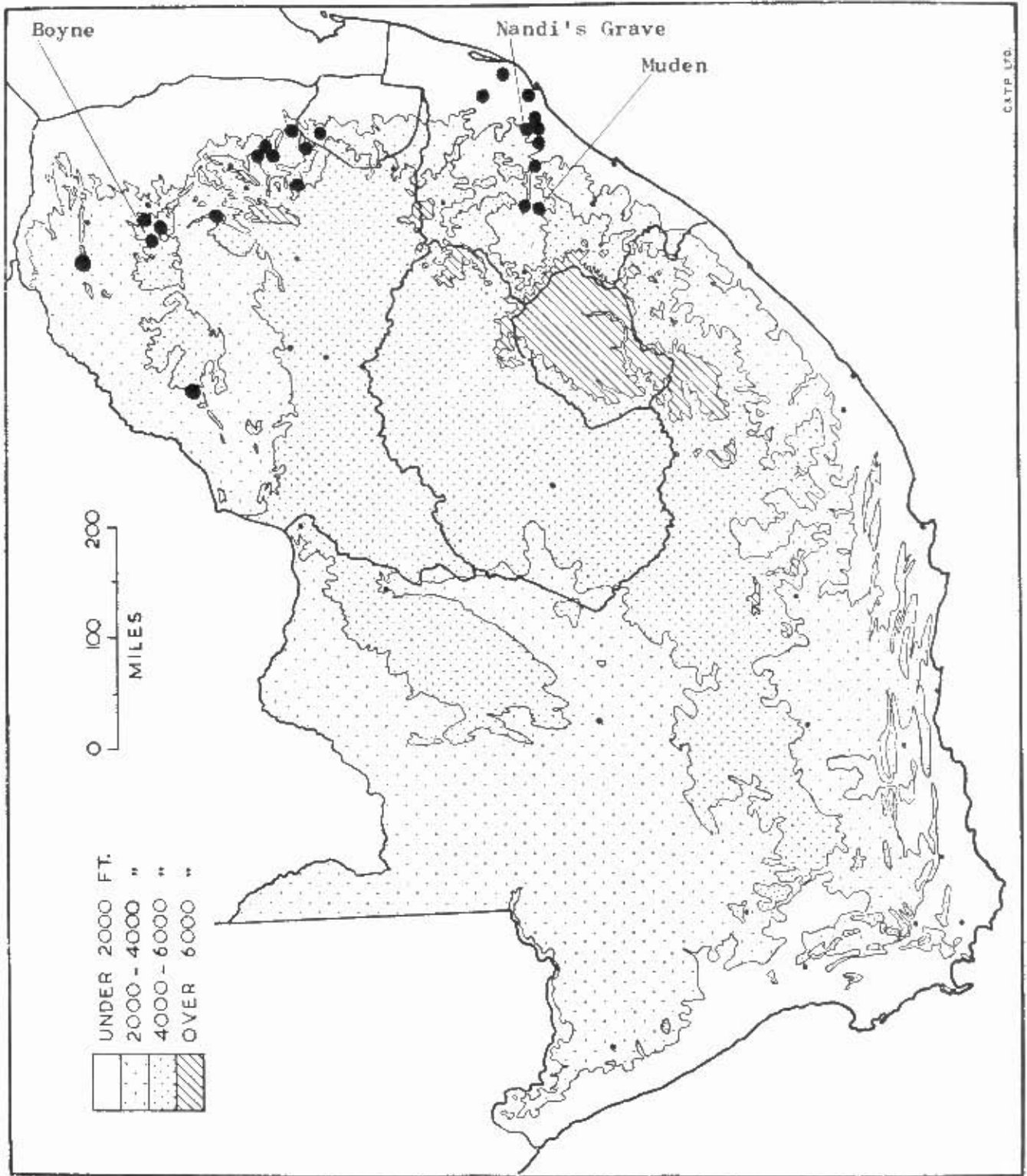
It was shown on pages 56 - 60 that E.petersii is a rather variable species. Herbarium studies have also indicated that there might be only limited variation among the plants of a local population. The variation of three populations was studied in the field, two being 65 miles apart in Natal (Muden, 28° 59'S. 30° 23'E.; Nandi's Grave, 28° 48'S. 31° 35'E.) and the other about 200 miles to the north in the Transvaal (Boyne, 23° 56'S. 29° 49'E.: see Map 19).

Measurements of two parameters of flower size, petal length and the distance from the spur apex to the base of the mentum are given in Diagram 36. Measurements of flowers from Muden are generally larger than those from the neighbouring coastal population at Nandi's Grave, which in turn generally exceed those from Boyne in the Northern Transvaal. Inflorescence branching was

was also studied in these populations. This is a rather conspicuous variable: the scapes may be unbranched, or may bear simple lateral branches (primary branching), or the laterals themselves may bear further branches (secondary branching). The frequencies of these forms in the three populations are given in Table 19. Plants in the two Natal populations usually lack lateral branches; if present, they are few in number on each inflorescence. Branching, in some cases prolific, is recorded throughout the Boyne population. Herbarium studies indicate that the distribution of this local variation is complex and may not take the form of a simple regional topocline.

Table 19: Showing the numbers of plants of Eulophia pet-  
ersii Reichb.f. with various degrees of inflorescence br-  
anching in field populations at Muden, Nandi's Grave and  
Boyne.

<u>Branching type:</u>	<u>Unbranched</u>	<u>Primary</u>					<u>Secondary</u>
<u>No. of branches:</u>	0	1	2	3	4	5	1
Nuden .....	3	2	-	-	-	-	-
Nandi's Grave...	10	5	1	-	-	-	-
Boyne .....	-	2	2	4	1	1	2



Map 19: Distribution of *Eulophia petersii* Reichb.f. in South Africa, with the positions of the field populations described on page 211.

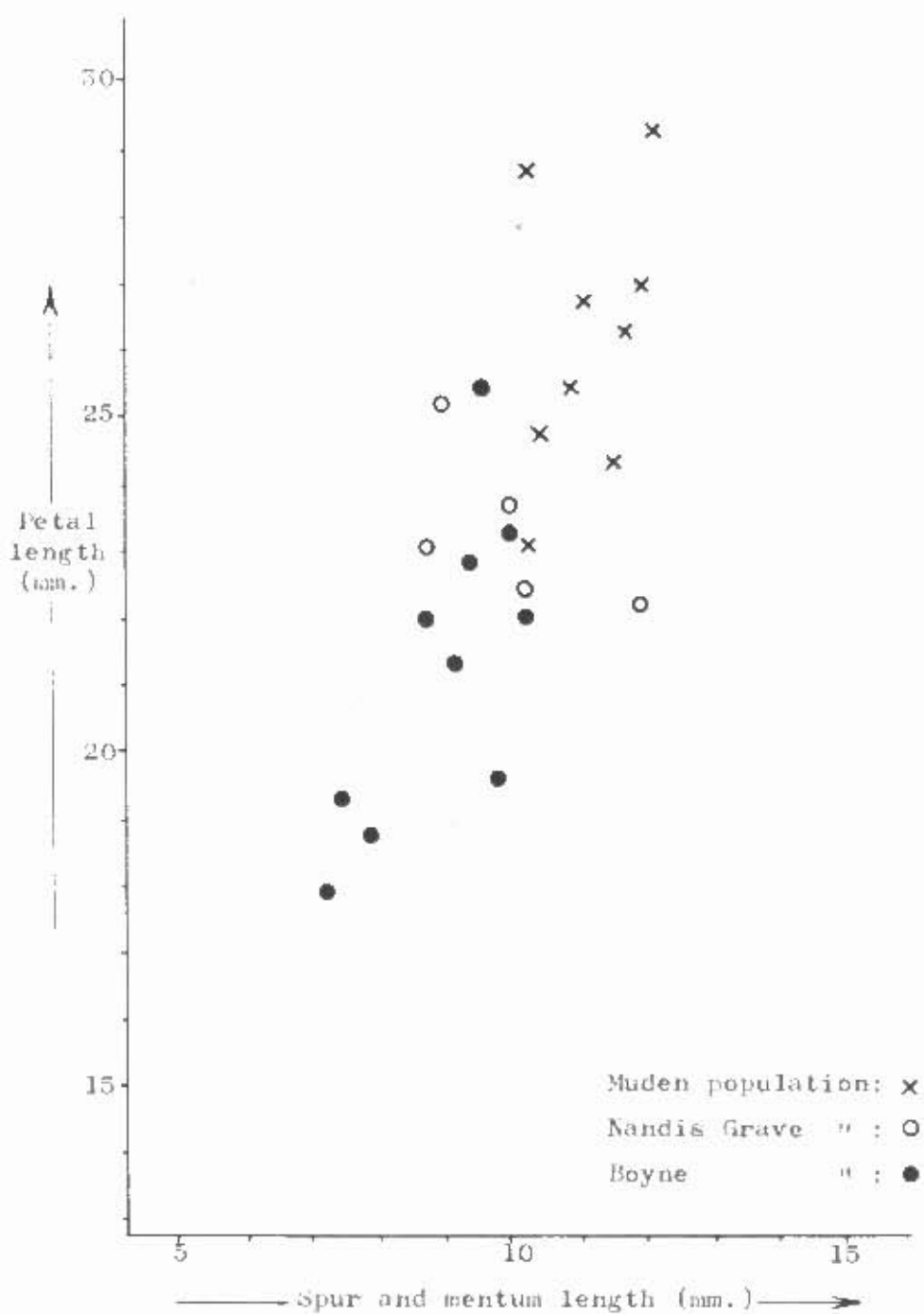


Diagram 36: Showing the variation ranges of petal length, and spur and mentum length in three populations of Eulophia petersii.

19. EULOPHIA ANGOLENSIS (REICHB.F.) SUMM.

(1) Description: Rhizome subterranean, cylindrical, about 15 - 20 mm. in diameter, occasionally branched with the branches usually exceeding 30 cm. in length. Leaves up to 90 cm. long and 5.0 cm. broad, plicate and stiffly erect with several veins emergent on the abaxial surface. Scape 0.5 - 1.4 m. tall, rather stout below, sometimes with 1 - 3 simple branches. Scape sheaths usually less than 1/3 the length of their internodes, closely clasping. Bracts elliptic, acute, generally rather shorter than the ovary. Flowers 4 - 10, laxly arranged on the inflorescence; sepals widely spreading, the petals declinate over the lip.

Odd sepal (17.3) - 19 - 24 - (25.7) mm. long, oblanceolate obtuse, rather cucullate near the apex; the lateral sepals similar. Petals narrowly oblong to oblong, slightly shorter than the odd sepal, obtuse. Column 9 - 14 mm. long, curved and rather slender, the operculum bilobed at the apex. Mentum 4 - 10 mm. long, passing into a shortly conical to vestigial spur. Side lobes of the lip fused to the mentum for most of its length, curving gradually from a broad base into the mid-lobe. Mid-lobe broadly oblong, the apex subtruncate to rounded, the lateral margins crispate and slightly deflexed. Crests consisting of 3 - 5 lamellae, usually low in the basal part of the lip and rising to more than

1.5 mm. tall on the mid-lobe, generally also tall beneath the apex of the column.

Sepals bright lemon yellow, variously tinged with olive and purplish brown. Petals and lip mostly bright lemon yellow but with the side lobes paler and the distal parts of the chief nerves on the side lobes marked with purple to pale gray. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has occasionally been mis-identified with Eulophia horsfallii (Batem.) Summ., which differs chiefly in having acute to apiculate sepals, the petals rotund to elliptic-oblong, and the flowers coloured green and purple.

(iii) Nomenclature: The earliest description resembling this species was published by Reichenbach in 1865, with the name Cymbidium angolense. The description is not very detailed and disagrees with the present concept in stating that the leaves are "branched"; this could perhaps be a mis-interpretation of a dried and pressed leaf fascicle. A sheet in the Reichenbach orchid herbarium at Vienna (W) is labelled as quoted in the type description (Welwitsch 734, Huilla) and bears the identification in Reichenbach's handwriting "Cymbidium. 734. angolense" on an attached drawing of flower parts. This drawing and the excellent specimen both clearly agree with the present concept, and may be regarded as the holotype of Cymbidium angolense

Reichb.f. Material of the type number in the herbaria at Kew (K) and the British Museum (BM) also clearly agrees with the present species. In 1878, Reichenbach transferred the epithet angolense from Cymbidium to Lissochilus.

In the same article, Reichenbach published another description matching the present taxon, with the name Lissochilus buchanani. The two syntypes from Natal at the Vienna herbarium (W) agree with the present concept in all respects, so that L.buchanani Reichb.f. should be regarded as a later synonym of Cymbidium angolense Reichb.f. In 1889, Bolus transferred the epithet buchanani from Lissochilus to Eulophia.

Summerhayes (1958<sup>a</sup>) was the first to transfer Reichenbach's epithet angolense from Cymbidium to Eulophia. At the same time, Summerhayes gave a number of names, based on material from Tropical Africa, as synonyms of E.angolensis (Reichb.f.) Summ.: Lissochilus longifolius Lindl. non Benth., L.paludicolus Reichb.f., L.lindleyanus Reichb.f., L.platypterus Reichb.f., L.antunesii Rolfe, L.validus Rendle, L.validus var. minor Rendle, L.latus Rolfe, Eulophia lindleyana (Reichb.f.) Schltr., Cyrtopera stolziana Kraenzl., Eulophia eylesii Rendle, Lissochilus ugandae Rolfe, L.mildbraedii Kraenzl., L.stolzianus (Kraenzl.) Schltr. and L.katentaniensis de Wildem. The descriptions and available types of these names were examined and no reason was found for differing from Summerhayes' conclusions.

(iv) Nomenclatural references and types:

Cymbidium angolense Reichb.f. Flora 48: 188 (1865).

Holotype: Welwitsch 734, Huilla (W, holotype!; K, type number!; BM, type number!).

Lissochilus longifolius Lindl. J. Linn. Soc. 6:

133 (1862), non illegit., non Lissochilus longifolius

Bentham. Holotype: Barter 1486, Nupe (K, syntype!);

Paratype: Ansell s.n., Grand Bassa.

L. paludicolus Reichb.f. Otia Bot. Hamb. 64 (1878).

Holotype: Schweinfurth 3983, North of Ibba, Nianniam (W, holotype!; K, isotype!).

L. buchanani Reichb.f. Otia Bot. Hamb. 64 (1878).

Syntypes: Buchanan s.n., Port Natal (W, syntype!; K, isosyntype!); Sanderson s.n., Natal (W, syntype!).

L. angolensis Reichb.f. Otia Bot. Hamb. 64 (1878).

Basionym: Cymbidium angolense Reichb.f.

L. lindleyanus Reichb.f. Otia Bot. Hamb. 65 (1878).

Holotype: Barter 1486, Nupe (W, holotype!).

L. platypterus Reichb.f. Flora 65: 533 (1882).

Holotype: von Mechow 415, Malange (W, holotype!).

Eulophia buchanani (Reichb.f.) Bolus J. Linn. Soc.

25: 185 (1889).

Lissochilus antunesii Rolfe Bolet. Soc. Brot. 7:

236 (1890). Holotype: Antunes s.n., Huilla (K, holotype!).

L. validus Rendle J. Bot. Lond. 33: 197 (1895).

Holotype: Scott - Elliot 8347, Urundi, (K, type number!).

Lissochilus validus var. minor Rendle J. Bot. Lond.  
33: 197 (1895). Holotype: Scott-Elliott 7305, Jumotu  
swamp, Kampala, Uganda (K, type number!).

Lissochilus latus Rolfe Fl. Trop. Afr. 7: 79 (1897).  
Holotype: Carson 28, Lake Moero, British Central Africa  
(K, holotype!).

Eulophia lindleyana (Reichb.f.) Schltr. Westafr.  
Kautschuk. Exped. 279 (1900).

Cyrtopera stolziana Kraenzl. Bot. Jahrb. 33: 69  
(1902). Holotype: Stolz 13, Kondeland, Nyassa terr-  
itory (K, isotype!).

Eulophia eylesii Rendle J. Bot. Lond. 43: 53 (1905).  
Holotype: F.Eyles 150, Matope Hills (BM, holotype!).

Lissochilus ugandae Rolfe Curt. Bot. Mag. 131: sub  
tab. 8044 (1905). Holotype: Cult. hort. Kew., ex Mahon  
s.n., Entebbe, Uganda (K, holotype!).

L.mildbraedii Kraenzl. Bot. Jahrb. 43: 338 (1909).  
Holotype: Mildbraed 277, Bukoba.

L.stolzianus (Kraenzl.) Schltr. Bot. Jahrb. 53:  
588 (1915).

L.katentaniensis de Wildem. Bull. Jard. Bot. l'Etat  
6: 91 (1919). Holotype: Homblé 765, near Katentania (BR,  
holotype!).

Eulophia angolensis (Reichb.f.) Summerh. Kew Bull.  
1958: 76 (1958). Basionym: Cymbidium angolense Reichb.f.

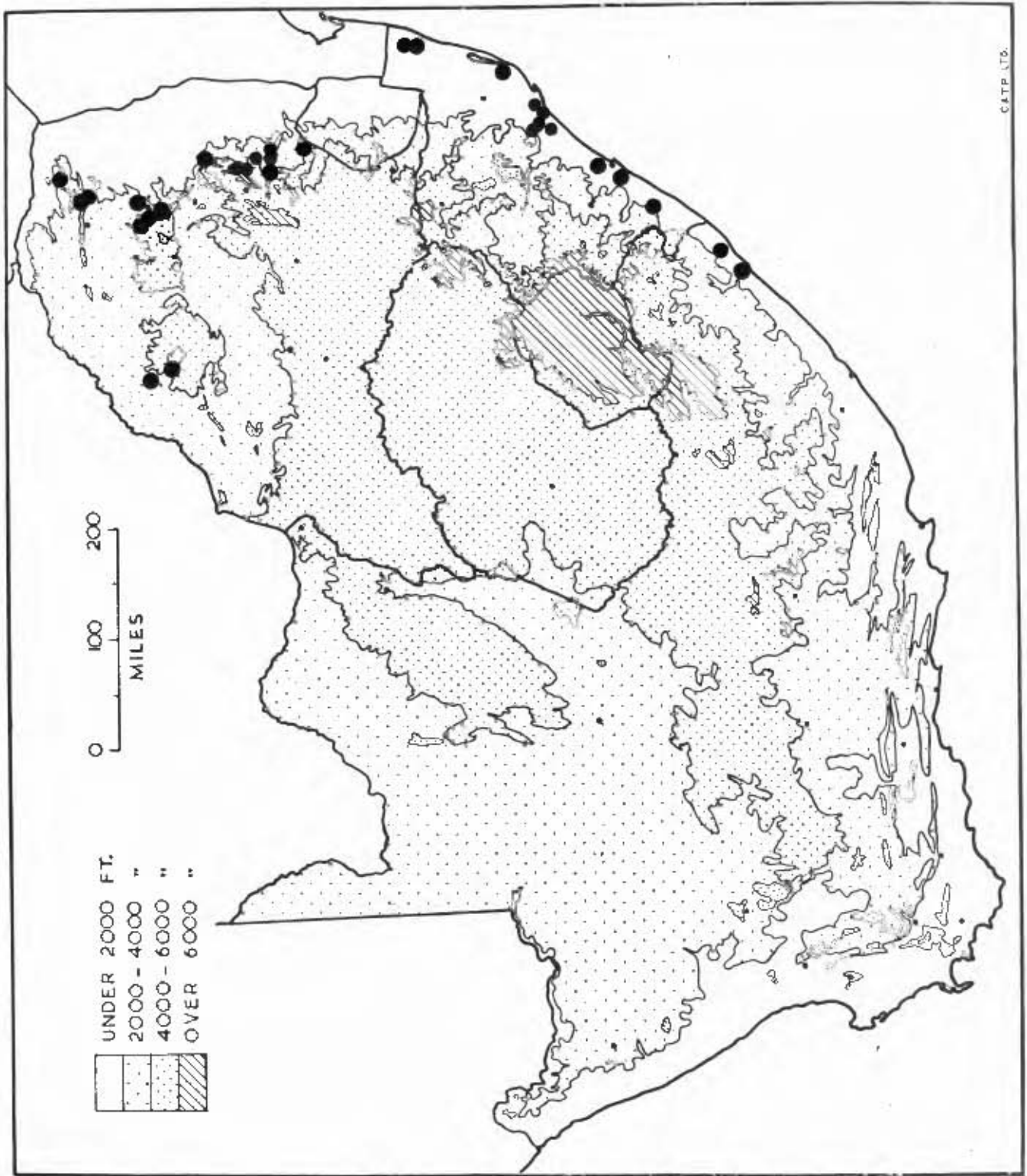
(v) General biology: Eulophia angolensis has a very large distribution range, extending from the north-eastern Cape through many parts of East Africa to the Sudan, to Angola, to the southern and eastern Congo, and from Oubangi - Chari and the Cameroons along the West African coast to Gambia. In South Africa the species is found near the coast in the north-eastern Cape and Natal, and in the higher parts of the eastern and western Transvaal (see Map 20).

Precipitation at accurately recorded localities in South Africa is usually high (40" - 60" per annum) except in the Western Transvaal, where it is 20" - 25" per year. Frost is unknown at the coastal localities, but may be experienced on up to 20 days of the year in the Transvaal. The species appears to be confined to swampy soils, often in open grassy places, and may be found in groups of a few to very many (50 or more) plants at a given locality. The denseness of the groups of plants could be a consequence of vegetative reproduction of the rhizomes.

Flowering takes place in the warm wet summer months in South Africa (see Table 20). The chromosome number of material from the Zoutpansberg in the Northern Transvaal was found to be  $n = 38$ ; however, there was reasonably clear evidence of lower chromosome numbers, suggestive of an aneuploid series, in material from Tzaneen ( $n = 34, 35, 36, 37$ ).

**Table 20:** Records in herbaria of the month of collection of flowering specimens of Eulophia angolensis (Heichb.f.)  
Summ. in South Africa.

<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	2
November	..	..	..	..	..	1
December	..	..	..	..	..	16
January	..	..	..	..	..	18
February	..	..	..	..	..	8
March	..	..	..	..	..	2



Map 20: Distribution of *Eulophia angolensis* (Reichb. f.) Summ. in South Africa.

20. EULOPHIA HORSFALLII (BATEM.) SUMM.

(1) Description: Rhizome consisting of subspherical pseudobulbs, ringed with numerous prominent leaf scars, lying mostly below soil level. Leaves 0.4 - 1.5 m. tall, tapering from a 2 - 3 cm. wide sheathing base into a narrow petiole, broadening in the central third of the leaf to a lamina 1.4 - 9.6 cm. wide, with several veins emergent on the abaxial surface. Scape about 0.6 - 2.0 m. tall, very stout below. Sheaths on the scape usually less than half the length of their internodes, rather loosely clasping. Bracts broadly elliptic, apiculate to acuminate, rather shorter than the ovary. Raceme lax to a little dense; flowers about 10 - 40 with spreading petals and sepals.

Odd sepal (12) - 13 - 22 - (29) mm. long, narrowly obovate, apiculate to acute, slightly clawed basally; lateral sepals similar. Petals rotund to elliptic-oblong, a little longer than the sepals, obtuse to acute. Column 9 - 16 mm. long, the operculum with two closely set distal lobes. Mentum 6 - 10 mm. long, passing into a shortly conical often acute spur about 3 - 5 mm. long. Side lobes adnate to about 1/2 the length of the mentum, semicircular, distally tapering gradually into the mid-lobe. Mid-lobe broadly oblong to subovate, with crispate lateral margins and the apex subacute to rounded. Crests consisting of 3 - 5 lamellae

on the central nerves of the lip, reaching more than 3 mm. high on the mid-lobe, the tops crenulate and the sides smooth to fluted.

Sepals green tinged with brownish purple. Petals pale purple to white outside, paler within with the chief nerves usually marked with purple. Side lobes of the lip green with the main nerves dark brownish purple. Mid-lobe purple with darker nerves and a deep purple area at the bases of the crests. Crests dull white. No flower scent recorded.

(ii) Distinctions from similar taxa: This species has occasionally been mis-identified with Eulophia angolensis (Reichb.f.) Summ., which differs chiefly in having obtuse sepals, narrowly oblong to oblong petals and the perianth mostly bright lemon yellow. E.horsfallii may be distinguished from other species of Eulophia in South Africa by its tall crenulate crest lamellae reaching more than 3 mm. high on the mid-lobe of the lip, the rotund to elliptic-oblong petals, the bilobed operculum, and the generally tall scape and leaves.

(iii) Nomenclature: The earliest description matching this species was published by Lindley (1843), with the name Lissochilus roseus. However, the type on which the description was based (K: Rucker s.n., Sierra Leone), although clearly matching the present concept, was

incorrectly said to belong to the same taxon as Dendrobium roseum Sw., which is now regarded as a synonym of Polystachya galeata Reichb.f. (Summerhayes, 1936). Dendrobium roseum was cited as the basionym for Lissochilus roseus (Sw.) Lindl., so that the epithet roseus cannot be used for the present species.

In 1865, Bateman published a description matching the present concept with the name Lissochilus horsfallii. A coloured plate given with the description agrees with the present species in all respects. A sheet in the herbarium at Kew (K) is labelled "Lissochilus horsfallii B. From Mr. Fitch Nov. 1865" and bears a flowering scape clearly belonging to the present taxon. There is no reference to the horticulturist who had grown the material used in the type description (J. B. Horsfall), or to the original collector and locality (Cheetham s.n., Old Calabar River).

The 'Mr. Fitch' referred to on the Kew sheet could well have been the artist and lithographer William Fitch, who prepared the plate given with the description. The specimen was received in November 1865, nearly a year after the plate and description had been published (January 1865); it resembles the plate and could well have been actually used by William Fitch. Bateman would have almost certainly seen William Fitch's painting before it was published and would have seen that it matched his concept of the species. However, it is open to doubt whether Bateman actually used this or another specimen for the description,

so that it seems best to regard the Kew material as the isotype of Lissochilus horsfallii Baten.

In 1878, Reichenbach published a short description resembling the present concept, with the name Lissochilus sandersonii (incorrectly spelt "sandersoni"). Although a few characters of the leaves and inflorescence are given, the only material that might be regarded as the type is a coloured sketch of a flower in the Kew Herbarium (K). The drawing closely resembles the present concept and bears the distinctive monogram of John Sanderson, quoted as providing the type material by Reichenbach. The younger Hooker (1886) later refers to this drawing and states that it was the source "From which Reichenbach's specific description was ... drawn up". If this is so, then the drawing may be regarded as only part of the holotype, as no vegetative parts are shown. A flower on the sheet bearing the drawing at Kew, and a detached lip on a sheet with a rough tracing of Sanderson's drawing in the Vienna herbarium (W) are probably from a specimen sent by Sanderson after Reichenbach had prepared the description (Hooker fil. 1886); although they do not form part of the type, they match the concept without reservation. There is little doubt that L.sandersonii Reichb.f. refers to the present concept, so that the name should be regarded as a later synonym of L.horsfallii Baten.

In 1912, Rolfe published a description agreeing with the present concept, with the name Lissochilus transvaalensis. This was based on a Burtt-Davy specimen

from the Transvaal in the herbarium at Kew (K), which clearly matches smaller-flowered and narrow leaved forms of the present species. L.transvaalensis Rolfe should therefore be regarded as another synonym of L.horsfallii Batem.

In 1936, Summerhayes transferred Bateman's epithet horsfallii from Lissochilus to Eulophia. It seems likely that future research will show that certain other names will have to be regarded as synonyms of E.horsfallii (Batem.) Summ.: Lissochilus welwitschii Reichb.f., L.giganteus Welw. ex Reichb.f., L.porphyroglousus Reichb.f., L.elliottii Rendle, Eulophia gigantea (Welw. ex Reichb.f.) N.E.Br., and Lissochilus eleogenus Schltr. As these names are based on material from Tropical Africa (Angola, Tanganyika, Uganda and the Sudan) and were published later than Lissochilus horsfallii Batem., they were not studied in detail (c.f. page 95).

(iv) Nomenclatural references and types:

Lissochilus horsfallii Batem. Bot. Mag. 91: sub tab. 5486 (1865). Holotype: ex hort. Horsfall, leg. Cheetham s.n., Old Calabar River (K, isotype?!; icon., Bot. Mag. 91: tab. 5486).

L.sandersonii ("sandersoni") Reichb.f. Otia Bot. Hamb. 62 (1878). Holotype: Sanderson s.n., The Bluff, Natal, 18 Jan. 1867 (K, icon.!).

L.transvaalensis Rolfe Fl. Cap. 5(3): 57 (1912).

Holotype: Burt - Davy 2900, Izaneen ("Izaneen"), Zoutpansberg, Transvaal (K, holotype!).

Eulophia horsfallii (Batem.) Summ. Fl. W. Trop. Afr. 2: 444 (1936).

(v) General biology: Eulophia horsfallii, together with several forms that are probably conspecific with it, has a very large distribution range, extending from Natal to the southern Sudan, Angola, the Congo and along the coastal territories of West Africa to Portuguese Guinea. In South Africa, the species is found near the Natal coast and inland in the higher parts of the Eastern Transvaal (see Map 21).

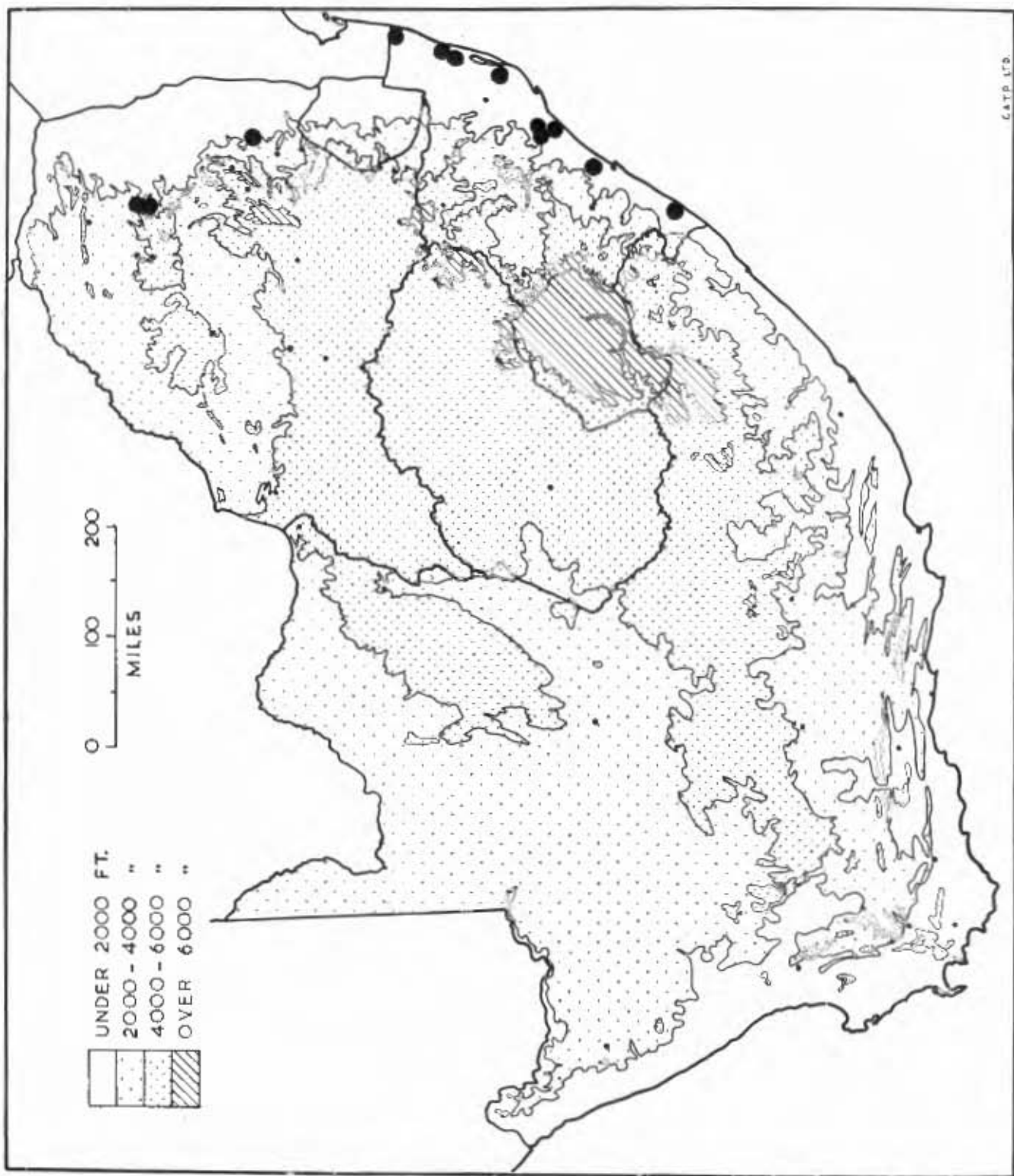
Precipitation at accurately recorded localities in South Africa is usually rather more than 30", reaching 50" - 60" along the Natal coast. Frost is seldom experienced. Several collectors note that the species grows in swampy soils, sometimes in the shade of bushes or forest trees. It appears to be confined to small colonies in a given area (E. Harrison, priv. comm.). The species has been collected in flower in the Spring, Summer and Autumn months (see Table 21).

A collector in Natal showed the author a place where he had found plants of the present species (Harrison 50 in Herb. Bolus., 11 miles W. of St. Lucia Bay Village, Hlabisa District). Several plants were seen with leaves matching the present concept, but with no flowers or remains of inflorescences, and with very peculiar rhizomes.

The underground parts appeared to be rootless, and consisted of numerous short branches 5 - 9 mm. in diameter bearing the remnants of small amplexicaul scales and forming a subspherical mass 6 - 10 cm. in diameter. This is very different from the usual thick-rooted pseudobulbous rhizome of this species. A dense mycorrhizal infection was found throughout the cortex of the underground parts, and it is possible that this may have been associated with the different morphology; it may also be significant that none of the plants were flowering.

Table 21: Records in herbaria of the month of collection of flowering specimens of Eulophia horsfallii (Batem.) Summ. in South Africa.

<u>Month</u>						<u>No. of records</u>
September	..	..	..	..	..	1
October	..	..	..	..	..	1
November	..	..	..	..	..	2
December	..	..	..	..	..	3
January	..	..	..	..	..	3
February	..	..	..	..	..	3
March	..	..	..	..	..	0
April	..	..	..	..	..	0
May	..	..	..	..	..	1



Map 21: Distribution of *Eulophia horsfallii*  
(Batem.) Summ. in South Africa.

21. EULOPHIA HEREROENSIS SCHLTR.

(1) Description: Rhizome subterranean to partly aerial, moniliform. Leaves partly to fully developed at anthesis, when mature up to 45 cm. long and 2.0 cm. broad, thin-tissued with three veins emergent on the abaxial surface, with a fine transverse line marking an abscission layer near the base. Scape 25 - 55 cm. tall, rather slender. Sheaths on the scape generally rather less than half the length of their internodes, closely clasping. Bracts usually much less than  $\frac{2}{3}$  the length of the ovary, oblong to lanceolate, acute. Raceme lax and elongate; flowers 7 - 25, with spreading sepals.

Odd sepal (11.4) - 13 - 16 - (19.0) mm. long, narrowly oblong to oblong or slightly oblanceolate, obtuse; lateral sepals similar but very oblique at the base. Petals slightly shorter than the sepals, oblong-lanceolate to oblong-elliptic, obtuse to acute. Column 6 - 8 mm. long. Mentum very prominent, 4 - 9 mm. long and 3 - 5 mm. broad, finely pubescent within, passing into a dorsiventrally flattened subconical spur 3 - 4 mm. long, directed away from the ovary and sometimes bilobed. Side lobes of the lip fused to most of the length of the mentum, broad at the base and tapering to a narrow apex, curving abruptly into the mid-lobe, with or without a shortly rounded free distal portion. Mid-lobe small and usually less than  $\frac{1}{3}$  the total length of the lip, deltoid to ovate-deltoid, obtuse to acute. Crests

consisting of thin subentire lamellae on all main nerves of the lip, rather low on the side lobes and tall on the mid-lobe, and finely pubescent at the base of the lip.

Sepals yellowish green, sometimes tinged with purple. Petals and lip pale yellowish green, with the crests pale lemon yellow. Leaves with small purple spots below the abscission layer; sheaths on the basal part of the scape sometimes also purple spotted. No flower scent reported.

(ii) Distinctions from similar taxa: In general appearance this species resembles some forms of Eulophia clavicornis Lindl., which differs in lacking an abscission layer on the leaves, in having the lip crests vestigial on the side lobes, the lip narrow at the base and the leaves and sheaths lacking purple spots. The flowers bear some resemblance to E. leachii Greatrex ex Hall, which differs chiefly in having the crests densely papillose and two fine papillae 1.2 mm. long on either side of the rostellum.

(iii) Nomenclature: The earliest description matching this species was published by Schlechter in 1896, with the name Eulophia hereroensis. The type is quoted as a Fleck specimen from Hereroland in South-West Africa. A drawing of flower parts at the Kew Herbarium (K), made by Summerhayes in 1936 from material bearing the type

number in the Berlin Herbarium (B), agrees with the concept in all respects. The Berlin specimen was almost certainly destroyed during World War II. It would have probably been from Schlechter's special collection of orchids and therefore perhaps the holotype. There is also material labelled with the type number in the herbarium at Zürich (Z), bearing the identification Eulophia hereroensis in Schlechter's handwriting. As Schlechter often sent duplicates from his special collection to the Zürich herbarium where he once worked (F. Markgraf, priv. comm.), this specimen is more likely to be an isotype than the actual holotype. The specimen agrees with the present concept without reservation.

In 1911, Bolus published a description matching the present concept, with the name Eulophia pillansii. The specimen annotated as the holotype from the Eastern Cape in the Bolus Herbarium (BOL) agrees with the present species in all respects, so that E. pillansii Bolus should be regarded as a later synonym of E. hereroensis Schltr.

It is likely that further research will show that two other names will have to be regarded as synonyms of E. hereroensis Schltr.: Eulophia junodiana Kraenzl. and E. undulata Rolfe. As these were both published later than E. hereroensis Schltr. and are based on material from beyond the borders of South Africa (Mozambique and Southern Rhodesia) they were not studied in detail (c.f. page 95).

(iv) Nomenclatural references and types:

Eulophia hereroensis Schltr. Bull. Herb. Boiss.  
Ser. 1, 4: 417 (1896). Holotype: Fleck 412, near Harris,  
Hereroland, Nov. 1871 (K, icon.!: Z, isotype!).

E.pillansii Bolus l.c. Orch. Austr. - Afr. 2: sub  
tab. 27 (1911). Holotype: Pillans s.n. in Herb. Bolus.  
10479, near Cookhouse (BOL, holotype!).

(v) General biology: This species, together with forms  
that are very probably conspecific with it, has an unusual  
distribution area extending north from the Eastern Cape to  
Bechuanaland and Southern Rhodesia, westwards to South-  
West Africa and east to the southern parts of Mozambique.  
In South Africa, it has been found in scattered localities  
in the Eastern Cape, the Northern Cape and the Western  
and Northern Transvaal. (See Map 22).

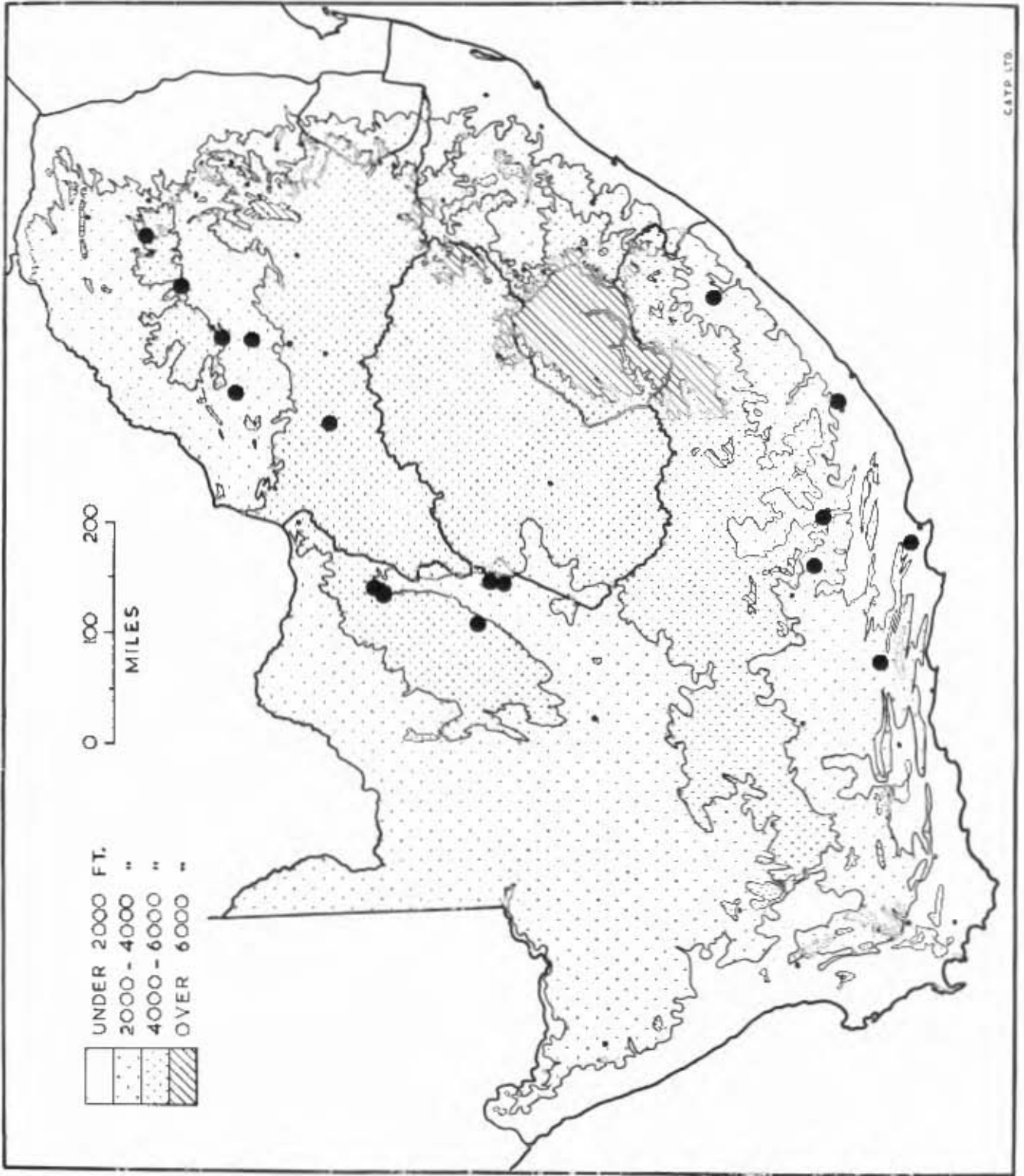
Precipitation at accurately recorded localities  
in South Africa is generally low, lying in the range 10"  
to 25" per annum, reaching 25" - 30" in the North-East  
Cape. Varying amounts of frost may be experienced, occ-  
urring on up to 20 days of the year at some places, and  
on 40 - 60 days at others. The regional soil types in  
the areas where the species is found vary considerably:  
Kalahari sand on a lime horizon, brack desert soils, black  
clay, ferruginous lateritic soils, and the podsols of the  
Eastern Cape. The vegetation at a locality visited by  
the author in the Eastern Cape consisted of Karroid thorn

scrub with the plants growing in the shade of scattered small bush clumps. At another in the Northern Transvaal the species was growing in arid thorn savannah. It has also been found in the semi-succulent valley bushveld of the Eastern Cape and the arid bush types in the Northern Cape.

The species appears to be restricted to a few small colonies of up to about 20 plants in a given area. At a locality in the Northern Cape the collector notes that the species is "frequent but rarely flowering" (Acocks 2257, Ditsyk, Barkly West District). The species rarely flowers in cultivation. Flowering in South Africa takes place in the Spring and Summer months (see Table 22).

Table 22: Records in herbaria of the month of collection of flowering specimens of Eulephia hereroensis Schltr.

<u>Month</u>						<u>No. of records</u>
September .. .. .	..	..	..	..	..	2
October .. .. .	..	..	..	..	..	2
November .. .. .	..	..	..	..	..	4
December .. .. .	..	..	..	..	..	5
January .. .. .	..	..	..	..	..	1



Map 22: Distribution of *Eulophia hereroensis* Schltr. in South Africa.

22. EULOPHIA PLATYPETALA LINDL.

(1) Description: Rhizome subterranean, moniliform.

Leaves apparently partly developed at anthesis, up to 23 cm. long and 1.6 cm. broad, somewhat leathery in texture, with several veins emergent on the abaxial surface. Scape 25 - 45 cm. tall, occasionally with one or two simple branches, a little stout below. Sheaths on the scape usually rather shorter than their internodes, loosely clasping. Bracts elliptic-ovate, acuminate, generally rather less than  $3/4$  the length of the ovary. Flowers 6 - 15, somewhat laxly arranged on the inflorescence; sepals and petals partly spreading.

Odd sepal (14.0) - 15 - 17 - (18.3) mm. long, narrowly oblong to elliptic-oblong, obtuse to mucronate; lateral sepals similar, very oblique at the base. Petals about as long as the odd sepal, rotund to elliptic, obtuse. Column 7 - 11 mm. long, somewhat slender. Mentum 4 - 9 mm. long, passing into a 2 - 3 mm. long elongate-conical spur generally curving away from the ovary. Side lobes of the lip adnate to the greater length of the mentum, with an obtuse distal free portion 3 - 5 mm. long. Mid-lobe 6 - 9 mm. long, obovate to very broadly obovate, entire with the apex obtuse to emarginate. Crests consisting of 3 - 5 rather fleshy subentire lamellae, rising to about 2 mm. high on the mid-lobe and reaching to within 2 mm. of the lip apex.

Sepals greenish-purple to chestnut brown, paler

on the inner surface. Petals and lip pale slightly greenish lemon yellow, with the crests bright yellow, and the chief nerves bluish gray along the margins of the mid-lobe and on the side lobes. Flowers with a faint soapy scent.

(ii) Distinctions from similar taxa: This species superficially resembles forms of Eulophia ovalis Lindl., E.cooperi Reichb.f. and E.coddii Hall, but differs chiefly in having crests consisting of rather fleshy, subentire lamellae. E.ovalis Lindl. has the crests always papillose distally and the petals variously ovate, never retund to elliptic. E.cooperi Reichb.f. has very low crests with a few short papillae mostly in the basal half of the mid-lobe, the petals narrowly ovate to lanceolate and the perianth nearly concolorous. E.coddii Hall has crests consisting of low verrucose ridges, the margins of the side lobes irregularly denticulate and the bracts about as long as the ovary.

(iii) Nomenclature: The earliest descriptions resembling this species were published simultaneously in 1837 by Lindley, with the names Eulophia platypetala and E.lissochiloides. The descriptions are too brief to exclude other forms, but the details given clearly agree with the present concept. Specimens from the Hooker collection in the herbarium at Kew (K) are labelled with the

collector's numbers and localities given in the two type descriptions (E.platypetala: Burchell 6611, nr. Zoetmelks River; E.lissochiloides: Burchell 6764, nr. Zoetmelks River), and clearly belong to the present concept. A tracing of one of the plants of Burchell 6611 in Lindley's orchid herbarium at Kew is labelled E.platypetala; Lindley also wrote Eulophia lissochiloides on the Hooker sheet of Burchell 6764. It seems therefore that these specimens could be regarded as the holotypes. There is also material of Burchell 6764 at Vienna (W), which may or may not have been seen by Lindley.

In 1891, Kuntze transferred the epithet lissochiloides to Graphorchis, a generic name against which Eulophia has since been conserved. (Summerhayes and Hall, 1962). Of the two available names, Bolus (1911) chose to use E.platypetala Lindl. rather than E.lissochiloides Lindl. for a published plate and description of the species. In accordance with Principle III (Int. Code 1961) this precedent is followed in the present work.

It is possible that further research might show that two other names may have to be regarded as synonyms of E.platypetala Lindl.: E.inyangensis Summ. and E.monticola Rolfe. As these names are based on material from Tropical Africa (Southern Rhodesia and Nyasaland) and were published later than E.platypetala they were not studied in detail (c.f. page 95).

(iv) Nomenclatural references and types:

Eulophia platypetala Lindl. Comp. Bot. Mag. 2: 202 (1837). Holotype: Burchell 6611, near the Zoutmelks River, Zwellendam District (K, holotype!).

E.lissochiloides Lindl. Comp. Bot. Mag. 2: 202 (1837). Holotype: Burchell 6764, hills near the Zoutmelks River, Zwellendam Dist. (K, holotype!; W, type number!).

Graphorchis lissochiloides (Lindl.) Kuntze Rev. Gen. 2: 662 (1891).

