Ethnobotanical Survey
of the Namib Desert
Final Report

C.E.C. contract B7-5040/91/005
01/10/1991 — 30/09/1992

by
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A word of appreciation

The authors would like to thank the European commission through its DG VIII division for financing this study (contract number B7-5040/91/005), more specifically Dr. Guerrato and the personnel at the division with whom we co-operated intensively, Mrs Diane and Mr. Huon.

The same appreciative feelings are extended to the E.C. Delegation in Windhoek, Namibia.

Most of the results would not have been obtained without the interest and sympathy of our partners and the institutions in Namibia with which we co-operated: The University Centre for Studies in Namibia, the Desert Ecological Research Unit, the ministries of Wildlife, Conservation and Tourism and of Agriculture, the National Herbarium and numerous others!

The field work was a real mind-opener. Ernst Boois and Lesley Mejiedt, were our motivated guides throughout the research period.

Last but not least we would like to thank the Topnaar people who received us with great feeling. We dedicate this study to them and hope it will give outsiders a better understanding of who they are and how they live. Respect can only come through understanding!

Gent, October 1992
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Part I

Introduction

1. Objectives

The Ethnobotanical Survey of the Namib Desert, C.E.C. contract B7-5040/91/006, project was started in October 1991. Its principal objectives were

(1) to make an inventory of plants used by the Topnaar people living in the Namib desert; in concrete this meant that work would be concentrated on the communities living in the Kuiseb river valley and in Sesfontein;

(2) to make a botanical survey of the Namib desert area, concentrating on the areas inhabited by the Topnaar but also taking into consideration the rest of the Namib desert area;

(3) to establish a slide collection of the plants surveyed depicting them both in situ and concentrating on botanical details;

(4) to collect and systematically classify plant material in the field;

(5) to establish a reference herbarium collection of the plants used by the Topnaar and of those collected during the botanical survey;

(6) to point out the potential utility of the plant species surveyed through literature survey (and laboratory testing if possible);

(7) to establish a list of promising species that could be used for further research and could eventually be implemented in local industry or agriculture.

The present document presents the results which were obtained during the course of the project. In a first part, the ethnobotany of the Topnaar is discussed while a second part devotes a lot of attention to the botanical survey work that was performed during the 7 months of work in the field.

In this introductory part, we will highlight the most interesting research findings and potential leads for further research stemming from the results of the present project.
2. Ethnobotany of the Topnaar

In the literature on the subject of ethnobotany of the Topnaar people there have not been too many plants described as being used by them for whatever purpose. Part of this can be explained by the fact that only a limited number of scholars have ever researched the matter.

Anthropological studies made in the beginning of the 20th century (Cartensen et al., 1987; Schultz, 1907) report on plant uses by the Topnaar, but scientific names are mostly lacking. Also the written representation of Nama clicks was not standardized in that time, resulting in sometimes confusing or even incomprehensible plant names, so that it is at this point in time very difficult to know for sure which species was exactly meant.

Basically there are only two scientists who did any field studies with the Topnaar people in recent times. They concentrated on only a few communities living in the Kuiseb river valley and thus only got a limited information set. In the case of Dentinger (1977), she stayed in only one village (Soutrivier) for a limited period of time and basically only got interested by Acanthosicyos horridus, the Inara plant used by the Topnaar as a staple. Du Pisani (1983) reported that the Kuiseb Topnaar used 12 plant species: Acacia albida and A. erioloba, Acanthosicyos horridus, Asparagus denudatus, Citrullus lanatus, Eucalyptus pseudebenus, Ficus sycomorus, Nicotiana glauca, Pairkinaeia africana, Tamarix usneoides, Gossypium anomalum and Menisoria senegalensis. The rest of the plants he mentions in his article are species important to people in Namaland, so not specific only for the Topnaar. Our study confirms his findings only partly: of the 12 species he presented, 9 were found by us to be used by the Kuiseb Topnaar; for one reason or another Asparagus denudatus, Citrullus lanatus and Gossypium anomalum were never mentioned by our correspondents nor were we offered samples of them.

Because of the limited number of communities their surveys were based on, it should be clear that the chances of them getting a complete idea of Topnaar plant use were rather small.

As a rule, ethnobotanical research should be conducted over a reasonable length of time by a multidisciplinary team of scientists combining researchers with a botanical, linguistic and sociological or anthropological background. If the timeframe over which data are collected is too short, one will not be able to collect in the field all plants mentioned as being used because of the differences in climate during the year and their influence on presence and absence of a number of especially annual plants. One will often only be able to collect information based on the informants’ recollections. Their information will not be corroborated, substantiated or supported by evidence from the field so that sometimes there will be a difficulty in actually knowing what exact plant species is (or are) used.

Multidisciplinarity is absolute must for sound ethnobotanical research: one can not expect a sociologist to be aware of techniques used by botanists to make a correct determination of the plant
samples offered or collected during the course of the ethnobotanical field work, whereas botanists do normally not master the specific methodologies used by their social studies’ colleagues. The few studies that concentrated in the past on the Topnaar were performed by single scientists who were basically only skilled in one scientific field thereby limiting the scope of the information gathered.

The only other records of Topnaar plant use apart from those we already mentioned, refer to situations dating back several thousand of years. They use archeological data gathered on several places in the Namib. One can wonder what the relevance of this information is for the present-day situation. In the authors’ opinion these data only give some background knowledge about the history of the Topnaar and on ‘how it used to be’. They are interesting because it has become clear that the *lnara* was already used as a staple in those days whereas a number of trees such as *Acacia crioloba* were used as fuel wood. There are, however, only a limited number of articles and research reports dealing with this subject so that here also the amount of information that is available is rather scarce.

All in all, we can conclude that

1. previous records of plant use by Topnaar are rather scarce; and that
2. researchers usually concentrated on but a few plant species;
3. archeological data are an interesting source of reference material but can basically be considered to have only limited value when the present-day situation is taken into consideration; at most it can tell us how the Topnaar people used to live x years ago.

The opinion advanced in the present project’s proposal that the Namib desert and the Topnaar people are both underresearched is herewith confirmed. When one has only some ten scientific references dealing with a subject (spanning several thousands of years of human activity and climatic changes), it should be clear that a lot is still unknown.

Both from the methodologies used in the past and the areas surveyed we can deduct that the data set which was available before this project was started was very incomplete and needed to be completed through an extensive survey both in space (taking into account both Kuiseb and Sesfontein communities) and time (data gathered over a one year period which can be considered to be a minimum for this kind of research).

Scientists challenging the fact that the Namib area is underresearched seem not to realize that knowledge about plant use by local people in general, and by the Topnaar in particular, has to change/is continuously changing with time because of changes in living conditions as influenced by both natural processes (e.g. climatic changes) and human influences (e.g. colonial policy confining people living in the Kuiseb area to the river valley). Data gathered at a particular moment in time therefore need to be updated regularly.
Another point is that a lot of the traditional knowledge is quickly disappearing and should be preserved. A great number of the local communities are disintegrating, people move to nearby cities where they take over urban habits and lose all contact with their traditional environment through a number of active or passive acculturation processes. Modern influences and practices change their lifestyle. The wealth of (inter alia ethnobotanical) knowledge that was accumulated by the traditional communities through the years is hereby threatened and will probably be lost in a few years’ time.

Part of this wisdom has more than just local importance. It can be expected that a number of plants used for whatever reason by the authochtonous communities could also be used elsewhere in similar or analogous ecological contexts.

As will become clear from the data presented here

(1) the actual number of plants used by the Topnaar greatly exceeds the number known up till now, whereas

(2) there also is a big difference in plants used by the communities in the Kuiseb and the one community living in Sesfontein.

This shows that the Topnaar are tributary to the environment they live in, using those plants that this environment offers them, whereas they can not be considered to be a ‘monolithic’ group of people sharing the same lifestyle and plant use wherever they live. There is a distinct difference in living conditions between both areas resulting in a pronounced difference in cultural attitude and expression (culture is here to be understood as all elements developed and used by the people to be able to cope with the environment they live in).

All in all we found that the Topnaar use some different plant species for a great number of purposes. They include lower and higher plants: there is one fungus (Batterea spp.), one seaplant (Ecklonia maxima) and one lichen (Parmelia hottenotlota), whereas the rest are Angiosperous species.

From our survey’s results it can be seen that the Kuiseb Topnaar use some different species, 65 of which are perennials which are easily found throughout the year. The Sesfontein community uses different species. There is an overlap between both areas: 20 are used by both Kuiseb and Sesfontein Topnaar.

It should be noted here that a number of the plant samples that were offered to us with their vernacular name, have up till now not been determined. In most cases, seeds are the only material we received and, as mentioned elsewhere, this is a rather poor basis to make a sound taxonomic diagnosis.
3. Botanical Survey

The Namib Desert Area was surveyed during the January - July 1992 period. All in all some sites were surveyed and thoroughly inventorized. These spanned an area of approximately 60,000 km². All major ecological zones were sampled; Namib: narrow tract of desert land on the southwest coast of Africa (Skeleton Coast: protected coastal area between the Kunene mouth and Ugab mouth); Pronamib: transition zone to the east, between the Namib and the savannah area.

In total, 812 relevés were held. A total number of 279 plants were identified over all relevés. Apart from the actual identification work, a lot of attention was given to the plant associations occurring in each site.

In the recent past, only a few analogous studies were undertaken in the same area. During the present project, we tried to come back on the same sites as those that were then covered, the Kuiseb area being the most obvious (and maybe also the easiest). Moreover, we were able to cover a lot of sites that had never been sampled before. The reader of the present report is referred to the detailed inventory given of the relevé work in the botanical survey part (part III, section 7.2).

From the results it seems clear that in the Kuiseb area the vegetation is indeed rapidly declining probably due to a combination of reasons.

- Water pumping downstream Swartbank\(^1\). Although one should admit that there is indeed a huge need for drinking (and industrial) water in the few cities bordering the area, we also think that the Kuiseb environment should be protected against this excessive water 'drainage'. Not only the local ecology will suffer (and has already suffered) but moreover the changes in vegetation and ecological environment are threatening the life of the Topnaar living in this area. Their scarce water resources are diminishing whereas the \textit{Inara} and other plants they use are also disappearing from the area.

- Decrease of the number of floods and the quantity of water supplied by floods due to an increasing number of dams in the upper Kuiseb and the drought during the last decade.

- The introduction of goats has also heavily burdened the environment and still continues to reduce annual and perennial plants' regrowth.

The overall picture thus emerging is that

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\(^1\)In Swartbank a dyke crosses the riverbed and diverts the subterranean waterflow towards Sandwich Bay. The subterranean water supply downstream Swartbank is independent from the one upstream Swartbank. The subterranean water supply downstream Swartbank is replenished by, among others, infiltrating flood water and infiltrating rain water. (The input/output mechanism is still not completely understood). To minimize the ecological effects of pumping, water levels are continuously monitored. Measures are taken to limit the extraction of water (e.g. water 'recycling'; pers. communication Water Affairs).
(1) the perennial vegetation in the Kuiseb area is declining due to a fall in water table caused by excessive water pumping for domestic and industrial uses; whereas

(2) both annual and perennial plants are having difficulties in re-establishing themselves during the few short periods of favourable growth conditions due to increased domestic animal load over the last years.

If no appropriate measures are taken, it is our feeling that the unique Kuiseb environment is threatened in its existence. In this respect the recently formulated plans of the Ministry of Wildlife, Conservation and Tourism to start a so-called ecotourism programme in the area can be interpreted with mixed feelings: on the one hand increased interest in the area might bring about the mostly needed protection measures (such as reduced pumping and/or adapted goat raising programmes) but on the other hand it might also increase human pressure on a basically fragile landscape. We feel that any ecotourism effort should take into account all parameters needed to come foreward with a sound management plan.

Whatever happens it is also obvious for us that the Topnaar people should be involved in decision making processes related to their specific situation and area. From what we know through our field work activities of the last few months, the Topnaar have hardly ever been consulted on matters related to their own life and living environment. In this post-colonial era, it would seem doubly unfortunate if this ‘approach’ should be maintained ... There is a feeling that our own project's activities involving the Topnaar people through interviews and interactive collaboration has raised a certain awareness at the Namibian official level that in the future the Topnaar should indeed be consulted and involved when decisions pertaining to their communities' future are to be taken. For the first time ever, they were asked to participate in discussions (on the ecotourism project) during the month of march 1992. We can only hope that in future this approach will become standard practice and that Topnaar will indeed have something to say (because there is of course always the danger of a certain window dressing consisting of involving people but not taking into account what they actually want or say ...).

For the rest of the area, the project has provided the scientific world with a lot of basic botanical and vegetation data. Not only the present situation has been more or less defined (there is of course always the question/problem that most of the inventory work has been done on only one moment in time, whereas ideally one would have to make an inventory of the vegetation in a specific spot at several moments of the year and during several consecutive years so as to collect data from different climatic situations) but these results can also be considered as being a reference for further research in the area. It is our firm hope and wish that researchers who will do similar work in the area will be able to build on the wealth of data we gathered and that they will be willing to co-operate with us on this matter.

It is our feeling that there is a great need for vegetation studies like we performed. Only, due to a number of reasons, there is a manifest lack of scientists that are either available or (when
available) willing to do this kind of survey work. It is our feeling that the 'sponsoring community' should provide more funding for this kind of research otherwise a lot of valuable information could be lost in the years to come because increased population and tourism pressure are clearly threatening fragile ecosystems and plants growing there.

4. Slide Collection

During the project's execution some 5,000 slides were made. Basically they cover the following subjects:

(1) Namib desert flora, including plants in situ, plant habitus, detailed pictures of diagnostic features such as flowers, leaves, stems, spines, etc.;

(2) landscapes and sites depicting all plant associations that were studied;

(3) ethnobotany: plant use by the local Topnaar communities: transformation of /nara fruits into the respective end products, collection of Acacia erioloba gum, etc.;

(4) illustration of the methodologies used especially in the botanical survey work: use of GPSys-
tem, Braun Blanquet method,dots

A data base is currently being made so that the said slides will be accessible to a broader public. Currently they are already of use in university courses dealing with ethnobotany (course: Applied Plant Systematics) and desert science (Eremology M.Sc. Programme at the University of Gent). Also slide collections will be given to DERUN, TUCSIN and the Ministry of Wildlife, Conservation and Tourism in Namibia.

5. Plant Collection and Herbarium

The project collaborated closely with the National Herbarium of Namibia, Windhoek, and the Desert Ecological Research Unit of Namibia (DERUN) based at Gobabeb (Kuiseb river). Both institutes have a reference herbarium. The National Herbarium has specimens for the whole of Namibia, while DERUN only concentrates on plants that occur in the Namib Desert.

During the course of the project work, it was necessary to collect samples of the plants that were mentioned during the ethnobotanical surveys and botanical trips, because it is often impossible to make a correct identification in the field. Collected material was first dried and then studied under the microscope and compared with the reference material available in both herbaria. In many cases, plants could also be classified using the literature at hand (MERXMÜLLER, 1966-1972). In doubtful cases, local flora specialists were consulted.
Once a specimen was determined, a dried specimen (including, when feasible, seeds) was mounted on a herbarium sheet, providing the necessary botanical information together with data on location, exposition, soil, etc. Whenever applicable ethnobotanical information was added. Herbarium sheets were thus prepared both for the National Herbarium and DERUN, so that both institutes are now having a duplicate series of the plants that were thus collected.

From the ethnobotanical side of the project 54 herbarium specimens were given to the National Herbarium of Namibia in Windhoek, whereas some 40 duplicates were also placed at DERUN's herbarium. The botanical part yielded some 120 specimens, covering over 50 species, which were partly deposited at the National Herbarium and DERUN. Duplicates will as well be deposited at the National Botanical Garden of Belgium (Meise) and the herbarium of the University of München (Germany). The latter has a huge reference collection of Southern Africa plant species. It has been consulted during the course of the project to elucidate a number of taxonomy problems and some of the herbarium material was accordingly left with the institute. Some specimens were deposited in the National Herbarium of Belgium in Meise and the herbarium of the University of Gent.

While performing the ethnobotanical survey work, the interviewed people would often present the team with dried material consisting of parts of the plants that are interesting to them and that they use. In the case of dried leaves and/or roots it is often difficult to make a correct botanical determination. Even seeds are often a too weak basis for this kind of work. Wherever possible informants were asked to provide us with fresh material of the specific plants in order to enable us to make a correct determination. In a number of cases, however, it has been impossible to find out what species was indeed meant or used.

6. Plant Utility

A number of plants which were inventorized are also used by other people and communities both in the area and outside. Literature survey has shown that in a number of cases the uses are similar, but in some other instances uses clearly differ. One is referred to the ethnobotany text for more specific details on this subject.

What emerges, however, is that a number of plants would seem to have more than local importance and thus justify further analyses and research. The Laboratory of Tropical and Subtropical Agriculture and Ethnobotany in collaboration with the Laboratory of Organic Chemistry (University of Gent) has therefore initiated some preliminary biological assay tests on several medicinal plant species, the results of which are listed in the ethnobotany part of the text.

In the near future, it will be necessary to continue this kind of work. If successful, it may eventually generate job opportunities for the local communities (that could be involved in plant growing/plant collecting activities, active principle extraction, conditioning of collected plants and/or plant parts, commercialization of products, ... ).
Whatever attempts are made in further analysing local plant material it is our feeling that both the local official and Topnaar communities should be involved in this work, so that they would be aware of any progress made and would also be able to use the results in their favour.

7. Avenues for Further Research

One of the interesting aspects and results of the project was and has been that a number of plants have been earmarked that could possibly have a broader than just local interest. In this respect, several proposals have been formulated and discussed with the local political and scientific institutions.

One of the most interesting and promising areas of interest and potential research is without any doubt the *Inara* plant. A complete research proposal concentrating on the agronomical potential of the *Inara* plant has been presented to the Minister of Agriculture and discussed with the National Herbarium, TUCSN, the Delegation of the EC in Windhoek and the technical division of DG VIII in Brussels. The draft text is included in annex 9. The Minister of Agriculture was favourably impressed by the scope of the proposed research. It fits into the priority list of the Ministry of Agriculture which would like to stimulate crop diversification into new areas, thus adding new species to the rather limited number of crops that are presently being cultivated in Namibia, and creating new job and income opportunities through not only developing a new crop but also new end products (for which there is a market!) that could be sold locally and on the international market. It is our firm hope that the Namibian counterparts will indeed be able to put this proposal on the priority list for funding (or for proposition for funding by external agencies). The Belgian laboratory that executed the present project is willing and interested in participating in any research effort that would work along the lines described in the proposal.

Apart from this agronomic proposal, we feel that there is still a further need for

(1) further inventarizing ethnobotanical data with the other people living in Namibia; up till now only a limited number of studies have been performed in Namibia and there sure is a need to broaden the scope of research efforts involving all ethnic groups and areas in which they live and updating the scarce information that is available;

(2) further inventarizing the vegetation of the different ecological zones of Namibia; in those cases were in the past similar studies were performed, new efforts would be able to show recent developments in vegetation characteristics; in most areas, however, it is clear that no data have ever been gathered so that these studies would provide the country with the basic data it needs to be able to plan future development efforts and conservation measures in a more knowledgeable manner.

The Belgian laboratory is willing to support any such effort that should be initiated/proposed by the Namibian scientific community. Through the present project we have gathered a lot of
information, know-how and expertise that could be used by others in the future. Moreover, we have, over the years, developed and gathered a wide range of know-how and research contacts which could be of interest in this respect.

8. Feedback

Past ethnobotanical work (and basically any effort involving local communities) has shown that when people are asked to participate through interviews in a data gathering process, the results of this work should be shared with them once they are available (or even better: before actually publishing them).

The present project has therefore prepared a text in Nama that resumes all the major findings of the ethnobotanical part of the project. We hope that this text (which is in the final process of being reviewed and corrected) will show the Topnaar people the results of ‘their’ participation in the project and thus raise their interest in the matter. As plant use differs from among the different communities (both between Kuiseb and Sesfontein, and within the Kuiseb area) they can ‘learn’ from each other, and see and appreciate the cultural differences that exist within their community.
Part II

Ethnobotany

1. Introduction & Methodology

The ethnobotanical survey of the Namib desert, funded under C.E.C. contract B7-5040/91/005, started on October 1st 1991. After preparatory work, making contacts, practical arrangements and obtaining the necessary research permits, the fieldwork could start the end of December 1991. The ethnobotanical part of the survey concentrates his activities on the Topnaar people, the only inhabitants of the central Namib Desert. The Topnaar live along the Kuiseb river, a seasonal river flowing from east to west through the central Namib (see map II.1 & II.2). This river forms the border between the northern stone desert and the southern sand desert. The catchment area of the Kuiseb river lies in the highland plateau east of the Namib. Rains falling in this plateau cause the Kuiseb to flow. Most of the year the riverbed is dry, but the river flows underground. This results in a linear oasis intersecting the Namib desert and extending the range of many non-desertic plants. About 400 Topnaar live along the lower Kuiseb river, spread over 12 villages. Another 400 live in Walvisbay.

During January, preliminary visits were made to all Topnaar settlements along the Kuiseb. During these visits the purposes and methodology of the ethnobotanical survey project were explained to the villagers, social contacts were made, basic socio-economic info was collected as well as preliminary information on the plants the Topnaar use.

From the beginning of February onwards, each settlement was visited for approximately 5 days. During these visits talks were held with all people living in the village (mainly the old people who have most knowledge of plants) on the plants they use for all kind of purposes. These talks were in Nama, the native language of the Topnaar, and interpreted by Ernst Boois. Most Topnaar people were very friendly and willing to tell a lot. Some of them however were suspicious and refused to give any information on plants, fearing misuse of this information (this due to bad experiences with previous researchers).
At the same visits, an inventory was made of all plants growing in the neighbourhood of the village (mainly the riverbed).

The information obtained from the villagers included the plants’ name in Nama and its common uses. Subsequently we tried to find the plants in the environment, guided by the Topnaar. This was not always so easy, as this year had been extremely dry. The area received not one drip of rain and the Kuiseb flooded only for 5 days. Many plants who only germinate after significant rainfall could not be found.

The plant specimens that could be collected were identified by the authors in the herbarium of the Desert Ecological Research Unit of Namibia (DERUN) at Gebabeb and the National Herbarium of Namibia in Windhoek. Other plants, not found growing, could be identified through literature research relating them to the vernacular names and plant descriptions by the Topnaar, and were cross-checked afterwards. Some plants, however, remain unidentified.

The following information, if at all possible, was collected for each plant: scientific name, vernacular name, use, used parts, preparation and processing. All this information was cross-checked via numerous interviews and compared to literature data. Doubtful information is not included in the results.

Herbarium specimens were collected and deposited at the National Herbarium of Namibia. Plant samples of medicinal plants were collected to screen for medicinal activities later on. The research in the Kuiseb area was finished by the end of May.

During the remaining time, the Topnaar in Sesfontein were also visited. Sesfontein does not belong to the Namib any more, but to the pro-Namib, and lies on the border between Damaraland and Kaokoland, about 500 km north of the Kuiseb river (see map II.1). Sesfontein, so called because of the six perennial springs issuing there, is a 10 km radius oasis surrounded by mountains. Normally this area receives about 100 mm rain per year. This year however, the rainfall was 0 mm.

In Sesfontein live approximately 100 Topnaar. The rest of the more than 1500 inhabitants are mainly Damaras and Hereros.

Sesfontein was visited for 2 weeks. The research methodology followed was the same as in the Kuiseb area. Due to the short period of time and the drought, this research can only be considered preliminary. The interviews were concentrated on the old Topnaar people and some Damara.

In Namibia, we worked together with the University Centre for Studies in Namibia (TUCSIN), DERUN, the Ministry of Wildlife, Conservation and Tourism, the National Herbarium of Namibia and many other individuals. Most contacts were very supporting and interesting.

Once back in Belgium the medicinal plants were screened for some medicinal activities (see 4.3). The research results were presented at the First World Congress on Medicinal and Aromatic
Plants in Maastricht, 18-25 July 1992 (paper presentation) and at the congress 'Etnobotánica '92', 20-25 September in Córdoba (poster presentation).

Map II.1: The Namib Desert
2. The Topnaar People

The Topnaar people belong to the Nama, who for their part, belong to the Khoi-Khoi race. They were called Hottentots by the European colonizers, probably because of their “click” language, Nama (the four used clicks in Nama are /:/ dental click, /:/ lateral click, /:/ palatal click and /: alveolar click). The Khoi-khoi, translated as ‘men of men’, were in the past widely dispersed in southern Africa. Within Namibia they consist of 3 groups: the Nama, the Oorlam and a number of San groups. Table II.1 shows the division of the Khoi-khoi into different tribes and groups, and their respective territory. Presently Khoi-khoi tribes are only found in Namibia.

The Nama are divided into 9 tribes, two of them are the Topnaar of the lower Kuiseb valley and the Topnaar of Sesfontein.

The name Topnaar is of Dutch origin, meaning ‘people of the upperland’ or ‘those who are on top’. This is probably a translation of the traditional Nama name +Aonin. Etymologically +Aonin is derived from +ab, meaning top. There are different explanations of the name +Aonin: ‘people on the top’, living in the mountains (Köhler, 1969); ‘people standing on top of the Nama’ (superior) (Köhler, 1969); ‘people living in a marginal area’, on the edge of the Nama territory (Budack, 1977); ‘people inhabiting the sea coast’ (Köhler, 1969).

The Topnaar are among the oldest inhabitants of Namibia. Their history is not completely known. The earliest known presence (found in the literature) of the Topnaar in the Walvisbay area goes back as far as 1670 when the Dutch East India Company ship, Grundel, first entered Sandwich Harbour. The natives on the shore were recognized as Hottentots by the crew, but their language was slightly different to that of the Cape Hottentots (who were known from the first trip of the Dutch East India Company to South Africa). During that time the Kuiseb still reached the sea at Sandwich Harbour. In recent times the course of the river was forced more north by dunes and these also block the passage to the sea.

Seven years later, in 1877, the Dutch East India Company vessel Boode visited Sandwich Harbour and met Hottentots, which were herding cattle and collecting Inara seeds.

Dr. Beatrice Sandelowsky discovered in 1973 near Conception Water some fragments of a Khoi clay pot, which were dated approximately 650 years back. This means that probably Khoi-khoi were living along the west coast already in the 14th century. It is not sure, however, whether these were Topnaar or whether they belonged to another tribe.

According to oral tradition, the Topnaar came from the north before they occupied the Walvisbay territory.

The Topnaar were among the first traders in Namibia. Already in 1877 they bartered with European sailors beef, lamb, milk, Inara and fresh water for groceries, clothes, weapons and alcohol.
### A. NAMA

<table>
<thead>
<tr>
<th>no.</th>
<th>Nama name</th>
<th>European name</th>
<th>Tribal centre (in Nama and English)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gai-ǁkhaun</td>
<td>Red Nation</td>
<td>!Hoaxa-ñas (Hochanas)</td>
</tr>
<tr>
<td>2.</td>
<td>!Gami=ǹún</td>
<td>Bondelswarts</td>
<td>!Ai-aibes (Warmbaths)</td>
</tr>
<tr>
<td>3.</td>
<td>!Aamun</td>
<td>Southern Topnaar</td>
<td>!Awa-ňaos (Roobank)</td>
</tr>
<tr>
<td>4.</td>
<td>!Ǧamun</td>
<td>Northern Topnaar</td>
<td>!Nansi-lous (Sesfontein)</td>
</tr>
<tr>
<td>5.</td>
<td>!Kharo-khoen</td>
<td>Simon Kopers</td>
<td>!Goxas (Gochas)</td>
</tr>
<tr>
<td>6.</td>
<td>!Haboben</td>
<td>Velskoendraers</td>
<td>!Khoës (Koës)</td>
</tr>
<tr>
<td>7.</td>
<td>!O-gain*</td>
<td>Groot Doden</td>
<td>!Hłe-lando (Schlip)</td>
</tr>
<tr>
<td>8.</td>
<td>!Khau-gōan</td>
<td>Swartboois</td>
<td>Frani-lous (Franzfontein)</td>
</tr>
<tr>
<td>9.</td>
<td>Kharo-loan</td>
<td>Keetmanshopers</td>
<td>#N₀-#goes (Keetmanshoop)</td>
</tr>
</tbody>
</table>

### B. “OORLAM” TRIBES

<table>
<thead>
<tr>
<th>no.</th>
<th>Nama name</th>
<th>European name</th>
<th>Tribal centre (in Nama and English)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>!Aman</td>
<td>Bethaniers</td>
<td>!Ul-#gantes (Bethanien)</td>
</tr>
<tr>
<td>11.</td>
<td>Gai-khauan*</td>
<td>Amraal Lamberts</td>
<td>!Nao-Sanabes (Naasanabes)</td>
</tr>
<tr>
<td>12.</td>
<td>!Hai-khauan</td>
<td>Berseba people</td>
<td>!Ou-sewisis (Berseba)</td>
</tr>
<tr>
<td>13.</td>
<td>!Hłe-laran*</td>
<td>Afrikaners</td>
<td>!Ai-ǁgams (Windhoek)</td>
</tr>
<tr>
<td>14.</td>
<td>!Khobesen</td>
<td>Witboois</td>
<td>Khaha-tsūs (Gibeon)</td>
</tr>
</tbody>
</table>

### C. SĀN GROUPS

<table>
<thead>
<tr>
<th>no.</th>
<th>Name or proper name</th>
<th>European name</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.</td>
<td>Nami-sān*</td>
<td>Namib Bushmen</td>
<td>southern Namib desert</td>
</tr>
<tr>
<td>16.</td>
<td>Kai-ǁorn</td>
<td>Keikum Bushmen</td>
<td>Outjo &amp; Tsumeb districts, Etosha Pan area, Owambo</td>
</tr>
<tr>
<td>17.</td>
<td>Naron (!Ai-khoen)</td>
<td>Naron Bushmen</td>
<td>Ghanzi &amp; Gobabis districts</td>
</tr>
<tr>
<td>18.</td>
<td>Koe (Kwengo)</td>
<td>Black Bushmen</td>
<td>Kavango, western Caprivi</td>
</tr>
</tbody>
</table>

*: Tribes marked with an asterisk have nearly died out.

Table II.1: The structure and localisation of the Khoi-khoi (Hottentots) in Namibia

There exist different opinions about how some Topnaar people migrated to Sesfontein in the Kaokoveld (about 500 km north of the Kuiseb). Hoernlé (1925) says the Topnaar told her that some of them returned to the north after having settled in the Walvisbay area. Other sources
(Köhler 1969, Kootjie, personal comment) say that in the 1880's, during the wars between the Nama and Herero, a group of Topnaar joined Jan Jonker Afrikaner, headman of the Afrikaners, to fight the Herero, and stayed in the north, in a place called 'Am-eib. Forced by drought they moved afterwards to Sesfontein, where at that moment lived Bushmen and Bergdama. A group of Swartboois followed them later.

The Topnaar of the lower Kuiseb valley traditionally live by herding cattle, some gardening, and gathering the lnara Acanthosicyos horridus. The latter is a wild cucurbit, endemic to the west coast of Namibia, providing food and water to the Topnaar. They therefor are also called Naranin, people living of the lnara. This however is a derogatory name as it stresses their dependency on "veldkos" (indigenous edible plants). The lnara is growing abundantly in the sanddunes near Walvisbay and south of the Kuiseb. Every family possess a number of lnara bushes. In this the Topnaar differ from the other Khoi-khoi: the lnara bushes (not the land) are private property, where normally all possessions are common. This perpetual right to the lnara was approved by Queen Victoria herself. Every familie can only harvest from their own lnara bushes. The property rights are based on hereditary rights. If the parents die, the lnara field is divided over the children that are interested in the lnara. The chief and his council decide on redivisions if necessary.

In the past, the Topnaar of the Kuiseb area were split up in Hurinin, hunter-gatherers and fishermen living from the sea along the coast, and Naranin, living more inland along the Kuiseb river. The latter were the dominant group. Now they have fused. The Topnaar have also fused with some Herero, Ovambo, Damara and Eurofican living in this same area.

The Khoi-khoi are all nomads. The Topnaars' mobility, however, is restricted by the environmental conditions of the area: the people depend on the waterholes in the riverbed and the lnara fields. They live in semi-permanent settlements along the lower Kuiseb and near the sea. During the harvesting season of the lnara, whole families move down to the coastal lnara fields and stay there until the end of the harvest. Only some people stay behind in the villages to attend the livestock.

In the past the Topnaars territory was much more extended and reached from the coast along the lower Kuiseb as far as Hu-daoeb in the east, and from Conception Bay in the South up to the Swakop river in the north (Budack, 1977; Köhler, 1969). They were driven from part of the area by the Herero coming from the north and the Nama coming from the south.

In 1907 the Namib desert was declared a National Park. This resulted in quite some restrictions for the Topnaar. They are not allowed to hunt any more, they are not allowed to herd their livestock outside the riverbed, and they can only move in a limited area around the riverbed. Following the South African Odendalsplan, some farms were bought in the south near Gibeon with the intention to move the Topnaar out of the park and settle them in Gibeon. They refused to leave their territory which they claim as their traditional tribal area as they occupy it already for several
centuries. Their culture is adapted to the l\textit{nara}, they depend on the sea and its food resources and there exist legal treaties respecting the traditional land rights (\textit{l\textit{nara}} fields).

Until today the presence of the Topnaar in the Namib-Naukluft park stays a point of dispute between the Ministry of Wildlife, Conservation and Tourism and the Topnaar people. A result of this is that under the South African regime no investments in development of the area were made. Only in 1979, the Department of Water Affairs improved the water supply in the villages by building windmills and dams or pipelines and water taps.

The Topnaar tribe is divided into sibs (clans) and the tribal government consists of a chief and a council. In the past the leadership was inheritable, now also the people have a vote on a new chief when the previous one dies. The first known chief of the Topnaar was Frederik \textit{Khaxab} (mid 19th century). After his death Piet \textit{Ebib} became chief of the Topnaar. When he died in 1910, leaving no son, two fractions struggled for the leadership, but the situation remained unresolved. For 66 years the Topnaar had no traditional leader. This resulted in the loss of their traditions and culture and tribal unity. Only in 1976, with Namibian independence becoming a possibility and the need for a Topnaar spokesman at national level, a new leader was nominated: chief Esau Kooitjie. On his retirement in 1981, his 18 year old son Seth Kooitjie was elected his successor. Since then the Topnaar have again someone to represent them and promote their interests on national level.

At the moment of the research about 400 Topnaar lived along the Kuiseb river, divided over 12 villages, all on the northern bank of the river on the gravel plains (far enough from the river so that big floods will not destroy the houses). The villages are (from east to west): Homeb, Osvater, Natap, Gobabeb, Soutrivier, Klipneus, Swartbank, Eduseb, Ururas, \textit{l\textit{Goatanab}}, Dawe-draais and Armst rea (the 4 last villages belong to the Walvisbay-enclave) (see map II.2). In each village live 1 to 10 families. Another 400 Topnaar live in Walvisbay itself. Since the middle of the 19th century, the life of the Topnaar has been influenced by the European way of life. Nowadays the Topnaar do not live in huts anymore but in houses made of wood and iron plates. Besides the houses one can find the kraals and, depending on a reliable water source, gardens.

The Topnaar of Sesfontein are also called \textit{l\textit{Gornen}}, "stupid people", speaking a strange, unintelligible dialect (Köhl er, 1969). In 1906, the farm Sesfontein, was granted to the Topnaar and Swartboois by the German Government. The earliest chief the Topnaar can remember was \textit{l\textit{Uichah}}. Under him they still lived in the south. During the leadership of his son Anibab Hendrik \textit{l\textit{Uichamab}} the Topnaar came to Sesfontein. The succession of Topnaar chiefs is given in table II.2.

As mentioned before, about 100 Topnaar are presently living in Sesfontein. Thanks to the six fountains, agriculture is possible in Sesfontein. Every male inhabitant owns a part of the irrigated fields. The major crops are wheat, corn and tobacco. Still, gathering of wild food plants is important to these people as well as some goat farming.
Map II.2: The Topnaar villages of the Kuiseb Valley
3. Plants in the Topnaar Culture

The Topnaar are much influenced by the Western way of living. Due to this, a great part of their knowledge on plant uses is lost now. Where in the past they depended completely on the natural environment, this dependency has become much weaker. The role the plants still play in the life of the Topnaar is different between the 2 groups of Topnaar. In what follows we give a short idea on how plants are used by both communities. The detailed information is presented in the next chapter.

The Topnaar of the lower Kuiseb river use one important wild food plant, the *Inara Acanthosicyos horridus*. In the past this was their staple food. Now corn has taken over this position, but the *Inara* still forms an important part of the Topnaar’s diet. Available during 5 months per year, the *Inara* fruit is processed in such way that it can be stored for several months up to years. Other food plants, besides some edible fruits, are short in this area. The other plants these people use are mainly medicinal plants. Although a mobile clinic visits all villages once a month, and provides the local population with medicine, medicinal plants are still extensively used. Several plant roots are used to curdle milk in order to increase the conservation time of the milk. Also many wild herbs are added to tea beverages or food for flavouring. Women are known to use yet other plants to
manufacture cosmetics: perfume, body powder, lotion, and the like. For building purposes wood is less used presently, garbage material is much more highly priced. Fuel is all provided by the trees found along the Kuiseb riverbed. The floods carry much dead wood and often uproot whole trees. Witchcraft has completely disappeared due to the influence of missionaries for more than a century. Plants are no longer being used for fibres, dyes, tannins, etc. Fodder for goats and cattle is reasonably abundant in the environment, Acacia pods and several herbs and shrub form the core of the livestock's diet.

Although most Topnaar in Sesfontein have a garden where they grow wheat, still many wild food plants are being used. Many different seeds are used for the preparation of porridge, different kinds of edible tubers are collected and many wild fruits are available. A hospital is present in the village, but still medicinal plants are widely used. For the other plant uses, the situation is comparable to the Kuiseb area.

4. Results

4.1 The Plants Used by the Topnaar

The plants used by the Topnaar people are given per family, according to the South African classification system (Merxmüller, 1972). Numbering of the families as used by Merxmüller (1972) is included. Within each family the plants are arranged in alphabetic order.

Behind the scientific plant name, the herbarium specimen is mentioned (VdE is the abbreviation of Van den Eynden). All specimens are deposited at the National Herbarium of Namibia and duplicates are deposited at the herbarium of the DERUN.

Per plant the Nama name is given, as well as the common names in English (E) and/or Afrikaans (A) as found in the literature. A short description of the plant is given. The location and habitat of the plants are based on observations of Patrick Vernemenen and Veerle Van den Eynden during the period of the research and are summarized by Patrick Vernemenen. All plant uses by the Topnaar are mentioned with indication of the use in the Kuiseb area (K) or in Sesfontein (S).

4.1.1 Nonvascular Plants

Basidiomycetes

**Battarea sp.** (see fig. II.1)

<table>
<thead>
<tr>
<th>Nama</th>
<th>/batsb/</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Fungi of about 25 cm high, light brown, with light brown spores.</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>Riverbank and old riverbed.</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Lower Kuiseb: between Honeeb and Gobabeb.</td>
</tr>
</tbody>
</table>
Uses The spores are rubbed on burning wounds to reduce the pain and hasten healing. They are also rubbed on rough spots of the body. Spores (mixed with fat or hnrta-oil or a red ground stone, called lswi) are used as a cosmetic. It also protects the skin from sunburn and drying out (K).

Alariaceae

Ecklonia maxima (Osbeck) Papenfuss
Nama huri || hāb, huri || hāb, || gamgūb
Description Sea plant up to 7 m long, hollow stipe, large terminal float, dense cluster of flat pinnae.
Habitat The sublitoral area: on the rocks, emerging partly at low tide.
Distribution All over the Namib coast.
Uses The stem of this sea plant is roasted and ground. The powder that is thus obtained (mixed with vaseline) is rubbed on wounds and burns. This treatment prevents infection and accelerates healing (K,S).

Lichens

Parmelia hottenrotta (Thunb.) Ach.
Nama lui || khaob
Description Gray-greenish lichen, up to 4 cm high.
Habitat On calcareous rocks.
Distribution Swartberkberg.
Uses The ground lichen is used as a deodorant / perfume (K,S). A decoction is drunk to cure coughs and to relieve stomach and chest pains (K).

4.1.2 Vascular Plants

16 Moraceae

Ficus sycomorus L. [VdE 12.4.a] (see fig. II.2)
Nama inomas
Common names sycamore fig (E), wildevye (A), gewone trosv (A)
Description Tree up to 25 m high and wider than high, bark smooth yellowish brown to grey, sometimes flaking; leaves simple, alternate, to 15 cm long, dark green, subcordate or ovate to orbicular, shortly stalked, pubescent to some degree on both sides, rough surfaced, exuding a milky latex when damaged, margins irregular; fruit a fig. 1.5 to 2.5 cm in diameter, in panicles on main branches and trunk, stalked, softly hairy, cream-coloured to yellow and sweet when ripe, edible.
Habitat Riverbank of rivers; soil: alluvium with fine sand and silt, often mixed with coarse sand and stones; seldom on stones or rocks.
Distribution Kunene: at about 30 km upstream of the mouth.
Hoanib: canyon between Sesfontein and Amspoort, end of Guiuin: small specimen.
Swakop.
Kuiseb: canyon, between Homeb and Soutrivier, some smaller specimens downstream.
Tsauchemb: Sesriem canyon.

Uses The wild figs are eaten fresh or dried. The raw fruits can be put in a jar with sugar, which makes a kind of jam. The dried and ground fruits are used as a substitute for coffee (K,S).

19 Olacaceae

Ximenia americana L. [VdE 17.6.6]

Nama ≠ńros
Common names sour plum (E), kleinsuurpruim, doring pruim (A)
Description Much-branched spiny shrub to 3 m high; straight spines; leaves clustered, oblong-elliptic to ovate, 2.5-1-2.5 cm, hairless, somewhat fleshy, often folded along the midrib; small greenish-yellow flowers in axillary cymes; fruit an ellipsoid to ovoid drupe, yellow to red, ca 3 cm long.
Uses The fruits are eaten (S).

27.5 Mesembryanthemaceae

Brownanthus kuntzei (Schinz) Ihlenf. & Bittrich [VdE 9.5.3] (see fig. 11.3)
Nama ≠nągub
Common name wonderplant (A)
Description Succulent bush, papillate, segmented stems; small opposite leaves, shriveling up and falling off when old; small white terminal flowers, per 1 to 3. numerous white petals of staminodal origin, numerous stamens, 4-5 stigmas; fruit a dry capsule with numerous seeds.
Habitat Washes in and around mountains, old riverbeds; sandy soil and gravel plains along the coast; plants of Brownanthus kuntzei (Schinz) Ihlenf. & Bittrich trap sand and form cushions on small hummocks.
Distribution Common in Central Namib:
Kuiseb: canyon: few spots; downstream Homeb: common; southern arm of the delta (inara fields).
Swakop: quite common on old riverbed and in side valleys.
Along the coast on gravel.
Swartbankberg: in washes in and around the mountain.
Northern Namib: Munutum: around Okau: common together with Psylocaulon salicornioides (Pax) Schwantes and Mesembryanthemum cryptanthum Hook.F.; becomes rare further upstream.
Battarea sp. (Kaasāb) spores are rubbed on burning wounds to reduce the pain and hasten healing. They are also rubbed on rough spots of the body. Spores (mixed with fat or Inara oil) are used as a cosmetic. It also protects the skin from sunburn and drying out.

*Figure II.1: Battarea sp.*

Inhalation of the vapour of a decoction of Brownanthus kuntzei (Schinz) Dinter & Schwantes (= naugub) cures colds, fever and flu and relieves nausea (induces vomiting). A decoction of the stems is drunk to relieve stomach pains, to solve constipation and to whet appetite.

*Figure II.2: Brownanthus kuntzei*

*Figure II.3: Ficus sycomorus*

(Fox & Norwood Young, 1982)
Uses A decoction of the whole plant is added to boiling water. The patient sits in the vapour to cure colds, fever and flu. Inhalation of the vapour, obtained by boiling the whole plant, induces vomiting and is used to relieve nausea. The decoction of the stems can be drunk to relieve stomach pains, to solve constipation and to whet the appetite. The same decoction is given to animals if their stomach is inflated or if they are infested with a tape-worm (K).

33 Amaranthaceae

*Amaranthus diueneri* SCHINZ ssp. *diueneri* [VdE 18.6.b, VdE 4.4.k]

Nama Khaubeb
Common name pigweed (E)
Description Low annual herb, small alternate obovate leaves, sometimes with a dark red spot; little black seeds, round, flat.
Uses The leaves and stems are cooked and eaten as vegetables. They can be prepared with onions and fat (S).

*Arthraerua leubnitziae* (KUNTZE) SCHINZ

Nama Sara
Common name ink bush (E)
Description Small bush, segmented, furcated stems; opposite, small, triangular leaves; terminal small flowers, perianth with silky hairs.
Habitat Gravelplain and old riverbed in the fog zone along the Namibian coast; plants trap sand and form small hummocks; on several places: monospecific stands, but with a cover (mostly) <1%; sometimes together with *Zygophyllum stapfii* SCHINZ.
Distribution Common on gravelplains and coast of Central and Northern Namib. Distribution strictly limited to the fog zone.
Uses A decoction of the roots is drunk to ease tremblings (K).

47 Capparaceae

*Boscia albitrunca* (Burch.) GILG & BENEDICT [VdE 20.6.d] (see fig. 11.4)

Nama Hunib
Common names witgat, witstamboom (A), caper bush, shepherd's tree (E)
Description Small tree up to 7 m high, straight trunk and well-trimmed, rounded crown; bark smooth, white with grey or yellow patches, flaking; simple grey-green leaves, evergreen, leathery, often bristle-tipped, single or clustered on twigs; small green-yellow flowers, 2-3 mm long, in dense racemes along the twigs, star-shaped, without petals but numerous yellow stamens; fruit a round, pale yellow, smooth-skinned berry, about 10 mm diameter, fleshy white pulp and a single hard seed.
Habitat Different types of savannah, on riverbanks, in washes; different types of soils.
Distribution Mainly east of the Namib; in the Namib limited to washes.
Uses: A decoction of the leaves is dripped into the ears to relieve earaches (K). The berries, soaked in water, mixed, and seeds removed, give a fresh juice to drink (S).

*Boscia foetida* Schinz ssp. *foetida* [VdE 19.6.6, VdE 13.2.c] (see fig. 11.5)

**Nama: xaubehunis**

Common names: stink-bush, smelly shepherd’s tree (E). stinkdoorn, witgatboom (A)

Description: Shrub or small tree up to 5 m high, branches stout, glabrous, often ending in a spine; bark smooth, grey; small oblong to obovate leaves in fascicles, leathery, glabrous on both surfaces; small yellowish-green flowers, 2-3 mm long, in axillary fascicles, unpleasant smell; fruit a spherical berry, yellowish-brown, densely hairy, about 10 mm diameter, with a single hard seed.

Habitat: Common on riverbanks and in washes; sandy soil, sometimes mixed with stones.

Distribution: Throughout the Namib: along all rivers and in washes of the Central Namib Plain (eastern part).

Uses: A decoction of the leaves and twigs is dripped into the ears to relieve earaches and into the eyes to relieve eye pains (K). The same decoction is drunk by the Topnaar in Sesfontein to cure colds and relieve stomach pains.

*Figure II.4: Boscia albitrunca*  
(TREDGOLD, 1986)

*Figure II.5: Boscia foetida* ssp. *foetida*  
(FOX & NORWOOD YOUNG, 1982)
Capparis hereroensis Schinz [VdE 21.4.a] (see fig. 11.6)

Name: sirub

Description: Dune forming shrub, 1-3 m high; long-stalked oblong leaves, 3-6 cm long, 1-3 cm wide, leathery; stipules transformed into short thorns; large, white, solitary flowers, 3-4 cm in diameter, K4 C4 A∞ G, with androgynophore; fruit a large green elliptic berry, 5 cm long, with dark green lines on the surface, many seeds.

Habitat: Plants of Capparis hereroensis Schinz trap sand and form hummocks; found together with Tamarix usneoides E.Meyer ex Bunge, Nicotiana glauca Graham and Acanthosicyos horridus Welw. ex Hook. F..

Distribution: Delta area of the Kuiseb.

Uses: The Topnaar of the lower Kuiseb eat the fruits raw. Most bushes however have disappeared due to the drought (K).

Maerua schinzii PAX [VdE 13.2.h, 14.2.a, 21.6.e] (see fig. 11.8)

Name: goradab, goardab

Common names: kwarda, lammerdrol (A)

Description: Shrub or small tree up to 7 m high; simple oblong leaves, alternate, 4-6 cm long and 1.5-3 cm wide, leathery, densely rough hairy; white flowers in terminal racemes, 4 valvate sepals connate into a tube, 4 or 0 petals, not exceeding the sepals, androgynophore longer than floral tube; fruit a long, small green capsule, constricted between the seeds like a string of pearls.

Habitat: Common on riverbanks, old riverbeds, scree slopes, washes and crevices in mountains; soil: sandy or scree.

Distribution: Throughout the Namib: along all rivers; mountain ranges (e.g. Peak 19); inselbergs (e.g. Spitzkoppe).

Uses: The body can be washed with a decoction of the leaves to treat skin disorders and acne and in cases of fever or weakness. The Topnaar people use a decoction of the leaves instead of soap to wash themselves. The body is also washed with this decoction when an improvement in mood is required (K). The Topnaar of Sesfontein drip the juice (or an extraction) of the leaves in the ears to relieve earaches. Drinking a leaf-decoction cures coughs.

51 Myrothamnaceae

Myrothamnus flabellifolius Welw. [VdE 20.6.e] (see fig. 11.7)

Name: ikhototorotosen, tôsên, ikhotortosen, ikhotôgôsên

Common names: resurrection bush (E), teebosie (A)

Description: A shrubby plant with red-brown erect stems; opposite leaves in fascicles, 5-10 mm, flabellate folded when dry, unfolding after the first good rain and showing green within; reddishbrown, unisexual flowers in catkin-like spikes from the leaf axils; plant dioecious; fruit a capsule.

Habitat: Riverbanks and old riverbeds, washes; less on mountain slopes; soil with coarse sand, sometimes mixed with stones and scree.
The fruits of *Capparis hereroensis* Schinz (siruh) are edible.

*Figure II.6: Capparis hereroensis*

*Figure II.7: Myrothamnus flabellofolius*

*TREDGOLD, 1986*

A decoction of the leaves of *Maerua schinzii* Pax (goradao) is used to wash the body and treat skin disorders and acne.

*Figure II.8: Maerua schinzii*
Distribution Riverbanks of Tsauchab, Kuiseb, Swakop, Hoanib, Hoarusib and Kunene; Spitzkoppe.

Uses Leaves and stems of this so-called resurrection bush are added to tea. They are also used as a spice (K,S).

58 Mimosaceae

*Acacia albida* Del. [VdE 12.4.g] (see fig. II.10)

**Nama** ana

**Common names** ana tree (E), anaboom (A)

**Description** Tree up to 30 m high, with spreading, drooping branches and a rounded crown; dark brown to dull grey bark; villous hairy branchlets with straight or slightly curved, greenish-white to light grey-brown, stipular, paired thorns with reddish brown tips, up to 1.5 cm long; bipinnate leaves, borne spirally along the twigs, 3-6 pairs of pinnae and 7-16 pairs of small, grey-green, pubescent leaflets of 5-10: 1-2.5 mm; cream coloured flowers in axillary spikes; fruit an orange to reddish-brown pod, 2-3 cm wide, contorted and curved, indehiscent, smooth; seeds light to dark brown, elliptic-lenticular.

**Habitat** Tree, typical for riverbanks, often together with *Acacia erioloba* E.Meyer and/or *Ficus sycomorus* L.; soil: silt and/or sand (fine, often coarse).

**Distribution** Very common tree on the riverbanks of the Kuiseb, as well as Tsauchab, Swakop, Ugab, Hoanib, Hoarusib and Kunene.

**Uses** The pods of the anatree are the most important fodder for the goats and cattle in the lower Kuiseb area. Also the leaves are browsed. The wood is used as a fuel and, due to its hardness, as timber (e.g. for drinking troughs) and for furniture. The stems are used as poles for the construction of houses, kraals and fences and the bark as covering for roofs and walls (K).

*Acacia erioloba* E. Meyer [VdE 17.4.a] (see fig. II.11)

**Nama** II ganab

**Common names** camel thorn (E), kameeldoringboom (A)

**Description** Large tree, 20 or more m high, wide spreading rounded crown; rough bark, dark greyish brown to black; long straight spines to 7 cm long, white, in pairs at the nodes, often thickened at the base; bipinnate leaves with 1-3 pairs of pinnae and 8-12 pairs of leaflets, 7-9:2-2.5 mm, bit leathery; inflorescence capitate, solitary or fascicled; small bright yellow flowers, sessile; fruit a thick woody pod, sickle-shaped, 7-10:3-5 cm, covered with persistent velvety gray hairs and rusty glandular hairs, indehiscent; dark reddish-brown seeds, lenticular to elliptic.

**Habitat** Tree, mostly found on riverbanks (often together with *Acacia albida* Del.) or in old riverbeds (typical). In old riverbeds *Acacia erioloba* E.Meyer grows together with *Tamarix usneoides* E.Meyer ex Bunge, *Euclea pseudobenus* E. Meyer ex A.DC, *Salvadora persica* L. and *Pechuel-Loesechea leubnitziae* (O. Kuntze) O. Hoffm. Sometimes the tree has a creeping habitus. The plants trap sand and form small hummocks. It grows sometimes in small washes.
Soil: sandy or with silt.

**Distribution** Very common tree in the valleys of Kuiseb, Hoanib and Hoarusib. Swartbankberg; washes Delta of the Kuiseb: as a creeper.

**Uses** This tree, together with Acacia albida forms the main perennial vegetation along the Kuiseb river. The wood is used as fuelwood and is said to be the best available in the area. It produces little smoke and good quality charcoal. In the past the Topnaar of the lower Kuiseb used to make charcoal of this tree and sell it, which is now forbidden by the Ministry of Wildlife, Conservation and Tourism. The wood is too hard for construction purposes, but is sometimes used for furniture and fences. It is termite resistant. The pods and leaves are eaten by livestock. In periods of food scarcity, the pulp of the pods is also eaten by the Topnaar themselves. The gum, exuded from the branches, solved in boiling water, is drunk to cure coughs, tuberculosis and colds. The powder obtained from between the stem and the bark is liberally applied to the body as a perfume, or is used to scent the house (K).

*Acacia tortilis* (Forsk.) Hayne ssp. heteracantha (Burch.) Brenan [VdE 18.6.c]

**Nama** Inarab, Inaras

**Common names** umbrella thorn (E), basterkameeldoring, krulpeul, haak-en-steek (A)

**Description** Tree up to 10 m high; spines either short and hooked or long and straight to 7 cm long, white, in pairs opposite the nodes; bipinnate leaves with 5-8 pairs of pinnae and 9-16 pairs of linear oblong leaflets, 2-3.5:0.5-1 mm; inflorescence capitate, yellow flowers; fruits spirally contorted pods, to 6 mm wide, flat.

**Habitat** On sandy plains and on riverbanks.

**Distribution** Very common on the plain around Sesfontein; some specimens found in the Kuiseb.

**Uses** This tree is very common in the Sesfontein valley. The Topnaar ground the pods, remove the seeds and boil the pulp with milk, blood or water to an edible porridge (corn or wheat can also be added). The pods are also eaten by the goats. The wood is used as fuelwood but gives much smoke (S). The gum, called hairan in Nama is edible (S,K).

*Prosopis glandulosa* Torrey [VdE 15.2.g] (see fig. 11.9)

**Nama** Inarab

**Common names** honey locust (E) soetpeul (A)

**Description** A shrub or small tree up to 10 m high, native from the U.S.A.; armed with paired or solitary straight spines at the nodes; bipinnate leaves, with 1-2 pairs of pinnae and 7-22 pairs of ovate leaflets; inflorescence an axillary many-flowered spike; very small sessile, yellow flowers; fruit a long, straight pod, apically beaked.

**Habitat** On riverbanks and in old riverbeds; on sandy soil.

**Distribution** Introduced in Southern Africa and now very common in a number of river valleys (Swakop, Ugab) where it replaces the native vegetation. In the lower Ugab it forms a plant community with other aliens (*Datura innoxia* Miller, *Datura stramonium* L., *Nicotiana glauca*
GRAHAM and *Ricinus communis* L.) Some specimens grow in the lower Kuiseb (Ururas-Rooibank). No specimens were found in the Kuiseb between Ururas and Schlesien.

**Uses** The pods are eaten by people and livestock (K).

![Image of Prosopis glandulosa](image)

*Figure II.2: Prosopis glandulosa (Craven & Marais, 1986)*

59 Caesalpiniaeae

**Caesalpinia rubra** (Engler) Brenan [VdE 23.6.k]

- **Nama** auauroi (?)
- **Description** Shrub up to 3 m high, fragrant, reddish-brown twigs, villous when young; bipinnate leaves, 5-12 pairs of pinnae, composed of up to 18 pairs of reddish leaflets, 2-5: 1-2 mm, hairless or short hairy, glandular, thorny stipules; red flowers in terminal racemes up to 20 cm long; reddish-brown legumes, teardrop-shaped, beaked, 2-seeded, dehiscent, with few thorns.
- **Habitat** Rock and scree.
- **Distribution** Mountains near Sesfontein.
- **Uses** The dried, ground leaves are used as a perfume in Sesfontein.

