Environment Southwest: Africa
The Central Namib Desert

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All deserts are the same. All deserts are different. Two seemingly contradictory statements, yet to a certain extent both are correct. In early 1988 I was given the opportunity to discover just how similar and different a desert in southwestern Africa, the Namib, was from xeric regions of the southwestern United States and northwestern Mexico. From January to March, during the southern hemisphere's summer months, areas of the central Namib Desert were researched by an international group of entomologists from South Africa, western Europe, and North America. The primary reason for choosing Namibia was to study its unique insect fauna, especially the Neuroptera—nerve-winged insects—which attain a high degree of endemism and diversity in this part of the African subcontinent.

Extending 1,250 miles south from Angola to the Olifants River of South Africa's northern Cape Province, the Namib Desert is one of the driest regions on earth. It lies between the south Atlantic Ocean to the west and what is termed the great western escarpment to the east, averaging 125 miles in width. The eastern boundary is also delineated by the 3.9-inch rainfall line which increases to the east and is almost nonexistent along the western coast.

It is believed by many that the Namib represents one of the oldest deserts in existence, continually alternating between arid and semi-arid conditions for the last 80 million years. Influencing and maintaining the present climate is the Benguela Current, which developed 5 million years ago and pushes cold Antarctic water along the western coast, which in turn creates an inversion layer that prevents cloud formation.

Only a few rivers cross the Namib and most of these are intermittent rather than permanent. The Kuiseb River, which flows by the Central Namib Desert Research Station at Gobabeb, originates from rain falling hundreds of miles to the east, and only sporadically flows to the coast. However, despite its unpredictable nature, this water source supports a permanent stand of large trees and smaller shrubs that in turn allow a limited nondesertic fauna to survive. To the east and north of the river extends the seemingly endless gravel plains, while to the west is the dune "sea" that characterizes much of the Namib.

The dune fields extending southwest from the research station are parallel, linear dunes that can reach a height of about 300 feet and average two-thirds of a mile apart. Despite their inert appearance, they are actually dynamic systems that have evolved as a result of wind movements, sand accumulation, and the presence of vegetation. Each dune system varies in color, shape, and complexity. Different parts of a dune support unique insect faunas. The dune base contains coarse sand grains that trap a
considerable amount of detritus on which many ground beetle scavengers depend. The second part of the dune, the dune slope, has an incline of about 14 degrees, which remains constant and supports a minimum of insect species. Finally, the actively changing slip-face, with a slope between 32 and 34 degrees, maintains much of the diversity in the dune, including many endemic moths and beetles. The unique character of the linear dunes is perpetuated by the existing winds which reverse their direction during the year, thus reversing the slip-faces.

Although deserts are known for their irregular and undependable rainfall, there are other sources of water in the Namib, the most important being fog. Condensing on west-facing surfaces, fog supports a variety of succulent vegetation. Many insects, especially certain tenebrionid beetles (see ESW #518), depend on this resource for most of their water requirements. Besides lapping up droplets of liquid from vegetation and rock surfaces, certain beetles have modified their behavior in a way that increases their ability to accumulate water. One group of tenebrionids, similar in appearance to “stink beetles” of the southwestern United States, employs a head-standing or “fog-basking” behavior. While the insect is in this position, the dorsal region serves as a condensation surface from which water drips downward to the mouth where it is sucked in. An individual beetle’s body weight can increase by 40 percent in a single morning. Another beetle genus, Lepidochora, has evolved a system of fog-trapping wherein the flattened insects construct narrow trenches perpendicular to the wind direction. These furrows collect more fog water than the surrounding sand and allow for a more efficient extraction of dew and water. It is not known whether similar adaptations have evolved for North American species, particularly in the more recently developed dune systems of Baja California. There are definitely prospects for future research in this region.

Right: Prominent female cones of the endemic Namibian plant Welwitschia mirabilis.

