

The Flora of the Brandberg

BERTIL NORDENSTAM

ABSTRACT

A check-list of 337 species of vascular plants from the Brandberg, the highest mountain in South West Africa, is herewith presented. The following new taxa are described: *Euphorbia chamaesycoides* B. Nord., *Euphorbia monteiroi* Hook. fil. subsp. *brandbergensis* B. Nord., *Scirpus aciformis* B. Nord., and *Scirpus hystricoides* B. Nord. Besides, taxonomic comments and notes on infraspecific variation are given in many cases.

The chromosome number $2n = 18$ is reported for *Felicia anthemidodes* and *Nidorella nordenstamii*.

The phytogeographical affinities of the flora are discussed. The mountain lies within the Karroo-Namib floristic region and no members of the Cape flora are represented. The endemic element consists of 11 taxa, known only from the Brandberg, and 28 species belonging to the Kaoko element.

Another large and significant group of species has remarkable disjunctions between a southern range in the Karroo-Namib region and a northern area in the arid parts of north and north-east Africa. These taxa are believed to be remnants of a once more widely spread arid African element.

ZUSAMMENFASSUNG

Eine Liste über 337 Arten von Gefäßpflanzen des Brandberges, des höchsten Berges von Südwestafrika, wird aufgestellt. Die folgenden neuen Taxa werden beschrieben: *Euphorbia chamaesycoides* B. Nord., *Euphorbia monteiroi* Hook. fil. subsp. *brandbergensis* B. Nord., *Scirpus aciformis* B. Nord. und *Scirpus hystricoides* B. Nord. Außerdem werden systematische Erläuterungen und in vielen Fällen Anmerkungen über infraspezifische Variationen gegeben.

Die Chromosomenzahl $2n = 18$ für *Felicia anthemidodes* und *Nidorella nordenstamii* wird angegeben.

Die pflanzengeographischen Verwandtschaften der Floren werden besprochen. Der Berg liegt in der Karroo-Namib Florenregion und keine Arten der Kapflora sind vertreten. Das endemische Element besteht aus 11 Taxa, die nur vom Brandberg bekannt sind, und 28 Arten gehören dem Kaoko Element an.

Eine andere große und bezeichnende Gruppe von Arten hat bemerkenswerte Disjunktionen zwischen einer südlichen Grenze in der Karroo-Namib Region und einem nördlichen Areal in den ariden Teilen von Nord- und Nordost-Afrika. Es wird angenommen, daß diese Taxa Reste eines einst weiter verbreiteten ariden Afrikanischen Elements sind.

OPSOMMING

'n Lys van 337 soorte vaatplante van die Brandberg, die hoogste berg in Suidwes-Afrika, is opgestel. Die volgende nuwe plantsoorte word beskryf: *Euphorbia chamaesycoïdes* B. Nord., *Euphorbia monteiroi* Hook. fil. subsp. *brandbergensis* B. Nord., *Scirpus aciformis* B. Nord., en *Scirpus hystricoides* B. Nord. In baie gevalle word opmerkings en aantekeninge oor infraspesifieke variasies gegee.

Die getal chromosome $2n = 18$ vir *Felicia anthemidodes* en *Nidorella nordenstamii* word genoem.

Die fitogeografiese verwantskappe van die plantegroei word bespreek. Die berg is in die Karroo-Namib plantegroëistreek geleë en geen plantsoorte van die Kaapflora is teenwoordig nie. Die endemiese element bestaan uit 11 taksie wat net tot die Brandberg beperk is. 28 van die plantsoorte behoort aan die Kaoko-element. 'n Ander groot en betekenisvolle groep van plantsoorte het 'n buitengewone disjunksie tussen 'n suidelike verspreiding in die Karroo-Namib streek en 'n noorde-like area in die ariede dele van Noord- en Noordoos-Afrika.

Dit kan aangeneem word dat hierdie plantsoorte 'n oorblyfsel van 'n eertydse wyd verspreide ariede Afrikaanse element is.

HISTORY OF EXPLORATION

It is a surprising fact that the impressive Brandberg mountain remained practically unknown well into the present century. As late as in the 1922 edition of 'The Times Survey Atlas of the World' there is no indication whatever of the mountain. Although the mountain was known to travellers already at the end of the last century, its altitude was generally believed to be little more than 1 000 m s.m.

The exploration of the mountain may be said to have started in 1909, when H. Jochmann, a German officer, visited the Tsisab Valley and found the first rock paintings there (Jochmann 1910).

The first attempt to climb the mountain was made in 1914 by two German surveyors, Burfeindt and Carstensen. From the Numas Valley they ascended one of the highest peaks, accompanied by a few native guides. As shown by Lempp

(1956, 1960), they must have reached the Horn, the fourth highest peak. Burfeindt remained a fortnight on the mountain, in vain waiting for further supplies, until he descended, probably through the Kharoab Ravine. He must have suffered severely from hunger, thirst and strain, but was eventually safely reunited with his company. Later in the same year the group made two further attempts to explore the upper regions of the mountain, but their work was interrupted by the outbreak of the war.

The first successful ascent of the highest peak was made via the Tsisab Valley on January 2nd, 1918, by R. Maack, G. Schulze and A. Gries. They measured the summit to be between 2 606 and 2 614 m and named it Königstein. On the way down, Maack discovered the famous rock painting, now known as the "White Lady". Maack immediately associated the human figures of the fresco with Egyptian-Mediterranean style and regarded the central figure as a male dancer.

In 1923 Maack published a report on the geography and geology of the Brandberg, including the first topographical map by the cartographer A. Hofmann. In 1917 the latter, together with Maack, started a photogrammetric survey of the mountain and many years later (1962) produced a thorough map of the mountain in the scale 1:40 000. Maack's interesting paper also contains some notes on the vegetation and he was the first to note the 'Brandberg Acacia' (*Acacia montis-usti*) and the 'Brandberg Euphorbia' (*Euphorbia monteiroi* subsp. *brandbergensis*), two of the most striking plants of the mountain.

The second ascent of the summit was made in 1943 by the South African mountaineer, D. Woods. Since then the mountain has been climbed many times by mountain enthusiasts, mostly along the shortest route in the south-east, known to mountaineers as the 'Basswaldrinne'.

Through the work of Abbé Breuil, the archaeologist, Brandberg suddenly gained world fame. In 1947 Breuil first visited the mountain in order to study the rock paintings of the so-called 'Maack shelter' in the lower Tsisab Valley (cf. above). Breuil's publications (1948—1959) attracted world-wide interest and the 'Maack shelter' fresco became renowned as 'The White Lady of the Brandberg'.

The increasing interest in the archaeology of the mountain resulted in a large expedition to its upper regions in 1955. The party consisted of six people, assisted by a number of Berg-Damas and at times received supplies by air. During the three weeks spent on the mountain one member of the expedition, Mr H.-J. Wiss, made a good collection of plants. These were later determined by Munich botanists and some of Wiss' plants turned out to be new to science (*Mentha wissii*, *Plumbago wissii*). A report on the botanical aspects of the expedition was published (Wiss 1957) and about 110 species of vascular plants were mentioned in the text. Simultaneously, the archaeological results of the expedition were published by Rudner (1957).

More recently, many new paintings have been discovered through the explorations carried out by Jipsen, Mason and others and a very interesting and thought-provoking study of the total archaeological picture of the mountain was produced by Viereck (1968). Further contributions can be traced in the bibliography concluding the present study.

OWN EXPLORATIONS

My own explorations of the Brandberg took place during three visits in 1963 and 1964. On all occasions I was accompanied by my friend, Mr H. P. W. Flensburg. During the first visit (2–7 May, 1963) the Tsisab Valley was explored up to about 1 200 m s.m. On the second occasion (26 May – 2 June, 1963) the Königstein was climbed. The third visit (3–7 April, 1964) was made by aeroplane to the high plateau of Orabeswand. 1963 was an exceptionally good year with abundant rains, but the last visit yielded comparatively little of botanical interest, because of the drought of that summer. A few details of my visits are given below.

First visit

2 May, 1963. Arrival by car to the entrance of Tsisab Valley. The road almost impassable, due to previous heavy rains. In the valley the brook was running with plenty of clear water with a rich algal vegetation and an abundance of tadpoles.

3 May. The rich flora on the black basaltic foothills and the lower granitic slopes was investigated.

4 May. Equipment was carried to a new camp near the 'White Lady', where the ample water supply in the rivulet invited to swimming.

5 May. Ascent up the valley from the 'White Lady'. Very rough terrain with large boulders and strenuous passages. The water in the brook soon petered out, but a waterhole was found in the vicinity of a large boulder with a painting of a giraffe (in reddish brown with a well marked net pattern). Higher up a camp for the night was made at a series of small rock pools with stagnant water.

6 May. Climbing upwards, a better waterplace with a large sycamore figtree (*Ficus sycomorus*) was soon found. A faded giraffe painting was noted on a cliff wall. The valley narrowed to a steep and difficult gorge and the ascent was continued on the western slope. The flora was rich, with trees of *Cyphostemma currori* now starting to occur and a single kokerboom (*Aloe dichotoma*) was observed on a ridge. At the junction of a side valley from the west with the Tsisab, a wonderful system of waterholes (= the '1200-m Wasser') was found. One of the rock-pools, three metres across and as deep as a man, was especially suited for swimming and we named it 'Flensburg's Bad'. Return down to the last camp.

7 May. A thunderstorm with intermittent heavy rain started at 5.30 in the morning and lasted for four hours. Descent mainly along the eastern valley side, which proved more comfortable, to the 'White Lady' and further down to the base camp.

Second visit

20 May, 1963. Arrival Tsisab Valley mouth.

27 May. Packed our heavy loads of sleeping-bags, blankets, field presses and other equipment, and food for about ten days. After lunch the ascent was

started. Having passed the 'White Lady' we chose again to walk along the eastern valley slope. The night was warm and comfortably spent at a waterhole.

28 May. The steep and narrow portion of the valley was climbed along the eastern slope. The packs were left at 'Flensburg's Bad' at 1 200 m, while I made a reconnaissance tour upwards in search of further waterholes. Already after half an hour's quick march the gorge widened to a broad and rather flat valley, where plenty of water was found.

29 May. The camp was moved to the newly discovered waterhole. Botanizing and reconnaissance tours upwards. I followed a side valley westwards up to about 1 850 m, where a previously unknown species of *Othonna* was found (*O. brandbergensis*). From that place a waterhole high up in the Tsisab was indicated by a green spot of sedge vegetation. I went there and found suitable water.

30 May. Moved up to the last found water in a rather comfortable terrain. The valley floor was sandy in parts and leopard spoor were seen here and there. No leopards were seen, however, although their smell was constantly in the air. The riverbed was now quite dry, but in a steep gorge westwards we found a little trickling water at about 1 750 m. I walked up to about 2 200 m and realized that Königstein must be one of the adjacent peaks. Returned to the camp with good hopes of reaching the summit the next day. In the evening beautiful rock paintings were found near the camp. They were all monochromes, but contained many male and female figures as well as animals, i.a. a very distinct elephant and a fine giraffe's head. Close by there was a living site with charcoal, pottery remains, small pieces of ostrich egg-shells and stone implements.

A noteworthy fact was the rich occurrence of *Tribulus zeyheri* on the site. It seemed that this easily recognized plant, which is well adapted for dispersal by man and his domestic animals, could be used as an indicator of former settlements. The spiny fruits were easily noticed, since they stuck to the rubber soles of our shoes.

31 May. We started early with the intent of reaching Königstein. Up to 2 200 m it was difficult to judge the location of the summit, but after climbing a somewhat lower peak we clearly recognized Königstein close by. The peak was then easily climbed. The beacon had fallen down, but the note-book on the top was found intact. From the summit there was a breathtaking view over the upper Brandberg, with the Horn, Numasfelsen and Aigub clearly recognizable. Beyond the yellow Namib desert in the west the Atlantic was barely visible. We returned to the camp with satisfactory samples of the interesting summit flora.

1 June. The descent was started at a quick pace.

2 June. After spending the night in the middle Tsisab, we arrived about noon at the base camp.

Third visit

3 April, 1964. Arrived at Uis Tin Mine, where we were informed that Brandberg was very dry, which meant that climbing the mountain would be difficult. Instead the manager, Mr J. Botha, offered to fly us to the Orabeswand plateau in his aeroplane, model Piper Cherokee 180. After a dangerous landing on a very

rough air strip on the plateau we were left alone at about 2 000 m with a limited supply of food and water. We made a primitive camp at a solitary 'wild pear' tree (*Dombeya rotundifolia*).

4 April. Botanizing with meagre results in the surroundings, including the nameless peak (2 281 m) on the western side of Orabeswand. Numerous small rodents were a pest during this and the following nights, gnawing at everything, including paper, cigarettes, clothes and plastic bottles. They even managed to slip inside the rucksack, which we had hung on a wire from the wild pear tree. In the middle of the night I was roused by one of the little beasts chewing my finger!

5 April. Walked down to the upper Tsisab Valley, where three small rock pools with green slimy water were found, scanty remains of the plentiful rains in the previous year.

6 April. Excursion on the plateau, where many living sites with rock paintings and stone implements were seen.

7 April. Mr Botha came to fetch us in his plane and we flew down the Tsisab Valley in an attempt to locate eventual permanent waterholes. There were no indications of water on this part of the mountain and we landed in Uis with a comparatively poor harvest of plants.

SOME PHYSICAL AND CLIMATIC FEATURES

With an altitude of 2 585 m the Brandberg is the highest mountain in South West Africa. The summit, named Königstein, is situated at c. 21° 10' S and 14° 35' E, about 135 km west of Omaruru and 100 km from the Atlantic. The mountain lies at the eastern border of the central Namib desert, just south of the Ugab River. The massif consists of an oval granite dome of late Karroo age, about 30 km wide in the W-E direction and 23 km in the N-S direction, covering an area of about 750 km². The mountain is a typical 'Inselberg' and rises very abruptly from the surrounding desert and semi-desert plain, which lies at an altitude of between 500 and 800 m s.m. The four highest peaks, viz. Königstein, Aigub, Numasfelsen and the Horn, all exceed 2 500 m and rise from a high plateau of about 2 000 m (see map). The mountain is surrounded by black basaltic lava, occurring as low, interrupted foothills and is in parts capped by the remnants of a porphyry layer.

A few arterial streams radiate from the central plateau and have cut deep valleys, the most prominent of which are the Tsisab in the north-east and the Numas to the west. There are no permanent streams, however, and even permanent waterholes are rare and small-sized, except in years with an extremely high rainfall (like 1934, 1950, 1963 and 1974).

The Brandberg has on the whole a desert climate. Rains fall mainly in January to March and the average yearly amount is probably only 15—30 mm. The prevailing winds are south-western and rather strong. They bring humidity from the ocean, and mists are frequent in the western parts. Night dews are a common phenomenon, adding to the precipitation from the meagre and sporadic rainfall.

The scanty temperature figures available (e.g. in Maack 1923) indicate that the daily maximum in summer lies between $+31^{\circ}$ and 35° C and the night minimum at about $+15^{\circ}$ C. The latter figure contrasts with the much lower night temperatures in the surrounding desert. No doubt the radiation from the stone masses is responsible for this levelling effect.

The granite has eroded to large blocks and boulders, which fill some of the valleys extensively, making them almost inaccessible. Soil layers are very scanty and consist mainly of coarse granitic sand, with some finer material locally assembled in the riverbeds and at the waterholes.

The accompanying map has been prepared mainly from Hofmann's map of 1962, the result of 50 years of Brandberg cartography.

Further sources of information on the topography, geology, archaeology, etc. of the Brandberg can be found in the bibliography terminating the present paper.

CHECK-LIST OF FLOWERING PLANTS

The check-list is based on my own collections from 1963 and 1964, supplemented by a few other collections and records from literature. The plants collected by Mr H.-J. Wiss on the 1955 Brandberg expedition are included. I have only seen a few of these specimens, which are distributed among the herbaria in Windhoek, Pretoria and Munich, but Mr W. Giess has supplied me with a list of the correct names of the Wiss collection. The published records in Wiss' report (1957) have also been included (and sometimes corrected).

In 1961 Mr W. Giess collected specimens in the Numas Valley mouth and on the eastern side of the mountain, about five miles south of the Tsisab Valley. Although this collection had not been worked out, Mr Giess kindly sent me a duplicate set, which I have determined and included in the list. Mr Giess has also put at my disposal a list of plants (about 25 species) collected by Dr R. Logan in the Numas Valley in 1970. Finally, some specimens collected by Dr L. E. Kers in the lower Tsisab (in 1963) and Numas Valleys (in 1968) have been included, as well as a few odd specimens, which I have come across in the herbarium of the Museum of Natural History, Stockholm (S). Dr Kers' and my own collections are preserved in the latter herbarium, as well as Mr Giess' duplicates from 1961. For the sake of completeness, scattered records in the literature have also been cited, although some of the old ones may need confirmation.

The check-list comprises 337 species, a few of which need to be confirmed by further observations. It should be noted, that large parts of the Brandberg are still botanically unexplored. The investigations have so far been concentrated to the Numas and Tsisab Valleys and the Aigub and Königstein areas. Thus several additions to the flora can be expected in the future.

Many colleagues have been helpful with determinations of plants belonging to their specialties. My thanks are due especially to Prof. H. Merxmüller and members of his staff, viz. Dr A. Schreiber, Dr H. Roessler, Dr H. C. Friedrich, Dr

P. G. Meyer and Dr J. Grau. I also wish to express my thanks to Prof. T. Norlindh, Prof. E. A. Schelpe, and Dr B. de Winter, and last, but not least, to Mr W. Giess, who has so kindly provided me with notes and material.

The sequence and naming of the plants are in accordance with the 'Prodromus' (Merxmüller 1966—72), with a few minor changes brought about by quite recent taxonomic studies. Synonyms are given in brackets, if used in earlier publications with relevance to the Brandberg flora.

Descriptions of new species from the Brandberg and some chromosome numbers have been published in various previous papers (Nordenstam 1966 a, b, 1967 a, b, 1969 b).

In the cited collections G. stands for W. Giess, N. for B. Nordenstam and W. for H.-J. Wiss.

7. *Sinopteridaceae*

Cheilanthes dinteri Brause — Between upper Tsisab and Königstein, c. 1 750 m, N. 2783 (det. E. A. Schelpe).

A small fern growing under stones and rocks.

Cheilanthes parviloba Swartz — Stony slopes W of middle Tsisab, c. 1 500 m, N. 2572 (det. E. A. Schelpe) — Summit of Königstein, 2 570 m, N. 2805 — Orabeswand, c. 2 000 m, N. 3652.

A fern with glabrous and glutinous fronds, frequently found in shade under rocks, in rock crevices, etc., in higher altitudes of the mountain, especially between 1 800 m and the summit.

9. *Aspleniaceae*

Ceterach cordatum (Thunb.) Desv. — Summit of Königstein, 2 575 m, N. 2799 — Orabeswand, c. 2 000 m, N. 3655.

A less frequent small fern favouring rock crevices and shaded localities under rocks.

13. *Welwitschiaceae*

Welwitschia mirabilis Hook. fil.

This famous plant has rich occurrences near the western and southern foothills of the mountain (N. obs., cf. Wiss 1957 p. 46, Kers 1967 p. 107, Giess 1969 b p. 11). Kers (op. cit. p. 108) also mentions a *Welwitschia* locality at the Ugab River north of the Brandberg, probably situated between Riet and Kamatsarab (Gomatsarab). This locality was indicated by Gürich (1895), but according to Kers not later confirmed. However, Maack (1960 p. 32) reports to have seen (in 1918) groups of *Welwitschia* at a place north of the Karoab Ravine. This locality is thus not far east of the waterhole Riet and about 15 km west of Kamatsarab.

16. *Moraceae*

Ficus guerichiana Engler — W of upper Tsisab, c. 1 800 m, N. 2777. A single shrub, c. 2 m high, with glabrous, leathery leaves. It was found growing below

a steep rock face. *F. "Gürichii"* in Maack 1923 (p. 10) probably also refers to this species.

Ficus sycomorus L. — Middle Tsisab, c. 1 200 m, N. 2576 — Also reported from the Numas Valley, c. 1 850 m (Wiss 1957 p. 56, Lempp 1956 p. 433). Already noted from the Brandberg by Maack (1923 p. 10, as *F. damarensis*) and also cited by Palmer & Pitman (1972 p. 443).

A large tree with pubescent or scabrid leaves, occurring in small groups or as occasional huge specimens at some of the larger waterholes.

17. Urticaceae

Forsskaolea candida L. fil. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2442; in the stony riverbed, c. 500 m, N. 2522.

A much branched, somewhat suffrutescent herb up to one metre high, with white-tomentose leaves and inconspicuous flowers enclosed in bracts.

Forsskaolea viridis Ehrenb. ex Webb — Numas Valley, in shade under overhang, G. 3623.

A smaller and weaker herb with green leaves.

21. Santalaceae

Osyris lanceolata Hochst. & Steud. (syn. *O. abyssinica* Hochst. ex A. Rich.) — Recorded from the upper Numas Valley by Wiss (1957 p. 58).

22. Loranthaceae

Plicosepalus curviflorus (Benth.) van Tieghem (syn. *Loranthus kalachariensis* Schinz) — Middle Tsisab, at a waterhole, c. 1 100 m, N. 2795 — Numas Valley, 1 900 m, W. 1458 (see also Wiss 1957 p. 52 and Balle 1968 p. 172).

A conspicuous parasite with red or orange flowers, growing on *Acacia montis-usti* (N.) and *A. hereroensis* (W.).

Tapinanthus oleifolius (Wendl.) Danser — Numas Valley, G. 3636.

Parasitic on *Parkinsonia africana*. Flowers red with yellow tips.

25. Nyctaginaceae

Boerhavia deserticola Codd — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2444 — SE side, c. 5 miles S of Tsisab Valley, G. 3663 — Numas Valley, sandy riverbed, G. 3602.

A laxly branched viscid herb about one metre high. The species seems to be quite variable e.g. in pubescence and especially in flower colour. Thus G. 3602 has pure white, G. 3663 light purple, and N. 2444 pink flowers.

Commicarpus squarrosus (Heim.) Standley — Middle Tsisab, c. 1 500 m, N. 2545 (conf. A. Schreiber).

A suffrutescent herb with somewhat fleshy leaves and purplish red flowers.

Phaeoptilum spinosum Radlk. — Tsisab Valley mouth, granitic mountain slopes, c. 600 m, N. 2499 — Numas Valley, c. 650 m, Logan 102 — Upper Numas, according to Wiss (1957 p. 57).

Divaricate, spiny shrubs, about 1,5 m high, with greyish green leaves.

26. Molluginaceae

Corbichonia decumbens (Forsk.) Exell — Tsisab Valley, end of road, Kers 1005 — SE side, c. 5 miles S of Tsisab Valley, G. 3662.

A small half-shrub c. 0,4 m high, with purplish blue petaloid staminodes.

Gisekia africana (Lour.) OK. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2461 — Numas Valley, in sand, G. 3609.

A glabrous herb with decumbent branches and rather dense clusters of intensely purple to lively crimson flowers.

Hypertelis bowkeriana Sonder — Upper Tsisab, sandy riverbed, c. 1 500 m, N. 2568.

A small annual with fleshy, terete leaves and white flowers.

Limeum argute-carinatum Wawra & Peyr. — Tsisab Valley mouth, granitic mountain slopes, c. 600 m, N. 2497.

A prostrate annual. Flowers small, with herbaceous petals and white petaloid staminodes.

Limeum dinteri Schellenb. — SE side, c. 5 miles S of Tsisab Valley, G. 3710.

A sticky plant up to 35 cm high, somewhat woody at the base.

Mollugo cerviana (L.) Ser. ex DC. — Lower Tsisab Valley, sandy riverbed, c. 650 m, N. 2521.

A glabrous annual with whorled leaves and small, whitish flowers with five stamens.

27. Aizoaceae

Aizoanthemum dinteri (Schinz) Friedrich — Edge of Numas Valley, 2 100 m, W. 1446 (cf. Wiss 1957 p. 67) — Numas Valley, sandy riverbed, G. 3591 — Also in Tsisab Valley (Wettstein 389 is cited in Friedrich 1957 b p. 345).

A papillate and somewhat succulent, light green annual with sessile, yellow flowers.