**Colophospermum mopane** (Kirk ex Benth.) Kirk ex Leonard [VdE 21.6.m]

- **Nama** tsaurahais
- **Common names** mopane, ironwood (E), mopani (A)
- **Description** Tree or bush up to 10 m high; bifoliolate leaves, falcated, outer margin cordate, 5-12 cm long, glandular; greenish-yellow flowers in axillary racemes, K4 C0 A20-25; kidney-shaped legumes, yellow-brownish, leathery, flat, 3-5: 2-3 cm, 1-seeded, dehiscent, crinkled, glandular seed.
- **Habitat** Main constituent of the savannah in Kaokoveld; soil: coarse sand and stones, sometimes scree.
- **Distribution** Kaokoveld, along some rivers (Engo, Munutum, Sechomib and Khumib) in the Northern Namib. Common around Sesfontein. Not in Central and Southern Namib.
The wood of Acacia albida Del. (enasi) is used as fuelwood, timber (very hard), for furniture and for the construction of houses, kraals and fences. The pods and leaves are the most important fodder in the Kuiseb area.

Figure II.10: Acacia albida

The wood of Acacia erioloba E Meyer (organza) is the best fuelwood in the Kuiseb area. The pods and leaves provide fodder. The pods are edible. The exudated gum, solved in boiling water, is drunk to treat coughs, TB and colds. The powder from between the stem and bark is used as a bodypowder.

Figure II.11: Acacia erioloba

The leaves of Cullen obtusifolia (DC) Stirton (lhonab) are added to tea (whets appetite). A decoction of the leaves is drunk to relieve stomach pains and postnatal pains. The root curdles milk.

Figure II.12: Cullen obtusifolia
Uses All parts of this tree are widely used in Sesfontein. The wood is used for carving, also for the construction of houses, kraals, fences, sheds, etc. as well as as fuelwood. A decoction of the leaves is drunk to relieve stomach pains and cure colds. For this last, the body is also washed with the extraction. In cases of headache/eyepains, the head/eyes are washed with a decoction of the leaves whereafter the boiled leaves are put on the head/eyes. The twigs are chewed to clean the teeth. The dried, sugar and gum containing secretions of aphids parasiting the leaves are collected and eaten.

*Parkinsonia africana* Sonder  [VdE 1.4.d]

*Common names* peulboom (A), wild green-hair tree (E)

*Description* Up to 6 m high thorny bush with brownish-yellow bark; bipinnate leaves with short thorny rachis, one pair of pinnae, 4-20 cm long, with 5-15 pairs of minuscule, elliptic leaflets, 5: 1.5 mm, thorny stipules; yellow zygomorphic flowers in axillary racemes, K5 C5 A10 G1; fruits linear-lanceolate legumes, slightly falcate, 7-12 cm long, 0.8 cm wide, dehiscent, many-seeded.

*Habitat* Old riverbeds, riverbanks, washes; soil of coarse sand (sometimes mixed with fine sand and silt). Often found in mountains.

*Distribution* Very common in old riverbeds and washes in the Northern Namib (e.g. Engo, Munutum, Sechomib and Khumib).

- On the riverbank of the Kunene, common in washes in the Central Namib.
- Some specimens found in the Kuiseb valley.

*Mountain Range Peak 16.*

*Uses* The roasted and ground seeds can be added to coffee to improve its taste (K).

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60 *Fabaceae*

*Cullen obtusifolia* (DC) Stirton  [VdE 15.2,f, 4.4.n, 7.2.h.] (see fig. II.12)

*Nama* Ihonab

*Description* Procumbent or erect herb, perennial, densely covered with white hairs and glands, aromatic sweet smell; trifoliate pinnate leaves, dentate margins, stipules; small purple papilionaceous flowers per 3 in the axil of a hairy, glandular bract, banner bright violet-pinkish; small legumes, ovate-oblong, 1-seeded, non-dehiscent, surrounded by the persistent calyx.

*Habitat* As an ephemeral in new riverbeds; in mountains; in fixated dunes.

*Distribution* Northern Namib: fixated dunes, west of the Hartmann Valley; Mountain Range Peak 16. Central Namib: Kuiseb: riverbed

*Uses* The leaves or the whole plant can be added to tea for flavouring. This tea whets the appetite. Adding the root to milk gives the milk a good taste and curdles it (yoghurt) (K,S). An extraction of the plant in water or milk, or tea made from it is drunk for the relief of stomach pains and post-natal pains. This is also given to goats after parturition (K).
Sesbania sphaerosperma  WELW.  [VdE 21.6.g]

Nama -

Description  Shrub up to 3 m high; even-pinnate leaves, 10-30 cm long, composed of 10-40 pairs of leaflets, 10-30:3-8 mm, stipules fugacious, small spines on the leaf axis; yellow papilionaceous flowers, banner purple-brown marbled, 8-14 mm long; inflorescence axillary racemes; fruit a long, straight legume, 13-25:0.5 cm, apically beaked, dehiscent with 2 valves, sepalae 4-5 mm from each other; spherical orange seeds.

Habitat  Riverbanks and old riverbeds; soil fine sand and silt

Distribution  Kuiseb: canyon

Sesfontein: Hoanib valley

Uses  The roasted, ground seeds can be used as a substitute for coffee (S).

Tephrosia dregeana  E. MEYER  [VdE 14.2.g, 17.1.a]

Nama  hena'hbab

Description  Annual or perennial erect herb or shrub, woody at base, up to 1 m high; odd-pinnate leaves, 2-5 pairs of linear lanceolate leaflets, 3-9:0.2-0.8 cm; lilac papilionaceous flowers in racemes; small yellowish-green legumes, 3-5-seeded, 15-30: 3-4.5 mm, slightly falcated.

Habitat  Gravelplain (plant community with Salsola, Stipagrostis sabulicola (PILGER) DE WINTER), often on riverbanks and riverbeds (plant community with Peckuel-Loeschea leubnitziæ (O. KUNTZE) O. HOFFM.).

Distribution  Kuiseb: canyon. Gravelplain of the Central Namib

Uses  The Kuiseb's Topnaar put the root of this herb in milk to curdle it (yoghurt).

64 Geraniaceae

Monsonia sp.  L.

Nama  harapab, rabab, bosui (seeds), surobe (unripe seeds)

Description  Annual or perennial herb, erect or creeping; opposite, simple, heart-shaped leaves, stipules present; flowers solitary or in umbels; fruit a 5-partite, beaked schizocarp; teardrop shaped reddish-brown seeds, 2-3 cm long.

Uses  The seeds of this plant are collected by ants. The seeds are collected from such ant nests and added to tea or roasted and ground and added to coffee for a better flavour. The seeds can also be boiled as a porridge or baked and eaten. The unripe seeds are also ground and added to porridge. This gives the porridge a fatty taste. Also the leaves are used to improve the flavour of tea (K,S).

67 Euphorbiaceae

Ricinus communis  L.  [VdE 31.3.n,  VdE 21.6.p]

Nama  ķhēras

Common names  castor bean (E), kasterolieboom (A)
Description Monococious tree up to 4 m high, woody base, upper branches herbaceous; palmately lobed leaves, 5-7 lobes, serrate margins, 15-30 cm long; flowers in spikes, male flowers at the apex and female flowers at the base of the spike; fruit a dehiscent, spiny capsule composed of 3 carpels, each containing 1 mottled seed.

Habitat Riverbanks and old riverbeds

Distribution Very common alien in all river valleys, grows together with Euclea pseudoebenus E. MEYER ex A.DC., Acacia albida DEL. and acer.

Uses In cases of mumps or tooth pain, the Ricinus seeds are ground and boiled and rubbed on the swollen cheek (or fat is rubbed on the swollen cheek). The whole is covered with a warmed leaf and a compress (K,S). The roasted and ground seeds are applied on burns and wounds. A warmed leaf can be put on wounds and skin diseases, also on painful knees or breasts and on the throat in case of throat pain (K).

68 Rutaceae

Thamnosma africana ENGEL [VdE 5.4.h]

Nama  khanab

Common name flea bush (E)

Description Strong aromatic perennial herb, woody, up to 1 m high, hairless but glandular; compound leaves, 3-5 linear-spathulate leaflets, 10-25:1-2 mm; yellow, tetramerous flowers in terminal panicles or racemes, K4 C4 A8 G(2); fruit a 2-locular capsule with dark brown, kidney-shaped, thorny seeds.

Habitat Riverbanks and old riverbeds; together with Acacia erioloba E.MEYER.

Distribution Kuiseb.

Uses Drinking a decoction of the whole herb induces vomiting and is used to relieve stomach pains and nausea (K,S). This decoction also cures coughs. Leaves are thrown on the fire to ‘induce happiness’ (K).

Zanthoxylum ovatifoliatum (ENGEL) FINKELSTEIN

Nama  peperhais

Description Shrub or tree up to 3 m high, with strong curved spines on the branches and smaller spines on the petioles; leaves at the ends of the twigs, odd-pinnate, 2-4 pairs of leaflets, sessile, ovate, 2.5-5:1-2.5 cm; unisexual flowers in racemes or panicles, probably dioecious; fruit a unilocular, spherical capsule, 5-6 mm in diameter, orange-brown, covered with big glands, dehiscing with two valves; one round, bluish-black, shiny seed inside.

Uses Fruits and seeds are dried and ground for body powder/perfume. A decoction of the fruits is drunk to relieve throat pain (S).
70 Burseraceae

Commiphora giesii V.D. WALT [VdE 23.6.c]

Nama | lasab

Description Slender shrub about 2 m high, goldbrown bark, not flaking; slender, flexible branches; trifoliate leaves, entire margins, hairless, obovate; minuscule unisexual flowers, dioecious plant; fruit a spherical or ellipsoid drupe, leathery, dehiscing with 2 valves when ripe.

Habitat Gravel plains with scree; mountain slopes.

Distribution Very common on Gravel plains around Sesfontein.

Uses The twigs are used as fire-sticks (S).

Commiphora krauseianna HEINE

Nama | ana

Description Shrub up to 2 m high, thick, swollen trunk, papery flaking bark; compound, clustered leaves, 6-8 pairs of very small leaflets, 12-20:0.5 mm, hairless; minuscule flowers in clusters, hairy; fruit a fleshy drupe, dehiscing with 2 valves when ripe.

Habitat Gravel plains with scree (sometimes together with Welwitschia mirabilis HOOK.F.); mountain slopes.

Distribution Common between Wereldsend and Sesfontein.

Uses A decoction of the bark or branches is drunk to cure heart problems, palpitations, chest pains, coughs and colds. Washing oneself with water in which twigs of this shrub were soaked brings luck (S).

78 Salvadoraceae

Salvadora persica L. [VdE 23.3.a] (see fig. II.13)

Nama | khibis

common names tooth-brush tree, salt bush (E), kerriebos (A)

Description Scrambling shrub; leathery simple leaves, opposite, elliptic, entire margins, bright green; small greenish-white flowers in terminal panicles; fruits small round, pink-reddish drupes, 6 mm in diameter, 1-seeded; seed contains benzyl mustard oil (fruit and leaves are said to be the mustard of the bible).

Habitat Old riverbeds (together with Tamarix usneoides E.MEYER ex BUNGE and Acacia erioloba E.MEYER), lowest part of dune slipfaces.

Distribution All valleys.

Uses The fruits, who smell like cress, are edible but cause diarrhoea. In Sesfontein, the fruits are dried, remoisturized and rolled into balls. This is very nutritious knapsack food. A decoction of the roots is drunk to cure colds and coughs (S). The wood is sometimes used ad a fuel. The leaves are browsed by livestock and the fruits can be fed to chickens (K).
Figure II.13: *Salvadora persica*

*(Fox & Norwood Young, 1982)*

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Figure II.14: *Ziziphus mucronata*

*(Tredgold, 1986)*

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Figure II.15: *Berchemia discolor* *(Tredgold, 1986)*
79 Rhamnaceae

Berchemia discolor (Klotsch) Hemsley [VdE 19.6.f] (see fig. II.15)

Nama  #hûs

Common names  bird plum, wild date (E), wilde dadel (A)

Description  Deciduous tree up to 12 m high, with a dense rounded crown; simple, alternate or opposite leaves, smooth and waxen, elliptical, dark green above, pale below; small yellow-green flowers in small clusters from the leaf axils; fruit a fleshy ovoid drupe with 2 locules, each with one seed, ripens from bluish green to pale orange.

Uses  The fruits are eaten fresh or dried. They can be cooked in milk and eaten (S).

Ziziphus mucronata Willd  [VdE 19.6.i] (see fig. II.14)

Nama  #fûs

Common names  buffalo thorn, shiny leaf (E), wag-'n-bietjie, blinkblaar, haak-en-steek (A)

Description  A much-branched, thorny shrub or rarely a tree up to 12 m high, with zigzag young stems between the nodes; simple ovate leaves, alternate, glabrous, asymmetrical at base, to 6 cm long; each leaf subtended by a pair of thorns of which one is bent that hooks you and the other is straight and stabs you as you back up to unhook yourself (this explains the Afrikaans name ‘haak-en-steek’, meaning hook and stick); small, star-shaped, yellow-green flowers in axillary clusters; fruit a bright red to red-brown, round drupe, 1-2 cm in diameter, smooth and fleshy with one hard pip inside, containing two flat seeds.

Habitat  Riverbanks, often part of a plant community with Acacia albida Del. and Duclea pseudobenue E. Meyer ex A.DC.

Distribution  Common along the Tsauchab, also along the Kuiseb (mainly canyon), Swakop and Kunene.

Uses  The fruits are eaten raw or boiled (S).

80 Vitaceae

Cyphostemma sp. (Planchon) Alston

Nama  kowas

Common name  cobas tree (E)

Description  The Namibian Cyphostemma species are usually thickset, succulent trees; the bark is pale-coloured and peeling; 3-foliolate large leaves; bisexual flowers, small, yellowish to pale green, in branched terminal, axillary or leaf-opposed cymes on a succulent stalk, or peduncle, all flower parts in fours; fruit oval to spherical, fleshy and indehiscent.

Uses  The fruits are eaten raw. The juice can be squeezed out of the fruits and drunk (S).
81 Tiliaceae

Grewia tenax (FORSK.) FIORI [VdE 23.6.i]

Nama ǂats

Description Shrub to 3 m high; leaves elliptical obovate, 1.5-4.1-2.5 cm, opposite, serrate margins, stellate pubescence; solitary white flowers, sepals 10-15 mm long, petals ca. 3/4 as long; fruit a deeply 4-lobed berry, orange-red, 1 cm in diameter, tearformy seeds.

Habitat Old riverbeds, sometimes on riverbanks; plant community together with Acacia erioloba E.MEYER, Salvadora persica L. and Tamarix usneoides E.MEYER ex BUNGE.

Distribution Along all rivers.

Uses The fruits are eaten raw (S). The wood is used as a fuel (K).

84 Sterculiaceae

Sterculia africana (LOUR.) FIORI

Nama huina

Common name african star-chestnut (E)

Description Large tree, white or orange bark; longstalked cordate leaves, covered with tomentose stellate hairs; unisexual flowers in panicles, monoecious tree; woody, sessile, thick follicles, brown, also covered with tomentose stellate hairs, many seeds.

Habitat Mountains; soil: scree and rocks.

Distribution Mountains of the Central and Northern Namib, very common on the mountain range of Peak 16 and on the Brandberg.

Uses A decoction of the fruits is drunk to relieve post-natal pains and pregnancy pains (S).

90 Tamaricaceae

Tamarix usneoides E. MEYER ex BUNGE [VdE 21.4.b]

Nama dawab

Common name tamarisk (E)

Description Halophyte tree with slender branches bearing alternate, small leaves; regular unisexual pinkish-white flowers in racemes, dioecious, 5 free sepals and 5 permanent petals, petals and 5 stamens inserted on a fleshy disk, superior unilocular ovary, 3 sessile stigmas; fruit a capsule containing many small seeds.

Habitat Old riverbeds, depressions in dunes; soil: sandy, sometimes salty; forms often monospecific stands, mostly forming a plant community with Acacia erioloba E.MEYER and Euclea pseudobenus E. MEYER ex A.D.C.

Distribution All riverbeds of the Namib; in the Swakop very common.

Uses A decoction of the roots is drunk to cure indigestion and diarrhoea and to relieve stomach pains (K).
The *hare*. *Acanthosicyos horrida* Welw. ex Bentham & Hooker was not the staple food of the Tsapano people. This wild melon endemic to the Namib desert, grows in the sand dunes along the coast of Namibia. It forms the main vegetation in the dunes and is an important dune forage. To prepare the *hare*, the fruits are peeled and heated, and soap are separated. Both are dried and used in soups. Round flat cakes, called *koekkraal*, are eaten like nuts. The dried cakes are chewed and soaked to remove. The fruit is also eaten raw or the fresh juice drunk. Raw pips are roasted and eaten.

The *hare* is also used in many other ways. A decoction of the roots is drunk medicinally to treat various diseases, such as headaches, nausea, kidney problems, and internal diseases. A decoction of the roots is boiled to relieve stomach and chest pains. For the same purposes the root can be chewed. Some people say it cures all diseases and heals any illness within one day. The crushed root mixed with fat can be rubbed on the feet to hasten healing. Oil from the pips is used to moisturise the skin and protect it from sunburn.

*Figure 11.16: Acanthosicyos horrida*
94 Cucurbitaceae

Acanthosicyos horridus Welw. ex Hook F. (see fig. II.16)

Nama: Inara

Common names: nara bush (E) butterpits (seeds) (E)

Description: Spiny, leafless, xerophytic shrub, forming large dense bushes, dioecious; bright green stems, much branched, longitudinally grooved, with paired opposite sharp straight spines, 2-3 cm long; yellow-greenish unisexual flowers in the axils of the leaves, pentameres, inferior spiny ovary; green melon-shaped fruits, up to 15 cm in diameter, covered with small spiny protuberances; creamy seeds, size of almonds, embedded in the orange-yellow protein-rich pulp.

Habitat: Plants trap sand and form hummocks; part of several plant communities consisting of Cladopholis spinosa (L.F.) S.M.Phillips or Tamarix usneoides E.Meyer ex Bunge or Sesuvium sesuvioides (Fenzl.) Verdc. or Acacia crioloba E.Meyer. These plant communities are typical for dune areas in or along rivers (availability of subterranean water); soil: sand.

Distribution: Central and Northern Namib; large stands in the dunes along the lower Kuiseb (between Gobabeb and Rooibank) and in the delta area of the Kuiseb (inara fields); large stands in the Unibab valley and Munutum valley; between the Eno and Kunene: large field in poor condition.

Uses: Archaeological studies indicate that the Inara has been a food for humans living in the Namib desert during the past 8000 years. Sandlewsky (1990) discovered Inara seed coats of 8000 years ago at Mirabib Hill Shelter in the central Namib desert. The patterns of breakage on the seed coats closely resemble those observed on seed coats collected from the yards of present day Topnaar houses.

In the past the Inara was the staple food of the Topnaar living in the lower Kuiseb valley, therefore also called Inarnin (people of the Inara). Now the Inara still plays an important role in the diet of the Topnaar.

The Inara bushes grow in the sand dunes south of the Kuiseb river and close to the coast. This is the area where fog coming from the sea (cold Benguela current) is an important factor in the water balance of the vegetation.

The harvesting season of the Inara lasts from about November till May. Many Topnaar families still move to the Inara fields for some months to harvest and process the Inara fruits locally. When the fruits are ripe, they are collected and buried in the soil or put in the sun for a few days to make them softer.

For the traditional preparation, the fruits are peeled and boiled for some hours, until the pips are released from the pulp and the pulp becomes deeply orange and thick. Then the pips are separated from the pulp by sieving the soup. The pips are dried in the sun for a few days and then stored in bags. The pips are eaten like nuts or ground and added to dishes. A part of the pips is sold to Walvisbay traders who export them to Cape Town where they are eaten raw (called butterpips) or used in confectionery. The taste is similar to this of almonds and the pips are highly nutritious: they contain 57% oil, which has a high percentage of poly-unsaturated fatty acids and 31% protein. The boiled pulp is pored on the sand or on bags and dried in the sun for a few
days. This dried pulp forms flat cakes called *goakaribeb*. These cakes are chewed or added to porridge. This preparation and drying allows the Topnaar to store the *Inara* for months, and eat it the whole year through.

The fresh fruit can also be eaten raw and has a pleasant fruity taste but contains cucurbitacins which burn in the mouth. Eating the fresh fruit relieves stomach pains. The raw pips, separated from the pulp by rubbing in the sand, are eaten raw or roasted.

The *Inara* is not only an important foodplant. A decoction of the roots is called a life elixir and is used to cure many internal diseases, such as venereal diseases, stomach pains, nausea, kidney problems, arteriosclerosis and chest pains. Therefore also the roots can be chewed. Some people say it cures all diseases and heals you within a day. The crushed root, mixed with fat is rubbed on wounds to hasten healing.

Oil from the raw or boiled pips is used to moisturize the skin and protect it from sunburn. For this treatment the pips are ground in a mortar and this mixture is rubbed on the skin. The pieces of seed coats and pips are wiped off afterwards.

The peels of the fruit are fed to donkeys and goats and the pips to chicken (K).

*Citrullus ecirrhosus* Cogn. (see fig. II.17)

**Nama** tsamab

**Common names** tsama melon, bitter apple (E), bitterappel (A)

**Description** Few branched perennial creeper, not climbing, without tendrils; ovate leaves, short stalked, deeply 3-5 lobed, till 8 cm long, only stiff white hairs on veins of upperside, underside densely hairy; male and female flowers, solitary, axillary, yellow, inferior ovary; spherical fruit, about 8 cm in diameter, dark green striped, many-seeded, bitter

**Habitat** Washes in gravel plains; soil of fine gravel.

**Distribution** Central Namib.

**Uses** The seeds are roasted and eaten. The pulp is inedible (K).

*Figure II.17: Citrullus ecirrhosus* (Craven & Marais, 1986)
Coccinia sp. WIGHT & ARN.

Nama /hâb

description Perennial, herbaceous climber with a tuberous rootstock; simple tendrils; sessile or stalked leaves, pentagonal to 3-7-lobed; unisexual flowers, dioecious plant, flowers yellowish, female flowers solitary, male flowers solitary or clustered; fruit spherical to ellipsoid, red when ripe, till 9 cm long, many-seeded.

uses The tubers are roasted and eaten (S).

99 Combretaceae

Combretum imberbe WAWRA [VdE 24.6.c]

Nama /hâs

Common names leadwood (E), menshout, hardelkoolboom (A)

Description Large tree up to 20 m high, bark grey-brown, rough; opposite leaves, ovate-elliptical to obovate, scaled on both surfaces; greenish-yellow tetramerous flowers, also scaled on the outside, in racemes; fruit 4-winged legumes, greenish-yellow, 1.5-2 cm in diameter, 1-seeded.

Habitat Sandy soil, near washes, together with Acacia tortilis (FORSKAL) HAYNE subsp. heterocentha (BURCHELL) BRENNAN.

distribution Plain around Sesfontein.

uses A decoction of the leaves is drunk to relieve chest pains (S).

Terminalia prunioides LAWSON [VdE 23.6.a]

Nama /khâas

Common names sterkbos, hardekool, deurmekaar (A)

Description Bush or tree up to 9 m high; stalked leaves, grey-green, short hairy on both sides, oval to obovate, 2.5-1.2.5 cm; pentameroius flowers in racemes; red-brown 2-winged flattened fruits, about 3.5 by 6 cm, 1-seeded.

Habitat Between rocks, on scree.

distribution Mountains near Sesfontein.

uses The Topnaar of Sesfontein drink a decoction of the roots or chew the roots to cure colds. The leaves are added to tea to improve its flavour. The wood is used as a fuel.

107 Ebenaceae

Euclea pseudoebenus E. MEYER ex.A.DC. [VdE 17.1.b] (see Fig. II.18)

Nama /tsâbis, tswis

Common names black ebony, cape ebony (E), swartebbe, basterebbehout (A)

Description Tree 3-9 m high with pendant branches; young twigs and leaves pubescent hairy; linear leaves, ten times longer than wide, 30-50: 2.5-5 mm, hairless, alternate; white-yellowish flowers in small axillar racemes, female flowers often smaller than the male ones, K(4-5)C(4-5)A10-20G(2-6); fruits spherical fleshy berries, 4-8 mm in diameter, 1-seeded.
**Habitat** Typical tree for riverbanks and old riverbeds, mostly forming a plant community together with *Acacia albida* DEL. and/or *Acacia erioloba* E.MEYER.

**Distribution** Along all rivers.

**Uses** The wood of this tree is used as fuelwood, for the construction of houses and kraals and in the manufacture of utensils (K,S). The roots are chewed to clean the teeth. The leaves are browsed by livestock, the berries can be fed to chickens (K).

*Figure II.18: Euclea pseudoehneus (Craven & Marais, 1986)*

109 Loganiaceae

*Strynchos sp.* L.

**Common names** kaffir orange (E), klapperboom (A)

**Description** Tree up to several meters high, with or without thorns in the leaf axils; opposite leaves, sessile to shortly stalked, simple, entire margins, stipules reduced to a bulge on the nodes; very small actinomorphic flowers in axillar or terminal cymes; fruit a spherical, fleshy, many-seeded berry, 6-12 cm in diameter, with a thick, woody, orange outer shell.

**Uses** The pulp of the fruits is eaten raw. The seeds are extremely toxic (strychnine) (S).

113 Periplocaaceae

*Curroria decidua* Planchon ex Hooker Fil & Bentham [VdE 23.6.b]

**Nama** arhaib, hinis

**Common name** bokhorinkie (A)

**Description** Upright shrub, red brown branches; opposite, lanceolate leaves, 30-50:5-20 mm, in clusters; greenish-white-violet, inconspicuous flower, 4-10 mm long, solitary or grouped, axillar; fruits solitary or paired follicles, 7-10 cm long, 6-9 mm wide.

**Uses** A decoction of the roots is given to rabid dogs.
114 Asclepiadaceae

Fockea augustifolia K. SCHUM
Nama ≠hawab, ≠hapab
Common name water root kamboo (E)
Description A semi-erect perennial herb with slender, twining, simple, hairy stems arising from a large tuber; simple opposite leaves, linear-lanceolate, hairy; small, creamy flowers in axillary clusters; fruit a brown mottled follicle, many flat seeds with a marginal wing.
Uses The tubers are roasted and eaten. They contain much water (S).

Hoodia currori (HOOKER) DECKE (see fig. II.25)
Nama ≠khowa, ≠khobab
Description Succulent, leafless plant with 12-18 ribbed, straight stem, 10-20 cm high and 2.5-10 cm thick, conical thorns on the ribs; grey-purple flowers on long peduncles, corolla hairy (2-4 mm long hairs) and papillose at the inside, triangular corolla-lobes, corina present; fruits paired follicles.
Habitat In rock crevices; sometimes on scree and fine gravel in mountains.
Distribution Vogelfederberg, mountains along the Swakop River.
Uses The stems are eaten raw after the removal of the outer skin and thorns. Eating this lowers high blood pressure, cures colds and indigestion and relieves stomach pains. The flesh is applied on the eyes to relieve eye pains. Pieces of the stem added to sugarwater give a refreshing drink (K,S).

Orthanthera albida SCHINZ [VdE 3.4.a] (see fig. II.22)
Nama larib
Description Non-succulent shrub, erect, hairless grey-pruinose stems; linear-lanceolate leaves, 3-50-1.2 mm, reduced to scales or falling when flowering; greenish flowers, in sessile pseud umbels, corolla tube 5 mm long, corolla lobes 2.5-3 mm long, corona present; fruit a green follicle, black marbled, beaked, 10.1-2.5 cm, many seeds with long white hairs.
Habitat Washes on gravelplains and in mountains.
Distribution Common in the Central Namib, less common in the Northern Namib.
Uses The stems are chewed to clean the teeth. Drinking a decoction of the stems or chewing the stems relieves stomach pains. For the same reason roots can be used. A decoction of the ground seeds is drunk to cure kidney and back diseases. The root is put in beer to improve its flavour (K). The fruits are eaten, mainly by children. Young fruits are eaten completely, from old fruits only the inner part of the peel is eaten (the outer part and the seeds are removed) (K,S).

Pergularia daemia (FORSK.) CHiov. var. daemia [VdE 14.2.d, VdE 6.2.e] (see fig. II.20)
Nama īgubib, īgwib, dāigubib, īgūtana || īb
Description Strong herbaceous twiner with milky latex, often covering shrubs and trees; stems covered with 1 mm or longer hispid erect hairs; opposite leaves, simple, heart-shaped, 2-12 cm long; greenish-white flowers in axillary pseudo-umbels; green corolla, 10 mm long; double white
corona, at base of staminal column, ending in five horns; fruits paired follicles, 5-8 cm long, 1 cm in diameter, with short fleshy prickles, tapering into a long beak, many seeds with long white hairs.

**Habitat** Climbing in scrubs on riverbanks and old riverbeds.

**Distribution** Very common in the Kuiseb; also in Swakop, Ugab, Koigab, Uniab, Hoanib and Hoarib.

**Uses** Latex added to drinking water poisons this water and can therefore be used to kill all animals. A decoction of the roots is drunk to cure venereal diseases and vein problems. The powder obtained by roasting the root (or leaf) and grinding it, is applied on wounds (K). In cases of backache, incisions are made in the back and ground root is introduced in these incisions (S).

**Pergularia daemia** (FORSK.) CHIOV. var. leiocarpa (K. SCHUM.) H. HUBER [VdE 11.5.f] (see fig. II.20)

**Nama** lgbib, lguwib, dai-lgubib, lgb̩am ḳh

**Description** cf. *P. daemia* var. *daemia*. Smaller leaves, 1.5-6 cm long; stems hairless or covered with short 0.5 mm long bristly hairs.

**Uses** see *P. daemia* var. *daemia*.

**Trichocaulon pedicellatum** SCHINZ (see fig. II.19)

**Nama** lgoab

**Description** Succulent, leafless plant with 12-30 ribbed short columnar stem, higher than 10 cm, with 1-3 mm long thorns on the ribs; stalked flowers in clusters on the top of the stem, dark red-brown corolla, inside papillose, hairless, triangular corolla lobes, double corona; fruits follicles.

**Habitat** Mountains: crevices, between rocks, on scree.

**Distribution** Common on Swartbankberg and Vogelfederberg.

**Uses** Same uses as *Hoodia currori*, butter very bitter (K).

120 Boraginaceae

**Cordia gharaf** (FORSK.) EHRENB ex ASCHERSON [VdE 20.6.a]

**Nama** laes, ḳhās

**Description** Shrub or small tree, opposite to alternate leaves, elliptic-ohovate, obtuse, 3-10:1.5-5 cm, with very short hirsute hairs; white-pink flowers in terminal cymes, tubular; fruit an elongated elliptical drupe, ca 1 cm long, orange, surrounded by the persistent calyx.

**Uses** The fresh fruits are eaten (S).

123 Lamiaceae

**Ocimum canum** SIMS [VdE 8.2.c]

**Nama** ḳammb, lgaubeb, ḳaubāb

**Description** Annual herb, woody at base, quadrangular stem, 20-30 cm high; linear-lanceolate leaves, opposite, 1-4.5 cm long, pleasant fresh odour; pink-violet labiate flowers in whorls, upper corolla lip 4-lobed, lower lip not lobed; fruit a nutlet.
Habitat: As ephemeral plant growing on riverbanks and in new riverbeds after flood or sufficient rain.

Distribution: Very common in Kuiseb.

Uses: The leaves give a fresh flavour to tea. The crushed roots are used as a body powder (K).

124 Solanaceae

Datura innoxia MILLER [VdE 19.8.e]

Nama: lõhis

Common names: thorn apple (E), stinkblaar (A)

Description: Herbaceous much-branched plant, 1 m or higher; large ovate leaves, irregular margins; long white flowers, solitary in axis, corolla to 20 cm long, funnel form; fruit a spiny ovate capsule, 4-valved, pendant, numerous black seeds.

Habitat: Common alien in new riverbeds and on riverbanks, often also on old riverbeds. Soil: sandy, often with silt; sometimes in marshes; resistant to relative high concentration of salts (e.g., in Sesrusvlei Datura innoxia MILLER forms a monospecific stand on the most salty places).

Distribution: In all river valleys.

Uses: A warm leaf can be put on sores in the armpit to draw out pus (S).

Lycium cinereum THUNB. [VdE 17.4.b]

Nama: lõnis

Common names: thorny shrub, covered with sessile glands, grey bark; linear-spathulate leaves clustered on shoots, 15-2 mm; tubular flowers solitary or in clusters, white-pinkish, K(4)[C(4) A2+2][G1, tender calyx tube, corolla 5-10 mm long, anthers and style rise above the corolla tube; fruit a red berry.

Habitat: Common in coastal depressions (e.g., Dorob) and in vleis (e.g., Gui-uin) with silty soils, rich in salts. Sometimes along rivers.

Distribution: Delta of the Kuiseb, Dorob, Gui-uin, along the lower Kunene.

Uses: All parts of the shrub (flowers, leaves, twigs and roots) can be dried and crushed. This powder is used as a body powder. The crushed twigs are worn under the clothes for their pleasant smell (K).

Nicotiana glauca R. GRAHAM [VdE 18.4.k]

Common names: blue-green nicotiana (E), wilde tabak (A)

Description: Shrub or small tree; stalked oblong to ovate leaves, bluish-green, up to 10 cm long; greenish-yellow tubular flowers in terminal panicles, cup-shaped calyx, 10-12 mm long, tubular corolla, 30-45 mm long, ending in short, obtuse lobes; fruit a 2-valved capsule with many minuscule seeds.

Habitat: In new and old riverbeds and on riverbanks; often together with Tamarix usneoides E.MEYER ex BUNGE, Acacia albida DEL. and Acacia ecrioloba E.MEYER; soil: sand and silt.
Figure II.19: *Trichocaulon pedicellatum*
(CRAVEN & MARAIS, 1986)

Figure II.20: *Pergularia daemia* (FOX & NORWOOD YOUNG, 1982)

Figure II.21: *Aloe dichotoma*  
(PALGRAVE, 1990)
Distribution  Common in most riverbeds (especially in the Kuiseb, Swakop and the Ugab).

Uses  Warmed leaves are put in shoes in case of painful, tired feet; put on the throat to relieve throat pain or put on the head to relieve headache. A boiled leaf, put onto sores and pimples, draws out pus. If children have mumps, a warm leaf is put on the swollen cheek and this is covered with a compress in order to reduce the swelling. The branches are used for the construction of houses, kraals and fences. It is a very strong construction material (K).

*Solanum inanum* L.

**Nama**  soropas

**Common names**  bitter apple (E), bitterappel (A).

**Description**  Shrub, about 1 m high; oblong-elliptic leaves, 5-18:3-10 cm, undulate margins, densely covered with white tomentose stellate hairs above, sparsely under; twigs, petioles and calyx are thorny; lilac flowers solitary or clustered, pentamerous; fruit a yellow berry; 2-3 cm diameter.

**Uses**  A decoction of the root is drunk to treat venereal diseases and urinating problems (S).

*Withania somnifera* (L) Dunal  [VdE 21.6.k, VdE 17.4.c]

**Nama**  Il aume

**Common names**  bitterappeliefe, genesiebaar, vuilsiktebos (A)

**Description**  Herb to shrub, erect up to 1.5 m high, covered with stellate hairs; oblong-ovate leaves, 3-15 cm long; flowers in axillary umbels, cup-shaped flowers; spherical red berries, enclosed in a bladder-like inflated calyx.

**Uses**  The berries are used as beads. The ground root is sniffed to cure nose cancer (S).

126 Scrophulariaceae

*Sutera corymbosa* (Marloth & Engler) Hiern  [VdE 23.6.j, VdE 23.3.j]

**Nama**  blohmabain

**Description**  Annual or perennial shrub, glandular; opposite stalked leaves, ovate-round, dentate margins; pink-lila tubular flowers, zygomorphous, in cymes; fruit an ovate capsule.

**Uses**  A decoction of the roots is drunk to relieve all body pains. The roasted, ground root is applied on burns (S).

128 Bignoniaceae

*Cataphractes alexandri* D.Don  [VdE 24.6.h]

**Nama**  lgawas, lgabas

**Common names**  swartdoring, skaapbos (A)

**Description**  Shrub about 2 m high, densely white-tomentose, some axillary branches spinescent; simple leaves, obovate-oblong, 1-3:0.4-1 cm, serrate to crenate margins; solitary, white flowers, perianth tube about 7 cm long, round lobes about 2-3 cm long; fruit an oblong-elliptical capsule, warty surface, woody, 4-8 cm long, 2 cm wide; long-pilose, winged, flat seeds.

**Habitat**  Among rocks, on scree.
Distribution Hils and mountains around Sesfontein.

Uses A decoction of the bark of branches and roots is drunk or the bark is chewed to cure colds (S).

130 Acanthaceae

Monochma sp. Hochst [VdE 23.6.e]

Description Small shrub, oblong leaves in clusters, cystolithes on the leaves; zygomorphous, flowers in spikes or solitary in the leaf axes; fruit a dehiscing capsule with 2 valves, containing 1 or 2 seeds.

Uses A decoction of the roots is drunk to relieve general body pains (S).

Ruellia diversifolia S. Moore [VdE 21.6.e]

Nama l'golmgomme'hib

Description Woody herb, glandular; opposite ovate leaves; red zygomorphous tubular flowers, solitary; 5 spathulate sepals, inequally long, corolla labiate; fruit a linear capsule, containing 18-32 seeds.

Habitat Mountains: among rocks and scree, in washes; sometimes on riverbanks.


Huarosib: on the riverbanks, in the hills: washes.

Uses Honey can be sucked out of the flowers (S).

131 Pedaliaceae

Harpagophytum procumbens (Burchell) DC ex Meissner

Nama || khuripe || kham

Common names grapple vine, devil's claw (E), duiwelsklou (A).

Description Perennial creeper, succulent roots and potato-like tubers; stalked leaves, oblong-ovate, pinnately lobed, under densely, above sparsely covered with glandular hairs; solitary pink-purple flowers, axillary, corolla 5-7 cm long; fruit an ovate, flat capsule, 2-locular, 2 rows of 8 cm long thorns with strong bars; many long dark brown seeds.

Uses A decoction of the tubers is drunk or else the bulbs are chewed to relieve stomach pains and post-natal pains. Before gathering the tubers, a needle or button is put in the soil to 'buy the tubers from the earth', the believe is that one will not find tubers otherways (S).

Rogeria longiflora (Royen) D. Gay ex DC. [VdE 7.2.m] (see fig. II.23)

Nama d'aulanab, || gamlawib

Description Annual herb, up to 2 m high; large leaves, rhombic-triangular, 5x15 cm long and wide, tortuous serrate margins, underside covered with glandular hairs; large yellowish-white flowers, 5-6 cm long, in axillary cymes per 3 to 7, spurred; fruit a woody capsule, 4-6 cm, with 2 big cone-shaped thorns, dehiscing.
Habitat: Riverbeds, washes and in mountains.

Distribution: Common in the Kuiseb, also in the Swakop In the mountain range of Peak 16.

Uses: The roasted and ground seeds, sometimes mixed with fat, are applied on wounds to stop bleeding. This is also rubbed on burns to provide relief. Warmed leaves are put on the breasts to cure cracked nipples (K).

139 Asteraceae

Antiphona fragrans (MERXM.) MERXM. [VdE 23.6.I]

Nama: doebaloabe

Description: Shrub or halfshrub, glandular; alternate leaves, double pinnately parted; flowerheads solitary, homogamous; involucre inverted cone-shaped, many rows of linear-lanceolate bracts; tubular, bisexual flowers, yellow-purple, pappus composed of numerous yellowish bristle-hairs of unequal length.

Habitat: Among rocks, on scree.

Distribution: Mountains around Sesfontein.

Uses: A decoction of the whole plant is drunk to relieve chest pains. The dried, ground leaves are used as a body powder (S).

Aspilia eeuii S. MOORE [VdE 5.4.I] (see fig. II.26)

Nama: damadawib

Description: Herb to 1 m high, densely hispid haired; opposite leaves, lanceolate up to 12 cm long and 1-1.5 cm wide, covered with short hispid hairs; yellow flowerheads ca. 3 cm in diameter, solitary, terminal, heterogamous; involucre of 3 rows ovate-lanceolate bracts; shaffy bracts, black striped on the receptacle; ray flowers linguiform, infertile; disc flowers black striped, bisexual, pappus with dentate scales and 2-3 bristle-hairs.

Habitat: Riverbeds and riverbanks, rare in washes.

Distribution: Kuiseb, Swakop, Hoanib, Hoarusib.

Uses: The root may be put in milk to induce curdling and to improve its flavour (yoghurt) (K).

Blumea decurrens (Vahl.) MERXM. [VdE 2.4.e]

Nama: tunub

Description: Halfshrub, densely silvery haired, tomentose; winged stem; alternate, sitting leaves, oblong-lanceolate, up to 3 cm long and 5 mm wide, entire margins; yellow flowerheads, in terminal panicles, heterogamous; rigid involucral bracts; whitish, filiform ray flowers; disc flowers tubular, yellow, bisexual, caudate anthers, pappus composed of many bristle-hairs.

Habitat: Riverbeds and riverbanks, rare in washes.

Distribution: Kuiseb, Swakop, Uniab, Hoanib, Hoarusib.
The roasted and ground seeds of *Rogeria longiflora* (Royen) J. Gay ex DC. (*dában*, *gam-a-wíb*), mixed with fat, are applied to wounds and burns. Warmed leaves are put on breasts to cure cracked nipples.

*Orthanthera albida* Schinz (*garib*) stems are chewed to clean the teeth. Drinking a decoction of the stems or chewing the stems relieves stomach pains. A decoction of the seeds is drunk to cure kidney and back diseases. The fruits are edible.

*Figure II.22: Orthanthera albida*

A decoction of the leaves of *Pechnel-Loeschen leuhnitza* (O. Kuntze) O. Hoffm. (*lautsilkhanner*) is drunk to treat gonorrhoea, fever, colds, chest and stomach pains. The same decoction is used externally for the treatment of measles, sores and skin disorders and for the disinfection of wounds. The vapour is inhaled to cure colds and coughs. A decoction of the root is drunk to cure TB.

*Figure II.24: Pechnel-Loeschen leuhnitza*
Uses A decoction of the leaves or the roots is drunk to relieve stomach pains. This extraction is also used to wash the body; it acts against acne. The leaves are put in the shoes to relieve painful feet. The branches were in the past used for the construction of huts and are now still used to cover the roof (this makes the roof impermeable) (K).

Helichrysum tomentosulum (KLATT) MERM. ssp. aromaticum (DINTER) MERM.

Nama lurueb
Description Halfshrub, much branched, woolly tomentose haired; linear-lanceolate alternate leaves, entire margins 10-50:2-10 mm; cylindrical flowerheads, clustered, homogamous; white-reddish bracts in several rows; yellow, bisexual disc flowers, pappus composed of one row, shortly dentate bristle-hairs.

Uses The dried, ground flowerheads are used as a perfume (S).

Kleina longiflora DC.

Common names sambokbossie (A)
Description Halfshrub, 60-75 cm high; erect, succulent stems, ribbed when dry; leaves slightly succulent, oblong to lanceolate, 50-3-4 mm, deciduous; headflowers homogamous, no ray flowers, 5-6 red disc flowers.

Habitat Among rocks, mostly in calcareous conditions, sometimes on granite.
Distribution Common near the Swartbankberg
Uses A decoction of the stems is drunk to relieve tooth pain and headache (K).

Peckuel-loeschea leubnitziae (KUNTZE) O. HOFFM. [VdE 9.2.a] (see fig. II.24)

Nama outsikhanneb
Common names bitterbush, stinkbush (E), bitterbos (A)
Description Shrub up to 2 m high, fine grey pubescence; alternate linear-lanceolate leaves, sitting, grey-green, entire margins, numerous lilac flowerheads in leafy panicles, heterogamous; involucres imbricated with several rows of bracts; 1 row of ray flowers; bisexual disc flowers, pappus one row of bristle-hairs.

Habitat Old riverbeds; soil: sand and silt; forms plant community with Acacia erioloba E.MEYER and Tamarix usneoides E.MEYER EX BUNGE, often part of a plant community with Zygophyllum stapfii SCHINZ.; monospecific stands on degraded soils in Koakoland.

Distribution Throughout the whole Namib.
Uses This plant is used medicinally in different ways. An extract of the leaves is drunk to treat gonorrhoea, fever, colds, chest and stomach pains. The extract is also used cutaneously for the treatment of measles, sores and skin disorders and for the disinfection of wounds. The extract may also be heated to produce vapour. The patient both exposes his body to the vapour as well as inhales it to cure colds and coughs and to treat skin disorders. The crushed fresh or dried leaves are applied to wounds. Warmed leaves are applied to relieve painful, tired feet and are also applied on the head as a treatment for headaches. An extraction of the root is drunk to cure tuberculosis (K).
**Senecio marlothianus** O. Hoffm.  [VdE 4.4.g]

**Nama** /gât/gaub

**Description** Herb to halfshrub, tomentose pubescent; alternate leaves, obovate-lanceolate, serrate to entire margins; solitary flowerheads on very long, leafless stalks (10-25 cm), homogamous, yellowish-white; cylindrical involucre 1 row of free bracts; disc flowers bisexual, pappus composed of numerous long, white hairs.

**Habitat** Riverbanks and new riverbeds; soil: silty sand.

**Distribution** Very common in the riverbed of the Kuiseb. Also in Tsauchab and Swakop.

**Uses** The root is added to home-brewed beer (made from corn) to flavour it. The root is wrapped in a cloth, put in the sun, crushed and then added to the beer (K).

---

**Tagetes minuta** L.  [VdE 2.4.d, VdE 18.4.k]

**Common names** stinkbos, kokiebos (A), khaki bush (E)

**Description** Annual herb, native from south America, pungent smell; opposite leaves (the uppermost leaves alternate), pinnate, linear-lanceolate leaflets, serrate margins, covered with oil-glands; small yellow flowerheads in terminal umbelliform panicles, heterogamous; small, cylindrical involucre, fasciated, with linear oil-glands; 2-3 ray flowers, whitish-yellow; 2-4 disc flowers, yellow, tubular, bisexual; pappus composed of some unequal subulate scales.

**Habitat** New riverbeds; soil: sand and silt.

**Distribution** Kuiseb: riverbed.

**Uses** The leaves can be added to tea to flavour it. The dried, ground leaves are also used as a perfume (K).

---

147 Liliaceae

**Aloe asperifolia** A. Berger (see fig. II.27)

**Nama** /akoreb

**Description** Succulent, stemless plant; leaves in rosettes, lanceolate, falcate, 15-25:4-7 cm, grey-green, serrate margins, stipules 3-4 mm wide; scarlet flowers in racemes, 20-25 cm long, tubular perianth, 28 mm long, straight or bent, 6 tepals; inflorescence branched or not, 70-80 cm high; fruit a capsule.

**Habitat** Mostly on calcareous mountains in the Central Namib: on scree, in washes, sometimes forming large stands; often together with *Euphorbia guiesii* LEACH.

**Distribution** Swartbankberg, Hamiltonberge, Witpoorterge, further north on small calcareous outcrops.

**Uses** A decoction of the leaves is drunk to treat arteriosclerosis, kidney problems, asthma, epilepsy and colds. The decoction is drunk by people and livestock to induce discharge of the afterbirth. The decoction is also given to donkeys when they have eaten poisonous plants. The leaves are chewed or a decoction of it is drunk for the relief of stomach and chest pains. A leaf is put in the drinking water of chickens should they suffer from a disease, whose symptoms consist
of falling and paralysis (K).

*Aloe dichotoma* Masson (see fig. 11.21)

**Nama** || *garab*

**Common names** kokerboom (A), quiver tree (E).

**Description** Tree up to 6 m high; stem at ground level up to 1 m or more in diameter; smooth bark; leaves in rosettes, 25-35 cm long, 5 cm wide, triangular, acute, bluish-green, serrate margins; yellow flowers, fleshy, to 35 mm long, flower heads branched; spikes, ca. 30 cm long.

**Habitat** Mountains in the pro-Namib; on scree, in crevices and in washes.

**Distribution** Kuiseb: canyon, escarpment (Schlesien, Gamsberg, ...), Witpoortberge, Spitzkoppe, Brandberg.

**Uses** A decoction of the root is drunk to treat tuberculosis (K).

*Aloe hereroensis* Engler

**Nama** *akorab*

**Description** Stemless plant or short stem, erect or horizontal; leaves in rosettes, 30 cm long, 6 cm wide, triangular-lanceolate, acute, grey-green, underside white spotted, serrate margins, teeth 3-4 mm long, brown; inflorescence much-branched, up to 1 m high, short panicles; flowers yellow-red, 25-35 mm long.

**Habitat** Mountains: on scree, in crevices and in washes.

**Distribution** Brandberg, mountains around Sesfontein, further north: range of Peak 16.

**Uses** A decoction of the leaves is drunk as a remedy for chest and heart pains. The same decoction is given to dogs to treat rabies (S).

149 Tecophilaeaceae

*Walleria nutans* Kirk

**Nama** || *nūs*

**Description** Singular, annual stem, sometimes branched, 10-40 cm high; yellow-white potato-like tubers, 4 cm in diameter; lanceolate leaves, sometimes main nerves of underside and stems covered with small unicate prickles; solitary, lavender blue, axillary flowers, yellow anthers converging in a cone (potato-like flower).

**Uses** The tubers are roasted in hot ashes and eaten whole or stamped. This is very filling foodstuff and available for 10 months per year (S).

160 Poaceae

*Setaria verticillata* (L) Beauv. [VdE 18.6.a]

**Nama** *soreb*

**Common names** bur-bristle grass (E), klitsgras (A).
The stem of *Hoodia currori* (Hooker) Decne (*ikhoab*) is edible and very refreshing. Eating this lowers high blood pressure, cures colds and relieves stomach pains and indigestion.

The *Aspilia emii* S. Moore (*damadita*) root is put in milk to curdle this and improve the flavour.

A decoction of the leaves of *Aloe asperifolia* A. Berger (*aukoreb*) is drunk to cure arteriosclerosis, kidney problems, asthma, epilepsy and colds; induce the discharge of the afterbirth and to relieve stomach and chest pains.
Description  Tender, bright green, tufted annual, up to 1.2 m high, erect or geniculate, sometimes developing roots from the lower nodes; leaf-blad up to 25 cm long and 22 mm wide, hairy; ligula a fringe of short hairs; leaf-sheaths flattened or keeled; inflorescence a dense, spike-like panicle, up to 16 cm long, purple-green, spikelets up to 2 mm long, light green; spines at the bases of the spikelets with fine, tooth-like projections.

Habitat  Forms small bushes on riverbanks; mountains: washes.

Distribution  Mountain range of Peak 16.

Hoarusib, Hoanib, Swakop, Kuiseb and Tsauchab.

Uses  The seeds are ground and boiled in water, milk or fat to a porridge (S).

161 Arecaceae

*Hyphaene petersiana* Klotzsch

Nama  *lunib*

Common names  makalani palm, ivory palm, dum palm, real fan palm (E), opregte waaiertaal-palm (A)

Description  Unbranched dioecious palm tree, 20 m high or more, swollen in the middle; palmately compound leaves, 40-60 leaflets of 1.5-2 m long, black curved spines to 1 cm long on the rachis; inflorescence a much-branched panicle, borne in a spathe, to 2 m long, small male flowers, 6 stamens; larger female flowers, connate staminodia, 3 carpels, 3 stigmas; fruit a spherical, dark brown drupe, 5-7 cm in diameter, fibrous mesocarp, large ivory-like central endosperm.

Habitat  Introduced, common on riverbanks and old riverbeds.

Distribution  Along the Kunene, Hoarusib and Swakop.

Uses  The sweet fibrous mesocarp is eaten. The leaves are used to cover roofs. The leaves, divided into thin strips, are used for weaving all kind of baskets (S).

*Phoenix dactylifera* L.

Common names  dadel (A), date palm (E)

Description  A dioecious tree up to 30 m high, erect unbranched cylindrical stem covered with the remains of old leaf-bases, very large leaves, pinnate, long linear-lanceolate leaflets, acuminate at the apex, irregularly spaced in 2 rows, entire margins; small, white flowers in axillary, multi-branched spadices; fruit an ovoid, fleshy drupe (date) with one furrowed stone.

Habitat  Old riverbed.

Distribution  Planted in the lower Kuiseb and in Sesfontein.

Uses  The fruits are eaten fresh or dried (S,K). A decoction of the roots is drunk to treat tuberculosis (K). These trees were planted in the past by the Germans, but have gone wild and multiplied since then.
165 Cyperaceae

*Cyperus marginatus* Thunb.  [VdE 19.6.c, VdE 23.3.c, VdE 8.2.f, VdE 12.5.c]

**Nama**  | harub

**Description**  
Perennial grassy herb; woody rhizome; cylindrical leafless stem, 30-90 cm high; small, inconspicuous flowers arranged in spikelets, 6-25 mm long and 2.5-3 mm wide, clustered per 1 to 10; finger-shaped or clustered spikelets, forming a spear; 2-32 bracts per inflorescence; fruit a one-seeded triangular nut.

**Habitat**  
Moist places in riverbeds.

**Distribution**  
Riverbeds of Kuiseb, Swakop, Ugab, Uniab, Hoanib, Hoarusib and Kunene.

**Uses**  
The stems are used to cover roofs (K,S).

*Cyperus sp.* (C. fulgens C.B. Clarke or C. usitatus Burch.)

**Nama**  | hanni

**Common name**  
uintjie (A)

**Description**  
Annual or perennial grassy herb; subterrestrial stolons ending in bulbs of 8-25 mm in diameter; 10-60 cm high stem with leaves as long as or longer than the stem; flowers arranged in spikelets with winged axes, 6-25 mm long; inflorescence a spear, bracts as long as or longer then the spear.

**Uses**  
The bulbs are eaten raw or boiled (S).

*Cyperus rotundus* L.  [VdE 19.6.h]

**Nama**  | laren, larebes

**Common names**  
nut-grass (E), uintjie (A)

**Description**  
A herb about 30 cm high, slender, woody rhizomes ending in small, nut-like tubers, edible; leaves 3-6 mm wide; flowers arranged in spikelets, 10-20 mm long and 2 mm wide, winged spikelet-axes, inflorescence a spear, 3-8 radiated.

**Uses**  
The dried, ground tubers are used as a perfume (S).

4.1.3 Unidentified Plants

Because of the drought, some plants (mostly annuals) could not be found in the field. Only the Nama name of these plants is known and their uses. Also the scientific name could not be found in literature starting from the Nama name. These plants are listed in alphabetic order on name.

The order for the clicks is 1, 2, 1, ±.

*aib*

The root is put in milk to curdle it and improve its flavour (K).

*aibaib*

A small shrub with red twigs. A decoction of the root is drunk to treat liver disease (S).

*anto*

Large tree with large, oval leaves. The wood of this tree is used for carving (S).
aueb, aub

Large tree, oval opposite leaves, entire margins. A decoction of the ground root or wood is drunk to relieve stomach pains (K,S) and to treat coughs, heart diseases and lack of appetite (S). The root is put in home-brewed beer for flavouring (K). The ground root is used as a perfume (K). The wood is used for carving (also beads) (S).

*Spirostachys africana?* (Eiseb et al, 1991)

*sapibes*

The raw fruits are eaten. The fruit is composed of 3 or 4 white-brown berries (S).

* básun*

This is a mixture of gras and other seeds, collected by ants and gathered from ant nests. Porridge is boiled from it. Also beer can be brewed from these seeds. Therefore hot water and sugar is added to the seeds and this mixture is then fermented (S).

*Sirin*

The dried, ground stems are used as a perfume (S).

*uiai*

The tubers are eaten raw or boiled. The plant resembles a cornplant (S).

*kaihais*

The ground bark is used as a perfume (S).

*lghirhaisb*

The root, mixed with tea, is boiled. This decoction is given to donkeys who suffer from constipation. The root is chewed or the decoction is drunk to relieve stomach pains and solve constipation (K).

*lhus*

A tree of about 2m high, flaking yellowish-green bark, red bark on young twigs; small rhombic leaves. The wood of this tree is used for carving and furniture (K,S). A decoction of the leaves and bark is drunk to treat heart diseases. The gum (*haïran*) secreted from the branches, mixed with oil or fat is applied on the body as a perfume. The powdery corn wood (*lorai*) is used as a body powder and a decoction of this wood is drunk to relieve post-natal pains and cure intestinal problems. A decoction of the root is also drunk to relieve post-natal pains. The dead, rotten wood (*êgæ*) is used as a body powder and baby powder for boys.

*lotsamab*

The (crushed) root is boiled in water or milk. This decoction is drunk for the relief of stomach pains, intestinal pains, menstruation pains and post natal pains. To relieve these pains the root can also be chewed. The boiled and dried leaf is put into wounds to stop bleeding and hasten healing. The roasted and ground root or whole plant (mixed with fat or vaseline) is rubbed into
to compare medicinal plant uses for different tribes. Table 11.3 will show this clearly.

Of the 42 plants species listed in table 11.3, 18 are not cited in the literature covered. Most other species are used for similar or the same purposes. Some of the ‘Topnaar’ species look promising because they are often cited by several Topnaar communities both in the Kuiseb and Sesfontein area.
Table II.3: Comparison between Plant Use by the Topnaar (Author’s Findings) and Other People in Southern Africa and Some Other Areas (Literature). Plants are Listed in Alphabetical Order (Latin Name).

