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## Some Fungous Diseases and Their Treatment

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# SOME COMMON FUNGOUS DISEASES AND THEIR TREATMENT.

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(By Bayard F. Floyd, Assistant in Botany, University of Missouri.)

## APPLE SCAB.

*Venturia pomi* (Fr.) Went.

The apple scab is the most injurious of all apple diseases. It attacks the foliage and fruit, causing injury and destruction to both. There are two important stages of this disease. First, the summer stage, in which the disease attacks the buds, leaves and fruit; second, the winter stage, in which spores are formed on the fallen leaves, or possibly on twigs. These spores cause a new infection in the spring.

The vegetative part of the fungus lives in the tissue of the plant, spreading through the leaves and fruit as it is formed. The scabs are produced by the fruiting fungus, which breaks down the tissue and sends up erect hyphae, from the tips of which are cut off small spores. These, carried by the wind or insects, cause a new infection. In the spring, soon after the leaves unfold, round, light greyish to olive spots or scabs appear. These may coalesce, forming large areas of such abundance that the leaf will shrivel and fall off. Earlier in the season the buds and blossoms may be attacked.

The fruit is the part that is most seriously attacked; on it the dark brown or blackish scabs develop from small circular spots to large irregular patches, which may cause the apple to be one-sided and to crack open. After cracking open, the soft rots will attack the fruit. The stems may also be attacked, allowing the fruit to fall. The twigs are rarely attacked.

This production of scabs is the summer stage. The vegetative part of the fungus in the leaves, which have fallen to the ground, will live there during the winter. In the early spring it will develop minute black bodies in the tissue of the dead leaf. These, on opening, will liberate spores which will infect the new leaves. This constitutes the

winter stage. The fungus thrives best during cool, moist weather, and upon closely crowded trees from which air and light are shut out.

Before the buds open the tree should be sprayed with a strong solution of copper sulphate. Bordeaux should be used just before and after blossoming, and several times afterwards at intervals of two or three weeks. The trees should not be crowded, and all the dead rubbish should be burned, and the ground plowed.

#### APPLE CANKER. BLACK ROT.

##### *Sphaeropsis malorum* Pk.

The apple canker and black rot are two very common orchard diseases, caused by the same fungus. The former attacks the stems and branches of the apple tree, while the latter attacks its fruit and leaves.

The black rot attacks summer apples at the time of ripening, and fall and winter apples after storage. Green apples are rarely attacked, except when injured by insects or otherwise. Windfall apples are very susceptible to the disease. Apples affected by this fungus first turn brown, then black. They lose their firmness and dry out, becoming much wrinkled and shrunken. Beneath the epidermis small black dots or cups appear. These dots contain many spores, which escape through a small opening into the air.

These black dots can also be seen upon twigs which have been attacked.

Upon the leaves the fungus forms roundish or irregular dark brown spots. They may become so numerous as to cause the leaves to die and fall.

The pear and quince are also attacked by this fungus, causing the same appearance upon them.

The treatment for the black rot is the same as that given for the scab. The fungus, in attacking the stems and branches, forms large cankers. These appear in the early spring as discolored areas on the bark. The areas enlarge, killing the inner bark; the limb becomes swollen and the bark rough and dark colored. The wood may become exposed. The cankers cause an interference with the circulation of the sap, and they either kill or weaken the branch accordingly, as they either wholly or only partially girdle it. Cankers are also formed on pear trees by the fungus. All cankered limbs should be removed and burned. Cankers on very large limbs may be cut out and the wounds painted over with some paint or wash. The branches should be sprayed when spraying for other diseases.

## PEAR BLIGHT. FIRE BLIGHT. TWIG BLIGHT.

*Bacillus amylovorus.*

Although this disease is caused by bacteria, it is included here on account of its great importance. This blight is caused by a very destructive bacterial disease, which does most harm on the pear, but is also very injurious to the apple and quince. Its first appearance is indicated by a turning black of the leaves at the ends of growing shoots, and a withering of the stems. This disease may work slowly backward until the larger limbs are killed. In some cases the entire tree may be killed. The young shoots, when attacked, crack, and a gummy fluid oozes out, which contains millions of the bacteria. Bees and other insects feeding upon this carry the bacteria to the blossoms. Here they cause the "blossom blight." The disease may spread back into the branches in the same manner as it did from the shoots.

