99/CRDC20C

A Summary of the Silverleaf Whitefly in Australia July 1998 to January 2000

Paul De Barro, CSIRO Entomology
John Brown, QDPI, QHI
Ali Rezaian, CSIRO Plant Industry

The Whitefly Report No. 5 February 2000

The Whitefly Report No. 5 February 2000

Paul De Barro, CSIRO Entomology
John Brown, QDPI, QHI
Ali Rezaian, CSIRO Plant Industry

A Summary of the Silverleaf Whitefly in Australia July 1998 to January 2000

Contents **Page**

Changes to the Silverleaf Whitefly Research Program

In July 1999, the separate silverleaf whitefly (SLW) projects of QDPI, CSIRO Entomology and CSIRO Plant Industry were combined in order to provide a more coordinated research effort that was better able to meet the needs of growers. The new program includes studies on the biology and ecology of whiteflies and their parasitoids, epidemiology of geminiviruses and effectiveness and use of insecticides and their effects on natural enemies. The research aims to provide an integrated approach to managing silverleaf whitefly and geminiviruses which also takes into account management strategies for other crop pests. The ultimate aim is to develop system-wide management strategies rather than linear crop/pest strategies. In addition, a small project to look at the potential of soybean to act as an over summer bridging crop for SLW is being undertaken with the BSES (Bureau of Sugar Experiment Stations).

Research staff:
QDPI (QHI): John Brown (insecticides and soybean), Des McGrath (irregular ripening and geminivirus resistance breeding) and Siva Subramaniam (insecticides, irregular ripening, parasitoid dispersal, soybean and whitefly and parasitoid ecology)
CSIRO Plant Industry: Ali Rezaian (geminivirus)
CSIRO Entomology: Paul De Barro (insecticides, irregular ripening, parasitoid dispersal, geminivirus and soybean), Marc Coombs (parasitoid dispersal) and Peter Hart (geminivirus)
BSES: Peter Allsopp (soybean).

As part of the changes, Paul De Barro moved from Canberra to CSIRO Entomology's laboratories at Long Pocket, Brisbane and Dr W. Siva Subramaniam (Subra) was appointed to QDPI from mid-January 200.

Contact details:
Paul De Barro, CSIRO Entomology, PB3 Indooroopilly, QLD 4068
ph (07) 3214 2811, fax (07) 3214 2885, email paul.debarro@brs.ento.csiro.au
Siva Subramaniam, QDPI, Bowen Horticultural Research Station, PO Box 538, Bowen QLD 4805
ph (07) 4785 2255, fax (07) 4785 2427, email subrams@dpi.qld.gov.au

The new program has three components. The first seeks to determine which insecticides are effective against SLW and how and when to apply and rotate them so as to maximise their efficacy. We will also look at how they can be integrated with the use of natural enemies so as to reduce reliance on chemical pesticides. This will reduce the potential for the development of resistance.

The second component aims to determine how best to incorporate the native parasitoid *Eretmocerus mundus* (Australian parthenogenetic form), a highly effective natural enemy of SLW, into commercial horticulture. The third seeks to prepare for the likelihood of serious geminivirus outbreaks through the development of contingency plans. These will provide growers with realistic management options and the components of IPM necessary for managing geminivirus diseases. The major threat is from the tomato leaf curl geminivirus complex (TLCV), which as a group are able to attack numerous different vegetable crops as well as tomato. Currently, we know nothing of the crop and weed host range of the four or five TLCV strains known from Australia but we do know that SLW is able to transmit them. In addition, we do not know whether there are other geminiviruses in Australia. Given our proximity to Asia, and the large number of different geminiviruses known from there, it is likely that there are others present here that may threaten crops. This is borne out by the detection in recent surveys of a new geminivirus in melons in Kununurra. It is likely that as SLW increases in numbers and spreads onto non-crop hosts that it will come in contact with these viruses and spread them to susceptible crop hosts.

Research results from all aspects of the work will be combined to produce a best practice standard for the development of a sustainable management package of SLW.

Progress Summary

Whilst some research was delayed pending the appointment of Siva Subramaniam, considerable progress has been made and the following is a summary of research from all areas of the SLW program.

Insecticide efficacy

Eleven new compounds, including oils, insecticidal soaps, insect growth regulators and several new mode of action insecticides, are being trialed for efficacy against SLW along with several existing insecticides. The chemical companies will then submit data from the trials to the National Registration Authority for approval to use their compounds in vegetable crops. This means that compounds found to effective in the trials will not be available for grower use in the short term. There are ongoing discussions with the companies involved on producing the appropriate data needed for registration and, in some cases, further evaluations are under way and results will forwarded to the companies for their future determination.

