

essary in order to avoid a repetition of the trouble in the future. It is estimated that the cost of constructing the course was increased by at least \$15,000. It was necessary to put in drains of extra size, and in one fairway a 24 inch storm sewer was built to handle the water.

This is of course in many ways an extreme instance and the club can hardly be blamed for not foreseeing the extraordinary weather condition which would have to be faced. Nevertheless, the lesson which is taught by this experience is an important one and one which should be taken carefully into consideration in order to reduce the risk of a similar occurrence elsewhere.

(To be continued).

Grass Diseases

(Continued from the October Issue)

Epiclloe Typhina, known as *reed mace*, *red muff*, etc., is a parasitic fungus found in summer growing on the base or stalks of many grasses growing in damp places. I have found specimens of *cocksfoot*, *Timothy*, and especially *tall oat grass* with this characteristic parasite in various eastern counties, but have not seen it growing on *agrostis*, which is said by authorities to be its commonest host plant. It grows in the form of a muff surrounding the stem usually above the node or joint, and is white at first, then turns orange or purple, when it is in the *conidia* or spore-bearing stage. Although it is practically harmless, it is as well to cut the grass before the fungus turns orange-colored.

IV.—FUNGUS GROWTHS

The second division consists of those diseases set up by poisonous conditions of the soil, the commonest example being the fairy ring. These are caused by various fungi, the commonest being *Marasmius oreades*, but *Lycoperdon perlatum* and *Stropharia squamosa* are two other species often observed. The *mycelium* of these fungi feed to a certain extent on the roots of the grass, and the *mycelium* sets up a kind of

fermentation in the soil, rotting the roots so that the grass dies off in patches or is at least considerably weakened. As it is difficult to dig out the rings, it is best to apply a solution of sulphate of iron (one pound to one and a half gallons of water) starting from the outside of the green ring. A second solution at half strength may be applied fourteen days later, three applications generally being sufficient. The ground should first of all be pricked over with a fork before watering, and it is best to do it in the evening if the weather is hot or dry. The other fungi, *Tricholoma* and *Lycoperdon*, are more troublesome on light soils where the *mycelium* spreads out in an irregular net work, causing the turf to look very unsightly. It is generally due to decaying roots of trees or hedges that have been cut down on the site of the lawn or green.

I must class in this division the Clover Mildew, *Peronosporum trifoliorum*. This is not a grass disease, as it only attacks clovers and other leguminous plants; but when it does, it sets up a decay which spreads to the grasses, and for this reason it should be checked where noticed. It can be distinguished by the under surface of the clover leaves becoming covered with a dense dingy and lilac-colored mildew. The leaves turn yellow and then rot off. The disease spreads rapidly outwards in rings if the weather is warm and moist, but a spell of frost or dry bright weather will generally check it. A particularly bad case came under my notice at Cobham, where one of the most beautiful lawns I have seen was made unsightly a few years ago by the clover being attacked by this mildew. It was checked, however, by mowing the turf very closely and applying a weak solution of liver of sulphur followed by muriate of potash. Besides clover mildew, there are other mildews which attack plants in turf, such as *Peronosporum calotheca*, which is common on *Spurrey*, *Sheradia*, *Serastium*, etc. None of these diseases actually attack grass, but they make the turf unsightly and

weaken it, hence my making reference to them here.

Spumaria Alba.—Although not actually a parasitic grass fungus as it lives in the soil, yet it may be considered as an enemy of the greenkeeper, as the *plasmodium* creeps up the blades of grasses, especially on a calcareous soil, and forms a dense mass of hard sponge-like crust which effectually chokes the grass. It is also said to kill horses if they eat this crusted grass, so it is advisable to mow it as closely as possible when noticed and the grass forced by sulphate of ammonia or a quick-acting manure. I might also refer to the poisonous drips of trees which kill grass, that from sycamores, beech, and horse chestnut being particularly poisonous. Where it is necessary to make grass grow strongly under trees it must be helped along with good dressings of lime and manure.

Slimy Morrell (Leotica lubrica).—This is troublesome in wet lawns under trees, as it causes large black masses of fungus which rot the grass. It often originates from the use of sawdust or peat moss manure; and if troublesome a dressing of basic slag or powdered lime may be given.

Peltidia Canina Refulgens.—This is a small black lichenous growth often found in mossy turf. It may be destroyed or checked by a five-per-cent. solution of sulphate of iron, the turf afterwards being dressed with potassic manures.

The Elf or Fairy Cup (Peziza aurantia) is a troublesome fungus on loamy soils overlying chalk, but as it is so readily removed by being cut bodily out with a knife no further reference need be made to it.

Slime Fungus (Myxomycetes).—Under this name may be classed the various slimes, green or black, that cover a soil in shady or confined situations where it is not covered by grass. They usually prove most troublesome on a damp soil or after a spell of continuous warm wet weather. A two-per-cent. solution of sulphate of iron may be used if the grass is very thin, but

half this quantity if the turf is of fine quality.