Galenia africana L. — Upper Tsisab, c. 1 500 m, N. 2556a — Numas Valley, c. 2 000 m, Logan 96, W. 1413 (cf. Wiss 1957 pp. 57, 64).

A shrub with almost linear leaves and numerous, yellowish green flowers.

Lithops gracilidelineata Dtr — Below Aigub, Rudner s.n. (not seen).

The Brandberg *Lithops* was found on the 1955 expedition (cf. Lempp 1956 p. 434, Wiss 1957 pp. 67, 68). It was by Schwantes first referred to *L. dendritica* Nel and later described as *L. pseudotruncatella* (Berger) N. E. Br. var. *brandbergensis* De Boer. Friedrich (in 'Prodromus' 27: 75) points out the close relationship between *L. pseudotruncatella* and *gracilidelineata* and refers the Brandberg plant to the latter species. A photograph of the plant is found in Jacobsen 1970 (Plate 174).

"*Mesembryanthemum crystallinum* L." is reported from the upper Numas Valley by Wiss (1957 p. 55). This record may refer to *M. guerichianum* Pax, but has not been confirmed.

Psilocaulon melanospermum (Berger) N. E. Br. — Königstein, E slopes, c. 2 300 m, N. 2882 (brought into cultivation at Kirstenbosch; no dried material preserved) — Orabeswand, c. 2 000 m, N. 3654 — Aigub, W. 1421 (cf. Wiss 1957 p. 66).

A succulent shrub, up to 0,7 m high, with white flowers.

Another succulent 'mesem' was collected on Orabeswand, near the escarpment, c. 2 000 m, and brought into cultivation at Kirstenbosch. The identity of the latter collection (N. 3679) was never settled. It is possibly identical to the "*Hereroa* spec." mentioned by Wiss (1957 p. 67; perhaps *H. puttkamerana*, which is known from the district).

Sesuvium sesuvioides (Fenzl) Verdc. — Tsisab Valley mouth, c. 600 m, N. 2491 — SE side, c. 5 miles S of Tsisab Valley, G. 3695.

A frequent annual along the stony riverbed of the lower Tsisab Valley. The leaves are glaucous and somewhat fleshy. The flowers are bright scarlet.

28. Tetragoniaceae

Tetragonia arbuscula Fenzl ex Sonder — Upper Numas, and up to 2 600 m, W. 1431 (cf. Wiss 1957 p. 64).

Shrubs up to 2 m high, with inconspicuous flowers and 2 cm large, four-winged fruits.

Tribulocarpus dimorphanthus (Pax) S. Moore — Tsisab Valley, end of road, Kers 1020.

A shrub about 0,7 m high, with whitish twigs and white flowers.

29. Portulacaceae

Anacampseros albissima Marl. — Summit of Orabes Kop, c. 2 300 m, N. 3678.

Living specimens of this collection have flowered and set seeds in the Botanical Garden, Lund, Sweden.

31. Caryophyllaceae

Dianthus namaensis Schinz — Reported from the upper Numas Valley (Walter 1972 p. 3).

Silene burchellii Otth. — Summit of Königstein, E side, 2 575 m, N. 2804.

A perennial herb about 0,5 m high, with dirty green to cream-coloured flowers.

32. Chenopodiaceae

Atriplex vestita Thunb. — Upper Numas, above 2 000 m, W. 1432, 1433, 1434 (cf. Wiss 1957 p. 64).

Grey shrubs about 1,5 m high.

Salsola aphylla L. fil. and *S. tuberculata* Fenzl ex Moq. var. *tomentosa* Aellen are reported from the upper Numas Valley by Wiss (1957 p. 55), but these records have not been confirmed. Further, *S. arborea* C. A. Smith ex Aellen has been reported from "one of the watercourses of Ugab River, Brandberg, Wiss 1501" (Aellen 1963 p. 118).

33. Amaranthaceae

Calicorema capitata (Moq.) Hook. fil. — Tsisab Valley mouth, granitic mountain slopes, c. 600 m, N. 2504 — SE side, c. 5 miles S of Tsisab Valley, G. 3717 — Numas Valley, c. 650 m, Logan 104 (also reported from Numas by Wiss 1957 p. 49).

Dense and tough, greyish green shrubs about one metre high. Perianth copiously woolly; anthers and style pink.

Celosia spathulifolia Engler — Tsisab Valley mouth, granitic mountain slopes, c. 600 m, N. 2502.

Erect annual with white perianth and pink stamens.

Cyathula albida Lopr. — Summit of peak W of Königstein, c. 2 520 m, N. 2831. A tall herb, 1–1,5 m high, with broadly ovate, petiolate leaves.

Leucosphaera bainesii (Hook. fil.) Gilg — Numas Valley (fide Wiss 1957 p. 49).

Marcelliopsis splendens (Schinz) Schinz — Tsisab Valley mouth, granitic mountain slopes, ca. 600 m, N. 2510 — Tsisab Valley, near the 'White Lady', Kers 986 — SE side, c. 5 miles S of Tsisab Valley, G. 3643 a — Numas Valley, G. 3643.

A suffrutex up to 1,5 m high, with tomentose stem and branches and silky, dense, spike-like inflorescences.

Sericocoma heterochiton Lopr. — Aigub, 2 600 m, W. 1429 (cf. Wiss 1957 p. 67) — Numas Valley, G. 3641.

A small erect half-shrub up to 0,5 m high.

46. Papaveraceae

Argemone ochroleuca Sweet — Reported only by Maack (1923 p. 10, as *A. mexicana*).

47. Capparaceae

Boscia albitrunca (Burch.) Gilg & Benedict — Numas, plateau, c. 2 000 m, Logan 94 — Amis and Numas Valleys (Wiss 1957 pp. 47, 49, 54). — Tölken (1970 p. 153) cites Liebenberg 5010 from the Brandberg, and in Palmer & Pitman (1972 p. 618) there is a photograph of the tree from the lower parts of the mountain.

A tree with rather small, leathery, petiolate leaves.

Boscia foetida Schinz — Reported from the Amis and Numas Valleys by Wiss (1957 pp. 47, 49), but not confirmed as yet.

Cadaba schroepelii Suesseng. — Tsisab Valley mouth, granitic mountain slopes, c. 600 m, N. 2512 a — Numas Valley, G. 3651 — Also Tölken 1135 according to Marsh (1970 p. 175).

A robust, divaricate shrub with small, greyish, fasciculate leaves.

Cleome angustifolia Forsk. subsp. *diandra* (Burch.) Kers — SE side, c. 5 miles S of Tsisab Valley, G. 3655.

An erect herb up to one metre high. The petals are yellow with purple base.

Cleome elegantissima Briq. — Twice reported from the Numas Valley (Wiss

1957 p. 64 sub nomen *C. confusa* Dtr, Walter 1972 p. 6), but not confirmed by me.

Cleome foliosa Hook. fil. (syn. *C. luederitziana* Schinz) — Tsisab Valley mouth, granitic mountain slopes, c. 600 m, N. 2495 — SE side, c. 5 miles S of Tsisab Valley, G. 3680, 3701.

Much-branched herb up to one metre tall, with yellow petals and purple filaments. The species is common along the riverbed of the lower Tsisab Valley. The three varieties distinguished by Codd & Kers (1970) seem to be difficult to distinguish sometimes. The collection Merxmüller & Giess 1671 is referred to var. *foliosa*. Hardy & de Winter 1504, also from the Brandberg, is said to be transitional to var. *namibensis* (Kers) Codd. The latter is a local race of the central Namib.

Cleome oxyphylla Burch. — Upper Tsisab, c. 1 500 m, N. 2576 a — Orabeswand, c. 2 000 m, N. 3649 — Upper Numas, W. 1443; also found there by Walter (1972 p. 6).

A purple-flowered herb.

Gynandropsis gynandra (L.) Briq. — Reported by Maack (1923 p. 10, as *Pedicularia pentaphylla*), but not yet verified.

Maerua schinzii Pax — Numas Valley, c. 650 m, Logan 101 — Also in Amis Valley, according to Wiss (1957 p. 47).

A tree with short-pubescent leaves and large, greenish yellow flowers.

48. Brassicaceae

Lepidium divaricatum Ait. — Summit of Königstein, 2 575 m, N. 2802.

A perennial herb up to 0,5 m high, with oblanceolate leaves and very inconspicuous flowers.

50. Moringaceae

Moringa ovalifolia Dtr & Berger — Entrance to Numas Valley (Wiss 1957 p. 48, Giess 1970 p. 63) — E side of mountain in middle altitude (Giess loc. cit.) — Also mentioned from "the Brandberg Valley" (probably = Tsisab Valley) by Palmer & Pitman (1972 p. 157) — Lower Tsisab (N. obs.).

A characteristic and attractive tree with a thick, silvery stem, light green foliage and long, hanging fruits.

51. Myrothamnaceae

Myrothamnus flabellifolius Welw. — Upper Numas and Aigub Rock (Wiss 1957 pp. 59, 66).

A virgate shrub with cuneate, leathery leaves.

52. Crassulaceae

Adromischus sp. — Königstein, E slopes, 2 400 m, N. 2837 — Slopes of Orabeskop, c. 2 300 m, N. 3677.

This is perhaps an undescribed species, but in view of the confused taxonomy of the genus I refrain from creating a new taxon. However, a short description and a drawing are provided (Fig. 1).

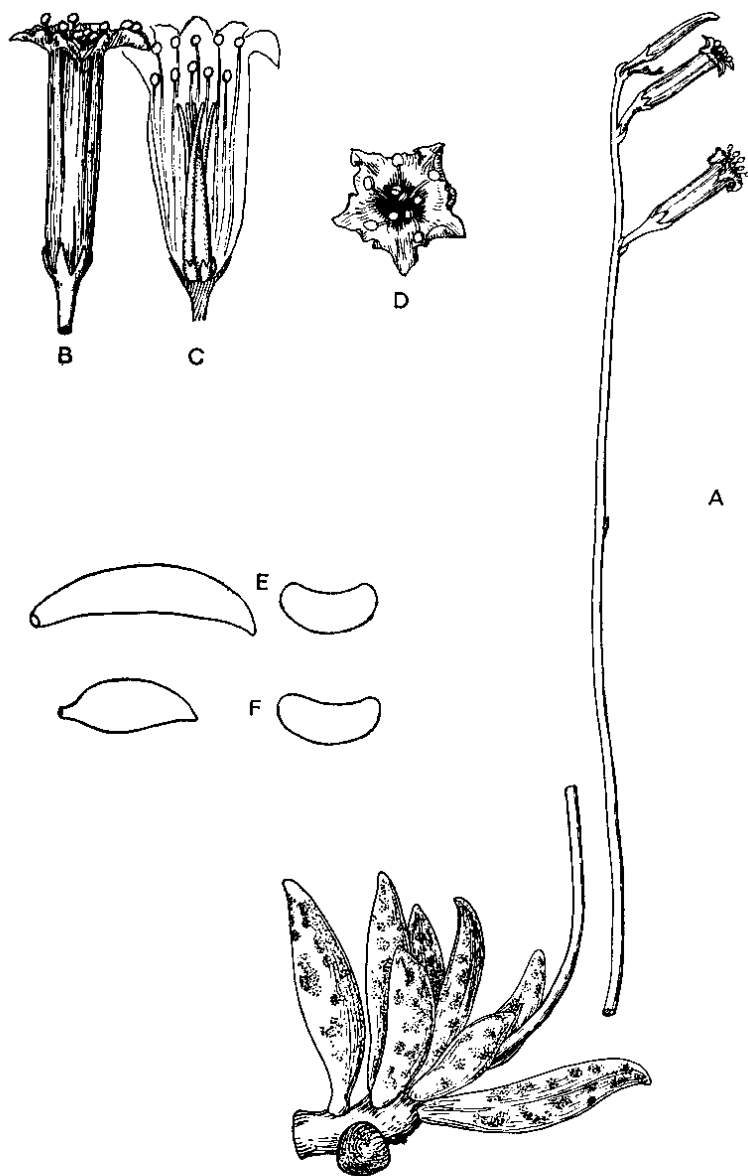


Fig. 1. *Adromischus* sp. from the Brandberg (N. 3677), flowered in the Botanical Garden, Lund, Sweden. — A: Flowering branch, x 1. — B: Flower, x 2½. — C: Corolla, opened to show styles and stamens, x 2½. — D: Corolla, dorsal view, x 2½. — E—F: Leaf outlines in side view and transect, x 1. — Del. auct.

Stems succulent, short and thick, in cultivation up to 7 cm long, up to 1 cm thick, greyish. Leaves alternate, spreading, subfusiform-ellipsoid or \pm semi-terete, without a distinct margin, flattened or shallowly concave above, 2–7 cm long, 1–1,5 cm wide, 0,5–1 cm thick, tapering to the base and to the acute – obtuse and often somewhat recurved tip, dark green and marmorated with white or dull red areas. Peduncle 15–50 cm long (in cultivation), 1,2–1,5 mm thick, simple or branching above the middle, terete, glabrous, greenish brown or reddish, with 2–15 almost patent flowers in a \pm one-sided raceme. Bract 1,5 mm long, acute, thickish. Bracteoles 2, basal, subulate, c. 1 mm long, acute. Pedicel 5–17 mm long, somewhat thickened towards the apex. Calyx lobes narrowly triangular, 1,8–2 mm long, 0,6–1 mm wide, acute. Corolla 1,2–1,5 cm long, pinky white or wax-coloured; tube cylindric, 2,5–3 mm wide; lobes patent, deltoid, acute, with somewhat wavy margins; throat bright purple inside. Styles subulate-filiform, 5–8 mm long, apically white, basally light green. Scales oblong, bifid, 1 mm long and 0,8 mm wide, white. Filaments white or pinkish; the 5 longer ones adnate for 5 mm, c. 12 mm long; the 5 shorter ones adnate for 3 mm, c. 10 mm long. Anthers 0,4 mm long, oblong.

My collections have flowered repeatedly in the greenhouses of the Botanical Garden in Lund, and I have also sent specimens to Dr H.-C. Friedrich in Munich. He suggests that they come closest to *A. schuldtianus* Poelln., which does not develop a distinct stem, however, and has more flattened leaves with a distinct margin.

Also Wiss (1957 p. 67) reports to have found a species of *Adromischus*, viz. below Aigub Peak. Most likely it belongs to the same species.

Cotyledon orbiculata L. — Numas Valley, plateau, c. 2 000 m, Logan 77.

Kalanchoe lanceolata (Forsk.) Pers. — Upper Numas, above 2 000 m, W. 1444.

The flowers are orange yellow (cf. Wiss 1957 pp. 65, 66).

53. Vahliaceae

Vahlia capensis (L. fil.) Thunb. — Lower Tsisab, in the riverbed, c. 650 m, N. 2490 — Orabeswand, c. 2 000 m, dry watercourses, N. 3671.

A yellow-flowered herb, common on the mountain and occurring in annual as well as perennial forms.

54. Montiniaceae

Montinia caryophyllacea Thunb. — Upper Tsisab, c. 1 600 m, N. 2785 — Numas Valley, G. 3644 (also recorded from there by Wiss 1957 p. 58).

Up to two metres high shrubs with glaucous leaves and terete, light brown capsules.

58. Mimosaceae

Acacia albida Del. — Amis Valley, according to Wiss (1957 p. 47).

The 'anatre' here only attains shrub form, being heavily grazed by zebras (Wiss loc. cit.).

Acacia giraffae Willd. — Amis and Numas Valley mouths, according to Wiss (1957 pp. 46, 49).

Occurring as gnarled and rather low trees.

Acacia hereroensis Engler — Upper Tsisab, c. 1 700 m, N. 2775 — Orabeswand, W end, c. 2 100 m, N. 3665 — Numas Valley, 1 650—2 100 m (Lempp 1956 p. 432, Wiss 1957 pp. 52, 64).

Occasional trees in watercourses, up to four metres tall (or sometimes up to 10—12 m according to Wiss, loc. cit.), with white flowers. My collection N. 2775 is atypical, having unarmed twigs, but nevertheless belongs to this species according to Dr A. Schreiber of Munich.

Acacia montis-usti Merxm. & Schreiber — Tsisab Valley mouth, in the riverbed, N. 2518 — Lower Tsisab, near the 'White Lady', N. 2528 — Numas Valley, c. 650 m, Logan 103 — Also reported from the lower Numas and Amis Valleys by Wiss (1957 pp. 47, 49).

The 'Brandberg Acacia' seems to be frequent in the valleys investigated, from the lower parts up to about 1 200 m, and then more occasional up to about 1 650 m (cf. Wiss 1957 p. 52). It is a characteristic tree up to eight metres tall, usually many-stemmed from the base and hence somewhat broom-like, and with a brown, papery cortex. The local name is 'ysterhout' according to Palmer & Pitman (1972 pp. 153, 757), who also provide some illustrations (pp. 154, 754, 756). There is also a photograph in Giess (1971 p. 70).

59. Caesalpiaceae

Adenolobus garipensis (E. Mey.) Torre & Hillc. — Numas Valley, G. 3646. A tall shrub with dark purplish veined corolla. (Also cited in Maack 1923 p. 10, as *Bauhinia garipensis*).

Parkinsonia africana Sonder — Middle Tsisab, c. 1 200 m, N. 2552 — Numas Valley, G. obs. — SW side of the mountain (Wiss 1957 p. 48).

A large and wide spiny shrub with needle-like leaflets and long, narrow pods.

60. Fabaceae

Crotalaria barnabassii Dtr. ex Bak. fil. — Tsisab Valley mouth, granitic slopes, c. 550 m, N. 2496 — SE side, c. 5 miles S of Tsisab Valley, G. 3668.

An annual about 0,5 m high, with rounded and inflated pods.

Cyamopsis senegalensis Guill. & Perr. — SE side, c. 5 miles S of Tsisab Valley, G. 3659.

An erect herb with purplish-veined flowers and erect pods. In several characters, e.g. dentation and pubescence of leaflets, the specimen resembles the so-called *C. dentata* (N.E.Br.) Torre, which is mentioned under *C. serrata* Schinz in the 'Prodromus' (60: 29—30). This may be due to a gene flow from *C. serrata* to *senegalensis*, and the connections between these species should be further investigated.

Indigofera auricoma E. Mey. — Numas Valley, G. 3607.

A herb with golden green young leaves, which become silvery grey with age. The flowers are small and red.

Indigofera disjuncta Gillett var. *disjuncta* — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2449 (det. A. Schreiber).

An erect annual, a few dm high, with simple leaves and flesh-red flowers.

Indigofera fleckii Schinz s. lat. — Tsisab Valley mouth, granitic slopes, c. 600 m, N. 2507 — Middle Tsisab, c. 1 400 m, N. 2547 (det. A. Schreiber).

A suffrutex up to one metre tall, with flesh-red to purplish corolla. The species belongs to a taxonomically intricate and insufficiently studied complex (cf. Schreiber in 'Prodromus' 60: 49, 56, 57).

Indigofera teixeirae Torre — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2448 — Middle Tsisab, c. 1 500 m, N. 2551 (det. A. Schreiber) — Numas Valley, sandy riverbed, G. 3586.

A decumbent herb with red, but finally blue, small flowers.

Mundulea sericea (Willd.) A. Chev. — Orabeswand, c. 2 000 m, N. 3650.

Vigorous shrubs up to one metre high, or more depressed when growing in rock crevices. Flowers purplish blue.

Rhynchosia candida (Welw. ex Hiern) Torre — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2474 — Tsisab Valley, end of road, Kers 1004 — SE side, c. 5 miles S of Tsisab Valley, G. 3666.

A rather dense suffrutex up to 1,5 m tall, with greyish tomentose twigs and yellow flowers. Previously regarded as a variety of *R. memnonia* DC., and my chromosome count on the Brandberg collection was published under the latter name (Nordenstam 1969 b).

Sesbania pachycarpa DC. subsp. *dinterana* Gillett — Tsisab Valley mouth, common in the riverbed, c. 600 m, N. 2480 (det. A. Schreiber).

A gracile, tall herb. Corolla yellow with black dots on the carina and the back of the vexillum. Pods long, terete.

Sutherlandia frutescens (L.) R. Br. — Numas Valley, 1 950 m, W. 1469 (cf. Wiss 1957 pp. 55, 68); also found here by Walter (1972 p. 4).

A shrub with bright red flowers and inflated, papery pods.

Tephrosia dregeana E. Mey. var. *dregeana* — Tsisab Valley mouth, granitic slopes, c. 600 m, N. 2494, 2506 (conf. A. Schreiber).

Erect slender annual up to one metre high, with narrowly pinnate leaves and pinky mauve to purple flowers.

Tephrosia monophylla Schinz — SE side, c. 5 miles S of Tsisab Valley, G. 3661.

Erect shrublet c. 0,4 m high, with purplish blue flowers.

Tephrosia rhodesica Bak. fil. var. *rhodesica* — Orabeswand, c. 2 000 m, N. 3646.

A half-shrub up to c. one metre tall, with purple flowers.

63. Oxalidaceae

Oxalis purpurascens Salter — Upper Tsisab, c. 1 350 m, N. 2554 — Orabeswand, c. 2 000 m, N. 3676.

A brittle herb with pinky mauve flowers. This is probably the "Sauerklee" mentioned by Lempp (1956 p. 430) from the Hungarob Ravine.

64. Geraniaceae

Monsonia senegalensis Guill. & Perr. — Tsisab Valley mouth, granitic mountain slopes, c. 600 m, N. 2500 — Numas Valley, G. 3585 a.

Annual with pink, single flowers.

Monsonia umbellata Harv. — SE side, c. 5 miles S of Tsisab Valley, G. 3585 b — Numas Valley, G. 3585.

An annual herb with white, umbellate flowers.

Pelargonium otaviense Knuth — E of Königstein, c. 2 300 m, N. 2814 — Orabeswand, c. 2 000 m, N. 3667.

Erect half-shrubs, about one metre high. Petals white with pink markings.

Sarcocaulon mossamedense (Welw. ex Oliver) Hiern (syn. *S. marlothii* Engler) — Recorded from the upper Numas Valley by Wiss (1957 p. 59), who describes the plant as a thorny shrub up to one metre high and with four cm large flowers. Already Maack and his company used 'bushman's candles' as firewood on the Brandberg (Maack 1960 pp. 12, 18).

65. Zygophyllaceae

Tribulus zeyheri Sond. — Tsisab Valley mouth, along the riverbed, N. 2513 — SE side, c. 5 miles S of Tsisab Valley, G. 3713.

Decumbent or prostrate yellow-flowered herb. Observed in several places up to c. 1 700 m, especially in the old living sites in the Tsisab Valley.

Zygophyllum simplex L. — Tsisab Valley mouth, along the riverbed, c. 550 m, N. 2514.

A prostrate annual, which is very common in the lower Tsisab, especially in sandy places.

67. Euphorbiaceae

Croton gratissimus Burch. — Middle Numas, W. 1468 (cf. Wiss 1957 p. 54).

Shrubs up to two metres tall. Leaves silvery below.

Euphorbia chamaesycoides B. Nord., sp. nov. — Upper Tsisab Valley, granite rock crevices, c. 1 600 m, 6.V.1963, N. 2567 (S holotype, M) — 10 km S of Tsisab Valley, G. 13315 — Numas Valley, G. 3587.

Illustr.: Figs. 2 H—L, 3 A—C.

E. chamaesyce L. valde similis sed habitu erecto vel adscendente nec prostrato, stipulis minoribus deciduis, styli profunde bifurcati, appendicibus glandularum minoribus differt.

An erect or ascending glabrous annual 10—20 cm high, repeatedly and somewhat divaricately branching in a dichotomous fashion; branches terete, smooth; internodes 1—3 cm long.

