

The Gibbaeum Handbook

A POPULAR GENUS OF HIGHLY SUCCULENT PLANT



PLATE FOUR

by G. C. NEL

Edited by P. G. JORDAAN, D.Sc. and E. W. SHURLY, F.C.S.S.

THE GIBBAEUM HANDBOOK

☺ **Ivan Boldyrev**, scanning

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THE GIBBAEUM HANDBOOK

A genus of highly succulent plants, native to South Africa

by

The late G. C. NEL

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PREFACE

When Professor Nel died on February 16th, 1950, it was known that his work on *Gibbaeum*, a genus of the succulent *Aizoaceae*, was at an advanced stage and that he was preparing his results for publication. His widow asked me, as personal friend of the family and because I was responsible for teaching the taxonomy of the vascular plants, to take the manuscript under my care, make it ready for the press, and have it published — a task which I gladly undertook but which, unfortunately, was greatly delayed for various reasons.

The first thing to do was to put the pieces of the manuscript together and to find out whether the manuscript was completed. The account of *G. dispar* was very evidently not finished and was completed by Mr. Herre, Curator of the Botanical Garden of the University of Stellenbosch, from published sources. According to the technical assistant who regularly accompanied Professor Nel on his expeditions, there were two species which Professor Nel intended to study further in the field. Unfortunately, it could not, with certainty, be established which species these were. It may have been *G. haagei* Schwant. and *G. tischleri* Wulff. In the bibliography and synonymy of the manuscript *G. haagei* is underlined to indicate that the species is accepted, but nowhere else is there any reference to this species in the manuscript. The underlining of *G. haagei* may be a typing error, but then the synonymy is wanting. This problem, therefore, cannot be solved without further study. The editors have decided to publish a description of *G. haagei*, copied from Jacobsen's Succulent Plants. *G. tischleri* is not mentioned at all in the manuscript, although, according to Mr. Herre, Professor Nel was well aware of its description. It may be that Professor Nel considered that this species ought to be sunk in one of the previously described species, but then he omitted to say to which species *G. tischleri* belongs. Here too, it appears, the problem cannot be solved without further study of the plants concerned. The only

statement that can be made in connection with the above-mentioned two species, is that Professor Nel, who visited all the known habitats of *Gibbaeum* and who had an intimate knowledge of the species in the field, did not succeed in finding these two or any other as distinct species.

Except for the above-mentioned points, the manuscript was undoubtedly complete. The manuscript, however, had to be heavily edited, as any one who had edited his (her) own results after the first write-up, will well appreciate.

I was fortunate inasmuch as Professor Nel had interested Mr. E. Shurly, F.C.S.S., Editor of the Cactus and Succulent Journal of Great Britain, in the publication of the manuscript. I found he was willing to assist me in my task, and it was largely due to his experience as an editor, his knowledge of succulent plants, his contacts and the use of his very extensive library on succulent plants, that the editing of this manuscript was completed.

As editors, Mr. Shurly and I had to make decisions on many points. For many of these decisions we were guided by the previous book of Professor Nel: "Lithops" (University Publishers and Booksellers, Stellenbosch) — a book which is in several respects unconventional in its make-up. Only a few points on which we had to decide, will be mentioned. It would have been more in accordance with general usage to give the bibliography and synonymy with each species. As the bibliography and synonymy was given separately in the manuscript, as in "Lithops," we decided to keep it like that. As far as the writing of specific epithets (second word in the name of a species) is concerned, the decision was to write all with small initial letters, although many had capital initial letters in the manuscript. In "Lithops" the species are alphabetically described and it may be that Professor Nel would have done similarly with "Gibbaeum." It was decided to arrange them according to the key as is the common practice in a work of this kind. In most of the cases the species were originally described in Latin. The manuscript did not contain copies of all these Latin descriptions. As several of the original descriptions are, in any case, in English, the editors decided not to include the few missing Latin descriptions.

In several cases the exact meaning of a sentence was not clear, but

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in all cases we could clear up the difficulty — in most cases by referring to the photographs and other parts of the manuscript. Every precaution was taken not to alter the meaning of what Professor Nel had written. In a few cases it was found necessary to supplement the bibliography and in a few cases the author (or authors) of a species was incorrect. The two authors associated with the name of the genus and the writing of their names, namely *Gibbaeum* (Haw.) N.E.Br., were left as in the manuscript, although N. E. Brown himself wrote *Gibbaeum* Haw. To decide whether any one of these methods of writing is correct, a critical study will have to be undertaken. The correct way of writing may be *Gibbaeum* Haw. ex N.E.Br. or even *Gibbaeum* N.E.Br. if only one author is preferred.

The statement made by Professor Nel in “Lithops” (p. 1) that “the present account is an attempt to place on record such facts as are known, and it must be left to posterity to complete it” can also be applied to “*Gibbaeum*.” Not only the few points mentioned above need further study, but nothing is as yet known about the anatomy, embryology, biology, development and evolution of the genus and species. Professor Nel intended to include the results of the research of Wulff and also those of de Vos on the chromosome morphology, but the results of de Vos became available only after his death (Journ. S. Afr. Bot. 17: 77-81. 1951).

In concluding the remarks on the manuscript a few notes on the place names may lead to a greater appreciation of the book. The *Klein* (Little) Karoo is in the *platteland* or countryside of South Africa and most of the names shown on the map are those of farms. Most of these names are in Afrikaans and the following, with their English equivalents, are some of the words regularly occurring in these place names: *berg*, a mountain, *berge* being the plural; *fontein*, fountain; *groot*, great; *kraal*, pen or fold; *kuil*, pool; *perde*, horses; *rooi*, red; *swart*, black; *vlakke*, plain; *wit*, white. These words are often compounded into names which can be readily understood. For example, *Perde fontein*, *Rooinek*, *Swartberge*, *Witvlakte*. It may be of interest to know that *kinderboudjies*, the name that is sometimes used for these plants, literally means the haunches of a child.

Professor Nel left no special record of the names of those who

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assisted him. In acknowledging the help he and myself received, I trust that I will be pardoned in case names are omitted. The help of the following I heartily wish to acknowledge:

Mr. E. Shurly, the co-editor, for his invaluable help, advice and the compilation of the comprehensive index.

Mr. H. Herre, of Stellenbosch, who has an extensive knowledge of the species under natural and cultivated conditions and of the literature on them, for his assistance in clearing up several points in the manuscript, for checking and supplementing the bibliography and for sorting out the names to be marked on the map and collation of the photographs and drawings.

Miss E. M. Smuts, of the Department of Geology, University of Stellenbosch, for the map of the Klein (Little) Karoo.

Miss H. French, of Cape Town, for the beautiful coloured drawings.

Miss Ursula Jacobsen, of Hamburg, Germany, for the excellent drawings of the capsules.

The Director and staff of the Royal Botanic Gardens, Kew, for permission to publish a letter of Dr. J. Muir and for advice in connection with some of the valid names of species.

Dr. L. Bolus, of the Bolus Herbarium, Rondebosch, for permission to consult plants and literature in the herbarium.

Mr. J. S. L. Gilmour, of Cambridge, for help in connection with the nomenclature.

Mr. A. J. Joubert, of Ladismith, who has an extensive field knowledge of these plants and assisted in various ways.

Mr. G. C. Crafford, the technical assistant, who is responsible for most of the photographs and who, with his knowledge of the Klein Karoo, assisted in various ways.

Mr. L. Kortenhoeven, of George, for material collected.

PREFACE

The many plant lovers in the Klein Karoo who in many ways assisted Professor Nel on his expeditions hunting for these plants.

The University of Stellenbosch which provides special facilities for studying these plants.

The permission to use the University Library in Cambridge and the libraries of the Botany School and Botanical Garden of the University of Cambridge is greatly appreciated.

Professor Dr. H. J. Lam, Director of the State Herbarium (Ryksherbarium), Leiden, kindly went through the page proofs in November, 1952. His remarks, which have been taken into account, were a great help to the editors.

The libraries of the "Ryksherbarium" and "Botanical Laboratory" in Leiden were indispensable in clearing up doubtful points in the galley and page proofs.

P. G. JORDAAN.

Cambridge,
England.

NOTES: *Perdefontein*, a name often mentioned in the book, is not indicated on the map. It is on the bight of the road between Laingsburg and Witvlakte and is about 20 miles from Laingsburg. The measurements of length, which should all be in the metric system, have been left as in the manuscript.

LIFE SKETCH OF THE AUTHOR

GERT CORNELIUS NEL (1885-1950)

The sudden death of Professor Nel on February 16, 1950, was a very great shock to his friends who lived in close touch with him and to those who knew him through his publications on succulents, especially his *magnum opus*, "Lithops." In the summer vacation on January 16th, 1950, while he was still actively and ambitiously engaged on research on the succulent *Aizoaceae*, he was suddenly taken ill and was sent to the Volkshospitaal in Cape Town, where it was soon ascertained that his chances of recovery were very meagre.

Gert Cornelius Nel was born on a farm at Greytown, Natal, in 1885 on Foundation Day (April 6th). In this "Garden Province" of South Africa he was first imbued with his love for the South African veld and flora — a love which grew and became more deeply rooted in Franshoek where he matriculated and in Stellenbosch where he studied for his B.A. degree. At the latter two places in the Boland he came in touch with the botanically rich and varied flora (with its geophytes, Proteaceae, etc.) of the winter rainfall area — a flora very much different from the subtropical and savannah flora he became acquainted with in Natal. He could not have realized at this stage that he should later spend several years in the Orange Free State in the grass steppes (*grasveld*) of South Africa and that his future research would lead him to an intimate experience, love and knowledge of the flora of the vast, arid regions of Southern Africa, such as the Klein Karoo, Groot Karoo, Namakwaland and South-West Africa.

After studying in Halle and Berlin he obtained the Ph.D. degree in 1914 on a thesis on the *Amaryllidaceae-Hypoxideae*, embodying the results of his research under the well-known A. Engler. After filling responsible educational posts in Lindley and Bloemfontein in the Orange Free State, he was appointed in 1921 to the newly-



The late Professor G. C. Nel

LIFE SKETCH OF THE AUTHOR

instituted professorship of Botany in the University of Stellenbosch — a post he held up to his death in 1950 — where he could build on the sound foundation laid by Professor R. Marloth and Dr. A. V. Duthie.

One of the first tasks to receive the attention of Professor Nel was the founding of a botanical garden, and through his endeavours the Botanical Garden of the University of Stellenbosch came into being only two years after he assumed duty as Professor of Botany. He had the good fortune in getting the services of Mr. H. Herre as head gardener and curator who, to a great extent, was responsible for building up at Stellenbosch a collection of succulents of international repute and who collaborated closely with Professor Nel. In the Botanical Garden Professor Nel could study, under close observation, living plants which were collected in their natural habitats by himself and others or which were raised from seeds collected in nature and could so exclude the danger of studying plants that have been unintentionally hybridized by cross-pollination under cultivated conditions.

Administration and teaching, especially during the first years of renewed expansion in the Botany Department, took up much of the time of Professor Nel and it was only about 1930 that he could find time for research. He started off with studying the succulent Euphorbias and the Stapelieae and described many new species and varieties. After the publication of the book of White and Sloane on the Stapelieae (1937) and the book of White, Dyer and Sloane on the succulent Euphorbias (1941), in both of which his authority and research on these plants are acknowledged, he switched over to the succulent *Aizoaceae* — or *vygies* as they are called in Afrikaans — and for the rest of his life he spent on them the time he had available for botanical research.

During the last three decades very many new genera and species of the succulent *Aizoaceae* were described. Many of these descriptions were based on inadequate material and without taking the phyto-geographical and ecological variation of these plants into consideration. Furthermore, no keys for the identification of the species were published. In this way a chaotic state of affairs came into existence and very few, perhaps nobody, could again identify all the plants from the descriptions — often lengthy descriptions in Latin —

occurring in a great variety of books, periodicals and pamphlets published all over the world. To bring the taxonomy of the *Aizoaceae* on a sounder basis a better knowledge of the different species and varieties in their natural environments was essential, as well as keys to the different genera and to the species of each genus. Professor Nel was more attracted to a study of related species and stressed the importance of taking a genus, studying its species carefully and erecting a key. He started with the highly succulent genus *Lithops* and published his results in 1946 in the beautiful book: "Lithops" (University Publishers and Booksellers, Stellenbosch). *Gibbaeum* was the second genus to receive his attention and, if it were not for his sudden death, revisions of several other genera could have been expected as he had already made extensive observations on several other of the highly succulent genera, such as *Dinteranthus* and *Titanopsis*.

Most of the succulent *Aizoaceae* occur in South Africa, where they exist in nature under conditions quite different from that in Europe where much of the research on them had been and is being done. One of the urgent needs in furthering the scientific knowledge of succulent plants is experience of these plants in their natural environments. This need Professor Nel clearly realized and one of his great contributions to the study of South African succulents is the field knowledge of these plants he put on record and tried to incorporate in his taxonomic studies. To study these succulents he made many expeditions and excursions into the arid parts of Southern Africa and in this way obtained a field knowledge of these plants, especially of *Lithops*, *Gibbaeum* and other highly succulent genera, which few, if any, possessed and much of which is lost to botany through his sudden death. Reading his descriptions, as in his book on *Gibbaeum*, is not only enjoyable because these descriptions transfer the reader to the natural habitats of these plants, but his reasoning, attempting to show that many of the described species merge into one another in nature, is an intellectual pleasure. His books, "Lithops" and "Gibbaeum," the first and only two monographs on genera of succulent *Aizoaceae*, are monuments to emphasize the importance of knowing these plants under natural conditions and may well be an inspiration and models for further study of and

LIFE SKETCH OF THE AUTHOR

research on the numerous remaining genera. Not only his two books, but also the genus *Nelia*, the number of specific epithets bearing his name and the great number of plants described by him, will let his name live on in the botanical literature and in the history of the study of succulents.

Several short accounts of the life and work of G. C. Nel have been published in various journals. The most comprehensive of these is the "In Memoriam" by P. G. Jordaan (Tydskr. v. Wet. e. Kuns. 10: 2: 14-22. 1950) who knew the author personally for twenty years and was his colleague for ten years. In that account the services he rendered to other aspects of botany and biology in South Africa are also mentioned.

G. C. Nel was not only a lover and student of succulents and a botanist with a sound knowledge of the fundamentals of his subject, he also possessed a deep and intimate knowledge of human nature which grew from a wide experience and an understanding of all sections and races which make up the population of South Africa. He had a sound philosophy of life, a very good sense of humour and a strong personality. He was kind-hearted, friendly, approachable and intimately interested in each member of his staff. In many respects he had his own ways of doing things, of which the unconventional make-up of his book on *Lithops* is proof.

Professor Nel is survived by his wife, who was Miss F. S. Ashpole before their marriage in 1917, and their son, a lawyer, and two daughters.

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INTRODUCTION

Haworth described (Rev. Pl. Succ. 104. 1821) the section *Gibbosa* of *Mesembryanthemum* and the four species (*gibbosum*, *luteoviride*, *perviride* and *pubescens*) he included in this section, as follows:

16. *Gibbosa*, subacaulia: foliis connatis fere ad medium, difformibus grossissimis laevibus; uno singuli paris gibbose abbreviato, altero apice oblique aucto: calyce sexfido; corollis parvulis hyemalibus roseis; stylis 6. — Genus bonum, et *Gibbaeum* nomen propono.
- gibbosum* M. (great pale gibbous) subacaule: foliis lutescenteviridibus patentibus ovatis semicylindricis, apice rarissime carinatis. Nob. in Syn. succ. p. 226.
62
- luteoviride* M. (long pale gibbous) caule debili 2-3 entali, foliis oblongis semicylindricis, superne triquetris luteoviridibus. Nob. in Syn. succ. 226.
63
- perviride* M. (dark green gibbous) caule debili 3-4 unciali; foliis semicylindrico-triquetris subovatisve perviridibus. Nob. in Syn. succ. 227.
64
- pubescens* M. (hoary gibbous) foliis pubescenti-canis sericeisve laevibus. Nob. in Syn. succ. 227.
65
- Obs. Forma praecedentis, subsericio-canum, oculo armato pubescens; caulis debilis trientalis, foliis semicylindricis obliquis obtusisque, apicibus ut in affinibus.

From the above it is apparent that Haworth considered the species forming this section should be separated and form a new genus *Gibbaeum*, “a good genus, I propose the name *Gibbaeum*” to quote his own words.

Curiously enough, a century had to elapse before the genus was elaborated by Dr. N. E. Brown under Haworth’s proposed name *Gibbaeum*. This author, in 1922, gave a fuller description of the

INTRODUCTION

genus, partly from the account given by Haworth and partly from living material. The genus thus constituted comprised the four species of Haworth's section *Gibbosa* and, in addition, he described *G. shandii*, *G. geminum* as new species. Later he added several new species (*G. album*, *G. dispar*) to the above list.

During the period 1921-40, systematic botanists, following the example of N. E. Brown, created a large number of new genera out of the old Linnean genus, *Mesembryanthemum*. There was literally a race for priority in describing new genera and quite a large number were uncritically described on inadequate material and, frequently, so insufficiently that they could never be recognized again. At one time, there were no less than 144 genera (von Poellnitz in 1933), a number that rose to about 178 later. Fortunately, quite a number of these pseudo-genera have been dropped, but the taxonomy of the succulent *Aizoaceae* is still in a chaotic state. This is partly due to (I) the insufficient data supplied in the description of some of the genera, and (II) the difference between the various genera were not clearly stated.

Frequently the name of a new genus only appeared in a key.

This state of affairs is also largely due to the fact that these descriptions were not accompanied by adequate illustrations. It need hardly be emphasized that it is sometimes very difficult, if not impossible to describe these highly succulent and very variable plants adequately and in such a way that the name of a specific plant can be determined and not leave a certain amount of doubt as to its true identity as they frequently show only very slight morphological differentiation.

In this re-arrangement and re-grouping of the *Mesembryanthemum* species (Linnean and later), several new species belonging to the *Gibbosa* section (*M. heathii*, *M. angulipes*, *M. cryptopodium*) were transferred to the new genus, *Gibbaeum*.

Due to the prevailing tendency to create new genera, several were formed (I) from existing *Mesembryanthemum* species (*Rimaria heathii*, *Mentocalyx velutinus*) or (II) new species were placed under new genera (*Argeta petrensis*, *Imitaria muirii*). The result was that species, which in reality formed a fairly homogenous group, were distributed amongst five genera (*Argeta*, *Gibbaeum*, *Imitaria*, *Mentocalyx*,

Rimaria). The pendulum had evidently swung too far and, in course of time, these genera were merged in the genus *Gibbaeum* and that is how the matter stands for the present.

The monotypic genus *Muiria* (*M. hortenseae*) should also be included in the genus *Gibbaeum*, but, due to its peculiar appearance and mode of growth and flowering, it can safely, for the present, be retained as a separate genus.

Wulff has adopted Schwantes' suggestion to elevate *Mesembryanthemum fissoides* Haw. to generic rank as *Antegibbaeum fissoides* (Haw.) Schwantes on account of its growth form, presence of disc, and size of seed. I am not prepared to attach too much importance to the last two characters. There remains the question of the general appearance of the plant. While it may be true that as regards its general appearance, especially in the field, one could be tempted to hold that it does not seem to resemble any of the other *Gibbaeum* species, it must not be lost sight of that it differs from *Gibbaeum pachypodium* only to a certain amount and whether this difference is sufficient to create a new genus will, I presume, remain a matter of opinion and taste. I personally, after examining quite a number of these two species in the field, am not prepared to go so far.

The subterranean part of the plant consists frequently of a very stout hard woody rootstock (*G. heathii*, *G. gibbosum*, *G. velutinum*, *G. pubescens*, *G. schwantesii*), which may be 6-10 cm. in diameter at its upper end. This rootstock does not penetrate very deep into the soil, at most about 20 cm. In other cases, the rootstock is very poorly developed. That of *G. nebrownii* has been considerably reduced due, probably, to the occurrence of this species between shale layers in which it apparently thrives best, since it is only found in these layers. The rootstock is about 2 cm. long and about 2-4 mm. in thickness, with a tuft of roots at its lower end. The rootstock of this species is usually flattened and plate like, due most probably to the pressure of the upright shale layers. Roots are very sparsely developed on the rootstocks of most species.

In most cases, at the upper end of the rootstock, numerous branches are developed, each ending in a pair of sub-equal, or very unequal leaves and consequently forming a short shoot. Each branch constitutes a growth or body.

INTRODUCTION

In the evolution of the genus, it seems that the development has proceeded along two more or less divergent, if not diametrically opposite lines. In quite a number of cases (*G. heathii*, *G. cryptopodium*, *G. gibbosum*, *G. petrense*, *G. pilosulum*) the development in length has, as it were, been arrested with the result that at the upper end of the rootstock a congestion of the bodies or growths has taken place. This has led to the formation of a more or less compact clump. This clump may, at times, be very massive, consisting of twenty to thirty closely packed growths attaining a diameter of 30 cm. In some cases (*G. heathii*, *G. cryptopodium*, *G. pilosulum*) the growths are so closely packed that the plant seems to consist of one solid mass of leaves. It is only with very great difficulty that the individual growths can be separated from one another. In this particular group the leaves are connate (united at base), with, at times, only a slight fissure at the top.

