Chapter **8**

The Parts of A Plant and Their Functions

There are many different kinds of plants. Some are small like grasses, and some are big trees like breadfruit, pines, and Sequoias. Some plants have no stems, only leaves; some have no true leaves, only stems; some never have flowers or true seed. But altogether, plants are characterized by having roots, stems, leaves, flowers, and seeds.

To understand the lessons that follow it is vital that this chapter be well understood.

ROOTS (Fig. 8:1)

The first root to grow when a seed is germinated is called a *radicle.* The radicle keeps on growing down into the ground and can become the *taproot.* At the top of the taproot, where it joins the seeds, two or more roots grow out that are called *side roots* or *lateral roots.* When the taproot enlarges, lateral roots grow out from its sides. Lateral roots often also grow out from the stem above the seed. These are called *adventitious roots.*

For dicot seedlings the taproot and its lateral roots are very important, but for the monocot seedlings the adventitious roots are more important because the taproot does not become as strong as it does in dicots.

The growing point of the root, called the *root tip,* keeps pushing its way down into the soil. Just behind the root tip, if it is healthy, numerous fine white

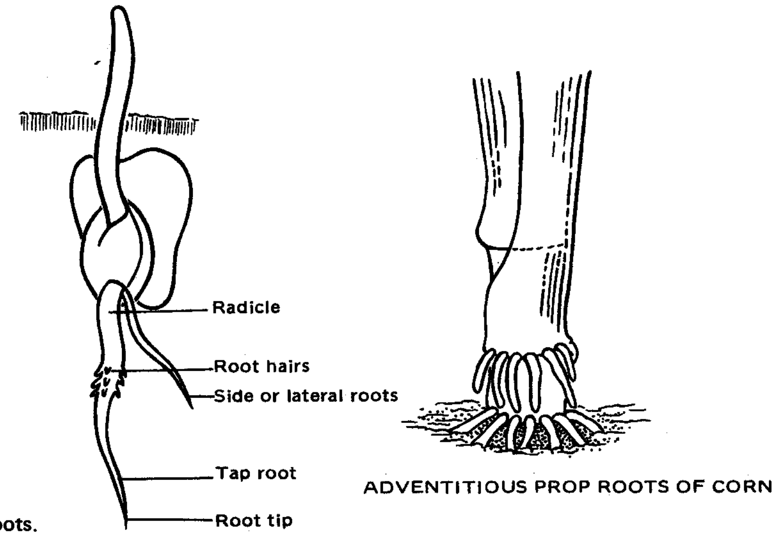


Figure 8:1—Roots.

hairs grow out from the root. These root hairs help the plant secure food and water from the soil and can easily be seen on examining newly germinated corn or bean plants.

Along the sides of the larger roots, little swellings called *root eyes* can be seen. These are the places where lateral roots are forming. If a root becomes broken, one of the root eyes will grow a new root to take the place of the broken end.

ROOT FUNCTIONS

The root is the portion of the plant axis that is normally below the surface of the soil. It functions both as the primary absorbing organ of the plant and as an anchor for the support of the *aerial stem* (the part above ground), together with the numerous appendages. In general, the absorption of mineral nutrients and water takes place through the walls of the root hairs. These root hairs are similar to the above-ground hairs found on the stem and leaves of the plant. Root hairs may be lacking in certain kinds of plants or in cuttings. In this case, water and mineral salts in solution enter directly through the thin root epidermis. The roots also serve as the chief food storage regions in certain plants. (Fig. 8:2) For example, the sweet potatoes are swollen roots, but they also serve as a means of propagation. (The Irish potato is a tuber, however, growing on an underground stem.)

The functions of the root may be summarized as follows:

1. To store food for the plant.
2. To hold the plant firmly in the ground.
3. To take up plant food and water from the soil.
4. To propagate certain species.

