1-1-1972

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DISEASES OF RAPE

By A. Bokor, Plant Pathologist

A few serious outbreaks of disease occurred in rape crops in Western Australia in 1971 but future crop losses will be much greater where routine disease prevention is not practised. Of the five main diseases that have been recorded on rape in W.A., black leg has been responsible for the greatest losses. An unexplained condition known as "shoot collapse" has caused significant yield reductions in some localities. There have been isolated outbreaks of white rust, black spot and sclerotinia stem rot, but they are, so far, of minor economic importance.

Control measures for all these diseases are based on efficient destruction of crop residues by grazing and burning and by rotations which allow time for decay of below ground residues.

BLACK LEG

Black leg should be regarded as a potentially important disease of rape in Western Australia. Mild wet weather conditions during winter and early spring are particularly favourable for its development and spread, and a few serious outbreaks of this disease occurred in 1971. The outbreaks were always associated with the previous year's stubble and, if much trash was left lying on the soil surface, adjacent crops were also affected. First crops were only slightly affected when grown some distance from previous year's plantings.

Black leg can affect other cruciferous crops—cabbage, cauliflower, swede—and the disease has been well known to vegetable growers for many years. It is not yet recorded on the cruciferous weeds such as wild radish and wild turnip.

The fungus causing black leg is *Plenodomus lingam*. This is the imperfect stage of the fungus and it produces asexual spores in pycnidia. These spores are responsible for the spread of the disease on the living plant. The perithecia of the perfect stage (*Leptosphaeria maculans*) are formed on the crop residue. These small black fruiting bodies develop on the grey surface of tissues colonised by the fungus and contain the sexual spores or ascospores.

Black leg symptoms: Top—circular lesions on leaves. Middle—Small, black fruiting bodies (pycnidia) on pod. Bottom—Dry rot or canker of stem base.
Symptoms

Any part of the plant can be affected by this disease throughout its development. Affected seedlings show blackening at the base of the stem with small black fruiting bodies (pycnidia) in the affected area. Young seedlings die as a result of girdling (or ringbarking) of the basal stem. Such primary infections arise from infected seed or sowing into contaminated soil.

Infection of the leaves will also occur in the seedling stage but it usually occurs later in the rosette stage. The greyish coloured lesions are circular with a darker edge and are studded with numerous pycnidia which exude spores under wet conditions.

The most devastating form of this disease is dry rot or canker of the base of the plant. At soil level, or just below, the fungus girdles the stem and impairs water and nutrient uptake. As a result, pods fail to fill and seed is pinched. Under moist conditions this form of the disease can advance at a rapid rate. In the final stages the affected parts rot, causing the plant to lodge. A partly affected plant may appear normal but break at ground level if pulled up or bent.

Less frequently, lesions develop on any part of the stem or flowering structure. At the point of attack the stem is weak and breaks easily. Pods showing fungal lesions produce infected seed. This seed is usually shrunken and has a low percentage germination.

Mode of spread

The disease can be introduced into new production areas with infected seed. Experimentally, it has been found that the level of seed infection is very low (on the average 0.1 per cent) and it is not likely to contribute significantly to the level of primary infection in the field. Negligible losses can be expected if seed is the only source of infection.

At harvest, infected debris can be spread by wind onto nearby clean paddocks. Following a diseased crop, the fungus can survive on undecomposed crop residues for many years. Severe losses can occur where rape is sown into such ground. Overseas work has shown the black leg fungus to survive for four years on undecomposed crop residue. The main taproot may resist decomposition the longest.

Perithecia develop on crop residues left on the soil surface in the following season or are found on plant fragments when re-exposed by cultivation even after several years in the soil. Ascospores are released during wet weather at temperatures around 60°F and may be blown on to neighbouring rape crops to cause infection. Less severe losses can be expected in a first year crop if the main source of inoculum is airborne ascospores from diseased rape trash in nearby paddocks.

The primary lesions caused by ascospores are identical in appearance to those produced by the spores of the pycnidial stage. The spores produced in the pycnidia are exuded as slimy masses during a rainy period and lead to the secondary spread within a crop. Spores washed from the leaf lesions down into the soil infect the base of the plant and cause the dry rot phase of the disease.

Climatic factors determine the further course of the disease. Under moist conditions the disease advances at a relatively rapid rate. A plant may be completely severed at the base in two or three weeks. Dry conditions will hinder the development of the disease. Winter temperatures in W.A. are not sufficiently low to effectively limit growth of the black leg fungus.