<table>
<thead>
<tr>
<th>Plant Name — family</th>
<th>Use by the Topnaar [used plant part]</th>
<th>Use in other countries/areas (tribe) [used plant part] (reference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia erioloba — Mimosaceae</td>
<td>cough, TB, colds [gum]</td>
<td>Namibia (Ovambos): swellings [pods], injuries [ashes] (Rudin, 1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Botswana (Moukushi): cough [roots] (Le Roux, 1971)</td>
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<td></td>
<td></td>
<td>Namibia (Himba): cough [roots], diarrhoea, astringent [bark] (Von Koenen, 1977)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Botswana: nose bleeding [roots] (Hedberg &amp; Staagard, 1983)</td>
</tr>
<tr>
<td>Acanthosicyos horrida — Cucurbitaceae</td>
<td>venereal diseases, stomach pains, nausea, gonorrhoea, kidney pains, internal diseases, arteriosclerosis, chest pains [roots]</td>
<td></td>
</tr>
<tr>
<td>Aloe asperifolia — Aloeaceae</td>
<td>arteriosclerosis, kidney pains, asthma, epilepsy, colds, removal afterbirth, stomach pains, chest pains [leaves]</td>
<td></td>
</tr>
<tr>
<td>Aloe dichotoma — Aloeaceae</td>
<td>TB [root]</td>
<td>Namibia (Nama): asthma [root], (Du Pisani, 1983)</td>
</tr>
<tr>
<td>Aloe hereroensis — Aloeaceae</td>
<td>chest pains, heart pains, rabies [leaves]</td>
<td>Namibia (Kaokaland): chest pains, stomach pains, gonorrhoea [juice] (Malan &amp; Owen-Smith, 1974)</td>
</tr>
<tr>
<td>Antiphona fragrans — Asteraceae</td>
<td>chest pains [leaves]</td>
<td></td>
</tr>
<tr>
<td>Arthraerua leubnitziae — Amaranthaceae</td>
<td>tremblings [roots]</td>
<td></td>
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<tr>
<td><strong>Plant Name — family</strong></td>
<td><strong>Use by the Topnaar</strong> [used plant part]</td>
<td><strong>Use in other countries/areas (tribe)</strong> [used plant part] (reference)</td>
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<tr>
<td>Battarea sp. — Basidiomycetes</td>
<td>burns [spores]</td>
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<td></td>
<td></td>
<td>Namibia (Ovambos): colds (ROBIN, 1985)</td>
</tr>
<tr>
<td>Boscia albitrunca — Capparidaceae</td>
<td>carache [leaves]</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Southern Africa: inflamed eyes cattle [leaves], haemorrhoids [roots], epilepsy [fruit] (WATT &amp; BREYER-BRANDWJK 1962)</td>
</tr>
<tr>
<td>Boscia foetida — Capparidaceae</td>
<td>carache, eye pains, stomach pains, colds [leaves, twigs]</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Namibia (Hottentots): emmenagogue, back pains (WATT &amp; BREYER-BRANDWIK 1962; LAIDLER, 1928)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Namibia (Heikum-Bushmen): carache [leaves, twigs] (VON KOESEN 1977)</td>
</tr>
<tr>
<td>Brownanthus kuntzei —</td>
<td>colds, fever, flu, nausea, stomach pains, constipation, tape-worm animals [whole plant]</td>
<td>Namibia (Bergdamara): stomach pains [roots] (VON KOESEN, 1977)</td>
</tr>
<tr>
<td>Mesembryanthemaceae</td>
<td></td>
<td>Namibia (Nama): stomach disorders [root] (DU PISANI, 1983)</td>
</tr>
<tr>
<td>Catophractes alexandri —</td>
<td>colds [bark]</td>
<td></td>
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<tr>
<td>Bignoniaceae</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Namibia (Ovambos): infectious wounds [gum] (ROBIN, 1985)</td>
</tr>
<tr>
<td>Plant Name — family</td>
<td>Use by the Topnaar [used plant part]</td>
<td>Use in other countries/areas (tribe) [used plant part] (reference)</td>
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<tr>
<td>(Colophospermum mopane ctd)</td>
<td></td>
<td>Namibia (Heikum-Bushmen) : diarrhoea [bark] (Von Koenen, 1977)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Namibia (Bergdamara) : stomach pains [leaves] (Von Koenen, 1977)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Namibia (Himba) : stop excessive bleeding, antiseptic [leaves] (Malan &amp; Owen-Smith, 1974)</td>
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<tr>
<td></td>
<td></td>
<td>Zimbabwe : diarrhoea [root] (Gelfand et al., 1985)</td>
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<td></td>
<td></td>
<td>Zimbabwe (Ndebele) : bilharziasis [root] (Gelfand et al., 1985)</td>
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<tr>
<td></td>
<td></td>
<td>Namibia (Ovambos) : stomachache [root] (Rodin, 1985)</td>
</tr>
<tr>
<td>Commiphora krausseliana — Burseraceae</td>
<td>heartproblems, chest pains, cough, colds, palpitations [branches, bark]</td>
<td></td>
</tr>
<tr>
<td>Cullen obtusifolia — Fabaceae</td>
<td>stomach pains, post-natal pains [leaves]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Namibia (Kaokoland) : laxative, venereal diseases, expell afterbirth, prevent constipation [root] (Malan &amp; Owen-Smith, 1974)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Namibia (Ovambos) : madness, calming [root] (Rodin, 1985)</td>
</tr>
<tr>
<td>Plant Name — family</td>
<td>Use by the Topnaar [used plant part]</td>
<td>Use in other countries/areas (tribe) [used plant part] (reference)</td>
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</tr>
<tr>
<td><em>Hoodia currori</em> — Asclepiadaceae</td>
<td>high blood pressure, colds, stomach pains, indigestion, eye pains [stem]</td>
<td>Namibia (Nama): prevent unborn baby from being ill (Du Pisani, 1983)</td>
</tr>
<tr>
<td><em>Laminaria sp.</em></td>
<td>wounds, burns [stem]</td>
<td></td>
</tr>
<tr>
<td>Plant Name — family</td>
<td>Use by the Topnaar [used plant part]</td>
<td>Use in other countries/areas (tribe) [used plant part] (reference)</td>
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<tr>
<td><em>Monechma sp.</em> — Acanthaceae</td>
<td>general body pains [root]</td>
<td></td>
</tr>
<tr>
<td><em>Nicotiana glauca</em> — Solanaceae</td>
<td>painful, tired feet, throat pain, headache, sores, pimples, mumps [leaves]</td>
<td></td>
</tr>
<tr>
<td><em>Orthanthera albida</em> — Asclepiadaceae</td>
<td>stomach pains [stem, seeds, root], kidney &amp; back diseases [seeds]</td>
<td></td>
</tr>
<tr>
<td><em>Parmelia hottentotta</em> — Lichens</td>
<td>cough, stomach pains, chest pains</td>
<td></td>
</tr>
<tr>
<td><em>Pectuel-Loeschea leubnitziae</em> — Asteraceae</td>
<td>gonorrhoea, fever, colds, cough, chest pains, stomach pains, measles, sores, skin disorders, wounds, painful feet, headache [leaves]; TB [root]</td>
<td>Namibia (Kaokoland): gonorrhoea, venereal diseases, skin diseases, mange livestock [leaves] (Malan &amp; Owen-Smith, 1974) Namibia (Ovambos): fever, colds [leaves] (Rodin, 1985)</td>
</tr>
<tr>
<td>Plant Name — family</td>
<td>Use by the Topnaar [used plant part]</td>
<td>Use in other countries/areas (tribe) [used plant part] (reference)</td>
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<tr>
<td><em>Pergularia daemia</em> clt</td>
<td></td>
<td>Southern Africa: expectorant, asthma, rheumatism [juice] (Watt &amp; Breyer-Brandwijk, 1962)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Botswana: venereal diseases, back pain [root] (Hedberg &amp; Staugeard, 1969)</td>
</tr>
<tr>
<td><em>Phoenix dactylifera</em> — Areaceae</td>
<td>TB [root]</td>
<td></td>
</tr>
<tr>
<td><em>Ricinus communis</em> — Euphorbiaceae</td>
<td>mumps, toothache [seeds, leaves]; burns, wounds [seeds], skin diseases, painful knees, painful breasts, throat pain [leaves]</td>
<td>Namibia (Ovambo): styptic [root]; purgative [fruit]; swollen muscles [leaves] (Rodin, 1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southern Africa (Zulu): stomachache [leaf]; purgative [seeds]; toothache [root] (Watt &amp; Breyer-Brandwijk, 1962)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zimbabwe: stitch up wounds, dressing for wounds and sores [bark] (Watt &amp; Breyer-Brandwijk, 1962)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southern Africa (Transvaal Sotho): sores, boils [seeds]; headache, boils [leaves] (Watt &amp; Breyer-Brandwijk, 1962)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Africa: wounds, sores [leaf] (Watt &amp; Breyer-Brandwijk, 1962)</td>
</tr>
<tr>
<td>Plant Name — family</td>
<td>Use by the Topnaar [used plant part]</td>
<td>Use in other countries/areas (tribe) [used plant part] (REFERENCE)</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
</tbody>
</table>
Vietnam: diaphoretic, diuretic *(WATT & BREYER-BRANDWJK, 1962)*  
India: rheuma, lumbago, sciatica, pleurodynia, skin diseases [root, leaf]; fever, jaundice, nervous disorders [root] *(WATT & BREYER-BRANDWJK, 1962)*  
Angola: ulcers, inflammations, analgeticum, external parasites [leaves] *(MENDES DOS SANTOS, 1989)*  
Cabo Verdo: galactogogue [leaf] *(MENDES DOS SANTOS, 1989)*  
Gabon: uterus contraction, galactogogue, emollient [leaf] *(MENDES DOS SANTOS, 1989)*  
Zimbabwe: toothache, pneumonia [root]; abdominal pains, earache [seed]; sprains & strains [leaves] *(GELFAND ET AL., 1985)*  
Zimbabwe (Shona): convulsions, constipation, external parasites, haemostomata in ruminants, measles, depressed fontanelle [seeds]; hiccoughs, cataracts, sore eyes, heart pains [leaves]; bilharziasis, syphilis [root] *(GELFAND ET AL., 1985)*  
Zimbabwe (Ndebele): madness, palpitations [leaves]; diarrhoea [seeds] *(GELFAND ET AL., 1985)*  
Malawi: cause abortion, palpitations, heart pains [leaves]; earache [seeds] *(GELFAND ET AL., 1985)*  
East Africa: abdominal trouble, diarrhoea *(GELFAND ET AL., 1985)*  
Kenya: purgative *(GELFAND ET AL., 1985)*  
Somalia: rheuma, purgative *(GELFAND ET AL., 1985)*  
West Africa: fever, swellings, headache, lactagogue, emmenagogue *(GELFAND ET AL., 1985)*  
South Africa: toothache *(GELFAND ET AL., 1985)* |
<table>
<thead>
<tr>
<th>Plant Name — family</th>
<th>Use by the Topnaar [used plant part]</th>
<th>Use in other countries/areas (tribe) [used plant part] (reference)</th>
</tr>
</thead>
</table>
| *(Ricinus communis* cld) |                                     | Nigeria: chancre *(Gelfand et al., 1985)*  
Zaïre: blennorrhagia *(Gelfand et al., 1985)*  
Ivory Coast: bronchial infections, fever *(Gelfand et al., 1985)*  
Europe: stomach pains, intestinal pains, skin diseases [seed oil] *(Von Koenen, 1977)*  
Burundi: rheuma, laxative, purgative, constipation, tape-worm, abscess, galactogogue *(Baerts & Leimann, 1989)* |
| *Rogeria longifolia* — Pedaliaceae | wounds, burns [seeds], cracked nipples [leaves] | |
Namibia *(Kaokoland)*: diarrhoea livestock, intestinal complaints cattle [root] *(Malan & Owen-Smith, 1974)*  
Namibia *(Bergdamara)*: stomach pains, intestinal pains, diarrhoea [root] *(Von Koenen, 1977)*  
| *Solanum incanum* — Solanaceae | urinating problems, venereal diseases [root] | Namibia *(Kaokoland)*: cuts, abrasions on animals [juice fruit] *(Malan & Owen-Smith, 1974)*  
Namibia *(Bergdamara)*: gonorrhoea [fruit] *(Von Koenen, 1977)* |
<table>
<thead>
<tr>
<th><strong>Plant Name — family</strong></th>
<th><strong>Use by the Topnaar (used plant part)</strong></th>
<th><strong>Use in other countries/areas (tribe) (used plant part) (REFERENCE)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>(Solanum incanum ctd)</em></td>
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<td>Namibia (Heron) : gonorrhoea, external tumors (Von Koenen, 1977)</td>
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<tr>
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<td>Southern Africa (Pedi) : chest troubles, pleuritis, pneumonia (Watt &amp; Breyer-Brandwijk, 1962)</td>
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<tr>
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<td></td>
<td>Southern Africa (Southern Sotho) : toothache, sore throat (Watt &amp; Breyer-Brandwijk, 1962)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>South Africa (Zulu) : ringworm [juice] (Watt &amp; Breyer-Brandwijk, 1962)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tanzania : abdominal pains, liver troubles, carbuncle [root]; snake-bite remedy [fruit]; earache (Watt &amp; Breyer-Brandwijk, 1962)</td>
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<td>Europe : dandruff [juice fruit] (Watt &amp; Breyer-Brandwijk, 1962)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zimbabwe : venereal diseases, diarrhoea, pneumonia, oedema [root]; constipation, headache, backache (Gelfand et al, 1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zimbabwe (Shona) : painful menstruation, sore eyes, headache, sore throat, toothache, snake-bite [root]; headache [leaves]; constipation [fruit] (Gelfand et al, 1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zimbabwe (Ndébele) : antiemetic [root]; ulcers, general body pains, depressed fontanelle [leaves] (Gelfand et al, 1985)</td>
</tr>
<tr>
<td>Plant Name — family</td>
<td>Use by the Topnaar [used plant part]</td>
<td>Use in other countries/areas (tribe) [used plant part] (REFERENCE)</td>
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</tr>
<tr>
<td>(Solanum ineanum culd)</td>
<td></td>
<td>Malawi: sore eyes, pneumonia [root] (GELFAND ET AL, 1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>West-Africa: syphilis, gonorrhoea, rheumatic and swollen joints, horse sickness, nasal catarrh, cattle sickness (GELFAND ET AL, 1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>East Africa: abdominal pains, dyspepsia, fever, stomachache, indigestion, toothache, snake-bite, earache, cuts, chest pains, ringworm, syphilis, cough in sheep, emetic (GELFAND ET AL, 1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tanzania: delayed after-birth (GELFAND ET AL, 1985)</td>
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<tr>
<td>Tamarix usneoides — Tamaricaceae</td>
<td>indigestion, diarrhoea, stomach pains [root]</td>
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<td></td>
<td>Namibia (Damara): cough [root] (VON KOENEN, 1977)</td>
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<tr>
<td></td>
<td></td>
<td>Botswana: constipation, abdominal discomfort [root]         (HEDBERG &amp; STAUCHARD, 1989)</td>
</tr>
<tr>
<td>Thamnosma africana — Rutaceae</td>
<td>stomach pains, induce vomiting, cough [whole plant]</td>
<td>Namibia (Bergdamara): cold, flu, infections [leaves, stems] (VON KOENEN, 1977)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southern Africa (Ndebele): relief chest conditions (WATT &amp; BREYER-BRANDWYN, 1962)</td>
</tr>
<tr>
<td>Plant Name — family</td>
<td>Use by the Topnaar [used plant part]</td>
<td>Use in other countries/areas (tribe) [used plant part] (reference)</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Trichocaulon pedicellatum</em> — Asclepiadaceae</td>
<td>high blood pressure, colds, stomach pains, indigestion, eye pains [stem]</td>
<td>Namibia (Kaokoland) : stomach complaints [fruits] <em>(MALAN &amp; OWEN-SMITH, 1974)</em></td>
</tr>
<tr>
<td><em>Zanthoxylum ovalifoliatum</em> — Rutaceae</td>
<td>throat pain [fruits]</td>
<td></td>
</tr>
</tbody>
</table>
4.3 Screening of Medicinal Plants

Part of the plants, used medicinally by the Topnaar people, were screened for their antimitotic and antimicrobial activity. This screening is the first step when one is searching for medicinal activities in plant species and can be carried out in the laboratory without sophisticated equipment. The tests were carried out with the assistance of Dr. L. Van Puyvelde and Mr. D. Schneider at the University of Gent. The remaining plants will be screened afterwards. A number of other tests will be done later.

4.3.1 Methods

4.3.1.1 Screening for Antimitotic Activity

A method to search possible sources of anticancer activity in plants is to screen the plants for antimitotic activity. Therefore a preliminary test was used, based on the Ceriotti method (Schneider, 1992) whereby the inhibition of the growth of wheat rootlets is investigated. The screened plants are:

- *Blumea decurrens* (Vahl) Merxm.
- *Pechuel-Loeschea leubnitziæ* (O. Kuntze) O. Hoffm.
- *Acanthosicyos horridus* Welw. ex Hook F.
- *Enucle pseudobenus* E. Meyer ex A. DC.
- *Acacia erioloba* E. Meyer
- *Cullen obtusifolia* (DC) Stirton
- *Thamnosma africana* Engl.
- *Laminaria* sp.
- *Tamarix usnoides* E. Meyer ex Bunge
- *Boïcia foetida* Schinz subsp. foetida
- *Parmelia hottentotta* (Dinter & Schwantes)
- *Colophospermum mopane* (Kirk ex Bentham) Kirk ex Leonard
- *Maerua schinzii* Pax
- *Kleina longiflora* DC.
- *Orthotheca albida* Schinz
- *Brownanthus kuntzei* (Schinz) Ihlenf. & Bittrich
- *Aloe asperifolia* A. Berger
- *Pergularia daemia* (Forsskal) Chiov.
- *Sulcera corymbosa* (Marloth & Engler) Hiern
- *Catophractes alexandri* D. Don.

The plant material is air-dried and powdered mechanically. Wheat grains are first germinated in a petri dish, on a filter paper, with 10 ml of tap water, during 24 hours in darkness. Afterwards, 10 well-germinated grains are put on a filter paper circle in a petri dish containing 10 ml of tap water and 1000 mg of plant powder (concentration 100 mg/ml). After keeping the petri dishes at ambient temperature in darkness for 6 days, the rootlet growth is evaluated. Therefore the length of the longest rootlet of each grain is measured and the average root length calculated over the
whole sample. The inhibition of the rootlets' growth is given in percent compared to the root growth of non-treated grains under the same conditions (a negative value means stimulation of the root growth). The experiment is repeated with 0.2 ml plant methanol extract (preparation see 4.3.1.2.) instead of plant powder, under the same conditions.

4.3.1.2 Screening for Antimicrobial Activity

The same plant samples as in 4.3.1.1 were screened for their antimicrobial activity. The plant powder is extracted in a percolator with a 75 % methanol solution until exhaustion. The extract is dried under vacuum at 50°C, weighed, and dissolved in a 75 % methanol solution to obtain a concentration of 50 mg/ml.

The used micro-organisms are:
- Gram- bacteria: Escherichia coli, Pseudomonas aeruginosa, Salmonella typhimurium.
- Fungi: Mucor racemosus, Candida albicans, Cryptococcus neoformans, Candida kefyr.
- Yeast: Saccharomyces cerevisiae.

The media used are BHI broth for all bacteria except Lactobacillus brevis, MRS broth for Lactobacillus brevis and Sabouraud-dextrose broth for the fungi and yeast. For each test, 0.1 ml of the solution of micro-organisms is inoculated in the respective media in a test tube, and incubated at 37°C during 24 h (48 h for Mycobacterium smegmatis; partial anaerobic conditions for Lactobacillus brevis; 30°C for the fungi and yeast). 0.2 ml plant methanol extract is incorporated in 10 ml agar medium to obtain a dry matter concentration of 1 mg/ml. The solution is homogenized by mechanical shaking and drawn in a petri dish. The inoculum is inoculated on the surface of the medium by a zigzag method, using a calibrated handle. The petri dishes are then incubated, at 37°C, Lactobacillus brevis at 37°C in partial anaerobic conditions, and fungi and yeasts at 30°C. The results are analyzed after 24 h for the bacteria and after 48 h for the fungi and yeast.
4.3.2 Results

4.3.2.1 Screening for Antimyototic Activity

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Part</th>
<th>% inhibition (with 100mg powder/ml)</th>
<th>% inhibition (with 0.02ml methanol extract/ml)</th>
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</thead>
<tbody>
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<td>Blumea decurrens</td>
<td>leaf</td>
<td>64</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>root</td>
<td>70</td>
<td>33</td>
</tr>
<tr>
<td>Pechuel-Loeschea leubnitziae</td>
<td>leaf</td>
<td>96</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>root</td>
<td>76</td>
<td>63</td>
</tr>
<tr>
<td>Acathosicyos horridus</td>
<td>root</td>
<td>92</td>
<td>32</td>
</tr>
<tr>
<td>Euclea pseudobenus</td>
<td>root</td>
<td>54</td>
<td>44</td>
</tr>
<tr>
<td>Acacia erioloba</td>
<td>gum</td>
<td>-30</td>
<td>-</td>
</tr>
<tr>
<td>Cullen obtusifolia</td>
<td>leaf</td>
<td>94</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>root</td>
<td>97</td>
<td>53</td>
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<td>88</td>
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<td>Tamarix usneoides</td>
<td>root</td>
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<td>18</td>
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<td>Boscia foetida</td>
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<td>Kleinia longiflora</td>
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<td>67</td>
<td>55</td>
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<td>Orthanthera albida</td>
<td>stem</td>
<td>53</td>
<td>44</td>
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<td>Brownantthus kuntzei</td>
<td>stem, leaf</td>
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<td>100</td>
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<tr>
<td>Salvadoria persica</td>
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<td>76</td>
<td>63</td>
</tr>
<tr>
<td>Pergularia daemia</td>
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<td>63</td>
<td>92</td>
</tr>
<tr>
<td>Sutera corymbosa</td>
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<td>39</td>
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<tr>
<td>Catophractes alexandri</td>
<td>root</td>
<td>-83</td>
<td>57</td>
</tr>
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</table>

NB: A negative value means stimulation of the rootlet growth.

*Table II.3: Inhibition of Wheat Rootlets by Medicinal Plants*
4.3.2.2 Screening for Antimicrobial Activity

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Part</th>
<th>Bs</th>
<th>Ec</th>
<th>Lb</th>
<th>M</th>
<th>Ms</th>
<th>Pa</th>
<th>St</th>
<th>Sa</th>
<th>Sf</th>
<th>Sc</th>
<th>Mr</th>
<th>Ca</th>
<th>Cn</th>
<th>Ck</th>
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<tr>
<td><em>Pergularia daemia</em></td>
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<td><em>Sutera corymbosa</em></td>
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<tr>
<td><em>Cataphractus alexandri</em></td>
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+ : inhibition of the micro-organism; - : no inhibition; / : no results, ± : some inhibition

Table II.A: Antimicrobial Activity of Medicinal Plants
4.4 Non-plant Material used by the Topnaar

Beer is brewed from honey, collected from wild beehives, mixed with water. This honey beer is drunk or honey is eaten to cure malaria.

The powder obtained by grinding a red stone, called lnau, is mixed with fat and rubbed on the face as a cosmetic.

Ashes from the fire are applied on wounds and burns.

Several animal parts are used medicinally. When children have a collapsed chest, incisions can be made in the chest or back. Roasted and ground kudu skin is set in these incisions. At the same time they drink a decoction of kudu skin and wear a piece of kudu skin around their neck or chest.

When someone has a cold, a goat can be killed and skinned. The stomach content of the goat, or ostrich dung is rubbed on the still warm skin and the person is wrapped in this skin. This will cause transpirating. After removing the skin, the body is rubbed with fat.

The bones of goats are roasted and ground. This powder is applied on burns to reduce the pain.

Bird stomachs are dried and ground. A decoction of this powder is given to children to calm them down when they are scared.

Also dung is used in several ways. A decoction of goat dung is drunk to treat measles. At the same time the body is washed with this decoction. Fresh chicken dung is rubbed on wounds and burns.

Roasted ostrich dung is sniffed up to stop nosebleed. Ostrich dung and eggshells are roasted and ground. A decoction of this powder is given to children to cure coughs and colds. Their bodies can also be rubbed with this powder.

5. Conclusion

The information collected on plants used by the Topnaar people during this study extends far the results of previous similar surveys with the Topnaar (DENTLINGER, 1977 and DU PISANI, 1983).

DENTLINGER limited her survey to the village Soutrivier and concentrated her survey mainly on the lnara. DU PISANI studied the plant utilization in Namaland (the territory of all Nama tribes). He lists only 17 plants used in the Kuiseb area in his article. Some old articles (CARSTENS ET AL, 1987 and SCHULTZE, 1907) contain valuable information on the plants used in the past, but are also limited in scope. A great part of the once broad plant knowledge of the Topnaar has already been lost through time due to contacts with western civilization. The present project has tried to collect what is still known. We fear, however, that in the near future a lot of the knowledge might be lost.

Because of the extreme drought some plants could not be found in the field and remain unknown for the moment.

In table II.5 a summary is given of the plants used in the Kuiseb area and in Sesfontein. 25 plants are used in the Kuiseb area, 35 in Sesfontein and 20 in both areas.
<table>
<thead>
<tr>
<th>Kuiseb Area</th>
<th>Kuiseb Area &amp; Sesfontein</th>
<th>Sesfontein</th>
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<tr>
<td>Acacia albida</td>
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<td>Zanthoxyllum ovatifoliatum</td>
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<td>Ziziphus mucronata</td>
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</table>

Table II.5: The plants used by the Topnaar people in the Kuiseb area and in Sesfontein
Some of the medicinally screened plants give promising results, such as Peckael-Leucocéa leubnitziae, Acanthosicyos horridus, Cullen obtusifolia, Thamnoosma africana and Ecklonia maxima. Further tests should be done on these plants in order to try to find the active components.

6. Further plans

A book will be written and published on the ethnobotany of the Topnaar. A vast amount of literature has been collected on each of the plants used by the Topnaar. Broader descriptions will be made, including information on chemical composition and distribution maps of the plants (ordered from the National Herbarium of Pretoria). The medicinal plants will be tested more extensively. Seeds of some of the still unknown plants were collected and have been sown in Gent in order to be able to identify the plants when mature.

7. Recommendations

In order to complete the information on the ethnobotany of the Topnaar, it would be advisable to visit the same area during a wet period to find and identify the plants which remain unknown at this moment as they were not growing.

The most important plant of the list is definitely Acanthosicyos horridus. Not only because it is such an important plant for the Topnaar people, but also because of the extensive uses for so many purposes. The culture of the Kuiseb Topnaar is based on the Inara. So far the pips are only exported to Cape Town. This could become an important source of income for the people.

Although many articles have been published on this plant, not much research has been done on it. It would be very interesting to study the cultivation possibilities of the Inara, as the fruit production seems to decrease with time. This could be an interesting way to develop the area. Also other economic uses could be investigated, like cosmetic use of the oil and medicinal use of the roots.

8. Acknowledgements

I wish to thank first of all Ernst Boois for his assistance to the fieldwork and for interpreting Nama. I am very grateful to the staff of the Desert Ecological Research Unit of Namibia, The University Centre for Studies in Namibia and the National Herbarium of Windhoek for their support. I am also very grateful to the people of the Ministry of Wildlife, Conservation and Tourism of Namibia for allowing us to work in a national park.

Many thanks to Mr. Giess for his assistance in plant determination, Prof. Haacke and Mr. Eiseb for their help with the Nama plant names, to Griet Pauwels and Lut Van Haut for the typing work, and to Prof. Dr. ir. Patrick Van Damme and Nick Snow for reading and correcting so many times.

9. Literature


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**Sydow W.** Contributions to the History and Protohistory of the Topnaar Strandloper Settlement at the Kuiseb River Mouth near Walvisbay. South African Archaeological Bulletin, vol. 28, p. 73-77.


Wie is die Nama? Bylae oor Namas. Bylae tot die Suidwester, August, 1, 1986.
Part III

Flora and Vegetation of the Namib

1. Introduction

The Namib ("Namib" is a Nama name, meaning "endless expanse" (Martin in Mertens, 1971)) is a relatively long but narrow tract of desert land on the southwest coast of Africa. It is considered to be one of the oldest deserts in the world (about 80 million years). Climatic gradients and geological diversity created a mosaic of habitats in which — during its long history as a desert — plants and animals could adapt and specialize to cope with the harsh conditions of the desert. The Namib desert became through the process an important centre of endemism: in the kingdom of the animals as well as in the kingdoms of the plants and the fungi a considerable number of taxa are only occurring in this area. Some well known examples are a number of taxa belonging to the family of the Tenebrionid beetles (e.g. Onymacris unguicularis, the head standing fog-basking beetle), the golden mole (Emetitalpa granti namibensis, a dune-living insectivore), the Wolwitschia mirabilis Hook.f. (an interesting Gymnosperm, sometimes referred to as a "living fossil") and Acanthosicyos horridus Welw. ex Hook. F. (the lnara, an important staple food for the Kuiseb Topnaar).

2. Geography (maps: annex 4)

The Namib desert extends from São Nicolau (north of Moçâmedes in southern Angola) to the Olifants River (South Africa). It is a long, narrow strip which is about 2000 km long and up to 200 km wide. It stretches over three countries: Angola (northern part), Namibia (central part) and South Africa (southern part). In the west it is bordered by the southern Atlantic Ocean: the Benguela current flows along the coast and has a very important influence on the climate of the Namib. In the east the Namib desert is for the greater part bordered by the escarpment of the Southern African central plateau.

2.1 Rivers

Apart from the perennial rivers (Kunene River and Orange River) the Namib desert is crossed by several dry riverbeds (e.g. Ugab). In these dry riverbeds there is only some superficial waterflow during a period which depends nearly completely on the rainfall in the catchment area.
Most of these rivers never or very seldomly reach the sea because of evaporation and endoreic drainage. On the other hand there is an important permanent subterranean flow of water under most of these riverbeds. This subterranean water, in addition to the temporary flow of the river itself, is in a lot of cases sufficient to initiate the formation of a linear oasis along the riverbeds. On the surrounding plains run off water, coming from occasional rainfall, results in small depressions (washes). The accumulation of run off water due to rainfall in these washes is sufficient to have more plantgrowth when compared with the areas between the washes. Every river crossing the Namib desert has its own particular features, which have an important influence on the vegetation which develops in or near the riverbed. The following text gives the features of those Namib rivers which were studied in the scope of the present project. In table III.1 the rivers are mentioned with their respective catchment area.

2.1.1 Kunene

The source of the Kunene can be found in the Serra do Chilengue in an area with relatively speaking a lot of rainfall (e.g. in Huambo, a weather station near the source, the mean annual precipitation is 1369 mm). As a result of the high input of water, the Kunene is a perennial river. In Kaokoland the Kunene is a turbulent stream confined to a narrow gorge with a considerable number of waterfalls and rapids, intersecting a vast plateau which extends in the northwest of Namibia and the southwest of Angola. This plateau is for the greater deal covered with sand dunes: the so called Engo - Kunene Sand Sea. The wind, which is mostly blowing from the southwest, moves the sand sea towards the northeast. The Kunene, however, is a natural barrier against this sand transport: most of the sand is trapped by the river and transported towards the sea. As a result, the plateau, north of the Kunene is almost devoid of dunes. The possibilities for the formation of vegetation in the valley are limited to crevices in the gorge, islands and some small patches of alluvion. Towards the west the height of the plateau decreases and the valley becomes wider and less deep. A wide estuarium with islands, marshes and a lagoon is formed. Due to the climatic regime (a well defined dry period in winter and wet period in summer) in the catchment area, the water level of the river varies throughout the year. As a result of the variable water level the marshes and islands in the estuarium as well as the riverbanks are often inundated.

Fig. 1: (p.84) Kunene: islands in the estuarium

Fig. 2: (p.84) Kunene: right (Namibia): the plateau is covered with dunes of the Engo-Kunene Sand Sea. The main wind direction is south - southwest. The sand is transported in northern - northeastern direction but is trapped by the Kunene. The plateau on the Angolan side is devoid of dunes. Further north in Angola there is another dune area: the Baia dos Tigres - Curoca Sand Sea (annex 4, map 1).

Fig. 3: (p.84) Kunene: dunes of the Engo - Kunene Sand Sea cascade into the Kunene. Only at a small number of places there is a limited area available for the development of riverine vegetation.

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1 Drainage through the soil of the riverbed.
Fig. 4: (p.86) Kunene: riverine vegetation.

2.1.2 Engo

The Engo (or Ondondujengo, as it is called by the Himba) is an ephemeral stream with only some waterflow during rain storms in the catchment area. The river starts in the Otjihipa Mountains and Southern Hartmann Mountains (Western Kaokoveld). The catchment area is nearly completely situated in the extremely dry northern Namib and for the rest in the dry western Kaokoveld. As a result the amount of water which is received in the catchment area is too small to result in any considerable superficial waterflow in the riverbed. There is however some subterranean waterflow. In the west, the riverbed is blocked by the Engo - Kunene Sand Sea.

2.1.3 Munutum

The Munutum is also an ephemeral stream with only some apparent waterflow during rain storms in the catchment area. The river has its source in the Southern Hartmann Mountains (western Kaokoveld). As the river is also completely situated in an extremely dry area, the waterflow is very limited. At some places the riverbed is crossed by huge barchan dunes. The existence of a well developed vegetation of trees and scrubs in the upper-Munutum, the occurrence of Acanthosicyos horridus Welw. ex Hook. F. in the lower Munutum and the existence of a quite active fountain (Okau) in the lower Munutum, point to the fact that there is a considerable subterranean waterflow. In the west the river ends in the saltpan of Angra Fria.

2.1.4 Sechomib

The Sechomib is a small ephemeral stream which starts in the mountains north of Orupembe (Western Kaokoveld). There is very little superficial waterflow during rainstorm periods. The vegetation is limited to herbs and small scrubs, which points to the fact that the subterranean waterflow is also limited. In one of the affluent of the Sechomib there is an important permanent waterpoint (fountain), with abundant vegetation, visited by a lot of game, birds and used by the Himba as a source of drinking water. At about 15 km from the coast the river disappears in the sandy plains of the Skeleton Coast Park.

2.1.5 Khumib

Starting as an affluent of a mountain chain in the dry Western Kaokoveld the amount of water received in the catchment area is very low and irregular. Superficial waterflow is therefore limited to periods of heavy rainstorms. The fairly well developed vegetation of trees, scrubs and herbs indicates that subterranean waterflow is important. In Skeleton Coast Park, at about 10 km from the sea, there is an important fountain (Sarussas) with a well developed swamp which attracts a lot of game and waterfowl. The riverbed of the Khumib reaches the sea.
2.1.6 Hoarusib

The Hoarusib is ecologically seen one of the most important rivers of the Northern Namib. A large part of the catchment area lies within the Central Kaokoveld where the mean annual precipitation is 100 - 200 mm. It is one of the rivers with a substantial superficial waterflow. Nearly every rainy season the Hoarusib reaches the sea. Due to a very active fountain at the foot of the Etendeka Mountains (Western Kaokoveld) there is a semi-permanent waterflow downstream Purros. That part of the Hoarusib runs through a quite narrow gorge with a very luxurious vegetation. This linear oasis is intensively visited by game. The part of the gorge upstream of the border of Skeleton Coast Park is also an important grazing ground for the cattle and goats of the Himba community of Purros. Downstream the border of the Skeleton Coast Park the gorge becomes less deep. In a number of places dunes of the Skeleton Coast Sand Sea try to cross the riverbed, but the floods during the rainy seasons are sufficient to prevent this. Towards the coast the river crosses this dunefield. The last 5 km of the river contain some salt marshes.

Fig. 5: (p.86) Hoarusib: gorge, downstream Purros.

2.1.7 Hoanib

The Hoanib forms over a large distance the boundary between Kaokoveld in the north and Damaraland in the south. The Hoanib is very important as a linear oasis. It attracts a lot of game. A large part of the catchment area is situated in the central part of Kaokoveld and Damaraland. A mean annual precipitation of 100 - 250 mm in this area is sufficient to yield some superficial waterflow during the rainy season. The source of the river is situated west of Karmanjab on the central Namibian plateau. Downstream it forms a deep gorge (the Khwarib Schlucht) before it enters the plains of successively Warmquelle, Sesfontein and Okambonde-Otongoro. From there on the river forms a deep gorge towards Amaapoor. While the plains are used as grazing grounds for the livestock of Damara, Topnaar, Herero and Himba, the gorge is an important grazing ground and watersource for a lot of game, including important numbers of elephants, rhinos and giraffes. Downstream Amaapoor the Hoanib riverbed widens and forms a large vlei2 (Gui-un). The lower Hoanib, downstream Gui-un is completely covered by dunes for about 15 km. Although there is no superficial waterflow downstream Gui-un, the cavernous waterflow is considerable. Auses and Die Oase are two open permanent waterholes in windblown depressions. In the old mouth of the river there are a few more waterholes and ephemeral wetlands.

Fig. 6: (p.89) Auses: a permanent waterhole in the dunes, south of Möwe Bay. The water is brakish. Subterranean waterflow of the Hoanib feeds the waterhole.

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2When an ephemeral river is overflowed by dunes, there is no longer superficial waterflow possible towards the coast. The river is stopped and forms temporarily a swamp (= a vlei); part of the water continues a subterranean flow further to the sea, the rest evaporates. Due to this process, the amount of salts in the soil of the swamp increases, which results in a deterioration of the vegetation or initiates a salt-tolerant vegetation consisting of halophytes.
2.1.8 Uniab

In contrast with the Hoarusib and the Hoanib, the catchment area of the Uniab is limited in size and situated nearly completely in the dry western part of Damaraland. Its source lies in the Palmwag region. Waterflow is therefore limited to subterranean waterflow which supports a vegetation which is quite well developed over most of the river's length. There is only some superficial waterflow during occasional rainstorms. At 4 to 5 km from the mouth, a pumping station extracts water from the riverbed which is used in Terrace Bay and Möwe Bay. At about 15 km from the mouth the river reaches the Skeleton Coast Sand Sea. The riverbed crosses the dunes for about 10 km. Due to insufficient superficial waterflow the dunes cross the riverbed for about 0.5 km. At about 2.5 km from the mouth the subterranean water surfaces. In that part of the riverbed a quite extensive swamp occurs. Downstream the river flows in a narrow, up to 15 m deep gorge. Due to the permanent flow of water the plant cover is well developed.

Fig. 7: (p.91) Uniab: riverbed

Fig. 8: (p.91) Uniab: gorge

2.1.9 Koigab

The Koigab is an ephemeral river south of the dune sea of the Northern Namib. Quite similar to the Uniab, the Koigab has its source in the dry western area of Damaraland near Wereldsend and Driefontein. The catchment area is also quite small. In comparison with the Uniab, the availability of water is rather limited. This can be deduced from the lack of a well developed vegetation in the riverbed. In the lower part of the river, close to the coast, the vegetation in the riverbed is almost similar to the vegetation near the riverbed on the gravel plains because of the lack of water.

2.1.10 Huab

The Huab has its source near Kamanjab. In this area the amount of rainfall is relatively high (mean annual precipitation of 400 - 500 mm). In combination with the fact that this river has a fairly large catchment area, the waterflow is considerable. At some places, e.g. near Scott Bridge in the Skeleton Coast Park, there is permanently superficial waterflow resulting in a well developed vegetation. As in the case of the Koigab, the Huab flows through an area without dunes. The riverbed is a well defined depression in the gravel plain.

Fig. 9: (p.91) Huab: well developed vegetation in the riverbed near Scott Bridge.
2.1.11 Ugab

The Ugab is a long river with its source between Outjo and Otavi. As it has a large catchment area in a region with a mean annual rainfall of up to 500 mm, the superficial waterflow can be important. Regularly a flood can be observed and in wetter years the flood can reach the sea. In the riverbed there are a number of (semi) permanent waterholes, especially in the section north of the Brandberg. Its general aspect is quite similar to that of the Huab: the Ugab has a well defined watercourse in the gravel plain. Upstream (about 20 km from the mouth) towards the Brandberg the river flows through a deep valley.

2.1.12 Swakop

Being the second largest ephemeral river, the Swakop ("Swakop" is a nama word meaning "smell of flowing water") forms a very important linear oasis in the Central Namib. Its source can be found near Okahandja, a region with an annual precipitation of about 400 mm. Together with its largest sideriver (the Khan) it drains a very large catchment area. The waterflow could be considerable, but a lot of dams built on the Swakop and some of its siderivers, reduce the run off that ultimately reaches the lower Swakop. In the last century there have been some serious floods reaching the sea, but a number of reasons (dams, drought of the eighties, ... ) reduced the number of floods drastically. Downstream Otjimbingwe the river forms a deep valley, which widens towards the coast. In the coastal area the Swakop forms the northern border of the Southern Namib Dune Sea.

2.1.13 Tumas

The Tumas is a small river on the gravel plain between the Swakop and the Kuiseb. The catchment area is rather small. It is generally believed that it was once the lower riverbed of the Swakop, but as it dug a new riverbed more towards the north, the catchment area of what was left from the old Swakop (= now Tumas) was reduced dramatically. The dune sea of the Southern Namib crosses the riverbed of the Tumas. A small catchment area, situated completely in the Namib desert, results in a low amount of waterflow. The vegetation in the riverbed is not well developed.

2.1.14 Kuiseb

The Kuiseb is the largest and most important river of the Central Namib. It has a large catchment area which extends for a great deal over the moutaineous area of Khomas Hochland, a zone with an annual rainfall of about 300 mm. Its source can be found near Windhoek. About 230 km downstream it leaves Khomas Hochland and enters a canyon of about 130 km. Nearly every year floods pass through the narrow canyon. In the narrowest parts of the canyon the mechanical stress is too strong as to allow the development of perennial vegetation. In these places only a
vegetation composed of ephemeral plants develops after a flood. Near Hombre the depth of the canyon decreases while the riverbed widens. About 50 km downstream the riverbed is more than 1.5 km wide.

Downstream from Rooibank, at about 27 km from the coast, a bifurcation of the riverbed is caused by a granite outcrop. The southern branch goes westernly towards the coast. This branch is nearly completely overblown by dunes. As a result the superficial flowing water of the Kuiseb cannot reach the sea. On the other hand the subterranean waterflow is still sufficient to support plant growth. Large parts of this area nowadays form the main 'nara' field, used by the Topnaar. The northern arm once formed a very wide delta which reached the ocean in the Walvisbay Lagoon. Since 1837 the river has reached the coast only 15 times (Stengel, 1964 and Seely (pers.comm.) in Robinson, 1979). Due to the building in the early sixties of a 7.3 km long dam to prevent flooding of the town of Walvisbay, no superficial flowing flood water can enter the northern arm of the lower Kuiseb. As the dam is built on a granite subsoil, only a small quantity of subterranean water can enter the northern delta. This has resulted in a steady deterioration of the vegetation (incl. 'nara' fields) in that area over the last 3 decades. recently the authorities of Walvisbay have made plans to replace part of the dam by sluices.

The Kuiseb forms the northern border of the Southern Namib Dune Sea. The wind regime and the related sand dune movement was studied during the Kuiseb project of the early eighties (Huntley, 1985). Ward and Von Brunn (1982) pointed out that two main trends may be noted:

1. west of Rooibank there is a high-energy, dominantly SSW wind regime while inland from Rooibank a low to intermediate energy, complex wind regime occurs;

2. the SSW to SW wind dominates in summer, while during winter east winds with high velocity occur at a low frequency and SSW and SW winds are less dominant.

This results in the movement of dune sand in a NNE - NE direction into the Kuiseb. The greatest rates of movement are measured west of Rooibank. Between Rooibank and Swartbank the movement is limited by large stands of *Stipagrostis sabulicola* (Pilger) de Winter (Poaceae) combined with a wind regime less effective for unidirectional sand movement.

The flooding of the Kuiseb is probably the most important factor in checking the migration of the dunes. The yearly floods transport huge amounts of silt and sand (inclusive the sand coming from the dunes): However, due to endoreic drainage, evaporation, lower rainfall and the smaller fall of the river, the amount of water transported by the flood and the energy of the flood decreases towards the coast. As a result, floods usually end somewhere in the lower Kuiseb (e.g. in January 1992 the flood stopped near Ururas, about 30 km from the coast (pers.obs.)).

A combination of less frequent and less powerful floods and an important transport of sand in a northerly direction due to the dominating high-energy SSW-SW winds, results in a crossing of
the Southern Namib Sand Sea over the Kuiseb west of Rooibank. A continuous drought since the
beginning of the eighties and the building of many dams by farmers upstream on the side rivers of
the Kuiseb have reduced the number of floods considerably (pers. comm. Water Affairs).

As explained above, the effect of floods is of considerable importance for the ecosystem:

1. sand, blown into the riverbed from the dunes, is scoured away, preventing the dunes from
advancing northwards and crossing the Kuiseb and the gravel plains of the Central Namib;

2. a huge amount of fruits and seeds coming from, among others, Khomas Hochland are trans-
ported, germinate and thus enrich the flora of the valley;

3. the subterranean watersupply, which maintains the riverine woodland on the riverbanks, is
replenished on a regular basis.

On the other hand, the colonization of the riverbed by trees and other perennials is restricted
because floods uproot and wash away virtually all plants hit by the stream of water.

Fig. 10: (p.95) Kuiseb: canyon near Schlesien.

Fig. 11: (p.95) Kuiseb near Gobabeb: a linear oasis between the Southern Namib Dune Sea an
the gravel plain of the Central Namib. It is the residential area for the Topnaar and a
very important habitat for game.

2.1.15 Tsauchab

The Tsauchab is a small ephemeral river with its sources in the mountains southeast of the
Naukluft Mountains. The complete catchment area is within the Namib and Pronamib which has
very low precipitation. Superficial waterflow is limited, but enough to maintain some sheltered
rockpools throughout the year in the Sesriem Canyon. The subterranean waterflow is enough to
maintain a riverine vegetation of trees, scrubs and herbs. Near the Sesriem Farm the river has
dug a narrow (at some places less than 1 m), but deep (± 30 m) canyon. Downstream, the river
forms a wide valley through the dunes towards the coast. The old valley, which reaches the sea, is
completely covered by dunes up to about 40 km upstream from the coast. At one time the river
was blocked and a vlei (Sossusvlei) was formed. Dissolved salts left after the evaporation of the
flood waters precipitated and formed thick salty layers. A similar process blocked the Tsondab
River (between Kuiseb and Tsauchab) and formed the Tsondab Vlei (Seely & Sandelowsky, 1974).

Fig. 12: (p.95) Tsauchab: Sossusvlei.
### Table III.1: Catchment area (km²) of rivers, studied under the present project. Data were obtained by planimetric measurements on topographical maps (1:250,000) except for the Kunene (Times Atlas (1:5,000,000) and the Kuiseb (Kuiseb Project, 1982))

<table>
<thead>
<tr>
<th>River</th>
<th>Catchment Area (km²)</th>
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<tr>
<td>Kunene</td>
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<tr>
<td>Engo</td>
<td>580</td>
</tr>
<tr>
<td>Munutum</td>
<td>890</td>
</tr>
<tr>
<td>Seiomib</td>
<td>1.200</td>
</tr>
<tr>
<td>Khumib</td>
<td>2.000</td>
</tr>
<tr>
<td>Khumib</td>
<td>2.000</td>
</tr>
<tr>
<td>Hoarusib</td>
<td>15.000</td>
</tr>
<tr>
<td>Hoanib</td>
<td>16.000</td>
</tr>
<tr>
<td>Uniab</td>
<td>4.200</td>
</tr>
<tr>
<td>Koigab</td>
<td>2.400</td>
</tr>
<tr>
<td>Huale</td>
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<tr>
<td>Ugab</td>
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<td>Tumas</td>
<td>3.000</td>
</tr>
<tr>
<td>Kuiseb</td>
<td>14.700</td>
</tr>
<tr>
<td>Tasuchab</td>
<td>3.800</td>
</tr>
</tbody>
</table>

2.2 Plains

2.2.1 Gravel Plain of the Central Namib

The gravel plains of the Central Namib cover a vast area north of the Kuiseb. The altitude of the plain gradually increases from the coast towards the east (up to 800-900 m). At several places on the plain granite mountains (inselbergs or bornhardts) occur. In the west a calcrete mountain range (Swartbankberg-Hamiltonberge-Witpoortberge) intersects the plain. On the plain numerous washes form small depressions in which some waterflow occurs only after a rain shower. Due to run off water accumulates in the washes. This amount of water is enough to maintain a vegetation different from the vegetation that occurs on the plain itself.
2.2.2 Coastal Plain, South of Walvisbay

In the Walvisbay area a depression occurs between the coastal dune row and the dunes which cross the Kuiseb. This flat plain (called Dorob) extends from the Walvisbay Lagune towards the border of Namibia. The soil contains mainly sand and silt and a high amount of salt. On several places salt crusts appear. Due to its low altitude (sea level) and its small distance from the sea, sea water seeps into the soil.

2.2.3 Plains around Sesfontein

Around Sesfontein some large stone plains exist:

- Giribes: WNW of Sesfontein;
- Okambonde-Okongoro: SW of Sesfontein;
- Sesfontein;
- Warmquelle, seperated from the Sesfontein plain by the Nameb-Gomgurib mountains.

2.2.4 Skeleton Coast

This long narrow strip along the shore is a mosaic of gravel plains, salt pans, small dunes and rocky outcrops, intersected at some places by rivers. This area has a mean annual precipitation between 15 mm and 25 mm. Due to fog the amount of water available to plants is up to three times higher than actual precipitation. A number of species, specialized in intercepting the fog, form a patchy vegetation.

Fig. 13: (p.98) Skeleton Coast: gravel plain.

2.3 Mountains

2.3.1 Range with Peak 16 (Trigonometric Point nr 16)

This range (without a name) extends between the dune sea of the Northern Namib and Hartmann Valley. Some peaks reach a height of 1000 m (maximum 1078 m). The range is orientated north-south. In the north the height decreases towards the Kunene, in the south towards the Engo or Odundujengo.

Fig. 14: (p.98) Mountain range between Hartmann valley and the Engo - Kunene Sand Sea. Picture taken from Peak 16.
2.3.2 Nameb-Gomgurib Mountain Range

This mountain range is north-south orientated, perpendicular to the Hoanib, which has cut through the range. It separates the plain of Sesfontein and the one of Warmquelle. It has a maximum height of 1325 m.

Fig. 18: (p.99) Sesfontein: the Nameb - Gomgurib mountain range.

2.3.3 Brandberg

In this mountain area the highest mountain of Namibia can be found: Konigstein (2573 m). It is intersected by deep gorges, which create a lot of conditions favourable for plant grow. The mountain is situated on the border of the Namib.

2.3.4 Spitzkoppe and Other Inselbergs

At several places in the gravel plains of the Central Namib inselbergs were formed by magmatic intrusions which are sometimes transected by dolorite dykes. These granite plutons\(^3\) contain, due to their morphology, a large number of habitats for plants. In crevices, gullies, depressions and cracks, as well as at the foot of these inselbergs, run off water can be accumulated which is necessary for plant grow. Some inselbergs (e.g. Vogelfederberg) receive a considerable amount of water through fog.

2.3.5 Swartbankberg, Hamiltonberge, Witpoortberge

This calcrete range of mountains extends from the Kuiseb in the south and crosses the Swakopprivier towards the north. Due to its height (interception of fog) and its geology, this range offers a quite different vegetation in comparison with neighbouring inselbergs.

2.3.6 Salt Pans

These depressions filled with brine and covered with a crust of salt can be found all along Skeleton Coast. Some of them are still in connection with the sea. Due to physical properties (e.g. high concentration of salts which creates osmotic problems) of the brine pans no vegetation occurs.

2.3.7 Dunes

In the area studied there are three main dune areas: the Engo - Kunene Sand Sea, the Skeleton Coast Sand Sea and the main Namib Sand Sea of the Southern Namib. The first one extends from the Engo to the Kunene, the second one extends on the Skeleton Coast between Torrabay and the Munutum while the third one extends from the Kuiseb, southwards to Lüderitz.

\(^3\) Bodies of igneous rock formed beneath the surface of the Earth.
Five types of dunes can be recognized:

1. **Longitudal (= linear or seif) dunes** are all orientated in the same direction, determined by the prevailing wind directions (SSW and NE). This type of dune is the most common one in all three dune areas. They move northwards at a speed of up to 2 m/year in response to intermediate-energy winds.

2. **Barchan (= parabolic) dunes** are moonshaped dunes which are quite rare in the sand sea of the Southern Namib (except in the coastal area). They occur sporadically in both sand seas of the Northern Namib. They wander across gravel plains and riverbeds at a speed of up to a few metres/year.

Fig. 15: (p.98) Skeleton Coast: barchan dunes crossing the gravel plain.

3. **Star dunes** occur in a multi-directional wind regime. They are the typical dunes of the eastern part of the sand sea of the Southern Namib and can have a height of up to 325 m. Once they get stabilized by vegetation they give rise to reticulate dunes.

4. **Reticulate (= network) dunes** are dunes that are more or less stabilized by perennial vegetation. They occur along the eastern margin of the sand sea of the Southern Namib.

5. **Crescentic dunes** are dominant in the coastal belt. They are fast moving dunes (up to 100 m/year in the Southern and Northern Namib; up to about 10 m/year in the Central Namib). They occur in the coastal belt where strong SSW winds prevail.

   Along the coast, between Sandwich Bay and the Kunene plants of *Salsola* sp.div. (e.g. *Salsola nolothensis* Aellen) trap windblown sand. This is the first stage of the formation of dunes which are typical for the coastal area. Between Sandwich Bay and Walvisbay and along Skeleton Coast these dunes can reach heights of more than 10 m.

Fig. 16: (p.99) Skeleton Coast: *Salsola* sp. traps windblown sand and forms dunes.

Fig. 17: (p.99) Skeleton Coast: dune formed by *Salsola* sp.

3. **Geology**

3.1 **Introduction**

Several geological processes over a period of more than 2 billion years created a considerable number of formations which resulted in a mosaic of different habitats. In the following a brief history is given followed by the most important geological features of the studied areas.
3.2 History

3.2.1 Precambrium

During the Precambrium two cratons\(^4\) were formed in Southern Africa. The northern parts of Namibia are part of the Congo Craton while the southern and eastern parts belong to the Kalahari Craton. These cratons were formed more than 1 billion years ago. Some datings of precambrian geological entities up to 2 billion years and more are known. Granite and gneiss are the most abundant rocks found from this period.

In the Late Precambrium (920 million - 500 million years ago) the Damara Sequence was deposited by sedimentation, covering large parts of Namibia. The schists which are so typical for e.g. the middle and upper Kuiseb, originate from this period (about 700 million years ago). Beside schists also quartzite, conglomerate, and marble formations (e.g. Witpoortberge, Zwartbankberg) were formed. The bedrock of the plateau of the Northern Namib (Koigab - Kunene) is also from that period.

3.2.2 Cambrium

During the Cambrium erosion of the Precambrian bedrock occurred. This resulted in an extensive platform: the Namib Unconformity Surface. This period of pediplanation went on till 500 million years ago.

3.2.3 Ordovicium, Carbon, Devon, Jura and Cretaceous

During this period which lasted about 380 million years the Karoo sequence was formed. In large areas of Damaraland and the Northern Namib basaltic layers formed in volcanic conditions during this period are exposed. In other places, sediments were deposited which gave rise to conglomerate, sandstone shale and limestone formations.

3.2.4 Tertiary and Quartenary

The Paleogene (first period of the tertiary period (65 million - 22.5 million years ago)) was a very dry period resulting in the deposition of an extensive cover of desert-related sediments. Different kinds of cemented quartz arenite, rich in carbonate and breccia are the main elements found. During this period, palaeo-dunes and pans were formed in the Namib. This is proof for the desert conditions which existed already during the Paleogene. On the other hand valleys were filled with alluvium. After this phase of deposition known as the Tsondab Sandstone Formation, the Kuiseb cut its canyon, almost to present level, after a period of erosion of the Tsondab Sandstone.

The full establishment of the Benguela Current and its associated cold water upwelling system

\(^4\)Relative stable portions (shield areas) of the Earth's crust
in the Late Miocene (somewhat over 5 million years ago) promoted the development of the current Namib Desert Regime. This desert phase led to the accumulation of the Sossus Sand Formation, whose deposits constitute the main Namib Sand Sea. At several places along the coast salt flats were formed. In the Northern Namib a large sand sea was also created. During the Quaternary the level of the riverbed of the Kuiseb varied a lot, depending on the climatic conditions. Also the course of the Kuiseb changed during the Quaternary. In the beginning of the Quaternary the Kuiseb course extended from the Klein Klipneus/Klipneus area westwards to the northern half of Sandwich Bay. During the Quaternary the course of the lower Kuiseb shifted towards the north. A delta was formed, south of Walvisbay. This displacement may have been caused primarily by the northward encroachment of dunes from the main Namib Sand Sea. The shift in the lower course was only possible because here the Kuiseb did not flow in a canyon but rather in a broad valley with low banks.

