ASPECTS OF THE BIOLOGY OF DESERT ORGANISMS

The extreme nature of desert environments presents a myriad of problems to the plants and animals that inhabit them. But just as there are a variety of problems, there are also a great number of solutions to these difficulties. Desert animals and plants fascinate and amaze me with their adaptations, which in some cases, are quite complex. In others they are simple, even though they solve complex problems.

Just a few of the adaptational problems faced by desert species are listed below. In fact many species have developed adaptations to several of these problems, and some individual adaptations solve more than one problem. Remember that one of the most common adaptations to desert conditions is simply to avoid its rigors altogether.

Some of the problems are these: 1. Water is in low supply most of the time. When present, it often occurs in floodlike quantities. 2. Water occurs at unpredictable intervals and in unpredictable quantities. 3. Summer daytime temperatures may be extremely high. 4. The difference between daytime and nighttime temperatures may be extreme. 5. Loose substrates, which are easily blown about and difficult to traverse, may dominate the landscape. 6. Because vegetation is sparse and open, concealment from enemies is difficult, and there is little protection against the harsh environment.

Plants

We are used to seeing trees, shrubs, flowers, and cacti in deserts. It may be surprising, however, to realize that algae and fungi occupy deserts as well, since these plants are usually thought to inhabit moist areas. Actually, certain algae and fungi, as well as lichens—the symbiotic outcome of the association of the other two—may be significant elements in the desert landscape.

Nonflowering Plants

Algae—both green and blue-green forms—are common in the surface soils of deserts. More than one hundred species are known to inhabit the deserts of North America. Their prevalence is often inversely related to the proportion of land area covered by taller plants: Where shrubs are common, algae are not as abundant. The number of soil algae also decreases with depth. Virtually no algae are found twenty inches below the surface of the ground.

The algae in deserts survive the high temperatures and low water levels as a result of their physiological durability. Algae preserved in dry soil for over fifty years may remain viable, "greening up" when they come in contact with water. These microorganisms have certain advantages because of their small size. Because they can live in the spaces between soil particles, they can derive moisture from the dew condensed on the soil surface out of the cool night air, or from condensation within the soil pores themselves. They may even obtain the water that condenses under rocks. An interesting example of this desert adaptation can be seen by picking up a somewhat translucent rock, such as quartz, that is exposed at the surface of the desert soil. Often the sides and bottoms of such rocks are covered with algae. These plants receive sufficient light *through* the rock to carry on photosynthesis, and they use as a source of water the moisture on the underside of the rock.

In addition to occurring in the soil and under rocks, algae can also be found in rock crevices and, astonishingly, within the very fabric of the rock itself. In both of these cases, water is made available to the plants, and the rocks provide protection, to some extent, from extreme heat.

Fungi occur in desert soils, and in part are responsible for the development of crusts on the soil surface. If you wish to examine a crust, you can, with care, remove a hand-size chunk that is up to an inch thick. Microorganisms, including algae, fungi, and lichens, bind the soil particles together with their "bodies"; this helps to hold down soil erosion.

More commonly recognized, above-ground, mushroom forms of fungi also occur in deserts. Such species include the common Desert Inky Cap, which occurs practically worldwide in desert areas that are as low as sixty-five feet below sea level. A species of more northern distribution is the Desert Stalked Puffball, which ranges as far north as Alaska. Another species, the Buried-stalk Puffball, is most common in sandy areas, including sand dunes.

Desert Inky Cap
Podaxis pistillaris
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Desert Stalked Puffball
Battarrea phalloides
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Buried-stalk Puffball
Tulostoma simulans
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Some fungi form a symbiotic relationship with higher plants. The structure resulting from this association, called a mycorrhiza, resembles root hairs and occurs in the same place on plants as roots do. The association helps the plant take up water and phosphorus. Many desert shrubs, trees, and flowers have such an arrangement; indeed, virtually ninety percent of all plant species worldwide are involved in these mycorrhizal associations. Scientists are studying this relationship with great intensity. One reason for such studies involves the difficult task of reestablishing plants in arid lands that have been used for mining. In cases where the plants being used for restoration are mycorrhizal species, it is important that the fungus be locally available to form the mycorrhizae. Such plants will fare much better in the harsh environment when the proper fungus exists and the symbiosis develops.

Lichens are quite abundant in deserts, both on the soil surface and when attached to plants in areas where fog occurs. They are also found on rock surfaces on the upper portions of bajadas. The lichens and algae that form soil crusts can capture nitrogen from the air. They put the nitrogen compounds required for plant growth into the biological cycle and, as a result, improve soil fertility. During times of the year when moisture is available, it "activates" the crusts, stimulating high rates of biochemical activity.

Other nonflowering plants may be common on certain specialized desert sites. Ferns occur in rock crevices or beneath the edges of boulders, places that funnel water to the plant. Such strategic locations, which also reduce insolation, help the fern to survive the desert's rigors. Desert ferns have adapted to tolerate repeated and prolonged dehydration; in addition, they are covered with "hairs" that reflect light and may thus insulate the fronds. Both of these strategies aid survival. The