

REMEDIES.

Sulphur is well known to be one of the most satisfactory remedies against this fungus, and is in universal application where the disease prevails. It is generally applied dry, by means of bellows, though, it seems to me, the wet method would have advantages with the use of the cyclone nozzle. Mr. A. Vitch, of New Haven, Connecticut, has found that in greenhouses the sulphur may be advantageously applied by mixing it with linseed oil to the consistency of paint, and brushing it on the flues or hot-water pipes. Mr. William Saunders, the Horticulturist of the Department of Agriculture, has for many years used, with great satisfaction, a weak solution of lime and sulphur, obtained by pouring water on one-half bushel of lump lime and ten pounds of sulphur, and then diluting for use.

THE DOWNEY GRAPE-VINE MILDEW.

General Appearance.—The other mildew, namely the *Peronospora*, shows itself on the underside of the leaves in the form of a small patch of whitish down, and sends its mycelium into the adjacent tissues, destroying the parts, which scorch and turn brown as if sunburnt. It has been known by various popular names, as "blister of the leaf," "blight," and so on. It generally escapes attention in its earliest stages, and experience shows that it is most destructive where the dews are heavy, or in continued damp, rainy weather. This particular mildew is the *Peronospora viticola* (Berkeley and Curtis), DeBarry having first referred to it as *Botrytis viticola*.

Structural Characteristics.—The mycelial threads or hyphæ are about .01mm. in diameter, somewhat larger in the stems and petioles than in the leaves. They are found everywhere except in the wood proper, but particularly in the tissues of the leaves. Their contents are granular and somewhat oily, and cross partitions so characteristic of the *Uncinula* are rare. Just beneath the stomata of the leaves the hyphæ are particularly abundant. Those which are to bear the conidia pass through the stomata and grow more rapidly than the rest, ramifying and reaching from .3mm. to .6mm. in height, and bearing the conidia on the tips of the branchlets. The conidia are oval and obtuse, varying in size from .012mm. to .03mm. in diameter. Germination takes place with great rapidity whenever there is sufficient moisture. Conidia placed in water become swollen and somewhat segmented in an hour. The segments become oval bodies, collect at the distal end of the conidia, rupture the wall in a short time, and escape, swimming off as zoöspores, each with two ciliæ. Each conidium produces, on an average, five or six zoöspores, though the number is quite variable. They vary also in shape, and from .008mm. to .01mm. in length. They move from fifteen to twenty minutes, then come to rest, when the ciliæ drops off, and a new mycelium develops from the side.

The winter spores, or oöspores, are found in September and October, in discoloured and shrivelled parts of the leaves. They are spherical, .03mm. in diameter, with a thick, smooth, yellow cell-wall. They fall to the ground with the leaves, and lie dormant till spring.

So far as I can find, the actual steps by which the winter spores are produced have not been observed in this species, or, for that matter, in the *Uncinula*, but as the process is known in the order *Perisporiaceæ*, we may confidently assume that they result, later in the season, from the union of the contents of two cells or hyphæ, *i.e.*, they are of sexual origin.

We thus have, as in the *Uncinula*, both summer and winter spores. The summer spores develop outside the leaf, and germinate rapidly as soon as moistened by rain or dew. Consequently, during a wet summer, the spread of the fungus is extraordinarily rapid, so that within a few days a large vineyard becomes infested. The winter spores are found in the interior of the dry leaves, and hibernate within those on the ground. In summer they again get on to the young leaves by the agency of animals, wind, and rain.

Sulphur, as a means of checking or remedying this particular mildew, has proved a failure, and indeed no satisfactory remedy has until recently been found, though prophylactic means, such as those recommended by Mr. William Saunders—namely, the sheltering of the vines by a board covering over the trellis—have been more or less successful.

The fact that no satisfactory remedy existed until lately was well illustrated by the discussion which followed the reading of a paper by Mr. F. S. Earle, at the meeting of the American Horticultural Society, at New Orleans, last February, on "Fungoid Diseases of the Strawberry." The consensus of opinion was that we have no remedy for most of the fungus diseases of plants. That this was, unfortunately, a true state of the case practical cultivators will admit; for, though intelligent treatment will check the growth of the black knot, and the proper use of lime and sulphur will check *Erysiphe* and *Uncinula*, these are about the only fungus diseases which we can control with satisfaction and certainty. Professor G. C. Caldwell is reported to have stated that mildew could be prevented by soaking the stakes in the vineyard in a solution of blue vitriol; but, as that report does not specify which mildew was intended, I know not how authoritative it is.

During my visit to South France in the summer of 1884 I was struck with the prevalence of this downey mildew in most of the vineyards, and the French grape-growers around Montpellier felt far more anxiety as to the consequence of this *Peronospora* than they did as to the work of the grape-vine *Phylloxera*. They feel now that with the aid of our American stocks they can control and defy this underground pest; but the *Peronospora*, which was a few years ago unknown to them, but which has been introduced with the American vines, has so far entirely baffled them, as I believe it has baffled our own grape-growers.

In an address which I had the honor to deliver before the Central Society of Agriculture of the Department of Hérault in June, 1884, and which treated principally of insecticides and insecticide appliances, I took occasion, in view of the interest then felt in this mildew, to recommend the use of the following as a promising fungicide: The ordinary milk-kerosene emulsion prepared after the formula given in my late official reports as *United States Entomologist*, with from 2 to 5 per cent. of carbolic acid and the same percentage of glycerine, and then diluted in twenty to fifty parts of water to one of the emulsion and sprayed on to the under surface of the leaves by means of a cyclone