Leaves opposite, petiolate, the two members of a pair somewhat unequal; petiole 1—2 mm long; lamina broadly elliptic-oblong — obovate or orbicular, 3—10 mm long and 2—7 mm wide, entire, somewhat oblique at the base, flat, subcoriaceous,

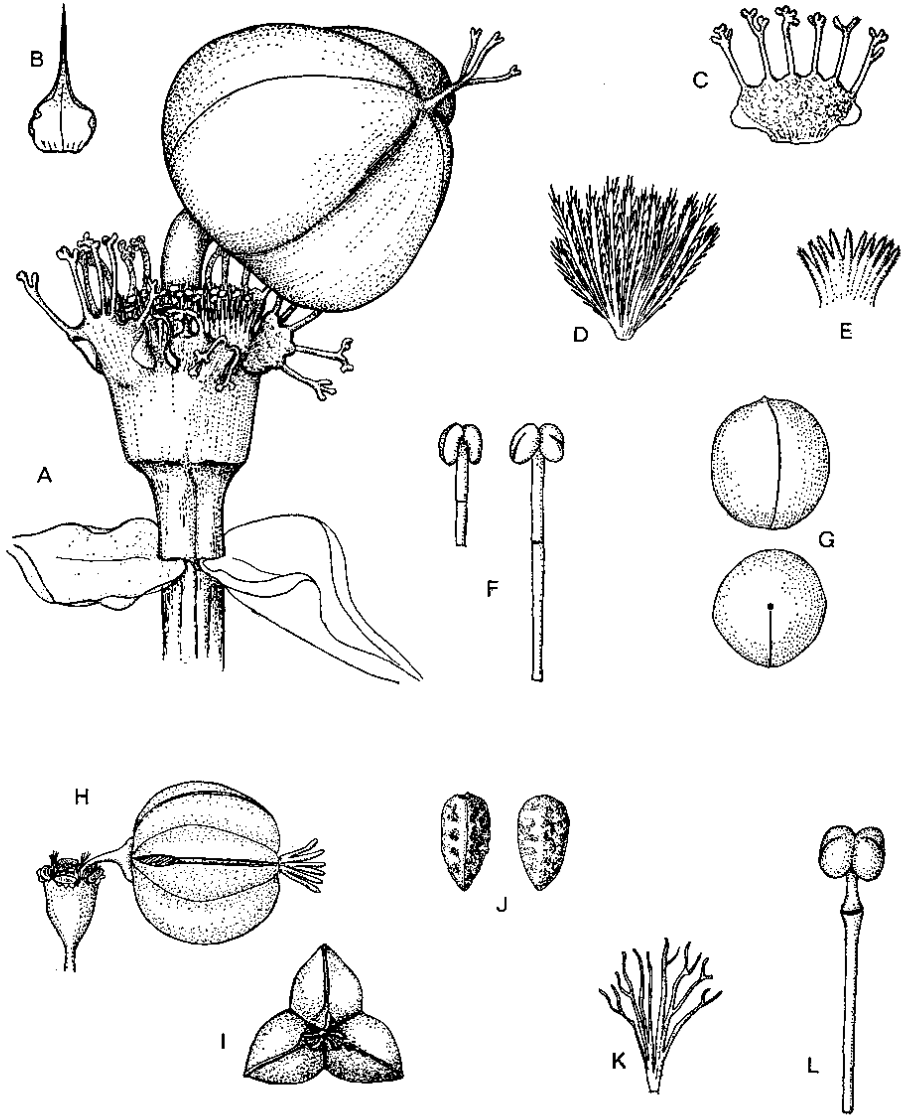


Fig. 2. A—G: *Euphorbia monteiroi* Hook. fil. subsp. *brandbergensis* B. Nord. (N. 3644). — A: Cyathium, x 5. — B: Paired bract, x 1. — C: Gland, x 5. — D: Bracteole of male floret, x 5. — E: Involucral lobe, x 5. — F: Stamens, young and old, x 5. — G: Seeds, side and top view, x 5. — H—L: *Euphorbia chamaesyoides* B. Nord. (N. 2567). — H: Cyathium, x 10. — I: Capsule, top view, x 10. — J: Seeds, adaxial side (left) and abaxial side (right), x 10. — K: Bracteole of male floret, x 20. — L: Stamen, x 20. — Del. auct.

dull green, midveined and with a reticulate venation pattern. Stipules 2 to each leaf, free, minute, deciduous, usually 2- to 4-lobed with lanceolate-subulate lobes.

Cyathia axillary, one to a leaf pair, apical ones on short axillary branchlets not much longer than the subtending leaves. Involucre campanulate, 0,8–1,2 mm long and 0,7–1,2 mm wide, shortly pedicellate (stalk up to 1,5 mm long). Involucral lobes narrowly triangular, 0,1–0,2 mm long, distinctly white-ciliate. Glands 4, transversely elliptic-oblong, 0,4 mm wide, yellowish, somewhat concave, with a very narrow white petaloid appendage like a lateral rim (this entire, 2-lobed or shortly 3-lobed), shortly stalked with white ciliae on the stalk. Male florets c. 5. Pedicel filiform, up to 1,2 mm long, somewhat flattened. Filament c. 0,1 mm long. Anther 0,3–0,4 mm long and wide. Bracteole membranous, white, up to 1 mm long, deeply lacerate with narrow filiform segments.

Ovary exerted on a curved apically thickened stalk. Styles 3, \pm erecto-patent, deeply bifurcate to below the middle or almost to the base, c. 0,5 mm long, filiform. Capsule 2 mm long and wide, trigonous and distinctly trisulcate, glabrous, smooth. Seeds narrowly ovoid-quadrangular, 1–1,3 mm long, 0,5–0,7 mm wide, pinkish—light brown—greyish white, irregularly and coarsely rugose.

This new species of subgenus *Chamaesyce* Raf. has been confused with *E. inaequilatera* Sonder, but stands perhaps closer to the north hemispherical *E. chamaesyce* L. Although there is much variation within these two species, *E. chamaesycoides* may be readily distinguished by its erect habit, repeatedly forking stems with comparatively long internodes, and the distinctly petioled leaves, which are in outline rather more rounded than oblong. Furthermore, the stipules are much smaller and deciduous, the styles are longer and deeply bifurcate, and the leaf-bases are less asymmetrical than in *E. inaequilatera*. The latter species is widely spread in Africa, whereas *E. chamaesycoides* appears to be restricted to the Namib borderland of northern South West Africa. The following collections, all from the Karibib District and preserved in the Munich herbarium (M), belong to the new species: Otjozondü, Walter 1487; Okomitundu, Seydel 2964; Karibib, Sandsteinhügel, Dinter 6750; Erongo, Ameib, Dinter 6750. The two Dinter collections (which have the same number) are stouter with somewhat larger leaves and floral parts, but certainly belong to the same species. In the Windhoek herbarium the new species is represented by the following collections, de Winter & Leistner 5335, Ohopoho, KAO; Volk in herb. Giess 6118, between Welwitschia and Fransfontein; Kers 241, Petrified Forest, OU.

E. serpens Kunth, a native of America, may be distinguished by its connate stipules and smaller seeds. The seeds of *E. chamaesycoides* (Fig. 3 A–C) are smaller and especially narrower than those of *E. chamaesyce*, and also smaller and rather more rugose than in *E. inaequilatera*.

Euphorbia glanduligera Pax — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2446 — Numas Valley, stony riverbed, G. 3588.

Erect, glabrous, dichotomously branching herb.

Euphorbia guerichiana Pax — Upper Tsisab, c. 1 500 m, N. 2561 — Also recorded from Numas Valley (Wiss 1957 p. 52).

Sparingly branching trees, three to four metres high, with papery cortex and narrow leaves. No flowers or fruits observed by me.

Euphorbia lignosa Marloth — Lower Numas Valley, according to Wiss (1957 p. 50), who describes the plant as a small, spiny shrub, looking like a hedgehog.

Euphorbia monteiroi Hook. fil. subsp. *brandbergensis* B. Nord., subsp. nov. — Between upper Tsisab and Königstein, stony—rocky slopes, c. 1 750 m, 29.V.1963, N. 2786 (S holotype) — Orabeswand, c. 2 000 m, N. 3644 — Numas Valley, plateau, c. 2 000 m, Logan 83.

Illustr.: Figs. 2 A—G, 3 D—G.

A subspecies typica habitu altiore, bracteis pedunculorum angustioribus, glandulis flavo-viridibus utrinque lobo laterali linguiformi instructis differt.

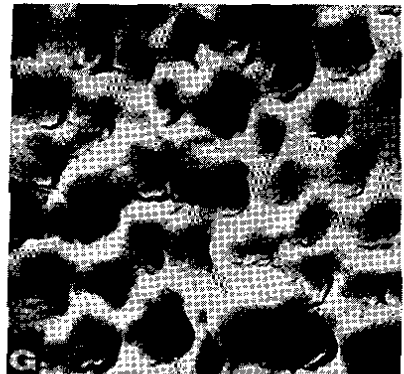
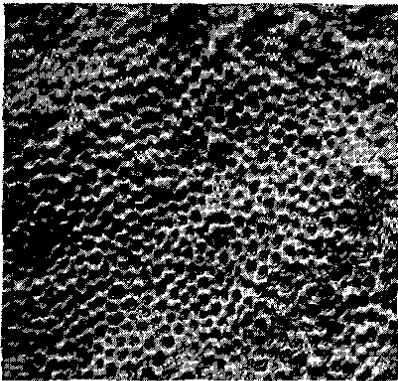
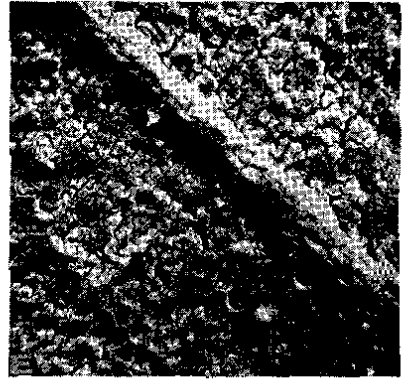
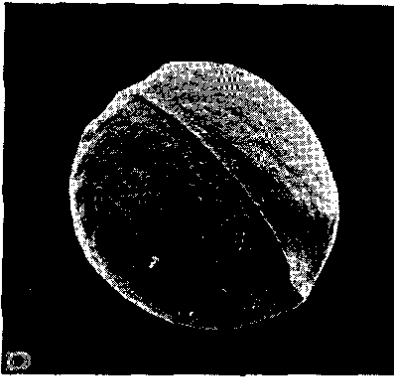
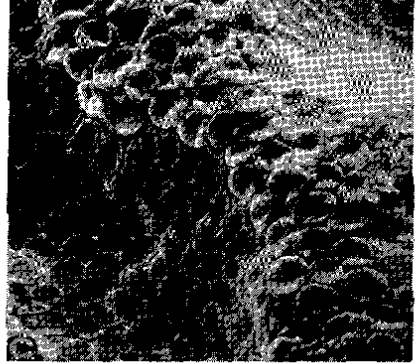
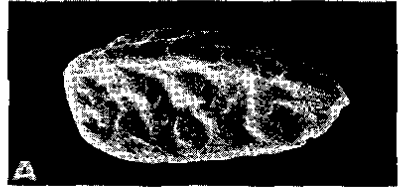
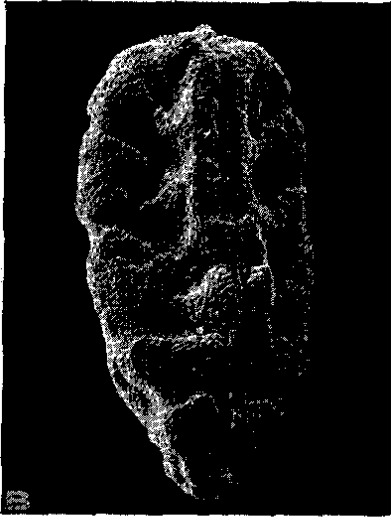
A glabrous erect succulent-stemmed perennial. Stem simple or sparingly branched above, usually 1–2(–3) m tall, up to 1(–2) dm thick, ending abruptly with a ± rounded apex, leafless, with spirally arranged tubercles.

Peduncles crowded apically, lower down persistent after withering and giving the stem a spiny appearance, simple or cymose, 5–25 cm long, 1,5–3 mm thick (up to 5 mm thick near the base), suberect to almost spreading, with numerous alternate foliaceous bracts and apically with whorled bracts. Peduncular bracts erectopate, linear, tapering to both ends, subsessile, 4–15 cm long (basal ones shorter), 1–3 mm wide, flat, green, herbaceous, midveined, acute–acuminate. Whorled bracts usually 3 or sometimes more, ± lanceolate with a half-clasping truncate base and an attenuate acuminate narrow apex, 2–4 cm long, 2,5–5 mm broad near the base. Cyme branches 1–5, 1,5–4 cm long, with one pair of opposite bracts, terminated by a stipitate cyathium (if several paired bracts present, branch consisting of successive generations of cyme branches each terminated by a bract pair and a developed or rudimentary cyathium). Paired bracts ovate–lanceolate, 1–2 cm long, 0,5–1 cm wide, long-acuminate or aristate with attenuate tips.

Involucre cup-shaped (broadly campanulate when young) with a truncate base, 2–3 mm wide at the base, with erect sides or slightly widening above with ± straight sides to 3–4 mm diam. apically, 2–2,5 mm high from the base to the base of the lobes and glands, stipitate; stipe 1–2 mm long. Involucral lobes ± transversely rectangular, c. 2 mm wide and 1,5 mm long, longitudinally ribbed, subtruncate or slightly rounded at the apex, fimbriate with c. 10 filiform-subulate short-ciliate c. 0,5 mm long lobes. Glands 5 in all involucre examined, transversely elliptic-oblong, 3 mm wide and 1,5 mm long, yellow or yellowish green, with two short linguiform lateral lobes ± folded outwards, and with 4–6 conspicuous processes; these cylindrical-filiform, 1,5–2 mm long, irregularly shortly few-lobed and subclavate at the apex.

Male florets c. 25 in 5 fascicles, developing successively. Bracteoles 3–4 mm long, deeply fimbriate-lacerate into c. 12 filiform or narrowly linear plumose segments. Pedicels (1–)2,5–4,5 mm long. Filaments 1,5–3 mm long, erect or often somewhat curved. Anthers 1–1,2 mm long, 0,8–1 mm wide, elliptic-oblong.

Capsule on a curved 1–1,2 mm thick stipe, slightly trigonous with rounded–obtuse midveined angles, c. 8 mm wide and 7 mm long, glabrous, faintly reticulate.



Styles 3, connate to or somewhat below the middle, 2,2–3,5 mm long, apically bifid.

Seed subspherical, 3–4 mm long, 3–3,5 mm wide, only slightly subquadrangular in transect, with a narrow longitudinal light brown line along one side, somewhat shortly pointed apically, orange brown and somewhat mottled or with a polished grey surface.

This striking plant shows too close affinities to *E. monteiroi* to be separated as a species, and I think it is best to add a third subspecies to the two distinguished by Leach (1968). The Brandberg taxon differs remarkably in habit from typical *E. monteiroi*, which has a subclavate stem normally only about 0,3 m high (rarely up to 1 m). Subsp. *brandbergensis* further differs by the generally shorter peduncles, the narrower peduncular bracts, and in the shape and colour of the glands. These seem to be normally five instead of four, and they are yellow or greenish yellow, not red. Furthermore, they are furnished with longer processes and with two lateral lobes, which are folded outwards.

The conspicuous 'Brandberg Euphorbia' was naturally observed by earlier Brandberg explorers (e.g. Lempp 1956 p. 434, Wiss 1957 p. 66, see also Leach 1968 p. 137). It is a common and very characteristic plant of the upper Brandberg, from about 1 750 m to the summit. From plants cultivated in Mr H. Roth's garden in Windhoek there is a herbarium sheet in Munich (Merxmüller & Giess 1257).

Subsp. *brandbergensis* appears to be a very local race within the distribution range of subsp. *monteiroi*. The latter occurs from southern Angola throughout northern South West Africa to Ngamiland in northern Botswana. The third subspecies, subsp. *ramosa* Leach, is a basally branching dwarf shrub practically confined to the Transvaal in South Africa (for further details, see Leach 1968).

It should be pointed out, that the *E. monteiroi* complex requires further taxonomic investigation. Leach (1968 p. 135) mentions two collections from Serra da Chela in south Angola, which he believes may belong to a distinct taxon. Not having seen these specimens (Torre 8330 and Mendes 1350, both in LISC) I have no opinion on their taxonomic status, but it does not seem unlikely, that they may come closest to subsp. *brandbergensis*.

Euphorbia virosa Willd. — Middle Numas Valley (Wiss 1957 p. 54, photograph p. 53).

A candelabra-shaped shrub with five-angled spiny stems.

Phyllanthus pentandrus Schum. ex. Thonn. — Tsisab Valley, at the 'White Lady', c. 700 m, N. 2542.

An annual growing in coarse granitic sand between boulders, with small simple leaves in two rows and greenish, five-lobed, small flowers.

Fig. 3. Seeds and seed surfaces of *Euphorbia chamaesycooides* B. Nord. (A–C, N. 2567) and *E. monteiroi* Hook. fil. subsp. *brandbergensis* B. Nord. (D–G, N. 3644). — A x 25. — B x 50. — C x 260. — D x 12. — E x 115. — F x 120. — G x 600. — SEM photomicrographs by the author.

Ricinus communis L. — Lower Tsisab, in the riverbed, c. 600 m, N. 2523. Vigorous herbs about two metres tall, with large, palmately lobed leaves. Also observed by Maack (1923 p. 10).

Seidelia firmula (Prain) Pax & K. Hoffm. — Between upper Tsisab and Königstein, c. 1 700 m, N. 2773.

A small annual with inconspicuous flowers, growing in shade under stones and rocks. Also observed lower down in the Tsisab Valley at about 1 100 m.

68. Rutaceae

Thamnosma africanum Engler — SE side, c. 5 miles S of Tsisab Valley, G. 3592 a. Erect aromatic half-shrub about 0,5 m high. Petals yellow, becoming red when dry.

70. Burseraceae

Commiphora glaucescens Engler — Recorded from the foot of the Brandberg by Palmer & Pitman (1972 p. 1038, photograph).

Commiphora kraeuseliana Heine — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2458 — SE side, c. 5 miles S of Tsisab Valley, G. 3692 — Numas Valley, G. 3649 — Also cited and illustrated from the entrance to the Tsisab Valley by Palmer & Pitman (1972 p. 1035).

Vigorous shrubs with much dissected leaves. Some specimens observed by me attained tree shape and a height of three to four metres.

Commiphora saxicola Engler — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2456 — Numas Valley, G. 3650.

Arborescent shrubs up to three metres tall. Leaves pinnate with almost rounded, crenate leaflets.

Commiphora virgata Engler — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2455.

Arborescent shrubs, two to three metres high. Leaves trifoliolate with obovate, entire leaflets.

Commiphora wildii Merxm. — Numas Valley, G. 3589.

A lower shrub with finely pubescent, rather deeply lobed leaves.

73. Polygalaceae

Polygala guerichiana Engler — Tsisab Valley mouth, stony granitic slopes, c. 550 m, N. 2511 — Numas Valley, stony riverbed, G. 3590.

A divaricate suffrutex about 1,5 m tall, with lanceolate leaves.

74. Anacardiaceae

Ozoroa crassinervia (Engler) R. & A. Fernandes — Orabeswand, c. 2 000 m, N. 3642 — Numas Valley, plateau, c. 2 000 m, Logan 98.

A single tree seen by me, about five metres tall and with white flowers.

Rhus marlothii Engler — Numas Valley, plateau, c. 2 000 m, Logan 95, 97.

Rhus undulata Jacq. var. *burchellii* (Sond. ex Engler) Schonl. — Upper Numas, W. 1442 (cf. Wiss 1957 p. 56).

A much-branched shrub about two metres high, with sticky leaves.

75. Sapindaceae

Cardiospermum pechuelii OK. — Upper Tsisab, in the riverbed, c. 1 550 m, N. 2817.

A dense and entangled, erect suffrutex about 1,5 m tall and very wide.

Cardiospermum pechuelii OK. var. — Upper Tsisab, c. 1 500 m, N. 2556 — Numas Valley, G. 3647 — Probably also Numas Valley, 1 950 m, W. 1410 (judging from the brief description in Wiss 1957 p. 57).

This differs from typical *C. pechuelii* in being scandent and in this respect it resembles *C. halicacabum* L., which is a very wide-spread and highly variable species. However, these plants have more narrow leaf segments than any forms of *C. halicacabum*, and in this character they strongly resemble *C. pechuelii*. The fruits are smaller and less inflated than in the other two species. Even compared to the most small-fruited forms of *C. halicacabum*, referable to var. *microcarpum* (Kunth) Blume, they are about half the size. Also the seeds are smaller, although perhaps not quite ripe. This form may deserve a closer study, but in this context I cannot do better than dismissing it as a scandent variety of *C. pechuelii*.

76. Melianthaceae

Melianthus comosus Vahl — Aigub, 2 400 m, W. 1420 (cf. Wiss 1957 p. 68). Shrub with red flowers and inflated capsules.

78. Salvadoraceae

Azima tetracantha Lam. (syn. *A. spinosissima* Engler) — Upper Numas, according to Wiss (1957 p. 58).

Salvadora persica L. — Numas Valley, c. 650 m, Logan 100 — Also reported by Wiss (1957 pp. 46, 49) from Amis Valley mouth and Numas waterhole, and from the Tsisab Valley by Palmer & Pitman (1972 p. 1839 and p. 1840, photograph). The latter authors describe the Brandberg trees as big and luxuriant with branches weeping to the ground, and forming a soft green mass on the valley floor.

79. Rhamnaceae

Ziziphus mucronata Willd. — Upper Numas, according to Wiss (1957 p. 56).

80. Vitaceae

Cyphostemma bainesii (Hook. fil.) Desc. — Recorded from the Numas Valley by Wiss (1957 p. 50).

Cyphostemma congestum (Baker) Desc. ex Wild & Drumm. — Reported from the upper Numas by Wiss (1957 p. 58), but not confirmed.

Cyphostemma currori (Hook. fil.) Desc. (syn. *Cissus cramerianus* Schinz) — Numas Valley, plateau, c. 2 000 m, Logan 92.

Thick-stemmed and large-leaved trees up to five metres tall. Observed by me in several places of the upper Brandberg, and also recorded by Lempp 1956 p. 432,

Wiss 1957 pp. 50, 54, 58, and Maack 1960 p. 13 (see also photographs in Lempp loc. cit. and Nordenstam 1966 a Fig. 2).

81. Tiliaceae

Corchorus merxmülleri Wild — Middle Tsisab, c. 1 200 m, N. 2550.

Fairly dense, yellow-flowered shrubs, 1 to 1,5 m high.

Grewia bicolor Juss. — SE side, c. 5 miles S of Tsisab Valley, G. 3696 — Also upper Numas, according to Wiss 1957 p. 57.

A shrub about 1,6 m high.

82. Malvaceae

Abutilon pycnodon Hochr. — Lower Tsisab, in the riverbed, c. 600 m, N. 2483.

Erect single-stemmed herb, about one metre high or more. All specimens seen were white-flowered.

Gossypium anomalum Wawra — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2466 — SE side, c. 5 miles S of Tsisab Valley, G. 3698.

Shrubs up to 1,5 m high. The flowers of my specimens are dirty mauve with purple centre.

Hibiscus castroi Bak. fil. & Exell — SE side, c. 5 miles S of Tsisab Valley, G. 3691.

Suffrutex about 1,5 m high, with pure white flowers.

Hibiscus engleri K. Schum. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2438.

Erect herb, 1—1,5 m tall, with large funnel-shaped flowers. Petals lemon yellow with blood-red base; anthers pure yellow; style dark red.

Hibiscus micranthus L. fil. — Between upper Tsisab and Königstein, c. 1 750 m, N. 2784.

Suffrutex with grey leaves and white flowers.

Pavonia rehmannii Szyszyl. — SE side, c. 5 miles S of Tsisab Valley, G. 3656.

A low half-shrub with yellow, dark-centred flowers.

84. Sterculiaceae

Dombeya damarana K. Schum. — Upper Tsisab, c. 1 500 m, stony slopes, N. 2559 — Also in middle and upper Numas Valley, according to Wiss (1957 pp. 54, 57).

A white-flowering shrub, 1 to 1,5 m high. This species is in Merxmüller's 'Prodrumus' (84:2) included in *D. rotundifolia*, but may in my opinion possibly be kept as a distinct species. In contrast to *D. rotundifolia* the leaves develop before the flowers and are silvery grey.

Dombeya rotundifolia (Hochst.) Planchon — Orabeswand, c. 2 000 m, N. 3643. A tree or large shrub with big white flowers, developing before or with the leaves, which have a brownish tinge and a very dense stellate tomentum.

Hermannia affinis K. Schum. — Tsisab Valley mouth, granitic mountain slopes, c. 550 m, N. 2508.

