

### A Study of Fungi—Bacteria, Rusts, and Mildews—Prevention and Remedies.

There are numerous microscopic plants embraced under the name of fungi, which differ very much in their structure, their methods of reproduction and nutrition, and their habits of life. It is little use to say that a certain affection in a plant is caused by a fungus, for there are many varieties, each requiring separate treatment.

Fungi are divided into three groups, viz., Saprophytes, Parasites and Parasite-Saprophytes. Saprophytic fungi are those which feed on dead or decaying vegetable matter, such as moulds, toadstools, puff-balls, etc. They never feed on living tissue, so that the growers of healthy trees need not take alarm. They abound in decaying timber.

Parasitic fungi, on the other hand, feed on the living tissue of plants and animals, penetrating it and appropriating its nutrient juices, lowering the vitality of the plants or animals on which they live, or causing their death. The parasite dies with the host on which it feeds, and there the life of the saprophyte begins.

The Parasitic Saprophytic fungi are saprophytic in habit, also more or less parasitic. They attack weakened tissue, hastening its decay, and then feed on the decomposing mass. They sometimes attack apparently healthy cells, and should be regarded as a source of alarm. The destructive fungi are classified by their modes of reproduction, and may sometimes be identified by examining a single spore.

1. BACTERIA.—These are practically the lowest in the scale of the fungi families, and are probably the minutest of living organisms. All bacteria are not harmful; it is they which cause the decomposition of vegetable substances, changing organic matter to nitric acid—an essential ingredient of plant food. They are composed of single cells or a chain of cells. The injurious bacteria live by absorbing nutriment from adjacent bodies. When existing in the blood of animals, they absorb its essence, disturbing the natural proportions of its constituents, or of the constituents of the cell when in the plant, producing fermentation and decay. New cells are produced by the division of old ones, and the work of reproduction thus goes on with great rapidity. In 1880 it was discovered by Prof. Burrill that bacteria were the cause of the blight in the apple and the pear, and the disease is said to be analogous to small-pox in man and anthrax in domestic animals. When the juice or gummy matter of an affected apple tree exudes, being dried by the winds, the bacteria are wafted great distances and in this manner the blight spreads.

2. MILDews.—These belong to a higher organization of microscopic plants, differing very widely from the bacteria. They are related to the potato-rot fungus (*Peronospora*), described in a recent issue of the *Advocate*. The mildew plant consists of slender, tube-like, branching threads which penetrate the tissues of its host, branching in every direction, and gathering nourishment from the living cells. Many of the threads send out root-like branches. The following is the method of reproduction: Filaments grow out to the surface of the plant, pushing their way through the

breathing spores into the air. The ends of these threads swell, forming roundish spores, and fall on the ground, or are wafted in all directions by the winds. When they fall upon the leaves of a species of plant suited to the fungus, they germinate and multiply very rapidly, providing the necessary conditions of warmth and moisture are present. There are also "Black-fungi," being hardened growths, exemplified in the black-knot of the plum and the cherry. The spores of these are wafted by the winds, and are conveyed great distances by birds and insects. They are reproduced by tube-like threads which penetrate the tissues of their host. Other Black-fungi are the strawberry rust, spots on the leaves of the horseradish, the parsnip fungus, beet rust, the dry-rot fungus of the grape, the bean fungus, and apple leaf blight.

3. THE RUSTS (*Uredineae*).—These are very varied in their character, and their life-cycles are very complex. Prof. Bessey, in a paper read before the American Pomological Society, makes the following allusion to the rusts:

