Illustrated

SCIENCE READERS

Volume III

Approved by the Board of Education

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THIRD BOOK

1. THE SEEDS

Nearly all of the plants that have flowers produce seed. There are a great many different kinds of seeds and they have different coverings.

Let us study a very familiar seed.

The common beans are in a seed case called *a pod*. Several seeds grow together in the same pod.

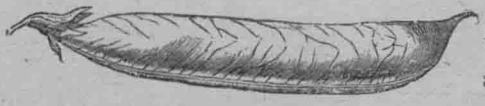

Fig. 1. Bean-pod.

Take a pod in your hand and observe it closely; see how it is closed up to protect the young and tender seeds from injury. When the beans are full grown, this pod can be easily opened. It splits open to let the ripe seeds get out that they may produce new plants.

Notice that each bean is attached to the pod by a little stem. This is called the *funiculus*. When we pull

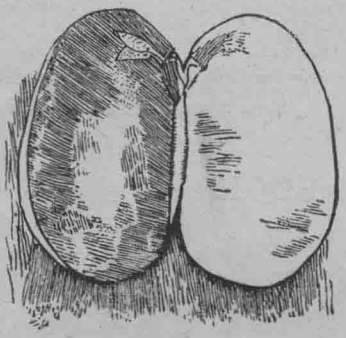

Fig. 2. Parts of scarlet runner bean.

it loose, it leaves a little scar showing where it was attached. This scar is called the *hilum*.

Take a number of seeds and put them in warm water for several hours. The first change that we notice is that there are *wrinkles* around the edges of the thin covering which we call the *seed-coat*. These are caused by the fact that the seed-coat has *absorbed* the water more rapidly than the inside part of the seed, and has increased more in size. Very soon the inside part also absorbs the water and increases in size until it fills up the seed-coat and the wrinkles are smoothed out again. Now the seed looks as it did at first, except that it is larger.

Fig. 3. Bean showing parts.

Tear off the seed-coat and split open the two thick pieces. These are the food stores for the young plant before its roots are able to get food, and are called *seed-leaves* or *cotyledons*.

Lying where these two cotyledons are joined together is the most important part of the seed; it is called the *embryo*. It is the young plant asleep. It is made up of two parts, the leaflike part called the *plumule*,

and the root-like part which grows into both root and stem, called the *caulicle*.

What is food for the plant is also food for man, and we eat a great many of the beans, but some are planted and grow into plants.

It is interesting to learn what happens when a seed makes a plant.

Get a small box and fill it with moist sand, *saw dust*, or moss, and plant a number of bean seeds in it. Do not cover them with much sand. Now cover the box with a piece of glass to keep the sun from drying out the moisture too quickly, and watch what takes place after about a week or ten days.

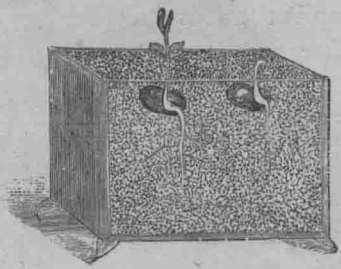

Fig. 4. Observation box.

If you do not keep the sand moist, the seed will not grow. If it is kept too wet the seed will rot, so we must get the right amount of water. If it is too cold the seed will not grow, therefore we must keep them in a warm place.

There is one other thing that we must remember, the seeds must have air, if we wish them to grow.

Light is not necessary to make them grow, but the plants which grow in the light are green and healthy looking, while those grown in the dark are white and delicate.

If, then, you let your seeds have air, moisture and warmth, after a few days they will begin to grow.

First, you will see the sand cracked, then a round, white object pushing up through the sand. One end of this loop is the root and the other end is made up of the seed-leaves, the middle is the stem. As the stem grows stronger, it pulls the seed-leaves out of the sand. The sunlight soon causes the young plant to become straight and it grows rapidly.

