The extraordinary plant

Carpets of yellow, lilac and white, dainty little flowers, hundreds of intricate, beautiful lilies and the welcome green sheen of patches of grass are the rewards for those lucky or patient enough to get their timing right to pay the Namib Desert a visit after good rains.

Everything changes during these fortunate times. The unforgiving sun that scorches the plains to barrenness at other times has lost much its glare, the air is filled with the hum of thousands of insects, and puddles of water draw wildlife from the savannahs and desert edge where they usually roam.

To most visitors the Namib Desert is known for its spectacular vistas, surprising abundance of large game and the unique adaptations of plants and animals that have evolved to live with a bare minimum of resources. The currency in this extremely efficient natural economy is water, and much of what we see as modifications, behaviour and metabolism in desert creatures and their interaction with each other, is determined by the lack, acquisition and utilisation of water in the most efficient manner possible. Well – mostly.

There are the famous fog-basking tenebrionid beetles (locally known as tok-tokkies) that live mainly

*Endemic to Namibia, the pencil bush (*Arthraerua leubnitziae*) occurs only in the fog belt of the central and northern Namib plains.*

diversity of the Namib

TEXT, PHOTOS AND ILLUSTRATIONS BY ANTJE BURKE

on the meagre but regular supply of fog droplets. There are antelope that can go without water for longer than recorded in any other desert area, and there are many creatures that do not need to drink at all, satisfying their water needs by eating juicy succulents and insects.

The Namib Desert flora is, as far as arid regions go, extremely diverse and presents a complex picture of adaptations. Not all of these can be traced directly to water. In terms of its leaf structure and metabolism for example, the famous *Welwitschia mirabilis* is not at all well adapted to desert conditions. It has many more breathing pores than other desert plants and hence loses a reasonable amount of water when it photosynthesises. Neither does it follow an obvious arid-adapted metabolic strategy (CAM) that would allow it to close its breathing pores during the heat of the day and breathe only at night.

The massive, leafless, spiny !nara bushes (*Acanthosicyos horridus*) are also not conservative water users. They follow a rather wasteful strategy, showing high transpiration rates throughout the year. But then they have taproots that reach deep into underground water resources, making sure that sufficient moisture is provided to the plant to support steady growth.

Most short-lived herbs in the desert are anything but water savers. They grow fast, have hardly any means of reducing transpiration and their main goal is to flower and produce seeds as fast and prolifi-

Growing low along the ground clearly has advantages in the wind-swept southern Namib. Why else would such a large variety of low-growing succulents such as Ebracteola derenbergiana *grow only in this area?*

cally as the warm temperatures will allow. All their resources go to seed production, their essential ticket to the next rainy season.

Yet there are plants that can do with very little water. An example is the low dune succulent *Trianthema hereroensis*, the only Namib plant reported to date that takes up fog water through its breathing pores. This is an unusual adaptation in the plant kingdom, found only in some tropical plants growing on trees in rain forests and in the South American fog desert, the Atacama.

Many other Namib plants also rely on small amounts of regular fog moisture, even if they don't absorb it directly through their leaves. The pencil bush (*Arthraerua leubnitziae*), Kuntze's brownanthus (*Brownanthus kuntzei*) and the dollar bush (*Zygophyllum stapffii*) are plants restricted to the Namib fog belt, which reaches about 30 km inland.

Although no detailed information on their water usage and growth strategy is known, the fact that they are all succulents and that they store water in the leaf and/or stem tissue, suggests that this adaptation has some advantages when there is a little bit of water all year round. Whether or not the same reasoning applies to the tremendous succulent diversity in the southern Namib, remains to be seen.

Regular water supply is also provided along the coast, but the succulent diversity extends far inland, much beyond the reach of the fog, suggesting that other factors come into play here. The Namibian section of the Succulent Karoo Biome is a transitional area between winter and summer rain, and rains can fall almost any time of the year, albeit by no means reliably.

Nearly one quarter of the flora in the whole of Namibia occurs in the Sperrgebiet, the main part of the southern Namib. The majority of these species are succulents. What makes them 'tick' in such diversity and bounty in this part of the Namib Desert is still a mystery.

In the central Namib are strange and unique plants that are restricted to the plains of this area, such as the pencil bush (*Arthraerua leubnitziae*) and dollar bush (*Zygophyllum stapffii*). In the northern Namib the variety of peculiar stem-succulents excites a visitor's curiosity, for example the many corkwood (*Commiphora*) species, bottle trees (*Adenium boehmianum* and *Pachypodium lealii*) and *Sesamothamnus* species.

At present we know very little about the adaptations, plant diversity and factors behind the evolution of these unique plants. Some of the rarest ones grow only in confined areas in the Namib, such as the strange succulent shrub *Jensenobotrya lossowiana*,

restricted to a few outcrops on the coast north of Lüderitz. Other examples are the stone plants (*Lithops* and *Conophytum* species), tiny little succulents that bury most of their stems underground. These occur on ridges along the coast and on a few isolated mountains in the Sperrgebiet. There are certain low shrubs (seen nowhere else on this planet) that grow only on the enigmatic Brandberg Mountain, such as *Nidorella nordenstamii*, *Plumbago wissii* and *Ruellia brandbergensis*.

Somehow these plants must have been separated from a common ancestor and evolved in a confined area to form separate species, probably in response to unique environmental conditions that required specific adaptations. Or they established themselves during periods of different climatic conditions of the past and were left behind when the rest of the savannah species retreated east as the Namib became a desert again. Now separated from their relatives, they followed a different path of evolution.

This is one of the theories regarding the current distribution range of *Welwitschia*. Some researchers believe it to be a savannah species that has remained in the Namib Desert despite climatic changes. Many such fluctuations of wetter and drier periods have occurred in the past, and knowing more about them will provide us with many clues regarding the vegetational history of the Namib.

With the current focus on the all-important effect of environmental change, many researchers also try to learn from the past to plan for the future. That and rapid steps forward in technology are likely to generate a wealth of knowledge to help us understand the current patterns. Pollen trapped in seafloor deposits, now accessible through offshore drill cores, for example, can shed light on vegetation changes in the past. Many exciting discoveries are in store for us.

The bounty of adaptations and resulting plant diversity is the result of the interwoven history, ecology and evolution of our diverse vegetation. Which single factor may have caused one or other of the adaptations, the wonder of the high diversity and how it was caused still remain largely unexplained. This makes being a botanist in Namibia very exhilarating!

Antje Burke has described examples of the diverse plant life of the Namib in a series of photographic field guides covering the southern, central and northern Namib Desert. The guides introduce the most commonly seen plants, providing a wealth of information on the Namib environment, ecology and special features, as well as information on the selected plants.

*The milkbush (*Euphorbia virosa*) is one of the most common stem-succulents of its kind in Namibia. It grows all along the escarpment and on inselbergs in the Namib Desert. Vicious spines and poisonous sap ward off would-be plant eaters. Yet some animals, such as gemsbok and zebra, are not put off and chew the young shoots.*

*The intricate markings on the petals of Lichtenstein's gazania (*Gazania lichtensteinii*), a small herbaceous daisy, are believed to attract certain pollinators. In the plant kingdom daisies are the most advanced with regard to attracting pollinators.*