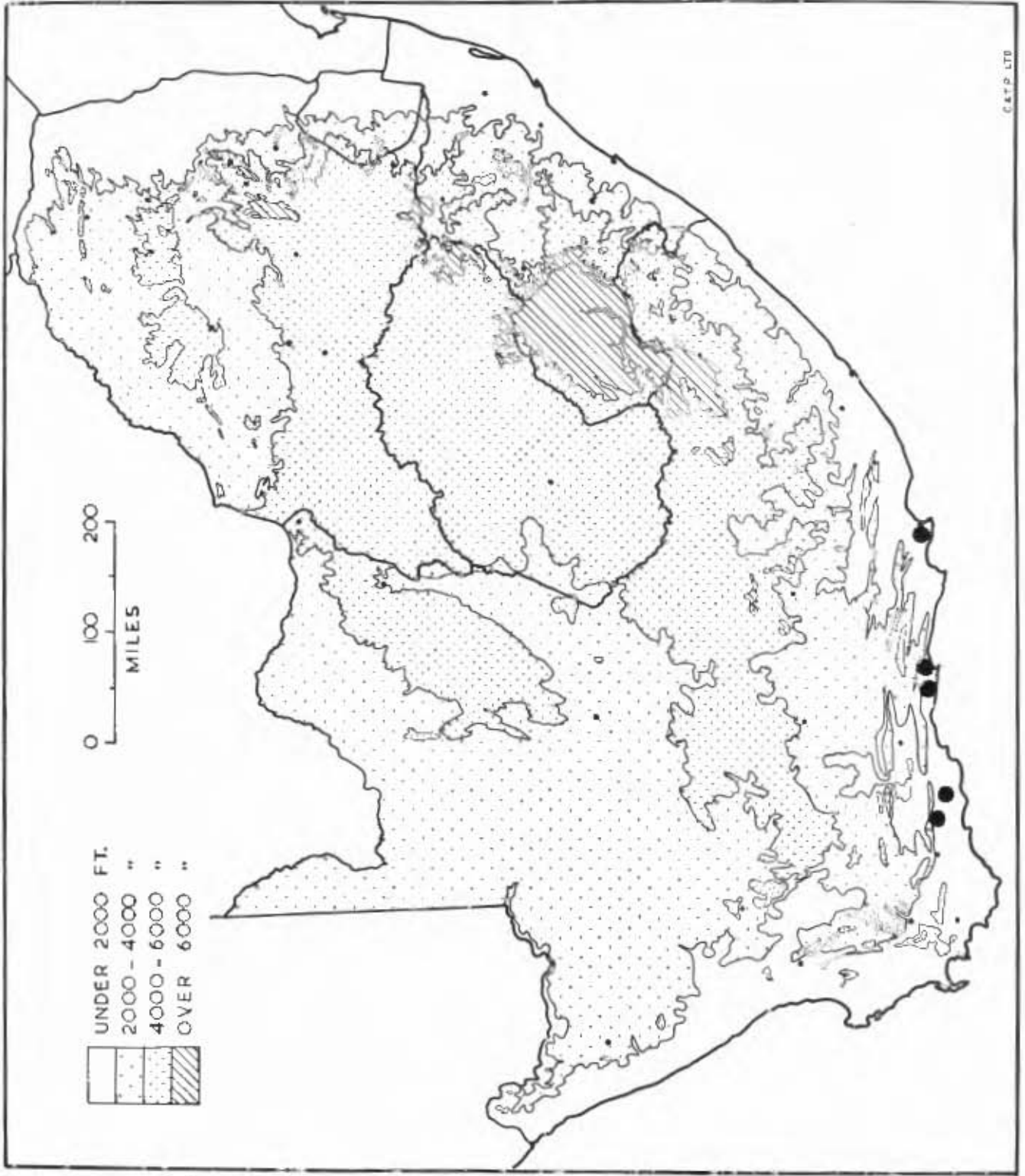
(v) General biology: This species appears to be confined to a belt lying along the southern Cape coast (see Map 23). If the material now known as Eulophia inyangensis Summ. from the Eastern Districts of Southern Rhodesia should prove to be conspecific, there would be an exceptionally large disjunction of about 1200 miles in the distribution range.

Precipitation at accurately recorded localities may vary from rather low (15" - 20") to quite high (35" to 40" per annum). Up to 20 days with frost per year may be experienced. The regional soil types in the areas where the species is found vary from gray sand derived from Table Mountain sandstone to sandy loams with or without clay. The species may be found in dry coastal renosterbosveld and grassy places in coastal

forest where it may be locally frequent. The few records available show that the species flowers in the early summer months (see Table 23).

Table 23: Records in herbaria of the month of collection of flowering specimens of Eulophia platypetala Lindl.

<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	1
November	..	..	..	..	..	6



Map 23: Distribution of *Eulophia platypetala* Lindl.

23. EULOPHIA ZEYHERIANA SOND.

(i) Description: Rhizome subterranean, moniliform.

Leaves more than half the length of the scape at anthesis, 20 - 40 cm. long, 0.3 - 0.7 cm. wide, somewhat leathery in texture, with 3 - 7 veins emergent on the abaxial surface. Scape 15 - 35 cm. tall, slender. Sheaths on the scape usually about half the length of their internodes, tightly clasping. Bracts about  $1/2$  -  $2/3$  the length of the ovary, rarely longer, lanceolate, acuminate, remaining nearly straight when dried. Raceme rather lax; flowers 4 - 17, the perianth partly spreading.

Odd sepal (6.8) - 7 - 9 - (9.5) mm. long, oblong, apiculate; lateral sepals similar. Petals a little longer than the sepals, elliptic-oblong, obtuse to finely mucronate. Column stout, 3.5 mm. long. Mentum absent. Spur at the base of the lip stoutly cylindrical, 2 - 3 mm. long. Side lobes of the lip elliptic with their longest axis lying at about  $45^\circ$  to the margin of the mid-lobe. Mid-lobe oblong to subobovate with the apex truncate to acute. Crests consisting of fleshy verrucose ridges on the central nerves of the lip, rising to about 0.5 mm. high on the mid-lobe.

Sepals green tinged with purplish brown. Petals pale blue with the margins and apices tinged with purple. Side lobes of the lip and the uncrested parts of the mid-lobe pale blue. Crests mostly white, the lateral crests pale blue to purple. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has sometimes been mis-identified in herbaria with Eulophia tenella Reichb.f., which differs in having the side lobes of the lip expanded near the base and subrhomboid-oblong, distally overlapping the margins at the base of the mid-lobe, the apex of the mid-lobe retuse to emarginate, the bracts often curled and twisted when dried, and the petals yellow outside, purple within.

There is a general resemblance to the forms of E.clavicornis Lindl. var. clavicornis which have the side lobes of the lip relatively short. These forms differ from the present species in having dissected lamellae about 1.5 mm. high on the mid-lobe and generally larger flowers with longer spurs (3 - 9 mm. long).

(iii) Nomenclature: The earliest description matching this species was published by Sonder in 1846, with the name Eulophia zeyheriana. The description is detailed and agrees with the present concept in all but one character, the collector's report of the flower colour which is given as "yellow-brown". Material clearly belonging to the present species was found in the Lindley orchid herbarium at Kew (K), labelled with the collector and locality given in the type description (Zeyher s.n., Winterberg Mt., Kafferland). It bears the identification E.zeyheriana in Lindley's handwriting, but there is no evidence that it was seen or used by Sonder for drawing up

the type description. The material consists of a single flower and leaf, and lacks the scape described by Sonder. It can only be regarded as having been collected at or near the type locality, although its fragmentary nature suggests that it may have been broken off another specimen, perhaps the holotype. No additional material could be found in other herbaria (see page 96; enquiries were also made at UPS, S, G). The type description includes sufficient detail to exclude other taxa, so that the name Eulophia zeyheriana Sond. can be taken as referring to the present taxon with reasonable certainty.

In 1899, Schlechter published a description matching the present species, with the name Eulophia brachystyla. A drawing of the flower with notes and measurements of vegetative parts in the herbarium at Kew (K) clearly agrees with the present concept; the specimen from which this was taken was said to be labelled with the collector and locality given in the type description (Schlechter 6489, Insiwa Mt., Griqualand East), and annotated "Eulophia brachystyla Schltr. typ. auct." The specimen had been borrowed from the Berlin herbarium (B) where Schlechter kept his special orchid collection, and was probably the holotype; it has since almost certainly been destroyed during World War II. Specimens labelled with the same collector's number and locality and clearly belonging to the present species, have been found in several other herbaria (W, Z, P, NH, GRA, BOL, PRE). Some were not

identified by Schlechter, while others were inscribed "E.microchila Schltr. n.sp.", a manuscript name which was not subsequently published. As the name E.brachystyla Schltr. almost certainly refers to the present species, it should be regarded as a later synonym of E.zeyheriana Sond.

(iv) Nomenclatural references and types:

Eulophia zeyheriana Sond. Linnaea 19: 73 (1846).

Holotype: Zeyher s.n., marshy places on the Winterberg Mt., Alt. VI, Kafferland, Dec. (K, type collection?!).

E.brachystyla Schltr. Bot. Jahrb. 26: 336 (1899).

Holotype: Schlechter 6489, Insiwa Mt., Griqualand East (K, icon.!: W, Z, P, NH, GRA, BOL, PRE: type number!).

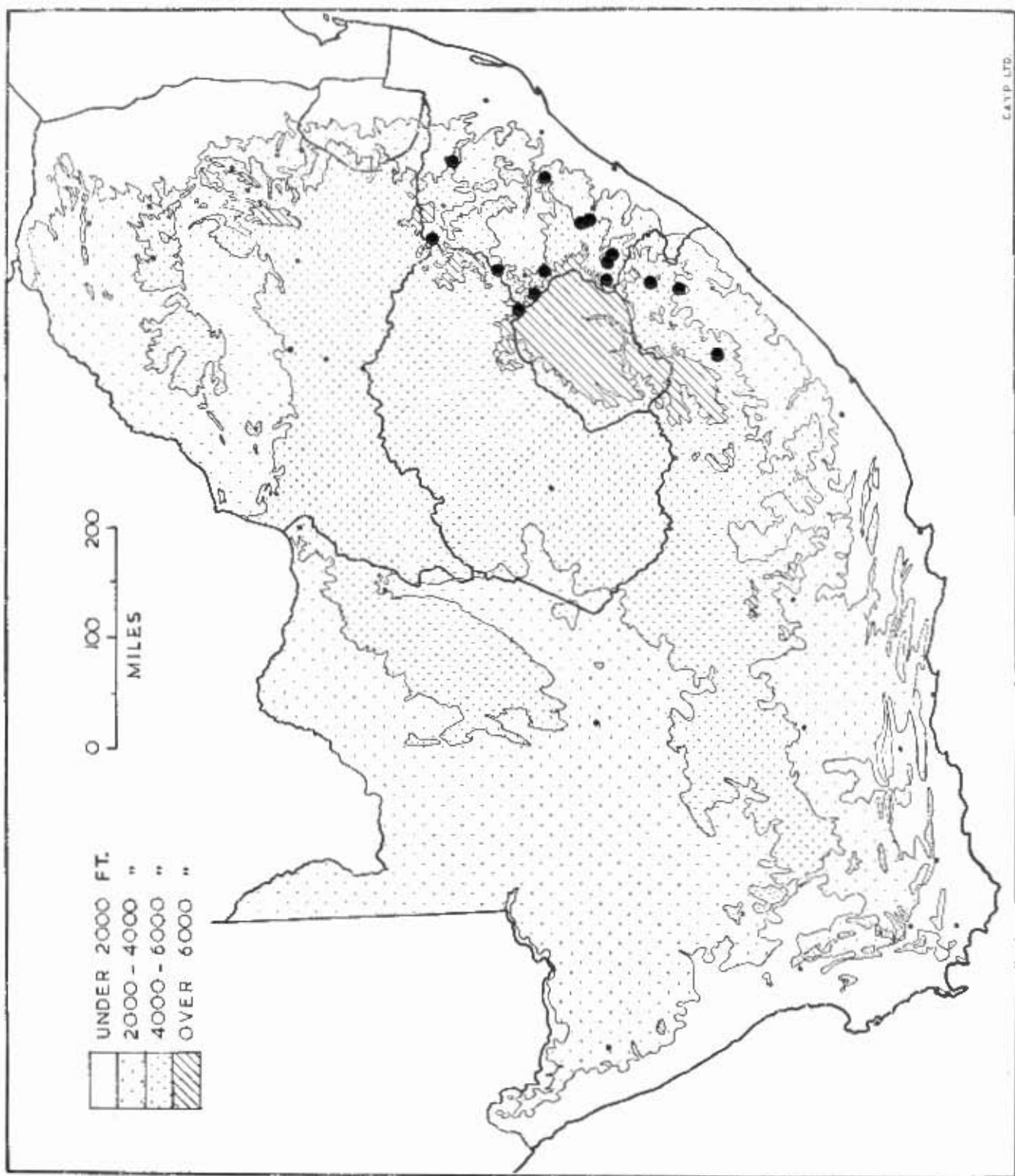
(v) General biology: This species appears to be confined to the higher parts of the North-East Cape and Natal (see Map 24). Precipitation at accurately recorded localities is rather high, lying in the range 30" to 60" per annum. Frost may be experienced at all localities, at some on up to 20 days of the year, at others 40 - 60 days. Several collectors note sandy and stony soils where they collected the species, and in addition they may be somewhat marshy (Hall 786, Drakensberg Garden, Himeville Dist., Natal). The species inhabits open grassland, generally occurring in small numbers at a given locality.

Flowering takes place in the mid-summer months

(see Table 24). The chromosome number of material from southern Natal was found to be  $n = 56$ .

**Table 24:** Records in herbaria of the month of collection of flowering specimens of Eulophia zeyheriana Sond.

<u>Month</u>						<u>No. of records</u>
December	..	..	..	..	..	2
January	..	..	..	..	..	12



Map 24: Distribution of *Eulophia zeyheriana* Sond.

24. EULOPHIA TENELLA REICHB.F.

(1) Description: Rhizome subterranean, moniliform. Leaves generally fully developed at anthesis, reaching 10 - 42 cm. long and 0.2 - 0.6 cm. wide, with 3 - 5 veins emergent on the abaxial surface. Scape 15 - 60 cm. tall, very slender. Sheaths on the scape slightly longer to less than half the length of their internodes, tightly clasping. Bracts subulate, often curled and twisted when dry,  $\frac{2}{3}$  the length to slightly longer than the ovary. Raceme dense; flowers 5 - 25, with the perianth partly spreading.

Odd sepal (5.3) - 6 - 8 - (8.5) mm. long, oblong to elliptic-oblong, mucronate; lateral sepals similar, oblique at the base. Petals rotund to elliptic-oblong, as long as the odd sepal, obtuse to finely mucronate. Column stout, 3 - 5 mm. long. Mentum absent. Spur at the base of the lip stoutly cylindrical, 2 - 3 mm. long. Side lobes of the lip expanded at the base, subrhomboid-oblong with the extreme apex a little divergent and part of the distal margin always overlapping a small portion of the base of the mid-lobe. Crests consisting of fleshy subentire ridges and lamellae, rising to about 0.7 mm. high on the 3 central nerves of the lip, very low on the distal parts of the side lobes.

Sepals dark green to brownish purple. Petals outside dull straw yellow, pale brownish purple within.

Lip dull pale purplish brown, the median crest on the mid-lobe bright cadmium yellow. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has occasionally been mis-identified in herbaria with Eulophia keyheriana Sond., which differs in having the side lobes of the lip elliptic and not overlapping part of the base of the mid-lobe, a truncate to obtuse mid-lobe apex, the bracts nearly straight when dried, and the petals pale blue. The forms of E.clavicornis Lindl. var. nutans (Sond.) Hall which resemble E.tenella may be readily distinguished by their papillose crests on the lip.

(iii) Nomenclature: The earliest description matching the present concept was published by Reichenbach in 1847, with the name Eulophia tenella. The type is quoted as a Mund specimen from "Kleinfountain" in the Berlin Herbarium (B); it would therefore have been destroyed with other orchid collections at this institute during World War II. However, there are detailed drawings at the Kew Herbarium (K) of a specimen borrowed from Berlin (B), said to have been labelled as quoted in the type description; an enlarged flower and three plants are shown, all clearly agreeing with the present concept. In the Reichenbach orchid collection at Vienna (W) there is a flower and three

buds in a capsule labelled "Geodorum tenellum Hb. Berol. Eulophia tenella" in Reichenbach's handwriting. The material clearly belongs to the present species, but although Reichenbach's inscription suggests that the material came from the Berlin Herbarium, there is no evidence that it was taken from the Mund specimen. The numerous details in the type description, and the drawing at Kew show that it is very likely that the name E. tenella Reichb.f. refers to the present species.

The detailed descriptions and available types of three other names clearly agree with the present concept: Eulophia natalensis Reichb.f., E. flaccida Schltr. and E. collina Schltr. As E. tenella Reichb.f. was published earlier than these names they should be regarded as later synonyms.

(iv) Nomenclatural references and types:

Eulophia tenella Reichb.f. Linnaea 20: 681 (1847).

Holotype: Mund s.n., Kleinfountain (K, icon!).

E. natalensis Reichb.f. Flora 48: 186 (1865). Holo-

type: Gueinzius s.n., P.Natal (W, holotype!; K, isotype!).

E. flaccida Schltr. Bot. Jahrb. 20, Beibl. 50: 3

(1895). Holotype: Schlechter 2860, the Bluff, near Durban (no authentic material available).

E. collina Schltr. Bot. Jahrb. 26: 336 (1899).

Holotype: Wood 5783, Mt. Edgecombe, Natal (K, type number!).

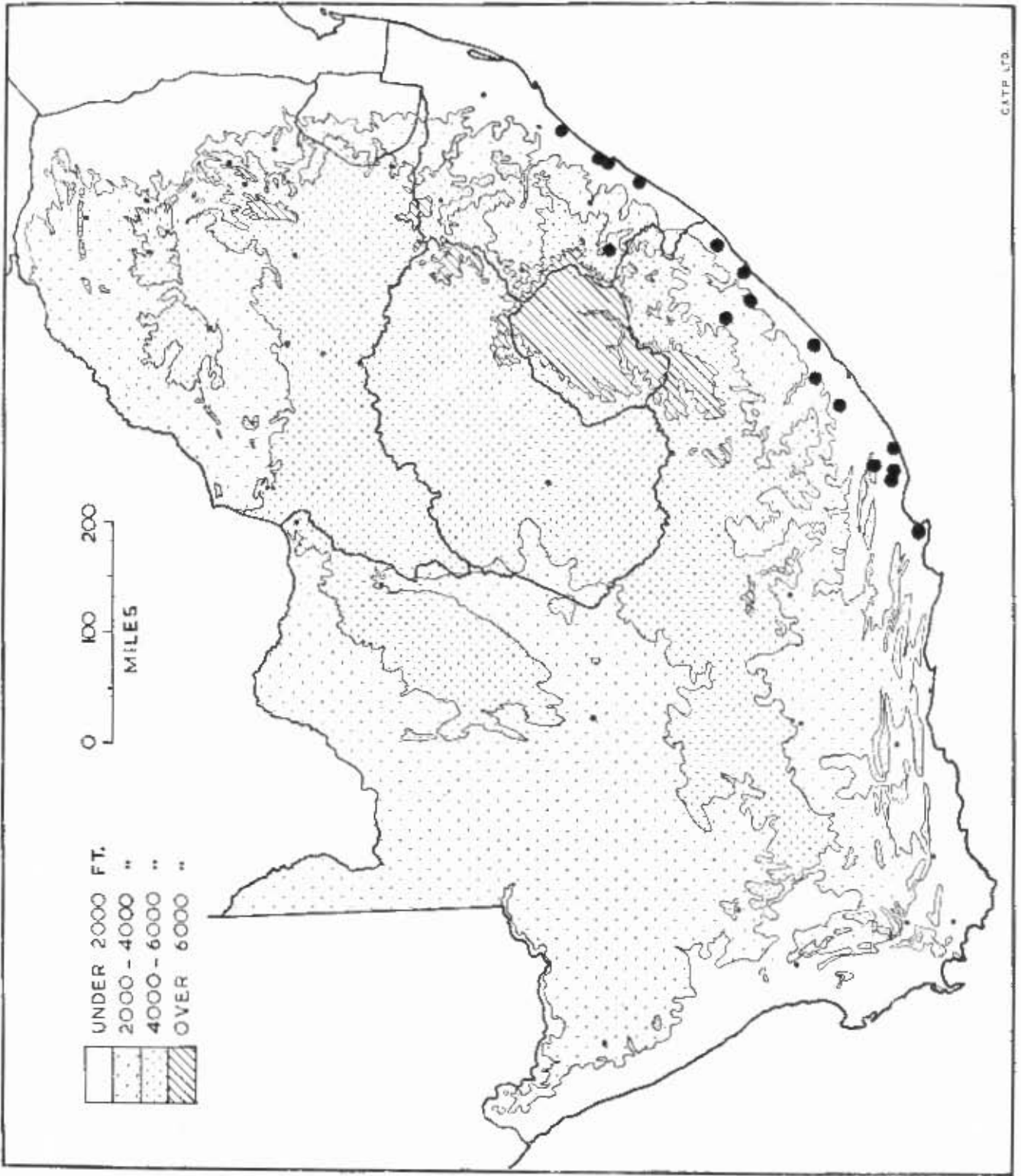
(v) General biology: This species occurs in the Eastern districts of Southern Rhodesia (Hall 340, Chimanimani Mts.) and in the coastal districts of the eastern Cape and Natal (see Map 25). The disjunction between Rhodesian and Natal localities is rather large, about 650 miles long.

Precipitation at accurately recorded localities in South Africa is generally higher in the north (30" to 45") than in the south (20" - 35" per annum). Frost is absent at most localities, occurring on up to 80 days of the year at others. The regional soil types in the areas where the species grows vary from sandy loams to podsoils. The species inhabits areas with sour grassveld, and grassy places in coastal thornveld. It may be rare to locally frequent, sometimes in colonies of up to about 30 plants in an area of a few square yards. The plants are remarkably difficult to find when the surrounding grass is taller than the inflorescences: the flowers are small and inconspicuously coloured and the leaves are rather slender. It is possible that the species may have been overlooked in the area between central Natal and Southern Rhodesia.

Flowering takes place mostly in the warm, wet summer months (see Table 25). The chromosome number of material from the Eastern Cape was found to be  $n = 60$ . The anthers of some of the flowers from which the chromosome count was made were deformed, one or both cells being smaller than usual.

**Table 25: Records in herbaria of the month of collection of flowering specimens of Eulophia tenella Reichb.f. in South Africa.**

<u>Month</u>						<u>No. of records</u>
August	..	..	..	..	..	1
September	..	..	..	..	..	1
October	..	..	..	..	..	0
November	..	..	..	..	..	9
December	..	..	..	..	..	9
January	..	..	..	..	..	7
February	..	..	..	..	..	1



Map 25: Distribution of *Eulophia tenella*

Reichb.f. in South Africa.

25. EULOPHIA LEACHII GREATREX EX HALL SP. NOV.

(i) Description: Pseudobulbi subcylindrici ad conici, 7 - 14 cm. alti, basi 1.5 - 2.0 cm. diametro. Folia ad 20 - 30 cm. longa, 0.8 - 1.5 cm. lata, paulo coriacea, marginis enatiis minutis scabris vestitis. Scapus 45 - 60 cm. altus, paulo gracilis. Vaginae scapi plerumque minores dimidio longitudo suorum internodiorum, 1.5 - 3.2 cm. longae, arcte ad laxe amplectentes. Bracteae subulatae, 1/8 - 1/2 longitudo ovarii. Racemus laxis; flores 3 - 24, sepalis erectis, apicibus petalis recurvatis, lobo intermedio labelli decurvato.

Sepalum anterius (14.0) - 15 - 19 - (22.0) mm. longum, anguste oblongo - loratum ad sub-oblancheolatum, acutum; sepala lateralia similia, obliqua ad basem. Petala longitudo sepalorum aequantes, lanceolata ad anguste ovata, acuta. Columna 9 - 11 mm. longa, papillis duabus 1.2 mm. longis prope apicem, operculo bilobato. Mentum 4 - 6 mm. longum, 3 - 4 mm. latum, adnatis lobis lateralis labelli saccum conicum formans, calcare dorsiventrato compresso, paulo bilobato et 3 - 5 mm. longo terminans. Labellum lobis lateralis rotundatis, gradatim in lobum intermedium fastigantibus. Lobum intermedium semi-ellipticum, subacutum, marginis lateralis crispatis-undulatis. Labellum nervis mediis dense papillis cristatis.

Pseudobulbs cylindrical to conical, 7 - 14 cm. high, 1.5 - 2.0 cm. in diameter near the base, mostly aerial,

linked by subcylindrical underground portions 0.5 - 2.0 cm. long. Leaves up to 20 - 30 cm. long, 0.8 - 1.5 cm. wide, somewhat leathery in texture, the margins with minute scabrous enations. Scape 45 - 60 cm. tall, somewhat slender. Sheaths on the scape generally less than half the length of their internodes, 1.5 - 3.2 cm. long, closely to loosely clasping. Bracts subulate,  $1/8$  -  $1/2$  the length of the ovary. Raceme lax; flowers 3 - 24, with the sepals erect, the apices of the petals recurved and the mid-lobe of the lip deflexed.

Odd sepal (14.0) - 15 - 19 - (22.0) mm. long, narrowly oblong-lorate to sub-oblancheolate, acute; lateral sepals similar, oblique at the base. Petals as long as the sepals, lanceolate to narrowly ovate, acute. Column 9 - 11 mm. long, with a papilla 1.2 mm. long arising on either side of the rostellum, and the operculum with two small divergent distal lobes. Mentum 4 - 6 mm. long, 3 - 4 mm. wide, forming with the distally adnate side lobes of the lip a conical sac, and terminating in a dorsiventrally compressed, slightly bilobed spur 3 - 5 mm. long, generally curved away from the ovary. Side lobes of the lip rounded, gradually tapering into the mid-lobe. Mid-lobe semi-elliptic, subacute, with the lateral margins crispate-undulate. Crests consisting of densely crowded papillae on the central nerves of the lip, the chief lateral nerves with low ridges and occasional short papillae.

Sepals and petals yellowish green tinged with purple, with the nerves marked purple on the inner surface of the

petals. Lip greenish-yellow basally to white distally, the main side lobe nerves purple. Crests white, with minute purple speckles near the base of the lip. Column pale green with short purple streaks, the distal papillae dark violet-purple. No flower scent detectable.

(ii) Distinctions from similar taxa: This taxon appears to be unique among African species of Eulophia in having papillae near the apex of the column. Many of its more unusual features resemble those of Eulophia petersii Reichb.f., such as the scabrous leaf margins, the mostly aerial pseudobulbs, the rounded side lobes and crispate mid-lobe margins, the recurved petals and the general flower colouring. However E.petersii may be readily distinguished by its lamellate crests and stiff leaves with larger enations on the margins.

The flowers of this species superficially resemble those of E.hereroensis Schltr., which differs in having crests consisting of entire lamellae on all chief nerves of the lip, a relatively small deltoid to ovate-deltoid mid-lobe, and a fine transverse line marking an abscission layer near the base of the leaf.

It is unlikely that this species would be misidentified with any other taxa in South Africa.

(iii) Nomenclature: This species is described here for

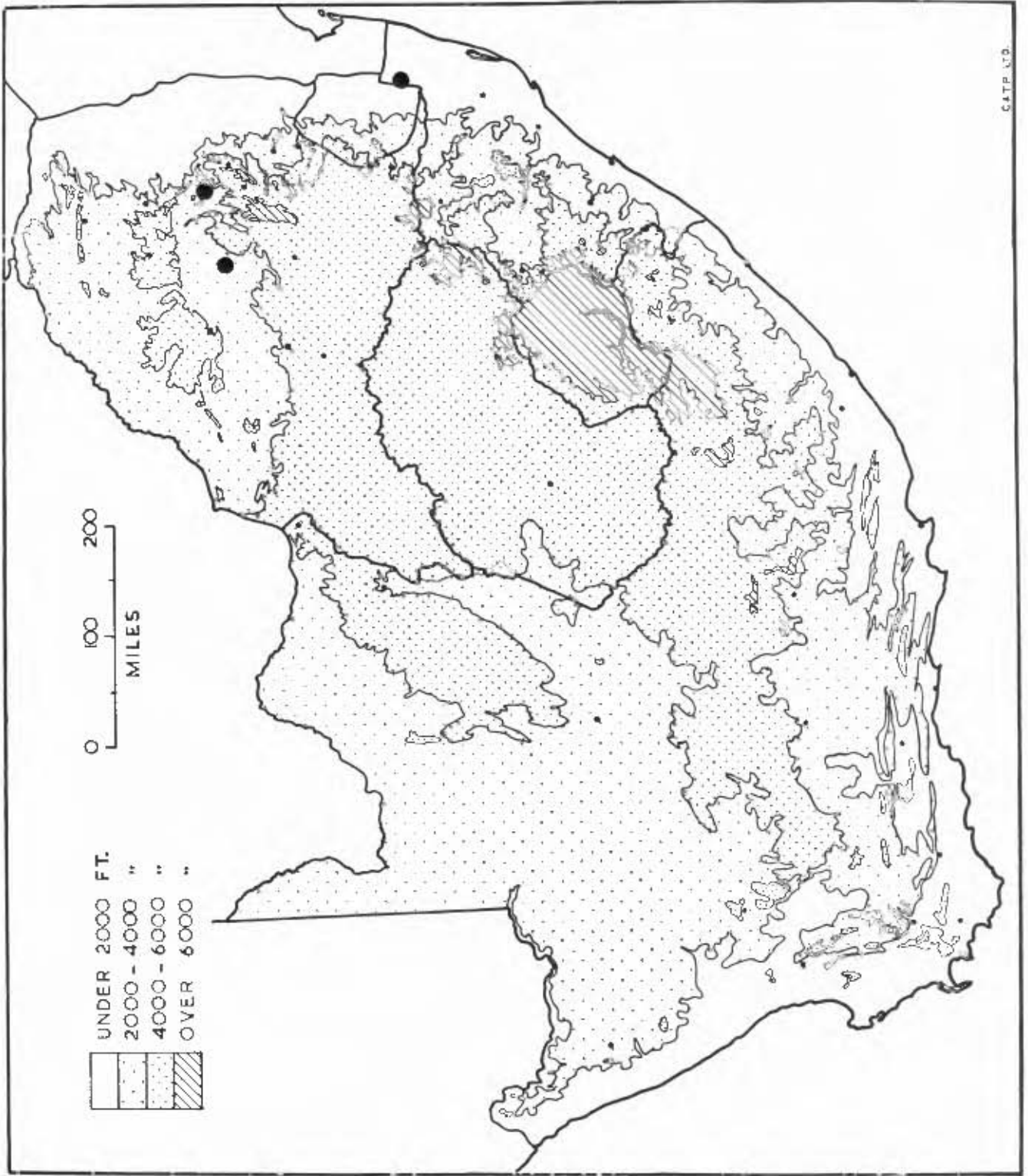
the first time, and in accordance with Art. 36 (Int. Code 1961) a Latin description has been included to validate its publication should the present work be printed. The name has been used in manuscript by Greatrex for Rhodesian material of the species, so that it should be written as Eulophia leachii Greatrex ex Hall. The species is named after a Rhodesian collector, Mr. L. C. Leach.

(iv) Nomenclatural type: McNeil s.n. in Herb. Bolus. 27336, about 150 yards South of the Ingwavuma River, about half a mile from the Swaziland border, Ingwavuma District, northern Natal: cult. hort. P. G. McNeil, Ofcolaco, Letaba District, Transvaal (BOL, HOLOTYPE!).

(v) General biology: This species is known to occur in the western and south-eastern districts of Southern Rhodesia, in the Transvaal and northern Natal (see Map 26).

Precipitation at the South African localities is rather low, lying in the range 15" - 30" per annum. Frost may only occur at the Transvaal localities, on up to 20 days of the year. The soil at the Natal locality is given by the collector as very stony, black and heavy; in the Transvaal the species occurs in areas with ferruginous lateritic soils. The species grows in bushveld under trees and may form large colonies, chiefly made up of the persistent pseudobulbs of previous season's growth.

Flowering takes place in the warm wet summer months December and January. The chromosome number of material from Natal (taken from the holotype before it was pressed and dried) was found to be  $n = 26$ .



Map 26: Distribution of *Eulophia leachii*

Greatrex ex Hall in South Africa.

26. EULOPHIA MACOWANII ROLFE

(i) Description: Rhizome subterranean, moniliform.

Leaves partly to fully developed at anthesis, up to 15 - 40 cm. long and 1.0 - 3.0 cm. wide, slightly leathery in texture, usually arcuate - spreading. Scape 23 - 40 cm. tall, a little stout. Upper sheaths on the scape rather longer to 1/2 the length of their internodes, closely to loosely clasping. Bracts 10 - 38 mm. long, rather longer to less than half the length of the ovary, elliptic - ovate to narrowly lanceolate, acuminate. Raceme rather lax; flowers 4 - 20, mostly quite unresupinate, occasionally the ovaries slightly twisted, never through more than about 20°; petals and sepals partly spreading.

Odd sepal (17.8) - 20 - 28 - (33.0) mm. long, nearly oblong, acute to apiculate; lateral sepals similar, with a prominent keel on the outer surface. Petals usually rotund to elliptic, sometimes variously obovate, very rarely narrowly ovate - oblong, a little longer to shorter than the odd sepal, acute to obtuse. Column 5 - 8 mm. long, a little stout. Mentum 1.0 - 2.5 mm. long, passing into a cylindrical spur 5 - 8 mm. long lying at about 30° - 45° to the ovary. Lip with the basal third cuneate and the apices of the side lobes shortly rounded to elongate and subacute. Mid-lobe generally very broadly ovate, obtuse to retuse or subacute, up to 15 mm. wide. Nerves of the lip numerous and often closely set, especially in the side lobes. Crests consisting of 2 - 5 lamellae in

the basal half of the lip, those on either side of the central nerve often reaching 2 mm. high, with a few rows of acuminate papillae distally, usually terminating about half-way along the mid-lobe.

Sepals pale to dark chestnut brown outside, pale green within. Petals white tinged with yellow, sometimes with the chief nerves purple near the base of the inner surface. Lip white, the main uncrested nerves purple except on the distal parts of the mid-lobe; crests pale to bright yellow, sometimes tinged with pale orange distally. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has often been mis-identified with forms of Eulophia ovalis Lindl., which it resembles in many respects. E.ovalis differs in having the flowers always resupinate at anthesis, the petals variously ovate, the lamellae in the basal half of the lip generally less than 1 mm. high, and the nerves of the lip seldom numerous and closely set. The species also resembles E.cooperi Reichb.f., which differs in having the spur at the base of the lip less than 2.2 mm. long, the crest papillae few and less than 0.5 mm. high, the petals narrowly ovate to lanceolate and the perianth concolorous (c.f. pages 36 - 52).

There is also a general resemblance to E.parvilabris Lindl., which differs in lacking numerous acuminate papillae on the lip, in having the leaves up to 5.5 cm.

wide, the mentum vestigial to less than 1.0 mm. long, and the lip with the basal third dark maroon.

(iii) Nomenclature: The earliest description matching this species was published by Rolfe in 1912, with the name Eulophia macowanii (mis-spelt "macowani"). Eleven specimens are cited with this description which was in English and formed part of the Flora Capensis. In 1913, Rolfe gave a Latin translation of the original description, evidently to validate the publication of the species. Only two of the original eleven specimens are cited, and were probably intended to represent the type material. Both specimens in the Kew Herbarium (K) agree with the present concept and with the original description, so that they may be regarded as the syntypes of E.macowanii Rolfe.

In 1946, H. M. L. Bolus published a description matching the present concept, with the name Eulophia schnelliae. The material annotated as the holotype from the Eastern Cape in the Bolus Herbarium (BOL) clearly agrees with the present species, so that E.schnelliae H.M.L.Bolus should be regarded as a later synonym of E.macowanii Rolfe.

(iv) Nomenclatural references and types:

Eulophia macowanii ("macowani") Rolfe Fl. Cap. 5(3): 38 (1912), et Kew Bull. 1913: 30 (1913). Syntypes: Macowan 184, Kaaouga River, Bathurst (K, syntype!); Hutton

s.n. in Herb. Norm. Austr. Afr. 1215, Kowie River Mouth (K, syntype!).

Eulophia schnelliae H.M.L. Bolus Fl. Pl. Afr. 25: sub tab. 965 (1946). Holotype: Schnell s.n. in Herb. Bolus. 22860, near Kingwilliamstown, Nov. 1942 (BOL, holotype!).

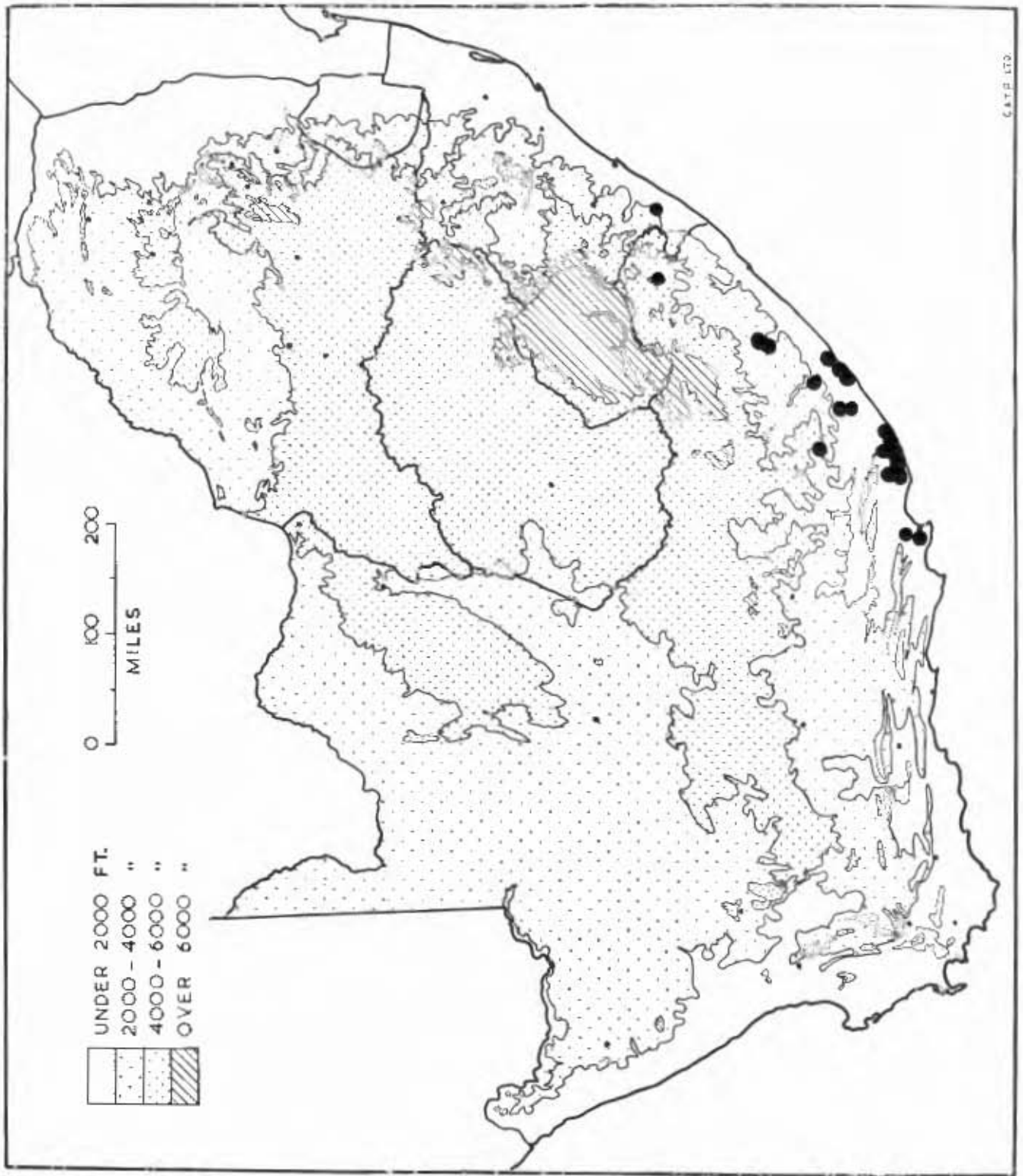
(v) General biology: This species appears to be confined to South Africa, where it is found mostly in the South-East Cape and occasionally in the north-eastern Cape and Natal (see Map 27).

Precipitation at accurately recorded localities may be slightly low, lying in the range 20" - 40". Frost may be absent or occur on up to 20 (rarely 40 - 60) days of the year. The regional soil types in the areas where the species grows vary from sandy loams to podsols. Many collectors note that the species inhabits grassland, where it may be rare or form very large populations of 300 or more scattered individuals.

Flowering takes place mostly during the warm wet summer months (see Table 26). The chromosome number of material from near Umtata in the Eastern Cape was found to be  $n = 28$ .

**Table 26:** Records in herbaria of the month of collection of flowering specimens of Eulophia macowanii Rolfe.

<u>Month</u>						<u>No. of records</u>
August	..	..	..	..	..	1
September	..	..	..	..	..	1
October	..	..	..	..	..	0
November	..	..	..	..	..	4
December	..	..	..	..	..	11
January	..	..	..	..	..	7
February	..	..	..	..	..	3
March	..	..	..	..	..	0
April	..	..	..	..	..	1



Map 27: Distribution of *Eulophia macowanii* Rolfe.

27. EULOPHIA COOPERI REICHB.F.

(1) Description: Rhizome subterranean, moniliform.

Leaves scarcely to partly developed at anthesis, 8 - 18 cm. long, 0.7 - 1.6 cm. wide, later reaching about 30 cm. long, rather leathery with several veins emergent on the abaxial surface. Scape 16 - 37 cm. high, rather stout. Upper sheaths on the scape slightly longer to half as long as their internodes, loosely to very loosely clasping. Bracts generally a little shorter than the ovary, elliptic to narrowly elliptic, acuminate. Raceme dense to lax; flowers 6 - 18, often unresupinate at anthesis, with the perianth sub-campanulate.

Odd sepal (16.8) - 19 - 26 - (29.0) mm. long, lanceolate to lanceolate-oblong, very acute; lateral sepals similar, sometimes slightly broader. Petals as long to a little shorter than the odd sepal, narrowly ovate to lanceolate, acute. Column 7 - 8 mm. long. Mentum 2 - 5 mm. long, passing into a very short subcylindrical spur 1.2 - 2.2 mm. long. Side lobes of the lip fused to the distal  $1/2$  -  $1/3$  of the mentum, broadened somewhat near the base and tapering slightly to the variously rounded free apical portion. Mid-lobe 6 - 8 mm. wide near the base, broadly ovate, obtuse. Crests consisting of 3 - 7 low undulate ridges in the basal third of the lip, distally becoming verrucose and with a few stout papillae less than 0.5 mm. high, terminating about half-way along the mid-lobe. Sepals pale straw yellow, tinged with green.

Petals and lip straw yellow with the lip variously tinged purple and the crests bright yellow. Flowers reported to be heavily scented, especially at night.

(ii) Distinctions from similar taxa: This species has been occasionally mis-identified in herbaria with Eulophia ovalis ssp. bainessii (Rolfe) Hall, which differs in having the crest papillae more than 1.5 mm. long, acuminate and slender, the leaves fully developed at anthesis, the flowers resupinate when fully open, with the sepals generally widely spreading and green to brownish green, and the flowers lacking scent when fresh. E.cooperi differs from both E.macowanii Rolfe and E.ovalis Lindl. ssp. ovalis in having the spur at the base of the lip less than 2.2 mm. long and the leaves partly developed at anthesis.

(iii) Nomenclature: The earliest description resembling this species was published in 1881 by Reichenbach, with the name Eulophia cooperi. The description is not sufficiently detailed to exclude certain similar taxa (e.g. E.ovalis Lindl.) but clearly agrees with the present concept in all but one detail, the collector's report of the flower colour, given as "green and purple".

Reichenbach gives as the type specimen Cooper 977b, collected in the Orange Free State. In the collector's manuscript notes in the Library of the Kew Herbarium (K), the colours originally given for this specimen (reading

"green pin/pur") were deleted, indicating that Cooper was uncertain about the accuracy of his observation. A specimen bearing the type number in the Vienna herbarium (W), and consisting of leaves and a flowering scape of the present species, is identified as E.cooperi in Reichenbach's handwriting. This specimen should be regarded as the holotype. There is also material of the type number at Kew (K) and the Bolus Herbarium (BOL), likewise matching the concept. There seems little doubt therefore that the name E.cooperi Reichb.f. refers to the present species.

In 1895, Schlechter published a description with the name Eulophia fragrans, including nearly all the distinguishing features of the present species. Material from the central Transvaal bearing the Type number at Kew (K) and the Bolus Herbarium (BOL) agrees with the present concept in all respects, so that E.fragrans Schltr. should be regarded as a later synonym of E.cooperi Reichb.f.

In 1910, Rolfe published a description with the name Eulophia robusta. Of the four scapes annotated as the Type by Rolfe in the Kew Herbarium (K), three match the present concept but the fourth (marked "D") belongs to Eulophia clavicornis Lindl. var. clavicornis. As some features of this scape are included in the original description (petals elliptic - oblong, pink or white, sepals brown), the name Eulophia robusta Rolfe should be regarded as being based on discordant elements and must therefore be rejected in terms of Art. 70 (Int. Code, 1961). In

1912, Rolfe published a description matching the present concept, with the name Eulophia sankeyi. The specimen annotated as the type by Rolfe in the Kew Herbarium (K) agrees with the concept in all respects, so that E.sankeyi Rolfe should be regarded as a later synonym of E.cooperi Reichb.f.

(iv) Nomenclatural references and types:

Eulophia cooperi Reichb.f. Flora 64: 330 (1881).

Holotype: Cooper 977b, Orange Free State, 1862 (W, holotype!; K, type number!; BOL, type number!).

E.fragrans Schltr. Bot. Jahrb. 20 Beibl. 50: 27

(1895). Holotype: Schlechter 3531, near Heidelberg (K, type number!; BOL, type number!).

E.sankeyi Rolfe Fl. Cap. 5(3): 46 (1912). Holo-

type: Sankey 306, Harrismith, Orange River Colony (K, holotype!).

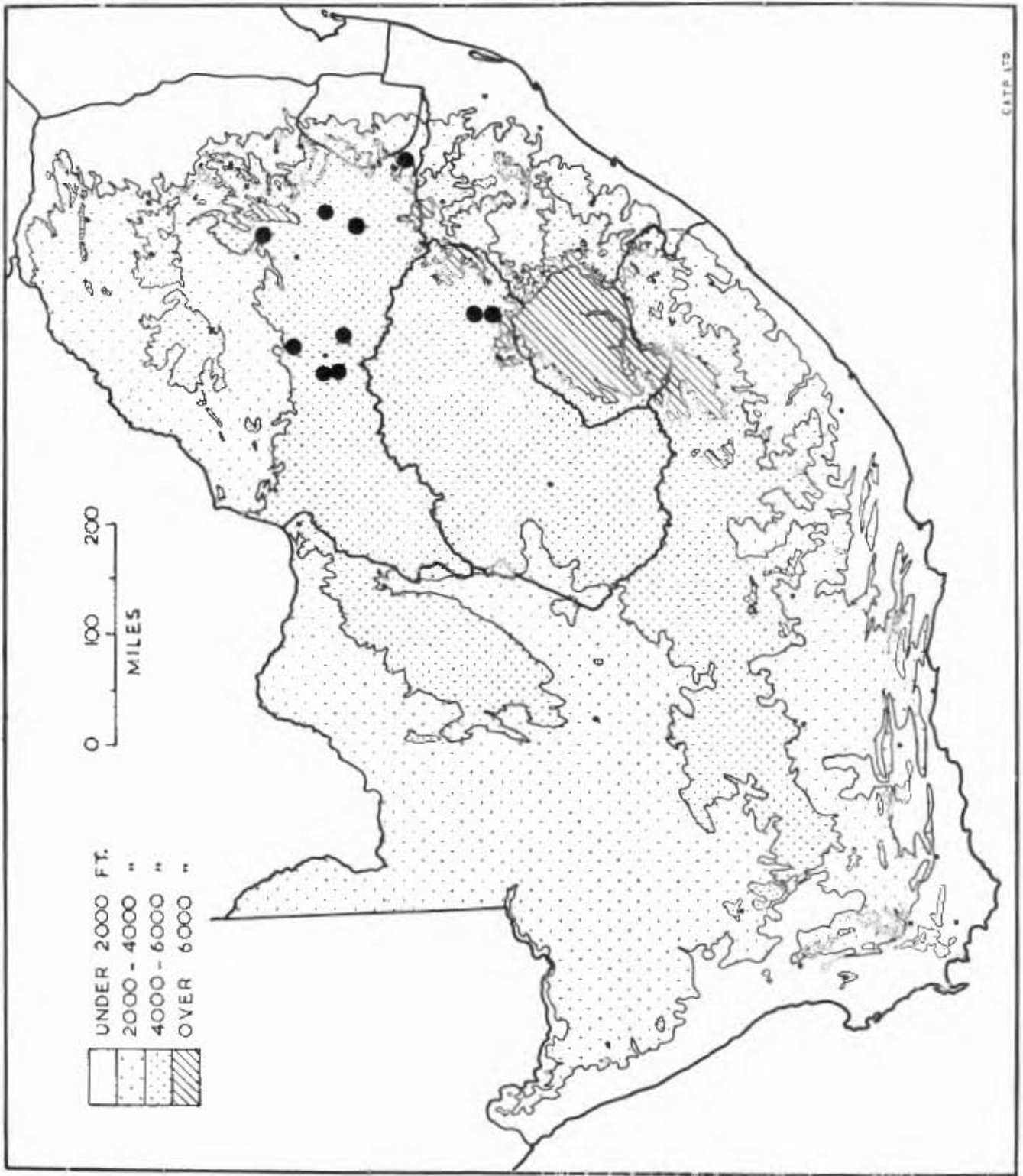
(v) General biology: This species appears to be confined to the central and eastern parts of the southern Transvaal, and the Eastern Orange Free State (see Map 28).