A divaricate suffrutex, 0,3–0,5 m high. In fruit only.

Hermannia amabilis Marl. ex. K. Schum. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2443 — Tsisab Valley, end of road, Kers 1017 — Also recorded from the Numas Valley (Walter 1972 p. 6).

An erect suffrutescent herb, about 0,5 m high. The attractive pendulous flowers have white petals with a red base.

Hermannia elliottiana (Harv.) K. Schum. — Königstein, E slopes, c. 2 300 m, N. 2812 — Also Numas Valley, according to Walter (1972 p. 3).

A much-branched erect suffrutex, about 0,5 m high, densely glandular, with brown cortex and nodding, deep red flowers (Fig. 4).

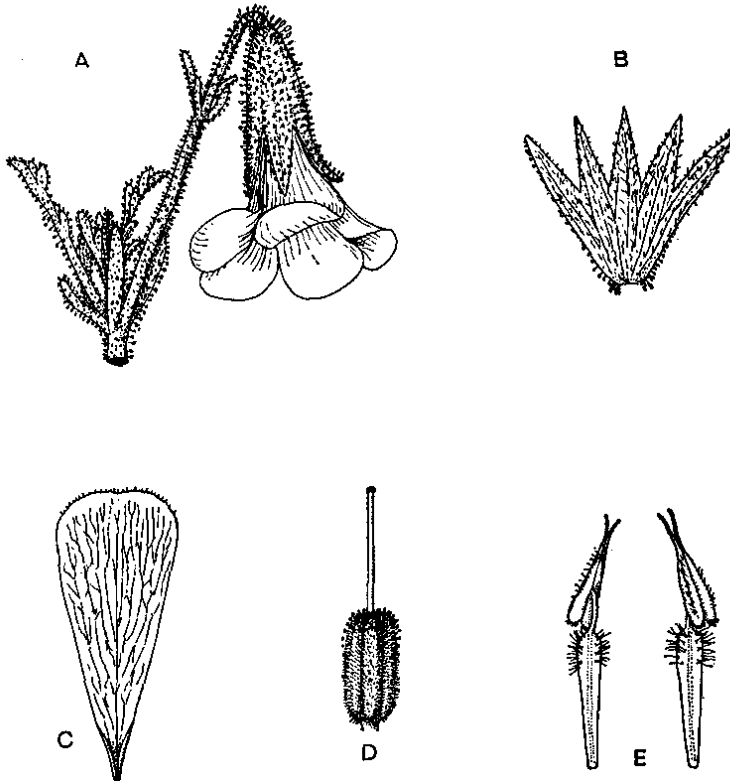


Fig. 4. *Hermannia elliottiana* (Harv.) K. Schum. (N. 2812). — A: Flowering branch tip, x 2½. — B: Calyx, split up, from inside, x 2½. — C: Petal, adaxial side, x 2½. — D: Gynoecium, x 5. — E: Stamens, adaxial side (left) and abaxial side (right), x 5. — Del. auct.

Hermannia helianthemum K. Schum. — Middle Tsisab, dry riverbed, c. 1 000 m, N. 2792 (conf. H. Roessler).

A canescent suffrutex, 0,3–0,6 m high, with dull red flowers.

Hermannia merxmuelleri M. Friedr. — Middle Tsisab, stony slopes, c. 1 050 m, N. 2794.

About one metre tall suffrutex with dull purple flowers. The ciliate appendages on the capsules make this a very characteristic species. It is only known from the Tsisab Valley, where it has been collected twice before (see further M. Friedrich 1961).

Hermannia mildbraedii Dtr & Engler — Tsisab Valley, at the 'White Lady', c. 700 m, N. 2541 (det. H. Roessler) — SE side, c. 5 miles S of Tsisab Valley, G. 3672.

A gracile, soft annual, found in coarse granitic sand. The petals of my specimens are pale sulphur yellow with a brown base. Those of Mr Giess are described as yellow with a deep red base.

Hermannia minutiflora Engler — Upper Numas, W. 1441 (cf. Wiss 1957 p. 56).

A densely tomentose half-shrub with small yellow flowers.

Hermannia modesta (Ehrenb.) Mast. — Tsisab Valley mouth, granitic stony slopes, c. 550 m, N. 2493 — Lower Tsisab, in the riverbed, c. 600 m, N. 2517 — SE side, c. 5 miles S of Tsisab Valley, G. 3702 — Upper Numas, W. 1462 (cf. Wiss 1957 p. 56).

Much-branched but gracile herbs, usually annual, but highly variable. The corolla is pink or red. My two collections lack the glandular pubescence, which normally characterizes the species (H. Roessler in litt.).

Hermannia solamiflora K. Schum. — Numas Valley, riverbed, G. 3610.

Erect herb, about 0,3 m high. Flowers brownish purple with long exerted anthers.

Melhania damarana Harv. — Numas Valley, 1 950 m, W. 1415 (det. I. C. Verdoorn, who adds "forma?") — Numas Valley, Logan 80.

A small, velvety, shrubby plant with soft leaves (in Wiss 1957 p. 68 cited as *M. ovata*).

Sterculia africana (Lour.) Fiori — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2470 (reported from here also by Palmer & Pitman 1972, p. 1487, photograph p. 1486, and by Giess 1971, p. 70, Plate 26). — Also recorded from the lower and upper Numas Valley (Wiss 1957 pp. 48, 58, sub nomen *S. guerichii* K. Schum.).

A tree, three to four metres high, with a thick trunk and a papery, light brown or almost white cortex.

Sterculia quinqueloba (Garcke) K. Schum. — Middle Tsisab, waterhole, c. 1 000 m, N. 2577 — Also Numas Valley, according to Wiss (1957 p. 58 as *S. tomentosa* Guill. & Perr.).

Big trees with larger leaves and white-mealy cortex.

89. Passifloraceae

Adenia pechuelii (Engler) Harms — Middle Tsisab, observed in several places — Also found in the Numas Valley (Wiss 1957 p. 51).

The thick grey tubers with several rigid branches are peculiar and very characteristic.

90. Tamaricaceae

Tamarix usneoides E. Mey. ex Bunge (vel *angolensis* Niedenzu) — Tsisab Valley mouth, in the riverbed, c. 550 m, N. 2524 — Numas Valley, 1 900 m, W. 1459. My collection is unfortunately sterile and cannot be determined with certainty, but Mr Podlech of Munich has suggested, that it might belong to *T. angolensis* rather than *T. usneoides*. However, Mr Giess reports that the Wiss collection belongs to *T. usneoides* (see also Wiss 1957 pp. 52, 55).

93. Loasaceae

Kissenia capensis Endl. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2473 — SE side, c. 5 miles S of Tsisab Valley, G. 3695 — Also in Amis Valley, according to Wiss (1957 p. 47 as *K. spathulata* Engler).

A robust, very scabrid, yellowish green herb with conspicuously enlarged calyx and with white flowers.

94. Cucurbitaceae

Citrullus lanatus (Thunb.) Mansf. — Tsisab Valley mouth, in the riverbed close to the running water, c. 550 m, N. 2512 — SE side, c. 5 miles S of Tsisab Valley, G. 3712.

A prostrate annual herb with green or salmon-coloured, pear-shaped fruits about 10 cm large or more.

Corallocarpus welwitschii (Naud.) Hook. fil. — Orabeswand, near the escarpment, c. 2 000 m, N. 3673 — Also recorded from the upper Numas Valley (Walter 1972 p. 3).

There are no fruits in my collection, but it probably belongs to this species according to Dr H. Roessler (*in litt.*). The flowers are small and yellow.

Cucumella aspera (Cogn.) C. Jeffrey — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2468 — Tsisab Valley, Kers 1825 — Orabeswand, c. 2 000 m, N. 3657 (det. H. Roessler).

A prostrate, very rough herb with small, yellow flowers.

Cucumis meeusei C. Jeffrey — SE side, c. 5 miles S of Tsisab Valley, G. 3721.

A scabrid herb with yellow, ovoid, bristly fruits.

Dactyliandra welwitschii Hook. fil. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2469 — Lower Tsisab, in the riverbed, c. 500 m, N. 2516 — SE side, c. 5 miles S of Tsisab Valley, G. 3664.

Prostrate or twining herb with small yellow, creamy or greenish flowers and small round berries.

Kedrostis foetidissima (Jacq.) Cogn. — Recorded from Numas Valley by Wiss (1957 p. 49).

Momordica humilis (Cogn.) C. Jeffrey — SE side, c. 5 miles S of Tsisab Valley, G. 3693.

A twining annual with large orange flowers.

95. Lythraceae

Nesaea luederitzii Koehne — Middle Tsisab, c. 1 100 m, at a waterhole, N. 2789 — Numas Valley, 1 950 m, W. 1419 — Upper Numas, 2 200 m, W. 1455 (cf. Wiss 1957 p. 62).

A much-branched herb or half-shrub with purplish red flowers. The leaves of my collection are unusually large, up to 3,5 cm long and 1 cm wide.

(*Rotala fluitans* Pohnert is mentioned in Lempp 1956 p. 433 and Wiss 1957 p. 61, but the record must be regarded as doubtful. Mr Giess has informed me, that the specimen in herb. Windhoek, viz. Wiss 1416 from Numas Valley, is very poor, but possibly belonging to the genus *Limosella*).

99. Combretaceae

Combretum apiculatum Sond. — Middle Numas Valley (fide Wiss 1957 p. 52). Shrubs with glossy green leaves and two cm long, four-winged, finally red fruits.

Combretum imberbe Wawra — Reported from the entrance to the Tsisab Valley by Palmer & Pitman (1972 p. 153 as "lead-wood" and p. 1644, photograph).

103. Apiaceae

Steganotaenia araliacea Hochst. — Reported by Maack (1923 p. 10, as *Peucedanum "arabiaceum"*, sphalm.). Although not verified, the record is quite plausible.

105. Plumbaginaceae

Dyerophytum africanum (Lam.) OK. — SE side, c. 5 miles S of Tsisab Valley, G. 3697.

A shrub with characteristic spatulate leaves, membranous-winged calyx and yellow flowers.

Plumbago wissii Friedr. — Königstein, E of summit, occasional between 2 200 and 2 500 m, N. 2822 — Aigub, 2 350 m, W. 1425 (cf. Wiss 1957 p. 67, Friedrich 1957 a).

A half-shrub about one metre tall, only known from these two collections. To the original description may be added, that the flower colour varies from yellow to pink or purplish red.

107. Ebenaceae

Euclea pseudebenus E. Mey. ex A. DC. — Recorded by Maack (1923 p. 10), but not verified.

Euclea undulata Thunb. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2475 — Numas Valley, plateau, c. 2 000 m, Logan 86.

A shrub about two metres high, with more or less undulated, firm leaves.

108. Oleaceae

Olea africana Mill. — Near summit, 2 500 m, W. 1428 (cf. Lempp 1956 p. 434, Wiss 1957 p. 67, and 'Prodromus' 108:2).

A tree with lanceolate, leathery leaves.

113. Periplocaceae

Curroria decidua Planch. ex Hook. fil. & Benth. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2457.

Rather dense shrubs, up to one metre tall. Leaves opposite, linear, dull green.

114. Asclepiadaceae

Decabelone barklyi Thiselton-Dyer — Reported from the upper Numas Valley by Walter (1972 p. 3).

Gomphocarpus tomentosus (Masson) Sweet — Recorded by Maack (1923 p. 10), but not verified.

Hoodia gordonii (Masson) Sweet — Mentioned in Walter's brief report on a Brandberg ascent in 1972 (Walter 1972 p. 3). The occurrence is not unlikely, and there can hardly be a confusion with the following species, which according to the description is very different.

Hoodia montana Nel ex White & Sloane — This species is only known from a single collection. It was found in 1935 by Dr C. G. Nel on granitic mountain sides of the Brandberg and later flowered in Stellenbosch. The species is said to be related to *H. currorii* (Hook.) Decaisne and *H. dregei* N. E. Br.

Microlooma hereroense Wanntorp — Summit of Königstein, 2 575 m, N. 2801. A recently described species, which is also known from the Otjijhorongo Native Reserve (Wanntorp 1969). It is an erect half-shrub, 0,5 to 0,7 m high, with dull red flowers. Walter (1972 p. 3) reports to have seen and photographed the species in the upper Numas Valley.

Orthanthera albida Schinz — Tsisab Valley, according to Giess (1971 p. 70, in legend to photograph).

Sarcostemma viminalis (L.) R. Br. — Middle Tsisab (N. obs.) — Numas Valley (Wiss 1957 pp. 51, 59).

The numerous succulent shoots form a low and much entangled network, which is very difficult to penetrate and sometimes covers large areas.

Stapelia kwebensis N. E. Br. — Reported from Aigub by Wiss (1957 p. 67). I also collected a *Stapelia* at c. 1 400 m in the upper Tsisab. This collection (N. 2860) was brought into cultivation in Kirstenbosch and to my knowledge never determined as to species.

115. Rubiaceae

Amphiasma merenskyanum Bremek. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2465 — Numas Valley, G. 3629.

A dense and much-branched half-shrub up to 1,5 m high, with reddish brown twigs. The flowers are white with hairy insides.

Kohautia cynanchica DC. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2445 — Lower Tsisab, in the riverbed, c. 600 m, N. 2487 — Numas Valley, sandy riverbed, G. 3601.

Erect slender annual with small white flowers.

116. Convolvulaceae

Convolvulus sagittatus Thunb. — Orabeswand, near the escarpment, c. 2 000 m, N. 3672.

A decumbent herb with white flowers.

Ipomoea verbascoidea Choisy — Orabeswand, c. 2 000 m, N. 3647 — Also recorded from the 'Cascades' in the upper Numas (Walter 1972 p. 4).

A striking, white-tomentose, subscaudent herb with large, purplish mauve flowers. *Merremia guerichii* Meeuse — Tsisab Valley mouth, stony ground near the riverbed, c. 550 m, N. 2515 — SE side, c. 5 miles S of Tsisab Valley, G. 3703 p.p. (as host for *Cuscuta planiflora*).

A prostrate or decumbent herb with palmately lobed leaves and cream-coloured flowers with a slight dash of pink.

117. Cuscutaceae

Cuscuta planiflora Ten. var. *mossamedensis* Welw. ex Hiern — Middle Tsisab, stony slopes, c. 1 100 m, N. 2796 — SE side, c. 5 miles S of Tsisab Valley, G. 3703.

Parasitic on various herbs and grasses.

118. Hydrophyllaceae

Codon schenckii Schinz — Tsisab Valley mouth, in the riverbed, c. 550 m, N. 2519 — Numas Valley, W. 1450 (in Wiss 1957 p. 62 erroneously cited as *C. royenii* L.).

A densely prickly, vigorous herb with broadly campanulate flowers. My specimens have a yellow, 12-lobed corolla and 12 stamens.

119. Heliotropiaceae

Cordia gharaf (Forsk.) Ehrenb. ex Ascherson — Tsisab Valley, near the 'White Lady', Kers 953 — Tsisab gorge, Strey 2411.

A shrub, 2–4 m tall, with elliptic, somewhat scabrid, opposite leaves. No doubt *C. "ovalis"* in Maack 1923 (p. 10) refers to this species.

Heliotropium albiflorum Engler — Middle Tsisab, c. 1 000 m, N. 2546 (det. H. Roessler) — Numas Valley, between rocks in the riverbed, G. 3614.

An erect herb up to 0,8 m high, with small white flowers. My collection differs insignificantly from typical *H. albiflorum* by its completely glabrous fruits (see drawing in Fig. 5).

120. Boraginaceae

Trichodesma africanum (L.) Lehm. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2447 — Numas Valley, in shade under overhang, G. 3628.

A vigorous scabrid herb, up to one metre high. Mr Giess' specimen is white-flowered, but in my collection the corolla is pale blue with a yellow centre.

122. Verbenaceae

Chascanum garipense E. Mey. — Tsisab Valley mouth, in the stony riverbed, c. 550 m, N. 2520.

A herb, c. 0,8 m high, with irregularly five-lobed white flowers.

Chascanum pumilum E. Mey. — SE side, c. 5 miles S of Tsisab Valley, G. 3718.

Erect low herb with short greyish pubescence.

Lantana dinteri Moldenke — Numas Valley, plateau, c. 2 000 m, Logan 88.

123. Lamiaceae

Acrotome fleckii (Gürke) Launert — Upper Tsisab, c. 1 500 m, N. 2564.

An erect herb with lanceolate, serrate leaves and whorled white flowers.

Leonotis dysophylla Benth. — Summit of peak W of Königstein, 2 520 m, N. 2832 (det. A. Schreiber).

An erect, little-branched herb, up to 1,5 m tall, with conspicuous, brownish orange flowers.

Leucas glabrata (Vahl) R. Br. — Upper Tsisab, c. 1 500 m, N. 2557; c. 1 600 m, N. 2574 — Königstein, E of summit, c. 2 300 m, N. 2813.

Erect, little-branched, suffrutescent herb, up to c. 0,5 m high, with white flowers.

Mentha wissii Launert — Numas River, W. 1440 — Upper Numas, waterholes, W. 1418.

Said to be taller than a man and to have either white or blue flowers (Wiss 1957 p. 61).

Plectranthus hereroensis Engler (syn. *Neomuelleria damarensis* S. Moore) — Lower Tsisab, at the 'White Lady', c. 700 m, N. 2539 — SE side, c. 5 miles S of Tsisab Valley, G. 3686 — Orabeswand, c. 2 000 m, N. 3656 — Middle Numas, c. 1 950 m, W. 1467 (cf. Wiss 1957 p. 55).

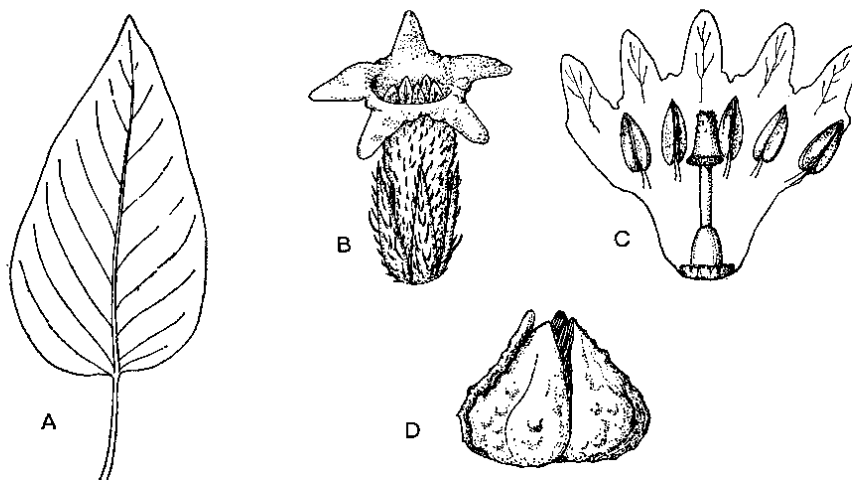


Fig. 5. *Heliotropium albiflorum* Engler (N. 2546). — A: Leaf, x 1. — B: Flower, x 10. — C: Corolla, split up, x 10. — D: Fruit (calyx removed), x 10. Note absence of hairs. — Del. auct.

An attractive annual with more or less cordate leaves and bright blue flowers.

Salvia garipensis E. Mey. — Numas Valley, G. 3640.

Somewhat cushion-shaped half-shrub, about 0,6 m high and wide, with aromatic white flowers.

124. Solanaceae

Lycium trothae Dammer — Upper Tsisab, dry stony riverbed, c. 1 500 m, N. 2788 (det. H. Roessler) — Numas Valley, G. 3632.

An erect or decumbent, thorny shrub, c. 1,5 m tall, with watery-white flowers.

Nicotiana glauca R. Graham — Reported by Maack (1923 p. 10). Although not verified by later workers, the record is not at all unlikely.

Solanum nigrum L. — Upper Tsisab, in the riverbed, c. 1 500 m, N. 2571 — Summit of Königstein, 2 575 m, N. 2809.

A white-flowering annual with yellow anthers.

Solanum rigescentoides Hutch. — Lower Tsisab, in the riverbed, c. 600 m, N. 2484 (det. H. Roessler) — Numas Valley, G. 3645.

A spiny shrub up to the size of a man, with purplish blue, yellow-centred flowers and finally yellow to orange-red, rounded berries.

126. Scrophulariaceae

Anticharis ebracteata Schinz — SE side, c. 5 miles S of Tsisab Valley, G. 3715.

Erect annuals up to a few dm high. Flowers purplish blue with white and almost black markings. In the 'Prodromus' (126: 10) this species is differentiated from *A. inflata* mainly by the size of leaves and corolla. However, normally the flowers are about the same size in both species, and the lower leaves of *A. ebracteata* may reach a length of three cm. The capsules and especially the seeds provide better diagnostic characters, and there is no doubt about the distinctness of the two species.

Anticharis inflata Marl. & Engler — Middle Tsisab, stony slopes, c. 1 100 m, N. 2790 — SE side, c. 5 miles S of Tsisab Valley, G. 3667.

A low annual herb with spatulate leaves. The corolla is deep blue with a darker throat.

Aptosimum angustifolium Weber & Schinz — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2462; granitic mountain slopes, c. 600 m, N. 2498 — SE side, c. 5 miles S of Tsisab Valley, G. 3716.

A spinescent half-shrub, up to 0,4 m high, with narrow leaves. Corolla inside intensely deep blue with darker throat, outside pale brownish or straw-coloured.

Diclis petiolaris Benth. — Upper Tsisab Valley, at a waterhole, c. 1 500 m, N. 2573.

Brittle white-flowered annuals growing in small waterfalls and streams. Dr Roessler of Munich has kindly confirmed the determination, although he points out, that my specimens have larger and more distinctly dentate leaves than other collections from South West Africa.

Limosella capensis Thunb. — Between upper Tsisab and Königstein, damp sandy patches in rivulet, c. 1 900 m, N. 2835.

A dwarf herb with rosulate leaves and small white flowers.

Lindernia intrepidus (Dtr) Oberm. (syn. *Chamaegigas intrepidus* Dtr) — Reported by Giess (1969 a p. 26) from the "Hochbrandberg" on the basis of a colour photo by H. Roth.

Manulea dubia (Skan) Overkott ex Roessler — Upper Tsisab, dry stony riverbed, c. 1 700 m, N. 2772 — Orabeswand, W end, c. 2 000 m, N. 3658.

An erect annual herb with orange-coloured flowers. Also observed in the middle Tsisab Valley and near the summit of Königstein.

Manuleopsis dinteri Thell. — Slopes above upper Tsisab, c. 1 600 m, N. 2816 — Orabeswand, rock crevices, c. 2 000 m, N. 3651.

Erect shrubs up to three metres tall, with white and somewhat irregularly lobed corollas.

Nemesia fruticans (Thunb.) Benth. — Between upper Tsisab and Königstein, c. 1 700 m, N. 2774 — Numas River, 1 800—1 900 m, W. 1437 (cf. Wiss 1957 p. 64. sub nomen *N. affinis* Benth.).

My specimens are annual and white-flowered.

Nemesia lilacina N. E. Br. — Middle Tsisab, in the riverbed, c. 1 200 m, N. 2787 (det. H. Roessler).

An annual with purplish mauve flowers.

Striga gesnerioides (Willd.) Vatke ex Engler — Tsisab Valley, below the 'White Lady', stony riverbed, c. 700 m, N. 2580.

A parasitic herb drying black, with purple bilabiate flowers in elongated spikes. The specimens are somewhat atypical, having linear leaves about one cm long or even more, rather long calyx, and long corolla tube (cf. Fig. 6 A—D). *S. gesnerioides* is a widespread and quite variable species, however, which may deserve a closer taxonomic study.

Sutera cf. *atropurpurea* (Benth.) Hiern — Summit of Königstein, 2 580 m, N. 2797. Also observed lower down towards upper Tsisab.

A shrub up to one metre high. Flowers dull dark to brownish orange. The collection deviates from typical *S. atropurpurea* in several respects. According to Dr Roessler it agrees well with two numbers (Dinter 849 and Volk 12861) mentioned as possible hybrids with *S. lyperioides* in the 'Prodromus' (126: 49). The Brandberg population is not likely to have a hybrid origin, however. Its taxonomic status can hardly be decided without a revision of several closely allied species of the *S. atropurpurea* and *S. burkiana* complexes.

