

White blister control in vegetable brassica crops

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White blister is a fungal disease caused by *Albugo candida*, which affects many brassica crops and weeds including broccoli and cauliflower. Currently 17 different races of the disease have been identified throughout the world. In Western Australia, race 9 causes symptoms on cauliflower and broccoli and the disease has been found in all major vegetable brassica growing regions.

What does white blister look like?

White blister may have both local and systemic expression of symptoms. The disease mainly infects parts of brassica plants that contain chlorophyll (i.e. the green parts), however, systemic infections can cause any part of the plant to be affected. Localised symptoms are white 'blisters', which in the early stages of infection are seen on the underside of leaves. As the symptoms progress, circular areas of leaf discolouration (light green to yellow) appear on the upper leaf surface, corresponding to white blisters on the underside of the leaves (Figure 1). The blisters contain white powdery spores which are spread by wind when they are released (Figure 2). They can be released at any time of the day.

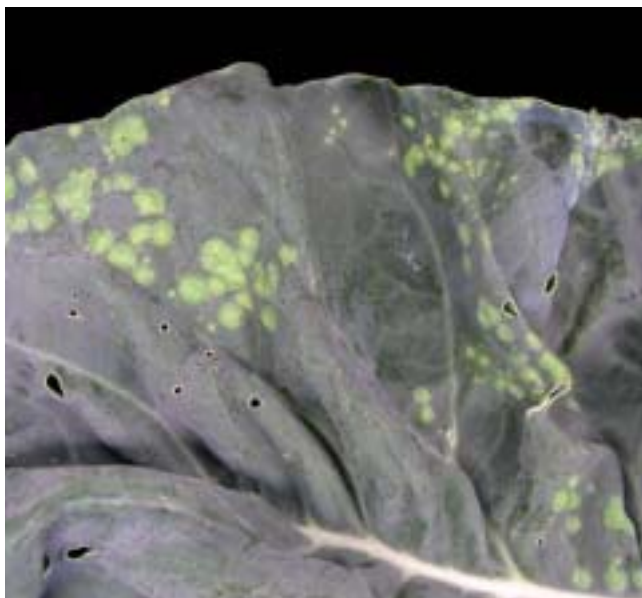


Figure 1. White blister symptoms on upper surface of a brassica leaf



Figure 2. White powdery spores of the white blister pathogen, *Albugo candida*

Systemic infections, where the disease grows throughout the plant's tissue are more difficult to control. Abnormal growth, distortion of affected plants or the formation of galls (Figure 3 and Figure 4) are an indication of a systemic infection of white blister. The galls and distorted plant parts contain another type of spore which can be spread in crop debris and on seed. In seedlings, affected plants may look 'leggy' and taller compared to non-affected seedlings due to the abnormal growth of the affected seedlings.

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Figure 3. Galls formed on a brassica leaf due to white blister infection



Figure 4. Distorted broccoli head caused by white blister infection

Conditions for infection and disease development

White blister spores need certain conditions to infect brassica plants. These are:

- Temperature range of 13 °C to 25°C.
- Leaf wetness for a minimum of 2 hours (e.g. from dew, fog, rain or irrigation).

Symptoms will develop 6 to 21 days after infection and the disease is more common in autumn and spring but can occur at any time of the year.

How does white blister spread?

White blister can be spread by many different methods including:

- infected produce (e.g. broccoli heads) and leaves;
- infected crop debris;
- rain or irrigation splash of the spores;
- wind and soil that contain the spores;
- infected seedlings;
- contaminated seed.

Volunteer vegetable brassica crops, brassica species used for biofumigation (e.g. mustard) as well as brassica weeds (e.g. wild radish and wild turnip) may also be hosts for various races of the disease.