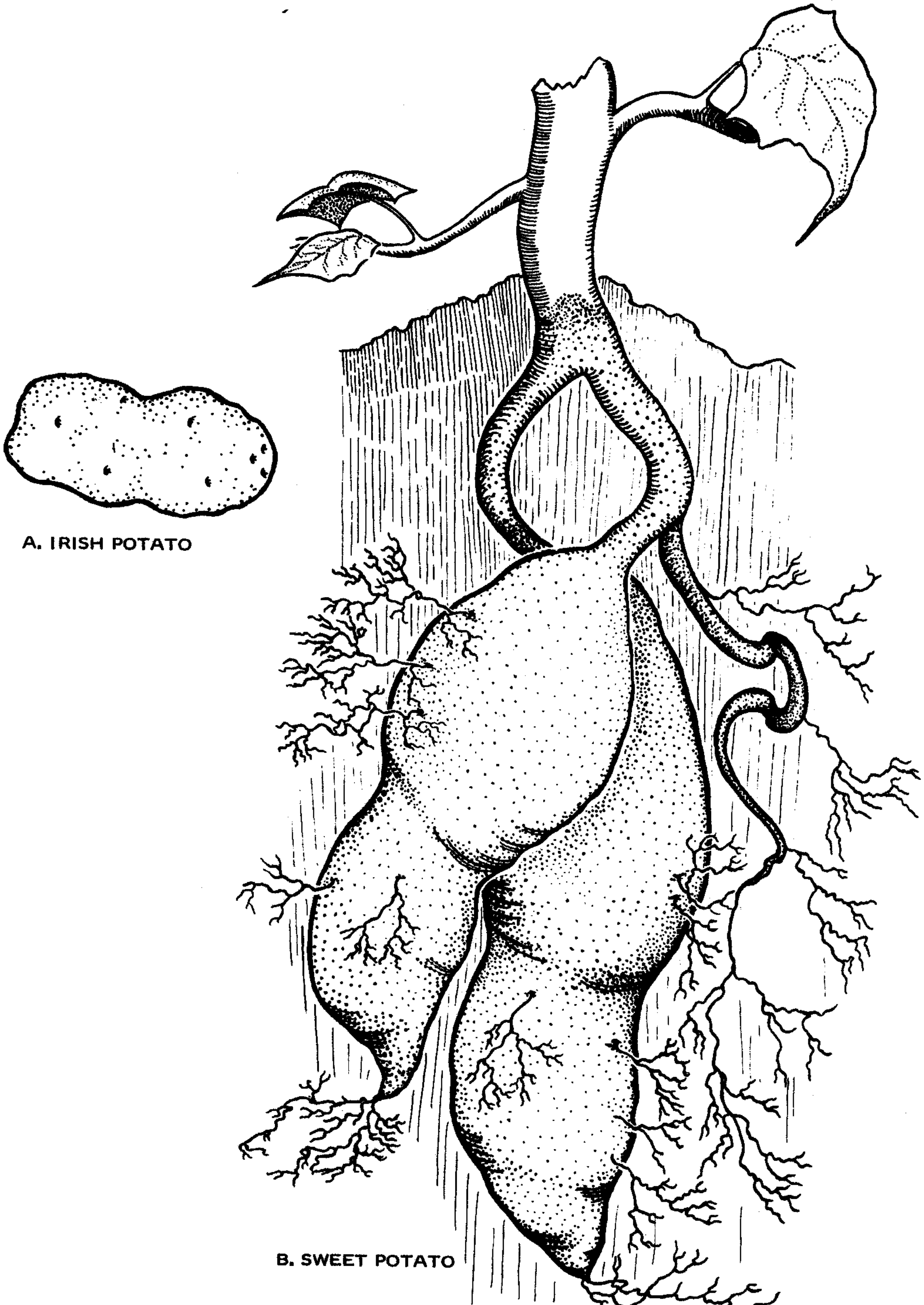


Figure 8:2a—Food storage tuber; b—food storage root.

STEMS AND BRANCHES

The stem is attached to, and grows up from, the root. (Fig. 8:3) The stem supports the branches, leaves, and flowers in most flowering plants. Along the sides of the stem the leaves grow. Underneath the leaf, where it is attached to the stem, are found one or more swellings called buds. The nodes are the places along the stems where the leaves, flowers, or branches grow out, and the spaces on the stem in between are called internodes.