3.3 Most Important Geological Features of the Studied Areas

3.3.1 Northern Namib

In the Northern Namib two sand seas cover huge areas: the Engo - Kunene Sand Sea and the Skeleton Coast Sand Sea. These sand seas were deposited mainly during the Quaternary on a plateau of mainly quartzite of the Kuiseb formation (late Damara period, late Precambrium). This plateau extends from the Kogab towards the Kunene and South West Angola. In some places vertical layers of schists occur. Between the dune area and the Hartmann Valley a range of intrusive mountains was formed during the Cambrium. In this range granites are dominant. Large areas along the Skeleton Coast (Möwe Bay - Cape Fria) and the mountain ranges between Purros and Orupembe belong to the youngest formation (Etendeka) of the Karoo sequence (early Cretaceous, about 120 million years old). It consists of basalt, latite and sandstone. The area around Sesfontein, Warmquelle and southwards to Khoraxa-ams belongs to the latest formation of the Damara sequence (about 650 million years old) and consists of phyllite, quartzite, schist and conglomerate. The Nameb-Gomgurib mountain range and the mountains north of Sesfontein, east and south of Warmquelle are older (based on relative datings) and consist of dolomite, limestone, shale and chert. South of the Hunkab towards the Hub a large area is covered by basalt and latite of the Etendeka formation (Karoo sequence, early Cretaceous; about 120 million years old). The landscape in this area is characterized by table mountains. South of this area a SW-NE (Ambrose Bay - Twijzelfontein) orientated intrusive formation (Cretaceous) of dolerite surfaces.

3.3.2 Central Namib

In the Central Namib the Kuiseb formation (Damara sequence, late Precambrium) is the main exposed lithographic unit. In this area schists are the most abundant geological formation (e.g. Khomas Hochland, Kuiseb Canyon). In large parts of the Central Namib intrusive rocks
from the Cambrium are dominant (e.g. area between Okanhandja and Omaruru, some granitic rock formations near Gobabeb, Mirabib and some other inselbergs in the Central Namib plain). Some large magmatic intrusions from the Cretaceous resulted in inselbergs (e.g. Spitzkoppe), the Brandberg and the Messum Crater. Granite dominates in these intrusions.

A very important geological entity, from a biological point of view, are the calcareous (marble) mountain ranges of the Swartbankberg, Hamilton Range or -berge and the Witpoortberge. This entity belongs to the Karibib formation (Damara sequence, late Precambrium). The Ca²⁺-rich conditions have an influence on the vegetation (e.g. Aloe asperifolia A. BERGER is a typical plant for these mountains). Parts of the Kuiseb formation are covered with recent layers of sand, gravel, calcrite and alluvium of the Cenozoicum (Tertiary and Quaternary). Ward (1987) studied the succession of the cenozoic deposits in the Kuiseb Valley. In the valley of the Tumas a thick layer of alluvium is found. This entity joins the valley of the Swakop a few kilometres downstream Salem. This fact supports the hypothesis that the Tumas was once the downstream part of the old Swakop.

3.3.3 Southern Namib (Partim Kuiseb - Sossusvlei)

The Sand Sea of the Southern Namib was formed largely during the Quarternary. In some dune valleys older formations (mainly Tertiary) can be found: calcrite and red, partially consolidated, dune deposits. Only at a few places intrusive rocks, from various ages, surface.

4. Climate

The climate of the Namib is characterized by a low and very variable rainfall, an evaporation exceeding precipitation, high insolation, cool to very high temperatures and frequent occurrence of fog and stratus clouds.

It is strongly influenced by the Benguela Current, a branch of the Westerly Wind Drift Current. The Benguela Current flows northwards along the coast of South West Africa to the equator where it merges into the South Equatorial Current. Along the western margin of the Benguela Current part of the surface water flows westwards into the Atlantic Ocean and is replaced by upwelling cold bottom water from the Antarctic Intermediate Current (Jackson, 1951; Wellington, 1955). The result is a mass of cold water along the coast with a mean annual sea temperature of about 15°C. This current of cold water is one of the major reasons of the aridity of the Namib. The anticyclone of the South Atlantic Ocean causes movement of warm air towards the west coast of Southern Africa. There it comes in contact with the cooled air above the Benguela Current resulting in condensation of moisture, producing fog. Inland, strong insolation results in low pressure cells, producing sea-breezes. As the cool, moist air comes inland it is warmed and relative humidity decreases. During the night when the temperature inland drops dramatically a reverse situation is
created: dry, cool land-breezes predominate (Jackson, 1951; Wellington, 1955). The overall result is a nearly continuous high relative humidity along the coast and inland a decreasing relative humidity with increasing distance from the sea.

Fog and low stratus clouds are very common and extend sometimes more than 50 km inland. The condensation of the water, originating from fog and low stratus clouds, on plants is the most important water source for these plants in the coastal belt and on the mountain ranges up to about 50 km from the coast.

Although there is high relative humidity along the coast, precipitation by rain is very low. The reason is that due to the cool ocean water a strong, stable temperature inversion is created. Circulation of the air around the anticyclone of the South Atlantic leads to a flow of air more or less parallel to the coast. The cool, moist air is warmed up when entering the warm land, resulting in an increase of the water holding capacity of the air. Every drop of water evaporates and rain cannot occur in such a condition (Walton, 1969). The influence of this climatic system decreases with increasing distance from the sea. As a result the amount of rain increases along this gradient.

Temperatures along the coast are cool and show little diurnal variation, due to the influence of the cold sea water and the frequent occurrence of fog and/or stratus clouds. Inland, maximum temperatures increase (up to more than 40°C) with distance from the sea. Sometimes a strong warm anticyclone is situated on the central plateau of Southern Africa. This air mass descends towards the coast. As a result of increased atmospheric pressure adiabatic heating occurs and results in strong, extremely hot and dry winds (the dreaded "east winds").

Following the climatic classification of Köppen (cfr. table III.2; Vernemmen, 1978) the climate in the Namib can be considered as a BW climate. Towards the east the climate becomes gradually a BS climate. Along the coast, due to the fog there is a BWkn', BWk'n' or BWmn' climate. Further inland in most cases a BWh or BSh climate exists.

Rain distribution in the southern part of the Namib is different from that in the northern part. In the southern part, rain occurs only in winter. On the other hand in the northern part, rain occurs only in summer. The transition zone of these two regions is south of Luderitz.

Annex 5 shows climatograms of some meteorological stations in and around the Namib. The rain distribution calculated over several years recorded in a number of stations is given in diagrams 24 - 29.
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<th>Symbols</th>
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<td>$R_j$</td>
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<td>B climates are subdivided in BS and BW climates</td>
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**Table III.2: Symbols used by Köppen for climate classification**

5. **Phytogeography**

5.1 **Phytogeography of Southern Africa**

Based on the distribution of plant taxa, Africa can be divided in nine phytogeographical regions (annex 4, map 12). In southern Africa 5 regions are recognized:

- **The Sudano-Zambian Region:**
  This region corresponds to the tropical savannah and is by far the largest region in Africa, extending both north and south of the equator, but physically continuous by an isthmus in east Africa. The southern African part belongs to the Zambesian Domain.
• The Guineo-Congolian Region:

This region represents the main evergreen rain forests and partly evergreen forests of Africa. The scattered relics of rain forests along the eastern coast of Africa belong to the Usambara-Zululand Domain.

• The Karoo-Namib Region:

This region represents the extensive desert and semi-desert areas of the Namib and the Karoo, extending from the south west of Angola to the centre of South Africa.

• The Cape Region:

This small region corresponds to the mountainous areas along the south coast of South Africa.

• The Afro-Montane Region:

This region corresponds to the montane forests and Ericaceous belts of the tropical African mountain regions. The region is notably disjunct, with strong concentrations in eastern Africa.

5.2 The Karoo-Namib Region (annex 4, map 13)

This region occupies parts of South Africa, immediately to the north of the Cape region and extends northwards as an increasingly narrow band along the coast of Namibia into south-west Angola. The surface area of the region is about 661000 km².

The following geomorphic units belong to the region: Cape Middle Veld, Karoo, Namib and Kaokoveld, as well as parts of “Highveld” and Damaraland.

Rainfall in the Namib Desert is less than 100 mm per year. In the Karoo it rarely exceeds 250 mm (annex 4, map 13; annex 5: climatograms). There is considerable variation in the amount and distribution of rainfall from year to year, especially in the driest parts (annex 5: figures 24-29). Fog is abundant throughout the coastal belt all year round.

The flora of the Karoo-Namib region consists of about 3500 species, of which more than half are endemic. There is one endemic family: Welwitschiaceae and more than one hundred endemic genera (most of them belong to the Aizoaceae and Mesembryanthemaceae⁶: 95 endemic genera). Some genera have an important concentration of endemic species in the region (e.g.: Aloe, Cotyledon, Crassula, Euphorbia, Haworthia, Hermannia, Sarcocaulon, Stipagrostis, Tetragonia and Zygodium).

⁶classification sensu Herre
There is little intermingling with the Cape Flora at species level. On the other hand a considerable number of species are common with the Sudano-Zambian region (e.g. *Acacia mellifera* (Vahl) Benth., *Acacia erioloba* E.Meyer, *Acacia karroo* Hayne, *Boscia albitrunca* (Burch.) Gilg & Benedict, *Ziziphus marmelos* Willd., *Fingerhuthia africana* Nees and *Coleophosphere mopane* (Kirk ex Bentham) Kirk ex Leonard).

6. Methods

6.1 Area

The botanical survey of the Namib was limited in space (grosso modo) to the region between the Kunene and the Tsachab (i.e. the Namibian part of the Northern Namib, the Central Namib and a small part of the Southern Namib).

The following subregions were studied in detail (maps: annex 4):

- **The Kuirib catchment area** (partim Dorob-Schlesien): residential area of the Topnaar-people.
- **The area around Sesfontein**: residential area of the Topnaar-people.
- **The river valleys between the Tsachab and the Kunene**: only a limited number of studies have been done in most parts of this area (pers.comm. Ministry of W.C.T. and Maggs, National Herbarium).
- **Inselbergs and other rocky outcrops**: These geographical entities often have a relatively rich vegetation.
- **Coastal area**: Due to the special climatological conditions (small amount of rainfall, fog), a well adapted vegetation can be found in the coastal belt.

The selection of the exact areas studied under the present project is based on advice by the Min. of W.C.T. and Maggs (National Herbarium). The following criteria are used:

* accessibility of the area. The Namib is an extremely fragile ecosystem. Therefore damage has to be minimized as much as possible;

* previous studies of the area (areas, where as yet no botanical work has been done, got priority; these areas were defined by consulting the literature and information given by the Min. of W.C.T.).
6.2 Fieldwork

6.2.1 Inventory Work

Selected areas are completely surveyed (all species are listed in section 7.2.), pictures of plants and plant communities taken and plant material sampled for identification. For reasons of conservation only a minimum of samples (only parts of the plant, absolutely necessary for identification) were taken. Identification was done using the following keys:

- Merxmüller (1966-1972): general
- Palgrave (1990): trees
- Müller (1984): grasses
- Gibbs et al. (1990): grasses
- Nel (1983): Stipagrostis spp. (Central Namib)

The main problem is the identification of plants which haven’t got enough features for determination. Through comparison with herbarium specimens most of them were identified in the herbariums of Windhoek and Gobabeb. The rest will be compared and identified in the herbarium of Munich, where a lot of herbarium specimens from Namibia are stored.

6.2.2 Study of the Vegetation Through the Braun-Blanquet-Method

The Braun-Blanquet-method is one of the several methods which have been developed for the study of vegetations. This method was chosen because it is a relatively quick way to get an idea about the existing plant communities in a certain area (Westhoff, 1967). As Robinson (1975) used this method to study the Central Namib, a combination of his data with the data of the present project is possible for a more detailed study of the different plant communities in this area.

The aim of this method is to delimit plant communities based on similarity and the classification of these plant communities in a hierarchical floristic system.

The association is considered as the basis for this floristic system. It is defined by characteristic plants, which form a particular plant community. As this plant community is considered to be a result of interaction with the environment, the presence of an association can be used as an indicator for a certain environmental situation.

This method consists of 4 major steps.
6.2.2.1 Field Description

Fig. 33: (p.110) a relevé or plot is set out.

Fig. 34: (p.110) slope of a plot is measured with a clinometer.

Fig. 35: (p.110) plant species growing on a plot are recorded as well as the cover percentage and the sociability.

In the first place, plots (relevés) are delimited taking into account that the vegetation in the selected plot is uniform and homogeneous.

In case of clear gradient situations (e.g. caused by topography, humidity) plots must be delimited perpendicular on the gradient. The size of the plot is dependent on the type of vegetation studied (e.g. cryptogamic vegetations on hills: less than 1 m², tropical forest: 1 ha).

A graph in which the relation between the number of species and the surface area is plotted, gives a good idea about the size of the relevé. Each description of a relevé should contain the following data:

- number of the relevé (for further reference)
- date (some plant associations occur only for a limited period of time; e.g. shortly after a rain shower)
- locality
- grid reference or geographical position
- altitude
- angle of slope
- exposition of the stand
- area of the stand
- percentage of cover of the different vegetation layers: percentage of cover of resp. trees, shrubs, herbs, mosses (if necessary)
- soil data
- for each species:
  - cover - abundance:
When the data are processed manually, the following classification is used:

1: less than 1% cover
2: 1% - 5% cover
3: 6% - 25% cover
4: 26% - 50% cover
5: 51% - 75% cover
6: 76% - 100% cover.

When a computer is used for the grouping, in most cases the actual percentages of cover estimated in the field are used.

These percentages are determined visually and are therefore estimations. For the homogeneity of the data, it is very important that the determination of the percentages is done by one person or a fixed team of persons doing all the work together.

* sociability: the following grouping is used:
  1: single
  2: grouped or tufted
  3: troops, small patches or cushions
  4: carpets, small colonies
  5: great colonies or pure populations.

Annex 7 contains some examples of relevés from different regions.

6.2.2.2 Aggregation of Field Data in Tables

All field data are put in a relevé-number/species table. This table can then be used as basis for further grouping or clustering.

6.2.2.3 Investigation of Similarity: Grouping or Clustering; Delimitation of Units

Relevés are rearranged manually or by computer in a table based on similarity. As a result, groups or clusters of similar relevés are formed. Such a group or cluster is more or less homogeneous and can be considered as a unit. It is distinctive from other units by the absence and/or presence of one or more species or by great differences in percentage of cover for a (number of) species. In cases of gradient situations the delimitation of the units can be difficult due to a continuous transition from one community to another. In this case, the two communities have to be divided by an arbitrary boundary.
6.2.2.4 Erection, Definition, Characterization and Differentiation of Associations

Each unit is now studied in detail:

- which species are characteristic and can be used as indicator-species;
- which species are companions;
- which species are strangers (rare, accidental or alien);
- which species are ubiquists (plants which appear in most types of vegetation);
- transitions to other units.

These data can be derived from the constancy of a species (i.e. the percentage of presence in the relevés of a unit).

By comparing the unit with other units, differentiating characteristics can be defined: which differences with other units can be found (absence and presence of species, great differences in percentages of cover). Abiotic properties of the habitats are defined.

At this stage the definition of the unit as an association can be done (Braun-Blanquet, 1932; Poore, 1955).

Variations (s.l.) of the association are mentioned. In some cases they can be recognized as sub-associations or as a variety.

The erected units are incorporated in the hierarchical floristic system of Braun-Blanquet (Braun-Blanquet, 1932; Poore, 1955).

6.2.3 Floristics

The geographical positions of species and relevés are defined with a GPS-instrument\(^6\). By using these results subsequent mapping of the species and relevés is possible.

7. Vegetation

7.1 Introduction

For more than a century botanists have explored the Namib. Their research resulted in an ever increasing list of plants and their distribution. Based on these results and on his own results, Giess made in 1971 an attempt to make a vegetation map. The Namib was divided in 3 regions:

\(^6\)GPS: Geographical Positioning System: by means of using the exact position of 3 satellites the geographical position is calculated.
• the Northern Namib: desert between the Ugab and the Kunene;

• the Central Namib: desert between the Kuiseb and the Ugab;

• the Southern Namib: desert between the Orangeriver and the Kuiseb;

The inventarisation of the plants occurring in these regions continued afterwards (e.g. by Giess, 1981 and Jacobson & Moss, 1987).

In the period 1972-1975 Robinson did a first phytosociological study of the Central Namib (partim Namib Desert Park). A set of 472 relevés were studied using the Braun-Blanquet method (Robinson, 1976).

In 1975, Moisel and Moll did a phytosociological study of the Welwitschia Plain which resulted in a set of 36 relevés (Moisel & Moll, 1981).

In the eighties the study of the vegetation was focused on the Central Namib between Swakop and Kuiseb (e.g. Theron et al., 1980; Seely et al., 1981; Nel, 1983).

The Botanical Survey of the Namib in the scope of the present project started on the 14th of January. Due to restrictions of the research permit, the survey was done exclusively in the Kuiseb valley and the Walvisbay area during the month of January. Later on, the permit was extended, resulting in the following programme:

14/01/1992 - 24/01/1992: Central Namib (Kuiseb valley and Walvisbay Area);

22/02/1992 - 02/03/1992: Northern Namib (Valleys of Kunene, Hartmann, Engo and Munutum; Peak 16);

09/03/1992 - 15/03/1992: Central Namib (Kuiseb valley);

22/03/1992 - 16/04/1992: Central Namib (Valleys of Kuiseb and Swakop; the granite outcrops Mirabib and Vogelfederberg). Southern Namib (Valley of the Tsauhchab, incl. Sossusvlei and the Sesriem canyon);

17/04/1992 - 21/04/1992: Central Namib (Spitzkoppe, Uis, Brandberg): Northern Namib (Skeleton Coast Park: Valleys of the Ugab, Koigab and Uniab);

01/05/1992 - 16/05/1992: Central Namib (Kuiseb valley and Walvisbay Area); Southern Namib (the dunes of Elim, Tsamsvlei, a small vlei, north of Sesriem);

22/05/1992 - 31/05/1992: Kaokoveld (botanical excursion, no relevés);

13/06/1992 - 28/06/1992: Northern Namib (Valleys of Munutum, Sechomib, Khumib, Hoarusib, Hoanib, Uniab, Koigab and Huab; area around Sesfontein);
04/07/1992 - 05/07/1992: Central Namib (Kuiseb valley);

7.2 Vegetation and Plant Communities in the Studied Areas

7.2.1 Mountains and Rocky Outcrops

7.2.1.1 Calcareous Ranges and Outcrops

7.2.1.1.1 Swartbankberg and Hamilton Range

The Swartbankberg and the Hamilton Range form a linear series of outcrops, consisting of limestone and intruded by dolomite dykes. The maximum height is 549 m (Hamiltonberge). The Swartbankberg is 404 m heigh. Due to this height a lot of fog is trapped. This results in a relatively well developed vegetation in sharp contrast with the surrounding gravel plain which is only sparsely covered with plants. Near the top, most plants grow in crevices and cracks where run off water can be collected. The soil is shallow (in most cases less than 15 cm) and consists of coarse mineral material. The exposed rocks are nearly completely devoid of vegetation. In the lower ranges between the boulders and in the washes quite a lot of plant species appear. There the following species were found and could be identified:

\textit{Aloe asperifolia} A. BERGER
\textit{Euphorbia giessii} LEACH
\textit{Euphorbia phylloclada} BOISS.
\textit{Euphorbia lignosa} MARLOTH
\textit{Acacia erioloba} E.MEYER
\textit{Trichocaulon pedicellatum} SCHINZ
\textit{Calicorema capitata} (Moq.) HOOK F.
\textit{Orthanthera albida} SCHINTZ
\textit{Eucla pseudobenus} E. MEYER EX A.DC
\textit{Acanthosicyos harridus} WELW. EX HOOK. F.
\textit{Citrullus ecirrhus} COGN.
\textit{Sutera mazzii} HIERN.
\textit{Pechuel-Loeschea lebnitziae} (O. KUNTZE) O. HOFFM.
\textit{Arthrecura lebnitziae} (KUNTZE) SCHINZ
\textit{Zygophyllum stapffii} SCHINZ
\textit{Zygophyllum cylindrisfolium} SCHINZ
\textit{Zygophyllum simplex} L.
\textit{Blepharis grossa} (NEES) T.ANDERS
\textit{Brownanthus kuntzei} (SCHINZ) IHLENF. & BITTRICH
Kleinia longiflora DC.
Stipagrostis gonatostachys (Pilger) De Winter
Galeola africana L.
Heliotropium ovalifolium Forsk.
Senecio engleranus O. Hoffm.
Hereroa puttkamerana (Dinter & Berger) Dinter & Schwantes
Sesuvium sesuvioideus (Fenzl.) Verdc.
Stipagrostis obtusa (Delile) Nees ex Kunth
Deverra denudata (Viv.) Pfisterer & Podl. subsp. aphylloa (Cham. & Schlecht.)
Pfisterer & Podl.
Gasania jurinefolia DC. subsp. scabra (DC.) Roessler.

Fig. 25: (p.120) Hereroa puttkamerana (Dinter & Berger) Dinter & Schwantes on the Swartbankberg.

Fig. 27: (p.116) Deverra denudata (Viv.) Pfisterer & Podl. subsp. aphylloa (Cham. & Schlecht.) Pfisterer & Podl. (Swartbankberg).

The plant community developing on the mountains is quite different from the vegetation in the washes around the mountains. Aloe asperifolia A. Berger, Trichocaulon pedicellatum Schinz, Sesuvium sesuvioideus (Fenzl.) Verdc. and Hereroa puttkamerana (Dinter & Berger) Dinter & Schwantes are found exclusively on the cracks and crevices on the mountains.

On the other hand Acanthosicyos horridus Welw. ex Hook. F., Acacia erioloba E. Meyer, Euphorbia phylloclada Boiss., Gasania jurinefolia DC. subsp. scabra (DC.) Roessler (only 1 specimen observed) and Pechuel-Loeschea lennartzii (O. Kuntze) O. Hoffm. are found only in the washes around the mountain.

Euphorbia lignosa Marloth is found only on a ridge, west of the Swartbankberg together with Kleinia longiflora DC.

A few kilometers southwest from the mountain Euphorbia lignosa Marlothitis quite common on a small calcrete hill, near the Kuiseb (Swartbank). Citrullus ecirrhosus Cogn. is quite common on a plain near a wash.

On the whole mountain, cover percentages are very low (mostly not more than 1%, except for a small depression filled with scree and coarse sand, on the southern slope of the mountain: cover of the phanerogames: ± 20 %).

In the washes around the mountains the percentage of cover is higher (up to 30 %). Lichens are very abundant: at some places up to 90 % of the area is covered by them.
7.2.1.1.2 Witpoortberge

The Witpoortberge is a small calcareous range of mountains, south of the Swakop. A side river of the Swakop, cutting a gorge in the mountain range, was investigated. The plants are generally confined to the gullies in the mountain range and to the riverbed. Except for the riverbed, with a cover of up to 30%, the overall cover of plants on the hills is less than 1%. In the riverbed the plant community exists of:

*Zygophyllum stapfii* SCHINZ
*Codon royenii* L.
*Blepharis bossii* OBERM.
*Sutera maxii* HIERN.
*Petalidium variabile* (ENGL.) C.B.CL.
*Brownanthus kunzei* (SCHINZ) IHLENF. & BITTRICH
*Heliotropium* sp.
*Cleome foliosa* HOOK.F. var. foliosa.

In the valley there is a small permanent fountain. The area around the fountain is covered with *Odyssea paeoniiflora* (NEES) STAFF(60%) and *Zygophyllum stapfii* SCHINZ(15%).

On the riverbank the following plants were observed:
*Commiphora sasicolora* ENGL.
*Trianthema triquetra* WILDL. ss. *parviflora* (SONDER) JEFFREY
*Acacia ecklonis* E.MEYER
*Codon royenii* L.
*Zygophyllum stapfii* SCHINZ
*Sutera maxii* HIERN.
*Blepharis grossa* (NEES) T.ANDERS
*Tamarix usnoides* E.MEYER ex BUNGE
*Salvadora persica* L.
*Salsola* sp.

On the hills, covered with scree of marble, only a few species are growing (cover less than 1%):
*Aloe dichotoma* MASSON
*Commiphora sasicolora* ENGL.
*Euphorbia virosa* WILDL.
*Euphorbia lignosa* MARLOTH
*Poaceae* spp.div. (poor condition, not identified).
7.2.1.2 Granite Ranges and Outcrops

7.2.1.2.1 Peak 16

Between the sand sea of the Skeleton Coast Park and the Hartmann Valley a granite mountain range with a maximum height of 1078 m extends in N-S direction. A mountain with a height of 1014.5 m (trigonometric point number 16) was surveyed. Due to the presence of many cracks, washes, depressions, small gorges, etc. a vegetation, rich in species can develop. The distance to the coast is 50 km, so that fog often reaches the mountain and provides an additional amount of water. The soil is shallow in most places, only in a few depressions the soil is more than 0.5 m deep. The following plants were found:

_Acanthosicyos horridus_ Welw. ex Hook. F.
_Adenolobus garipensis_ (E. Meyer) Torre & Hillcoat
_Antheponia ramosa_ Goossens
_Commpiphora glauescens_ Engl.
_Commpiphora saxicola_ Engl.
_Commpiphora virgata_ Engl.
_Commpiphora wildii_ Merxm.
_Chamaesyce inaequalata_ (Sonder) Sojak
_Sterculia africana_ (Lour.) Fiori
_Maerua schinzii_ Pax
_Monechma divaricatum_ (Nees) C. B. Cl.
_Monechma cleomoides_ (S. Moore) C. B. Cl.
_Stipagrostis hirtigluma_ (Steudel ex Trin. & Rupr.) de Winter
_Setaria verticillata_ (L.) Beauv.
_Monelytrum luederitzianum_ Hackel
_Eragrostis echinochloidea_ Staff
_Eragrostis rotifer_ Rendle
_Indigofera cunenensis_ O. Hoffm.
_Rogeria adenophylla_ J. Gay ex Delile
_Parkinsonia africana_ Sonder
_Orchanthera albida_ Schinz.
_Helichrysum roseo-niveum_ Marloth & O. Hoffm.
_Euphorbia phylloclada_ Boiss.
_Sesamum_ sp.
_Heliotropium_ sp.
_Helichrysum cfr._ riparium Brenan
_Aloe_ sp.

_Commpiphora wildii_ Merxm. and _Commpiphora saxicola_ Engl. are the most common trees on
7.2.1.2 Granite Ranges and Outcrops

7.2.1.2.1 Peak 16

Between the sand sea of the Skeleton Coast Park and the Hartmann Valley a granite mountain range with a maximum height of 1078 m extends in N-S direction. A mountain with a height of 1014.5 m (trigonometric point number 16) was surveyed. Due to the presence of many cracks, washes, depressions, small gorges, etc., a vegetation, rich in species can develop. The distance to the coast is 50 km, so that fog often reaches the mountain and provides an additional amount of water. The soil is shallow in most places, only in a few depressions the soil is more than 0.5 m deep. The following plants were found:

Acanthosicyos horridus Welw. ex Hook. F.
Adenolobus garipensis (E.Meyer) Torre & Hillcoat
Antheophora rosina Goossens
Commiphora glaucescens Engl.
Commiphora saxicola Engl.
Commiphora virgata Engl.
Commiphora wildeii Merxm.
Chamaesyce inaequilateral (Sonder) Sojak
Sterculia africana (L.) Fiori
Maerua schinzii Pax
Monechma divaricatum (Nees) C.B.Clar.
Monechma cleomoides (S.Moore) C.B.Clar.
Stipagrostis hirtigluma (Steudel ex Trin. & Rupr.) De Winter
Setaria verticillata (L.) Beauv.
Moneymtrum kederitzianum Hackel
Eragrostis echinochloidea Staff
Eragrostis rotifer Rendle
Indigofera cunenensis O. Hoffm.
Rogeria edenophylla J.Gay ex Delile
Parkinsonia africana Sonder
Orthosiphon thibida Schintz
Helichrysum roseo-niveum Marloth & O.Hoffm.
Euphorbia phylloclada Boiss.
Sesamum sp.
Heliotropium sp.
Helichrysum cfr. riparium Brenan
Aloe sp.

Commiphora wildeii Merxm. and Commiphora saxicola Engl. are the most common trees on
this mountain. Acanthosicyos horridus Welw. ex Hook. f. was found only on one small hill at the western side of the mountain.

Fig. 19: (p.128) On several places in the Namib circles, completely devoid of vegetation can be found. One hypothesis says that this phenomenon is due to a Euphorbia which secretes a phytotoxic substance in the soil. Even long after the Euphorbia died off, the substance still prevents the germination of seeds. On the border of the circle, plants are mostly better developed than outside the circle. The Poaceae growing on this plain is Stipagrostis giessei KERS.

7.2.1.2.2 Brandberg

The Brandberg is a huge granite mountain range, with several mountain tops exceeding 2000 m. It is known as a very important centre of endemism: a number of plant taxa have an area limited to this mountain. Nordenstam (1974) mentioned 11 taxa (this list does not contain Lithops pseudotruncatella (Berger) N.E. Br. var. brandbergensis De Boer which was described as a separate taxon by De Boer). The number of plant species, recorded on this mountain is increasing regularly. In 1970 the number of taxa was 337 (Nordenstam, 1974).

During the present project two botanical excursions were organized: the first one was an excursion in the Tsabab Valley, at the eastern side of the mountain; a second exploration took place in the southern part of the mountain (Orabeswand and Aigub). During the second exploration two endemic taxa (of the total of 12, listed in literature) were found: Euphorbia monteiroi Hook.f. subsp. brandbergensis B.Nord. and Lithops pseudotruncatella (Berger) N.E. Br. var. brandbergensis De Boer.

Fig. 26: (p.120) Euphorbia monteiroi Hook.f. subsp. brandbergensis R.Nordenstam: endemic of the Brandberg.

In the valleys of the Brandberg Acacia montis-usti Merxm. & Schreiber is the most important tree, forming important stands.

In the Tsabab valley the following plants were found and could be identified:

Commiphora krauseliana Heine
Commiphora sazicola Engl.
Commiphora virgata Engl.
Zygophyllum simplex L.
Tribulus zeyheri Sonder
Galenia africana L.
Calicorema capitata (Moq.) Hook f.
Chamaesyce chamaesyoides (R.Nordenstam) Koutnik
Chamaesyce glanduligera (PAX) KOUTNIK
Mollugo cerviana (L.) Ser. ex DC.
Cadaea roehrsellii SOESSING
Gisekeia africana (LOUR.) O.KUNTZE
Sesuvium sessuvioides (FENZL.) VERDC.
Tephrosia dreyana E.MEYER
Monsonia senegalensis GUIL. & PERR.
Cyperus marginatus THUNB.
Mariscus aristatus (ROTTB.) CHERMEZON
Vahlia capensis (L.F.) THUNB.
Hibiscus engleri K. SCHUM.
Hermannia amabilis MARL. ex K.SCHUM.
Cleome foliosa HOOK.F. var. foliosa
Ricinus communis L.
Abutilon pycnodon HOCHR.
Plectranthus hereroensis ENGL.
Launaea intybaecea (JACQ.) BEAUVERD
Solanum rigescenoides HUTCH.
Gossypium anomalum WAWR.
Tamarix usneoides E.MEYER EX DUNGE
Sutera canescens (BENTH.) HIERN.
Monochma arenicola (ENGL.) C.B.C.L.

During the second excursion on the Orabeswand and the Aigub the following plants were found:

Lithops pseudotruncatella (BERGER) N.E.BR. var. brandbergensis DE BOER
Euphorbia monteiroi HOOK.F. subsp. brandbergensis B.NORD.
Myrothamnus flabellifolius WELW.
Stapelia kwabensis N.E.BR.
Vahlia capensis (L.F.) THUNB.
Acacia hereroensis ENGLER
Cheilanthes parviloba SWARTZ
Cyphostemma curreri (HOOK.F.) DESC.
Aspilia cenii S.MOORE
Sterculia africana (LOUR.) FIORI
Sterculia quineloha (GARCKE) K.SCHUM.
Wahlenbergia androsacea A.DC.
Helichrysum sp.
Kleinia sp.
Aloe dichotoma Masson
Aloe hereroensis Engler
Aloe littoralis Baker
Aloe viridiflora Reynolds.

Fig. 30: (p.124) Lithops pseudotruncatella (Berger) N.E.Br. var. brandbergensis De Boer; very rare endemic of the Brandberg.

7.2.1.2.3 Spitzkoppe

On the gravel plain between the Omaruru and Swakop there are two bornhardts (inselbergs) which date from the Cretaceous (post Karoo intrusions): Klein Spitzkoppe (height: 1580 m) and Gross Spitzkoppe (height: 1728 m). Both inselbergs are made up of granite. A botanical excursion was done at the southern side of the Gross Spitzkoppe together with 2 relevés on the plain southeast of the mountain. The following plants were found:

Acacia karroo Hayne
Acacia mellifera (Vahl) Benth.
Acacia reficiens Wawra
Boscia foetida Schinz subsp. foetida
Maerua schinzii Pax
Acacia senegal (L.) Willd.
Sterculia africana (Lour.) FIORI
Rogeria longiflora (Royen) J.Gay ex DC.
Aloe dichotoma Masson
Boscia foetida Schinz subsp. foetida
Boscia albibractea (Burch.) Gilg & Benedict
Euphorbia phylloclada Boiss.
Ficus cordata Thunb.
Commiphora anacardiifolia Dinter & Engl.
Commiphora multijuga (Hiern.) K.Schum.
Commiphora saxicola Engl.
Commiphora tenutipetiolata Engl.
Commiphora virgata Engl.
Commiphora vildeii Merxm.

Fig. 22: (p.125) Aloe dichotoma Masson, endemic on the eastern edge of the Namib Desert.
7.2.1.2.4 Vogelfederberg

The Vogelfederberg is a small granite outcrop, about 55 km north of Gobabeb. It consists of two hills with a maximum height of 527 m. The smooth surface of the two hills is devoid of any plant growth except for some crevices, gullies and depressions. Around the hills a plant community, rich in species and with a high percentage of cover can develop (fig. 20, p.128). These plant communities can be typified by Aloe asperifolia A. BERGER which is quite abundant here. Other common plants are:

* Galenia africana L. 
* Sutera maxii HIERN. 
* Salsola tuberculata (MOQ.) FENSL. 
* Euphorbia phylloclada BOISS. 
* Chamaesyce inequidens (SONDER) SOJAK 
* Calicorema capitata (MOQ.) HOOK F. 
* Blepharis grossa (NEES) T.ANDER 
* Blepharis bossii OBERM. 
* Kleinia longiflora DC. 
* Peckel–Loeschea leubnitziae (O. KUNTZE) O. HOFFM. 
* Othonathera albida SCHINTZ 
* Arthracna leubnitziae (KUNTZE) SCHINTZ 
* Geigeria ornata O.HOFFM. 
* Zygophyllum stapfii SCHINTZ.

In a few crevices, especially at the western side of the hills, Hoodia currori (HOOK.) DECNE is growing. Unfortunately specimens of this quite rare species are often uprooted or otherwise damaged by tourists (pers.obs.).

Due to grazing of game, most of the grasses growing at Vogelfederberg were reduced to browsed tufts. A lot of them could not be identified. Four species were found:

* Enneasapogen brachystachus (JAUB. & SPACH) STAFF 
* Stipagrostis hirtigluma (STUEDEL ex TRIN. & RUPR.) DE WINTER 
* Stipagrostis uniplumis (LICHT. ex ROEMER & SCHULTES) DE WINTER 
* Stipagrostis obtusa (DELILE) NEES ex KUNTH.

Species of plants which were found on a limited number of spots are:

* Tephrosia dregeana E.MEYER 
* Commiphora saxcola ENGL. 
* Euclca pseudobenus E. MEYER ex A.DC 
* Asclepias buchanaviana SCHINTZ
Myrothamnus flabellosus Welw.
Zygophyllum simplex L.
Ziziphus mucronata Willd.
Lamacea intybacea (Jacq.) Beauverd.

Fig. 20: (p.128) Around the Vogelfederberg a dense vegetation of Aloe asperifolia A. Berger, Calicorema capitata (Moq.) Hook f., Blepharis spp. div. and several other species develops.

7.2.1.2.5 Mirabib

Mirabib is a small granite inselberg WNW from Gobabeb with a height of 840 m. Due to the continuous drought during the last years, a lot of plants were found dried out (e.g. Mesembryanthemum guerichianum Pax, a quite abundant plant in the mountain) and the vegetation was reduced. Plant communities were found in small crevices, gullies and depressions and on the fring of the mountain. The plant community on the mountain consisted of the following species:

Commiphora saxicola Engl.
Boscia foetida Schinz subsp. foetida
Meeria schinzii Pax
Sutera mazzii Hiern.
Zygophyllum cylindrofolium Schinz
Rogeria longispora (Rozen) J.Gay ex DC.
Protasparagus pearsonii (Kies) Oberm.
Myrothamnus flabellosus Welw.
Giselia africana (Lour.) O.Kuntze
Chamaesyce glanduligera (Pax) Koutnik
Forsskaelea candida L.F.
Sesuvium sesuvioides (Fenzl.) Verdc.
Calicorema capitata (Moq.) Hook f.
Euclea pseudobenus E. Meyer ex A.DC
Tephrosia dregeana E.Meyer
Zygophyllum simplex L.
Blepharis sp. non ident.
Poaceae spp. non ident.

In the washes around the mountain Acacia reficiens Wawra, Commiphora saxicola Engl., Boscia foetida Schinz subsp. foetida, Acacia ciroloba E.Meyer, Parkinsonia africana Sonder and Adenolobus garipensis (E.Meyer) Torre & Hillcoat were growing together with Blepharis sp., Sutera mazzii Hiern., Poaceae sp. and Acanthaceae sp. Southeast from the Mirabib there is a complex of small granite hills which belong to the same geological entity. In these hills a plant community, consisting mainly of Sarcocaulon marlothii Engl. was found.
7.2.2 Riverbeds and Valleys

7.2.2.1 Kunene

In the northern Namib the Kunene forms a barrier against the Engo – Kunene Sand Sea. This sand sea consists of sand dunes with heights up to 25 m and lying on a granite bedrock. The prevailing wind direction is S–SW. The result is a north to northeasterly movement of the sand. This sand cascades via slipfaces or is blown by wind in the Kunene river. This process is quite similar to what happens along the lower Kuiseb except for the fact that the Kunene is a perennial river.

The southern (Namibian) side of the Kunene is mostly very steep consisting of slipfaces of dunes and cliffs of up to 90°. Only at a few places a riverine vegetation can develop.

The northern (Angolan) side on the other hand is mostly less steep and creates more possibilities for the establishment of riverine plant communities. Towards the mouth the valley becomes wider and forms an estuarian with marshes. *Phragmites australis* (Cav.) Steudel dominates the plant communities on the riverbank (cover of up to 100 %). At some places *Phragmites australis* (Cav.) Steudel can be found several metres high along slipfaces. Sometimes the reed plants serve as phorophytes for *Ipomoea rubens* Choisy. Patches of *Poaceae* sp.div. and *Cyperaceae* sp.div. develop among the reed. *Heliotropium* sp. is fairly abundant (cover of up to 25 %) while *Datura innoxia* Mill and *Ricinus communis* L. are common aliens.


Along the Kunene the bedrock is mostly covered by sand dunes. At the few places were the bedrock is not covered, a sparse vegetation develops. Characteristic species are *Zygophyllum stapfii* Schinz, *Zygophyllum simplex* L., *Salsola* sp., *Heliotropium* sp. and the prostrate creeper *Merremia multisecta* Hall.f.. Other species which were encountered are:

- *Orthotheca albida* Schinz
- *Tribulus zeheri* Sonder
- *Euclea pseudobenus* E. Meyer ex A.DC
- *Commiphora wilidi* Mерьxm.
- *Lycium cinnereum* Thunb.
- *Commiphora sasicola* Engl.
- *Sterculia africana* (Lour.) Fiori.
The shifting dunes are devoid of vegetation. At the eastern end of the sand sea a huge \textit{lnara} field of several square kilometres exists. \textit{Acanthosicyos horridus} Welw. ex Hook. f. forms small dunes. However, at the time of inventarisation, a large part of the plants was dead, dying or in fairly bad condition. Around these small dunes \textit{Stipagrostis giessii} Kers is the most common grass.

7.2.2.2 Engo

The Engo or Ondondujengo catchment area consists of parallel washes which drain the Hartmann Mountains. Within the scope of this survey the southernmost wash was studied together with the adjacent rocky hills.

Fig. 28: (p.139) \textit{Euphorbia kaokokensis} (White, Dyer & Sloane) Leach: rare \textit{Euphorbia} of Kaokoveld.

The studied river has a west-east direction and ends at the eastern edge of the sand sea of Skeleton Coast Park. On this place a \textit{lnara} field of several square kilometres exists.

In the riverbed \textit{Parkinsonia africana} Sonder is a fairly common tree. \textit{Calicorema capitata} (Moq.) Hook f. is very common and forms little hummocks in the riverbed. \textit{Cleome foliosa} Hook. var. foliosa, \textit{Forsskaoltea candida} L.f. and \textit{Blepharis} sp. can be found together with \textit{Merremia guerichii} Meeuse. On the riverbank some specimens of \textit{Commiphora wildii} Merxm. and \textit{Commiphora saxicola} Engl. appear.

The vegetation on rocky hills south of the river is characterized by \textit{Commiphora wildii} Merxm., \textit{Euphorbia virosa} Willd., \textit{Aloe} sp. and \textit{Sarcocaulon} sp. Other plants which were found were:

\textit{Commiphora saxicola} Engl.
\textit{Euphorbia phylloclada} Boiss.
\textit{Orthoboea albida} Schinz
\textit{Adenolobus garipensis} (E. Meyer) Torre & Hillcoat
\textit{Helichrysum} sp.

7.2.2.3 Munutum

Okau fountain is an oasis of brackish water. Large stands of \textit{Phragmites australis} (Cav.) Steudel (cover of up to 100 %) are characteristic for the oasis. Patches of Cyperaceae can be found among the reed. Immediately around the reed stands \textit{Tamarix usneoides} E. Meyer ex Bunge is fairly common (cover up to 10 %), sometimes in association with \textit{Salvadora persica} L..

sesuvioideae (FENZL.) VERDC. and Mesembryanthemum cryptanthum HOOK.F. form a patchy vegetation among the large hummocks with Acaenhotisios horridus WELW. ex HOOK. F., Further upstream, Balanites welwitschii (TIEGHEM) EXELL & MENDOCA, Parkinsonia africana SONDER and Colophospermum mopane (KIRK ex BENTHAM) KIRK ex LEONARD become quite common trees in the riverbed.

In the rocks, northwest of the fountain Arithraea lebuinitziae (KUNTZE) SCHINZ and Salsola sp. are the most characteristic plants of the vegetation.

7.2.2.4 Sechomib

The Sechomib is a small river, southwest of Orupembe. In the riverbed the vegetation is not very luxuriant. Parkinsonia africana SONDER, Salvadora persica L., Gisekea africana (LOUR.) O.KUNTZE, Calicorema capitata (MOQ.) HOOK.F., Cleome foliosa HOOK.F. var. foliosa, Zygoophyllum simplex L., Bosia foetida SCHINZ subsp. foetida, Balanites welwitschii (TIEGHEM) EXELL & MENDOCA and Tribulus zeyheri SONDER are the main plant species typical for the riverine vegetation. Kohoutia cynanchica DC. was found on a few places in the riverbed between Orupembe and Ogams. Ogams is a small permanent waterhole or fountain in the valley of the Sechomib, about 5 km from the riverbed. The plant community in the waterhole consists of Typha capensis (ROHRB.) N.E.BR., Phragmites australis (Cav.) STEUDEL and a Cyperaceae sp. In the small valley along the track from Ogams to the Klinimb there is a rich vegetation. The following plants were found and identified:

Welwitschia mirabilis HOOK.F.
Chloris flabellata (HACKEL) LAUNERT
Calicorema capitata (MOQ.) HOOK.F.
Talinum arnottii HOOK.F.
Cleome foliosa HOOK.F. var. foliosa
Adenia pachnellii (ENGL.) HARRMS
Indigofera auricoma E.MEY.
Gossypium anomalum WAWRW
Zygoophyllum stapfii SCHINZ
Euphorbia virosa WILLD.
Commiphora virgata ENGL.
Commiphora wildii MERXN.
Sarcocaulon marlothii ENGL.
Gisekea africana (LOUR.) O.KUNTZE
Heliotropium sp.
Acanthaceae sp.div.
Poaceae sp.div.
Fig. 31: (p.132) Welwitschia mirabilis Hook.f.: male cones.

Fig. 32: (p.132) Adecvia pechuelii (Engl.) Harms: a succulent Passifloraceae.

7.2.2.5 Khumib

The Khumib was investigated only over a short stretch near the border of the Skeleton Coast Park. The following plants were determined:

Balanites welwitschii (Tieghem) Exell & Mendoza
Phaeopilum spinosum Radlk.
Zygophyllum simplex L.
Zygophyllum stapffii Schinz
Cleome foliosa Hook.f. var. foliosa
Parkinsonia africana Sonder.

At about 10 km from the mouth there is a huge permanent waterhole: Sarussas. Due to logistic problems the investigation of this interesting area had to be canceled.

7.2.2.6 Hoarusib

The canyon downstream Purros was investigated. Several plant communities could be recognized. In the riverbed, with permanent waterflow, Phragmites australis (Cav.) Steudel forms very dense stands. Cyperus laevigatus L., Juncus rigidus Desf., Scirpus dioicus (Kunth) Boeck. and Mariscus aristatus (Rottb.) Chermezon can be found between or around these stands. Mariscus aristatus (Rottb.) Chermezon forms sometimes monospecific stands.

In that part of the riverbed, with only waterflow during the floods Pechuel-Loeschea leubnitziae (O. Kuntze) O. Hoffm., Datura innoxia Miller, Datura stramonium L., Zygophyllum simplex L., Tribulus zeyheri Sonder, Juncus rigidus Desf., Phragmites australis (Cav.) Steudel, Heliotropium sp. and Paeaceae sp.div. occur.

In the old riverbed, situated about 0.5 - 1.5 m above the present riverbed the plant community consists of:

Pecheuel-Loeschea leubnitziae (O. Kuntze) O. Hoffm. (with a cover of up to 25 %)
Tamarix ussuroides E. Meyer ex Bunge (with a cover of up to 80 %)
Suaeda sp.
Heliotropium sp.
Salsola sp.
Salvadora persica L.
Zygophyllum simplex L.
Acacia eriophba E. Meyer
Acacia albida Del.
Zygophyllum stapfii Schinz
Hyphaene petersiana Klotzsch (introduced).

7.2.2.7 Hoanib

The Hoanib river flows through a narrow gorge between Sesfontein and Amâpoom. The vegetation in the Hoanib riverbed resembles the vegetation in the Huarusib. Some plants which were not found in the Huarusib were Flaveria bidentis (L.) Kuntze, Forskaloa viridis Ehrenb. ex Webb and Tribulus zeyheri Sonder.

The Gui-un Vlei is completely covered by Suaeda cf. plumosa Aellen and Tamarix usneoides E. Meyer ex Bunge. At some places Nicotiana glauca Graham and Ficus sycomorus L. can be found.

The floodplain near the coast is a mosaic of marshes, open water and small dunes. In the marshes Phragmites australis (Cav.) Steudel covers up to 95% of the area. Higher up the percentage of cover decreases while other species become more abundant: Salza nollothensis Aellen, Salza aphylla L.F., Psyllocaulon salicornioides (Pax) Schwantes, Sporobolus virginicus (L.) Kunth, Suaeda cf. plumosa Aellen and Cladoraphis cypereoides (Thunb.) S.M. Phillips grow on small dunes around and in the marshes.

7.2.2.8 Uniab

Close to the coast the Uniab has cut a small canyon over the years. The continuous running water gives rise to the possibility for the formation of a dense vegetation. Polypogon monspeliensis (L.) Desf. (cover: max. 60%) and Cyperus laevigatus L. (cover: max. 85%) form very dense stands. The following plants were part of this plant community:

Typha capensis (Rohrb.) N.E. Br.
Phragmites australis (Cav.) Steudel
Juncus rigidus Desf.
Geigeria spinosa O.Hoffm.
Sporobolus virginicus (L.) Kunth
Eragrostis walteri Pilger
Lannaea intybus (Jacq.) Beauverd
Scirpus dioicus (Kunth) Boeck.

In a small pool at the exit of the canyon a Characeae sp. (an algae) and Potamogoton pectinatus L. was found.

At about 5 km from the coast a damp place extends over an area of several hectares. The
plant community of this area consisted of the following species:

*Phragmites australis* (Cav.) Steudel  
*Sporobolus virginicus* (L.) Kunth  
*Scirpus dioicus* (Kunth) Boeck.  
*Suaeda* sp.  
*Typha capensis* (Rohrb.) N.E.Br.  
*Epallets gariepina* (DC.) Steetz.

Upstream the following observations could be done: *Acanthosicyos horridus* Welw. ex Hook. f. is growing on the borders of the riverbed from km 6 to km 15, forming large hummocks. A lot of plants were not healthy: large parts were grey and dying off. This could be caused by a blight (pers.comm. D.Bartlett of the National Geographical Society). *Tamarix usnocides* E.Meyer ex Bunge and *Salvadora persica* L. were found upstream from km 14.

At about 20 km from the coast a second part of the rivervalley was investigated. The plant community in the riverbed (sand and silt) was dominated by five plants: *Tamarix usnocides* E.Meyer ex Bunge, *Chloris flabellata* (Hackel) Launert, *Zygophyllum stapfii* Schinz, *Salvadora persica* L. and *Suaeda* sp. On the rocky riverbank *Arthracena leucnitiae* (Kuntze) Schinz, *Zygophyllum simplex* L., *Zygophyllum stapfii* Schinz and *Heliotropium* sp. were found. Further away from the river *Welwitschia mirabilis* Hook.f. and *Trichocalon dinteri* Berger were growing on a slope (±25°, exposition: N) with scree. A small crevice, south of the river was also examined. A plant community with the following species was found:

*Cisekia africana* (Lour.) O.Kuntze  
*Senna italica* Miller subsp. *micrantha* (Brenan) Lock  
*Tephrosia dregena* E.Meyer  
*Welwitschia mirabilis* Hook.f.  
*Zygophyllum stapfii* Schinz  
*Trichodesma afromanum* (L.) Lehmann  
*Trichocalon dinteri* Berger  
*Kleinia longiflora* DC.  
*Blepharis grossa* (Nees) T.Anders  
*Merremia guerichii* Meunier.

7.2.2.9 Koigab

In the upper part of the catchment area (on the farm Wereldsend at an altitude of 800-850 m) the vegetation was examined along a gradient, perpendicular on a wash. Due to the drought (no rain during the rainy season of 1991-1992) there were no ephemerals growing. Based on the observations of the perennials the following plant communities could be delimited.
In the wash (coarse sand and some stones) *Welwitschia mirabilis* HOOK.F., *Parkinsonia africana* SONDER and *Boscia foetida* SCHINZ subsp. *foetida* together with an *Acanthaceae* sp. (poor condition, not yet identified) were the main plants, composing the plant community. Among these trees and shrubs some specimens of *Blepharis gigantea* OBERM., *Euphorbia damarana* LEACH, *Commiphora saxicola* ENGL. and a *Blepharis* sp. *non ident.* were present.

On the bank of the wash (slope of ± 5°) *Welwitschia mirabilis* HOOK.F. was more abundant, while *Parkinsonia africana* SONDER and *Boscia foetida* SCHINZ subsp. *foetida* were no longer present. *Euphorbia damarana* LEACH and *Blepharis gigantea* OBERM. were the dominating elements of the plant community on the bank.

Further away from the wash, on a slope of ± 30°, the plant community was typified by *Commiphora krausseliana* HEINE, *Acacia robynsiana* MERM. & SCHEIBER and *Euphorbia siroza* WILDL. *Euphorbia damarana* LEACH, which is very abundant in this area was completely absent on this steep hill but reappeared higher up when the hill became less steep. On this hill four species of *Commiphora* could be identified: *Commiphora saxicola* ENGL., *Commiphora tenuipelota-lata* ENGL., *Commiphora wilddii* MERM. and *Commiphora krausseliana* HEINE. *Blepharis gigantea* OBERM. was less abundant than on the bank of the wash. *Welwitschia mirabilis* HOOK.F. was completely absent.

Along the road a gradient (inland - coast) on a plain (slope: less than 1%, exposition: S - SW) in the catchment area of the Koigab was examined. *Welwitschia mirabilis* HOOK.F. was the only plant growing there (cover never exceeding 1%) up to 15 km from the coast. In washes, *Arthraerua leubnitziae* (KUNTZE) SCHINZ was found in an area between the coast and a mountain hill, nearly 30 km from the coast. A small hummock with *Acanthusicagos korridus* WELW. EX HOOK. F. was found about 10 km from the coast.

In the riverbed of the Koigab the plant communities were examined on three spots (hereafter numbered 1,2,3), situated at several distances from the coast.

1: 6 km from the coast (along the main road between Ugab mouth and Torra Bay). The plant community consisted of *Zygophyllum stapfii* SCHINZ and *Salsola* sp. Both plants form small hummocks with a height of up to 2 m. The global cover never exceeds 1%. One specimen of the prostrate creeper *Merremia multisepta* HALL.F. was found in the riverbed.

2: 18 km from the coast (along the main road between Torra Bay and Wereldsend). *Welwitschia mirabilis* HOOK.F., *Zygophyllum stapfii* SCHINZ and *Arthraerua leubnitziae* (KUNTZE) SCHINZ determined the general aspect of the vegetation in the riverbed. *Merremia guerichii* MEUSE and two species of Fabaceae (non ident.) and *Stipagrostis ramulosa* DE WINTER were found at several places in the riverbed.

3: 35 km from the coast (along the main road between Torra Bay and Wereldsend) *Tamarix*
usneoides E. MEYER ex BUNGE (cover: max. 5%), Zygophyllum stapfii SCHINZ (cover: max. 1%), Phaeophilum spinosum RAD. (cover: max. 2%), Salsola sp. (cover: max. 25%) and Suada sp. (cover: max. 30%) were the main constituents of the plant community in the riverbed. The following species were also found in the riverbed (cover: less than 1%):

Maerua schinzii PAX
Adenolobus pechuelii (O. KUNTZE) TORRE & HILLCOAT
Calicorema capitata (MOQ.) HOOK F.
Sesbania pachicarpa DC. subsp. dinterana GILLET
Sutera maffii HIERN.
Galenia africana L.
Boscia foetida SCHINZ subsp. foetida
Stipagrostis sp.
Poaceae sp. non ident.

In the washes on hills, north of the riverbed Welwitschia mirabilis HOOK. F., Hermannia amabilis MARL. ex K. SCHUM., Euphorbia virosa WILD., Commiphora sazicola ENGL., Helichrysum roseo-nitens MARLOTH & O. HOFFM., Adenolobus garipensis (E. MEYER) TORRE & HILLCOAT, Adenolobus pechuelii (O. KUNTZE) TORRE & HILLCOAT, Kleinia longiflora DC., Sarcoceylon marlothii ENGL., Arthrocneua lehmitziæ (KUNTZE) SCHINZ and Trichocalon dinteri BERGER were growing. Non of these species covered more than 1% in any plot.

7.2.2.10 Huab

At about 1 km from the river mouth the number of species found in the riverbed was limited. Two members of the Chenopodiaceae (Suada sp. (cover: max. 20%) and Salsola sp. (cover: max. 5%)) were the only species found in the riverbed. The soil in the riverbed consists of fine sand and silt.

A second part of the river was investigated. At about 9 km from the coast, near the Jack Scott Bridge, permanent running water creates the possibility for a very dense riverine vegetation. A monospecific stand of Phragmites australis (Cav.) STEUDEL is found ± 100 m downstream the bridge. Along the running water a community of Odyssea paucinervis (NEES) STAFF, Suada sp. and Juncus rigidus DESF. was found. Further away from the water Zygophyllum stapfii SCHINZ, Brownanthus kunzei (SCHINZ) IHLENF. & BITTRICH and Salsola sp. replaced Juncus rigidus DESF.. In a small wash Zygophyllum stapfii SCHINZ, Zygophyllum clavatum SCHLECHTER & DIELS and Arthrocneua lehmitziæ (KUNTZE) SCHINZ were found among the schists.

7.2.2.11 Ugab

The Ugab has the largest catchment area of all ephemeral rivers in the Namib. The riverbed was studied over a distance of about 15 km, upstream from the entrance of the Skeleton Coast
Park. The vegetation of the riverbed and riverbanks is completely dominated by aliens:

*Prosopis* sp.
*Nicotiana glauca* GRAHAM
*Datura innoxia* MILLER
*Datura stramonium* L.
*Ricinus communis* L.

Other plants, which can be found in the riverbed are:

*Tamarix usneoides* E.MEYER ex BUNGE(on the old riverbed and on the riverbanks)
*Cyperus marginalis* THUNB.
*Citrullus ecirrhosus* COGN.
*Sutherlandia maxii* HIERN..