In the case of some species (*G. geminum*, *G. angulipes*) the development has gone in another direction more or less opposite to that described above. Here, the branches have remained separate and free from one another and have spread out more or less uniformly in all directions from the main axis with the resultant formation of prostrate forms. Instead of a massive clump, the plant has become flattened with spreading branches. These prostrate branches, in turn, give off upright branches of unequal length, which may branch again. In this case the plant consists of a number of growths quite free from one another. Some of the prostrate branches in *G. geminum* develop adventitious roots at the nodes, where the upright branches are given off. These branches are of unequal length. These branches end in a pair of very unequal leaves which are connate up to the full length of the shorter leaf. The secondary branches nearest the main axis are longer than those further away.

Between these two extremes just described lie, on the one hand, plants like *G. fissoides* and *G. pachypodium*, where the growths are upright, free from one another and, at the same time, the leaves are still more or less free from one another. The plants have, therefore, a bushy appearance. On the other hand, in *G. velutinum* and *G. schwantesii*, the growths are a loosely packed compact body, but not to any extent, as in the group represented by *G. heathii*. The leaves of the latter group are solidly spherical, ovoid to deltoid, whereas

those of *G. velutinum* group are flat. In *G. velutinum*, *G. schwantesii* the leaves are more or less separate and free from one another and only connate towards the base.

Each growth consists of two sub-equal leaves (*G. heathii*, *G. cryptopodium*, *G. pilosulum*, *G. fissoides*) or the leaves may be very unequal, the one being much longer than the other (*G. velutinum*, *G. geminum*, *G. pubescens*, *G. gibbosum*). The leaves are wholly or partly connate and in *G. fissoides* they are only slightly connate at the base. The leaves are united to form a body which may be :

- (i) a spherical, obliquely ovoid, or oblong-ovoid body, with a fissure which may be small or narrow and which may be oblique or not, with or without a keel (*G. heathii*, *G. album*, *G. cryptopodium*, *G. pilosulum*);
- (ii) sub-cylindric with two very unequal leaves, fissure below the middle of the body, and shaped like a shark's mouth (*G. geminum*, *G. pubescens*, *G. shandii*);
- (iii) of two very unequal leaves, the larger one more or less triquetrous (three angled) with a triangular flat upper boat-shaped end (*G. velutinum*, *G. schwantesii*);
- (iv) of two unequal leaves, both sub-cylindric, the larger one acute finger-shaped, the fissure quite distinct (*G. gibbosum*); or
- (v) of two more or less free, sub-equal, upright, semi-terete to triquetrous leaves (*G. fissoides*, *G. pachypodium*, *G. angulipes*).

The leaves are acute, obtuse or sometimes flat on the upper part, light to dark green, glaucous green, reddish, metallic grey, yellowish green, whitish to silver white, grey white, glabrous to minutely pubescent, to covered with long white flexuous hairs which may remain free or they may form a thick tomentose covering with the hairs pointing downwards.

Flowers solitary, pedicellate (stalked), bractless. Calyx: six sepals, free. Corolla: petals numerous, free, light red, red, white, staminodes (non-functional stamens) present. Stamens numerous, erect. Ovary usually 6-8 locular, seldom up to 11 loculi (*G. heathii*), placentas on outer wall or floor of ovary chamber.

Capsules same number of chambers as ovary, valves with expanding keel, the latter diverging from the base and shorter than the valves, with broad membraneous obtuse marginal wings produced nearly, or quite to the tip of valve.

GEOGRAPHICAL DISTRIBUTION

The Ladismith Karoo is an intermontane basin and in this area the genus *Gibbaeum* has attained its maximum development. On the southern side the Langeberge Range cuts this area off from the moisture bearing winds from the southern part of the Indian Ocean during the summer months and from the prevailing north-westerly winds from the southern Atlantic during the winter months. On the northern side, the Witteberg Range, continuing into the Swartberg Range (Towerkop 7,008 ft.) cuts the Ladismith Karoo off from the north. In between these mountains, mainly in its western part on the upper reaches of the Touws River, are found plains, e.g. Groot Vlake. The rest of the basin consists of more or less undulating hills. Two fairly large rivers, Touws River and Buffels River, later join and become the Groot River. The latter eventually flows into the Gouritz River. The basin is, therefore, fairly well drained. These rivers are, as a rule, dry except after a heavy rainfall when large quantities of soil and water are carried down to the ocean.

The Great Karoo became desiccated in late tertiary times and lost most of its soil cover, whereas the N.W. Little Karoo has been much more protected against soil and sheet erosion.

The Touws River is the oldest river, geologically. The Oudtshoorn Karoo is a later physiographic addition to the Little Karoo.

The genus *Gibbaeum* has evidently found, within a part of the Little Karoo (see map), favourable edaphic (soil) and climatic conditions for its development. Within a relatively and fairly uniform area of 85 miles long by about 25 miles broad, all the species are found. The genus is not confined exclusively to this area since *G. heathii* is found on the Laingsburg-Sutherland road and also at Perdefontein in the Swartberge. *G. gibbosum* again has escaped from this area and appears near Touws River Station, Matjiesfontein and in the Ceres Karoo (Kareehoek, Southpan, Koppies) and about twenty miles from Laingsburg on the Laingsburg-Sutherland road.

Another species, *G. cryptopodium*, occurs at Sebra about midway between George and Oudtshoorn, just on the border of the Little Karoo. It is a matter of opinion whether this genus has arisen within the confines of the Little Karoo and that the above species have escaped from this area, but have not been able to spread further, or whether one must assume that *G. heathii* or *G. gibbosum*, or plants related to these, were the ancestors of the present species and that these have wandered downstream (along the Buffels River) to their present favourable habitats. *G. gibbosum* has crossed the water shed of the rivers flowing to the Indian Ocean and takes up an abode, however precarious, on the rivers flowing into the Tangua and eventually reaching the Atlantic Ocean by the Doorn River (not the Doom River shown on the map).

On examining the distribution of the individual species, it appears that they fall into two fairly distinct groups:

A. Localized distribution

G. album
G. petreuse
G. velutinum
G. schwantesii
G. angulipes
G. dispar

B. Wide distribution

G. heathii
G. pubescens
G. fissoides
G. cryptopodium
G. gibbosum
G. shandii
G. geminum
G. nebrownii
G. pilosulum
G. pachypodium

All the species, with the exception of *G. dispar*, of localized distribution, are confined to relatively very small areas, sometimes about a mile square and in one particular case (*G. schwantesii*) to an area of about 100 sq. yds.

G. album and *G. petrense* are found growing in closest proximity to one another on a hillock covered with quartz pebbles, etc., together with *Muiria hortenseae*, *Conophytum*, *Crassula columnaris*. *G. album* and *G. petrense* are confined mainly to the northern slope of the hillock, whereas, higher up, *Muiria hortenseae* predominates. The area in question can be hardly as large as an acre. About a mile further on towards the west, *G. album* and *G. petrense* are again found

GEOGRAPHICAL DISTRIBUTION

spread over a slightly larger area and spread more widely apart, and here *G. velutinum* is fairly common. These three species are found on Springfontein Farm, Riversdale Division. Both localities are approximately a mile or two from the crest of the Langeberg Range. *G. velutinum* has also been located on the Muiskraal-Van Wyksdorp road, fairly close to the above mentioned mountain range. Here it is very rare.

G. schwantesii is another very localized species and it seems to thrive best in fairly deep alluvial soil, where it forms beautiful and large clumps together with *Euphorbia suzannae* and *G. fissoides*. The vegetation here consists of shrubs and isolated trees. This species, like *G. album*, *G. petrense* and *G. velutinum*, seems to thrive best within a mile or two from the Langeberge, as they disappear as one travels further inland and away from the mountain range. If one drew a line parallel to and distant about two miles from the Langeberge, then *G. album*, *G. petrense*, *G. schwantesii*, *G. velutinum* and *G. angulipes* will not be found outside this area.

During a visit to this locality in December, 1948, a cold, moist southerly driving wind was blowing. This wind came from the Indian Ocean and blew from the mountain. The amount of rain in this wind was just about sufficient to moisten the upper layer of the soil. Further inland, on that particular day, there was no rain at all. It should be remembered that this wind blows very frequently, as it is the prevailing wind from the ocean. This wind is laden with moisture and the result is that the rainfall just behind the mountain is higher than further inland. Proof of this is that during the winter months and until late in the summer, the mountain streamlets always contain water. The farms within this area have permanent springs to supply them with drinking water. It stands to reason that these small quantities of rain, which fall frequently, but irregularly, must have an appreciable influence on the highly succulent plants. It must also be borne in mind that the temperature changes as suddenly. On the particular day in December, 1948, it was bitterly cold and a few days later the temperature had again run between 90 and 100 deg. F.

On the farm Phisantefontein, Riversdale Division, on which *G. schwantesii* is found, *G. angulipes* forms extensive mats on the

stony slopes and tops of hillocks common in this area. This species not only forms these mats, but is fairly frequent within an area of about a square mile.

Gibbaeum dispar occurs near the banks of the Groot River from Van Wyksdorp along the so-called Kromkloof. Curiously enough it seems to prefer the southern side of the river, and is usually not found further than about 500 yards from the river. So far, it has not been located on the northern bank. It is the only species which does not grow together with any other species of *Gibbaeum*. *G. heathii* is found higher up along the banks of the same river, but about fifteen miles separate the two species. *G. dispar* frequently, like *G. nebrownii*, forms only one body. In other cases, it tends to grow into a more or less compact clump, consisting of six to ten growths. It develops its body above laminated shale. At some places *Glottiphyllum* sp., *Crassula columnaris*, *Stapelia* sp. and *Aloe variegata* are found in the same vicinity. So far, this species is confined to the banks of the Groot River for a distance of about six to eight miles. Further upstream it disappears.

Gibbaeum pachypodium occurs in the vicinity of Ockertskraal and further up along the banks of the Touws River. About six miles separate these two localities. In both these localities the plant grows among large loose stones in not very deep soil and forms, in both places, a colony about an acre or two in size.

A species, nearly allied to *G. dispar*, is *G. nebrownii*, and yet they are about forty miles away from one another. The type of its habitat is more or less similar to that of *G. dispar*. *G. nebrownii* is found in the vicinity of Karreevlakte and also at Dammetjies. The shale hillocks, on which it seems to thrive best, consist of laminated shales and are entirely devoid, at times, of any other vegetation. They are quite bare and *G. nebrownii* is embedded in the soil and only the top surface is exposed. During the hot summer months, it is withdrawn into the soil and one only sees a brown membrane, the remainder of the old leaves, and is, consequently, very difficult to find. It resembles a *Lithops* or an *Ophthalmophyllum* in this respect. It is squeezed into the crevices between the slate layers. It should be borne in mind that the rainfall at Karreevlakte is appreciably less than at Van Wyksdorp.



Figure 2. The Langeberge (on the south side of the Little Karoo) taken from Phisantefontein in April, 1949

GEOGRAPHICAL DISTRIBUTION

The most widely distributed species are *G. heathii*, *G. cryptopodium*, *G. gibbosum* and *G. fissoides*. *G. heathii* is found on the Dwyka and Ecca series on the Laingsburg-Sutherland road. It then appears again at the foot of the Swartberge, near Perdefontein and sporadically between this locality and Witvlakte, where it grows in large numbers together with *G. pubescens*. On the great plain, Groot Vlakte, it resembles in appearance, mode of occurrence (sunk into the ground) and size with the form found at Perdefontein. As a rule, it seldom forms a clump, but is usually only one and, at most, two bodies to a plant. In the more or less central part of the Little Karoo, near Warmbad, the species has evidently found ideal conditions for its development. The clumps bear a large number of bodies, which show all gradations in size and the number of clumps runs into hundreds within a small area. For a distance of about ten miles on the road Warmbad-Hondewater, quite a number of such areas can be observed, each with a large number of clumps. The soil is fairly loose and loose stones are, at times, frequent. In this particular locality, *G. pubescens* and *G. shandii* are found forming large colonies or growing socially with *G. heathii*.

At a particular locality, Koeniekuil, in an area of hardly a square mile, no less than five species are growing together, *G. geminum*, *G. heathii*, *G. pubescens*, *G. pilosulum* and *G. cryptopodium*. The predominant species here is *G. geminum* which covers every part of this interesting spot, as it forms large mats. On the banks of the Touws River, between the main roads Barrydale-Ladismith and Ladismith-Riversdale, *G. heathii* is fairly common and somewhat lower down the river it re-appears at Stofvlei, near Van Wyksdorp. Adamskraal, Ockertskraal and Algerynskraal are all more or less near the Touws River. At Algerynskraal it reaches its furthest point away from the Langeberge. *G. heathii* then re-appears near Calitzdorp in the Enon series. From the above, it is apparent that this species has spread itself over a large area. *G. heathii* has evidently not been able to develop within the immediate vicinity of the Langeberge, as its nearest point is about ten to fifteen miles from the mountains.

Gibbaeum gibbosum is confined to the western part of the Little Karoo (Ratelfontein, Dammetjies, Groot Vlakte and Hoekvanden-

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berg) and is found near Touws River Station, Matjiesfontein and in the Ceres Karoo about thirty miles from Laingsburg.

Gibbaeum cryptopodium, while not so widely distributed as *G. heathii*, still shows an interesting distribution as it reaches furthest east of all the representatives of this genus at Sebra in the Table Mountain sandstone. Its furthest point west is at Rooinek in the Swartberge, and in the Little Karoo it is found at Lemoenshoek together with *G. pubescens*, at Dammetjies with *G. gibbosum* and at Koeniekuil as mentioned above.

Gibbaeum pubescens is confined more or less to the western and southern part of the Little Karoo. It forms a large colony at Lemoenshoek, together with *G. fissoides*, *Euphorbia suzannae*, *Crassula columnaris*, on a hillock covered with quartz pebbles, etc., but has invaded the level parts where it thrives well together with *G. cryptopodium*. About fifty to sixty miles from this locality these three species are again found growing together on a similar hillock as the above near Allemorgens Station. This hillock, with its loose quartz pebbles, differs entirely from the rest of the surrounding country and is a kind of an island, not only in appearance, but also as regards the type of vegetation it carries. Between Warmbad and Bellair Dam and near Karreevlakte, *G. pubescens* is frequently found either forming extensive colonies or with *G. heathii*, *G. shandii* and occasionally with *G. cryptopodium*. This species is also found between Dammetjies and Karreevlakte with *G. cryptopodium* and at Witvlakte with *G. heathii*. *G. pubescens*, *G. cryptopodium* and *G. fissoides* are species which thrive near the Langeberge, but also grow further inland.

G. fissoides is another species which is fairly widely distributed.

The following table will indicate to what extent the species are growing in immediate proximity to one another:

| | |
|------------------------|------------------------|
| <i>Lemoenshoek</i> | <i>Phisantefontein</i> |
| <i>G. pubescens</i> | <i>G. schwantesii</i> |
| <i>G. fissoides</i> | <i>G. fissoides</i> |
| <i>G. cryptopodium</i> | |
| <i>Allemorgens</i> | <i>Dammetjies (I)</i> |
| <i>G. pubescens</i> | <i>G. nebrownii</i> |
| <i>G. fissoides</i> | <i>G. fissoides</i> |
| <i>G. cryptopodium</i> | <i>G. cryptopodium</i> |

GEOGRAPHICAL DISTRIBUTION

Koeniekuil

G. pubescens
G. geminum
G. heathii
G. pilosulum
G. shandii
G. cryptopodium

Bakoond

G. pubescens
G. heathii
G. pilosulum
G. cryptopodium

Warmbad

G. heathii
G. shandii
G. pubescens

Ratelfontein

G. pubescens
G. fissoides
G. cryptopodium

Dammetjies (II)

G. pubescens
G. cryptopodium

Calitzdorp

G. heathii
G. cryptopodium

Groot Vlakte

G. gibbosum
G. cryptopodium

Springfontein (I)

G. album
G. petrense
G. velutinum

Muiria hortenseae

Springfontein (II)

G. velutinum
G. fissoides

Key to the species of Gibbaeum (Haw.) N.E.Br.

- A. Leaves more or less as long as broad
- a. Plants glabrous
 - I. Top of plant flat or rounded, body round 1. *G. heathii*
 - II. Top of leaf with a definite keel, body angular
 - x. Body white .. . 2. *G. album*
 - xx. Body greenish to greyish 3. *G. petrense*
 - b. Plants pubescent
 - I. Plants usually greenish yellow, with either white silky hairs or short white hairs (sometimes only sparsely at sides)
 - x. Hairs long, silky at apex 4. *G. pilosulum*
 - xx. Hairs short, sparse .. 5. *G. cryptopodium*
 - II. Plants definitely greyish velvety
 - x. Top of plant usually flat or round, fissure minute 6. *G. nebrownii*
 - xx. Top of plant angular with keel, fissure oblique .. 7. *G. dispar*
- B. Leaves very unequal and usually 2-5 times as long as broad
- a. Plants glabrous
 - I. Plants forming compact clumps with apical part of larger leaf finger like, upper basal part deltoid, leaves unequal, glands separate 8. *G. gibbosum*
 - II. Plants bushy, upright, leaves finger like (terete), leaves sub-equal, disc (glands) ring shaped 9. *G. fissoides*

KEY TO THE SPECIES

- b. Plants pubescent
 - a. Leaves entirely connate, fissure present
 - I. Leaves thickly tomentose with hairs pointing downwards 10. *G. pubescens*
 - II. Leaves with short straight hairs
 - x. Plants forming a clump 11. *G. shandii*
 - xx. Plants prostrate .. 12. *G. geminum*
 - b. Leaves partly connate at base only
 - I. Leaves triquetrous
 - x. Plants upright, bushy 13. *G. pachypodium*
 - xx. Plants prostrate .. 14. *G. angulipes*
 - II. Leaves broad, boat shaped, curved at apex
 - x. Plants greyish in appearance .. 15. *G. velutinum*
 - xx. Plants yellowish-greenish 16. *G. schwantesii*

1. *Gibbaeum heathii* (N.E.Br.) L. Bol.

Acaulis. Folia 2 vel 4; si 2 erecta et in corpus 3-4½ cm. altum, 2-3 cm. latum et 15-20 mm. crassum, compresso-ovoideum vel oblongum obtusum ad medium vel ultra fissum connata; si 4 inferiora subpatula, glabra albida vel albo-virentia. Pedunculus foliis subaequans, compressus, 10-13 mm. latus. Calyx 7-8 lobus, glaber; lobi 6-8 mm. longi, 3½-5 mm. lati, oblongi vel ovati, obtusi. Corolla ad 4 cm. diametro; petala numerosa, 3-4 seriata, libera, 1½-2 cm. longa, ½-1½ mm. lata, linearia, obtusa, alba. Stamina numerosa in annulum erecto-patentia.

Plants forming compact sub-globose clumps 15-30 cm. in diameter, frequently well above the soil or smaller clumps well embedded in the soil with only the top exposed. Sometimes the plant consists of a single body embedded in the soil so that only the top surface is exposed. Growths closely packed on a stout woody rootstock. Growths varying in size from about 8 mm. to 6 cm. in diameter and from a few millimetres to about 6 cm. in height, sub-globose, compressed obovoid, or semi-elliptic, with the two sub-equal to equal leaves closely pressed together and showing a definite fissure of varying width and depth, usually just a line where the two leaves meet, leaves connate, sometimes up to three quarters of their length, top of leaves round or sometimes slightly keeled, completely entire, glabrous, uniformly whitish, white greyish, metal grey to pale glaucous green, green, sometimes tinted yellowish, purplish or sometimes quite reddish (this latter colour probably indication that clump is shrivelling off).

Pedicel stout, equalling or slightly exceeding the growths, flattened with acute edges, 1-1.2 cm. long. Calyx usually six, seldom seven; the two longer are 6 mm. long, 4 mm. broad, glabrous, hooded apex, rounded; the other four have membraneous edges and are oblong, obtuse, 4-5 mm. long.

Flower single, 1-3 cm. in diameter, petals numerous, 6-15 mm. long, 1.5 mm. broad, obtuse, emarginate or slightly acute, light reddish or white, sometimes with delicate 2-3 lines, linear; stami-

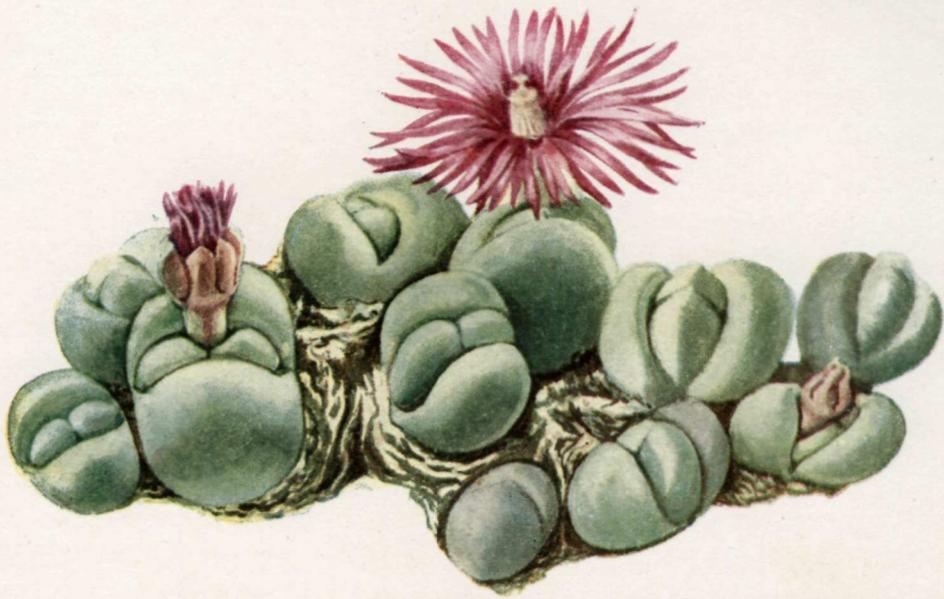


PLATE ONE

Gibbaeum heathii

nodes longer than stamens; filaments slightly papillate (small protuberances), 6 mm. long, anthers yellow; glands 6, crenulate (finely notched), dark green; ovary convex, stigmas 6-11, 3 mm. long; capsule about 1.4 cm. in diameter.