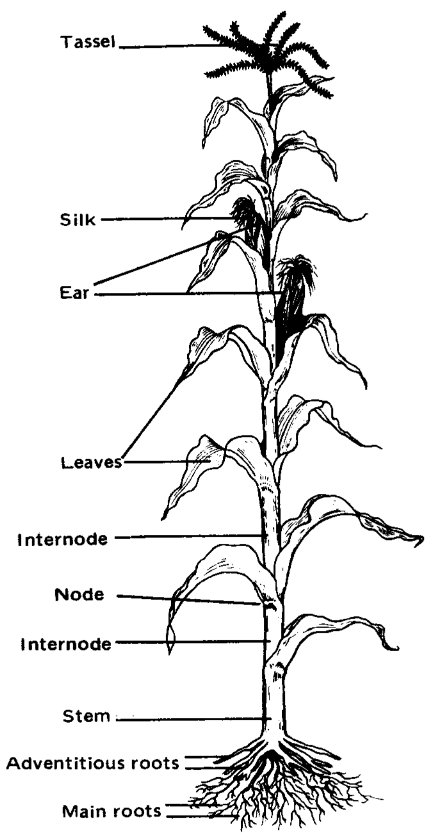
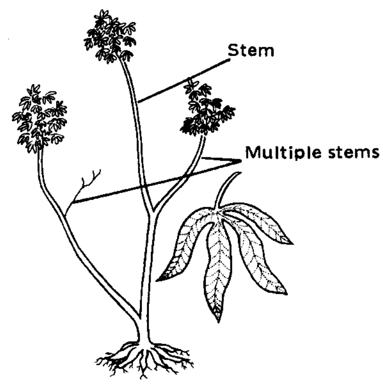
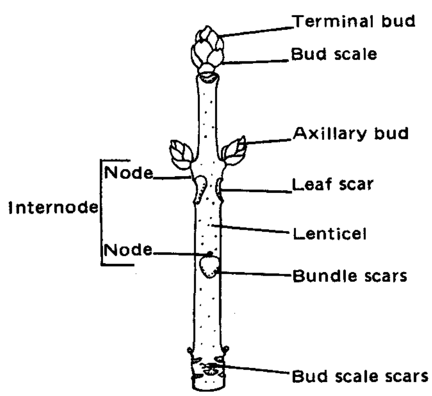


Figure 8:3—Stems and branches.



CASSAVA (TAPIOCA)

Figure 8:4—Multiple plant.



The lateral shoots grow out from the buds on the stem and are also called lateral branches, or they can grow straight up to become vertical water shoots or suckers, which, if permitted to grow, will become new stems; but they are usually cut out. A multiple plant is a plant with two or more stems. (Fig. 8:4) On big plants the first stem is called the trunk or the main stem. Some buds grow into leaves and flowers instead of stems and branches.

THE FUNCTIONS OF STEMS

Stems serve:

1. To carry water and plant foods through the veins from the roots to the leaves and from the leaves to the roots.
2. To hold up the leaves where they can get plenty of light and air and to hold up the flowers where the bees and other insects can have access to them.
3. To store plant foods like sugar in sugarcane stems and starch in sego palm trunks.
4. To hold up the fruits and seeds so that the birds and other animals can find them to eat and thereby spread the seeds and so that the wind can catch the seeds and blow them about.

SEEDS

Seeds are marvelous depositories of life. After being stored for years or even centuries, they can spring into life when the environment is right.

Some seeds are huge and cheap like the heavy coconut, (Fig. 8:20) whereas others like those of the F_1 petunia hybrid are tiny and very expensive. Seeds from that petunia cost from $900 to $1,100 an ounce! But the number of seeds in the ounce is about 230,000.

The need for preserving vegetables is almost a thing of the past because geneticists have "redesigned" many of the "cool-weather" crops to mature out of season. Through careful selection and breeding, seedsmen have developed non-bolting varieties of lettuce, broccoli, cauliflower, and cabbage for hotter climates. Seeds for these new out-of-season varieties are now widely available.

Some seeds have wings to carry them through the air like glider planes. Some are covered with silky fibers so that the wind can blow them about. Some, like cotton, have woody fibers that can get caught in the fur of animals and be carried away. The tumbleweed rolls all over the landscape to distribute its seeds. There are a great many ways in which seeds are distributed without any help from man.

LEAVES (Fig. 8:5)

The leaf is the most important vegetative organ and is specially adapted to manufacture food for the plant. (Fig. 8:6) Leaves are attached to the stems and branches of a plant and are arranged in a rather definite manner. This arrangement varies with plant species and genera.

THE STRUCTURE OF LEAVES

On nearly all flowering plants, along the sides and at the tips of the stems and branches, are the *foliage leaves.* These leaves contain *chlorophyll.* This wonderful substance gives the plant the ability, during the daytime, to make carbohydrates such as starch and sugar from the oxygen, hydrogen, and carbon it gets from the air and water. Each leaf has a skin called the *cuticle,* in which there are many tiny holes called *stomata* through which the leaf can breathe.

(Fig. 8:7, 8) The main part of the leaf is called the *leaf blade,* which is held fairly flat by its *midrib.* Across the leaf blade many *leaf veins* are seen. In dicot leaves, the veins make a network, whereas in monocot leaves the veins are usually in straight lines side by side. Most dicot leaves are attached to the stem at a narrow leaf stalk or *petiole.* Monocot leaves are usually attached to the stem by a wide leaf sheath or leaf base.

