Silverleaf whitefly alert for soybean growers

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Which whitefly is it?

Silverleaf whitefly (SLW) is the B-biotype of the whitefly *Bemisia tabaci*. The B-biotype is a pesticide-resistant strain of *B. tabaci* that has gained entry into Australia, most likely from the United States of America. SLW is a major global pest of horticultural and agricultural crops and is highly resistant to most current pesticides. SLW can occur in uncontrollable plagues with billions of individuals per hectare of crop.

What do SLW look like?

Silverleaf whiteflies are small, fragile sap-sucking insects in the same bug sub-order as aphids and scale insects. Adults have powdery white wings and are only 1.5 mm long (see Fig. 1).

SLW is similar to, but smaller than, greenhouse whitefly (*Trialeurodes vaporariorum*) and has a distinct gap between its forewings. SLW can only be distinguished from other strains of *B. tabaci* by biochemical testing (see Monitoring and identification below). Eggs are laid on the underside of leaves, are very small and sit on a pedicle or stalk. When laid en masse, the eggs can look like brown velvet. Whitefly nymphs settle under leaves and become sedentary like scale insects. Nymphs are pale yellow-green, flat and oval in shape with red 'eyes'. Most SLW nymph stages are immobile and pupate in situ on the leaf.

Why is the B-biotype of SLW so difficult to manage?

SLW has resistance to many common pesticides, including organophosphates, carbamates and synthetic pyrethroids. Australian experience and research shows SLW can develop resistance to pesticides extremely rapidly, due in part to its short generation time (egg to adult in as little as 12 days in summer) and to the huge populations that can develop (billions/ha). It generates resistance to chemicals much faster than *Helicoverpa armigera*.

Fig. 1. Adults (1.5mm long) and nymphs of silverleaf whitefly on the underside of a soybean leaf.
Photo N. Moore, NSW Agriculture.

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What damage can it cause?

SLW sucks sap from the plant and can rapidly generate large populations, which reduce crop yields. Like aphids, SLW also secretes 'honey dew', a food source for sooty mould that covers leaves with black growth and reduces photosynthesis (Fig. 2).

Fig. 2. Soybean crop severely affected by sooty mould due to silverleaf whitefly infestation. Photo N. Moore, NSW Agriculture.

Once SLW populations explode little can be done to control them and crops can be decimated in a short time if conditions are favourable (for example, hot, dry weather). Many cotton and soybean crops in Central Queensland were devastated by SLW in the 2001-2002 season.

If you suspect an outbreak of SLW, please DON'T SPRAY!

The first line of action for a SLW outbreak should be identification to confirm the B-biotype (see Monitoring and identification below). This will determine available control options. If it is the B-biotype, don't be tempted to spray with pesticides. SLW is known to be moderately to highly resistant to all commonly used broadacre crop pesticides currently used in Australia. Spraying with pesticides will likely promote the development of further pesticide resistance in SLW, kill beneficial insects and probably cause the SLW population to flare, along with other pests such as mites.

Monitoring and identification

The areas to which this pest will spread and establish in Australia are still unknown. Predictions have been made about potential areas for spread of SLW but more information needs to be gathered from soybean cropping areas to determine which ones are likely to be most at risk. Although SLW may spread throughout soybean growing areas, it is not known whether it will necessarily cause economic damage in all regions.

In general, areas with hot summers, mild winters and a year-round abundance of susceptible host plants are considered to be at highest risk. However, some areas at lesser risk may experience outbreaks when conditions are favourable. Soybean production areas considered to be at greatest risk include coastal Queensland (Qld) (including the Lockyer and Fassifern valleys), central Qld, and the Northern Rivers district of New South Wales (NSW). Production areas at lesser risk include the inland Burnett and Darling Downs in Qld and the North West slopes in NSW.

We need to identify your whiteflies!