Sutera canescens (Benth.) Hiern — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2453 — Tsisab Valley, end of road, Kers 1010 — SE side, c. 5 miles S of Tsisab Valley, G. 3675.

A much-branched canescent herb or half-shrub, with a quite variable leaf-shape. In the Brandberg population the leaf lamina is unusually broad, more or less

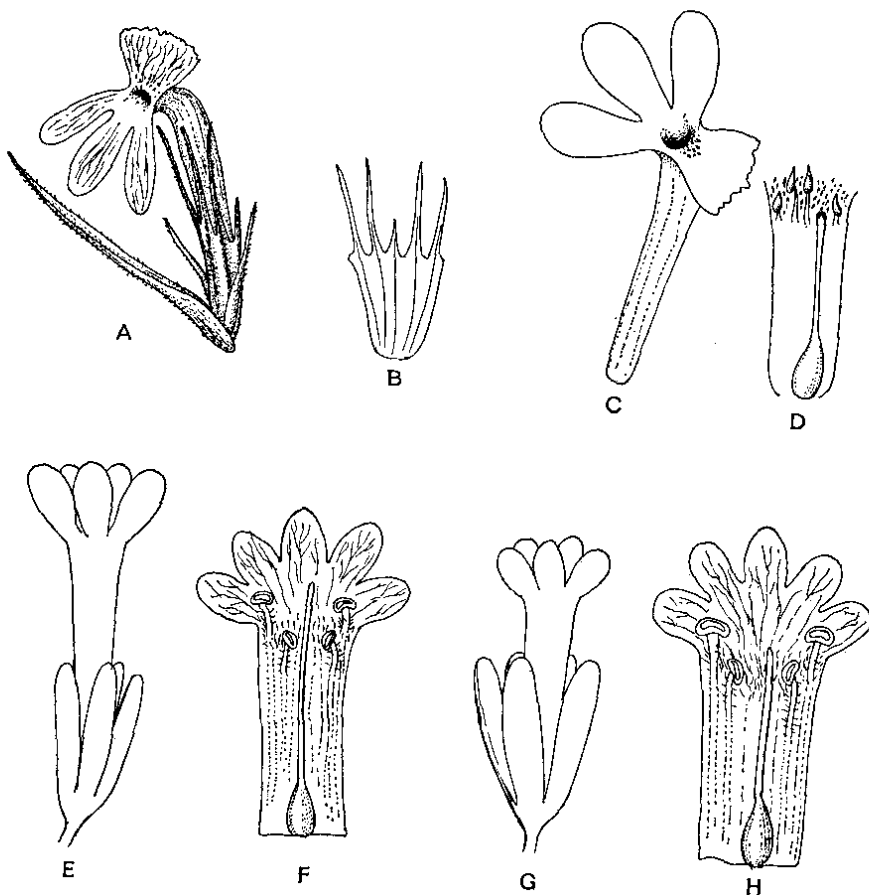


Fig. 6. A—D: *Striga gesnerioides* (Willd.) Vatke ex Engler (N. 2580). — A: Flower, x 2½. — B: Calyx, opened abaxially, x 2½. — C: Corolla, x 2½. — D: Corolla tube, laid out, x 2½. — E—H: *Sutura corymbosa* (Marl. & Engler) Hiern. — E—F: Shade form from the Brandberg (N. 2532). — G—H: Typical specimen from S.W. Africa, Outjo Distr., Twyfelfontein (N. 3699). — E, G: Outline of calyx and corolla, x 2½. — F, H: Corolla, opened and laid out, x 2½. — See further in the text. — Del. auct.

ovate and rather deeply dentate. The narrowly tubular corolla is yellow or sulphur yellow.

Sutura corymbosa (Marl. & Engler) Hiern — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2471 — Tsisab Valley, end of road, Kers 944 — Tsisab Valley, at the 'White Lady', c. 700 m, N. 2532 — SE side, c. 5 miles S of Tsisab Valley, G. 3674.

Soft herbs growing in shade under rocks and boulders. The flower colour is pink or light purplish or occasionally white. My two collections are apparently flowering as annuals and at first sight look rather different from the typically suffrutescent *S. corymbosa*. The leaves are larger, and the flowers are mostly borne singly.

Dr Roessler has suggested, that they may be extreme shade forms, and there is nothing to contradict this assumption. The similarity in flower morphology between my specimens and typical *S. corymbosa* is apparent from the accompanying drawing (Fig. 6 E—H).

Sutera hereroensis (Engler) Skan — Tsisab Valley, at the 'White Lady', c. 700 m, N. 2540 — SE side, c. 5 miles S of Tsisab Valley, G. 3677.

A soft and slender annual with small pinkish or pale purple flowers, growing in coarse granitic sand in the shade of large boulders.

Veronica anagallis-aquatica L. — Waterholes in Numas Valley at the 'Cascades', W. 1439 (cf. Lempp 1956 p. 434, Wiss 1957 p. 62) — The record of "*Myosotis anagallis*" in Maack 1923 (p. 10) certainly also refers to this species.

Aquatic herb with light blue flowers.

127. Selaginaceae

Hebenstretia integrifolia L. — Summit of Königstein, 2 575 m, N. 2807.

Observed in several places from about 1 800 m to the summit. An erect herb with narrow leaves. The corolla is creamy white with a deep orange throat.

Selago albida Choisy — Summit of Königstein, 2 575 m, N. 2810.

Frequent from about 1 800 m to the summit. A shrub up to 1,3 m high, with blue flowers.

Walafrida sp. — Numas Valley, 2 100 m, W. 1449.

A shrublet up to 0,3 m high, with a three-lobed, purple calyx. Mr Giess has suggested (in litt.), that it is a species of *Walafrida*, different from those included in the 'Prodromus'. Perhaps this is the collection cited as "*Selago glomerata* Kraus." by Wiss (1957 p. 64).

130. Acanthaceae

Barleria lancifolia T. Anders. — SE side, c. 5 miles S of Tsisab Valley, G. 3665.

Suffrutex with whitish cortex and large, purplish blue flowers.

Barleria merxmulleri P. G. Meyer — Upper Numas, W. 1411 (cf. Meyer 1957 p. 383, Wiss 1957 p. 57).

Very spiny cushions with deep blue flowers.

Barleria prionitoides Engler — SE side, c. 5 miles S of Tsisab Valley, G. 3671 — Tsisab Valley, end of road, Kers 1011.

A rather dense shrubby plant about 0,6 m high and wide. The flowers are cream-coloured.

Barleria senensis Klotzsch — Tsisab Valley, end of road, Kers 1027.

A much-branched half-shrub with yellow flowers.

Blepharis obmitrata C. B. Clarke — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2464 — Numas Valley, plateau, c. 2 000 m, Logan 78 — Numas Valley, above 1 800 m, W. 1412 (in Wiss 1957 p. 57 cited as *B. acaulis* Lindau).

Much-branched shrubs up to 0,7 m high, with light blue flowers.

Hypoestes forskaelei (Vahl) R. Br. ex C. B. Clarke — Königstein, 2 560 m, N. 2800 (det. P. G. Meyer) — Observed in several places between 1 800 m and the summit.

An unarmed half-shrub, 0,3 to 0,6 m high. The corolla is white with a purplish pink tip. The leaves are unusually short and broad.

Monechma arenicola (Engler) C. B. Clarke — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2439 — Numas Valley, between rocks in and at the river, G. 3600.

A much-branched suffrutex, 0,5—1 m high and wide, with pale blue flowers. The collections agree best with the form series 'a' in the 'Prodromus' (130: 43). The leaves are rather broad and obtuse, which may be interpreted as an influence from *M. cleomoides* (S. Moore) C. B. Clarke.

Monechma divaricatum (Nees) C. B. Clarke — Upper Tsisab, dry riverbed, c. 1 600 m, N. 2781.

Erect half-shrubs, 0,5—1 m high, with purplish red flowers. A fairly frequent plant in the upper parts of the mountain.

Peristrophe grandibracteata Lindau — Upper Tsisab, c. 1 300 m, N. 2563 — Numas Valley, G. 3631.

A cushion-like suffrutex up to one metre high, with white cortex and purplish red flowers. The Brandberg population seems to deviate in several respects from typical *P. grandibracteata*, e.g. in the unusually broad, ovate leaves.

Petalidium canescens (Engler) C. B. Clarke — Tsisab Valley mouth, granitic mountain slopes, c. 550 m, N. 2505 — Numas Valley, G. 3605.

Flowers in basal clusters, purplish pink with darker veins. The leaves are extremely broad for this species (lamina broadly ovate to elliptic, up to four cm wide). Cf. P. G. Meyer's remark (in 'Prodromus' 130: 55), that a broad-leaved form occurs in the Brandberg area.

Petalidium lanatum (Engler) C. B. Clarke — SE side, c. 5 miles S of Tsisab Valley, G. 3658.

Erect or ascending branches with dense woolly basal clusters of flowers. Corolla reddish brown with yellow markings.

Petalidium variabile (Engler) C. B. Clarke — SE side, c. 5 miles S of Tsisab Valley, G. 3657 — Numas Valley, c. 650 m, Logan 105.

A cushion-shrub with whitish or light grey cortex.

Ruellia brandbergensis Kers — Tsisab Valley, at the 'White Lady', Kers 955 — Upper Tsisab, stony slopes, c. 1 400 m, N. 2562 — SE side, c. 5 miles S of Tsisab Valley, G. 3707.

An erect half-shrub, up to one metre tall, with white cortex and conspicuous blue or purplish blue flowers.

Ruellia diversifolia S. Moore — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2452 (det. H. Roessler) — Also recorded from the Numas Valley by Wiss (1957 p. 53, as *Dinteracanthus marlothii* in the text to the photograph).

An erect herb with soft, cordate leaves.

131. Pedaliaceae

Rogeria adenophylla J. Gay ex Delile -- Tsisab Valley mouth, black kopjes, c. 550 m, N. 2463 — Upper Numas Valley, according to Wiss (1957 p. 60).

Erect annual up to one metre tall, with powdery-tomentose leaves. Corolla narrowly funnel-shaped, dirty purple with inside of throat rich yellow.

Sesamum capense Burm. fil. — SE side, c. 5 miles S of Tsisab Valley, G. 3681, G. 3690 — Numas Valley, G. 3597.

According to U. Grabow-Seidensticker (in litt.) the polymorphic species *S. capense* consists of several races, three of which are represented in this material from the Brandberg.

Sesamum marlothii Engler — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2451.

An erect herb, up to two metres tall, branching from the base. In this collection the corolla is pale purple.

136. Campanulaceae

Lightfootia dinteri Engler ex Dtr — Königstein, summit, 2 580 m, N. 2806.

Densely much-branched shrub up to one metre high. The corolla is white, but sometimes with a slight tinge of blue.

Wahlenbergia androsacea A. DC. — Aigub, according to Walter (1972 p. 4).

139. Asteraceae

Anthiphiona fragrans (Merxm.) Merxm. — Numas Valley, foot of Brandberg, Kers 2007 — The type locality is Tsisab Valley (Wettstein 177, cf. Merxmüller 1950 p. 44).

A yellow-flowered shrub, about one metre high, with a strong odour.

Arctotis venusta T. Norl. — The record of *A. stoechadifolia* in Maack 1923 (p. 10) certainly must refer to this species. The record is of interest as the northernmost locality of the species, but it needs confirmation.

Aspilia eenii S. Moore — Middle Tsisab, at a waterhole, c. 1 100 m, N. 2791 — Orabeswand, c. 2 000 m, N. 3640 — Numas plateau, c. 2 000 m, Logan 93.

A large and rather dense, yellow-flowered half-shrub, up to two metres high.

Berkheya spinosissima (Thunb.) Willd. — Middle Tsisab, among granite boulders, c. 900 m, N. 2549.

A prickly suffrutex, about one metre high, with light green foliage and yellow flowerheads. It belongs to subsp. *spinosissima*, which has its northernmost locality on the Brandberg (see Roessler 1959 p. 137, who cites Wettstein 393 from the Tsisab Valley).

Calostephane divaricata Benth. — SE side, c. 5 miles S of Tsisab Valley, G. 3694. Erect herb about 0,5 m high. Rays and disc yellow.

Cineraria canescens Wendl. ex Link — Orabeswand, W end, in rock crevices, c. 2 000 m, N. 3659 (det. H. Merxmüller) — Upper Numas, W. 1438 (cf. Wiss 1957 p. 62).

A suffrutescent herb with reniform, dentate leaves and yellow-flowered capitula. The involucre bracts and rays are about eight in number. The Brandberg population is unusually glabrescent (cf. Merxmüller in 'Prodromus' 139: 42).

Dicoma capensis Less. — SE side, c. 5 miles S of Tsisab Valley, G. 3684 — Tsisab Valley, end of road, Kers 1822 — Tsisab Valley, near the 'White Lady', Kers 993.

A tomentose perennial with ascending or prostrate branches.

Dicoma tomentosa Cass. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2454 — SE side, c. 5 miles S of Tsisab Valley, G. 3683.

Erect annual, about 0,5 metre high, with pungent involucre scales and greenish white disc.

Engleria africana O. Hoffm. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2472 — Tsisab Valley, near the 'White Lady', Kers 989 — Numas Valley, among boulders, Kers 2010 — Numas Valley, in shade under overhang, G. 3616. Herb up to 0,7 m high, with petiolate, cordate, dentate leaves and discoid, yellow-flowered capitula.

Epaltes gariiepina (DC.) Steetz — Tsisab Valley, near the 'White Lady', Kers 992. A half-shrub about one metre high, with narrowly lanceolate, somewhat dentate leaves and small, purple-flowered capitula.

Eriocephalus dinteri S. Moore — Königstein area, c. 1 800 m, N. 2779 — Orabeswand, c. 2 000 m, N. 3641 — Numas, plateau, c. 2 000 m, Logan 89.

Shrubs up to 1,5 m high, with white rays. Frequent from about 1 800 m to near the summit.

Eriocephalus pinnatus O. Hoffm. — SE side, c. 5 miles S of Tsisab Valley, G. 3653.

A canotomentose, dense shrub, up to 0,5 m high and wide, with five (or sometimes more) yellow rays.

Euryops subcarnosus DC. subsp. *vulgaris* B. Nord. — Königstein, stony places, c. 2 200 m, N. 2829 — Orabeswand, c. 2 000 m, N. 3653 — Aigub, 2 000—2 600 m, W. 1426 (cf. Lempp 1956 p. 434 and Wiss 1957 p. 67, sub nomen *E. "multifidus"*).

Erect, moderately branching shrubs up to 1,5 m high, with yellow rays and disc. N. 3653 is the type collection of this subspecies, which is widely distributed in karroo areas of South and South West Africa (cf. Nordenstam 1966 b).

Felicia anthemidodes (Hiern) Mendonça — Tsisab Valley mouth, granitic mountain slopes, c. 550 m, N. 2501 — Tsisab Valley, Wettstein 180 (fide Grau 1973 p. 446) — Numas Valley, in river sand under rocks, G. 3599.

A scabrid annual or sometimes biennial herb with yellow disc and white ray-florets. Seeds of my collection produced plants in the Botanical Garden of Lund, and the chromosome number $2n=18$ was counted in root tip preparations (cf. Grau 1973 p. 224). The same number was also obtained in two other collections of this species, both from Outjo district, viz. N. 3695 (from farm 525 Uitkoms) and N. 3723 (from 6 miles N of Huab River on road to Torra Bay).

Felicia clavipilosa Grau subsp. *clavipilosa* — Numas Valley, in shade under overhang, G. 3624 (also W. 1445, fide Grau 1973 p. 366).

A much-branched shrub with pale purple rays and yellow disc. The species was until recently much confused with *F. hyssopifolia* (Berg.) Nees, which is a more southern species not known from South West Africa.

Felicia filifolia (Vent.) Burt Davy subsp. *schaeferi* (Dtr) Grau — Königstein, E slopes, c. 2 300 m, N. 2825 (det. J. Grau).

Shrubs 1—1,5 m high, with purple rays and yellow disc. This is the northernmost locality for this species. It is recorded in Grau's map (1973 p. 681), but has by mistake been omitted in the locality list (p. 292).

Felicia gunillae B. Nord. — Königstein, W slopes near summit, 2 500 m, N. 2803. An erect shrub up to 1,5 m high, with spatulate, dentate leaves, purple rays and yellow disc. Only known from this single collection (cf. Nordenstam 1967 a, Grau 1973 p. 328).

Felicia hirsuta DC. — Königstein, E slopes, c. 2 200 m, N. 2828.

A shrub about 0,5 m high, with glandular peduncles, yellow disc and blue rays. Dr Grau of Munich has referred my specimen to *F. hirsuta* x *muricata* (Grau 1973 p. 376), but I think it can without too much difficulty be included in the variable and strongly modificative species *F. hirsuta*. This extends the range of the species considerably northwards.

Felicia smaragdina (S. Moore) Merxm. — SE side, c. 5 miles S of Tsisab Valley, G. 3688.

Annual with yellow disc and yellow rays, which turn green in the press.

Geigeria acaulis Benth. & Hook. fil. ex Oliv. & Hiern — SE side, c. 5 miles S of Tsisab Valley, G. 3660.

A low herb with white-woolly, narrow, rosulate leaves and small basal flowerheads.

Geigeria alata (DC.) Benth. & Hook. fil. ex Oliv. & Hiern — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2467 — SE side, c. 5 miles S of Tsisab Valley, G. 3682.

A repeatedly forking erect herb with winged stems and branches and small yellow flowerheads.

Geigeria ornativa O. Hoffm. — Numas, 1 850 m, W. 1463 (in Wiss 1957 p. 55 cited as *G. africana* Griess.).

A herb with whitish stem and more or less congested yellow capitula.

Helichrysum fleckii S. Moore — Orabeskop, SE slopes, c. 2 150 m, N. 3664 — Aigub, 2 400 m, W. 1423 (in Wiss 1957 p. 66 cited as *H. cerastioides* DC. var. *gracile* Moeser).

A much-branched, grey-tomentose suffrutex with acute, pink and whitish involucre bracts.

Helichrysum herniarioides DC. — Orabeswand, c. 2 000 m, N. 3662 — Orabeswand, near the escarpment, c. 2 100 m, N. 3669.

These collections differ in several respects from typical *H. herniarioides* from southern South West Africa and karroo areas of South Africa. The latter is a woolly annual without distinct glandular pubescence, with prostrate or decumbent branches, with laxly set, spatulate leaves, and with white and somewhat brownish involucre. The Brandberg plants are vigorous and much-branched herbs with erect and closely leafy branches. The leaves are linear or oblanceolate and only 1–2 mm wide. They are greyish cobwebby when young, but glabrescent and more green with age, and densely glandular with stalked and sessile yellow glands. The involucre bracts are white or (the inner ones) rosy pink to glossy red, especially in young capitula. Their lamina has a rounded to almost truncate tip. The capitula are homogamous and about 13-flowered. All these characters may seem sufficient for the distinction of a taxon of its own, but this should preferably be done in connection with a revision of the whole species complex (cf. 'Prodromus' 139: 4). A collection from the Great Gamsberg (Merxmüller 950 in M) comes very close to the Brandberg specimens and certainly belongs to the same taxon.

Helichrysum leptolepis DC. — Between upper Tsisab and Königstein, dry stony watercourse, c. 1 800 m, N. 2776 — Numas Valley, sandy river at foot of mountain, Kers 2001.

Rather dense woolly herb, also with white and rosy involucre.

Helichrysum tomentosulum (Klatt) Merxm. subsp. *aromaticum* (Dtr.) Merxm. — Numas Valley, G. 3635.

Cushion-shaped shrubs up to 0,7 m high. Capitula small, pinkish, aromatic.

Helichrysum zeyheri Less. — Summit of Königstein, 2 580 m, N. 2798.

A half-shrub, 0,5–1 m high, with small white capitula.

Hirpicium gazanioides (Harv.) Roessler — Tsisab Valley mouth, granitic slopes, c. 550 m, N. 2503 — Tsisab Valley, end of road, Kers 1803 — SE side, c. 5 miles S of Tsisab Valley, G. 3598 a — Numas Valley, G. 3598.

A scabrid erect annual with yellow-flowered radiate capitula. Very common in the Tsisab Valley mouth.

Kleinia longiflora DC. — Upper Tsisab, stony slopes, c. 1 600 m, N. 2570 — Numas, plateau, c. 2 000 m, Logan 82.

A stem-succulent with deciduous leaves. No flowerheads present in my specimen.

Leyssera tenella DC. — Königstein, E slopes, c. 2 300 m, N. 2823.

A yellow-flowered annual, in South West Africa previously only known from the southernmost districts.

Nidorella nordenstamii Wild — Orabeswand, W end, in dry watercourse, c. 2 000 m, N. 3663.

An erect herb, about 0,5 m high, with discoid, yellow-flowered capitula. A species allied to *N. resedifolia* DC. and only known from this single collection (cf. Wild 1969 p. 230). The chromosome number ($2n = 18$) reported in Wild (loc. cit.) was counted by me on specimens cultivated in the Botanical Garden in Lund. Voucher specimens are preserved in S.

Ondetia linearis Benth. — Lower Tsisab, at the 'White Lady', c. 700 m, N. 2538 — SE side, c. 5 miles S of Tsisab Valley, G 3708 — Orabeswand, c. 2 000 m, N. 3648 — Upper Numas, W. 1448, 1448 a (cf. Wiss 1957 pp. 56, 66).

An erect, light green herb, up to 0,4 m high. The entire flowerhead falls off and remains at the stem base of the new plant, that grows up from it (synaptospermy).

Osteospermum angolense T. Norl. — Upper Tsisab, stony slopes, c. 1 500 m, N. 2560 — Brandberg, Merxmüller & Giess 1677 and Tsisab Valley, Merxmüller & Giess 1665 (fide Norlindh 1960 p. 394) — SE side, c. 5 miles S of Tsisab Valley, G. 3678 — Orabeswand, c. 2 000 m, N. 3645 — Orabeswand, W end, c. 2 100 m, N. 3668 — Numas Valley, below overhang, G. 3627 — Upper Numas, above 1 900 m, W. 1414 — Numas, plateau, c. 2 000 m, Logan 84. — Prof. Norlindh has confirmed the determination of my specimens.

Much-branched, glandular-puberulous to almost glabrous half-shrub up to 1,5 m high and wide, with yellow rays and disc.

Osteospermum microcarpum (Harv.) T. Norl. subsp. *microcarpum* — Tsisab Valley mouth, black kopjes, N. 2441 (det. T. Norlindh).

A somewhat lignified, erect, pubescent, yellow-flowered herb about one metre high. This new locality extends the range of the subspecies well into the distribution area of the northern subsp. *septentrionale* (T. Norl.) T. Norl.

Osteospermum muricatum E. Mey. ex DC. subsp. *longiradiatum* T. Norl. — W side of Orabeswand, c. 1 900 m, N. 3660 (det. T. Norlindh).

A yellow-flowered, glandular herb, about 0,3–0,4 m high, with numerous, straight and erect branches with small, pinnatipartite leaves. Previously only known from the type locality, viz. the Great Gamsberg in Rehoboth District (cf. Norlindh 1960 p. 392).

Osteospermum nervosum (Hutch.) T. Norl. — Königstein, E slopes, c. 2 250 m, N. 2818 (det. T. Norlindh).

A viscid herb, 0,3–0,5 m high, with yellow disc and short yellow rays.

Othonna brandbergensis B. Nord. — Between upper Tsisab and Königstein, c. 1 850 m, N. 2780 — Orabeswand, c. 2 000 m, N. 3639 — Numas, plateau, c. 2 000 m, Logan 81.

A vigorous suffrutex up to two metres tall, with somewhat glaucous, dissected leaves, and numerous, yellow-flowered capitula. This characteristic species is frequent on the mountain from about 1 800 m to the summit (see further Nordenstam 1966 a). It is apparently not endemic to the Brandberg, since a collection from the Hakos Mountains (Dinter 7961) should probably be referred to the same species (cf. 'Prodromus' 139: 31).

Pegolettia oxyodonta DC. — Middle Tsisab, riverbed and stony slopes, c. 1 050 m, N. 2793.

Erect perennial herb c. 0,5 m high. The capitula are discoid with rich yellow florets.

