SCIENCE NEWS

Science Service, Washington, D. C.

PAPERS READ BEFORE THE SIXTH INTERNATIONAL BOTANICAL CONGRESS

SIR E. JOHN RUSSELL, director of the Rothamsted Experimental Station at Harpenden, England, speaking before the Sixth International Botanical Congress, called attention to the fact that plants, constantly sucking upward the water that trickles and oozes downward through the ground, profoundly affect the character of the soil in which they grow. In the eastern part of England the water drainage through cultivated soils is only about half that through uncultivated soils. The whole nature of the soil is affected, and the marked differences between feebly and strongly leached-out soils turn very largely on the intensity of action of plant roots in removing the soil water. Associated with this removal of water is also a transfer of mineral substances and nitrates from the subsoil to the aerial parts of the plant. Calcium, potassium and silica in particular are lifted in quantity to the leaves and stems: when the plants die they fall back on the surface of the soil. The details vary with individual plants, and in the end striking differences may result. The general result is, however, that this process counteracts the washing down by the rainfall, and it confers upon the soils of mild humid countries one of their characteristic properties that the upper layer tends to be richer in calcium and potassium and to be more nearly neutral than the lower layers. These characters are of profound ecological significance and react greatly upon the vegetation. The plant roots evolve considerable amounts of carbonic acid. This evolution of carbon dioxide is of special importance in dry regions where soils tend to be alkaline, for it offers the possibility of reducing the alkalinity and so profoundly changing the vegetation. Experiments are being tried in various regions to find crops which by evolving large amounts of carbon dioxide from their roots, can be used for the reclamation of alkali soils. Plants also exercise marked influence on each other through their roots. The legumes, or plants of the pea-bean-clover family, not only obtain nitrogen for their own needs through the activities of the bacteria that live in their root nodules, but also excrete it and make it available for other plants. On the other hand, several British investigators have conducted experiments, in which drainage through the perforated bottoms of trays in which plants were growing was permitted to flow over the roots of other plants. The latter were unfavorably affected, either through poisons formed by the roots in the trays, or through their absorption of all available nitrates, or through some combination action resulting finally in a nitrogen poverty. The importance of roots in other connections was also pointed out: weed competition, crop rotations, and the final conversion of dead roots into soil humus.

THE sociology of American plant life in prairies, forests and mountains, was described by Professor H. S. Conard, of Grinnell College. In America, as everywhere in the world, regional differences in climate, soil and other conditions find expression quite as much in plant communities as they do in the cities and states of human beings. Long grass is as natural to Iowa-Nebraska prairies as are farmers raising corn and hogs. Short grass belongs to Montana and Wyoming quite as inevitably as cattlemen. Beech-maple-hemlock forests are as true a sociological expression of Michigan and northern Ohio as are automobile and tire manufacturers. But these plant societies are no more completely uniform than are human societies. There are plenty of local and even individual differences within the broad frame of a general regional type. Groves of bur oak are as truly a part of the prairies as are the wider stretches of long grass, and in the Eastern forests one will find plenty of places where the dominating trees give way to such things as white pines or tulip trees. Moreover, there are plenty of ''strangers'' that get into seemingly unaccountable places. Thus, far up into the prairies southeastern trees, such as the Kentucky coffee tree, can be found. Or, on Hempstead Plain on Long Island, there are wild grasses, legumes and other plants that are atmospherically ''Western.'' Such seeming aliens can usually be accounted for. The plants from the Southeast that have wandered out into the prairies have followed the moist, rich, sheltered lands that line the stream courses. Such plants are fairly common in the eastern prairies of Illinois and eastern Iowa; in western Iowa and central Nebraska they become rare. The ''Westerns'' that crop up in the East are usually found on extremely porous soil, which permits the heavier rains of the region to drain right through, producing a set of moisture conditions resembling those of the drier prairies or even the plains. One should not speak of these local ''foreign'' plant societies as ''detached fragments'' of East or West. They should be frankly recognized as outliers, as true foreigners, which have kept their own identity but which do not really color the communities into which they have for one reason or another found their way.

THE possibility was suggested of fighting the fungus diseases that now devastate crops by sowing or spraying the germs of counter-diseases. The suggestions came from research laboratories in widely separated parts of the world. Dr. S. D. Garrett, of the University of London, who carried on his studies in Australia on a destructive wheat disease called ''take-all,'' found in certain types of soils a complex of fungi and other obscure organisms useful in combatting the disease. From the University Farm, St. Paul, Minn., Miss Delia E. Johnson reported the antagonism of a newly discovered species of bacterium against the smut diseases of corn and various small grains. A most comprehensive study in the field of microbiological antagonisms was presented by Professor S. Endô, of the University of Tokyo. He has examined dozens of kinds of bacteria and molds for their effects on several different disease-causing microorganisms. Some he has found to be decidedly depressing, others less so; a fair number completely lethal. It may be that bacteriologists and plant pathologists are ready to take a leaf out of the book of the entomologists, who long ago learned to fight enemy insects by turning their own insect enemies loose upon them.