Precipitation at accurately recorded localities is a little high, lying in the range 25" - 35" per annum. Frost may occur on up to 20 days of the year at some places, on 60 - 80 days at others. The regional soil types in the areas where the species grows vary from black clay to

podsoils and lateritic soils. Many collectors note that the species inhabits grassland, where it may be rare to frequent. Flowering usually takes place in Spring (see Table 27).

**Table 27:** Records in herbaria of the month of collection of flowering specimens of Eulophia cooperi Reichb.f.

<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	10
November	..	..	..	..	..	8
December	..	..	..	..	..	1
January	..	..	..	..	..	0
February	..	..	..	..	..	1
March	..	..	..	..	..	0
April	..	..	..	..	..	1



Map 28: Distribution of *Eulophia cooperi* Reichb.f.

28. EULOPRIA OVALIS LINDL.

(1) Description:

(a) ssp. ovalis: Rhizome subterranean, moniliform. Leaves fully developed and generally more than half the length of the scape at anthesis, up to 11 - 46 cm. long, 0.4 - 3.0 cm. wide, somewhat leathery, with 3 or more veins emergent on the abaxial surface. Scape about 15 - 50 cm. tall, slender to stout. Upper sheaths on the scape generally slightly longer than their internodes, usually rather loosely clasping. Bracts rather longer to about half the length of the ovary, narrowly lanceolate to narrowly elliptic, acuminate. Raceme lax to dense; flowers 3 - 18, fully resupinate at anthesis with the sepals partly to widely spreading and the petals declinate over the lip to slightly spreading.

Odd sepal (13.8) - 17 - 23 - (26.0) mm. long, oblong to lanceolate-oblong, acute to subobtuse or apiculate; lateral sepals similar. Petals about as long as the odd sepal, narrowly ovate or narrowly elliptic-ovate, tapering to a subacute apex. Column 6 - 9 mm. long. Mentum 1 - 5 mm. long, passing into a conical to cylindrical spur 2.5 - 5.6 mm. long, variously curved away from the ovary. Side lobes of the lip fused to the distal half of the mentum, somewhat rounded to suboblong, passing into a short to elongate, variously rounded free distal portion. Mid-lobe broadly ovate to suborbicular,

5 - 12 mm. broad and 5 - 15 mm. long, obtuse to retuse or mucronate. Crests consisting of 2 - 5 undulate ridges in the basal third of the lip, passing into slender acuminate papillae up to about 1.5 mm. long in the central third, generally extending a little more than half-way along the mid-lobe.

Sepals reddish-purple to green or dark purplish olive outside, paler within. Petals white, slightly tinged with yellow, purple at the base of the outer surface, the inner surface with minute dark blue speckles chiefly along the nerves. Lip similar to the petals, with the side lobes more heavily speckled than the mid-lobe and the crests yellow. No flower scent detectable.

(b) *ssp. bainesii* (Rolfe) Hall, stat. nov.: Differs from *ssp. ovalis* as follows: Leaves up to 62 cm. long, the scape up to 65 cm. tall. Upper sheaths on the scape nearly always longer than their internodes, very rarely  $\frac{2}{3}$  as long. Odd sepal (18.4) - 22 - 28 - (36.0) mm. long. Mid-lobe 8 - 15 mm. broad, 9 - 18 mm. long. Spur stout, dorso-ventrally compressed, 1.0 - 2.9 mm. long. Crest papillae generally extending a little less than half-way along the mid-lobe.

Sepals green tinged with brown to purplish-brown, paler on the inner surface. Petals pale straw yellow, brownish-purple at the base of the outer surface, the inner side with a few minute dark blue speckles chiefly near the

base, and the main nerves lemon yellow. Lip similar to the petals, with the side lobes with numerous dark purple speckles along the nerves and the areas in between often tinged pale bluish purple; crests bright lemon yellow. No flower scent detectable.

(ii) Distinctions from similar taxa: Both subspecies are somewhat variable and have been mis-identified with several taxa, chiefly Eulephia macowanii Rolfe, which differs in having unresupinate flowers usually with rounded to elliptic petals and tall lamellae in the basal half of the lip, often reaching 2 mm. high. E.cooperi Reichb.f. is another similar species, differing in having the leaves scarcely to partly developed at anthesis, usually less than half the length of the scape, the crests consisting of low undulate ridges, distally becoming verrucose and shortly papillose, the flowers heavily scented with the sepals pale straw yellow tinged with green.

Some forms of E.clavicornis Lindl. superficially resemble E.ovalis ssp. ovalis, but differ in having the leaves partly developed at anthesis, the petals variously oblong and very obtuse, often fused to the column and somewhat distorted, the distal crests consisting of variously dissected and papillose lamellae terminating near the mid-lobe apex.

Both subspecies have been occasionally mis-identified with E.ensata Lindl., which differs chiefly in having

the petals narrower than the odd sepal and the perianth segments yellow throughout.

(iii) Nomenclature: Among the names given by Rolfe (1912) as referring to the present species, the earliest is Serapias capensis L. However, the description given by Linnaeus with this name disagrees with the present concept in referring to a "terminal raceme", and material probably representing the type of Serapias capensis in the Linnaean herbarium (s.leg., Linn. Herb. No. 1057.9, s. loc.) clearly belongs to the genus Acrolophia (Summerhayes and Hall, 1962).

The two earliest descriptions matching the present species were published simultaneously in 1837 by Lindley, with the names Eulophia ovalis and E.dregeana. Specimens in the Lindley orchid herbarium at Kew (K), labelled with the collector and locality cited in the type description, clearly match the present concept. The sheets bear the identifications "Eul. ovalis" and "Eulophia dregeana" in Lindley's handwriting, so that the specimens may be regarded as the nomenclatural types of the two names.

It may be noted that the flowers of the type material of E.ovalis are rather smaller than those of E.dregeana. This may have been the chief feature which led Lindley to regard the specimens as belonging to two different species. In fact both types can be clearly identified with the long-spurred subspecies of the present

concept. There appears to be no precedent for the choice of either of the two available names. The epithet ovalis is preferable to dregeana as it is short and descriptive; the name of the long-spurred subspecies should therefore be written as Eulophia ovalis Lindl. ssp. ovalis.

Several names were subsequently published which appear to be synonymous with E.ovalis Lindl. ssp. ovalis. In 1847, Sonder published a description of a variety with the name Eulophia dregeana var. angustior. Material in the Vienna herbarium (W) is labelled "Herb. W. Sonder" and bears the collector's names and the locality quoted in the original description (Ecklon and Zeyher s.n., Siloh, Tambukiland). This specimen agrees with the description and may be regarded as an isotype. There is also material at the Stockholm herbarium (S) which may or may not be part of the type collection: it is labelled briefly "Eul. dreg. Lindl. varietas Sond. E.Z.". Both specimens clearly belong to the long-spurred subspecies, so that it is very probable that E.dregeana var. angustior Sond. should be regarded as a synonym of E.ovalis Lindl. ssp. ovalis.

In 1891, Kuntze transferred the epithet ovalis to Grapherchis, a generic name against which Eulophia has since been conserved (c.f. Summerhayes and Hall, 1962). In the years 1895 - 1912 Rolfe published several descriptions matching the long-spurred subspecies, with the names Eulophia deflexa, E.thunbergii, E.haygarthii, E.ovatipetala, and E.bakeri. The specimens annotated as the Types by

Rolfe at Kew (K) and the Bolus Herbarium (BOL) clearly belong to the long-spurred subspecies, so that these names should be regarded as later synonyms of E.ovalis Lindl. ssp. ovalis.

In 1910, Rolfe published a description based on material consisting of a plant belonging to the present concept and a flower of Eulophia ensata Lindl. The name given with the description was E.oblonga Rolfe. The description includes details of the flower (side lobes divergent, disc copiously barbate, mid-lobe oblong) and of the plant (raceme 10 cm. long, flowers white), so that neither element of the type can be excluded. Being based on a mixed nomenclatural Type, the name Eulophia oblonga Rolfe should be rejected (Art. 70, Int. Code, 1961).

The earliest description resembling the short-spurred subspecies was published by Rolfe in 1897, with the name Eulophia bainesii. The specimen annotated as the Type by Rolfe in the Kew Herbarium (K: Baines s.n., Tropical South Africa) consists of several well-developed leaves and a scape bearing a few buds apparently about to open. The short spurs (about 1 mm. long) which were unlikely to have enlarged more than a few tenths of a millimeter in later development of the bud, and the absence of crest papillae on the distal two-thirds of the mid-lobe suggests that the material more probably belongs to the present subspecies than to E.ovalis ssp. ovalis. The

taxon is regarded as a subspecies of E.ovalis here for the first time, so that its name should be written as Eulophia ovalis ssp. bainesii (Rolfe) Hall.

In 1924, Schlechter published descriptions of a species and a variety, both of which match E.ovalis ssp. bainesii. The species was given the name Eulophia transvaalensis, which is illegitimate owing to the prior existence of Eulophia transvaalensis Rolfe, which had been applied to material belonging to E.clavicornis var. inaequalis (Schltr.) Hall. Schlechter named the variety E.transvaalensis var. thorncroftii. Material of the type number of this variety at the Pretoria Herbarium (PRE: Thorncroft s.n. in Herb. Transv. Mus. 5005, Barberton), which may or may not have been seen by Schlechter, clearly belongs to the short-spurred subspecies of the present concept. It seems likely therefore that E.transvaalensis var. thorncroftii Schltr. should be regarded as a synonym of E.ovalis ssp. bainesii (Rolfe) Hall.

In 1933, H. M. L. Bolus published a full description closely resembling the short-spurred subspecies, with the name Eulophia pretoriensis. However, the flower colours are described as similar to those of E.fragrans Schltr. (at present known as E.cooperi Reichb.f.), with the petals and sepals pale straw yellow tinged with green. On a plate given with the description, the artist shows the same flower colours as had been used in a previous illustration of E.fragrans (H.M.L.Bolus 1928). However,

in specimens annotated as the syntypes at Pretoria (PRE) and the Bolus Herbarium (BOL), the sepals have dried a dark purple and the petals pale brown, as is frequently seen in herbarium specimens of the present concept, but not in E.cooperi Reichb.f. The specimens clearly agree with the present concept in all respects, so that E.pretoriensis H.M.L.Bolus should be regarded as a synonym of E.ovalis ssp. bainessii (Rolfe) Hall.

In 1949, Verdoorn published a new name, Eulophia complanata, to replace Schlechter's illegitimate E.transvaalensis var. transvaalensis. It should be noted that the precise identity of Schlechter's concept is in doubt, as although the original description of E.transvaalensis probably refers to the short-spurred group, material of the type number at Pretoria (PRE: Korthals s.n. in Herb. Transv. Mus. 6380, Pienaarsrivier) belongs to the other subspecies, E.ovalis ssp. ovalis. The specimen has shorter leaves than are given in the type description (16 cm. shorter), and there is no evidence that it was actually seen by Schlechter. The specimen may therefore be excluded from the type description, which can be taken as referring to the short-spurred subspecies. Both E.transvaalensis Schltr. var. transvaalensis and E.complanata Verdoorn can therefore be regarded as synonyms of E.ovalis ssp. bainessii (Rolfe) Hall.

(iv) Nomenclatural references and types:

(a) Eulophia ovalis Lindl. ssp. ovalis Comp. Bot. Mag. 2: 202 (1837). Holotype: Drège s.n., Ado, Grassy Hills (K, holotype!).

E.dregeana Lindl. Comp. Bot. Mag. 2: 202 (1837). Syntypes: Drège s.n., nr. Vischrivier in grass (K, syntype!); Drège s.n., between Keiskamma and Omsamcaba (K, syntype!).

E.dregeana var. angustior Sond. Linnaea 19: 75 (1847). Holotype: Ecklon & Zeyher s.n., near Siloh on the Klipplat R., Tambukiland, Nov. (W, isotype!; S, type collection?!).

Graphorchis ovalis (Lindl.) Kuntze Rev. Gen. 2: 662 (1891).

Eulophia deflexa Rolfe Kew Bull. 1895: 192 (1895). Holotype: ex hort. Kew. June 1895, leg. Allison s.n. (K, holotype!).

E.thunbergii Rolfe Kew Bull. 1910: 369 (1910). Holotype: Thunberg s.n., S. Africa (K, holotype!).

E.haygarthii Rolfe Kew Bull. 1910: 370 (1910). Syntypes: Haygarth in Herb. Wood. 1960 (K, syntype!); Wood 469, Camperdown, Natal (K, syntype!).

E.ovatipetala Rolfe Kew Bull. 1910: 281 (1910). Holotype: Bolus 10674, Emerald Hill, Port Elizabeth (BOL, holotype!; K, icon!).

E.bakeri Rolfe Fl. Cap. 5(3): 40 (1912). Holotype:

Baker s.n., high ridge outside Johannesburg, 5000', Transvaal (K, holotype!).

(b) Eulophia ovalis ssp. bainesii (Rolfe) Hall, stat. nov. Basionymus pro nom. ssp.: Eulophia bainesii Rolfe Fl. Trop. Afr. 7: 65 (1897). Holotype: Baines s.n., Tropical South Africa (K, holotype!).

E.transvaalensis Schltr. var. transvaalensis Ann. Transv. Mus. 10: 237 (1924), nom. illegit. non E.transvaalensis Rolfe Kew Bull. 1910: 282 (1910). Syntypes: Korthals s.n. in Herb. Transv. Mus. 6380, Pienaarsrivier, Transvaal, Nov. 1908 (excl. specim. PRE!); Jenkins s.n. in Herb. Transv. Mus. 10033, Krugersdorp, Jan. 1911 (no authentic material available).

E.transvaalensis var. thorncroftii Schltr. Ann. Transv. Mus. 10: 237 (1924). Holotype: Thorncroft s.n. in Herb. Transv. Mus. 5005, Barberton (PRE, type number!).

E.pretoriensis H.M.L.Bolus Fl. Pl. S. Afr., 13: sub tab. 500 (1933). Syntypes: Stent s.n. in Govt. Herb. 9949, The Willows, Pretoria Dist. (PRE, syntype!); Rogers s.n. in Nat. Bot. Gardens 90/18, Premier Mine (BOL, syntype!).

E.complanata Verdoorn Fl. Pl. Afr. 27: sub tab. 1056 (1949), nom. nov. pro syn. Eulophia transvaalensis Schltr.

(v) General biology:

(a) E.ovalis ssp. ovalis: This subspecies has been recorded at a large number of localities, in a distribution range extending from the Eastern Cape through Natal, the eastern Orange Free State, Basutoland and the southern half of the Transvaal. There are two outlying localities in the Northern Cape. (See Map 29).

Precipitation at accurately recorded localities lies mostly in the range 25" - 40" per annum, dropping to 20" - 25" at several places in the Western Transvaal. Of the two Northern Cape localities, the more southerly lies in an area receiving only 10" - 15" per annum. This very low figure suggests that the name of the locality given for the specimen (PRE: de Wet 4243, Griquatown) is either erroneous or ambiguous. If the subspecies actually does grow in this part of the Northern Cape, the habitat would have to be locally moister to compensate for the low rainfall.

Frost may be absent, or may occur on up to 80 days of the year. The regional soil types in the areas where the <sup>sub</sup>species grows vary widely, from podsoils to lateritic soils, sandy loams, Kalahari sand and desert soils with a lime horizon, and black clay. The subspecies inhabits open grassland, and may be rare to scattered or locally frequent in a given area.

Flowering takes place mostly in the warm wet summer months (see Table 28). The chromosome number of smaller

flowered material from the Eastern Cape and the Transvaal was  $n = 21$ ; plants with flowers of similar size but with less purple gave  $n = 20$ . Large purple-flowered specimens from the Eastern Transvaal were found to have a chromosome number of  $n = 40$ .

**Table 28:** Records in herbaria of the month of collection of flowering specimens of E.ovalis Lindl. ssp. ovalis.

<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	1
November	..	..	..	..	..	12
December	..	..	..	..	..	54
January	..	..	..	..	..	50
February	..	..	..	..	..	8
March	..	..	..	..	..	4
April	..	..	..	..	..	1

(b) E.ovalis ssp. bainesii: This subspecies is known to occur in Southern Rhodesia, the Northern and central parts of the Transvaal, and at an outlying locality in the Orange Free State (see Map 30).

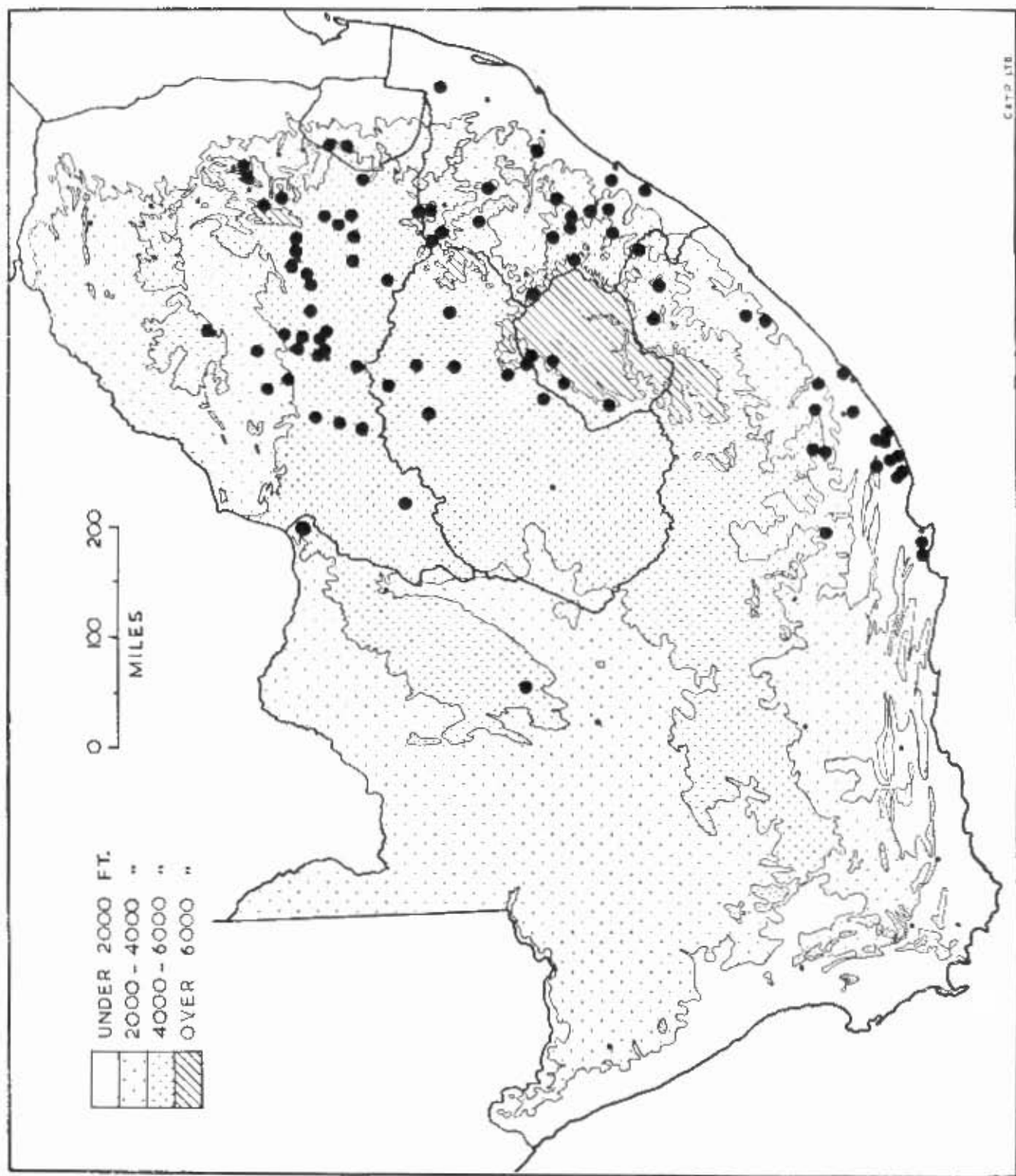
Precipitation at accurately recorded localities in South Africa usually lies in the range 30" - 50" per annum, occasionally as low as 15" - 20" (e.g. Hall 901, 1.5 miles East of Boyne, Pietersburg Dist., Transvaal).

Frost may be experienced on up to 20 days of the year at some places, at others on up to 40 or 60 days. The regional soil types in the areas where the subspecies grows are frequently lateritic and ferruginous, sometimes quartzitic. The subspecies inhabits open grassveld, or grassy places in bush or thornveld, in dry to seasonally marshy situations. It may be rare to scattered or locally frequent at a given locality.

Flowering takes place mostly in the months December and January, the warmest and wettest time of the year (see Table 29). The chromosome number of material from the Eastern and Northern Transvaal was found to be  $n = 38$ .

Table 29: Records in herbaria of the month of collection of flowering specimens of E.ovalis ssp. bainessii.

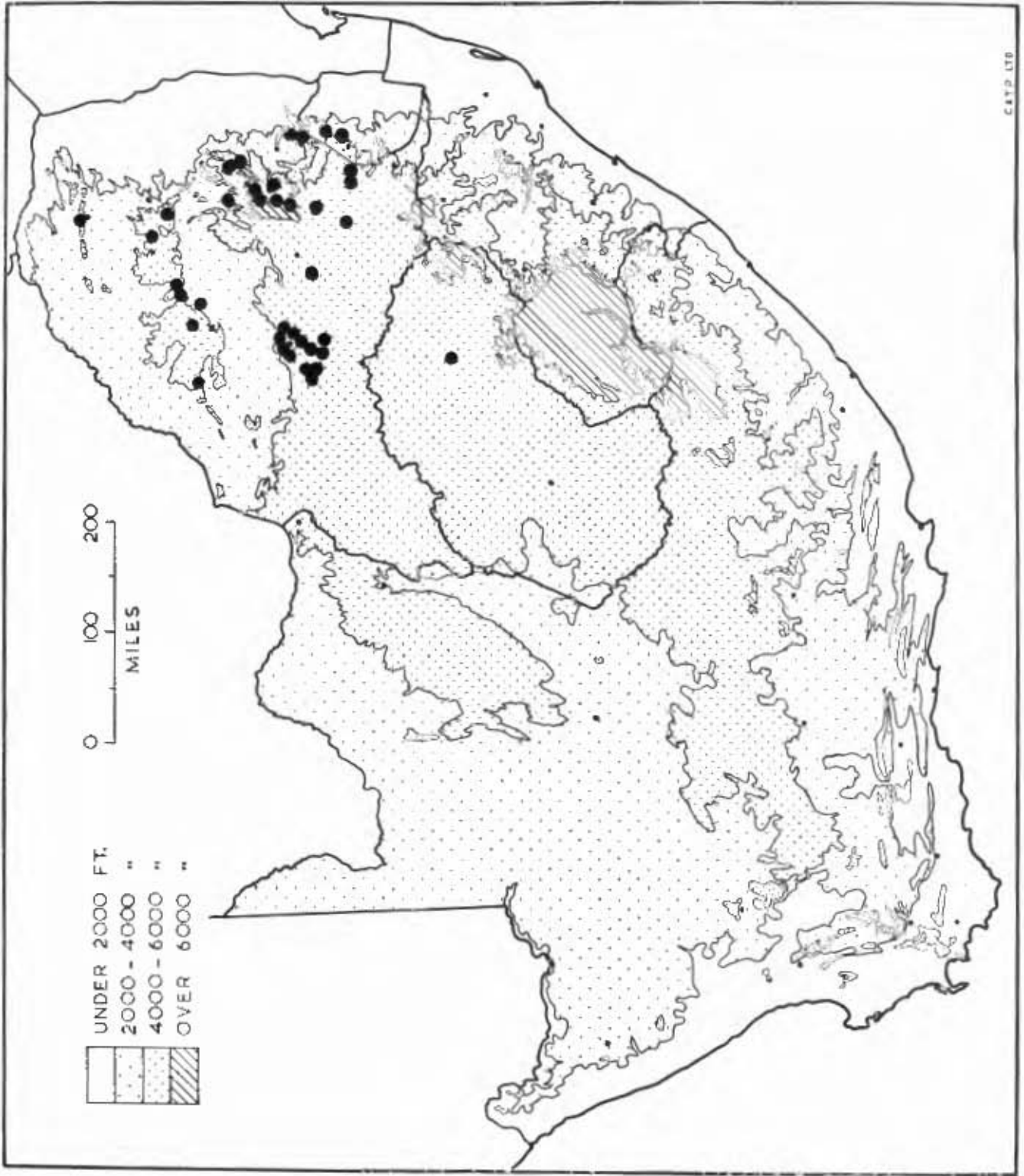
<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	1
November	..	..	..	..	..	0
December	..	..	..	..	..	33
January	..	..	..	..	..	36
February	..	..	..	..	..	0
March	..	..	..	..	..	2



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Map 29: Distribution of *Eulophia ovalis*

Lindl. ssp. *ovalis*.



Map 30: Distribution of *Eulophia ovalis* ssp. *bainesii* (Rolfe) Hall in South Africa.

29. EULOPHIA CLAVICORNIS LINDL.

(1) Descriptions:

(a) var. clavicornis: Rhizome subterranean, mon-  
illiform. Leaves partly developed, generally less than  
half the length of the scape at anthesis, 5 - 20 cm. long,  
0.3 - 0.9 cm. wide, later up to about 30 cm. long, with  
3 - 5 veins slightly emergent on the abaxial surface.  
Scape 11 - 45 cm. long, slender to a little stout. Upper  
sheaths on the scape generally  $1/3$  -  $1/2$  the length of  
their internodes, somewhat loosely clasping. Bracts  $1/3$   
-  $2/3$  the length of the ovary, narrowly elliptic to very  
broadly elliptic, acuminate. Raceme lax; flowers 3 -  
18, the perianth slightly spreading.

Odd sepal (8.5) - 9 - 13 - (17.5) mm. long, var-  
iously oblong to lanceolate-oblong, obtuse to acute or  
mucronate; lateral sepals similar. Petals broadly  
oblong to slightly ovate-oblong, very obtuse to truncate,  
rarely shortly apiculate, about as long as the sepals,  
often fused to the back of the column and falcate or  
variously distorted. Column 4 - 7 mm. long, the pollinia  
sometimes with one or both cells vestigial. Mentum abs-  
ent to less than 1.0 mm. long. Spur slender, cylindrical  
to slightly clavate, curved away from the ovary, (2.9) -  
4 - 7 - (8.9) mm. long. Lip, excluding the spur, about  
as long as the odd sepal; side lobes very narrow at the  
base of the lip, gradually broadening or falcate-divergent

distally, with the distal nerves curving away from the central axis of the lip. Mid-lobe about half the total length of the lip excluding the spur, usually broadly obovate, sometimes oblong, with the margins slightly undulate and the apex obtuse to truncate to retuse. Base of the lip sometimes fused to the margins of the column, leaving a low passage to the spur, with the side lobes variously distorted and reduced. Crests consisting of very low sometimes sparsely pubescent ridges in the basal half of the lip, rising to 3 - 7 thin lamellae, variously dentate and papillose, terminating within 2 mm. of the mid-lobe apex.

Sepals purplish green to dark reddish purple. Petals white, tinged pale pink to pale blue, the inner surface marked with faint bluish purple along the nerves, and the apex and margins sometimes purple. Lip similar to the petals with the chief uncrested nerves darker and the crests pale pink to straw yellow, sometimes distally tipped with dark purple. No flower scent detectable.

(b) var. *inaequalis* (Schltr.) Hall, stat. nov.:

Differs from var. *clavicornis* as follows: Upper sheaths on the scape frequently less than 1/3 the length of their internodes. Odd sepal (8.0) - 10 - 14 - (15.1) mm. long. Mentum elongate, 1 - 2 mm. long, the lip attached to the apex. Lip excluding the spur often somewhat shorter than the odd sepal; side lobes with the nerves distally scarcely curved away from the central axis of the lip.

Mid-lobe generally semi-ovate. Sepals green to dark reddish brown, paler within. Petals and lip bright yellow. No flower scent reported.

(c) var. mutans (Sond.) Hall, stat. nov.: Differs from var. clavicornis and var. inaequalis as follows: Leaves mature and generally more than half the length of the scape at anthesis, 17 - 73 cm. long. Scape 19 - 92 cm. long, slender to very slender, sometimes with 1 - 3 simple branches. Upper sheaths on the scape (excluding the topmost) more than half the length of their internodes, usually about as long, sometimes longer.

Odd sepal (8.0) - 9 - 16 - (18.8) mm. long, narrowly oblong to lorate. Petals usually narrowly oblong to elliptic-oblong, subobtuse, very rarely falcate or distorted. Spur often nearly parallel to the ovary, (1.4) - 2 - 4 - (5.2) mm. long. Lip with the side lobes usually broadened near the base, very rarely distorted. Distal crests on the lip usually consisting of distinct papillae, sometimes numerous.

Sepals green to yellow-green or dark purplish brown. Petals pale to rather deep purplish pink or white tinged with yellow and purple, the distal margins often purple. Lip similar to the petals with the crests white to pale yellow and sometimes with purple tips distally.

**(ii) Distinctions from similar taxa:** Material of all three varieties of this species has been mis-identified with E.ovalis Lindl. ssp. ovalis, which differs in having the petals tapering in the distal half to a subacute apex, the crests generally extending only a little beyond half-way along the mid-lobe, the flowers frequently larger, with the odd sepal (13.8) - 17 - 23 - (26.0) mm. long, and the spur often conical for much of its length, especially in the smaller-flowered forms.

Specimens of E.clavicornis var. clavicornis which have the side lobes partly fused to the margins of the column may resemble E.zeyheriana Sond., which differs in having the crests consisting of fleshy verrucose ridges and usually smaller flowers with shorter spurs 2 - 3 mm. long.

Smaller-flowered specimens of var. nutans have been occasionally mis-identified with E.tenella Reichb.f., which differs in having crests consisting of fleshy ridges, the petals relatively broad and often rotund, and the lip with the side lobes overlapping a small portion of the base of the mid-lobe.

**(iii) Nomenclature:** Many authors have considered that the name Eulophia hians Spreng. should be regarded as referring to the short-leaved, purple-flowered taxon given the status of a variety in the present work. If this were so it would be the earliest name referring to

any member of the present species. However, although Sprengel's synoptic description resembles the present concept, he gives no nomenclatural Type but cites the earlier name Limodorum hians Thunb., evidently as the basionym of his new combination Eulophia hians (Sprengel 1826). Thunberg (1794) gives as the basionym of his Limodorum hians a name published by the younger Linnaeus, Satyrium hians. The younger Linnaeus' description of Satyrium hians differs from the present concept in several details, and the only material named as such in the Linnaean Herbarium (LINN: T 321, Linn. Herb. No. 1055.8, s.loc.) probably belongs to the species at present known as Disa lacera Sw. (c.f. Lindley, 1838). The epithet hians therefore cannot be used for referring to the present concept.

The earliest descriptions matching a variety of the present species were published simultaneously in 1837 by Lindley, with the names Eulophia clavicornis and E.emarginata. Specimens in the Kew Herbarium (K), identified by Lindley with these two names, clearly match the short-leaved, purple-flowered variety of the present species. The two sheets also bear sketches, morphological notes and references to collectors and localities, agreeing in all respects with the details given in the original description (E.clavicornis: Drège s.n., Katberg; E.emarginata: Drège s.n., between Shiloh and Windvogelberg). It is very likely therefore that these specimens should be regarded as the holotypes of the two names. E.clavicornis

has been used more commonly in herbaria than E.emarginata; in the absence of a published precedent, this suggests that the epithet clavicornis is preferable, so that the variety should be referred to as Eulophia clavicornis Lindl. var. clavicornis.

It may be noted that the holotype of the variety clavicornis has flowers with the perianth variously distorted. Art. 71 states that "a name must be rejected if it is based on a monstrosity" (Int. Code, 1961). However, the distortions are frequently found in this taxon, so that they do not strictly constitute "monstrosities" in the sense of abnormal forms.

In 1847, Reichenbach published a description with the name Eulophia violacea, matching the forms of E.clavicornis with distorted purple flowers. The type, a specimen collected by Mund at 'Doukamma, Cape of Good Hope', was said to be in the Schöneberg herbarium at Berlin, and would have therefore been destroyed during World War II. However, in the Kew Herbarium (K) there is a detailed drawing of a similarly labelled specimen that had been borrowed from Berlin and was alleged to be the Type of E.violacea. This drawing closely resembles the variety clavicornis. There are also four flowers clearly matching this concept in the Vienna Herbarium (W), in a capsule labelled Eulophia violacea by Reichenbach, but without any evidence that they were actually taken from the Berlin specimen. It seems reasonably likely that the

name E.violacea Reichb.f. refers to the present concept, so that it should be regarded as a synonym of E.clavicornis Lindl. var. clavicornis.

In 1891, Kuntze transferred the epithets clavicornis and emarginata to Graphorchis, a generic name against which Eulophia has since been conserved (c.f. Summerhayes and Hall, 1962).

In 1917, Rolfe published a description resembling the present concept, with the name Eulophia obcordata. The specimen in the Kew Herbarium (K) annotated as the Type by Rolfe clearly agrees with the present concept, having distorted flowers with curved side-lobe nerves. E.obcordata Rolfe should therefore be regarded as a synonym of E.clavicornis Lindl. var. clavicornis.

The earliest description matching the variety with short leaves and scarcely curved side-lobe nerves was published in 1895 by Schlechter, with the name Eulophia inaequalis. Several characteristics of the present concept are given, but there is a major disagreement in the reference to a "short spur". The holotype (Sanderson 1011, Natal) may have been kept by Schlechter in his special collection in the Berlin Herbarium (B), and would almost certainly have been destroyed during World War II.

However, a sheet labelled with this number in the Natal Herbarium at Durban (NH) bears the identification

"E. inaequalis Schltr. n.sp." The sheet bears several scapes clearly agreeing with the present concept and with Schlechter's description, except for the spurs, which are elongate-cylindrical and were therefore probably erroneously described. The Durban specimen should be regarded as an isotype. It seems reasonably certain that the name E. inaequalis Schltr. refers to the present concept. The taxon is regarded as a variety here for the first time, and as Lindley's epithet clavicornis is earlier than Schlechter's inaequalis, the name should be written as Eulophia clavicornis var. inaequalis (Schltr.) Hall.

In 1910, Rolfe published four descriptions matching this concept, with the names Eulophia transvaalensis, E. aliwalensis, E. longipes and E. engleri. The material annotated as the Types by Rolfe in the Kew Herbarium (K) clearly agree with the present concept, so that the names should be regarded as synonyms of E. clavicornis var. inaequalis (Schltr.) Hall.

Rolfe published another description matching the concept in 1913, with the name Eulophia watkinsonii. One of the specimens quoted in the type description and annotated as "Type" by Rolfe in the Kew Herbarium (K: Stewart 42, Swaziland) belongs to E. clavicornis var. clavicornis, and may be excluded from the concept in having the lip as long as the sepals with the side lobes falcate-divergent. The two other specimens quoted in the original

description and labelled 'Type' by Rolfe agree with the present concept in all respects, so that E.watkinsonii Rolfe should be regarded as a synonym of E.clavicornis var. inaequalis (Schltr.) Hall. A specimen also labelled 'Type' by Rolfe (K; Watkinson s.n., s.loc.) was not quoted in the original description; it belongs to E.clavicornis var. clavicornis and like the Stewart specimen, may be excluded by having falcate - divergent side lobes.

The earliest description matching the long-leaved variety was published in 1846 by Sonder, with the name Eulophia nutans. No specimens have been found that could be regarded as authentic types of E.nutans. There is, however, a single flower in the Vienna Herbarium (W), in a capsule labelled by Reichenbach "Eulophia nutans", with no other data. The capsule is one of several on a sheet containing material from other herbaria, and it is possible that the flower might have been taken from one of Sonder's syntypes to assist in making subsequent identifications. Four flowers in a capsule at Vienna (W) labelled Harvey 340 and also belonging to the present concept were also identified as E.nutans by Reichenbach.

The original description of E.nutans Sond., besides agreeing in all respects with the long-leaved variety, contains features which exclude similar taxa. The crests are said to be "ramentaceous", excluding E.tenella Reichb.f.

which has fleshy subentire ridges and lamellae on the lip. The leaves are given as equalling the scape in length, and with the "rounded base of the lip", exclude both E.clavicornis Lindl. var. clavicornis (mentioned as distinct by Sonder), and E.clavicornis var. inaequalis (Schltr.) Hall. The lip is described as subrotund with oblong side lobes, which excludes E.zeyheriana Sond., whose characteristic lip with spreading subelliptic side lobes is accurately portrayed on the same page as the original description of E.nutans Sond. The oblong petals and obovate mid-lobe would exclude forms of E.ovalis Lindl.

It therefore seems reasonably likely that the name E.nutans Sond. refers to the long-leaved variety. The taxon is regarded as a variety here for the first time, and as Lindley's epithet clavicornis is earlier than Sonder's nutans, the name should be written as Eulophia clavicornis var. nutans (Sond.) Hall.

Several names were subsequently published in the period 1889 - 1924, with descriptions and types that clearly match forms of the long-leaved variety: Eulophia carunculifera Reichb.f., E.laxiflora Schltr., E.galpinii Schltr., E.aemula Schltr., E.flanaganii Bolus, E.purpurascens Rolfe, E.gladioloides Rolfe, E.nelsonii Rolfe (mis-spelt "nelsoni"), E.triloba Rolfe, E.decurva Schltr., E.ernestii Schltr., and E.amajubae Schltr. These names should be regarded as synonyms of E.clavicornis var. nutans (Sond.) Hall.

It is possible that further research will show that

certain other names may have to be regarded as synonyms of E.clavicornis var. nutans: Eulophia vaginata Ridley, E.crinita Rolfe non G.Don, and E.ukingensis Schltr. As these names are based on material from beyond the borders of South Africa (Madagascar, Nyasaland and Western Tanganyika), and were published later than E.nutans Sond., they were not studied in detail. (c.f. Page 95).

(iv) Nomenclatural references and types:

(a) Eulophia clavicornis Lindl. var. clavicornis Comp. Bot. Mag. 2: 202 (1837). Holotype: Drège s.n., Katberg (K, holotype!).

E.emarginata Lindl. Comp. Bot. Mag. 2: 202 (1837). Holotype: Drège s.n., between Shiloh and Windvogelberg (K, holotype!).

E.violacea Reichb.f. Linnaea 20: 683 (1847). Holotype: Mund s.n., Doukamma, Cape of Good Hope, Nov. 1819 (K, icon.!).

Graphorchis clavicornis (Lindl.) Kuntze Rev. Gen. 662 (1891).

G.emarginata (Lindl.) Kuntze Rev. Gen. 662 (1891).

Eulophia obcordata Rolfe Kew Bull. 1917: 82 (1917). Holotypes: Wood 11789a, Gillitts, Natal (K, holotype!).

(b) Eulophia clavicornis var. inaequalis (Schltr.) Hall, stat. nov. Basionymum pro nom. var.: Eulophia

inaequalis Schltr. Bot. Jahrb. 20, Beibl. 50: 3 (1895).

Holotype: Sanderson 1011, Natal (NH, isotype!).

E.transvaalensis Rolfe Kew Bull. 1910: 282 (1910).

Holotype: Bolus 10676, Vaal Bank, between the Devils Kan-  
toor and Pretoria (BOL, holotype!; K, icon.!).

E.aliwalensis Rolfe Kew Bull. 1910: 368 (1910).

Holotype: Bolus 10671, Elands Hoek near Aliwal North (BOL,  
holotype!; K, icon.!).

E.longipes Rolfe Kew Bull. 1910: 280 (1910). Holo-

type: Buchanan 3, Natal (K, holotype!).

E.engleri Rolfe Kew Bull. 1910: 282 (1910). Holo-

type: Engler 2745, Klip River Mts. (K, icon.!).

E.watkinsonii Rolfe Kew Bull. 1913: 339 (1913).

Syntypes: Watkinson s.n., Ermelo (K, syntype!); Galpin  
509, Musidora nr. Barberton (K, syntype!); Stewart 42,  
Swaziland (excl. specim. K!).

(c) Eulophia clavicornis var. nutans (Sond.) Hall,  
stat. nov. Basionymum pro nom. var.: Eulophia nutans  
Sond. Linnaea 19: 73 (1846). Syntypes: Ecklon & Zeyher  
s.n., Uitenhage, Nov.; Ecklon & Zeyher s.n., Katriviers-  
berg (W, flor. unic.?!; no definitely authentic material  
available).

E.carunculifera Reichb.f. Flora 64: 329 (1889).

Holotype: Buchanan s.n., Port Natal (K, holotype!).

Eulophia laxiflora Schltr. Bot. Jahrb. 20, Beibl. 50: 4 (1895). Syntypes: Wood 3430, nr. Blaauw Krantz (BOL, type number!); Wood 725, nr. Itafamasi (K, holotype!).

E.galpinii Schltr. Bot. Jahrb. 20, Beibl. 50: 10 (1895). Syntypes: Galpin 1151, Umlomati Valley (BOL, isotype!); Culver 82, Musidora.

E.aemula Schltr. Bot. Jahrb. 20, Beibl. 50: 26 (1895). Syntypes: Schlechter 4057, Botsabelo (Z, BOL, BM, K, iso-syntypes!); Schlechter s.n., nr. Elim, Feb. 1894; Culver 14, Moodies nr. Barberton (BOL, syntype!); Flanagan 1117, nr. Komgha (BOL, syntype!); Wylie s.n. in Herb. Wood. 5372, nr. Sevenfontein (K, syntype!).

E.flanaganii Bolus Trans. S. Afr. Phil. Soc. 16: 143 (1905). Syntypes: Flanagan 1029, nr. mouth of the Kei River (BOL, syntype!; K, isosyntype!); Galpin 1713, nr. Queenstown (BOL, syntype!); F.Bolus s.n. in Herb. Bolus. 10544, Elands Hoek nr. Aliwal North (BOL, syntype!).

Eulophia purpurascens Rolfe Kew Bull. 1910: 281 (1910). Holotype: Wood s.n. in Herb. Norm. Austr. Afr. 1367, Tongaat River, Natal (K, holotype!).

E.gladioloides Rolfe Kew Bull. 1910: 281 (1910). Holotype: Wood 7922, Lidgetton, Natal (BOL, holotype!; K, icon!).

E.nelsonii Rolfe ("nelsonii") Kew Bull. 1910: 369 (1910). Holotype: Nelson 297, Pretoria Dist., Wanderwald (K, holotype!).

Eulophia triloba Rolfe Kew Bull. 1917: 81 (1917).

Holotype: Haygarth s.n. in Herb. Wood. 11785, Gingishlovu, Natal (K, holotype!).

E.decurva Schltr. Ann. Transv. Mus. 10: 235 (1924).

Holotype: Flanagan 1117, nr. Komgha (BOL, isotype!).

E.amajubae Schltr. Ann. Transv. Mus. 10: 236 (1924).

Holotype: Wood 4837, Amajuba Mt., Natal (no authentic material available).

E.ernestii Schltr. Ann. Transv. Mus. 10: 235 (1924).

Holotype: Galpin 2250, nr. Queenstown (BOL, isotype!).

(v) General biology: The three varieties have a remarkably similar distribution in South Africa (see Maps 31 - 35). Forms closely resembling the variety mutans and very probably belonging to it have been found in Nyasaland, Madagascar, Western Tanganyika and Kenya (BM: Davis 18, Londiani, Kenya). However, the localities in these territories are very widely dispersed in spite of intensive collecting in some areas, so that they could be regarded as forming a reduction margin of the more densely populated part of the range in South Africa. Neither of the two other varieties are at present known from outside South Africa.

Precipitation at accurately recorded localities in South Africa lies chiefly in the higher parts of the range 20" - 60" per annum. Frost may be absent, or may occur on up to 80 days of the year. There appears to be

no preference for a particular regional soil type; however, collector's records indicate that only the variety nutans may be found growing in marshy conditions. All three varieties are confined to grassland, where they may be rare or form small colonies of up to about 30 scattered plants.

Members of a population of the variety nutans may differ from those at neighbouring localities in small details of colouring, perianth size and lip shape. In the variety clavicornis the relative frequency of plants with distorted flowers may also differ between populations (c.f. page 62).

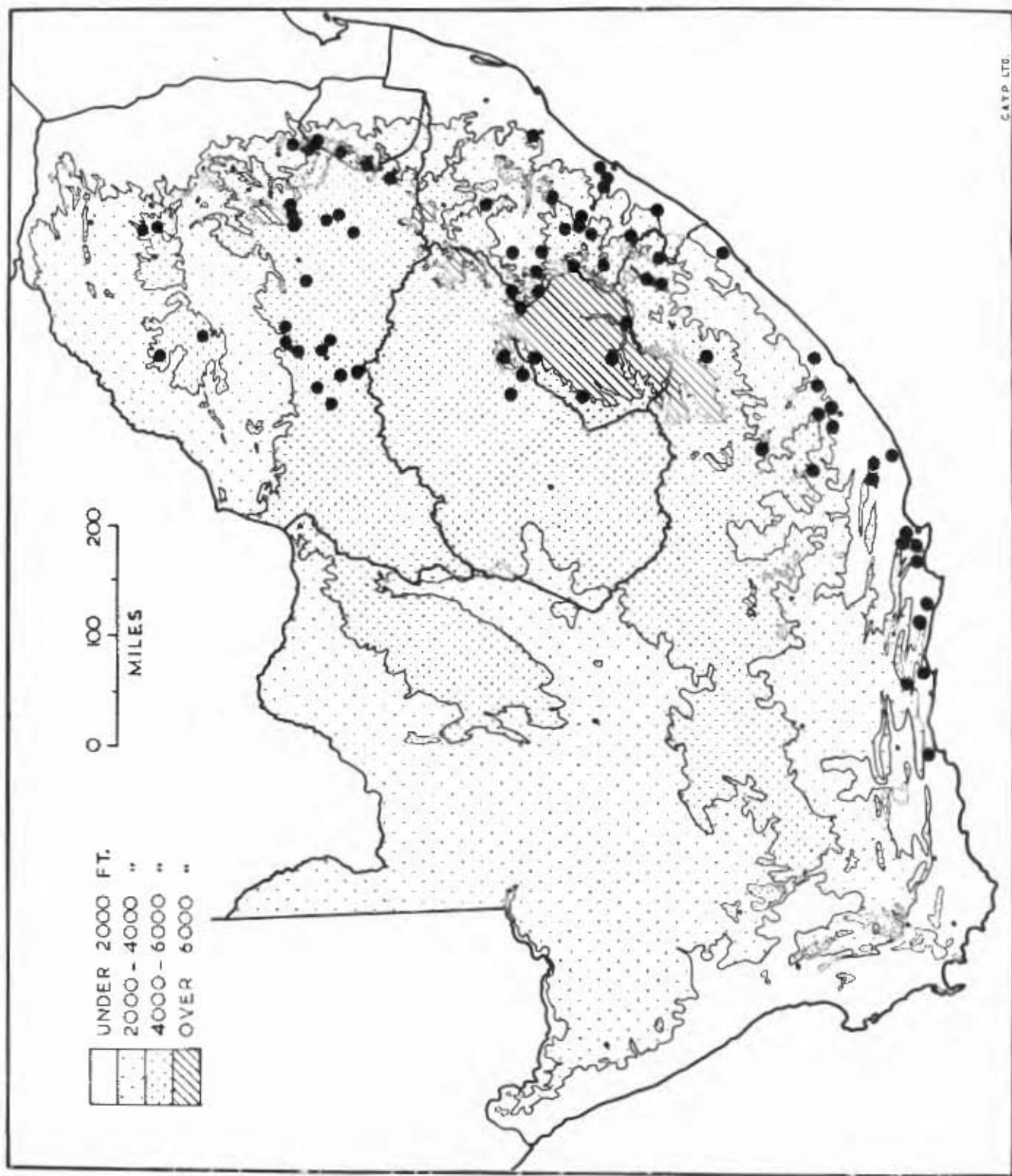
The varieties inaequalis and clavicornis flower mostly in the Spring and early Summer months, the variety nutans usually somewhat later (see Table 30). The chromosome number of material of var. clavicornis from two places in the Eastern Cape was found to be  $n = 50$ . Specimens of var. nutans from near Pilgrims Rest in the Eastern Transvaal gave  $n = 47$ , while the count of  $n = 25$  was obtained from very similar plants growing 40 miles away near Lydenburg. Other material of the variety nutans from the Eastern Transvaal and Natal also gave  $n = 25$ .

**Table 30:** Records in herbaria of the dates of collection of flowering specimens of the three varieties of *E.clavicornis* Lindl. in South Africa.

