Gummy Stem Blight On Cucurbit Transplants

Background

Gummy stem blight (GSB) is a major disease of many cucurbits. The change from direct seeding to transplanting cucurbits in modern agricultural systems has increased the importance of the disease. The pathogen may be present both in and on cucurbit seed; planting seed from infested fruit can lead to an outbreak of GSB in production nurseries. Disease development is favoured by the high humidity and warm conditions found in such nurseries. It can also be very difficult to distinguish nursery plants infected with gummy stem blight from other cucurbit pathogens, particularly *Fusarium* wilt.

Pathogens

GSB is caused by three ascomycete fungi from the genus *Stagonosporopsis*, *S. cucurbitacearum*, *S. citrulli* and *S. caricae*. Until recently, all three of these pathogens were known as *Didymella bryoniae* (synonymous to *Phoma cucurbitacearum*). Research on the genetic relationships of the pathogen on different host plants has indicated that the three pathogens have distinct lineages, but are all very similar in appearance (Stewart et al. 2015). The fungus was first found on the native perennial herb *Bryonia* (also a member of Cucurbitaceae) in Europe in 1869, and now has worldwide distribution. It has been moved globally in infested or infected seed. GSB pathogens are mostly host-specific to cucurbit species; *S. caricae* is the only species also known to be aggressive to a non-cucurbit species, papaya. All three species are present in Australia. Other species from *Stagonosporopsis* have also been reported from non-cucurbit plants in Australia.

Symptoms

GSB can occur on cucurbits grown in nurseries for use as transplants. While all above ground plant parts can become affected, the most typical symptom is a water-soaked lesion on the hypocotyl where the cotyledons attach. Necrotic spots may also be present on the margins of cotyledons or true leaves. Cotyledons and leaves of watermelon and rockmelon are particularly susceptible whereas those of cucumber and pumpkin are relatively

Seedling watermelon with early symptoms caused by GSB.

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resistant, but they do become more susceptible as they mature. In the nursery, a seedling initially infected from seed transmission, may die and be surrounded by seedlings with secondary infections, some of which may not show visible symptoms until later. If such plants are transplanted into the field and survive, they may develop cankers on crowns, main stems or vines, and devastate an entire crop.

Young seedlings may be infected but not show any symptoms until they are a few weeks old. Therefore, it is possible to sell infected, but asymptomatic plants, which later develop symptoms and may eventually die.

Crown cankers are lethal. They are at first pale-brown, a bleached area soon develops, often with a reddish gum oozing from cracks. Affected areas may be studded with fruiting bodies of the fungus. Cankers can also girdle stems and vines causing wilting.

Lesions on leaves commence as spreading water-soaked areas which may be surrounded by a yellow halo. They become light brown and irregular in outline. Spots may tear and drop out giving the leaves a tattered appearance. However there are a wide range of leaf symptoms on cucurbits. Fruit develop greasy-green spots that eventually turn dark and may have a gummy exudate and black fruiting bodies of the fungus.

Most cucurbits are affected but GSB pathogens, but different pathogens are more severe on different hosts. For example, in recent research *S. citrulli* was more severe on watermelons than cucumber or butternut pumpkins, whereas *S. caricae* were equally severe across the three host species tests. While it is likely that there are differences in the severity of each pathogen across the range of cucurbit varieties currently available, GSB pathogens can be very serious on watermelons, rockmelons, honeydew, squash, pumpkin and cucumber.

Spread

The fungus is seed-borne, and because of this has worldwide distribution and is a significant problem in production nurseries. Infected planting material and infected fruit also provide a means for long-range dispersal. As stated above, infected asymptomatic plants may sold, planted and infest the soil, which may infect healthy plants subsequently grown in that block.

The fungus produces two spore stages and has a complex lifecycle; sexual and asexual spores are produced. Sexual spores are spread from field to field by wind and are regarded as the primary inoculum. Asexual spores are released in a gummy material and are well adapted for short-range dispersal by water splash, which leads to secondary spread of the disease in production nurseries and in

Dieback caused by GSB on seedlings (above)**. Grafted plants infected with GSB; corky symptoms are just above the graft** (below)**.**

the field. Both types of spores can be spread on knives, hands and clothing. Inoculum can reside in infected organic matter that remains in the growing area and may lead to infection of future crops.

Biology

Besides being seedborne, the pathogen survives between crops in soil, weeds and crop residues. It can survive in dead infected host material for up to two years in the subtropics. The optimum conditions for infection are temperatures ranging from 20-25°C and a moisture level of 85% RH. Moisture is more important than temperature for disease development. The dispersal of sexual spores peaks after rain and during dew periods at night. Free moisture on the leaves for at least one hour is needed for infection, and further leaf wetness is needed for subsequent disease development. Wounding facilitates infection in older plants and may occur from a variety of factors including infection by other leaf diseases, e.g. powdery and downy mildew and insect damage.