Gibbaeum heathii was described by N. E. Brown as a new species in 1920. Subsequently, in Gard. Chron. (1926. 1. p. 135, fig. 66 and 67) a further description was given and a photograph and drawing of the flower were given. Later, L. Bolus described the following:

- (i) *Gibbaeum luckhoffii* (1931).
- (ii) *Gibbaeum comptonii* (1932).
- (iii) *Gibbaeum blackburnii* (1937).

The same author described furthermore two varieties: *G. heathii* var. *elevata* and *G. heathii* var. *major*.

It is to be deplored that, in describing the new species, L. Bolus made no reference to the relation of these new species and varieties to the existing species, *G. heathii*, as conceived by N. E. Brown. What relation these species bear to one another and in what way they are supposed to differ is not mentioned. The reader is left to make out as best he can, from the copious Latin descriptions, in what particular characteristic or points they differ from the original *G. heathii* and from one another. To my mind there is only one species, viz. *G. heathii*, and that it is impossible to find any marked difference between the three described by L. Bolus and also in what way they differ from *G. heathii*. *G. heathii* is a variable species and its vegetative features are not constant.

For a closer examination of the number of carpels in the ovary of *G. heathii*, numerous flowers and capsules were examined in the field. It appears that the following numbers occur: 6, 7, 8, 9 and in no single case was the number 14 found, and the most frequent numbers were from 6 to 8, mostly 7 and 8. The attempt to found a distinct genus, *Rimaria*, on this characteristic, therefore, falls away.

During April, 1948, no less than ten different localities where *G. heathii* is found in the Little Karoo and one in the Laingsburg area were visited by three of us. Some of these places are more than one hundred miles apart. In some of these localities hundreds of clumps are growing and some of these are very large. On the Warm-



PLATE TWO

Gibbaeum heathii

bad road this species is found on and off for a distance of over ten miles and there are numerous clumps. A careful examination of the plants *in situ* was made by us and we had ample opportunity to discuss the differences between the various plants, having the plants actually before us in large numbers. It is quite obvious that, when these plants are critically examined, one can only come to one conclusion and that is there is only one species, *G. heathii*, with a very wide variation in its morphological features.

The whole question of the description of a new species is intimately bound up with the conception of what a species is by the individual who describes the new species. It is my considered opinion that, in order to avoid the unnecessary multiplication of species and the attendant confusion, one has to be doubly careful in describing new species from these highly succulent plants. Very frequently these plants show such slight morphological differentiation of their vegetative organs that no weight can be attached to the appearance of their organs. After all, the idea of giving a specific name to a plant is to enable anyone to find and recognize the plant, either in the field or in the live state. Consequently, one should be very critical of the characteristics on which a species is based and it should be specifically stated in what respects the new species differs from the existing ones.

If one set out to describe a new species from plants found in one of the many localities in which *G. heathii* is to be found, it could only be done by basing that description of the new species on constant and distinct differences in one or more of the following:

- (i) Shape of growth or body;
- (ii) Colour of body;
- (iii) Size of body;
- (iv) Presence or absence of keel on body;
- (v) Colour of flower;
- (vi) Structure of flower, fruit.

(i). *Shape of body.* From the various photos, it appears that the body is more or less regular in form. It is more or less globular or elliptic, globose or elliptic-ovoid, sometimes compressed at the sides. Most of the bodies have a smooth surface, others frequently



PLATE THREE

Gibbaeum heathii

have an irregular, somewhat triangular depression near the apex. It is quite obvious that a plant with such a regular body would tend to show so many gradations which gradually merge into one another, that it becomes difficult, if not impossible, to draw any line between the various forms.

One has to bear in mind that the plant consists of a number of short branches forming a clump and at the end of the branch is a pair of more or less connate leaves, which constitute the body or growth. If one attempted to put into simple language the differences between any two forms, one at once realizes the impossibility of the task. Consequently, no description, however minute and accurate of any particular plant, nor any number of drawings, would enable one to find this particular plant, when mixed with others, from a number of other plants of *G. heathii*. After all, the description of a new species is not the only task of the trained botanist. That, in itself, is a very simple matter. The difficulty begins when the points of differences have to be stated in such a way that one can find the new species. In this particular case, one has a spherical body. This body shows no markings of any kind. There are no hairs, no teeth. In examining hundreds of plants it became quite evident that the form of the body is useless to differentiate species and any attempt to make use of it only leads to confusion.

(ii) *Colour of body.* In a large population the colour of the body varies from green, light green, light green with a yellowish tint, grey (gun metal) to greyish green and, finally, green or grey with a tinge of red. If the above colours had been observed in, say, April, then when the same plants are examined again in December one can hardly believe that you have the same plant before you. In the latter period they are in the dormant stage. This just shows how careful one has to be. Bodies showing a red colouration are usually attached to clumps in the state of shrivelling or dying off. The colour of the body varies according to the degree of turgidity of the plant. Plants growing under a bush, where they are protected against insolation (sun's rays) and desiccation, are usually more turgid and greener than those growing out in the open which show signs of wilting and are then whitish with a certain amount of suffused green, if the soil is dry after a long drought. One cannot lay down a general

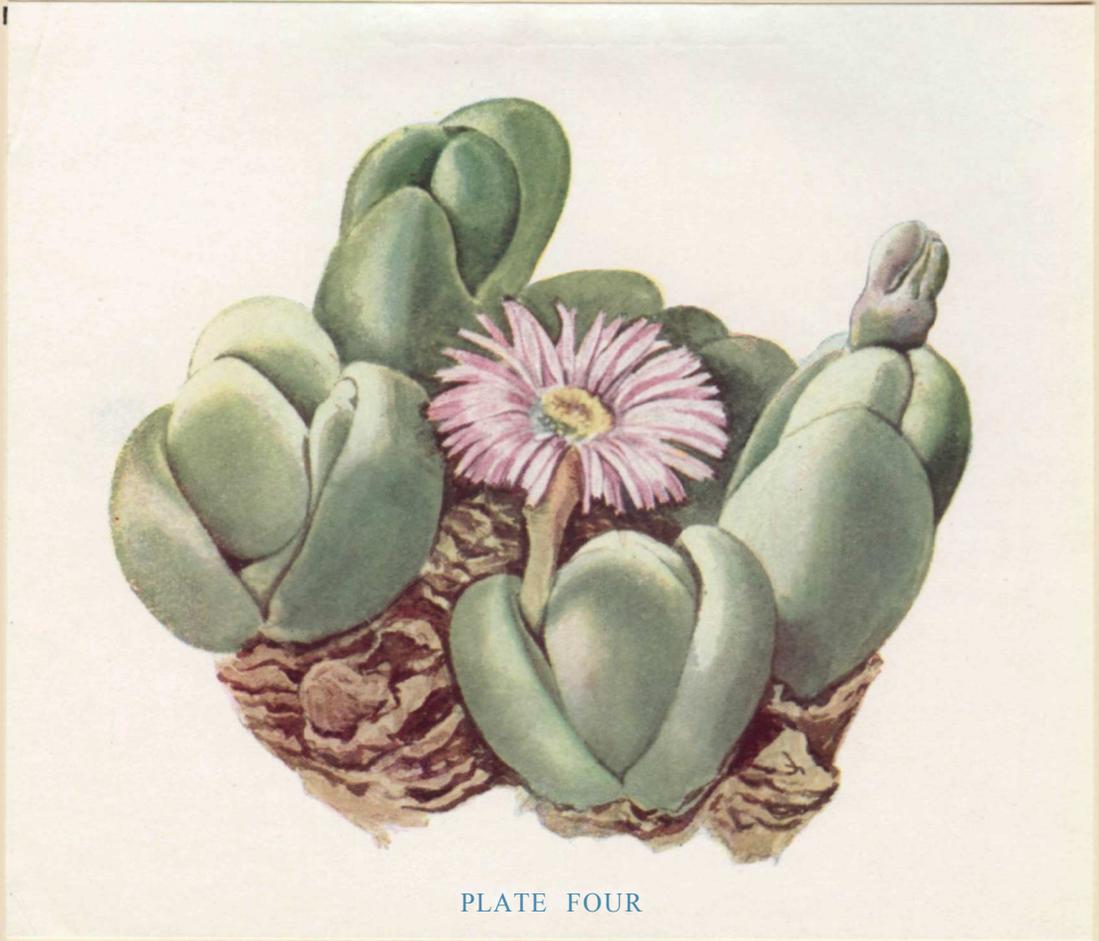


PLATE FOUR

Gibbaeum heathii

rule for these plants, because you will find plants growing fully turgid a few paces away from those indicating signs of wilting. Colour in this species is far too variable and the colour gradations are so delicate and gradual that one cannot use it to distinguish one species from the other, nor any of its varieties. One need only examine the plants in the locality where the species described by L. Bolus as *G. blackburnii* grows to see that, although some and probably the majority of the plants growing there are of a "natural grey or pink colour," quite a number of clumps show the typical green body too. Furthermore, this natural grey or pink colour is found in plants growing profusely together with plants of all possible colours miles away from the locality of the supposed *G. blackburnii*.

(iii) *Size of body.* L. Bolus has described two varieties (a) *G. heathii* var. *major* and (b) *G. heathii* var. *elevata*. From the three photographs accompanying the descriptions, it seems that especially *G. heathii* var. *major* is based on the abnormal size of the body. *G. heathii*, as a rule, forms clumps of a varying size 15-30 cm. in diameter and with a varying number of growths (20-30) to each clump. It does occur, although very seldom, that the number of bodies forming a clump may be reduced to one or, sometimes, two to three only. On examination of such a clump, it appears that frequently only one or a few of the branches are left and, in this particular case, although not necessarily so, the body tends to become enlarged above the normal. The other branches have died off and it stands to reason that all the nourishment from the soil is now available for one branch. It is quite clear that the single plant shown as *G. heathii* var. *major* is not a normal one. It frequently happens that lay collectors just choose one abnormal plant and pass it on to somebody to describe. The locality at Ockertskraal was visited by the author and it is true that some of the plants, but not all, are large ones. At Warmbad you can find many large plants growing amongst others of all sizes. One is not justified in selecting a few large ones of them in describing new varieties.

N. E. Brown published a photograph of *G. heathii* (Gard. Chron. 1926. 1. fig. 67. p. 135) which is misleading. *G. heathii* is a plant forming a clump and the species cannot be judged adequately by a photograph of a single body, or three bodies as in the above photo-



Figure 3. *Gibbaeum heathii* in natural habitat near Stofkraal se nek, near Van Wyksdorp

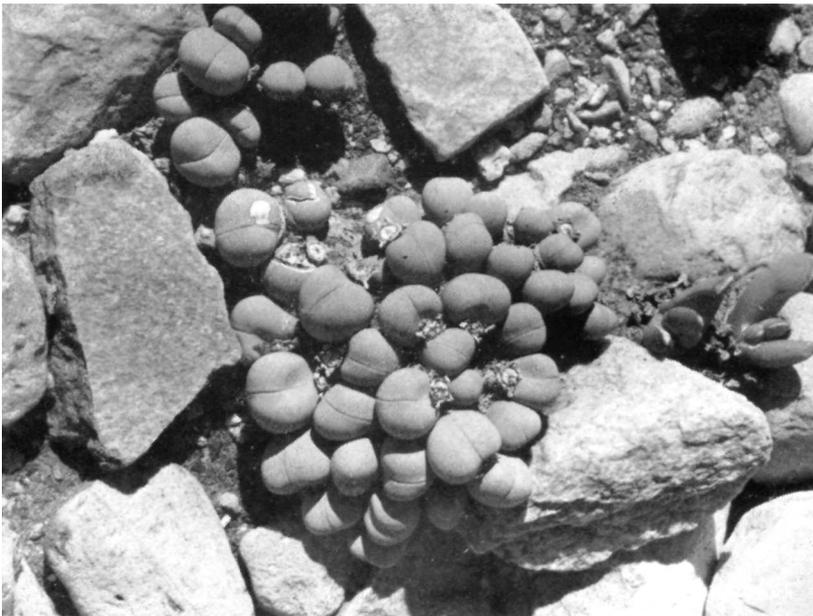


Figure 4. *Gibbaeum heathii* in natural habitat at Kaaiensklouf, near Calitzdorp



Figure 5. *Gibbaeum heathii* with pink flowers. Taken in cultivation



Figure 6. *Gibbaeum heathii* in natural habitat near Dammetjies

graph. The same applies to the photograph published by L. Bolus in "South African Gardening" (1932 p. 330, 331). Surely one could hardly expect that, because a single branch of *Quercus pedunculata* is stronger developed than the other branches, that you can describe this branch as a new variety. One has, therefore, to be very careful in selecting plants in the field to make sure that those selected are a typical sample of the population inhabiting that area.

As a rule, the plants growing at Perdefontein, i.e. at the locality where the *G. luckhoffii* L. Bolus is found, are smaller than those growing at Warmbad and at Ockertskraal. This is probably due to the fact that the soil at these two places is of a looser texture, but the important reason is that the rainfall at these two places is considerably higher than at Perdefontein, situated right in the Swartberg Range. Plants found near Dammetjies resemble, in certain ways, those at Perdefontein. In both of these places the plants are embedded in the soil. The rainfall is also considerably less than at Warmbad and Ockertskraal. The difference in size is not such as to warrant the upholding of *G. luckhoffii* and the difficulty still remains as to where the line is to be drawn. It is possible to select plants just as small at any of the other habitats of this species.

(iv) *Presence or absence of keel.* The top of the body shows a great deal of variation. In some cases it is more or less flat or slightly round and pointed. In some cases there is a definite ridge or keel. Between the definite keel and the absence of any keel there are all kinds of gradations, which gradually merge into one another, so that one does not know where to draw the line. The keeled and keelless plants grow intermixed and on the same plant both kinds of bodies can be observed at times.

(v) *Colour of flower.* This characteristic has been used, too, in differentiating the various species. It is stated that *G. heathii* has a white flower, whereas three (*G. blackburnii*, *G. comptonii*, *G. luckhoffii*) were supposed to have red coloured flowers. Mr. A. J. Joubert, M.Sc, who has extensive field experience and who has been observing these plants for a considerable period and who lives in Ladismith, informs me that *G. heathii* has a white flower but, on the second day, the flower gets a reddish tint which gradually increases in intensity so that it becomes very difficult to say exactly what the

colour of the flower is. The author has observed in *Muiria hortenseae* two contiguous growths, one with a white flower, the other has the petals coloured at the tips red and these gradually lose this red colouration and become white. In *G. album* not only do clumps with white grow together with those with red flowers on a small area of about an acre in size, but, on one and the same clump, growths with white flowers are found together with those with red flowers. *G. blackburnii* was supposed to be confined to one certain locality, but not five hundred yards away plants supposed to be *G. heathii* were growing in large numbers. To my mind no value whatsoever can be attached to the colour of the flower in this genus.

(vi) *Structure of flower and fruit.* These show so little difference that one cannot use it to distinguish any of these four species.

From the above it is clear that only one species can be recognized as valid and this is *G. heathii*. It is a species which shows a great deal of variation in its vegetative organs and it is not possible to make more species within this range of variation.



PLATE FIVE

Gibbaeum album with white flowers

2. *Gibbaeum album* N.E.Br.

Plants stemless, consisting of a number of growths and forming a compact clump, 6-12 cm. long and 6-8 cm. broad, or less, according to the age of the clump, on a rootstock with fibrous roots. Growths irregular, and obliquely sub-globose or ovoid, 2-3 cm. long, 1.5 cm. broad, 1 cm. thick, formed of two unequal or sub-equal short leaves with their faces closely pressed together, the fissure indicated by a line and sometimes hardly visible, oblique. The two leaves elliptical-ovoid, somewhat rounded at the top, both with a definite oblique keel, the smaller one has a concave groove at its side in which the pedicel of the previous growth fits; surface of growths smooth, glabrous to the eye, but velvety to the touch, with a minute papillose pubescence, scale like and dividing the surface into irregular areas or fields, whitish to pale whitish grey.

Flowers solitary, terminal, exerted from the fissure and, by the development of the new growth, appearing at the side of the latter. Pedicel 5-6 mm. long, 4 mm. broad, slightly flattened with acute edges of the same colour as the body. Sepals sub-equal, 6 mm. long, 4 mm. broad, elliptic or elliptic-oblong, rounded at the apex, without membranous edges. Corolla about 25 mm. in diameter, white or rose pink, petals in several series, 8-10 mm. long, about 1 mm. broad, linear, obtuse, the innermost being filiform (thread like) staminodes; stamens numerous, about 3 mm. long, erect, white or reddish purple. Stigmas 6, erect from a slightly spreading base, about 2 mm. long, stoutly subulate, acute, plumose, white; ovary flat at the top, 6-locular. Glands six, green, crenulated. Capsule 5 mm. in diameter, with six furrowed, brown, prominent ridges at top, 6-valved.

Riversdale Division: on hillocks on Springfontein Farm, growing among white quartz pebbles on Bokkeveld shales or just on the shales with very few quartz pebbles about, to about 1,500 ft. above sea level. At one spot, with *Muiria hortenseae*, *G. petrense*, *Conophytum muirii*, *Crassula columnaris*. About a mile further west, found with *G. petrense* and *G. velutinum*.



PLATE SIX

Gibbaeum album with pink flowers

Gibbaeum album is a very distinct and easy to recognize species and is confined to a small area in the Little Karoo. Its peculiar oblique shape, fissure and glossy white colour, characterize and differentiate it from all other species of this genus.

An attempt has been made by N. E. Brown to form a variety, *G. album* var. *roseum*, on account of the red flower. The fact of the matter is that (1) plants with white, and those with red flowers grows indiscriminately together in the small locality, and (2) it has been observed that red and white flowers are found on one and the same clump. Consequently, no value can be attached to the colour of the flower as a characteristic. The plant flowers in December.