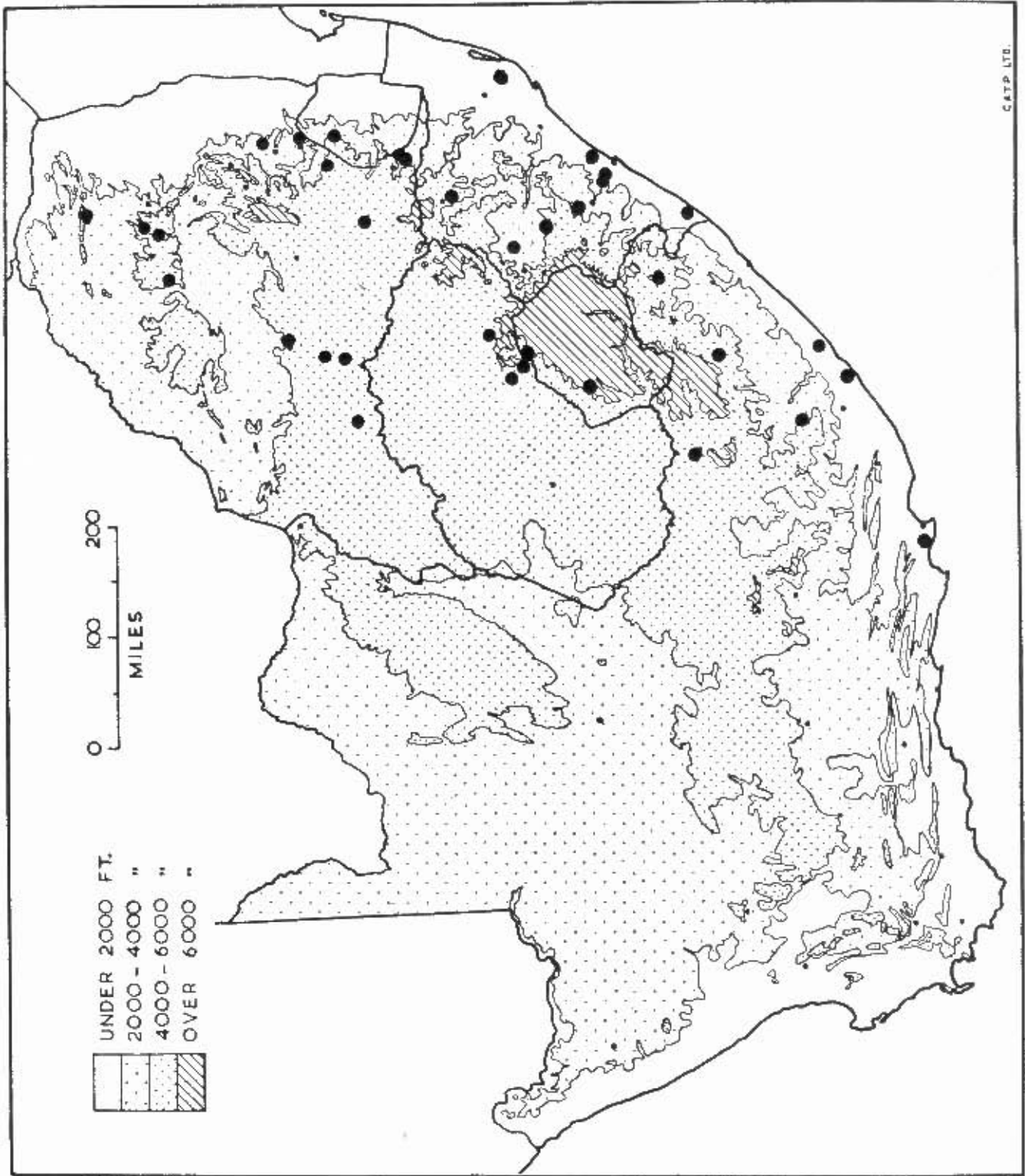
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<u>Month</u>	<u>No. of records</u>		
	<u>var.clavicornis</u>	<u>var.inaequalis</u>	<u>var.nutans</u>
July ..	0	1	0
August ..	6	5	0
September ..	41	24	2
October ..	53	16	1
November ..	44	5	6
December ..	13	0	29
January ..	2	1	78
February ..	1	1	18
March ..	0	1	1

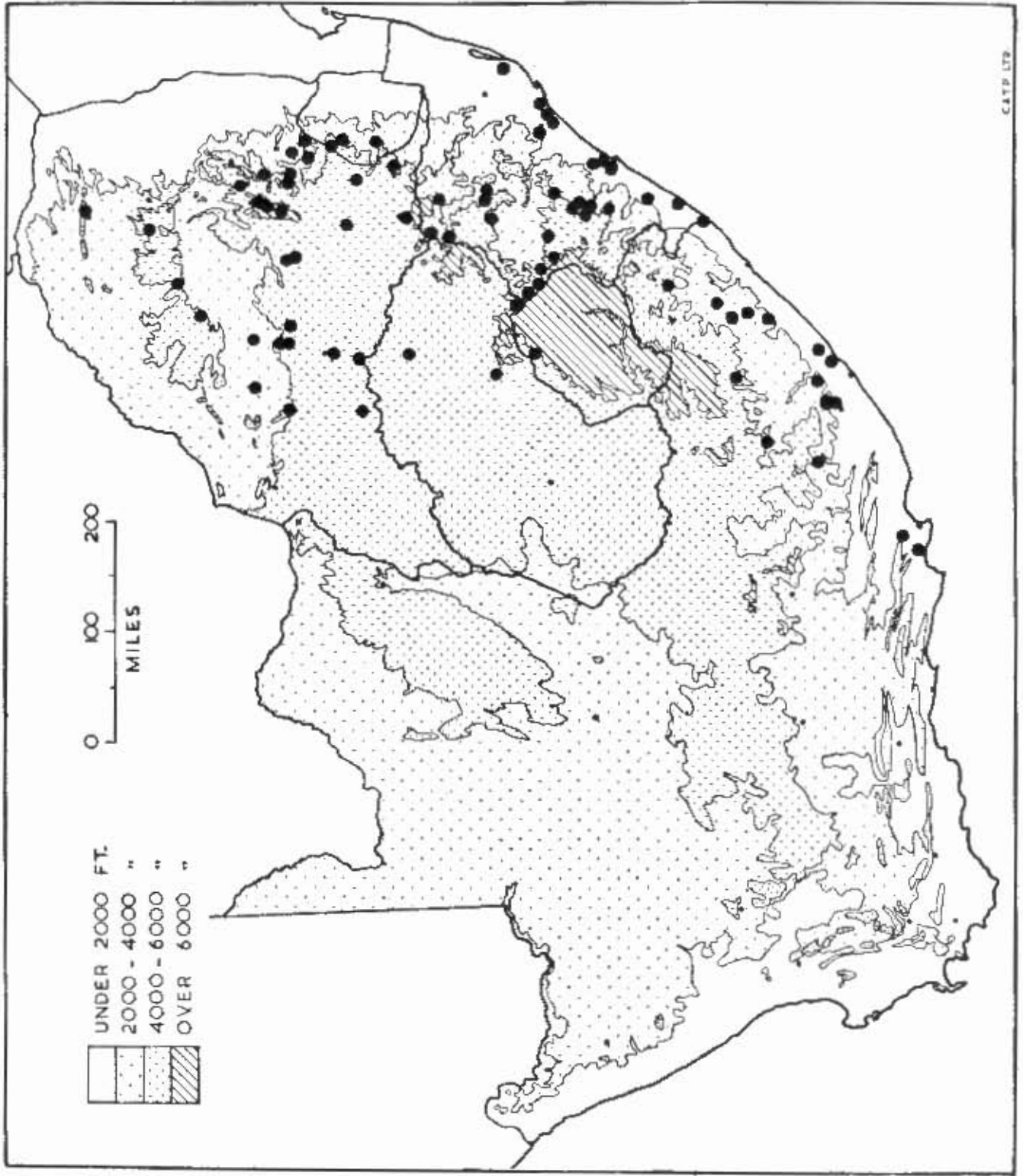
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Map 31: Distribution of *Eulophia clavicornis*  
Lindl. var. *clavicornis*.



Map 32: Distribution of *Eulophia clavicornis* var. *inaequalis* (Schltr.) Hall.



Map 53: Distribution of *Eulophia clavicornis* var. *nutans* (Sond.) Hall in South Africa.

30. EULOPHIA MILNEI REICHB. F.

(i) Description: Rhizome subterranean, moniliform.

Leaves very slender, partly to fully developed at anthesis, up to 39 cm. long, 2 - 3 mm. wide. Scape very slender, 18 - 52 cm. tall. Upper sheaths on the scape generally rather shorter than their internodes, closely clasping. Bracts often longer than the ovary, subulate, frequently curved and twisted on drying. Raceme rather dense with about 5 - 19 flowers, the perianth partly arcuate - spreading.

Odd sepal (3.1) - 4 - 7 - (8.4) mm. long, oblong to narrowly elliptic - oblong, acute to obtuse; lateral sepals similar. Petals about as long as the odd sepal, oblanceolate to narrowly obovate. Column 1.5 - 3.5 mm. long. Mentum absent. Spur stout, (1.4) - 2 - 4 - (4.1) mm. long, lying close to the ovary. Side lobes of the lip very narrow for more than half their length, distally divergent with the short free apex rounded to acute or dentate. Mid-lobe about as wide as long, the margins finely undulate to dentate, the apex rounded to truncate or retuse. Crests consisting of 2 - 4 very low ridges on the basal half of the lip, rising to several rows of slender papillae distally.

Sepals and petals dull to bright yellow. Lip pale yellow with the crests a deeper yellow. Column white tinged with purple. No flower scent reported.

(ii) Distinctions from similar taxa: This species may be readily distinguished from similar taxa with the petals and sepals about the same width, by its elongate raceme of very small flowers lacking a mentum, the spur stout and lying close to the ovary, and the scapes and leaves generally long and slender. It has been occasionally mis-identified with the smaller-flowered forms of E.clavicornis var. nutans (Sond.) Hall, which differ in having the lateral margins of the mid-lobe of the lip subentire, the side lobes never falcate-divergent, and the perianth variously tinged with purple.

(iii) Nomenclature: The earliest description matching this species was published in 1881 by Reichenbach, with the name Eulophia milnei. The type is given as a Milne specimen from 'Nimbo River' (Cameroons) in Reichenbach's herbarium. A sheet in this herbarium at Vienna (W) is labelled as given in the type description and bears Reichenbach's identification as E.milnei. The specimens on the sheet clearly agree with smaller-flowered members of the present concept, and also match the original description, so that they may be regarded as the holotype of E.milnei Reichb.f.

In the years 1895 and 1924, Schlechter published two descriptions matching the present concept, with the names Eulophia corallorrhiziformis and E.bulbinoides. The available type specimens from South Africa clearly belong

to the present species, so that the two names should be regarded as synonyms of E. milnei Reichb.f. It is possible that future research may show that certain other names may have to be regarded as synonyms of E. milnei: Eulophia warneckeana Kraenzl., E. lujacana Kraenzl. and E. dictyostegioides Kraenzl. As these names are based on types from Tropical Africa (Togo, Congo and Angola), and were published later than E. milnei, they were not studied in detail (c.f. page 95).

(iv) Nomenclatural references and types:

Eulophia milnei Reichb.f. Otia Bot. Hamb. 2: 116 (1881). Holotype: Milne s.n., Niabo River, Benito Ground (W, holotype!).

E. corallorrhiziformis Schltr. Bot. Jahrb. 20, Beibl. 50: 9 (1895). Syntypes: Galpin 1221, Ualomatí valley (K, type number!); Schlechter s.n., nr. Middelburg in the Transvaal Republic, Dec. 1893 (BOL, iso-syntype!).

E. bulbinooides Schltr. Ann. Transv. Mus. 10: 234 (1924). Holotype: Wood 4075, nr. Clairmont, Natal (BOL, isotype!; K, isotype!).

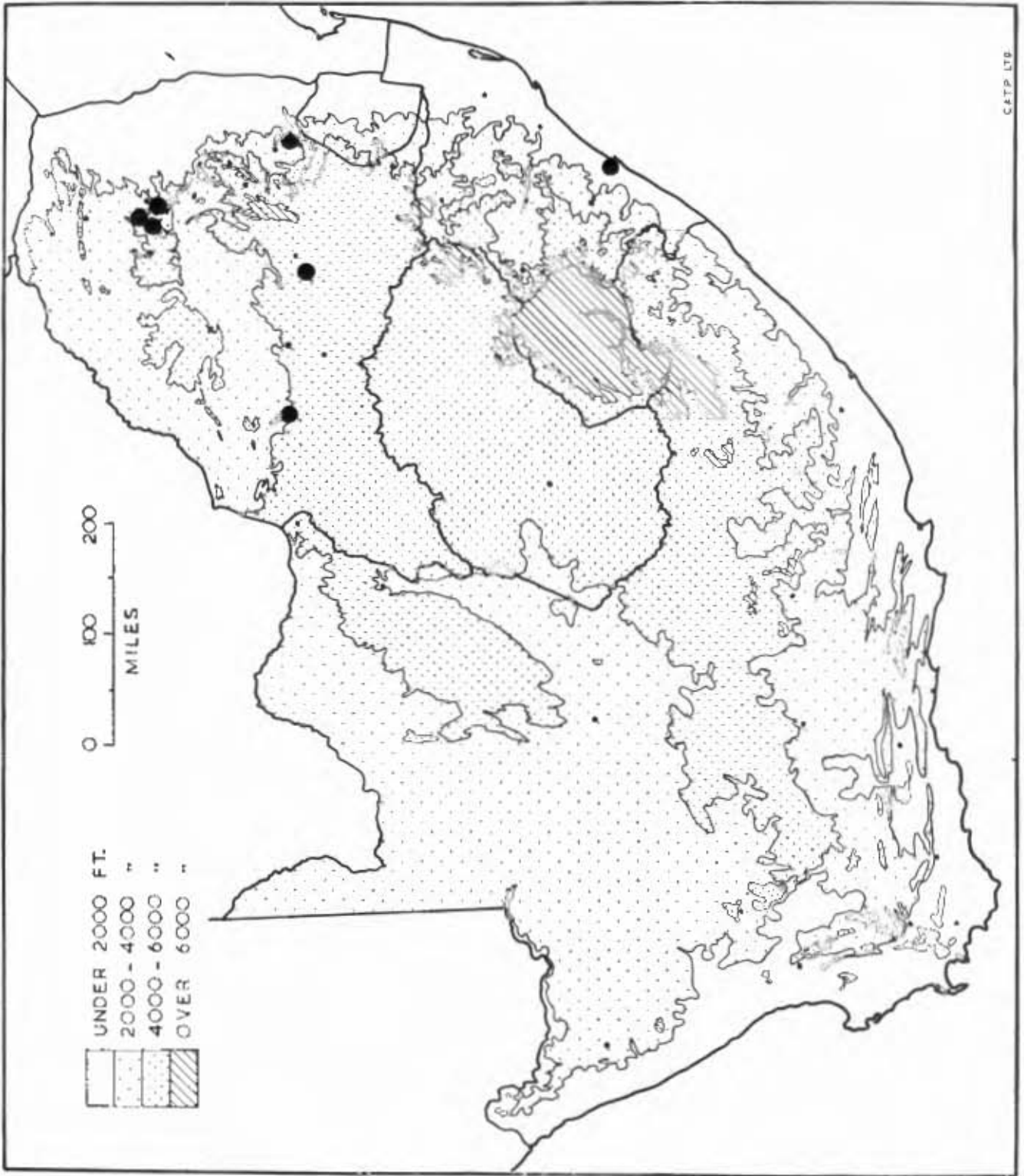
(v) General biology: This species, together with numerous similar forms probably conspecific with it, is known from many parts of Tropical Africa, including the Rhodesias and Nyasaland, Angola and the Congo, and along the coastal

territories of West Africa to Togo. In South Africa it is known from scattered localities in Natal and the Transvaal (see Map 34).

Precipitation at accurately recorded localities in South Africa generally lies in the higher part of the range 25" - 60" per annum. Frost may be absent or occur on up to 60 days of the year. Most collectors indicate that the species grows in swampy soils, sometimes in free standing water. It may be rare, or form localised populations of many hundreds of individuals. Flowering takes place in the warm wet summer months (see Table 31).

Table 31: Records in herbaria of the month of collection of flowering specimens of Eulophia milnei Reichb.f.

<u>Month</u>	<u>No. of records</u>
November .. .. .	5
December .. .. .	6
January .. .. .	2
February .. .. .	1



Map 34: Distribution of *Eulophia milnei* Reichb.f. in South Africa.

31. EULOPHIA LITORALIS SCHLTR.

(i) Description: Rhizome subterranean, moniliform, bearing velaminous roots at the constrictions. Leaves absent to vestigial, rarely a single lamina up to 2 cm. long, not developing after anthesis. Scape 22 - 66 cm. long, stout to slender. Sheaths on the scape about as long to half as long as their internodes, loosely clasping. Bracts usually about half the length of the ovary, sometimes up to twice as long. Raceme elongate, rather lax; flowers 6 - 27, occasionally some scarcely resupinate; perianth partly spreading with the mid-lobe of the lip deflexed.

Odd sepal (11.8) - 17 - 24 - (29.8) mm. long, lanceolate to lanceolate-oblong, acute to acuminate; lateral sepals similar. Petals oblanceolate to narrowly elliptic-oblanceolate, slightly shorter to slightly longer than the sepals, acute to subacuminate. Column 10 - 13 mm. long, slightly incurved, with the operculum shortly rostrate. Mentum vestigial to 2 mm. long, passing into a slender cylindrical spur 2.5 - 4.5 mm. long. Side lobes broadening mostly near the narrow base of the lip, suboblong with a free apical portion 4 - 7 mm. wide, acute. Mid-lobe broadly elliptic to broadly obovate, the margins a little undulate and the apex rounded. Crests consisting of two fleshy ridges in the basal third of the lip, passing into several rows of stiffly erect acuminate papillae on the mid-lobe.

Sepals yellowish green, faintly tinged with olive;

Petals and lip yellow, the side lobes tinged with purple, especially along the nerves, and the crested part of the lip bright cadmium yellow. Flowers with a very faint scent.

(ii) Distinctions from similar taxa: This species may be readily distinguished from similar taxa with the petals about as wide as the sepals, by its elongate raceme, acute side lobe apices, the rather scattered, stiffly erect acuminate papillae on the mid-lobe, and the rather large flowers in which the column is more than 10 mm. long. The species has apparently not been mis-identified with other taxa in herbaria.

(iii) Nomenclature: A description matching the present concept was published in 1899 by Schlechter, with the name Eulophia litoralis. The description was based on material collected by Schlechter in the South-West Cape (Schlechter 9468, Hawston, Caledon Dist.). Specimens labelled with this number and bearing Schlechter's identification "E.litoralis Schltr. n.sp." have been found in many herbaria (Z, BOL, K, W, P, BR); all such specimens clearly match the original description and belong to the present concept. As the holotype was probably destroyed with Schlechter's special orchid collection at Berlin (B) during World War II, these specimens should be regarded as isotypes. It is almost certain that the name E.litoralis Schltr. refers to the present species.

(iv) Nomenclatural reference and types:

Eulophia litoralis Schltr. Bot. Jahrb. 26: 338 (1899). Holotype: Schlechter 9468, Hawston, at the Mouth of the Bot River, Caledon Dist., Cape (Z, BOL, K, W, P, BR, isotypes!).

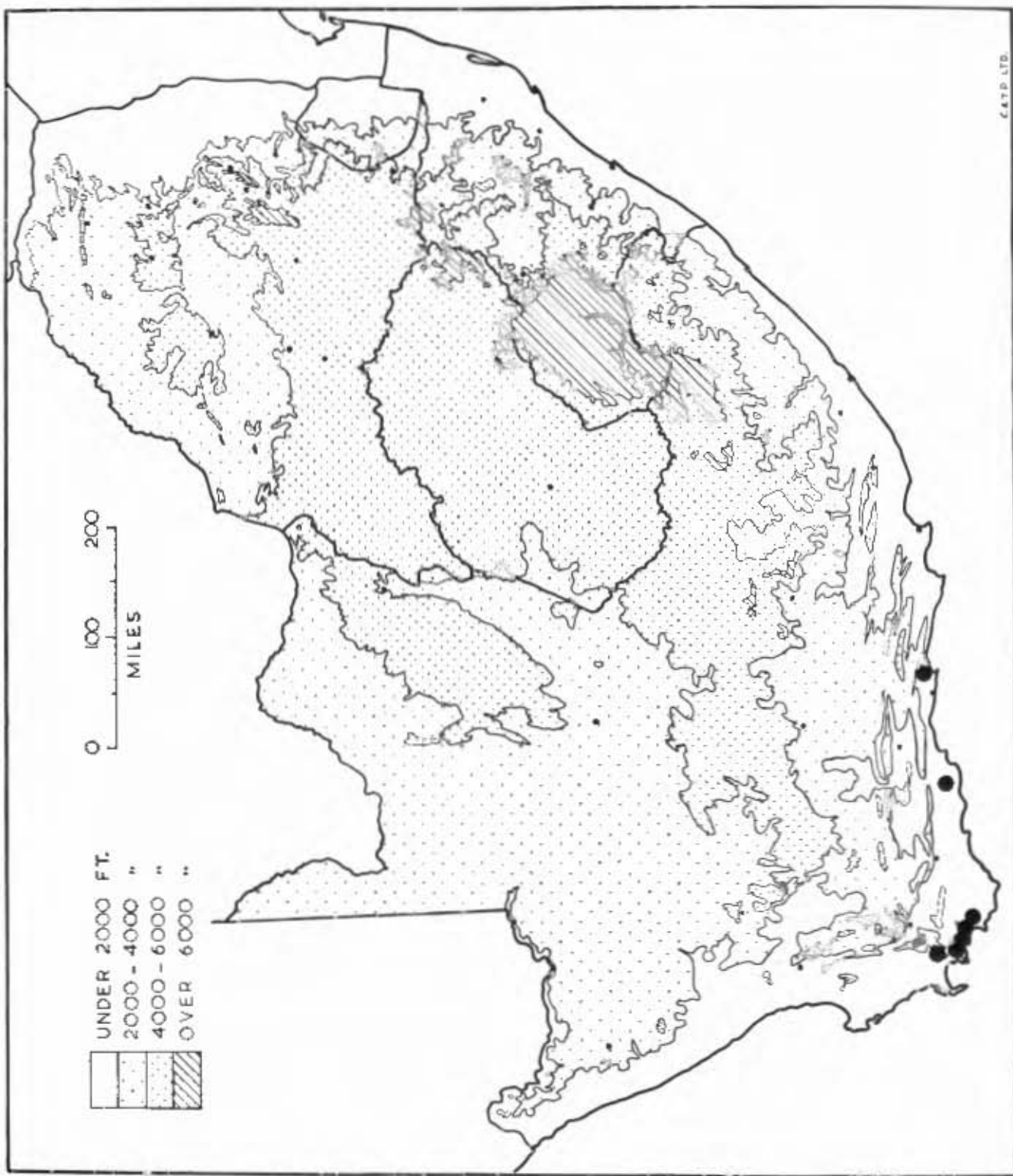
(v) General biology: This species appears to be confined to a narrow belt along the south Cape coast (see Map 35).

Precipitation at accurately recorded localities usually lies in the higher parts of the range 15" - 35", and occurs mostly during the colder winter months. Frost may be absent or occur on up to 20 days of the year. The regional soil types in the areas where the species grows may be fixed coastal sand dunes, or gray sandy soils derived from Table Mountain Sandstone. The species may be very rare to locally frequent at a given locality.

Flowering takes place during the warm, relatively drier summer months (see Table 32). It is remarkable that the leaves should be vestigial in a species with so large an inflorescence. Their absence throughout the year has been verified by the author and several collectors in field populations in the Caledon District (I.B.Walters, M.Cloete, J.S.Linley, E.G.H.Oliver, priv. comm.). Future research might reveal a particularly active mycorrhizal association to compensate for the absence of leaves.

**Table 32:** Records in herbaria of the month of collection of flowering specimens of Eulophia litoralis Schltr.

<u>Month</u>						<u>No. of records</u>
November	..	..	..	..	..	2
December	..	..	..	..	..	7
January	..	..	..	..	..	2



Map 35: Distribution of *Eulophia litoralis* Schltr.

32. EULOPHIA NIGRICANS SCHLTR.

(1) Description: Rhizome subterranean, moniliform. Leaves absent to partly or (rarely) fully developed at anthesis, up to 52 cm. long and 0.8 cm. wide, plicate with 3 - 7 veins emergent on the abaxial surface. Scape stout to a little slender, 30 - 87 cm. tall. Upper sheaths on the scape usually about as long as their internodes to about half the length, loosely clasping. Bracts as long as, to about 3 times the length of the ovary, narrowly lanceolate to subulate, acuminate. Raceme elongate, rather lax; flowers 4 - 22, with the perianth partly spreading, slightly fleshy.

Odd sepal (16.0) - 17 - 21 - (23.6) mm. long, narrowly oblong to lanceolate, acute to obtuse; lateral sepals similar. Petals slightly shorter and narrower than the odd sepal, narrowly oblong-lorate, acute to obtuse. Column 9 - 12 mm. long, rather slender with the operculum shortly rostrate. Mentum 3 - 6 mm. long, passing into a cylindrical to slightly conical spur 2.5 - 5.0 mm. long, directed away from the ovary. Side lobes of the lip fused to the greater length of the mentum, broadening near the base, suboblong, with a very shortly rounded free apex 3 - 5 mm. wide. Mid-lobe about 1/3 the length of the lip excluding the spur, suborbicular to very broadly oblong, the margins entire and the apex rounded to truncate or retuse. Crests consisting of two broad low ridges in the basal two-thirds of the lip, passing into

herbaria at Kew (K) and Durban (NH) clearly match the present concept. However, there is no evidence that they were actually seen by Schlechter, so that they should strictly not be regarded as isotypes. The holotype was probably in Schlechter's special orchid collection at the Berlin Herbarium (B) which was destroyed during World War II. There seems little doubt that the name Eulophia nigricans Schltr. refers to the present species.

It is very likely that further research will show that the following names will have to be regarded as synonyms of E.nigricans: Eulophia aristata Rendle, E.lanceolata Rolfe and E.baumiana Kraenzl. As these names are based on material from Tropical Africa (Nyasaland, Northern Rhodesia and Angola), and were published later than E.nigricans Schltr. (E.aristata only one month later), they were not studied in detail.

(iv) Nomenclatural references and types:

Eulophia nigricans Schltr. Bot. Jahrb. 20, Beibl. 50: 5 (1895). Holotype: Wood 335, nr. Inanda, Natal (K, type number!; NH, type number!).

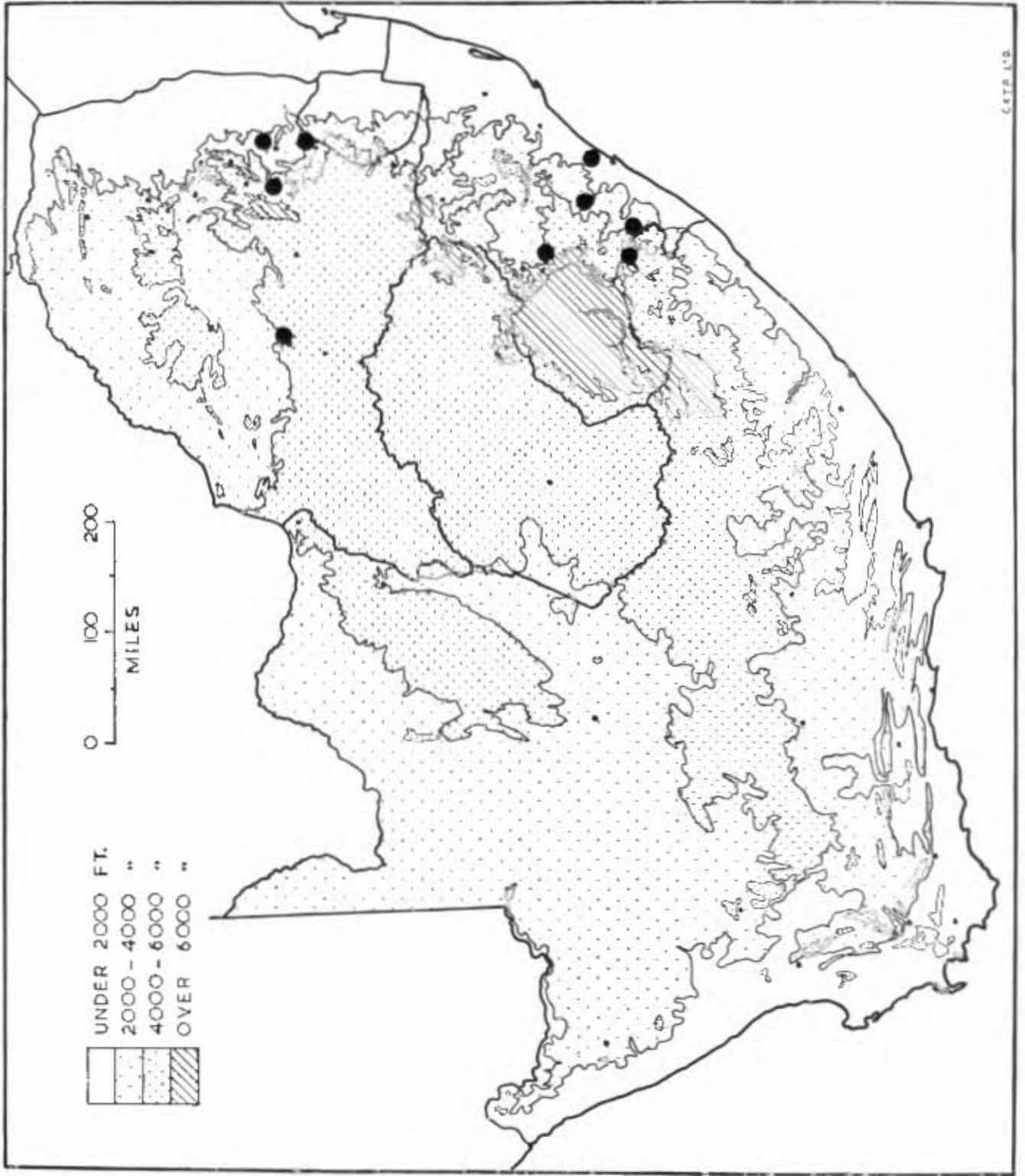
(v) General biology: Forms very closely resembling E.nigricans, and probably conspecific with it, are known from a small number of very widely dispersed localities in East

African territories from Mozambique and Northern Rhodesia to north-west Kenya. In South Africa, it has been collected in scattered localities in the central Transvaal and the southern half of Natal (see Map 36).

Precipitation at accurately recorded localities in South Africa lies mostly in the upper parts of the range 25" - 45" per annum. Frost may be absent or occur on up to 60 days of the year. The species grows mostly in areas with lateritic regional soil types; at a locality near Pretoria (Codd 5905, Pretoria University Farm), the soil is described by the collector as a red sandy loam. The species appears to be confined to grassland, and records indicate that it is always rare in a given area. The local and regional rarity may be in part due to the species being inconspicuous and easily overlooked by collectors: the flowers have dull colours and the leaves and scapes are relatively small and narrow. Flowering takes place during the warm wet summer months in South Africa (see Table 33).

Table 33: Records in herbaria of the month of collection of flowering specimens of Eulophia nigricans Schltr.

<u>Month</u>						<u>No. of records</u>
November	..	..	..	..	..	1
December	..	..	..	..	..	5
January	..	..	..	..	..	2



Map 36: Distribution of *Eulophia nigricans* Schltr. in South Africa.

33. EULOPHIA WELWITSCHII (REICHB.F.) ROLFE

(i) Description: Rhizome subterranean, moniliform.

Leaves partly to fully developed at anthesis, up to 70 cm. long, 2-3 cm. broad, stiffly erect, plicate with several veins emergent on the abaxial surface. Scape 26 - 88 cm. tall, rather stout. Upper sheaths on the scape generally half to nearly as long as their internodes, rather loosely clasping. Bracts longer to twice as long as the ovary, subulate to very narrowly elliptic, acuminate. Raceme short and dense; flowers about 4 - 25, the perianth scarcely spreading, subcampanulate.

Odd sepal (17-1) - 22 - 35 - (46-0) mm. long, variously elliptic to narrowly oblong, very acute to subacuminate; lateral sepals similar. Petals slightly shorter than the sepals, usually narrower, narrowly elliptic-oblong, acute. Column rather stout, 5 - 7 mm. long, with the operculum very slightly rostrate. Mentum 1 - 2 mm. long. Spur at the base of the lip subcylindrical, slender, 2.7 - 6.8 mm. long. Lip, excluding the spur, often somewhat shorter than the odd sepal, narrow at the base, with the side lobes broadening gradually to a rounded apex 4 - 6 mm. wide. Mid-lobe rotund to oblate or very broadly ovate, the margins entire, the apex rounded to retuse or subacute. Crests consisting of two fleshy ridges on the basal third of the lip, passing into numerous filiform papillae extending to about half-way along the mid-lobe.

The flowers are scarlet to bright orange in plants from Angola; South African specimens have the flowers coloured as follows:- Sepals straw yellow tinged with pale green. Petals and lip pale straw yellow with dark reddish purple on the side lobes, the distal crest papillae and on the basal parts of the mid-lobe. Operculum tipped with dark purple. No flower scent detectable.

(ii) Distinctions from similar taxa: Herbarium material of this species has frequently been mis-identified as E.ensata Lindl., which it closely resembles in the dried state. E.ensata differs in having the crest papillae dense to near the apex of the suboblong mid-lobe of the lip, the flowers generally smaller with the odd sepal (13.2) - 16 - 23 - (25.2) mm. long, and the lip yellow throughout.

There is also some resemblance to E.litoralis Schltr., which differs in having the side lobes of the lip acute, the column 10 - 13 mm. long, the crest papillae stiffly erect and acuminate, and the leaves vestigial.

(iii) Nomenclature: The earliest description matching the present concept was published by Reichenbach in 1865, with the name Orthochilus welwitschii. Although the description is not sufficiently detailed to exclude similar taxa, there is a clear reference to a type specimen,

Welwitsch 720, collected in Huilla (Angola). Material labelled as such in the Vienna herbarium (W) and at Kew (K) clearly agrees with the present concept. The Vienna material was identified as Orthochilus welwitschii by Reichenbach, and should be regarded as the holotype.

On the same page as the account of O.welwitschii, Reichenbach and Sonder published a description based on material belonging to the yellow and scarlet forms of the present species, with the name Eulophia bicolor. This name is illegitimate, as it had been used previously in 1851 by Dalzell for an Indian species at present known as Eulophia nuda Lindl., and also for a Timor species by Blume in 1858.

In 1889, Rolfe transferred the epithet welwitschii from Orthochilus to Eulophia.

In 1893, Hooker recognised the illegitimate nature of Eulophia bicolor Reichb.f. & Sond. He considered that the two specimens quoted as the types by Reichenbach and Sonder belonged to two different species. For the yellow flowered type (Zeyher s.n., Magaliesburg) he proposed a new name, Eulophia zeyheri, which has since been generally used for South African forms of the present concept. For the scarlet - flowered type (Welwitsch 718, Huilla) he used the name Eulophia welwitschii, evidently unaware that Rolfe had made this combination four years previously. In this case Rolfe and Hooker were both referring to material of the same species, so that the later reference should be

regarded as an identification and not as the citation of an illegitimate name.

In 1895, Schlechter published a description matching the present concept, with the name Eulophia woodii. The description is not sufficiently detailed to exclude similar taxa, but the type is clearly given as a Wood specimen from Natal (Wood 3577, nr. Berlin Mission Station, Dec. 1885). A specimen matching the concept in the Natal herbarium at Durban (NH) is labelled with this date and locality, but the number is given as "Wood 3420 in Herb. Natal. 3577". This indicates that Schlechter erroneously cited the number given by the Natal herbarium as that of the collector. Although there is no evidence that Schlechter saw this specimen, its identity lends weight to the probability that the name E.woodii Schltr. refers to the present species, and should be regarded as a synonym of E.welwitschii (Reichb.f.) Rolfe.

Future research may show that certain other names might also have to be regarded as synonyms of E.welwitschii: Orthochilus renschianus Reichb.f., Eulophia praestans Rendle, E.renschiana (Reichb.f.) Dur. & Sch., and E.dichroma Rolfe. As these names are based on types from Tropical Africa (Angola and Nyasaland), and were published later than Orthochilus welwitschii Reichb.f., they were not studied in detail (c.f. page 95).

(iv) Nomenclatural references and types:

Orthochilus welwitschii Reichb.f. Flora 48: 186  
(1865). Holotype: Welwitsch 720, Huilla (W, holotype!;  
K, type number!).

Eulophia bicolor Reichb.f. & Sond. Flora 48: 186  
(1865), nom. illegit., non Eulophia bicolor Dalzell Kew  
Journ. 3: 343 (1851), nec Eulophia bicolor Blume Orchid.  
Archipel. Ind. 181 (1857). Syntypes: Zeyher s.n., Magal-  
iesberg?, South Africa (W, syntype!); Welwitsch 718,  
Huilla (P, iso-syntype!).

E.welwitschii (Reichb.f.) Rolfe Bolet. Soc. Brot.  
7: 236 (1889).

E.zeyheri Hook.f. Bot. Mag. 119: sub tab. 7330  
(1893), nom. nov. pro syn. Eulophia bicolor Reichb.f. &  
Sond. non Dalzell nec Blume.

E.woodii Schltr. Bot. Jahrb. 20, Beibl. 50: 5  
(1895). Holotype: Wood 3577, nr. Berlin Mission Station,  
Dec. 1885 (NH, Wood 3420 in Herb. Natal. 3577!).

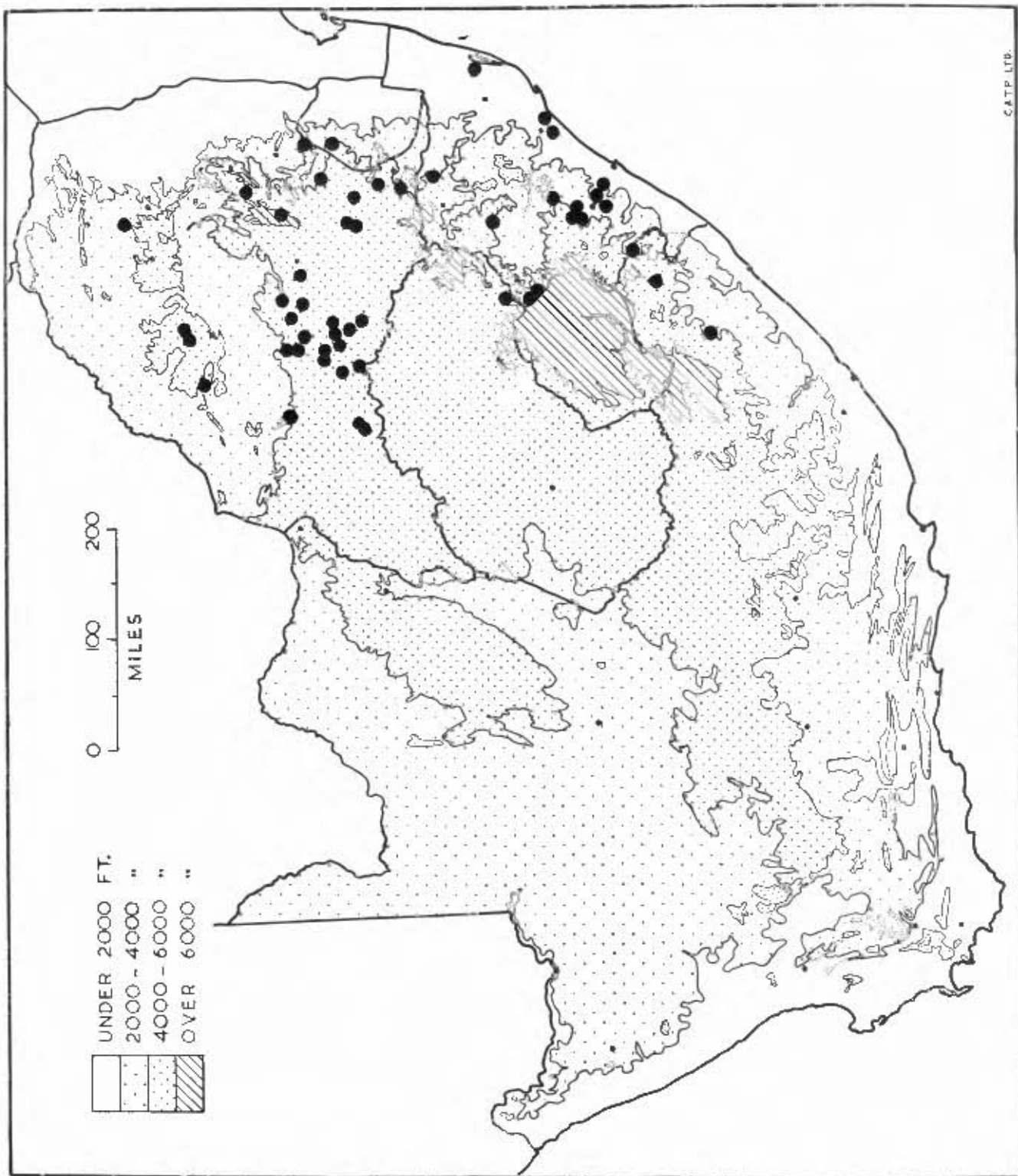
(v) General biology: This species has a large distribution  
range in Tropical Africa, extending through most of the  
East African territories to Kenya and Uganda, and westwards  
to Angola and the Congo. In South Africa, it has been  
found in the north-eastern Cape and in many parts of Natal  
and the Transvaal, being especially frequent near Pretoria  
and Johannesburg (see Map 37). Precipitation at accurately

recorded localities in South Africa lies in the range 20" - 50" per annum, being relatively low in the Transvaal and higher in Natal and the Cape. Frost may be experienced at most localities, and may occur on 20 - 40 or (rarely) 40 - 80 days of the year. The species appears to be most frequent in areas with brown to red-brown ferruginous lateritic soils, and grows in dry to marshy situations in grassveld. The species is often found scattered throughout a wide area, or it may be rare to locally frequent. It is very conspicuous in the field, so that collector's records probably give a reasonably accurate picture of the true distribution pattern.

Flowering takes place mostly during the warm wet summer months (see Table 34). The chromosome number of material from northern Natal was found to be  $n = 27$ .

**Table 34:** Records in herbaria of the month of collection of flowering specimens of E.welwitschii (Reichb.f.) Rolfe in South Africa.

<u>Month</u>						<u>No. of records</u>
September .. .. .	..	..	..	..	..	1
October .. .. .	..	..	..	..	..	1
November .. .. .	..	..	..	..	..	8
December .. .. .	..	..	..	..	..	40
January .. .. .	..	..	..	..	..	27
February .. .. .	..	..	..	..	..	1



Map 37: Distribution of *Eulophia welwitschii*  
(Reichb.f.) Rolfe in South Africa.

34. EULOPHIA CHLORANTHA SCHLTR.

(1) Description: Rhizome subterranean, moniliform.

Leaves partly to fully developed at anthesis, up to 37 cm. long and 0.5 cm. wide, stiffly erect with 3 veins prominently emergent on the abaxial surface. Scape 9 - 35 cm. tall, rather slender. Distal sheaths on the scape (except the uppermost) about as long as their internodes, closely to loosely clasping. Bracts rather longer to half the length of the ovary, subulate, curved and twisted when dry. Raceme somewhat lax; flowers 5 - 18 with the sepals partly spreading.

Odd sepal (6.9) - 8 - 11 - (13.0) mm. long, oblong to narrowly oblong, acute; lateral sepals similar, slightly broader. Petals slightly shorter than the odd sepal and about as wide, oblanceolate to narrowly obovate, acute to subobtuse. Column 3 - 4 mm. long, with the operculum shortly rostrate. Mentum about 1.0 - 1.5 mm. long, passing into a short stout cylindrical spur 1.2 - 1.8 mm. long. Lip narrow at the base, the side lobes gradually broadening to a free apical portion 2 mm. long and 1.5 - 2.0 mm. broad, rounded, with the margin next to the mid-lobe minutely serrulate. Mid-lobe suborbicular with the margins entire and incurved. Crests consisting of two finely pubescent lamellae in the basal two-thirds of the lip, passing into a few rows of irregular papillae on the mid-lobe.

Sepals green. Petals and lip pale green with the

side lobes and the basal margins of the petals almost white. Column white with the rostrate portion of the operculum dark purple. Flowers faintly scented.

(ii) Distinctions from similar taxa: This species has been mis-identified with the superficially similar taxon Eulophia aculeata (L.f.) Spreng. ssp. aculeata, which differs in lacking a spur at the base of the lip, in having no pubescence on the crest lamellae, more obtuse sepals, the flowers more crowded on the inflorescence axis (averaging 3.2 - 10.7 flowers per cm. of axis as compared with 1.3 - 3.7 for E.chlorantha), and the flowers mostly white, occasionally tinged with green.

There is also some resemblance to the smaller-flowered forms of Eulophia foliosa Lindl., which differ in having very stout short papillae confined to the basal half of the mid-lobe, no spur at the apex of the mentum, and the side lobes broadened close to the base of the lip. E.odontoglossa Reichb.f. differs in having the margins of the mid-lobe denticulate, the side lobes subrhomboid, and the flowers yellow, purple and reddish-brown.

(iii) Nomenclature: In 1895, Schlechter published a description matching this species, with the name Eulophia chlorantha. The description is sufficiently clear to

exclude similar taxa, and a clear reference is made to two syntypes from the Eastern Transvaal and northern Swaziland. A sheet in the Bolus Herbarium (BOL) bears two sets of specimens labelled with the collectors and localities given in the original description, together with the note in Schlechter's handwriting "n.sp.? .... Flower in Glyc. .... E.chlorantha RS?" If Schlechter had used this as the holotype, the question marks would have probably been deleted. It seems more probable that the description was made from specimens taken by Schlechter to Berlin (B) where they would have been destroyed during World War II. The 'flower in Glycerine' could have been taken from one of the Bolus Herbarium specimens, which may be regarded as isotypes. The name E.chlorantha Schltr. almost certainly refers to the present species.

(iv) Nomenclatural reference and types:

Eulophia chlorantha Schltr. Bot. Jahrb. 20, Beibl. 50: 9 (1895). Syntypes: Saltmarshe s.n. in Herb. Galpin. 652, Havelock Concession, Swaziland (BOL, iso-syntype!); Culver 3, Berea, Harberton (BOL, iso-syntype!).

(v) General biology: This species appears to have a very restricted distribution, confined to north-west Swaziland and an adjacent area in the Eastern Transvaal (see Map 38).

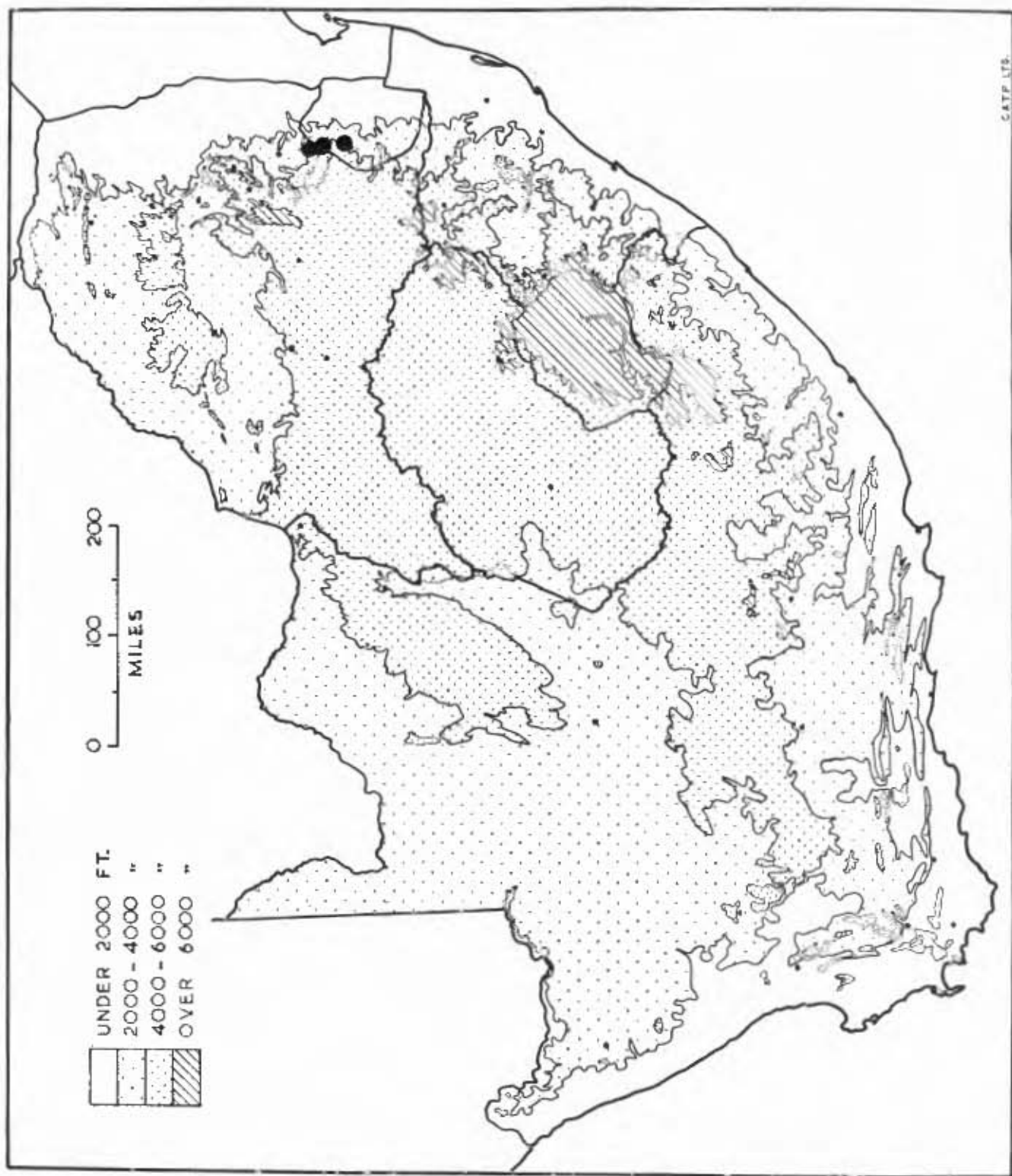
Precipitation at these localities is very high, lying in the range 45" - 60" per annum. Frost may occur

on up to 20 days of the year. The regional soil type in the area is a lateritic red earth; at two localities visited by the author the soils were very stony. The species grows on exposed grassy slopes or in sheltered grassy places in bushveld, where it assumes a taller and more robust habit. It may be rare to locally frequent at a given locality. The small green flowers and slender leaves make the species very difficult to find, so that it is likely to have been overlooked by collectors in other areas.