EVOLUTION appears to be at its most active state in producing new varieties of plant diseases affecting grain crops. What one species of smut fungus can do in the way of producing new strains was outlined by Professor E. C. Stakman, of the University of Minnesota. He described a research project in which a single reproductive cell of this smut fungus was isolated and its offspring propagated in the laboratory. Within a few months there were 162 distinct physiological strains of this one fungus from the single-celled start. These physiological strains of plant-disease fungi are the more difficult to deal with because within a given species they all look alike. They are different only in their behavior. Thus, there is one well-known variety of stem-rust of grain that attacks wheat and barley but not rye and oats, another that attacks rye and barley but not wheat and oats, and still another that attacks oats but none of the other small grains. Under the microscope they all look exactly the same. The multiplication of fungus varieties that occurred with the smut specimen in the laboratory is duplicated thousands of times over in the field. Many new varieties rise by hybridization through sexual crossing of existing varieties, but others occur without interbreeding, through the "straight evolution" process of mutation or "sporting." There is an endless race between the plant breeder and the natural new origin of these plant diseases. The breeder will carefully produce a new crop variety that is resistant to all known diseases—only to have a newly originated disease attack it.

YOUNG plants, cut down and buried in the soil as fertilizer, decay much more quickly than older plants of the same kinds do. This was one of the points discussed by Dr. Selman A. Waksman of the New Jersey Agricultural Experiment Station. In these experiments a number of plants were cut at different stages of growth and definite amounts allowed to undergo decomposition by microorganisms, under identical conditions. Of the young plants, 73 per cent. of their material was decomposed in thirty days, while it took sixty days to decompose only 42 per cent. of the material of older plants. One of the reasons for the difference in decomposition rate is the marked difference in the chemical make-up of older and younger plants. The older plants contain higher proportions of more resistant materials, especially the celluloses and lignins. The latter substances, which are the basis of the "woodiness" of wood, are exceedingly difficult for bacteria, fungi and other microorganisms to digest. Moreover, there is a difference between the lignins of old and young plants; in the younger stages the lignins are chemically "tenderer" and easier to break down. Differences in humus formation in the soil are traceable not only to differences in the plant materials that are decomposed but also in the living agents of decay, the bacteria, molds, protozoa and other microscopic forms. Insects, worms and other larger animals that feed on dead wood and leaves also aid by chewing them into more manageable morsels for the smaller creatures. The relative abundance of these microorganisms is influenced partly by the nature of the dead plant materials themselves, for some of them like wood, others straw, still others dead leaves; and also by such factors as temperature, moisture, soil ventilation and soil acidity or alkalinity.

WEEDS in a farmer's pasture may be an indication that he does not have the right kind of animals in it. Frequently one kind of farm animal will eat plants rejected by others. Observations of animal feeding habits and the selection of stock that will clean up a particular weed species will aid toward the solution of a weed problem. This suggestion was offered by Dr. Winifred E. Brenchley, of the Rothamsted Experimental Station, Harpenden, England. Dr. Brenchley has observed, in English pastures, that cattle will eat bracken-fern but will not touch broom-weed, while sheep like broom but will not eat bracken. To blanket the pasture-weed problem, Dr. Brenchley recommended running horses, cattle and sheep in the same enclosure. Weeds that can stand up against their combined preferences must be voted hopeless.

GREAT BRITAIN presents a peculiar picture to the student of plant life: a relatively limited assortment of plant species, but a wide variety of climatic and soil conditions, according to Professor A. S. Watt, of the University of Cambridge. These circumstances give rise to some rather unique situations. Since there are fewer plant species, there is a tendency for each one to spread out more. In other lands, especially in the botanically rich North American region, keen competition between species holds each one very close to the habitat it can occupy to the very best advantage. In Great Britain, on the contrary, each species tends to be limited only by climatic and soil conditions, rather than by the competition of its fellow-plants. The great variety of British climate, in a comparatively small area, has brought into close contact species usually thought of as belonging to widely separated regions. In the British Isles plants of Mediterranean affinities rub elbows with almost-Arctic species, and plants that thrive best in damp island climates are found growing close to others that are more characteristic of drier inland countries. The sharp contrast between the soil types of western and eastern parts of the islands tends to accentuate the effects of the climate. At the same session of the Congress Professor J. Braun-Blanquet, of the University of Montpellier, France, compared the principal vegetational types of northwestern Europe with those of northeastern North America. He found striking resemblances between the two regions, both in the kinds of plants that inhabit them and in the soil types on which the vegetations grow.