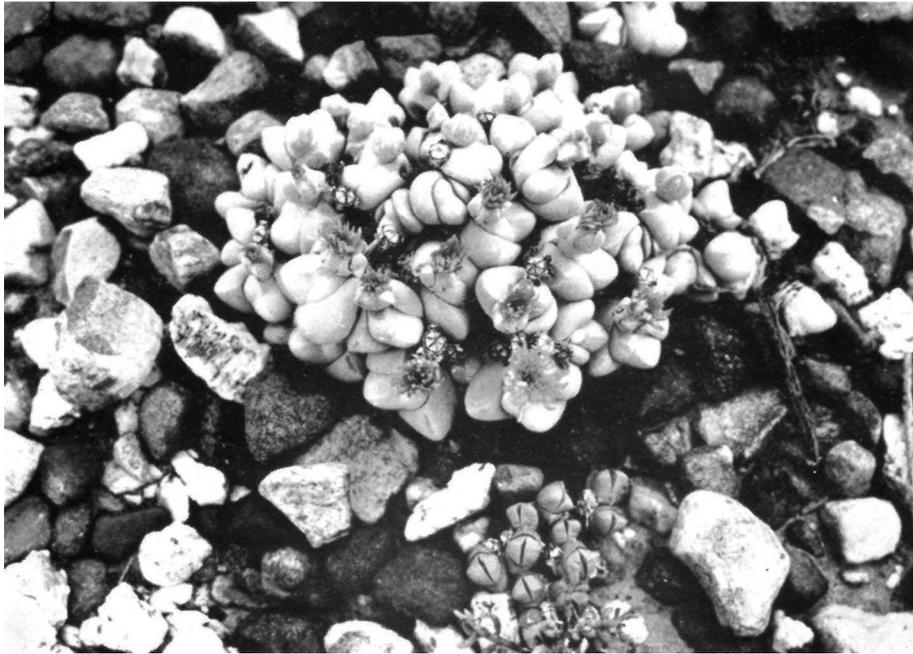


Figure 7. *Gibbaeum album* and *Gibbaeum petrense* in natural habitat at Springfontein in December 1949



Figure 8. *Gibbaeum album* with flowers

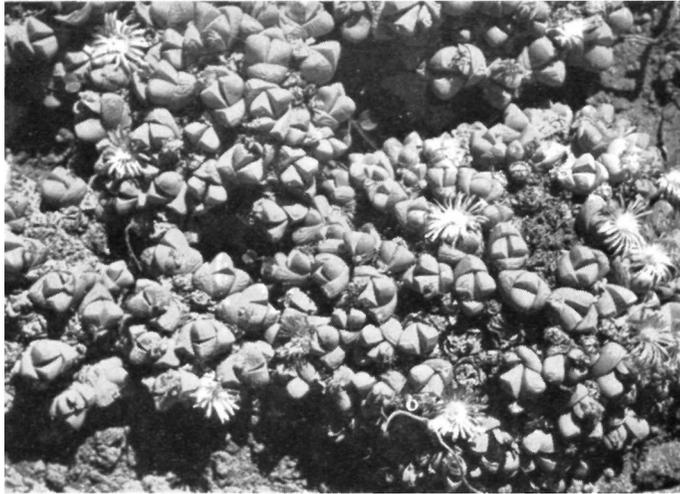


Figure 9. *Gibbaeum petrense* in natural habitat near Springfontein, with flowers



Figure 10. *Gibbaeum petrense* and *Muiria hortenseae* in natural habitat near Springfontein in December, 1949

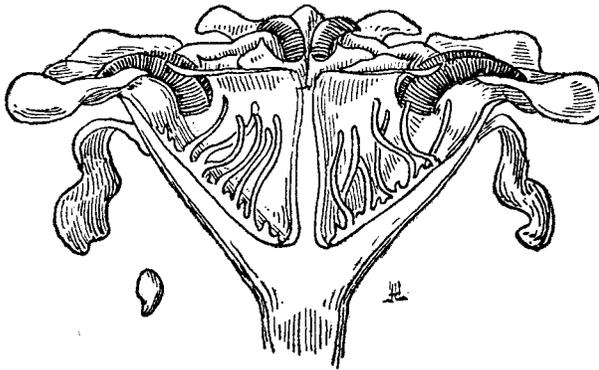
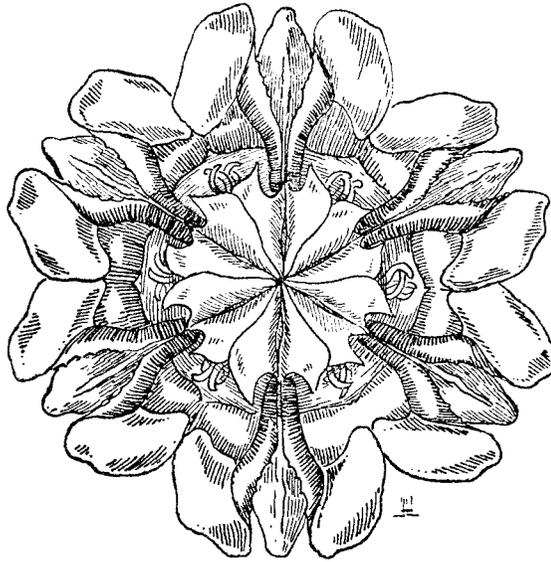
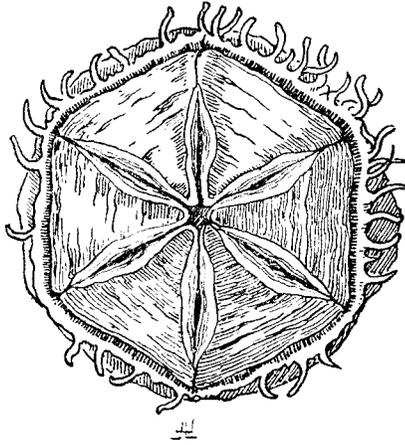


FIGURE 11.
Gibbaeum petrense. A closed and an opened capsule, seen from the top, and a longitudinal section of a capsule.

3. *Gibbaeum petrense* (N.E.Br.) Tisch.

Plants forming clumps of various sizes, frequently 5-10 cm. in diameter and 2-5 cm. in height. Growth consisting of two more or less sub-equal leaves with a definite fissure separating the two leaves, at first the leaves may be contiguous, but frequently the fissure becomes wider and, thereby, the two leaves become separated, leaves deltoid-ovate or triangular in outline, with sharp edges and acute or obtuse at the apex, with a definite keel running lengthwise over the two leaves, grey green to slightly dark green, glabrous, 5-12 mm. long, 5-8 mm. broad and 4-7 mm. thick. Pedicel rather compressed and acutely two-edged. Calyx 6-lobed, the two lateral lobes 6-8 mm. long, 2-3 mm. broad, inner surface flat, outer surface with prominent semi-membraneous keel, laterally compressed, the other four lobes smaller, 3-4 mm. long, 1-2 mm. broad, keeled on the back, with narrow membraneous wings, slightly hooded. Flower single, 1.4-1.5 cm. in diameter, corolla with about 30 petals, in 1-2 series, petals 6-7 mm. long, 1 mm. broad, linear, obtuse or notched at apex, magenta coloured (purple), with a prominent purple midrib, wings lighter coloured. Stamens erect, 3 mm. long, filaments bearded at base, surrounded by filiform staminodes which are slightly longer than stamens and recurved at tips. Glands dark green, semi-circular, crenulate, 1 mm. broad. Ovary convex at top and vertically lobed, stigmas 6, erect, subulate, 2 mm. long.

Riversdale Division: Springfontein on shale amongst white quartz pebbles.

This species, although similar to *G. album* in some respects, can be as easily recognized by the very definite deltoid-ovate and sharp edged leaves and by its grey green colour. *G. album* is always white, frequently glossy, the leaves, although somewhat ovate and keeled, have not the very prominent sharp edges and acute ends so characteristic of *G. petrense*.

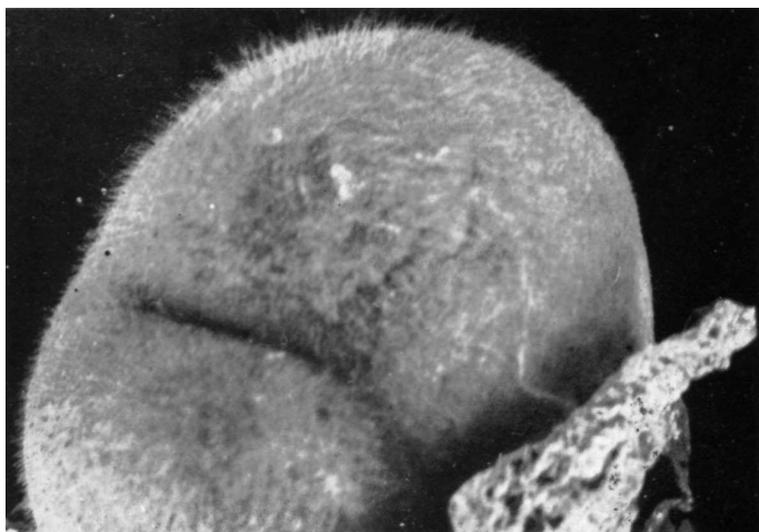
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Figure 12. *Gibbaeum pilosulum* in natural habitat along Barrydale Road in April, 1948



Figure 13. *Gibbaeum pilosulum*, taken in cultivation

Figure 14. *Gibbaeum pilosulum*, single body showing hairs (enlarged)



4. *Gibbaeum pilosulum* (N.E.Br.) N.E.Br.

Corpuscula 6-12, conferta, 12 mm. alta, 10-20 mm. lata et 8-15 mm. crassa, obovata, apice leviter obcordata, fissura centrali 3-5 mm. longa, breviter et molliter pilosa, omnino viridia vel apice purpureo-suffusa, impunctata. Flores circa 15 mm. diametro, pulchre purpurei.

Ladismith Division: south of Touwsberg. Pole Evans, 6927.

Plants consisting of a number of closely packed growths forming a compact clump embedded in the soil and up to 10 cm. in diameter. Growths 5-10 mm. in diameter, sub-globose or obcordately obovoid, flat or sometimes tapering slightly to a point, lobes very unequal or sub-equal, soft and fleshy, pubescent with fine delicate light long white hairs, yellowish to yellowish green, sometimes slightly suffused with purple. Pedicel included in the body of the growth, without bracts, moderately stout, green, adpressed pubescent. Calyx, with the exception of the tips of the sepals, included in the body of the plant or perhaps sometimes exerted, 6-lobed down to its union with the ovary, pubescent, sepals about 1 mm. long, oblong, obtuse, green, four with membranous margins. Corolla 1.2-1.6 cm. in diameter, scentless, petals about 30-35, free, 6-8 mm. long, 1 mm. broad, linear, obtuse, bright pink. Stamens very numerous, erect, filaments white, anthers pale yellow. Glands about seven, separate, dark green. Style none, stigmas seven, erect, with spreading tips, 5 mm. long, filiform, pale yellowish. Ovary inferior, convex on the top, 7-locular.

Ladismith Division.

This species resembles *G. cryptopodium* both in its mode of occurrence and form. These two closely allied species grow within half a mile from one another. This species is easily recognized by the very long hairs, resembling those of an old man's head, only, of course, very much shorter. *G. cryptopodium* is often glabrous or, if pubescent, the hairs are very short. This species, like *G. cryptopodium*, sinks into the soil and only the capsules are visible to indicate where the plant grows. This is usually in the dry hot months (November to March).

5. *Gibbaeum cryptopodium* (Kensit) L. Bol.

M. corpusculis late ovatis vel orbicularibus lateraliter subcompressis epunctatis viridibus; floribus pedunculatis pedunculis inclusis ad 2 cm. longis; petala rosea; stylis 6.

Corpuscula late ovata vel orbicularia lateraliter subcompressa brevissime pubescentia vel glabra 2-3 cm. longa; folia subaequalia subacuta parte libera 0.4-0.7 cm. longa; flores pedunculati, pedunculis compressis in corpusculis inclusis ad 2 cm. longis; calyx in pedunculum attenuatus exsertus, segmentis 6 oblongis obtusis 0.5 cm. longis; petala 2-seriata obtusa basi attenuata et breviter connata rosea vittata 1.2 cm. longa; glandulae 6 semi-orbicularia atro-viridia; ovarium supra convexum 0.25 cm. diam., stylis erectis filiformibus.

Between Wittepoort, Worcester Division and Laingsburg, Prince Albert Division. Approx. altitude 690 metres. Flowers June.

Lemoenshoek; between Barrydale and Ladismith; near Calitzdorp; on the mountain at Sebra, between George and Oudtshoorn; near Warmbad; frequent on Groot Vlakte (Dammetjies, Hoekvanden-berg); Witvlakte.

A distinct species with something of the habit of Sect. *Gibbosa*, except that the leaves are almost equal in size and united for nearly their whole length. In the *Sphaeroidea* it is easily distinguishable by its somewhat acute leaves not united quite to the apex and the pedunculate flowers.

Plant consisting of a large number of growths attached to a thick descending rootstock, lying flat on the ground, or, at times, hardly visible during the latent period. Each growth compressed sub-globose, or ovoid to gibbose, 2-2.5 cm. high, 2-2.5 cm. broad, 3-4 cm. in diameter, fissure sometimes hardly visible, at times running right across and separating the two unequal or sub-equal leaves, frequently the body resembles a shark's head, apex of body sub-depressed, flat or convex, body at times covered with very short white hairs, or top of body glabrous and pubescence confined to the sides of the body. Body usually yellowish green or sometimes tinted red, substance of body very soft and pulpy. Peduncle included, enclosed between the leaves, about 5-12 mm. long; sepals 6, sub-equal, ovate, obtuse,

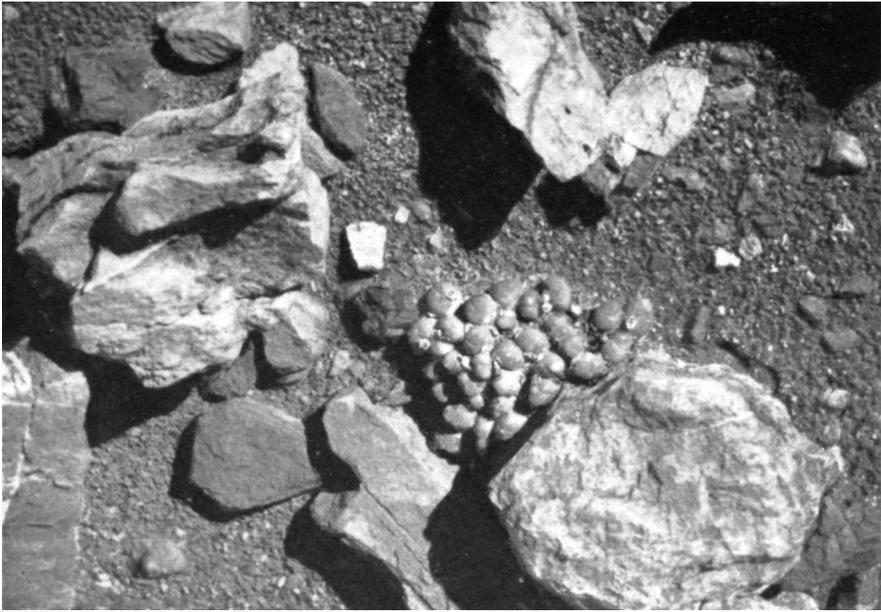


Figure 15. *Gibbaeum cryptopodium* in natural habitat.



Figure 16. *Gibbaeum cryptopodium* and *Rhinephyllum* sp. in natural habitat near Hoekvandenbergh



Figure 17. *Gibbaeum cryptopodium* in natural habitat



Figure 18. *Gibbaeum cryptopodium*, *Gibbaeum gibbosum* and *Gibbaeum fissoides* in natural habitat between Dammetjies and Allemorgensfontein in November, 1948

GIBBAEUM CRYPTOPODIUM

pubescent, 4-5 mm. long, exterior ones fleshy, keeled, four interior ones membranaceous with margins; petals about 35 in 2-series, cunately (wedge shaped) linear, obtuse or slightly emarginate, towards the middle somewhat narrow, rose pink, slightly fasciated, 1.3-1.6 cm. long, 2 mm. broad, the corolla spreads over the top of the body; staminodes acute, white; stamens as long as or slightly longer than staminodes, 6 mm. long; filaments papillate towards the base; glands 6, emarginate, deep green, large, nearly touching the apex of the tube of receptacle; lobes of ovary convex; stigmas 6, slender, filiform, ascending-recurving or ascending-spreading or recurving, more or less plumose.

This is a very widely distributed species and resembles, to some extent, *G. pilosulum*. The latter is covered with long white silky hairs, whereas *G. cryptopodium* is frequently quite glabrous with only a slight pubescence on the sides.

N. E. Brown described a species, *G. molle*, and L. Bolus one she named *G. helmiae*. Both authors fail to indicate in what specific character or characters these differ from the original *G. cryptopodium*. There is only one species, *G. cryptopodium*, and this opinion is based on observations made on hundreds of plants in the field. This species is fairly variable.

6. *Gibbaeum nebrownii* Tisch.

Planta ad *Conophytum* et *Lithopem* consimilis. Calycis tubus elongatus superne inaequaliter 6-lobus. Petala numerosa, inferne in tubum connata. Staminodia plurima, filiformia, apice recurvata. Stamina 18-20, biseriata, inferiora inclusa, superiora exserta. Stylus elongatus, filiformis; stigmata 6, minuta. Ovarium inferum, 6-loculare; ovula in solum loculorum inserta. Capsula parva, 6-valvata; valvarum carinis contiguis centralibus alato-marginatis, loculis alis membranaceis tectis; semina compresso-ovoidea, levia.

Plant resembling *Lithops* and *Ophthalmophyllum*, succulent, stemless, consisting of a single or two or more growths in a clump, embedded in the soil. Each growth being an obconic, ovate or globose body with a transverse shallow fissure across the top, dividing the top into two convex or fiat lobes. The size of the body varies from 0.5-1.6 cm. long, and about 0.4-1.5 cm. broad. The top of the growth is slightly different from the sides in being somewhat more transparent, or sometimes quite transparent like *Ophthalmophyllum*. The body is soft, pulpy, smooth, velvety, puberulous to the touch, covered with minute forked stiff hairs, dull greyish, becoming greenish, frequently purplish along the sides under cultivation. Flower solitary, terminal, partly included in the body of the growth. Calyx with a compressed tube above the ovary, 3 mm. long, two lateral sepals about 2 mm. long, fleshy and keeled, the other four about 3 mm. long and 2 mm. broad, flat with broad membraneous margins. Corolla tube 6 mm. long; petals in 3-4 series, spreading horizontally upon the top of the growth, overlapping about 6-8 mm. long, 1 mm. broad, slightly toothed at tip, linear, rose pink to deep reddish. Staminodes about 3 mm. long, erect with recurved tips, filiform, acute. Stamens 18-20; anthers yellow. Style about 4 mm. long, reaching to the top of the lower series of anthers, rather stout, yellowish; stigmas less than 0.5 mm. long. Capsule 4 mm. in diameter; valves pallid within, and expanding keels honey coloured. Seeds rather less than 1 mm. long, brown.

Karreevlakte: on the summit of barren shale hillocks; Dammetjies.



Figure 19. *Gibbaeum nebrownii* taken in natural habitat near Dammetjies in April, 1949



Figure 20. *Gibbaeum nebrownii* with flowers, taken in natural habitat near Dammetjies in April, 1949



Figure 21. *Gibbaeum nebrownii*. Single plants showing the root system



Figure 22. *Gibbaeum nebrownii* in natural habitat near Karreevlakte

GIBBAEUM NEBROWNII

This species resembles *G. dispar* to which it is probably related. In the field this plant is embedded in the soil and its top is level with it and can easily be taken for an *Ophthalmophyllum*, or even a *Lithops*. Its pubescence distinguishes it from these two genera and, although it seems to have a kind of pellucid area, the resemblance goes no further. Only under cultivation does it tend to grow out of the soil and this pellucid area then becomes more pronounced, often accompanied by a purplish colour of the sides. *G. dispar* is never found embedded in the soil. *G. nebrownii* is frequently found as a single plant and may, at times, form a clump of 6-8 plants. *G. nebrownii* has a flat or, sometimes, a conical top without any keel, whereas *G. dispar* has a definite keel and the shape of the body of the latter is irregularly angular ovoid. *G. nebrownii* is one of the most difficult plants to find in the field during the dry hot summer months as can be seen by the photographs.

April to September is its growing period and it flowers at the end of April. When not in flower, it resembles the ground it grows in, both in colour and texture. The fissure is not so prominent and deep as indicated in Brown's "Mesembryanthea," Fig. 120.

7. *Gibbaeum dispar* N. E. Brown

Plants frequently single or forming a closely packed clump of two or more growths, 2-6 cm. in diameter, 1-2 cm. high; in cultivation the clumps are up to 12 cm. in diameter. Growths arise from a small woody stem to which are attached numerous fibrous roots. Growths consisting of two sub-equal to unequal leaves, each growth 1-1.5 cm. broad and about 1-1.4 cm. high. Growths obliquely sub-globose or obliquely ovoid, obtuse, fissure oblique, one leaf frequently very much larger than the other, with a minute whitish to greyish pubescence of very short papillae, velvety to touch and in appearance.

(Here ends Dr. Nel's description and it is continued and finished according to the publications of Dr. N. E. Brown in Gard. Chron. 1926 1. p. 215 and 1927. 1. p. 430).

Pedicle 1-2 lines long. Calyx sub-equally 6-lobed, lobes about 2½ lines long, two of them keeled and green, the other four flat, broadly oblong and with membranous margins, rounded at the apex. Corolla 12-13 lines in diameter, fully open from 10.30 in the morning, according to Dr. Muir; petals in one series, about 5-5½ lines long and ½-¾ line broad, linear, obtuse, intense pink, with the median very faint or absent (ex Muir). Stamens numerous, 2-2½ lines long, filaments not hairy at the base, white; anthers yellow. Stigmas 6, finally 2½ lines long, erect, filiform-subulate. Ovary flattish at the top. Capsule 3½ lines in diameter, whitish and with six ridges at the top, 6-valved and 6-celled, of the same structure as detailed under the genus.

Ladismith Division; between Waterval and Van Wyksdorp, 1,200 ft. alt., growing on shales. As pointed out under Geographical Distribution, it is the only species which does not grow together with any other species of *Gibbaeum*.