At about 20 km of the coast a small gorge near the river was investigated. The plant community consists of the following species:

*Lithops ruschiorum* (DINTER & SCHWANTES) N.E.BR. var. *ruschiorum*
*Cotyledon orbiculata* L.
*Sutherlandia maxii* HIERN.
*Euphorbia giessei* LEACH
*Arthraerina leubnitziar (KUNTZE) SCHINZ
*Browallia kuntzei (SCHINZ) HILLENF. & BITTRICH
*Zygophyllum stapfii* SCHINZ
*Zygophyllum simplex* L.
*Senecio engelmannii* O. HOFFM.
*Senecio flavus* (DECNE) SCHULTZ-BIP.
*Calicorema capitata* (MOQ.) HOOK F.
*Hoodia currorii* (HOOK.) DECNE
*Welwitschia mirabilis* HOOK.F.
*Sarcocaulon marlothii* ENGL.

Fig. 29: (p.139) *Lithops ruschiorum* (DINTER & SCHWANTES) N.E.BR. var. *ruschiorum* (Ugab).
7.2.2.12 Swakop

In the Swakop, downstream Salem, the vegetation is dominated by *Tamarix usneoides* E. MEYER ex BUNGE. At several places (e.g. upstream from Goanikontes) it forms monospecific stands of several hectares. The alien *Prosopis sp.* is very common. *Hyphaene petersiana* KLOTZSCH has been introduced along the river and is now quite common in the riverbed. Also the aliens *Argemone ochroleuca* SWEET, *Datura innoxia* MILLER, *Datura stramonium* L., *Nicotiana glauca* GRAHAM and *Ricinus communis* L. are very common in the riverbed. *Acacia albida* DEL., *Acacia erioloba* E. MEYER and *Salvadora persica* L. form a plant community, typical for riverbanks. The following *Poaceae* are also found:

*Antheophora pubescens* Nees  
*Aristida meridionalis* HenrARD  
*Tricholaena monachae* (Trin.) Staff & C. E. Hubbard  
*Stipagrostis uniplumis* (Licht. ex Roemer & Schultes) De Winter  
*Stipagrostis oblusa* (Delile) Nees ex Kunth  
*Stipagrostis hirtigluma* (Steu. ex Trin. & Rupr.) De Winter  
*Pogonarthria fleckii* (Hackel) Hackel  
*Fingerhuthia africana* Nees  
*Enneapogon brachystachus* (Jaub. & Spach) Staff  
*Eragrostis annulata* Rendle  
*Eragrostis rotifer* Rendle  
*Phragmites australis* (Cav.) Steudel.

Other plants found in the valley are:

*Tribulus zeferi* Sonder  
*Tribulus terrestris* L.  
*Zygophyllum stafffi* Schinz  
*Zygophyllum simplex* L.  
*Chamaesyce glanduligera* (Pax) Koutnik  
*Euphorbia phylloclada* Boiss.  
*Cleome foliosa* Hook. F. var. foliosa  
*Sutera mazzii* Hiern.  
*Cucumis africanus* L.f.  
*Citrullus ecirrhosus* Cogn.  
*Parkinsonia africana* Sonder  
*Pechuel-Loeschen leubnitziae* (O. Kuntze) O. Hoffm.  
*Rogeria longiflora* (Røyen) J. Gay ex DC.

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*Prosopis* is an alien genus of spiny trees and shrubs, which displaces the native vegetation in several Namibian rivers. In spite of the efforts of the Ministry of Wildlife, Conservation and Tourism to get rid of the trees by cutting or spraying with selective herbicides, the plague is still aggravating (pers. comm. Min. W.C.T.).
Flaveria bidentis (L.) KUNTZE
Codon rogenii L.
Galenia africana L.
Hermannia amabilis MARL. ex K.SCHUM.
Launaea intybacea (JACQ.) BEAUVERD
Maerua schinzii Pax
Mollugo cerviana (L.) Ser. ex DC.
Cullen obtusifolia (DC.) C.H.STIRTON
Cyperus marginatus THUNB.
Pergularia daemia (FORSSKAL) CHIOV.

At the mouth of the Swakop there is a brackish swamp with a very rich vegetation. *Odyssea paucinervis* (NEES) STAFF., *Cyperus marginatus* THUNB., *Sarcocornia natalensis* (BUNGE ex UNG.-STERNB.) A.J.SCOTT and *Phragmites australis* (Cav.) STEUDEL form very dense stands. The following other plants belong to the same community:

*Salsola* sp.
*Brownanthus kuntzei* (SCHINZ) IHLENF. & BITTRICH
*Galenia papulosa* ECKLOM & ZEYHER) SONDER var. *papulosa*
*Zygophyllum simplex* L.
*Heliotropium ovatifolium* FORSK.
*Cladophris spinosa* (L.F.) S.M.PHILLIPS
*Tamarix usneoides* E.MEYER ex BUNGE

together with the aliens *Nicotiana glauca* GRAHAM and *Heliotropium curassavicum* L.. Higher up, on the old riverbed, the plant community is supplemented with:

*Trichus zeyheri* SONDER
*Brownanthus kuntzei* (SCHINZ) IHLENF. & BITTRICH
*Tetragonia reduplicate* WELW. ex OLIVER
*Merremia guerichii* MEEUSE
*Lycium cinereum* THUNB.
*Galenia africana* L.
*Launaea intybacea* (JACQ.) BEAUVERD
*Sesuvium sesuvioides* (FENZL.) VERDC.
*Senecio engleranus* O. HOFFM.

In a side valley of the Swakop, southwest of the Husabberg a rich plant community was found on scree, among boulders. The following plants were found:

*Sterculia africana* (LOUR.) FIORI
*Boscia foetida* SCHINZ subsp. *foetida*
Hermannia amabilis MARL. ex K.SCHUM.
Aloe dichotoma MASSON
Hoodia currorsii (HOOK.) DECNE
Euphorbia virosa WILDL.
Adenia pechuelii (ENGL.) HARMS
Galenia africana L.
Calicorema capitata (MOQ.) HOOK F.
Monochma genistifolium (ENGL.) C.B.CL.
Petalidium variabile (ENGL.) C.B.CL.
Ruellia diversifolia S.MOORE.

7.2.2.13 Tumas

The Tumas is one of the major washes between the Kuiseb and Swakop. The riverbed of the Tumas does not reach the coast as the Sand Sea of the Southern Namib crosses the Tumas. This sand sea extends further north to the riverbanks of the Swakop. At the place where the Tumas is overblown by dunes the bottom of the wash is covered by little hummocks formed by Zygozphyllum stapfii SCHINZ, Arthraera leubnitziae (KUNTZE) SCHINZ and Salsola sp. (most abundant). The cover of these species is always less than 1%.

Fifteen kilometers further upstream the wash is a well defined riverbed with a soil composed mainly of fine sand and silt, covered with a plant community consisting of:

Arthraera leubnitziae (KUNTZE) SCHINZ
Galenia africana L.
Zygozphyllum stapfii SCHINZ
Radula urens (L.F.) BULLOCK
Calicorema capitata (MOQ.) HOOK F.
Euphorbia phylloclada BOISS.
Salsola tuberculata (MOQ.) FENSL.
Acanthisicyos horridus WELW. ex HOOK. F.
Pechuel-Loeschea leubnitziae (O. KUNTZE) O. HOFFM.

7.2.2.14 Kuiseb

The riverine communities of the Kuiseb are of considerable importance to the central Namib biome since they provide shelter and food for many species of animals. It is also the most important residential area of the Topnaar.

In the riverbed ephemeral species germinate and grow after a flood or heavy rain. The number of species on a certain place in the riverbed during a certain year is determined by the following factors:
1. Flood:

- Affluents of the Kuiseb come from different regions. The species composition can be different depending on which affluents were flowing.

- The point in the riverbed were the flood stopped. Seeds and fruits can be transported by the flood and deposited anywhere along the water course.

- Duration of the flood. The longer the flood continues the deeper the water can penetrate into the soil of the riverbed. Sometimes the amount of water, thus drained into the soil, is too small for full development of the seedlings (pers.obs.).

2. Riverbed:

- The water-holding capacity of the soil can be a selective factor. For complete growth and development plants need a certain amount of water, a factor which is different for every species.

- Availability of suitable places for germination (at some places in the canyon, only polished rock is present: no germination possible).

3. Grazing:

- The game and the livestock of the Topnaar are selective consumers of germinating and growing plants. The composition of plant communities is influenced to a certain extent by the grazing habits of these animals.

During the botanical survey of the Kuiseb valley it was found that the number of species decreased towards the coast. The vegetation in the riverbed near Topnaar villages was very poor. The percentage of cover never exceeded 1%. On the other hand a percentage of more than 50 % was regularly found upstream from Homb. In the section Ururas (the 1992 Kuiseb flood stopped in this village (pers.obs.)) - Roobank the following plants were found:

Amaranthus dinteri SCHINZ subsp. dinteri
Aiptosimum arenarium ENGL.
Calocephane marlothiana O. HOFFM.
Cladoraphis spinosa (L.F.) S.M.PHILLIPS
Cleome foliosa HOOK.F. var. foliosa
Cleome gynandra L.
Cullen obtusifolia (DC.) C.H.STIRTON
Cucumis rigidus E.MEY. EX NAUDIN
Dicoma capensis LESS.
Euphorbia isothricha MURB. isothricha
Heliotropium nelsonii C.H.WRIGHT
Indigofera adenocarpa E.MEY.
Pechuel-Loeschea leucoclitiae (O. KUNTZE) O. HOFFM.
Manulea dubia (SKAN.) OVEKOTT EX ROESSLER
Momordica humilis (COGN.) C.JEFFREY
Nicotiana glauca GRAHAM
Ocimum canum SIMS
Osteospermum microcarpum (HARVEY) T.NORL. ssp. microcarpum
Pergularia daemia (FORSSKAL) CHIOV.
Rogeria longiflora (ROYEN) J.GAY EX DC.
Ruella diversifolia S.MOORE
Solanum rigescendoides HUTCH.
Sutera mariae HIERN.
Sutera pallida (PILGER) OVEKOTT EX ROESSLER
Suaeda plumosa AELLEN
Sutera sessilifolia (DIELS) HIERN.
Withania somnifera (L.) DUNAL
Zygophyllum simplex L.

In the section Swartbank - Eduseb the following species were found:

Argemone ochroleuca SWEET
Aspilia eeni S.MOORE
Cladoraphis spinosa (L.F.) S.M.PHILLIPS
Codon royenii L.
Chamaesyce inaequalitaria (SONDER) SOJAK
Chenopodium ambrosioides L.
Cleome foliosa HOOK.F. var. foliosa
Cucumis sagittatus PEYR.
Cyperus marginatus THUNB.
Euphorbia phylloclada BOISS.
Hermobitaedria spathulifolia (ENGL.) BAKER
Hibiscus engleri K. SCHUM.
Indigofera cryptantha BENTH. EX HARVEY
Launaea interbeca (JACQ.) BEAUVERD
Lencas pechuelii (O.KUNTZE) GÜRKE
Melanthera marlothiana O.HOFFM.
Nicotiana glauca GRAHAM
Pergularia daemia (FORSSKAL) CHIOV.
Rogeria longiflora (ROYEN) J.GAY EX DC.
Suteramazii HIERN.
Suaedaplumosa AELLEN
Sutera canescens (BENTH.) HIERN.
Suteraacutiloba (PILGER) OVERK. ex ROESSLER
Tephrosiadregeana E.MEYER.

In the section Soutrivier - Klippeus the following species were found:

Acrobotremokeckii (GUERKE) LAUNERT
Anticharisinflata MARLOTH & ENGL.
Argemoneochroleuca SWEET
Aaspiliaeenii S.MOORE
Amaranthusdinteri SCHINZ subsp. dinteri
Cladoraphisspinosa (L.F.) S.M.PHILLIPS
Codonyenii L.
Chamaesycinessaequilara (SONDER) SOJAK
Cleomefoliosa HOOK.F. var. foliosa
Cullenobtusifolia (DC.) C.H.STIRTON
Cucumissagittatus PEYR.
Citrullusecirrhosus COGN.
Daturainnozia MILLER
Euphorbiaphyllocadaboiss.
Helichrysumcandelasum BUKK
Heliotropiumovalifolium FORSK.
Hibiscusfleckii GÜRKE
Melanthseramarlothiana O.HOFFM.
Nicotianaglaucagraham
Ocimumcanum SIMS
Pergulariadaemi (FORSSKAL) CHIOV.
Pechuel-Loeschealeubnitziae (O. KUNTZE) O. HOFFM.
Phyllanthuspentandrausch. ex THONNING
Rogeria longiflora (ROYEN) J.GAY ex DC.
Ruellia diversifolia S.MOORE
Seneciomarlothinus O.HOFFM.
Sesamummariothii ENGL.
Strigagesnerioides (WILLD.) VATKE ex ENGL.
Suteramazii HIERN.
Suaedaplumosa AELLEN
Tephrosiadregeana E.MEYER
Tagetesminuta L.
*Thamnosma africana* ENGL.
*Galenia africana* L.
*Flaveria bidentis* (L.) KUNTZE
*Gisetia pharacoides* L.
*Pavonia burckellii* (DC.) R.A.DYER
*Blumea cafra* (DC.) O.HOFFM.

In the section Gobabeb - Homeb the following plants were found:

*Argemone ochroleuca* SWEET
*Aspilia eunii* S.MOORE
*Battarea* sp. (fungus)
*Blumea decurrent* (VAHL) MERXM.
*Cassia italica* (MILLER) LAM. ex F.W.ANDR. ssp. micrantha BRENAN
*Cladoraphis spinosa* (L.F.) S.M.PHILLIPS
*Codon royenii* L.
*Codon schenckii* SCHINZ
*Chamaesyce inequinatera* (SONDER) SOJAK
*Clome foliosa* HOOK.F. var. foliosa
*Cyperus marginalis* THUNB.
*Datura inoxia* MILLER
*Dichrostachys cinerea* (L.) WIGHT & ARN
*Euphorbia phyllactada* BOISS.
*Hibiscus engleri* K. SCHUM.
*Indigofera alternans* DC.
*Indigofera cryptantha* BENTH. ex HARVEY
*Limeum myosotis* H.WALTER
*Meroera parvifolia* PAX
*Merremia guericchii* MEEUSE
*Momordica humilis* (COGN.) C.JEFFREY
*Melanthera mariothiana* O.HOFFM.
*Nicotiana glauca* GRAHAM
*Ocimum canum* SIMS
*Petalidium setosum* C.B.CLARKE ex SCHINZ.
*Psylocaulon salicornioides* (PAX) SCHWANTES
*Rogeria longiflora* (ROYEN) J.GAY ex DC.
*Ruellia diversifolia* S.MOORE
*Solanum namaquense* DAMMER
*Solanum rigescentoides* HUTCH.
*Sutera maxii* HIERN.
Sutera canescens (Benth.) Hiern.
Sutera corymbosa (Marloth & Engl.) Hiern.
Suada plumosa Aellen
Sutera sessilifolia (Diels) Hiern.
Tagetes minuta L.
Tephrosia dregeana E. Meyer
Trianthemum triquetra Willd. sep. parviflora (Sonder) Jeffrey
Zygophyllum simplex L.

Cucumis africanus L.F.
Gisekiya pharmacooides L.
Sesamum capense Burm.f.
Stipagrostis ciliata (Desf.) de Winter var. capensis (Trin. & Rupr.) de Winter
Tribulus zeyheri Sonder.

In the lower Kuiseb canyon (Homeb - Hudaeb) the following plant species were found:

Argemone ochroleuca Sweet
Aspilia cennii S. Moore
Amaranthus dinteri Schinz subsp. dinteri
Blumea decurrens (Vaeh.) Merxm.
Cladoraphis spinosa (L.f.) S.M. Phillips
Cleome foliosa Hook.f. var. foliosa
Chamaesyce inaequilatera (Sonder) Sojak
Cyperus marginatus Thunb.
Cullen obtusifolia (DC.) C.H. Stirkton
Citrus cecirrhosus Cogn.
Citrus lanatus (Thunb.) Mansfeld
Datura innoxia Miller
Gomphocarpus fruticosus (L.) Aiton
Hibiscus engleri K. Schum.
Heliotropium ovatisolium Forsk.
Heliotropium subulatum (Hochst. ex A.D.C.) Vatke
Helichrysum roseo-niveum Marloth & O. Hoffm.
Mesembryanthemum cryptanthum Hook. f.
Melanthera marlothiana O. Hoffm.
Chenopodium pumilio R. Br.
Nicotiana glauca Graham
Flaveria bidentis (L.) Kuntze
Occimum canum Sims
Pergularia daemia (Forsskal) Chiov.
Pelalidium setosum C.B.Clarke ex Schinz.
Rogeria longiflora (Royen) J.Gay ex DC.
Ruellia diversifolia S.Moore
Sesamum capense Burm.f.
Sesamum triphyllum Weiw. ex Asch.
Solanum namaquense Dammer
Ricinus communis L.
Sutera maxii Hiern.
Sutera pallida (Pilger) Overkott ex Roessler
Tephrosia dregeana E.Meyer
Zygophyllum simplex L.
Phragmites australis (Cav.) Steudel
Cucumis africanus L.f.
Gisekia pharacceoides L.
Stipagrostis ciliata (Desf.) De Winter var. capensis (Trin. & Rupr.) De Winter
Tribulus zeyheri Sonder
Tephrosia monophylla Schinz
Panonia burckellii (DC.) R.A.Dyer
Flaveria bidentis (L.) Kuntze.

In the upper Kuiseb canyon (mouth of the Gaub - Schlesien) the following plants were found:
Flaveria bidentis (L.) Kuntze
Argemone ochroleuca Sweet
Aspilia eunii S.Moore
Amaranthus dinteri Schinz subsp. dinteri
Aptosimum arenarium Engl.
Blumea decursens (Vahl) Merxm.
Cladoraphis spinosa (L.f.) S.M.Phillips
Codon royenii L.
Chamaesyce inaequilatera (Sonder) Sojak
Cleome foliosa Hook.f. var. foliosa
Cyperus marginatus Thunb.
Cullen obtusifolia (DC.) C.H.Stirton
Datura inoxia Miller
Dicoma capensis Less.
Hibiscus engleri K. Schum.
Heliotropium ovalifolium Forsk.
Melanthera marlothiana O.Hoffm.
Nicoliana glauca Graham
Occimum canum Sims
Pergularia daemia (Forskal) Chiov.
Ruellia diversifolia S. Moore
Sutera mazii Hiern.
Ricinus communis L.
Sutera canescens (Benth.) Hiern.
Suaeda plumosa Aellen
Chenopodium pumilio R. Br.
Tephrosia dregeana E. Meyer
Tegetes minuta L.
Zygophyllum simplex L.
Cucumis africanus L.F.
Sesamunum capense Burm. F.
Stipagrostis ciliata (Desf.) de Winter var. capensis (Trin. & Rupr.) de Winter
Gisekia pharnacoides L.
Tribulus zeyheri Sonder
Pavonia burchellii (DC.) R. A. Dyer
Flaveria bidentis (L.) Kuntze
Blumea cafra (DC.) O Hoffm.
Aristida adsensionis L.

The vegetation on and immediately above the flood mark is characterized by Nicotiana glauca Graham (an alien) and Acacia albida Del. At some places Cladorphis spinosa (L.F.) S.M.Phillips is very abundant and has a cover of up to 20%. Pechuel-Loeschea leubnitziae (O. Kuntze) O. Hoffm. is a regular companion in this community together with Tribulus zeyheri Sonder, Sutera mazii Hiern. and Adenolobus garipensis (E. Meyer) Torre & Hillcoat. Downstream from Sourriver Pechuel-Loeschea leubnitziae (O. Kuntze) O. Hoffm. forms very dense stands together with some Poaceae spp.

Further away from the riverbed Acacia albida Del. becomes the dominant species within the plant community (cover of up to 75%), sometimes together with Tamarix usneoides E. Meyer ex Bünger (cover of up to 10%) and Acacia erioloba E. Meyer (cover of up to 20%). Under the tree layer Pechuel-Loeschea leubnitziae (O. Kuntze) O. Hoffm. is the most abundant species (cover of up to 3%). In some places a single Euclea pseudobenus E. Meyer ex A. DC can be found.

Higher up, the plant community consists of Acacia albida Del. and Acacia erioloba E. Meyer, together with thick stands of Salvadora persica L. (cover of up to 50%). Tamarix usneoides E. Meyer ex Bünger is a regular companion (cover of up to 80%). Towards the dunes the hummock forming grass Stipagrostis sabulicola (Pilger) de Winter, sometimes together with Salvadora persica L., becomes dominant.
The Kuiseb delta is an important biotope as it includes the greater part of the \textit{tnara} fields. The delta can be divided in 3 areas:

1. The southern Kuiseb arm: In this area the main \textit{tnara} fields are situated. \textit{Acanthosicyos horridus WELW. EX HOOK. F.} forms large hummocks. Together with \textit{Stipagrostis sabulicola (PILGER) DE WINTER, Tamarix usneoides E.MEYER EX BUNGE and Acacia erioloba E.MEYER, Acanthosicyos horridus WELW. EX HOOK. F.} is characteristic for this area. At some places \textit{Acacia erioloba E.MEYER} is a creeping bush and contributes in this way in the formation of hummocks. Other species growing in this area are:

\textit{Aizoanthemum diateri (SCHINZ) FRIEDRICH}
\textit{Pachuel-Loeschea leubnitziae (O. KUNTZE) O. HOFFM.}
\textit{Cladoraphis spinosa (L.F.) S.M.PHILLIPS}
\textit{Galenia africana L.}
\textit{Datura inoxia MILLER}
\textit{Nicotiana glauca GRAHAM}
\textit{Ricinus communis L.}
\textit{Datura stramonium L.}
\textit{Lycium cinereum THUNB.}
\textit{Zygophyllum simplex L.}
\textit{Chenopodium pumilto R.BR.}

Due to works (installation of new pumping stations and pipelines for water) and the extraction of water and a decreasing number of large floods, resulting in a drop of the water table, the vegetation is declining.

In a few places the bedrock is visible. On these spots a plant community with \textit{Salsola sp.} and \textit{Zygophyllum stapfii SCHINZ} together with \textit{Arthraea leubnitziae (KUNTZE) SCHINZ} and \textit{Heliotropium tubulosum E.MEYER EX DC.} is present.

2. The northern Kuiseb arm is separated from the Kuiseb river by a dam. The vegetation is composed of the same species as the southern part, but is generally in a very bad condition. The dam prevents the Kuiseb of flooding in northern direction. The result is that no water of the floods can enter this area. The \textit{tnara} fields are drying and abandoned by the Topnaar. In this area \textit{Capparis hereroensis SCHINZ} and \textit{Aizoanthemum diateri (SCHINZ) FRIEDRICH} were found.

3. Dorob is a wet depression between the coastal dunes and the northern Kuiseb arm. The vegetation consists mainly of \textit{Phragmites australis (Cav.) STEUDEL} (cover of up to 90 %), \textit{Oudyssea paucinervis (NEES) STAFF} (cover up to 30 %) and \textit{Salsola nollothensis AELLEN} (cover up to 40 %). \textit{Tamarix usneoides E.MEYER EX BUNGE, Suaeda sp.} and \textit{Lycium cinereum
Thu nb. are widely distributed and sometimes form monospecific stands.

7.2.2.15 Tsauchab

The Tsauchab enters the Namib Naukluft Park in Sesriem. It forms a deep gorge with a vegetation consisting of the following plants:

*Adenolobus garipensis* (E.Meyer) Torre & Hillcoat
*Ficus cordata* Thunb.
*Ficus sycomorus* L.
*Gossypium anomalum* WawRw
*Ziziphus mucronata* Willd.
*Acacia albida* Del.
*Acacia crioloba* E.Meyer
*Chenopodium pumilio* R.br.
*Boscia foetida* Schinz subsp. *foetida*
*Peckel-Loeschea leubnitziae* (O. Kuntze) O. Hoffm.
*Maerua schizii* Pax
*Melanthera marlothiana* O.Hoffm.
*Calicorema capitata* (Moq.) Hook f.
*Caesalpinia personii* L.Bolus
*Euclea pseudobenus* E. Meyer ex A.DC
*Calicorema capitata* (Moq.) Hook f.
*Acacia karroo* Hayne
*Codon royenii* L.
*Argemone ochroleuca* Sweet
*Datura innoxia* Miller
*Rogeria longiflora* (Royen) J.Gay ex DC.
*Lauinaea inybahca* (Jacq.) Beauverd
*Triraphis ramosissima* Hackel
*Pergularia daemia* (Forsslal) Chiov.

Downstream, towards Sossusvlei, the number of species decreases. In Sossusvlei, the number of species is limited. A typical plant community of *Acanthosicyos horridus* Welw. ex Hook. f. and *Stipagrostis sabulicola* (Pilger) de Winter can be found around the vlei. At some places *Acacia erioloba* E.Meyer and *Cladopholis spinosa* (L.f.) S.M.Phillip is growing between the hummocks. In the vlei *Datura innoxia* Miller is very common together with *Salsola* sp. and *Peckel-Loeschea leubnitziae* (O. Kuntze) O. Hoffm.
7.2.3 Plains

7.2.3.1 Coastal Plains

The vegetation on the coastal plain benefits from the fog: little droplets of water are deposited on the plants and the sand. For a lot of plants this often limited amount of water is enough to survive in regions with an annual precipitation of less than 20 mm. The coast is very windy. Most of the plants trap windblown sand and form small hummocks. Some species (e.g. *Salsola nollothensis* AELLEN) form large dunes. Some other plants have a creeping habitus or form small cushions. The following species were found along the coast:

- *Arthremia lehniitzi*ae (KUNZ) SCHINZ
- *Zygophyllum stapfii* SCHINZ
- *Zygophyllum clavatum* SCHLECHTER & DIELS (Northern Namib)
- *Indigofera cuneensis* O. HOFFM. (Northern Namib)
- *Psylocaulon salicornioides* (PAX) SCHWANTES (Northern Namib)
- *Cladoraphis cyperoides* (THUNG.) S.M.PHILLIPS (Northern Namib)
- *Hermannia gariepina* ECKL. & ZEYH. (Northern Namib)
- *Senecio engleranus* O. HOFFM. (Northern Namib)
- *Mesembryanthemum cryptanthum* HOOK.F. (Northern Namib)
- *Chloris flabellata* (HACKEL) LAuNcKT
- *Salsola aphylla* L.F.
- *Salsola nollothensis* AELLEN
- *Drosanthemum paxianum* (SCHLTR. & DIELS) SCHWANTES (south of Wlotzka’s Baken)
- *Tetragonia repudicata* WELW. ex OLIVER (south of Wlotzka’s Baken)
- *Sesuvium sesuvioides* (FENZL.) VERDC.
- *Merremia mutisecta* HALL.F. (on sand, in dunes)
- *Odissea pancinervia* (NESS) STAPF (on salt flats).

Fig. 21: (p.128) South of Möwe Bay the plant community found in washes along the coast consists of *Hermannia gariepina* ECKL. & ZEYH., *Indigofera cuneensis* O. HOFFM., *Psylocaulon salicornioides* (PAX) SCHWANTES, *Zygophyllum stapfii* SCHINZ, *Zygophyllum clavatum* SCHLECHTER & DIELS, *Cladoraphis cyperoides* (THUNG.) S.M.PHILLIPS, *Chloris flabellata* (HACKEL) LAuNcKT and *Salsola nollothensis* AELLEN.

Fig. 23: (p.152) *Mesembryanthemum cryptanthum* HOOK.F.: forms small patches on the gravel plain of Skeleton Coast.

Fig. 24: (p.152) *Zygophyllum stapfii* SCHINZ: endemic of the Namib Desert.
7.2.3.2 Central Namib Plain

The Central Namib Plain is a large, flat area with most of the perennial vegetation living in washes, in river valleys, in depressions and on rocky outcrops or inselbergs. The greater part of the plain is nearly devoid of plants for long periods. Shortly after a rain this plain changes into a green carpet of mainly *Poaceae*.


7.2.3.3 Plains around Sesfontein

The plains around Sesfontein did not receive any rainfall this year. This resulted in a complete absence of ephemerals at the time of survey. The sandy plain around Sesfontein is covered with a plant community dominated by *Acacia tortilis* (Forsskål) Hayne subsp. *heterocantha* (Burchell) Brenan and *Colophospermum mopane* (Kirk ex Bentham) Kirk ex Leonard. The following plants were found:

- *Combretum imberbe* Wavra var. *Petersii* (Klotzsch) Engl. & Diels
- *Zygophyllum simplex* L.
- *Acacia erioloba* E.Meyer
- *Acacia albida* Del.
- *Amaranthus dinteri* Schinz subsp. *dinteri*
- *Cyperus marginatus* Thunb.
- *Datura innoxia* Miller
- *Ziziphus mucronata* Willd.
- *Bosbia foetida* Schinz subsp. *foetida*
- *Bosbia albitruncata* (Burch.) Gilg & Benedict
- *Myrothamnus flabellifolius* Welw.
- *Cordia gharaf* (Forsk.) Ehrenb. ex Ascherson
- *Sesbania sphaerocarpa* Welw.
- *Withania somnifera* (L.) Dunal
- *Ricinus communis* L.
Grewia tenax (FORSK.) Fiori.

The sandy Giribis plain, northwest of Seefontein mainly consists of Stipagrostis uniplanis (Licht. ex Roemer & Schultes) De Winter and Stipagrostis giessii KERS. Further north a stand of Commiphora giessii Van Der Walt and Colophospermum mopane (Kirk ex Bentham) Kirk ex Leonard was found on a gravel plain.

The Omaruru - Okambonde - Okongoro plain, southwest of Sesfontein is covered with mainly gravel and stone. The vegetation consists mainly of Colophospermum mopane (Kirk ex Bentham) Kirk ex Leonard and Acacia tortilis (Forsskal) Hayne subsp. heterocantha (Burchell) Brenan. At several places Welwitschia mirabilis Hook. f., Commiphora giessii Van Der Walt, Calicoera capitata (Moq.) Hook f., Adenolobus garipensis (E. Meyer) Torre & Hillcoat, Boscia fettida Schinz subsp. fettida and Boscia albitrunca (Burch.) Gilg & Benedict can be found together with Parkinsonia africana Sonder, Meuera schinzii Pax, Galenia africana L., Cleome foliosa Hook. f. var. foliosa and Acacia montis-usti Merxm. & Schreiber.

7.2.4 Dunes

The moving sand dunes pose serious problems for the establishment of plants: instability of soil, low precipitation, high temperatures and high insolation. Most perennials show adaptations to these conditions: xeromorphy (reduction of the exposed leaf area: rolled, water storing or reduced leaves) and long taproots which can reach the water table. Most dune plants immobilize the moving sand which results in the formation of often large hummocks.

7.2.4.1 Coastal Dunes

The dunes on the salty plain along the coast between the lagoon of Walvisbay and Sandwich Bay are small (up to 8 m) and are mainly covered by Salsola noilethensis Aellen (cover up to 50 %). More inland Tamarix usneoides E. Meyer ex Bunge covers whole dunes.

7.2.4.2 Dunes South of the Kuiseb

Stipagrostis sabulicola (Pilger) De Winter and Acanthoscys horridus Welw. ex Hook. f. are the most common dune plants in the sand sea south of the Kuiseb.

In the dunes between Dorob and the northern Kuiseb arm, these two species are quite abundant, together with Zygophyllum simplex L. and especially Trianthema harrisonii Schinz.

In the depressions between the dunes Zygophyllum stapfii Schinz and Arthraerva lebinitziae (Kuntze) Schinz appear.

On the slipfaces towards the Kuiseb river Tamarix usneoides E. Meyer ex Bunge and Sal-
8. Discussion, Further Planned Research and Recommendations.

Notwithstanding the short period of field work, practical constraints (e.g. accessibility of certain areas) and the unfavourable climatic conditions (a continual drought, already lasting several years) a large number of plants were found.

The botanical part of this research project resulted in:

- a lot of floristic data (geographical positions), phytosociological (plant communities) and ecological data for a large number of plants. Data on habitat and distribution of all plants, used by the Topnaar and which were found in the area, are mentioned in part II, section 4.1.

- a considerable number of relevés. During the botanical survey relevés were made in a number of areas were no vegetation studies were done up to now. This is particularly so for the Northern Namib. Those relevés gave already a lot of information on the composition of the vegetation (part III, section 7). Further investigation of the relevés will include grouping or clustering and the delimitation of units. These results will be compared with those of Robinson (1975) and Moisel & Moll (1981). Finally a more detailed study of the units will be done. Due to the absence of a lot of ephemerals (absence of sufficient rain during the period of the field work), a “complete” description of the units can not be done.

The floristic and ecological data, obtained during this survey can be used for further studies:

- detailed studies on specific plants (e.g. autoecology);

- detailed studies on the different plant communities (relation plant community and environmental conditions);

- detailed synecological studies;

- detailed floristic studies.

Therefore it is recommended to go on with a further study of the flora and the vegetation in the area: data obtained can then be used for several purposes:

- updating the knowledge on the flora and the vegetation in the region;

- mapping of the flora and the vegetation;

- land use management and conservation;
• cultivation of certain noble plants.

9. Acknowledgements

This botanical survey was part of the research project "Ethnobotanical Survey of the Namib". It was financed by the Commission of the European Community (contract B7-5040/91/005).

We wish to thank Veerle Van den Eynden for giving a lot of additional information on the distribution of certain plants.

We also want to thank all the people who helped us with the relevés. In the first place we wish to express our special thanks to Lesley Mejiendt, who assisted us on nearly all botanical trips, but also to Ernst Booie, Veerle Van den Eynden, Joris De Wolf, Patrick Van Damme, Martine Deblonde, Jo Walter, Jo Hamilton, Alison Rawlinson and Lorna Davis.

We are very grateful to the staff of DERU (the Desert Ecological Research Unit in Gobabeb), the National Herbarium of Windhoek and TUCSIN (The University Centre for Studies In Namibia) for their logistic support.

We thank also the National Weather Bureau in Windhoek for climatic records and the National Geological Service for information on the geology.

We also wish to express our special thanks to the staff of the Ministry of Wildlife, Conservation and Tourism for the permits, the numerous useful advices, the information, the practical help and for escorting us in potentially dangerous areas.

Finally we are very thankful to all the people who helped us for the typing and lay-out: Griet Pauwels, Lut Van Haute and Martine Deblonde, and the review of the text: Prof. Dr. ir. Patrick Van Damme.

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09/12/91 Meeting with Mrs. Hannah Reeves, American anthropologist, studying the anthropology of the Topnaar

11/12/91 Meeting with Dr. Chris Brown (Ministry of WCT) and Dr. Anthony B. Cunningham (government advisor on ethnobotany): presentation of the project, discussion on problems concerning permits

12/12/91 Literature review in the library of the National Museum Windhoek

13/12/91 Meeting with Dr. Mary Seely (Desert Ecological Research Unit, Gobabeb), Dr. Anthony B. Cunningham, Mr. Brian Jones (Min. WCT), Mrs. Gillian Maggs and Mrs. Hannah Reeves: discussion on problems concerning permits

16/12/91 Meeting with Mr. Sabah (European Commission representative in Windhoek); discussion on problems concerning permits

20/12/91 Windhoek - Gobabeb

21/12/91 Meeting with Dr. Mary Seely, Mrs. Hannah Reeves, Ms. Patricia Skyer (student of the University, studying the socio-economy of the Topnaar) and Mr. Johannes Goamab (U.S. Aid) in the DERU, Gobabeb on the Integrated Development Plan for the Kuiseb in the Namib Naukluft Park

23/12/91 Return to Windhoek

25/12/91 Arrival of Dr. Patrick Van Damme (Project Promotor)

Discussing & evaluation of the project with Dr. Patrick Van Damme

27/12/91 Meeting with Dr. Chris Brown and Mr. Dieter Morsbach: obtaining of the research permits

28/12/91 Windhoek - Gobabeb

30/12/91 Meeting with Ms. Patricia Skyer at Gobabeb: arrangements on collaboration during January

03/01/92 Meeting with Mr. Seth Kooshtjie (Chief of the Topnaar) in Homeb: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

03/01/92 Preliminary visit and meeting in Osvate: introduction of the survey + basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)
04/01/92 Presentation of the project at the DERU, Gobabeb

05/01/92 - 06/01/92 Botanical excursion to Wlotzkasbaken, Cape Cross and Spitzkoppe

07/01/92 Return to Windhoek

08/01/92 Departure of Dr. Patrick Van Damme

08/01/92 Financial report

09/01/92 Financial report

11/01/92 Determination of so far collected plant species

12/01/92 Report writing

13/01/92 Windhoek - Soutrivier

14/01/92 Preliminary visit and meeting in Soutrivier: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

15/01/92 Meeting with Dr. Hu Berry (biologist of the Ministry of WCT at DERU): presentation of the project, discussion on restrictions of the permit

   Preliminary visit and meetings in Eduseb: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

16/01/92 Preliminary visit and meeting in Swartbank: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

17/01/92 Preliminary visit and meeting in Klipneus: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

18/01/92 Preliminary visit and meeting in Natab: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

20/01/92 Visit to Rooibank, where weren’t living Topnaar any more

21/01/92 Preliminary visit and meetings in Armstraat: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)
22/01/92 Preliminary visit and meetings in Dawe-draais: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

23/01/92 Preliminary visit and meeting in /Goatanab: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

24/01/92 Botanical excursion to the Swartbankberg with B. Herero, R. Herero and R. Swartbooi (villagers of Swartbank) to explain the uses of the plants growing there and give the Nama names;

Preliminary visit and meetings in Ururas: introduction of the survey, basic socio-economical information (way of living of the Topnaar) and information on plant uses (with Patricia Skyer as Nama speaking interpreter)

25/01/92 Return to Windhoek

27/01/92 -31/01/92 Analyzing and resuming the so far obtained information, comparing this information with literature data, drafting questionnaires for further research

29/01/92 Presentation of the project to the students at TUCSIN

30/01/92 Meeting with Mr. Brian Jones (Ministry of WCT): permit for fieldassistants: Oscar Dax & Lesley Mejiedt

31/01/92 Patrick Vernemmen leaving for Belgium

03/02/92 Windhoek - Gobabeb

04/02/92 Appointment made with Betwel Herero (Dawe-draais) to visit the Nara fields on February, 10, 1992.

05/02/92 -09/02/92 Ururas: talks with all people living in Ururas on the uses of plants (4 talks) and inventory of the plants growing in the riverbed, the gravel plains and the dunes

10/02/92 Visit to the Nara fields with Betwel Herero (Dawedraais)

11/02/92 Determination of so far collected plant species

11/02/92 -15/02/92 Oswater: Talks with all people living in Oswater on the uses of plants and inventory of the plants growing in the riverbed west of Oswater

16/02/92 Literature review in the library of the DERU Gobabeb

17/02/92 Return to Windhoek
18/02/92 Literature review in the library of the Scientific Society, Windhoek

19/02/92 Report writing

21/02/92 Flight Windhoek - Frankfurt - Brussels

24/02/92 -16/03/92 University of Ghent: report writing, discussions with Dr. Patrick Van Damme, financial report, correspondence, etc.

16/03/92 Flight Luxembourg - Johannesburg - Windhoek

17/03/92 Arrival in Windhoek

18/03/92 -19/03/92 Literature review

Preparing the continuation of the research

20/03/92 Meeting with Mr. Andreas J. Burghofer about the cosmetic use of Inara oil (Acanthosicyos horrida).

21/03/92 Windhoek - Gobabeb

22/03/92 -24/03/92 Determination of plant species in the herbarium of the Desert Ecological Research Unit of Namibia (DERUN) - Gobabeb

25/03/92 -26/03/92 Gobabeb: Talks with all people living in Gobabeb on the uses of plants and inventory of the plants growing in the riverbed and surrounding area

27/03/92 -29/03/92 Trip to Sesriem - Sossusvlei

30/03/92 -03/04/92 Homeb: talks with all people living in Homeb on the uses of plants and inventory of the plants growing in the riverbed and surrounding area

04/04/92 -06/04/92 Klipneus: talks with all people living in Klipneus on the uses of plants and inventory of the plants growing in the riverbed and surrounding area

07/04/92 Return to Windhoek

Arrival of Dr. Patrick Van Damme (Project promotor)

09/04/92 Windhoek - Gobabeb

10/04/92 -14/04/92 Soutrivier: talks with all people living in Soutrivier on the uses of plants and inventory of the plants growing in the riverbed and surrounding area

15/04/92 -21/04/92 Dawe-drais, /Goatana/, Armstrett: talks with all people living in these villages on the uses of plants, inventory of the plants growing in the riverbed and surrounding area and collecting plant samples of medicinal plants
19/04/92 Meeting with Mr. Schweickhardt, who buys the Inara pips from the Topnaar and exports them to Cape Town

22/04/92 Return to Windhoek

23/04/92 - 24/04/92 Determination of plant species in the herbarium of Windhoek

24/04/92 - 25/04/92 Rehoboth: conduct a workshop on ethnobotany at the General Annual Meeting of the Namibian Museum Association

27/04/92 Meeting with Mr. W. Giess (former director of the National Herbarium of Namibia)

27/04/92 - 29/04/92 Book-keeping

29/04/92 Meeting with Prof. Wilfried Haacke (University of Namibia, Dept. of African Languages): revision of the Nama plant names

30/04/92 Windhoek - Gobabeb

30/04/92 - 01/05/92 DERUN Gobabeb: analysing research results so far, determination of plant species and collecting plant samples of medicinal plants

02/05/92 - 05/05/92 Eduseb: talks with all people living in Eduseb on the uses of plants and inventory of the plants growing in the riverbed and surrounding area

05/05/92 Meeting with Mrs Brits, who buys the Inara pips from the Topnaar and exports them to Cape Town.

06/05/92 - 08/05/92 DERUN Gobabeb: determination of plants species and collecting samples of medicinal plants

09/05/92 - 12/05/92 Swartbank: talks with all people living in Swartbank on the uses of plants and inventory of the plants growing in the riverbed and surrounding area

13/05/92 - 16/05/92 DERUN Gobabeb: literature review, determination of plant species, mounting the plant species for the herbarium

17/05/92 Gobabeb - Windhoek

18/05/92 - 21/05/92 Windhoek: determination of plant species, visit Estorff Reference Library, preparations article WOCMAP congress (Maastricht)

22/05/92 - 31/05/92 Trip to the Kaokoland

01/06/92 - 02/06/92 Windhoek: determination of plant species

03/06/92 - 07/06/92 Trip to Johannesburg
08/06/92 -10/06/92 Gobabeb: visiting all the Topnaar villages to check and compare all the information on plant uses and to find the last plant samples of medicinal plants and food plants

11/06/92 Gobabeb - Windhoek

11/06/92 -12/06/92 Windhoek: determination of plant species

13/06/92 Windhoek - Sesfontein

14/06/92 -25/06/92 Sesfontein: talks with the Topnaar people and some Damara people living in Sesfontein on the uses of plants, collecting plant samples of medicinal and food plants and inventory of the plants growing in the Sesfontein valley and in the surrounding hills and riverbeds

25/06/92 -28/06/92 Sesfontein - Windhoek via the Skeleton Coast Park (research of Patrick Vernemmen)

29/06/92 -03/07/92 Windhoek: determination of plant species with the help of W. Giess, mounting the plant species for the herbarium

30/06/92 -01/07/92 Meetings with Mr. W. Giess, Prof W. Haacke and Pastor E. Eiseb (Nama, writing a Nama dictionary together with Prof. W. Haacke): discussing all the research results of the plants used by the Topnaar people, checking the Nama names and determination of the plants: the plants which were not mentioned in the preliminary list of Khoekoe (Nama/Damara) Plant Names (EISEB, GIESS, & HAACKE, 1991) will be included in the Nama dictionary, written by E. Eiseb and Prof. W. Haacke.

03/07/92 -05/07/92 Trip to DERUN Gobabeb, visiting all the Topnaar villages for the last time to say goodbye

04/07/92 DERUN Gobabeb: talk for the other researcher on the course of the research and the research results

06/07/92 -09/07/92 Windhoek: determination of plant species, mounting the plant species for the herbarium

08/07/92 Radio talk on ethnobotanical research in Namibia - Namibian Broadcasting Cooperation

10/07/92 -11/07/92 Flight Windhoek - Johannesburg - Luxemburg

13/07/92 -17/07/92 Writing the article for the WOCMAP congress

19/07/92 -25/07/92 World Congress on Medicinal and Aromatic Plants (WOCMAP) - Maas-trzym
Presentation of the talk "Medicinal and Aromatic Plants used by the Topnaar" (see annex)

27/07/92 - 18/09/92 Antimyotical and antimicrobial tests on the medicinal plants of the Topnaar

Poster preparation on the research for DERUN - Gobabeb and for the congress ‘Etnobotanica '92' in Cordoba

Report writing

Writing article for the congress ‘Etnobotanica '92’ (see annex)

20/09/92 - 26/09/92 Attending the congress ‘Etnobotanica '92’ in Cordoba - Spain

Presentation of a poster

MEDICINAL AND AROMATIC PLANTS USED BY THE TOPNAAR - NAMIBIA

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Abstract

The study of the medicinal and aromatic plants used by the Topnaar is part of the ethnobotanical survey of the Namib desert, carried out by the authors. To obtain data, Topnaar people living in the Namib desert were visited. A list of interesting plant species is produced (including plant names, systematic classification and ethnomedical properties). Several plants were analysed for active substances. The results are presented and discussed.

1. Introduction

The study of the medicinal and aromatic plants used by the Topnaar people is part of the study of the ethnobotany of the Topnaar, carried out by the authors. The aim of the global survey was inventorising all plants used by the Topnaar people for all kinds of purposes: food, beverage, medicine, spices, fermentation, coagulation, hygiene, cosmetics, fodder, fuelwood, timber, tools, furniture, utensils, fibres, tannins, colorants, poison, narcotics, art, religion and others.

The Topnaar belong to the Khoi-Khoi (Hottentot) race. In Namibia, the Khoi-Khoi are represented by the Nama and the Oorlams. The Nama consist of 9 tribes. Two of them are

(1) the Topnaar of the Kuiseb-valley, called =Aonin (people of the top) or !Nanin (people living of the Gnara), and

(2) the Topnaar of Sesfontein, called !Gomen ("stupid people", speaking an unintelligible dialect).

The mother tongue of the Topnaar is Nama, a so-called click language. /, //, ! and = are the four clicks used, each corresponding to a definite sound.

1.1. The Lower Kuiseb Area

The Kuiseb river is a seasonal river flowing through the central Namib. It forms the border between the northern stone desert (mainly consisting of gravel plains and inselbergs) and the southern sand desert (consisting of sand dunes up to 300 m high). The catchment area of the Kuiseb river lies in the highland plateau. Rains falling in this plateau cause the Kuiseb to flow. Most of the year the riverbed is dry, but the river flows underground. This results in a linear oasis intersecting the Namib desert and extending the range of many non-desertic plants.

The vegetation in and along the riverbed is dominated by Acacia erioloba in the upper part of the Kuiseb valley and Acacia albida further downstream. Frequently occurring are Tamarix usneoides, Salvadora persica, Euclea pseudobenm, Stipagrostis sabulicola, Pachuel-Loeschea leubnitiae, Nicotiana glauca and Eradragos spinosa, all perennials. Most of the annual plants only occur after a river flood or rainfall. Acanthosicyos herida is together with Stipagrostis sabulicola the only plant found in the sand dunes. Both are important sandbinders and dune formers. On the northern Namib gravel plains, vegetation is also very scarce, and mainly consists of Zygophrillum stapfii and Arthraera leubnitiae.

Climatological data have been recorded at the Desert Ecological Research Unit - Gobabeb since 1963. According to these data the mean annual temperature in the area is 21.3°C. The area
receives 19.1 mm rainfall per year, most rain falls from January to April. The mean evaporation on the other hand is 281.5 mm per annum. The Köppen climatological type is BWh.

Along the lower Kuiseb river live approximately 400 Topnaar, spread over 12 villages. These villages are from east to west: Homeb, Oswater, Natab, Gobabeb, Soutrivier, Klipneus, Swartbank, Eduseb, Ururas, Goathanab, Dawe-draasis and Armstraat (the last three belong to the Walvisbays area, South African territory). They live from goat farming and gathering of food plants. The most important gathered food is the lnana, the fruit of *Acacanthocyos horrida*, a wild cucurbit, endemic to the Namib, growing in the dunes close to the coast. In the past the lnana was the staple food of the Topnaar. It still forms a major part of their diet now.

Important detail for the use of medicinal plants is the fact that the mobile clinic of Swakopmund or Walvisbaai is visiting all villages monthly.

1.2. Sesfontein

Sesfontein, so called because of the six perennial springs issuing there, is a 10 km radius oasis surrounded by mountains, situated in the pro-Namib on the passage from Damaraland to Kaokoland.

The vegetation in the valley is dominated by *Acacia tortilis* sp. heteracantha. *Colophospermum mopane* is largely found along the riverbeds, as well as *Salvadora persica*. As main undergrowth are found *Oranthiera albida*, *Pergularia daemia*, *Zygophyllum simplex*, *Pachuelo-Leeschen lebbnitata* and *Cyperus marginatus*.

Only the rainfall has been recorded in Sesfontein. The mean annual rainfall is 95.4 mm, mostly falling during the summer.

In Sesfontein live approximately 100 Topnaar. The rest of the more than 1500 inhabitants are mainly Damaras and Hereros.

Thanks to the six fountains agriculture is possible in Sesfontein. Every male inhabitant owns a part of the irrigated fields and the major crops are wheat, maize and tobacco. Enormous planted fig trees (*Ficus sycomorus*) and date palms (*Phoenix dactylifera*) embellish the whole area. Still gathering of wild food plants is important to these people as well as some goat farming. A hospital is present in the village.

2. Methods

2.1. Ethnobotanical Survey

To collect information on plant uses the 12 Topnaar villages along the Kuiseb and Sesfontein were visited for 6 months (January-June 1992), whereby all Topnaar families were interviewed. Information on plant species, their uses, the parts used, the preparation and processing was collected. All plant names mentioned by the Topnaar were in Nama. The scientific names were obtained in different ways. If the plant could be collected in the field, it was identified in the herbarium of the Desert Ecological Research Unit - Gobabeb and the National Herbarium of Namibia, Windhoek by the authors. Other Latin names could be obtained through existing lists (Eiseb et al., 1991, Le Roux, 1971 and Du Pisan, 1983) relating them to vernacular names, and were cross-checked afterwards. Some plants could not be identified through neither of both ways (mainly because many plants did not grow at the moment of the research as a result of the prolonged period of drought) and remain unknown (these plants are not mentioned in the article).

2.2. Preliminary Screening of Medicinal Plants

A preliminary screening for antimitotic and antimicrobial activity of 9 plants was made in the Laboratory of Organic Chemistry of the University of Ghent. All 9 plants are used medicinally by the Topnaar and could be collected before May 1992. The remaining plants will be screened afterwards.
2.2.1. Screening for Antimitotic Activity

A method to search possible sources of anticancer activity in plants is to screen the plants for antimitotic activity. Therefore a preliminary test was used, based on the Curiotti method (Schneider, 1992) whereby the inhibition of the growth of wheat-rootlets is investigated. The screened plants are:

*Blumea decurrens* (Vahl) Merxm.
*Pechuel-Loeschea lebuniziana* (O. Kuntze) O. Hoffm.
*Acanthosicyos horrida* Welw. ex Bentham & Hooker
*Euclia pseudoebenus* E. Meyer ex A. DC.
*Acacia erioloba* E. Meyer
*Cullen obtusifolia* (DC) Stirton
*Thanosoma africana* Engler
*Laminaria* sp.
*Tamarix usneoides* E. Meyer ex Bunge

All plants are air-dried and powdered mechanically. The plant powders are tested at concentrations of 100 mg/ml and 10 mg/ml to determine the minimum inhibitory concentration.

Grains of wheat are first germinated in a petri dish, on a filter paper, with 10 ml of tap water, during 24 hours in darkness. Afterwards, 10 well-germinated grains are put on a filter paper circle in a petri dish containing 10 ml of tap water and 1000 mg of plant powder (concentration 100 mg/ml). After keeping the petri dishes at ambient temperature in darkness for 6 days, the rootlet growth is evaluated. Therefore the length of the longest rootlet of each grain is measured and the average root length calculated over the whole sample. The inhibition of the rootlets’ growth is given in percent compared to the root growth of non-treated grains under the same conditions (a negative value means stimulation of the root growth). The experiment is repeated with 100 mg (concentration 10 mg/ml) of plant powder under the same conditions.

2.2.2. Screening for Antimicrobial Activity

The same plant samples as in 2.2.1. were screened for their antimicrobial activity.

The plant powder is extracted in a percolator with methanol until exhaustion. The methanolic extract is evaporated under reduced pressure. The dry extract is dissolved in methanol to obtain a concentration of 50 mg/ml.

The used micro-organisms are:

Gram + bacteria: *Bacillus subtilis*, *Lactobacillus brevis*, *Micrococcus spp.*, *Mycobacterium smegmatis*, *Staphylococcus aureus*, *Streptococcus faecalis*.

Gram - bacteria: *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*.

Fungi: *Macor racemosus*.

Yeast: *Saccharomyces cerevisiae*.

The used media are BHI broth for all bacteria except *Lactobacillus brevis*, MRS broth for *Lactobacillus brevis* and Sabouraud-dextrose broth for the fungi and yeast.

For each test, 0.1 ml of the solution of micro-organisms is inoculated in the respective media in a test tube, and incubated at 37°C during 24 h (48 h for *Mycobacterium smegmatis*, partial anaerobic conditions for *Lactobacillus brevis*, 30°C for the fungi and yeast). 0.2 ml of the plant methanol extract is incorporated in 10 ml of the agar medium to obtain a concentration of 1 mg/ml. The solution is homogenized by mechanical shaking and drawn in a petri dish. The inoculum is seeded on the surface of the medium by a radial method, using a calibrated handle. Dishes are then incubated, bacteria at 37°C, *Lactobacillus brevis* at 37°C in partial anaerobic conditions, and fungi and yeasts at 30°C. The results are analyzed after 24 h and confirmed after 48 h.
3. Results

3.1. Ethnobotanical Survey

The plants used by the Topnaar people for medicinal and aromatic purposes are given in alphabetic order. The medicinal plants are split up in plants used for internal and external application. The name in Nama as well as the plant family are mentioned.

3.1.1. Medicinal Plants for External Uses

*Acanthostegys horrida* Welw. ex Bentham & Hooker
Nama: Inkarab  
family: Cucurbitaceae
The crushed root, mixed with fat can be rubbed on wounds to hasten healing.

*Battarea sp.*
Nama: leasab  
family: Basidiomycetes
The spores are rubbed on burning wounds to reduce pain and hasten healing. They are also rubbed on rough spots of the body.

*Blumea decurrens* (Vahl.) Merxm.
Nama: tumub  
family: Asteraceae
A decoction of the leaves is used to wash the body and acts against acne. The leaves are put in the shoes in case of painful feet.

*Boszia albitrunca* (Burch.) Gilg & Benedict
Nama: /hunib  
family: Capparidaceae
An extraction of the leaves is dripped into the ears in case of ear problems or pains.

*Boszia foetida* Schinz
Nama: xaube /hunis  
family: Capparidaceae
An extraction of the leaves and twigs is dripped into ears / eyes to relieve earaches / eye pains.

*Brownanthus kunzei* (Schinz) Dinter & Schwantes
Nama: *naugub  
family: Mesembryanthemaceae
An extract of the whole plant is added to boiling water. The patient hangs over the vapour to cure colds, fever and flu.

*Calophospermum mopane* (Kirk ex Bentham) Kirk ex Léonard
Nama: tsaurahais  
family: Cassalpiniaceae
In cases of headache/ eye pains, the head/ eye is washed with a decoction of the leaves and boiled leaves are put on the head/ eye subsequently. To cure colds, the body is washed with a decoction of the leaves.

*Datura inoxia* Miller
Nama: /ohais  
family: Solanaceae
A warmed leaf can be put on infected wounds or sores to draw out pus.

*Hoodia curreri* (Hooker) Deene
Nama: /khobab  
family: Asclepiadaceae
The flesh is applied on the eyes to relieve eye pains.

*Laminaria sp.*
Nama: buiri//bāb = //gam/gūb  
family: Laminariaceae (Algae)
The stem is roasted and ground. The powder (mixed with vaseline) is rubbed on wounds and burns. This treatment prevents infection and accelerates healing.
Maerua schinzil Pax
Name: goradab
family: Capparidaceae
The body can be washed with a decoction of the leaves to treat skin disorders and acne and in
case of fever or weakness. The Topnaar people use a decoction of the leaves instead of soap to
wash themselves. An extraction of the leaves is dripped in the ears to relieve earaches.

Nicotiana glanca R. Graham
Name: -
family: Solanaceae
Warmed leaves are put in shoes in case of painful, tired feet, put on the throat to relieve throat
pain or put on the head to relieve headache. A boiled leaf, put onto sores and pimples, draws out
pus. If children have mumps, a warmed leaf can be put onto the swelling and covered with a
compress in order to reduce such swelling.

Pechuel-Loeskea leubnitziae (O. Kuntze) O. Hoffm.
Nama: autsikhan neh
family: Asteraceae
A decoction of the leaves is used cutaneously for the treatment of measles, sores and skin
disorders and for the desinfection of wounds. The decoction may also be heated to produce
vapour. The patient both exposes his body to the vapour as well as inhales it to cure colds and
and coughs and to treat skin disorders. The crushed fresh or dried leaves are applied to wounds.
Warmed leaves are applied to relieve painful, tired feet and are also applied on the head as a
treatment for headaches.