Pegolettia senegalensis Cass. — Numas Valley, under overhang, G. 3621.

Annual herb up to 0,3 m high, with discoid, yellow-flowered capitula.

Pentzia acutiloba (DC.) Hutch. — Tsisab Valley, at the 'White Lady', c. 700 m, N. 2543 (det. H. Merxmüller).

A stinking small annual with discoid yellow-flowered capitula.

Pentzia tomentosa B. Nord. — Königstein, E slopes, c. 2 000 m, N. 2821.

A much-branched, canescent half-shrub, up to 1,5 m high, with solitary, stalked, discoid capitula. Only known from this single collection (cf. Nordenstam 1967 a).

Philyrophyllum schinzii O. Hoffm. — Middle Tsisab, c. 1 000 m, N. 2548.

A softly pubescent, smelling herb, with yellow disc and inconspicuous ray-florets.

Pteronia cylindracea DC. — Numas, plateau, c. 2 000 m, Logan 85, 90.

According to Mr Giess these collections may be transitional forms to the closely allied *P. unguiculata* S. Moore. Not having seen the material I cannot express an opinion in this matter.

Pteronia glauca Thunb. — Königstein, E slopes, c. 2 300 m, N. 2830 — In the upper valleys, W. 1427 (cf. Wiss 1957 p. 64).

A grey-leaved shrub 1—1,5 m high, with yellow-flowered discoid capitula. Fairly frequent between 2 000 and 2 500 m.

Pteronia mucronata DC. — Königstein, E slopes, c. 2 300 m, N. 2824.

Shrubs up to 1,5 m high, with green leaves and yellow flowerheads. Apparently much less frequent than the preceding species.

Senecio alliarifolius O. Hoffm. — Upper Tsisab, on rocks, c. 1 500 m, N. 2566 — SE side, c. 5 miles S of Tsisab Valley, G. 3700.

Cushion-like shrubs, up to 0,6 m high and 0,8 m wide, with numerous, white-flowered, discoid capitula.

Senecio burchellii DC. — E of Königstein, c. 2 000 m, N. 2819 — Orabeswand, W end, c. 1 900 m, N. 3661 — Orabeswand, c. 2 000 m, N. 3670 (det. H. Merxmüller).

Herbaceous or suffrutescent plants, up to about one metre high, perhaps sometimes flowering already in the first year, with yellow-flowered, radiate capitula.

Senecio cinerascens Ait. (syn. *S. namaquanus* Bol.) — Königstein, E slopes, c. 2 400 m, N. 2833 — Upper Numas and Aigub, 1 900—2 600 m, W. 1434 (cf. Wiss 1957 pp. 58, 66).

A conspicuous, grey-leaved, yellow-flowered suffrutex, 1—1,5 m high. Similar in habit to *Othonna brandbergensis*, with which it often grows together at higher altitudes.

Senecio eenii (S. Moore) Merxm. — Upper Tsisab, c. 1 300 m, N. 2555 — SE side, c. 5 miles S of Tsisab Valley, G. 3689 — E of Königstein, c. 2 000 m, N. 2820.

Annuals, usually only one or a few dm high, with dentate or lobate leaves, yellow disc and purple rays. The specimens from the Königstein area (N. 2820) differ considerably from those collected lower down. The leaves of the former are much narrower with linear segments, and the flowerheads, florets and achenes are smaller. The rays are revolute and only half the size of those of typical *S. eenii* or

even smaller. The achenes are greyish rather than brownish, but otherwise rather typical, i.e. covered with short papilliform hairs, which become mucilaginous when soaked in water. The summit population may be regarded as a montane race of *S. eenii*. Similar, but less extreme forms have been collected e.g. in the Otavi Mountains.

Senecio flavus (Decne) Sch. Bip. — Upper Tsisab, under rocks, c. 1 500 m, N. 2575 (det. H. Merxmüller).

Small annual with inconspicuous yellow-flowered capitula.

Senecio marlothianus O. Hoffm. — Middle Tsisab, c. 1 000 m, N. 2544 — Numas River, G. 3606.

A vigorous, somewhat glaucous, erect herb, with white-flowered discoid capitula on long stalks.

Tarchonanthus camphoratus L. — Reported by Maack (1923 p. 10), but not seen by later workers.

Ursinia nana DC. — Numas River, 1 900–2 000 m, W. 1436 — Middle Numas, 2 000 m, W. 1447 (cf. Wiss 1957 p. 64 sub nomen *U. annua* Less.).

A small yellow-flowered annual.

Vernonia obionifolia O. Hoffm. subsp. *obionifolia* — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2440 — Tsisab Valley, near the 'White Lady', Kers 1034 — A further collection from the Tsisab Valley, viz. Wettstein 182, is cited by Merxmüller (1960 p. 609).

Suffrutex up to one metre high, with silvery leaves and purplish red disc.

140. Cichoriaceae

Launaea intybacea (Jacq.) Beauv. — Lower Tsisab, in the riverbed, c. 600 m, N. 2482 — Upper Tsisab, c. 1 500 m, N. 2553.

An erect herb, sometimes as tall as a man. Capitula small and narrow, with pale yellow or pinkish florets.

141. Alismataceae

Burnatia enneandra Micheli (syn. *Rautanenia schinzii* [Buch.] Buch.) — Wiss (1957 p. 61) has suggested, that a non-flowering water plant from the upper Numas Valley might belong to this species. The record must be regarded as doubtful.

145. Zannichelliaceae

Zannichellia palustris L. — Lower Tsisab, waterhole below the 'White Lady', c. 700 m, N. 2530, 2531.

A narrow-leaved, submersed water plant. In shallow water the plants become more condensed with shorter internodes (N. 2531). They were found growing together with a charophyte, probably *Chara vulgaris* L. (N. 2529).

147. Liliaceae

Aloe asperifolia Berger — Said to reach the Brandberg (cf. Reynolds 1950 p. 313, 'Prodromus' 147: 16), but I have seen no exact locality statement or specimen from the mountain.

Aloe dichotoma Masson — Ridge W of middle Tsisab Valley, c. 1 000 m (N. obs.) — Numas Valley (Lempp 1956 p. 431, photograph p. 433; Wiss 1957 p. 58, photograph p. 59) — Also observed already by Maack (1923 p. 10, 1960 pp. 11, 13).

A very characteristic, yellow-flowered tree.

Aloe hereroensis Engler — Middle Numas, according to Wiss (1957 p. 54), who records both red- and yellow-flowered forms.

Aloe littoralis Baker (syn. *A. rubrolutea* Schinz) — Between upper Tsisab and Königstein, stony slopes, c. 1 700 m, N. 2782 — Middle Numas (Lempp 1956 p. 432, Wiss 1957 p. 54).

A red-flowered *Aloe* with dotted leaves. Young plants are stemless, but in older specimens a stem is usually developed.

Aloe viridiflora Reynolds — E side of the mountain, according to Mr Giess (in litt.), who in 1969 received an inflorescence from Mr C. G. Coetzee. A green-flowered rare species, previously only known from two localities in central South West Africa.

Androcymbium melanthioides Willd. — Upper Numas, above 2 000 m, W. 1435. Leaves rosulate, whitish, more or less appressed to the ground (cf. Lempp 1956 p. 434, Wiss 1957 p. 164).

Asparagus nelsii Schinz — Upper Tsisab, stony slopes, c. 1 300 m, N. 2558 (conf. J. Jessop) — SE side, c. 5 miles S of Tsisab Valley, G. 3706.

Erect plants up to 0,8 m high, with grey or brownish branches and filiform, straight phylloclades.

Asparagus retrofractus L. — Königstein, E slopes, c. 2 300 m, N. 2815 (det. J. Jessop).

Dense shrubs up to 1,5 m high, with light grey, striate branches, curved filiform phylloclades and red berries. A common plant of higher altitudes.

Ornithogalum pulchrum Schinz — Upper Tsisab, c. 1 500 m, N. 2565.

A stately lily up to 1,5 m tall. The rounded bulb is creamy yellow and about 6 cm in diameter. The leaves are rosulate and white-dotted. The tepals are greenish white with a broad green median band.

152. Velloziaceae

Xerophyta viscosa Baker — Numas, plateau, c. 2 000 m, Logan 91 — Also reported by Walter (1972 p. 6).

155. Iridaceae

Kentrosiphon saccatus (Klatt) N. E. Br. subsp. *steingroeveri* (Pax) Oberm. — Between upper Tsisab and Königstein, c. 1 800 m, N. 2778 — Numas area, 2 000 m, W. 1422 (cf. Wiss 1957 p. 62) — Also seen by Walter (1972 p. 6).

Erect plant with linear leaves and long, deep red flowers. It is a matter of opinion, whether this taxon should be treated as a subspecies of *K. saccatus* or as a separate species. It differs from typical *K. saccatus* chiefly by the more slender stems without basal spots and the smaller flowers.

Lapeirousia gracilis Vaupel — Königstein, E slopes, c. 2 300 m, N. 2834 — Orabeswand, c. 2 000 m, N. 3666.

The collection N. 3666 has flowers with a pure blue perianth, whereas N. 2834 was collected in the fruiting state and only hesitatingly is referred to the same species. It belongs to a group of species (incl. *L. bainesii* Bak. and *L. sandersonii* Bak.) in urgent need of revision.

160. Poaceae

Antheophora pubescens Nees — Upper Tsisab, stony riverbed, c. 1 500 m, N. 2578 — Side valley of Tsisab, Merxmüller & Giess 1660 (M).

A somewhat tufted, greyish green, perennial grass with villous, cylindric spikes.

Antheophora ramosa Goossens — Orabeswand, c. 2 000 m, N. 3674 — Numas Valley, G. 3630, de Winter & Hardy 8224 (M) — Numas Valley, foot of mountain, Kers 2013.

A tufted perennial grass with strictly erect, usually branching culms. The spikes are narrower than in the preceding species. The taxonomy of this group appears to be very intricate, however, and the naming of the Brandberg collections must be regarded as tentative. The collection N. 3674 is particularly deviating, with very narrow leaves, acuminate outer glumes, and dark brown inner glumes and outer lemmas (cf. Fig. 7).

Antheophora schinzii Hack. — SE side, c. 5 miles S of Tsisab Valley, G. 3709.

A small annual grass up to 0,3 m high.

Aristida adscensionis L. (syn. *A. curvata* [Nees] Trin. & Rupr.) — Between upper Tsisab and Königstein, c. 1 700 m, N. 2771 — Königstein, E slopes near summit, c. 2 500 m, N. 2811 (conf. B. de Winter).

A decumbent to erect, small or medium-sized annual with a purplish tinge on the panicles.

Aristida scabrivalvis Hack. — Reported from Amis Valley by Wiss (1957 p. 48), but the record needs confirmation.

Asthenatherum mossamedense (Rendle) Conert — Numas Valley, sandy riverbed, Kers 2012.

A coarse grass with large, pale spikelets in a contracted, elongated panicle.

Cenchrus ciliaris L. — Numas, 1 850 m, W. 1464 (cf. Wiss 1957 p. 54).

A vigorous grass with spike-like inflorescences.

Cymbopogon excavatus (Hochst.) Stapf — Upper Numas, according to Wiss (1957 p. 62).

Danthoniopsis dinteri (Pilg.) Hubb. — Tsisab Valley mouth, granitic mountain slopes, c. 550 m, N. 2509 — Numas Valley, Kers 2008.

A robust, rather broad-leaved grass with a lax panicle.

Enneapogon desvauxii Beauv. (syn. *E. brachystachyus* [Jaub. & Spach] Stapf, fide Launert 1971 p. 145) — Aigub, 2 300 m, W. 1451 (cf. Wiss 1957 pp. 55, 60) — Also in the Amis Valley (Wiss 1957 p. 48).

A small perennial grass with spike-like panicles.

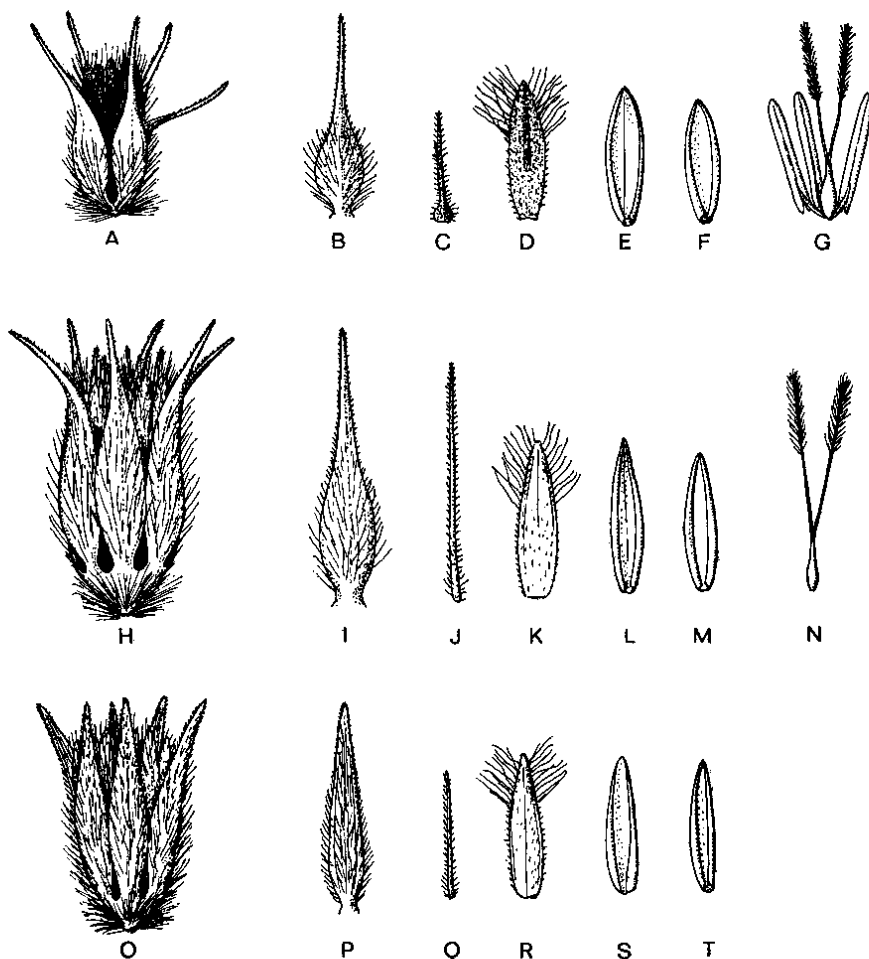


Fig. 7. A—G: *Anthephora ramosa* Goossens (N. 3674 from the Brandberg). — H—N: *A. pubescens* Nees (N. 2578 from the Brandberg). — O—T: *A. ramosa* Goossens (N. 3809 from S.W.Africa, Outjo Distr., Farm Palm). — A, H, O: Spikelet cluster. — B, I, P: Lower glume, abaxial side. — C, J, Q: Upper glume. — D, K, R: Lower lemma, abaxial side. — E, L, S: Upper lemma, adaxial side. — F, M, T: Palea, abaxial side. — G: Gynoecium and stamens. — N: Gynoecium. — All x 5. — Del. auct.

Enneapogon cenchroides (Licht.) Hubb. — Lower Tsisab, in the riverbed, c. 600 m, N. 2525 — Upper Tsisab, stony riverbed, c. 1 400 m, N. 2579.

A fairly vigorous, pubescent grass with greyish to purplish, condensed panicles.

Enneapogon scaber Lehm. — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2450 — Amis Valley, according to Wiss (1957 p. 48).

A tufted low grass, apparently flowering as an annual.

Enneapogon scoparius Stapf — Tsisab Valley, at the 'White Lady', c. 700 m, N. 2535.

A tufted annual, about 0,2 m high. It differs in some respects from typical *E. scoparius* and perhaps agrees with *E. filifolium* (Pilger) Stapf ex Garab., which in the 'Prodromus' (160: 79) is included in *E. scoparius*.

Eragrostis annulata Rendle — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2459 (conf. B. de Winter).

About 0,3 m high annual with tufted culms. A frequent grass of the valley mouth and its surroundings.

Eragrostis aristata de Winter — Lower Tsisab, in the riverbed, c. 600 m, N. 2477, 2489 — Brandberg, along riverbed, Schweickerdt 2252 (isotype in S).

Annual with a lax panicle. The spikelets are unusual for the genus, having three-fid, shortly awned lemmas (see further de Winter 1961 p. 469).

Eragrostis echinochloidea Stapf — Lower Tsisab, in the riverbed, c. 600 m, N. 2485 (conf. B. de Winter).

A tufted grass with many-flowered spikelets in clusters on the panicle branches. *Eragrostis rotifer* Rendle (syn. *E. margaritacea* Stapf) — Lower Tsisab, in the riverbed, c. 600 m, N. 2476 (conf. B. de Winter) — Tsisab Valley mouth, in the riverbed, c. 550 m, N. 2526 — Numas Valley, 2 000 m, W. 1453 (cf. Wiss 1957 pp. 55, 60).

A somewhat glaucous, tufted grass, up to 1,5 m tall, with a broad and lax panicle. The species grows close to running water.

Fingerhuthia africana Nees in Lehm. — Reported by Wiss (1957 p. 60) from the upper Numas Valley.

Heteropogon contortus (L.) Beauv. ex Roem. & Schult. — Upper Numas, according to Wiss (1957 p. 62).

Loudetia ramosa (Stapf) Hubb. — Orabeswand, c. 2 000 m, N. 3675.

Erect perennial grass with conspicuous, purplish brown spikelets in a somewhat contracted panicle.

Pennisetum foermeranum Leeke — Above 2 300 m, W. 1452 (cf. Wiss 1957 pp. 55, 60).

Similar to *Cenchrus ciliaris*, but inflorescence more lax.

Rhynchelytrum brevipilum (Hack.) Chiov. — Numas Valley, river between rocks, G. 3613.

A small annual with shortly pubescent, yellow to pink spikelets.

Rhynchelytrum villosum (Parl.) Chiov. — Lower Tsisab, c. 600 m, N. 2488 — Tsisab Valley, at the 'White Lady', in granitic sand, N. 2534, 2536 — Also in the upper Numas, according to Wiss (1957 p. 55).

An elegant grass with silky-villous, coppery red or silvery spikelets.

Schmidtia kalahariensis Stent — Upper Numas Valley, according to Wiss (1957 p. 66). but not confirmed.

Setaria verticillata (L.) Beauv. — Tsisab Valley mouth, c. 550 m, N. 2527.

A light green annual grass, up to one metre high, with a dense and spike-like panicle. The species is common in the riverbed of the lower Tsisab.

Sporobolus fimbriatus (Trin.) Nees — Upper Numas, according to Wiss (1957 p. 62), but the record needs verification.

Stipagrostis hirtigluma (Steud. ex Trin. & Rupr.) de Winter subsp. *hirtigluma* — Numas Valley, G. 3593; between rocks in the riverbed, G. 3612; in sand between rocks, G. 3603 — SE side, c. 5 miles S of Tsisab Valley, G. 3679.

An annual grass from c. 0,2 to 0,7 m high.

Stipagrostis hirtigluma (Steud. ex Trin. & Rupr.) de Winter var. *pearsonii* (Henr.) de Winter — Lower Tsisab, in the riverbed, c. 600 m, N. 2481.

An annual with numerous, slender, tufted culms. I could not name this peculiar form, which practically lacks plume on the awns and hairs on the glumes. However, Dr de Winter (in litt.) regards it as an abnormal form of the var. *pearsonii*, which in the 'Prodromus' (160: 197) is included in subsp. *hirtigluma*. This form may deserve a closer study.

Stipagrostis hochstetterana (Beck ex Hack.) de Winter — Lower Tsisab, c. 600 m, N. 2486 — Numas Valley, W. 1465 (cf. Wiss 1957 pp. 54, 66) — Also in Amis Valley, according to Wiss (1957 p. 48).

A grass with tufted culms and a condensed, almost spike-like panicle. Wiss' collections are referred to as *Aristida secalina* Henr. and would thus come closest to var. *secalina* (Henr.) de Winter, whereas my specimens agree best with var. *hochstetterana*. In Launert's opinion ('Prodromus' 160: 198) these two varieties cannot be upheld.

Stipagrostis obtusa (Delile) Nees ex Kunth — Recorded from the Amis and Numas Valleys (Wiss 1957 pp. 48, 55), but not confirmed.

Stipagrostis uniplumis (Licht. ex Roem. & Schult.) de Winter — Tsisab Valley mouth, black kopjes, c. 550 m, N. 2460 — Numas Valley, G. 3594 — Amis and Numas Valleys, according to Wiss (1957 pp. 48, 54, 55).

Perennial or perhaps sometimes annual grass with more or less tufted culms. Very common in and around the mouth of Tsisab Valley.

Tragus berteronianus Schultes — Amis Valley, according to Wiss (1957 p. 48).

Tragus racemosus (L.) All. — Recorded from Amis Valley and upper Numas (Wiss 1957 pp. 48, 66).

Tricholaena monachne (Trin.) Stapf & Hubb. var. *annua* J. G. Anders. — Numas Valley, G. 3608.

A gracile, low annual, which may deserve a higher taxonomic rank (cf. Launert in 'Prodromus' 160: 208).

Trichoneura eleusinoides (Rendle) Ekman — Tsisab Valley, at the 'White Lady', in coarse granitic sand, c. 700 m, N. 2533.

Panicle contracted, with numerous, almost spreading, spike-like branches.

Triraphis ramosissima Hack. — Upper Numas, according to Wiss (1957 p. 55).

164. Typhaceae

Typha latifolia L. subsp. *capensis* Rohrb. — Upper Numas, W. 1454.

This characteristic plant of wet localities was found in the waterholes of Numas Valley, up to about 2 100 m (cf. Lempp 1956 p. 434, Wiss 1957 p. 61), and also in the middle Hungarob Valley (Lempp 1956 p. 429).

165. Cyperaceae

Bulbostylis humilis Kunth — Summit of Königstein, 2 575 m, N. 2808.

A dwarf annual growing in bare sandy patches just below the top. In South West Africa previously only found in Otjiwarongo District.

Cyperus marginatus Thunb. — Lower Tsisab, c. 600 m, N. 2479 — Tsisab Valley, near the 'White Lady', Kers 990 — Numas, 1 850 m, W. 1461 (cf. Lempp 1956 p. 433, Wiss 1957 p. 55).

A vigorous sedge, growing in tufts close to the water, with leafless, terete culms up to two metres tall.

Mariscus aristatus (Rottb.) Cherm. — Lower Tsisab, waterhole below the 'White Lady', c. 700 m, N. 2537 — Upper Tsisab, near a waterhole, c. 1 500 m, N. 2569 (det. D. Podlech).

A small annual, growing in damp sand.

Mariscus assimilis (Steud.) Podl. — Tsisab Valley, near the 'White Lady', Kers 958.

Found in moist sand like the preceding species, from which it differs i.a. by the greener and less distinctly awned glumes.

Scirpus aciformis B. Nord., sp. nov. — Between upper Tsisab and Königstein, damp sandy places in steep stony watercourse, c. 2 000 m, 31.V.1963, N. 2826 (S holotype, M).

Illustr.: Fig. 8 A—E.

S. cernuo Vahl affinis, sed planta graciliore, spica minore, glumis acutis subaequalibus nunquam bracteiformibus, apice foliorum acuto, anthera minore, fructu dimidio minore indistincte punctato acute triquetro differt.

A tufted glabrous annual with numerous erect or erecto-patent stems up to 7 cm high; roots very slender, thread-like. Stems filiform, up to 0,2 mm thick, green, somewhat striate, with a single basal produced leaf, otherwise leafless and terminated by a single spike.

Basal sheaths loosely imbricated, ovate-lanceolate, c. 2 mm long, submembranous and subhyaline, pale brown or whitish, obtuse, many-nerved. Produced leaf single, near the stem base; sheath stem-clasping, 3—4 mm long, submembranous, pale green—whitish, sometimes with brownish veins; leaf-blade subfiliform-canaliculate, 0,5—1 cm long, 0,1—0,2 mm wide, somewhat spirally twisted, acute and mucronate or short-acuminate, green.