Where the blacker olive-colored algae *Nostoc commune* makes its appearance, it is as well to apply a dusting of dry lime. This pest spreads rapidly over the ground towards the end of summer in damp situations, especially when situated near slow-running streams or pools. As the *Nostoc* has the power of movement and travels over the ground, in all probability it originates from adjoining pools, and it is therefore advisable to apply a dusting of dry lime around the banks of the pool if it proves troublesome at all.

V.—THIRD DIVISION

The third division consists of those plant parasites that live more or less on grasses, and I will briefly refer to a few of the commonest plants that are parasitic on grass.

The Yellow Rattle (Rhinanthus cristagalli) is a pretty yellow-flowered plant found in meadows that are badly drained. Spring grazing with sheep and an application of six cwt. of salt or basic slag is a good preventive and will tend to check or destroy the plants.

Red Rattle (Pedicularis palustris) is another parasitic plant found on grasses, especially cocksfoot and tall oat grass when growing in peaty or damp soils.

Bartsia Odontites is a red flowered parasitic plant found on poor soils by the roadsides or in gravel pits, and, whilst not invariably parasitic on grass, several of its roots will be found attached to grass roots by means of little suckers.

Melanpyrum Pratense, the *Cow Wheat*, is also semi-parasitic on grass, but as a rule only when growing strongly on the edge of a plantation will it become parasitic.

Euphrasia Officinalis, the common *Eyebright*, is more often than not parasitic on grass. The *Bastard Toad Flax (Thesium linophyllum)* is another semi-parasitic plant, found more especially on chalk pastures in the southern counties.

Bastard Toad Flax.—All the above parasites attach themselves to the grass roots by means of *haustoria* or suckers, and rob it of the food material that it manufactures for itself.

Dodder on Gorse.—The well-known *Dodder* of clover is not parasitic on grass, but there is a species, *Cuscuta epithymum*, that is said to be parasitic on grass; but whilst I have found it growing on many other plants, I have only once come across it, and even then it was doubtful whether the *Dodder* was living on a piece of heather or the grass that surrounded it.

REMEDIES

Having described the more common grass diseases, I must say something about the remedies. First and foremost the best treatment in all cases where grass is attacked by disease is to mow the turf as closely as possible and then to encourage a strong growth of grass by quick-acting manures, so as to enable the grass to grow away from the disease. In soft shady turf, and on those golf courses that lie on river flats where fungoid diseases spread very quickly, drastic treatment may be rendered necessary. In this case, spraying with sulphide of potassium (one ounce to ten gallons of water) may be done. Permanganate of potash diluted to a clear rose color also makes a useful preventive, and applications of flowers of sulphur applied when the grass is wet may also be recommended for bad outbreaks of the red mould, etc. Excepting in cases where soil is sour, solutions of Kainit (one ounce per gallon) are useful in helping the grass to resist mild attacks of rust, etc. Dry lime is particularly useful in most cases, excepting that it is always well to avoid using lime as much as possible, as it encourages clover.

All dressings are best applied in the evening, as it is during the night that mildew spreads most rapidly. On soils liable to repeated attacks of various grass mildews, the excessive use of nitrogenous and crude acid manures should

be avoided, and where it is necessary to hasten the growth without unduly forcing the grass, phosphatic dressings should be used. Bone meal must be blamed for causing a large amount of fungoid growth as well as encouraging clover; whilst leaf mould, especially that from ash and sycamore leaves, also sets up mildews, though the advantages of the leaf mould may possibly outweigh the disadvantages.

Most of the diseases referred to are noticeable when they are in the form of white, gray or orange-colored moulds, this generally being the spore-bearing stage. It is then that precautions to prevent the disease from spreading should be taken. Rough grasses in hedgerows, reeds, and rushes are nearly always infected with rust and other diseases, so these should be kept cut down as much as possible. Cigarette ends and bits of rag lying in the turf are frequently the starting place of the white grass mildew. Leaving cut rye grass on the turf is also particularly bad, as a poisonous ferment is set up by the rye grass leaves that rots the finer grasses.

There is, however, a brighter side to this gloomy lecture, for parasitic fungi are not always injurious to the plants on which they live, and in some cases plants when infested with a particular parasite often grow more robust and vigorous than the non-infested plants. This condition, known as *symbiosis*, is noticeable in the case of rye grass. Even if grasses have their parasitic enemies, all plants are affected in the same manner, and, like "the fleas that have lesser fleas upon their backs to bite 'em," so these different mildews and fungi have other moulds that live upon them, which keeps the balance of Nature and prevents every blade of grass in the country from being destroyed. The *Yellow Rattle* is also punished for its greedy disposition of living on the grass roots by suffering in its turn from a parasitic fungus that causes gouty swellings on its roots.