Pergularia daemia (Forsk.) Chiov.
Nama: dal'guwib = kgwilb
family: Asclepiadaceae
The powder obtained by roasting the root (or leaf) and grinding it, is applied on wounds.
In case of backache, cuts are made in the back and ground root are applied to these cuts.

Ricinus communis L.
Nama: /kheras
family: Euphorbiaceae
In case of mumps or toothpain, the seeds are ground, boiled and put on the swollen cheek. A
warmed leaf is put over it and everything is covered with a compress. The roasted and ground
seeds are applied on burns and wounds. A warmed leaf can be put on wounds and skin diseases,
also on painful knees or breasts and on the throat in case of throat pain.

Rogeria longiflora (Royen) J. Gay ex DC.
Nama: dau/anab = /Gam/awib
family: Pedaliaceae
The roasted and ground seeds, sometimes mixed with fat, are put on wounds to stop bleeding. It
is also rubbed on burns to provide relief. Warmed leaves are put on the breasts to cure cracked
nipples.

Sutera corymbosa (Murloth & Engler) Hiern
Nama: -
family: Scrophulariaceae
The powder obtained from the roasted, ground roots is applied on burns.

3.1.2. Medicinal Plants for Internal Uses

Acacia erioloba E. Meyer
Nama: //ganab
family: Mimosaceae
The gum, solved in boiling water, is drunk to cure coughs, TB and colds.

Acanthosicyos horrida Welw. ex Bentham & Hooker
Nama: !nara
family: Cucurbitaceae
Eating the fresh fruit relieves stomach pains. A decoction of the roots is medicinally drunk to cure
venereal diseases, stomach pains, nausea, gonorhoe, kidney problems, internal diseases,
arteriosclerosis and chest pains. For the same purposes the root can also be chewed. Some people say it cures all diseases and it heals you within a day (similar to a life elixir).

*Aloe asperifolia* A. Berger  
Nama: aukoreb  
family: Aloeaceae  
A decoction of the leaves is drunk to cure arteriosclerosis, kidney problems, asthma, epilepsy and colds. The decoction is also drunk to induce discharge of the afterbirth. The leaves are chewed or a decoction of it is drunk for the relief of stomach and chest pains.

*Aloe dichotoma* Masson  
Nama: //garab  
family: Aloeaceae  
A decoction of the root is drunk to cure TB.

*Antiphona fragrans* (Merxm.) Merxm.  
Nama: doebalohe  
family: Asteraceae  
A decoction of the whole plant is drunk to relieve chest pains.

*Arthraerua leubnitziae* (O. Kuntze) Schinz  
Nama: saris  
family: Amaranthaceae  
A decoction of the roots is drunk to ease tremblings.

*Blumea decurrens* (Vahl.) Merxm.  
Nama: tunub  
family: Asteraceae  
A decoction of the leaves or the roots is drunk to relieve stomach pains.

*Bosca foetida* Schinz  
Nama: xaube/hunis  
family: Capparidaceae  
A decoction of the leaves and twigs is drunk to relieve stomach pains and cure colds.

*Brownanthus kuntzei* (Schinz) Dinter & Schwantes  
Nama: # naïgub  
family: Mesembryanthemaceae  
Inhalation of the vapour, obtained by boiling the whole plant, induces vomiting and is used to relieve nausea. The extract of the stems can be drunk to relieve stomach pains, to solve constipation and to whet the appetite.

*Catophractes alexandri* D. Don  
Nama: !gawas  
family: Bignoniaceae  
A decoction of the bark of branches and roots is drunk to cure colds. For the same treatment the bark can be chewed.

*Colophospermum mopane* (Kirk ex Bentham) Kirk ex Léonard  
Nama: taubahais  
family: Caesalpiniaceae  
A decoction of the leaves is drunk to relieve stomach pains and to cure colds.

*Combretum imberbe* Wawra  
Nama: !has  
family: Combretaceae  
A decoction of the leaves is drunk to relieve chest pains.

*Cullen obtusifolia* (DC) Stirtop  
Nama: !thonab  
family: Fabaceae  
A decoction of the plant in water or milk, or tea made from it is drunk for the relief of stomach pains and post-natal pains.
Harpagophytum procumbens DC. ex Meissner
Nama: /khirips/kham family: Pedaliaceae
A decoction of the bulbs is drunk or the bulbs are chewed to relieve stomach pains and post natal pains.

Hoodia curret (Hooker) Deane
Nama: !kobob family: Asclepiadaceae
The stems are eaten raw after the removal of the outer skin and thorns. Eating this lowers high blood pressure, cures colds and relieves stomach pains and digestion problems.

Maerua schinzii Pax
Nama: goradiab family: Capparidaceae
A decoction of the leaves is drunk to cure colds.

Orthanthera albida Schinz
Nama: /gariib = /ariib family: Asclepiadaceae
Drinking a decoction of the stems or chewing the stems relieves stomach pains. For the same reason roots can be used. A decoction of the ground seeds is drunk to cure kidney and back diseases.

Parmella hottentotta (Thunb.) Ach.
Nama: /hui//khaob Lychens
A decoction is drunk to cure coughs and to relieve stomach and breast pains.

Pechuel-Loeschea leubnitziæ (O. Kuntze) O. Hoffm.
Nama: ausili/hanneb family: Asteraceae
A decoction of the leaves is drunk to cure gonorrhoe, fever, colds, chest and stomach pains.
A decoction of the root is drunk to cure TB.

Pergularia daenæa (Forsk.) Chiov.
Nama: dailguwib = /guwib family: Asclepiadaceae
A decoction of the root is drunk to cure venereal diseases and vein problems.

Phoenix dactylifera L.
Nama: - family: Arecales
A decoction of the root is drunk to cure TB.

Salvadora persica L.
Nama: xoris family: Salvadoraceae
A decoction of the roots is drunk to cure colds and coughs.

Solanum incanum L.
Nama: soropees family: Solanaceae
A decoction of the roots is drunk if one can’t urinate.

Sterculia africana (Lour.) Fiori
Nama: huina family: Sterculiaceae
A decoction of the whole fruit is drunk to relieve post natal and pregnancy pains.

Sutera corymbosa (Marloth & Engler) Hiern
Nama: - family: Serrophulariaceae
A decoction of the roots is drunk to relieve all pains.
Tamarix usneoides E. Meyer ex Bunge
Nama: daweb family: Tamaricaceae
The roots are boiled and the extract is drunk during cases of bad digestion, diarrhoea and to relieve stomach pains.

Terminalia prunioides Lawson
Nama: kheas family: Combretaceae
A decoction of the roots is drunk or the root is chewed to cure colds.

Thamnosma africana Engler
Nama: khanaab family: Rutaceae
A decoction of the whole plant, except the root, is drunk in case of stomach pains and induces vomiting. This decoction also cures coughs.

3.1.3. Medicinal Plants for Veterinarian Uses

Aloe asperifolia A. Berger
Nama: sorkoreb family: Aloeaceae
A leaf is put in the drinking water of chickens should they suffer from a certain disease, with falling and paralysis as symptoms. A decoction of the leaves is given to livestock to induce discharge of the afterbirth. The decoction is also given to livestock when they have eaten poisonous plants.

Brownianthus kuntzei (Schinz) Dinter & Schwantes
Nama: naugub family: Mesembryanthemaceae
A decoction of the whole plant is given to animals if their stomach is inflated or if they have a tape-worm. Drinking this induces vomiting.

Cullen obtusifolia (DC) Stirton
Nama: thonab family: Fabaceae
A decoction of the whole plant is given to goats after parturition to relieve post natal pains.

Curroria decidual Planchn ex Hooker f. & Bentham
Nama: arhaib family: Periploceae
A decoction of the root is given to dogs to cure rabies.

3.1.4 Aromatic Plants

Cullen obtusifolia (DC) Stirton
Nama: thonab family: Fabaceae
The leaves or the whole plant can be added to tea for flavouring. This tea whets the appetite.

Monsonia spp. L.
Nama: harapab = rabab family: Geraniaceae
The leaves are used to improve the flavour of tea.

Myrothamnus flabellifolius Welw.
Nama: (kho)torotorosen family: Myrothamnaceae
Leaves and stems of the so-called resurrection plant are added to tea. They are also added to food as a spice.

Ocimum canum Sims
Nama: gamaab family: Lamiaceae
The leaves give a fresh flavour to tea.
**Togetes minuta** L.

Nama: -  
family: Asteraceae

The whole plant (except roots) is added to tea to flavour it.

3.2. **Preliminary Screening of some Medicinal Plants**

3.2.1. Screening for Antimitotic Activity (Table 1)

3.2.2. Screening for Antimicrobial Activity (Table 2)

4. **Discussion**

The information collected on medicinal and aromatic plants used by the Topnaar people exceeds all expectations, knowing that in the whole Namib desert grow only about 400 different plant species. The results are much more extended than the results of previous similar surveys with the Topnaar (Dentlinger, 1977 and Du Pisani, 1983).

All medicinal plants will be screened for their medicinal activities and the most promising plant species will be studied more in detail. The plant uses will also be compared with uses by other people through literature review.

Of the 9 screened plant samples, 4 inhibit the growth of rootlets of wheat for more than 90% at a concentration of 100 mg/ml (table 1). These are Puchuel-Loeschaet leubnitziae (leaves), Acnidosicyos hordita (root), Cullen unstrictula (leaves) and Laminaria sp. (stem). At 10 mg/ml these plants show inequal growth inhibition. *Thamnosma africana* shows 86% of growth inhibition at 100 mg/ml and 84% at 10 mg/ml, which also seems interesting. These plants may be interesting for further investigations, but it is necessary to keep in mind that this is only a preliminary test in the search for antimitotic activity and that inhibition of the growth of the rootlets does not necessarily indicates an anticancerous action.

All 9 plant samples show an activity against one or more micro-organisms. *Blumea decurrens*, *Cullen unstrictula* and *Thamnosma africana* show good antimitotic and antimicrobial activity. All these results can be used as a base for further research.

5. **Acknowledgements**

This research project was financed by the Commission of the European Community (contract B7-5040/91/005), wherefore we are very grateful.

We wish to thank Patrick Vermeiren for helping with fieldwork and determination of plants. We wish to express our thanks to Ernst Boois, our Nama interpreter, without whose assistance the ethnobotanical research would not have been possible. We are grateful to the staff of the Desert Ecological Research Unit-Gobabeb and The University Centre for Studies In Namibia for their support.

We also wish to thank Dr. L. van Puyvelde and Mr. D. Schneider from the Laboratory of Organic Chemistry of the University of Ghent for the preliminary screening of the medicinal plants.

**References**


Table 1: Inhibition of Wheat Rootlets by Medicinal Plants

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Plant part</th>
<th>% inhibition at plant 100 mg/ml</th>
<th>powder concentration 10 mg/ml</th>
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<tr>
<td>Blumea decurrens</td>
<td>leaf</td>
<td>64</td>
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<td>Pechuel-Loeschea leubnitziæ</td>
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<td>78</td>
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<tr>
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<td>0</td>
</tr>
<tr>
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<td>54</td>
<td>49</td>
</tr>
<tr>
<td>Acacia erioloba</td>
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<td>-25</td>
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<tr>
<td>Cullen obtusifolia</td>
<td>leaf</td>
<td>94</td>
<td>54</td>
</tr>
<tr>
<td>Thamnosma africana</td>
<td>whole</td>
<td>86</td>
<td>84</td>
</tr>
<tr>
<td>Laminaria sp.</td>
<td>stem</td>
<td>93</td>
<td>-35</td>
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<tr>
<td>Tamarix usneoides</td>
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<td>67</td>
<td>-19</td>
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Table 2: Antimicrobial Activity of Medicinal Plants

<table>
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<th>Ee</th>
<th>Lb</th>
<th>M</th>
<th>Ms</th>
<th>Pa</th>
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<th>Sf</th>
<th>Sc</th>
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<tr>
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<td>-</td>
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<td>-</td>
<td>-</td>
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<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
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<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
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<tr>
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<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
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<td>+</td>
</tr>
<tr>
<td>Tamarix usneoides</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
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<td>-</td>
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</tr>
</tbody>
</table>


+ inhibition of the growth of the micro-organism
- no inhibition of the growth of the micro-organism

THE ETHNOBOTANY OF THE NAMIB DESERT

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Abstract

The Topnaar are the only inhabitants of the Namib desert. They live in very harsh conditions along the lower Kuiseb river, a seasonal river flowing through the desert. For 7 months, an ethno botanical survey was carried out in this area through interviews with the Topnaar and a vegetation study. The plants used for all kind of purposes together with their ethno botanical properties are listed.

Resumen

Los Topnaar son los únicos habitantes del desierto del Namib. Viven en condiciones duras a lo largo del río Kuiseb, un río temporal que atraviesa el desierto. Una investigación etnobotánica ha sido realizado en esta región durante 7 meses por entrevistas con los Topnaar y por un estudio de la vegetación. Las plantas utilizadas para varios fines son descritas así como sus características etnobotánicas.

1. Introduction

The Namib desert is the second largest zone of extreme aridity in Africa and the oldest desert of the world. This desert lies on the western coast of southern Africa and stretches from Mossamedes in Angola across the full length of Namibia to the mouth of the Olifants River in the Cape province of South Africa - a length of almost 2000 km. Its width is much less, about 90 to 120 km.

Along the coast, the cold Benguela Current flows northward, with water temperatures of around 10 °C. This temperature is too cold to allow significant evaporation. The result is an extremely dry desert with, however, a high relative air humidity due to the regular fogs. The mean annual rainfall is about 20 mm, but this is unevenly distributed over subsequent years.

The Topnaar are the only inhabitants of the Namib desert. This tribe, belonging to the Khoi-Khoi (Hottentots) lives in very harsh conditions along the lower Kuiseb river, a seasonal river flowing through the central Namib. The Kuiseb forms the border between the northern gravel plain desert and the southern dune desert. The catchment area of the Kuiseb river lies in the highland plateau. Most of the year the riverbed is dry, but a subterranean river flow is constant. The result is a linear oasis bysecting the Namib desert and extending the range of many non-desertic plants.

The vegetation in and along the riverbed is dominated by Acacia erioloba in the upper part of the Kuiseb valley and Acacia albida further downstream. Frequently occurring are Tamarix usneoides, Salvadorata persica, Eucalyptus pseudebenus, Spigrogenis sabulicola, Pachuel-Loeschea leubnihiae, Nicotiana glauca and Eragrostis spinoa, all perennials. Most of the annual plants only occur after a river flood or rainfall. Acanthosicyos horrida is, together with Spigrogenis sabulicola, the only plant found in the sand dunes. Both are important
sandbinders and dune formers. On the northern Namib gravel plains, vegetation is also very scarce, and mainly consists of *Zygophyllum stapfit* and *Arthroaera leubnitziae*.

Along the lower Kuiseb river live approximately 400 Topnaar, spread over 12 villages. They subsist from goat farming, some gardening and from the gathering of wild plants.

2. Methods

To collect information on plant uses the 12 Topnaar villages along the Kuiseb and Sesfontein were visited for 6 months (January-June 1992), and all Topnaar families were interviewed. Information on plant species, their uses, the parts used, and the preparation and processing methods was collected. All plant names mentioned by the Topnaar were in Nama. The scientific names were obtained in different ways. If the plant could be collected in the field, it was identified in the herbarium of the Desert Ecological Research Unit of Namibia at Gobabeb and the National Herbarium of Namibia, Windhoek by the authors. Other Latin names could be obtained through existing lists (Eiseb et al., 1991, LeRoux, 1971 and Du Pisani, 1983) relating them to vernacular names, and were cross-checked afterwards. Some plants could not be identified through either of these methods (mainly because they did not grow at the time of the research, a result of the prolonged period of drought) and therefore they remain unknown. These plants are not mentioned in the article.

3. Results

The Topnaar are now much influenced by a western way of living. Due to this, a great part of their knowledge on plant uses has been lost. They still depend for many things on the wild plants found in their environment, the Kuiseb area. The information collected on the wild plants used by the Topnaar people is given per type of plant use. Following the scientific name, the vernacular plant name in Nama is mentioned between brackets.

3.1. Food Plants

The most important food plant to the Topnaar is the nara, *Acanthosicyos horrida* Welw. ex Bentham & Hooker (*tsamib*). In the past this was their staple food and still today forms an important part of their diet. This spiny wild cucurbit, endemic to the coastal area of the Namib, grows in the sand dunes along dry riverbeds. It is an important dune former and sand binder. The spiny melon shaped fruits of about 15 cm in diameter are harvested from November till May. Many Topnaar families still move to the nara fields for some months specifically to harvest and process the nara's. In traditional preparation, the fruits are peeled and boiled for some hours, until the pips are released from the pulp and the pulp becomes deeply orange and thick. Then the pips are separated from the pulp by poring the same through a sieve. The pips are dried in the sun for a few days and then stored in bags. The pips can be eaten like nuts or ground and added to dishes. A portion of the pip harvest is sold to Walvis Bay traders who export them to Cape Town where they are eaten raw as ‘butternuts’ or used in confectionery. The taste is similar to that of almonds and the pips are highly nutritious: they contain 5.7 % oil, which has a high percentage of poly unsaturated fatty acids and 31 % protein. The residual pulp is poured onto the sand or on plastic and dried in the sun for a few days. This dried pulp forms flat cakes called =gonakaribbe. These cakes are chewed or added to porridge. This preparation and drying process allows the Topnaar to store the nara for months, and eat it the whole year round. The fresh fruit can also be eaten raw and has a pleasant fruity taste but contains cucurbitacins which burn the mouth. The raw pips, separated from the pulp by rubbing in the sand, are eaten raw or roasted.

The fruits of another wild cucurbit, *Citrullus ecrirhosus* Cogn. (*tsamib*) are inedible, but the seeds are eaten roasted. The stems of the succulents *Hoodia currori* (Hooker) Decne (*khobab*) and *Trichocaulon pedicellatum* Schinz (*goab*), growing in rocky areas are edible and refreshing, but very bitter when dry. Only a few edible fruits are found in this area: the wild sycomore figs of *Ficus sycomorus* L. (*nomas*), the dates
of Phoenix dactylifera L. and the fruits of the dune former Capparis hereroensis Schinz (sirub). The pulp of the pods of Acacia erioloba E. Meyer (/ganab) is eaten in periods of food scarcity. The gum (‘hairan), secreted by Acacia tortilis (Forsk.) Hayne ssp. heteracantha (Bruch.) Brenan and collected by making incisions into the branches, is also edible. The alien Prosopis glandulosa Torrey (/narab), whose pods are edible and sweet, is now also present in the Kuiseb riverbed. Children eat the follicles of Orthanthra albida Schinz (/garib).

3.2. Beverages

The leaves of Cullen obtusifolia (DC) Stiron (/honab), Myrothamnus flabellifolius Welw. (lhotorotoroson), Tagetes minuta L. and Ocimum canum Sims (lgamebe) are added to tea for flavouring. The dried and ground figs of Ficus sycomorus and the roasted and ground seeds of Parkinsonia africana Sonder are used as a substitute for coffee. A refreshing drink is made by mixing the stem of Hoodia currori or Trichocalon pedicellatum with sugar water. The roots of Senecio martoehianus O. Hoffm. and Orthanthra albida can be added to self-brewed corn beer to improve its flavour.

3.3. Fermentation

To curdle milk into yoghurt in order to increase its longevity, the roots of Aspilia enii S.Moore, Tephrosia dregeana E. Meyer and Cullen obtusifolia are put into the milk.

3.4. Medicinal Plants

Many plants are used for medicinal purposes. The remedial use of plants depends on their availability in the environment, the beliefs of the people, their visions on plants, the way animals use the plants, etc. Mankind has attempted to source plants to satisfy every conceivable need. Because of the scarce vegetation in the Namib, a relatively high percentage of the plants found there are used for medicinal purposes.

3.4.1. Medicinal Plants for External Use

The crushed root of Acanthosicyos horrida, mixed with fat is rubbed on wounds to hasten healing. The roasted and ground stem of the sea pelargonium Ecklonia maxima (Osbeck) Papenfuss (huri/hab) is rubbed on wounds and burns. This treatment prevents infection and accelerates healing. For the same treatment the roasted and ground seeds of Robergia longiflora (Roven) J. Gay ex DC. (dau/anab, /Gam/awib), sometimes mixed with fat can be used. The warmed leaves of this plant are applied to the breasts to cure cracked nipples.

The spores of the fungi Battarea sp. (lolasab), found growing in the riverbed are rubbed on burns to reduce pain and hasten healing. The spores are also rubbed on rough spots of the body.

A decoction of the leaves of Blumea decurrens (Vahl.) Merxm. (tunub) is used to wash the body and acts against acne. The leaves are put in the shoes in case of painful feet.

An extraction of the leaves of Boscia albitrunca (Burch.) Gilg & Benedict (lunub) or Boscia foetida Schinz (xabie /hunis) is dripped into the ears and eyes to relieve respective pains. The flesh of Hoodia currori is also applied to the eyes to relieve pain.

The bitterbos, Pechuel-Loeschea leuconiaea (O. Kuntze) O. Hoffm. (autsilkhaneb) is extensively used as a medicine. A decoction of the leaves is used cutaneously for the treatment of measles, sores and skin disorders and for the disinfection of wounds. The decoction may also be heated to produce vapour. The patient both exposes his body to the vapour as well as inhales it to cure colds and coughs and to treat skin disorders. The crushed fresh or dried leaves are applied to wounds. Warmed leaves are applied to relieve painful, tired feet and are also applied on the head as a treatment for headaches.

To treat skin disorders and acne, the body can be washed with a decoction of the leaves of Maerua schinzii Pax (goradab). The same treatment is used in case of fever or weakness.

An extract of Brownanthus kunzei (Schinz) Dinter & Schwantes (=naugub) is added to boiling water. The patient inhales the vapour to cure colds, fever and flu.

Warmed leaves of Nicotiana glauca R. Graham are put in shoes in case of painful, tired feet; put on the throat to relieve throat pain or put on the head to relieve headache. A boiled leaf, put onto sores and pimples
draws out pus. If children have mumps, a warmed leaf can be put onto the swelling and covered with a compress in order to reduce such swelling.

The powder obtained by roasting the root (or leaf) of *Pergularia daemia* (Forsk.) Chiov. (dailguwib, ![guwib]) and grinding it, is applied on wounds.

In case of mumps or toothache, the seeds of *Ricinus communis* L. (ikheras) are ground, boiled and put on the swollen cheek. A warmed leaf is put over it and everything is covered with a compress. The roasted and ground seeds are applied on burns and wounds. A warmed leaf can be put on wounds and skin diseases, also on painful knees or breasts and on the throat in case of throat pain.

3.4.2. Medicinal Plants for Internal Use

Eating the fresh nara fruit, *Acanthosicyos horrida* relieves stomach pains. A decoction of the roots is medicinally drunk to treat venereal diseases, stomach pains, nausea, kidney problems, internal diseases, arteriosclerosis and chest pains. For the same purposes the root can also be chewed. Some people say it cures all diseases and it heals you within a day (similar to a life elixir).

The gum of *Acacia erioloba*, dissolved in boiling water, is drunk to cure coughs, tuberculosis and colds.

A decoction of the roots of *Aloe dichotoma* Masson (l!garab) or *Phoenix dactylifera* is drunk to cure tuberculosis.

The very bitter decoction of the leaves of *Aloe asperifolia* A. Berger (sukoreb) is drunk to treat arteriosclerosis, kidney problems, asthma, epilepsy and colds. The decoction is also drunk to induce discharge of the afterbirth. The leaves are chewed or a decoction of it is drunk for the relief of stomach and chest pains.

To ease tremblings, a decoction of the roots of *Arthraera leubnitziae* (O. Kuntze) Schinz (saris) is drunk.

Inhalation of the vapour obtained by boiling *Brownanthus kunzei*, induces vomiting and is used to relieve nausea. The extract of the stems can be drunk to relieve stomach pains, to solve constipation and to what the appetite.

A decoction of the leaves or the roots of *Blumea decurrens* is drunk to relieve stomach pains.

A decoction of *Cullen obtusifolia* in water or milk, or tea made from it is drunk for the relief of stomach and post-natal pains.

A decoction of the lichen *Parmelia hortentotta* (Thunb.) Ach. (l!m!khob) is drunk to cure coughs and to relieve stomach and chest pains.

*Hoodia currori* stems are eaten raw after the removal of the outer skin and thorns. Eating this lowers high blood pressure, cures colds and relieves stomach pains and indigestion.

Drinking a decoction of the stems or chewing the stems of *Orthanthera albida* relieves stomach pains. For the same reason roots can be used. A decoction of the ground seeds is drunk to treat kidney and back diseases.

A decoction of the leaves of *Pechuel-Loeschea leubnitziae* is drunk to treat gonorrhoea, fever, colds, chest and stomach pains. A decoction of the root is drunk to cure tuberculosis.

A decoction of the stems of *Kleinita longiflora* DC is drunk to relieve tooth and headaches.

A decoction of *Pergularia daemia* (Forsk.) Chiov. root is drunk to treat venereal diseases and vein problems.

To cure colds and coughs, a decoction of the roots of *Salvadora persica* L. (xoris) is drunk.

The roots of *Tamarix usneoides* E. Meyer ex Bunge (daweb) are boiled and the extract is drunk for indigestion, diarrhoea and to relieve stomach pains.

A decoction of *Thamnosma africana* Engler (=khanah) is drunk to relieve stomach pains and cure coughs (induces vomiting).

3.5. Hygiene

To wash themselves, the Tswana sometimes use a decoction of the leaves of *Maerua schinzii*. The stems of *Orthanthera albida* and the roots of *Euclea pseudebenus* E. Meyer ex A. DC. are chewed to clean the teeth.
3.6. Cosmetics

Oil from the raw or boiled nara pips is used to moistenize the skin and protect it from sunburn. For this treatment the pips are ground in a mortar and this mixture is rubbed on the skin. The pieces of seed coats and pips are wiped off afterwards. The spores of the fungi Battarea sp. may be added to the nara oil.

Several plants are used as body powder and perfume: the dried and ground lichen Parmelia botteniota, the leaves of Oenimum canum and Tagetes minuta, the powder obtained from between the stem and the bark of Acacia erioloba and the crushed shrub Lycium tetrandrum Thunb.

3.7. Fuel

All fuelwood the Topnaar need is found along the Kuiseb riverbed. The floods provide much dead wood and often whole trees are uprooted by big floods. The best fuel tree in this area is Acacia erioloba. It produces little smoke and a good quality charcoal. The other trees found along the river, such as Acacia albida Del. (anas), Salvadoria persica L., Euclea pseudebenus and Tamarix usneoides are less used.

3.8. Timber

The hard wood of Acacia albida is used mostly for the construction of houses, kraals and fences. The bark is used as a covering for roofs and walls. Nowadays a lot of garbage material and iron plate is used to construct the walls and roofs. This tree is also used to make drinking troughs and furniture. The wood of Acacia erioloba is too hard for construction purposes, but is sometimes used for furniture and fences. This wood is termite resistant. Euclea pseudebenus wood is used for the construction of houses and kraals and in the manufacture of utensils. The strong, flexible branches of Nicotiana glauca are also used to build houses, kraals and fences; mostly as crossbeams.

3.9. Fodder

The pods of the ana tree Acacia albida are the most important fodder for the goats and cattle in the lower Kuiseb area. The leaves are also browsed. The pods and leaves of Acacia erioloba may also be browsed. Furthermore many herbs, shrubs and trees are eaten by the livestock.

The berries of Salvadoria persica and Euclea pseudebenus can be fed to chickens.

3.10. Other Uses

No plants are used for fibres, dyes, tannins or narcotics. Witchcraft has completely disappeared amongst the Topnaar, because of the christianization the missionaries. Art is uncommon, typical for nomadic tribes.

4. Conclusion

The information collected on plants used by the Topnaar people vastly extends the results of previous ethnobotanical surveys with the Topnaar (Dentlinger, 1977 and Du Pisani, 1983). Du Pisani listed 17 used plants for the Kuiseb area and Dentlinger concentrated her survey on the nara. Much knowledge however has already been lost due to contacts with western civilization in the area. The information collected during this survey is only a part of the once broad plant knowledge of the Topnaar. Because of the extreme drought some plants could not be found in the field and remain for the moment unknown. This means that the authors do not claim that this research is complete.

5. Acknowledgements

This research project was financed by the Commission of the European Community (contract B7-5040/91/005), for which we are very grateful.

The authors wish to thank Patrick Veenemmen for helping with field work and in the determination of
plants. Also our thanks to Ernst Boois, our Nama interpreter, without whose assistance the ethnobotanical research would not have been possible. We are grateful to the staff of the Desert Ecological Research Unit of Namibia-Gobabeb and The University Centre for Studies in Namibia for their support. We are also very grateful to the Ministry of Wildlife, Conservation and Tourism for giving permission to work in the Namib-Naukluft Park.

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Diagram 1

Mocâmedes
BWhn''

- Precipitation (mm) — Temperature (°C)

Elevation: 500m
Mean annual temperature: 20.4 °C
Mean annual precipitation: 80 mm

Diagram 2

Opuwo
BSh

- Precipitation (mm) — Temperature (°C)

Elevation: not known
Mean annual temperature: 21.5 °C
Mean annual precipitation: 352.8 mm

Diagram 3

Cape Frio
BWhn'
(period of recording: 1956-1966)

- Precipitation (mm) — Temperature (°C)

Elevation: not known
Mean annual temperature: 16.7 °C
Mean annual precipitation: 164 mm

Diagram 4

Sesfontein
BWh

- Precipitation (mm)

Elevation: 600m
Mean annual temperature: not available
Mean annual precipitation: 95.4 mm
6. List of Plants found during the Research Period

130 Welwitschiaceae

*Welwitschia mirabilis* Hook.f.

160 Moraceae

*Ficus cordata* Thunb.

*Ficus sycomorus* L.

170 Urticaceae

*Forskaolaea candida* L.f.

*Forskaolca viridis* Ehrenb. ex Webb

190 Olacaceae

*Ximenia americana* L. var. *microphylla* Welw. ex Oliver

250 Nyctaginaceae

*Phacophium spinosum* Radlk.

270 Aizoaceae

*Aizoanthemum dinteri* (Schinz) Friedrich

*Galenia africana* L.

*Galenia papulosa* Ecklon & Zeyher) Sonder var. *papulosa*

*Gieseia africana* (Lour.) O.Kuntze

*Gieseia pharnaccoides* L.

*Limeum myosotis* H.Walter

*Mollugo cerviana* (L.) Ser. ex DC.

*Sesuvium sesuvioides* (Fenzl.) Verdc.

*Tetragonia reduplicate* Welw. ex Oliver

*Trianaema hereroensis* Schinz

*Trianaema triqueta* Willd. ssp. *parviflora* (Sonder) Jeffrey
275 Mesembryanthemaceae

Browanthus kuntzei (Schinz) Ihlenf. & Bittrich

Hereroa puttkamerana (Dinter & Berger) Dinter & Schwantes

Lithops pseudotruncatella (Berger) N.E. Br. var. brandbergensis De Boer

Lithops ruschiiorum (Dinter & Schwantes) N.E. Br. var. ruschiiorum

Mesembryanthemum cryptanthum Hook.f.

Mesembryanthemum guerichianum Pax

Psylocaulon salicornioides (Pax) Schwantes

290 Portulacaceae

Talinum arnotii Hook.f.

320 Chenopodiaceae

Chenopodium ambrosioides L.

Chenopodium pumilio R.Br.

Salsola aphylla L.f.

Salsola nollothensis Aellen

Salsola tuberculata (Moq.) Fensl.

Sarcocornia natalensis (Bunge ex Ung.-Sternb.) A.J.Scott

Suada plumosa Aellen

330 Amaranthaceae

Amaranthus dinteri Schinz subsp. dinteri

Arthrocrura leubnitziae (Kuntze) Schinz

Calicocea capitata (Moq.) Hook f.

Hermbstaedtia spathulifolia (Engl.) Baker

460 Papaveraceae

Argemone ochroleuca Sweet
470 Capparaceae

*Boscia albitrunca* (Burch.) Gilg & Benedict

*Boscia foetida* Schinz subsp. *foetida*

*Cadaba Schroepelii* SuessenG

*Capparis hereroensis* Schinz

*Cleome foliosa* Hook.f. var. *foliosa*

*Cleome gynandra* L.

*Maerua parvifolia* Pax

*Maerua schinzii* Pax

500 Moringaceae

*Moringa ovalifolia* Dinter & Berger

510 Myrothamnaceae

*Myrothamnus flabellifolius* Welw.

520 Crassulaceae

*Cotyledon orbiculata* L.

530 Vahliaeeae

*Vahlia capensis* (L.f.) Thunb.

600 Fabaceae

*Acacia albida* Del.

*Acacia erioloba* E.Meyer

*Acacia hereroensis* Engler

*Acacia karroo* Hayne

*Acacia mellifera* (Vahl) Benth.

*Acacia montis-usili* Merxm. & Schreiber

*Acacia reficiens* Wawra
Acacia robynsiana Merxm. & Schreiber

Acacia senegal (L.) Willd.

Acacia tortilis (Forsskal) Hayne subsp. heterocantha (Burchell) Brenan

Adenolobus garipensis (E.Meyer) Torre & Hillcoat

Adenolobus pechuelii (O.Kuntze) Torre & Hillcoat

Cassia italic (Miller) Lam. ex F.W.Andr. ssp. micrantha Brenan

Caesalpinia rubra (Engler) Brenan

Caesalpinia pearsonii L.Bolus

Colophospermum mopane (Kirk ex Bentham) Kirk ex Leonard

Cullen obtusifolia (DC.) C.H.Sterton

Dichrostachys cinerea (L.) Wight & Arn

Indigofera adenocarpa E.Mey.

Indigofera alternans DC.

Indigofera auricoma E.Mey.

Indigofera cryptantha Benth. ex Harvey

Indigofera cuneenensis O. Hoffm.

Parkinsonia africana Sonder

Prosopis glandulosa Torrey

Senna italic Miller subsp. micrantha (Brenan) Lock

Sesbania pachicarpa DC. subsp. dinterana Gillett

Sesbania sesban (L.) Merrill subsp. sesban var. zambeziaca Gillett

Sesbania sphaerosperma Welw.

Tephrosia dregeana E.Meyer

Tephrosia monophylla Schinz

640 Geraniaceae
Monsonia senegalensis Guill. & Perr.
Sarcocaulon marlothii Engl.

650 Zygophyllaceae
Fagonia isotricha Murb. isotricha
Tribulus terrestris L.
Tribulus zebreri Sonder

Zygophyllum clavatum Schlechter & Diels
Zygophyllum cylindrisolium Schinz
Zygophyllum simplex L.
Zygophyllum stepffi Schinz

660 Balanitaceae
Balanites welwitschii (Tieghem) Exell & Mendoza

670 Euphorbiaceae
Chamaesyce chamaesyoides (R. Nordenstam) Koutnik
Chamaesyce glanduligera (Pax) Koutnik
Chamaesyce inaequilatera (Sonder) Sojak
Euphorbia damarana Leach
Euphorbia giesii Leach
Euphorbia kaokoensis (White, Dyer & Sloane) Leach
Euphorbia phylloclada Boiss.
Euphorbia lignosa Marloth
Euphorbia monteiroi Hook.f. subsp. brandbergensis R. Nordenstam
Euphorbia virosa Willd.
Phyllanthus pentandrus Schum. ex Thonnin
Phyllanthus reticulatus Poiret
Ricinus communis L.

680 Rutaceae

Themnosma africana ENGL.

700 Burseraceae

Commiphora anacardiifolia DINTER & ENGL.

Commiphora giessii VAN DER WALT

Commiphora glaucescens ENGL.

Commiphora kraeuseliana HEINE

Commiphora multijuga (HIERN.) K.SCHUM.

Commiphora sazicola ENGL.

Commiphora tenuipetiolata ENGL.

Commiphora virgata ENGL.

Commiphora wildii MERXM.

740 Anacardiaceae

Rhus quartiniana A.RICHARD var. quartiniana

780 Salvadoraceae

Salvadora persica L.

790 Rhamnaceae

Berchemia discolor (KLOTZSCH) HEMSLEY

Ziziphus mucronata WILLD.

800 Vitaceae

Cyphostemma currori (HOOK.F.) DESC.

810 Tiliaceae

Grewia tenaz (FORSK.) FIORI

820 Malvaceae
Abutilon pycnodon Hoehr.
Gossypium anomalum Wawra
Hibiscus elliottiae Harvey
Hibiscus engleri K. Schum.
Hibiscus fleckii Gürke

Pavonia burchellii (D.C.) R.A. Dyer

Radiera urens (L.f.) Bullock

830 Bombacaceae

Adansonia digitata L.

840 Sterculiaceae

Hermannia amabilis Marl. ex K. Schum.
Hermannia gariepinia Eckl. & Zeyh.
Sterculia africana (Lour.) Fiori
Sterculia quinqueloba (Garcke) K. Schum.

890 Passifloraceae

Adevia pechuelii (Engl.) Harms

900 Tamaricaceae

Tamarix usneoides E. Meyer ex Bunge

940 Cucurbitaceae

Acanthosicyos horridus Welw. ex Hook. f.
Citrullus cincinnus Cogn.
Citrullus lanatus (Thunb.) Mansfeld
Cucumis africanaus L.f.
Cucumis meleusei C. Jeffrey
Cucumis rigidus E. Mey. ex Naudin
Cucumis sagittatus Peyr.

Memordica humilis (Cogn.) C.Jeffrey

990 Combretaceae

Combretum imberbe Wawra var. Petersii (Klotzsch) Engl. & Diels

Terminalia prunioides Lawson

1030 Apiceae

Deverra denudata (Viv.) Pfisterer & Podl. subsp. aphylia (Cham. & Schlecht.) Pfisterer & Podl.

1070 Ebenaceae

Euclea pseudobenus E. Meyer ex A.DC

1120 Apocynaceae

Packypodium lealii Welw.

1130 Periploceae

Curroria decidua Planchon ex Hook.f. & Benth.

1140 Asclepiadaceae

Asclepias buchenoviana Schinz

Gomphocarpus fruticosus (L.) Aiton

Hoodia currori (Hook.) Decne

Hoodia parviflora N.E.Br.

Orthanthera albida Schinz

Pergularia daemia (Forsskal) Chiov.

Stapelia kuebensis N.E.Br.

Trichocaulon dinteri Berger

Trichocaulon pedicellatum Schinz

1150 Rubiaceae
Kohulia cynanchica DC.

1160 Convolvulaceae

Ipomoea rubens CHOISY

Merremia multisecta HALL.F.

Merremia guerichii MEUSE

1180 Hydrophyllaceae

Codon royanii L.

Codon schenckii SCHINZ

1200 Boraginaceae

Cardia scharf (FORSK.) EHRENB. EX ASCHERSON

Heliotropium curassavicum L.

Heliotropium nelsonii C.H.WRIGHT

Heliotropium ovatifolium FORSK.

Heliotropium subulatum (HOCHST. EX A.DC.) VATKE

Heliotropium tubulosum E.MEYER EX DC.

Trichodesma africanum (L.) LEHM.

1230 Lamiaceae

Acerotome fleckii (GUERKE) LAUNERT

Leucas pechuelii (O.KUNTZE) GÜRKE

Octium canum SIMS

Plectranthus hereroensis ENGL.

1240 Solanaceae

Datura innoxia MILLER

Datura stramonium L.

Lycium cinereum THUNB.
Nicotiana glauca Graham

Solanum namaquense Dummer

Solanum rigescens Jacq.

Solanum rigescenoides Hutch.

Withania somnifera (L.) Dunal

1280 Scrophulariaceae

Anticharis inflata Marloth & Engl.

Aptosimum arenarium Engl.

Manultea dobia (Skan.) Overkott ex Roessler

Pelostomum leucorrhizum E. Mey. ex Benth. var. linearifolium Weber

Striga gesnerioides (Willd.) Vatke ex Engl.

Sutera acutiloba (Pilger) Overk. ex Roessler

Sutera canescens (Benth.) Hiern.

Sutera corymbosa (Marloth & Engl.) Hiern.

Sutera maxii Hiern.

Sutera pallida (Pilger) Overkott ex Roessler

Sutera sessilifolia (Diels) Hiern.

1280 Bignoniaceae

Cotophractes alexandri D. Don

1300 Acanthaceae

Blepharis bossii Oberm.

Blepharis gigantea Oberm.

Blepharis grossa (Nees) T. Anders

Monoechma arenicola (Engl.) C. B. Cl.

Monoechma cleomoides (S. Moore) C. B. Cl.
Monechma divaricatum (NEES) C.B.CL.
Monechma genistifolium (ENGL.) C.B.CL.
Petalidium selosum C.B.CLARKE ex SCHINZ.
Petalidium variabile (ENGL.) C.B.CL.
Ruellia diversifolia S.MOORE

1310 Pedaliaceae

Harpagophytum procumbens DC. ex MEISSNER.
Rogeria adenophylla J.GAY ex DELILE
Rogeria longiflora (ROYEN) J.GAY ex DC.
Sesamum capense BURM.F.
Sesamum marlothii ENGL.
Sesamum triphyllum WELW. ex ASCH.

1360 Campanulaceae

Wahlenbergia androsacea A.DC.

1390 Asteraceae

Antiphiona fragrans (MERXM.) MERXM.
Aspilia cenii S.MOORE
Blumea cafr (DC.) O.HOFFM.
Blumea decurrens (VAHL) MERXM.
Calostephane marlothiana O. HOFFM.
Dicoma capensis LESS.
Epaltes gariepina (DC.) STEETZ
Flaveria bidentis (L.) KUNTZE
Gasania juricefolia DC. subsp. scabra (DC.) ROESSLER
Geigeria ornativa O.HOFFM.
Geigeria spinosa O.Hoffm.

Helichrysum candolleanum Buek

Helichrysum roseo-niveum Marloth & O.Hoffm.

Kleinia longiflora DC.

Launaea intybus (Jacq.) Beauverd

Melanthera marlothiana O.Hoffm.

Osteospermum microcarpum (Harvey) T.Norl. ssp. microcarpum

Othonna lasiocarpa (DC.) Schultz-Bip.

Pechuel-Loeschea lebnitziae (O. Kuntze) O. Hoffm.

Senecio engleranus O. Hoffm.

Senecio flavus (Decne) Schultz-Bip.

Senecio marlothianus O.Hoffm.

Tugetes minuta L.

1440 Potamogetonaceae

Potamogeton pectinatus L.

1470 Liliaceae

Aloe asperifolia A. Berger

Aloe dichotoma Masson

Aloe hereroensis Engler

Aloe littoralis Baker

Aloe viridiflora Reynolds

Protasparagus pearsonii (Kies) Oberm.

1560 Juncaceae

Juncus rigidus Desf.

1600 Poaceae
Antheaphora ramosa Goossens
Antheaphora pubescens Nees
Aristida adscensionis L.
Aristida meridionalis Henrard
Chloris flabellata (Hackel) Launert
Cladoraphis cyperoides (Thungh.) S.M. Phillips
Cladoraphis spinosa (L.f.) S.M. Phillips
Enneapogon brachystachus (Jaub. & Spach) Stapf
Eragrostis annulata Rendle
Eragrostis echinochloidea Stapf
Eragrostis rotifer Rendle
Eragrostis walteri Pilger
Fingerhuthia africana Nees
Monelytrum laederitzianum Hackel
Odyssea paucinflores (Nees) Stapf
Phragmites australis (Cav.) Steudel
Pogonarthria fleckii (Hackel) Hackel
Polypogon monspeliensis (L.) Desf.
Setaria verticillata (L.) Beauv.
Sporobolus virginicus (L.) Kunth
Stipagrostis ciliata (Desf.) De Winter var. capensis (Trin. & Rupr.) De Winter
Stipagrostis giesii Kers
Stipagrostis gonostachys (Pilger) De Winter
Stipagrostis hirtigluma (Steudel ex Trin. & Rupr.) De Winter
Stipagrostis obtusa (Delile) Nees ex Kunth
Stipagrostis ramulosa De Winter
Stipagrostis sabulicola (Pilger) De Winter
Stipagrostis uniplumis (Licht. ex Roemer & Schultes) De Winter
Tricholaena monachae (Trin.) Stapf & C.E. Hubbard
Triraphis ramosissima Hackel

1610 Arecaceae

Hyphaene petrosiana Klotzsch
Phoenix dactylifera L.

1640 Typhaceae

Typha capensis (Rohrb.) N.E. Br.

1650 Cyperaceae

Cyperus laevigatus L.
Cyperus marginatus Thunb.
Mariscus aristatus (Rottb.) Chermezon
Scirpus dioicus (Kunth) Boeck.
7. Relevés done in the Namib

**Relevé number : 1 (16.1.92)**
- **GPS-coordinates :** S : 23°17’
  E : 14°49’
- **Grid reference :**
- **Height :** 300-320 m
- **Exposition :** n.a.
- **Slope :** <1%
- **Surface :** 1000 m²
- **Geographical and Geological data :** Gravelplain, N of Swartbankberg, rocks (± vertical layers of schists) + coarse sand

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthrosera leubnitziæ (KUNTZE) SCHINZ</td>
<td>&lt;1%</td>
<td>3</td>
</tr>
<tr>
<td>Zygocephalum stipfii SCHINZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks :** homogeneous cover of <1%

---

**Relevé number : 2 (16.1.92)**
- **GPS-coordinates :** S : 23°18’09”
  E : 14°49’31”
- **Grid reference :**
- **Height :** 460-464 m
- **Exposition :** top of the Swartbankberg
- **Slope :**
- **Surface :** 30 m²
- **Geographical and Geological data :** calcereous rocksurface

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senecio engleranus O. HOFFM.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Remarks :** homogeneous cover of lichens (± 50%), single plant on rocksurface, devoid of plants

---

**Relevé number : 3 (16.1.92)**
- **GPS-coordinates :** S : 23°18’10”
  E : 14°49’38”
- **Grid reference :**
- **Height :** 450-460 m
- **Exposition :** S-SW
- **Slope :** 20°-60°
- **Surface :** 50 m²
- **Geographical and Geological data :** S-SW-slope of Swartbankberg; calcereous rocksurface with cracks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aloe asperifolia A. BERGER</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Euphorbia giessii LEACH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Zygocephalum stipfii SCHINZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Hereroa putkamerana (DINTER &amp; BERGER) DINTER &amp; SCHWANTES</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Sesuvium sesuvioides (FENZL.) VERDC.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>
**Sutera mazii HIERN.**<br>
**Trichocaulon pedicellatum SCHINZ**<br>
**Calico cerea capitata (Moq.) Hook F.**

Remarks: linear vegetation pattern of phanerogams; rock surfaces with homogeneous cover of lichens (± 50%)

<table>
<thead>
<tr>
<th>Relevé number : 4 (16.1.92)</th>
</tr>
</thead>
</table>
| GPS-coordinates: S: 23°18'12"<br> E: 14°49'37"
| Grid reference: |
| Height: ± 440 m |
| Exposition: S-SW-S |
| Slope: 20°-40° |
| Surface: 50 m² |

Geographical and Geological data: SW-slope of Swartbankberg & boulders; calcareous rock surface with cracks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arthraea leubnitziue (Kuntze) Schinz</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum stapfii Schinz</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Euphorbia giesii Leach</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Calico cerea capitata (Moq.) Hook F.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Aloe asperifolia A. Berger</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Sutera mazii HIERN.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Hereroa puttkamerana (Dinter &amp; Berger) Dinter &amp; Schwantes</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks: linear vegetation pattern of phanerogams; rock surfaces with homogeneous cover of lichens (± 40%)

<table>
<thead>
<tr>
<th>Relevé number : 5 (16.01.92)</th>
</tr>
</thead>
</table>
| GPS-coordinates: S: 23°18'09"<br> E: 19°49'38"
| Grid reference: |
| Height: ±450 m |
| Exposition: W |
| Slope: 20°-40° |
| Surface: 50 m² |

Geographical and Geological data: W-slope of Swartbankberg; calcareous rock surface with cracks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Euphorbia giesii Leach</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Arthraea leubnitziue (Kuntze) Schinz</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum stapfii Schinz</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Calico cerea capitata (Moq.) Hook F.</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis obtusa (Delile) Nees ex Kunth</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Deverra denuda (Viv.) Pfisterer &amp; Podl.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>subsp. aphylla (Cham. &amp; Schlecht.) Pfisterer &amp; Podl.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Sutera mazii HIERN.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks: phanerogamic vegetation restricted to cracks and crevices; rock surfaces covered with lichens
Relevé number: 6 (16.01.92)
GPS-coordinates: S: 23°18'19"
              E: 19°48'37"
Grid reference:
Height: ±420 m
Exposition: S
Slope: 0°-15°
Surface: 30 m²
Geographical and Geological data: small depression on S slope of Swartbankberg; filled with scree and coarse sand; calcereous

Species

- Sutera maxii
- Aloe asperifolia A. BERGER
- Stipagrostis obtusa (DELLILE) NEES EX KUNTH
- Euphorbia giessii LEACH
- Calicorema capitata (MOQ.) HOOK F.
- Deverra demudata (VIV.) PFISTERER & PODL.
  subsp. aphylia (CHAM. & SCHLECHT.) PFISTERER & PODL.
- Euclea pseudelenus E. MEYER EX A.DC
- Hereroa pulikamerana (DINTER & BERGER) DINTER & SCHWANTES

Sociability

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sutera maxii</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>Aloe asperifolia A. BERGER</td>
<td>3%</td>
<td>3</td>
</tr>
<tr>
<td>Stipagrostis obtusa (DELLILE) NEES EX KUNTH</td>
<td>8%</td>
<td>3</td>
</tr>
<tr>
<td>Euphorbia giessii LEACH</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td>Calicorema capitata (MOQ.) HOOK F.</td>
<td>6%</td>
<td>3</td>
</tr>
<tr>
<td>Deverra demudata (VIV.) PFISTERER &amp; PODL.</td>
<td>3%</td>
<td>3</td>
</tr>
<tr>
<td>subsp. aphylia (CHAM. &amp; SCHLECHT.) PFISTERER &amp; PODL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Euclea pseudelenus E. MEYER EX A.DC</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>Hereroa pulikamerana (DINTER &amp; BERGER)</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks: cover of lichens limited (±5%)

Relevé number: 7 (16.01.92)
GPS-coordinates: S: 23°18'07"
              E: 19°59'34"
Grid reference:
Height: ±440 m
Exposition: NW
Slope: 35°-40°
Surface: 25 m²
Geographical and Geological data: Swartbankberg: calcereous; boulders, scree and coarse sans in cracks and crevices

Species

- Orthanthera albida SCHINTZ
- Calicorema capitata (MOQ.) HOOK F.

Sociability

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthanthera albida SCHINTZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Calicorema capitata (MOQ.) HOOK F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks: boulders and scree with lichens (±80%)

Relevé number: 8 (16.01.92)
GPS-coordinates: S: 23°18'09"
              E: 14°49'48"
Grid reference:
Height: ±420 m
Exposition: NE
Slope: 26°-30°
Surface: 25 m²
Geographical and Geological data: Calcereous rocky slope on Swartbankberg with diorite dyke
Species

*Trichocaulon pedicellatum* SCHINZ
*Stipogrostis obtusa* (DELILE) NEES EX KUNTH
*Calicorema capitata* (MOQ.) HOOK F.
*Aloe asperifolia* A. BERGER
*Zygophyllum stapfii* SCHINZ

Remarks: lichens cover (±90%)

Relevé number: 9 (16.01.92)
GPS-coordinates: S: 23°18’12”
Grid reference: E: 14°49’32”
Height: - m
Exposition: /
Slope: <1%
Surface: 10 m²

Geographical and Geological data: plain of coarse and stones near a wash in a valley, west of Swartbankberg

Species

*Euphorbia phylloclada* BOISS.

Remarks: plain nearly devoid of plants; *Euphorbia phylloclada* BOISS. sparsely scattered

Relevé number: 10 (16.01.92)
GPS-coordinates: S: 23°18’19”
Grid reference: E: 14°49’32”
Height: - m
Exposition: NW
Slope: 30°
Surface: 4 m²

Geographical and Geological data: border of wash, west of Swartbankberg; coarse sand and stones

Species

*Euphorbia phylloclada* BOISS.
*Poa caec* sp. non ident.

Remarks: linear vegetation pattern along a wash

Relevé number: 11 (16.01.92)
GPS-coordinates: S: 23°18’13”
Grid reference: E: 19°49’31”
Height: - m
Exposition: W
Slope: 2°
Surface: 200 m²

Geographical and Geological data: wash with coarse sand, fine sand and silt; W of Swartbankberg
### Part IV: Annexes

#### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Euphorbia phylloclada</em> BOISS.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Euphorbia gieissi</em> LEACH</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Calicorema capitata</em> (MOQ.) HOOK F.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Acanthosicyos horridus</em> WELW. EX HOOK. F.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Suteria maxii</em> HIERN.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Deverra denudata</em> (VIV.) PFISTERER &amp; PODL.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>subsp. <em>aphylla</em> (CHAM. &amp; SCHLECHT.) PFISTERER &amp; PODL.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Poaceae</em> sp. non ident.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Gasteria jutensis</em> DC. subsp. <em>scabra</em> (DC.) ROESSLER</td>
<td>1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Heliotropium ovalifolium</em> FÖRSK.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks: wash is very sparsely overgrown; Aconth. hors forms a small dune in the wash

---

#### Relevé number: 12 (16.01.52)

GPS-coordinates: S: 23°18'13" E: 14°49'26"

Grid reference: 

Height: - m
Exposition: W
Slope: 1° - 2°
Surface: 200 m²

Geographical and Geological data: wash with coarse sand, fine sand and silt; W of Swartbankberg

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Euphorbia phylloclada</em> BOISS.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Orthanthera aibida</em> SCHINTZ</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Euphorbia gieissi</em> LEACH</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Calicorema capitata</em> (MOQ.) HOOK F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Suteria maxii</em> HIERN.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Deverra denudata</em> (VIV.) PFISTERER &amp; PODL.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>subsp. <em>aphylla</em> (CHAM. &amp; SCHLECHT.) PFISTERER &amp; PODL.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Stipagrostis obtusa</em> (DEILLE) NEES EX KUNTH</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Poaceae</em> sp. non ident.</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><em>Tribulus zeppheri</em> SONDER</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Zygophyllum cylindrisfolium</em> SCHINZ</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Asteraceae</em> sp. non ident.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks:

---

#### Relevé number: 13 (16.01.52)

GPS-coordinates: S: 23°18'12" E: 14°49'22"

Grid reference: 

Height: - m
Exposition: NW
Slope: <1%
Surface: 200 m²

Geographical and Geological data: wash with coarse sand, fine sand and silt; W of Swartbankberg
Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia erioloba</em> E.MEYER</td>
<td>5%</td>
<td>1</td>
</tr>
<tr>
<td><em>Sutera mazzii</em> HIERN.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Orthanthera albida</em> SCHINTZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygochium stapfii</em> SCHINZ</td>
<td>8%</td>
<td>3</td>
</tr>
<tr>
<td><em>Galenia africana</em> L.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Deverra denudata</em> (Viv.) PFISTERER &amp; PODL.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>subsp. <em>aphylla</em> (CHAM. &amp; SCHLECHT.) PFISTERER &amp; PODL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Blepharis grossa</em> (NEES) T.ANDERS</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Acanthosicyos horridus</em> WELW. EX HOOK. F.</td>
<td>2%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks: *Acanthosicyos horridus* WELW. EX HOOK. F. forms a small dune in the wash.

