What the World Would Look Like After a Million Years of Drought

IS told in Science News-Letter's second report on the recent International Botanical Congress which met at Cambridge, England. This article also explains how a botanist analyzes the soil from an airplane; it tells why scientists spend years studying the sex life of the fungi, and describes a form of evolution of moulds that takes place almost over-night.

SUPPOSE the drought extended millions of years instead of a few weeks. What would happen to the vegetation then was discussed by the two eminent botanists, Prof. T. G. Halle, of Stockholm, and Prof. A. C. Seward, of Cambridge.

Evolution on a grand scale would be promoted if the American lack of rain experienced this summer were stretched to extend millions of years.

The botanists were not just using their imaginations. For something like an extremely lengthy drought happened in the Permian geologic age, about two hundred million years ago, in the interval of earth history between the luxurious exotic vegetation of the coal age and the beginnings of the age of reptiles when dinosaurs ruled the earth and our present flora had its beginnings.

At that time of drought the myriad of strange carboniferous species were cleared off the face of the earth as with a razor.

Then a new kind of plants, quite different from the vegetation of the coal age and beginning to look really modern, began to evolve upward in the precarious struggle for existence.

The layers of earth laid down in the eons between the Permian and the present tell the story of long periods of great dryness. Few of the plants are preserved in the record of the rocks as fossils but such as are discovered there have leaves and roots adapted to life under conditions of drought.

While it was one long drought in Permian times, the botanists find that it was not necessarily hot then. Sometimes, their studies show them, glaciation is an effective aid to plant evolution by sweeping clear large land areas and leaving empty land suitable for rapid development of new types of vegetation when times and climate become better.

How plants today keep house in deserts under conditions like those that occurred in the ancient Permian age was discussed by Prof. N. Maximov of Leningrad, Dr. B. Huber of Freiburg, Germany and Dr. E. Schratz of Berlin. Contrary to former notions, plants of the desert often evaporate more water into the air than the plants of moist regions. Their thick harsh skins, often covered with hairs, hold evaporation to a very low value when their leafpores or stomata are closed. But when rains bring brief and temporary abundance of water, the desert plants open their pores and the evaporation of water is then very rapid. This increased activity on the part of the plant means that it is manufacturing food at a rapid rate while the water is available for this purpose.

Desert plants resemble some human beings in that they work hard and spend freely when times are good but live parsimoniously when they are broke.

Botanical Airplane Survey

Airplane surveys, or photographs made from the air, are the latest tools of the botanist and soil scientists in their service to farmers. From hundreds of feet in the air they find it possible to probe scientifically into the soil some eight to ten feet under the surface.

Not that the photographs mysteriously penetrate into the soil itself but they give up pictures that tell the conditions of crops.

Dr. W. L. Balls, of Cairo, Egypt, explained that since soil conditions powerfully influence deeprooted crops, the plants that grow can be used to tell what is beneath the surface.

He uses the roots of cotton, corn, clover and other crop plants as instruments of exploration. Standing on a hill he makes a detailed survey of soil conditions through his binoculars. Then he checks his results by making occasional borings into the soil and by taking airplane flights to obtain a more general view.

Study Sex of Fungi

Sex life among the fungi was discussed by the scientists attending this International Congress.

This may sound frivolous but the subject is really of profound practical and economical importance. Fungi are the germs of the worst crop and orchard diseases and they are the spoilers of food, clothing and other things used by man.

Prof. J. H. Craigie, of Winnipeg, announced to the botanist "that he has discovered that blackstem rust of wheat, a serious disease of that cereal, hybridizes and originates new strains of that fungus." This is unhappy news to wheatgrowers since it may mean that the new rust resisting wheats that plant breeders have developed through hybridization may find the disease that they were bred to escape evolving to catch up with them. Growers of the new hybrid wheats given them by science may find them attacked by the new rusts and the battle between scientist and fungus will need to be renewed.

Pink mold such as sometime grows on the housewife's bread follows the laws of heredity as discovered by the monk Mendel in his monastery garden. Dr. B. O. Dodge, of the New York Botanical Garden, told the congress that three species of pink breadmolds that he had crossbred showed typically mendelian hybrid behavior among their offspring. One kind of mold that has two protoplasmic hearts or nuclei keeps its love-making within its own particular group, but another strain adventurously marries out of its species every chance it gets.