Below: Centuries-old male specimen of Welwitschia are examined for pollinators by Florida entomologist Lionel Stange.

One of the many endemic dune associate plants is nara, Acanthosicyos hortoniana, a spiny member of the cucumber family first described by Friedrich Welwitsch in the 1800s. This plant is abundant along water courses and dune bases and relies on a tap root to reach available ground water. Leaves are greatly reduced and modified and the stems are responsible for most of the plant’s photosynthetic activity. The plant produces a fruit (melon), which along with the male and female flowers, is an important nutritional resource for insects, such as the blister beetle genus Mylabris, and for two- and four-legged vertebrates.

Of all the plants on the Namib, none is more bizarre in appearance than Welwitschia mirabilis. Classified somewhere between pine trees and club mosses, Welwitschia is truly the strangest endemic of the region. The plants possess only two leaves that grow continually from the trunk, twisting, fraying, and splitting endlessly from the terminal ends. Being dioecious, the Welwitschia has male cones on some plants and female cones on the others. Research on how the plants are pollinated is still inconclusive; however, the male cones attract a variety of pompilid and vespid wasps that easily transport the sticky pollen from one plant to another. The Welwitschia bug, Probergrothius sexpunctatus, which is restricted to this host, may also play an important role in pollination.

One other aspect of the Welwitschia plant is its longevity. The few “middle-aged” specimens that have been carbon dated were estimated to be 1,000 years old. This is indeed one of the best adapted organisms to be found in any desert.
Indigenous dune ant, Camponotus detritus, on stems of the Stipagrostis grass.

A variety of plant and animal life is supported by the dunes and associated habitats near Gobabeb. A dune grass, Stipagrostis sabulicola, which is also dependent on fog condensation for survival, provides a suitable environment for a number of insect species. Feeding on fluids derived from the plants' tissues are scale insects and aphids which are in turn tended by the abundant carpenter ant, Camponotus detritus. Unlike its nocturnal North American counterpart, this dune ant, about two-thirds of an inch long, is distinctively marked and is active during the day. When disturbed this aggressive insect will pursue the agitator throughout the dune. While not equipped with a sting structure that many other species possess, the dune ant compensates by biting the victim and spraying formic acid from abdominal glands into the wound. This has been shown to be a successful defense against potential predators and slow moving entomologists.

At the base of dune grass can be found antlions, the predaceous larvae of a family of neuropteroid insects. Although they are recognized by the conical pits they construct in the soil, it should be mentioned that only a few genera have evolved this behavior, while the majority of species prefer to lie motionless below the soil. Upon coming into direct contact with a prey species the antlion quickly impales the insect on its curved mandibles, pulls the victim under the ground, and sucks it dry. The soon empty cuticle is then discarded.

Some of the world's largest antlions inhabit this region, with adults reaching a wingspan of over 5 inches. Little data are available as to their life cycles and less is known of their adult stages. Larval resource partitioning—the explanation for how certain insects can exist in the same habitats and use the same resources, yet not out-compete or displace one another—as well as desert survival strategies still remain mostly a mystery, but current studies are revealing more complex and specialized behaviors than were originally thought to exist.

Larvae of a number of species were collected by sifting sand through graduated sieves and waiting a few minutes for the antlions to move. Well-adapted for desert existence, the larvae have evolved numerous specialized structures for dune and sand dwelling. Modified setae, or hairs, face forward, which allow the insect to pull prey underground while restricting the prey from dragging the larvae to the surface. However, this adaptation also prevents the antlion from moving in a forward direction.

Almost nothing is known of adult antlion biology though gut content analysis has revealed that certain species feed on soft bodied insects and pollen. One southern African species specializes in the nocturnal capture of other antlion adults, snaring them in flight and landing on vegetation to devour their meal.

Much work remains to be done on the insects in this region as well as the southwestern United States. The opportunities for extended research are present and with the continued efforts of scientists and observant naturalists many of the Namib's secrets will finally emerge.