

roll if the ground is not frozen.

This quarter-inch covering, while not absolutely necessary serves as a protection for the roots of the grass plants, and at the same time, working into the soil improves its mechanical condition.

There are a few golf clubs who, after top-dressing their greens, make a practice of covering them with a very thin layer of clean straw through which the turf can easily be seen—the idea being to help prevent the ground from thawing out in the middle of the day during moderate weather and freezing again at night.

This sort of covering is all right where conditions are severe, but it is fatal to apply any heavy covering of straw or manure, as the turf becomes tender, and in the early Spring, when the covering is removed, the turf is easily killed by an unexpected return of cold weather and frost.

## Grass Diseases

(Continued from the September Issue)

### II.—RUST GROUP

We now come to another group called the *Puccinia*, which causes the well-known rust on grass. This is a more troublesome group of fungi, as it attacks the leaves and stems of grasses in all stages of their growth, even when growing strongly under good conditions. Nearly all greens and lawns will show a more or less badly rusted patch of grass in a dry Spring or at the end of a dry Summer; in fact, it is the most widely-distributed of all fungoid pests, attacking corn, tea, coffee plants, and chrysanthemum, etc., and attacks nearly a hundred species of grass.

The commonest form of rust found on grass is *Puccinia avenæ*, found on foxtail, tall oat grass, and cocksfoot. *Puc. airæ* is found on *Aira cæspitosa* on open heath lands; whilst *Puc. agrostidis* is nearly always found on *Agrostis alba* and *A. canina*. I have seen large patches of both these grasses attacked by rust on Wimbledon Common; and on Horsell Heath, near Woking, several varieties of grasses

will be seen infested with various rusts. *Puc. poæ* confines itself to the various *Poas*, and will be seen on *Poa pratensis* and *Poa compressa*, even when these are shaded by trees. Another rust, *Puc. coronifera*, produces the spores in the form of a small crown on the leaves of foxtail, rye grass, tall fescue, Yorkshire fog, etc. In America *Timothy* is commonly attacked by *Puc. Phleii pratensis*, but it is comparatively rare in this country. Several of these *Rusts* also grow on buttercups, nettles and docks. It is, therefore, desirable to keep these weeds down as much as possible whenever the grass appears liable to attacks of rust. A usual sign of turf being infested by rust is in the turf turning a dingy brown or gray color, which afterwards becomes white as the stems and leaves die and get bleached. Directly these patches are noticed a mixture of copper sulphate, lime and water should be applied, if it is late in the season; or permanganate of potash (using a quarter-ounce to five gallons of water) if the rust occurs in the spring.

There is another disease allied to the rusts that causes long brown stripes on barley as well as grass leaves: this may be called the "grass leaf stripe," *Pyrenophora trichostoma*. It was found to have broken out very badly in Norfolk and eastern counties in 1908, and I came across specimens of *Poas* cocksfoot, *Sheep's fescue*, tall oat grass, &c., all badly diseased. It is presumed that the disease was spread in that year by the large quantity of cut hay left lying on the fields during the two previous bad haymaking years: and it certainly seems that where cut grass is left on the ground the spread of disease is hastened, more especially amongst the *Poas* and softer meadow grasses.

The next group of fungoid diseases are the *Mildews*. Although there are several of these that attack grasses, the commonest species is a white powder-like *Mildew*, *erysiphe graminis*, which grows on several grasses, and can be found in almost any hedgerow during



September, and also where grass grows rankly on damp, badly-drained soils. It forms irregular brownish white spots on the sheaves and blades of the grass and the tips of the grass shoots are covered with a very minute mould. Another *Mildew*, *Phytium de bary-anum*, is that which causes the damping-off of seedlings, and those of you interested in gardening know the effect of this disease when it gets a start in a box of seedlings. It also attacks seedling grasses at the neck when these are growing on a very alkaline soil, or if a spell of wet weather comes just after the seed has sprouted, but, unlike the gardener's seedlings, the grass does not appear to be destroyed by the mildew, and grows away from it directly the weather becomes dry again. In cases where this damping-off occurs a good dressing of sand or a dusting of fine dry lime will often check it. As a rule, this *Phytium mildew* is more often found where grass seed has been sown on a sour kitchen garden soil.

The different mildews only attack the *Poas* and softer grasses, as a rule, and it is seldom that *Fescues*, etc., get attacked. The disease breaks out at any time of the year whenever the weather is muggy, damp and foggy, though it is seldom noticed in wind-swept places, and is therefore more common on inland courses than those by the sea coast.

In addition to these mildews, there is a small red mould which sometimes attacks grasses named *Fusarium heterosporum*. This will be found on *Yorkshire fog*, *rye grass*, and grasses with downy leaves or stems. Although not so common in England, it breaks out periodically in most European countries. I came across several cases of this disease last July near Witham, Essex, the grass flower-heads and shoots being covered with a red or orange-colored gelatinous substance, which became very slimy after a shower of rain. One species of mould, *Fusarium loliacum*, only attacks Italian rye grass, and is seen on sewage farms where the soil is excessively manured. It indicates itself

by producing well-defined brown spots on the leaves, these spots developing into a dense mass of mould, which ultimately causes the leaves to rot off.