Flowering takes place during the early summer months (see Table 35). The chromosome number of material from near Barberton was found to be approximately  $2n = 56$  (Hall, 1959, MS).

Table 35: Records in herbaria of the month of collection of flowering specimens of Eulephia chlorantha Schltr.

<u>Month</u>	<u>No. of records</u>
September .. .. .	1
October .. .. .	2
November .. .. .	5
December .. .. .	1



Map 38: Distribution of *Eulophia chlorantha* Schltr.

35. EULOPHIA ENSATA LINDL.

(1) Description: Rhizome subterranean, moniliform.

Leaves partly to fully developed at anthesis, up to 90 cm. long and 1.5 cm. wide, stiffly erect, plicate with several veins emergent on the abaxial surface. Scape 30 - 100 cm. tall, stout to rather slender. Upper sheaths on the scape generally a little longer than their internodes, closely clasping. Bracts rather longer to slightly shorter than the ovary, subulate to narrowly elliptic, acuminate. Raceme short and very dense; flowers 6 - 30, with the perianth subcampanulate to partly spreading.

Odd sepal (13.2) - 16 - 23 - (25.2) mm. long, narrowly oblong to narrowly elliptic, acute; lateral sepals similar. Petals a little shorter and narrower than the odd sepal, narrowly oblong to narrowly elliptic-oblong, obtuse to mucronate or acute. Column 6 - 8 mm. long, a little slender and the operculum very shortly rostrate. Mentum about 2 mm. long. Spur at the base of the lip cylindrical and slender, 4 - 7 mm. long. Side lobes of the lip broadening near the base, suboblong, with a rounded slightly spreading free distal portion 3 - 4 mm. long 3 - 4 mm. wide and 2 - 5 mm. long. Mid-lobe about half the length of the lip, excluding the spur, suboblong, broadening slightly towards the truncate to retuse or mucronate apex, with the lateral margins entire to denticulate basally. Crests consisting of two broad ridges in the basal half of the lip, passing into densely crowded filiform papillae on

the mid-lobe, extending to near the apex; a few papillae rarely also present on the inner surface of the petals.

Sepals, petals and lip bright to pale yellow, with the crests a slightly deeper yellow. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has often been mis-identified with Eulophia welwitschii (Reichb.f.) Rolfe, which differs in having the mid-lobe of the lip rotund to oblate with the crests mostly absent on the distal half, generally larger flowers with the odd sepal (17.1) - 22 - 35 - (46.0) mm. long, the column stout, and the flowers either scarlet or pale yellow with the side lobes dark reddish purple.

The species sometimes resembles E.leontoglossa Reichb.f. in the dried state. E.leontoglossa differs in having the scape generally rather less than 30 cm. tall, often with the axis of the raceme nutant, the mid-lobe about 1/3 the length of the lip excluding the spur, and the apices of the side lobes subacute.

(iii) Nomenclature: Lindley published a description matching the present concept in 1828, with the name Eulophia ensata. The type, quoted as a specimen originally from the 'Cape of Good Hope' and cultivated in a London nursery, cannot be found. Being of considerable interest

to a horticulturist at that time, the plant was probably returned to the nursery that supplied it. A detailed coloured plate is given with the description, and Lindley probably considered that it was sufficient as a basis for comparison when making subsequent identifications. The plate shows a plant without doubt belonging to the present concept, although the underground parts are rather inaccurately drawn (perhaps the artist relied on a description rather than uprooting the specimen). In the absence of dried material this plate may be regarded as the Lectotype.

(iv) Nomenclatural reference and types:

Eulophia ensata Lindl. Bot. Reg. 14: sub tab. 1147 (1828). Holotype: s.leg., s.n., Cape of Good Hope, cult. hort. Sloane Street Nursery (no authentic material available). Lectotype: Bot. Reg. 14: tab. 1147 (1828)!

(v) General biology: This species appears to have a distribution range confined to South Africa, extending in a rather narrow belt along the coastal districts of the Eastern Cape and Natal, and through Swaziland to the mountainous parts of the Eastern Transvaal (see Map 39).

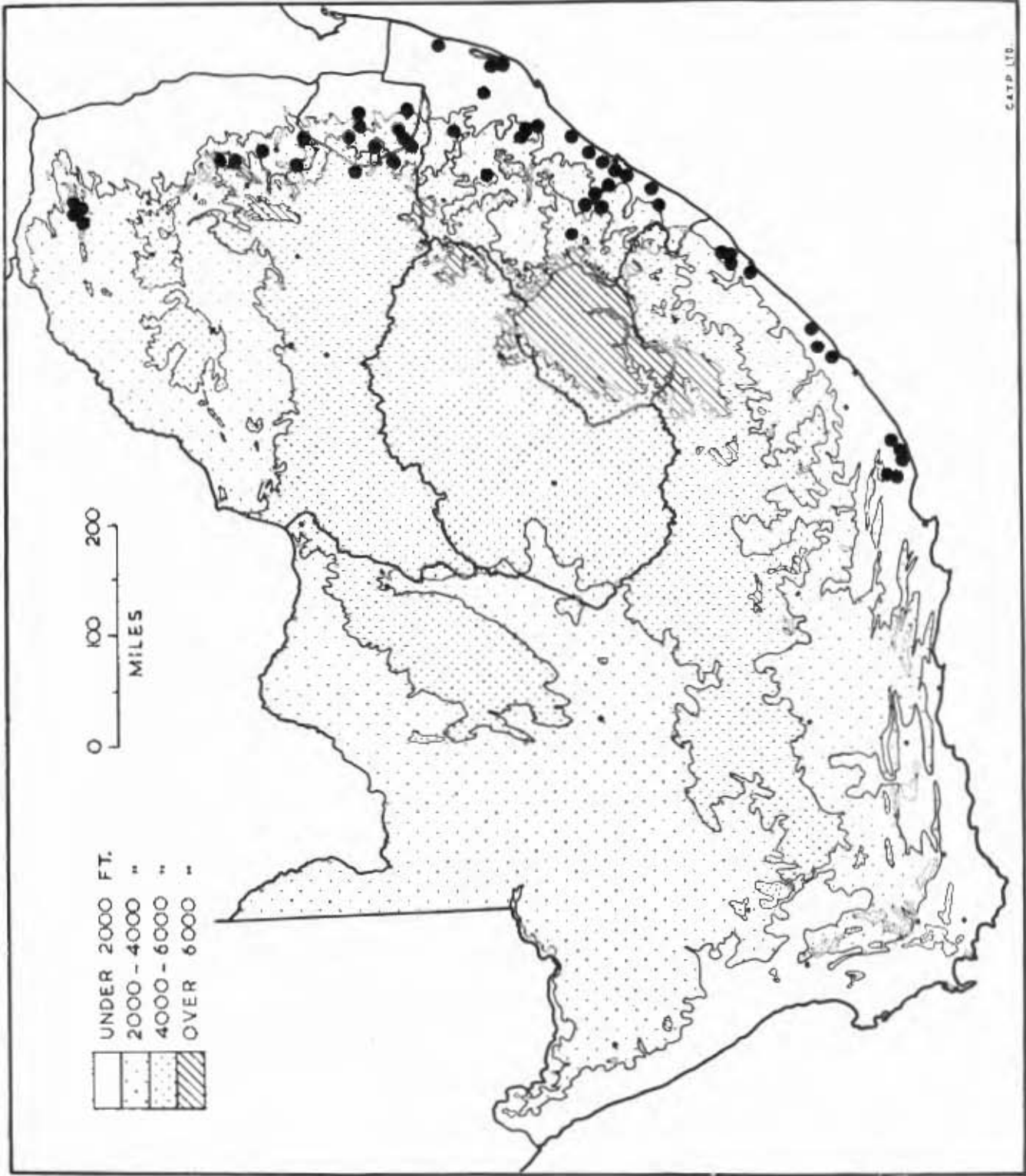
Precipitation at accurately recorded localities lies mostly in the higher parts of the range 20" - 60" per annum. Frost is absent at many localities, and is rarely experienced on more than 20 days of the year at

others. The regional soil types in the areas where the species grows vary from podsoles to sandy loams and lateritic soils; collectors note rocky conditions at several places. The species has been found in open grassveld, in grassy places in coastal bushveld, in moderate shade in pure bushveld and Eucalyptus plantations in the Northern Transvaal. It may be rare to locally frequent at a given locality, sometimes forming small populations of 25 or more plants scattered over an area of a few square meters.

Flowering takes place chiefly in the warm wet summer months December and January (see Table 36). The chromosome number of material from the Eastern Cape and northern Natal was found to be  $n = 27$ .

Table 36: Records in herbaria of the month of collection of flowering specimens of Eulophia ensata Lindl.

<u>Month</u>						<u>No. of records</u>
October	..	..	..	..	..	4
November	..	..	..	..	..	2
December	..	..	..	..	..	30
January	..	..	..	..	..	39
February	..	..	..	..	..	2



Map 39: Distribution of *Eulophia ensata* Lindl.

36. EULOPHIA LEONTOGLOSSA REICHB.F.

(1) Description: Rhizome subterranean, moniliform. Leaves partly to fully developed at anthesis, up to 37 cm. long and 0.9 cm. wide, plicate and stiffly erect with several veins emergent on the abaxial surface. Scape 6 - 28 cm. tall, stout to rather slender. Sheaths on the scape generally longer than their internodes, loosely clasping, the uppermost often large and extending beyond the raceme. Bracts longer than the ovary, subulate. Raceme short and dense, with the axis curved to nutant; flowers 7 - 35, the perianth segments slightly spreading distally.

Odd sepal (8.5) - 10 - 14 - (16.4) mm. long, oblanceolate to narrowly oblong, obtuse to acute; lateral sepals similar, oblique at the base. Petals oblanceolate to oblanceolate-oblong, with the apex obtuse and the base oblique. Column 4 - 6 mm. long. Mentum vestigial. Spur at the base of the lip cylindrical, rather slender, 3 - 5 mm. long. Side lobes of the lip very narrow for about half their length, broadening to a subacute apex with the distal free portion very short. Mid-lobe forming about 1/3 the length of the lip excluding the spur, broadly oblong with denticulate margins and the apex rounded to truncate or retuse. Crests consisting of 2 - 4 very low ridges in the basal two-thirds of the lip, passing into several rows of slender papillae extending to near the apex of the mid-lobe.

Sepals white tinged with yellow, to bright lemon

yellow or pink tinged with dull green. Petals and lip white to pale yellow or pink, with the crests yellow to pale yellowish brown distally. No flower scent detectable.

(ii) Distinctions from similar taxa: This species has occasionally been mis-identified with Eulophia aculeata ssp. huttonii (Rolfe) Hall, which differs in lacking a spur at the base of the lip, and having a prominent mentum mostly free from the side lobes and 2.3 - 5.0 mm. long.

The species sometimes resembles material of E.ensata Lindl. in the dried state. E.ensata differs in having the side lobes of the lip broadened near the base, the mid-lobe about half the length of the lip excluding the spur, and the scape scarcely flexuose and more than 30 cm. long.

(iii) Nomenclature: The earliest description matching this species was published in 1881 by Reichenbach, with the name Eulophia leontoglossa. The types are given as Atherstone and Burke specimens from the Transvaal in Reichenbach's herbarium and at Kew. Only the Atherstone specimen at Vienna (W) bears an identification in Reichenbach's handwriting ("E.leontoglossa").

In the original account of E.leontoglossa Reichb.f.,

Reichenbach indicated by an exclamation mark that he had seen the Burke specimen. There is no conclusive evidence that he also saw the Atherstone specimen at Kew, so that this should be regarded as a paratype. All three specimens clearly agree with the present concept and the original description, so that there is no doubt as to the identity of Eulophia leontoglossa Reichb.f.

In 1895, Schlechter published a detailed description closely matching the present species, with the name Eulophia stenantha. The type was given as a single specimen from the "Elandspruit Mountains" (= Steenkampsberg) in the Eastern Transvaal. This specimen cannot be found, and was probably destroyed with Schlechter's special orchid collection at Berlin (B) during World War II. However, in the Bolus Herbarium (BOL) there is a tracing of a drawing said to have been made from material of the holotype. The tracing shows flower parts resembling the present species and matching Schlechter's description. However the spur is shown to be shorter and the mentum longer than in the present species: this could have been caused by accidental tearing along the sides of the spur during dissection. In other respects the tracing clearly resembles the present concept and could scarcely be mis-identified with any other taxon. It seems reasonably certain that the name Eulophia stenantha Schltr. refers to the present species, so that it should be regarded as a synonym of E.leontoglossa Reichb.f.

(iv) Nomenclatural references and types:

Eulophia leontoglossa Reichb.f. Flera 64: 329  
(1881). Syntypes: Atherstone s.n., Lydenburg (W, syntype!); Burke s.n., Magaliabug (K, syntype!). Paratype: Atherstone s.n., Lydenburg (K, paratype!).

Eulophia stenantha Schltr. Bot. Jahrb. 20, Beibl. 50: 27 (1895). Holotype: Schlechter 4004, Elandspruit Mountains, Transvaal (BOL, icon.!).

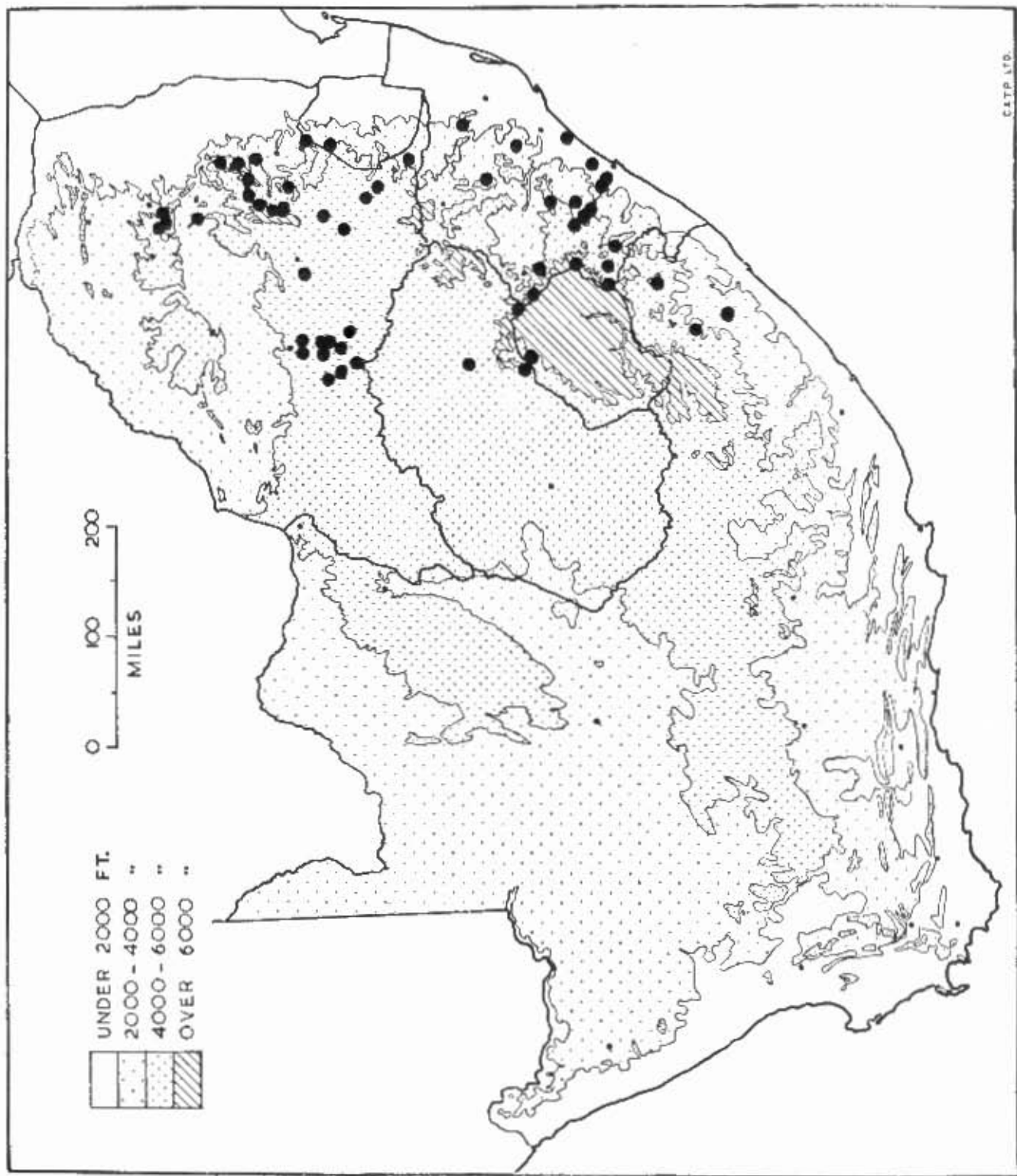
(v) General biology: This species appears to be confined to South Africa, occurring in the north-eastern Cape, Natal, the Eastern Orange Free State and Basutoland, and in the eastern and central parts of the Transvaal (see Map 40).

Precipitation at accurately recorded localities generally lies in the higher part of the range 25" - 80" per annum. Frost may be absent at some localities while at others it may occur on up to 20, 40 or rarely 80 days of the year. There appears to be no preference for a particular soil type; collectors note that the species grows in dry, moderately moist, and occasionally marshy situations. It inhabits grassland, and may be rare to locally frequent at a given locality.

Flowering takes place during the warm wet summer months (see Table 37). The chromosome number of material from central Natal was found to be  $n = 27$ .

**Table 37:** Records in herbaria of the month of collection of flowering specimens of Eulophia leontoglossa Reichb.f.

<u>Month</u>						<u>No. of records</u>
August	..	..	..	..	..	1
September	..	..	..	..	..	3
October	..	..	..	..	..	6
November	..	..	..	..	..	20
December	..	..	..	..	..	35
January	..	..	..	..	..	25
February	..	..	..	..	..	1
March	..	..	..	..	..	1



Map 40: Distribution of *Eulophia leontoglossa* Reichb.f.

37. NOMINA REJICIENDA ET INCERTAE SEDIS

Satyrium giganteum L.f. Suppl. Pl. 402 (1781).

(= Eulophia speciosa (R.Br. ex Lindl.) Bolus, E.tuberculata Bolus, et E.streptopetala Lindl.).

Limodorum giganteum (L.F.) Thunb. Prodr. Pl. Cap. 4 (1794).

Cymbidium giganteum (L.f.) Sw. Schrad. Journ. 2: 224 (1800).

Eulophia robusta Rolfe Kew Bull. 1910: 369 (1910).

(= E.clavicornis Lindl. var. clavicornis pro parte, et E.cooperi Reichb.f.).

Eulophia oblonga Rolfe Kew Bull. 1910: 370 (1910).

(= E.ensata Lindl. pro parte, et E.ovalis Lindl. ssp. ovalis).

PART 4: CORRELATIONS BETWEEN TAXA

## 1. SUBGENERIC GROUPINGS OF SPECIES

It is generally desirable that genera with numerous species be divided into subgenera or sections in order to ease the comprehension of the ranges of form present. The members of each grouping should have a number of more or less distinctive characters in common.

Preliminary inspection showed that about a third of the South African species of Eulophia could be arranged in small rather clear-cut groups, consisting of about 2-4 species each. An attempt was made to add other species to these groups, without reducing the number of common characters to an insignificant level. Chromosome number, flower colour and to some extent, ecological characters were used as aids to the morphological criteria in setting up the classification.

No basis could be found for grouping about a quarter of the taxa, nor was it possible to deduce systematic linear arrangements within and between the groups, at least in the majority of cases. As the classification appears to be only slightly more comprehensive than other possible arrangements, future research may well lead to significant alterations. The groups should therefore be regarded as very much more hypothetical than the other taxa delimited in this work. For this reason, the groups are not given formal ranks or names. It may be noted that the groupings proposed by Perrier (1935, 1941) for the species of Eulophia

in Madagascar were found to be scarcely applicable to the taxa occurring in South Africa.

The groups are given below, together with their constituent taxa. Some taxa are marked with an asterisk to indicate that they closely resemble other species in Tropical Africa. The characteristics of each group are given, together with a figure in parentheses to show the number of taxa in which a given feature occurs.

Eulophia foliosa group: E.tabularis, E.foliosa, E.chlorantha, E.aculeata ssp. aculeata, E.aculeata ssp. huttonii, E.odontoglossa\*, E.milnei\*, E.leontoglossa, E.ensata, E.welwitschii\*, E.litoralis, E.nigricans. Characteristics: Petals about as wide, or narrower than, the sepals (12). Mid-lobe of the lip variously papillose (11) or with a lobed ridge (1). Raceme dense (9) or sub-lax (3). Petals yellow (7), green (2) or varying from white to yellow or green, sometimes purplish (3). Petals suboblanceolate (6), subelliptic (4) or oblong to lanceolate (3). Chromosome number  $n = 27$  (5),  $2n =$  approx. 56 (2), unknown in 5 species.

Eulophia ovalis group: E.macowanii, E.cooperi, E.ovalis ssp. bainesii, E.ovalis ssp. ovalis, E.clavicornis var. inaequalis, E.clavicornis var. clavicornis, E.clavicornis var. nutans. Characteristics: Crests on the mid-lobe of the lip variously papillose (7). Petals somewhat

broader than the suboblong sepals, and about the same length (7). Leaves leathery, single-channelled, mostly rather less than 3.0 cm. broad, the margins entire (7). Distal part of the spur at the base of the lip subcylindrical (7). Habitat in open grassland or grassy places in savannah (7).

Eulophia petersii group: E.petersii, E.leachii.

Characteristics: Leaf margins with scabrous enations (2). Pseudobulbs with most of their length above soil level (2). Petal apices recurved (1) or circinnate (1). Operculum of anther bilobed at the apex (2). Sepals and petals green, tinged with purple; the lip similar but with white and purple distally (2). Habitat: rocky places in dry savannah or bushveld (2).

Eulophia speciosa group: E.fridericii\*, E.streptopetala\*, E.parviflora, E.speciosa\*, E.schweinfurthii\*, E.clitellifera\*, E.tuberculata. Characteristics: Distal crests composed of fleshy ridges gradually becoming lower near the apex of the lip (6) or terminating abruptly (1). Petals rather broader than the sepals (6) or nearly as broad (1). Mentum about as long or slightly shorter than the column (7), with the side lobes of the lip fused to its complete length (6) or half its length (1). Leaves thick-tissued with numerous fine veins (4), or thin-tissued with a transverse line near the base marking an abscission layer (2), or leathery (1). Petals yellow

with reddish - brown to purple markings along the nerves on the inner surface (5), or pure yellow (2).

Ungrouped species: E.calanthoides, E.parvilabris,  
E.hereroensis, E.longisepala\*, E.zeyheriana, E.tenella,  
E.platypetala\*, E.angolensis\*, E.horsfallii\*, E.cucullata\*,  
E.coddii, E.meleagris.

## 2. GENERIC RELATIONSHIPS

A re-evaluation of the characters delimiting Eulophia from similar genera would involve the study of very many more species than are given in the present work. However, a number of observations have been made.

The genus Acrolophia Pfitz. is considered to differ in having the inflorescence terminal on the axis bearing the leaves, while in Eulophia it is said to be always lateral (Pfitzer 1888; Schlechter & Bolus 1894). Only a single case has been found of variation of this character within a species. A specimen in the Kew Herbarium (K: Brown 232, Uganda) clearly matches material of Eulophia euglossa Reichb.f. in all but the position of the scape, which arises terminally on the leaf-bearing axis. In all other known specimens of E.euglossa the inflorescence is clearly lateral, and the species scarcely resembles members of the genus Acrolophia in other respects. E.euglossa is clearly not intermediate between the two genera, and it seems that the Uganda specimen is best regarded as a monstrosity.

Several species of Eulophia have the inflorescence arising some distance along the leaf-bearing shoot or aerial pseudobulb (E.lindiana Kraenzl., E.longisejala Rendle, E.callichroma Reichb.f.). However, in all known specimens of these species the inflorescence arises laterally. It appears that no other known character will differentiate

the two genera. Such species as Eulophia aloifolia Reichb.f., E.callichroma Reichb.f. and E.leachii Greatrex ex Hall, although differing in having lateral inflorescences and large pseudobulbs, have quite similar flowers to Acrolophia, with purplish green sepals and petals and a white, purple and green lip, the anther bilobed at the apex, the petals slightly wider than the sepals, as well as stiff to leathery single-channelled leaves.

Summerhayes (1957) gave a detailed account of the distinctions of the genus Eulophidium Pfitz., which differs from Eulophia in having a distinct quadri-lobed lip with two calli at the base, the pseudobulbs mostly aerial with 1 - 3 leaves articulate on the elongate or rarely vestigial petiole. The present author finds no reason to differ from Summerhayes' view of the distinctness of this genus.

The lack of distinctness between previous conceptions of Eulophia and Lissochilus R.Br. is pointed out on pages 78 - 79. It is interesting to note that the E.speciosa group proposed on page 349 includes many of the taxa previously ascribed to Lissochilus, although the chief delimiting characters are somewhat different. It appears that the E.petersii group is more distinctive than the E.speciosa group. However, neither has a sufficiently distinct facies to be distinguished at the same level as Eulophidium or Acrolophia.

### 3. COMPARATIVE CYTOLOGY

Chromosome numbers were obtained for about two-thirds of the species of Eulophia occurring in South Africa (see Table 38, Appendix 4). There is no clear evidence in this data for a basic number in the genus. Of the groupings of species given on pages 348 - 349, only the E.foliosa group appears to have the same chromosome number for several species ( $n = 27$  in five taxa). Wide ranges are found in the E.ovalis group ( $n = 20, 21, 25, 28, 38, 40, 47, 50$ ) and the E.speciosa group ( $n = 20, 24, 25, 27, 50$ ). E.petersii has a gametic number of  $n = 24$ ; that of the very similar taxon E.leachii is  $n = 26$ .

Different chromosome numbers were found for two outwardly very similar forms of E.clavicornis var. nutans,  $n = 25$  and  $n = 47$ . Aneuploidy could have occurred in this case, involving doubling and subsequent loss of three chromosomes. The chromosomes are small and only slightly elongate at the first metaphase of meiosis, so that it is extremely difficult to observe whether multivalents are formed in the putative polyploid. Aneuploidy could have also taken place in Eulophia ovalis ssp. ovalis: a robust, large-flowered form gave  $n = 40$ , while a smaller form had a gametic number of  $n = 21$ . In material of E.angolensis, numerous counts were obtained ranging from  $n = 34$  to  $n = 37$ . Material from a different locality consistently gave  $n = 38$ .

It may be suggested that frequent aneuploidy could

have obscured the basic chromosome number of the genus. The problem is not elucidated by the only previous published work referring to the cytology of the genus, in which Sampathkumaran and Sheshagiriah (1931) give  $n = 16$  for material said to belong to Eulophia.

No chromosome numbers are known for other genera in the Cyrtopodiinae (sens. Schlechter 1927). However, the related group Cymbidiinae (sens. Schlechter 1927) includes the large genus Cymbidium Sw., for which much cytological data is available. Mehlquist (1952) and Wimber (1957) found that most of the large number of species and hybrids of Cymbidium they studied had somatic complements of  $2n = 40$ . Some hybrids gave  $2n = 60, 80$  or rarely 100. Wimber and Hernlund (1955) found evidence for complex aneuploidy in two Cymbidium hybrids, and an unusual number ( $2n = 75$ ) in another. These appear to be the only well-established cases of numbers with a possible aneuploid origin in the genus (c.f. Wells 1956). This may be contrasted to the high incidence of evidence for aneuploidy in the species of Eulophia studied in the present work.

#### 4. PHYTOGEOGRAPHY

The area in which members of the genus Eulophia have been found in South Africa may be pictured as a belt, narrow along the southern Cape coast to the eastern Cape, where it broadens to encompass Natal, parts of Basutoland and the Orange Free State, finally expanding to cover most of the Transvaal, Swaziland and a little of the northern Cape (see Map 41).

Twenty - one of the forty taxa studied in the present work are known to occur in Tropical territories beyond the borders of South Africa. Several of these taxa have distributions extending to Angola and Kenya, some as far north as Eritrea, and a few up to about 4500 miles away on the West African coast (Nigeria to Gambia). Two taxa are also found on Madagascar, which at its closest point lies 260 miles off the African mainland.

Four taxa are more or less confined to the southern Cape coast. Eulophia tabularis and E. litoralis are found at the greatest number of localities in the South - West, with reduction margins extending eastwards (see pp. 103, 316). E. aculeata ssp. aculeata occurs throughout the area, with a long reduction margin extending to the Eastern Transvaal (see p. 130). E. platypetala (p. 242) is rare, being unknown in the South - West.

E. macowanii has been found in many parts of the South - East Cape, and has a reduction margin extending to

the southern borders of Natal (see p. 266). All other taxa in the Cape generally have extensive distribution ranges to the north. They often show reduction margins extending south and westwards along the coast, i.e. in an opposite direction to those of E.macowanii and the other taxa cited above.

No 'northern' taxa are found in the winter rainfall region of the South-West Cape. They are confined to summer rainfall areas in the East, although a few occur in the Knysna district where the rainfall is relatively high both in summer and winter (e.g. E.speciosa, p. 160; E.clavicornis var. clavicornis, p. 304). E.aculeata ssp. aculeata is the only taxon which grows in extreme conditions of winter rainfall in the South-West Cape, and in summer rainfall areas in the Eastern Transvaal. (See Table 5, p. 126).

In Natal, some taxa are relatively evenly distributed (e.g. E.leontoglossa, p. 344; E.foliosa, p. 110), while others are chiefly montane (E.calanthoides, p. 189; E.zeyheriana, p. 248), or confined to the coast. These coastal species are the only taxa in South Africa that have distributions extending to territories between Nigeria and Gambia (E.milnei, p. 311; E.horsfallii, p. 230; E.edontoglossa, p. 117; E.cucullata, p. 183; E.angolensis, p. 222). This coastal distribution of Tropical elements could be chiefly due to the fact that such areas are warm and humid with a relatively high rainfall (about 40" - 60"

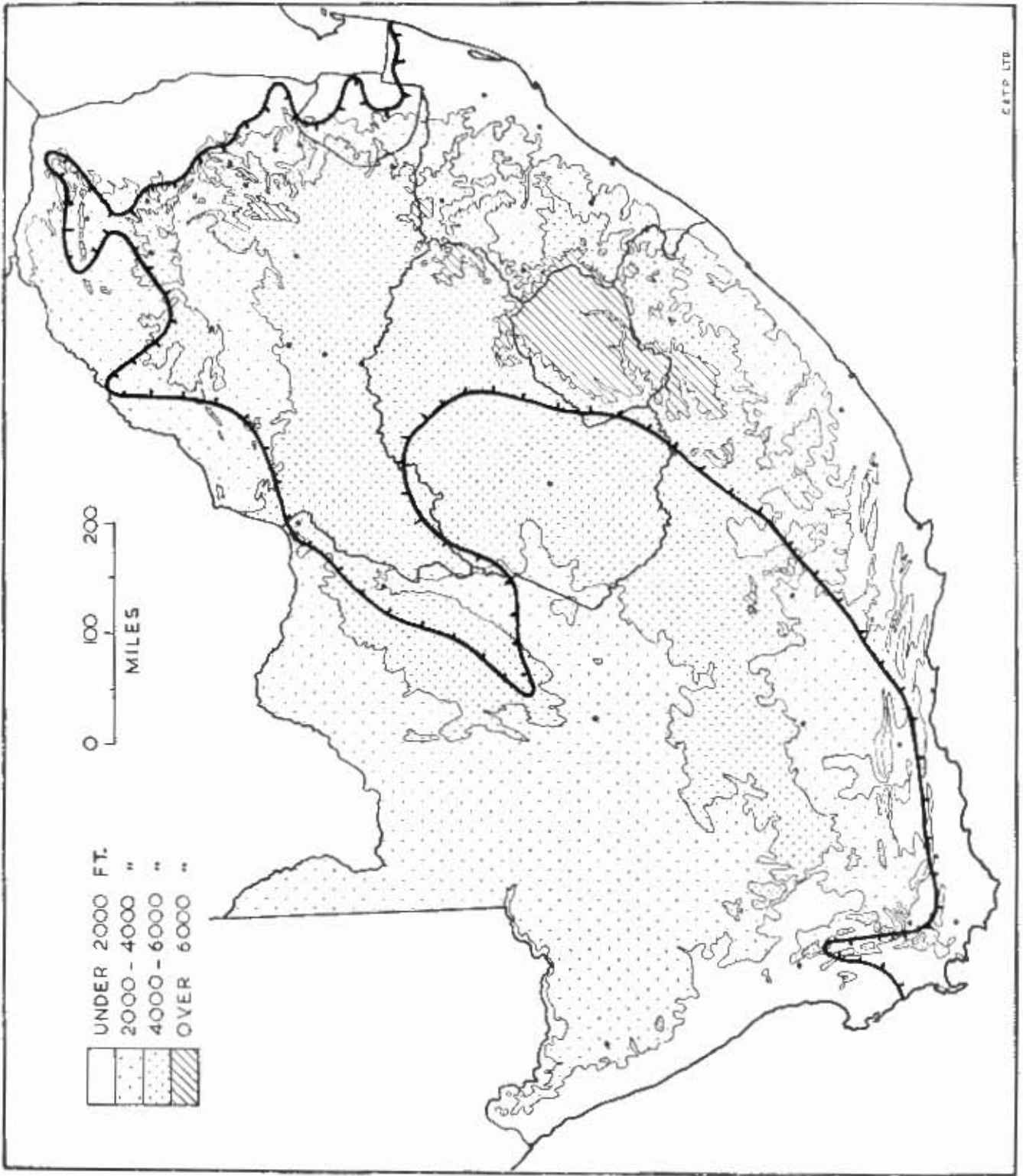
per annum). Similar conditions are found in the mountainous eastern parts of the Transvaal, where some of these species are found at many localities (E.angolensis, E.ed-entoglossa), while others are rare (E.milnei, E.horsfallii) or absent (E.cucullata).

In the Transvaal, the majority of species have a predominantly eastern distribution, while a few occur chiefly in the west. The eastern distribution belts may be narrow, confined to the moister mountainous areas (e.g. E.ensata, p. 338). Others may have outliers or reduction margins in the west (e.g. E.streptopetala, p. 144). Some species may occur at evenly distributed localities from the eastern mountains to the central Transvaal (e.g. E.welwitschii, p. 328). E.ovalis ssp. ovalis (p. 286) is an extreme case, extending almost throughout the southern Transvaal to a reduction margin in the northern Cape. The width of the distribution belt of <sup>these</sup> a species in the Transvaal could be governed largely by <sup>their</sup> its tolerance to dry conditions which generally increase towards the west.

Three species have a predominantly western distribution in the Transvaal. E.coddii (p. 199) is only known from two localities. E.tuberculata (p. 205) has a distribution range with a large disjunction between localities in the South-West Transvaal and the Eastern Cape. A similar disjunction is evident for E.hereroensis (p. 236) between localities in the northern and eastern Cape respectively. Although both species are somewhat inconspicuous,

they have been collected reasonably frequently in their known areas, so that it is rather likely that the disjunction is real and not a an artifact of inadequate collecting.

Both E.tuberculata and E.hereroensis generally grow only in areas with an annual precipitation of 15" - 25" per annum, rarely as high as 30". It is possible that an increase or (rather more likely) a reduction of annual rainfall may have led to extinction of the species in the now disjunctive zones. Intolerance to rainfall higher than 30" per annum could be the chief factor preventing the spread of these species to the Eastern Transvaal.



Map 41: The area lying on the stippled side of the heavy line represents the overall distribution of the genus Eulophia in South Africa.

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APPENDICES

APPENDIX 1: DISCRIMINANT ANALYSIS

This procedure was followed to provide data for the assessment of the distinctness of two groups differing in several variables (see p. 11).

Firstly, measurements were taken of all characters likely to contribute to the distinction between the two groups. Without electronic computation only a limited number of characters could be used. More than four or five characters give very large numbers in parts of the calculation with the samples of specimens used. This greatly increases the incidence of arithmetical errors. A selection was therefore made by finding the characters that give the greatest amount of separation of the groups, either by plotting their frequency distributions or comparing their variance ranges in the two sets.

The basic equation for a discriminant function Z compounded of four weighted characters A, B, C and D is as follows (Fisher 1936):

$$Z = W_A M_A + W_B M_B + W_C M_C + W_D M_D \dots\dots\dots(1)$$

To calculate the weightings  $W_A, W_B \dots W_K$  for the measurements  $M_A, M_B \dots M_K$ , values resulting from the following procedure were found for Z and  $M_A, M_B \dots M_K$ . Firstly, values of a function P (see equation 2) were calculated separately for the two sets of specimens.

$$P_{K_x K_y} = \frac{\sum (M_{K_x}^s \cdot M_{K_y}^s)}{n - 1} - \frac{(\sum M_{K_x}^s)(\sum M_{K_y}^s)}{n - 1} \dots\dots(2),$$

where  $P_{K_x K_y}$  = value of P for a particular set, for characters  $K_x$  and  $K_y$ ;  $M_{K_x}^s$  = value of measurement of character  $K_x$  for a specimen  $s$  of the set, and  $M_{K_y}^s$  = value of measurement of character  $K_y$  of the same specimen;  $\sum M_{K_x}^s$  = sum of the measurements of character  $K_x$  in the set, similarly for  $\sum M_{K_y}^s$ ;  $n$  = number of specimens in the set.

The values of P obtained for the sets I and II are then added together, to give  $S_{K_x K_y}$  for each character combination:

$$S_{K_x K_y} = P_{K_x K_y}^I + P_{K_x K_y}^{II} \dots\dots\dots(3).$$

Another function  $Z_K$  was found by subtracting the mean of measurements of each character in set I from that of the same character in set II:

$$Z_K = \bar{x}_K^{II} - \bar{x}_K^I \dots\dots\dots(4).$$

The values of  $S_{K_x K_y}$  and  $Z_K$  obtained in this way were substituted in four simultaneous equations similar to (1), to find the weightings  $w_K$ . The coefficients were arranged as follows:

$$\begin{aligned} Z_A &= w_A S_{AA} + w_B S_{AB} + w_C S_{AC} + w_D S_{AD} \\ Z_B &= w_A S_{AB} + w_B S_{BB} + w_C S_{BC} + w_D S_{BD} \\ Z_C &= w_A S_{AC} + w_B S_{BC} + w_C S_{CC} + w_D S_{CD} \\ Z_D &= w_A S_{AD} + w_B S_{BD} + w_C S_{CD} + w_D S_{DD} \dots\dots(5). \end{aligned}$$

Determinants were used to find the relative values of the weightings  $W$  for each character from the simultaneous equations (5). The result of each determinant  $A_K$  may be related to the weightings  $W_K$  as follows:

$$\frac{W_K}{A_K} = \frac{W_A}{A_A} = \frac{W_B}{A_B} = \frac{W_C}{A_C} = \frac{W_D}{A_D} \dots\dots\dots(6).$$

Let  $W_A = 1$ , then  $A_A$  and  $A_B$  being known, the value of  $W_B$  relative to  $W_A$  may be found; similarly for  $W_C$  and  $W_D$ . As the solution of the equations (5) involves very large numbers, it is essential to check the calculations. A general check may be carried out by substituting the values of  $W_A, W_B \dots W_K$  in any of the two equations (5). In the case of equations for  $Z_A$  and  $Z_B$  the right-hand sides should come to values  $V_A$  and  $V_B$  respectively, such that

$$\frac{Z_A}{Z_B} = \frac{V_A}{V_B} \dots\dots\dots(7).$$

The weightings  $W_A, W_B \dots W_K$  may now be substituted in equation 1, which may be used for finding the value of  $Z$  for each specimen. Two frequency histograms of  $Z$  are then plotted, one for each set of specimens. The distinctness of the two groups, as based on the characters included in the analysis, may be assessed by the amount of overlap (if any) of the two histograms.

## APPENDIX 2: TERMINOLOGY

In view of certain variations and deficiencies in terminology in the past, it is necessary to define and illustrate the meanings of some of the terms used in the present work. Current usage is followed as far as possible (e.g. Summerhayes 1951).

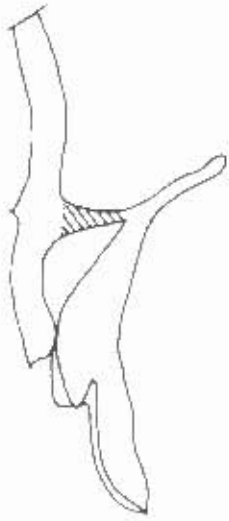
Scapes: The axis of the inflorescence, taken to include the flower-bearing portion which is referred to collectively as the raceme.

Mentum: Tissue lying between the base of the column and the spur (see diagram 37a), or in spurless species, the base of the lip (see diagram 37b). The side lobes of the lip may be fused to the mentum giving a conical portion, usually with a terminal subcylindrical spur (diagram 37c).

Side lobes of the lip: Tissue lying distally to a line passing from the deepest indentation on the margin of the lip to the sides of the mouth of the spur. Side lobes defined in this way may have their longest axis parallel to that of the lip (diagram 38a), or in some taxa, diagonal (diagram 38b) or perpendicular (diagram 38c). The Free distal portion is that tissue lying distally along the longest axis of the side lobe which has both lateral margins unattached to other parts of the lip or mentum.

Mid-lobe of the lip: The expanse of tissue lying on the distal side of a line joining the two deepest incisions or indentations on each side of the lip (see diagrams 39a, 39b).

Basal portion of the lip: The tissue lying basally to the side and mid-lobes, as defined above (see diagram 40).



(a) Buchanan 5 (K)

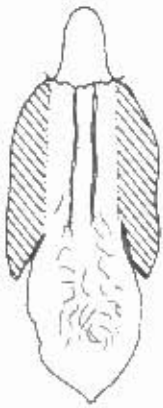


(b) Junod 2587 (Z).

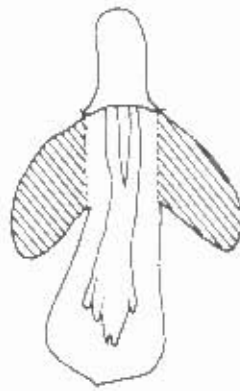


(c) Holland 3723 (BOL).

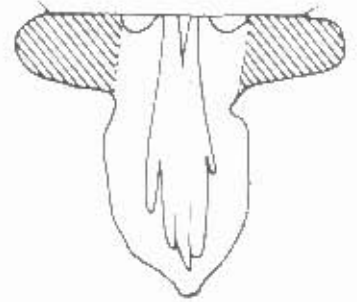
Diagram 37: Showing various forms of the mentum (hachured areas).



(a) Hall 642 (BOL)

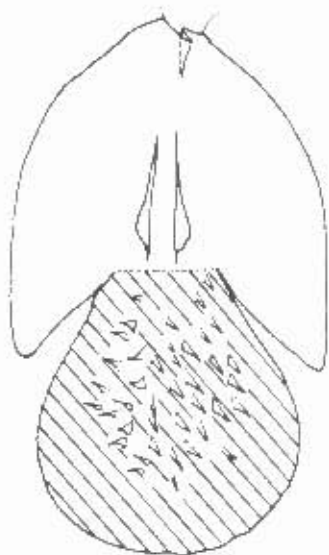


(b) Harrison 1 (PRE).

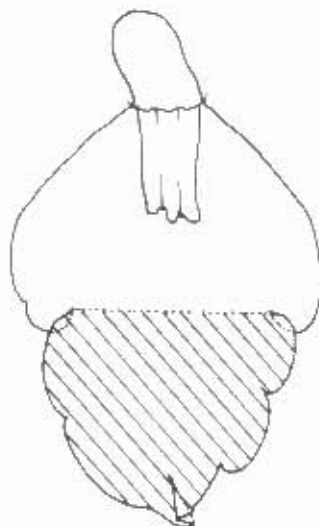


(c) Nat. Bot. Gdns. 1836/26 (BOL).

Diagram 38: Showing various forms of the side lobes of the lip (hachured areas).

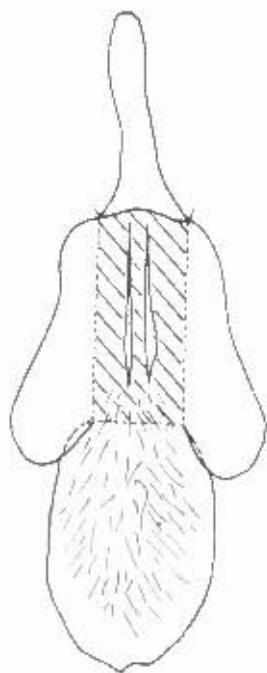


(a) Newdigate in Herb.  
Bolus 10615 (BOL).



(b) Ewins in Herb.  
Bolus 26607 (BOL).

Diagram 39: Showing position of the  
mid-lobe of the lip (hachured area).



Bolus 12304 (BOL).

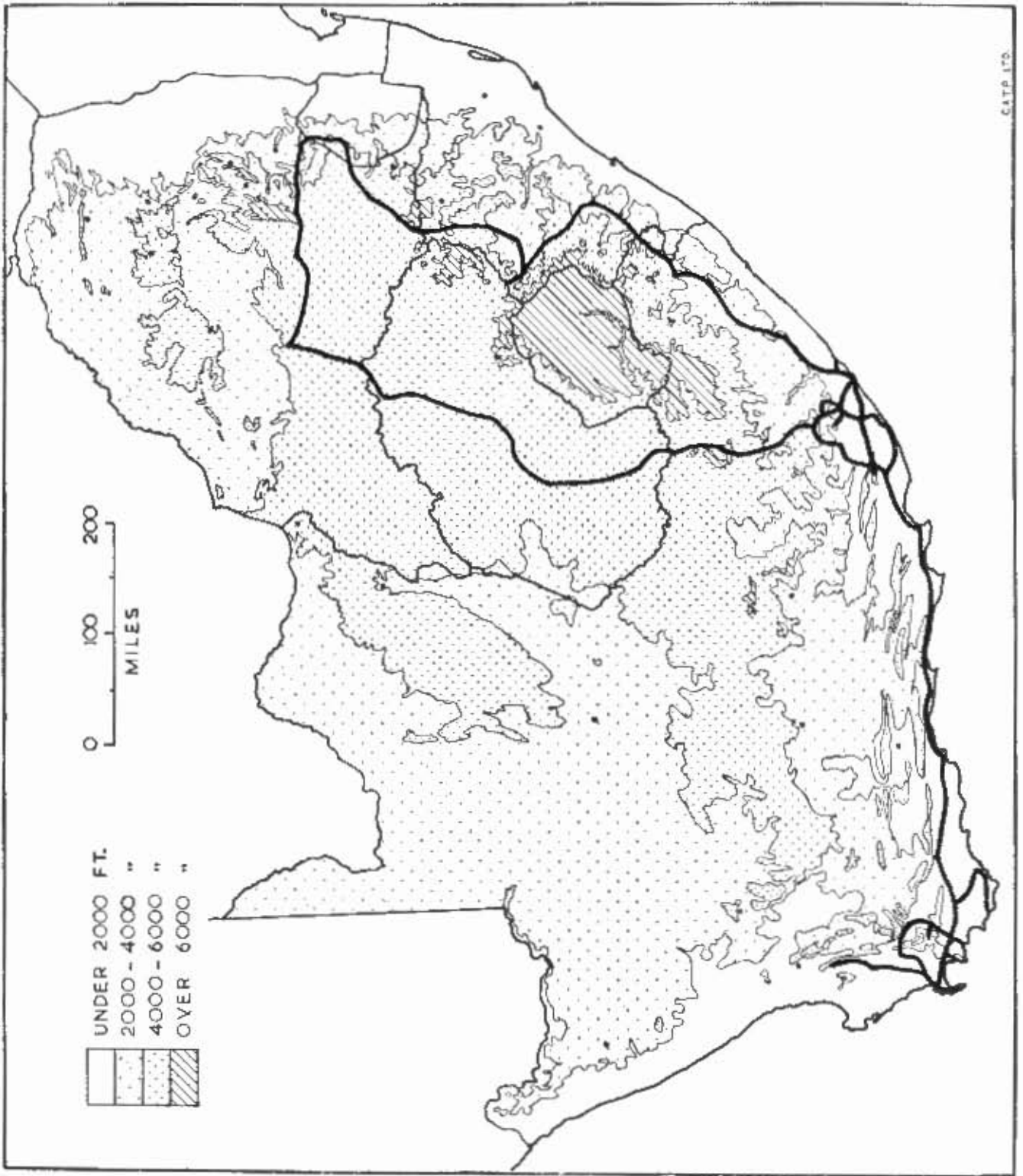
Diagram 40: Showing position  
of the basal portion of the  
lip (hachured area).

