"THE PLANTS WILL TEACH YOU"

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In the deserts of the Southwest grows an interesting plant, the yucca, or Spanish bayonet. The name is derived from a dense rosette of long, daggerlike leaves that rise a foot or two above the ground. In the spring a flower stalk grows upward from the center of this rosette, reaching a height of from four to six feet. It is crowned at the upper foot or two with scores of cream-colored lily-like blossoms, each about two inches long and drooping from the end of a short branch.

The remarkable feature of these beautiful flowers is their manner of pollination. The stigma, that sensitive area on the end of the style, which must receive the pollen from the stamens in order to stimulate the growth of the seeds, is not like most stigmas. On the contrary, it is hollow, and the sensitive area is inside the hollow. Hanging down as it does, no pollen can drop into it. Ordinary methods of pollination are impossible. Neither wind nor passing insects are of any use in the pollination of the yucca.

Here is where the female pronuba moth enters the picture, just as if she had been given a special role to play in the economy of the desert. Entering a flower, she brings in her mouth a wad of pollen which she has gathered from other flowers. Having taken enough to suit her instincts, she now goes about her business. Searching about in the flower, she crawls upward until she comes to the bulbous ovary, the case in which the seeds will be developed. Here she deposits her eggs.

As soon as she has done this, she performs a most surprising act. Crawling back down the long, hanging style, she finds the tubular stigma at the lower end and proceeds to pack it full of pollen she has been carrying in her mouth. Her mission has now been accomplished. Provision has been made for her offspring and at the same time for the reproduction of the yucca.

The yucca ovary contains about 200 ovules, each of which, fertilized by the pollen packed into the stigma, is capable of developing into a seed. About twenty seeds are all that will be needed by the growing pronuba larvae, so an abundance of seeds will mature.

How, by any stretch of the imagination, can we account for this remarkable feat performed yearly by thousands of pronuba moths? How did the process originate? In the first place, a yucca plant could not produce seed without the aid of the moth. But how does the moth know enough to pack the stigma full of pollen? Instinct you say? Yes, but instinct is merely an inherited action pattern. Before the pattern can be inherited, it must be formed. But how could yucca plants mature seeds while waiting for the moths to learn the process and set the pattern?

The whole procedure points so strongly to intelligent design that it is difficult to escape the conclusion that the hand of a wise and beneficent Creator has been involved.

But the yucca is not the only case where miraculous events occur in the plant world. In fact, the growth of every seed is a miracle.

In many flowers, such as the apple blossom, tiny nectar pits are placed at the base of the petals. The odor of the flowers, and probably the color also, attracts the honeybees. Seeking the nectar, from which they manufacture honey, the bees brush against the stamens and become covered with the sticky yellow pollen. Not only do they seek nectar, but they also deliberately gather pollen and pack it into pollen sacs provided on one pair of legs. In the course of gathering the pollen, they brush against the end of the style in the center of the flower. Some of the pollen is left sticking to the soft syrupy surface of the stigma. In this way the honeybees not only benefit from the nectar and pollen, but they return the favor by pollinating the flowers.

Again we may well ask how such an arrangement could have come about by accident, or how either the flowers or the bees could have survived alone. Intelligent design is again evident.

Sometimes it is better for a flower if it can receive pollen from another plant rather than to be pollinated by its own. Elaborate mechanisms ensure this cross-pollination. In some flowers the stigma and stamens mature at different times. This makes self-pollination impossible. Some flowers have two kinds of styles and stamens — long and short. A bee will enter a flower with a short style and long stamens, and will receive a pollen on the rear portion of its body. Then when it enters a flower with a long style, it will rub off some of the pollen on the stigma. At the same time it will obtain pollen on the front of its body from the short stamens, and this in turn will be rubbed off on the next short style the bee encounters. Remarkable, isn't it? A miracle? Surely no ordinary growth processes could account for such

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marvelous adaptive relationships. Such precise adaptations require something more than trial and error. They require intelligent planning.

You will notice that so far we have spoken only of sticky pollen. Some flowers have dry pollen that would not stick to the body of a bee, or even be held by the thick hairs that cover its body. These flowers put out no brilliantly colored flowers or sweet scents to attract the bees, but they have another way of carrying on their necessary functions.

Take the grasses, for instance. Their large stamens are dangled out on long filaments, which sway with every passing breeze and release their pollen to the wind. The pollen is so light and dry that it flies everywhere (ask any hay-fever victim), and the grasses are freely pollinated.

This kind of pollen distribution may be observed in many trees. In the dense pine forests, for instance, living conditions are not favorable for honeybees, and if the pine trees were to depend on them to carry pollen, the process would be poorly done. But the pines hang out thousands of tiny cone-like structures, each one with many pollen-bearing stamens. Every movement of the branches in the wind shakes loose a mass of minute powdery golden grains. I have seen a strong wind sweeping over a pine forest, picking up a cloud of yellow dust and sending it filtering through the trees. So dense was the cloud of pollen that it could be followed with the eye for miles. The wind-blown pollen is so abundant that it colors the surface of mountain lakes and collects in golden masses along the shores. Here is ample provision, and to spare, for the development of new pine seeds, and the bees are not needed.

After all, the process of pollination itself is a miracle. A tiny pollen grain lighting on the sticky surface of the stigma begins to sprout, using the sugary secretion as food. The sprout becomes a tube, which burrows its way down through the tissues of the stigma and style until it reaches the ovary, or egg ease. Here it does not wander about aimlessly, but leaves the walls of the ovary and enters the cavity inside. Here are located the ovules, each one destined to become a seed. Each is attached to the ovary wall by a short stalk, and at the base of the ovule, near to its attachment to the stalk, is a tiny opening, the micropyle. Into this micropyle the pollen tube enters. Once inside the ovule, it discharges its sperm cells, which immediately unite with egg cells to produce a new seed.

What causes the pollen tube to grow downward along the style? Some botanists suspect there is some kind of chemical attraction. But if this is true, how did it get that way to begin with? Even though we may find some cause for the directional growth, we are puzzled to know why it is that way. The whole process is so purposeful that it cannot be explained as mere coincidence.

These principles have been so well expressed by another that I would like to close this discussion with a short quotation:

"A mysterious life pervades all nature-a life that sustains the unnumbered worlds throughout immensity, that lives in the insect atom which floats in the summer breeze, that wings the flight of the swallow and feeds the young ravens which cry, that brings the bud to blossom and the flower to fruit." —Ellen G. White, *Education*, page 99.

In this age of scientific skepticism, we need to realize the hand of God in nature, and to recognize His power at work in all the things He has created.

POLLINATION OF YUCCA FLOWER BY
PRONUBA MOTH

A. General view of Yucca in bloom
B. Single flower. (Note stigma protrudin$_g$ on left side)
C. Moth placing ball of pollen inside open end of stigma which is a hollow tube
D. Seed capsule showing opening where moth emerged
E. The Pronuba Moth
F. Longitudinal section of stigma showing hollow into which pollen must be placed

Drawings by H. W. Clark