Relevé number: 14 (17.01.92)
GPS-coordinates: S: 23°18'07"
E: 14°49'15"
Grid reference:
Height: - m
Exposition: NW
Slope: <1%
Surface: 200 m²
Geographical and Geological data: Sandy wash, W of Swartbanking

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Citrculus esirrhus</em> COGN.</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td><em>Blepharis grossa</em> (NEES) T.ANDERS</td>
<td>8%</td>
<td>3</td>
</tr>
<tr>
<td><em>Deverra denudata</em> (Viv.) PFISTERER &amp; PODL.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>subsp. <em>aphylla</em> (CHAM. &amp; SCHLECHT.) PFISTERER &amp; PODL.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Euphorbia giessii</em> LEACH</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Galenia africana</em> L.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Zygochium stapfii</em> SCHINZ</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Pechuel-Loeschea leubnitziana</em> (O. KUNTZE) O. HOFFM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis gonatostachys</em> (PILGER) DE WINTER</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: 15 (17.01.92)
GPS-coordinates: S: 23°18'06"
E: 14°49'12"
Grid reference:
Height: - m
Exposition: NE
Slope: <1%
Surface: 100 m²
Geographical and Geological data: coarse sandy plain with calcareous rocks near wash; W of Swartbankberg

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Euphorbia lignosa</em> MARLOTH</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Euphorbia phylloclada</em> BOISS.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>
### Part IV: Annexes

#### Galenia africana L.
- **Zygophyllum stapfii Schinz**
  - Cover: 2%
  - Sociability: 3
- **Blepharis grossa (Nees) T. Anders**
  - Cover: <1%
  - Sociability: 2
- **Pechuel-Loeschea leubniziae (O. Kuntze) O. Hoffm.**
  - Cover: 2%
  - Sociability: 2
- **Acaris erioloba E. Meyer**
  - Cover: 3%
  - Sociability: 1
- **Desvera denudata (Viv.) Pfisterer & Podl.**
  - subsp. *aphylla* (Cham. & Schlecht.) Pfisterer & Podl.
  - Cover: <1%
  - Sociability: 1

**Remarks:**

**Relevé number:** 16  (17.01.92)

GPS-coordinates: S: 23°31'00"
E: 19°49'02"

Grid reference:
- Height: - m
- Exposition: S & N
- Slope: 40° - 60°
- Surface: 50 m²

Geographical and Geological data: vertical layer of calcrete rocks; W of Swartbankberg

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Euphorbia lignosa Marloth</em></td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td><em>Kleinia longiflora DC.</em></td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum stapfii Schinz</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum simplex L.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Remarks:**

- **Relevé number:** 17  (20.01.92)

GPS-coordinates: S: 23°33'12"
E: 15°02'13"

Grid reference:
- Height: - m
- Exposition: S-SE
- Slope: 0° - 20°
- Surface: 100 m²

Geographical and Geological data: small rocky outcrop in gravel plain between Gobabeb & Soutrivier; coarse sand and small stones on granite basement

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Orthotheca albida Schinz</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Calicorema capitata (Moq.) Hook F.</em></td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td><em>Pechuel-Loeschea leubniziae (O. Kuntze) O. Hoffm.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Indigofera auricoma E. Mey.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Stipagrostis obtusa (Delile) Nees ex Kunth</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Poaceae</em> spec. non ident.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**
Relevé number : 18 (20.01.92)
GPS-coordinates : S : 23° 20'
E : 15° 15'
Grid reference :
Height : - m
Exposition : NE
Slope : <1%
Surface : 100 m²
Geographical and Geological data : Dune area SW of Soutrivier; dune valley; coarse sand & fine gravel

Species

<table>
<thead>
<tr>
<th>Stipagrostis sabulicola (PILGER) DE WINTER</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8%</td>
<td>3</td>
</tr>
</tbody>
</table>

Remarks : *Stipagrostis sabulicola* (PILGER) DE WINTER forms hummocks on a gravel at the entrance of a dune valley

---

Relevé number : 19 (20.01.92)
GPS-coordinates : S : 23° 30'
E : 15° 15'
Grid reference :
Height : - m
Exposition : N-NE
Slope : 8° - 20°
Surface : 100 m²
Geographical and Geological data : Dune area SW of Soutrivier; dune valley coarse sand & fine gravel

Species

<table>
<thead>
<tr>
<th>Stipagrostis sabulicola (PILGER) DE WINTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acanthosicyos horridus Welw. ex Hook. f.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stipagrostis sabulicola (PILGER) DE WINTER</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>12%</td>
<td>3</td>
</tr>
</tbody>
</table>

Remarks : Both plants form large hummocks at the base of the dunes

---

Relevé number : 20 (20.01.92)
GPS-coordinates : S : 23° 20’
E : 15° 10’48"
Grid reference :
Height : - m
Exposition : W
Slope : 9°
Surface : 25 m²
Geographical and Geological data : Wash near Ururas; sand & silt

Species

<table>
<thead>
<tr>
<th>Zygophyllum stapfii Schinz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galenia africana L.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zygophyllum stapfii Schinz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galenia africana L.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zygophyllum stapfii Schinz</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30%</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>8%</td>
<td>3</td>
</tr>
</tbody>
</table>

Remarks :
<table>
<thead>
<tr>
<th>Relevé number: 21</th>
<th>GPS-coordinates: S: 23°11′18″ E: 14°40′48″</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height:</td>
<td>1 m</td>
</tr>
<tr>
<td>Exposition:</td>
<td>W</td>
</tr>
<tr>
<td>Slope:</td>
<td>2°</td>
</tr>
<tr>
<td>Surface:</td>
<td>25 m²</td>
</tr>
<tr>
<td>Geographical and Geological data: Wash near Ururas; sand &amp; silt</td>
<td></td>
</tr>
<tr>
<td>Specie</td>
<td>Zygophyllum stapfii Schinz</td>
</tr>
<tr>
<td>Remarks:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15%</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relevé number: 22</th>
<th>GPS-coordinates: S: 23°03′01″ E: 14°27′35″</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height:</td>
<td>1 m</td>
</tr>
<tr>
<td>Exposition:</td>
<td></td>
</tr>
<tr>
<td>Slope:</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Surface:</td>
<td>25 m²</td>
</tr>
<tr>
<td>Geographical and Geological data: Coastal plain, south of Walvisbay salty soil</td>
<td></td>
</tr>
<tr>
<td>Specie:</td>
<td>Odyssea paucinervis (Nees) Stapf</td>
</tr>
<tr>
<td></td>
<td>Salsola nollothensis Aellen</td>
</tr>
<tr>
<td>Remarks:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odyssea paucinervis</td>
<td>30%</td>
<td>4</td>
</tr>
<tr>
<td>Salsola nollothensis</td>
<td>2%</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relevé number: 23</th>
<th>GPS-coordinates: S: 23°03′03″ E: 14°27′35″</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height:</td>
<td>1 m</td>
</tr>
<tr>
<td>Exposition:</td>
<td></td>
</tr>
<tr>
<td>Slope:</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Surface:</td>
<td>25 m²</td>
</tr>
<tr>
<td>Geographical and Geological data: Coastal plain, south of Walvisbay; salty soil</td>
<td></td>
</tr>
<tr>
<td>Specie:</td>
<td>Odyssea paucinervis (Nees) Stapf</td>
</tr>
<tr>
<td></td>
<td>Salsola nollothensis Aellen</td>
</tr>
<tr>
<td></td>
<td>Phragmites australis (CAV.) Steudel</td>
</tr>
<tr>
<td>Remarks:</td>
<td>Revele 23; more wet than 22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Odyssea paucinervis</th>
<th>&lt;1%</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salsola nollothensis</td>
<td>16%</td>
<td>3</td>
</tr>
<tr>
<td>Phragmites australis</td>
<td>50%</td>
<td>4</td>
</tr>
</tbody>
</table>
Relevé number: 24 (21.01.92)
GPS-coordinates: S: 23°03'04"
Grid reference: E: 14°27'35"
Height: - m
Exposition: -
Slope: <1%
Surface: 25 m²
Geographical and Geological data: Coastal plain, south of Walvisbay; salty soil

Species

*Phragmites australis (Cav.) Steudel*

Cover  Sociability
100%  5

Remarks: relevé 29; more wet than 23

Relevé number: 25 (21.01.92)
GPS-coordinates: S: 23°03'02"
Grid reference: E: 14°27'37"
Height: - m
Exposition: -
Slope: <1%
Surface: 25 m²
Geographical and Geological data: Coastal plain, south of Walvisbay; salty soil

Species

*Phragmites australis (Cav.) Steudel*
*Odyssea pacinervis (Nees) Staff*

Cover  Sociability
4%  3
30%  4

Remarks: relevé 25: more wet than 22; less wet than 23

Relevé number: KC1 (12.09.92)
GPS-coordinates: S: 23°16'31"
Grid reference: E: 15°47'42"
Height: - m
Exposition: -
Slope: -
Surface: 100 m²
Geographical and Geological data: Top of a hill near the Kuiseb; flat; schists

Species

*Petalidium variabile (Engl.) C.B.Cl.*
*Tribulus terrestris L.*
*Commiphora virgata Engl.*
*Stipagrostis uniplumis (Licht. ex Roemer & Schultes) De Winter*
*Cleome foliosa Hook. f. var. foliosa*
*Menziesia genistifolia (Engl.) C.B.Cl.*

Cover  Sociability
<1%  <1%
<1%  <1%
<1%  <1%
<1%  <1%
<1%  <1%

Remarks:
Relevé number : KC2  (12.04.92)
GPS-coordinates : S : 23°16'31"
                E : 15°47'38"
Grid reference :
Height : ± 840 m
Exposition : NNW
Slope : ± 25°
Surface : 100 m²
Geographical and Geological data :

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Boscia foetida</em> SCHINZ. subsp. foetida</td>
<td>&lt;1%</td>
<td></td>
</tr>
<tr>
<td><em>Indigofera auricoma</em> E. MEY.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Commiphora virgata</em> ENGL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Monechma genistifolium</em> (ENGL.) C.B.CL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Petaldium variabile</em> (ENGL.) C.B.CL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Cleome foliosa</em> HOOK.F. var. foliosa</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis unipilumis</em> (LICHT. EX ROEMER &amp; SCHULTE) DE WINTER</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks :

Relevé number : TSAU1  (16.04.92)
GPS-coordinates : S : 24°38'35"
                E : 15°30'08"
Grid reference :
Height : - m
Exposition : S
Slope : 40°
Surface : 100 m²
Geographical and Geological data : river bank Tsuchab; sand, silt + small stones

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pechuel-Loeschea leubnitzei</em> (O. KUNTZE) O. HOFFM.</td>
<td>8%</td>
<td>4</td>
</tr>
<tr>
<td><em>Salvia sp.</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis sabulicola</em> (PILGER) DE WINTER</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Calicorema capitata</em> (MOQ.) HOOK F.</td>
<td>2%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks :

Relevé number : TSAU 2  (16.04.92)
GPS-coordinates : S : 24°38'35"
                E : 15°39'08"
Grid reference :
Height : - m
Exposition : S
Slope : 40°
Surface : 100 m²
Geographical and Geological data : Riverbank Tsuchab; sand, silt + small stones
### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Calicorema capitata</em> (Moq.) Hook F.</td>
<td>10%</td>
<td>4</td>
</tr>
<tr>
<td><em>Pechuel-Loeselca leubnitziae</em> (O. Kuntze) HOFFM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salsola sp.</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Ziziphus mucronata</em> WILLD.</td>
<td>30%</td>
<td>3</td>
</tr>
</tbody>
</table>

**Remarks:**

---

#### Relevé number: TSAU 3 (16.04.92)

GPS-coordinates: S: 24°39'35"
E: 15°39'08"

Grid reference:
Height: ± 680 m
Exposition: -
Slope: <1%
Surface: 900 m²

Geographical and Geological data: old riverbed Tsauchab, sand + small stones

### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Adenolobus garipensis</em> (E.Meyer) Torre &amp; Hillcoat</td>
<td>5%</td>
<td>2</td>
</tr>
<tr>
<td><em>Bosca foetida Schinz</em> subsp. foetida</td>
<td>8%</td>
<td>4</td>
</tr>
<tr>
<td><em>Pechuel-Loeselca leubnitziae</em> (O. Kuntze) HOFFM.</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Stipagrostis sabulicola</em> (Pilger) De Winter</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salsola sp.</em></td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Acacia erioloba</em> E.Meyer</td>
<td>3%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

---

#### Relevé number: UIS1 (18.04.92)

GPS-coordinates: S: 21°18'20"
E: 14°56'44"

Grid reference:
Height: - m
Exposition: N
Slope: 5°, 10°
Surface: 200 m²

Geographical and Geological data: rocky slope, south of Uis

### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Euphorbia giessii</em> Leach</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Bosca foetida Schinz</em> subsp. foetida</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Protasparagus pearsonii</em> (Kies) Oberm.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Commiphora glaucescens</em> Enlg.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Commiphora saxicola</em> Enlg.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Poaceae</em> sp. non ident.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**
Relevé number: UIS2 (18.09.92)
GPS-coordinates: S: 21°18'17"
E: 19°36'30"
Grid reference:
Height: ± 850 m - ± 900 m
Exposition: ENE
Slope: 10°
Surface: 100 m²
Geographical and Geological data: rocky slope of a small river

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hibiscus eliotii HARVEY</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>Boscia foetida SCHINZ subsp. foetida</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Commiphora glaucescens ENGL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Commiphora saxicola ENGL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Maerua schinzii PAX</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Poaceae spec. non ident</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Acanthaceae spec. non ident</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Asparagus africana</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>Galenia africana L.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: WE1 (19.04.92)
GPS-coordinates: S: 20°12'13"
E: 13°58'13"
Grid reference:
Height: 800-850 m
Exposition: N
Slope: 5°-10°
Surface: 400 m²
Geographical and Geological data: Wereldsend, catchment area Kogeb, bank of a wash, coarse sand and stones.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welwitschia mirabilis HOOK.F.</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>Blepharis gigantea OBERM.</td>
<td>6%</td>
<td>3</td>
</tr>
<tr>
<td>Euphorbia damarana LEACH</td>
<td>8%</td>
<td>4</td>
</tr>
<tr>
<td>Boscia foetida SCHINZ subsp. foetida</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>Acanthaceae sp. non ident.</td>
<td>4%</td>
<td>3</td>
</tr>
<tr>
<td>tree sp. non ident.</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>Blepharis sp. non ident.</td>
<td>1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: WE2 (19.04.92)
GPS-coordinates: S: 20°18'10"
E: 13°58'13"
Grid reference:
Height: 800-850 m
Exposition: N
Slope: ±5°
Surface: 400 m²
Geographical and Geological data: Wereldsend, catchment area Koigab, bank of a wash, coarse sand and stones.

**Species**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Blepharis gigantea</em> OBERM.</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Euphorbia damarana</em> LEACH</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Parkinsonia africana</em> SONDER</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Commiphora saxicola</em> ENGL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Welwitschia mirabilis</em> HOOK.F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>tree sp. non ident.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acanthaceae</em> sp. non ident.</td>
<td>3%</td>
<td>3</td>
</tr>
<tr>
<td><em>Blepharis</em> sp. non ident.</td>
<td>1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks: Relevé WE2 was closer to the center of the wash than WE1. *Blepharis gigantea* OBERM. and *Euphorbia damarana* LEACH had a larger coverage further away from the wash.

---

**Relevé number: WE3 (19.04.92)**

GPS-coordinates: S: 26°15'13"
E: 13°58'08"

Grid reference:
Height: 800-850m
Exposition: E
Slope: ±30°
Surface: 100 m²
Geographical and Geological data: Wereldsend, slope near wash, rocky

**Species**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Commiphora krausseliana</em> HEINE</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Commiphora saxicola</em> ENGL.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Commiphora tenuipetiolata</em> ENGL.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Commiphora wildei</em> MERXM. &amp; SCHREIBER</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Acacia robyniana</em> MERXM. &amp; SCHREIBER</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Euphorbia viroso</em> WILLD.</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Blepharis gigantea</em> OBERM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Acanthaceae</em> sp. non ident.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>tree sp. non ident.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Blepharis</em> sp. non ident.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks: *Commiphora krausseliana* HEINE, *Acacia robyniana* MERXM. & SCHREIBER and *Euphorbia viroso* WILLD. were typical for this plant association on the hill. *Welwitschia mirabilis* HOOK.F. was completely absent (in this area it was found only in the washes on the banks of the washes.) *Euphorbia damarana* LEACH was absent on steep hills but very common on banks of the washes and less steep hills.

---

**Relevé number: MB4 (18.06.92)**

GPS-coordinates: S: 19°21'18"
E: 12°42'29"

Grid reference:
Height: ±10m
Exposition: W
Slope: 25°
Surface: 100 m²
Geographical and Geological data: rocks near bbreach, north of Mowe Bay

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Zygothelynum clavatum</em> Schlechter &amp; Diels</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygothelynum stapfii</em> Schinz</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Psyllocaulon salicornioides</em> (Pax) Schwantes</td>
<td>3%</td>
<td>3</td>
</tr>
<tr>
<td><em>Cladophris cypervoides</em> (Thung.) S.M. Phillips</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Chloris flabellata</em> (Hackel) Launert</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: MB5 (19.06.92)

GPS-coordinates: S: 19°22'41"
E: 12°42'22"

Grid reference:
Height: ±10m
Exposition: NW
Slope: <1%
Surface: 100 m²

Geographical and Geological data: Wash near Mowe Bay

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Psyllocaulon salicornioides</em> (Pax) Schwantes</td>
<td>10%</td>
<td>4</td>
</tr>
<tr>
<td><em>Indigofera canecensis</em> O. Hoffm.</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Cladophris cypervoides</em> (Thung.) S.M. Phillips</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salsola nallothenis</em> Aellen</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: MB6 (19.06.92)

GPS-coordinates: S: 19°22'43"
E: 12°42'23"

Grid reference:
Height: ±15m
Exposition:
Slope: up to 30°
Surface: 100 m²

Geographical and Geological data: Dunes, ±4m above wash near Mowe Bay, fine and coarse sand

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Psyllocaulon salicornioides</em> (Pax) Schwantes</td>
<td>13%</td>
<td>3</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: MB7 (19.06.92)

GPS-coordinates: S: 19°23'01"
E: 12°42'35"
Grid reference: Height: ±10m
Exposition: W
Slope: ±2°
Surface: 100 m²
Geographical and Geological data: Wash near Mowe Bay, fine and coarse sand

Species

*Cladophora cypereoides* (Trung.) S.M. Phillips
*Psilocaulon salicornioides* (Pax) Schwantes
*Indigofera cuneensis* O. Hoffm.

Cover Sociability
---
3% 3
8% 3
<1% 2

Remarks:

**Relevé number:** MB8 (19.06.92)
GPS-coordinates: S: 19°23'01"
E: 12°42'24"

Grid reference:
Height: ±10m
Exposition: S
Slope: 25°
Surface: 50 m²
Geographical and Geological data: border of wash near Mowe Bay, coarse sand and stones

Species

*Psilocaulon salicornioides* (Pax) Schwantes
*Salsola nolothensis* Aellen
*Zygophyllum clavatum* Schlechter & Diels

Cover Sociability
---
<1% 2
<1% 2
1% 2

Remarks:

**Relevé number:** MB9 (19.06.92)
GPS-coordinates: S: 19°23'02"
E: 12°42'26"

Grid reference:
Height: ±18m
Exposition: W
Slope: ±6°
Surface: 50 m²
Geographical and Geological data: upper part of small wash near Mowe Bay, coarse sand

Species

*Zygophyllum clavatum* Schlechter & Diels

Cover Sociability
---
1% 2

Remarks:
Relevé number: MB10 (19.06.92)
GPS-coordinates: S: 19°23'16"
E: 12°42'29"
Grid reference: 
Height: ±15m
Exposition: W
Slope: <1%
Surface: 100 m²
Geographical and Geological data: wash south of Mowe Bay, coarse sand

Species

*Psyllocaulon salicornioides* (PAX) SCHWANTES
*Indigofera cuneensis* O. Hoffm.
*Clerodaphis cyperoides* (THUNG.) S.M.PHILLIPS

Cover  Sociability
---
4%    3
1%    2
2%    2

Remarks:

Relevé number: MB11 (19.06.92)
GPS-coordinates: S: 19°23'18"
E: 12°42'30"
Grid reference: 
Height: ±15m
Exposition: W
Slope: <1%
Surface: 50 m²
Geographical and Geological data: flat area between two washes, south of Mowe Bay, stony and coarse sand

Species

*Psyllocaulon salicornioides* (PAX) SCHWANTES
*Zygophyllum clavatum* SCHLECHTER & DIELS
*Indigofera cuneensis* O. Hoffm.
*Salsola noltiiensis* AELLEN

Cover  Sociability
---
2%    3
1%    2
<1%   2
9%    2

Remarks:

Relevé number: MB12 (19.06.92)
GPS-coordinates: S: 19°23'16"
E: 12°42'34"
Grid reference: 
Height: ±20m
Exposition: W
Slope: <1%
Surface: 100 m²
Geographical and Geological data: upper part of wash, south of Mowe Bay, coarse sand and stones

Species

*Clerodaphis cyperoides* (THUNG.) S.M.PHILLIPS
*Indigofera cuneensis* O. Hoffm.
*Hermannia garpepina* ECKL. & ZEYH.
*Psyllocaulon salicornioides* (PAX) SCHWANTES

Cover  Sociability
---
6%    3
<1%   2
<1%   2
2%    2
**Chloris flabellata (Hackel) Launert**

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

**Relevé number : MB13  (19.06.92)**

GPS-coordinates: S : 19°23'08"
                   E : 12°42'50"

Grid reference: 
Height: 25m
Exposition: NW-W-SW
Slope: 3°-5°
Surface: 100 m²

Geographical and Geological data: slight slope, south of Mowe Bay, coarse sand and stones

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zygochlylum clavatum Schlechter &amp; Diels</td>
<td>3%</td>
<td>2</td>
</tr>
<tr>
<td>Pylcaulon salticorioides (Pax) Schwantes</td>
<td>4%</td>
<td>3</td>
</tr>
<tr>
<td>Cladophora cyperoides (Thung.) S.M.Phillips</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>Indigofera cuneinensis O. Hoffm.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Hermannia gariepina Eckl. &amp; Zeyh.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Chloris flabellata (Hackel) Launert</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Senecio engleranus O. Hoffm.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:

**Relevé number : MB14  (19.06.92)**

GPS-coordinates: S : 19°22'41"
                   E : 12°43'04"

Grid reference: 
Height: 25m
Exposition: —
Slope: up to 30°
Surface: 400 m²

Geographical and Geological data: small dunes (height up to 2m), south of Mowe Bay, coarse and fine sand

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zygochlylum clavatum Schlechter &amp; Diels</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>Zygochlylum stapfii Schinz</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>Pylcaulon salticorioides (Pax) Schwantes</td>
<td>8%</td>
<td>3</td>
</tr>
<tr>
<td>Indigofera cuneinensis O. Hoffm.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Hermannia gariepina Eckl. &amp; Zeyh.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

**Relevé number : MB15  (19.06.92)**

GPS-coordinates: S : 19°22'39"
                   E : 12°43'07"

Grid reference: 
Height: 30m
Exposition: W
Slope: 20°-60°
Surface: 50 m²
Geographical and Geological data: dyke, south of Mowe Bay, rocks, scree and coarse sand

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Zygophyllum stepfii</em> Schinz</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum clavatum</em> Schlechter &amp; Diels</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Chloris flabellata</em> (Hackel) Launert</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Othonna lasiocarpa</em> (DC.) Schultz-Bip.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Salsola nolothensis</em> Aellen</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: SESF1 (20.06.93)
GPS-coordinates: S: 19°16'53"
E: 13°32'27"
Grid reference:
Height: 550-600m
Exposition: W
Slope: 10%-30%
Surface: 400 m²
Geographical and Geological data: rocky slope, SSW of Sesfontein, scree and boulders

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tamarix usneoides</em> E.Meyer ex Bunge</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Colophospermum mopane</em> (Kirk ex Bentham) Kirk ex Leonard</td>
<td>8%</td>
<td>4</td>
</tr>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td><em>Maerua schinzii</em> Pax</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Calicorema capitata</em> (MQ.) Hook f.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Ruellia diversifolia</em> S.Moore</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: SESF2 (20.06.93)
GPS-coordinates: S: 19°19'06"
E: 13°35'48"
Grid reference:
Height: 500-550m
Exposition: —
Slope: —
Surface: 400 m²
Geographical and Geological data: plain, south of Sesfontein, covered with stones and boulders

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Welwitschia mirabilis</em> Hook.f.</td>
<td>1%</td>
<td>3</td>
</tr>
<tr>
<td><em>Colophospermum mopane</em> (Kirk ex Bentham) Kirk ex Leonard</td>
<td>2%</td>
<td>4</td>
</tr>
<tr>
<td><em>Boszia fasciculata</em> Schinz subsp. fasciculata</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Maerua schinzii</em> Pax</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Pomeaeae</em> sp. non ident.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>
Remarks:

Relevé number: SESF3 (20.06.92)
GPS-coordinates: S: 19°25'" E: 13°37'"
Grid reference:
Height: ±860m
Exposition: NW
Slope: <1%
Surface: 200 m²
Geographical and Geological data: wash, south of Sesfontein, coarse sand and gravel

Species

Commiphora giesii Van Der Walt
Fabaceae sp. non ident.
Colophospermum mopane (Kirk ex Bentham) Kirk ex Leonard
Roaceae sp. non ident.
Welwitschia mirabilis Hook.f.
Boscia foetida Schinz subsp. foetida

Cover Sociability
4% 4
2% 3
1% 2
1% 3
2% 3
3% 3

Remarks:

Relevé number: OHH1 (04.04.92)
GPS-coordinates: S: 23°38'14"
Grid reference: E: 15°10'03"
Height: - m
Exposition: W
Slope: <1%
Surface: 50 m²
Geographical and Geological data: riverbed Kuiseb between Ooswater and Homeb, sand and silt

Species

Rogiera longiflora (Roben) J.Gay ex DC.
Sutera mazi Hiern.

Cover Sociability
<1% 1
<1% 2

Remarks: rivervalley used as grazing ground for goats

Relevé number: OHH2 (04.04.92)
GPS-coordinates: S: 23°38'13"
Grid reference: E: 15°10'08"
Height: - m
Exposition: S
Slope: 5°-10°
Surface: 100 m²
Geographical and Geological data: riverbank Kuiseb between Ooswater and Homeb, sand and silt

Species

Cover Sociability
Sutera maxii HIERN.
Nicotiana glauca GRAHAM
Tamarix usnooides E.MEYER ex BUNGE

Remarks: rivervalley used as grazing ground for goats

Relevé number: OHH3 (04.04.92)
GPS-coordinates: S: 23°38'12"
E: 15°10'07"
Grid reference:
Height: - m
Exposition: W
Slope: <1%
Surface: 200 m²
Geographical and Geological data: Kuiseb between Oswater and Homeb, old riverbed, 60 cm above new riverbed, sand with thin organic layer

Species
Nicotiana glauca GRAHAM
Tamarix usnooides E.MEYER ex BUNGE
Acacia albida DEL.
Pergularia daemia (FORSSKAL) CHIOV.

Sociability

Cover
<1% 2
<40% 4
<30% 4
<1% 2

Remarks: dense stand of Tamarix usnooides E.MEYER ex BUNGE and Acacia albida DEL.

Relevé number: OHH4 (04.04.92)
GPS-coordinates: S: 23°38'19"
E: 15°10'24"
Grid reference:
Height: - m
Exposition: W
Slope: <1%
Surface: 200 m²
Geographical and Geological data: Kuiseb riverbed, between Oswater and Homeb, sand and silt

Species
Gisekia africana (LOUR.) O.KUNTZE
Cucumis africansus L.F.
Rogeria longiflora (ROYEN) J.GAY ex DC.
Acacia albida DEL.
Sesamum capense BURM.F.

Sociability

Cover
<1% 1
<1% 1
<1% 1
<1% 1

Remarks: rivervalley used as grazing ground for goats, Acacia albida DEL seedling

Relevé number: OHH5 (04.04.92)
GPS-coordinates: S: 23°38'28"
E: 15°10'19"
Grid reference:
Height: - m
Exposition: W
Slope: <1%
Surface: 200 m²
Geographical and Geological data: riverbed Kuiseb between Oswerter and Homeb, sand and silt

Species

*Cyperus longiflorus* (ROYEN) J.GAY ex DC.
*Nicotiana glauca* GRAHAM
*Acacia albida* DEL.
*Sesamum capense* BURM.F.
*Tribulus zeyheri* SONDER

Cover Sociability

<1% 1
<1% 1
<1% 1
<1% 1
Remark: rivervalley used as grazing ground for goats, *Acacia albida* DEL.seeding

Relevé number: OHH6 (04.04.92)

GPS-coordinates: S: 23°38'26"
E: 15°10'36"

Grid reference:
Height: - m
Exposition: W
Slope: <1%
Surface: 200 m²
Geographical and Geological data: riverbed Kuiseb between Oswerter and Homeb, sand and silt

Species

*Cucumis africanus* L.F.
*Acacia albida* DEL.
*Stipagrostis ciliata* (DESP.) DE WINTER
var. *capensis* (TRIN. & RUPR.) DE WINTER

Cover Sociability

<1% 1
<1% 1
<1% 1
Remark: rivervalley used as grazing ground for goats, *Acacia albida* DEL.seeding

Relevé number: OHH7 (04.04.92)

GPS-coordinates: S: 23°38'27"
E: 15°10'34"

Grid reference:
Height: - m
Exposition: W
Slope: <1%
Surface: 200 m²
Geographical and Geological data: riverbed Kuiseb between Oswerter and Homeb, sand and silt

Species

*Ocimum canum* SIMS
*Argemone ochroleuca* SWEET
*Acacia albida* DEL.
*Gisekeia africana* (LOUR.) O.KUNTZE
*Stipagrostis ciliata* (DESP.) DE WINTER
var. *capensis* (TRIN. & RUPR.) DE WINTER

Cover Sociability

<1% 1
<1% 1
<1% 1
<1% 1
Remark: rivervalley used as grazing ground for goats, *Acacia albida* DEL.seeding
Relevé number: OHH8 (04.04.92)
GPS-coordinates: S : 23°38'20"
E : 15°11'16"
Grid reference:
Height: - m
Exposition: W
Slope: <1%
Surface: 200 m²
Geographical and Geological data: riverbed Kuiseb between Oswater and Homeb, sand and silt

Species

Sutera mazii Hiern.

Cover Sociability
<1% 1

Remarks: rivervalley used as grazing ground for goats

Relevé number: OHH9 (04.04.92)
GPS-coordinates: S : 23°38'19"
E : 15°11'16"
Grid reference:
Height: - m
Exposition: S
Slope: 20°-60°
Surface: 100 m²
Geographical and Geological data: riverbank Kuiseb between Oswater and Homeb, rocks

Species

Cyperus marginatus Thunb.
Tamarix usneoides E.Meyer ex Bunge
Sutera mazii Hiern.
Zygophyllum simplex L.

Cover Sociability
<1% 2
2% 2
<1% 2
<1% 1

Remarks:

Relevé number: OHH10 (04.04.92)
GPS-coordinates: S : 23°38'20"
E : 15°11'18"
Grid reference:
Height: - m
Exposition: W
Slope: <1%
Surface: 200 m²
Geographical and Geological data: riverbed Kuiseb between Oswater and Homeb, sand and silt

Species

Zygophyllum simplex L.
Acacia albida Del.
Tephrosia dregeana E.Meyer
Tagetes minuta L.

Cover Sociability
<1% 2
<1% 1
<1% 1
<1% 1
**Ocimum canum Sims**

**Remarks:** rivervalley used as grazing ground for goats

---

**Relevé number: OHH11 (05.04.92)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia albida Del.</em></td>
<td>20%</td>
<td>3</td>
</tr>
<tr>
<td><em>Acacia erioloba E.Meyer</em></td>
<td>30%</td>
<td>3</td>
</tr>
<tr>
<td><em>Tamarix usneoides E.Meyer ex Bunge</em></td>
<td>70%</td>
<td>4</td>
</tr>
<tr>
<td><em>Excoea pseudobenus E. Meyer ex A.DC</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Pechnel-Laeskea lebinitziae (O. Kuntze) O. Hoffm.</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Ruellia diversifolia S.Moore</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Remarks:** the old river is situated about 50 cm above the new riverbed, *Tamarix usneoides E.Meyer ex Bunge* forms very dense stands

---

**Relevé number: OHH12 (05.04.92)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia albida Del.</em></td>
<td>20%</td>
<td>3</td>
</tr>
<tr>
<td><em>Acacia erioloba E.Meyer</em></td>
<td>15%</td>
<td>2</td>
</tr>
<tr>
<td><em>Tamarix usneoides E.Meyer ex Bunge</em></td>
<td>50%</td>
<td>4</td>
</tr>
<tr>
<td><em>Excoea pseudobenus E. Meyer ex A.DC</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Pechnel-Laeskea lebinitziae (O. Kuntze) O. Hoffm.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Ruellia diversifolia S.Moore</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Salvadora persica L.</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:** the old riverbed is situated about 50 cm above the new riverbed, *Tamarix usneoides E.Meyer ex Bunge* forms very dense stands

---

**Relevé number: OHH13 (05.04.92)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia albida Del.</em></td>
<td>20%</td>
<td>3</td>
</tr>
<tr>
<td><em>Acacia erioloba E.Meyer</em></td>
<td>15%</td>
<td>2</td>
</tr>
<tr>
<td><em>Tamarix usneoides E.Meyer ex Bunge</em></td>
<td>50%</td>
<td>4</td>
</tr>
<tr>
<td><em>Excoea pseudobenus E. Meyer ex A.DC</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Pechnel-Laeskea lebinitziae (O. Kuntze) O. Hoffm.</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Ruellia diversifolia S.Moore</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Salvadora persica L.</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:** the old riverbed is situated about 50 cm above the new riverbed, *Tamarix usneoides E.Meyer ex Bunge* forms very dense stands
Grid reference: 
Height: - m 
Exposition: W 
Slope: <1% 
Surface: 400 m² 
Geographical and Geological data: riverbed Kuiseb near Homeb

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tribulus zeyheri Sonder</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks: rivervalley used as grazing ground for goats

Relevé number: OHH14  (05.04.92)
GPS-coordinates: S: 23°38'45" 
E: 15°11'52"

| Grid reference: 
| Height: - m 
| Exposition: NE 
| Slope: 20°-25° 
| Surface: 100 m² 
| Geographical and Geological data: slipface dune (lowest part) near Homeb, coarse and fine sand

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cladoraphis spinosa (L.F.) S.M.Phillips</td>
<td>8%</td>
<td>3</td>
</tr>
<tr>
<td>Ruellia diversifolia S.Moore</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>Stipagrostis sabulicola (Pilger) De Winter</td>
<td>5%</td>
<td>3</td>
</tr>
<tr>
<td>Tephrasia monophylla Schinz</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: OHH15  (05.04.92)
GPS-coordinates: S: 23°38'45" 
E: 15°11'52"

| Grid reference: 
| Height: - m 
| Exposition: NE 
| Slope: 2° 
| Surface: 120 m² 
| Geographical and Geological data: old riverbed Kuiseb near Homeb, sand and silt

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicotiana glauca Graham</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Aspilia enii S.Moore</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>Pechuel-Lozschea lebusnitzae (O. Kuntze) O. Hoffm.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks: old riverbed: narrow strip between slipface (OHH14) and riverbed
Relevé number : OHH16  (05.04.92)
GPS-coordinates : S : 23°38'45"
                  E : 15°11'52"
Grid reference :
Height : - m
Exposition : NE
Slope : 16°-20°
Surface : 80 m²
Geographical and Geological data : riverbank Kuiseb near Homeb

Species

*Melanthera marlothiana* O.HOFFM.
*Acacia albida* DEL.

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks :

---

Relevé number : OHH17  (05.04.92)
GPS-coordinates : S : 23°38'47"
                  E : 15°11'52"
Grid reference :
Height : - m
Exposition : NE
Slope : 35°
Surface : 2800 m²
Geographical and Geological data : slipface dune near Homeb

Species

*Cladoraphis spinosa* (L.F.) S.M.PHILLIPS
*Stipagrostis sabulicola* (PILGER) DE WINTER
*Tephrosia dregeanca* E.MEYER

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>3</td>
</tr>
<tr>
<td>1%</td>
<td>3</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks :

---

Relevé number : OHH18  (05.04.92)
GPS-coordinates : S : 23°38'42"
                  E : 15°11'52"
Grid reference :
Height : - m
Exposition : SE
Slope : <1%
Surface : 1000 m²
Geographical and Geological data : riverbed Kuiseb near Homeb

Species

*Acacia albida* DEL.
*Argemone ochroleuca* SWEET
*Melanthera marlothiana* O.HOFFM.

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>4%</td>
<td>3</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks : the stand of the *Acacia albida* DEL consists of young trees and seedlings
Relevé number : OHH19  (05.04.92)
GPS-coordinates : S : 23°39'00"
                        E : 15°12'49"
Grid reference : 
Height : - m
Exposition : S-SE
Slope : 20°-30°
Surface : 400 m²
Geographical and Geological data : riverbank Kuiseb between Homeb and Hudaob

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ricinus communis</em> L.</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Euclea pseudoebenus</em> E. MEYER EX A.DC</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Acacia albida</em> DEL.</td>
<td>60%</td>
<td>4</td>
</tr>
<tr>
<td><em>Sutera mazzii</em> HIERN.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sutera canescens</em> (BENTH.) HIERN.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Ruellia diversifolia</em> S.MOORE</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Nicottiana glauca</em> GRAHAM</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks : *Acacia albida* DEL. forms a dense stand on the riverbank

Relevé number : OHH20  (05.04.92)
GPS-coordinates : S : 23°38'45"
                        E : 15°13'29"
Grid reference : 
Height : - m
Exposition : SE
Slope : <1%
Surface : 500 m²
Geographical and Geological data : old riverbed Kuiseb between Homeb and Hudaob

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ricinus communis</em> L.</td>
<td>20%</td>
<td>3</td>
</tr>
<tr>
<td><em>Aspilia cernii</em> S.MOORE</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Acacia albida</em> DEL.</td>
<td>40%</td>
<td>3</td>
</tr>
<tr>
<td><em>Melandra marlothiana</em> O.HOFFM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Pergularia daemia</em> (FORSSKAL) CHIOV.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Euclea pseudoebenus</em> E. MEYER EX A.DC</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sutera mazzii</em> HIERN.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks : the alien *Ricinus communis* L. was very abundant along the Kuiseb between Homeb and Hudaob

Relevé number : OHH21  (05.04.92)
GPS-coordinates : S : 23°38'45"
                        E : 15°13'23"
Grid reference : 
Height : - m
Exposition : SE
Slope : <1%
Surface : 200 m²
Geographical and Geological data : old riverbed of the Kuiseb between Homeb and Hudaob
### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aspilia ecnii</em> S.MOORE</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Pergularia daemia</em> FORSSKAL CHIOV.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Ricinus communis</em> L.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Acacia albida</em> DEL.</td>
<td>60%</td>
<td>4</td>
</tr>
<tr>
<td><em>Melanthera marlothiana</em> O.HOFFM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:** *Acacia albida* DEL. forms a dense stand on the riverbed close to the river.

### Relevé number: KL1 (06.04.92)

**GPS-coordinates:** S: 23°23'32"  
E: 14°53'17"

- **Grid reference:**
- **Height:** - m
- **Exposition:** S
- **Slope:** <1%
- **Surface:** 2300 m²

**Geographical and Geological data:** old riverbed Kuiseb near Klipneus

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia albida</em> DEL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Pechuel-Loeschea leubnitziae</em> (O. KUNTZE) O. HOFFM...</td>
<td>8%</td>
<td>3</td>
</tr>
<tr>
<td><em>Galenia africana</em> L.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Acacia tortilis</em> FORSSKAL HAYNE subsp. heterocontha* (BURCHELL) BRENAN</td>
<td>5%</td>
<td>3</td>
</tr>
<tr>
<td><em>Acacia erioloba</em> E.MEYER</td>
<td>20%</td>
<td>3</td>
</tr>
<tr>
<td><em>Nicotiana glauca</em> GRAHAM</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Flaveria bidentis</em> (L.) KUNTZE</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Remarks:**

### Relevé number: KL2 (06.04.92)

**GPS-coordinates:** S: 23°26'26"  
E: 14°56'03"

- **Grid reference:**
- **Height:** - m
- **Exposition:** S
- **Slope:** <1%
- **Surface:** 900 m²

**Geographical and Geological data:** old riverbed Kuiseb near Klipneus

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia erioloba</em> E.MEYER</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Calostephe mariothiana</em> O. HOFFM.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Blumea cafra</em> (DC.) O.HOFFM.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Cladoraphis spinosa</em> (L.P.) S.M.PHILLIPS</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Acacia albida</em> DEL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Pechuel-Loeschea leubnitziae</em> (O. KUNTZE) O. HOFFM.</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Melanthera marlothiana</em> O.HOFFM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Pergularia daemia</em> FORSSKAL CHIOV.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Argemone ochroleuca</em> SWEET</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>
**Datura innoxia Miller**

**Pavonia burchellii (DC.) R.A.Dyer**

**Remarks:**

---

**Relevé number:** GOSO1  *(08.06.92)*  
**GPS-coordinates:** S : 23°33'43"

E : 15°02'10"

**Grid reference:**  
**Height:** - m  
**Exposition:** NE  
**Slope:** 10°-16°  
**Surface:** 200 m²

**Geographical and Geological data:** riverbank Kuiseb between Gobabeb and Soutrivier, sand and silt

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ficus sycomorus</em> L.</td>
<td>8%</td>
<td>2</td>
</tr>
<tr>
<td><em>Tamarix usneoides</em> E.Meyer ex Bunge</td>
<td>10%</td>
<td>3</td>
</tr>
<tr>
<td><em>Acacia albida</em> Del.</td>
<td>5%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>2%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:** grazing area for goats

---

**Relevé number:** GOSO2  *(08.06.92)*  
**GPS-coordinates:** S : 23°33'41"

E : 15°02'10"

**Grid reference:**  
**Height:** - m  
**Exposition:** SW  
**Slope:** ±30°  
**Surface:** 200 m²

**Geographical and Geological data:** riverbank Kuiseb between Gobabeb and Soutrivier, sand and silt

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia albida</em> Del.</td>
<td>13%</td>
<td>2</td>
</tr>
<tr>
<td><em>Tamarix usneoides</em> E.Meyer ex Bunge</td>
<td>10%</td>
<td>2</td>
</tr>
<tr>
<td><em>Nicotiana glauca</em> Graham</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:** grazing area for goats

---

**Relevé number:** GOSO3  *(08.06.92)*  
**GPS-coordinates:** S : 23°33'40"

E : 15°02'10"

**Grid reference:**  
**Height:** - m  
**Exposition:** SW  
**Slope:** <1%  
**Surface:** 400 m²

**Geographical and Geological data:** old riverbed Kuiseb between Gobabeb and Soutrivier, sand and silt, thin layer of organic material
### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tamarix usneoides</em> E.MEYER EX BUNGE</td>
<td>40%</td>
<td>4</td>
</tr>
<tr>
<td><em>Acacia albida</em> DEL.</td>
<td>10%</td>
<td>2</td>
</tr>
<tr>
<td><em>Euclea pseudobenus</em> E. MEYER EX A.DC</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks: grazing area for goats

### Relevé number: GOSO4 (08.06.92)

GPS-coordinates: S: 23°33'34"
E: 15°01'59"

Grid reference:
Height: - m
Exposition: NE
Slope: <1%
Surface: 400 m²

Geographical and Geological data: old riverbed Kuiseb between Gobabeb and Soutrivier, sand and silt, thin layer of organic material

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ficus sycomorus</em> L.</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td><em>Tamarix usneoides</em> E.MEYER EX BUNGE</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td><em>Euclea pseudobenus</em> E. MEYER EX A.DC</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Acacia albida</em> DEL.</td>
<td>5%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>2%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks: grazing area for goats

### Relevé number: GOSO5 (08.06.92)

GPS-coordinates: S: 23°33'26"
E: 15°01'53"

Grid reference:
Height: - m
Exposition: ENE
Slope: 10°-15°
Surface: 200 m²

Geographical and Geological data: riverbank Kuiseb between Gobabeb and Soutrivier, sand and silt

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ficus sycomorus</em> L.</td>
<td>3%</td>
<td>2</td>
</tr>
<tr>
<td><em>Acacia albida</em> DEL.</td>
<td>15%</td>
<td>3</td>
</tr>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Acacia erioloba</em> E.MEYER</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td><em>Tamarix usneoides</em> E.MEYER EX BUNGE</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td><em>Saturea mazitzi</em> Hiern.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Euclea pseudobenus</em> E. MEYER EX A.DC</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks: grazing area for goats
Relevé number : GOSO6 (08.06.92)
GPS-coordinates : S : 23°33'23"  E : 15°01'52"
Grid reference :  
Height : - m  
Exposition : ENE  
Slope : ±15°  
Surface : 200 m²  
Geographical and Geological data : riverbank Kuiseb between Gobabeb and Soutrivier, sand and silt

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ficus sycomorus L.</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td>Acacia albida DEL.</td>
<td>10%</td>
<td>2</td>
</tr>
<tr>
<td>Tamarix usnecoides E.MEYER ex BUNGE</td>
<td>15%</td>
<td>3</td>
</tr>
<tr>
<td>clsp</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks : grazing area for goats

Relevé number : GOSO7 (08.06.92)
GPS-coordinates : S : 23°33'23"  E : 15°01'30"
Grid reference :  
Height : - m  
Exposition : NE  
Slope : <1%  
Surface : 400 m²  
Geographical and Geological data : old riverbed Kuiseb between Gobabeb and Soutrivier, sand and silt, covered with thin layer of organic material

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia erioloba E.MEYER</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td>Salvadoria persica L.</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td>Tamarix usnecoides E.MEYER ex BUNGE</td>
<td>3%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks : grazing area for goats

Relevé number : GOSO8 (08.06.92)
GPS-coordinates : S : 23°33'23"  E : 15°01'49"
Grid reference :  
Height : - m  
Exposition : E  
Slope : ±35°  
Surface : 400 m²  
Geographical and Geological data : slipface dune near Gobabeb

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salvadoria persica L.</td>
<td>45%</td>
<td>4</td>
</tr>
</tbody>
</table>

Remarks : Salvadoria persica L. forms very dense stands on the lower part of the slipface of the dunes along the
Kuiseb

Relevé number: GOSO9 (08.06.92)
GPS-coordinates: S: 23°33'22"
E: 15°01'40"
Grid reference:
Height: - m
Exposition: E
Slope: ±20°
Surface: 400 m²
Geographical and Geological data: slipface dune near Gebabeb

Species

*Salvadora persica* L.
*Acacia erioloba* E. MEYER

Cover Sociability
30% 3
10% 2

Remarks: *Salvadora persica* L. forms very dense stands on the lower part of the slipface of the dunes along the Kuiseb

Relevé number: GOSO10 (08.06.92)
GPS-coordinates: S: 23°32'20"
E: 15°01'24"
Grid reference:
Height: - m
Exposition: SE
Slope: ±10°
Surface: 200 m²
Geographical and Geological data: riverbank Kuiseb between Gebabeb and Soutrivier

Species

*Ficus sycomorus* L.
*Acacia albida* DEL.
*Tamarix usneoides* E. MEYER ex BUNGE
*Euclla pseudobenus* E. MEYER ex A. DC

Cover Sociability
20% 2
15% 3
2% 2
<1% 2

Remarks: grazing area for goats

Relevé number: GOSO11 (08.06.92)
GPS-coordinates: S: 23°32'21"
E: 15°01'25"
Grid reference:
Height: - m
Exposition: NW
Slope: <1%
Surface: 400 m²
Geographical and Geological data: old riverbed Kuiseb between Gebabeb and Soutrivier

Species

*Tamarix usneoides* E. MEYER ex BUNGE

Cover Sociability
70% 4
Acacia albida DEL.

Remarks: Tamarix usneoides E.MEYER EX BUNGE forms a very dense stand on the old riverbed

Relevé number: GOSO12 (08.06.92)
GPS-coordinates: S: 23°32'11"
E: 18°01'26"
Grid reference: 
Height: - m
Exposition: E
Slope: ±5°
Surface: 200 m²
Geographical and Geological data: riverbank Kuiseb between Gobabeb and Soutrivier

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ficus sycomorus L.</td>
<td>8%</td>
<td>2</td>
</tr>
<tr>
<td>Euclea pseudobenus E. MEYER EX A.DC</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Tamarix usneoides E. MEYER EX BUNGE</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>Acacia albida DEL.</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td>Salvadora persica L.</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td>Sutera mazzii Hiern.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: GOSO13 (08.06.92)
GPS-coordinates: S: 23°31'47"
E: 18°01'12"
Grid reference: 
Height: - m
Exposition: ENE
Slope: 5°-10°
Surface: 200 m²
Geographical and Geological data: riverbank Kuiseb between Gobabeb and Soutrivier

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ficus sycomorus L.</td>
<td>5%</td>
<td>2</td>
</tr>
<tr>
<td>Tamarix usneoides E. MEYER EX BUNGE</td>
<td>3%</td>
<td>2</td>
</tr>
<tr>
<td>Acacia albida DEL.</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>Nicotiana glauca GRAHAM</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Sutera mazzii Hiern.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: WASW1 (09.06.92)
GPS-coordinates: S: 22°53'30"
E: 14°32'46"
Grid reference: 
Height: ±10m
Exposition: —
Slope: —
Surface: 10 m²
Geographical and Geological data: small dunes along the road from Swakopmund to Walvisbay, coarse sand

**Species**

*Trianthema hereroensis Schinz*  

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>60%</td>
<td>4</td>
</tr>
</tbody>
</table>

Remarks: *Trianthema hereroensis* Schinz forms small dunes (hummocks) by trapping windblown sand

---

**Relevé number: WASW2 (09.06.92)**

GPS-coordinates: $S: 22° 53' 33"$  
$E: 14° 32' 46"$

Grid reference:  
Height: ±10 m  
Exposition: —  
Slope: —  
Surface: 30 m²

Geographical and Geological data: small dunes along the road from Swakopmund to Walvisbay, coarse sand

**Species**

*Salsola nollothensis Aellen*  

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>3</td>
</tr>
</tbody>
</table>

Remarks: *Salsola nollothensis* Aellen forms small dunes (hummocks) by trapping windblown sand

---

**Relevé number: WASW3 (09.06.92)**

GPS-coordinates: $S: 22° 52' 16"$  
$E: 14° 32' 37"$

Grid reference:  
Height: ±10 m  
Exposition: —  
Slope: —  
Surface: 28 m²

Geographical and Geological data: small dunes along the road from Swakopmund to Walvisbay, coarse sand

**Species**

*Trianthema hereroensis* Schinz  

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>4</td>
</tr>
</tbody>
</table>

Remarks: *Trianthema hereroensis* Schinz forms small dunes (hummocks) by trapping windblown sand

---

**Relevé number: WASW4 (09.06.92)**

GPS-coordinates: $S: 22° 46' 16"$  
$E: 14° 32' 20"$

Grid reference:  
Height: ±5 m  
Exposition: —  
Slope: —  
Surface: 900 m²

Geographical and Geological data: small dunes along the road from Swakopmund to Walvisbay, coarse sand, dunes on salty subsoil
### Relevé number: WASW5 (09.06.92)

**Species**

*Brownanthus kuntzei* (Schinz) Ihlenf. & Bittrich

**Cover**: 3%

**Sociability**: 2

**Remarks**: *Brownanthus kuntzei* (Schinz) Ihlenf. & Bittrich forms small dunes (hummocks) by trapping windblown sand

---

### Relevé number: CPL1 (09.06.92)

**Species**

*Triandera hereroensis* Schinz

*Echium aridosum* (L.) Reichb.

*Galenia papulosa* Eckl. & Zeyher var. papulosa

*Mesemaria guerichii* Meeuse

*Lycium cinereum* Thunb.

*Zygophyllum simplex* L.

*Galenia africana* L.

*Lasiota simplex* (Jacq.) Beauverd

*Odyssea paucinervis* (Nees) Staff

*Sesuvium sesuvioides* (Fenzl.) Verdc.

**Remarks**: *Brownanthus kuntzei* (Schinz) Ihlenf. & Bittrich forms small dunes (hummocks) by trapping windblown sand
Relevé number: CPL2 (09.06.92)
GPS-coordinates: S: 22°43'23" E: 14°37'49"
Grid reference:
Height: 100-180m
Exposition: SW
Slope: <1%
Surface: 200 m²
Geographical and Geological data: wash east of Swakopmund, coarse sand and fine gravel

Species

- *Galenia africana* L.
- *Arthraea leubnitziae* (KUNTZE) SCHINZ
- *TriantHEMA hereroensis* SCHINZ

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Galenia africana</em> L.</td>
<td>4%</td>
<td>3</td>
</tr>
<tr>
<td><em>Arthraea leubnitziae</em> (KUNTZE) SCHINZ</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td><em>TriantHEMA hereroensis</em> SCHINZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: CPL3 (09.06.92)
GPS-coordinates: S: 22°44'34" E: 14°40'22"
Grid reference:
Height: 150-200m
Exposition: SW
Slope: <1%
Surface: 400 m²
Geographical and Geological data: wash east of Swakopmund, coarse sand and fine gravel

Species

- *TriantHEMA hereroensis* SCHINZ
- *Sesbania sesban* (L.) MERRILL subsp. sesban var. zambesiana GILLETT
- *Arthraea leubnitziae* (KUNTZE) SCHINZ
- *Zygophyllum simplex* L.
- *Galenia africana* L.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>TriantHEMA hereroensis</em> SCHINZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sesbania sesban</em> (L.) MERRILL subsp. sesban var. zambesiana GILLETT</td>
<td>3%</td>
<td>3</td>
</tr>
<tr>
<td><em>Arthraea leubnitziae</em> (KUNTZE) SCHINZ</td>
<td>1%</td>
<td>3</td>
</tr>
<tr>
<td><em>Zygophyllum simplex</em> L.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Galenia africana</em> L.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: CPL4 (09.06.92)
GPS-coordinates: S: 22°44'36" E: 14°40'22"
Grid reference:
Height: 180-200m
Exposition: SW
Slope: <1%
Surface: 400 m²
Geographical and Geological data: wash east of Swakopmund, coarse sand and fine gravel

Species

- *Sesbania sesban* (L.) MERRILL subsp. sesban var. zambesiana GILLETT
- *Arthraea leubnitziae* (KUNTZE) SCHINZ
- *Galenia africana* L.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sesbania sesban</em> (L.) MERRILL subsp. sesban var. zambesiana GILLETT</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td><em>Arthraea leubnitziae</em> (KUNTZE) SCHINZ</td>
<td>1%</td>
<td>3</td>
</tr>
<tr>
<td><em>Galenia africana</em> L.</td>
<td>&lt;1%</td>
<td>3</td>
</tr>
</tbody>
</table>
Zygophyllum simplex L.  

Remarks:

Relevé number: CPL5  (09.06.92)
GPS-coordinates: S: 22°45'41"  
E: 14°43'23"
Grid reference:
Height: ±200m
Exposition: SW
Slope: <1%
Surface: 400 m²
Geographical and Geological data: wash east of Swakopmund, coarse sand and fine gravel

Species | Cover | Sociability
--- | --- | ---
Galenia africana L. | 4% | 4
Arthraera leubnitziae (KUNTZE) SCHINZ | 1% | 3
Sesbania sesban (L.) MERRILL subsp. sesban var. zambesiaca GILLET | 1% | 3
Zygophyllum stapfii SCHINZ | <1% | 2

Remarks:

Relevé number: CPL6  (09.06.92)
GPS-coordinates: S: 22°45'33"  
E: 14°43'02"
Grid reference:
Height: ±200m
Exposition: SW
Slope: <1%
Surface: 400 m²
Geographical and Geological data: wash east of Swakopmund, coarse sand and fine gravel

Species | Cover | Sociability
--- | --- | ---
Galenia africana L. | 10% | 4
Arthraera leubnitziae (KUNTZE) SCHINZ | 2% | 3
Sesbania sesban (L.) MERRILL subsp. sesban var. zambesiaca GILLET | 1% | 3
Zygophyllum stapfii SCHINZ | <1% | 2

Remarks:

Relevé number: CPL7  (09.06.92)
GPS-coordinates: S: 22°50'18"  
E: 14°43'42"
Grid reference:
Height: ±150m
Exposition: SW
Slope: <1%
Surface: 400 m²
Geographical and Geological data: wash east of Swakopmund, coarse sand and fine gravel, drainage area Tumas

Species | Cover | Sociability
--- | --- | ---
**Arthraena leuciticae (Kuntze) Schinz**
*Galenia africanana* L.

Remarks:

<table>
<thead>
<tr>
<th>Relevé number: CPL8 [09.06.92]</th>
</tr>
</thead>
</table>
| GPS-coordinates: S: 22°50'19"
E: 14°43'42"
| Grid reference: |
| Height: ±180m |
| Exposition: SW |
| Slope: <1% |
| Surface: 400 m² |
| Geographical and Geological data: wash east of Swakopmund, coarse sand and fine gravel, drainage area Tumas |

### Species

<table>
<thead>
<tr>
<th>Arthraena leuciticae (Kuntze) Schinz</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Galenia africanana</em> L.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
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<tbody>
<tr>
<td>&lt;1%</td>
<td>3</td>
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</tbody>
</table>

Remarks:

<table>
<thead>
<tr>
<th>Relevé number: CPL9 [09.06.92]</th>
</tr>
</thead>
</table>
| GPS-coordinates: S: 22°50'40"
E: 14°43'44"
| Grid reference: |
| Height: ±180m |
| Exposition: SW |
| Slope: <1% |
| Surface: 400 m² |
| Geographical and Geological data: wash east of Swakopmund, coarse sand and fine gravel, drainage area Tumas |

### Species

<table>
<thead>
<tr>
<th><em>Galenia africanana</em> L.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arthraena leuciticae</em> (Kuntze) Schinz</td>
</tr>
<tr>
<td><em>Rodyera urens</em> (L.f.) Bullock</td>
</tr>
<tr>
<td><em>Calicoema capitata</em> (Moq.) Hook F.</td>
</tr>
<tr>
<td><em>Euphorbia phyllocidea</em> Boiss.</td>
</tr>
<tr>
<td><em>Salsola tuberculata</em> (Moq.) Fensl.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1%</td>
<td>3</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>1%</td>
<td>2</td>
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</tbody>
</table>

Remarks:

<table>
<thead>
<tr>
<th>Relevé number: CPL10 [09.06.92]</th>
</tr>
</thead>
</table>
| GPS-coordinates: S: 22°54'03"
E: 14°43'27"
| Grid reference: |
| Height: ±140m |
| Exposition: W |
| Slope: <1% |
| Surface: 400 m² |
| Geographical and Geological data: riverbed Tumas, sand and silt |
Species

*Galenia africana* L.
*Galenia africana* L.
*Arthraera lebniitiae* (KUNTZE) SCHINZ

Cover  Sociability

<1%  2
<1%  2
<1%  2

Remarks:

**Relevé number**: CPL11  (09.06.92)

**GPS-coordinates**: S : 23°54'05"
E : 14°43'27"

**Grid reference**:  
**Height**: ±140m  
**Exposition**: W  
**Slope**: <1%  
**Surface**: 400 m²

Geographical and Geological data: riverbed Tumas, sand and silt.

