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Published by NSW Department of Primary Industries,
a part of the Department of Regional New South Wales.

Southern cotton seedling thrips species composition

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Key findings

- Onion thrips were the dominant thrips species observed during monitoring.
- Western flower thrips constituted less than 5% of thrips monitored.
- During early cotton establishment there were more tomato thrips larvae than onion thrips larvae. By December, onion thrips larval numbers exceeded tomato thrips larval numbers.

Introduction

Thrips are common seedling pests of cotton in most growing districts. They feed on growing terminals causing leaf distortion and sometimes death of the terminals. Heavy infestation can result in yield loss and delayed maturity. Most insecticides applied in the southern cotton production region are targeted against thrips. The cotton industry thrips spray threshold of 10 thrips per plant and >80% leaf area loss from seedling to 6-leaf stage has been developed and validated in many research experiments in the northern production areas (see Cotton Pest Management Guide 2015–16). The southern production areas have a shorter season and early crop establishment has been strongly linked with high yields.

Western flower thrips (WFT), *Frankliniella occidentalis*, is a widespread thrips pest in horticultural production in the Riverina and was anticipated to be relatively more important in southern cotton production areas compared with the northern production areas. WFT is a species that is highly resistant to most registered thrips insecticides. Therefore, understanding thrips species composition during cotton establishment in the southern cotton production region is important in accessing the validity of the cotton industry thrips spray thresholds and recommendations.

Site details

Site 1	Coleambally Demonstration Farm (CDF) [145.95 E; -34.74 S]; planted and 1st water 8 October 2014; cooperators: Matt Toscan and Ben Witham
Site 2	Huddersfield (H), Darlington Point [145.91 E; -34.60 S]; planted and 1st water 8 October 2014
Site 3	Irrigation Research and Extension Committee (IREC) demonstration site, Whitton [145.92 E; -34.65 S]; planted and 1st water 1 October 2014; cooperators: Matt Stott (lessee of IREC demonstration site); James Hill (agronomist for Matt) and farm operations staff
Site 4	Point Farms (PF), Darlington Point [145.91 E; -34.65 S]; planted 10 October 2014 and 1st water 14 October 2014; cooperators: Matt Stott (lessee of IREC demonstration site); James Hill (agronomist) and farm operations staff

Treatments

Variety	Bt cotton: Sicot 74BRF D2; conventional cotton: Sicot 71 RRF D2
Seed treatment	D2= Dynasty® - azoxystrobin+ metalaxyl-M+ fludioxonil
Irrigation	Drip (IREC); furrow (PF, CDF & H)
Monitoring dates	CDF: 28 October, 3 November, 10 November, 17 November, 27 November, and 5 December 2014 Huddersfield: 28 October, 11 November, 17 November, 25 November, and 1 December 2014 IREC: 21 October; 27 October, 3 November, 13 November, 20 November, and 1 December 2014 PF: 27 October, 3 November, 10 November, 17 November, 25 November and 4 December 2014
Sample unit	10 whole random plants from untreated Bt and conventional cotton plots
Monitored	Thrips adults, nymphs and species composition
Analysis	Permutational Multivariate Analysis of Variance (MANOVA), significant treatment effects were detected (P<0.05)

Results and discussion

Thrips pressure was relatively low in October, ranging from 0.55 to 2.20 per plant for adult thrips and 0.60 to 2.33 per plant for larval thrips (Figure 1). The pressure built up quickly in the next two months, reaching >40 per plant in November for adult thrips and >190 per plant for larval thrips. The IREC site recorded the highest thrips pressure for both adult and larval thrips, with peak thrips density over twice as many than that at the other three sites.

