



Plants

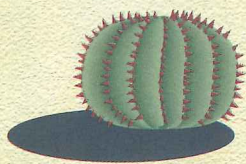


in the Desert

Terrarium

TEXT AND PHOTOS BY

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About 35 percent of the world's land area has a climate with relatively little annual rainfall, dry seasons of 10–12 months, and a high rate of evaporation. The plants found in these regions have adapted to the unfavorable environmental condition of lacking water during most of the year. Within this general description we can further distinguish between true deserts and semideserts.

True deserts appear to have no vegetation except when, directly after a rainfall, specialized ephemeral plants sprout, grow briefly, quickly flower, form seeds, and die. Reptiles found in such regions include the horned viper, *Cerastes cerastes*.

Semideserts are characterized by an annual rainfall of 50–200 millimeters, and a vegetation of grasses,

bulbs, low brush, and small trees in addition to ephemeral plants. As long as there is some rain each year — especially when in the form of two short rainy seasons — succulents also thrive, such as cacti, agaves, aloes, and others. In subtropical semidesert there is often a great diversity of reptile and amphibian species.

In Anza Borrego Desert State Park, California (USA), for example, there are 58 reptile species and 13 amphibian species (FOLEY et al., 1991). In the desert and semidesert regions of the Great Artesian Basin of southwestern Queensland (Australia), 142 reptile species and 21 amphibian species are known (INGRAM and RAVEN, 1991). SUPTHUT and AKERET (2000) and WILMS and WERNING (2002) provide general overviews of desert flora and herpetofauna.

Plants from arid regions

Differences between desert plants and non-desert plants are not great. Desert plants usually have less leaf surface and better protection against evaporative water-loss than their relatives from wetter regions have. Many succulents have shallow, spreading root systems (only a couple of centimeters deep) that quickly soak up scarce rainwater as soon as it hits the ground. On the other hand, many shrubs and trees have very deep roots (those of some Saharan salt cedars, *Tamarix*, go down more than 20 meters), directly tapping ground water to cover their needs. Some species have developed a water-saving gas exchange system called crassulacean metabolism.

All this is to say that even desert plants in the terrarium must be watered sufficiently, although not

too much, or they easily begin to rot. Deep-rooted plants (such as the Australian bottlebrush, *Callistemon*) are often especially sensitive to lack of water, whereas most succulents can survive several weeks of drought. Since many species have relatively little photosynthesis-active green surface, it is important that they get plenty of light (see the photoreport in this issue of *Reptilia*). EGGLI (1994) provides information about raising succulents.

Plants in the desert terrarium

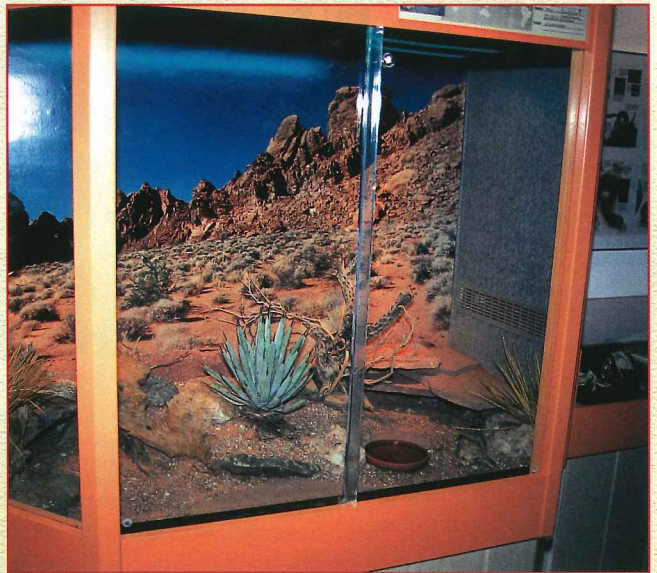
Plants are often more than mere decoration in the terrarium. Many desert reptiles spend part of the day in the shade of shrubs or grasses. In addition to hiding places, plants can be used as visual barriers dividing the terrarium such that the animals need not be in constant view of each other. Plants also increase the relative humidity of the air, which, even in desert terrariums, can be too dry. Insufficient humidity can lead to shedding problems (KÖHLER, 1996). Many keepers forget that when heating a terrarium, as temperature increases humidity decreases. Even in desert regions, dew often forms during the night so humidity is higher. In deserts such as the Atacama in South America or the Namib in southwestern Africa, fog envelops the dunes with 100 percent humidity for many days a year providing water for plants and animals. Fog machines are commonly used in rainforest terrariums (HENKEL and SCHMIDT, 1997), but can also be used in desert terrariums for periodic simulation of natural fog and nighttime dew. Nocturnal desert reptiles and amphibians take in significant quantities of water at these times. Diurnal desert species often spend part of the day in slightly humid retreats, which can be provided in the terrarium with hide boxes containing moistened substrate (AKERET, 1992). Many species like to dig their own cool, moist dens among the roots of plants. Watering keeps the soil diggable, and subsequent evaporation increases air humidity. It is important to have sufficient ventilation to prevent stagnant damp air, which could cause health problems for animals and plants alike.