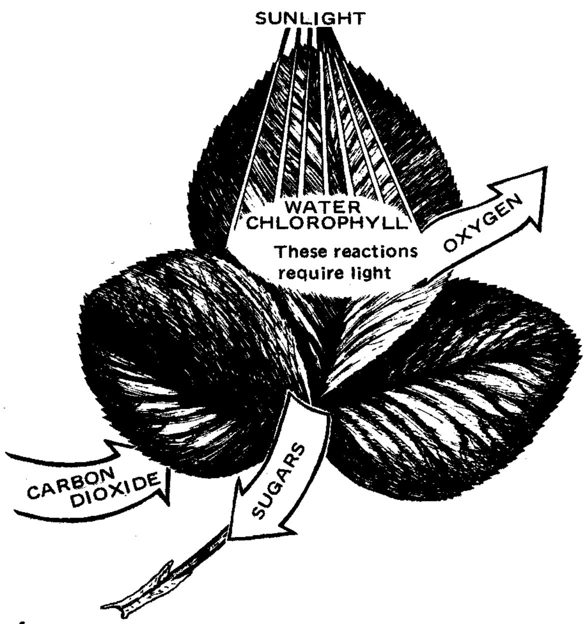


Figure 8:5—The leaf.

Figure 8:6—Leaf arrangement.

Figure 8:7—Parts of a dicot leaf (willow).

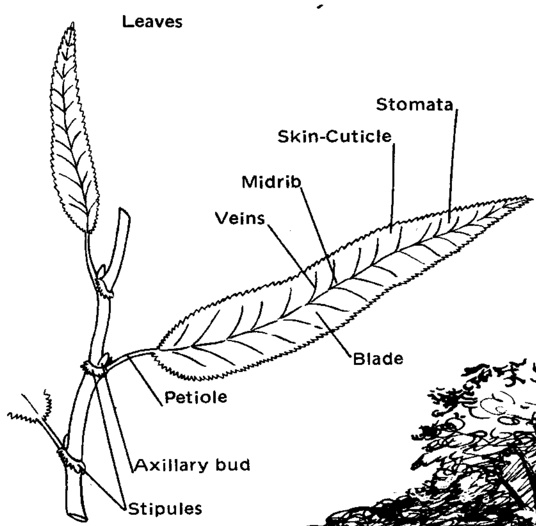
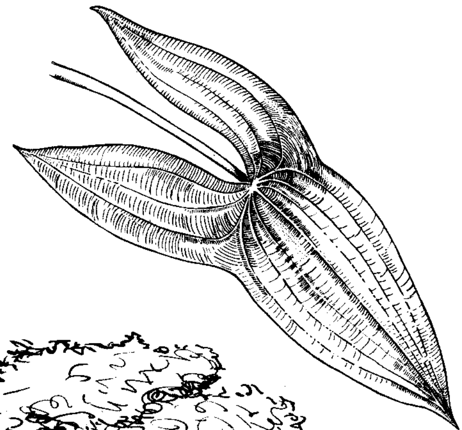


Figure 8:8—Monocot leaf (arrowhead).



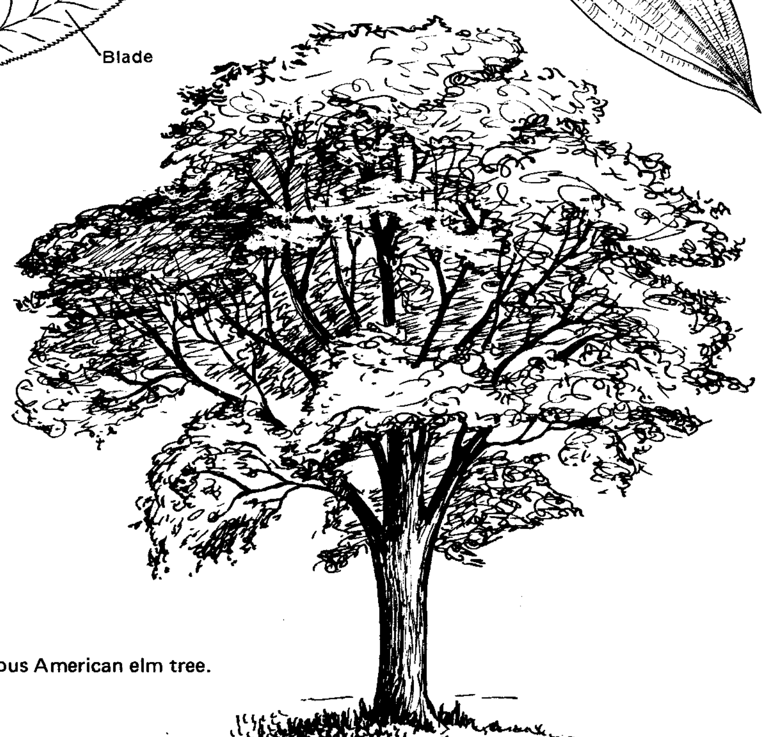


Figure 8:9—The deciduous American elm tree.