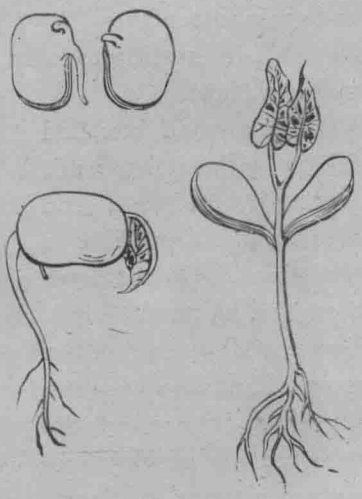

Fig. 5. Stages in growth of bean.

From between these seed leaves come true leaves and the plant now has all of its parts, the root, the stem, and leaves.

The root grows down into the soil and draws food from it, so the seed leaves wither and drop off, as the plant does not need them any longer.

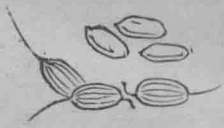

Fig. 6. Rice grains.

The bean has two seed leaves. The *squash*, the *sun-flower*, the *peanut*, and a number of other seeds also have two, but corn, rice, *wheat*, *barley* and *rye* have only one.

Fig. 7. Morning glory vine.

2. SEED DISPERSAL

Some one has estimated that the *morning glory* produces three thousand seeds in one year. The *dandelion* has from one to three hundred seeds on a

flower stalk. Other plants produce a great many more than these.

If, then, every seed of all the plants grew to be a plant and produced seeds which also became plants, soon the whole earth would be covered with plants so thick that there would be no *room* for man. But we must remember that only a very small proportion of the seeds ever become plants at all and that many that begin their growth never reach the seed producing age.

You know that a plant gets food out of the ground where it grows. If the three thousand seeds from the morning glory or the several hundred from the dandelion all fell down to the ground just where they were produced, only a very few of them could get food enough to live and grow. Perhaps several could grow, but they would make small, weak plants. If only one grew it would be able to make a large strong plant.

Because they cannot grow so close together, many plants have various plans by which they can travel from place to place. There are several different methods of scattering seeds, some are scattered by the *violent bursting of the seed vessel*, some by their roots, some by the wind, some by water and others by animals.

It will prove very helpful if you will collect during the whole school year as many seeds of the various kinds as possible. Put these in glass cases or bottles so that you may have them ready for a close study of this question, for it is full of *information* and will reward you abundantly.

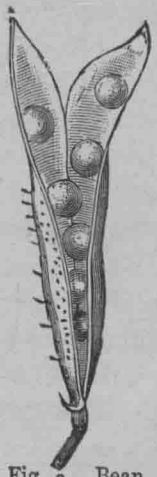

Fig. 6. Bean pod splitting open.

Notice the bean pod when it is very dry and the beans are ripe. Often you will find the empty pod hanging on the vines, for the pod has split so suddenly that the seeds have been shaken loose and thrown some distance from the parent plant. The pod coils up when it splits open.

The *violet* also scatters its seeds some distance from the plant by the same method, and the next season new plants come up all around the old one. This enables the plant to spread until it covers a large area with its young plants.

The *touch-me-not* has a seed pod that will split open with a good deal of force when it is ripe. If you take a ripe pod in your hand, the touch of the hand causes it to burst and scatter its seeds. This is the reason for its peculiar name.

Many plants are constantly spreading by means of their roots. The bamboo is one that we can all see. Pull up a small stem and notice the root *system*. It spreads out in all directions, and in the spring we gather the young *shoots* or plants and eat them. If we plant several roots, we can soon get a small grove of bamboos.

Another plan that is used by other plants is to send out above the ground stems or *runners* that take root and produce new plants. The *strawberry* is a good example of this class of plants.

