2025 SLW resistance surveillance

Management of silverleaf whitefly (SLW; *Bemisia tabaci*), an important late season pest of cotton, often requires an application of insecticide. Unfortunately, SLW has a history of developing resistance to insecticides, so each year populations of this pest are collected from most cotton-growing regions and tested against products commonly used in cotton (see Table 1).

This year, 21 field populations were collected in QLD and NSW and tested for resistance to pyriproxyfen, spirotetramat, buprofezin, acetamiprid and diafenthiuron. Lower priority insecticides were tested against one population from each region only. Annual testing results are used to guide the revision of the Insecticide resistance management strategy (IRMS) for the cotton industry.

Key points:

- Low level resistance to pyriproxyfen is still present in many regions.
- Spirotetramat resistance was detected in most areas at low levels.
- Bifenthrin resistance is widespread, but generally low level.
- In a small number of populations there was reduced sensitivity to acetamiprid but further testing indicated this was not due to resistance.
- No resistance was detected to buprofezin, diafenthiuron, dinotefuran or emamectin benzoate

Table 1. Summary of insecticide resistance in silverleaf whitefly collected from cotton in 2025.

	Pyriproxyfen	Spirotetramat	Buprofezin	Acetamiprid	Diafenthiuron	Bifenthrin	Dinotefuran	Emamectin
Emerald	*	*	*	*	*	*	*	*
Theodore	*	*	*	*	*	*	*	*
St George	***	***	***	***	***	*	*	*
Mungindi	**	**	**	**	**	*	*	*
Goondiwindi	***	***	***	***	***	*	*	*
Moree	***	***	***	***	***	*	*	*
Namoi Valley	***	***	***	***	***	*	*	*
Narromine	**	**	**	**	**	*	*	*
Griffith	**	**	**	**	**	*	*	*
Hillston	*	*	*	*	*	*	*	*

Each asterisk represents a population; colour denotes resistance: none (*), low (*), moderate (*) or high (*)

How do we determine resistance?

Two responses are evaluated:

1. **survival of a population at the discriminating dose** (DD; a concentration of insecticide in a laboratory bioassay that kills 100% of susceptible insects).
2. **the concentration of insecticide required to kill 50% of the tested population** (LC_{50}).

Where there is survival at the DD, there is reasonable confidence that the population tested contains resistant individuals. Populations with resistance have been highlighted in orange in the individual insecticide results.

Reduced sensitivity in field populations can be measured by dividing the LC_{50} of the field population by the LC_{50} of a known susceptible population to give the resistance ratio (RR). The 'known susceptible' population used for SLW resistance testing has been kept in a laboratory without contact with insecticides since the mid-1990s.

A ratio of 1 means there is no difference between the known susceptible population and the field population. A ratio of 10 means that the concentration required to kill 50% of population was 10 times the concentration to kill the known susceptible.

Interpreting RRs can be difficult, especially when bioassays responses are highly variable and when ratios are low. Generally, the following system is used:

- susceptible (RR=1)
- tolerance to low resistance (RR=2-10)
- moderate resistance (RR=11-30)
- high resistance (RR= 31-100)
- very high resistance (RR>100).

Collecting whitefly populations for resistance testing.

Surveillance results 2025

Pyriproxyfen

Resistance was detected in 7 populations (RRs 5.2–11.7) out of 21 tested (Table 2). Populations with the highest survival both came from the lower Namoi valley at 2.8 and 3.7% survival at the discriminating dose of 10 mg/L ai. While the 30-day window has been removed from the IRMS, it is still critical to only apply a single application of pyriproxyfen per field.

Table 2. Toxicity of **pyriproxyfen** to SLW, 2025.

Population	LC_{50} (mg/L)	Survival (%) at DD (10 mg/L)	RR
Emerald	0.038	0	2.0
Theodore	0.092	0	4.9
St George (1)	**0.096**	**0.4**	**5.2**
St George (2)	**0.157**	**0.8**	**8.5**
St George (3)	0.066	0	3.6
Mungindi (1)	**0.226**	**0.8**	**12.2**
Mungindi (2)	0.120	0	6.5
Macintyre (1)	0.170	0	9.1
Macintyre (2)	0.185	0	10.0
Macintyre (3)	**0.355**	**1.7**	**19.1**
Moree (1)	0.224	0	12.0
Moree (2)	0.104	0	5.6
Moree (3)	0.162	0	8.7
Namoi (1)	0.179	0	9.7
Namoi (2)	**0.167**	**2.8**	**9.0**
Namoi (3)	**0.218**	**3.7**	**11.7**
Narromine (1)	0.127	0	6.8
Narromine (2)	0.181	0	9.8
Hillston	0.255	0	13.7
Griffith (1)	0.194	0	10.4
Griffith (2)	**0.216**	**1.7**	**11.6**

Spirotetramat

The genetics of resistance to spirotetramat are well understood and the bioassays results are correlated with molecular screening to more confidently detect low frequency (RRs of 1-2) resistance in populations, so the level of survival at the discriminating dose is more critical than the RR.