Some trees lose their leaves every year when the days are short. These are called *deciduous* trees. (Fig. 8:9) Those that do not lose their leaves are called *evergreens.*

THE SHAPE OF LEAVES

Leaves have many different shapes and sizes, as illustrated by those on the following trees: banana, pineapple, coffee, and breadfruit. Botanists have scientific names to describe all the different shapes of leaves, but the biggest difference lies between *simple leaves* and *compound leaves.* (Fig. 8:10) A leaf is compound when it is composed of two or more small leaves, called leaflets. Coconut and sego palms have compound leaves.

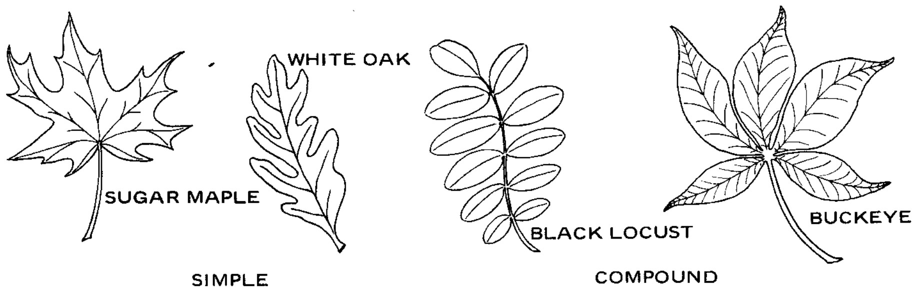


Figure 8:10—Two types of leaves.

THE FUNCTIONS OF LEAVES

Leaves serve:

1. To manufacture much of the plant food.
2. To store protein and other plant foods, as well as vitamins and other important substances.
3. To keep the plant cool in hot weather.
4. To breathe air in and out so that the plant is supplied with carbon dioxide. During this process it loses moisture.

Because many leaves contain protein and other good foods, cattle, horses, and people eat the leaves of some plants.

THE GROWING POINT

At the end of each stem and each branch, shoot, and sucker is a very important bud called the *growing point* or *terminal bud.* (Fig. 8:11) This is the bud that keeps on growing to make the stem or branch longer and larger.

If the terminal bud is broken off, the bud farther down the stem will begin to grow and take its place. This new sucker is then called the *leader.* Some monocots, like the coconut, very seldom have any suckers.

FLOWER BUDS AND ROOT EYES

At the nodes of the stems of many dicot plants such as coffee, there are two kinds of *buds* that produce either *lateral branches* or *suckers.* But some, like

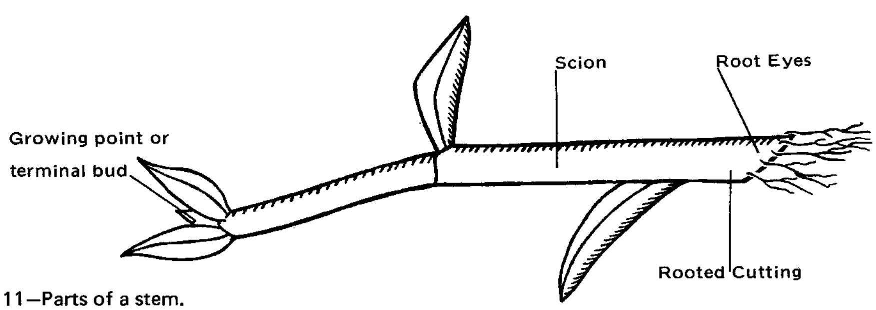


Figure 8:11—Parts of a stem.

cocoa and figs, also have on their stems a third kind of bud that can give shoots that will carry flowers and produce fruit on the side of the stem.

At or near the nodes of the stems of some plants are often seen small root eyes from which adventitious roots can grow. These are easy to see on corn and sugarcane stems, but on other plants they are too small to see. These are the eyes that *produce roots* on *cuttings.* (Fig. 8:11)

These adventitious roots grow out from the stem while the plant is still growing and produce *prop roots,* which can be seen at the base of old corn stems and Pandanas trees.