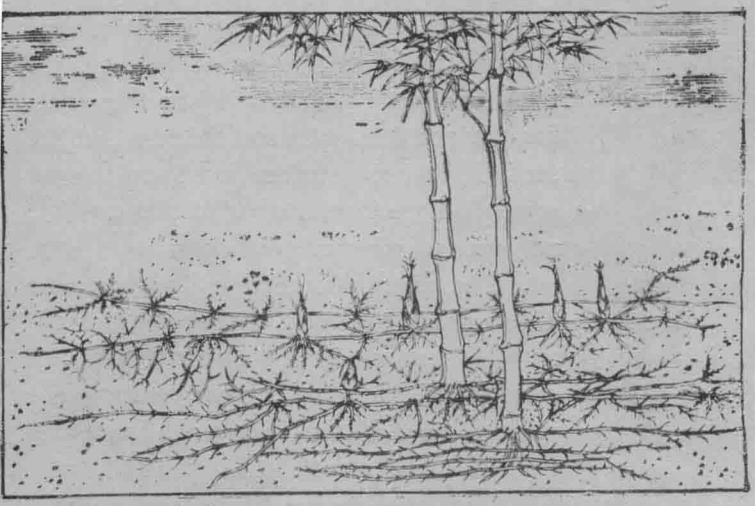

Fig. 9. Bamboo root system.

Fig. 10. Dandelion seed head.

The wind does much for the plants in helping them to scatter their seeds. Find a dandelion that has *gone to seed*. It looks like a white ball of small feathers, but soon a hard wind blows and the seeds are all carried away. The light feathery tops act as kites to carry the seeds to distant places. This plant may be scattered over a large field in this way, and when it once gets a start in a field it is hard to get rid of it without hard work.

The *common thistle* is another plant that has the same plan to scatter its seeds. Its top is larger than that of the dandelion, and its seeds may be often carried many miles by a hard wind.

Now look at some of the common trees. The *sterculia*—Japanese *varnish tree*—has an unusual arrangement. The seeds are borne on a large, flat, leaflike body which the wind can blow far away from the root of the tree.

In addition to these that have wings, there are a number of very light plants among the grasses that are broken down and blown about by the wind. As they are blown from place to place they leave their seeds scattered about behind them. The *tickle-weed* is very common, and in open countries may be blown many miles, scattering its seeds as it goes.

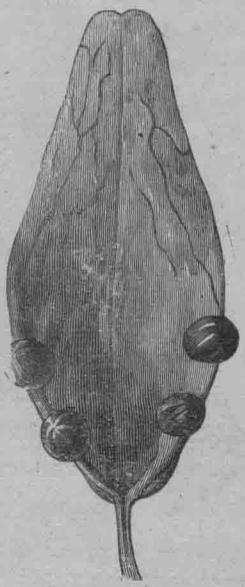

Fig. 11. "Seeds are borne on a large, flat, leaflike body."

Our canals and rivers also carry large numbers of seeds. Some of the seeds have thick coverings and may remain in the water for a long time without being injured. *Cocoanuts* have been known to float as far as a thousand miles and then grow on distant islands.

Animals carry many more seeds than we would think. Such seeds as the *beggarticks* or *pitch-forks* (*Bidens*), *wild carrot*, *cockle-bur*, *burdock* and *tick-trefoil* (*Desmodium*) have sharply curved hooks on

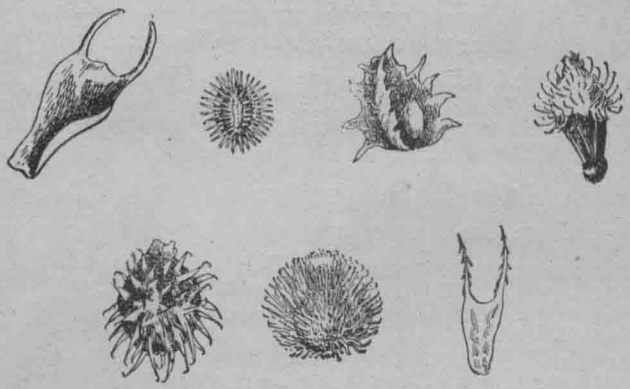

Fig. 12. Seeds that catch on the fur of animals. (Dana)

them, and they catch in the hair of passing animals and take long rides before they are shaken off in some suitable place. Look at any sheep, horse, goat, cow or other animal that has been feeding in uncultivated places, and you will probably find some of these seeds.

