Bacterial leaf scorch – a nursery industry biosecurity threat

Background

Fig. 1. Oleander affected by bacterial leaf scorch. Photo by Jack Kelly Clark, University of California Statewide IPM Program.

Bacterial leaf scorch (BLS) is caused by the bacterium *Xylella fastidiosa*, a slow growing bacterium that blocks xylem and produces water stress symptoms. It has a large number of common names depending upon the host plant it is affecting, e.g. Pierce's disease on grapevine, oleander leaf scorch on oleander (Fig. 1), phony peach disease on peach, oak leaf scorch, plum leaf scald, periwinkle wilt, citrus variegated chlorosis and others. The exact symptoms produced are influenced by the host plant infected but often involve necrotic or scorched spots of leaves and leaf margins, stunting of young shoots, leaf drop and dieback, chlorosis or bronzing of the leaf margin and may become water-soaked before browning and drying. BLS affects over 100 plant species including ornamentals, perennial fruit crops, grasses and forest trees, some of which can carry the disease without symptoms. BLS is found throughout the western hemisphere in sub-tropical and tropical regions of North, South and Central America. Outside of these areas it has only been confirmed in Taiwan on pear. BLS can be transmitted by a number of species of leafhoppers, sharpshooters, froghoppers and spittlebugs. These insects are small, cicada-like insects from the family Cicadellidae.

Host range

A large number of host plant species can be affected, with or without symptoms, including golden wattle, big leaf maple, Scotch broom, green couch, *Duranta erecta*, *Fuchsia*, French broom, English ivy, *Hydrangea*, sweet marjoram, evening primrose, sycamore, California wild rose, blackberry, rosemary, and various stone fruit to name just a few [3]. While *X.*

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fastidiosa is known to affect a very large number of hosts, there are a number of strains currently recognised which may have a smaller sub-set of plant species that they can affect. For example, the grape strain can also affect alfalfa and almond; the peach-plum strain affects peach, plum, coffee and citrus. However, the situation is complicated, e.g. oleander strains did not infect grape and grape strains did not infect oleander but both strains affected almond [2]. As more research occurs, more of these sorts of examples are likely to be discovered. However, the grape strain does appear to have a wide host range of over 100 hosts **Error! Bookmark not defined.**.

Fig. 2. Typical symptoms of Pierce's disease in grapes caused by *Xylella fastidiosa*. Photos by Elaine Backus, USDA.

Symptoms

Symptom development depends on the rate and extent of colonisation of the xylem vessels of the host. The symptoms produced are usually those associated with water stress and vary with host plant. As mentioned above, symptoms typically include leaf scorch, veinal chlorosis, wilt and dwarfing. Below are more details on well known symptoms of certain hosts [3]. The leaf scorching symptoms caused by BLS may be confused with moisture stress, salt toxicity or herbicide injury.

On oleander, first chlorotic mottling of leaves occurred from the tips and margins and moving towards the mid-rib (Fig. 1). Leaf tips and margins then became necrotic and plants could become defoliated and die [4].

On grape, the disease is commonly associated with leaf scorch, defoliation, uneven hardening of shoots, shoot dwarfing and drying of fruit clusters. Initially large parts of green leaves suddenly dry and turn brown and necrotic (Fig. 2). Surrounding tissue become yellow and red. It can be confused with salt toxicity, boron, copper or phosphorous deficiency. Eventually, vines may have a low and short production period and may die.

On peach, first symptoms are stunted young shoots that have numerous and relatively dark green leaves that may occur on one scaffold limb or the entire tree. Twigs have relatively short internodes and increased lateral branching which grow horizontal or droop. Trees bloom earlier and leaves and flowers remain on trees longer. Any fruit produced is small and ripen early, however, fruit production is much reduced. Symptom development may take up to 18 months and BLS generally does not kill the tree, per se, but trees are more susceptible to pests and other diseases.