WHITE RUST OR STAGHEAD

White rust is caused by the fungus Albugo candida. It occurs on all cruciferous crops but is more commonly found on radish, mustard and turnip. The disease is important on rape but is confined only to Brassica campestris, the turnip type rape varieties. The Argentine types (B. napus) are completely resistant to the disease. Serious seed losses result when flower heads are attacked. Up to 25 per cent infection of this type has been observed on a few crops in certain districts, but the disease is only of minor economic importance.

White rust has been recorded in Western Australia on shepherd's purse, wild mustard and wild turnip. The role of these weeds in distributing the disease has not been determined.

Symptoms and spread

The disease is first noticed and easily recognised as white pustules on the underside of the leaves. Later, the pustules appear on stems and, subsequently, on flowering organs. The pustules contain the spores of the fungus. The mature pustules break open and release spores which are widely spread by wind.

Following infection, the fungus grows inside the plant causing enlargement and distortion of the affected parts. Infection of the entire flower stalk results in a spiny swollen structure resembling the antlers of a deer, hence the name “staghead”.

Black leg: Small, black fruiting bodies (perithecia) on crop residue.
**Carry over of fungus**
Towards the end of the season the fungus forms resting spores (oospores) within the infected plant parts. The oospores, together with fungal threads (mycelium) remaining in infected crop residues carry over the fungus from one season to another. Oospores liberated into the soil after the decomposition of infected crop residues are an important source of infection in the following season. Seed may become contaminated with infected plant fragments or else the fungus may grow within developing seed coats and provide a source of seed infection.

**Conditions favouring disease**
Although moisture is necessary for reproduction and infection by the fungus, heavy, continuous rainy periods are not as favourable as successive periods of dew or fog. The spores require drying before they will germinate. Free moisture is then essential for germination and penetration. Temperature requirements are also critical. Maximum spore germination is in the range of 50° to 56°F and the optimum for penetration is 68°F. Development of the disease is checked with the onset of hot dry weather.

**BLACK SPOT**
The black spot fungus (*Alternaria brassicae*) attacks nearly all cruciferous crops and weeds. All varieties of rape are susceptible to the disease. The disease has been recorded on rape in W.A. but, so far, is of no economic importance. Losses occur through attack on the plant and pod stalk before seed is formed and result in empty pods or pinched seed.

**Symptoms and spread**
The symptoms consist of grey to black lesions on leaves, stems and pods. The lesions enlarge rapidly and often form a concentric pattern. The fungus is seed borne and infected seed may be shrivelled and have low germination. Seedling blight, seen as a damping off effect and subsequent stunting of the young plant, may result from sowing infected seed. A further source of infection is wind-blown spores released from infected crop residues.

**SCLEROTINIA STEM ROT**
The fungus *Sclerotinia sclerotiorum* attacks many kinds of herbaceous plants and has been observed in rape crops in W.A. in recent seasons. Affected plants have been found scattered throughout some crops. These were often seen as plants showing premature senescence or death and could be pulled up easily.
Symptoms and spread
Black resting bodies (sclerotia) of the fungus are visible inside the stems when affected plants are split open. Under moist conditions the fungus produces a dense white growth (mycelium) at the base of the plant or further up the stem. Often sclerotia are found externally within this mycelium. Considerable shredding of the affected stem portion is evident as the end stage of fungal infection. Diseased plants may not produce seed.

Sources of infection in the following season are the sclerotia remaining in the trash or in the soil. Lupin crops are also susceptible to sclerotinia stem rot and this should be considered when planning rotations.

SHOOT COLLAPSE
Shoot collapse is characterised by wilting of the main growing point at flowering time. Young flowers topple over about four inches from the top, wither and die. Usually only the main growing point is affected but occasionally the laterals also collapse. Shoot collapse has been observed in W.A. more often on B. napus than on B. campestris varieties of rape. In some localities significant reduction in seed yield has occurred due to this condition. No explanation is known for this condition.

CONTROL OF RAPE DISEASES
A disease control programme should be based on a suitable rotation with non-cruciferous crops together with an efficient destruction of trash.

- The length of rotation will be determined largely by the time undecomposed crop residues remain in the soil. It is recommended that the length of rotation be at least three or four years.
- Destruction of crop residues can be hastened by burning or by stock grazing followed by ploughing into the soil.
- To prevent distribution of diseased crop remains, grazing animals should be kept in a clearing paddock for at least 2 to 3 days before transfer onto clean land.
- New plantings should be located as far away as possible from the previous year's crop.
- Wherever possible, seed should be selected from a disease-free crop to minimise spread of rape diseases.