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POWDERY MILDEW OF GRAPE AND ITS CONTROL

by

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Powdery mildew has long been recognized as a serious disease of the grape. It is widely distributed over the world and is particularly serious on European varieties of grapes, such as Flame Tokay, Zinfandel and other firm-fleshed kinds. It does not harm the American varieties to such an extent although these are subject to its attack, especially in seasons that are cool and moist in the early summer. Among varieties there are various degrees of susceptibility. Certain regions are more inclined to harbor the disease than other localities. It is rather prevalent in the Pacific Coast region and has become established to such an extent as to warrant annual precautionary and control measures.

Description of the Disease

Powdery mildew is caused by a fungus which is parasitic on all green parts of the plant, including leaves, shoots, flowers and fruit.

On the leaves the disease is first manifested in small, grayish or white patches of fungous growth which appear on both the upper and lower surfaces, but most abundantly on the under side of the leaves. The fungus patches may quickly enlarge and cover the entire surface of the leaf if climatic conditions are favorable. The mildewed surface may take on a whitish, powdery appearance, due to the accumulation of the summer spores of the fungus. As the disease progresses the surface of the leaf may lose some of its whitish color and become dirty grayish or brownish in color. Later the leaves may become brown, crinkled, and curled, or hard and brittle. Finally they may die completely. A moldy odor may emanate from a severely attacked vine. The disease saps the vitality of the leaves and devitalizes the entire plant.

On the shoots also patches of mildew may appear. At first they are inconspicuous but later acquire a grayish tint, as in the case of the mildew on the leaves. The infection on the twigs if severe may result in stunting or killing the parts affected.

Blossom infection may also occur if conditions in the vineyard are favorable. The flowers shrivel and fail to set fruit when affected. This is not as common a form of infection as that of the other parts of the vine.

The young fruits are frequently attacked shortly after the blooming period and throughout the course of their development until they begin to show color. The mildewing of the fruits may be the greatest source of loss due to this disease. If attacked when very small, the berries fail to develop and drop off. If attacked later, the fruit continues to develop but may be deformed. Infected grapes become gray and scurfy in appearance, finally turning a dark grayish or brownish color, and often the skin cracks open, thus completely ruining the fruits. The fruit does not become soft but rather hardened and darkened in advanced stages. The fruit stems in the cluster may also be overrun by the mildew.

An additional sign of the disease consists of the minute black spore cases which sometimes appear scattered over the surface of affected leaves, shoots and fruits in advanced stages of the disease. These appear as tiny black specks just large enough to be seen with the naked eye.

Cause of the Disease

This disease is caused by a parasitic fungus which grows over the surface of the green parts of the plant. The fungus consists of minute filaments, somewhat resembling the threads of a spider's web. These filaments cling close to the surface of the host and send out short suckers or "feeding roots" which penetrate the epidermal cells of the plant and thus enable the mildew fungus to get its living from the parasitized grape plant.

This fungus multiplies and perpetuates itself by means of two kinds of spores. The whitish powdery material mentioned above, which appears on the mildewed parts during the earlier progress of the disease, consists of the summer spores which are carried about by air currents, fall on healthy but susceptible green parts of the plant, and germinate when the weather conditions are favorable. The germinating spore sends out a thread-like tube in the same manner as a seed sends down a root. The germ thread of the spore penetrates an epidermal cell to establish a foothold for the fungus which then begins to grow and spread its web of threads over the surface of leaf, shoot or fruit, as the case may be.

Late in the season when the grape vine has been more or less completely invaded by the mildew, a second spore stage appears as the small, black, speck-like spore cases mentioned above. These spore cases contain spores which, on account of the heavy case in which they are enclosed, are resistant to adverse weather conditions and can survive the winter. Thus they are known as winter spores. The mildew may be perpetuated over winter on canes and leaves by means of this spore stage.

It has been determined, however, that the summer spores, also, can survive the winter lodged in the buds. Thus both of the spore stages are probably instrumental in the overwintering of the fungus.

This fungus does not require much moisture or high temperature. Dews and light rains in the spring are sufficient to give it a start. Even the humidity prevalent in irrigated vineyards is sufficient to favor the growth of the fungus.

Control Measures

Powdery mildew can be controlled by two general methods: (1) cultural practices, and (2) application of fungicides. The fungus can be held in check to a considerable extent by cultural practices which permit the free circulation of air and admittance of light to all parts of the vine. Drainage of wet places in the vineyard and methods of pruning and training which tend to spread out the vines so as to avoid still, moist air will diminish the damage caused by powdery mildew. The use of American varieties and others known to be less susceptible of attack will also be worth considering.

However, the disease is rather easily controlled by the simple application of fungicidal materials, especially sulfur. Applications of sulfur at critical times during the growing period have been very satisfactory and economical. The fumes given off from sulfur easily reach the superficial fungus and bring about the control of the mildew. A good dusting sulfur, such as sublimed flowers of sulfur, has proven effective. This is a light, fluffy sulfur, which floats to all parts of the vine, covering the underside of the leaves as well as the upper, and sticks through wind and light showers. When the temperature is about 75° F. or higher, the gas known as sulfur dioxide is liberated, and this is absorbed by the fungus, killing it. To be effective, sulfur must be followed immediately by two or three days of rather warm weather, and unless this happens, sulfuring should be repeated as many times as are necessary until proper weather conditions prevail.

There are three applications which should be given to the vines during the summer. The first sulfuring should be made when the new shoots are between 6 and 15 inches long. It should be done in such a way that every leaf throughout the vine receives some sulfur. The sulfur may be applied either by throwing handfuls into the vine, by shaking through a flour sack or perforated can, or by means of a machine duster. The second application should be made just before blossoming, at this time being careful not to miss a single leaf. The third application should be when the berries have set and grown to about one-half or one-quarter of their full diameter. In some sections a fourth or fifth sulfuring may be necessary, either when the berries are half grown or just before the ripening of the grapes. In these later treatments the sulfur should be dusted only on the fruit and in the centers of the vines.

Control measures should be used every year when the fungus is known to occur and one should not wait for signs of its growth, for then it may be too late. The fungus is killed easily and quickly by contact or close proximity with sulfur. About two to five pounds of sulfur are required for one application of an acre of vineyard, and a man with a knapsack blower can sulfur one acre an hour.

Summary

The following points should be kept in mind regarding powdery mildew on the grape.

1. The fungus grows only on the green part of the vine and does not grow inside the plant tissues, but only on the surfaces. It grows during the growing season of the vine, spreading by delicate summer spores. The germinating summer spores are easily killed by sulfur, which acts rapidly during warm weather and is effective as long as it remains on the plants. Mildew will not grow in hot, dry weather on leaves exposed to the sun, or where there is good ventilation.

2. Obtain 15 to 25 pounds of sulfur for every acre of vineyard in advance of the growing season. Obtain a very finely ground or sublimed flowers of sulfur. Secure an efficient dusting machine, if there is a large acreage. One machine for 20 or 40 acres is desirable.

3. Sulfur the vines first when the shoots are 6 to 15 inches long; second, just before blossoming; third, after the fruit has set. Do not miss a single leaf. Do not dust when the leaves are dry or very wet. Early morning when the dew is on and when the air is still is a good time.

4. Warm weather following the sulfur application will be advantageous. Do not wait for mildew before applying the sulfur. The early application is most important. After the third application, watch the vines carefully and, at the first sign of any mildew, apply a fourth or subsequent treatment.

5. The use of resistant varieties or less susceptible kinds may be advisable but not necessary. Training and pruning the vines so as to expose them to the maximum amount of sun and ventilation, will automatically reduce the attack of powdery mildew.