### III.—CLADOCHYTRIUM GRAMINIS

I now come to one of the most troublesome of the mildews, which can best be described as the *blood mildew*. This is a comparatively new grass disease which broke out in various parts of the country six years ago, where my firm sent some of the first specimens to Kew for examination. It seems only to attack grasses in the seedling stage when they have grown about one to two inches high. Whilst previous to being attacked the grass may have grown strongly and evenly, it will suddenly be seen to turn a brownish or blood-red color in small patches which rapidly extend outwards, and at the same time the ground is seen covered with a very minute reddish-gray mould. If the affected grasses are examined it will be seen that all the tissue is infected with the disease, but that the *seminal node* or *callus* is alive, and this soon puts forth two little tillering shoots, and in a month or so later the lawn is perfectly green again. This will also be hastened by a little stimulant in the way of a weak solution of Kainit.

It is a curious coincidence that the majority of the outbreaks of this disease brought to my notice have occurred immediately after a thunderstorm, and it is possible that sudden atmospherical changes may account for the rapid spread of the disease. Last year it was particularly bad, and I saw many varieties of grasses attacked, including *Poas*, for as a rule only the *Fescues* and down grasses are attacked. I am glad to say that all the lawns that were attacked last year are now in good condition, and, in fact, it is interesting to say that one of the most badly infested lawns was one in Putney, which was so bad that an inspector was sent from the Board of Agriculture to discuss the matter with me as to what could be done to arrest the spread of the disease. In some places the turf looked quite destroyed and dead at the



end of March, but in July the lawn was being used for croquet without another ounce of seed being sown, and in September an almost perfect "sole" of turf had been formed.

Where this *Cladochytrium* or blood mildew breaks out it is inadvisable to roll the lawn until the turf has recovered. The treatment consists of applying a weak solution of sulphate of iron followed by a solution of Kainit. Paraffin has been tried with sometimes successful results, but I do not recommend this. I have also tried solutions of sulphide of potassium, and this may be used as a very weak solution applied in the evening in very bad cases, but should not be done unless the circumstances render it imperative, as I am inclined to think that the liquid injures the young tillering shoots springing from the *callus* or basal node of the plant.

Another cause of alarm is when the grass is seen to turn yellow in the autumn, but this is a very minor ailment and no harm occurs through it. It is due to a kind of "influenza" attack that the grass suffers from, caused by changes of temperature, and is more often seen when the nights are cold after a hot day. The grasses most liable to attack are the different species of *Poas*, *Aira*, *Lolium*, etc. If the leaves are examined they are found crowded with small whitish yellow spores which grow into irregular shaped masses. These spread and connect with each other, destroying the chlorophyll, which causes the leaves to turn yellow and appear to be dying. It is commoner on soils containing an excess of potassic salts or on a strong alkaloid soil. No special treatment is necessary, but a little quick-acting manure soon puts matters right, and if, as is sometimes the case, it is due to an excess of carbonate of lime in the soil, a one-per-cent. solution of iron will often counteract it.

Besides the above microscopical moulds there are other fungi that live as actual parasites on the grass, taking

their food from the host plant, *Isaria fuciformis*.

This is a common fungoid parasite that attacks the leaves of *Fescues* and temporarily causes the "flag" to rot off, though the plant itself does not appear to be injured. Where noticed it is a good plan to try a dusting of dry quicklime, followed by a solution of nitrate of soda or Kainit, and this will check the pest and enable the grass to withstand its attacks. It is generally found on light or calcareous soils, more especially in Herts, Surrey and Kent. It does not do much damage in this country, however, though in Australia it is sometimes rather troublesome, where it attacks all sorts of grasses. It is said by some authorities that this *Isaria* fungus is an early stage of the *Cordyceps* fungus which lives as a parasite on caterpillars and other insects. The *Isaria* has the peculiar property of being bright and luminous under certain conditions.

#### ERGOT IN RYE

I should make a passing reference to the Ergots, *Claviceps purpurea*, which are very troublesome to the farmer, as they attack rye and sometimes barley. The *Ergot* will also be found to attack grass in fairly large patches on pastures adjoining roadsides or where a footpath runs through a field. It is chiefly troublesome in July, when the flowers or spikes of rye grass, barley grass, etc., will be found to contain small black spore masses called *Sclerotium*. Its only harm as far as the greenkeeper is concerned is that grass attacked by *Ergot* has a tendency to throw up a large number of embryonic flower stems instead of tillering, so that the grass becomes coarse. Cattle are said to be poisoned by the *Ergots*, though some authorities dispute this, and there appears to be no absolute proof of this happening. Where grass is badly *Ergoted* the grass should be mown with a scythe and then raked and burned on the spot, if possible.

(To be Continued)