

In spring the dark spores germinate and give rise to another form of simple spores (*Sporidia*) formed at the ends of threads growing from each cell of the black spores. (See Fig. 3.) These (*Sporidia*), when they reach the leaves of the barberry shrub, germinate, enter the leaf and soon give rise on the underside to masses of cup-like structures, in which are produced innumerable round golden-colored spores, (*Aecidium*) (see fig. 4) which will produce a vegetative growth only when they germinate on the wheat or some closely allied plant. They then give rise to the condition referred to as "rust." Thus we see in the rust plant a very complicated life history, there being no less than four kinds of spores

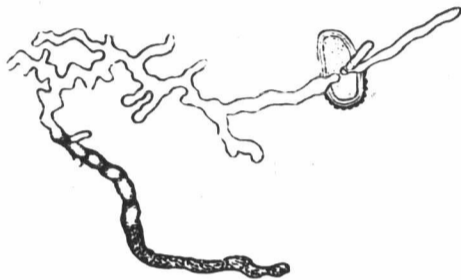


FIG. 5.—A germinating spore uredo fourteen hours after it was shed.

produced, *Uredo*, *Teleuto*, *Sporidia*, and *Aecidium*, which for convenience we might name summer, winter and spring, spring referring to the last two. Two grow on the wheat plant, upon the stalks (*Uredo* and *Teleuto*), one in spring on stubble or fragments of straw (*Sporidia*), and one on the leaves of the barberry (*Aecidium*).

From extensive inquiries into the presence and cause of rust, the following conclusions have been reached:—

1. Seasons are the chief cause of rust. Sudden changes of temperature and rain, accompanied with close still weather are favorable.
2. Low-lying rich soils are most subject to attack.
3. Excessive use of manures rich in nitrogen encourage rust.
4. Late sown grain is liable to attack.
5. Thinly sown crops seem liable to injury.
6. Red wheats are less affected than white varieties.

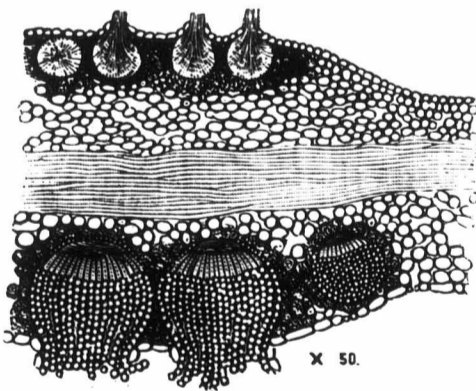


FIG. 6.—Section through Barberry Leaf showing *Aecidia* below.

7. Rust is more common in the vicinity of barberry hedges than at a distance.

To protect ourselves against this foe we should, as far as possible, avoid the conditions favorable to its growth; by doing this we are following in the line of practical and theoretical teaching, and may reasonably expect favorable results.

The question has frequently been raised, "Is the barberry shrub to be blamed for all the rust?" In answer to this several views have been set forward.

1. The *Uredo* spores may be carried over the winter months upon plants that do not perish like wheat at the close of the season, e. g., couch grass, etc.

2. *Sporidia* may germinate on wheat without the intervention of another plant. This has been done in the laboratory.

3. *Sporidia* may develop on other plants than the barberry.

However, it does seem that a sufficient case has been made out against the barberry, as a hedge plant in the neighborhood of wheat fields. We may reasonably expect that other sources than this shrub will be found, but in the meantime farmers are acting in harmony with the teachings of science in using it no longer as a hedge plant.

Application of Chemistry and Geology to Agriculture.

BY JAMES MILLER.

(Continued from September issue.)

OXYGEN—ITS PROPERTIES AND RELATIONS TO VEGETABLE LIFE.

Oxygen is the most wonderful and important of all the elementary substances. We are only acquainted with it in a gaseous or aeriform state. It is readily obtained by heating in glass retorts the red oxide of mercury of the shops, or a white salt known by the name of chlorate of potash. Without assistance we cannot perceive it from common air; it is without taste, color, or smell. It exists in the free (uncombined) state in the atmosphere we breathe, but there is no way we can obtain it pure except from some of its compounds. Oxygen is a recent discovery, being discovered by Dr. Priestly in 1774. Many metals unite readily with oxygen, forming compounds (oxides) which, when heated again, separate into their ingredients, and thus pure oxygen is formed. Oxygen in its pure state has a deadly effect on animals and vegetable life. When a living animal or plant is placed in a large vessel containing pure oxygen the rapidity of the circulation is increased, all the living functions are stimulated and excited, fever comes on, and in a short time life becomes extinct. It exists in the atmosphere to the amount of about one-fifth of the whole, and this state is necessary to the existence of animals and plants and to the support of combustion on the earth's surface. It exists largely in water, containing eight-ninths of the whole.