It is during blossoming time that the disease spreads most rapidly. Rapidly-growing trees are most susceptible to this disease; hence, the trees should be neither too well cultivated nor too heavily pruned in the winter time. Diseased parts should be cut away and destroyed as soon as discovered.

## PEAR SCAB.

*Fusicladium pirinum* (Lb.) Fckl. *Venturia pirinum* Aderh.

This disease is very similar to the apple scab fungus, both in its appearance and in the injury it produces upon the leaves, fruit and branches. But the fungus, being of a different species, can not infect the apple, or vice versa, as is commonly thought. Certain varieties of pears are more susceptible to this disease than are others. Treatment for this disease is the same as that recommended for apple scab.

## BROWN ROT.

*Sclerotinia fructigena* (Kze. and Schm.) Norton.

The brown rot is a very common disease, attacking peaches, plums, cherries, apples, raspberries, blackberries and other fruits. On account of the variety of hosts it may live upon, it is a very hard disease to combat. It attacks the flowers, twigs and fruit. It probably causes greatest harm to the fruit.

The disease spreads best during warm, moist weather. On the flowers a slight discoloration appears, which soon spreads until they become brown and much withered. This is particularly the case during wet springs. On the fruits a brownish discoloration forms, and within a few hours causes the decay of the affected fruit. The epidermis becomes ruptured in many places, and small greyish tufts of spores appear. These, spread to other plants or parts, cause a new infection. The fruits dry up and become mummified. These mummied fruits, if allowed to remain until spring, produce small dark trumpet-shaped bodies, on the broad end of which are borne spores which start the disease in the new season. The twigs are also apt to be infected and killed by the mycelium of the fungus growing down into them from the infected flowers and fruits. Small cankers may result.

All infected parts should be removed from the tree and destroyed. Bordeaux mixture should be used just before the buds open; just before and after blooming, and about two weeks later. A solution of ammonium copper carbonate should be used when the fruit begins to ripen.

#### LEAF SPOT. SHOT-HOLE FUNGUS.

##### *Cylindrosporium padi* Karst.

The leaf spot or shot-hole fungus is very prevalent in the cherry and plum. It attacks only the leaves. Numerous small purplish spots appear on their upper surface. On the under surface of the spots may be seen small pustules containing small pinkish masses of spores, which spread the disease.

These spots of dead tissue separate from the healthy tissue and drop out, leaving small holes which suggest the name shot-hole fungus. In extreme cases the fungus may kill the entire leaf, causing it to fall prematurely.

Bordeaux should be applied as soon as the leaves are well out, and several times afterwards, at intervals of a few weeks.

#### BLACK KNOT.

##### *Plowrightia morbosa* (Schw.) Sacc.

The black knot grows very abundantly on plums and cherries. It is characterized by the occurrence of black, warty, gall-like bodies on the twigs and branches, and in severe cases, on the trunks. These bodies are elongated, irregular, and of two or three times the thickness of the

small branches. They may become so numerous and of such size as to produce much distortion in the branches. They start with a swelling of the tissue beneath the bark. This enlargement increases until the bark is ruptured. The exposed surface of these knots becomes of a dark olive velvety appearance. This is due to the formation of large numbers of erect spore stalks which bear conidia or spores. These spread the disease during that season, but do not carry it over the winter.

Late in the fall the knots lose their velvety appearance, and the surface becomes black and cracked with numerous minute elevations. In these elevations are borne the winter spores, which carry the disease through to the next season. These knots are caused by an extensive growth of the fungal mycelium in the plant. The mycelium can be traced in the wood by the black streaks it forms.

The diseased parts should be cut away and burned as soon as found. Large cut surfaces should be painted. Bordeaux will protect the plant from infection if the disease is prevalent in the neighborhood.

#### LEAF CURL OF PEACH.

*Exoascus deformans* (Burk) Fckl.

In the spring, soon after the foliage has expanded, the peach leaves become thickened and develop large blisters, which bend and distort them. In severe cases they may be killed and fall away, thus seriously checking growth, and causing a loss of fruit for the season.

The surface of these blisters become covered with a greyish bloom. This is due to the formation of large numbers of upright sacs which contain the spores that spread the disease. The fungus mycelium lives through the winter in the buds and twigs of the affected branches, growing out into the new leaves in the spring.