In the most complete species, there are no less than five distinct kinds of reproductive bodies produced. There is first the cluster-cup stage of the fungus, consisting of little cup-shaped structures filled with orange spores. With these structures there are usually others of a flask-shape (spermagones) producing minute colorless spores (spermatia), whose function is entirely unknown. The orange colored spores known as acidiospores, germinate readily, and the filaments developing from them bore into the new hosts; from this new growth there are produced a little later many groups of stalked spores, each spore being rounded and supplied with a stalk double or treble its length. These burst through the epidermis of the host, and as they form reddish patches, this is known as the red-rust stage, and the spores are red-rust spores (uredospores). These are here the particular elements of contagion; they are blown freely from plant to plant, and in warm, damp weather germination takes place at once, resulting in the rapid spread of the disease. This production of red-rust spores goes on as long as the tissues of the host and the other controlling conditions are favorable, and then another kind of spore is developed. This fourth spore is thick-walled, and often dark colored. It is frequently two or more celled, and is always provided with a little stalk. The dark color of the spores gives the spore-clusters a dark appearance; hence this stage is known as the black-rust stage, and the spores are called black-rust spores (teliospores). These thickened wall spores are admirably adapted for resting spores, and we find that in fact they are such. In the common rust of wheat the black spores remain quiescent upon the rotting straw until the advent of the warm, wet weather of spring, when they begin to germinate. In germination they send out a slender thread which soon produces a few excessively minute spores (sporidia). The latter (the fifth of the series of spores), on account of their minuteness, are readily carried by winds, and are thus disseminated. When the sporidia alight upon a moist surface, they germinate, and if the surface is a leaf of the right species, the young parasite enters and begins anew the round of life.

Many species of rusts, according to Mr. Chas. Plowright, abridge their life history, the cluster-cup stage sometimes being omitted. The writer goes on to say that—

"When the black-rust spores germinate in the presence of very young seedling wheat plants, the sporidia of the parasite have sufficient strength to penetrate the tender epidermis of the young wheat leaves. When the wheat seedlings are older the epidermis becomes too tough and hard for the delicate fungus thread to penetrate. It can, however, gain access to

the tissues of the young barberry leaves, and here it grows and gains strength to produce the cluster-cup spores mentioned above. If we look over the several stages of rust we observe that, as in previous fungi, there is a non-sexual production of spores which marks the contagious period of the parasite. This is the so-called red-rust stage, and here the rapid spread of the rust takes place. A single affected plant in a wheat field may, under favorable conditions, become a centre from which the parasite may spread to all parts of the field, just as a single small-pox patient may become a centre of contagion in a neighborhood. In the black-rust stage there is no contagion, but it is more dangerous than the red-rust spores, for it is the means of carrying the parasite from year to year and from crop to crop."

The writer says that the knife is the only remedy. The diseased leaf or fruit or limb or root must be cut off, and in extreme cases the whole tree, or even the whole orchard, must be cut down, dug out and burned up.

With regard to preventative measures, the writer says that it is almost impossible to prevent the spreading of the disease after the period of contagion is reached, when the fungus produces a great number of spores. At this period, every orchard in the neighborhood is in danger, but before it the fungus is not contagious, and may be renewed. The parasite may be destroyed when the resting spores are produced, the fungus then being dead—such as the black-rust resting state in the case of wheat, the straw and stubble being affected. The dead leaves and twigs killed by the fungi of the preceding summer should be burned during the fall and winter in order to prevent the resting spores from causing destruction the following spring.

With regard to the application of poisons or fungicides, the writer recommends sulphur and the many sulphur compounds; iodine, salicylic acid, and borax and its compounds, applied in destroying the spores in the same manner as smut spores are destroyed by washing wheat in a solution of copper sulphate (blue-stone), or they may be applied to the growing fungus, as sulphur is applied to destroy the mildew upon rose leaves in the conservatory. These applications are only of use when they come into direct contact with the fungus upon the surface of the plant, and are useless in destroying the internal parasites.

### Parable of the Farmer and the Ox.

BY CORNY SPARKINS.

"You've got to go; you're a 'scrub.' I'm sorry for it; but the law of the land demands it. You must go, you brute."

These words the farmer said to his ox, to which the latter replied:

"What! me go? Me, why, I have served you faithfully under the yoke for years, and now just when I am beginning to imagine what a delicious piece of roast I shall furnish you for your Xmas repast, you thump me with such cruel words that I cannot fatten. The pleasing delight of having served you so faithfully has already begun to cover my bones with wholesome and tender flesh. You sorry, you; why, you could have sat upon that law, but you didn't want to. O base ingratitude!"

"Tis too true," replied the farmer; "but I neglected it too long. There is no use in bawling over it; the government officials will be here to-morrow morning, so be prepared for slaughter."