When planting a terrarium for desert reptiles and amphibians, it is important to leave a large part of the ground surface dry. In small terrariums, a good way to do this is by using a plant trough to keep moist substrate separate from dry substrate (SCHNEIDER, 1997). The trough should nonetheless not be entirely waterproof, otherwise the plants could easily become too wet.

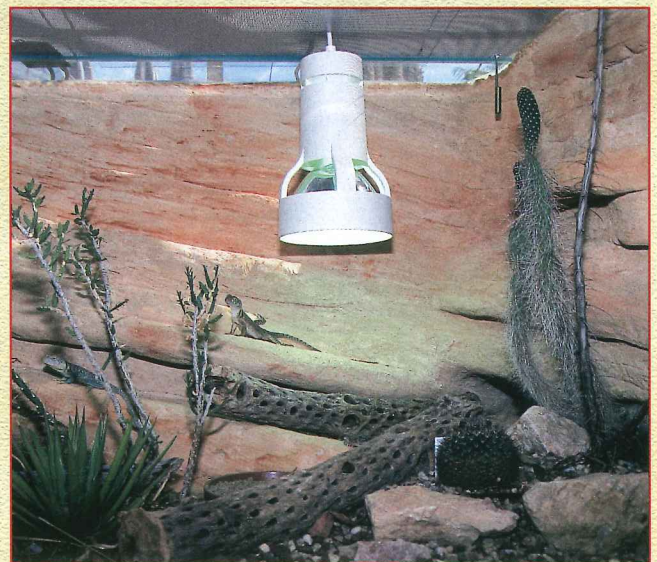
Plants are also sensitive to too much heat, so should be kept away from heat mats and lamps. In small terrariums there should be some sort of insulation (e.g., Styrofoam) between the ground heater and the plant trough. It is best to divide the terrarium into two or more zones. One part can be planted and watered, providing animals with a cooler, moister area, which may also be used for laying eggs. A different part of the terrarium is heated, and used for basking. This way, the animals are free to move away from the plants, and cause them less damage.



An agave and a *Fouquieria splendens* grow among cacti in this heated outdoor terrarium for horned lizards, *Phrynosoma platyrhinos*



Tiger rattlesnake (*Crotalus tigris*) terrarium with an agave and dry grass, at the Sipplinger Vivarium



Terrarium for collared lizards (*Crotaphytus collaris*) and horned lizards (*Phrynosoma platyrhinos*) with cacti (*Cylindropuntia*, *Echinocereus*, *Opuntia*) and agaves



Sahara terrarium for horned vipers (*Cerastes cerastes*), planted with euphorbias

The basking spots of lizards should be positioned in the front of the terrarium, toward the room where observers will be. The planted part of the terrarium, and hiding places, should be in the back, with the biggest plants in the farthest corners. This is not only more aesthetically pleasing for viewers, but also gives the animals the opportunity to flee to shelter in a natural direction — away from the people. It is important that the plants get sufficient light from above, so fluorescent tubes or metal halide lamps should be mounted over them, always at a sufficient distance to prevent the leaves from being burned.

Geographically correct terrariums

Which plants can be used in which terrariums? In general, plants and animals found in the same natural habitat can be tried together in the same terrarium. But few keepers can legally collect their own plants and animals from the wild; not only the animals, but also many plants, including most succulents, are protected by law. Most people are limited to what is available in nurseries, and it can be difficult to find out about the origins and natural habitats of these plants. Even the

dealers seldom have this information. Research can be done using available literature (e.g., STETTLER, 1978; SCHNEIDER, 1979; EGGLI, 1994; and CHEERS et al., 1999), and a visit to the botanical gardens greenhouse displays can be both informative and inspiring. Other botanical or terrarium organizations can also be helpful.