Spike without subtending leaf-like bracts, oblong-ovoid, with c. 10—25 spirally arranged flowers, 1,5—2 mm long, 1—1,5 mm wide. All glumes fertile and subequal, ovate, 0,8—1,2 mm long, 0,4—0,6 mm wide, reddish brown, keeled with a

thickish green or brown midrib, with 2–3 faint lateral veins on each side, towards the margins thin and subhyaline, apically acute and mucronate or short-acuminate. Pistil 1 mm long; ovary 0,3 mm and style 0,7 mm long; stigmas 3, 0,3–0,4 mm long, finely papillate. Stamen 1; filament 0,15–0,25 mm long; anther 0,25 mm long, yellow. Nut 0,4×0,3 mm, sharply triquetrous with the adaxial side less convex than the abaxial faces, greyish black (brownish when immature), minutely punctate with a glistening subpapillate surface, apically mucronate.

S. aciformis belongs to subgenus *Isolepis* (R. Br.) C. B. Clarke and is probably closely allied to *S. cernuus* Vahl, from which it differs by the slender growth,

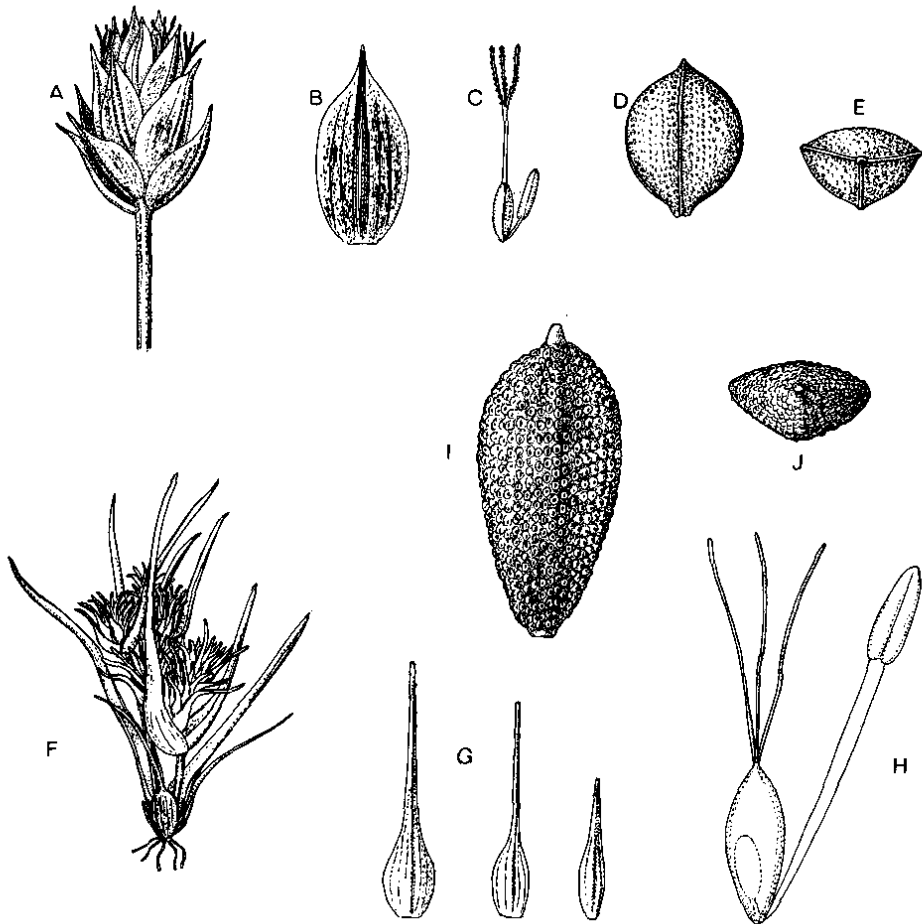


Fig. 8. A–E: *Scirpus aciformis* B. Nord. (N. 2826). — A: Spike, x 15. — B: Glume, x 25. — C: Pistil and stamen, x 25. — D: Nut, lateral view, x 50. — E: Nut, dorsal view, x 50. — F–J: *Scirpus hystricoides* B. Nord. (N. 2827). — F: Plant, x 2½. — G: Glumes, x 5. — H: Pistil and stamen, x 25. — I: Nut, lateral view, x 50. — J: Nut, dorsal view, x 50. — Del. auct.

smaller spikes without leaf-like bracts, acute glumes, acute leaf-blade, shorter anthers, and the smaller, sharply three-angled and less distinctly punctate nut.

Scirpus hystricoides B. Nord., sp. nov. — Between Königstein and upper Tsisab, damp sandy patches in steep stony watercourse, c. 1 900 m, 31.V.1963, N. 2836 (S holotype, M) — Königstein, E slopes, damp sandy soil in rivulet bed, c. 2 100 m, N. 2827.

Illustr.: Fig. 8 F—J.

Ad *S. hystricem* Thunb. et *S. brevicaulem* Levyns accedens, a priore aristas glumarum apice truncatis vel minute denticulatis, fructu obtuse (nec acute) trigono sat compresso distincte punctato, a posteriore anthera normaliter singulari, stigmatibus 3, fructu trigono (nec biconvexo) angustiore differt.

A dwarf annual herb. Roots fibrous, thin. Stems usually several to many, 0—2,5 cm long, less than 0,5 mm thick, glabrous, somewhat ribbed, with 2—4 basal leaf-sheaths and usually 1 produced leaf.

Basal sheaths subhyaline, ovate—lanceolate, distinctly many-nerved, conspicuously reddish brown. Produced leaf linear-subulate, up to 2 cm long, flat or somewhat channelled, green, ± curved, minutely and laxly denticulate, tapering to an attenuate subulate-filiform apex.

Spikes 3—6 together in terminal compact clusters (sometimes with additional rudimentary spikes), subtended by elongated bracts. Lowest bract sterile, distinctly longer than the spike cluster, up to 3 cm long, linear-lanceolate or subulate with an attenuate tip, basally up to 2,5 mm broad, subpellucid and clasping, distinctly many(10—15)-veined, reddish brown, sometimes with a rudimentary axillary spike with a perfect flower and 1—2 hyaline ovate obtuse glumes 1—3 mm long and 0,5—1,5 mm wide. Spike generally with c. 20—50 spirally arranged flowers; receptacle oblong, cylindrical, alveolate, glabrous. Glumes long-acuminate with a green filiform apex from a broad ovate subhyaline base, up to 7 mm long, towards the spike apex successively smaller (to 3 mm long and lanceolate), 3—7-nerved basally; tips somewhat arcuate-spreading; apex truncate or blunt, minutely and laxly denticulate or almost smooth. Stamens 1 or sometimes 2 in the lowermost flower(s). Filament narrowly linear, somewhat dilated above, flat, hyaline.

Anther narrowly oblong, 0,5 mm long, yellow. Ovary (in anthesis) 0,7—0,8 mm long. Stigmas 3, sessile, filiform, 1—1,2 mm long. Nut narrowly obovate, 0,7—0,9 mm long, 0,3—0,4 mm wide, bluntly three-angled, shortly beaked (beak c. 0,05 mm), grey, distinctly punctate (surface covered by rounded convex cells with a central dark point), abaxial angle very convex and sometimes indistinct basally, slightly compressed dorsally, c. 0,25 mm thick.

This new species is allied to *S. hystrix* Thunb., differing i.a. by the less pointed tips of the glumes, which are long aristate and very conspicuous, and by the shape of the nut, which is bluntly (not sharply) three-angled, dorsally compressed and distinctly punctate.

From *S. brevicaulis* Levyns the new species is distinguished by the three stigmas and the normally single stamen (2 stigmas and 2 or 3 stamens in *S. brevicaulis*) as well as by the trigonous (not biconvex), narrower nut.

Scirpus laetiflorens C. B. Clarke — Lower Tsisab, in the riverbed, c. 600 m, N. 2478.

Growing in tufts close to the water, with culms up to about two metres tall.

PHYTOGEOGRAPHICAL ASPECTS

The Brandberg is situated in the north-western corner of the Karroo-Namib floristic region (Monod 1957, White 1965, Volk 1966). Quite naturally a large proportion of the Brandberg flora belongs floristically to this region. However, the flora of the Brandberg is composed of species with various phytogeographical relationships, and which may be assigned to different floristic elements. Some of these have a wide distribution, while others are more limited in space. The latter are generally more significant from a phytogeographical point of view and will be discussed more fully in this chapter.

The Brandberg endemics

The small, but interesting group of species and subspecies, which are known only from the Brandberg, comprises the following eleven taxa.

Euphorbia monteiroi subsp. *brandbergensis*

Hermannia merxmuelleri

Plumbago wissii

Hoodia montana

Mentha wissii

Ruellia brandbergensis

Felicia gunillae

Nidorella nordenstamii

Pentzia tomentosa

Scirpus aciformis

Scirpus hystericoides

It is probable, that some of the Brandberg endemics may be found in other localities as well. Those from the lower altitudes, e.g. *Hermannia merxmuelleri* and *Ruellia brandbergensis* might occur in other suitable, more or less nearby localities (just as *Acacia montis-usti*, *Euphorbia chamaesycooides*, *Eragrostis aristata* a.o.). Some of the higher altitude endemics may recur in mountainous regions like the Erongo, the Hakos Mountains, the Auas Mountains or the Gamsberg. An example of such a distribution is afforded by *Othonna brandbergensis*, which has been collected once in the Hakos Mountains (in a somewhat deviating form, but certainly conspecific). Other examples are *Osteospermum muricatum* subsp. *longiradiatum*, occurring on the Great Gamsberg, and *Aloe viridiflora*, which is known from the Auas Mountains. The insufficiently known *Sutera* cfr *atropurpurea* also seems to belong to this group of South West African disjunct montane taxa and perhaps also the form series discussed under *Helichrysum herniarioides*.

Some of the Brandberg endemics have apparently close relatives elsewhere in South West Africa or in Angola. Such endemics may have originated as isolated populations of once more continuously distributed taxa. The isolates have then in some cases undergone enough differentiation to merit distinction as species or subspecies. This type of Brandberg endemics may be regarded as neo-endemics. As an example may be quoted *Nidorella nordenstamii*, which is closely related

to *N. resedifolia* and can be regarded as a montane derivative of the latter. *N. resedifolia* is widely spread in Southern and Central Africa and has some weedy tendencies (Wild 1969). Another example is *Euphorbia monteiroi* subsp. *brandbergensis*, which is probably derived from the widely distributed lowland subspecies *monteiroi*. As an example of a relict population, which also may have undergone some evolution after isolation, could be mentioned *Felicia gunillae*. Its nearest relatives seem to be *F. scabrada* from the Cedarbergen (Cape Province) and *F. brevifolia*, a Namaqua species extending into southern South West Africa (cf. Grau 1973 p. 324 ff.).

Other Brandberg endemics appear to be taxonomically and phytogeographically more isolated. Species like *Plumbago wissii*, *Hermannia merxmulleri* and *Pentzia tomentosa* have the aspect of being relic and probably epibiotic taxa.

To this discussion of Brandberg endemism should be added, that in many species the Brandberg population is somewhat deviating in one or several respects, but perhaps not sufficiently distinct to merit taxonomic recognition. Others are insufficiently studied and may have to be distinguished as new endemic taxa in the future. In the check-list there are many indications of such conditions, e.g. under *Adromischus* sp., *Cardiospermum pechuelii* var., *Diclis petiolaris*, *Striga gesnerioides*, *Sutera* cfr *atropurpurea*, *Sutera canescens*, *Hypoestes forskalei*, *Peristrophe grandibracteata*, *Petalidium canescens*, *Cineraria canescens*, *Helichrysum herniarioides*, *Senecio eenii*, *Antheophora ramosa*, and *Stipagrostis hirtigluma* var. *pearsonii*.

Thus, with increased knowledge of the Brandberg flora, some of the endemics will probably have to be deleted from the list, and others, still undescribed or not yet collected, will have to be added.

The Kaoko element

A very interesting phytogeographical group comprises species confined to southern Angola and the northwestern part of South West Africa (Kaokoveld, Outjo, Omaruru, Swakopmund and Karibib districts). The most famous member of this so-called Kaoko element (Volk 1964) is *Welwitschia mirabilis*, which is, however, more confined to the Namib coastal plain than most other members of the group (cf. Kers 1967 p. 119).

Many members of the Kaoko element have their centre in the Kaokoveld and/or Outjo districts and do not penetrate southwards to the Brandberg (e.g. *Acacia robynsiana*, *Balanites welwitschii*, many *Petalidium* spp., and the monotypic genus *Kaokochloa*). However, on further analysis it is seen that the Brandberg is not all that marginally situated in the Kaokoveld phytogeographic centre, but rather takes quite a significant position there. No less than 28 species, or more than 8% of the Brandberg flora, may be counted to the Kaoko element. The impressive list is as follows.

Welwitschia mirabilis
Boerhavia deserticola
Marcellipsis splendens
Cadaba schroepelii
Acacia montis-usti

Indigofera teixeirae
Rhynchosia candida
Euphorbia chamaesycoides
Commiphora kraeuseliana
Commiphora wildii
Corchorus merxmuelleri
Hermannia amabilis
Hermannia solaniflora
Microlooma hereroense
Merremia guerichii
Anticharis ebracteata
Aptosimum angustifolium
Sutera corymbosa
Petalidium canescens
Sesamum marlothii
Antiphiona fragrans
Engleria africana
Eriocephalus pinnatus
Osteospermum angolense
Senecio alliariifolius
Vernonia obionifolia
Asthenatherum mossamedense
Eragrostis aristata

A few further species are excluded because they extend eastwards into the northeastern districts of South West Africa or even into Botswana (*Aizoanthe-mum dinteri*, *Felicia anthemidodes*, *Philyrophyllum schinzii* a.o). Species ranging further southwards along the central Namib (*Adenia pechuelii*, *Celosia spathuli-folia*, *Barleria merxmuelleri*) are also excluded and referred to the Vor-Namib group.

Generally speaking the members of the Kaoko element are well defined species with few close allies. Many of them give the impression of being very old. Although some of them have retained or developed a certain variability, they may on the whole be regarded as epibiotic relic endemics. This impression is enhanced by the presence of taxonomically isolated, monotypic genera like *Welwitschia*, *Phlyctidocarpa* and *Kaokochloa*. However, an intense speciation leading to progressive endemism seems to be going on in some groups, the best example of which appears to be the Acanthaceae, especially the genus *Petalidium* (cf. Meyer in 'Prodromus' 130: 50).

Other Karroo-Namib species

The more widely distributed Karroo-Namib species are naturally well represented in the Brandberg flora. They could be referred to various phytogeographical groups, but no detailed classification shall be attempted here. Only some selected

examples will be cited to illustrate the variety of distribution types within the region.

Species with a more or less continuous distribution throughout the arid areas of Southern Africa may be termed *Karoo ubiquitous*s. Some examples are *Euryops subcarnosus* subsp. *vulgaris* (Nordenstam 1969 a Map 79), *Felicia hirsuta* (Grau 1973 Map 27) and *Pteronia glauca*. Others (e.g. *Hypertelis bowkeriana*) have a similar, but more broken range. Many Karroo ubiquitous, like the species of Compositae just mentioned, have their northern limit at the Brandberg.

Many species are more or less confined to the Namaqualand region, from about the Olifants River in the south, northwards into South West Africa. Such species are referred to the *Namaqua group* (Nordenstam 1969 a p. 46). A typical example is *Aloe dichotoma* (map in Volk 1964 and 1966). Another Brandberg species belonging here is *Senecio cinerascens*. The Brandberg is often a northern outpost for members of this and certain other Karroo groups and there is sometimes a marked disjunction from the main range in Namaqualand (*Leyssera tenella*, *Felicia filifolia* subsp. *schaeferi*).

A considerable number of species have their main range in South West Africa, with or without extensions into the adjoining districts of the northern Cape Province (Little Namaqualand, Kenhardt, Gordonia etc.). The Orange River is no phytogeographic boundary to the mainly xerophytic taxa discussed here. Nevertheless several species happen to be restricted to South West Africa. To this *South West African group* belong, i. a.,

Cardiospermum pechuelii

Limeum dinteri (if a record from Transvaal is regarded as false)

Lindernia intrepidus (an aquatic species, map in Giess 1969 a)

Felicia smaragdina (Grau 1973 Map 53)

Hirpicium gazanioides (map in Roessler 1959 p. 461)

Ondetia linearis

Antheophora schinzii

Some South West African species are more restricted to certain regions. Thus a *Namibrand group* could be distinguished, with species more or less confined to the Namib border zone (rarely with extensions into southern Angola and northern Namaqualand). Some examples are *Adenolobus garipensis*, *Commiphora saxicola*, *Acrotome fleckii*, *Salvia garipensis*, *Monechma arenicola*, *Peristrophe grandibracteata*, and *Ruellia diversifolia*. The distinction against species of the more or less stony 'Vor-Namib' may be difficult to draw. To the *Vor-Namib group* *Lithops gracilidelineata*, *Celosia spathulifolia*, *Adenia pechuelii*, *Barleria merxmuelleri* and *Aloe asperifolia* may be referred.

South West African species with extensions into the Cape Province (and sometimes Botswana and southern Angola) are, e. g.,

Sesuvium sesuvioides

Leucosphaera bainesii

Dianthus namaensis

Maerua schinzii

Phaeoptilum spinosum
Parkinsonia africana
Commiphora glaucescens
Cyphostemma currori
Lantana dinteri
Felicia clavipilosa subsp. *clavipilosa* (also in Zambia, Grau 1973 Map 25)
Pentzia acutiloba
Anthephora ramosa
Stipagrostis hochstetterana (Volk 1964 Map 5, de Winter 1965 Fig. 84)
Triraphis ramosissima

This group leads over to a category of species with more extensive ranges in the inner, arid parts of southern Africa. The typical distribution includes large parts of South West Africa, the northern Cape districts, Griqualand West and adjacent parts of the Orange Free State. A few examples are *Boscia foetida*, *Decabelone barklyi* and *Hoodia gordonii*.

Sudano-Zambesian species

A number of species with more or less continuous distribution ranges within the Sudano-Zambesian region also reach the Brandberg, e. g., *Ficus sycomorus*, *Plicosepalus curviflorus*, *Acacia albida*, *Mundulea sericea*, *Ziziphus mucronata*, *Salvadora persica*, *Grewia bicolor*, *Cordia gharaf* and *Sterculia quinqueloba*. Others are more restricted to the southern hemisphere, e.g., *Boscia albitrunca*, *Acacia giraffae*, *Combretum apiculatum* and *C. imberbe*. However, a more interesting group of species have marked disjunctions between two distribution areas, one on each side of the equatorial belt. This group will be treated separately below.

The disjunct Afro-arid element

These species have a southern range within the Karroo-Namib region and a northern area in the Sahalian-Oriental domain of the Sudano-Zambesian region or in the adjacent Saharo-Sindian region (denoted with 'ss'). Some of the latter penetrate through Arabia to the arid parts of India. A large number of Brandberg species belong to this interesting group, e.g.,

Osyris lanceolata
Commicarpus squarrosus (ss)
Corbichonia decumbens (ss)
Tribulocarpus dimorphanthus
Atriplex vestita
Cyamopsis senegalensis
Indigofera disjuncta
Monsonia senegalensis
Gossypium anomalum
Zygophyllum simplex (ss)

Hermannia modesta (ss)
Kissenia spathulata
Trichodesma africanum (ss)
Barleria lancifolia
Hypoestes forskaolei
Rogeria adenophylla (ss)
Dicoma capensis
Geigeria acaulis
Enneapogon desvauxii (ss)
Enneapogon scaber (ss)
Fingerhuthia africana (ss)
Stipagrostis hirtigluma (ss)
Stipagrostis obtusa (ss)
Trichoneura eleusinoides (ss, very close to or conspecific with
T. arenaria from Egypt and North Africa, cf. de Winter 1971)

Such remarkable disjunctions between the arid regions on either side of the equator have been discussed by various authors, especially quite recently (Burt 1971, Lebrun 1971, Monod 1971, de Winter 1971). In addition to these disjunct species there are vicarious taxa (such as *Stipagrostis uniplumis* in the south versus *S. papposa* in the north) and other examples of floristic affinities between the two regions. *Dyerophytum africanum*, e.g., has a typical Karroo-Namib distribution, but nevertheless also affinities to the Saharo-Sindian region, because the two other species of the genus occur in India and Socotra, respectively. Similarly *Thamnosma* subgenus *Palaeothamnosma* is known from Arabia and Socotra, in addition to the Karroo-Namib range of *T. africanum*. Thus the north-south disjunction is evident also on the generic level and to the genera mentioned *Forsskaolea*, *Moringa*, *Kissenia*, *Tamarix*, *Citrullus*, *Dactyliandra*, *Rogeria*, *Stipagrostis* and *Trichoneura* may be added.

All the evidence together indicates a former connection between the arid regions on both side of the equator, either via an 'arid corridor' or as more continuous ranges during periods of more arid conditions in Central Africa.

More widely distributed species

Brandberg species belonging to more widely distributed floristic elements are phytogeographically less significant and will not be discussed in detail.

Several species are widely spread in the Old World tropics and may be referred to a *paleotropical element*, e.g., *Mollugo cerviana*, *Gynandropsis gynandra*, *Kalanchoe lanceolata*, *Sarcostemma viminale*, *Salvadora persica*, *Azima tetra-cantha*, *Melhanina ovata*, *Hibiscus micranthus*, *Striga gesnerioides*, *Dicoma tomentosa*, *Pegolettia senegalensis* and *Rhynchelytrum villosum*. Some of these may have had much in common with the Afro-arid element in the past.

Still more widely distributed species, which can be classified as *pantropical*, include *Aristida adscensionis*, *Heteropogon contortus*, *Tragus berteronianus* and *Mariscus aristatus*.

The number of weeds on the Brandberg is comparatively small, which no doubt is due to the rather recent appearance of the white man in the area. Although primitive tribes have had a long history on the mountain, they seem to have contributed very little to the introduction of an alien flora. More or less *weedy species* are *Lepidium divaricatum*, *Argemone ochroleuca*, *Ricinus communis*, *Tribulus zeyheri*, *Nicotiana glauca*, and *Setaria verticillata*. The almost cosmopolitan *Solanum nigrum* may also be mentioned here.

Finally, a few wide-spread waterplants occur on the Brandberg, viz. *Zannichellia palustris* and *Veronica anagallis-aquatica*.

The Cape element in South West Africa

Outliers of the Cape flora, as generally defined, occur in several regions outside the Cape proper, e.g. in the Drakensbergen and further north in the East African mountains. There are also records of a Cape element in Angola, mainly on the Huilla Plateau. There is a generally accepted belief that the migrations of the Cape flora has taken place along an eastern route with a westward connection to Angola high up in the present tropics. The numerous disjunctions in these regions give testimony to this hypothesis. Commenting upon this suggested pathway of the Cape element into Angola, Weimarck (1934 p. 219) writes, "If this is not the case then we might expect to find relic Cape plants in South West Africa, where . . . the Brandberg reaches an altitude of 8277 feet and the Auas Range 7886 feet". This statement led Rennie (1935) to investigate a sample of the flora of the Auas Mountains, which he thought contained several relics of the Cape flora. However, of the species mentioned by Rennie, only *Stoebe plumosa* may be said to constitute a link in a presumptive western migration route between the Cape and Angola. Another such species was supposed to be *Passerina glomerata*, which grows on the summit of Moltkeblick in the Auas Mountains. However, it is now ('Prodrromus' 86:3) with some hesitation referred to *P. montana*, a species of the Drakensbergen and Rhodesia. If the latter determination is correct, the already meagre evidence in favour of a western migration route is further diminished.

The other species cited as Cape relics by Rennie (l. c.) cannot be regarded as typical members of the Cape flora, but rather belong to the Karroo-Namib region. Some of these are also known from the Brandberg, like *Osyris lanceolata* (syn. *O. abyssinica*), which is a species with northern affinities, as pointed out above in the discussion of the 'Afro-arid element'. Others are *Montinia caryophyllacea* and *Senecio cinerascens*, which both occur in the Cape, but in addition have a general Karroo and Namaqua distribution, respectively. It is sometimes difficult to assign a taxon unambiguously to the Cape or the Karroo element. Many South African genera (or more widely spread genera with a concentration of species in Southern Africa) are richly represented in both floristic regions. For this reason genera like *Euryops*, *Felicia* and *Osteospermum*, all occurring on the Brandberg, are not regarded as representatives of the Cape flora.