Most of the infections arise, however, from the spores. Bordeaux should be used just before the buds open, soon after the petals fall, and as soon as the first leaves become full-grown. Winter spraying against the San Jose scale with the lime-sulphur-salt wash is a very effective check.

#### LEAF SPOT OR LEAF BLIGHT OF STRAWBERRY.

*Sphaerella fragariae* (Tul.) Sacc.

This is a very common strawberry disease. It first appears as round, purplish spots on the leaves. Later the interior of these turn white, leaving a purplish border. On these white areas erect tufts of fungal filaments arise, which cut off numerous small summer spores,

which carry the disease to other leaves. These spots may become so numerous as to destroy the leaves attacked and stunt the fruit growth. In the late autumn the white areas of the infected leaves that have fallen to the ground develop small black bodies beneath the epidermis. These contain the winter spores which cause infection during the following spring.

Bordeaux should be used before blossoming, after the petals fall, and several times after the picking season. In severe cases the plants should be removed. A selection of the less susceptible varieties also helps in keeping down the disease.

#### ANTHRACNOSE OF RASPBERRY AND BLACKBERRY.

##### *Gleosporium venetum* Speg.

The anthracnose of the raspberry and blackberry is a very common disease, and, not being easily recognized, is liable to do much harm before being found. It attacks the canes, young shoots and leaves. On the canes it produces spots which are purplish at first, but later become white and sunken in the center. These spots may merge into each other, forming large elongated areas, which, in some cases, entirely encircle the cane. During the following season the spots dry out and produce cracks in the wood. On the leaves somewhat similar but smaller spots are formed. The leaf stems and small fruiting branches are also often infected.

The young shoots are the principal points of attack. The fungus lies dormant during the winter in the canes. In the spring spores are produced upon the diseased areas, and from these other plants are infected. The disease reduces the vigor of the plant, causing the fruit to mature improperly, and often to dry up before ripening.

The deceased parts should be cut out and destroyed during pruning time. After the new canes are attacked, the worst of these should be cut away. Bordeaux should be used in the spring before the leaf buds swell, soon after the foliage is out, and soon after the berries are picked. In starting a new plantation, only healthy plants should be used, and a short rotation of crops should be adopted.

#### DOWNY MILDEW OF THE GRAPE.

##### *Plasmopara viticola*, B. and C.

The downy mildew is the most destructive disease of the grape. It attacks all parts of the vines above ground. But the leaves are most

susceptible. Pale brownish spots are seen upon their upper surfaces, while on their lower surfaces grey downy patches appear. These patches are produced by outgrowths of the branched fungal filaments from the breathing pores. On the ends of these branches bunches of oval-shaped spores are borne. These spores carry the disease to other plants. Later in the year winter spores are formed in the diseased leaf tissue. These are set free by the decay of the leaves in the spring to start a new infection.

The next most important point of attack is the fruit. It is generally attacked when only partly grown. It turns to a brownish color and becomes soft and shriveled, followed by a downy spore growth. Young shoots are usually killed when affected.

The same treatment is used for the downy mildew as for the black rot.

#### BLACK ROT OF THE GRAPE.

*Guignardia bidwelli* (Ell.) Viala et Rav.

The black rot is a common and injurious disease of the grape. It attacks all parts of the vines except the roots. Upon the leaves it produces reddish brown spots. Within these spots are formed small black bodies, with an opening, through which the small summer spores, which are produced within, escape. The fruit which is attacked when it is half grown begins to rot by turning brown; finally it dries up into a wrinkled black mummy. The small black summer spore containers are also found here.

Late in the year other small black bodies appear on the old grapes and leaves hanging on the vine or fallen to the ground. These bodies contain the winter spores, which are formed in small sacs. It is from these that the infection starts anew in the spring.

All the rubbish and old fruits about the vines should be destroyed. Diseased parts should be trimmed and burned as soon as they appear. Plants should be sprayed with Bordeaux before and after blossoming, and at intervals of two weeks thereafter until the middle of July. From then till the middle of August Soda Bordeaux or ammoniacal copper carbonate may be used.

#### LEAF SPOT OF TOMATO.

*Septoria lycopersici* Speg.

