Explains Development of Plant Disease

Botany

The following reports illuminate some of the highlights of papers presented at the sessions on botany, plant pathology, forestry and allied sciences at the meeting of the American Association for the Advancement of Science.

The involved sex life of the rust diseases of plants, some varieties of which cause millions of dollars' worth of damage to grain crops, was the subject of discussion by Dr. J. H. Craigie of the Dominion Experimental Farms, Winnipeg.

A rust fungus has a complex life history. Each spore cell that carries its life through the winter sends out a little thread, which divides on the end and produces just four new spores. These first spring spores drift on the wind to young leaves—in the case of wheat rust, to barberry leaves—and there sprout and take hold. They produce little spots of growth, called pustules. If a pustule grows on a leaf by itself it produces no new spores; but two, growing side by side, often coalesce in what appears to be a true case of vegetable mating, and a cluster-cup of a third type of spores appears, which are the reproductive bodies that carry the fungus back to the wheat or other host.

These cluster-cups always grow on the under side of the leaf. Directly above them, on the opposite surface, grow other diseased spots, producing tiny spore-like cells whose function has never been discovered, together with a nectar-like secretion. Dr. Craigie has taken drops of this nectar and inoculated them into the young cluster-cups, with the result of greatly increasing the rate of reproduction in them. This is the first hint botanists have gained that these upper-surface spots have any significance at all in the life of the fungus.

By exceedingly delicate miscroscopic manipulation, Dr. Craigie has been able to separate out and plant where he pleased each of the four first spring spores of two different species of rusts. He finds that each of these sets of quadruplets seems to pair off into two "male" and two "female" spores; except that because they can not be told apart by looking at them they are called merely "minus" and "plus." Pustules developing from spores of opposite sign developed cluster-cups when they fused, strong evidence that even in so reduced an organism as this parasitic mould genuine sex has been retained.

Flax Poisons Fungus

Flax attacked by a fungus disease forms a substance in its sap poisonous to the fungus, somewhat as a man attacked by a bacterial disease forms in his blood a substance that will drive out the bacteria or at least render their toxins harmless. Experiments demonstrating this internal chemical warfare of plants were described before the physiological section of the Botanical Society by Dr. Ernest S. Reynolds, of Washington University, St. Louis.

Dr. Reynolds has extracted from the sap of flax plants a substance which will prevent the growth of fungi, especially of the fungus causing the serious flax wilt disease. When much diluted, it seems to act as a stimulant to the growth of the fungus, but in the concentration in which it occurs in normal sap it wholly inhibits the parasitic growth. Chemical analysis shows the substance, whose exact composition is still unknown, to contain the deadly cyanogen combination.

Plants Want Full Light

The full white light of day, without any tinkering or subtractions, is what plants can do their best work on, Dr. Hardy L. Shirley of the Boyce Thompson Institute for Plant Research has discovered. He grew buckwheat, sunflowers and a couple of species of weeds under various conditions of light and shade, and under colored panes of glass that cut out certain parts of the solar spectrum. Some plants liked to be partly shaded, as they showed by their response in making stem and leaf substance; but they all preferred white light to any fractionated product. Where they had to do without part of their light, they were better off without the red end of the spectrum than without the blue.

Dr. Shirley also told his fellow plant scientists about a new instrument he has devised for the measurement of natural light in the field, always a difficult undertaking. By soldering together many turns of two different kinds of wire he produces an instrument that converts the radiant energy of the sun into a minute electrical current, which may be measured directly with a microammeter. The whole set may be assembled at a cost of from $50 to $100, weighs only a few pounds, and is sufficiently rugged to stand the handling of ordinary field travel.

Boston Fern a Hybrid

The Boston Fern, the tough and hardy houseplant that will live even in a modern apartment, owes its vigor to the same process that has successively made great the human strains of Rome, Allemagne, Spain, France, Britain and America—hybridization. Its strong and prolific growth, enabling it to live under conditions no other fern is able to endure, are evidences of that quality with which horticulturists conjure but which they nevertheless as yet understand but little, called hybrid vigor.

The Boston Fern has always been considered a mutation, or "sport", of a non-hardy tropical fern, Prof. Edward C. Jeffrey of Harvard University today told the Botanical Society. But he has lately been making a close study of the minute structure of the cells of this fern, and he has found that "while its tropical forebear is quite normal in the organization of its cells, the structural details of the nuclei in the Boston Fern indicate clearly that it has originated by the crossing of its tropical parent with some other species, as yet unknown.

"The Boston Fern presents an interesting parallel to other hybrids of tropical origin which are able to flourish in cold climates," Prof Jeffrey continued. "The Dahlias and the Cannas are both characteristically tropical but in their numerous hybrid forms can be cultivated far beyond the tropics. It is thus clear that a great future for horticulture may lie in the direction of experimental crossing of forms which are unsuited to particular conditions. The results of such crosses may obviously be of greater value in practical horticulture than either of their parents."