SUMMARY AND CONCLUSIONS

In the flora of the Brandberg two phytogeographical groups stand out as most significant and interesting. One comprises the endemics, which are either confined to the mountain (11 taxa) or belong to an endemic element of northwestern South West Africa and southern Angola, known as the Kaoko element (28 species).

The other group contains a disjunct arid element with northern affinities, occurring in arid regions on both sides of the equatorial belt. These species (>25) have a southern range of varied extension within the Karroo-Namib region and a northern range in the Saharo-Sindian region or adjacent areas of the Sudano-Zambesian region. They are probably the remnants of an old Afro-arid flora, once connected and more widely distributed, but now split up into a southern and a northern distribution range.

The Cape flora has very few representatives in South West Africa and no typical representative at all on the Brandberg. This implies that there is very little evidence of a western migratory pathway between the southwestern Cape and Angola. Instead the Cape element in Angola seems to be connected to an eastern migration route, which runs from the East African mountains to the mountains of Rhodesia and via the Drakensbergen to the Cape.

LITERATURE CITED

- ALLEN, P.; 1963: Ergänzungen zu den Salsolae von Südwestafrika. — *Mitt. Bot. München* 5: 117–119.
- BALLE, S.; 1968: *Les Loranthacées de l'Afrique du Sud-Ouest*. — *Ibid.* 7: 119–209.
- BURTT, B. L.; 1971: From the south: an African view of the floras of western Asia. — In Davis, P. H., Harper, P. C. & Hedge, I. C. (ed.), *Plant life of South-west Asia*: 135–149.
- CODD, L. E. & KERS, L. E.; 1970: Cleome, in Codd, L. E., de Winter, B. & Killick, D. J. B. (ed.), *Flora of Southern Africa* 13: 119–140.
- FRIEDRICH, M.; 1961: Eine neue *Hermannia* aus den Brandbergen. — *Mitt. Bot. München* 4: 167–169.
- FRIEDRICH, H.-C.; 1957 a: *Plumbago wissii* n. sp. (Dicot., Plumbaginaceae), ein charakteristischer Strauch der höchsten Gipfel des Brandberges in Südwestafrika. — *Senck. biol.* 38: 417–419.
- 1957 b: *Aizoanthemum Dinter* ex Friedr. Eine wenig beachtete Gattung der Ficoideae aus Südwestafrika. — *Mitt. Bot. München* 2: 339–349.
- GIESS, W.; 1969 a: Die Verbreitung von *Lindernia intrepidus* (Dinter) Oberm. (*Chamaegigas intrepidus Dinter*) in Südwestafrika. — *Dinteria* 2: 23–28.
- 1969 b: *Welwitschia mirabilis* Hook. fil. — *Ibid.* 3: 3–55.
- 1970: Die Verbreitung von *Moringa ovalifolia* Dinter & Berger in Südwestafrika. — *Ibid.* 5: 59–64.
- 1971: A preliminary vegetation map of South West Africa. (Text also in Afrikaans and German). — *Ibid.* 4.
- GRAU, J.; 1973: Revision der Gattung *Felicia* (Asteraceae). — *Mitt. Bot. München* 9: 195–705.
- GÜRICH, G.; 1895: *Deutsch Südwest-Afrika. Reisebilder und Skizzen aus den Jahren 1888–1889*. — *Mitt. Geogr. Ges. Hamburg* (1891–92).
- JACOBSEN, H.; 1970: *Das Sukkulentenlexikon*. Stuttgart.

- KERS, L. E.; 1967: The distribution of *Welwitschia mirabilis* Hook. f. — *Svensk Bot. Tidskr.* 61: 97–125.
- 1970: A new species of *Ruellia* (Acanthaceae) from S.W.Africa. — *Ibid.*: 170–172.
- LAUNERT, E.; 1958: Systematische und arealkundliche Bearbeitung einiger Pflanzenfamilien Südwestafrikas. — Diss. München.
- 1971: Gramineae, in Fernandes, A., Launert, E. & Wild, H. (ed.), *Flora zambesiaca* 10, 1.
- LEACH, L.; 1968: *Euphorbia* species from the Flora zambesiaca area, 6. — *Kirkia* 6: 133–145.
- LEBRUN, J.; 1947: La végétation de la plaine alluviale au sud du lac Édouard. — Exploration du Parc National Albert, Fasc. 1. Inst. Parcs Nat. Congo Belge. Bruxelles.
- LEBRUN, J.-P.; 1971: Quelques phanérogames africaines a aire disjointe. — *Mitt. Bot. München* 10: 439–448.
- LEMPPE, F.; 1956: Eine Erkundung der Brandberge in Südwestafrika. — *Kosmos* (Sept. 1956): 424–436.
- MAACK, R.; 1923: Der Brandberg: ein Beitrag zur Landeskunde von Südwestafrika. — *Zeitschr. Ges. Erdkunde Berlin*: 1–14.
- 1960: Erstbesteigung des Brandberges und Entdeckung der „Weißen Dame“. — *Journ. S.W.A. Sci. Soc.* 14: 5–38.
- MARSH, J. A.; 1970: *Cadaba*, in Codd, L. E., de Winter, B. & Killick, D. J. B. (ed.), *Flora of Southern Africa* 13: 171–175.
- MERXMÜLLER, H.; 1950: Compositen-Studien I. — *Mitt. Bot. München* 1: 33–46.
- 1960: Asteraceae, in Merxmüller, H. (ed.), *Weitere Beiträge zur südwestafrikanischen Flora*. — *Mitt. Bot. München* 3: 605–609.
- (ed.); 1966–72: *Prodromus einer Flora von Südwestafrika*. Lehre.
- MEYER, P. G.; 1957: Beitrag zur Kenntnis der Acanthaceen Südwestafrikas. — *Mitt. Bot. München* 2: 368–385.
- MONOD, T.; 1957: Les grandes divisions chorologiques de l'Afrique. — *C.S.A./C.C.T.A. Publ.* no. 24, London.
- 1971: Remarques sur les symétries floristiques des zones sèches nord et sud en Afrique. — *Mitt. Bot. München* 10: 375–423.
- NORDENSTAM, B.; 1966 a: Two new Compositae from Southern Africa. — *Bot. Notiser* 119: 365–370.
- 1966 b: *Euryops* in South West Africa. — *Ibid.* 119: 475–485.
- 1967 a: New species of *Felicia* and *Pentzia* (Compositae) from the Brandberg, South West Africa. — *Ibid.* 120: 196–201.
- 1967 b: Chromosome numbers in South African Compositae. — *Aquilo, Ser. Bot.* 6: 219–227.
- 1969 a: Phytogeography of the genus *Euryops* (Compositae). A contribution to the phytogeography of Southern Africa. — *Opera Botanica* 23.
- 1969 b: Chromosome studies on South African vascular plants. — *Bot. Notiser* 122: 398–408.
- NORLINDH, T.; 1960: Additions to the monograph on *Osteospermum*. — *Ibid.* 113: 385–399.
- PALMER, E. & PITMAN, N.; 1972: *Trees of Southern Africa*, 1–3. Cape Town.
- RENNIE, J. V. L.; 1935: On the flora of a high mountain in South-West Africa. — *Trans. Roy. Soc. S. Afr* 23: 259–263.
- REYNOLDS, G. W.; 1950: *The Aloes of South Africa*. Johannesburg.
- ROESSLER, H.; 1959: Revision der Arctotideae-Gorteriinae (Compositae). — *Mitt. Bot. München* 3: 71–500.
- TÖLKEN, H.; 1970: *Boscia*, in Codd, L. E., de Winter, B. & Killick, D. J. B. (ed.), *Flora of Southern Africa* 13: 150–159.
- VOLK, O. H.; 1964: Die afro-meridional-occidentale Floren-Region in SW-Afrika. — In Kreeb, K. (ed.), *Beiträge zur Phytologie*: 1–16. Stuttgart.
- 1966: Die Florengebiete von Südwestafrika. — *Journ. S.W.A. Sci. Soc.* 20: 25–58.

- WALTER, J.; 1972: Eine Brandberg-Besteigung Ostern 1972. — Mitt. S.W.A. Wiss. Ges. 13/5: 2–7.
- WANNTORP, H.-E.; 1969: *Microloma hereroense* Wanntorp (Asclepiadaceae), a new species from South West Africa. — Svensk Bot. Tidskr. 63: 337–340.
- WEIMARCK, H.; 1934: Monograph of the genus *Cliffortia*. Lund.
- WHITE, F.; 1965: The savanna woodlands of the Zambesian and Sudanian Domains. An ecological and phytogeographical comparison. — *Webbia* 19: 651–681.
- WILD, H.; 1969: The genus *Nidorella* Cass. — *Bol. Soc. Brot.* 43 (2. ser.): 209–245.
- DE WINTER, B.; 1961: Gramineae, in 'Notes and new records of African plants'. — *Bothalia* 7: 467–480.
- 1965: The South African Stipeae and Aristideae (Gramineae). (An anatomical, cytological and taxonomical study). — *Bothalia* 8: 199–404.
 - 1971: Floristic relationships between the northern and southern arid areas in Africa. — *Mitt. Bot. München* 10: 424–437.
- WISS, H.-J.; 1957: Brandberg Expedition 1955. Ein Bericht über die gesammelten und beobachteten Pflanzen. — *Journ. S.W.A. Sci. Soc.* 12: 45–68.

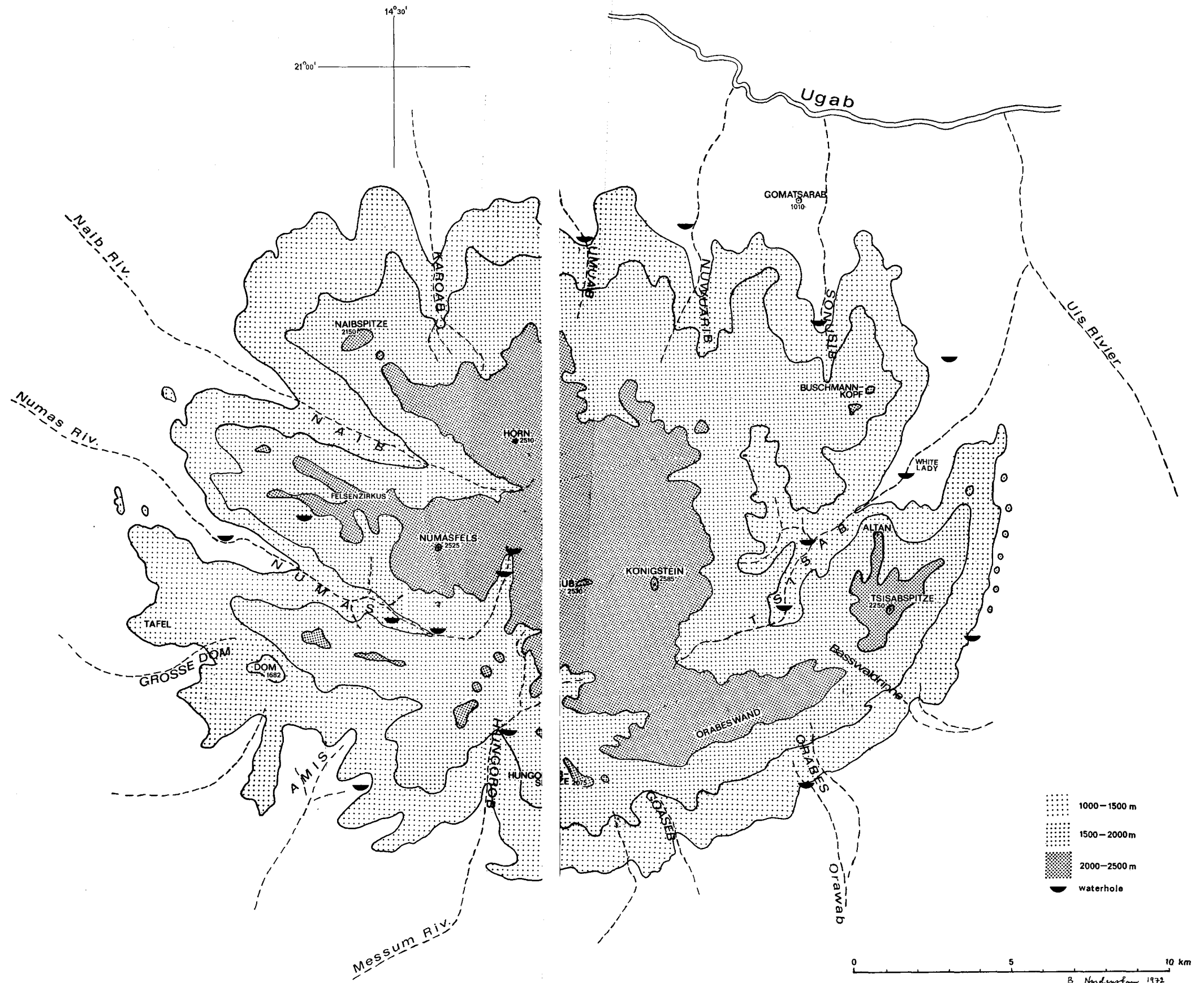
A BRANDBERG BIBLIOGRAPHY

This list comprises archaeological, geological and general papers dealing with the Brandberg. Botanical references will be found only in the preceding literature list.

- BATISS, W.; 1948: The artists of the rocks. Pretoria.
- BOYLE, MARY; 1951: The redhaired people in the rockpaintings of South West Africa. — *Journ. S.W.A. Sci. Soc.* 8: 5–10.
- BREUIL, ABBÉ H.; 1948: The *White Lady* of the Brandberg, South-West Africa, her companions and her guards. — *S.Afr. Archaeol. Bull.* 3(9): 2–11.
- 1949: Remains of large animal paintings in South-West Africa, older than all the other frescoes. — *Ibid.* 4(13): 14–18.
 - 1949: The age and the authors of the painted rocks of Austral Africa. — *Ibid.* 4(13): 19–27.
 - 1949: Some foreigners in the frescoes on rocks in Southern Africa. — *Ibid.* 4(14): 39–50.
 - 1949: Les roches peintes d'Afrique australe, leurs auteurs et leur age. — *L'Anthropologie* 53: 377–406.
 - 1954: Les roches peintes d'Afrique australe. — *Académie des Inscriptions et Belles-Lettres* 44. Paris.
 - 1955: *The White Lady of the Brandberg*. London.
 - 1959: *The Tsissab Ravine and other Brandberg sites*. Clairvaux.
- BURFEINDT, C.; 1970: *Der Weg zum Brandberg*. Selbstverlag.
- 1971: Wasser im Brandberg — *Mitt. S.W.A. Wiss. Ges.* 11//11: 8–9.
 - & LEMPP, F.; 1962: Ist Okombahe vom Brandberg aus sichtbar? — *Ibid.* 3/2–3.
- CLOOS, H.; 1929: Alter und Verband der jungen Granite in Südwestafrika. — *Intern. Geol. Congr.* 15, Pretoria, Comptes rendues 2.
- 1929: Die jungen Plateaugranite in Südwestafrika. — *Zentralblatt für Mineralogie, Abt. A* (1929): 370–371.
 - & CHUDOBA, K.; 1931: *Der Brandberg: Bau, Bildung und Gestalt der jungen Plutone in Südwestafrika*. — *Neues Jahrb. Mineral., Beilage Band* 66, Abt. B: 1–82.
- COETZEE, C. G.; 1970: Brandbergekspedisie Augustus 1969. — *Mitt. S.W.A. Wiss. Ges.* 10/10–11.
- DAVIS, S.; 1948: *Abbé Breuil and the expedition to the rock paintings of the Brandberg*. — *S.W.A. Annual* 1948: 69–70.
- FINKELDEY, H.; 1953: Die „Weiße Dame“ von Südwest-Afrika. — *Kosmos* 49(5): 218–220.
- FROBENIUS, L.; 1931: *Madsimu Dsangara*. Vol. 2. Die ethnographisch-prähistorischen Stile. Berlin.

- 1935: Kunst der Eiszeit. Velhagen und Klasings Monatshefte, 49. Jhrg. Nr. 5: 604—613. Berlin.
- GAERDES, J.; 1962: Beobachtungen während einer Brandbergfahrt. — Mitt. S.W.A. Wiss. Ges. 3/10.
- GEVERS, T. W.; 1931: The fundamental complex of western Damaraland. Cape Town. (Univ. C. T. diss.).
- 1934: Untersuchungen des Grundgebirges im westlichen Damaraland. I. Zur Gliederung des Grundgebirges im westlichen Damaraland. — Neues Jahrb. Mineralogie, Abt. B, Beilage Band 72: 283—330.
- 1934: Untersuchungen des Grundgebirges im westlichen Damaraland. II. Die alten Granite des Grundgebirges. — Ibid.: 399—428.
- 1934: Untersuchungen des Grundgebirges im westlichen Damaraland. III. Tektonik des Grundgebirges und Intrusionsmechanismus der alten Granite im westlichen Damaraland. — Ibid. 73: 27—41.
- 1936: The morphology of western Damaraland and the adjoining Namib desert of South West Africa. — S. Afr. Geogr. Journ. 19: 61—79.
- & FROMMURZE, H. F.; 1929: The geology of northwestern Damaraland in South West Africa. — Trans. Geol. Soc. S. Afr. 32: 31—55.
- HOLM, E.; 1960: Maack-Grotte und Jochmann-Höhle in anderer Sicht. — Mitt. S.W.A. Wiss. Ges. 1/9.
- HOOGENHOUT, P. I.; 1965: An Abbé and an Administrator visit a beautiful but very old lady. — S.W.A. Annual 1965: 24—25.
- JEPPE, J. F. B.; 1952: The geology of the area along the Ugab river west of the Brandberg. — Univ. Witwatersrand Ph. D. diss.
- JIPSEN, H.; 1961: Privatexpedition für folgende Zwecke: Wohnstellen früherer Bewohner zu erkunden; weitere Felsmalereien zu suchen; einfache Karte des Gebietes anzufertigen. — Mitt. S.W.A. Wiss. Ges. 2/5—6.
- 1961: Neues vom Brandberg. — Ibid. 2/10—11.
- 1961: Bericht über Brandberg-Erforschung. — Ibid. 2/12.
- 1962: Feldarbeit am Brandberg. — Ibid. 3/12.
- 1965: Unbekannte Felsmalereien im inneren Brandbergmassiv. — Ibid. 6/3—4.
- 1961—65: Prehistoric living sites in the inner Brandberg. Part 1, 2, 3. (See also Allg. Zeit. 163, 23.8.1963).
- JOCHMANN, H.; 1910: Die Buschmannzeichnungen in Deutsch-Südwestafrika. — Die Woche 3. Berlin.
- KORN, H. & MARTIN, H.; 1937: Die jüngere geologische und klimatologische Geschichte Südwestafrikas (Vorläufiger Bericht). — Zentralblatt für Mineralogie, Abt. B (1937): 456—473.
- KREINER, W.; 1965: Berichterstattung über eine Brandbergbesteigung. — Mitt. S.W.A. Ges. 6/3—4.
- KRENZ, F. K.; 1973: Anmerkungen zu „Eine Brandbergbesteigung Ostern 1972“. — Mitt. S.W.A. Wiss. Ges. 13/12: 10—12.
- 1974: Brandbergbesteigung Ostern 1972. — Ibid. 14/9—10: 8—13.
- LEMPPE, F.; 1956: Eine Erkundung der Brandberge in Südwestafrika. — Kosmos, 52. Jhrg. Heft 9 (Sept. 1956): 424—436.
- 1960: Übersicht über die Besteigungen des Königstein. — Journ. S.W.A. Sci. Soc. 14: 38.
- 1960: Erkundungsarbeiten des Vermessungstruppe in Hoch-Brandberg. — Ibid. 14: 39—42.
- 1961: Erkundung eines neuen Aufstiegs zum Hochbrandberg. — Mitt. S.W.A. Wiss. Ges. 2/5—6.
- 1962: Neue Felsbilder am Brandberg. — Ibid. 3/6—7.
- 1962: Neues vom Brandberg. Untersuchung von Hüttenkreisen. — Ibid. 3/6—7.
- MAACK, R.; 1923: Der Brandberg: ein Beitrag zur Landeskunde von Südwestafrika. — Zeitschr. Ges. Erdkunde Berlin: 1—14.

- 1960: Erstbesteigung des Brandberges und Entdeckung der „Weißen Dame“. — Journ. S.W.A. Sci. Soc. 14: 5–38.
- 1966: Die „Weiße Dame“ vom Brandberg. — Ethnologica N.F. 3: 1–84. Köln.
- MABBUTT, J. A.; 1952: A study of granite relief from South West Africa. — Geol. Mag. 89: 87–96.
- 1952: The evolution of the middle Ugab Valley, Damaraland, South West Africa. — Trans. Roy. Soc. S.Afr. 33(3): 333–365.
- MACCALMAN, H. R.; 1965: Große Dom-Schlucht, Brandberg. — Ipek 21.
- MASON, R.; 1954: Notes on the later Stone Age in South West Africa. — S. Afr. Arch. Bull. 9: 144–147.
- 1955: Notes on the recent archaeology of the Scherz Basin, Brandberg. — Ibid. 10: 30–31.
- 1958: New prehistoric paintings in the Brandberg, South West Africa. — Lantern 4: 357–368.
- OBERMAIER, H. & KÜHN, H.; 1930: Bushman art: rock paintings in South West Africa. London. (German edition: Buschmannkunst: Felsmalereien aus Südwestafrika. Berlin).
- RUDNER, J.; 1957: The Brandberg and its archaeological remains. — Journ. S.W.A. Sci. Soc. 12: 7–44.
- 1973: Radiocarbon dates from the Brandberg in South West Africa. — S. Afr. Archaeol. Bull. 27: 107–108.
- RUST, H. J.; 1970: Mit 80 Jahren im Hubschrauber auf den Brandberg. — Mitt. S.W.A. Wiss. Ges. 11/5: 10–12.
- 1973: Der Brandbergfilm von Frau Marianne Reuning. — Mitt. S.W.A. Wiss. Ges. 14/3–4: 7–10.
- SCHERZ, E. R.; 1960: Verzeichnis von Büchern und Aufsätzen über die Felsbilder im Brandberg. — Journ. S.W.A. Sci. Soc. 14: 37.
- 1965: Der Abbé Breuil besucht die Weiße Dame am Brandberg, 1947. — Disp. Prov. Barcelona Inst. Prehist. Arqueol.: 359–362.
- STRACK, P.; 1972: Eine unbekannte Malerei im Hoch-Brandberg? — Mitt. S.W.A. Wiss. Ges. 13/5: 7.
- VIERECK, A.; 1961: Beziehungen zwischen Jungsteinzeitkulturen und Felsmalereien in Südwestafrika. — Journ. S.W.A. Sci. Soc. 15: 67–70.
- 1961: Neues vom Brandberg. Untersuchung von Hüttenkreisen. — Mitt. S.W.A. Wiss. Ges. 2/9.
- 1962: Südwestafrikanische Felsmalereien. Windhoek.
- 1968: Die Spuren der alten Brandbergbewohner. — Wissensch. Forsch. S.W.A., 6. Folge. Windhoek.
- WAGNER, D.; 1973: Eine Brandbergbesteigung Ostern 1972. — Mitt. S.W.A. Wiss. Ges. 14/3–4: 10–11.
- WALTER, J.; 1972: Eine Brandberg-Besteigung Ostern 1972. — Ibid. 13/5: 2–7.
- WALTON, J.; 1954: South-West African rock paintings and the triple-curved bow. — S. Afr. Archaeol. Bull. 9: 131–134.
- WEYERSBERG, M.; 1930: Buschmann-Malereien in Südwest. — Journ. S.W.A. Sci. Soc. 5: 46–54. (Also in English, *ibid.*: 55–63).



14°30'
21°00'

Naib Riv.

Numas Riv.

Messum Riv.

Ugab

Uis Rivier

Orawab

KAROAB
NAIBSPITZE 2150
HORN 2510
NUMAFELS 2525
TAFEL
GROSSE DOM 1692
AMIS
HUNGOROP
LUNGO 2500

GOMATSARAB 1010
BUSCHMANN-KOPF
WHITE LADY
KONIGSTEIN 2585
ORABESWAND
TSISABSPITZE 2250
ORABES

- 1000-1500 m
- 1500-2000 m
- 2000-2500 m
- waterhole

0 5 10 km