Piratical partnerships between fungi and parasitic insects preying on trees

were described by Dr. J. N. Couch, of the University of North Carolina. The scale insects that suck the sap of trees live in shelters formed by the fungus. They raise large families of young insects which crawl away carrying the fungus with them and planting it in new unworked locations. Thus the children pay the fungus for the service it rendered to their parents.

Sometimes however there is double-crossing among these parasitic gangsters. The fungus will infect and devour some insects instead of housing them and at other times an invading fungus is merely used as food and digested by insects.

Alcohol's Love for Protoplasm

Alcohol, the liquid that has caused much political and moral controversy, particularly in America, has a fatal attraction for protoplasm, the very basic stuff of life which forms a large part of every living plant or animal cell.

This scientific observation was presented to the Congress by Prof. L. Jost, physiologist of Heidelberg University, Germany.

The protoplasmic lining of plant cells lets alcohol through much more readily than it does water, this eminent scientist explained. Some plant cells placed in a solution of half alcohol and half water absorb alcohol so greedily that they become greatly swollen, burst and die. The substances that have such an avidity for alcohol are apparently lipoids, fatty substances that play an important part in the structure of living matter. And if the plant is given a good place in the sun it soaks up more alcohol with disastrous results because ordinary simple sunlight increases the permeability of the protoplasm.

Sun Speeds Things Up

But this speeded action due to the rays of the sun is not partial to alcohol alone, for Prof. W. W. Lepeschkin, of Tuscon, Ariz., reported that plants put in colored water and exposed to the light, become colored faster than plants that were left in the dark. The dye always travelled faster in veins and leaves of the illuminated plants than those not in the light.

The kick in coffee, tea, cocoa, and other such mildly stimulating beverages is due to substances that are of apparently secondary importance to the plants themselves, Prof. T. Weevers, of Amsterdam, told the botanists. Caffein, theein and such substances appear in the young leaves but disappear as plants approach maturity. Sometimes, as in coffee and cocoa, these substances migrate to the seeds and are stored there. Despite the fact that man cultivates and raises plants to obtain these stimulating substances, they seem to be to the plants merely halfway products used in the chemical upbuilding processes of the plant.

Evolution While-You-Wait

Whatever believers in the permanence and unchangeability of species may have to say about higher plants, they must speak softly when they deal with the lowly moulds. Evolution while you wait seems to be the order of the day with some of them.

Dr. William B. Brierly of the Rothamsted Experimental Station, England, told of his experiences in culturing *Botrytis cinerea,* a common fungus found on grapes.

This organism simply will not "stay put," he has discovered. Starting with a single spore, to make sure he had as uniform a stock as could be secured by any known method, he found that the offspring organism varies constantly. Some of the variations were discontinuous, some progressed continuously. He could induce a continuous modification at will by varying the culture medium, and return it to the original type by restoring original environmental conditions. But some of the discontinuous variants refused to revert to type even under prolonged selection.

If you were a physician, what would you make of a disease germ that changed its trade almost overnight, and thereafter produced some other kind of disease?

That is one of the diagnostic difficulties that plant pathologists are up against, it is indicated from studies by J. Henderson Smith of the Rothamsted Experimental Station.

The only way one can be quite sure of his diagnosis of a plant disease caused by a filterable virus is to have a pedigreed culture of the virus and a standardized host plant of known source, age and environment. Under unstandardized conditions, such as one has to deal with in the field, the symptoms of the various virus diseases differ so much as to make identification by inspection alone untrustworthy. Even a difference in the mode of infection may make a considerable difference in the appearance of the disease.

The most baffling difficulty encountered in some cases, however, is the tendency of the viruses themselves to change, especially when the disease has been transferred from one plant to another of a different species or variety. These changes in some instances seem to be permanent.

The virus diseases with which Mr. Smith has been dealing are caused by organisms (if they are organisms) too small to be seen with even the highest powers of the microscope. Whatever the causal bodies may be, they can pass through the pores of a fine-grained porcelain filter; whence their name, filterable viruses.

Plant Made a Hinge

What happened to a plant when it is turned into a hinge was investigated by Prof. P. Jaccard, of Zurich. He arranged an apparatus that bent plants back and forth at intervals from a minute to a day. Afterwards he dissected the plants and studied their structure. He found tissues that ordinarily were woody remained unhardened and that the normally woody parts elsewhere were modified in shape and position to meet the new conditions.

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The ponderous stone temples and palaces built by the Incas in Peru had roofs of thatch.

Recent excavations in Crete have revealed remains of houses, their painted stucco pavements and stairways still brilliantly colored, and many of the household articles still among the ruins.