Managing white blister

Hygiene practices

Good hygiene practices should be implemented by brassica producers and seedling production nurseries to help restrict the movement of white blister to production areas where it is not currently present. White blister is easily spread by wind blown spores, which can make reducing infection in a local area more difficult. Good hygiene practices for reducing the risk for many plant diseases include:

Seedling production nurseries

- restrict access by visitors to seed and seedling areas;
- ensure that nursery staff and visitors are aware of nursery hygiene practices;
- prevent the movement of soil and organic matter into the nursery production area;
- inspect seedlings regularly for disease symptoms;
- remove brassica weeds and volunteer seedlings from the nursery area;
- have a dedicated seedling pick up and return area that is separate from the seedling production area;
- establish a hygiene protocol for the handling of returnable trays and racks, while they are on-farm.

Vegetable brassica producers

- producers who grow their own seedlings should follow the information for seedling production nurseries, ensuring seedling production areas are not located close to cropping areas;
- restrict access by visitors to paddock areas (using signs or have a designated meeting place for visitors);
- ensure that farm staff and visitors are aware of the farm hygiene practices;
- rotate brassica crops with non-brassica crops to reduce the likelihood of disease carry over;
- inspect seedlings for disease symptoms upon their arrival at the farm or when collecting from the nursery;
- prevent the movement of soil and organic matter on to the farm by:
 - Φ ensuring that all equipment (bins, crates etc.) and machinery entering the farm has been thoroughly cleaned prior to arriving at the farm, preferably with a high pressure washer;
 - Φ ensuring that all staff and visitors entering the farm do not have soil and organic matter on their shoes and equipment;
- regularly inspect broccoli and cauliflower crops for symptoms of the disease;

- remove volunteer brassica plants and brassica weeds, particularly around crops and in non-host (i.e. non-brassica) crops;
- thoroughly clean on-farm machinery and equipment leaving the farm to prevent a build up of soil and organic matter, preferably using a high pressure washer.

Cultural practices

Additional cultural practices beside hygiene that can be used to manage white blister include:

- destroy brassica crops soon after harvest to remove the brassica host. Crop residue should be ploughed or disked into the ground;
- plan watering so the leaves of broccoli and cauliflower are not wet for long periods (i.e. long light applications of water will favour disease formation). Avoid watering in the evening and at night if possible;
- increase the ventilation between plants by aligning planting rows in the direction of the prevailing wind and / or increasing the space between plants and planting rows;
- some brassica varieties are less susceptible to white blister. Consult your nursery, seed representative or agronomic advisor for further information on tolerant varieties that are available;
- ensure adequate phosphorus and potassium as these nutrients may help to reduce the susceptibility of brassicas to white blister. High nitrogen rates may increase susceptibility to white blister;
- a predictive computer model, Brassica^{spot} may be a helpful decision support tool for predicting weather conditions which lead to a high risk of white blister infection. The model indicates when crops should be specifically checked for white blister and assists in the decision on whether chemical application should occur to manage the disease. The model requires local weather data (from a weather station) to accurately predict increased risk of white blister infection. The model was developed in the United Kingdom and has been tested in Victoria, where its predictions of infection times have been used to reduce the number of chemical applications required to control white blister.

Chemical management

Registered fungicides are available which can help to manage the disease and should be used in conjunction with cultural management practices as part of an integrated pest management program. Vegetable brassica producers should not depend on fungicides alone to manage the disease. Producers should also note:

- it is essential that a fungicide resistance management strategy is implemented. *Albugo candida*, which causes white blister, can rapidly develop resistance to fungicides. Consult your agronomic advisor for currently registered products to control white blister;
- the instructions, application rates and withholding periods listed on permits and product labels must be followed. There may be restrictions with some products on the number of times a product can be applied or when it should be applied.

Producers should control other pests and diseases such as downy mildew in their brassica crops using registered products at the label rates as this may assist to reduce the susceptibility of the plant to white blister. Read the label and relevant permits before using these products.

Acknowledgments

Figures 2 and 4 were kindly supplied by Dr Kristen Stirling, Department of Agriculture WA.

Further information

White Blister Control Notes. Prepared by Dr Elizabeth Minchinton, Department of Primary Industries, Knoxfield, Victoria. Contact your local Department of Agriculture office for copies of these fact sheets.

