**High Soil Moisture Effects**

Excessive soil moisture occurs much less often than drought where plants are grown. However, poor drainage or flooding of planted fields, gardens, or potted plants may result in more serious and quicker damage, or death, to plants than that from lack of moisture. Poor drainage results in plants that lack vigor, wilt frequently, and have leaves that are pale green or yellowish green. Flooding during the growth season may cause permanent wilting and death of succulent annuals within 2 to 3 days (Figs. 10-6A–C). Trees, too, are killed by waterlogging, but the damage usually appears more slowly and after their roots have been flooded continually for several weeks.

As a result of excessive soil moisture caused by flooding or by poor drainage, the fibrous roots of plants decay, probably because of the reduced supply of oxygen to the roots. Oxygen deprivation causes stress, asphyxiation, and collapse of many root cells. Wet, anaerobic conditions favor the growth of anaerobic microorganisms that, during their life processes, form substances, such as nitrites, that are toxic to plants. In addition, root cells damaged directly by the lack of oxygen lose their selective permeability and may allow toxic metals or other poisons to be taken up by the plant. Also, once parts of roots are killed, more damage is done by facultative parasites that may be favored greatly by the new environment. Thus, the wilting of the plants, which soon follows flooding, is probably the result of lack of water in the aboveground parts of plants caused by the death of the roots, although it appears that translocated toxic substances may also be involved.

In addition, many plants, particularly potted houseplants, show several symptoms that are the result of incorrect watering: either the soil is allowed to dry out too much before it is then flooded repeatedly with water or the plant is almost constantly overwatered. In either case, overwatered plants may suddenly drop their lower leaves or their leaves may turn yellow. Sometimes they develop brown or black wet patches on the leaves or stems, or the roots and lower stem may turn black and rot as a result of infection by pathogenic microorganisms encouraged by the excessive watering. Such symptoms can be avoided or corrected by watering only when the topsoil feels dry and then applying enough water to saturate thoroughly the whole mass of soil. Plants should never be watered when the soil is still wet, especially during the winter. When watering, any excess water should be drained through the drainage hole,

which should always be present in the bottom of the pot.

A period of dryness should not be followed with repeated heavy watering but by a gradual return to normal watering. Generally, the supply of water should be maintained as uniform as possible.

Another common symptom of houseplants, and sometimes of outdoor plants, that is caused by excessive moisture is the so-called edema [or oedema (swelling)]. Edema (Fig. 10-6D) appears as numerous small bumps on the lower side of leaves or on stems. The “bumps” are small masses of cells that divide, expand, and break out of the normal leaf surface and at first form greenish- white swellings or galls. Later, the exposed surface of the swelling becomes rusty colored and has a corky texture. Edema is caused by overwatering, especially during cloudy, humid weather, and can be avoided by reduced watering and providing better lighting and air circulation to the plant. Many other disorders are caused by excessive or irregular watering. It is known, for example, that tomatoes and some other fruits, such as cherries and grapes, grown under rather low moisture conditions at the time they are ripening often crack if they are suddenly supplied with abundant moisture by overwatering or by a heavy rainfall. Also, bitter pit of apples, consisting of small, sunken, black spots on the fruit, is the result of an irregular supply of moisture, although excessive nitrogen and low calcium fertilization also seem to be involved in bitter pit development.