Figure 23. *Gibbaeum dispar* in natural habitat

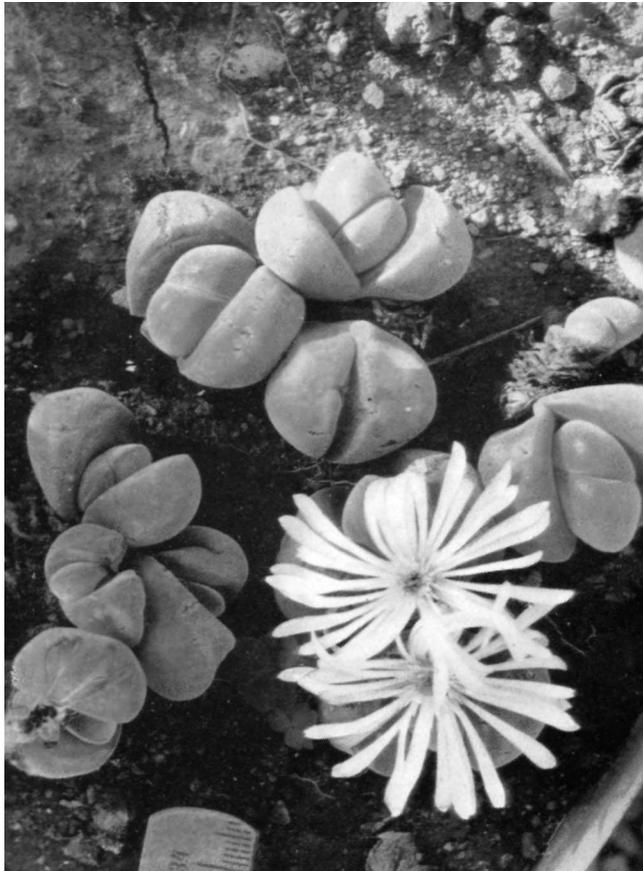


Figure 24. *Gibbaeum dispar* with flowers. Taken in cultivation

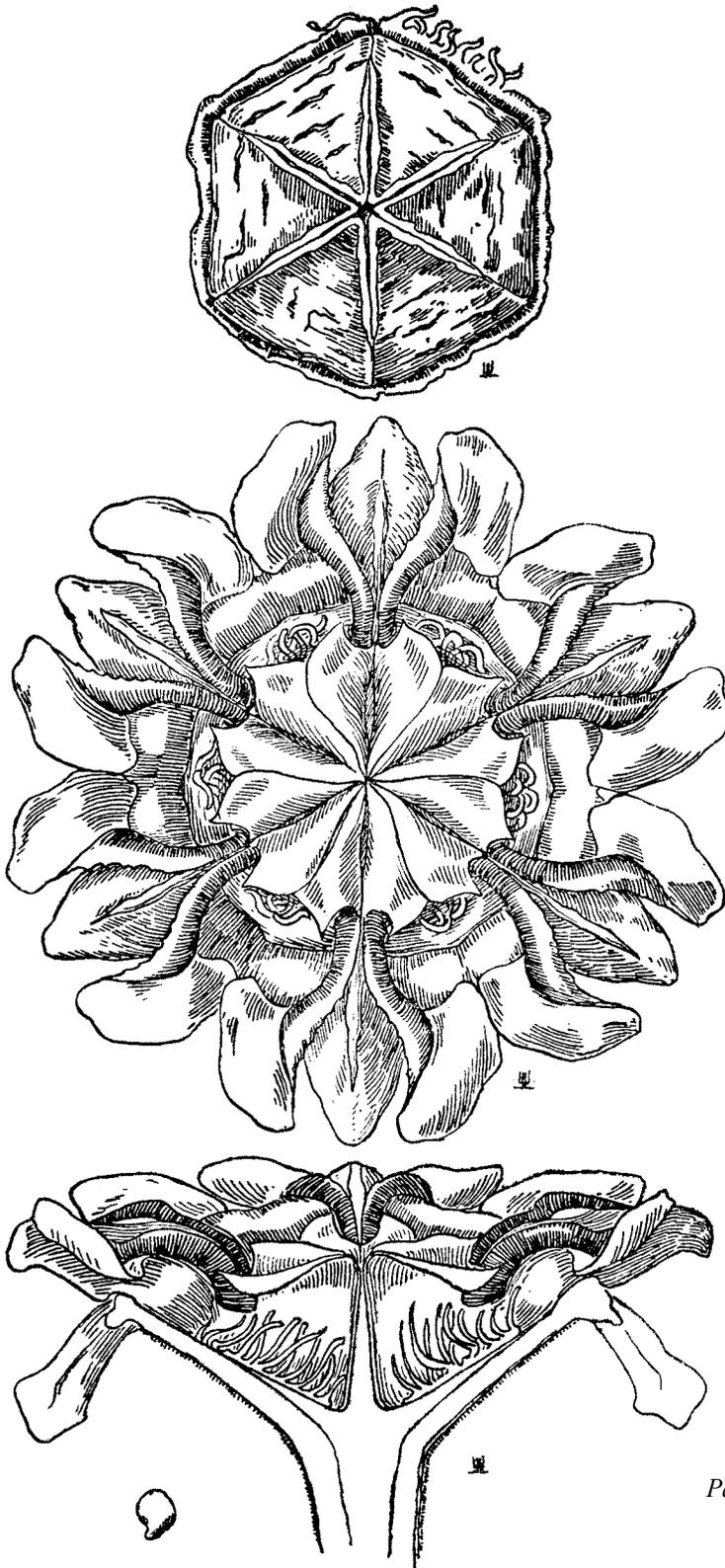


FIGURE 25.
Gibbaeum dispar.
A closed and an
opened capsule,
seen from the top,
and a longitudinal
section of a
capsule.

8. *Gibbaeum gibbosum* (Haw.) N.E.Br.

Plants forming more or less compact, highly succulent clumps 6-15 cm. in diameter, 3-6 cm. high, green to yellowish green, during a drought frequently with a reddish to purplish tint, consisting of a large number of growths upon a woody rootstock. Each growth 2-6 cm. long, 1-2 cm. thick at base, consisting of two very unequal leaves. The larger leaf frequently slightly incurved, sub-cylindrical towards the apex, but slightly flattened in the upper half, i.e., not quite round, bluntly 2-keeled towards the apex, with a flat deltoid part in the basal half which narrows to the apex, apex obtuse. The smaller leaf about a third of the larger one and fits, in the young stage, with its upper surface on the deltoid surface, with the result that there is a slight fissure, which becomes wider as the leaves are older. Leaves glabrous, smooth. Pedicel 8-12 mm. slightly compressed. Sepals sub-equal, outer two slightly keeled, with minute papillae on keel, 5 mm. long, inner four deltoid, membranous margin. Petals 1 cm. long, linear, obtuse, 1 mm. broad, pale pink with prominent purple midrib, staminodes few, stamens 4 mm., filaments papillate, glands six, dark green, crenulate. Ovary convex, stigmas 6, 1 mm. long.

Notes on the genus Gibbaeum by Dr. J. Muir. (Letter to Dr. N. E. Brown, June 13, 1927.)

"In reading over the description of *Gibbaeum gibbosum*, *G. perviride* and *G. luteoviride*, I think that Haworth may have received only individual branches and may not have seen the big masses. I saw these masses about Touws River Railway Station in 1897 before I took an interest in S.A. Botany and had forgotten them until I saw them in 1925 and 1927. Pole Evans' lump No. 968 seems to have been the first sent before I sent my range. Then I sent material (scrappy) from which *G. muirii* was described. It is unfortunate that my first expeditions only touched the outer edge of the region in which it, and the range sent, lately grows. The description of *G. muirii* as 'plant growing in masses with large prostrate main branches and upright secondary ones with growths often in pairs' is good as far as it goes. But if *G. muirii* is the same as Pole Evans 968

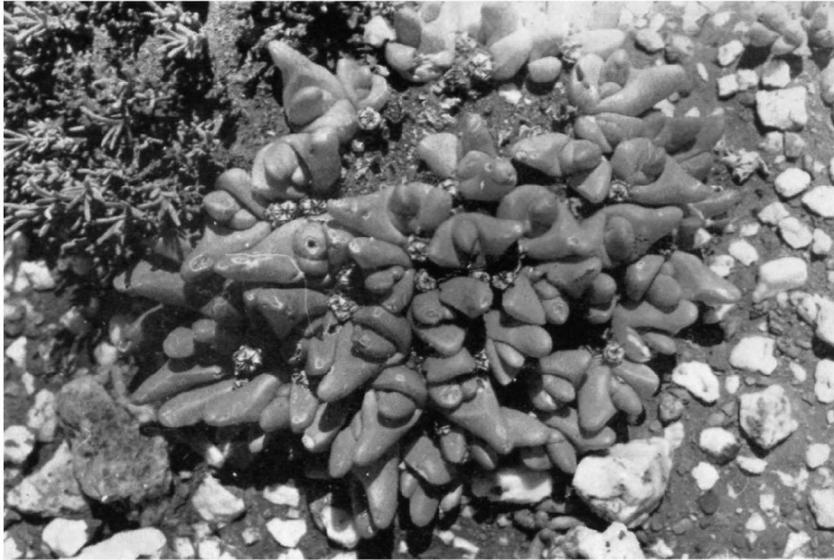


Figure 26. *Gibbaeum gibbosum* in natural habitat near Dammetjies in November, 1948



Figure 27. *Gibbaeum gibbosum* in resting condition in natural habitat



Figure 28. *Gibbaeum gibbosum* with flowers. Taken in cultivation

GIBBAEUM GIBBOSUM

and my range, a further description would be 'plant growing in hemispherical masses, each mass separate, with longer or shorter main branches and upright secondary ones with growths often in pairs, all the branches being packed together lightly or sometimes more loosely, so that little or nothing of the branches is seen on looking down on it from above, but only the leaves; the primary branches all proceeding from a more or less short central rootstock descending deeply and vertically into the ground and which is somewhat brittle and easily broken unless dug out carefully.'

Not only did Haworth possibly never see a mass, since he only describes stems, but he was so much struck by the colour of the leaves of his species, that it dominated his mind so far that he named two of them *perviride* and *luteoviride*. This seems suggestive to me.

The next point is this, that with regard to *G. muirii* I said 'the natural colour is of a pale sickly greenish yellow.' This was exactly true at the time, but since then I have found that under cultivation and care, it has lost this colour and become green without a trace of yellow. A big mass in my garden, growing there since 1925 and which is the same as the range sent you, has varied at different times from green with some yellow in it to green without yellow. At other times the leaves at the tips are reddish whilst remaining green below. It seems to me an accident that Haworth never described a '*rubro-viride*.'

The original *G. muirii* (eight little growths left) has been kept under the verandah, and the mass out of doors, and all seem to be *G. gibbosum*. No specimen I have ever seen had flowers except *G. muirii* and the specimens in cultivation have never flowered with me. My remarks apply, therefore, to the vegetative characters only.

Of the range of masses I sent you, selected from many thousands of plants in different localities, the variation in size, colour and degree of approximation of the leaves to each other was very marked. In some cases the leaves were appressed and in others unduly divergent. Under shrubs where there was some shelter and deeper soil the leaves were deep green (*perviridia*), longer, more or less divergent and luxuriant. In exposed places, a few feet away, the leaves were often small, appressed, yellowish green (*luteo-viridia*), half the size of the first. I hope you can make this out from the masses I sent you.

Can we dismiss absolutely any idea that *G. gibbosum*, *G. perviride*, *G. luteoviride* and *G. muirii* are all one species? If so, there would be with *G. pubescens* only two Haworthian species. Haworth may have seen scraps only — indeed his descriptions read like it. It is only now that the real localities for the range sent you have been noted. By sending extreme forms of the same species, without descriptive notes, I believe I could lead you to think that they were different species. It is a pity that a wide range of flowers cannot be had at present, but they do not flower in my garden and the trip is an expensive one.
Gibbaeum album N.E.Br.

Under locality; alter Ladismith Div. which is an error to Riversdale Div. (i.e., both Phisantefontein and Derde River are in Riversdale.)

Later I sent you collections from Springfontein, Riversdale Div. with pink flowers 3975 appearing in November, not yet mentioned in the literature. My 3976 with white flowers also came from the same locality. This has got to be mentioned by you in a later paper.

Gibbaeum dispar N.E.Br.

I sent you flowers of 3797 which have still to be described. They were unknown when your paper was published.

Gibbaeum geminum N.E.Br.

Alter ‘masses up to a foot in diameter’ to ‘patches a yard in diameter.’ It does not grow in dense masses like *G. gibbosum* but in patches. The patches are uniformly covered with the plant, but show little bare areas in between. Hondewater is correctly given in Ladismith Div. (I have now the latest detailed map).

Gibbaeum molle N.E.Br.

The original description says ‘grows in clefts between the upturned edges ... of the laminated ... shales.’ This is correct and others among white stones usually. Further observations show that it often grows among white stones in clayey soil covering the underlying rocks and away from rocky clefts. It is very widely distributed in Ladismith, Swellendam and Montagu but almost invariably among white stones either in clefts or in argillaceous soil as stated. Very often associated with *Rimaria heathii*.

Gibbaeum muirii N.E.Br. (? *Gibbaeum gibbosum*)

Occurs among white stones, but also frequently away from them among stones and pebbles of any colour or in bare clayey soil in more

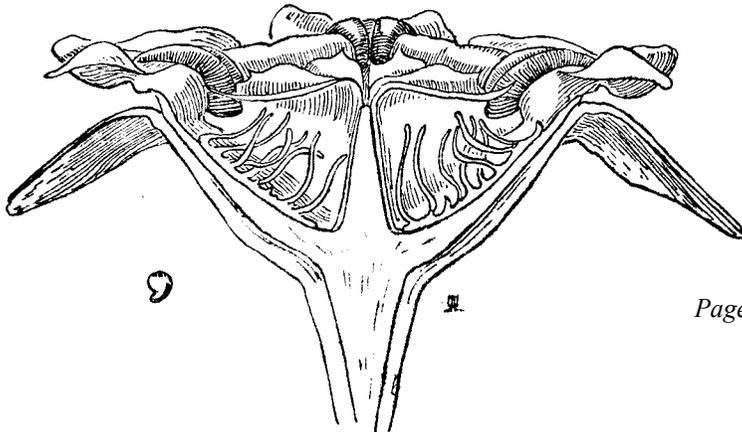
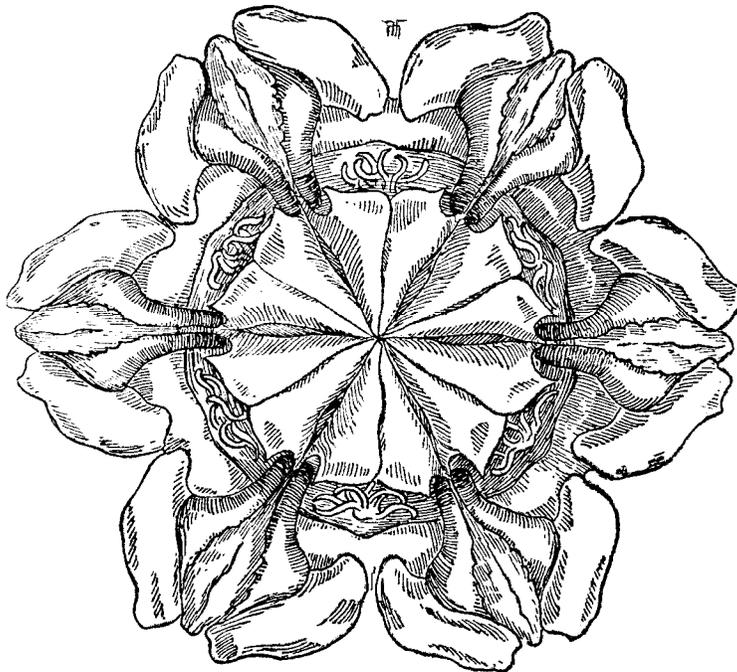
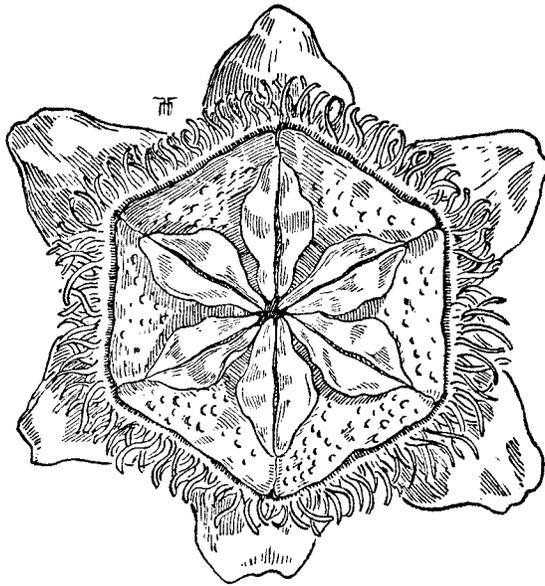


FIGURE 29.
Gibbaeum gibbosum. A closed and an opened capsule, seen from the top and a longitudinal section of a capsule.

open places. Occurs in sandy soil derived from the Witteberg series and in clayey soil derived from the Bokkeveld series, if my range of plants is all one species.

Gibbaeum pilosulum N.E.Br.

In locality 'between Hondewater and Warmbad' alter Ladismith Division to Swellendam Division (Barrydale is in the Swellendam Division). Touwsberg is in the Ladismith Division as correctly stated by you, but say Touwsberg only and not 'Touwsberg Mts.' as 'berg' means mountain. It is like saying 'Ben Nevis Mountain.' This has, I see now, a wide distribution in Swellendam, Ladismith, Montagu and Worcester.

Montagu, Ladismith and Worcester portions of the Little Karoo, e.g., between Hoekvandenbergh and Nauga Hills in the Montagu Division. At Bloutoring and Lettas Kraal, Worcester Division, Bakoven in Swellendam Division, Hondewater in Ladismith Division. Near Karreevlakte Siding (i.e., Sevenfontein) in Ladismith Division. Very often among white stones covering the Bokkeveld shales but also found outside such areas.

Gibbaeum pubescens N.E.Br.

Very abundant in certain parts of the Little Karoo growing in large social patches in white stones. Widely distributed in Montagu, Swellendam and Ladismith. Can be seen glittering in the sun at a considerable distance. Lemoenshoek not far from Barrydale in Swellendam Division. Bakoven (Swellendam), Hondewater (Ladismith), Eierpoort, enormous patches (Montagu Division) etc.

Gibbaeum shandii N.E.Br.

You have seen my 3815 from near Bellairs Dam and collections of mine from Hondewater (Ladismith) and Koeniekuilen (Swellendam). It is abundant around Hondewater Railway Station (Ladismith), also between Karreevlakte Siding and Eierpoort. Last June-July I sent you flowers which require description in a future article. Nearly always in the shales, but also sometimes among white stones although not usually.

Gibbaeum (?*Mesembr.*) *angulipes* N.E.Br.

Type in Annals IV, p. 2, Phisantfontein 1,200 ft. Riversdale Division, Muir 3898. Flowers reddish. September-October. Also common at Derde River and many other localities. Chiefly on the

white stones or near them. Position of this plant still to be determined. (?) *Gibbaeum* spec. nov. Muir 4021.”

The foregoing is from a letter written to Dr. N. E. Brown by that indefatigable collector and careful observer, Dr. J. Muir, to whom we owe a great deal of knowledge about the flora of the Little Karoo. I am indebted to Sir E. J. Salisbury, Director of the Kew Botanical Gardens, for permission to make use of this letter.

It appeared, in course of time, that there were no less than five *Gibbaeum* species (*G. gibbosum*, *G. luteoviride*, *G. perviride*, *G. muirii*, *G. marlothii*) more or less resembling one another. If a plant belonging to any of the above species was found, it was impossible to state with any degree of accuracy which particular species it was. The drawings by N. E. Brown did not carry the matter any further. Unfortunately, N. E. Brown had drawn at most one or two growths and had had, consequently, no guide as to what the plant, as a whole, looked like. In 1922 (*Gard. Chron.* 1922. 1. fig. 75 p. 151) Brown published a photograph of what he called *G. gibbosum?* and that, at least, gave one an idea of what the plant looked like. This photograph was republished in *Gard. Chron.* 1926. 1. fig. 80, p. 171 as being *Gibbaeum gibbosum*. The other drawings, *G. perviride* (*Gard. Chron.* 1922. 1. fig. 74, p. 151), *G. gibbosum* (*Gard. Chron.* 1926. 1. fig. 81, p. 172), *G. muirii* (*Gard. Chron.* 1926. 1. fig. 105 (a), p. 215) all point to the fact that these plants were identical. It may just be stated that Fig. 74 is the same as Fig. 81. In the local collection we had what we thought to be all the species except *G. muirii*. The latter plant was supposed to grow in the area between Allemorgens and Touwsfontein. On a search in this locality, which is not too large, it was found that plants resembling *G. gibbosum* were frequent, but one answering the drawing, Fig. 105 (a), could not be found. On a closer examination of this drawing, and comparing it with *G. gibbosum*, it was felt that since Brown had evidently only had a branch of *G. muirii*, it could be nothing other than *G. gibbosum*. It was then found that plants resembling *G. gibbosum* were frequent in the area between Ratelfontein and even Touws River. *G. gibbosum* actually grows about a mile from this railway station.

On examining quite a large number of plants in the field and in various habitats, there seems to be no doubt at all that one cannot

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On examining quite a large number of plants in the field and in various habitats, there seems to be no doubt at all that one cannot

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find a difference between them to warrant the retaining of the five species and, therefore, it is suggested to group all these species as *Gibbaeum gibbosum* (Haw.) N.E.Br. The colour, which evidently seemed important to Brown, is no guide at all, since green, greenish yellow, yellowish green and even reddish purple plants are frequent. The latter colour is the prevailing one during a drought. The locality near Touws River Station was visited in April, 1948, and a large number of green to greenish yellow plants were observed. The same spot was again visited in April, 1949, during a prevailing drought. The plants were shrunk and shrivelled and considerably reduced in size, reddish, reddish purple to yellowish green and one could hardly believe that these were the same plants of a year ago.