Please contact your local District Agronomist or Entomologist to coordinate the identification of specimens. Biochemical analysis is required to distinguish the B-biotype - this is done by Dr Robin Gunning's team at the Tamworth Centre for Crop Improvement, NSW Agriculture, Calala Lane, Tamworth, NSW 2340.

Your District Agronomist or Entomologist will also assist you to collect the specimens correctly.

- Adult flies are preferred for analysis.
- Late-stage nymphs are also acceptable.
- Send specimens as quickly as possible to arrive in good condition for analysis.
- Keep SLW specimens cool and send alive.
- Do not kill or put in alcohol.

Where to look for SLW

SLW survives on a wide range of crops, weeds and ornamental plants including, but not limited to, the following:

- Highly preferred hosts such as soybean, melon, sunflower (young), tomato, bladder ketmia (*Hibiscus trionum* - see Figs. 3 and 4), native rosella (*Abelmoschus ficulneus*), Convolvulaceae vines, for example, cow vine (*Ipomoea lonchophylla*) and bell vine (*Ipomoea plebeia*), sow or milk thistle (*Sonchus oleraceus*), Cucurbitaceae and Euphorbia weeds, and many ornamental plants.

- Less preferred hosts that may still support large populations include cotton, sunflower (mature), pumpkin, peanuts, and pasture legumes (including lucerne). Numerous other plants may support SLW, especially when populations flare.

Fig. 3. Adult silverleaf whitefly on the weed host bladder ketmia (*Hibiscus trionum*) Photo courtesy N. Forrester, Deltapine.

Fig. 4. Silverleaf whitefly nymphs (left) and adults (right) under bladder ketmia leaves. Photo courtesy N. Forrester, Deltapine.

Implications for soybean growers in northern NSW

Presently there are no chemical treatments registered for use against SLW in soybean in Australia. Until effective control measures are found, SLW has the potential to prevent highly susceptible crops, such as soybean, being grown in areas where large populations of the pest become established. After devastating losses to soybean crops in Central Queensland (Emerald) and Bundaberg in 2002, soybeans should not be grown in these high-risk areas until control measures are developed. This will bring production pressures (and opportunities) to production areas where SLW does not establish in large numbers.

Since it was first detected in Darwin and Tamworth in 1994, monitoring of SLW has shown that it is still spreading to new cropping areas in the Northern Territory, Queensland, and New South Wales, (and in glasshouses in Adelaide and Perth) (R. Gunning, pers. comm.). The southern and western limits for its future establishment are unknown. Cold winters are thought to reduce SLW populations, so the boundaries for damaging populations may shift depending on seasonal conditions, but this cannot be predicted with certainty at this stage.

Whilst SLW has previously been recorded in northern NSW on a variety of horticultural crops, only one severe outbreak has been confirmed in a soybean crop north of Ballina in the 2002 season (see Fig. 5).

The impact of control measures used on other pests (for example, early season organophosphate or synthetic pyrethroid sprays) must be considered in areas where SLW is known to occur, as these can flare SLW populations. This flaring occurs because 'harder' sprays kill many of the beneficial insects that attack SLW, in particular lady beetles and SLW parasites. As well, 'harder' pesticides kill susceptible strains of *B. tabaci* resulting in a greater proportion of the *B. tabaci* population being SLW.

SLW must be viewed as a multi-pest management problem. In developing management strategies for SLW we cannot focus on SLW alone. Soybean growers may need to consider more pest-specific controls (for example, NPV or Bt products for heliothis) to avoid flaring SLW populations.

Fig. 5. An average of 25% yield loss resulted from this infestation of SLW (*B. tabaci* B-biotype) in soybeans north of Ballina in northern NSW. The pest appeared in February 2002 in an otherwise healthy, vigorous crop. Feeding by the pest and extensive sooty mould, which developed on honey dew produced by the pest, caused the pods not to complete filling. Photo N. Moore, NSW Agriculture.