Birds eat many fruits or *berries* like the *raspberry*, *mulberry* or the *red haw*. They digest the soft parts, but the hard seeds often pass through their bodies uninjured, and in this way are dropped far from where they were grown.

Fig. 13. Mulberry seeds.

3. THE LEAVES

Look at the trees all around you. If it is winter time and cold, the leaves have fallen and the trees are bare and leafless. If it is spring or summer time, the weather is warm and the trees are full of beautiful green leaves. During this time of the year, gather as many of the different kinds of leaves as you can find so that we may have them to study during the cold weather when the trees are bare.

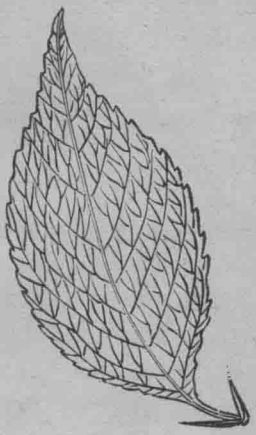

Fig. 14. Elm leaf.

First, we must learn to tell the names of the different parts of the leaves. This *elm* leaf has a wide green part that we call the *blade*, and the stem-like part is the *petiole*. Some leaves have also small green little things like leaves on the lower part of the petiole, these are *stipules*. All of the leaves do not have stipules, so we must be sure to find some with them. Take an oak leaf in your hands and look at it carefully. Notice that its blade is all made up of one piece. This is a *simple leaf*. But the blade of the bean leaf is made up of several pieces, and it is therefore

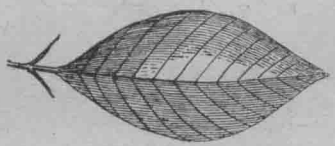

Fig. 15. Oak leaf.

a *compound leaf*. You should be able to find examples of all of these leaves if you look carefully. On the under side of nearly all of the leaves, there are *ridges* that are thicker than the other parts of the blade. These are the *leaf veins*. They help the leaves in two ways:—first, they spread the leaf out so that it can get more sunshine than if it were rolled up: second, they help to bring the plant water from the ground to the leaf so that it may use it to make plant food. If you will break some of these veins in a healthy young leaf, this plant water or sap will run out on your hands.

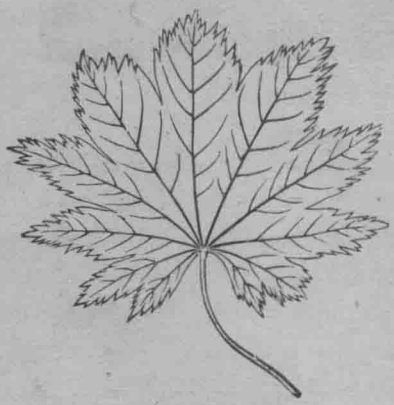

Fig. 16. Palmately veined leaf.

Put five or six of your leaves together on the table and compare them. The veins are not all alike. See this one (Fig. 14). There is one large central vein and a great many smaller veins running from this one out toward the edge of the blade. This kind of leaf is called a *pinnately* veined one. The *palmately* veined leaf has several, usually five, veins beginning at the top of the petiole very much like the fingers from the palm of the hand.

This Bamboo leaf illustrates another kind of veining. It is the *closed system* or *parallel* veined leaf.