A management strategy based on rotation of chemical groups and a 'no-use' period for chloronicotinyl compounds (specifically Confidor) is being developed. In the tropics, this period, is based on a four weeks, the length of a pest generation. This will ensure that a single generation of insects is not subjected to more than one chloronicotinyl spray. Chloronicotinyl compounds have been the most effective products trialed to date. Restricting their use will help delay the development of resistance (which is already occurring overseas) and the compounds will thus be available for use in severe outbreaks. Most of the chemical companies support this management tool.

Economic Injury Level (EIL) trial into tomato irregular ripening

The following recommendations are based on two trials in tomato crops:

1. A damage threshold based on the minimum number of 0.2 nymphs/cm^2 of leaf be adopted.
2. A warning that damage exceeding 30% could be expected if the minimum number of nymphs/cm^2 is $\geq$0.25 nymphs/cm^2 of leaf.
3. If densities are below 0.25 nymphs/cm^2 of leaf and plants are starting to fruit then a larger sample, concentrating on leaves above and below fruit bearing stalks needs to be considered.

Parasitoid dispersal trial determined dispersal using large field cages and marked parasitoids

The use of an array of numerous small battery operated fan traps has been tested for monitoring the movement of parasitoids in crops. Preliminary results suggest that it will be an effective tool it and will be used this year to follow the movement of parasitoids.

Crops screened for TLCV examining different varieties and weeds for susceptibility

The SLW has been shown to be a very effective vector of TLCV. It has also been shown to both acquire TLCV from, and transmit it to, all commercial classes of tomato (cherry, round, roma and gourmet).

Both the eastern and western forms of the native *B. tabaci* have been shown to acquire and transmit TLCV from tomato. This suggests that tomato growing regions such as the Lockyer Valley where SLW is uncommon are at risk as the eastern form of the native *B. tabaci* is present.

These results also raise the question as to why TLCV has not yet been found south of Lakeland (150 km north of Mareeba) despite the eastern form of *B. tabaci* being common as far south as northern NSW. There are several possible explanations. The first is that TLCV is a relatively recent incursion into Australia, the second is that it has undergone a mutation that has lead to (a) a broadening of host range (b) an increase in virulence or (c) an increased ability to be acquired and transmitted. Either may explain why TLCV suddenly became a significant problem of tomatoes in the Northern Territory in the late 1960s. It also suggests that TLCV can be expected to continue its southward spread irrespective of any quarantine measures. This does not mean that quarantine measures will not be useful in slowing the spread of the virus, but it does suggest that infection of the southern tomato growing regions is inevitable.

Another possible explanation is that there may be a discontinuity of host plant that stops the virus persisting year round. If that is so, a good knowledge of the non-crop hosts is an essential part of any plan to restrict its spread. Control of key non-crop hosts may significantly reduce the size of any disease reservoir and so reduce the impact of the disease on tomato production. A sound knowledge of non-crop hosts may also contribute to the planning of an effective quarantine barrier and may suggest the likely effectiveness of quarantine in restricting the spread of the disease.

The following table lists the crop, nursery and weed species that are being screened for susceptibility to TLCV. At present 4 or 5 variants of TLCV are known from Australia. Two have been found in Lakeland, Qld and we are concentrating on determining the host range which covers major crops, weed and nursery plants.

Table of species being screened for susceptibility to TLCV

Species	Common Name/variety	Species	Common Name/variety
Cucumis sativus	cucumber	*Ageratum sp.*	
Cucurbita pepo	zucchini	*Capsicum* sp.	birds eye chilli
	squash	*Physalis peruviana*	cape gooseberry
	pumpkin	*P. minima*	wild gooseberry
Cucumis melo	rockmelon	*P. virginiana*	perennial ground cherry
	honeydew melon	*Solanum nigrum*	blackberry nightshade
	watermelon	*S. americanum*	glossy nightshade
Lycopersicon esculentum	cherry 110	*S. torvum*	
L. esculentum	tempest	*S. hispidum*	
L. esculentum	redcoat	*S. mauritianum*	tree tobacco
L. esculentum	burkes backyard	*S. linnaeanum*	apple of Sodom
L. esculentum	grosse lisse	*Solanum hirsutum*	
Capsicum annum var bell capsicum	capsicum	*S. seaforthianum*	
C. annum	chilli	*S. esuriale*	
Solanum melongena	eggplant	*S. jasminioides*	potato jasmine
S. tuberosum	english potato	*S. pseudocapsicum*	Jerusalem cherry
Hibiscus esculentus	okra	*S. wrightii*	tree potato
Gossypium hirsutum	cotton	*Nicandra physalodes*	wild hops
Hibiscus rosa-sinensis	hibiscus	*Nicotiana tobaccum*	tobacco
	pea	*Datura inoxia*	downy thornapple
Vicia sp.	bean	*D. stramonium*	common thornapple
Glycine max	soybean	*D. ferox*	fierce thornapple
Ipomoea batatas	sweet potato	*Lantana camara*	lantana
Euphorbia pulcherrima	poinsettia	*Petunia*	petunia
	broccoli	*Brugmansia versicolor*	angel's trumpet
	cabbage	*Streptosolen jamesonii*	marmalade bush
	chinese cabbage	*Brunfelsia americana*	yesterday, today & tomorrow
	cauliflower		
	bok choy	*B. australia*	yesterday, today & tomorrow