Management strategies

In the absence of pesticides registered for SLW in soybeans, the key strategies at present are:

1. **Weed control** year round to remove host plants, especially winter hosts

2. **Awareness** of the pest, frequent inspection of crops, volunteer plants and weeds for early detection and identification of SLW

3. **Avoiding spraying** with 'hard' chemicals early in the season to protect beneficial insect populations and to avoid flaring SLW if present

4. **Adoption of IPM** (integrated pest management) practices that maximise beneficial insect populations (see Fig. 6).

5. **Overhead irrigation**, where appropriate, as there is anecdotal evidence that this can reduce sooty mould by washing adults and honey dew from leaves.

Fig. 6. Generalist predators such as Lady beetles (Family Coccinellidae, above), lacewings (order Neuoptera) and big-eyed bugs (*Geocoris sp.*) feed on SLW and can reduce SLW populations provided they are not overwhelmed by SLW 'flares'. Photo N. Moore, NSW Agriculture.

Pesticides?

The cotton industry in Australia is pursuing the registration of several new pesticides for SLW as components of an Insecticide Resistance Management Strategy (IRMS). The strategy involves pesticides from at least four different chemical groups (including insect growth regulators) for use at different stages of the season. Because of SLW's great capacity to develop resistance to pesticides, the success of such a strategy needs all growers in a region to comply with strict usage patterns so that only one spray with one type of chemical is allowed in any one season and no mixes are allowed. Coordination is essential so that everyone does 'the same thing at the same time' for greatest impact on the local SLW populations. The success of this strategy will be known in the coming seasons.

Registration of chemicals for use against SLW in soybean in the future will require the generation of residue (MRL) data. For some products this may mean a minimum of two years' trial work. The high cost of some new pesticides may prove to be prohibitive.

Experience from Central Queensland suggests that soaps and oils (for example, petroleum oils) may be effective in suppressing early SLW population build up by 'smothering' the nymphs. For effective under-leaf coverage, high volume, ground application may be needed. Registration issues for soaps and oils in soybean were still being investigated at the time of writing (March 2003). Penetration of dense canopy crops such as soybean may make under-leaf coverage difficult to achieve later in the season.

Parasites and predators

Farming systems that are being driven by SLW-susceptible crops (for example, cotton and soybeans) and climate must introduce a stabilising effect to prevent SLW population flares. Year-round refuges of suitable plant species that help to build up parasites and predators may achieve this. Researchers are looking at ways of using these means to manage SLW in Australia.

A new project led by Dr Richard Sequeira, Department of Primary Industries (DPI), Emerald, is investigating movement patterns of SLW and the impacts of beneficial insect refuges.

Research is also under way to import and trial parasitoid wasps that attack SLW. Dr Paul De Barro of CSIRO in Canberra has imported one such wasp (*Eretmocerus*) for trials in 2002-2003. These wasps were effectively used to manage SLW in the United States of America where refuges of 'banker plants' to host the wasp were planted among summer crops and in the winter.

Other approaches and research

- The Area Wide Management (AWM) approach that has been useful for managing *Helicoverpa armigera* in Australia could be useful for SLW in the future, particularly in mixed cropping areas with year-round availability of host crops. Cooperation between plant industries is critical for effective management of this pest.
- Dr Robin Gunning's group at NSW Agriculture, Tamworth, is continuing to monitor the spread of the B-biotype and investigating the potential for it to develop resistance to new pesticides.
- Fungal biopesticides of SLW and other insect pests (for example, Green Vegetable Bug) are being investigated by Dr Carrie Hauxwell, DPI, Brisbane.
- 'Soft' management options for *Helicoverpa armigera* and bug pests are being developed by Dr Dave Murray and Hugh Brier respectively (DPI, Toowoomba and Kingaroy). These options will also reduce the risk of SLW in soybean.

Further information

Please contact your local NSW Agriculture or DPI District Agronomist or Entomologist for updated information on this pest.

More information is available at the Australian Cotton CRC website: www.cotton.crc.org.au

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