The quantity stored up in the solid rocks is still more remarkable. It forms one-third of the soils and rocks, as well as of all the plants and animals that exist upon the globe, known to us, as I have already said, in the form of a gas. In fact there are not many compound substances occurring in nature into which oxygen does not enter as a necessary ingredient, and it is a remarkable work of our Creator that this element should constitute the means by which all animal and plant life depends, and nothing less than wonderful, that a substance which we know only in the state of thin air should by some wonderful mechanism be bound up and imprisoned in such vast stores in the solid mountains of the earth, be destined to pervade and refresh all nature in the form of water, and to beautify and adorn the earth in the solid parts of animals and plants. Again, all nature is full of such wonders, and every step you take in the study of the principles of the art by which we live, you will not fail to perceive the united skill and bounty of the same originator.

Oxygen gas is heavier than common air in the proportion of about eleven to ten. One hundred measures of water dissolves six and one-half parts of this gas. (According to Dr. Henry, one hundred parts of water absorb only three and one-half parts of oxygen.) All kinds of water always contain a certain portion of oxygen, as they pass through the soil administering to the growth and nourishment of plants in various ways which will be explained further on.

[TO BE CONTINUED.]

A Speech by Ontario's Minister of Agriculture.

On a recent occasion, when speaking before a large number of leading farmers and breeders, the Hon. John Dryden expressed himself in the following characteristic speech:—

It is very gratifying indeed to anyone who undertakes new duties and assumes new responsibilities to be able to realize that he has the sympathy and hearty co-operation of those in whose interests he labors. The Legislature to which I have had the honor of belonging so long is composed of able men, chosen from different classes of the community, and I think we may fairly say that they represent all classes. But I have this to say to you—the Legislature will be all the better for being watched. The members will be able to perform their duties all the better if they are able to listen to the free and frank expression of opinion of those who sent them there. I believe that our Legislatures are largely what we make them, and if the people speak out their views will be listened to by those who represent them. A statesman in England once, sitting with other gentlemen at the festive board, was asked what he considered the great object of legislation. He replied that the great object was to bring about the greatest good to the greatest number. When asked what he regarded as the greatest number, he replied, "Number One." I am afraid that some of us are sometimes disposed to think that the legislation is carried on with that idea. Speaking for myself, if the doctrine of Number One is to be accepted, I want to associate with myself the thousands of farmers we have in Ontario. I am sure that no position in which I am placed will ever separate me from the farmers with whom I have been associated ever since I reached manhood. I have lived among the farmers all my life, and I expect to live among them and to be known as a plain, practical farmer. I think I know something of their needs. I think I know something of the difficulties they meet in fighting life's battle. I think I know something of the value of the industry they represent in this country, and I am sure, in the position to which I have just been called it will be my highest ambition and earnest effort to do what can be done to assist men all over the country to produce the best quality and greatest quantity of the products of the soil. No one born in this country or intending to make this his home could go from department to department of the last Toronto exhibition without feeling instinctively an emotion of pride at what has been done. Not one of us would feel like holding down his head with shame at the display. We are proud to show out exhibits to those coming from any other country, whether Britain, the United States, France or elsewhere. We are proud of the products that were shown at Toronto, and those products, I am bound to say, express fairly the best efforts of some of our best men following agricultural pursuits in this country. But some of us feel that we would be rejoiced all the more were we able to realize that the average product of our country came fairly up to what we saw there. I think what we ought to aim at in this country is to so educate our farmers that the great mass of them will be able to come up somewhat to what we see at exhibitions. I am of those who believe in a man in any pursuit having an ideal—some high purpose and object. A man may achieve a little temporary success by accident, but to continue in a successful course he must have some ideal before him. Where are the mass of our people to get their ideals? I say largely they must get them at the exhibitions. The man who goes to the exhibition cattle shed or the horse ring or among the grain or vegetables will be able to see what his ideal ought to be, and will be able to copy it. The difficulty is that a great many people say, "That is well enough for these men, but I can never accomplish the same." I would like to inspire our young men who are following agriculture with the idea that what one man has done he, under like circumstances, can do also. Let us have ambition to excel in these matters, and so educate the farmer that the bulk of our products will fairly equal those which we see represented