Low level resistance was detected in 13 populations out of 21 tested. The highest survival at the discriminating dose was 6.47% from a population collected at St George. The highest incidence of resistance is in the border rivers area (St George, Mungindi & Macintyre) (Table 3). If you have used spirotetramat in the past season, rotate to another insecticide group to reduce resistance selection in SLW to spirotetramat.

Table 3. Toxicity of **spirotetramat** to SLW, 2025.

Population	LC_{50} (mg/L)	Survival (%) at DD (100 mg/L)	RR
Emerald	**3.51**	**0.8**	**0.9**
Theodore	**6.37**	**4.2**	**1.6**
St George (1)	**9.35**	**3.4**	**2.3**
St George (2)	**10.71**	**6.5**	**2.6**
St George (3)	**9.88**	**4.8**	**2.4**
Mungindi (1)	**3.25**	**1.0**	**0.8**
Mungindi (2)	**4.75**	**0.7**	**1.2**
Macintyre (1)	**8.34**	**3.5**	**2.0**
Macintyre (2)	**8.99**	**2.1**	**2.2**
Macintyre (3)	**7.61**	**2.6**	**1.9**
Moree (1)	**4.79**	**3.2**	**1.2**
Moree (2)	2.56	0	0.6
Moree (3)	3.01	0	0.7
Namoi (1)	**6.32**	**0.7**	**1.5**
Namoi (2)	6.93	0	1.7
Namoi (3)	5.09	0	1.2
Narromine (1)	6.01	0	1.5
Narromine (2)	5.12	0	1.3
Hillston	4.81	0	1.2
Griffith (1)	4.92	0	1.2
Griffith (2)	**6.03**	**0.8**	**1.5**

Bifenthrin

Nine out of 10 populations had resistance to bifenthrin. Of these, 8 had low frequency resistance, while a population from the Namoi had moderate resistance with 32% survival at the discriminating dose and a resistance ratio of 12.9, with that level of survival, field failure is likely (Table 4).

Table 4. Toxicity of **bifenthrin** to SLW, 2025.

Population	LC_{50} (mg/L)	Survival (%) at DD (320 mg/L)	RR
Emerald	**7.89**	**4.1**	**2.6**
Theodore	**12.07**	**12.5**	**4.0**
St George	**22.51**	**14.7**	**7.5**
Mungindi	**6.59**	**4.0**	**2.2**
Macintyre	4.97	0	1.6
Moree	**14.42**	**14.4**	**4.9**
Namoi	**38.59**	**32.0**	**12.9**
Narromine	**7.92**	**2.4**	**2.7**
Hillston	**8.09**	**5.0**	**2.7**
Griffith	**11.66**	**3.8**	**3.9**

Buprofezin

All 21 populations were susceptible with 100% mortality recorded at ≤200 mg/L. A population from Emerald had the highest recorded LC50 at 3.93 resulting in a low toxicity ratio of 4.0 (Table 5). No evidence of resistance was found in 2025. Buprofezin has low impact on natural enemies and is a suitable alternative to use in place of either pyriproxyfen or spirotetramat.

Table 5. Toxicity of **buprofezin** to SLW, 2025.

Population	LC_{50} (mg/L)	Survival (%) at DD (200 mg/L)	RR
Emerald	3.93	0	4.0
Theodore	1.53	0	1.5
St George (1)	0.63	0	0.6
St George (2)	0.48	0	0.5
St George (3)	0.64	0	0.6
Mungindi (1)	1.96	0	2.0
Mungindi (2)	2.13	0	2.1
Macintyre (1)	2.71	0	2.7
Macintyre (2)	1.40	0	1.4
Macintyre (3)	2.04	0	2.1
Moree (1)	1.44	0	1.5
Moree (2)	1.24	0	1.2
Moree (3)	1.55	0	1.6
Namoi (1)	3.03	0	3.0
Namoi (2)	1.39	0	1.4
Namoi (3)	2.37	0	2.4
Narromine (1)	0.73	0	0.7
Narromine (2)	0.55	0	0.6
Hillston	3.81	0	3.8
Griffith (1)	0.57	0	0.6
Griffith (2)	0.87	0	0.9

Acetamiprid

Three populations, Narromine (1), Hillston and Griffith (1) had low level survival (1.3–2.0%) at 300 mg/L ai (Table 6). Further testing at higher doses could not confirm resistance in these populations. Existing datasets from the past decade were collated in 2025 and a discriminating dose of 600 mg/L ai was developed to include in future testing.

