

are many sorts, and many shapes, as for example, *mildew* (*Uredo Carbo*, *Ustilago*) which attacks oats, barley, Indian corn, devouring stalk, leaves, and glumes; *Uredo caries*, which feeds on the ear of the wheat, and the *rust*, properly so called (*Uredo rubigo vera*) which attacks all grain, but more especially devotes itself to the wheat-plant.

*Ergot*, most abundant on rye and rye-grass (*Lolium perenne*), is simply the stem (*mycelion*) of a fungus (*secleratum*) which develops itself on the flower of the plant. The cause of the rotting of the potatoes is another, the *Botrytis*, but I do not intend to carry my excursus further than the *rust*



Fig. 3.



Fig. 4.

proper, for the history of one of these fungi is, with hardly an exception, the history of the whole family; the remedy for one answers against the rest.

Mr. l'abbé Provancher, in his *Flora Canadensis*, page 754, has given so good a description of the genus that I am tempted to borrow it: "The numerous fungi of this genus," says the learned abbé, "are all developed in the *parenchyma* (tissue) of living *phanerogamous* plants (those in which *stamens* and *pistils* are visible), and particularly in the *graminaceæ* (*grain*, *grass*, wheat oats, &c., and the grasses proper). Simpler even, than the *truffle*, which has neither stem, nor root, fruit nor flower, they want every sort of filament except those which constitute the *spores* which reproduce them. Thus, each spore is a perfect individual plant, since although they are massed together in great numbers, they have no connection with each other. The following description of the manner of their reproduction may be trusted, as it is the fruit of long and serious investigation: Each microscopic spore or globule, which composes the *dust*, so to speak, of these fungi, when, buried in the ground it meets with the necessary condition of heat and moisture, swells to twice its size, and thrusts out a filament or tubercle five or six times the length of its diameter. The tubercle then divides at its end into six, eight, or even ten branches, sometimes *sessile*, sometimes *pedunculate*, which soon show *articulations*, or, rather, infinitely small internal berries, and the

intended for the support of the grain, or in diverting the sap from its ordinary course, the fungi constitute a real state of disease for the plant, and frequently cause its death."

Rust, then, is a fungus whose seed, scientifically called spores, falls to the ground in the form of dust, and remaining hidden there until it finds its way into the plants, is nourished at their expense, and frequently repays its nurse by bringing it to destruction. The fungus often, carried along by the air, settles on the exterior of the plant itself, and aided by a moist state of the atmosphere, attaches itself irremovably there.

To make my readers more thoroughly understand the nature and mode of growth of the rust, let us examine, closely, the engraving which accompany this article. Fig. 1 shows one of the spores which has just deposited itself in a wrinkle in a stalk of wheat. In fig. 2, is shown the condition of this spore 48 hours after its deposition. The warmer and moister the air, the more rapid the growth of the fungus. Fig 3, at *a*, displays a group of fungi bursting through the epidermis (envelope) of a wheat-straw. At *b* and *c*, the same engraving shows a capsule containing spores, one of the wheat-rust, the other of the rust affecting the oat. These capsules are magnified 800 times.

It is these cells which cause the reddish-brown dust which covers wheat attacked in its green state by rust; and the dust is woefully visible when the said wheat is undergoing the process of threshing. In fig. 4, is shown the progress of the rust, after the death of the straw which supports it; and its later appearance, when the straw begins to rot, is depicted in fig 5. Lastly, fig. 6 shows the rust at maturity: the pods of the fungus contain, each, myriads of spores or seeds. In all these engravings, the different parts represented are, of course, greatly magnified.

It takes the rust about six weeks, from the middle of June to the end of July, to pass through all the changes we have described.

In the propagation of the rust fungus, that which attacks wheat differs from that which attacks oats in the form of the spores, in fact, they are never alike on any two sorts of plants; whence, some botanists conclude that the fungi belong to different species, whilst others think that the form of each is modified by the nourishment it finds. This point is not clear. That the rust can hardly, if at all, attack successfully a strong, healthy plant, because its tiny root cannot pierce the strong, thick epidermis, is a very reasonable conjecture, and leads us to the study of the means of combating the parasite we are discussing.

If we examine the epidermis of wheat, barley, oats, and other plants of the same order, we shall find it to consist of a sort of glassy substance. This glass is composed of *silica* or sand, with, as a base, potash, soda, lime, &c., according to the character of the soil on which the plant in question grows, and these alkalis form with the *silicic acid* matters that are called *silicates*. So we may conclude that the soils must contain a fit proportion of alkalis and silicic acid to form a proper envelope for the plant against the attacks of the rust.

We now begin to see that where land is troubled with the rust, it is not a highly nitrogenous manure that is wanted, so much as a dose of silica or sand, or of alkalis, which may be added by means of a dressing of clay. Experiments have proved that these dressings have banished the rust, or at least minimized its ravages, on land which had been previously rendered almost useless by the attacks of the parasite. Salt has frequently been recommended as a manure, but I must say I have little faith in it ("I have none at all" A. R. J. F.). Still, where there are little few alkalis in the

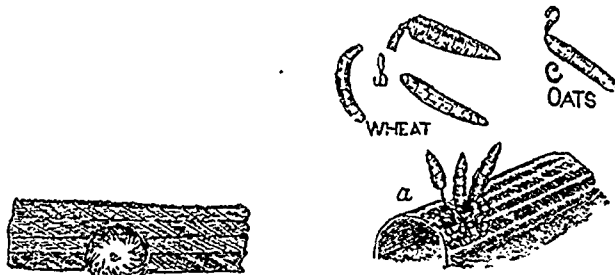


Fig. 5.

Part of Fig. 4

globules ultimately fade and die. If, at the moment when the branches of the spore divide into berries, they happen to come in contact with germinating grains, or even with the extremities (*spongioles*) of the roots, the berries absorbed by the juices flow with them through the capillary tubes of the plant, until they find conditions favourable to their development, when they oblige the *epidermis* to give them entrance, and show themselves, externally, in the form of yellow, brown, or black patches. In absorbing the nourishment