CALIFORNIA has a whole chain of "plant orphanages," where species of plants are found in limited areas and nowhere else in the world. These were described by Professor W. L. Jepson, of the University of California. All the endemic, or orphan plant, areas were once islands but some of them are now mountains rising up to 6,000 feet in altitude. The original flora of the geologically-ancient islands has been taken for a gradual slow ride upward without apparently being changed thereby. Of more than 5,000 species of higher plants in the state of California some 2,000 of them are of endemic, or "orphan," types. To show how widely varied is the flora of California it may be recalled that in the whole northeastern quarter of the United States there are only 3,500 species of higher plants altogether. Since the days when Darwin and Wallace popularized the idea of evolution, the rôle of island isolation in enabling new species to develop has been taken as an axiom among students of the life sciences. Here, then, is an ideal situation for the development of large numbers of unique and solitary species of plants. Many of the areas would not now impress the casual observer as former islands. Some of them are rather lofty mountains. In certain instances these endemic-bearing areas have been elevated from 1,000 to 6,000 feet, carrying their plants with them. And the plants, curiously enough, seem to have been changed relatively little by their slow ride high into the air.

X-RAYING plants to produce hereditary changes in their offspring is not limited in its effects to what happens in the immediate outcome. An x-rayed plant may produce offspring with new peculiarities, such as changed leaf-size or flower-color, which will duly appear in subsequent generations. But these generations may also begin to produce other changes, even without being x-rayed themselves. Changes of this character, and an explanation for them, were described by Professor T. H. Goodspeed, of the University of California, one of the pioneers in the field of x-ray genetics. While the details of the process are highly technical, the essential fact underlying the three types of cellular change is a state of instability, of continuing change, induced in the chromosomes by the first impact of the x-ray bombardment.

MOUNTAINS in mid-Sahara are not the sun-baked piles of barren rock which popular imagination, fed by Hollywood versions of the Foreign Legion, has pictured them. They manage somehow to gather enough moisture to support vegetation, even a growth of trees. Professor René Maire, of the University of Algiers, told of his explorations in what is probably the least-known botanical region of the world, the high mountains of central and southern Sahara, which rise to heights of 6,500 to 10,000 feet. Earlier travelers' tales had clothed them with "forests" of pistachio and cypress pine, trees unknown in the New World. Under the more critical botanical eye of Professor Maire, these forests dwindled to a thinner growth, mostly of pistachio and a kind of desert cypress. He did not deny, however, that denser forest growth may once have existed there, in a bygone age when the Sahara itself was a grassland instead of a desert. Among the trees, and above them on the treeless mountain-tops, were lower growths of shrubs. Prominent among them the exploring botanist found a bush botanically related to the sagebrush of western North America. In general, Professor Maire stated, the vegetation of these mountains has been derived from that of the shores of the Mediterranean.

ITEMS

THE increasing magnitude of chemical research is the latest sign pointing to improved economic conditions. Professor E. J. Crane, of Ohio State University, head of the international reporting system of the American Chemical Society, announced that during the first six months of 1935 the number of research projects completed was ten per cent. greater than in the first half of 1934. Abstracts of chemical reports from all parts of the world numbered 20,342 this year as compared to 18,664 during the first six months last year. A staff of 400 men scattered over the globe is required to keep the abstracts of chemical research up to date.

FLUORESCENT light, the luminescence given off by plants when they are subjected to ultra-violet and certain other kinds of rays, may yield a clue to the still unsolved riddle of how plants capture and use sunlight in making their own food out of water and carbon dioxide. This was the suggestion laid before the American Chemical Society by Dr. James Franck, German physicist, who shared in the Nobel Prize for physics in 1925. A plant's food-making activity and its fluorescence, Dr. Franck pointed out, are inversely proportional to each other. The greater the amount of sun-energy plants re-emit as light, the less they have to use in the tiny food-factories in their green cells.

PROFESSOR R. NORRIS SHREVE and M. W. Swaney, of Purdue University, have tied mercury to what chemists know as the pyrrol ring, a relatively simple organic hookup somewhat resembling benzol in composition. They find that their mercury-pyrrol compounds are highly effective in their germ-killing power, and that they have the advantage over mercury-benzol compounds of being more easily soluble in water and other fluids in common use as germicide solvents.

FOSSIL insects by the thousand have been found in a sandstone stratum near the mouth of the Mezer River, on the Arctic coast of the U. S. S. R. The remains of wings constitute the majority of the fossils, but casts of bodies are abundant also, and there are a few plant fossils as well. Professor A. G. Marynov, a leading Russian entomologist, has made a partial study of the specimens, and states that all Paleozoic families of insects are represented. The sandstone layer has been identified as of Permian date, that is, of the age immediately following the great Coal Age. Insect-bearing deposits of similar age have been found in Kansas, in the United States. Most abundant among the fossils are primitive cockroaches. Early forms of grasshoppers, dragonflies, scorpion flies and other primitive insect orders are also well represented. Entomologists regard the few small beetles present as of especial interest. Several entirely new fossil species have already been identified. An expedition of the Russian Academy of Sciences is at present in the region making further studies and collections.