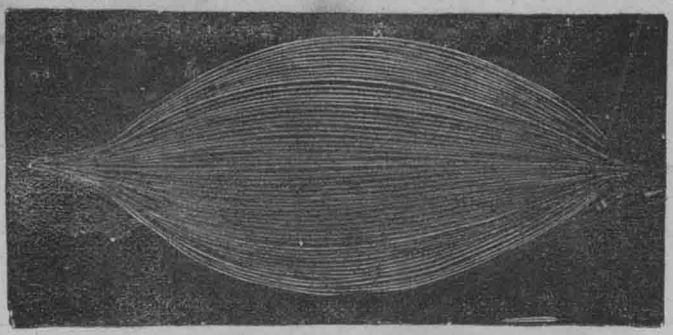

Fig. 17. Parallel veined leaf.

Rice, barley and the other *cereals* all have leaves of this kind. The grasses also have parallel veined leaves.

We have already noticed that leaves are wide and thin and that they are green in colour. They are really only spread-out parts of the stems, and they are made this way in order to do a special work.

They need a great deal of sunshine, so they are arranged to get as much as possible. Did you ever notice that they are so arranged as to cut off just as little sunshine from each other as possible? If you have not yet looked closely at this arrangement, go out some day and study it.

There are a great many small plants that grow close to the ground. Gather some of them and study their leaf arrangement. The lower leaves have long petioles and push the blades out beyond those of the top ones which have only short petioles. Then, too, the leaves are placed between each other instead of

Fig. 18. Leaves that do not shade each other.

on top of each other. They are arranged *alternately*. These short-stemmed plants with this plan of leaves are called *rosettes*. The study of the arrangement of the leaves on the stem is very interesting also. You will

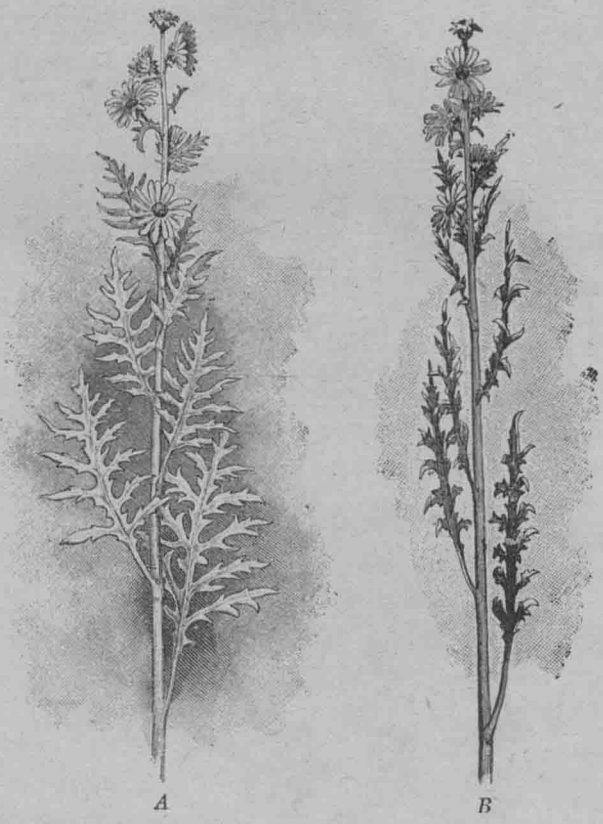

Fig. 19. Leaves standing nearly vertical in compass plant. A, view from east or west; B, from south or north. (Kerner)

find a great variety of arrangements, but all for the same purpose—to let each leaf get plenty of sunlight.

Watch the sunflower in the morning. The flower and the leaves on the upper part of the stalk are turned

toward the sun. The flower follows the sun as it comes up in the east and goes down in the west. This is an example of a plant that follows the sun to get all the heat it can. But there are some that arrange their leaves to get only the morning and the afternoon sunlight. The mid-day sun is too hot for them. These are sometimes called the *compass plants* because the edges of their leaves point north and south.

It is interesting to watch what becomes of the rain water that falls upon the leaves. Most trees are arranged like the palm; they pour all of the water from the leaves down toward the roots of the tree. Very few turn it away from the roots.

Fig. 20. The oxalis during the day time.