Leaf spot is a very serious disease of the tomato. It attacks the leaves, stems, and sometimes the green fruit. The leaves become covered

with small irregular spots having a greyish center and a deeply colored border. Somewhat similar spots appear upon the stems. On the fruit small black specks are produced, which are only immature forms of the fungus. Within these spots on the stems and leaves the spores are borne in small hollow receptacles. These are thought to carry the disease over the winter season.

Bordeaux is a good preventative for this disease. It should be used three or four times after transplanting at intervals of three weeks.

#### LEAF BLIGHT OF BEETS.

##### *Cercospora Ceticola Sacc.*

This leaf blight is a common disease on the leaves of the beet. It produces small roundish spots with white centers and purplish borders. Spores are produced on small filaments which arise within these spots. These probably carry the disease through the winter. All infected plants should be carefully destroyed. Bordeaux mixture should be used frequently through the growing season.

#### STERILE-FUNGUS, ROT OF THE BEET.

##### *Species of Rhizoctonia.*

This is one of the common rots of garden plants, attacking beans, beets, carrots, celery, lettuce, potatoes, radishes, rhubarb cabbage cauliflower and asparagus. It thrives best during hot, damp weather. On the beet it attacks the leaf bases, causing them to blacken, wilt and fall over. The fallen leaves turn brown. The fungus works down into the crown and root proper, producing a browning of these parts. Later cracks appear. The brown mycelial threads can easily be seen in the affected parts. No real spores have been found. It is from this fact that the fungus derives its name. All decaying vegetable matter should be destroyed. Liming the soil is a help, but not an absolute preventative.

#### LEAF BLIGHT OF CELERY.

##### *Cercospora apii Fr.*

This leaf blight is closely related to that of the beet. It produces brownish irregular spots upon the leaves. As these increase in number, they cause the leaf to take on a yellowish, sickly appearance. Within these spots the spores are cut off from the ends of erect filaments.

The plants should be sprayed soon after they are transplanted, and continued at intervals of two weeks until banked. Bordeaux should be used at first and ammoniacal copper carbonate for the last applications.

#### BEAN RUST.

##### *Uromyces appendiculatus* (P.) Link.

This rust is a disease which attacks the stems, leaves and pods of the bean plant. It is characterized by the formation of roundish pustules, which break and expose to the air a powdery mass of spores or "seeds." These pustules bear three kinds of spores during the year.

First, the spring spores or aecidiospores. Second, the summer spores or uredospores. Third, the winter spores or teleutospores. In the spring these broken pustules are filled with a yellowish dust. This dust is made up of thousands of small spring spores. This is known as the cluster-cup stage of the disease. In the early summer pustules arise which contain light brown spores. These are the summer spores. The spring spores must germinate soon after they are formed, or they will die. It was formerly thought that this was also true of the summer spores; but it has recently been found that some of them can live over the winter.

In the late summer or early autumn the contents of these spore pustules appear to turn to a dark reddish brown or blackish color. This appearance is due to the presence of another kind of spores. These spores are the winter spores. They require a long period of rest before they will germinate. They are capable of carrying the disease over the winter season. These different kinds of spores are the fruits of the rust plant. The plant itself is within the host plant. Some of these small spores are carried to the epidermis of the host plant by air, water or insects. Finding conditions favorable they germinate. The small "roots" or hyphae grow into the host plant through some breathing pore or wound. In here they branch and rebranch, spreading through the whole plant. This much branched system of "roots" or hyphae is the vegetative body of the rust plant, and is known as the mycelium. This mycelium can be seen only by means of the microscope. After the plant body of the rust has become quite extensive, it is ready to fruit. It does this by sending up a bunch of erect hyphae from parts of the mycelium, which is just beneath the epidermis of the host plant. As the hyphae lengthen, they raise the epidermis into the form of pustules. At the tips of these branches numerous spots will be formed, which when the pustules break look like a powder.

All infected plants should be burned. Bordeaux mixture does little good in checking the ravages of this disease. The rust will not grow upon certain varieties of beans. Only these varieties should be planted upon a field where infected plants formerly grew.

#### ORANGE RUST OF BLACKBERRIES, DEWBERRIES AND RASPBERRIES.

*Gymnoconia interstitialis* (Schl.) Lagerh. *Caeoma niteus*.

The orange rust gets its name from the color of its spores. It has the spring, summer and winter spores; but the last two are not very noticeable. The spring spores are very conspicuous. The cluster-cup stage differs from the same stage on other plants in not being produced in a cup beneath the epidermis. The fungus threads grow erect from the mycelium, burst the epidermis and allow its orange yellow spores to escape. The pustules are found on the under surface of the leaves and upon the stems.