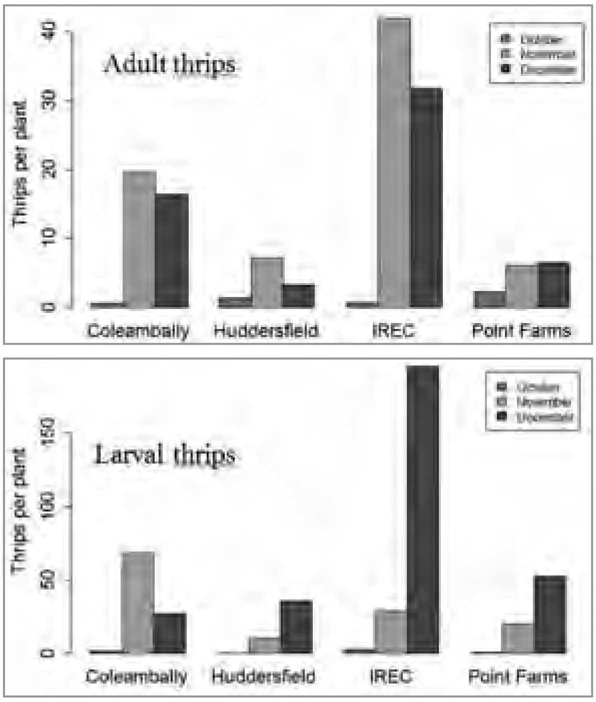

Figure 1. Density of adult (top) and larval thrips (bottom) during October–December 2014 at the monitoring sites in Coleambally, Huddersfield, IREC and Point Farms.

Four thrips species were regularly identified from the foliage samples and a number of other species were occasionally identified and are grouped as 'other thrips':

1. onion thrips (*Thrips tabaci*)
2. tomato thrips (*Frankliniella schultzei*)
3. western flower thrips (*Frankliniella occidentalis*)
4. plague thrips (*Thrips imaginis*)
5. 'other thrips' including: *Haplothrips* sp., *Australothrips bicolor*, *Tenothrips frici*, *Desmothrips* sp., *Anophothrips* sp., and *Andrewarthaia kellyana*.

Overall, onion thrips is the most dominant adult thrips species (71–83%), followed by tomato thrips (9–22%) (Figure 2). Adults of the other thrips species were only found in very small numbers (<5%). Onion thrips and tomato thrips also dominated in larval thrips, accounting for 29–69% and 19–50%, respectively. It is worth noting that tomato thrips was much more abundant in larval samples than in adult samples. Larval tomato thrips even outnumbered larval onion thrips in some samples.

From month to month, there were noticeable changes in the relative abundance of onion thrips, tomato thrips, and WFT. Relative abundance of tomato thrips decreased steadily from October to December in both adults and larvae (Figure 2). In larval thrips, the gradual decrease of tomato thrips was accompanied by a gradual increase of onion thrips (Figure 2).

In particular, the abundance of tomato thrips larvae was twice as high as onion thrips larvae in October, but dropped to less than one third of onion thrips larvae in December. There is also a noticeable increase in WFT larvae abundance from October (1%) to December (9%).

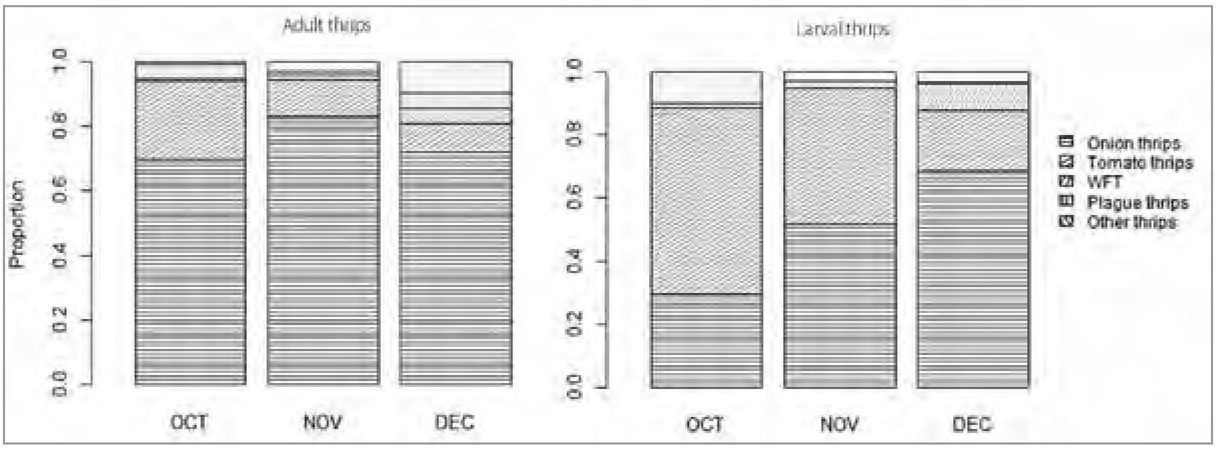

Figure 2. Monthly changes in overall compositions of adult and larval thrips species across four sites. Coloured areas indicate the relative proportions of the thrips species.