A testing system has been developed that ensures 100% infection of the controls. It has been essential to develop a rigorous and reliable mass screening system to ensure that potential hosts are not missed. Once hosts have been identified they well be further tested to determine whether SLW is able to acquire the virus from them and to then transmit it to a known susceptible host, in this case tomato.

If anyone has fruit of various species of Solanaceae not included here, we would be happy to have samples. Please send them to
Paul De Barro
CSIRO Entomology
PB3
Indooroopilly, QLD 4068

The potential role of soybeans as a summer crop source of autumn whiteflies
Across many of the Queensland vegetable growing regions few vegetable crops are grown from around December to early February. This effectively of reduces the number of whiteflies and there are relatively few adults available to infest early sown crops. If a suitable host were to be grown over this period, then this dynamic would change.

One such crop is soybean. It is proposed that soybean be planted as a summer rotation crop (October to February) either as a green manure or as a cash crop, as a possible solution to declining yields in sugar cane. Unfortunately, soybean is a good host for SLW. If such a system becomes widely adopted in the Burdekin and Bundaberg regions then the whitefly susceptible cropping dynamic changes from the current discontinuous system to a continuous system, which is ideal for this pest. This could lead to a possible conflict of interest between canegrowers and vegetable growers.

The concern of the vegetable industry is that even modest plantings of soybeans could significantly increase the numbers of early season whiteflies necessitating earlier and more frequent applications of insecticide. This, combined with the possible need for insecticide applications in soybean greatly increases the risk of insecticide resistance developing in whitefly populations. One way to possibly reduce the threat is to use varieties of soybean that are less suitable to SLW thereby minimising the numbers of whiteflies produced.

In order to assess, this threat CSIRO approached BSES to undertake two small variety trials in soybean, one in Bundaberg and the other in the Burdekin. These trials are comparing whitefly numbers across 51 soybean varieties. Those in Bundaberg were planted on 11 November between two rows of eggplant seedlings that were already infested with whitefly. This was to ensure that sufficient whitefly had the opportunity to infest the soybean so that any varietal differences in susceptibility could be readily determined. In late November, large numbers of adult whitefly were observed feeding and ovipositing on the soybean. The trial is being run cooperatively between BSES, CSIRO and QDPI and will be regularly monitored till the end of February.

The trial site consisted of two randomised blocks. Each block contains a 5 m planting of each of the 51 varieties. The first samples, 10 leaflets from each variety in each of the two blocks, were collected on 16 December. The leaflets were collected at random from the lower 2/3 of the plant. The total number of nymphs on each leaflet was counted and the leaf area estimated by taking the maximum length and width measurement for each leaflet. There was no significant between block variation, but there was a significant difference in the whitefly density between varieties. At the time of counting, plants ranged in height from 15 cm to 40 cm, but height had no significant effect on the variation between varieties. Flowering had not yet commenced. The mean density ranged from 2.8 to 35.4 nymphs/cm^2. None of the varieties tested was free of infestation. There is some anecdotal evidence that the hairy leafed varieties were more susceptible to whiteflies than the smooth leafed varieties. This is being investigated further.

The results suggest that all varieties of soybean are likely to be host to the SLW, but that choosing less susceptible varieties could reduce numbers. The trial will be sampled again in January and in February to determine whether susceptibility changes over time. If the level of infestation persists then it is likely that even the least susceptible varieties may lead to a significant increase in the early season number of whiteflies. Growers therefore will need to be aware of the potential for early season infestations if their crops are grown in close proximity to soybean.