Black rot of cabbage, cauliflower and related plants

W P. Cass Smith
BLACK ROT is a widespread disease which attacks many kinds of cruciferous plants. In Western Australia, it is most prevalent and serious on cabbage and cauliflower, but it may also attack many other related plants, including brussels sprout, broccoli, turnip, swede, and a number of weeds such as mustard and wild radish.

Black rot is usually of little consequence during the cold winter months, but during warm wet weather, it may become very destructive and cause serious crop losses where control measures have been neglected.

SYMPTOMS

Plants may be affected with black rot at any stage of growth.

The earliest symptoms of the disease may appear on very young seedlings and comprise yellowing and premature dropping of the cotyledon or "seed" leaves, together with the shedding of successive leaves which form on the stem.

These symptoms are not very conspicuous, and in seed-beds where plants are crowded, they often escape notice. Numbers of affected seedlings may be killed outright; those which survive develop ultimately into unthrifty plants with a terminal tuft of leaves borne on a long bare stem which is marked with the scars of cast-off leaves.

Usually, the first obvious symptoms of black rot develop at the leaf margins, in the form of yellowish wilted areas, which gradually enlarge and extend inwards towards the mid-rib. The small veins in these areas turn black in colour and appear as a conspicuous black network on a yellowish or light brown background (fig. 1). Similar lesions may also develop around wounds caused by biting insects.

The disease advances along the water conducting vessels in the veins, which become dark in colour, and gradually extends into the mid-rib, down the leaf stalk and into the main stem.

The progress of the disease can be traced in the smaller veins by their black appearance (fig. 2) but in the thick leaf stalks and main stem this symptom is only visible on cross-sectioning (fig. 3).
Once the main stem is infected, the disease spreads up or down, and subsequently invades younger or older leaves, which yellow and drop prematurely.

The main effects of the disease are:
- Unthriftiness and dwarfing of plants.
- One-sided growth, which develops when one side of the stem is healthy and the other diseased (fig. 4), and
- Serious reduction in the yield and market quality of the crop.

Black rot alone does not cause a soft rot, but frequently secondary soft rot bacteria enter the invaded tissues causing a putrid head decay and stump rot.

CAUSE AND DEVELOPMENT

Black rot is a seed-borne bacterial disease caused by *Xanthomonas campes-tris* (Pam.) Dowson.

These minute bacterial organisms are generally introduced to new areas by contaminated seed which has been harvested from affected plants. They can also survive for at least 12 months in diseased crop residues in the soil.

Crucifers such as cabbage, cauliflower and brussels sprout, which are started in a seed-bed, often show the first signs of black rot in this area.

These primary infections can often be traced to the planting of contaminated seed.

Although at first only a few infected seedlings may be present, the bacteria multiply enormously in the stems of these plants and become available for spread from the scars of cast-off leaves.

Thus, from a few primarily infected seedlings sufficient inoculum may be produced to start a serious outbreak.

The bacteria are spread mainly by splashing water from rain or sprinklers. If they lodge near the water-pores at the leaf margins, where moisture exudes during humid weather, they cause infection and rapidly invade the water conducting vessels in the veins.

Biting insects can also spread the disease, for they may carry the bacteria on their mouth parts, and make wounds through which the bacteria enter the veins and cause infection.

The disease progresses most rapidly during warm humid weather, when plants are turgid and making vigorous growth. The worst outbreaks generally occur in autumn and early summer.

CONTROL

1. All seed should be disinfected by the hot water treatment before planting. Steep seed in water at 122° F. (= 50° C.) for 25 minutes for cabbage, or 15 minutes for other crucifers. Spread thinly in shade and dry quickly. Also dust seed with an organic mercury dust just prior to sowing.

2. Locate the seed-bed well away from established cruciferous crops, and on new ground or ground which has not grown crucifers for several years. Eradicate weed hosts such as mustard or wild radish from the vicinity. (If there is any possibility that the ground is not disease-free, disinfect it with formalin solution, or methyl bromide.)

3. If practicable, protect the seed-bed from rain, and water by furrow irrigation instead of overhead sprinklers.

4. Transplant the seedlings into the field as soon as possible, and discard any with bare stems or yellow wilted areas on the leaves.

Do not hold cabbage seed-beds for more than one planting, as is customary with some growers. When the beds are retained for this purpose a rapid build-up of black rot often occurs, and later plantings fail.

5. Do not grow cruciferous crops more often than once in three years on the same ground.

6. Eliminate biting insects with appropriate insecticides.