FIBERS AND THE CAMBIUM LAYER (Fig. 8:12)

If we cut through the stem of dicot and monocot plants, a big difference can be seen. Coffee is a dicot. Its stem has a fairly thick bark that can be peeled off. Sometimes the bark contains a lot of cork, as in cork trees; and sometimes it contains strong fibers, as in jute and tapa.

When the bark from a dicot is peeled off, it tears away from a thin layer or skin called the *cambium.* The cambium layer is very important because it is

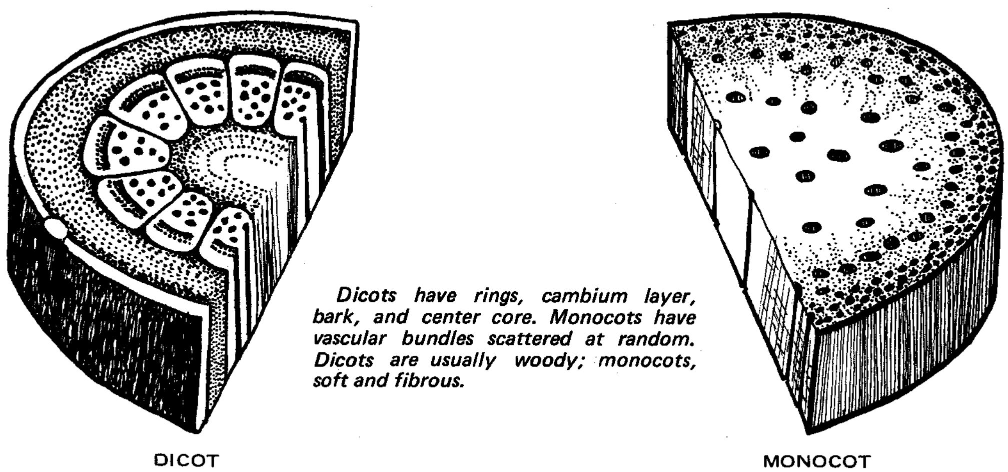


Figure 8:12—Cross sections of stems.

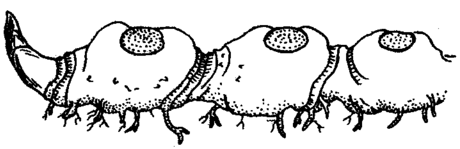
growing tissue. It continually produces wood and veins inside the stem and pushes the bark out farther all the time. Thus the stem keeps on getting thicker with every growing season. This causes the formation of growth rings, which can be counted to tell the age of even very old trees.

When the cambium layer is cut or broken, the wound will heal if it is not too big; but usually a lumpy scar will form where the wound was. That is why rubber tappers must always learn to tap the rubber trees without cutting through the cambium, for otherwise lumpy scars will form and remain, making further tapping very difficult.

VASCULAR BUNDLES

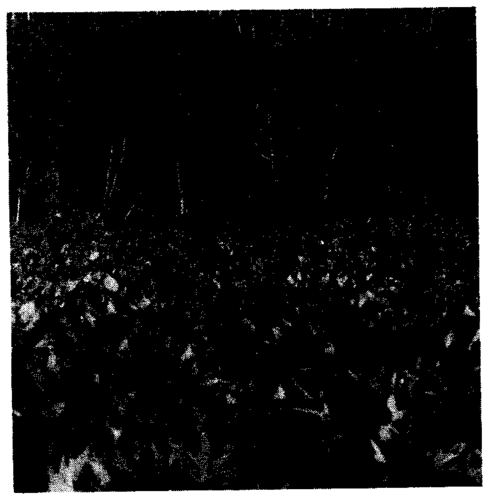
If we cut through a monocot stem, such as sugarcane or the coconut, we find a tough skin around it but no bark that can be peeled off as in a dicot stem. Neither are there any cambium growth rings–just a lot of fiberlike threads running vertically through the wood or flesh of the internodes. These are vascular fibers or vascular bundles and are the veins of the stem that carry the plant foods and water from the roots to the leaves.

In the dicot stem, the veins are in the growth rings and new rings are formed every growing season. In the monocot stem, the veins are scattered all through the stem. In dicots the stem grows big and fat because the cambium is making new tissues all the time. In monocots the stem grows bigger because the old tissues swell and because the vascular bundles grow thicker too.



RHIZOME (SOLOMON'S SEAL)

Figure 8:13–Rhizomes and runners.



SWEET POTATOES–A PLANT WITH MANY RUNNERS.