### APPENDIX 3: EXPEDITION ROUTES

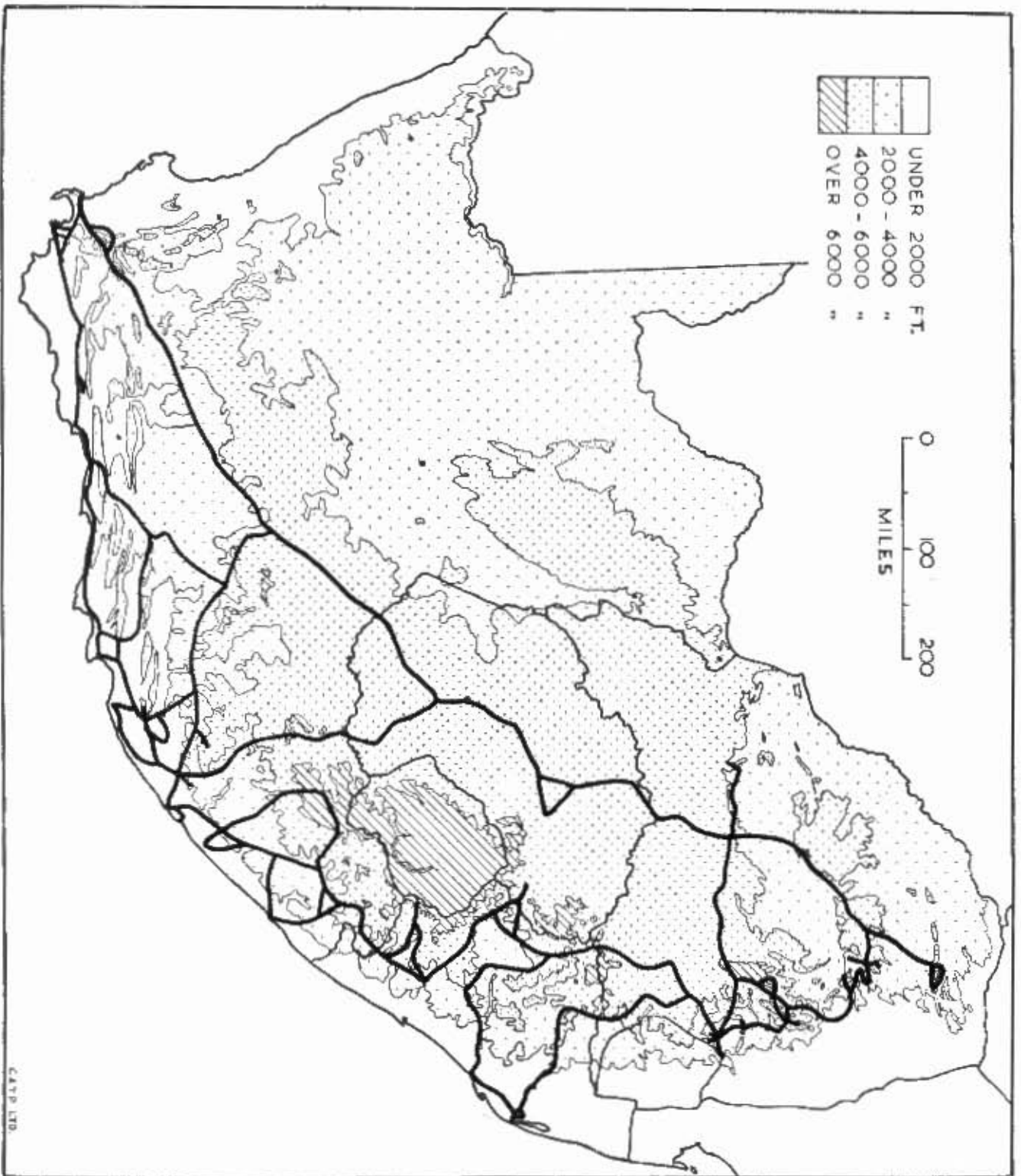
The rather large range of flowering times of the South African species of Eulophia made it necessary to conduct expeditions in both Spring and Summer (see Maps 42, 43).

Few localities of previous spādētors proved to be as rich in species as herbarium records would suggest. For example only two of the seventeen previously recorded taxa in the Barberton district in the Eastern Transvaal could be found. Although about 16,000 miles were travelled in areas where the genus is found in South Africa (c.f. Map 41, p. 359), only 70% of the total number of taxa were seen. While a few species are relatively frequent, many appear to be becoming increasingly rare.

The expeditions may not therefore have been too significant in confirming distribution patterns based on previous herbarium records.



Map 42: Routes of expeditions carried out in Spring (September to November).



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#### APPENDIX 4: CYTOLOGICAL METHODS AND RESULTS

Nearly all chromosome counts given in Table 38 were made from anther-squashes stained with iron acetocarmine (Belling 1926; Darlington and La Cour 1950). A small number of results are included from a previous study (Hall 1959, MS.), in which meristematic tissue was stained by the Feulgen method and examined with a phase contrast microscope; such results are marked with an asterisk in Table 38.

A method was found of speeding the process of finding anthers with countable chromosomes. A sequence of stages in the development of pollen may be identified in up to 20 buds above the open flowers of an inflorescence. The most suitable stage for making a chromosome count (metaphase of the division forming the generative and tube nuclei) may be found in the lower buds, although earlier stages in upper buds may also be used (e.g. metaphase of the second division of meiosis).

For finding such stages, the anthers should be in the exact order in which they occur on the inflorescence. This cannot be judged accurately by comparing the size of excised anthers or columns, and inclusion of the inflorescence axis would necessitate the use of large volumes of fixative. (Fresh material should not exceed 5% of the volume of fixative for studying chromosomes). As a compromise, excised columns bearing anthers were threaded onto a length of cotton with a fine needle, in the order in

which they occurred on the inflorescence. The material was kept for about 1 - 2 days in a fixative solution of 1 vol. glacial acetic acid in 3 vols. absolute ethanol (Clarke 1851). It was then transferred to 70% ethanol where it could be stored for periods of up to about three months.

For staining, the contents of the anthers were spread out on a slide with a needle. A drop of stain was added, consisting of 0.5% carmine in 45% acetic acid, brought to a bluish-red colour with a saturated solution of ferric acetate in 45% acetic acid (Belling 1926; Darlington and La Cour 1950). When the cells had been dispersed through the drop of stain, the preparation was gently heated and squashed under a coverslip, and examined under a microscope. This procedure generally gave satisfactory results (see Plates 3 and 4, p. 383).

Camera-lucida drawings were prepared of each complement of chromosomes counted, to a scale of 1 cm. = 4.2  $\mu$ . The drawings of complements giving the clearest counts in each taxon are reproduced in diagrams 41 - 69. Photographs were attempted in every case, but proved to be of limited value. This was largely due to the cells and chromosomes being small, necessitating the use of high magnifications. The depth of field under such conditions was generally too shallow to accommodate chromosomes lying slightly above and below the plane of focus.

Voucher specimens have been deposited at the Bolus Herbarium (BOL), University of Cape Town.

**Table 38:** Chromosome numbers of South African species of Eulophia. Those marked with an asterisk were found in a previous study (Hall 1959, MS.).

Taxon	A.V. Hall no.	Locality	Chromosome number		No. of counts		Diagram No.
			2n	n	Accu- rate	Approx- imate	
<u>E.foliosa</u>	755	S.E. Cape		27	2	1	-
	801	Cent. Natal		27	4	-	41
<u>E.chlorantha</u>	573	E. Transvaal	56?*		-	2	-
<u>E.aculeata</u>							
<u>spp. aculeata</u>	610	S.E. Cape	56*		1	-	-
<u>spp. huttonii</u>	785	S. Natal		27	1	-	42
<u>E.leontoglossa</u>	800	Cent. Natal		27	5	-	43
<u>E.ensata</u>	754	S.E. Cape		27	5	2	-
	816	N. Natal		27	15	-	44
<u>E.welwitschii</u>	822	N. Natal		27	6	9	45
<u>E.macowanii</u>	762	N.E. Cape		28	6	2	46
<u>E.ovalis</u>							
<u>spp. bainesii</u>	867	E. Transvaal		42	7	2	47
<u>spp. ovalis</u>	833	E. Transvaal		40	5	4	48
	773	N.E. Cape		20?	-	6	-
	854	E. Transvaal		21	2	1	-
	853	E. Transvaal		21	3	1	-
	760	S.E. Cape		21	6	-	49
<u>E.clavicornis</u>							
var. <u>clavicornis</u>	724	S.E. Cape		50	2	4	50
	735	S.E. Cape		50	2	-	-
var. <u>nutans</u>	810	N.E. Natal		25	2	1	51

Table 38, continued.

<u>Taxon</u>	<u>A.V. Hall no.</u>	<u>Locality</u>	<u>Chromosome number</u>		<u>No. of counts</u>		<u>Diagram No.</u>
			<u>2n</u>	<u>n</u>	<u>Accu- rate</u>	<u>Approx- imate</u>	
<u>E.clavicornis</u>							
var. <u>nutans</u>	828	E. Transvaal		25	2	8	-
	851	E. Transvaal		25	4	2	52
	871	E. Transvaal		47	4	8	53
<u>E.petersii</u>	797	Cent. Natal		24	2	-	54
<u>E.leachii</u>	-	N.E. Natal		26	3	5	55
<u>E.fridericii</u>	919	N. Transvaal		24	7	1	56
<u>E.streptopetala</u>	755	S.E. Cape		20	2	3	57
(wide leaved)	-	?	40?		-	5	58
<u>E.parviflora</u>	725	S.E. Cape		25	4	-	59
<u>E.speciosa</u>	765	N.E. Cape		27	4	1	60
	795	Cent. Natal		27	1	2	-
	726	S.E. Cape		27	1	1	-
<u>E.tuberculata</u>	728	S.E. Cape		50	3	4	61
<u>E.calanthoides</u>	791	W. Natal		23?	-	2	62
<u>E.parvilabris</u>	643	E. Transvaal	56?*		-	2	-
<u>E.zeyheriana</u>	786	S.W. Natal		56	2	-	63
<u>E.tenella</u>	759	S.E. Cape		60	1	4	64
<u>E.angolensis</u>	937	N.E. Transvaal		38	2	4	65
	887	E. Transvaal		34	2	-	66
				35	3	2	67
				36	8	3	68
				37	3	1	69



Plate 3: Showing the depth of staining of chromosomes with iron-acetocarmine, at metaphase of the division into tube and vegetative nuclei in a pollen tetrad of E.ensata Lindl. (Hall 816, N. Natal). Scale: 1 cm. = 5.4  $\mu$ .

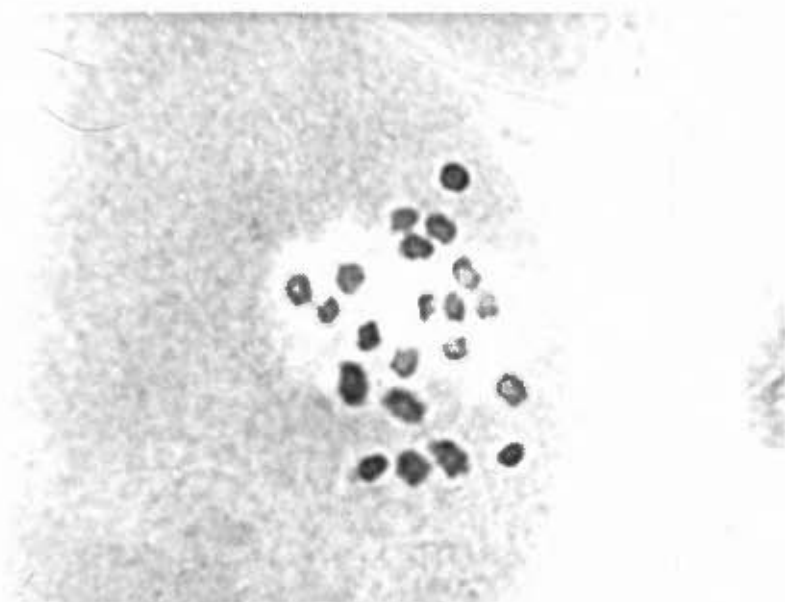


Plate 4: Showing the depth of staining of chromosomes with iron-acetocarmine, at metaphase of the second meiotic division of pollen mother cells of E.ovalis Lindl. ssp. ovalis (Hall 854, E. Transvaal). Scale: 1 cm. = 4.2  $\mu$ .

**CAMERA - LUCIDA DRAWINGS OF CHROMOSOMES**

Diagram 58 was made from the metaphase of a somatic division in the anthers. All other diagrams are from the metaphase of the division forming the generative and tube nuclei. For details of origin of material see Table 38. Scale: 1 cm. = 4.2 u.



41. E. foliosa n = 27.



42. E. aculeata ssp.  
huttonii n = 27.



43. E. leontoglossa n = 27.



44. E. ensata n = 27.



45. E. welwitschii n = 27



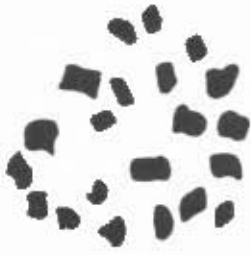
46. E. macowanii n = 28.



47. E. ovalis ssp. bainesii  
n = 42



48. E. ovalis ssp. ovalis ...  
n = 40.



49. E.ovalis ssp. ovalis  
n = 21.



50. E.clavicornis var.  
clavicornis n = 50.



51. E.clavicornis  
var. nutans n = 25



52. E.clavicornis  
var. nutans n = 25.



53. E.clavicornis  
var. nutans n = 47.



54. E.petersii n = 24.



55. E. leachii  $n = 26$ .



56. E. fridericii  $n = 24$ .



57. E. streptopetala  
(narrow-leaved form)  
 $n = 20$ .



58. E. streptopetala  
(wide leaved form)  
 $2n = 40$ , approx.



59. E. parviflora  $n = 25$ .



60. E. speciosa  $n = 27$ .



61. E. tuberculata n = 50.



62. E. calanthoides  
n = approx. 23.



63. E. zeyheriana n = 56.



64. E. tenella n = 60.



65. E. angolensis n = 38.



66. E. angolensis n = 34.



67. E. angolensis n = 35



68. E. angolensis n = 36



69. E. angolensis n = 37.

APPENDIX 5: SPECIMENS EXAMINED

Specimens are given below under taxa arranged in alphabetical order. For a given taxon, specimens from the southern and south-western parts of the geographical range are cited first. The specimens are arranged according to Provinces and Magisterial Districts (Dr. L. E. Codd, priv. comm.).

*Eulophia aculeata* (L.f.) Spreng. ssp. *aculeata*:

CAPE PROVINCE: Cape Peninsula, Table Mt., Bolus 3900 (K, BM, BOL, SAM), Schlechter 69 (Z, P), Dümmmer 704 (NBG), Esterhuysen 11214 (BOL), Salter s.n. (No. 54322 in SAM), Hall 84 (CT), Hall 602 (BOL), Marloth 365 (PRE), Young s.n., No. 27358 in TRV (PRE), Lewis 4755 (SAM), Giffen s.n., 26 Dec. 1924 (CT), Giffen 9 (CT), Dod 883 (BOL), Dod 2266 (BM), Zeyher s.n. (W), Rehmann 579 (Z), Steeke s.n. (No. 56059 in SAM), Guthrie 242 (CT); Muisenberg mountains, Fair s.n. in Herb. Bolus. 10005 (BOL, Z), Schlechter 104 (Z); Constantiaberg, Compton 14209 (NBG), Compton 8265 (NBG), Hall 77 (CT), Hall 78 (CT); Silvermine Valley, Lewis 789 (SAM); Steenberg, Bodkin s.n. in Herb. Bolus. 26700 (BOL); Simonstown, Thomas s.n. (No. 56539 in NBG); Modderdam, Lewis 485 (SAM); Klaarjagers, Linley s.n. (No. 59685 in SAM); Cape Flats, Purdie s.n. (W); Black River, Guthrie 242 (BOL); nr. Doornhoogte, Ecklon s.n. in Herb. Sond. 46 (W). Somerset West, nr. Sir Lowry's Pass, Bolus 4207 (K, BOL).

Malmesbury, Mamre, Cassidy 208 (NBG). Stellenbosch, Fransch Hoek, Marloth 8109 (PRE). Caledon, Viljoen's Pass, Pillans 4797 (BOL); Hermanus, Leighton 360 (BOL); nr. Palmiet R., Stokoe s.n. (No. 63747 in SAM). Bredasdorp, Uitkomst R., Bond 784 (NBG). Swellendam, Wolwekloof, Taylor 262 (BOL). Riversdale, Corenti River Farm, Muir s.n. in Herb. Galpin 5339 (PRE). Mossel Bay, Robinson Pass, H.Hall 277 (NBG), Schelpe 4986 (BOL, SAM). Oudtshoorn, Robinson Pass, Schelpe 4992 (BOL). George, Montagu Pass, Barker 681 (NBG), Martin 104 (NBG); nr. George, Penther 103 (W), Paterson 1234 (Z); Wilderness, Martin 12 (NBG), Mogg s.n. (No. 29058 in PRE); Victoria Bay, Compton 6832 (SAM). Uniondale, Lauterwater, Compton 5253 (BOL), Compton 4505 (BOL), Compton 23863 (NBG); Helpmekaar, Esterhuysen 4627 (BOL), Compton 10509 (NBG). Knysna, Zitzikama R., Penther 298 (W); Elands River, Penther 299 (W), Paterson s.n. (GRA); Keurboomriver, Immelman 272 (BOL); The Craggs, Barker 6063 (NBG). Humansdorp, Blaauwkrantz, Barker 6868 (NBG); Clarkson, Penther 301 (W); Storms R. Mouth, Fourcade 526 (GRA); Tsitsikama, Jeppe s.n., No. 33373 in TRV (PRE). Uitenhage, Cockscomb, Esterhuysen 27992 (BOL); Van Staadensberg, MacOwan s.n. (No. 20381 in SAM), Zeyher 3892 (W, P, SAM), Zeyher 300 (BOL, SAM), Pappe s.n. (20376 in SAM). Port Elizabeth, Matheson s.n. (No. 59686 in SAM), Sidey 3037, Kemsley 254 (GRA); Kragga Kama, Holland 3748 (GRA). Albany, Howison's Poort, Schönland s.n. (Z), Glass 455 (Z), Galpin 3087

(BOL); Grahamstown, Farguhar s.n. (GRA), Tidmarsh s.n. (GRA); Coldspring, Glass 437 (GRA); Manley Flats, Leighton 2636 (BOL), Compton 10973 (NBG). Kingwilliamstown, Hogsback Mt., Hall 610 (BOL), Rattray s.n. in Herb. Bolus. 15765 (BOL); Frankfort Hill, Sim 9 (BOL). Engcobo, Engcobo Mt., Bolus 10294 (BOL), Flanagan 2711 (PRE).

BASUTOLAND: Leribe, Leribe Plateau, Dieterlen 856 (P, PRE).

TRANSVAAL: Barberton, Saddleback, Culver 86b (BOL); Saddleback and Komatie Valley, Galpin 720 (BOL). Middelburg, Draaikraal, Acocks 3579 (K), Codd 8228 (K, PRE).

LOC. INCERT.: S.loc., s.leg. (P, GRA), s.leg. ex Herb. Portenschap. (W), s.leg. 8 (GRA), s.leg. 93 (W), Cooper s.n. (W), Drège s.n. (W), Burchell 7094 (W), Burchell 653 (K). CBS, Drège s.n. (P), s.leg. (W), Krebs s.n. (W), Lehmann 50 (W), Wawra 85 (W), Ecklon 1133 (W) Scholl 763 (W), Scholl 226 (W). Cape Mountains, Ecklon 1828 (W). Cape, Harvey s.n. (K). Nr. Wittklip, MacGwan 2129 (SAM). Riversdale Forestry Dept., Stokoe s.n. (No. 61041 in SAM). Winterberg, Zeyher 41 in Herb. Sond. (W).

E. aculeata ssp. huttonii (Rolfe) Hall:

CAPE PROVINCE: Queenstown, Katberg Mt., Schlechter 1684 (BOL). Stockenstroom, Chumie Peak, Scully 161 (BOL).

Kingwilliamstown, Keiskammahoek, Cooper 1881 (W); Pirie, Sim 1268 (BOL, SAM). Cathcart, Hogaback, Leighton 2954 (BOL), Mansergh s.n. (No. 26692 in BOL), Glickman s.n. (No. 26689 in BOL), Grant 3036 (BOL), Grant 3087a (BOL); Ellerslie, Cotterell s.n., Dec. 1916 (GRA); Fairford, Cotterell s.n., Dec. 1916 (GRA). Albany, Grahamstown, Rogers 27462 (Z). Between Maclear and Mount Fletcher, Werdermann & Oberdieck 1166 (PRE). Mount Currie, Vaal Bank, Haygarth s.n. in Herb. Wood. 4202 (BOL, K).

NATAL: Underberg, Drakensberg Garden, Hall 783 (BOL), Hall 785 (BOL). Polela, Wood 4586 (NH). Pine-town, Gillitts, Wood 11788 (NH). Lions River, Howick, Wood 11819 (NH, K), Wood 11818 (NH), Wood 12252 (Z, PRE). Bergville, Cathedral Peak, Killick 1157 (K, PRE, NH), Ruch 2025a (PRE); Mont aux Sources, Schweickerdt 768 (PRE), Schweickerdt 771 (PRE), Schweickerdt 772 (PRE), Schweickerdt 820 (PRE); Oliviershoek, Thode s.n. (No. 11881 in NH). Weenen, Culvers, Rogers 28168 (Z, GRA). Klip River, Sutherland s.n. (K). Ladysmith, Van Reenen, Wood 7545 (BM, BOL, NH), Wood 12186 (SAM). Utrecht, Naauwhoek, Devenish 213 (PRE).

BASUTOLAND: s.loc., Baring 5 (PRE).

ORANGE FREE STATE: Harrismith, van Wyk 142 (PRE); Valley of Elands River and Besters Vlei Mt., Flanagan 1986 (BOL, PRE, SAM), Bolus 8300 (GRA, BOL).

TRANSVAAL: Wakkerstroom, Oshoek, Devenish 235 (PRE). Barberton, Emlembe, Leistner 528 (PRE). Belfast,

Lewis s.n., 24 October 1929 (PRE).

LOC. INCERT.: S.loc., Zeyher s.n. (W). CBS,  
Ecklon 1134 (W). Natal, Dunne s.n. (BM). Cape, Bel-  
fort, Jacottet & Jacottet 75 (Z). Natal, Liddesdale,  
Wood 4259 (BOL, NH).

E. angolensis (Reichb.f.) Summ.:

CAPE PROVINCE: Between St. Johns and Umtata,  
Planagan 2555 (PRE, SAM); Port St. Johns, Bolus 8734  
(BOL, Z), Galpin 3414 (BOL, K). Lusikisiki, Mkambati  
Leper Institute, Marais 991 (PRE).

NATAL: Umzinto, Dumisa, Rudatis 612 (W). In-  
anda, Wood 845 (SAM, BOL). Mthunzini, Ngoye, Wood s.n.  
(No. 11543 in NH); Ginginhlovu, Haygarth s.n. (No. 11315  
in NH); Inyoni Leper Institute Road, Johnson 349 (NBG).  
Eshowe, Town Reservoir, Lawn 263 (NH); Swamps, Gerstner  
2653 (BOL). Umfolozi, between Empangeni and Felixton,  
Harrison 72 (BOL). Hlabisa, nr. St. Lucia Bay village,  
Hall 814 (BOL). Ngwavuma, Makhlosi Marsh, Tinley 309  
(PRE); nr. Kosi Bay, Roberts s.n., No. 28736 in TRV  
(PRE).

TRANSVAAL: Barberton, Rogers s.n., No. 22949 in  
TRV (PRE). Nelspruit, nr. Nelspruit, Thorp s.n. (No.  
29895 in NH), Codd 8193 (PRE), Prosser 1779 (PRE), Reyn-  
olds 5796 (PRE), Hall 639 (BOL); Plaston, Holt 93 (PRE);  
Alkmaar, Liebenberg 2875 (PRE); White River, Rogers 23603

(PRE). Pilgrims Rest, Wilgeboom Forest Station, Strey 3579 (PRE); nr. Sabie, Leighton 3258 (BOL), Hall 638 (BOL); Mariepskop, van der Schyff 4516 (PRE). Letaba, New Agatha, McCallum 137 (PRE), Hall 887 (BOL); Duiwelskloof, The Forester 14 (PRE), Scheepers 871 (PRE), Ibaar s.n., No. 13217 in TRV (PRE). Pietersburg, Houtbosch, van der Merwe 283 (PRE); nr. Magoebaskloof, van der Merwe 277 (PRE). Zoutpansberg, Entabeni, Grewcock 38A (PRE). Sibasa, Phiphidi Falls, Hall 937 (BOL); 25 miles N.E. of Sibasa, Codd 6904 (PRE). Waterberg, Hermanusdoorns, Meeuse & Strey 10420 (Z, PRE); Spruitskloof, Theron 2083 (W).

LOC. INCERT.: S.loc., Sanderson 92 (NH), Sanderson s.n. (No. 26720 in BOL). Natal, Buchanan s.n. (W), Buchanan 1 (K), Buchanan 2 (K), Wood s.n. (No. 26721 in BOL). Zululand, Haygath s.n. in Herb. Wood. 7547 (BOL). Coast, Sanderson 492 (SAM). Groenberg, Wood 845 (NH). Waterberg, Pongola R., Davy 18373 (BOL). Tweefontein Plantation, Germishuizen 43 (PRE). Vygeboompoort, Van Dam s.n., No. 15518 in TRV (PRE).

E.calanthoides Schltr.:

CAPE PROVINCE: Flagstaff, nr. Fort William, Tyson 2844 (SAM). Mount Currie, Fort Donald, Stephany 627 (BOL).

NATAL: Weenen, South Downs, Evans 488 (NH). Estcourt, Giants Castle, Symons s.n. (No. 25170 in PRE);

nr. Estcourt, Wood 3428 (BOL, K); nr. Berlin Mission Station, Wood 3419 (BOL); Cathkin Park, Galpin s.n., 10 Feb., 1932 (BOL), Galpin 11726 (BN). Bergville, Cathedral Peak, Killick 1327 (PRE, BOL, NH, K); Oliviershoek, Allison s.n.(K), Schelpe 5262 (BOL), Hall 791 (BOL). Dundee, Hlobane, Johnstone 595 (NH). Ladysmith, Van Reenen, Franks s.n. in Herb. Wood. 12184 (NH). Umsinto, Dumisa, Rudatis 567 (W, Z). Weenen, South Downs, Evans 488 (NH). Utrecht, Donkerhoek, Devenish 556 (PRE); Wonderhoogte Farm, Parkhouse s.n. (No. 41881 in NH).

LOC. INCERT.: S.loc., Gerstner 6267 (BOL). Cape of Good Hope, Cooper s.n. in Herb. Bolus. 3613 (BOL). Natal, Allison s.n. (K). OFS, Cooper 974 (W), Cooper 974a (Z). Zuurbergen, Schlechter 6610 (Z). Sevenfontein nr. Boston, Wood 5363 (K), Wylie s.n. in Herb. Wood. 4626 (NH, BOL).

E.chlorantha Schltr.:

SWAZILAND: Mbabane, Hill N.E. of Mbabane, Compton 26219 (PRE, NBG), Hall 586 (BOL), Karsten s.n. (PRE, NBG). Piggs Peak, Havelock Concession, Saltmarsh s.n. in Herb. Galpin. 652 (BOL).

TRANSVAAL: Barberton, Berea, Culver 3 (BOL); behind Barberton, Hall 572 (BOL); Saddleback Mt. near Golden Crescent Mine, Galpin 652 (NH, PRE); Mountain tops, Saddleback, Culver 86a (BOL).

E.clavicornis Lindl. var. clavicornis:

CAPE PROVINCE: George, between the Newsakamma R. and the Great Brak R., Burchell 6147 (W, BOL). Knyena, Forest Hall, Hutchinson 1383 (K). Humansdorp, Thode A1017 (PRE); Karreedouw, Jeppe s.n. No. 33374 in TRV (PRE); Geelhoutboom, Jeppe s.n. No. 33376 in TRV (PRE). Uniondale, Prince Alberts Pass, L.Bolus s.n. Oct. 1928 (BOL). Uitenhage, McEntee 92 (GRA), McEntee s.n. (GRA); van Staadensberg, Zeyher 3898 (W, SAM). Port Elizabeth, Thornhill, Cruden 453 (GRA); van Staadens, Paterson 754 (NH); nr. Port Elizabeth, O'Brien s.n. (Z), Cutting 1431 (PRE); Redhouse, Paterson s.n., Nov. 1916 (BOL). Alexandria, Zuurberg, Paterson 3370 (BOL), Archibald 5272 (GRA). Albany, between the Nazaar and Gankarivier, Zeyher s.n. (No. 20337 in SAM); Nr. Grahamstown, Schönland 1558 (PRE), Schönland s.n. in Herb. Bolus. 5980 (K, BOL), Galpin 170 (BOL, PRE), Galpin 291b (PRE), Farquhar s.n. Oct. 1896 (GRA), Glass 7 (BOL), Britten 5470 (GRA), Daly & Sole 2408 (PRE), Daly & Sole 529 (Z, PRE), s.leg. Herb. Bolus. 1957 (BOL), MacOwan 76 (GRA, SAM), MacOwan s.n. (No. 1067 in NH ), Hall 552 (BOL), Hall 598 (BOL), Hall 607 (BOL); Howieson's Poort, Salisbury 216 (GRA). Bathurst, nr. Port Alfred, Rogers 28070 (K), Hall 735 (BOL); Dixon's Bush, Bennie 144 (GRA); Belle View, Fletcher 18 (GRA). Queenstown, Cooper 1320 (W), Cooper 322 (W, Z), Galpin 1664 (PRE); Katberg, Ecklon & Zeyher s.n. (P). Kingwilliamstown, Amabele, de Vries 9 (PRE); Pirie, Sim 944 (PRE), Schnell s.n., Oct. 1942 (BOL), Flanagan 2232 (PRE,

BOL); nr. Kingwilliamstown, Schnell s.n., Nov. 8 1942 (BOL), Schnell s.n. 6 Jan. 1943 (BOL), Schnell s.n. Dec. 1942 (BOL); nr. Kei Road, Ranger 105 (PRE). East London, Wormald 10 (GRA). Komgha, nr. Komgha, Flanagan 1028 (GRA, PRE); Kei River Mouth, Flanagan 68 (PRE). Maclear, Ugie, Schnell s.n., Nov. 1943 (BOL). Kentani, Pegler 370 (PRE), Pegler 781 (PRE, BOL). Lusikisiki, Mkabati, Hone 33 (PRE); Maikaba River Mouth, Bellew s.n., 22 Sept. 1937 (PRE). Mount Currie, Goossens 278 (PRE); nr. Kokstad, Tyson 1602 (GRA, SAM, BOL), Hall 776 (BOL); Vaal Bank, Wood s.n. 12 Dec. 1884 (BOL).

NATAL: Underberg, about 10 miles S.E. of Underberg, Dyer 3283 (PRE); Drakensberg Garden, Hall 787 (BOL). Ixopo, Mogg 2318 (PRE). Impendhle, Levett 48 (NH). Umhinto, Dumisa, Rudatis 1678 (W, Z), Rudatis 674 (W). Durban, 'Port Natal', Gueingius s.n. (W). Pinetown, Gillitts, Wood 11789a (K), Wood 11807 (NH). Camperdown, Drummond, Galpin 10289 (PRE); Bothas Hill, Hutchinson, Forbes & McLean 53 (NH); Tafelberge, Krauss 406 (M). Inanda, Rehmann 8264 (Z), Wood 456 (NH). Maritzburg, Rehmann 7601 (Z), Allsop 894 (NH). Lions River, Howick, s.leg. (No. 12808 in NH), Haygarth s.n. (No. 13156 in NH), Wood 11817 (NH), Wood 11821 (K, NH); between Merrivale and Boston, Rycroft 2065 (NBG); Dargavel, Scheepe 6322 (BOL); Shafton, Hutton 38 (GRA); Hutton 355 (GRA). Mooi River, Mabelston, Mogg 3090 (PRE). Estcourt, P.R. Station, Acocks 9851 (NH); Giants Castle, Wylie s.n. in Herb. Wood. 11823 (NH). Bergville, Natal

National Park, Martin 423 (NBG), Oliver 375 (NH), Galpin 10401 (PRE); Cathedral Peak, Ruch 1483 (PRE), Ruch 2025 (PRE), Dohse 75 (PRE), Dohse 133 (NH), Schelpel 840 (BOL); Mont aux Sources, Schweickerdt 716 (PRE), Schweickerdt 834 (PRE), Schweickerdt 835 (PRE), A.Bolus s.n. in Herb. Guthrie. 4920 (PRE), Sidey 1994 (PRE); Oliviershoek, Thode s.n. (No. 11895 in NH), Hall 588 (BOL). Ladysmith, nr. Ladysmith, Schlechter 3431 (Z, BOL). Weenen, Culters, Rogers 28142 (Z, GRA). Dundee, 7 miles E. of Dundee, Codd s.n. (No. 28408 in PRE), Codd 5606 (PRE), Codd 6160 (PRE). Umvoti, Greytown, Wylie s.n. (Nos. 21675, 21725 and 33938 in NH); Rietvlei, Fry s.n. in Herb. Galpin. 2720 (PRE). Eshowe, nr. Eshowe Reservoir, Lawn 1000 (NH).

BASUTOLAND: Qachas Nek, Houston s.n. (Nos. 22306 and 22307 in NH). Mafeteng, Likhuele, Dieterlen s.n. (No. 28740 in PRE); Khonofane, Dieterlen 1295 (PRE); Pente, Dieterlen s.n. (No. 28731 in PRE). Maseru, Makhoarane Mt. nr. Morija, Dieterlen 1112 (PRE). Leribe, Dieterlen 1109 (PRE), Dieterlen 291 (SAM, PRE, NH), Martin s.n., Nov. 1892 (GRA).

ORANGE FREE STATE: Ficksburg, Gansfontein, Galpin 13920 (PRE); 'Strathcona', Fawkes 2 (NBG). Senekal, Marquard, Nicholson s.n. (No. 56510 in NBG). Bethlehem, Bells Farm and Digval Hill, Potgieter 31 (PRE); Clarens, van Hoepen s.n. No. 18262 in TRV (PRE). Harrismith, nr. Mont aux Sources, Flanagan 1984 (PRE).

SWAZILAND: Mankaiana, 10 miles W. of Mankaiana,

Compton 29180 (NBG). Mbabane, Ukutula, Compton 24497 (NBG), Compton 25168 (NBG). Piggs Peak, Havelock Mine, Miller s.n. (No. 2989 in PRE).

TRANSVAAL: Potchefstroom, Bank Station, Louw 373a (PRE). Ventersdorp, Goedgedacht, Sutton 705 (PRE). Vereeniging, Leslie 5731 (PRE). Johannesburg, Rand 794 (BM), Moss s.n. No. 20331 in TRV (PRE), Schnell s.n. 13 Oct. 1944 (BOL); Jeppestown Ridge, Gilfillan 25A (PRE), Gilfillan s.n. in Herb. Galpin 6072 (GRA); Grasmere, Bennett s.n. (No. 25324 in BOL); Bryanston, HBG s.n. in Herb. Moss. 26085 (PRE). Pretoria, Roberts Heights, Pole - Evans 471 (PRE); Kaalfontein, Pole - Evans 16817H (PRE); Lyttleton, Brent 123 (PRE); Magaliesbergen, J.W.Mogg 1 (BOL); Kopjes, Leendertz 282/ 4102 (PRE); Klapper Kop, Smith 554 (PRE); Donkerhoek, Repton 673 (PRE); Fountains Valley, Repton 301 (PRE); Sunnyside, Goossens 124 (PRE); Aapies River, Rehmann 4298 (Z); nr. Premier Mine, Rogers 23262 (Z), Phillips 3135 (PRE), Obermeyer 733 (PRE); nr. Pretoria, s.leg. 81 (BOL), Leendertz 282 (BOL), Goossens 47 (PRE), Eshuis 219 (PRE), Obermeyer 1521 (PRE). Krugersdorp, Witpoortjie Falls, Repton 3769 (PRE). Witbank, Rogers s.n. No. 24897 in TRV (PRE). Springs, Dersley, Flugge - de - Smidt s.n., 12 Oct. 1928 (PRE). Ermelo, Nooitgedacht Farm, Henrici 1017 (PRE); nr. Ermelo, Convent Pupils 80 (PRE), Leendertz 8043 (PRE), Bester s.n. in Herb. Davy. 2156 (BOL); Lake Chrissie, Pole - Evans H 13188 (PRE). Piet Retief, Iswepe, Sidex s.n., 20 Oct. 1948 (PRE); Mooihok, Devenish 59 (PRE).

Carolina, Galpin 12434 (PRE), Galpin 12435 (BOL), Rademacher s.n. No. 13218 in TRV (PRE). Belfast, nr. Belfast, Reynolds 2698 (PRE); Machadodorp, Strey 2801 (PRE); Waterval - Boven, Rogers 11683 (BOL). Barberton, Sheba Mt., Bolus 10675 (BOL); Saddleback Mt., Culver 52 (BOL), Galpin 550 (PRE), Galpin 1026 (Z, GRA, PRE). Nelspruit, Plaston, Holt 14 (PRE); White River, Rogers 23143 (Z). Letaba, The Downs, Rogers 22015 (Z). Pietersburg, nr. Haenertsburg, Grewcock 22 (PRE); Woodbush, Jenkins 8229 (PRE). Waterberg, 16 miles N. of Nylatroom, Häfstrom & Acocks 339 (PRE); Palala, Galpin s.n. (No. 28729 in PRE).

LOC. INCERT.: S.loc., s.leg. (W), Drège s.n. (W), Ecklon & Zeyher 3998 (W), Ecklon & Zeyher s.n. (Z), Dieterlen s.n. (No. 28741 in PRE), Barber s.n. (GRA), Bolus 10673 (BOL). CBS, Drège s.n. (P), Ecklon 1132 (W). S. Africa, Cooper 981 (BOL, W). Caffraria, Bowker s.n. (W); Brit. Caffraria, Cooper s.n., 1876 (Z). Natal, Buchanan s.n. (W). OFS, Cooper s.n., 1876 (W). Swaziland, Stewart 42 (K), Stewart s.n. No. 13212 in TRV (PRE). Transvaal, Erasmus Farm, Rehmann s.n. (Z). Beaufort Dist., Cooper 413 (W, Z). Craddock, Cooper 1320 (Z). Oudebosch, Fourcade 1726 (GRA, K). Kaffirland, Katberg, Ecklon & Zeyher s.n. (Nos. 10005, 22192 in PRE). Pondoland, Egossa, Sim 2453 (BOL). Natal, Clarence Estate, Indian Collector s.n. (No. 16348 in NH). Bishopstowe, Sanderson 1013 (NH). Nonoti, s.leg. (No. 13160 in NH). Umhloti R., Rehmann 8457 (Z). Mathèbé, Dieterlen s.n., Oct. 1917 (No. 28728

in PRE). Knoppiesfontein, Jenkins 7206 (PRE). Zwartkrans, Leendertz 5127 (PRE). Mavieriestad, Pott 5144 (PRE).

E.clavicornis var. inaequalis (Schltr.) Hall:

CAPE PROVINCE: Port Elizabeth, van Staudens, Paterson 192 (GRA); Frames Drift, Paterson 2421 (GRA). Bedford, Kagaberg, Hutton s.n. (K). East London, Rattray 830 (GRA), Rattray 803 (GRA); nr. Nahoon R., Rattray s.n. in Herb. Galpin. 7875 (PRE). Komgha, nr. Kei R., Flanagan 68 (K). Kentani, Pegler 841 (PRE, SAM), Pegler s.n., cult. in Hort. Bolus. (No. 26679 in BOL). Stutterheim, Fort Cunynghame, Sim 20092 (PRE). Maclear, Ugie, Schnell s.n. (No. 26682 in BOL). Aliwal North, Elands Hoek, F.Bolus in Herb. Bolus. 10671 (K, BOL). Mount Currie, Kokstad, Tyson 1602 (Z, BOL), Tyson 1601 (BOL), Tyson s.n. No. 12392 in TRV (PRE).

NATAL: Port Shepstone, Marberg, Wright s.n. (No. 56525 in NBG). Umzinto, Dumisa, Rudatis 1094 (W, Z). Durban, 'Port Natal', Gueinzius 267 (W). Pinetown, Sanderson 1011 (NH); Krantzkloof, Rogers 24618 (K). Camperdown, Franks s.n. (No. 12794 in NH), Eshuis s.n. (No. 28744 in PRE); Drummond, Galpin 10290 (PRE). Inanda, Wood 205 (NH). Umgeni, Albert Falls, Comins 467 (PRE). Estcourt, Estcourt commonage, Acocks 10629 (PRE, NH). Ladysmith, nr. Ladysmith, Schlechter 3432 (Z, BOL). Lower Umfolosi, Ntambanana, Codd 1884 (PRE).

Utrecht, Klipspruit, Breyer s.n. No. 17003 in TRV (PRE).

BASUTOLAND: Maseru, Makhoarane Mt. nr. Morija, Dieterlen 1113 (PRE). Leribe, Dieterlen 405b (PRE).

ORANGE FREE STATE: Ficksburg, 'Strathcoma', Fawkes 214 (NBG). Senekal, Marquard, Nicholson s.n. (No. 56526 in NBG). Bethlehem, Potgieter 57 (NBG)

SWAZILAND: Embabane, Davy 3014 (K).

TRANSVAAL: Potchefstroom, Klington, Louw 990 (PRE). Vereeniging, Paardeberg, Prosser 1013 (K, PRE). Johannesburg, Moss 9007 (K), Rand 793 (BM), Rogers 14257 (K). Pretoria, McLoughlin s.n. No. 13192 in TRV (PRE), J.Mogg s.n. (No. 26678 in BOL), Moss s.n. No. 11965 in TRV (PRE); Pretoria University Farm, Codd 5605 (PRE), Robertson s.n. (Nos. 28407 and 29059 in PRE); Meintjies Kop, Dyer 2513 (PRE); Groenkloof, Davy 1048 (BOL); Klapper Kop, Mogg 15200 (PRE); Roodeplaat, Merxmuller 6 (M); Koodoopoort, Reck s.n. No. 1002 in Dept. Agr. Herb. (K); Colleges, Bremekamp s.n. No. 27547 in TRV (PRE). Piet Retief, Inswepe, Sidey 1497 (PRE); Mooihoek, Devenish 23 (PRE). Ermelo, Nooitgedacht Farm, Henrici 1022 (PRE), Henrici 1024 (PRE). Carolina, Lochiel, Roberts s.n. No. 15876 in TRV (PRE). Barberton, Avoca, Thorncroft 3011 (PRE); Musidora, Galpin 509 (BOL, K). Nelspruit, Rogers 21435 (Z); Plaston, Holt 15 (PRE, NH). Pietersburg, nr. Haenertsburg, Grewcock 21 (PRE); Woodbush, Jenkins 8040 (PRE). Potgietersrust, Eersteling, Leendertz 5128 (PRE). Zoutpansberg, Louis

Trichardt, Breyer s.n. No. 24386 in TRV (PRE); Goede Hoop, Hutchinson & Gillett s.n. (K).

LOC. INCERT.: Cape Colony, Belfort, Jacottet 511 (Z). E.Cape, Cutting 1434 (PRE). Natal, Duchanan s.n. (K). Zululand, Egoa Farm, Curson s.n. (No. 28727 in PRE). Swaziland, Stewart s.n. No. 13214 in TRV (PRE), Stewart 42 (K). Ermelo Forestry Dept., Watkinson s.n. (K). Transvaal, High Veld nr. Waal Bank, Bolus 10676 (BOL). Knoppiesfontein, Jenkins 7205 (PRE).

E.clavicornis var. nutans (Sond.) Hall:

CAPE PROVINCE: Uitenhage, van Staadensberg, Zeyher 600 (K, BM, W), Ecklon & Zeyher 3899 (W, BM). Albany, Coldspring, Glass 1162 (Z, GRA). Kingwilliamstown, Kei Road, Ranger 44 (PRE); Frankfort Hill, Doe s.n. (No. 22859 in BOL), Doe s.n. Jan. 1942 (BOL, K). Komgha, nr. Komgha, Flanagan 1117 (BOL, PRE, GRA, SAM), Flanagan 1699 (K, SAM, BOL), Flanagan s.n. (BOL, W); nr. Kei Mouth, Flanagan 1029 (K, PRE, SAM, BOL), Flanagan 1031 (GRA, PRE, SAM, BOL). Kentani, Pegler 370 (SAM, PRE). Queenstown, Lesseyton Nek and Finchs Nek, Galpin 1713 (K, PRE, BOL), Galpin 2250 (PRE); Katberg, Galpin 1713 (GRA). Aliwal North, Elands Hoek, F.Bolus in Herb. Bolus. 10544 (BOL, GRA), F.Bolus in Herb. Bolus. 10543 (BOL, Z). Glen Grey, M'Qebanya Mt., Galpin 1915 (PRE). Between Cala and Engcobo, Flanagan 2706 (PRE). Mqanduli, Pegler 621 (PRE), Pegler

624 (PRE). Umtata, Engcekasi, Bolus 8775 (BOL), Flanagan 2602 (PRE); nr. Umtata, Flanagan 2875 (BOL, PRE). Tsolo, Payn 5 (GRA). Qumbu, between Qumbu and Shawbury, Schönland 4129 (GRA). Mount Ayliff, Insizwa, Penther 869 (W). Umzinkulu, nr. Clydesdale, Tyson 1912 (K, SAM, BOL).

NATAL: Port Shepstone, Porter s.n. (Nos. 56499, 56500 in NBG); Port Edward, Moss 19249 (BM). Umzinto, Dumisa, Bayer 393 (NH), Rudatis 242 (P, W, Z), Rudatis 806 (W, K, Z), Rudatis 808 (K), Rudatis 877 (P, PRE), Rudatis 1327 (Z). Richmond, Arnolds Hill, Wylie s.n. (No. 23374 in NH). Nr. Pietermaritzburg, Barker 5188 (NBG), Allsopp 640 (NH), Allsopp 975 (NH), Allsopp 993 (NH), Sim 4229 (Z); Table Mt., Killick 183 (PRE). Lions River, Howick, Wood 9460 (PRE), Wood 11787 (K, PRE, SAM, NH); Balgowan, Acocks 13944 (PRE); Clan Syndicate Estate, Burges s.n. (No. 27233 in PRE); Lidgetton, Wood 7922 (NH, K, BOL); Dargle, Bews s.n. (No. 15391 in BOL). Durban, 'Port Natal', Gueinzus 45 (W), Gueinzus 99 (W); nr. Durban, Sanderson 496 (NH); Umlazi, Wood 11790 (SAM, NH); Clairmont, Wood 12224 (PRE), Wood 12223 (NH). Inanda, Wood 434 (K, NH), Wood 471 (K); Itafamasi, Wood 725 (K, NH); Tongaat River, Wood s.n. No. 1367 in Herb. Norm. Austr. Afr. (K, P, BM, W, BR, BOL), Wood 500 (BM), Wood 700 (SAM); Tongaat, Wood 11776 (NH). Estcourt, Zaai Laaga, Wood 3422 (BOL); Research Station, West 677 (PRE); Tabamhlope Research Station, West 556 (PRE); nr. Estcourt, Wood 3412 (NH); Cathkin Park, Galpin 11704

(K, BOL, PRE), Galpin 11705 (BM, PRE), Galpin s.n. Jan. 1932 (BOL). Bergville, Grantleigh, King 416 (NH), King 417 (NH); Cathedral Peak, Killick 1244 (NH). Weenen, Culvers, Rogers 28299 (Z). Helpmekaar, nr. Rooke's Drift, Codd 6326 (K, BM, NH, PRE); nr. Helpmekaar, Codd 163 (PRE), Codd 164 (PRE), Codd 165 (PRE, K). Ladysmith, Wesselsnek, Schlechter 3397 (BOL, Z). Newcastle, nr. Newcastle, Wood 6748 (BM, BOL, PRE, SAM); Boscobello, Jenkins s.n. No. 28 in TRV (PRE). Utrecht, Wahl s.n. No. 15361 in TRV (PRE); Klipspruit, Breyer s.n. No. 17002 in TRV (PRE). Greytown, Wylie s.n. No. 22369 in NH (K, PRE, BOL, NH), Wylie s.n. (Nos. 22414, 22481 in NH), Galpin 14700 (PRE). Eshewe, Lawn 1484 (NH); nr. Eshewe Reservoir, Lawn 1903 (NH). Mthunzini, Ginginhlovu, Wood 11785 (K, NH, SAM), Wood 11778 (NH); nr. Mtunzini, Lawn 1382 (NH), Garland s.n. (No. 38635 in NH); Entabeni, Gerstner s.n. (No. 22295 in NH). Hlabisa, 8 miles N.W. of Mtubatuba, Hall 810 (BOL).

