DETECTION AND SPREAD OF CURRANT-LETTUCE APHID *NASONOVIA RIBISNIGRI* (MOSLEY) (HEMIPTERA: APHIDIDAE) IN NEW SOUTH WALES

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Summary

Following detection of currant-lettuce aphid *Nasonovia ribisnigri* (Mosley) (Hemiptera: Aphididae) in Tasmania in March 2004, surveillance was undertaken in lettuce production areas in New South Wales from March 2005 to October 2006. Regulation of risk produce and education were part of the response. Initial detections were made in January 2006 and surveys ceased in October 2006 after the pest had been detected in most production areas in the State. The survey demonstrated pest freedom in a progressively declining number of production areas and allowed lettuce trade from aphid free areas to continue with other Australian States sensitive to the pest. Interstate regulation of host produce may have delayed the spread of the aphid, allowing time for the industry to develop strategies to manage the pest.

Keywords: exotic incursion

INTRODUCTION

Currant-lettuce aphid (CLA), *Nasonovia ribisnigri*, (Mosley) (Hemiptera: Aphididae) is a pest of currants, blackcurrant, red currant, gooseberry (*Ribes* spp.), chicory (*Cichorium intybus* L.), lettuce (*Lactuca sativa* L.) and several other plant species. It is a major pest in Europe where it originated (Keep and Briggs 1971) and recently spread to the Americas and Australasia (Stufkens and Teulon 2003). CLA tends to be found widely dispersed in affected lettuce crops, under the wrapper leaves and on the first few leaves within the lettuce head (Figure 1), and hence is difficult to detect and treat with foliar application of pesticides (MacKenzie and Vernon 1988). It has winged forms which can disperse widely, particularly with wind assistance. CLA can also be spread by the movement of infested produce, undetected inside lettuce heads. Moreover, seedling trays may become infested with nymphs and be moved long distances between lettuce production areas (Stufkens and Teulon 2003).

In New Zealand, CLA was first detected in 2002 and spread to all of the main lettuce growing regions within a year of the initial detection. To protect the $113 million Australian lettuce-growing industry Australian regulators responded by restricting the movement of suspect product and produce from New Zealand. Despite this however, in mid-March 2004 CLA were identified in Tasmania. It was assumed that CLA reached Tasmania in late-January 2004 on an easterly weather stream from New Zealand, an uncommon and severe event. This weather pattern is consistent with eastern wind anomalies along the southern portions of Australia such as those reported by Watkins (2004). In Australia, CLA was found in Tasmania (March 2004), and subsequently in Victoria (June 2005), New South Wales (NSW) (January 2006), South Australia (SA) (May 2006), Queensland (October 2006) and Western Australia (December 2006).

This paper summarises the NSW regulatory response and the subsequent spread of CLA throughout NSW between March 2005 and November 2007.

MATERIALS AND METHODS

NSW Department of Primary Industries (NSW DPI) began intensive field surveys in March 2005. Staff conducted monthly inspections of up to 20 properties in each lettuce production area. At each site inspected, details of owners and crops were recorded together with latitude and longitude co-ordinates read from a hand-held GPS unit. Various procedures were used to ensure sheltered areas were sampled. For example, in

Figure 1. Mixed life stages of CLA inside a young lettuce head.

flat fields lettuces were sampled along a zig-zag transect. Weeds were also sampled for 30 minutes. For field and hydroponic lettuce crops, 100 lettuce heads were cut open and examined for aphids. Aphids suspected of being CLA were collected with a fine paint brush and placed in 700 g L^{-1} ethanol and sent to the NSW DPI Agricultural Scientific Collections Unit (ASCU) at the Orange Agricultural Institute for identification. Most positive samples were retained as voucher specimens in the ASCU.

RESULTS

In 2006 there were three main periods of CLA detections in NSW: January/February (Sydney basin), March (near north coast and northern tablelands), and May (central tablelands and far north coast). The distribution of positive (field and supermarket) and negative samples is provided in Figure 2. The sequence of events and subsequent regulatory responses are summarised in Table 1.