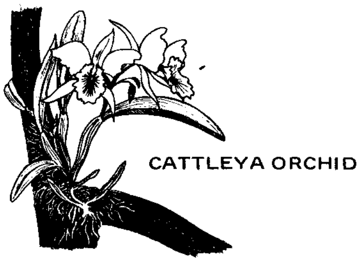
RHIZOMES AND RUNNERS

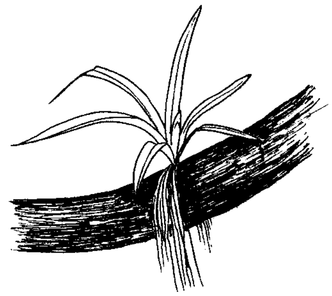
In some plants the stem is very short and is hidden by the bottoms of the leaves. The upright part of a banana tree is really not a stem but leaves rolled up together. Some plants like Bermuda (devil grass) or Kuni grass have pale-colored underground stems. These are called *rhizomes* and send out roots and shoots from some of their nodes. (Fig. 8:13)

Then there are plants like the sweet potato that have stems that run along the surface of the ground and send out new roots and shoots from some of their nodes. Such stems are called *runners.*

There are other plants, like pepper, orchids, and vanilla, whose stems grow along and around the stems and branches of other plants and send out roots that hold on to the other plants but do not obtain food or water from them; these are called *epiphytes.* (Fig. 8:14) They absorb moisture from rain and dew. From dust particles in the air, they obtain minerals.

There are also many plants called *vines* that climb about among the branches of other plants.





Aerial roots of an epiphytic orchid.

Figure 8:14—Epiphytes.

THE PARTS OF A FLOWER (Fig. 8:15)

The parts of a flower are as follows:

1. The green *stalk*, which holds the flower on the plant.
2. The green *calyx*, which is the cup of small green *floral leaves* at the bottom of the flower head. Each little green leaf is called a *sepal*, and in many flowers the sepals are not joined together.
3. The *corolla* is composed of flower petals, which in a hibiscus flower is the bright yellow cup setting in the calyx. This cup is made up of five yellow floral leaves called *petals*. In many flowers the petals are joined together.
4. In the middle of the flower is a white stalk called the *style*. Just above the calyx is a swollen and rounded part called the *ovary*. It is in this that the seeds are formed. The *stigma* is the top of the style. The ovary, style, and stigma together are called the *pistil*.
5. Coming out just at the ovary are usually other slender stems that normally reach to the top of the stigma. The ends of these slender stems are called *anthers* or *pollen sacs*, the male part of the plant. The pistil is the female part.

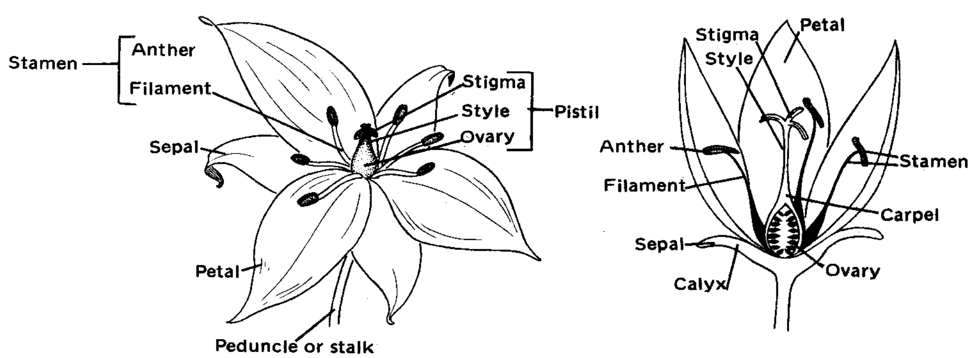
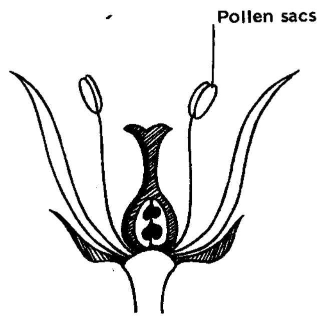


Figure 8:15—Parts of a flower.

POLLINATION AND FERTILIZATION

At the bottom of the petals inside many flowers there are little holes called *nectaries* where the flower makes a sweet syrup called nectar. Many flowers also have a pleasant odor of perfume. Their attractive colors and the perfumes attract



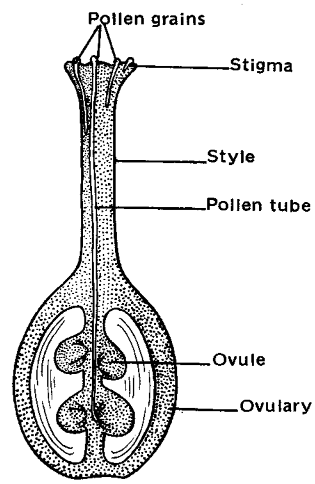
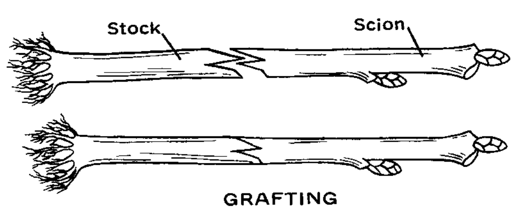


Figure 8:16—Pollinization.

bees and other insects, which come to drink the nectar. The bees take pollen and nectar to their hives to make bee bread and honey to feed their young ones.