BASUTOLAND: Leribe, Metlotlvaneng, Dieterlen 861 (PRE).

ORANGE FREE STATE: Senekal, Biddulphsberg, Wium 19 (PRE), Wium 20 (PRE), Wium 21 (PRE). Heilbron, Goosens 424 (PRE).

SWAZILAND: Mankaiana, Mkondo R., Compton 28454 (K, PRE, NBG). Mbabane, Forbes Reef Road, Compton 25463 (NBG, PRE), Compton 25565 (K, PRE, NBG); Dalriach, Bolus 12302 (K, BOL); Ndumu, Karsten s.n. (No. 43557 in NBG).

Piggs Peak, Devils Bridge, Galpin 722 (PRE).

TRANSVAAL: Potchefstroom, Klipdrif, Theron 1184 (PRE). Vereeniging, Burttholm, Davy 15054 (BOL). Johannesburg, Mainwaring s.n. in Herb. Davy. 1044 (BOL); Bezuidenhout Valley, Gilfillan s.n. (No. 28739 in PRE); Kempton Park, Hutchinson s.n. (K). Springs, Dersley, Flugge - de - Smidt s.n. (No. 28730 in PRE), Flugge - de - Smidt s.n. No. 169/29 in NBG (BOL). Heidelberg, Uitgevallen, Davy 9144 (K). Pretoria, Leendertz 503/4010 (PRE), Smith 6044 (PRE); nr. Pretoria, Schlechter 4143 (Z, BOL), Nelson 506 (K), Nelson s.n. (K); Bronkhorst-spruit, Mauve 4190 (PRE); 'The Willows', Bolus 12303 (BOL); Wonderboompoort, Rehmann 4463 (Z); Ashbury, van der Merwe 280 (PRE); Roodeplaat Hort. Res. Sta., de Wet 530036 (PRE); Middlekop, Smith 2204 (PRE). Middleberg, Botsabelo, Schlechter 4057 (K, BM, Z, W, BOL, PRE, GRA, NH, SAM). Wakkerstroom, Oshoek, Devenish 500 (PRE). Nr. Piet Retief, Kratschman s.n. (No. 28738 in PRE), Compton 22330 (NBG). Ermelo, Spitskop, Scheepers s.n. Nos. 13024, 15224 in TRV (PRE, BOL); nr. Amsterdam, van der Merwe 1060 (PRE). Barberton, Nelshoogte Pass, Hall 642 (BOL), Hall 828 (BOL); Umlomati Valley, Galpin 1151 (BOL, PRE); de Kaap Valley, Culver 14 (BOL); Musidora, Culver 82 (BOL). Belfast, Waterval Onder, Jenkins 6746 (PRE); nr. Slaaihoek, Bruce 513 (K, PRE); Schoon-gezicht, van der Merwe 1243 (PRE), van der Merwe 1261 (PRE); Dullstroom, Noomé s.n. No. 2096 in TRV (PRE). Lydenburg, nr. Steenkampsberg, Hall 851 (BOL); 15.5 miles

S.E. of Lydenburg, Marais 314 (K, PRE); Zwagershoek Farm, Obermeyer 343 (PRE). Pilgrims Rest, 9 miles N.W. of Pilgrims Rest, Hall 871 (BOL); nr. Sabie, van der Merwe 268 (PRE). Waterberg, Springbok Flats, Davy 1024 (BOL); Springbok Flats, Welbekend Farm, Galpin M757 (PRE); nr. Nylstroom, Davy 2007 (K); Naboomspruit, Mosdene Farm, Galpin M756 (PRE), Galpin M326 (PRE). Potgietersrust, Leendertz 1967 (PRE). Pietersburg, Houtbosch, Rehmann 5851 (Z). Zoutpansberg, Entabeni, Grewcock 37 (PRE).

LOC. INCERT.: S.loc., s.leg. (No. 26365 in BOL), Zeyher 1583 (BM), van der Bijl s.n. (No. 15674 in BOL), Buchanan s.n. (No. 1333 in NH). Kafferland, Harvey s.n. (W). Krielis Country, Bowker s.n. (W). Natal, Buchanan s.n. (K, W, BOL), Sanderson 496 (BOL, W), Buchanan 4b (K), Saunders s.n. 30 Nov. 1885 (BOL). Zululand, Roberts s.n. in Herb. Marloth. 5988 (PRE). Nr. Blauw Krantz, Wood 3430 (NH). Sevenfontein nr. Boston, Wylie s.n. in Herb. Wood. 5372 (K, NH). Transvaal, Crocodile River, Fegler s.n., 15 Dec. 1903 (BOL). Johannesburg?, Schnell s.n. Jan. 1944 (BOL). Rhinosterkop, Zeyher s.n. (W), Burke 508 (SAM, W). Transvaal, Hatherly (?), Collins s.n. (No. 68045 in SAM).

E.clitellifera (Reichb.f.) Bolus:

CAPE PROVINCE: Port Elizabeth, Thornhill, Cruden 454 (GRA); Redhouse, Paterson 753 (GRA), Paterson 712 (GRA).

Bathurst, Southwell, Britten 2274 (PRE).

NATAL: Port Shepstone, St. Michaels, Letty 15 (PRE). Umzinto, Dumisa, Rudatis 1077 (BM, PRE). Pietermaritzburg, Tafelberg, Krauss 406 (W); nr. Maritzburg, Wylie s.n. (No. 6058 in BOL). Camperdown, Drummond, Galpin 10291 (PRE). Pinetown, Krantzklouf, Haygarth s.n. No. 23285 in TRV (PRE), Sanderson 1008 (NH); Clairmont, Schlechter 3137 (Z, BOL, GRA), Schlechter s.n. (K, BR), Wood s.n. (No. 26703 in BOL), Wood 5419a (NH), Wood 3796 (NH), Wood 7653 (BM). Durban, Merebank, Indian Collector s.n. (No. 16441 in NH); 'Port Natal', Gueinzus 266 (W); nr. Durban, s.leg. (No. 26833 in NH). Inanda, Wood 170 (NH). Klip River, Biggarsberg, Codd 8621a (PRE). Umfolosi, Heatonville, Houghting s.n. (No. 56563 in NBG); Kwambonambi, Stayner 4 (BOL). Ubombo, Bazwana, Gerstner 3476 (NH). Ingwavuma, Aitken & Gale 39 (PRE).

TRANSVAAL: Rustenberg, Leendertz 3442 (PRE); Zwarttruggens, Sutton 774 (PRE). Brits, Groenewald 7 (PRE). Pretoria, Cullinan, Phillips s.n. (No. 28811 in PRE); nr. Pretoria, McLae in Herb. Bolus. 5819 (K, BOL); Brooklyn, McLoughlin s.n. No. 13194 in TRV (PRE); Klapper Kop, Repton 443 (PRE); Meintjies Kop, Riviera, Smith 667 (Z, PRE); Hills above Aapies River, Rehmann 4297c (K, Z); 24 miles N. of Pretoria, Häfatrom & Acecks 338 (PRE); Groenkloof, Davy 1049 (BOL); nr. Pienaars River, Codd 158 (PRE); Sunnyside, Tennant s.n. in Transv.

Dept. Agr. Herb. 4040 (K); Koodoo Poort, Reck 1004 (K).  
Piet Retief, Spiessdale Stn., Acocks 11533 (NH). Barb-  
erton, Saltmarabe s.n. in Herb. Galpin. 990 (BOL). Nel-  
spruit, Rogers 21404 (Z); Plaston, Holt 16 (PRE). Wat-  
erberg, nr. Nylstroom, Mœuse 9734 (PRE), Hefstrom &  
Acocks 341 (PRE); 16 miles N. of Nylstroom, Hefstrom &  
Acocks 340 (PRE); Banks of Limpopo, Leipoldt 6 (PRE).

LOC. INCERT.: Natal, Buchanan s.n. (W), Gueinzius  
s.n. (W), Saunders s.n. May 1881 (No. 26705 in BOL);  
Sterkspruit, Sanderson 2 (No. 1238 in NH); Bishopstowe,  
Sanderson 1012 (NH). Transvaal, Lindley, Phillips 436  
(PRE). Vijgeboompoort, van Dam s.n. No. 13720 in TRV  
(PRE).

E.cooperi Reichb.f.:

ORANGE FREE STATE: Harrismith, Kestell Rd.,  
Puttrill s.n. (No. 28797 in PRE); nr. Harrismith, Sankey  
306 (K); 11 miles N. of Aberfeldy, Acocks 13864 (PRE;  
BOL).

TRANSVAAL: Piet Retief, Inswepe, Sidey 1521 (PRE).  
Carolina, Galpin 13514 (K, PRE), Rademacher s.n. No. 8203  
in TRV (PRE), Moss & Rogers 1602 (PRE), de Winter & Schl-  
ieben 7159 (PRE). Middelburg, Tautenberg, Young A251  
(PRE). Heidelberg, nr. Heidelberg, Schlechter 3531 (K,  
Z, BOL), McLear s.n. in Herb. Bolus. 5818 (K, BOL). Ver-  
eeniging, Grasmere, Bennett s.n. (No. 25325 in BOL).  
Johannesburg, Palmietfontein, HEG. s.n. in Herb. Moss.

26148 (PRE); Bezuidenhout Valley, Rand 907 (BM). Pretoria, Leipoldt s.n. (No. 18814 in BOL); Kaalfontein, Pole - Evans 16818H (PRE), Pole - Evans s.n. (Nos. 11002, 11003 in PRE); Rayton, Rogers 20429 (BM).

LOC. INCERT.: OFS, Cooper 977 (W, K, BOL). Transvaal, s.leg. Nov. 1928 (BOL), Sanderson s.n. (W). Ermelo Forestry Dept., Watkinson s.n. (K). Witwatersrand, Hutton 919 (GRA, SAM). Zandspruit, Davy s.n. No. 10468 in TRV (PRE).

E.coddii Hall:

TRANSVAAL: Heidelberg, 1 mile N. of Heidelberg on Main Road, Codd 2316 (PRE). Rustenburg, Krantzberg Mt., Groothoek Farm, Codd 4811 (PRE).

E.cucullata (Afzel. ex Sw.) Steud.:

NATAL: Pinetown, Kloof, Sparks s.n. (No. 35016 in NH); nr. Pinetown, Wood s.n. (No. 1241 in NH). Inanda, Wood 820 (K, SAM); nr. Tongaat River, Wood s.n. in Herb. Norm. Austr. Afr. 1368 (K, P, BM, W, BOL), Wood 8992 (P), Wood s.n. 17 Nov. 1887 (GRA). Umvoti, Saunders s.n. (No. 6065 in BOL). Lower Tugela, Kearsney, Miller s.n. (No. 23262 in BOL). Mthunzini, Amatikulu, Lawn 1158 (NH), Sim 4235 (BOL); Hamewith, Mogg 5841 (PRE); Port Durnford, Mumby 4 (NBG). Hlabisa, W. of St. Lucia Estuary, Feely & Ward 11 (PRE); Dukuduku Forest,

Harrison 61 (BOL).

LOC. INCERT.: Zululand, McKenzie s.n. (No. 26722 in BOL).

E.ensata Lindl.:

CAPE PROVINCE: Alexandria, Wilson 9 (GRA). Albany, Kariega River, Pappe s.n. (No. 20361 in SAM), s.leg. 2 (BOL); Assegai River, Compton 19064 (NBG); Sevenfountains, Chew 662 (GRA), Britten s.n. 5 Jan. 1937 (GRA); 20 miles S.W. of Grahamstown, Hall 604 (BOL), Hall 754 (BOL). Bathurst, The Kowie, Hallack s.n. 12 Dec. 1884 (BOL); between Bathurst and The Kowie, South 445; nr. Mouth of the Kasouga River, MacOwan 717 (SAM). Cathcart, Tylden, Hill s.n. Feb. 1908 (GRA). Komgha, nr. Kei Mouth, Flanagan 1030 (K, BOL, SAM, GRA). Kentani, Pegler 301 (K, PRE). Willowvale, Qora R. Mouth, Hilner 475 (GRA). Port St. Johns, West Gate, McLoughlin 526 (PRE). Lusikisiki, Egling s.n. (No. 56490 in NBG), Galpin 9750 (K); 12 miles E. of Lusikisiki, Acocks 13244 (PRE); Fraser Falls, Leighton 2996 (BOL).

NATAL: Umzinto, Crookes 42 (NH); Dumisa, Rudatis 242 (W, Z). Durban, Sydenham, Moonsammy s.n. (No. 17116 in NH); 'Port Natal', Gueinzius 102 (W), Gueinzius s.n. (W); Umbogintwini, Indian Collector s.n. (No. 19051 in NH); nr. Durban, Rogers 15011 (Z), Rogers 27999 (K), Doidge s.n. in Herb. Transv. Dept. Agric. 5880 (K); Wentworth, Sanderson 494 (NH). Pinetown, Kloof, Lawson 687 (NH);

Clairmont, Wood 275 (NH), Wood 708 (BM), Wood 1069 (NH),  
Wood 1699 (NH). Inanda, Wood s.n. (Z); Smerdons Flat  
and Tongaat, Sanderson 1020 (NH, BOL). Camperdown,  
Barker 5231 (NBG). Pietermaritzburg, Hawthorns Hill,  
Allsopp 974 (NH); Allerton Mogg 6557 (PRE); Edendale,  
Sim s.n. in Herb. Rogers. 4222 (Z); Hilton, Dimock -  
Brown 221 (NH). Lions River, Karkloof, Schelte 5101  
(BOL); The Dargle, Sanderson 138E (NH). Lower Tugela,  
Compensation, Schelte 3138 (BM). Kranskop, S. of Que-  
deni Forest, Dyer & Collett 4706 (PRE). Eshowe, nr.  
Eshowe Railway Station, Lawn 46 (NH). Nkandhla, Reyburn  
s.n. (No. 23376 in NH). Nqutu, 5 miles E. of Nqutu,  
Codd 7661. (K, NH, PRE). Newcastle, Boscobello, Jenkins  
s.n. No. 12489 in TRV (PRE). Mthunzini, Hamewith, Mogg  
3952 (PRE). Entonjaneni, 8 miles W. of Melmouth, Schelte  
5188 (BOL); Denny Dalton, between Melmouth and Vryheid,  
Gerstner s.n. (No. 22433 in NH). Hlabisa, St. Lucia,  
Harrison 55 (BOL); nr. Hlabisa, Hall 816 (BOL); Hluhluwe  
Game Reserve, Wells & Vincent 3 (NH); 16 miles N. of  
Mtubatuba, Codd 2024 (PRE). Ngotshe, Ngome, Harrison 83  
(BOL). Ubombo, Mbagwane - Sordwana area, Ward 3495 (PRE).

SWAZILAND: Hlatikulu, Vondo Hill, Compton 29680  
(NBG); nr. Hluti, Pole - Evans 3361. (22) (PRE). Mbabane,  
Stroma, Compton 25319 (NBG); Polwane Valley, Compton  
28452 (K, NBG); Hills W. of Mbabane, Compton 25504 (NBG).  
Mansini, Nr. St. Josephs, Compton 27347 (NBG, PRE); nr.  
Bremersdorp, Bolus 12304 (BOL). Mankaiana, nr. Gege,  
Compton 26440 (NBG).

TRANSVAAL: Piet Retief, Kretzchmar s.n. (no. 28802 in PRE); Mahamba, Schroener s.n. No. 4619 in TRV (PRE); Inwepe, Sidey 1563 (PRE). Ermelo, Amsterdam, van der Merwe 1052 (PRE), van der Merwe 1065 (PRE), van der Merwe 1066 (PRE). Barberton, Sypkens s.n. (No. 28804 in PRE); Godwan River, Hofmeyer & Davison 161 (PRE); Lomati Valley, Thorncroft s.n. No. 5004 in TRV (PRE). Nelspruit, White River, Holt 351 (PRE). Pilgrims Rest, Bourkes Luck Mine, Galpin s.n. (No. 26668 in BOL); Blyde River Gorge, Galpin s.n. 11 Dec. 1937 (BOL), Galpin 14617 (K), Galpin 14202 (PRE). Sibasa, Mt. N. of Pepiti, Smuts & Gillett 3294 (PRE). Zoutpansberg, Gillett 4728 (PRE); Fleurfontein nr. Louis Trichardt, D'Arcy s.n. (No. 22810, 28886 in PRE); Roodewal nr. Louis Trichardt, Breyer s.n. No. 22021 in TRV (PRE); nr. Louis Trichardt, Hutchinson 2304 (BOL), Breyer s.n. No. 24228 in TRV (PRE); nr. Piesanghoek Store, Hall 951 (BOL); Tate Vondo Forest Reserve, Hall 943 (BOL); Entabeni Forest Reserve, Hall 923 (BOL).

LOC. INCERT.: S.loc., s.leg. 'orchid 2' (W), Botanic Gardens 6 (BOL), Sanderson 1035 (NH), Lehmann s.n. (W), Ecklon & Zeyher 9.1 ex Herb. Wien (Z). CBS, Drège s.n. (W), Ecklon 1126 (W). Cape, Erythrina Farm, Sellar s.n. (GRA). E.Griqualand, Egossa, Tyson 2842 (GRA, SAM, BOL). Natal, Gueinzius s.n. (W), Prosser 1419 (K), Hutton 455 (GRA). Swaziland, Stewart s.n. No. 9450 in TRV (PRE); Namahoshe Police Post, Daintree s.n. (No. 28803 in PRE).

E.foliosa Lindl.:

CAPE PROVINCE: Albany, nr. Grahamstown, Read s.n. (No. 1281 in BOL), Valentine s.n. Oct. 1938 (BOL), Britten s.n. Dec. 1942 (GRA), Davies s.n. Oct. 1952 (GRA), Schönland s.n. Dec. 1889 (GRA), Atherstone s.n. 5 Dec. 1868 (GRA), Hall 605 (BOL), MacOwan 681 (W, SAM), South s.n. (Z), Glass 437 (Z), Rogers 27462 (GRA), Pym s.n. Dec. 1900 (GRA). Kingwilliamstown, nr. Amabele, de Vries 10 (PRE). Komgha, nr. Kei River Mouth, Flanagan 439 (SAM, GRA). Kentani, Pegler 204 (BM, GRA). Cathcart, Katberg, Pappe s.n. (No. 20397 in SAM). Stockenstroom, Chumie Peak, Scully 172 (BOL); Benholm Farm, Scully 190 (BOL). Xalanga, nr. Cala, van Wyk 192 (GRA). Engcobo, McLoughlin s.n. No. 12765 in TRV (PRE). Umtata, Baziya Mt., Baur 459 (GRA). Tsolo, Payn 1 (GRA). Maclear, Murray 35 (GRA); Ugie, Schnell s.n. (No. 26695 in BOL). Mount Currie, nr. Kokstad, Tyson 1085, in Herb. Norm. Austr. Afr. 548 (W, BM, SAM, NH, GRA).

NATAL: Polela, nr. Polela River, Bewes 8 (PRE); nr. Bulwer, Lansdell s.n. (No. 34267 in NH); 17 miles E. of Underberg, Hall 780 (BOL). Underberg, Bushmansnek, Germishuizen 72 (PRE); 7 miles S.W. of Underberg, Dyer 3241 (PRE). Umzinto, Dumisa, Rudatis 511 (W), Rudatis 1529 (W, Z), Rudatis s.n. (W). Inanda, Wood 263 (NH). Pinetown, nr. Pinetown, Wood 11491 (PRE); Krantzkloof, Wood 941 (SAM); Pinetown and Bishopstowe, Sanderson 1006 (NH, BOL). Richmond, Arnolds Hill, Wylie s.n. (No. 23319 in NH). Nr. Pietermaritzburg, Barker 5206 (NBG),

Sim 4210 (Z), Dyer 3291 (PRE); Scottville, Allsopp 595 (NH); Manderston, Thomas 29 (NH). Lions River, nr. Howick, Hutton 151 (GRA). Umvoti, Muden, Wylie s.n. Nov. 1936 (PRE), Wylie s.n. (No. 27970 in NH); nr. Greytown, Saunders s.n. (No. 26690 in NH), Hall 799 (BOL), Wylie s.n. (No. 27971 in NH). Eshowe, Gerstner 2657 (BOL); nr. Entumeni, Gerstner 2401 (NH). Estcourt, Munro s.n. (No. 28890 in PRE); between Merrivale and Boston, Rycroft 2064 (NBG); Tabamblope, West 448 (PRE), West 475 (PRE), Acocks 10001 (NH); Cathkin Park, Galpin s.n. (No. 26693 in BOL), Edwards s.n. No. 126/34 in NBG (BOL); Giants Castle, Symons 192 (PRE). Kranskop, Qudeni Forest Reserve, Fisher & Schweickerdt 65 (NH); nr. Kranskop, Hall 801 (BOL). Weenen, Culvers, Rogers 28146 (Z), Rogers 27462 (K). Bergville, Cathedral Peak, Ruch 2027 (PRE), Killick 1204 (PRE), Killick 1777 (PRE); Oliviershoek, Boyle s.n. in Herb. Allison. 12 (Z); National Park, Oliver 369 (NH), Häfstrom & Acocks 352 (PRE); Umlambonja Valley, Killick 1777 (K); Mont aux Sources, Schweickerdt 717 (PRE), Schweickerdt 735 (PRE). Ladysmith, van Reenens Pass, Hall 792 (BOL); van Reenen, Wood 9723 (GRA), Wood 5863 (NBG). Dundee, Dundee Reservoir, Edwards 90 (PRE). Newcastle, Ingogo, Schweickerdt 972 (PRE). Ngotshe, Ngome, Harrison 84 (BOL). Utrecht, Charlestown, Hogg 9736 (PRE).

BASUTOLAND: Berea, Pulane, Jacot - Guillaumod 1611 (Rhodes University Botany Dept. Herbarium). Leribe, Dieterlen 739 (SAM), Dieterlen 865 (SAM).

ORANGE FREE STATE: Ficksburg, Fowkes 60 (BOL).  
Bethlehem, Potgieter s.n. No. 21927 in TRV (PRE).

SWAZILAND: Hlatikulu, Stewart 29 (SAM). Mbabane,  
Usutu Forests, Compton 25463 (NBG), Compton 27359 (NBG).  
Piggs Peak, Devils Bridge, Galpin 723 (BOL, GRA, PRE).

TRANSVAAL: Wakkerstroom, Volkarust, Godfrey s.n.  
(No. 28889 in PRE). Ermelo, nr. Amsterdam, Norval 27  
(PRE), van der Merwe 1077 (PRE); Spitskop, Pott 5143  
(PRE); Kranspoort, s.leg. (No. 68054 in SAM); 5 miles  
E. of Amsterdam, Reynolds 2723 (PRE). Bethal, Leendertz  
s.n. No. 9572 in TRV (PRE). Barberton, Moodies, Thorn-  
croft s.n. No. 5003 in TRV (PRE); Ivy Range, Thorncroft  
454 (NH), Thorncroft 556 (NH); Lomati Valley nr. Barberton,  
Thorncroft 2063 (PRE); Godwan River Station, Davison &  
Hofmeyer 17 (PRE). Nelspruit, White River Estate, Rogers  
24943 (Z, PRE). Belfast, 10 miles E. of Wonderfontein,  
Hall 662 (BOL); nr. Belfast, Bolus 12305 (BOL, BR),  
Schlieben 8439 (PRE), Leistner 517 (PRE); 'Elandspruit-  
bergen' (=Steenkampsberg), Schlechter 4001 (Z, BOL); nr.  
Dullstroom, Hall 848 (BOL); Machadodorp, Rogers 18192  
(Z). Middelburg, Draaikraal, Codd 8229 (PRE). Lyden-  
burg, 17 miles W. of Lydenburg, Codd 8062 (PRE). Pilgrims  
Rest, nr. Sabie, Hall 858 (BOL); nr. Pilgrims Rest,  
Rogers 40390 (PRE, Z), Hall 628 (BOL); Mount Anderson,  
Smuts & Gillett 2446 (PRE). Pietersburg, Houtbosch,  
Rehmann 5841 (W); Woodbush, Hall 904 (BOL), Schweickerdt  
s.n. (No. 28888 in PRE); Haenertsburg, Grewcock 11 (PRE),

Grewcock s.n. (No. 28887 in PRE), Pott 4734 (PRE), Cunliffe s.n. (No. 26694 in BOL). Zoutpansberg, Entabeni Forest Reserve, Hall 928 (BOL).

LOC. INCERT.: S.loc., s.leg. (W), Botanic Gardens 12 (BOL). Krakekamen, Ecklon & Zeyher 3895 (W). Cape Colony, Belfort, Jacottet & Jacottet 74 (Z). Durban Flower Show, s.leg. (No. 17069 in NH). Kat River, Hutton s.n. (W). Nr. Drakensberg, Wood 3423 (NH, BOL). Basutoland, Baring 2 (PRE). OFS, Cooper 975 (W), Cooper 980 (W, K).

E. fridericii (Reichb.f.) Hall:

TRANSVAAL: Kruger National Park, Pretoriuskop, van der Schijff 4038 (PRE). Letaba, nr. Ofcolaco, McNeil s.n. (Nos. 29056, 29057, 29060 in PRE), Hall 884 (BOL); Agatha Hills, Hood s.n. (No. 29055 in PRE). Zoutpansberg, Klein Australie Forest Reserve, Hall 919 (BOL).

E. hereroensis Schltr.:

CAPE PROVINCE: Tabankulu, 7 miles W.S.W. of Welsh Bridge, Acocks 13842 (PRE). Kingwilliamstown, Schnell s.n. 3 Dec. 1942 (BOL). Somerset East, Cookhouse, Pillans s.n. (No. 10479 in BOL); Cranmere Farm nr. Pearston, Doe s.n. (No. 22859 in BOL). Uitenhage, Thode A699 (PRE). Willowmore, Nortier s.n., ex hort. (No. 22859 in BOL). Kimberley, Riverton, Tapscott s.n. No. 2477 in KMG (BOL, KMG). Barkly West, Uitkyk, Acocks 2257 (PRE, KMG); Groen Kloof,

Cooke s.n. (No. 5409 in KMG). Vryburg, Minnaar s.n. (No. 28734 in PRE); Armoedsvlakte nr. Vryburg, Mogg 8149 (PRE).

TRANSVAAL: Venteradorp, Groenkloof, Cooke s.n. Dec. 1938 (BOL). Brits, Welgevonden, Obermeyer s.n. (No. 27599 in NH), Obermeyer s.n. No. 34761 in TRV (PRE). Warmbaths, Leendertz 5727 (PRE, K), Leendertz 1300 (K, BOL). Potgietersrust, Moorddrift, Leendertz 8178 (PRE). Pietersburg, nr. Boyne, Hall 899 (BOL).

LOC. INCERT.: S.loc., Tapscott s.n. comm. Willman 20 Jan. 1920 (BOL). Fish River Randt, Hutton s.n. Nov. 1897 (GRA). Griqualand West, Ongeluk, Burchell 2647 - 1 (K). Pretoria, Pienaars River ?, Codd 37 (PRE).

E.hersfallii (Batem.) Summ.:

NATAL: Port Shepstone, Porter s.n. (No. 25234 in BOL). Durban, Wentworth, Sanderson 1002 (NH); The Bluff, J.S. s.n. 18 Jan. 1867 (W). Inanda, Wood 374 (NH, BOL, SAM). Eshowe, Lawn 269 (NH), Wilson s.n. (No. 29048 in PRE). Mthungini, Wood 10295 (PRE). Hlabisa, Dukuduku Forest, Harrison 50 (BOL). Ubombo, Mafutaland, West 867 (PRE); Sordwana Bay, Gerstner 703 (PRE). Ingwavuma, Kosi Bay, Rodin 4702 (PRE); Kosi Bush, Aitken & Gale 38 (PRE).

TRANSVAAL: Kruger National Park, Pretoriuskop, van der Schijff 3193 (PRE). Letaba, Tzaneen, Davy 2900

(K); nr. Duiwelskloof, Botha s.n. (No. 29047 in PRE).

LOC. INCERT.: S.loc., J.S. 1002 (BOL). Natal, Lyle s.n. ex Hort. Kew. (K), s.leg. ex Hort. Kew. 18 July 1885 (BOL). Zululand, Harrison s.n. 27 Jan. 1957 (BOL), Woodward Bros. s.n. (No. 8597 in NH).

E.leachii Greatrex ex Hall:

NATAL: Ingwavuma, nr. Ingwavuma, McNeil s.n., ex hort. (No. 27336 in BOL).

TRANSVAAL: Lydenburg, Burgers Fort, van der Merwe 6 (PRE). Pretoria, Marble Hall, Lombard s.n. No. 5956 in Hort. Nat. Herb. (PRE).

E.leontoglossa Reichb.f.:

CAPE PROVINCE: Maclear, nr. Maclear, Bolus 10292 (BOL). Tsolo, Payn 8 (GRA). Mount Currie, nr. Kokstad, Tyson 1088 (BOL), Tyson 1538 (K, GRA, BOL, SAM); Insiswa, Penther 142 (W).

NATAL: Underberg, Bushmansnek, Germishuizen 71 (PRE); nr. Underberg, Dyer 3254 (PRE); 17 miles E. of Underberg, Hall 779 (BOL). Durban, 'Port Natal', Sanderson s.n. No. 64 in Herb. Harvey. (W). Inanda, Wood 1069 (GRA), Wood 1085 (NH, BOL, GRA). Pinetown, Krantz-kloof, Haygarth s.n. No. 22760 in TRV (PRE); nr. Pinetown, Wood 5479 (BM), Sanderson 828 (NH), Wood 5821 (NBG). Camperdown, Inchanga, Wood 7485 (SAM). Pietermaritzburg,

Krauss 251 (W); Cedara, Phillips 3456 (PRE); Dargle Road, Barratt s.n. (No. 37420 in NH). New Hangover, Impolweni, Rump s.n. (No. 20324 in NH). Lions River, nr. Howick, Rycroft 2043 (NBG), Hutton 391 (GRA, Z), Hutton s.n. (GRA), Hutton s.n. No. 2406 in TRV (PRE), s.leg. (No. 13163 in NH); nr. Lidgetton, Germishuizen 61 (PRE); Tweedie, Mogg 3441 (PRE). Estcourt, Giants Castle, Symons 16404a (PRE). Bergville, Umlambonja Valley, Schelpa 941 (BM, NH), Killick 1778 (PRE); Cathedral Peak, Dehse 149 (NH), Ruch 2051 (PRE); Oliviershoek, Boyle s.n. (Z). Umvoti, nr. Greytown, Hall 800 (BOL). Nkandhla, Reyburn s.n. (No. 23378 in NH). Nqutu, nr. Nqutu, Codd 7668 (NH, PRE). Ngotshe, 42 miles E. of Vryheid, Hall 818 (BOL).

BASUTOLAND: Leribe, Dieterlen 405a (PRE).

ORANGE FREE STATE: Ficksburg, Fawkes 92 (NBG), Fawkes s.n. no. 13379 in Herb. Galpin. (PRE). Harrismith, Elands River Valley nr. Mont aux Sources, Flanagan 1985 (PRE, SAM, NH, BOL).

SWAZILAND: Piggs Peak, 5 miles W. of Piggs Peak P.O., Codd 8175 (PRE).

TRANSVAAL: Piet Retief, Inswepe, Sidney 1496 (PRE). Ermelo, Henrici 36 (PRE), Pupils of Convent 81 (PRE), Davy 2162 (K); Spitskop, Pott 5265 (PRE), Scheepers s.n. (No. 68052 in SAM); Nooitgedacht Farm, Henrici 1385 (PRE); The Gem, Walker 112 (PRE). Carolina, Galpin 13515 (K), Rogers 19078 (PRE), Rogers 19797 (K), Rogers 21298 (K),

Rademacher s.n. No. 10486 in TRV (PRE), s.leg. Nov. 1909 (No. 68051 in NBG), Galpin s.n. 18 Oct. 1932 (BOL). Barberton, Thorncroft 3926 (PRE), Rogers 30161 (Z); Saddleback, Galpin 1194 (BOL); Lomati Valley, Thorncroft 1169 (PRE); Little Lomati and Moodies, Culver 12 (BOL). Nelspruit, Godwan River Station, Davison & Hofmeyer 16 (PRE). Vereeniging, Burttholm, Davy 15025 (BOL); Grasmere, Hall 614 (BOL). Heidelberg, Nigel, Louw 821 (PRE), Leendertz 381 (PRE). Johannesburg, Ginsberg Mine, Pegler 2013 (PRE); Houghton Estate, Moss 10567 (PRE); nr. Johannesburg, Guthrie s.n. 15 Dec. 1928 (NBG), Marloth s.n. (No. 26673 in BOL). Boksburg, Breyer s.n. No. 15008 in TRV (PRE), Breyer s.n. Jan. 1916 (SAM). Benoni, Bradfield 336 (PRE); Dunswart, Young 1116 (PRE). Pretoria, Roberts s.n. No. 13515 in TRV (PRE); Kaalfontein, Pole-Evans 16828H (PRE); 15 miles S.E. of Pretoria, Codd 6221 (PRE); Waterkloof, Fairall 1635 (NBG); Irene, Viljoen 8240 (PRE), Pole-Evans s.n. (No. 29063 in PRE); Pretoria University Farm, Codd s.n. (No. 29066 in PRE), Codd 2543 (PRE). Witbank, nr. Witbank, Hall 624 (BOL). Middelburg, nr. Trichardts Poort, Smith 3478 (PRE). Belfast, nr. Belfast, Hall 836 (BOL), Codd & de Winter 3206 (PRE), Janse s.n. No. 10008 in TRV (PRE); Dullstroom, Noomé s.n. No. 20792 in TRV (PRE). Lydenburg, van Wyk 5 (PRE); nr. Steenkampsberg, Hall 847 (BOL); Zwagershoek Farm nr. Lydenburg, Obermeyer 345 (PRE); nr. Lydenburg, Atherstone s.n. (K), Schlechter 3971 (BM, W, Z, BOL, GRA, NH); 6 miles E. of Lydenburg, Hall 856 (BOL). Nr. Pilgrims Rest

Village, Hall 635 (BOL), Hall 636 (BOL), Hall 640 (BOL);  
Mac Mac, Smuts & Gillett 2257 (PRE), van der Merwe s.n.  
(No. 28805 in PRE); 6½ miles N. of Graskop, Codd 6730  
(PRE); between Pilgrims Rest and Sabie, Rogers s.n. No.  
20770 in TRV (PRE); nr. Sabie, Hall 857 (BOL), Hall 860  
(BOL). Letaba, New Agatha, McCallum s.n. (No. 28807 in  
PRE). Pietersburg, Iron Crown Mt. nr. Haenertsburg,  
Hall 913 (BOL); nr. Haenertsburg, Eastwood s.n. (No.  
14892 in TRV (PRE), Cunliffe s.n. (No. 26671 in BOL);  
Houtbosch, Rehmann 5840 (Z).

LOC. INCERT.: S.loc., s.leg. (No. 3836 in NH),  
Dieterlen 405a (SAM), Botanic Gardens 2 (BOL). Griqualand  
East, Naloga, Penther 173 (W). Nonoti, Wood 11472 (NH).  
Transvaal, Atherstone s.n. (W); Caledon River, Geyher  
1585 (W). Witwatersrand, Hutton 891 (SAM, GRA); Alliance,  
Weintroub s.n. (No. 27414 in PRE). Macalisburg, Burke s.n.  
(K, BOL). Rhinosterrivier, Zeyher s.n. (W). Comm.  
Erasmus Farm nr. Pretoria, Gilfillan s.n. No. 6174 in Herb.  
Galpin. (PRE).

E.litoralis Schltr.:

CAPE PROVINCE: Stellenbosch, Jonkershoek Valley,  
Esterhuysen 9706 (BOL). Caledon, nr. Kleinmond, Marais  
s.n. (No. 26675 in BOL), Hall 661 (BOL); Bot River Mouth,  
Cléte s.n. No. 28493 in PRE (K, PRE); nr. Hawston, Schl-  
echter 9468 (K, BR, W, P, Z, BOL, GRA); nr. Hermanus,  
Compton 14228 (NBG), Buchanan s.n. Jan. 1930 (No. 26676 in

BOL), Selzer s.n. 23 Dec. 1947 (BOL), Marloth 7570 (PRE),  
Bolus 13472 (BOL, GRA); Papievlei nr. Stanford, Linley  
s.n. (Nos. 59684, 60402 in SAM). Riversdale, Albertinia  
Commonage, Muir 1914 (PRE). Knysna, nr. Forest Hall,  
Newdigate s.n. (No. 10615 in BOL).

E.longisepala Rendle:

NATAL: N. Zululand, 'Tongaland', s.leg. No. 846  
in Hort. Univ. Stellenbosch (BOL). Ingwavuma, Nluzi -  
Maputa area, Bell-Marley 5015 (NH).

E.macowanii Rolfe:

CAPE PROVINCE: Port Elizabeth, nr. Frames Drift,  
M.A. Holland 18 (BOL). Alexandria, nr. Whitney, Archibald  
5046 (GRA); N. side of Alexandria, Acocks 17879 (PRE);  
Plateau above Bushmans River, Holland 3815 (BOL). Bathurst,  
Kasouga River, MacOwan 184 (K, SAM); Round Hill, Bolus  
7368 (BOL); Kowie West, Tyson s.n. Feb. 1917 (BOL); Kowie,  
Hutton & MacOwan s.n. No. 1215 in Herb. Austr. Afr. (P, K,  
BM, W, BOL, SAM), Britton s.n. (GRA), Tyson s.n. (No. 16845  
in BOL); Port Alfred, Britton 10813 (PRE), South s.n. (No.  
28790 in PRE), White 73 (GRA), Tyson s.n. No. 8523 in Herb.  
Marloth. (PRE), Tyson s.n. No. 12668 in Herb. Dept. Agric.  
(PRE); Port Alfred East, Galpin 3025 (K); Trapps Valley,  
Ansley 15 (GRA); Kleinemund, MacOwan 1280 (BOL); nr.  
Mouth of the Fish River, MacOwan 184 (GRA). Albany, Fras-  
ers Camp, Compton 19095 (NBG). Stockenstroom, Chumie

Peak, Scully 173 (BOL). Kingwilliamstown, Mount Coke, Sim 20111 (PRE); nr. Kingwilliamstown, Schnell s.n. (No. 22860 in BOL); Keiakamma, Hutton s.n. (K). East London, Hallack s.n. (W); nr. East London Cemetary, Smith 3787 (PRE); Genubie Springs, Peacock s.n. (No. 6553 in SAM). Komga, nr. Komgha, Flanagan 2254 (W, P, BOL, PRE); nr. Kei Mouth, Flanagan 1032 (PRE), Flanagan 1033 (PRE). Umtata, 9 miles S. of Umtata, Hall 762 (BOL); nr. Aerodrome, Lowry s.n. No. 25759 in BOL (K, BOL); nr. Umtata, McLoughlin s.n. No. 4174/15 in NBG (BOL). Mount Currie, nr. Kokstad, Tyson 1086 (BOL).

NATAL: Umzinto, Dumisa, Rudatis s.n. (K).

LOC. INCERT.: S.loc., Zeyher 1587 (BM).

E.meleagris Reichb.f.:

CAPE PROVINCE: Stockenstroom, Benholm Farm, Scully 189, No. 5916 in Herb. Bolus. (K, BM, BOL, SAM). Cathcart, Hogsback Mt., Grant 3003 (BOL), Rattray 242 (BOL). Mount Ayliff, Fort Donald, Tyson 1611 (K, GRA, SAM, BOL); 2 miles N.W. of Fort Donald, Hall 770 (BOL).

NATAL: Utrecht, mountainous country, Parkhouse s.n. (No. 42695 in NH).

LOC. INCERT.: S.loc., s.leg. (No. 26661 in BOL), McLoughlin s.n. Dec. 1916 (BOL). CBS, Krebs s.n. (K, W).

E.milnei Reichb.f.:

NATAL: Pinetown, Clairmont, Wood 1430 (K, NH),  
Wood 4075 (K, BOL), s.leg. (No. 13195 in NH).

TRANSVAAL: Rustenburg, S.W. of Rustenburg at foot  
of Magaliesberg, Pegler 1001 (K, Z, GRA, BOL, PRE, SAM).  
Witbank, nr. Witbank Station, Gilfillan 345, No. 7241 in  
Herb. Galpin. (K, GRA, BOL, PRE). Barberton, Culver 77  
(K, BR); Umlomati Valley, Galpin 1221 (Z, GRA, SAM, PRE,  
NH, BOL). Letaba, New Agatha, McCallum s.n. 26 Nov. 1918  
(PRE). Pietersburg, Woodbush, Mogg 14657 (PRE), Rehmann  
5851 (Z); nr. Haenertsburg, Murray 6 (PRE).

LOC. INCERT.: Magaliesberg, Zeyher 1582 (W, BM).  
Macaliesberg, Burke 171 (K, W, SAM). Donkerhoek, Schlechter  
3725 (Z, BOL, GRA).

E.nigricans Schltr.:

CAPE PROVINCE: Umziakulu, nr. Clydesdale, Tyson  
2154 (BOL).

NATAL: Ixopo, Umkomanzi R., Penther 118 (W).  
Estcourt, nr. Berlin Mission Station, Wood 3414 (BOL).  
Inanda, Wood 335 (NH). Pietermaritzburg, Barker 5191  
(NBG).

TRANSVAAL: Pretoria, Pretoria University Farm,  
Codd 5905 (PRE). Belfast, Somerset Farm nr. Schoemans-  
kloof, Smuts & Gillett 2226 (PRE). Barberton, Berea,  
Culver 16 (BOL); Saddleback Mts., Thorncroft s.n. (K).  
Nelspruit, Plaston, Holt 3 (PRE).

E. odontoglossa Reichb. f.:

CAPE PROVINCE: Port St. Johns, West Gate, Galpin  
3412 (K, BOL, PRE, GRA).

NATAL: Port Shepstone, Margate, Richardson s.n.  
(No. 31056 in NH). Umzinto, Dumisa, Rudatis 243 (Z),  
Rudatis s.n. (W). Durban, Wood 11775 (K, NH, SAM);  
'Port Natal', Gueingius 100 (W), Gueinzius 101 (W), Guein-  
zius s.n. (W). Pinetown, Kloof, Lawson 694 (NH); Dohse,  
Lansdell & Shepherd 36 (NH). Inanda, Verulam, Wood 785  
(BM, NH, BOL, SAM). Camperdown, nr. Botha's, Wood 942  
(GRA); Bothas Hill, Indian Collector s.n. 10 Dec, 1913  
(PRE). Richmond, Arnolds Hill, Wylie s.n. (No. 23317 in  
NH). Nr. Pietermaritzburg, Barker 5200 (NBG), Sanderson  
829 (NH); Sweetwaters, Sim 4223 (BOL); Town Hill, Allsopp  
983 (NH). Lions River, Clan Syndicate Estate, Burges s.n.  
(No. 27184 in PRE); Karkloof, Wood s.n. No. 1532 in Herb.  
Austr. Afr. (K, W, Z, SAM, PRE); Dargle Road, Mogg 6861  
(PRE); nr. Howick, Hutton 239 (GRA), Evans s.n. (No.  
19986 in NH). Umvoti, Nr. Greytown, Wood 5954 (BM, BOL,  
PRE). Lower Tugela, Wood 11784 (NH). Mthunzini, Garland  
s.n. (No. 38630 in NH); Hamewith, Mogg 5840 (PRE); Gin-  
ginhlovu, Wood 9457 (Z, NH), Wood 11783 (NH, SAM); Entab-  
eni, Gerstner s.n. (No. 22292 in Nñ). Eshowe Dam, Gerst-  
ner 2649 (BOL).

SWAZILAND: Hlatikulu, Vonden Hill, Compton 29684  
(K, NBG). Mankaiana, nr. Gege, Compton 26443 (NBG).  
Mbabane, Rogers 11586 (GRA, PRE, BOL); Black Mbeluzi Valley,

Compton 25415 (NBG, PRE); Umbeluzi Valley, Compton 24875 (NBG); Sipekasini, Compton 25545 (NBG). Piggs Peak, Devils Bridge, Galpin 722 (BOL).

TRANSVAAL: Belfast, Dullstroom, Noomé s.n. No. 20794 in TRV (PRE), Noomé s.n. (No. 68053 in NBG); between Elands Hoek and Airlie, Pole - Evans 4725 (PRE). Barberton, Rogers 30167 (Z), Thorncroft 4857 (PRE); Umlomati Valley, Galpin 1219 (SAM, PRE, NH, GRA); Little Lomati Valley, 7 miles S. of Barberton, Reynolds 4134 (PRE); Lomati Valley, Thorncroft 1103 (PRE); Moodies, Thorncroft 460 (NH). Pilgrims Rest, Wood 24764 (Z); Waterfall Estate, Pole - Evans 4243 (PRE). Letaba, Duiwelskloof, Scheepers 824 (PRE), The Forester 13 (PRE). Pietersburg, Middelkop Forest Reserve, Grewcock 34 (PRE); Woodbush, Schweick-erdt s.n. (No. 29062 in PRE).

LOC. INCERT.: S.loc., O'Brien s.n. (K). Natal, Buchanan s.n. (W), Sanderson 497 (W), Sanderson 364 (BOL), Saunders s.n. (No. 6070 in BOL), Saunders s.n. 30 Nov. 1885 (BOL); Byrne, Wood 5261 (PRE). Zululand, Roberts s.n. No. 5986 in Herb. Marloth (PRE).

E.ovalis ssp. bainesii (Rolfe) Hall:

ORANGE FREE STATE: Lindley, Phillips 43 (PRE).

SWAZILAND: Mbabane, nr. top of Komati Pass, Compton 29645 (NBG); Polwane Valley, Compton 25359 (NBG), Dlamine s.n. (No. 11446 in NBG).

TRANSVAAL: Ermelo, nr. Amsterdam, van der Merwe

1059 (PRE); Lichfield nr. Amsterdam, van der Merwe 1076 (PRE); Nooitgedacht Farm, Henrici 1380 (PRE), Henrici 1224 (PRE). Carolina, Moss & Rogers 9006 (PRE), Rogers 14422 (Z). Johannesburg, Schnell s.n. No. 23180 in BOL (PRE, BOL), Schnell s.n. 11 Jan. 1944 (BOL), Hards s.n. (No. 28817 in PRE); Northcliff, Reynolds 5820 (PRE). Krugersdorp, Webster s.n. (No. 28812 in PRE); 4 miles N.E. of Krugersdorp, Acocks 18730 (PRE); Witpoortje nr. Krugersdorp, Murray 619 (PRE). Pretoria, S. of Pretoria, Wicht s.n. (No. 28815 in PRE); Irene, Hutchinson 2369 (K, BOL); The Willows, Stent s.n. No. 9949 in Herb. Dept. Agric. (PRE); Rietvlei Reserve, Repton 3449 (PRE); nr. Voortrekker Monument, Hall 618 (BOL); Waterkloof, Hofmeyer s.n. (No. 28813 in PRE), Verdoorn 146 (PRE); Fountains Valley, Hutchinson 2325 (K), Verdoorn 665 (PRE), Verdoorn 633 (PRE); Fountains, Chippindal 3 (PRE); nr. Pretoria, Wagner s.n. cult. (No. 29061 in PRE), Verdoorn 156 (PRE), Repton 3449 (PRE); E. of Pretoria, Verdoorn s.n. (No. 28211 in PRE); Premier Mine, Rogers s.n. No. 90/18 in NBG (BOL); nr. Leper Asylum, Pole - Evans s.n. 24 Dec. 1914 (BOL); Pretoria University Farm, Kies 347 (PRE); Codd s.n. (No. 28882 in PRE), Codd 2542 (PRE); Ashbury, van der Merwe 276 (PRE), van der Merwe 279 (PRE); Silikaatsnek, Obermeyer s.n. No. 35163 in TRV (PRE); nr. Danville, Aves s.n. (No. 28796 in PRE); Hornsnek 12 miles W. of Pretoria, Schlieben 7721 (M), Hutchinson 2596 (BOL), Pole - Evans s.n. (No. 28816 in PRE); Groenkloof, Pole - Evans 323 (PRE); Kuduspoort, Rehmann 4687 (Z), Rehmann 4688 (Z); nr. Koedoespoort, Smith 1549 (PRE); Quaggaspoort, Meeuse 9010 (PRE).

Rustenburg, Rogers 22414 (Z), Nation 33 (Z); Groothoek, Meeuse & Strey 10409 (M, PRE). Witbank, Murray s.n. Dec. 1933 (TCD). Belfast, 9 miles W. of Machadodorp, Bruce 469 (PRE); Dullstroom, Noomé s.n. No. 20793 in TRV (PRE). Barberton, Moodies, Thorncroft s.n. No. 5005 in TRV (PRE); Hills E. of Barberton, Clarke 26 (PRE); Sheba, Culver 17 (BR, K, BOL); nr. Barberton, Galpin 719 (BOL); Somerset Farm nr. Schoemanskloof, Smuts & Gillett 2149 (PRE). Lydenburg, nr. Steenkampsberg, Hall 852 (BOL); Zwagershoek, Obermeyer 344 (PRE); Het Fort Farm, Barnard & Mogg 927 (PRE). Pilgrims Rest, between Pilgrims Rest and Sabie, Rogers s.n. No. 20769 in TRV (PRE); 9 miles N.W. of Pilgrims Rest, Hall 623 (BOL). Potgietersrust, Mosdene Farm nr. Naboomspruit, Galpin M327 (SAM), Galpin M337 (PRE); nr. Potgietersrust, Rogers 848 (GRA), Rogers s.n. No. 2500 in TRV (PRE), s.leg. (No. 68065 in SAM); Naboomfontein, Galpin 133157 (PRE), Galpin s.n. 13 Dec. 1934 (BOL). Waterberg, Palala Road, Smuts & Gillett 3365 (PRE); nr. Groothoek, Meeuse & Strey 10409 (M). Pietersburg, The Downs, Hall 872 (BOL); nr. Boyne, Hall 901 (BOL); Molepo, Junod 1744 (Z); Wittek, Pole - Evans s.n. 18 Jan. 1952 (PRE). Zoutpansberg, Wylies Poort, Breyer s.n. (No. 68047 in SAM), Breyer s.n. No. 22020 in TRV (PRE).