I have quoted Dr. Muir's opinion and he had doubts about the validity of these five species. His suspicions have been borne out by my investigations in the field.

9. *Gibbaeum fissoides* (Haw.) Nel comb. nov.

Plants forming clumps, 5-18 cm. in diam., 3-4 cm. high, consisting of a number of loosely packed, erect to prostrate branches, which radiate more or less uniformly in all directions from a small woody stem, 2-3 cm. in diam. The latter is attached to the soil by numerous fibrous roots. Each branch bears 1-4, sometimes 5 growths, crowded more or less at the end of the branch. The growths are usually unequal in size. The oldest and largest growth, 3-4 cm. long, at the end of the branch, the younger and smaller ones arising laterally and behind the oldest growth.

Each growth consists of two sub-equal or unequal triquetrous leaves, both of which are flat on the upper side, frequently with a keel, rounded on the back, frequently sub-gibbous (somewhat humped) at the apex, obtuse, frequently margins of flat side slightly angled, glabrous, dark green in the field, tending to light green in cultivation.

Flower large, showy, 5.2 cm. in diam., terminal, nearly sessile; two fleshy bracts, 5 mm. long, membraneous margins. Sepals 6, sub-equal, 2 exterior ones oblong, 7 mm. long, 5 mm. broad, obtuse, inner 4, linear-oblong, 7 mm. long, 3 mm. broad. Petals numerous, 2.2 cm. long, 2 mm. broad, linear, emarginate, with prominent purple midrib, reddish to purple; staminodes none; stamens 3-5 mm. long, white, disc ring shaped (unbroken), light green, crenulate, ovary convex, 3 mm. high, stigmas filiform, 4 mm.

Lemoenshoek, Dammetjies, Allemorgens, Springfontein. Very frequent in the Little Karoo.

Wulff has adopted Schwantes' suggestion to elevate *M. fissoides* Haw. to generic rank as *Antegibbaeum fissoides* (Haw.) Schwantes on account of its growth form, presence of disc, size of seed, etc. I am not prepared to attach too much importance to the last two mentioned characters. There then remains only the general appearance of the species.

While it may be true that as regards its growth form, especially in the field, one could be tempted to hold that it does not resemble any of the other *Gibbaeum* species, this is, however, only on a super-

ficial examination. If reference be made to the photographs, it will be apparent that it resembles, in its mode of branching, that of *G. geminum* and *G. angulipes* to a marked degree. In the field, one is led to believe that it is found with a number of upright growths. On a closer examination, it is found that some of the growths are prostrate and some are more or less upright, which accounts for its bushy, erect nature. It appears that the older growths die off at the end and are replaced by younger ones basipetally. It is a kind of dichasial (double forked) branching. This accounts for its rather stunted growth. It does seem to differ from *G. geminum* and *G. angulipes* as with these two species the youngest growth is found at the end of the branch, whereas the oldest growth is terminal in *G. fissoides*. The main point, however, is that the two leaves are unequal and somewhat gibbous and the ovary is 6-locular. It appears to be related to *G. angulipes*.



Figure 30. *Gibbaeum fissoides* in natural habitat near Phisantefontein in April, 1949

Figure 32. *Gibbaeum fissoides* showing branching



Figure 31. *Gibbaeum fissoides* with flowers. Taken in cultivation



Figure 33. *Gibbaeum pubescens* in natural habitat

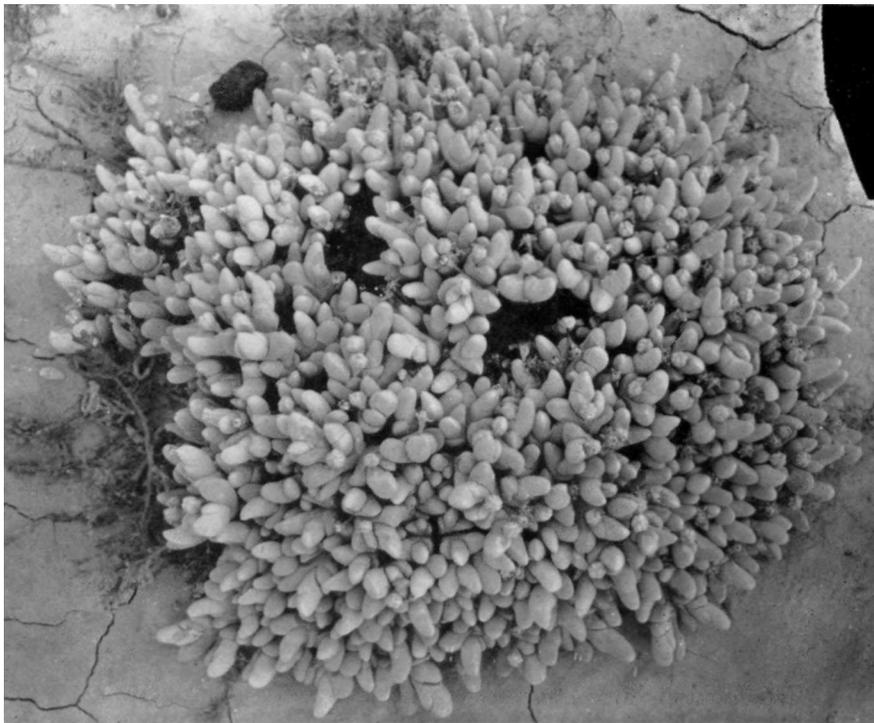


Figure 34. *Gibbaeum pubescens*, a single plant in natural habitat

10. *Gibbaeum pubescens* (Haw.) N.E.Br.

Plants stemless on a woody, shortly branched, rootstock, well raised above the ground, forming dense cushions, 6-12 inches in diameter, consisting of a large number of rather loosely packed branches at the tip of which are two unequal leaves forming the body, 1-2.5 cm. long, about 5 mm. in diameter, below each pair are remnants of old leaves. The branches arise from a more or less central axis and these repeatedly branch again and give off secondary branches.

Larger leaf of the pair, cylindrical-ovoid, more or less keeled at the rounded apex, broader at the base than at the apex, some leaves, frequently, slightly triquetrous with three definite keels at the apex and these run down the sides, the smaller leaf semi-lunate (crescent), about half as long as the large one; the fissure hardly visible in the young stage, usually at or just below the middle of the larger leaf, the whole body resembling a shark's head as seen from the ventral side; the body silvery white or greyish white, from a dense white tomentum of minute simple hairs, the hairs pointing downwards and closely adpressed to the surface.

Flowers pedicellate, arising from the side of the fissure; pedicel 10-15 mm. long, lengthening later up to 20 mm., somewhat pubescent growths, hardening and remaining on the plant.

Calyx sub-equally 6-lobed, somewhat pubescent growths, 2 sepals slightly longer and broader than the other four, 1.2 cm. long, 3 mm. broad, oblong, permanently keeled, other four with broad membranous margins, ovate, 4-5 mm. long, 2-3 mm. broad.

Petals numerous, free, pale to deep purple, 10-12 mm. long, 1 mm. broad, narrow linear, obtuse; staminodes about 2-3 mm. long; stamens numerous, outer stamens longer than inner, 1 mm. long, inner stamens creamy white with the filaments slightly pubescent at base. Stigmas 6, erect, subulate, acute, style absent; ovary convex on top, 6-locular, placentas on outer wall of loculi, ovules numerous in each loculus.

Ladismith Division; Hondewater, Eierpoort; frequent on road between Warmbad and Bellair Dam; Lemoenshoek; between Karree-

vlakte and Allemorgens; near Allemorgens; Witvlakte; Koeniekuil on Barrydale-Ladismith road.

Marloth (Trans. S.A. Phil. Soc.; Vol. XVIII, p. 44) states "owing to the white tomentum of the leaves it is hardly visible on the ground, for, up to the present, it has been found only on fields of white quartz." As a matter of fact, this species is very rarely, if ever, found growing isolated as a single plant. It usually forms large patches and, if growing in a field of quartzite, there are hundreds of plants covering several acres. These plants are distinctly visible at a distance of more than five hundred yards, since they are greyish from a distance on a white background.



PLATE SEVEN

Gibbaeum shandii with buds

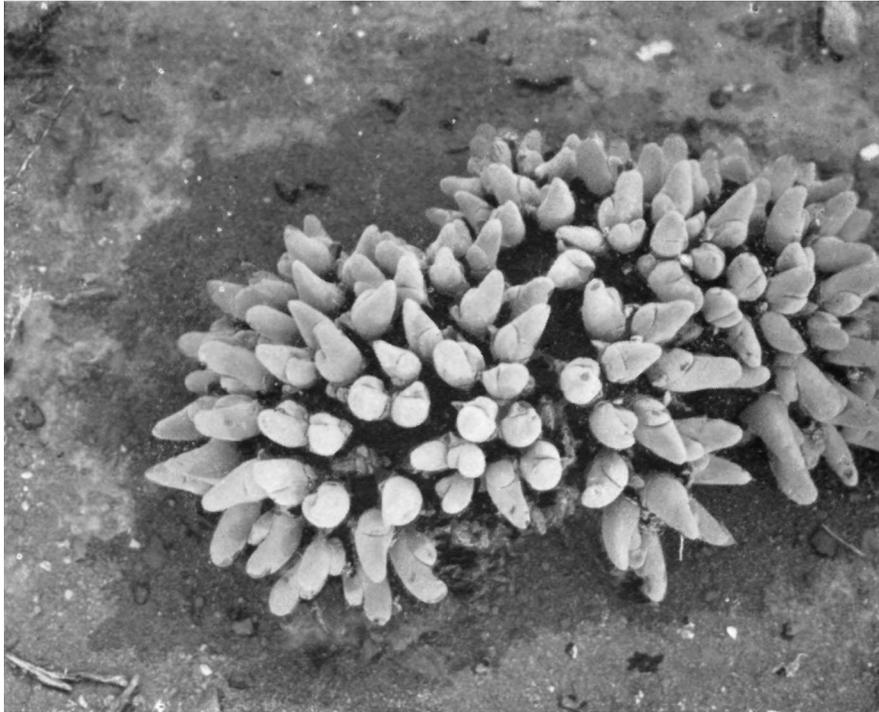


Figure 35. *Gibbaeum shandii* in natural habitat in April, 1949



Figure 36. *Gibbaeum shandii* with flowers. Taken in cultivation

11. *Gibbaeum shandii* N.E.Br.

This species is related to, and resembles *G. pubescens* in its general appearance so much that one can only decide after examining the tomentose covering with a hand lens, whether it is *G. pubescens* or *G. shandii*. The tomentose covering of *G. shandii* consists of separate, stellately branched hairs and the underlying greenish epidermis can be seen between the hairs. With the naked eye, the hairy covering seems continuous. The thick tomentose covering of *G. pubescens* consists of minute simple hairs pointing downwards and closely adpressed to the epidermis, to such an extent that the underlying epidermis is entirely covered by them. These two species occur either together in the same patch or they may be separated, at times, by a short distance. Both these species form large white greyish cushions of various sizes.

N. E. Brown (Gard. Chron. 1927. 1. p. 235) quotes J. Muir who states that *G. shandii* differs from *G. pubescens* "by being greener and by the larger leaf being different in shape and incurved." After an examination of numerous plants in the field, it has been found that the above contention is not in accordance with the facts.

Shape and curvature of the leaves of both show such variations, that one cannot use any of these characteristics to differentiate between the two species. *G. shandii* forms large patches several acres in extent. In other localities, either *G. shandii* or *G. pubescens* is found on the numerous hillocks covered with white quartzite pebbles.

As regards the occurrence of all the species of this genus, one must be very careful not to generalize, as there is no general rule. It is true that *G. pubescens* thrives in some localities on the white quartz fields, so common on some hillocks, but it is not confined to these hillocks. The same applies to *G. shandii*, which frequently covers large quartzite fields, but it is often located amongst other bushy plants, e.g., near Warmbad.

The description of *G. pubescens* is valid for that of *G. shandii*. The only important difference is in the nature of the tomentose covering.

12. *Gibbaeum geminum* N.E.Br.

Plant attached to soil by thin woody rootstock and consisting of a number of prostrate branches spreading in all directions and forming a mat 2-4 feet in diameter. These branches are of various lengths, 8-20 cm. or more and 4-5 mm. thick. On the prostrate branches numerous upright and branched, or unbranched secondary branches. The older upright branches up to 6 cm. long, those nearest to the central rootstock longer than the younger ones (about 3-4 cm.), near the tip of the prostrate branch. Upright branches 5-8, arising singly at the nodes and bearing one or more bodies consisting of two very unequal leaves. At the nodes of the older parts of the prostrate branches adventitious roots are developed. Growths 1-3 cm. long, 4-5 mm. thick, cylindrical or semi-cylindrical, with slightly flatter upper part, with a keel over the apex and running about halfway down the sides; diameter of lower portion smaller than the upper half, the whole resembling a club, greenish grey, with the upper half frequently somewhat reddish, obtusely rounded at the apex, the mouth like fissure situated well below the middle of the body; body velvety to the touch and eye, caused by a minute glistening pubescence, the large leaf about four times longer than the smaller one.

Flowers solitary, 1.2-1.4 cm. in diameter, light purple, pedicel 1.2-1.5 cm. long, slightly sulcate (grooved), minutely papillose, greyish, cylindrical, arising at base of young pair of leaves. Calyx 6; outer 2, 4-5 mm. long, 2 mm. broad, surface keeled, pubescent, inner surface glabrous, flat axe-shaped; four inner, 3 mm. long, 1 mm. broad, hood like with membranous margins. Corolla with many petals 1-seriate, light purple, petals 6 mm. long, cuneately linear, obtuse or slightly toothed at apex, light purple, midrib deeper purple. Stamens erect, outer staminodes in three series, pubescent at base. Glands dark green, 6; ovary upper surface convex; stigmas 6, erect, 1 mm. long, subulate, acute.

On sandy, more or less alluvial soil at Muurvlaakte and at Koeniekuil, Ladismith Division.

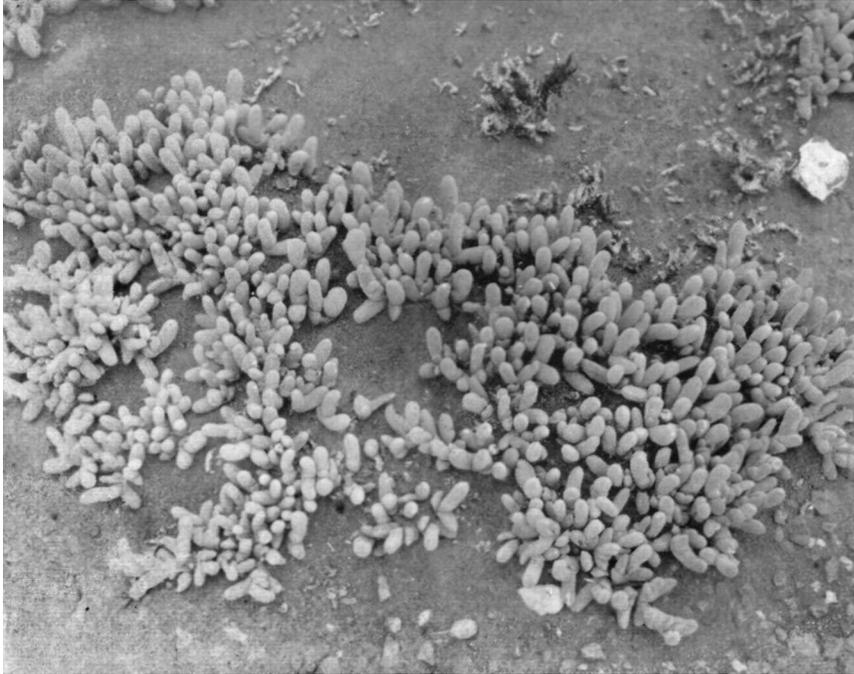


Figure 37. *Gibbaeum geminum* in natural habitat below Bellair Dam in November, 1948

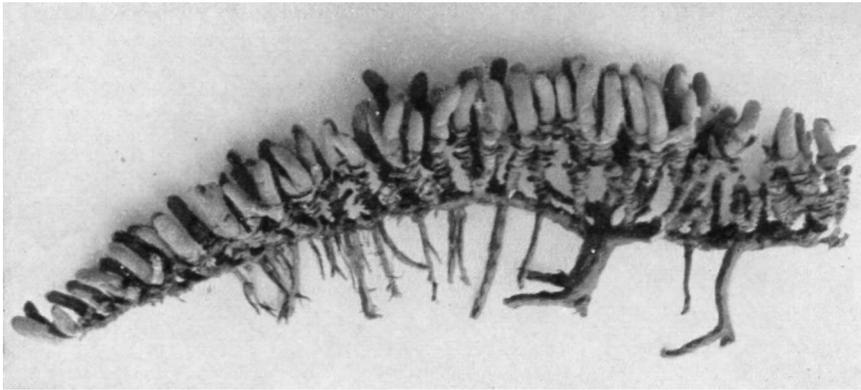


Figure 38. *Gibbaeum geminum*, one branch



Figure 39. *Gibbaeum geminum* in natural habitat along Barrydale Road

GIBBAEUM GEMINUM

This is one of the two prostrate species of this genus. It forms very extensive mats and, at a particular locality in the Little Karoo, it covers an area anything from 8-15 hectares. The patches are more or less contiguous, or are separated by open spaces and these mats are frequently from 2-8 feet in diameter. The peculiar upright club shaped body, with the delicate fissure below the middle, characterizes the species. It is obviously related to *G. pubescens* and *G. shandii*, but these two forms are much more robust and their leaves more or less taper towards the apex, whereas the larger leaf of *G. geminum* is uniform throughout and resembles a club. The pubescence of *G. geminum* is much more delicate than that of the other two mentioned species.

13. *Gibbaeum pachypodium* (Kensit) L. Bol.

M. molliter pubescens foliis semi-teretibus vulgo acutis; floribus solitariis longe pedunculatis pedunculus ebracteatis crassis; calycis segmentis inter se inaequalissimis; stylis 6 erectis carnosis.

Herba subacaulis undique breviter et molliter griseo-pubescens; folia erecta demum patentia vaginato-connata semi-teretia apicem versus leviter carinata acuta vel rarius subobtusata inaequalia, majoribus 6-10 cm. longis, 0.8-1.4 cm. diam., minoribus 5.5-8 cm. longis, 0.5-1 cm. diam.; flores solitarii longe pedunculati, pedunculis erectis subcompressis ebracteatis crassis basin versus attenuatis, 5.5-10 cm. longis, apice 0.5-0.8 cm. diam.; calyx gradatim in pedunculum attenuatus, segmentis 6 erectis e basi lata lanceolatis crassis inter se perinaequalibus exterioribus 2.7-4 cm. interioribus, 1.2 cm. longis; petala 3-seriata, linearia dilute rosea basin versus alba ad 2 cm. longa, 0.15 cm. lata; glandea 6 distincti; stamina staminodiaque numerosa; ovarium supra convexum 0.8 cm. diam., stylis 6 erectis subulatis carnosis 0.3 cm. longis.

Plant consisting of a large number of branches spreading in all directions and forming a flat bush varying in size from 25-40 cm. in diameter. Root about 1 cm. in diameter. New growths with remnants of dead leaves at their base and old leaves persistent on branches.

Leaves erect, slightly connate at the base, unequal, minutely pubescent with fine short white hairs, greenish to greenish grey, frequently tipped reddish, triquetrous to semi-terete, with a flat inner surface, slightly keeled on the outer surface near apex, acute or obtuse, 6-10 cm. in height, 0.5-1.5 cm. in diameter, lesser leaf 2.5-8 cm. long, 0.5-1 cm. in diameter.

Flowers single, pedicel 4-7.5 cm. long, erect, slightly compressed, somewhat tapering towards the base, minutely pubescent, upper half 0.8 cm., lower half 0.5 cm. in diameter.