The mycelium spreads throughout the plant. It lives in the roots during the winter. Infected vines should be dug and burned. Spraying with Bordeaux does little good.

#### ASPARAGUS RUST.

*Puccinia asparagi* D. C.

This is a very destructive disease, living in the plant tissue. It so weakens the plant as to prevent sufficient food from being stored up for the succeeding year.

It has the spring, summer and winter spore stages. The spring spores are usually not very abundant. They are of a bright orange color, and are borne in small cups which are clustered on the lower parts of the stem. Their position on the stem is due to the infection of the stem by the winter spores from the ground rubbish. In July and August the reddish brown summer spores appear in the roundish to elongated pustules. These and the black winter spores, which appear later in much elongated pustules, are very numerous. It is the production of these that enfeebles the plant.

All infected parts and plant remains should be burned. Resin, Bordeaux and sulphur have been used successfully in combating the disease. Irrigation has also been employed as a preventative.

## CARNATION RUST.

*Uromyces caryophyllinus* (Schrk.) Schroet.

This is a very destructive rust, attacking the stems and leaves of the carnation plant. On them it forms large, elongated pustules, which contain the summer and winter spores. The spring spores have never been found. The summer spores are reddish brown and are the first to appear. Later in the season come the winter spores, which are much darker in color. It is these that carry the disease through adverse conditions.

The mycelium spreads throughout the plant. Hence cuttings from infected plants are infected the same as the parent plant.

Certain varieties of carnations are more susceptible to this rust than others. Florists may take advantage of this fact in eradicating this pest from their houses.

Bordeaux in a fine spray at intervals of two to three weeks is an effective check. Proper attention to the ventilation, cultivation and watering of the plants helps materially in keeping the disease out. Diseased plant parts should be destroyed to prevent spreading.

## CHRYSANTHEMUM RUST.

*Puccinia chrysanthemi* Rozz.

This rust has only the summer or uredospore stage. The spores are reddish brown in color. The pustules in which they are borne are very small, being not much larger than a pin head. They occur mostly upon the under surface of the leaves, but they may also be found on the upper surfaces. Since only the summer spores are present, the disease is more easily combatted. The diseased parts should be cut away and destroyed at once. At the end of the season all the infected plants should be destroyed. Inside cultivation in summer and selection of rust free stock, are methods which check the disease.

## BEAN ANTHRACNOSE.

*Colletotrichum lindemuthianum* (Sacc. et mag.) Bri et Cav.

This is a very prevalent fungus disease which attacks all varieties of beans, and all parts of the bean plant. The veins and tissue of the leaf when attacked turn black; the tissue cracks open and the parts die. The stems and petioles also turn black, and their tissue is so destroyed that they often break over of their own weight.

Upon the pods, sunken areas or pits are formed by the breaking down of tissue beneath the epidermis. These are circular in shape and sometimes irregular, formed by the coalescing of several circular areas. They are large, dark in color, with purplish edges. Within these pits are found small whitish dots known as acervuli. Their color is due to the presence of a large number of small spores, by means of which the disease propagates itself. These spores are spread to other plants or parts of the same plant by wind, insects or water. They then germinate, sending a tube or hypha through the epidermis into the host plant. It grows into all parts of the plant.

The part of the fungus within the host plant is its vegetative body or mycelium. The spores in the dots or acervuli are its fruits.

When the mycelium is ready to fruit, numerous small branches shoot up from parts of it beneath the darkened areas. Some of the branches are black, spine-like, and do not bear fruits or spores. The others are white and cut off white spores from their tips. These branches elongate, raise the epidermis into small dots or acervuli which break, allowing the spores to escape. These spores carry the disease over the winter season.

It has another way of wintering over. Its plant body or mycelium in spreading through all parts of the plant grows into the seeds. Here it lies dormant in the ripened seeds until they begin to grow. It then grows out with the new plant parts. Hence beans from crops attacked by this fungus should never be used as seed.

In the autumn all rubbish from the field should be burned. Rotation of crops also helps in killing out the disease. Bordeaux should be used at intervals of a few weeks from the time the plant is small until the pods are beginning to ripen. Damp places are to be avoided in planting.