



## Clubroot of canola and mustard

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### Background

Clubroot is caused by the soilborne amoeba-like organism *Plasmodiophora brassicae*. The disease occurs worldwide and only affects plants in the Cruciferae family including canola, mustard, cabbage, cauliflower, brussels sprouts and broccoli. Internationally, clubroot can cause yield losses of up to 1.6 t/ha in canola, and it is considered a serious disease in Canada and Europe.

In Australian vegetable brassicas, clubroot is widespread and causes significant yield losses. The Australian oilseed industry has been protected from clubroot, as the major production areas for vegetable and oilseed brassicas are usually separated from one another. In addition most Australian pathotypes of clubroot are only able to cause disease in the warmer months and require irrigation water for dispersal, with the exception of Tasmania and some parts of NSW where disease occurs year round.

However, in 2003 two confirmed cases of clubroot were found on white mustard (*Sinapis alba L.*) in NSW. The seed used to sow both crops had been imported from Canada but it is unknown if this was the source of the clubroot.

The occurrence of this disease in broadacre crucifer crops is worrying because both cases were severe and occurred in areas that were distant from vegetable growing areas and during the cooler winter months. Australian oilseed growers should now be on the lookout for symptoms resembling clubroot. If seen, please ensure that suspect plants are sent to a plant pathologist for correct identification.

### Symptoms

Swollen, galled roots are the most typical symptom of infected plants. This ranges from tiny nodules to large, club-shaped outgrowths that may involve most of the root system. The galls are at first firm and white but become soft and greyish brown as they mature and decay. Affected roots have an impaired ability to assimilate water and nutrients, so severely affected plants can be stunted and will wilt under moisture stress. The two severely infected white mustard fields in Australia also had extensive leaf lesions which resembled symptoms of extreme nutrient deficiencies.

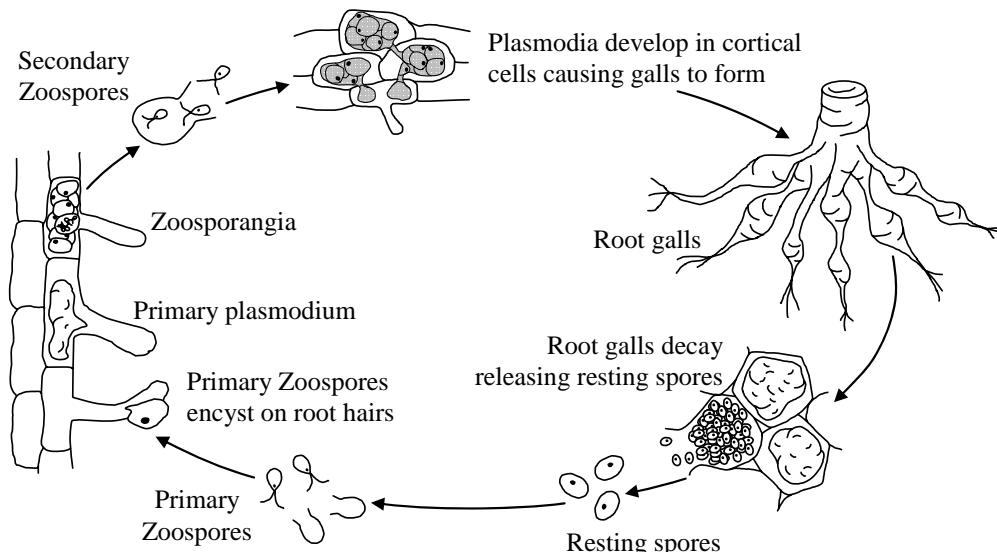


Swollen galled roots of white mustard found in NSW, Australia (Photo: Paul Parker)

### Disease cycle

Resting spores of clubroot can survive on seed harvested from infected crops and in soil for many years, even in the absence of a susceptible host. Infection can occur at any stage of growth and it is restricted to the roots. In the presence of susceptible roots, the resting spores germinate and release tiny zoospores that swim in free water to the surface of the rootlets, penetrate and form a colony (plasmodium) inside the root cells. The organism causes cells to enlarge and divide rapidly, resulting in the characteristic galls. Late in the season, resting spores develop in the infected roots and are released into the soil as the galls decay. Fields become infested mainly by the movement of soil on cultivation equipment





Disease cycle for clubroot (Adapted from Roberts and Boothroyd 1972)

and by seedling transplants. Seed can become infested if dust from an infected field comes into contact with the seed during harvest.

## Management

Several methods of control have been developed in the Australian vegetable brassica industry which may be useful for oilseed brassicas.

**5 year rotation:** Infested fields are kept free of susceptible crops and weeds for at least 5 years to allow sufficient natural decay of the long-lived resting spores. Repeated cropping with brassicas builds up soil inoculum to a level where symptoms become evident (about 1000 spores/gram soil). Thus the more frequently brassicas are grown on the same land, the sooner the disease will appear.

**Control brassica weeds:** Brassica weeds are susceptible to clubroot and can maintain soil inoculum levels in non-brassica crops.

**Equipment movement:** Do not move cultivating equipment from infested to non-infested areas before thoroughly cleaning the equipment.

**Liming:** Clubroot thrives in acid soils ( $\text{pH} < 7.0$ ), and liming to increase soil pH (7.0–7.5) has been successful for vegetable brassicas but would be cost-prohibitive in most oilseed brassica areas.

**Seed contamination:** Only purchase seed from crops that do not have clubroot because the dust around the seed could contain resting spores.

## Acknowledgments

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## Further reading

*Agriculture, Food and Rural Development*, Alberta Government:  
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Canola Council of Canada:  
<http://www.canola-council.org>

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