Sometimes it takes patience to find and acquire the desired species,

and it may be necessary to compromise, combining species from similar bioregions but not exactly the same geographic locations.

American plants

For a geographically correct terrarium, plants such as agaves, bromeliads, and cacti should be used with animals from the New World. These plants are so characteristic of North and South America, that



In a Kenya sand boa terrarium, *Sansevieria* and *Aloe* must be planted in pots to prevent the snakes from digging them up

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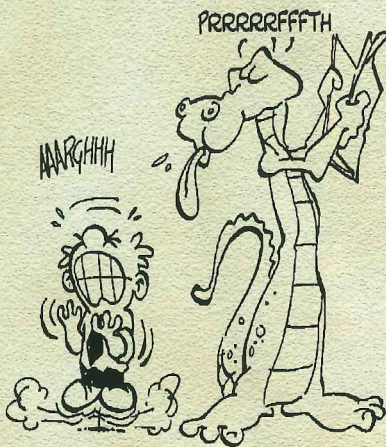
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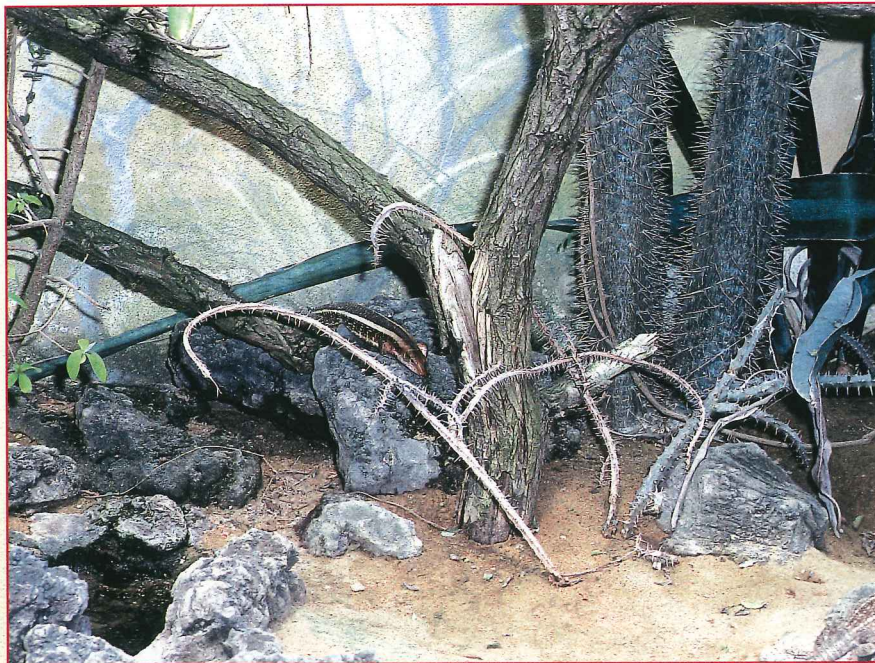
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BE WITHOUT IT?**



Madagascar dry terrarium at the Frankfurt Zoo for girdled lizards (*Zonosaurus*), planted with Madagascar palms (*Pachypodium*) and euphorbias

combining them with Old World reptiles and amphibians seems a little out of place. In any case, cacti in a terrarium often lack sufficient light, and are too warm in winter. They need good ventilation and a light source directly above them, and in winter they must be kept completely dry and cool, at 2–8°C (36–46°F) — perhaps in the garage, or even in the vegetable drawer of the refrigerator. The best cacti for the terrarium are ball-shaped species that have the least amount of spines. Heavily spined cacti require more light, and column-shaped cacti grow too fast. Terrariums representing habitat found in the southwestern United States and northern Mexico can include *Echinocactus*, *Ferocactus*, and *Mammillaria*. *Opuntia* (prickly pear) should be avoided because of its fine hairlike spines. South American species that are good for terrariums include *Gymnocalycium* and *Notocactus*. Cacti are generally good for outdoor enclosures, especially if they can be protected with a transparent shield against the weather in winter and during long periods of rain (KÖHLEIN, 1984; KÜMMEL and KLÜGLING, 1987). Other species that are good for terrariums include small agaves,

Echeveria, or ground bromeliads of the genus *Hechtia*. Ground bromeliads from dry regions of South America include the genera *Dyckia*, *Encholirium*, and *Orthophytum*, or the sand-desert air plants *Tillandsia latifolia* and *T. purpurea* of the Peruvian Atacama Desert. There are also epiphytic bromeliads in the dry tropics, such as *Tillandsia cacticola* of northern Peru, and *Aechmea recurvata* of eastern Brazil (LEME and MARIGO, 1993; RÖTH, 1991).