Anesthetics Don't Affect Plant

The sensitive plant, which seems more "human" than other vegetables because of the quickness with which it responds to a touch, is not human at all in its responses to various anesthetics which easily put us to sleep, such as chloroform, ethylene or nitrous oxid. Ether alone has a strong effect on it, Dr. Raymond H. Wallace of Columbia University told members of the Botanical Society. Exposed to a 13 to 15 per cent. concen- (*Turn to next page*)

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tration of ether vapor the sensitive plant would not "go to sleep" when touched or shaken; or, if exposed after it had lowered its leaves, would not "wake up" again after the usual interval of quiet. But to other common anesthetics, even in strong concentration, the plant remained nearly indifferent, responding to stimuli almost as though it were surrounded with nothing but ordinary air.

Plant Poison in Walnuts

Penta-hydroxy-alpha - naphtha - quinone. That is the exact name, outlining for the understanding of organic chemists the exact structure of the stuff in walnut trees that keeps the ground under them bare of plant life. The tracing of this walnut poison to its chemical lair was described before the physiological section of the Botanical Society of America by Everett T. Davis of the Virginia Agricultural Experiment Station.

The antagonism of walnut trees to other forms of plant life has long been noted by farmers as well as botanists. It was supposed that the trees poisoned the other plants, but nothing was really known of the nature of the substance until the Virginia researcher extracted and purified it. Having got the natural substance, he proceeded, after the manner of organic chemists, to make a synthetic duplicate of it. This artificial product proved to be just as poisonous to plants as its natural prototype.

Because the full descriptive chemical name is a bit cumbersome, Mr. Davis sought a shorter one for common use. The botanical name for the walnut is *Juglans,* so he called the newly discovered chemical "juglone."

Elms From China

Elms from China are brightening the farms of Kansas and giving relief to the one-time level monotony of the wind-blown plains of the West, Dr. Frank C. Gates, of the Kansas State Agricultural College, told the Botanical Society of America. West of the rolling prairie region the climate is too severe and droughty for the successful growth of the American elm, favorite street and yard tree in eastern states ever since Colonial times. But three species of Asiatic elms have shown their ability to withstand the hot droughty summers and the long, dry winters of the West. The best of the three, known to botanists as *Ulmus pumila,* reaches a height of 60 feet and a trunk diameter of a foot under average Kansas conditions.

Value of Pastures

The net income from pasture land exceeds the returns from crop land, according to Dr. E. G. Misner, professor of farm management at Cornell University.

Outstanding economic importance of our pastures as a cheap source of feed for cattle was emphasized by Dr. Misner, who said that the cost of feeding a cow on pasture is only 25 per cent. of the cost in winter. Records kept in one of the best diary regions of New York for five years showed that the value of milk produced in winter did not pay for the feed used, to say nothing of other costs. In summer the value of milk exceeded all of the costs, but this still did not mak up for the winter losses.

Transportation of cattle feed is expensive enough, so that farmers should realize the economic soundness of improving their pasture lands, cleaning up the land, spreading manure, and then using lime and super-phosphate, he pointed out.

Cucumber Needs No Pollination

A new hybrid variety of cucumber, which will set fruits and grow them to market size without having the flowers pollinated, was described by Prof. Richard Wellington and Leslie K. Hawthorn of the New York State Agricultural Experiment Station. Most cucumbers must have their flowers visited by insects before they will set fruit, and the crop is made to depend on the state of the weather when the flowers are in bloom. Varieties such as the one presented, it was pointed out, will yield a much more certain crop.

Sparks Start Forest Fires

Though not so prolific a cause of forest disaster as the careless camper's fire or tossed-away match or cigarette-butt, sparks from logging and railway engines start many forests fires and should therefore be investigated with a view to their prevention, according to Prof. A. C. Coonradt of New York University.

These destructive seeds of fire, Prof. Coonradt stated, are sown from two chief sources: smokestacks, and the ash-pits in the bowels of the engines. Which of the two is the more prolific in causing mischief has not yet been determined; but since both are trouble-makers both must be taken in hand. There are many good spark-preventing devices, the speaker said, but while they work well when they are new they eventually get out of order and the tendency is to let them stay that way. Efforts to obtain more nearly fool-proof machinery must be continued, for stringent regulations are looked on askance by men of the woods, and are likely to be shrugged aside when the inspector is not looking.

The oil-burning locomotive, hailed as a cure for spark trouble where oil is cheap enough to justify its use, has not been as great a success as was at first hoped, Prof. Coonradt said. Sheets of unburned carbon tend to accumulate in the flue, and then to get projected into the air like shots when the engine is puffing hard; and these are most dangerous carriers of fire.

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In the 15 years between 1851 and 1866, the floods which altered the course of the Yellow River of China took the lives of more than 30,000,000 people through drowning or malnutrition.