Figure 40. *Gibbaeum pachypodium* in natural habitat between Adamskraal and Barrydale-Ladismith Road in December, 1949

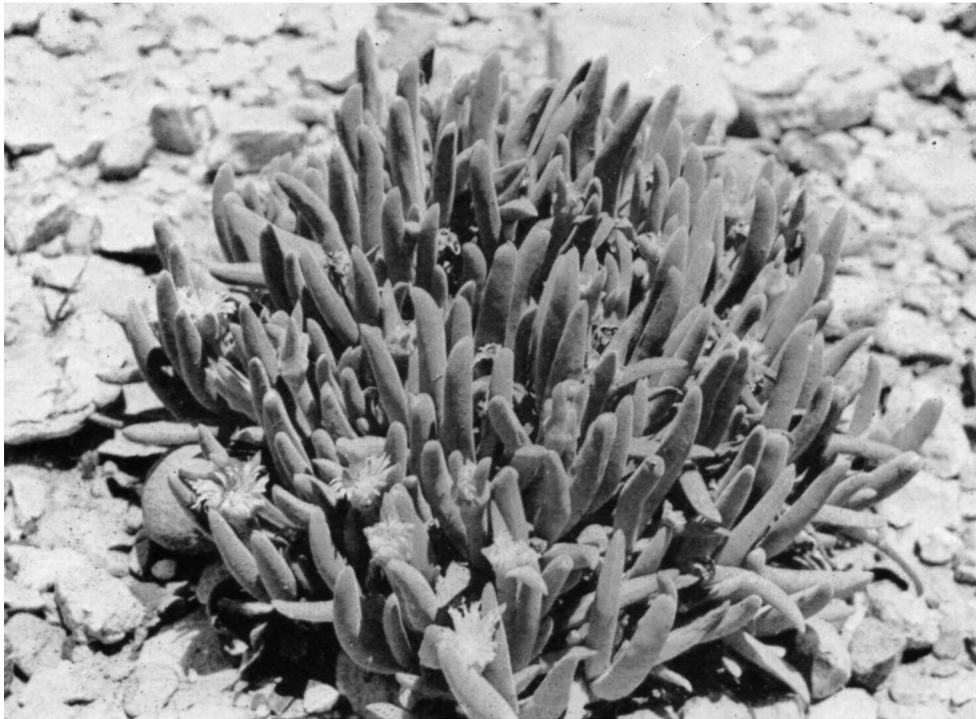


Figure 41. *Gibbaeum pachypodium* in natural habitat at Adamskraal in December, 1948

GIBBAEUM PACHYPODIUM

Calyx 6-lobed; 2 lateral 2 cm. long, fleshy, minutely pubescent, deltoid; other four 0.5 cm. long with membranous wings, hispid (stiffly) pubescent, oblong, slightly keeled; petals numerous, 3-series, linear, faintly pink to reddish, 1 cm. long, 1-2 mm. broad; outer staminodes white; stamens shorter than staminodes; glands 6, green, crenulate; ovary convex, 6 mm. in diameter; styles 6, minute 3 mm. long; capsule 7-8 mm. in diameter.

Ladismith Division: near Ockertskraal forming bushes amongst loose stones; on hillsides on banks of Touws River amongst loose large stones. Flowers November-December.

14. *Gibbaeum angulipes* (L. Bol.) N.E.Br.

Humile velutinum, vel, ob pilos minutos adpressos albidos, fere lepidotum, glauco-viride, ramis decumbentibus, ad 0.6 cm. diam., ramulis floriferis erectis, saepius 4-foliatis; folia demum patentia, alterum paris altero majus, basi connata, vagina 0.7-0.9 cm. longa, saepissime alterum paris conspicue, alterum inconspicue, carinatum, carina excentrica, folium majus obtusum, obscure apiculatum, ad 2.6 cm. longum, alterum abrupte acutum, apice demum recurvatum, ad 2.3 cm. longum (sine vagina), basi ad 0.9 cm. lata diametroque; flores solitarii 6-meri, ad 2.5 cm. diam., pedunculo angulato ebracteato, inferne sat gracili, superne gradatim incrassato in calycem, 2-2.4 cm. longo; calycis segmenta lanceolata vel ovato-oblonga, duo anguste membranaceo-marginata, 0.6-0.7 cm. longa; petala roseo-purpurea, basin versus albida, circa 1 cm. longa, 0.1 cm. lata; stamina collecta, vix ad 0.3 cm. diam., filamentis antherisque pallidis; discus e 6 glandulis discretis compositus; ovarium supra convexum, stigmatibus crassis subulatis brevibus.

Plant consisting of a number of prostrate branches attached to a woody stem about 20 cm. long, 2-3 mm. in diameter at its lower end, but at the upper end sometimes fairly stout, up to 1.2 cm. in diameter. Plant forms large mats or carpets 2-3 feet in diameter and sometimes larger. The prostrate branches give off growths, or they form secondary branches again. At the tip of each branch is a growth, seldom a pair, about 2-3 cm. long, sometimes a branch gives off a lateral growth. Each growth consists of two unequal leaves connated about a third of their length at the base. The larger leaf with a definite keel extending about a third of the length down from the apex, tapering towards the apex, 8 mm. at base, 5 mm. at apex in diameter, with a flat surface on the face adjoining the smaller leaf, slightly incurved towards smaller leaf at apex, smaller leaf about two thirds of the large leaf, with an eccentric slight keel, both leaves slightly acute or obtuse or flat, sometimes slightly apiculate (pointed), both leaves somewhat trigonous (three cornered), of a silvery or greyish colour, surface smooth, velvety to the touch from being covered with a very minute whitish, very sparse felt like pubescence;



Figure 42. *Gibbaeum angulipes* in natural habitat at Phisantefontein in December, 1949

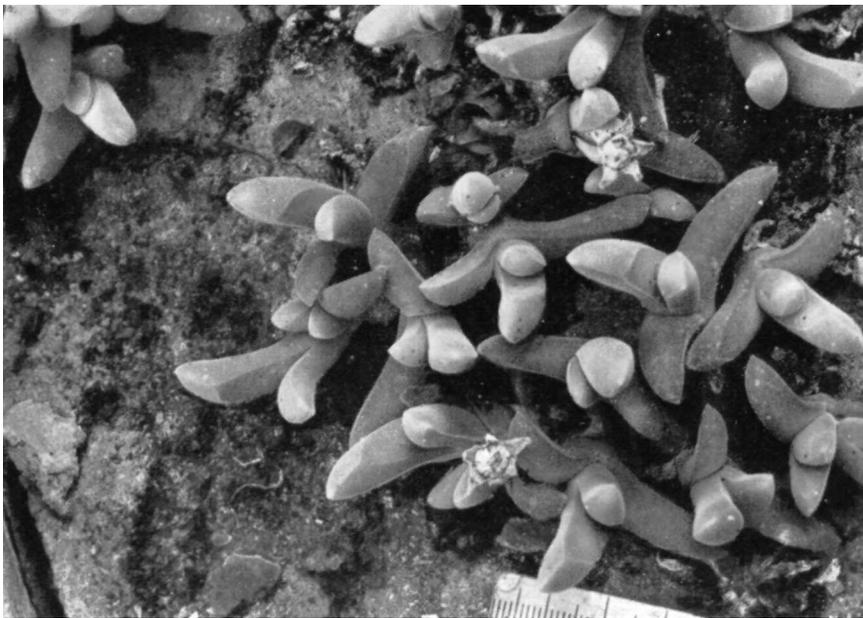
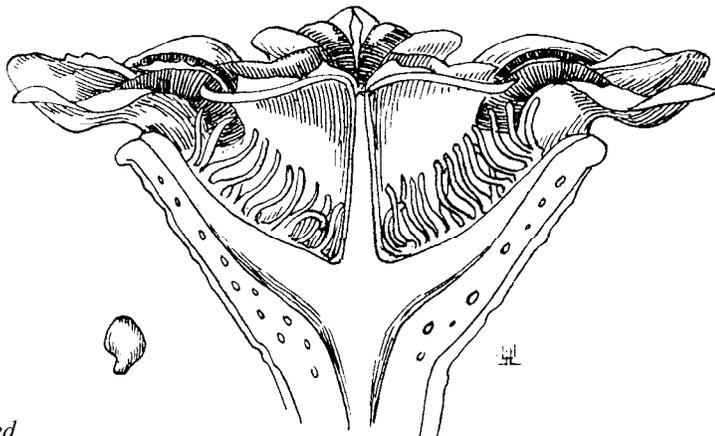
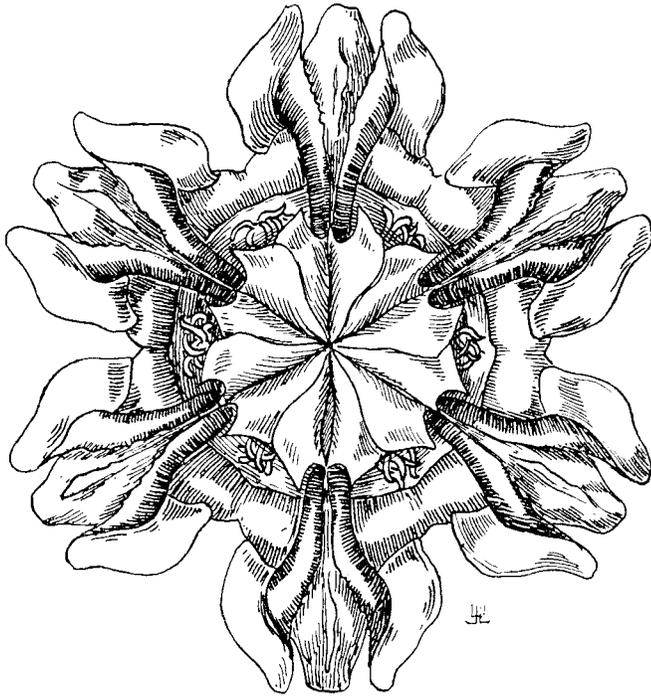
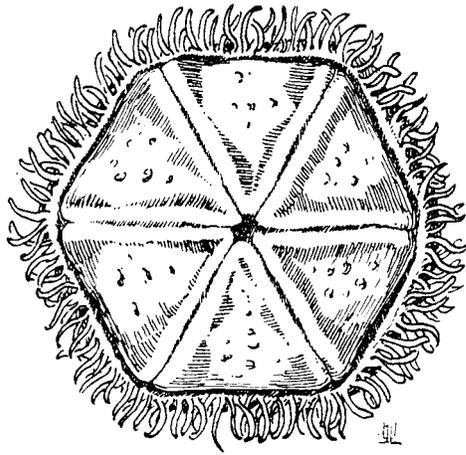


Figure 43. *Gibbaeum angulipes*. Taken in cultivation

Figure 44. *Gibbaeum angulipes*. A closed and an opened capsule, seen from the top, and a longitudinal section of a capsule.



GIBBAEUM ANGULIPES

in the young stage the two leaves are pressed together, but, in the older stage, they diverge from the base and more or less recurve.

Flower solitary, terminal, with a new growth on each side of its base, 2.5 cm. in diameter. Pedicel flattened, 2-2.4 cm. long. Sepals 6, 6-7 mm. long, lanceolate or ovate-oblong. Corolla about 2.-2.5 cm. in diameter; reddish purple; petals numerous, in two series, linear, obtuse, 1 cm. long, 1 mm. broad. Stamens numerous, erect, about 2-3 mm. long, white. Filaments hairy at base. Ovary convex; stigmas 6, subulate, short; disc consisting of six separate green glands. Capsule 6-valved, 5 mm. in diameter.

Riversdale District: Phisantefontein, on shale slopes on hillocks, 1,250-1,500 ft. above sea level, flowers October-December.

This is one of the two prostrate species of this genus and from the photographs it is apparent that it forms large mats and sometimes these mats, from different plants, cover several square yards. It is very frequent in an area of a few square miles on the above farm and, so far, has not been recorded anywhere else. The erect, silvery greyish, pubescent, slightly keeled and trigonous leaves, tapering somewhat towards their tips and slightly recurved at their apices, characterizes this species and differentiates it from the other species.

N. E. Brown (Gard. Chron. 1927, 1, p. 430) quotes Dr. Muir in describing the habit of this species as "a silvery, often depressed, somewhat scrubby undershrub, often with decumbent or spreading branches." This species was observed in two localities about a mile apart, but there was no indication at all of an undershrub. The plant spreads itself more or less evenly in all directions from the central root and lies flat on the ground. The upright branches never reach a height of more than about 3-4 inches from the ground. There cannot, therefore, be any question of an undershrub.

15. *Gibbaeum velutinum* (L. Bol.) Schwant.

M. velutinum L. Bolus; caule crasso, multo abbreviato, ramulis brevissimis confertis 2-4-foliatis; folia cum pedunculo calyceque velutina, sat polymorpha, alterum paris altero longius vel multo longius, patentia vel adscendentia, basi connata, oblonga, supra subconcava, superne triquetra, valde compressa vel breviora leviter compressa, interdum apice carinata, breviora subdimidiata, glaucoviridia, 2-4.5 cm. longa, basi ad 1.8, medio ad 1.5 cm. lata, ad 1.4 cm. diam.; flores solitarii, 6-meri, 4 cm. diam., pedunculo crasso, cum calyce valde compresso, 2.3 cm. longo, apice circa 1 cm. diam., calyx subcrateriformis, segmentis inter se inaequalibus, oblongis vel linearibus, acutis vel apice carinatis, duobus dorsaliter carinatis, ad 1.9 cm. longis, ceteris 0.9-1.4 cm. longis, tribus membranaceo-marginatis; petala erecto-patentia, 2-seriata lineari-spathulata obtusa, dilute rosea, saturate roseo-vittata, 1.8-2 cm. longa, 0.2 cm. lata; stamina collecta, filamentis parce barbatis, pallidis, ad 0.7 cm. longis, antheris pallidis; glandulae nectariferae discretae, transverse oblongae; ovarium supra globose convexum, insigniter profunde lobatum et verticale et horizontale, stylis e basi segmentorum orientibus, globose subulatis, 0.3 cm. longis.

Plants stemless with a strongly developed rootstock, forming tuft 6-8 inches in diameter, consisting of a number of closely packed branches ending in two pairs of highly succulent leaves, the larger leaf of the older pair is 5-6 cm. long and the smaller one 2-3 cm. long; of the younger pair, either the leaves are sub-equal or the larger one is 3 cm. long and the smaller one 2 cm. long, the width of the leaves varying from 1-2.2 cm. The leaves are connate towards the base for about a third of their length, the upper surface concave, sometimes partly triangular shaped, sometimes leaves are triquetrous, resembling front part of a boat, under surface obtusely keeled with a recurved point, remnants of the old leaves below. Leaf surface minutely velvety papillose, grey green, frequently with a whitish hue.

Flowers single, appearing in the angle between the old and the new leaves, pedicel 2-2.5 cm. long, bifacial, keeled, succulent, towards

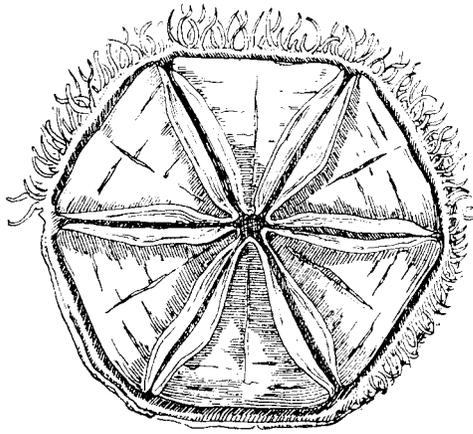


Figure 45. *Gibbaeum velutinum* in natural habitat at Springfontein in April, 1949

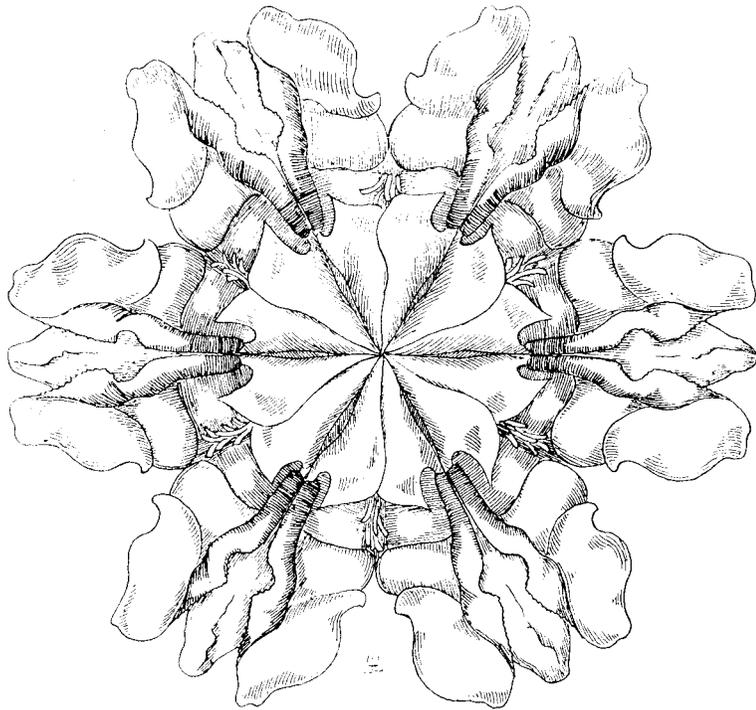


Figure 46. *Gibbaeum velutinum* with flowers.
Taken in cultivation

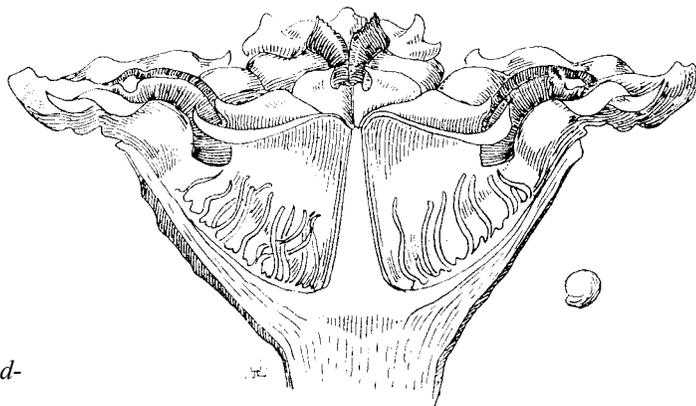
Figure 47. *Gibbaeum velutinum*. A closed and an opened capsule, seen from the top, and a longitudinal section of a capsule.



9c.



9d.



9e.

GIBBAEUM VELUTINUM

apex about 1 cm. broad; calyx lobes sub-equal, two are 1.5-1.8 cm. long, 1 cm. broad, the four others are 1-1.2 cm. long, 8 mm. broad, oblong or linear, acute. Petals in 2-series, 2-2.5 cm. long, 1 mm. broad, linear-spathulate, white or suffused reddish; staminodes 6 mm. long; stamens many, outer 6 mm. long, inner 3 mm. long, filaments and anthers white; nectaries 14, distinct, transversely oblong, sulcate; ovary with upper surface globose-convex, vertically permanently lobed; style subulate, 3 mm. long.

Riversdale Division: Springfontein.

16. *Gibbaeum schwantesii* Tisch.

Plants forming a more or less compact clump, consisting of a large number of loosely arranged fleshy bodies, 15-30 cm. in diameter and about 4-6 cm. in height, green to yellowish green. Each body consists of two very unequal leaves. The larger leaf 5-7 cm. long, 1-3 cm. broad at the base, more or less boat-shaped, with a flat upper surface, frequently incurved-hooked at the apical part, the smaller leaf about half as long and fitting on the flat upper surface of the larger leaf, in the young stage there is a definite fissure where the two leaves touch one another, surface of leaves smooth, glabrous.

Flower always produced in front of the new pair of leaves. Pedicel 3-5 cm. long, erect, slightly compressed and somewhat two-edged, 6-7 mm. broad; calyx, viewed from the side, has a somewhat chin-like base in front, the two larger 1.8-2.6 cm. long, 9-10 mm. broad at the base, narrowing to an acute apex, keeled down the back, more or less concave and covered at the apex, the smaller 1-1.3 cm. long, ovate, obtuse, with membranous margins. Corolla 3-5 cm. in diameter; petals numerous, 2-seriate, 1.8 cm. long, 1 mm. broad, linear, light red; stamens 5-7 mm. long, filament white; glands 6, dark green; stigmas 6, 3 mm. long, stoutly subulate, acute, somewhat bristly plumose; ovary entirely superior, 6-locular. Capsule 1 cm. in diameter.

Riversdale Division: Phisantefontein, 1,200 ft. above sea level.