LOC. INCERT.: S.loc., Rehmann 4690 (Z), Schnell s.n. Jan. 1944 (BOL). Transvaal, Menaars Farm, Rehmann 7873 (Z). Magaliesburg, Jones s.n. No. 3199/ 32 in NRG (BOL). Waterberg, Pongola R. Basin, Davy 18372 (BOL). Geelhoutkop, Breyer s.n. No. 17806 in TRV (PRE).

E.ovalis Lindl. asp. ovalis:

CAPE PROVINCE: Uitenhage, van Staadensberg, Zeyher s.n. (No. 26568 in BOL), Zeyher 230 (SAM); Olifantshoek Valley, Ecklon & Zeyher s.n. (P). Port Elizabeth, Long s.n. (K), Cutting s.n. SAM, BOL), Bagshawe s.n. 4 Feb. 1914 (GRA); Parsons Vlei, Long 537 (BOL, PRE), Long 174 (GRA); Kabega Park, Urton 356 (GRA). Alexandria, Wilson 8 (GRA); Bushmans River Mouth, Archibald 4204 (GRA). Albany, Southwell, Schönland 3340 (GRA, PRE); nr. Grahamstown, s.leg. (No. 1068 in NH). Bathurst, nr. Bathurst, South s.n. Dec. 1893 (GRA); Trapps Valley, Daly 648 (Z, GRA); Locke Moore nr. Port Alfred, Hall 760 (BOL); Port Alfred, Hutton 303 (Z, GRA), South 443 (GRA), Britten s.n. Jan. 1907 (GRA); Mouth of Fish River, Atherstone 11 (K); nr. Fish River Lighthouse, Dyer 2271 (GRA). Somerset East, Boschberg, MacOwan s.n. (No. 26567 in BOL). Stockenstroom, Mt. Chumie, Scully s.n. No. 5918 in BOL (SAM, K), Scully 173 (SAM, BM). Cathcart, Hogsback Mt., Rattray s.n. (No. 15775 in BOL). Stutterheim, Dohne, Dick 11 (PRE); Fort Cunyngame, Schönland 31 (GRA). Kingwilliamstown, Penther 158 (W); Amabelle, de Vries 11 (PRE); Mount Coke, Sim 20061 (PRE). East London, nr. Nahoon, Rattray 206 (GRA). Komgha, nr. Komgha, Flanagan 344 (PRE, BOL, SAM), Flanagan 2254 (SAM); nr. Mouth of Kei River, Flanagan s.n. No. 1533 in Herb. Norm. Austr. Afr. (K, Z, W). Mqanduli, Pegler 623 (PRE). nr. Matatiele, Hilner 18 (GRA), Tyson 1596 (BOL, SAM). Nr. Umtata, Pegler s.n. (No. 10672 in BOL). Tsole, Payn 3 (GRA). Mount Currie, nr. Kokstad, Stephany 7 (GRA),

Haygarth s.n. (No. 19053 in NH), Tyson 1086 (SAM, GRA);  
Insiwa Mt., Penther 137 (W). Umzimkulu, Barker 9162  
(NBG); Clydesdale, Tyson 2160 (BOL). Griquatown, de Wet  
4243 (PRE). Mafeking, Duparquet s.n. (P).

NATAL: Port Shepstone, Scottburgh, Crookes 5 (NH).  
Umzinto, Crookes 4 (NH); Dumisa, Rudatis 568 (BM, W, Z).  
Ipoelala, Deepdale, Evans 247 (NH). Richmond, Arnolds  
Hill, Wylie s.n. (Nos. 23339, 23373 in NH). Pietermar-  
itzburg, Sim 4208 (BOL). Nr. Camperdown, Haygarth s.n.  
No. 1960 in Herb. Wood. (K, NH), Wood 469 (BM). Lions  
River, Dargle, Bews s.n. (No. 15394 in BOL), Fannin s.n.  
(No. 1257 in NH); nr. Howick, Wood 9460 (K, Z, NH); nr.  
Balgowan, Acocks 13943 (PRE). Estcourt, Germishuizen 68  
(PRE); Giants Castle, Symons 228 (PRE). Bergville,  
Cathedral Peak, Germishuizen 54 (PRE). Dundee, Glencoe,  
Tinton s.n. (No. 7434 in NH). Newcastle, 4 miles N. of  
Newcastle, Hall 646 (BOL). Umvoti, Greytown, Wylie s.n.  
No. 22367 in NH (K, PRE, NH), Wylie s.n. (No. 22368 in  
NH). Eshowe, Entumeni, Wood 11816 (NH), Wood 9459 (NH).  
Nqutu, 2 miles E. of Nqutu, Codd 7662 (NH, PRE). Ubombo,  
nr. Ubombo Village, Harrison 88 (BOL). Utrecht, nr.  
Charlestown, Smith 5636 (PRE); Donkerhoek, Devenish 815  
(PRE).

BASUTOLAND: Mafeteng, Likhoele, Dieterlen 1232  
(PRE); Thabaneng, Watt & Brandwyk 2440 (PRE). Maseru,  
between Molikalike and Likheng, Jacot - Guillard 1688  
(PRE, Rhodes Univ. Bot. Dept.). Leribe, Dieterlen 134

(K, P, Z, PRE, NH, GRA, SAM); Meniameng Stream, Jacot - Guillarmod 2214 (PRE, Rhodes Univ. Bot. Dept.)

ORANGE FREE STATE: Ladybrand, Clocolan, Taylor s.n. (No. 6485 in SAM). Ficksburg, Fowkes 61 (BOL); Rosendal, Goossens 1881 (PRE). Senekal, Doornkop, Goossens 931 (PRE). Lindley, N. of Lindley, van der Merwe 1137 (PRE, K). Heilbron, Williams 6 (GRA); nr. Greenlands Station, Acocks 20993 (PRE, K, Z). Kroonstad, Pont 544 (Z, PRE).

SWAZILAND: Mbabane, Rogers 11473 (GRA, PRE); Forbes Reef Road, Compton 25494 (NBG); Forbes Reef, Compton 22408 (NBG).

TRANSVAAL: Wakkerstroom, Kastrol Nek, Fitzsimmons & van Dam s.n. No. 25995 in TRV (PRE); Oshoek, Devenish 372 (PRE). Ermelo, Davy 1005 (K); Nooitgedacht, Henrici 1214 (PRE); nr. Amsterdam, van der Merwe 1061 (PRE), van der Merwe 1091 (PRE); Dranel, Hoffe 15 (PRE); Spitskop, Scheepers s.n. No. 15026 in TRV (PRE). Carolina, Rademacher s.n. No. 7494 in TRV (PRE). Standerton, 2 miles S.E. of Standerton, Godfrey s.n. (No. 28814 in PRE). Bethal, Leendertz s.n. No. 9571 in TRV (PRE). Heidelberg, Kalkspruit, Schenk 780 (Z); Witkop Vlei, Davy 5627 (K). Vereeniging, Bolton Wold, Davy 15003 (BOL). Springs, Flugge - de - Smidt s.n. (No. 28795 in PRE); between Delmas and Kendal, Reynolds 5789 (PRE). Benoni, Bradfield 380 (PRE). Boksburg, Breyer s.n. No. 15003 in TRV (PRE). Germiston, Modderfontein, Haagner s.n. Dec. 1904 (GRA); Kempton Park, Smith 3501 (PRE). Johannesburg, Baker s.n.

(K), Marloth 3844 (PRE); Park View, Moss 9033 (BM); The Wilds, Hall 616 (BOL). Potchefstroom, Witkop, Louw 1340 (PRE). Wolmaranstad, Liebenberg 2864 (PRE). Ventersdorp, Rysmierbult, Louw 1252 (PRE). Rustenburg, Doornpoort, Pole - Evans H13232 (PRE). Brits, Beestkraal, Jenkins s.n. No. 6948 in TRV (PRE); de Kroon, Pole - Evans H16838 (PRE); Bokfontein, Jenkins s.n. (No. 68048 in SAM). Pretoria, Wilms 1391 (Z), McLoughlin s.n. (BOL); Irene, Rogers 30165 (Z); between Irene and Lyttleton, Smith 1154 (Z, PRE); Delmas, Davy 9969 (BOL); 10 miles S.E. of Pretoria, Codd 3516 (PRE); Wonderboompoort, Rehmann 4466 (Z); Kuduspoort, Rehmann 4688a (Z); Piensaarsrivier, Korthals s.n. No. 6380 in TRV (PRE); van Dyck's Spruit nr. Cullinan, Phillips s.n. (No. 28793 in PRE). Witbank, nr. Witbank, Hall 621 (BOL); nr. Witbank Station, Gilfillan s.n. No. 7238 in Herb. Galpin. (GRA). Middelburg, Kassner 1378 (BR); Arnot, Birch s.n. (PRE); nr. Klein Olifants Rivier, Schlechter 4049 (Z, K, BOL). Belfast, nr. Wonderfontein, Bolus 12306 (GRA, BOL), Hall 833 (BOL), Nelson 263 (PRE); Waterval Boven, s.leg. (No. 68046 in SAM); Roodeklip Farm nr. Dullstroom, Galpin s.n. 29 Jan. 1933 (BOL). Lydenburg, 18 miles S.W. of Lydenburg, Hall 853 (BOL), Hall 854 (BOL). Pilgrims Rest, Mount Anderson, Smuts & Gillett 2461 (PRE); Sabie, Rogers 23415 (Z, NH). Waterberg, nr. Nyabstroom, Davy 2011 (BOL).

LOC. INCERT.: s.loc., s.leg. (S, W), s.leg. No.27 (W), s.leg. No. 3794/15 in NBG (BOL), s.leg. Orchid 6 (W), s.leg. (No. 10674 in BOL), s.leg. (No. 26569 in BOL), Drège

s.n. (W), Ecklon & Zeyher (Z), Schnell s.n. 28 Nov. 1942 (BOL), Peers s.n. Dec. 1927 (BOL). CBS, Lehmann s.n. (W), Lehmann 56 (W), Ecklon 1129 (W), Ecklon 1130 (W), Ecklon 1131 (W), Drège s.n. (P), Thunberg (?) s.n. (W). Siloh, Tambukiland, Ecklon & Zeyher s.n. No. 46 in Herb. Sond. (W). Kagaberg, MacOwan 184 (Z). Somerset, Bowker s.n. (BOL). Nalogha, Penther 200 (W). Zwart Kei River, s.leg. 6 (BOL). Engcobo?, McLoughlin s.n. (BOL). Adelaide?, Marloth 8488 (PRE). Natal, Allison s.n. (K), Wood 28733 (PRE). Between Howick and Pinetown, Junod 408 (Z). OPS, Cooper 974 (Z), Cooper 976 (Z, W, BOL). Gatsrand, Gilfillan s.n. (No. 28792 in PRE). Modder East, Louw 981 (PRE). Gr. Olifants River, van Niekerk s.n. No. 7507 in TRV (PRE). Wilgepoort, van Dam s.n. No. 12748 in TRV (PRE). Derde Poort, Leendertz 680 (PRE). Imawahqha (?), Vulben s.n. (No. 7751 in NH).

E. parviflora (Lindl.) Hall:

CAPE PROVINCE: Humansdorp, Marreedouw, Jeppe s.n. No. 4874 in Herb. Fourcade (K), Jeppe s.n. No. 33396 in TRV (PRE). Port Elizabeth, Drège 127 (Z), Cutting 28 (BOL), Marloth 8880 (PRE), Marloth 12603 (BOL); Krakakamma, Zeyher 3895 (SAM, PRE); North End Cemetary, Long 173 (GRA), Long 1133 (PRE); Amsterdam Hoek, Urton 311 (GRA). Alexandria, Zuurberg, Atalaya Valley, Archibald 5271 (GRA). Albany, nr. Bathurst, South s.n. (Z); Trapps Valley, Ansley 1 (Z), Ansley 2 (Z); Coldspring nr. Grahamstown, Schönland 620 (Z, GRA, PRE, NH), Hall 592

(BOL), Hall 725 (BOL), Britten & Davies s.n. (GRA), Britten s.n. (No. 25320 in BOL); nr. Grahamstown, MacOwan 80 (W, BM), MacOwan 20 (W), Rogers 1303 (Z), MacOwan s.n. (No. 1284 in BOL), South s.n. No. 2407 in TRV (PRE). Kongha, Kei R. Mouth, Flanagan 1299 (K, BOL, SAM, PRE). Maclear, Ugie, Schnell s.n. (No. 206710 in BOL). Lusikisiki, Mkamati Leper Institute, Marais 1191 (PRE).

NATAL: Port Shepstone, 'The Valleys' Farm, Mogg 13931 (PRE); Oribi Flats, Dyer, Francis & Dohse 2 (NH). Inanda, Wood 659 (K), Rehmann 8265 (Z), Rehmann 8267 (Z); Indwedwe, Wood 976 (K, BOL). Pinetown, Krantzkloof, Schlechter 3200 (BOL, Z); Forest Hills above Kloof, Dohse 247 (NH); Gillitts, Wood 11788 (NH), Wood 11789 (K, NH). Camperdown, nr. Inchangga, Marloth 4170 (BOL). Lions River, above Howick, Haygarth s.n. (No. 13164 in NH). Estcourt, Giants Castle, Symons 65 (PRE). Bergville, National Park, Oliver 396 (NH); Cathedral Peak, Dohse 63 (PRE); Tugela Valley, Häfstrom & Acocks 350 (PRE). Eshowe, Forbes 719 (NH, PRE). Utrecht, Kaffir Drift, Thode A248 (PRE).

SWAZILAND: Hlatikulu, Stewart s.n. No. 13216 in TRV (PRE). Mbabane, Dalriach, Compton 28095 (PRE).

TRANSVAAL: Pretoria (cult.?), McLoughlin s.n. No. 13193 in TRV (PRE), McLoughlin s.n. (No. 26711 in BOL). Barberton, de Kaap, Culver 1 (BR, BOL); Saddleback, Galpin 546 (K, Z, GRA, BOL, SAM), Culver 32 (PRE), Galpin 670 (PRE, BOL, GRA, SAM); Mount Sheba, Bolus 9787 (BOL).

Lydenburg, Harwood s.n. (No. 28808 in PRE). Letaba, N.E. Westfalia Siding nr. Tzaneen, Scheepers 700 (BOL).

LOC. INCERT.: S.loc., s.leg. cult. Hort. Kew. May 1888 (No. 26714 in BOL), s.leg. s.n. (W), Buchanan 13 (K, W), Culver 52a (BOL). Wild Flower Show, s.leg. (No. 16334 in BOL). S.Africa, Drège s.n. No. 49656 in Herb. Reichenbach. (W). Kaffraria, Cooper 1877 (Z, W). CBS, E. frontier, Hutton s.n. (W). Pondoland, Egosaa, Sim 2543 (PRE). Natal, McKen & Gerrard 9 (NH). Inswatzi, Wylie s.n. No. 11781 in Herb. Wood. (NH, PRE). Niginya, Wylie s.n. No. 11824 in Herb. Wood. (NH). Brookhuizen Poort, MacOwan 80 (NH).

E. parvilabris Lindl.:

CAPE PROVINCE: Kentani, Pegler 2106 (PRE), Pegler 2107 (BOL). Mount Ayliff, Ewins s.n. (No. 26607 in BOL). Umzinkulu, R. Ibisi, Tyson 2845 (SAM).

NATAL: Umzinto, Dumisa, Rudatis 567 (W, BM), Rudatis 1861 (W). Pietermaritzburg, nr. Sweetwaters, Sim 4230 (BOL). Eshowe, Entumeni, Gerstner 3093 (BOL).

SWAZILAND: Hlatikulu, Stewart 41 (K, SAM). Mbabane, Dalriach, Bolus 12307 (BOL).

TRANSVAAL: Ermelo, Spitskop, Scheepers s.n. No. 15023 in TRV (PRE), Scheepers s.n. (No. 68044 in SAM). Carolina, Nelshoogte Pass, Hall 643 (BOL). Barberton, Schenble s.n. No. 12005 in TRV (PRE); Ivy Moodies', Culver 68 (BOL).

Belfast, Gunn s.n. (No. 28791 in PRE); Dullstroom, Roodeklip Farm, Galpin 12468 (PRE). Letaba, Duiwelskloof, Scheepers 872 (PRE). Pietersburg, Magoebaskloof, Murray s.n. (TCD); nr. Haenertsburg, Grewcock 7 (PRE); Houtbosch, Rehmann 5845 (K, Z), Rehmann 5484 (Z); Woodbush, Wager s.n. No. 23046 in TRV (PRE); Houtboschberg, Schlechter 4394 (Z, BOL), Davy 1252 (BOL).

LOC. INCERT.: S.loc., s.leg. (No. 26605 in BOL), s.leg. (No. 3983 in NH), Thorncroft 462 (NH). Pondoland, s.leg. (No. 26606 in BOL).

E.petersii Reichb.f.:

NATAL: Weenen, nr. Muden Police Station, Hall 797 (BOL). Msinga, 3 miles S. of Tugela Ferry, Codd 6337 (K, PRE). Kranskop, Middle Drift nr. Kranskop, Reyburn s.n. (No. 23375 in NH). Eshowe, Lawn 372 (NH); Entumeni, Haygarth s.n. (No. 15951 in NH); 13 miles N. of Eshowe, Verdoorn & Dyer s.n. No. 24546 in PRE (K, PRE); Nandi's Grave, 14 miles from Eshowe on main Empangeni Road, Hall 808 (BOL). Umfolozi, nr. Empelongeni Bridge, Lawn 1883 (NH); Empangeni, Bennet s.n. (No. 25243 in BOL). Hlabisa, Fiedler 1072 (PRE); nr. Sonkele, Harrison 35 (BOL). Nongoma, nr. Nongoma, Roberts s.n. No. 28735 in TRV (PRE).

SWAZILAND: Mbabane, Komati Bridge, Compton 29650 (NBG, K).

TRANSVAAL: Piet Retief, 20 miles from Pongola on Piggs Peak Road, Wells 2027 (PRE). Barberton, Galpin 965

(K); Slaaihoek, Pole - Evans 3920 (PRE); Umvoti Creek nr. Barberton, Culver 31 (BOL); Revolver Creek, Reynolds 2676 (PRE). Nelspruit, Breyer s.n. No. 17706 in TRV (PRE); Plaston, Holt 286 (PRE); White River, Rogers 24942 (PRE); Komati Poort, Kirk 64 (K). Pilgrims Rest, Graskop, Pole - Evans H 16919 (K). Lydenburg, Sukukuni, Barnard 588 (PRE). Letaba, nr. Tzaneen, cult, Bourke s.n. (No. 27265 in PRE). Kruger National Park, Favi, van der Schijff 1285 (PRE). Pietersburg, nr. Smitsdrift, van der Merwe 272 (PRE), van der Merwe 301 (PRE); nr. Smithdrift, Kies & Bruce 55 (K, PRE); 1 mile E. of Boyne, Hall 898 (BOL), Thompson & Smuts s.n. (No. 26744 in BOL); Pypkop in Woodbush Forest, Brady 17 (NH). Waterberg, Krantzberg, Codd & Erens s.n. (No. 28743 in PRE). Zoutpansberg, Saltpan, Mogg 24475 (PRE).

LOC. INCERT.: S.loc., s.leg. (No. 26743 in BOL), Warner 64 (W), Sanderson 1015 (BOL, K, W), Sanderson 1002 (K), Gerstner s.n. (BOL), Gerstner 3842 (BOL), Wood s.n. (No. 3551 in NH), van der Bijl s.n. (No. 15717 in BOL), Umvoti Co. (Nos. 12131, 12961 in NH). Zululand, Gerstner s.n. (No. 31439 in NH), Houting s.n. (No. 28745 in PRE), Mann s.n. Cult. (No. 28746 in PRE). N.Transvaal, cult. van Son s.n. (No. 29066 in PRE); Pietersburg, cult. Repton s.n. 5 Dec. 1928 (PRE).

E.platypetala Lindl.:

CAPE PROVINCE: Riversdale, nr. Zoetmelks R., Burchell 6611 (K, W, BOL), Burchell 6764 (K, W, BOL); Bottle-

iersfontein, Muir 1141 (PRE); Oude Tuin nr. Albertinia, Muir 1130 (PRE). Knyana, nr. Knysna, Newdigate s.n. Nov. 1911 (BOL); nr. Forest Hall, Newdigate s.n. (No. 6888 in BOL). Port Elizabeth, Cutting s.n. (No. 26680 in BOL).

E.schwenfurthii Kraenzl.:

TRANSVAAL: Barberton, Komati Poort, Schlechter 11886 (K, Z, BM). Kruger National Park, Nohpe, van der Schijff 3384 (PRE); Baiandbai, Lang s.n. No. 32215 in TRV (PRE). Waterberg, 10 miles N. of Nylstroom, Lang s.n. No. 31098 in TRV (PRE).

E.speciosa (R.Br. ex Lindl.) Bolus:

CAPE PROVINCE: George, Wilderness, Scheepe 500a (BOL), Gill 3 (BOL), Flugge - de - Smidt s.n. (No. 26719 in BOL), Hall 752 (BOL); Swart Vlei, Martin 134 (NBG). Knysna, Sedgefield, Middlemost 2005 (NBG), Craye s.n. (No. 65839 in SAM). Humansdorp, Geelhoutboom Dunes, Jeppe s.n. No. 33398 in TRV (PRE). Port Elizabeth, Hallack s.n. No. 3017 in Herb. Galpin. (PRE). Uitenhage, Mouth of the Coega R., Ecklon & Zeyher 3894 (BOL). Alexandria, Bushmans River Mouth, Johnson 852 (GRA). Bathurst, Port Alfred, Hoskyn 1 (GRA), Tyson s.n. No. 12667 in Herb. Dept. Agric. (PRE), Tyson s.n. No. 8521 in Herb. Marloth. (PRE); Kowie Mouth, MacOwan s.n. (No. 20418 in SAM); Port Alfred East, Galpin 2957 (PRE); Mouth of Gr. Visch-rivier, MacOwan 401 (GRA); Fish River Mouth, s.leg. 424

(GRA). Peddie, between Peddie and the coast, Leighton s.n. (No. 26716 in BOL). East London, Bonza Bay, Smith s.n., cult. (Nos. 56579, 56580 in NBG). Komgha, nr. Kei Mouth, Flanagan 1025 (BOL, PRE). Kentani, nr. beach, Pegler 782 (BOL, PRE). Willowvale, Qora R. Mouth, Hilner 554 (PRE). Nr. Port St. Johns, McLoughlin s.n. (No. 29052 in PRE), Theron 1556 (PRE); Port St. Johns nr. First Beach, Hall 764 (BOL).

NATAL: Port Shepstone, Morg 12761 (PRE). Durban, Isipingo, Forbes & Gower s.n. (No. 29051 in PRE); nr. Durban, Thomas 27 (NBG), Schlechter 3151 (PRE, K, BM, Z), Schlechter 2961 (Z), Wood s.n. Nov. 1887 (GRA), Wood s.n. (No. 20423 in SAM), Sanderson 493 (NH); Bluff, Obermeyer s.n. No. 35165 in TRV (PRE), Wood 12419 (NH); Berea, Wood 9966 (NH); Prospect, Forbes 490 (NH). Pinetown, Clairmont, Wood 1090 (NH). Mthunzini, Gerstner 3390 (NH, PRE); Amatikulu Beach, Lawn 1823 (NH); Ginginhlovu, Gerstner s.n. (No. 22208 in NH). Eshowe, Gerstner 2381 (NH); 13 miles N. of Eshowe, Hall 807 (BOL). Entonjaneni, 17 miles S. of Melmoth, Schelte 5194 (BOL); Umhlatzi Valley, Lawn 1267 (NH). Msinga, 3 miles S. of Tugela Ferry, Codd 6333 (PRE). Weenen, Muden, Wylie s.n. (No. 27979 in NH); nr. Muden Police Station, Hall 795 (BOL). Umfolozi, nr. Empangeni, Harrison 51 (BOL); Richards Bay, Lawn 992 (NH), Rump s.n. (No. 20124 in NH). Hlabisa, 10 miles from Mtubatuba, de Wet 1731 (PRE, BOL).

SWAZILAND: Hlatikulu, nr. Gollel, Compton 29409 (K, NBG), Compton 31006 (NBG); Ingwavuma R. Causeway, Compton 31030 (NBG).

TRANSVAAL: Barberton, North Kaap, Thorncroft 2103 (PRE); Louws Creek, van Dam s.n. No. 21229 in TRV (PRE); between Louws Creek and Barberton, Hutchinson 2516 (BOL, K); nr. Barberton, Culver 62 (K), Galpin 668 (PRE, BOL), Thorncroft s.n. No. 5292 in TRV (PRE). Lydenburg, Sukukuni, Barnard 287 (PRE), Barnard 442 (PRE), Barnard & Mogg 16996 (PRE); Burgers Fort, van der Merwe 5 (PRE). Groblersdal, nr. Loskop Dam Wall, Codd 9839 (PRE). Potgietersrust, Bolus 11165 (BOL), Leendertz 1929 (PRE). Waterberg, Quickborn, Bradfield 28 (PRE). Zoutpansberg, Eyam Farm, Obermeyer, Verdoorn & Schweickerdt 79 (PRE).

LOC. INCERT.: S.loc., Mackay s.n. No. 6373 in Herb. Marloth. (PRE), Pillans s.n. cult. March 1913 (BOL), Schröeter s.n. No. 1815/26 in Hort. Durban. (BOL), Ross s.n. cult. (No. 26718 in BOL), White s.n. Dec. 1901 (GRA), Long 1138 (GRA). CBS, Thunberg s.n. (UPS). Natal, Kirk 2 (W). Zululand, Houting s.n. (No. 29053 in PRE). Ntondweni, Wylie s.n. (No. 13159 in NH). Niginya, Wylie s.n. (No. 13158 in NH).

E.streptopetala Lindl.:

CAPE PROVINCE: Bedford, Cowie, Bennie 247a (GRA); Cavers, Gane 80 (GRA). Uitenhage, Thode A1089 (PRE, NH), Compton 20294 (NBG); Olifantshoek, Zeyher 3896 (P, W, SAM), Zeyher 12 (GRA); Zwartkops R., Pappe 609 (BOL), Pappe s.n. (No. 20415 in SAM), Zeyher s.n. (W), Zeyher 3897 (W); 15 miles N. of Uitenhage, Bolus 1551 (BOL). Port Elizabeth,

Cory 62 (GRA). Albany, Fullers Kloof nr. Grahamstown, MacOwan 401 (SAM); Bothas Hill N. of Grahamstown, Hall 662 (BOL), Hall 755 (BOL), Long 867 Cult. (BOL); Penrock Farm nr. Grahamstown, Dyer 1175 (GRA); Kenya Hill nr. Fort Brown, Britten 5477 (GRA); Committees, Fish R. Valley, Dyer 2164 (PRE, GRA); Coldstream, Schönland s.n. 19 Dec. 1891 (BOL). Bathurst, Port Alfred, Tyson s.n. No. 8522 in Herb. Marloth. (PRE); between Port Alfred and Bathurst, South 444 (GRA); Kowie River, First Picnic Place, Britten 429 (GRA); Port Alfred East, Galpin 2958 (PRE); between Riet R. and Kleinmond, MacOwan 1455 (W, SAM); Fish R., M.Owan s.n. (W). Kingwilliamstown, banks of the Buffalo R., Welsh 34 (PRE); nr. Kingwilliamstown, Sim 28 (BOL), Sim 936 (GRA); Kei Road, Ranger 11 (PRE); Amabele, Warren s.n. (No. 29050 in PRE). East London, Upper End of 2nd Creek, Dodd s.n. No. 7961 in Herb. Galpin. (PRE). Komgha, nr. Komgha, Flanagan 345 (PRE, SAM, BOL, GRA). Kentani, Pegler 232 (PRE, BOL). Butterworth, Emfenene Cascades, McLoughlin s.n. (No. 26265 in PRE). Ngqeleni, Crowther s.n. Nov. 1930 (GRA). Nr. Port St. Johns, Hall 765 (BOL). Lusikisiki, Mkambati Leper Institute, Maraie 959 (PRE).

NATAL: Umzinto, Dumisa, Rudatis 716 (BM), Rudatis 1236 (W, Z). Durban, Rogers 27998 (Z); 'Port Natal', s.leg. No. 1672 ex Herb. Berol. (W). Inanda, Tongaat, Wood s.n. (No. 13157 in NH). Pinetown, Clairmont, Wood s.n. (No. 20420 in SAM). Camperdown, Inchanga, Wodd 7544 (BOL). Pietermaritzburg, Town Bush Valley 4 miles N.E.

of Pietermaritzburg, Adlam 1 (BOL). Bergville, Cathedral Peak, Ruch 2037 (PRE); Newcastle Farm nr. top of Oliviershoek Pass, Hall 590 (BOL). Umvoti, Muden, Wylie s.n. (No. 27979 in NH). Weenen, Dalton Bridge, Acocks 10764 (PRE, NH); nr. Weenen, Hall 794 (BOL). Entonjaneni, 5 miles W. of Melmoth, Hall 806 (BOL); Umhlatuzi Valley, Lawn 2122 (NH). Mahlabatini, Gerstner 2336 (NH), 6½ miles N. of Mahlabatini, Codd 1930 (K, PRE). Nongoma, 18 miles from Hluhluwe Reserve turnoff on Nongoma Road, Wells 2667 (PRE). Ingwavuma, nr. Magistracy, West 878 (PRE).

SWAZILAND: Stegi, 3 miles S. of Stegi, Compton 28389 (NBG). Mankaiana, Sidey 1923 (PRE). Mbabane, Martin s.n. (No. 56573 in NBG); Coronation Park, Karsten s.n. (No. 43428 in NBG). Piggs Peak, Ngonini, Dlamini s.n. (No. 11468 in NBG).

TRANSVAAL: Piet Retief, Pole - Evans 8/3347 (PRE). Ermelo, nr. Amsterdam, van der Merwe 1063 (PRE). Carolina, Rademacher s.n. No. 10488 in TRV (PRE). Brits, nr. Skeerpoort, Connell 85 (PRE). Rustenburg, Buffelspoort Exp. Sta., Turner s.n. (No. 28885 in PRE). Barberton, Rogers 23866 (PRE), Thorncroft s.n. No. 4958 in TRV (PRE); Golden Crescent Creek, Thorncroft 230 (NH); nr. Barberton, Galpin 669 (PRE, GRA, SAM, BOL), Hall 641 (BOL); de Kaap, Culver 4 (BOL). Nelspruit, Plaston, Holt 89 (PRE); nr. Nelspruit, Liebenberg 2633 (PRE); White River, Cooke s.n. No. 10456 in TRV (PRE), Kay I, 27 Nov. 1933 (PRE). Pilgrims Rest, Collins s.n. No. 9885 in TRV (PRE); nr. Pilgrims Rest, Rogers 18318 (Z), Hall 637 (BOL); nr. Sabie, Hall 859

(BOL); Marieps Kop, Fitzsimmons & van Dam s.n. No. 26279 in TRV (PRE). Lydenburg, 12 miles N.W. of Lydenburg, Reynolds 2656 (PRE, K); Magnet Heights Farm, Barnard 114 (PRE), Barnard & Mogg 850 (PRE); Sukukuniland, van Warmelo s.n. No. 38107 in TRV (PRE), Barnard 430 (PRE); N. of Ohrigstad, Young A 726 (PRE). Kruger National Park, Pretoriuskop, van der Schijff 2193 (PRE), van der Schijff 3194 (PRE); 7 miles S. of Pretoriuskop, Codd 5680 (PRE). Letaba, The Downs, Hall 873 (BOL); Tzaneen, Rogers 12782 (Z); Magoebaskloof, van der Merwe 278 (PRE), van der Merwe 292 (PRE); Westfalia nr. Duiwelskloof, Scheepers 514 (PRE). Pietersburg, nr. Haenertsburg, Grewcock 4 (PRE); Houtbosch, van der Merwe 294 (PRE); Woodbush, Stierstra 3723 (BOL, PRE); Subiaco Mission 30 miles E. of Pietersburg, Gerstner 5335 (PRE), Gerstner 5594 (PRE); nr. Boyne, Moss & Rogers 752 (BM), Hall 879 (BOL), Hall 914 (BOL); Munnik, Freeberg s.n. (No. 29054 in PRE). Potgietersrust, Dewar s.n. (No. 28884 in PRE); nr. Lunsklip, Maguire 1407 (NBG). Waterberg, nr. Ypres Halt, Galpin 11587 (BOL, PRE, BM). Zoutpansberg, Obermeyer s.n. No. 30385 in TRV (PRE); Elim, Obermeyer 929 (PRE), Obermeyer s.n. No. 29325 in TRV (PRE); above Louis Trichardt, Hutchinson 2001 (K); Wylies Poort nr. Louis Trichardt, Smith 1917 (PRE), Pole - Evans 1944 (PRE); Laatsgevonden, Koker s.n. (No. 28883 in PRE); 9 miles E. of Louis Trichardt, Hall 915 (BOL); Entabeni, Obermeyer, s.n. No. 30386 in TRV (PRE). Sibasa, Hangklip 20 miles N.E. of Louis Trichardt, Gerstner 5727 (PRE).

LOC. INCERT.: S.loc., s.leg. (W), s.leg. cult. (No. 26713 in BOL), Sim s.n. (No. 23370 in BOL), Mearns s.n. (No. 56560 in NBG), Fraser O/2/A (PRE). CBS, Thunberg s.n. (UPS). Somerset, Bowker s.n. (W). Manfield, Atherstone s.n. (GRA). Natal, Gerrard s.n. (W); Umlaas Valley, Thorne s.n. (No. 23243 in NH). Attercliffe, Sanderson 496 (NH). Transvaal, Junod 1631 (Z). Duffelsnek, Janse 3025 (PRE). Magaliesberg, Krosfelder s.n. (No. 10944 in PRE).

E.tabularis (L.f.) Bol.:

CAPE PROVINCE: Clanwilliam, Elands Kloof, Lewis 843 (SAM). Ceres, Olifants R. Mountains, Esterhuysen 13357 (BOL). Paarl, Upper Wellington Sneeuwkop, Esterhuysen 15030 (BOL); Haalhoek Sneeuwkop, Esterhuysen 9683 (BOL). Worcester, Waaihoek, Wasserfall 814 (NBG). Paarl, French Hoek Mountains, Herre s.n. No. 5 in Hort. Univ. Stellenbosch (BOL). Stellenbosch, Vlakte at S.W. foot of Victoria Peak, Esterhuysen 9779 (BOL); Hottentots Holland between Triplets and Pic sans Nom, Esterhuysen 9804 (BOL); Hottentots Holland, MacPherson s.n. (No. 56550 in NBG). Somerset West, Hottentots Holland, Begley 3 (SAM); Landrost Nek, Prentice s.n. (No. 10354 in SAM). Peninsula, nr. Wynberg Reservoir, Dod 2304 (BOL); Table Mountain, Schlechter 172 (Z), Guthrie 320 (BOL), Giffen s.n. 13 Dec. 1924 (CT), Harvey s.n. (K), W.H.H. s.n. (W); Constantia-berg, Compton 8266 (NBG); Muizenberg, Hall 82 (CT), Bolus

4844 (BOL, K, SAM); Noordhoek Mountain, Goulimis s.n.  
Dec. 1942 (CT). Caledon, Mossel R. nr. Hermanus,  
Selzer s.n. (No. 25242 in BOL); nr. Caledon, Bolus s.n.  
(GRA); Mts. between Hottentots Holland and Palmiet R.,  
Zeyher s.n. (Z); nr. Genadendal, Bolus 13499 (BOL),  
Fappe s.n. (No. 20385 in SAM), Bodkin s.n. (No. 26697 in  
BOL). Swellendam, Langebergen, Stafford-Smith s.n.  
(No. 26698 in BOL). Knysna, Storms River, Newdigate  
s.n. (No. 26699 in BOL).

LOC. INCERT.: CBS, Wawra 85 (W), Thunberg s.n.  
(UPS). Kentani, Pegler? s.n. (No. 10677 in BOL).

E.tenella Reichb.f.:

CAPE PROVINCE: Uitenhage, van Staadensberg, Ecklon  
& Zeyher 3900 (W). Alexandria, de Bega Heights, Archibald  
5379 (PRE); Waaiheuvel, Archibald 6090 (GRA). Bathurst,  
Locke Moore nr. Port Alfred, Hall 759 (BOL). Albany, Gra-  
hamstown, Breyer 28 (PRE); Coldspring nr. Grahamstown,  
Hall 606 (BOL), Glass 475 (GRA), Glass s.n. comm. Schönland  
24 Jan. 1892 (BOL), Bolus 7366 (BOL). Nr. Kingwilliams-  
town, Schnell s.n. Dec. 26 1942 (BOL). Komgha, nr. Komgha  
Flanagan 1645 (BOL, K, GRA, PRE, SAM), Schlechter 6165 (Z).  
Kentani, Pegler 290 (PRE, BOL). Mqanduli, Mqanduli Heights,  
Pegler 622 (BOL, PRE). Tsolo, Payn 6 (GRA). Post St.  
Johns, coastal belt, Hutchinson 1742 (K, PRE, BOL); 1 mile  
from the coast, Dyer 1820 (GRA). Lusikisiki, Umsikaba  
Gorge, Acocks 13269 (PRE).

NATAL: Underberg, Bulwer, Rayer 342 (NM). Port

Shepatone, Scottburgh, Jenner s.n. (No. 56498 in NBG).  
Durban, 'Port Natal', Gueinzius s.n. (K); Pinetown, Clair-  
mont, Wood 12224 (Z, PRE, NH, GRA), Sanderson 476 (K, NH),  
Wood 5419 (NH), Wood s.n. (No. 7518 in SAM). Inanda,  
Mount Edgecombe, Wood 5783 (K, GRA); Up Park nr. Verulam,  
Wood 1417 (K, NH, BOL). Lower Tugela, Tugela, Wood 11786  
(K, NH).

LOC. INCERT.: S.loc., s.leg. ex Herb. Berol. (W),  
Wood 5783 (P), Barber 340 (GRA). Natal, s.leg. s.n. (W);  
Gueinzius s.n. (BOL). Mahwagua Mts., Evans 232 (NH).

E.tuberculata Bolus:

CAPE PROVINCE: Uniondale, Harlem, Esterhuysen  
6929 (BOL). Humansdorp, Karreedouw, Jeppe s.n. No. 33397  
in TRV (PRE). Port Elizabeth, Cutting s.n. (No. 26706  
in BOL). Uitenhage, nr. Uitenhage, Barker 5104 (NBG);  
Zwartkops R., Pappe 1120 (BOL), Zeyher 3893 (BOL, W). Alex-  
andria, Archibald 5353 (GRA, PRE). Bathurst, E. of Bush-  
mans River, Maguire 541 (NBG); Bathurst Valley, Schönland  
156 (GRA); Bathurst, Holland s.n. No. 1836/26 in Hort.  
NBG (BOL). Albany, Frasers Camp, Barker 6985 (NBG);  
Stones Hill, Rogers 30163 (Z); 2 miles S. of Grahamstown,  
Hall 728 (BOL); nr. Grahamstown, Galpin 289 (PRE), Galpin  
290 (PRE), MacOwan 1046 (K, W, BOL), Zeyher s.n. (E),  
R.W.R. s.n. (No. 26709 in BOL), Gowie s.n. Oct. 1908 (GRA);  
Bothas Hill, Dyer 2246 (GRA); Trumpeters Drift, Compton  
19343 (NBG); 10 miles from Grahamstown on Peggott Bridge

Road, Dyer 1219 (GRA); 24 miles E. of Grahamstown, Barker 7106 (NBG); Flats nr. Grahamstown, s.leg. s.n. (W). Somerset East, Zuurberg, Barker 4933 (NBG). Kingwilliamstown, Blue Stone Quarry, Sim 2 (BOL). Cathcart, Ellerslie, Cottrell s.n. Nov. 1921 (GRA).

TRANSVAAL: Potchefstroom, Klington, Goossens 1615 (PRE). Rustenburg, Zwartruggens, Sutton 941 (PRE). Johannesburg, Schnell s.n. (No. 26708 in BOL). Pretoria, Rietvlei Reserve, Repton 3197 (PRE);  $\frac{1}{2}$  mile E. of Voortrekker Monument, Hall 362 (BOL); Kopje S. of Pretoria, Obermeyer 16 (PRE); nr. Pretoria, Leendertz 281a (PRE), McLea s.n. No. 5819 in BOL (K, BOL); Kopjes nr. Pretoria, Leendertz 281 (GRA), Esterhuysen s.n. (No. 26707 in BOL); Meintjies Kop, Dyer 2514 (PRE), Robertson s.n. (No. 28406 in PRE), Mogg 15293 (PRE), Mogg 16321 (PRE), Smith 3300 (PRE), de Winter 373 (PRE); W. of Groenkloof, Smith 608 (PRE); Groenkloof Valley, Pole - Evans 459 (PRE); Water Tower Hill, Groenkloof, Mogg 15156 (PRE); nr. Louis Botha Home, Smith 860 (PRE), Smith 3243 (PRE); nr. Zoo, Smith 3282 (PRE), Schwieckerdt 999 (PRE); Pretoria University Farm, Codd 3068 (PRE); Koedoes Poort, Franks s.n. No. 10555 in Herb. Dept. Agric. (PRE); Johann Rissik Drive, Codd 4462 (PRE); Curtis Hill, Pole - Evans 142 (PRE); Muckleneuk, Goossens 59 (PRE), van der Merwe s.n. (No. 29049 in PRE); Daspoort Range, Kaplan s.n. No. 26469 in TRV (PRE); Aapies River, Rehmann 4296 (Z), Rehmann 4296a, 4296b (Z).

LOC. INCERT.: S.loc., Ecklon s.n. (W), Drége s.n.

(W), Ecklon & Drége 3893 (W). Cape of Good Hope, Zeyher  
s.n. (W). Brakkloof, White s.n. 22 Oct. 1900 (GRA).

E.welwitschii (Reichb.f.) Rolfe:

CAPE PROVINCE: Tsolo, Chenkwe Mt., Flanagan 3700  
(PRE), Flanagan 2863 (SAM, PRE), Bolus 8736 (Z, BOL).  
Mount Currie, nr. Kokstad, Tyson 1591 (BOL, SAM).

NATAL: Richmond, Arnolds Hill, Wylie s.n. (No.  
23340 in NH). Camperdown, Cato Ridge, Lawson 387 (NH);  
Harrison Flats, Thomas 30 (NH). Pietermaritzburg, Hard-  
ings Vale, Sanderson 826 (NH). Lions River, 25 miles N.W.  
of Pietermaritzburg, Hall 651 (BOL); Karkloof, Schelpe  
3100 (BOL); Lidgetton, Wood 7921 (SAM, NH, BOL); Shafton  
nr. Howick, Hutton 200 (GRA). Umvoti, nr. Greytown, Wylie  
s.n. No. 22366 in NH (PRE, NH). Estcourt, nr. Berlin  
Mission Station, Wood 3420 (NH); Greenwich Farm nr. Riet-  
vlei, Fry s.n. No. 5725 in Herb. Galpin. (GRA). Bergville,  
Cathedral Peak Area, Killick 1810 (PRE), Codd & Dyer 6254  
(PRE); Umlambonja Valley, Schelpe 3123 (BM). Klip River,  
Wessels Nek, Wood 5367 (NH). Newcastle, Ellendale, Sim  
4221 (Z). Vryheid, 24 miles N. of Vryheid, Hall 822 (BOL).  
Mthunzini, Ginginhlovu, Haygarth s.n. (No. 12689 in NH),  
Wylie s.n. (No. 12788 in NH), Wylie s.n. No. 11782 in NH  
(K, NH); Inyoni Leper Institute, Johnson 347 (NBG).  
Hlabisa, False Bay Area, Ward 2730 (NH).

ORANGE FREE STATE: Harrismith, 23 miles S.E. of  
Harrismith, Hall 648 (BOL).

SWAZILAND: nr. Mbabane, Forrester s.n. (No. 49261 in NBG).

TRANSVAAL: Piet Retief, 10 miles S. of Piet Retief, Devenish 328 (PRE). Ermelo, Collins 6339 (PRE); The Gem, Walker 100 (PRE), Walker 102 (PRE); nr. Bankkop, Henrici 1412 (PRE); Spitskop, Pott 5145 (PRE). Carolina, 6 miles S.W. of Badplaas, Hall 827 (BOL). Harberton, Lomati Valley, Thorncroft 1102 (PRE). Belfast, Gunn s.n. Dec. 1932 (PRE). Lydenburg, Schlechter 3940 (W, Z, GRA, BOL). Middelburg, 10 miles W. of Middelburg, Hall 620 (BOL). Heidelberg, 10 miles W. of Heidelberg, Repton 4336 (PRE); nr. Heidelberg, Davy 5630 (K), Leendertz 1038 (K, BOL, PRE), Thode A 1343 (PRE), Codd 2307 (PRE). Vereeniging, Davy 15003 (PRE); Grasmere, Hall 615 (BOL). Rustenburg, Nation 34 (BOL). Potcheistroom, Boskop, Louw 551 (NH, BOL, PRE); Dassiesrand, van der Westhuizen 857 (PRE). Johannesburg, s.leg. Dec. 1898 (GRA); Elandsfontein, Galpin 1428 (GRA, BOL); Auckland Park, Guthrie s.n. (No. 26663 in BOL); Springs, nr. Devon, Reynolds 5831 (PRE); between Delmas and Kendal, Reynolds 5790 (PRE). Pretoria, Irene, Pole - Evans s.n. (No. 2650 in PRE); Rietvlei 10 miles from Pretoria, Foster s.n. (No. 28799 in PRE); 15 miles S.E. of Pretoria, Codd 3626 (PRE); Koedoes Poort, Smith 1616 (PRE), Smith 1629 (PRE); Kuduspoort, Rehmann 4690a (Z); nr. Pretoria, Reck s.n. (No. 26664 in BOL); Zoutpan, van Dam s.n. No. 12747 in TRV (PRE); Brooklyn - Waterkloof boundary, Mogg 16352 (PRE); Trigaardts Poort, van der Merwe s.n. (No. 29065 in PRE); 15 miles W. of Bronkhorstspuit, Hall 619 (BOL);

27 miles N.E. of Bronkhorstspuit, Repton 4693 (PRE). Waterberg, Kaffer Kraal farm, Galpin 133139 (K, PRE), Galpin s.n. (No. 26666 in BOL); 22 miles N.E. of Thabazimbi, Codd 4797 (K, PRE). Pietersburg, Zoekmakaar, Botha s.n. (No. 28800 in PRE).

LOC. INCERT.: S.loc., s.leg. cult. Hort. Elwes. (K), s.leg. (No. 3824 in NH). Natal, Hutton 455 (PRE, GRA); Zululand, Woodward Bros. s.n. (No. 14496 in NH). Transvaal, McLea s.n. (No. 26662 in BOL); Canada, Young 1942 (PRE). Magalisberg, Zeyher 336 (SAM), Zeyher 1588 (W). Waterberg, Pongola R. basin, Davy 18386 (Z, BOL). 24 Rivers, s.leg. No. 20832 in TRV (PRE), s.leg. (No. 68049 in SAM). Natalane Hill, Junod 395 (PRE).

E.zeyheriana Sond.:

CAPE PROVINCE: Maclear, Ugie, Schnell s.n. Dec. 1944 (BOL). Mount Ayliff, Insiswa, Schlechter 6489 (W, Z, P, NH, BOL, GRA, PRE). Mount Currie, Stephany 88 (BOL).

NATAL: Underberg, Rogers 15109 (BOL); Umkomanza R. Valley, Marais 1427 (PRE); Drakensberg Garden, Hall 786 (BOL). Lions River, Dargle, Bews s.n. (No. 15399 in BOL); Karkloof, Schelpe 5098 (BOL); Nottingham Road, Harrison 1 (PRE); Bergville, Cathedral Peak Forest Station, Germishuizen 16 (PRE), Killick 1244 (PRE, BM). Klip River, van Reenen, Wood 11825 (K, NH), Franks s.n. (No. 14191 in NH). Dundee, Hlobane, Johnstone 596 (NH). Weenen, Culvers,

Rogers 28142 (K). Newcastle, Ingogo, Obermeyer s.n. No.  
35937 in TRV (PRE).

ORANGE FREE STATE: Harrismith, Mont aux Sources,  
Flanagan 1984 (SAM).

LOC. INCERT.: S.loc., s.leg. (W), Drège 50 (W),  
Ecklon & Zeyher 8 (W). Krielis country, Bowker s.n. (W).  
Liddesdale, Wood 4264 (K).

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