The use of grafted cucurbits to overcome other soil-borne diseases can increase the risk of gummy stem blight. After grafting, plants are held at a high humidity or are regularly misted to induce healing of the graft union, thus providing ideal conditions for the development of the disease.

Management

Infected transplants can readily introduce the disease into the field. Every effort should be made to produce healthy seedlings. It is often quite difficult for a grower to determine whether a fungus, bacteria or virus has caused the leaf spots and hypocotyl lesions on cucurbit seedlings; these organisms can produce similar symptoms. If symptoms are similar to that caused by gummy stem blight seedlings should be sent to a diagnostic laboratory, even if the cause of symptoms are thought to be abiotic, e.g. from a burn, or some other known source. Diagnostic reports can then be used to support the production of healthy plants.

As the disease is seedborne, disease-free seed should be used for all cucurbit plantings. Seed should be obtained from a reputable source. Dry heat of 70°C for 90 minutes has been shown to eliminate a number of seedborne pathogens including gummy stem blight. Germination rates and seed vigour remain very high, greater than 90% germination (Shi et al. 2016).

Seedlings should be inspected regularly for the presence of the disease, and any infected plant should be removed immediately. It is unwise to use healthy-looking seedlings from trays that contain infected plants as many may have invisible, latent infections that only begin to show symptoms after the product is sold and planted.

As moisture is important for disease development, manage ventilation and irrigation in the nursery to

Advanced GSB symptoms on young plants with fruiting bodies (above) **and close up of fruiting bodies** (insert above)**. Moderate to advanced GSB symptoms on seedlings** (below)**.**

reduce periods of leaf wetness. Where environmental conditions are extremely favourable for disease development (e.g. the high humidity required for grafting cucurbits onto disease resistant rootstocks) spraying with a fungicide may be necessary.

As the pathogen can survive in the soil or undecomposed plant material for two years, maintain good nursery hygiene standards. Clean and disinfest the growing area on a regular basis, particularly between crop cycles and remove crop organic matter.

Some varieties have been reported as being resistant to gummy stem blight overseas. Preliminary studies were conducted in Australia and resistant lines were identified. These lines have not been commercialised and current varieties are not known to have resistance to this disease. Therefore, breeding programs would have to be redeveloped and tested against all three GSB pathogens.

Field control is based on deep ploughing infested fields after harvest to ensure complete decomposition of all plant material, a two year rotation cycle, and regular applications of appropriate fungicides.

Fungicides

A number of active ingredients are registered for use against GSB on cucurbit crops. These actives (FRAC code following active in brackets) include contact and systemic products. All FRAC codes starting with 'M' are contact products only, but have multiple modes of action to protect plants from becoming infected. Remaining products are either translaminar or have variable levels of systemic activity. It is very unlikely that any of these products will eradicate GSB from plants once visible symptoms have occurred. All of the actives listed should be used on asymptomatic plants to protect them from infection. The actives azoxystrobin (11), chlorothalonil (M5), dimethomorph (40), mancozeb (M3 – sometimes in conjunction with sulfur – M2), metiram (M3), penthiopyrad (4) and propineb & oxadixyl (M3 & 4) are registered for use against GSB on cucurbit crops. Always read the label to ensure that they are suitable for your exact situation.

References

Shi, Y, S Meng, X Xiu, A Chai & B Li 2016. Dry heat treatment reduces the occurrence of *Cladosporium cucumerinum*, Ascochyta citrullina, and *Colletotrichum orbiculare* on the surface and interior of cucumber seeds. *Horticultural Plant Journal* **2**: 35-40.

Stewart, JE, AN Turner, MT Brewer 2015. Evolutionary history and variation in host range of three *Stagonosporopsis* species causing gummy stem blight of cucurbits. *Fungal Biology* **119**:370-382

This document was prepared by Ken Pegg and Andrew Manners (Agri-science Queensland, Department of Agriculture and Fisheries, Ecosciences Precinct, GPO Box 267, Brisbane QLD 4001) as part of NY15002 Building the resilience and on-farm biosecurity capacity of the Australian production nursery industry in 2016. Thanks go to Lindy Coates (DAF) for helpful comments on previous versions of this factsheet. All photos by DAF, unless otherwise stated.

Advanced GSB symptoms on young plants (above)**; watermelon field devastated by GSB** (below Photo by Chris Monsour, Prospect Agriculture).