Table 6. Toxicity of **acetamiprid** to SLW, 2025.

Population	LC_{50} (mg/L)	Survival (%) at 300 mg/L	RR
Emerald	4.10	0	1.0
Theodore	9.28	0	2.3
St George (1)	10.39	0	2.6
St George (2)	17.55	0	4.4
St George (3)	13.27	1.2*	3.3
Mungindi (1)	5.02	0	1.2
Mungindi (2)	5.33	0	1.3
Macintyre (1)	11.53	0	2.9
Macintyre (2)	13.41	1.1*	3.3
Macintyre (3)	11.54	0	2.9
Moree (1)	18.16	0	4.5
Moree (2)	16.71	0	4.2
Moree (3)	22.04	0	5.5
Namoi (1)	12.68	0	3.2
Namoi (2)	8.29	0	2.1
Namoi (3)	10.02	0	2.5
Narromine (1)	14.18	1.9*	3.5
Narromine (2)	9.69	0	2.4
Hillston	10.53	1.3*	2.6
Griffith (1)	13.5	2.0*	3.4
Griffith (2)	6.02	0	1.5

* Did not survive 600 mg/L ai

Diafenthiuron

All 21 populations were tested for resistance to diafenthiuron, with no evidence of resistance being detected. In all bioassays 100% mortality was observed at doses ≤30 mg/L ai (Table 7).

Table 7. Toxicity of **diafenthiuron** to SLW, 2025.

Population	LC_{50} (mg/L)	Survival (%) at DD (30 mg/L)	RR
Emerald	1.35	0	0.4
Theodore	1.47	0	0.4
St George (1)	2.18	0	0.7
St George (2)	3.32	0	1.0
St George (3)	2.78	0	0.8
Mungindi (1)	1.59	0	0.5
Mungindi (2)	1.42	0	0.4
Macintyre (1)	3.07	0	0.9
Macintyre (2)	3.18	0	0.9
Macintyre (3)	3.28	0	0.9
Moree (1)	1.96	0	0.6
Moree (2)	1.69	0	0.5
Moree (3)	2.42	0	0.7
Namoi (1)	2.04	0	0.6
Namoi (2)	3.36	0	1.0
Namoi (3)	2.94	0	0.9
Narromine (1)	3.09	0	0.9
Narromine (2)	4.09	0	1.2
Hillston	2.15	0	0.6
Griffith (1)	2.45	0	0.7
Griffith (2)	4.72	0	1.4

Dinotefuran

Testing in 2025 included a discriminating dose of 600 mg/L ai. Ten populations were tested and no resistance was detected with 100% mortality recorded at ≤ 600 mg/L (Table 8).

Table 8. Toxicity of **dinotefuran** to SLW, 2025.

Population	LC_{50} (mg/L)	Survival (%) at DD (600 mg/L)	RR
Emerald	13.86	0	1.1
Theodore	9.64	0	0.8
St George	18.00	0	1.5
Mungindi	9.52	0	0.8
Macintyre	32.92	0	2.7
Moree	7.82	0	0.6
Namoi	8.76	0	1.3
Narromine	17.86	0	1.5
Hillston	6.48	0	0.5
Griffith	14.31	0	1.2

Emamectin benzoate

Ten populations were tested and 2 had survivors at 10 mg/L ai, but subsequent testing at 30 mg/L ai resulted in 100% mortality in all populations (Table 9). Bioassay data from the past decade was collated and used to determine a discriminating dose of 30 mg/L ai to be included in future testing.

Table 9. Toxicity of **emamectin benzoate** to SLW, 2025.

Population	LC_{50} (mg/L)	Survival (%) at 30 mg/L	RR
Emerald	1.31	0	1.4
Theodore	1.28	0	2.4
St George	3.71	0	4.1
Mungindi	1.48	0	1.6
Macintyre	1.74	0	1.9
Moree	3.41	0	3.8
Namoi	2.32	0	2.6
Narromine	2.22	0	2.5
Hillston	1.48	0	1.6
Griffith	1.28	0	1.4