African plants

Although some species of cacti and agaves have been introduced to Africa by humans, these plants should really not be used for geographically accurate terrariums housing African reptiles or amphibians. Instead, there are many species of the spurge family, Euphorbiaceae, that can be used; some that are typical of African dry regions are column-shaped and similar to cacti in appearance. From northern Africa come the frequently available and terrarium-hardy *Euphorbia resinifera* and *E. echinus*, for example. These have even been successfully used in desert terrariums with spiny-tailed lizards of the genus *Uromastix*. Many succulent *Euphorbia* species are also found

south of the Sahara. Be careful handling these plants. Most contain a milky sap that can cause severe irritation of mucus membranes. Nonetheless, I have never seen a terrarium animal poisoned by these plants, and euphorbias are said to be less harmful to reptiles than to mammals (EGGLI and AKERET, 2000). Another group of column-shaped, hardy African plants are the carrion flowers, such as *Huernia* and *Stapelia*. The greenest species are best. Also good are *Aloe*, *Crassula*, *Gasteria*, and *Haworthia*; the last two grow in southern Africa on south-facing slopes (away from the sun), so do not need as much light as other succulents. A recently popular plant from Tanzania and Natal (South Africa) is *Zamioculcas zamiifolia*. However, its fleshy leaves are easily damaged by sharp reptile claws.

Madagascar has special vegetation, typified in the south by dense thornbush woods. An easy-to-keep Madagascan plant is the crown of thorns, *Euphorbia milii* (= *E. splendens*), but if this heavily spined plant is chosen for the terrarium, animals should also be given something else to climb on. *E. milii* is readily eaten by the Madagascan iguana, *Oplurus*, but the plant is poisonous to humans.



Sidewinders (*Crotalus cerastes*) und cacti — here *Echinocereus* sp. — should be kept cool in winter

Also from Madagascar is the popular Madagascar palm, *Pachypodium lameri*, which is really not a palm at all, but rather a type of dogbane of the family Apocynaceae. Another suitable plant is the rosette-forming *Lomatophyllum* species, which are closely related to *Aloe*. Typical of the dry forests of northern Madagascar are trees and shrubs that spread all their leaves horizontally; some of the less succulent species of *Euphorbia* with this leaf arrangement do well in terrariums, but they are unfortunately difficult to obtain.

Asian plants

A special problem exists when planting terrariums for west- and central-Asian animals, such as leopard geckos, *Eublepharis macularius*, or toadhead agamas, *Phrynocephalus*. Most deserts of these regions have extremely sparse vegetation, usually only ephemeral plants and small, solitary bushes. The best choices for such terrariums are dry shrubs and grasses. The latter must be replaced regularly because they crumble after a couple of months. One of the few easy-to-obtain succulents that is found in Pakistan and

Euphorbia turicalli is one of the few desert plants available to us from Pakistan and northwestern India, the range of the leopard geckos (*Eublepharis macularius*)





Echinocactus reichenbachii and dry grass characterize the Baja California desert in a terrarium for the Baja California rattlesnake (*Crotalus enyo*)

parts of India, as well as tropical Africa and Arabia, is *Euphorbia turicalli*. Other hardy succulents from the Middle East and Arabia are the carrion flowers of the genera *Caralluma*, *Duvalia*, and *Huernia*.

Australian plants

Because of highly irregular rainfall, many regions of Australia lack succulents. The only frequently available Australian succulents are the waxplants *Hoya australis*, and *H. bella*. For large terrariums, *Callistemon* is good. This sclerophyllous plant (having hard, tough leaves) also does well in very warm terrariums, as long as it is watered every day, otherwise the plants do not live long. An automatic watering system is helpful. The palmlike plants of the family Cycadaceae often grow in rocky areas of regions with regular precipitation. Although the commonly cultivated sago palm, *Cycas revoluta*, is actually from Korea, it is a good alternative to Australian species of the same genus, and has been shown to work well in bearded dragon enclosures. Put one *Cycas revoluta* in the

terrarium, and another outside (as long as there is no danger of frost). When the terrarium specimen begins to produce leaves, move it outside and put the outdoor specimen in the terrarium. Otherwise the leaves will grow too fast. An alternative is to use dry grasses and dead shrubs with eucalyptus leaves strewn over the ground to simulate the character of Australian dryland habitat. ■

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