Relative abundance of different adult thrips species was similar across the four sites (Figure 3) and between Bt and non-Bt crops (Figure 4). However, tomato thrips larvae were noticeably more abundant at Point Farms (55%) than at the other three sites (26–30%) (Figure 3) and there were slightly more onion thrips larvae and slightly less tomato thrips larvae in non-Bt crops than in Bt crops (Figure 4).

Analyses of permutational MANOVA or multivariate analysis of variance showed significant effects of site and month on the compositions of both adult and larval thrips species (P <0.05) (tables 1 and 2). On the other hand, variety (Bt or non-Bt) had no significant effects on the species compositions.

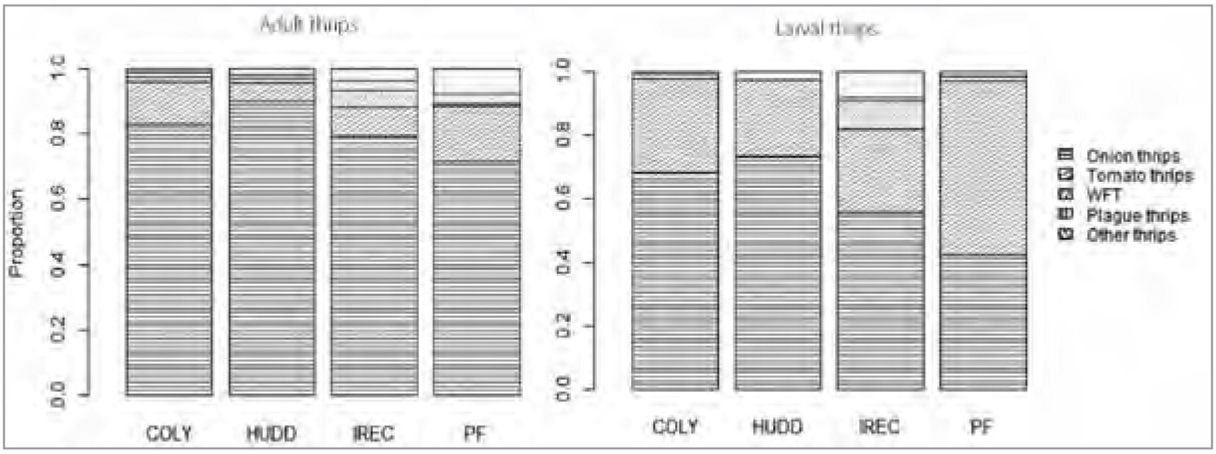

Figure 3. Overall compositions of adult and larval thrips species at individual sites. Coloured areas indicate the relative proportions of the thrips species.