On various shade trees, e.g. elm, sycamore and oak, first symptoms usually appear in late summer to early autumn. On some hosts scorching can occur on all leaves at the same time, e.g. oak, or progress from older to younger leaves, e.g. sycamore and elm. Symptomatic leaves may curl and drop prematurely and branches may die overtime (Fig. 3). Tree decline can occur quickly or over several years [i].

On citrus, plants do not usually die but younger plants are more often affected. Affected citrus trees have mottled leaves, similar in appearance to zinc deficiency, over all or part of the plant. In later stages brown necrotic spots develop on lower leaves below chlorotic areas. Wilting may occur and chronic infection may result in stunting and dieback of twigs. Fruit are small and hard and ripen early (Fig. 5).

Fig. 3. Leaf chlorosis and necrosis caused by BLS on mulberry (above) and liquidamber (below). Photos by John Hartman, University of Kentucky, Bugwood.org.

Dispersal

All strains of BLS can be transmitted in a similar manner. In most plants for which symptoms are visible, the bacterium is present in the plant systemically. Therefore, all grafts, be it stem, branch or root, will transmit the disease to the grafted plant [3]. BLS is not seed transmitted. In some symptomless hosts, e.g. mugwort and watergrass, BLS does not move systemically through the plant but may still provide a source of inoculum for insect vectors. However, in symptomless blackberry, BLS was found to move systemically.

Fig. 4. Side view of an adult GWSS, a major vector of BLS.

There are many insect vectors of BLS. One of the more significant vectors is glassy winged sharpshooter (GWSS – Fig. 4) which has a wide host range and can become very abundant quickly. In any given region, a number of species of sharpshooters may transmit BLS. Different species of insect vectors appear to transmit *X. fastidiosa* more efficiently to some plant species than others, e.g. GWSS transmits *X. fastidiosa* more efficiently from grape to grape than almond to almond [3]. Both nymphs and adults can transmit the disease and do so about 30% of the time on grapes [1]. Nymphs lose their ability to transmit the disease after each moult but adults

[i] http://www.apsnet.org/edcenter/intropp/lessons/prokaryotes/Pages/BacterialLeafScorch.aspx

are able to infect new plants for the remainder of their life after acquiring the bacteria. The rate of transmission increases as the number of infected insects feeding on a plant increases [1]. Since GWSS moves between plants frequently and populations can reach very large numbers, disease transmission is quick, despite being a relatively inefficient vector compared to other leafhopper species [1]. For more information about GWSS refer to the nursery factsheet [ii]. It is not known if native Australian leafhoppers and sharpshooters have the capacity to transmit BLS, but it is reasonable to assume that some could do so.

Management overseas

Overseas, management of BLS is focused on preventing the disease from occurring on susceptible trees. This is done by using resistant varieties, practising good hygiene and managing the vectors of the disease. Keeping plants under optimal growing conditions also assists in reducing the impact of the disease; environmental stresses increase disease symptoms. Infected plants should be removed to extend the life of outdoor growing areas. Weeds and susceptible plants should be removed from the growing area and within about 400 metres of the growing area. For nurseries, growing plants within insect-proof structures and using disease-free mother stock plants would be critical.

Fig. 5. Symptoms of BLS on citrus, leaf include chlorosis and small fruit. Photos by Alexander Purcell, University of California, Bugwood.org.

If you see or suspect that you have BLS contact your local biosecurity organisation or the Exotic Plant Pest Hotline (1800 084 881). Do not move the plant material suspected to be infected with BLS. There is no better way to manage BLS than to keep it out of Australia. Currently there is no management strategy of BLS that is completely successful.

This document was prepared by Andrew Manners (Agri-science Queensland, Department of Agriculture, Fisheries and Forestry, Ecosciences Precinct, GPO Box 267, Brisbane QLD 4001) as part of NY11001 Plant health biosecurity, risk management and capacity building for the nursery industry. Thanks go to John Duff for providing comments on earlier versions of this factsheet.

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[ii] http://www.ngia.com.au/Category?Action=View&Category_id=682