Species

*Galenia africana* L.
*Pechuel-Loeschen lebniitiae* (O. KUNTZE) O. HOFFM.
*Salsola tuberculata* (MOQ.) FENSL.
*Arthraera lebniitiae* (KUNTZE) SCHINZ

Cover  Sociability

<1%  2
<1%  2
<1%  2

Remarks:

**Relevé number**: CPL12  (09.06.92)

**GPS-coordinates**: S : 23°54'08"
E : 14°43'28"

**Grid reference**:  
**Height**: ±140m  
**Exposition**: W  
**Slope**: <1%  
**Surface**: 400 m²

Geographical and Geological data: riverbed Tumas, sand and silt.

Species

*Acanthosicyos horridus* WEL. EX HOOK. F.
*Salsola tuberculata* (MOQ.) FENSL.
*Arthraera lebniitiae* (KUNTZE) SCHINZ

Cover  Sociability

<1%  2
<1%  2
3%  2

Remarks: *Acanthosicyos horridus* WEL. EX HOOK. F. forms little hummocks in the riverbed.

**Relevé number**: HARA1  (09.06.92)

**GPS-coordinates**: S : 23°02'05"
E : 14°53'24"

**Grid reference**:  
**Height**: 350-400m  
**Exposition**: —  
**Slope**: —
Surface: 100 m²
Geographical and Geological data: Hamilton Range, calcrete hill: top ridge

**Species**

*Euphorbia lignosa* MARLOTH  
*Salsola tuberculata* (MOQ.) FENSL.  
*Zygophyllum stapfii* SCHINZ  
*Arthraeura leubnitziae (KUNTZE) SCHINZ*

**Remarks:**

Relevé number: HARA2 (09.06.92)  
GPS-coordinates: S: 23° 04' 19"  
E: 14° 54' 35"

Grid reference:
Height: ±400m
Exposition: W
Slope: 30°
Surface: 100 m²
Geographical and Geological data: Hamilton Range, calcrete hill: slope

**Species**

*Euphorbia lignosa* MARLOTH  
*Aloe asperifolia* A. BERGER  
*Salsola tuberculata* (MOQ.) FENSL.  
*Poaceae* sp. non ident.

**Remarks:**

Relevé number: Ambrose 1 (19.4.92)  
GPS-coordinates: S: 21° 05' 00"  
E: 13° 33' 31"

Grid reference:
Height: 0 m
Exposition: n.a.
Slope: n.a.
Surface: 50 m²
Geographical and Geological data: Ambrose Bay (Skeleton Coast), small dunes just above high water mark formed by *Arthraeura leubnitziae (KUNTZE) SCHINZ*, coarse sand

**Species**

*Arthraeura leubnitziae (KUNTZE) SCHINZ*

**Remarks:**

Relevé number: GS 1 (18.4.92)  
GPS-coordinates: S: 21° 49' 56"  
E: 15° 10' 00"

Grid reference:
Height: ± 1100 m
Exposition: NW
Slope: 2°-5°
Surface: 900 m²

Geographical and Geological data: plain NW of Gross-Spitzkuppe

Species

Acacia karroo Hayne
Acacia melifera (Vahl) Benth.
Acacia reficiens Wawra
Boscia foetida Schinz subsp. foetida
Maerua schinzii Pax

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>6%</td>
<td>4</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>3%</td>
<td>2</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: GS 2 (18.4.92)
GPS-coordinates: S: 21°49'54"
E: 13°09'58"
Grid reference:
Height: ± 1100 m
Exposition: NW
Slope: 2°-5°
Surface: 400 m²

Geographical and Geological data: plain NW of Gross-Spitzkuppe, fine stones and coarse sand

Species

Maerua schinzii Pax
Acacia karroo Hayne
Boscia foetida Schinz subsp. foetida
Acacia melifera (Vahl) Benth.
Acacia reficiens Wawra
Poa caerulea sp. non indent.

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>2%</td>
<td>2</td>
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<tr>
<td>4%</td>
<td>4</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: MB 1 (18.6.92)
GPS-coordinates: S: 19°22'17"
E: 12°42'32"
Grid reference:
Height: 2 m
Exposition: W
Slope: 5°
Surface: 100 m²

Geographical and Geological data: Beach, north of Mówe Bay, coarse sand and rocks

Species

Senecio engleriatus O. Hoffm.
Indigofera cuneifolia O. Hoffm.
Psilocaulon salicornioides (Pax) Schwantes
Cladophis cyperoides (Thunb.) S.M. Phillips

<table>
<thead>
<tr>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1%</td>
<td>3</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>3</td>
</tr>
<tr>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td>3%</td>
<td>4</td>
</tr>
</tbody>
</table>
**Chloris flabellata** (HACKEL) LAUNERT

**Remarks:**

---

**Relevé number:** MB 2 (18.6.92)

**GPS-coordinates:** S : 19°22'03"
E : 12°42'20"

**Grid reference:**

**Height:** 3 m

**Exposition:** W

**Slope:** 5°-10°

**Surface:** 100 m²

**Geographical and Geological data:** Beach, north of Möwe Bay, coarse sand and rocks

**Species**

- *Indigofera cuneensis* O. Hoffm.  
  Cover: <1%  
  Sociability: 2

- *Chloris flabellata* (HACKEL) LAUNERT  
  Cover: <1%  
  Sociability: 2

- *Senecio engleriarius* O. Hoffm.  
  Cover: <1%  
  Sociability: 2

- *Zygophyllum clavatum* SCHLECHTER & DIELS  
  Cover: 2%  
  Sociability: 4

- *Psilocaulon salticorioides* (PAX) SCHWANTES  
  Cover: 1%  
  Sociability: 2

- *Hermannia gariepina* ECKL. & ZEYG.  
  Cover: <1%  
  Sociability: 2

- *Cladoraphis cyperoides* (THUNG.) S.M.PHILLIPS  
  Cover: <1%  
  Sociability: 2

**Remarks:**

---

**Relevé number:** MB 3 (18.6.92)

**GPS-coordinates:** S : 19°22'01"
E : 12°42'28"

**Grid reference:**

**Height:** 3 m

**Exposition:** W

**Slope:** 5°-10°

**Surface:** 100 m²

**Geographical and Geological data:** Beach, north of Möwe Bay, coarse sand and rocks

**Species**

- *Lycium decumbens* WELW. EX HIERN.  
  Cover: <1%  
  Sociability: 2

- *Indigofera cuneensis* O. Hoffm.  
  Cover: <1%  
  Sociability: 2

- *Salsola nolothensis* Aellen  
  Cover: 1%  
  Sociability: 3

- *Chloris flabellata* (HACKEL) LAUNERT  
  Cover: <1%  
  Sociability: 2

- *Psilocaulon salticorioides* (PAX) SCHWANTES  
  Cover: 1%  
  Sociability: 2

- *Zygophyllum clavatum* SCHLECHTER & DIELS  
  Cover: <1%  
  Sociability: 2

- *Hermannia gariepina* ECKL. & ZEYG.  
  Cover: <1%  
  Sociability: 2

**Remarks:**

---

**Relevé number:** K1 (25.02.92)

**GPS-coordinates:** S : 17°16'09"
E : 11°47'30"

**Grid reference:**

---
### Geographical and Geological data:
Riverbank of Kunene; Granite rocks; small crevice, filled coarse sand

#### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Merremia multisecta</em> HALL.F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

#### Relevé number: K2 (26.02.92)

GPS-coordinates: S: 17°16'07" E: 11°47'50"

<table>
<thead>
<tr>
<th>Grid reference:</th>
<th>Height:</th>
<th>Exposition:</th>
<th>Slope:</th>
<th>Surface:</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- m</td>
<td>SE</td>
<td>15°- 26°</td>
<td>16 m²</td>
<td>Riverbank of Kunene; small dune on granite rocks</td>
</tr>
</tbody>
</table>

#### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Lycium cinereum</em> THUNB.</td>
<td>70%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

#### Relevé number: K3 (25.02.92)

GPS-coordinates: S: 17°16'08" E: 11°47'51"

<table>
<thead>
<tr>
<th>Grid reference:</th>
<th>Height:</th>
<th>Exposition:</th>
<th>Slope:</th>
<th>Surface:</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- m</td>
<td>N</td>
<td>10°- 20°</td>
<td>9 m²</td>
<td>Riverbank of Kunene; small crevice, filled with coarse sand</td>
</tr>
</tbody>
</table>

#### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salsola</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

#### Relevé number: K4 (25.02.92)

GPS-coordinates: S: 17°15'09" E: 11°47'50"

<table>
<thead>
<tr>
<th>Grid reference:</th>
<th>Height:</th>
<th>Exposition:</th>
<th>Slope:</th>
<th>Surface:</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- m</td>
<td>NW</td>
<td>6°- 5°</td>
<td>40 m²</td>
<td></td>
</tr>
</tbody>
</table>
Geographical and Geological data: Riverbank of Kunene; +/- 1 m above water level of the river

Species

*Heliotropium* sp.
*Phragmites australis* (Cav.) Steudel
*Lycium cinnarum* Thunb.
*Poaceae* sp.

small shrub, unidentified

Remarks: *Heliotropium* sp. forms small dunes (height: ± 0.5%)

Relevé number: K5 (25.02.92)
GPS-coordinates: S: 17°16'08"
                     E: 11°47'51"

Grid reference:
Height: - m
Exposition: -
Slope: 0°
Surface: 100 m²
Geographical and Geological data: Riverside Swamp of Kunene; inundated

Species

*Cyperaceae* sp.
*Phragmites australis* (Cav.) Steudel

Remarks:

Relevé number: K6 (25.02.92)
GPS-coordinates: S: 17°16'08"
                     E: 11°47'51"

Grid reference:
Height: - m
Exposition: NE
Slope: 5°-10°
Surface: 1 m²
Geographical and Geological data: Riverbank Kunene, small crevice filled with sand

Species

small shrub, not yet identified

Remarks:

Relevé number: K7 (25.02.92)
GPS-coordinates: S: 17°16'08"
                     E: 11°47'49"

Grid reference:
Height: - m
Exposition: N
Slope: 10°-18°

Remarks:

Cover  Sociability
---  ---
10%  3
<1%  2
2%  2
<1%  2
<1%  1

Cover  Sociability
---  ---
2%  3
95%  5
Surface: 25 m²
Geographical and Geological data: Riverbank Kunene; sand between boulders

Species

*Lycium cinereum* THUNB.

Cover | Sociability
--- | ---
<1% | 2

Remarks:

Relevé number: K8 (25.02.92)
GPS-coordinates: S: 17°18'10"
E: 11°47'48"

Grid reference:
Height: - m
Exposition: -
Slope: 0°
Surface: 30 m²
Geographical and Geological data: Riverside Kunene; swamp; 10-20 cm above waterlevel

Species

*Cynodon dactylon* (L.) PERS.

*Heliotropium* sp.

Cover | Sociability
--- | ---
6% | 3
1% | 3

Remarks:

Relevé number: K9 (25.02.92)
GPS-coordinates: S: 17°16'08"
E: 11°47'47"

Grid reference:
Height: - m
Exposition: -
Slope: 0°
Surface: 100 m²
Geographical and Geological data: Riverside Kunene; swamp, inundated

Species

*Cynodon dactylon* (L.) PERS.
*Heliotropium* sp.
*Phragmites australis* (Cav.) STEUDEL
Poaceae sp.

Cover | Sociability
--- | ---
25% | 4
8% | 3
<1% | 2
2% | 3

Opm

Relevé number: K10 (25.02.92)
GPS-coordinates: S: 17°16'07"
E: 11°47'43"

Grid reference:
Height: - m
Exposition: -
Slope: 0°
Surface : 100 m²
Geographical and Geological data : Riverside Kunene; swamp; inundated

Species

*Cynodon dactylon (L.) Pers.*
*Heliotropium sp.*
*Poaee sp.*

Remarks :

Relevé number : K11 (25.02.92)
GPS-coordinates : S : 17°16'06"
                  E : 11°47'44"
Grid reference :
Height : - m
Exposition : -
Slope : 0°
Surface : 100 m²
Geographical and Geological data : Riverside Kunene; swamp; inundated

Species

*Phragmites australis (CAV.) Steudel*
*Datura innoxia Miller*
*Ipomoea rubens Choisy*
*Heliotropium sp.*

Remarks :

Relevé number : K12 (25.02.92)
GPS-coordinates : S : 17°16'07"
                  E : 11°47'42"
Grid reference :
Height : - m
Exposition : -
Slope : 0°
Surface : 50 m²
Geographical and Geological data : Riverside Kunene, swamp; +/- 5 cm above waterlevel

Species

*Datura innoxia Miller*
*Cynodon dactylon (L.) Pers.*
*Heliotropium sp.*
*Poaee sp.*

Remarks :

Relevé number : K13 (25.02.92)
GPS-coordinates : S : 17°16'06"
                  E : 11°47'42"
Grid reference:
Height: - m
Exposition: -
Slope: 0°
Surface: 25 m²
Geographical and Geological data: Riverside Kunene, swamp; 10-20 cm above waterlevel

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lycium cinereum THUNB.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>Heliotropium sp.</td>
<td>25%</td>
<td>3</td>
</tr>
<tr>
<td>small shrub, not identified</td>
<td>1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: K14 (25.02.92)
GPS-coordinates: S: 17°16'06" E: 11°47'40"
Grid reference:
Height: - m
Exposition: -
Slope: 0%
Surface: 50 m²
Geographical and Geological data: Riverside Kunene, swamp; inundated

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ricinus communis L.</td>
<td>1%</td>
<td>1</td>
</tr>
<tr>
<td>Datura innoxia MILLER</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td>Cynodon dactylon (L.) PERS.</td>
<td>35%</td>
<td>3</td>
</tr>
<tr>
<td>Heliotropium sp.</td>
<td>8%</td>
<td>3</td>
</tr>
<tr>
<td>Phragmites australis (Cav.) STEUDEL</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>small shrub, not identified</td>
<td>2%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: K15 (25.02.92)
GPS-coordinates: S: 17°16'08" E: 11°47'48"
Grid reference:
Height: - m
Exposition: S
Slope: 20% - 40%
Surface: 25 m²
Geographical and Geological data: Riverbank Kunene; between river and swamp

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phragmites australis (Cav.) STEUDEL</td>
<td>90%</td>
<td>5</td>
</tr>
<tr>
<td>Heliotropium sp.</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td>Datura stramonium L.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks:
Relevé number: K16 (25.02.92)
GPS-coordinates: S: 17°16'05" E: 11°47'39"
Grid reference:
Height: - m
Exposition: N
Slope: 20°-40°
Surface: 25 m²
Geographical and Geological data: Riverbank Kunene, between river and swamp

Species

Phragmites australis (Cav.) Steudel
Ipomoea rubens Choisy

Cover  Sociability
100%  5
<1%  2

Remarks:

Relevé number: K17 (25.02.92)
GPS-coordinates: S: 17°15'39" E: 11°49'12"
Grid reference:
Height: - m
Exposition: NE
Slope: 5°-10°
Surface: 25 m²
Geographical and Geological data: Riverbank Kunene; ± 50 m above waterlevel, rocks covered with small patches of sand

Species

Merremia multisecta Hall. F.

Cover  Sociability
<1%  2

Remarks:

Relevé number: K18 (25.02.92)
GPS-coordinates: S: 17°15'32" E: 11°49'20"
Grid reference:
Height: - m
Exposition: NW
Slope: 10°-15°
Surface: 100 m²
Geographical and Geological data: Riverbank Kunene; ± 40 m above waterlevel; rocks covered with small patches of sand

Species

Zygophyllum stapfii Schinz
small shrub, unidentified
Salsola sp.

Cover  Sociability
<1%  2
1%  2
2%  2

Remarks: Salsola sp. forms small dunes
Relevé number: K19. (26.02.92)
GPS-coordinates: S: 17° 41' N
E: 11° 28' E
Grid reference:
Height: - m
Exposition:
Slope:
Surface: 100 m²
Geographical and Geological data: Small dune on riverbank of the Kunene

Species

*Tamarix usneoides* E. MEYER EX BUNGE

Cover Sociability
50% 3

Remarks:

Relevé number: K20 (26.02.92)
GPS-coordinates: S: 17° 36' N
E: 11° 34' E
Grid reference:
Height: - m
Exposition:
Slope:
Surface: 25 m²
Geographical and Geological data: Small dune on riverbank of the Kunene

Species

*Salsola* sp.

Cover Sociability
40% 3

Remarks:

Relevé number: K21 (26.02.92)
GPS-coordinates: S: 17° 48' N
E: 11° 27' E
Grid reference:
Height: - m
Exposition: N
Slope: 20°-30°
Surface: 60 m²
Geographical and Geological data: Riverbank of the Kunene; coarse sand

Species

*Sesbania sesban* (L.) MERRILL subsp. *sesban* var. *zambesiaca* GILLETT

Cover Sociability
80% 4

Remarks:
### Relevé number: K22 (26.02.92)

**GPS-coordinates:** S: 17° 0' E: 11° 0'  
**Grid reference:**  
**Height:** - m  
**Exposition:** NW  
**Slope:** 5% - 10%  
**Surface:** 25 m²  

**Geographical and Geological data:** Riverbank of the Kunene; rocks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Merremia multisecta</em> HALL.F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

---

### Relevé number: K23 (26.02.92)

**GPS-coordinates:** S: 17° 0' E: 11° 0'  
**Grid reference:**  
**Height:** - m  
**Exposition:** NE  
**Slope:** 10% - 25%  
**Surface:** 50 m²  

**Geographical and Geological data:** Riverbank of the Kunene; sandy patches between granite boulders

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Merremia multisecta</em> HALL.F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Helichrysum</em> sp.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Poaceae</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

---

### Relevé number: K24 (26.02.92)

**GPS-coordinates:** S: 17° 0' E: 11° 0'  
**Grid reference:**  
**Height:** - m  
**Exposition:** N  
**Slope:** 30% - 40%  
**Surface:** 50 m²  

**Geographical and Geological data:** Riverbank of the Kunene; sandy patches and crevices

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Helichrysum</em> sp.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Poaceae</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**
Relevé number: K25 (26.02.92)
GPS-coordinates: S: 17°14'28"
E: 11°50'53"
Grid reference:
Height: - m
Exposition: ENE
Slope: 0°
Surface: 100 m²
Geographical and Geological data: Riverbank of the Kunene coarse sand; partly inundated

Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sesbania sesban (L.) Merrill subsp. sesban var. zambesiaca Gillett</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td>Salvadorapersica L.</td>
<td>2%</td>
<td>3</td>
</tr>
<tr>
<td>Tamarix usneoides E.Meyer ex Bunge</td>
<td>5%</td>
<td>3</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: K26 (26.02.92)
GPS-coordinates: S: 17°14'28"
E: 11°50'53"
Grid reference:
Height: - m
Exposition: -
Slope: 0°
Surface: 100 m²
Geographical and Geological data: Riverbank of the Kunene, inundated

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sesbania sesban (L.) Merrill subsp. sesban var. zambesiaca Gillett</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>Salvadorapersica L.</td>
<td>10%</td>
<td>3</td>
</tr>
<tr>
<td>Tamarix usneoides E.Meyer ex Bunge</td>
<td>3%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: K27 (26.02.92)
GPS-coordinates: S: 17°14'28"
E: 11°50'53"
Grid reference:
Height: - m
Exposition: -
Slope: 0°
Surface: 100 m²
Geographical and Geological data: Riverbank of the Kunene; inundated

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sesbania sesban (L.) Merrill subsp. sesban var. zambesiaca Gillett</td>
<td>4%</td>
<td>2</td>
</tr>
<tr>
<td>Salvadorapersica L.</td>
<td>2%</td>
<td>2</td>
</tr>
<tr>
<td>Tamarix usneoides E.Meyer ex Bunge</td>
<td>1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:
**Relevé number: K28 (28.02.92)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sesbania sesban</em> (L.) MERRILL subsp. <em>sesban</em> var. <em>zambesiaca</em> GILLET</td>
<td>8%</td>
<td>2</td>
</tr>
<tr>
<td>Small shrub, unidentified</td>
<td>1%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Remarks:**

---

**Relevé number: K29 (28.02.92)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tamarix usneoides</em> E.MEYER EX BUNGE</td>
<td>40%</td>
<td>4</td>
</tr>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>15%</td>
<td>3</td>
</tr>
<tr>
<td><em>Sesbania sesban</em> (L.) MERRILL subsp. <em>sesban</em> var. <em>zambesiaca</em> GILLET</td>
<td>4%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

---

**Relevé number: K30 (28.02.92)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>80%</td>
<td>5</td>
</tr>
<tr>
<td><em>Sesbania sesban</em> (L.) MERRILL subsp. <em>sesban</em> var. <em>zambesiaca</em> GILLET</td>
<td>4%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**
Relevé number: K31 (26.02.92)
GPS-coordinates: S: 17°14'13" E: 11°50'48"
Grid reference:
Height: - m
Exposition: E
Slope: 20° - 30°
Surface: 40 m²
Geographical and Geological data: Riverbank of the Kunene

Species

Salvadora persica L.
Sesbania sesban (L.) Merril subsp. sesban var. zambesiaca Gillett

Remarks:

Relevé number: K32 (26.02.92)
GPS-coordinates: S: 17°
E: 11°
Grid reference:
Height: - m
Exposition: 10° - 40°
Slope: NW-N-NE
Surface: 20 m²
Geographical and Geological data: Gorge of the Kunene; ± 60 m above waterlevel; sandy patches among rocks

Species

Sporobolus virginicus (L.) Kunth

Remarks:

Relevé number: K33 (26.02.92)
GPS-coordinates: S: 17°14'08"
E: 11°50'43"
Grid reference:
Height: - m
Exposition: N-NE
Slope: 8° - 10°
Surface: 100 m²
Geographical and Geological data: Small gravelfield near the gorge of the Kunene

Species

Poaceae sp.

Remarks:

Relevé number: K34 (26.02.92)
GPS-coordinates: S: 17°
E: 11°
Grid reference:
Height: ± 70 m  
Exposition: N  
Slope: 0°-8°  
Surface: 100 m²  

Geographical and Geological data: Gorge of the Kunene; sand & gravel between granite rocks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poaceae sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

---

**Relevé number: K35** (26.02.92)  
GPS-coordinates: S: 17°01'  
E: 11°01'  
Grid reference:  
Height: ± 70 m  
Exposition: N  
Slope: 0°-8°  
Surface: 100 m²  

Geographical and Geological data: Gorge of the Kunene; sand & gravel between granite rocks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poaceae sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

---

**Relevé number: K36** (26.02.92)  
GPS-coordinates: S: 17°01'  
E: 11°01'  
Grid reference:  
Height: ± 70 m  
Exposition: N-NW  
Slope: 0°-5°  
Surface: 100 m²  

Geographical and Geological data: Gorge of the Kunene; sand & gravel between granite rocks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poaceae sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

---

**Relevé number: K37** (26.02.92)  
GPS-coordinates: S: 17°01'  
E: 11°01'  
Grid reference:  
Height: 60°-70 m  
Exposition: NNE  
Slope: 40°-50°  
Surface: 40 m²  

Geographical and Geological data: Gorge of the Kunene; sand & gravel between granite rocks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poaceae sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:
Geographical and Geological data: Gorge of the Kunene; crevice filled with sand

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Zygophyllum stapfii</em> SCHINZ</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td>small shrub, not identified</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: K38 (26.02.92)
GPS-coordinates: S: 17° 10' 44.95"
E: 11° 18' 02.51"
Grid reference:
Height: 66 m
Exposition: -
Slope: ± 0°
Surface: 25 m²

Geographical and Geological data: Gorge of the Kunene; granite rocks covered with patches of coarse sand

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Merremia multisecta</em> HALL.F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sporobolus virginicus</em> (L.) KUNTH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: K39 (26.02.92)
GPS-coordinates: S: 17° 13' 35.53"
E: 11° 29' 01.06"
Grid reference:
Height: ± 65 m
Exposition: W
Slope: 0° - 5°
Surface: 50 m²

Geographical and Geological data: Gorge of the Kunene; granite rocks covered with patches of coarse sand

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sporobolus virginicus</em> (L.) KUNTH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Merremia multisecta</em> HALL.F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum stapfii</em> SCHINZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number: K40 (26.02.92)
GPS-coordinates: S: 17° 15' 16.48"
E: 11° 16' 08.99"
Grid reference:
Height: - m
Exposition: W
Slope: ± 30°
Surface: 80 m²
Geographical and Geological data: Riverbank of the Kunene; small slipface; coarse sand; just above the waterlevel

**Species**

*Sesbania sesban* (L.) MERRILL subsp. *sesban* var. *zambesiaca* GILLET

Switching to a new line...

Cover Sociability

5% 3

Remarks: *Sesamium sesuioides* (Fenzl.) Verdc. forms small stands on sandy places just above waterlevel or partly inundated

---

**Relevé number:** K41  (26.02.92)

**GPS-coordinates:** S: 17° 9' N

E: 11° 9' E

Grid reference:

Height: ± 00 m

Exposition: NW

Slope: ± 10°

Surface: 40 m²

Geographical and Geological data: Riverbank of the Kunene; sandy patches on granite rock

**Species**

*Salsola* sp.

*Zygophyllum stapfii* SCHINZ

Cover Sociability

2% 2

1% 2

Remarks: 

---

**Relevé number:** K42  (26.02.92)

**GPS-coordinates:** S: 17° 9' N

E: 11° 9' E

Grid reference:

Height: - m

Exposition: N

Slope: ± 30°

Surface: 80 m²

Geographical and Geological data: Riverbank of the Kunene; just above the waterlevel

**Species**

*Salvadora persica* L.

*Sesbania sesban* (L.) MERRILL subsp. *sesban* var. *zambesiaca* GILLET

*Tamarix usneoides* E.MEYER ex Bunge

Cover Sociability

20% 3

1% 2

10% 3

Remarks: 

---

**Relevé number:** K43  (26.02.92)

**GPS-coordinates:** S: 17° 9' N

E: 11° 9' E

Grid reference:

Height: - m

Exposition: NW

Slope: ± 10°

Surface: 100 m²
### Geographical and Geological data: Gorge of the Kunene; sandy patches on granite rock

#### Species

- *Sporobolus virginicus* (L.) KUNTH
- *Zygophyllum stapfii* SCHINZ
- *Merremia multisecta* HALL. F.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sporobolus virginicus</em> (L.) KUNTH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum stapfii</em> SCHINZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Merremia multisecta</em> HALL. F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

### Relevé number: K44 (26.02.92)

- GPS-coordinates: S: 17° 11' N, E: 11° 51' E
- Grid reference:
- Height: ± 55 m
- Exposition: N
- Slope: ± 15°
- Surface: 100 m²

#### Species

- *Sporobolus virginicus* (L.) KUNTH
- *Zygophyllum stapfii* SCHINZ
- *Salsola* sp.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sporobolus virginicus</em> (L.) KUNTH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum stapfii</em> SCHINZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salsola</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

### Relevé number: 45 (26.02.92)

- GPS-coordinates: S: 17° 11' N, E: 11° 51' E
- Grid reference:
- Height: ± 50 m
- Exposition: N
- Slope: 10° - 20°
- Surface: 100 m²

#### Species

- small shrub, not identified
- *Sporobolus virginicus* (L.) KUNTH
- *Zygophyllum stapfii* SCHINZ

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td>small shrub, not identified</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Sporobolus virginicus</em> (L.) KUNTH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Zygophyllum stapfii</em> SCHINZ</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

### Relevé number: K 46 (26.02.92)

- GPS-coordinates: S: 17° 11' N, E: 11° 51' E
- Grid reference:
- Height: ± 50 m
- Exposition: NNW
Slope : $\pm 10^\circ$
Surface : 100 m$^2$
Geographical and Geological data : Gorge of the Kunene; sandy patches on granite rock

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Merremia multisecta</em> HALL.F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sporobolus virginicus</em> (L.) KUNTH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number : K 47 (26.02.92)
GPS-coordinates : S : 17°21' N
E : 11°36' W
Grid reference :
Height : ± 60 m
Exposition : NE
Slope : 5°- 10°
Surface : 100 m$^2$
Geographical and Geological data : Gorge of the Kunene; sandy patches on granite rock

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Merremia multisecta</em> HALL.F.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Lycium cinereum</em> THUNB.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sporobolus virginicus</em> (L.) KUNTH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salsola</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number : K48 (26.02.92)
GPS-coordinates : S : 17°37' N
E : 11°36' W
Grid reference :
Height : ± m
Exposition : NW
Slope : 20°- 30°
Surface : 80 m$^2$
Geographical and Geological data : Riverbank of the Kunene; sand between granite rocks

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tamarix aznoides</em> E. MEYER EX BUNGE</td>
<td>10%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>10%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

Relevé number : K49 (26.02.92)
GPS-coordinates : S : 17°36' N
E : 11°36' W
Grid reference :
Height : ± m
### Part IV: Annexes

**Exposition:** S  
**Slope:** 0°, 5°  
**Surface:** 100 m²

Geographical and Geological data: Gorge of the Kunene; sandy patches on granite rock, ± 50 m above waterlevel

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Lycium cinereum</em> Thunb.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Zygophyllum stapfii</em> Schinz</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sporobolus virginicus</em> (L.) KUNTH</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salsoia</em> sp.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Remarks:**

---

**Relevé number:** K50  (26.02.92)  
**GPS-coordinates:** S: 17°,  E: 11°  
**Grid reference:**  
**Height:** ~ m  
**Exposition:** N  
**Slope:** 20°, 30°  
**Surface:** 40 m²

Geographical and Geological data: Riverbank of the Kunene; partly inundated

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Phycnoites australis</em> (Cav.) Steudel</td>
<td>5%</td>
<td>2</td>
</tr>
<tr>
<td><em>Salvadora persica</em> L.</td>
<td>50%</td>
<td>3</td>
</tr>
<tr>
<td><em>Sesbania sesban</em> (L.) Merrill subsp. sesban var. zambesiaca* Gillett</td>
<td>10%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

---

**Relevé number:** K51  (26.02.92)  
**GPS-coordinates:** S: 17°,  E: 11°  
**Grid reference:**  
**Height:** ~ m  
**Exposition:** NW  
**Slope:** 5°, 10°  
**Surface:** 40 m²

Geographical and Geological data: Gorge of the Kunene; sandy patches on granite rock, ± 50 m above waterlevel

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Zygophyllum stapfii</em> Schinz</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Lycium cinereum</em> Thunb.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Remarks:**

---

**Relevé number:** ENGO 1  (02.03.92)  
**GPS-coordinates:** S: 6°,  E: 1°
Grid reference: 1712CC
Height: - m
Exposition: E
Slope: ± 35°
Surface: 100 m²

Geographical and Geological data: Rocky hill south of the Engo; schistose soil

Species

Euphorbia virosa Willd. 2% 2
Commiphora wildii Mérxm. 2% 3
Stipagrostis sp. <1% 2
Poaceae sp. <1% 2
herb, not identified <1% 1

Remarks:

Relevé number: ENGO 2 (02.03.92)
GPS-coordinates: S: °, "
E: °, "
Grid reference: 1712 CC
Height: - m
Exposition: E
Slope: 40°
Surface: 100 m²

Geographical and Geological data: Rocky hill; south of the Engo; schistose soil

Species

Commiphora wildii Mérxm. 3% 3
Stipagrostis sp. <1% 2
Commiphora saxicola Engl. <1% 2
Gisckia africana (Lour.) O.Kuntze <1% 1

Remarks:

Relevé number: ENGO 3 (02.03.92)
GPS-coordinates: S: °, "
E: °, "
Grid reference: 1712 CC
Height: - m
Exposition: mainly N
Slope: 0°- 20°
Surface: 100 m²

Geographical and Geological data: Ridge and Top of a rocky hill, south of the Engo, vertical schistose layers

Species

Commiphora saxicola Engl. <1% 2
Stipagrostis sp. <1% 2
Commiphora wildii Mérxm. <1% 2
Mollugo cerviana (L.) Ser. ex DC. <1% 2
Remarks:

**Relevé number : ENGO 4 (02.09.92)**

GPS-coordinates : S : 6° 7' N  
E : 3° 11' E

Grid reference : 1712 CC

Height : - m

Exposition : S

Slope : 10° - 20°

Surface : 100 m²

*Geographical and Geological data: Ridge of a rocky hill, south of the Engo, vertical schistose layers*

**Species**

- *Commiphora willdii *MERXM.
- *Mollugo cerviana* (L.) SER. EX DC.
- *Stipagrostis* sp.
- *Calicorema capitata* (MOQ.) HOOK F.
- *Fabaceae* sp.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Commiphora willdii</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Mollugo cerviana</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Calicorema capitata</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Fabaceae</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

Remarks:

---

**Relevé number : ENGO 5 (02.03.92)**

GPS-coordinates : S : 6° 8' N
E : 3° 15' E

Grid reference : 1712 CC

Height : - m

Exposition : W

Slope : 30° - 40°

Surface : 100 m²

*Geographical and Geological data: slope of a rocky hill, south of the Engo, schistose soil*

**Species**

- *Helichrysum* sp.
- *Sarcocaulon marlothii* ENGL.
- *Euphorbia phylloclada* BOISS.
- *Commiphora willdii* MERXM.
- *Mollugo cerviana* (L.) SER. EX DC.
- *Stipagrostis* sp.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Helichrysum</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Sarcocaulon marlothii</em></td>
<td>&lt;1%</td>
<td>3</td>
</tr>
<tr>
<td><em>Euphorbia phylloclada</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Commiphora willdii</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Mollugo cerviana</em></td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Stipagrostis</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:

---

**Relevé number : ENGO 6 (02.03.92)**

GPS-coordinates : S : 6° 8' N
E : 3° 15' E

Grid reference : 1712 CC

Height : - m

Exposition : S

Slope : 20° - 30°

Surface : 100 m²

*Geographical and Geological data: slope of a rocky hill, south of the Engo, schistose soil*
### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Commiphora wilii</em> MERXM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sarcocaulon marlothii</em> ENGL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

**Relevé number: ENGO 7** *(02.03.92)*

*GPS-coordinates: S: * 0° 0' 0"*

*Grid reference: 1712 CC*

*Height: - m*

*Exposition: *

*Slope: 0° - 15°*

*Surface: 100 m²*

*Geographical and Geological data: Rocky hill, south of the Engo, small pass on a ridge between 2 tops. schistose soil*

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Fabaceae</em> sp.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Mollugo cerviana</em> (L.) SER. EX DC.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td>Herb, not identified</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
<tr>
<td><em>Stipagrostis</em> sp.</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Remarks:**

**Relevé number: ENGO 8** *(02.03.92)*

*GPS-coordinates: S: * 0° 0' 0"

*Grid reference: 1712 CC*

*Height: ± 605 m*

*Exposition: *

*Slope: 0° - 10°*

*Surface: 100 m²*

*Geographical and Geological data: Rocky hill (top) south of the Engo, schistose soil*

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Commiphora wilii</em> MERXM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Mollugo cerviana</em> (L.) SER. EX DC.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

**Remarks:**

**Relevé number: ENGO 9** *(02.03.92)*

*GPS-coordinates: S: * 0° 0' 0"

*Grid reference: 1712 CC*

*Height: ± 600 m*

*Exposition: W*
Slope: 20°–30°
Surface: 100 m²
Geographical and Geological data: Rocky hill, south of the Engo, schistose soil

Species

*Euphorbia* sp.
*Commiphora wildii* MERXM.
*Stipagrostis* sp.
*Adenia pochoi (ENGL.) HARMS
*Orthanthera albida* SCHINTZ

Cover  | Sociability
-------|------------
1%     | 3          
<1%    | 2          
<1%    | 2          
<1%    | 1          
<1%    | 2          

Remarks:

Relevé number: ENGO 10 (02.03.92)

GPS-coordinates: S: 6°
E: 0°
Grid reference: 1712 CC
Height: ± 550 m
Exposition: W
Slope: ± 30°
Surface: 100 m²
Geographical and Geological data: Rocky hill, south of the Engo, schistose soil

Species

*Aloe* sp.
*Commiphora wildii* MERXM.
*Mollugo cerviana* (L.) SER. EX DC.
*Stipagrostis* sp.

Cover  | Sociability
-------|------------
<1%    | 2          
<1%    | 2          
<1%    | 2          
<1%    | 2          

Remarks:

Relevé number: ENGO 11 (02.03.92)

GPS-coordinates: S: 6°
E: 0°
Grid reference: 1712 CC
Height: ± 550 m
Exposition: W
Slope: ± 30°
Surface: 100 m²
Geographical and Geological data: Rocky hill, south of the Engo, schistose soil

Species

*Euphorbia* sp.
*Commiphora wildii* MERXM.
*Calicorema capitata* (MOQ.) HOOK F.
*Stipagrostis* sp. <1%
*Fabaceae* sp.
*Adenoleucus garipensis* (E.MEYER) TORRE & HILLCOAT
*Helichrysum* sp.

Cover  | Sociability
-------|------------
4%     | 4          
2%     | 3          
<1%    | 2          
<1%    | 1          
<1%    | 1          
<1%    | 1          

Remarks:
### Relevé number: ENGO 12 (02.03.92)

**GPS-coordinates:** S: °°"<br>**E: °°"**

- **Grid reference:** 1712 CCC
- **Height:** - m
- **Exposition:** W
- **Slope:** 10° - 20°
- **Surface:** 100 m²

**Geographical and Geological data:** Rocky hill, south of the Engo; schistose soil

#### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
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</thead>
<tbody>
<tr>
<td><em>Maerua schinzii</em> PAX</td>
<td>&lt;1%</td>
<td>1</td>
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<tr>
<td><em>Peuceae</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Commiphora soxcola</em> ENGL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Commiphora wilii</em> MERXM.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Chamaesyce glanduligera</em> (PAX) KOUTNIK</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Sarcocalon marlothii</em> ENGL.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Gisekia africana</em> (LOUR.) O.KUNTZE</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Remarks:

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### Relevé number: ENGO 13 (02.03.92)

**GPS-coordinates:** S: °°"<br>**E: °°"**

- **Grid reference:** 1712 CCC
- **Height:** - m
- **Exposition:** -
- **Slope:** 0° - 10°
- **Surface:** 100 m²

**Geographical and Geological data:** Ridge of a rocky hill, south of the Engo, schistose soil

#### Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Gisekia africana</em> (LOUR.) O.KUNTZE</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Chamaesyce inaequilatera</em> (SONDER) SOJAK</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Adenolobus garipensis</em> (E.MEYER) TORRE &amp; HILLCAT</td>
<td>&lt;1%</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Remarks:

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### Relevé number: ENGO 14 (02.03.92)

**GPS-coordinates:** S: °°"<br>**E: °°"**

- **Grid reference:** 1712 CCC
- **Height:** - m
- **Exposition:** NE
- **Slope:** 30°
- **Surface:** 100 m²
Geographical and Geological data: Rocky hill, south of the Enjo, schistose soil

<table>
<thead>
<tr>
<th>Species</th>
<th>Cover</th>
<th>Sociability</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Blepharis gerlindae</em></td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Poaceae</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Stipagrostis</em> sp.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Adenolobus garipensis</em> (E. Meyer) Torre &amp; Hillcoat</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Comniphora wildii</em> Merxm.</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
<tr>
<td><em>Chamaesyce glanduligera</em> (Pax) Koutnik</td>
<td>&lt;1%</td>
<td>2</td>
</tr>
</tbody>
</table>

Remarks:
8. Calendar of Activities of Patrick Vernemmen

01-10-1991 - 19-11-1991: Literature Review, Practicalities (Purchase and testing of equipment)
06-11-1991 Library National Botanical Garden of Belgium in Meise Library University of Leuven
13-11-1991 Library National Botanical Garden of Belgium in Meise Meeting with Royal Botanical Society of Belgium in Meise: discussion on the botanical aspects of the project
20-11-1991 Library National Botanical Garden of Belgium in Meise Meeting with Prof. Dr. Lejoly (ULB; Brussels): Database-system for medicinal plants
21-11-1991 Flight Brussels-Frankfurt-Windhoek
22-11-1991 Arrival in Windhoek Meeting with Mr. D. Morsbach (Ministry of Wildlife, Conservation and Tourism): problems about permissions
23-11-1991 Reconnaissance trip to the Kuiseb-valley (upper part) and the Northeastern part of the Namib-Naukluft-Park
28-11-1991 Meeting with Mr. D. Morsbach (Min. W.C.T.) Visit to the Department of Botany of the University of Namibia
29-11-1991 Meeting with Mr. P. Commissaris (Infoscience-CEC-project on land-use in Namibia): presentation of our project, exchanging ideas Meeting with Mrs. Maas (Assistant at the Department of Botany of the University of Namibia): presentation of our project, discussion on the present problems of research in Namibia
30-11-1991 - 02-12-1991: Hardap: Botanical excursion in the Game Park of the Hardap Recreational Resort
04-12-1991 Meeting with Mr. Schlaggbauer (University of Namibia): presentation of our project, discussion on the present problems of research in Namibia Meeting with Mrs. G. Maggs (Nat. Herb., Windhoek): presentation of our project, discussion on the future collaboration between the herbarium and the project
07-12-1991 Botanical Excursion to the lichen fields near Wlotzkasbaken: vegetations with lichens and Mesembryanthemaceae
08-12-1991 Botanical Excursion in the Catchment Area of the Swakopriver: Welwitschia-Trail
11-12-1991 Meeting with Dr. C. Brown (Min. W.C.T.) & Dr. A.B. Cunningham (Author of "The National Programme on Ethnobotany in Namibia": presentation of the project; discussion on the problems concerning the permissions
12-12-1991 Library National Museum of Namibia
13-12-1991 Meeting with Dr. M. Seely (Director DERUN), Dr. A.B. Cunningham, Mr. B. Jones (Min. W.C.T.), Mrs. G. Maggs (National Herbarium), Mrs. H. Reeves (Anthropologist U.S.A.): presentation of the project; discussion on the problems concerning the permissions
14-12-1991 - 15-12-1991: Botanical excursion in the Waterberg Park & Hereroland
16-12-1991 Meeting with Mr. Sabah (representative CEC in Windhoek): discussion on the problems concerning the permissions
17-12-1991 Meeting (telephone) with Mr. D. Reissner (Director Fundraising Conservation Projects): presentation of the project; discussion on the problems concerning the permissions
19-12-1991 Meeting with Mr. D. Morsbach (Min. W.C.T.): discussion on the problems concerning the permissions
20-12-1991 - 23-12-1991: Reconnaissance trips to Gobabeb and Soutrivier + Preliminary study of the vegetation in the Kuiseb-valley
21-12-1991 Meeting with Dr. M. Seely (DERUN), Mrs. H. Reeves, Mrs. P. Skyer (student University of Namibia), Mr. J. Goamab (U.S.-Aid): the Kuiseb-project: general outline, links with our project
25-12-1991 Meeting with Dr. P. Van Damme (promotor of the CEC project): evaluation
26-12-1991 Botanical Excursion to the Gamsberg (Pronamib)
27-12-1991 Meeting with Dr. C. Brown and Mr. D. Mörsbach (Min. W.C.T.): permissions: accomplishing the necessary formalities; elaboration of the research plan Meeting with Mr. Sabah (CEC): briefing on the permission-affair
30-12-1991 Meeting with Dr. M. Seely and Mrs. P. Skyer: the Kuiseb project: practicalities
04-01-1992 Presentation of the project to the scientific community in the Desert Ecological Research Unit in Gobabeb
05-01-1992 Botanical excursion to the Northern-part of the Namib-Naukluft-Park (Swakop- & Khanvalley) (incl. Welwitschia trail) + Wlotzaskasbaken + Cape Cross (Coastal vegetation)
06-01-1992 Visit seal-reserve of Cape Cross
                                   Botanical excursion in the Spitzkoppe-area
07-01-1992 - 12-01-1992: Literature Review
10-01-1992 Meeting with the staff of Landsurveyor General (use of trigometric points for calibration of the GPS-instrument)
         - the Inara fields and dunes near Rooibank
         - the Walvisbay-area: Dorob
                           Wortel
                           Tumasriver
                           Dunes, south of the Walvisbay-lagune
         - the Swartbankberg-area
15-01-1992 Meeting with Dr. H. Berry (Min. W.C.T.: biologist, responsible for the Namib): presentation of the project, discussion on the restrictions and possibilities, practicalities
24-01-1992 Meeting with Mr. A. Lenssens (Min. W.C.T.: General supervisor Namib Naukluft Park): presentation of the project, discussion on the restrictions and possibilities, practicalities
28-01-1992 National Herbarium in Windhoek:
identification-work
meeting with Mr. Strohhach (ecologist Nat. Herb.)
29-01-1992 Presentation of the project to the students of TUCSIN
30-01-1992 National Herbarium in Windhoek:
identification work
meeting with Mrs. G. Maggs on the collaboration concerning the development of the reference herbarium
Meeting with the staff of the Weather Bureau (meteorological data)
31-01-1992 National Herbarium in Windhoek: identification-work
Meeting with Mr. D. Morsbach and Mr. L. Van Rooyen (Min. W.C.T.): permissions for the Skeleton Coast Park, time-schedule, practicalities, logistics
Flight Windhoek-Frankfurt
01-02-1992 Flight Frankfurt-Brussels
03-02-1992 - 17-02-1992: RUG: practicalities
writing report (pro parte)
meetings with Dr. P. Van Damme (promotor): discussion on results future plans
meeting with Dr. P. Goetghebuer, and Prof. Dr. P. Van Der Veken (Lab.: Botany: Systematics, Ecology and Morphology, University of Gent): discussion on the botanical aspects of the project
computer work
identification work
18-02-1992 Flight Brussels-Paris
19-02-1992 Flight Paris-Luanda-Windhoek
20-02-1992 National Herbarium Windhoek: identification work
- meeting with Mrs. G. Maggs on the study of the Solanaceae in Namibia: request of sampling in the Namib
21-02-1992 Radio-contact with Mr. R. Braby (ranger of the Skeleton Coast Park): practicalities
Meeting with Mr. D. Morsbach:
- practicalities Botanical Survey in the Skeleton Coast Park
- renewal permit for the Namib Naukluft Park: further restrictions (annex 3)
22-02-1992 Meeting with Dr. M. Seely (DERUN) on the socio-ecological study of the Kuiseb:
- request to give a talk on the vegetation of the Kuiseb: present situation
- presentation of the project: “Ethnobotanical Survey of the Namib”
- request to attend the meetings
22-02-1992 - 02-03-1992: Botanical Survey of the Northern Namib:
- Kunene-valley (excl. mouth: this part of the survey was cancelled (on request of Mr. R. Braby) due to storm): part 1: mouth to the riverine forest at the fourth cataract
- Munutum-valley: Okau-fountain and inara fields
- North-westerly part of Hartmann Valley: inara fields (eastern part) + adjacent rock formations and plains
- Kunene-valley: part 2: cataract at Desert Adventure Safari Wilderness Camp to the waterfall, downstream of this camp
- Mountain Range (without a name), opposite to the Hartmann Mountain Range (Western side of the Hartmann Valley): survey of a rocky outcrop and a mountain (trigometric point number 19)
- Engo-valley: rocky slopes and riverbed

03-03-1992 Reconnaissance Trip to Sesfontein, the second residential area of the Topnaar. Meeting with the local headman.

04-03-1992 Return to Windhoek.

05-03-1992 Meeting with Dr. B. Sandelowsky (TUCSIN):
- invitation to a symposium on environmental ecology in the National Museum of Namibia in Windhoek (19-03-1992)
- request to give a talk on "Study of Vegetations: necessity, methods" + demonstration at the workshop of the Museums of Namibia (24/25-04-1992)

05-03-1992 - 08-03-1992: Identification of collected plant samples


presentation of the CEC-project: "Ethnobotanical Survey of the Namib" talk on the present situation of the vegetation in the Kuiseb meetings at Homeb, Swartbank and Iduseb (2x)
visit to the inara fields with special attention to the effect of the dam on the vegetation meeting with Dr. A. Williams and Mr. A. Mac Donald on the CEC-project (partim Walvis Bay-area)
talk on the need of a balanced situation in the Kuiseb-valley to prevent the further deterioration of the vegetation (Iduseb, on request of the Topnaar community) botanical survey of the Kuiseb: partim Gobabeb - Homeb

13-03-1992 Meeting with Prof. Dr. Hartmuth Lang (Antropologist, University of Köln) and Mrs. K. Weber (TUCSIN) on:
computer aided interpretation of data, resulting from oral questionnaires antropological ecology
writing interim report


20-03-1992: finalizing interim report

21-03-1992: ride Windhoek - Gobabeb


27-03-1992 - 29-03-1992: botanical survey of the Gaub (side river of the Kuiseb) and Sossusvlei
and a reconnaissance trip to Sesriem.

30-03-1992: ride Gobabeb - Windhoek


03-04-1992: ride Windhoek - Gobabeb


and Swakopmund)


14-04-1992 (night): return to Windhoek

15-04-1992: practicalities
ride Windhoek Sesriem

16-04-1992: botanical survey of the Sesriem canyon and the Tsauchab riverbed

17-04-1992 - 21-04-1992: botanical survey of the Spitkoppe, Uis, the Brandberg (Taisab valley)
and Wereldsend.
 botanical survey of the Skeleton Coast Park (partim Ugab - Unibab)

22-04-1992: return to Windhoek

23-04-1992: preparation talk in Rehoboth (Annual General Meeting of the Namibian Museum
Association)

on “Study of Vegetations: necessity, methods”.

identification of plant material
practicalities

30-04-1992 (evening): ride Windhoek - Gobabeb

the herbarium of Gobabeb.

area
 botanical survey of the Southern Namib: dunes of Elim, Tsamsvlei (a small vlei,
north of Sesriem)
17-05-1992 : ride Gobabeb - Windhoek
    identification of plant material
    Ministry of Mines and Energy (Geological Survey): literature review on the geology
    of the Namib
05-06-1992 - 07-06-1992: botanical excursion to the Brandberg (Orabeswand and Aigub)
08-06-1992 - 09-06-1992: botanical survey of the Kuiseb valley
10-06-1992 : ride Gobabeb - Windhoek
    Meeting with Dr. B. Sandolowsky on future collaboration between the RUG and
    TUCSIN
12-06-1992 : practicalities
    Ministry of Mines and Energy (Geological Survey): literature review on the geology
    of the Namib
    valleys of Munutum, Sechombib, Khumib, Hoarusib, Hoanib, Uniab, Koigab and Huab
    area around Sesfontein
    identification of plants
    Weather Bureau: collecting climatological data of the Namib
    identification of plants
    extraction of \textit{Inara} seed oil
11-07-1992 - 12-07-1992: botanical survey of the Kuiseb valley
    extraction of \textit{Inara} seed oil
    meeting with Dr. Joubert (Min. W.C.T.) on future collaboration
    identification of plants
    literature review
    writing
9. Nara Research Proposal

9.1 Introduction and Project Rationale

The \textit{Inara} (\textit{Acanthosicyos herridus}; Cucurbitaceae) plant is the most important staple for the Topnaar people living in the Namib desert. The Topnaar use it for food (they eat the seeds, process the fruit's flesh into a kind of fruit roll which is their most important source of food throughout the year), the juice contained in the fruit provides refreshing drinks, the root is used extensively in curing a variety of diseases. Preliminary researches have shown that it could be used in making biodegradable plastic-like substances, that the oil extracted from the seeds could be used in cosmetics and that the active substances contained in the roots could be used in preparing medicine. Moreover, it is growing in a desert environment. As such it is resistant to drought stress and, given its coastal growing environment, also to salt stress, which could make it an interesting crop for drought-prone areas with limited availability of irrigation water (of sometimes low quality). Its extensive root system actively binds sand so that \textit{Inara} plants could be used in sand dune fixation programmes.

Traditionally the Topnaar people collect the fruits and roots, process them and use the products themselves or, in the case of the seeds, also sell them on the South African market. Up till now, however, there has not been any extensive research on the possibilities of actually growing the \textit{Inara} plant as a crop. If the results of such a research effort would be successful the \textit{Inara} plant could be cultivated not only in its native environment, but also in other drought-stricken areas in Namibia and elsewhere. Cultivation would also allow a more stable inflow of cash income for those people now currently living off the (by)products of the plant, whereas it could create new income opportunities for other people that have as yet no experience with the plant. A number of private firms and NGO's abroad have recently or in the past shown interest in some of the potential products of the \textit{Inara} plants which could mean the beginning of a number of certain market outlets for the \textit{Inara} products (the conditions of producing and marketing to be drawn up by the Namibian government).

9.2 Project Proposal

9.2.1 Project Objectives

The \textit{Inara} research project would basically look into

(1) the agronomical potential of the \textit{Inara} plant, including its water use efficiency, its diseases and pests and the ways of dealing with them, its potential productivity under low and high level inputs, including irrigation, pesticides and fertilizers both natural and chemical;

(2) the physiology of the \textit{Inara} plant, i.e. the physiological and morphological reasons for its drought and salt tolerance;

(3) the chemical properties of both fruits and roots, and the potentials for its medicinal use, use in cosmetics and production of biodegradable plastics;

(4) the ecology of the \textit{Inara} plant, identifying specific biotypes adapted to specific envi-
ronments in the view of breeding new varieties;
Through its implementation not only scientific information (both basic and applied agronomical) would be accumulated but moreover ad hoc scientific personnel be trained.

9.2.2 Project Results
The project should result in the following:
(1) developing a technical memo detailing the methods of growing the *Inara* plant in different ecological and technical conditions;
(2) the morpho-physiological reasons for its drought and salt resistance;
(3) a list of biochemicals that are interesting as bioactive substances both at the plant’s level (natural resistance) as at the level of medicine;
(4) basic knowledge needed to develop its (chemical) (by)products on both a small and large scale;
(5) a taxonomical survey of *Inara* biotypes for use in breeding and improvement programmes (with possible links to biotechnological developments).

9.2.3 Primary and Secondary Benefits from the Project
The project would thus
(1) increase the scientific and agronomical knowledge about the *Inara* plant and its physiology with possible spin offs to other similar plants/crops;
(2) train a number of scientists in both informal (on the job training) and formal (university course work);
(3) develop technical processes to be used by local small scale industry so that value could be added locally to a local plant resource;
(4) develop a research template that could be used in the future for other interesting local plants.

9.2.4 Project Activities
Project activities would involve:
* a thorough screening of the different areas where *Inara* plants are known to occur naturally; this screening would imply
* a description of the vegetative and generative characteristics of the plants (bio- and ecotypes);
* the occurrence of pests and diseases, including (plant) parasites, including natural enemies, ecological characteristics, biotypes, natural resistance;
* description of the ecosystem parameters defining the habitat of the *Inara*: soil properties, climatology, ... and the parameters needed in germination and the establishment of new plant communities;
* sampling for mycorrhizal activity (in order to improve later cropping practices, involving low fertilizer input);
* monitoring of nutrient content through the year so as to get an idea about nutrient
use for growth and production;
* collection of seeds and vegetative plant material (the *Inara* plant being a dioecious plant, seed would not suffice), to be used to set up a reference collection and broaden the genetic base for the breeding programme of the project.

The agronomic research part would include
* seeding and planting tests, including grafting and in vitro propagation, under low and high input conditions (including high and low irrigation);
* optimal stand density testing;
* fruit set monitoring (ideal and normal circumstances leading to optimal and normal fruit and seed set; influence of abnormal, stress conditions: high and low temperature, low moisture availability, ...);
* fertilizer tests (linked with plant material sampling to monitor nutrient uptake, nutrient contents and yields);
* pest and diseases: monitoring and control through integrated protection trials (including economic threshold analysis);
* influence of weeds and weeding practices;
* breeding programmes to improve on existing ecotypes (not imperative);
* optimal irrigation doses and frequency (including economic use of - scarce - irrigation water).

These activities would esp. be executed in the field. Part of the above-mentioned activities would also have a laboratory component. The following subjects would have a strong laboratory component:
- research into the physiological properties of the *Inara* plant, including transpiration measurements, carbon dioxide uptake, hormonal patterns, ...
- research into the stress physiology of the *Inara* plant, including drought and salt stress tolerance mechanisms;
- nutrient uptake rates and limiting factors research.

### 9.2.5 Project Environment

Ideally the project should be executed in the proper growing environment of the *Inara* plant, which would imply the coastal areas of Namibia. It would also preclude a sure irrigation water source so as to be able to test a range of irrigation regimes.

### 9.2.6 Project Execution

The project would be executed under the scientific supervision of both the University of Gent, which would offer some of the laboratory facilities needed in the execution of the project and also one staff member responsible for the execution of the project and training and monitoring of Namibian staff both technical and scientific, and a Namibian institution acceptable to the Ministry of Agriculture and Ministry of Wildlife, Conservation and Tourism.

Outside financing would include the cost for research staff, training of Namibian
personnel, field experiments and laboratory testing. From the Namibian side, there would have to be a providing of land to do the experiments on, minimal infrastructure and technical personnel.

It is expected that a minimum of five years would be needed to be able to come up with some tangible results.

Outside financing could be provided through the Belgian bilateral interuniversity programme.

The nature of the results obtained would imply that the agricultural research services be sensitized to take up some of the findings of the project and that the necessary legal framework be developed to set up small scale industries using some of the (by)products of the \textit{Inara} plant on a local level for marketing in Namibia and elsewhere.