Plant Adaptations

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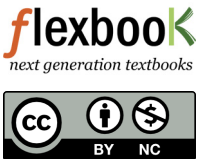

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CHAPTER 1 Plant Adaptations

- Explain how plants have adapted to a diversity of environments.
- Distinguish between xerophytes and epiphytes.

Look closely at the petals of this flower. Do they look different?

This flower is from an aloe plant. Aloes are succulent plants, which have adaptations that allow them to store water in their enlarged fleshy leaves, stems, or roots. This allows them to survive in arid environments.

Plant Adaptations

Plants live just about everywhere on Earth. To live in so many different habitats, they have evolved adaptations that allow them to survive and reproduce under a diversity of conditions.

All plants are adapted to live on land. Or are they? All living plants today have terrestrial ancestors, but some plants now live in the water. They have had to evolve new adaptations for their watery habitat.

Adaptations to Water

Aquatic plants are plants that live in water. Living in water has certain advantages for plants. One advantage is, well, the water. There's plenty of it and it's all around. Therefore, most aquatic plants do not need adaptations for absorbing, transporting, and conserving water. They can save energy and matter by not growing extensive root systems, vascular tissues, or thick cuticles on leaves. Support is also less of a problem because of the buoyancy of water. As a result, adaptations such as strong woody stems and deep anchoring roots are not necessary for most aquatic plants.

Living in water does present challenges to plants, however. For one thing, pollination by wind or animals isn't feasible under water, so aquatic plants may have adaptations that help them keep their flowers above water. For instance, water lilies have bowl-shaped flowers and broad, flat leaves that float. This allows the lilies to collect the maximum amount of sunlight, which does not penetrate very deeply below the water's surface. Plants that live in moving water, such as streams and rivers, may have different adaptations. For example, cattails have narrow, strap-like leaves that reduce their resistance to the moving water (see **Figure** 1.1).

FIGURE 1.1

Water lilies and cattails have different adaptations for life in the water. Compare the leaves of the two kinds of plants. How do the leaves help the plants adapt to their watery habitats?

Adaptations to Extreme Dryness

Plants that live in extremely dry environments have the opposite problem: how to get and keep water. Plants that are adapted to very dry environments are called **xerophytes**. Their adaptations may help them increase water intake, decrease water loss, or store water when it is available.

The saguaro cactus pictured in **Figure** 1.2 has adapted in all three ways. When it was still a very small plant, just a few inches high, its shallow roots already reached out as much as 2 meters (7 feet) from the base of the stem. By now, its root system is much more widespread. It allows the cactus to gather as much moisture as possible from rare rainfalls. The saguaro doesn't have any leaves to lose water by transpiration. It also has a large, barrel-shaped stem that can store a lot of water. Thorns protect the stem from thirsty animals that might try to get at the water inside.

Adaptations to Air

Plants called **epiphytes** grow on other plants. They obtain moisture from the air and make food by photosynthesis. Most epiphytes are ferns or orchids that live in tropical or temperate rainforests (see **Figure** 1.3). Host trees provide

FIGURE 1.2

The saguaro cactus has many adaptations for extreme dryness. How does it store water?

support, allowing epiphyte plants to obtain air and sunlight high above the forest floor. Being elevated above the ground lets epiphytes get out of the shadows on the forest floor so they can get enough sunlight for photosynthesis. Being elevated may also reduce the risk of being eaten by herbivores and increase the chance of pollination by wind.

FIGURE 1.3

These Elkhorn and Staghorn ferns are growing on a rainforest tree as epiphytes.

Epiphytes don't grow in soil, so they may not have roots. However, they still need water for photosynthesis. Rainforests are humid, so the plants may be able to absorb the water they need from the air. However, many epiphytes have evolved modified leaves or other structures for collecting rainwater, fog, or dew. The leaves of the bromeliad shown in **Figure** 1.4 are rolled into funnel shapes to collect rainwater. The base of the leaves forms a tank that can hold more than 8 liters (2 gallons) of water. Some insects and amphibians may spend their whole life cycle in the pool of water in the tank, adding minerals to the water with their wastes. The tissues at the base of the leaf are absorbent, so they can take in both water and minerals from the tank.

FIGURE 1.4

The leaves of this bromeliad are specialized to collect, store, and absorb rainwater.

Summary

- Plants live just about everywhere on Earth, so they have evolved adaptations that allow them to survive and reproduce under a diversity of conditions.
- Various plants have evolved adaptations to live in the water, in very dry environments, or in the air as epiphytes.

Explore More

Use this resource to answer the questions that follow.

- **Plant Adaptations** at http://www.mbgnet.net/bioplants/adapt.html .

1. What is a plant adaptation?
2. Describe three plant adaptations in each of the following biomes:
    1. Desert
    2. Taiga
    3. Tundra
    4. Tropical Rain Forest

Review

1. List special challenges that aquatic plants face.
2. What are xerophytes? Give an example.
3. Identify three general ways that plants can adapt to extreme dryness.
4. Describe how epiphytes can absorb moisture without growing roots in soil.
5. Why are epiphytes found mainly in rainforest ecosystems?
6. Apply the concept of symbiosis to epiphytes and their host plants. Do you think they have a symbiotic relationship? If so, which type of symbiotic relationship do you think they have? Explain your answer.

References

1. Lilies: Emmett Tullos; Cattails: Derek Jensen. Water lilies and cattail adaptations . Lilies: CC BY 2.0; Cattails: Public Domain
2. Jörn Napp. Saguaro cactus adaptations . Public Domain
3. Tatiana Gerus. Elkhorn and Staghorn ferns . CC BY 2.0
4. Robert Balog. Bromeliad rainwater collecting leaves . Public Domain