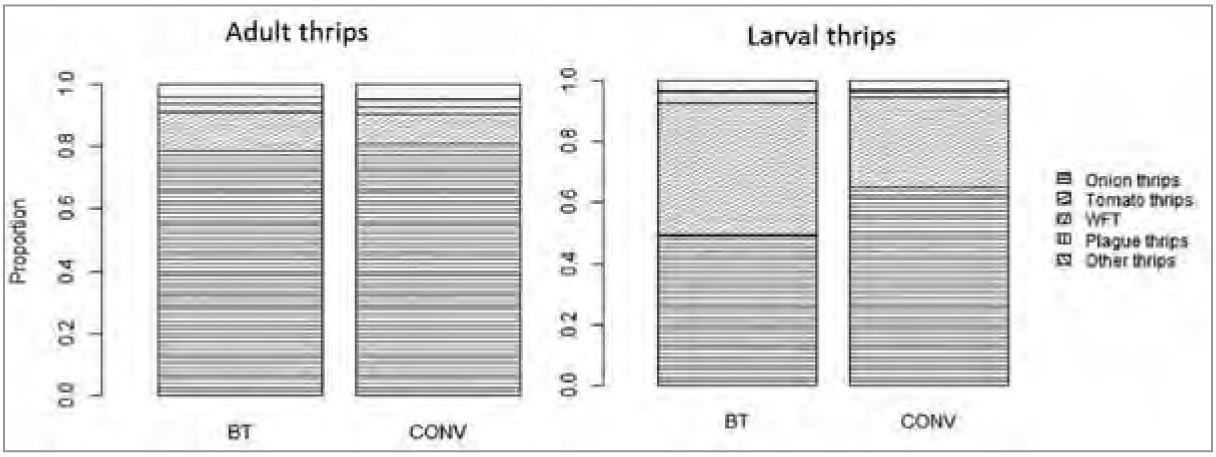

Figure 4. Comparing the compositions of adult and larval thrips species between Bt and conventional cotton crops. Coloured areas indicate the relative proportions of the thrips species

Table 1. Effects of site, month, and variety on the composition of adult thrips species as estimated by permutational MANOVA using distance matrices.

	DF	SS	MS	F	R^2	P (>F)
Site	3	1.1978	0.3993	6.0408	0.1669	< 0.0001
Month	2	1.4709	0.7355	11.1272	0.2049	< 0.0001
Variety	1	0.1475	0.1475	2.2321	0.0206	0.0818
Residual	66	4.3623	0.0661			
Total	72	7.1785				

crop protection

Table 2. Effects of site, month, and variety on the composition of larval thrips species as estimated by permutational MANOVA using distance matrices.

	DF	SS	MS	F	R^2	P (>F)
Site	3	1.2558	0.4186	5.5696	0.1807	0.0002
Month	2	0.9419	0.4710	6.2664	0.1356	0.0006
Variety	1	0.1664	0.1664	2.2138	0.0239	0.0993
Residual	61	4.5846	0.0752			
Total	67	6.9488				

Summary

Thrips populations in cotton seedlings in the Riverina were dominated by onion thrips and tomato thrips. Onion thrips was the single most dominant species in adult populations across the four sites and three monitoring months. Thrips larval numbers were initially dominated by tomato thrips and only at the end of the seedling period did onion thrips dominate. The results suggest that tomato thrips prefer to breed in cotton and probably only migrated into the crop early in cotton establishment, whereas onion thrips continually migrated into the cotton as adults and either didn't breed in the cotton until late spring, or were less successful in their breeding. WFT appeared to have been occasional visitors to cotton seedlings in the Riverina. Although it also established breeding populations in cotton, WFT did not appear to have colonised the study sites in significant numbers, resulting in its overall low numbers during the study period. The significant effect of the site on thrips composition could have been due to different vegetation at the four sites, with some sites having more alternative hosts to some thrips species than others. Bt toxin presence or absence in cotton crops did not appear to have made them more or less attractive to, or suitable for, some thrips species than others.

Given the dominance of onion thrips and relative absence of WFT, recommendations on thrips to the cotton industry are relevant to the southern cotton production areas. Pesticide management and thrips spray threshold validation is the subject of other experiments.

Acknowledgements

This project has been jointly funded by NSW DPI and the CRDC 'Establishing Southern Cotton - IPM project', DAN1501, 2014–17. We greatly appreciate the Coleambally Demonstration Farm committee's cooperation, Apex Coleambally and the grower cooperators: Matt Toscan and Ben Witham. Thanks to Ross Askins at Huddersfield and the IREC demonstration farm committee, the Stott family and farm staff, James Hill, and Matt Watson. Thanks to Jorian Millyard (Cotton Seed Distributors) for supplying seed.

Reference

CottonInfo 2015, *Cotton Pest Management Guide 2015–16*: www.crdc.com.au/publications/cotton-pest-management-guide-2015–16, viewed 28 April 2016.