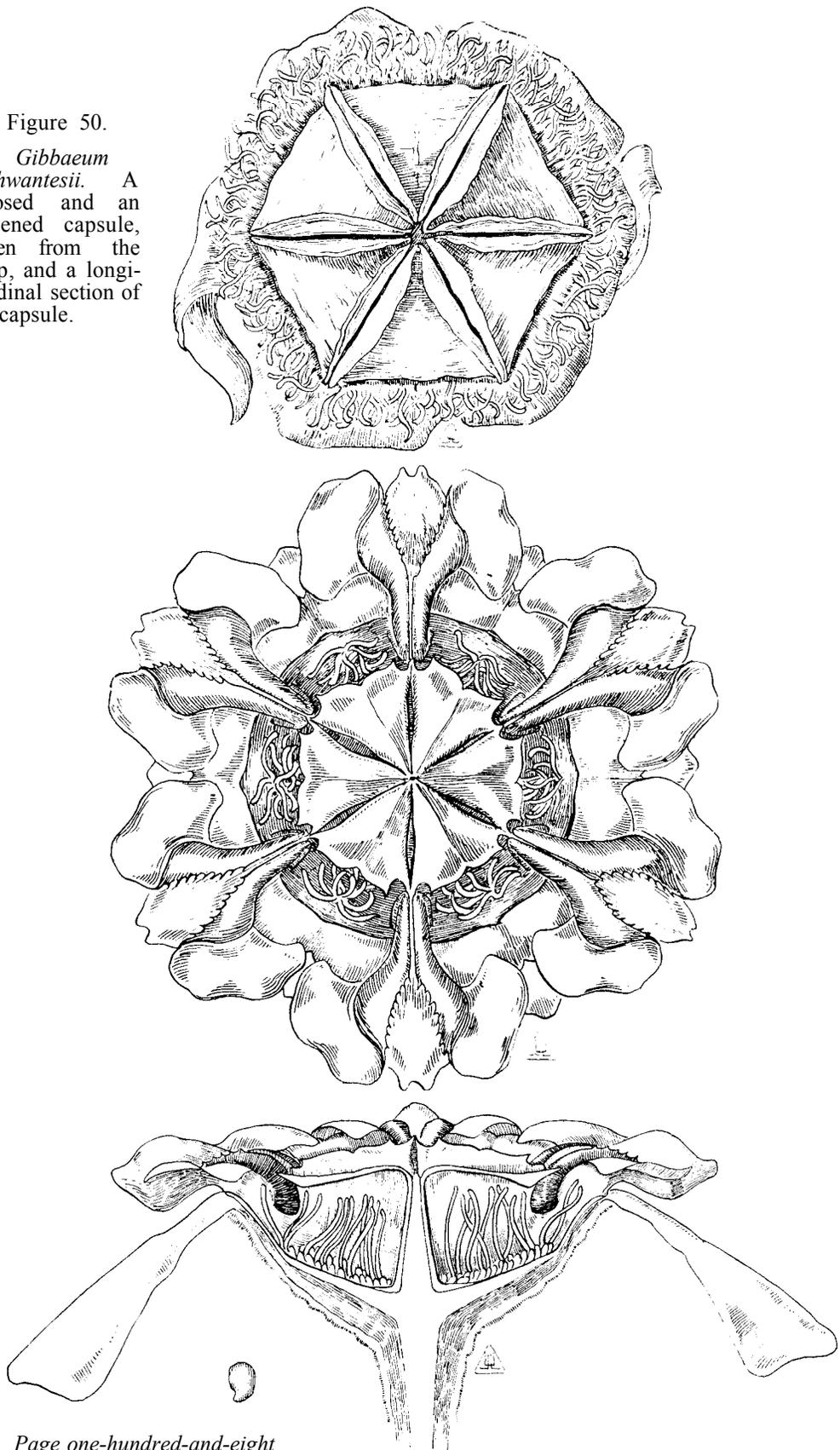


Figure 48. *Gibbaeum schwantesii* in natural habitat at Phisantefontein



Figure 49. *Gibbaeum schwantesii*. A single plant in its natural habitat at Phisantefontein in April, 1949

Figure 50.
Gibbaeum schwantesii. A closed and an opened capsule, seen from the top, and a longitudinal section of a capsule.



17. *Gibbaeum haagei* Schwant.

Named after Walter Haage, Erfurt.

Low, tufted plants, hardly more than $\frac{3}{4}$ inches high; growths numerous with one or two pairs of leaves, opposite leaves of different lengths, $\frac{1}{4}$ inch united together, half to three quarters of an inch long, one-third of an inch broad, one-quarter to one-third of an inch thick, upper side flat or slightly concave, back at first semicircular, then somewhat obliquely keeled, the longer leaves with the back drawn far over the tip; smooth, bluish grey green; F. on $\frac{5}{8}$ inch long stalks, c. $\frac{3}{4}$ inch \emptyset , lilac red.

(See Preface. The above description extracted from Jacobsen's "Succulent Plants," second edition 1946, page 179.)

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*There are two Societies catering for the interests of
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THE CACTUS & SUCCULENT SOCIETY OF GREAT BRITAIN

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and

THE NATIONAL CACTUS & SUCCULENT SOCIETY

Hon. Secretary:

S. H. SCOTT, ESQ.
15 Tithby Drive, Sherwood, Nottingham

BIBLIOGRAPHY AND SYNONYMY

Abbreviations of Literature on the following pages

| | | | |
|---------|--|-----------|---|
| Ann.B. | Annals of the Bolus Herbarium Wynberg, South Africa. | H.syn. | Haworth: Synopsis plantarum succulentarum, London, 1812. |
| Berg. | Berger: Mesembrianthemum & Portulacaceen, Stuttgart, 1908. | H.rev. | Haworth: Revisiones plantarum succulentarum, London 1821. |
| B.Notes | L. Bolus: Notes on Mesembryanthemum and some allied genera, Cape Town. | J.Bot. | Journal of Botany, London. |
| Cact.J. | Cactus Journal of the Cactus and Succulent Society of Great Britain, London. | J.Linn. | Journal of the Linnean Society of London. |
| DeCand. | De Candolle: Prodrromus systematis naturalis, volume III, Paris, 1823. | Jac.DS. | H. Jacobsen: Die Sukkulenten, Berlin, 1928. |
| D.K.G. | Monatsschrift der Deutschen Kakteen Gesellschaft, Berlin. | Jac.SP. | H. Jacobsen: Succulent Plants, London, 1935. |
| F.Cap. | Sonder: Flora Capensis, Cape Town. | Kew | Kew Bulletin, London. |
| Fedde. | Fedde: Repertorium specierum novarum regni vegetabilis, Berlin. | Mes. | Brown, Tischer & Karsten (ed. E. J. Labarre) Mesembryanthea, Ashford, Kent, 1931. |
| Gard.C. | The Gardener's Chronicle, London. | Moell. | Moeller's Deutsche Garten Zeitung. |
| H.obs. | Haworth: Observations on the genus Mesembryanthemum, London, 1794-5. | S.A.Gard. | South African Gardening and Country Life, Wynberg. |
| H.misc. | Haworth: Miscellanea naturalis London, 1803. | S.A.Ph. | Transactions of the South African Philosophical Society. |
| | | Succ. | Succulenta, Amsterdam. |
| | | T.R.Sty. | Transactions of the Royal Society of South Africa, Cape Town. |

The valid names are in capitals

GIBBAEUM proposed by Haworth in H.rev. p. 104; N.E.Brown, Gard.C., LXXI (1922.I.) pp. 129, 151; LXXVIII (1925.II.) pp. 413, 433 (in key); Brown, Tischer and Karsten in Mes. (1931) p. 31; Pax and Hoffman in naturl. Pflanz. 2nd ed. 16c (1934) pp. 206, 215; Jacobsen in Jac.SP. (1935) p. 178.

GIBBAEUM ALBUM N.E.Br., Gard.C. (1926. I.) p. 215, t. 105; Gard.C. (1927.I.) p. 430; D.K.G. (1927/1928) p. 227; Mes. p. 218, t. 107; Jac.DS. (1933) p. 132; Jac.SP. (1935) p. 178, t. 153.

GIBBAEUM ANGULIPES (L.Bol.) N.E.Br., Ann, B.IV. p. 2; Gard.C. (1927.I.) p. 430; D.K.G. (1927/1928) p. 227.

Gibbaeum argenteum N.E.Br., Gard.C. (1921.II.) p. 273, t. 121 = GIBBAEUM PUBESCENS (Haw.) N.E.Br.

Gibbaeum blackburnii L.Bol. in B.Notes, part III, p. 65 = GIBBAEUM HEATHII (N.E.Br.) L.Bol.

Gibbaeum comptonii L.Bol. in B.Notes, part II, p. 369; S.A.Gard. (1932) p. 330, 331; D.K.G. (1934) p. 55; B.Notes, part III, p. 65; Jac.SP. (1935) p. 178/179 = GIBBAEUM HEATHII (N.E.Br.) L.Bol.

GIBBAEUM CRYPTOPODIUM (Kensit) L.Bol. T.R.Sty. I, p. 150 et pl. XXI, C 6-7; Berg. (1908) p. 283; Fedde, XI, p. 476; Gard.C. (1922.II.) p. 84; D.K.G. (1925/1926) p. 138; D.K.G. (1927/1928) p. 224; B.Notes, part II, p. 402.

Gibbaeum digitiforme (Thbg.) N.E.Br. =
Dactylopsis digitata N.E.Br.

GIBBAEUM DISPAR N.E.Br. Gard.C.
(1926.I.) p. 215, t. 105.b; Gard.C. (1927.I.)
p. 430; D.K.G. (1927/1928) p. 227; D.K.G.
(1932) p. 17, t.p. 18; Jac. DS (1933) p.
132, t. 124; Jac.SP. (1935) p. 179, t. 154.

GIBBAEUM FISSOIDES (Haw.) Nel. H.obs.
p. 135; *M. obtusion* Haw. in H.mis. p. 25;
H.syn. p. 206; H.rev. p. 86; DeCand.
p. 418; F.cap. II, p. 394; Berg. (1908)
p. 273; *G. nelii* Schwant Jac.DS. (1933)
p. 133, t. 125; Jac.SP. (1935) p. 180, t. 155.

GIBBAEUM GEMINUM N.E.Br. Gard.C. (1922.
I.) p. 129, t. 64 F; Gard.C. (1926.I.)
p. 215; Gard.C. (1927.I.) p. 430; D.K.G.
(1927/1928) p. 227; B.Notes, part I, p. 58,
t. 11; S.A.Gard. (1928) p. 125; Mes.
p. 216, t. 106; Jac.DS. (1933) p. 133,
t. 127; Jac.SP. (1935) p. 179, t. 157.

GIBBAEUM GIBBOSUM (Haw.) N.E.Br. H.obs.
p. 137; H.mis. p. 36; H.syn. p. 226; H.rev.
p. 104; DeCand. p. 423; F.Cap. p. 404;
Berg. (1908) p. 226; Gard.C. (1922.I.)
p. 151, t. 75; D.K.G. (1927/1928) p. 227;
Jac.SP. (1935) p. 179.

GIBBAEUM HAAGEI Schwant. Jac.SP. (1935)
p. 179.

GIBBAEUM HEATHII (N.E.Br.) L.Bol. *Rimaria*
heathii N.E.Br. J.Linn. (bot.) XLV (1920)
p. 67; Gard.C. (1926.I.) p. 135, t. 66 et 67;
Moell. (1926) p. 342; D.K.G. (1926/1927)
p. 226; Succ. (1930) p. 24, t. 49, 50 et 52;
S.A.Gard. (1932) p. 330, 331; Mes. p. 288,
t. 160, 161; Jac.DS. (1933) p. 174/175,
t. 179; Jac.SP. (1935) p. 240, t. 227;
B.Notes, part III, p. 65.

Gibbaeum helmiae L.Bol. B.Notes, part II,
p. 402 = GIBBAEUM CRYPTOPODIUM (Ken-
sit) L.Bol.

Gibbaeum luckhoffii L.Bol. B.Notes, part
II, p. 232; S.A.Gard. (1931) p. 317;
B.Notes, part II, p. 368; S.A.Gard. (1932)
p. 330, 331; B.Notes, part III, p. 65 =
GIBBAEUM HEATHII (N.E.Br.) L.Bol.

Gibbaeum luteoviride (Haw.) N.E.Br.—
H.Syn. p. 226; H.rev. p. 104; DeCand.
p. 423; F.Cap.II, p. 104; Berg. p. 227;
Gard.C. (1922.I.) p. 151; Gard.C. (1926.I.)
p. 215; D.K.G. (1927/1928) p. 227;
Jac.DS. (1933) p. 133; Jac.SP. (1935)
p. 179 = GIBBAEUM GIBBOSUM (Haw.)
N.E.Br.

Gibbaeum marlothii N.E.Br.—Gard.C.
(1928.II.) p. 492 = GIBBAEUM GIBBOSUM
(Haw.) N.E.Br.

Gibbaeum molle N.E.Br.—Gard.C. (1926.
I.) p. 216 et p. 172, t. 82d; D.K.G. (1927/
1928) p. 227 = GIBBAEUM CRYPTOPODIUM
(Kensit) L.Bol.

Gibbaeum muirii N.E.Br.—Gard.C. (1926.
I.) p. 216, t. 105A et 82c. p. 172; D.K.G.
(1927/1928) p. 227 = GIBBAEUM GIBBOSUM
(Haw.) N.E.Br.

Gibbaeum muirii (N.E.Br.) Schwant.—*Men-
tocalyx muirii* N.E.Br. Gard.C. (1927.I.)
p. 252; Jac.DS. (1933) p. 133; Jac.SP.
(1935) p. 180; D.K.G. (1937) p. 152 =
GIBBAEUM SCHWANTESII Tisch.

GIBBAEUM NEBROWNII Tisch. *Imitaria muirii*
N.E.Br. J.Bot. (1927) p. 348; Mes. p. 190,
t. 169; Jac.DS. (1933) p. 141, t. 137;
Jac.SP. (1935) p. 190, t. 169; D.K.G. (1937)
p. 151.

Gibbaeum nelii Schwant. Jac.DS. (1933)
p. 133, t. 125; Jac.SP. (1935) p. 180, t. 155
= GIBBAEUM FISSOIDES (Haw.) Nel.

GIBBAEUM PACHYPODIUM (Kensit) L.Bol.
T.R.Sty.I. p. 152; Fedde XII (1913) p. 322;
B.Notes, part I, p. 152.

Gibbaeum perviride (Haw.) N.E.Br.—H.
obs. p. 136; H.mis. p. 227; H.rev. p. 104;
DeCand. p. 423; F.Cap. II, p. 405; Berg.
(1908) p. 227; Gard.C. (1922.I.) p. 151;
(Fig. published here No. 74 is not *G.
perviride*); Gard.C. (1926.I.) p. 234; D.K.G.
(1927/1928) p. 227; Jac.DS. (1933) p. 133,
t. 126; Jac.SP. (1935) p. 180, t. 156 =
GIBBAEUM GIBBOSUM (Haw.) N.E.Br.

GIBBAEUM PETRENSE (N.E.Br.) Tisch. *Argeta petrensis* N.E.Br. Gard.C. (1927.II.) p. 114, t. 52; S.A.Gard. (1929) p. 221; D.K.G. (1929) p. 234; Mes. p. 108, t. 18; Jac.DS. (1933) p. 90, t. 82; Jac.SP. (1935) p. 126, t. 104; D.K.G. (1937) p. 151.

GIBBAEUM PILOSULUM (N.E.Br.) N.E.Br. J. Linn. XLV. (1920) p. 98; Gard.C. (1922.I.) p. 214; Gard.C. (1925.I.) p. 484; Gard.C. (1926.I.) p. 234, t. 119; D.K.G. (1927/1928) p. 227; Mes. p. 220, t. 109; Jac.DS. (1933) pp. 133/134, t. 127; Jac.SP. (1935) pp. 180/181, t. 157.

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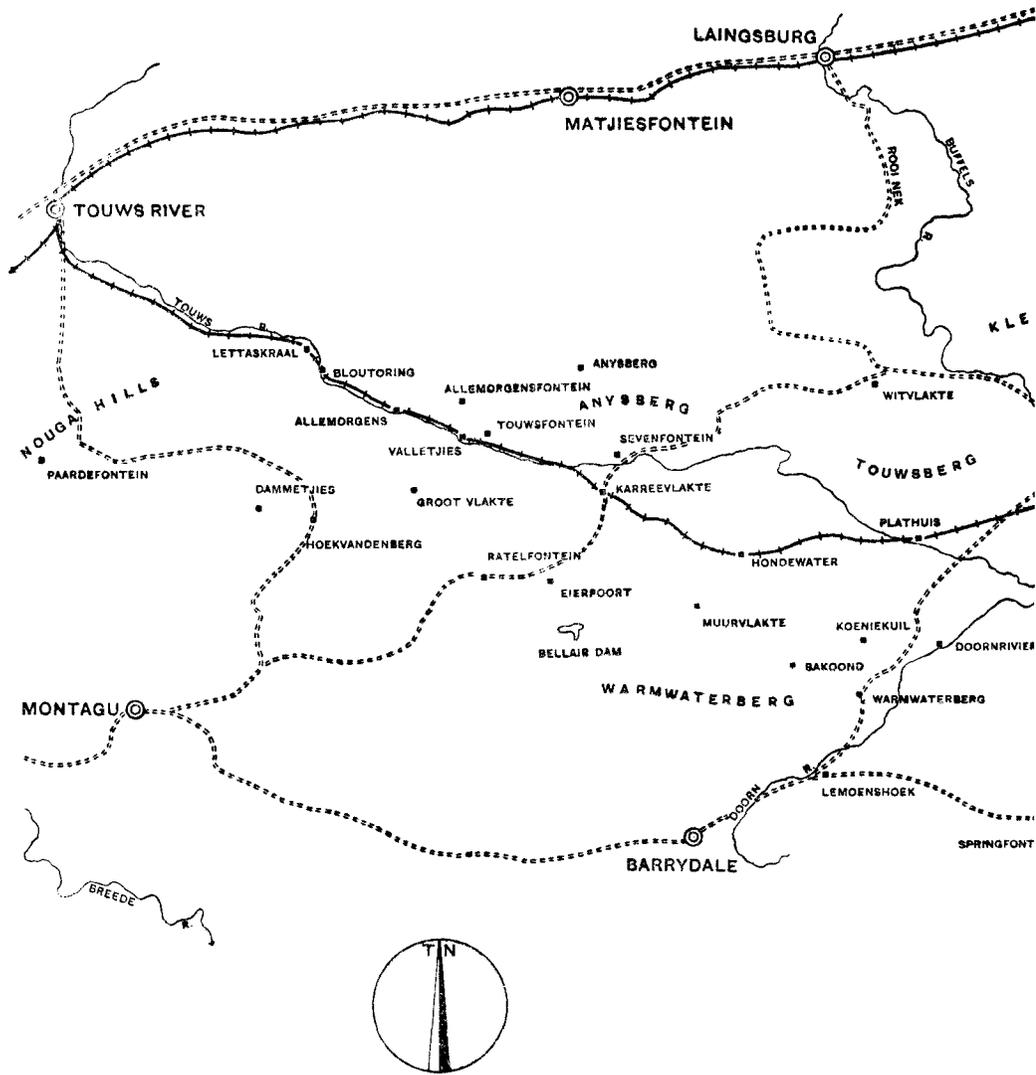
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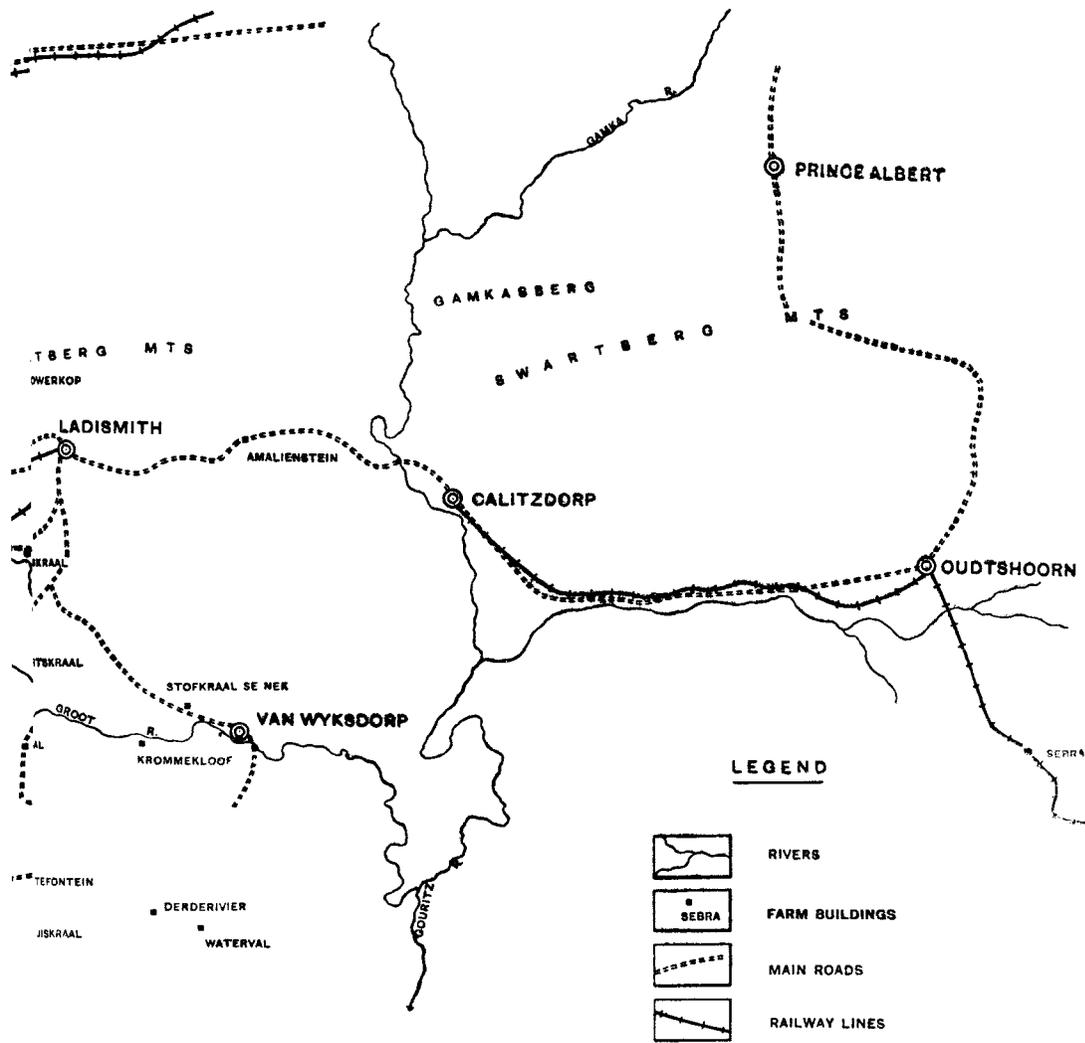
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SKETCH MAP OF THE
LITTLE



CENTRAL AND WESTERN

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