When the bees and other insects move about from one flower to another, they carry and distribute pollen to the stigma. When pollen is deposited on a flower's stigma, it is *pollinated.* Somewhat like a seed, each pollen grain after being on the stigma for a little while, germinates if it is a good grain. Then it grows a tiny thin root which is called the *pollen tube.* (Fig. 8:16)

The pollen tube goes down through the stigma, down the style, and into the ovary. Inside the ovary it joins a tiny organ called an *ovule,* which will then grow into a seed if the pollen was the right kind. When a pollen tube joins an ovule, the flower is said to be *fertilized.* Besides the bees and other insects, the wind also carries pollen and pollinates flowers. Some flowers, such as the vanilla, are ordinarily pollinated by hand. New plants or hybrids are often developed by hand pollination.



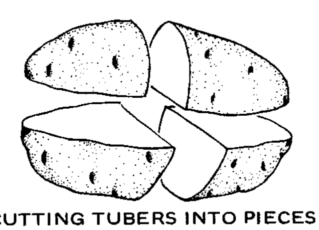


Figure 8:17—Two methods of increasing plants without using seeds.

INCOMPATIBLE AND STERILE PLANTS

When a plant can be fertilized with its own pollen, it is *self-compatible.* Sometimes, as in coffee and cocoa, a plant does not accept its own pollen and must be fertilized by the pollen from another plant. In such a case the plant is said to be *incompatible* to its own pollen, or *self-incompatible.* Sometimes one variety of plant is incompatible with another variety. For this reason, tree varieties are mixed at times, to be sure of getting good crops.

Some plants, like bananas and most pineapples, produce fruit but no seeds. Some plants are said to be sterile, which means that they cannot produce fruit in some cases, nor seed in others. Such sterile plants can only be reproduced from cuttings or from other parts of the mother plants. (Fig. 8:17)

PERFECT AND IMPERFECT FLOWERS

A flower is said to be complete when it has both male and female parts in the same flower, for example, the hibiscus, the carnation, some papayas, and certain passion fruits. Such are called *hermaphrodite* flowers. Many plants have the male parts and female parts on different flowers, for example, cucumbers, squash, and some papayas. Such flowers are called *imperfect* flowers. (Fig. 8:18)

If the male and female flowers are on the same plant, as in squash, pumpkins, corn, and the coconut, it is called a *monoecious* plant. (Fig. 8:19) The word *monoecious* means "one house." If the male and female flowers are on different plants, as in some papayas and the nutmeg, it is called a *dioecious* plant. In order for these plants to produce fruit or seeds, at least two must be planted close enough together for pollination to take place. The word *dioecious* means "two houses."

When a plant is pollinated by its own pollen, it is *self-pollinated.* When it is pollinated by pollen from another plant, it is *cross-pollinated.* If a flower of a plant of one variety is fertilized by the pollen from another variety, it has been *hybridized;* and if it produces seed and new plants grow from this seed, the plants are called *hybrids.*

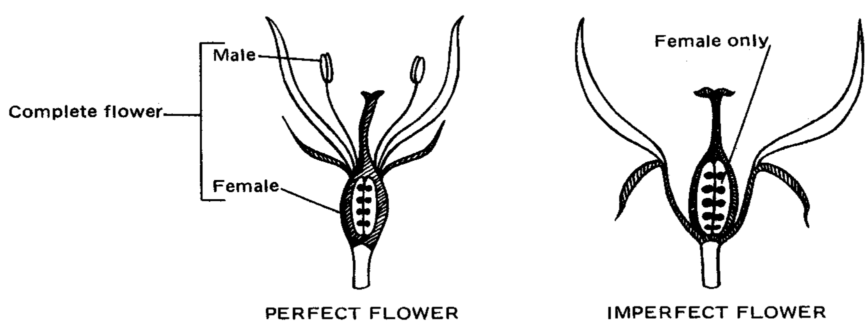


Figure 8:18—Perfect and imperfect flowers.