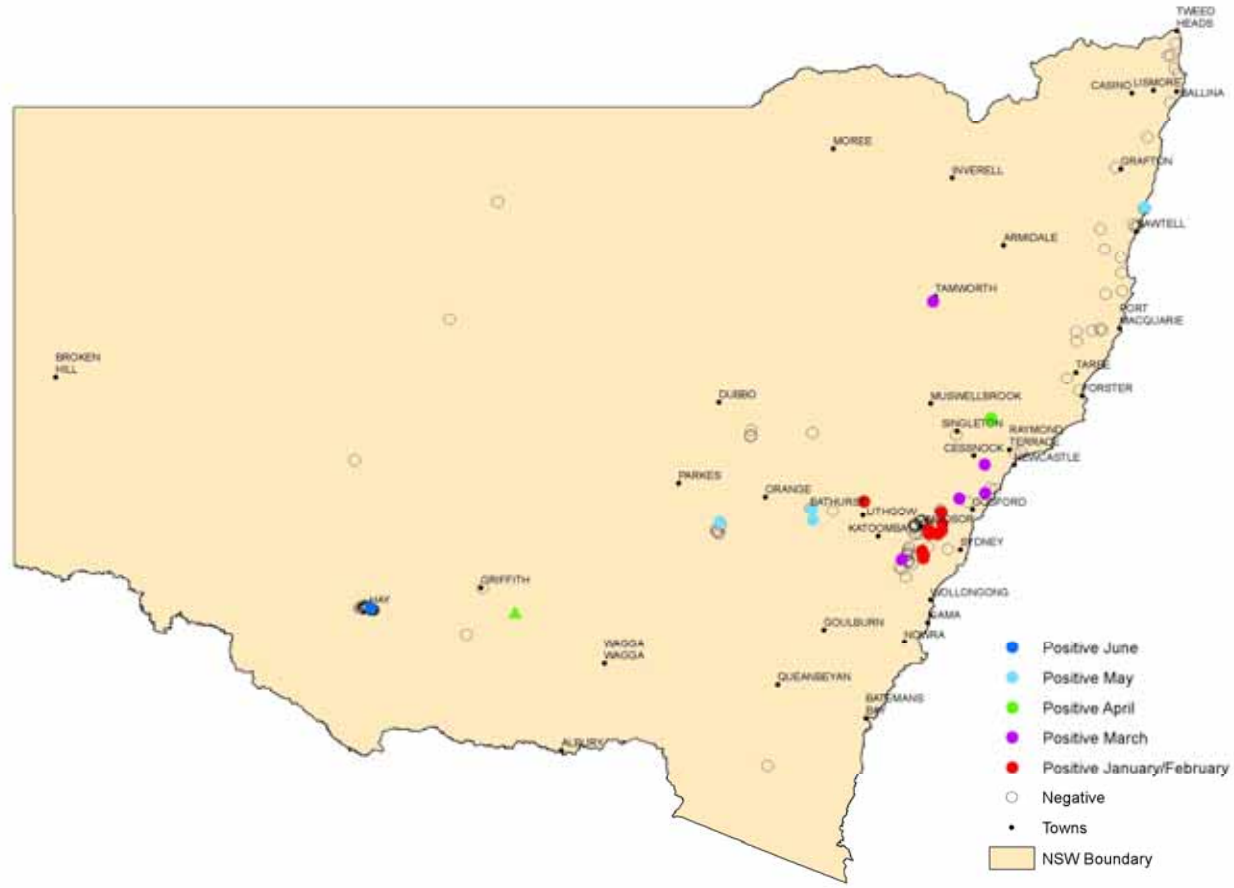
DISCUSSION

The spread of CLA detections in eastern Australia followed a different pattern to that seen in New Zealand. This may be attributable to geographical or environmental factors, or perhaps to differences in regulatory or control approaches between in the two countries. In New Zealand CLA spread a distance of 1200 km, including across the Cook Strait between the north and south islands, within one year. By contrast, in Australia

Table 1. Detections within Australian States, the spread of CLA and responses within New South Wales.

Location of Detection	Date	Response or event
Tasmania	March 2004	Lettuce trade with mainland Australia suspended. Emergency Plant Pest Alert issued by federal authorities. Emergency permit for use of imidacloprid issued by Australian Pesticides and Veterinary Medicines Authority.
	April 2004	Meetings held in all States to advise lettuce growers. Inspections of ferries from Tasmania to Sydney commence.
	June 2004	CLA information sheet distributed to all NSW vegetable growers.
	March 2005	Intensive monthly field inspections begin in NSW.
Victoria	June 2005	Trade of Victorian lettuce products regulated by NSW.
	September 2005	CLA widespread through Melbourne and regional Victoria.
New South Wales	January/ February 2006	CLA detected in Sydney basin. All other States regulate the movement of NSW lettuce. NSW regulates the movement of produce out of Sydney basin into the CLA-free parts of NSW to minimise spread.
	March 2006	NSW DPI published a Primefact issued to assist NSW growers manage CLA.
		CLA detected at north coast and Tamworth (Northern Tablelands).
	April 2006	CLA detected in supermarket produce in Leeton (near Griffith) but not in field crops.
	May 2006	CLA detected at Canowindra and Bathurst (Central Tablelands) and Woolgoolga (Far North Coast). Movement of lettuce produce regulated to minimise the CLA spread to Hay district.
South Australia	May 2006	South Australia revoked CLA legislation allowing unrestricted trade for NSW produce. All NSW inspections for South Australian markets cease.
	June 2006	CLA detected in supermarket produce in Hay but not in field crops.
Queensland	October 2006	All NSW field surveys for Queensland markets cease. Hay field crops remain unaffected by CLA.
Western Australia	December 2006	Western Australia removed trade restrictions on NSW produce.
	June 2007	Market access for New Zealand lettuce into NSW and other Australian states reinstated.
	November 2007	CLA detected in Hay field crops.

Figure 2. Map of NSW with locations checked for Currant Lettuce Aphid, showing all positive (field and supermarket) and negative detections from January/February 2006 till June2006.



it was 15 months after the initial detection in Tasmania before CLA was detected on mainland Australia and 26 months before its detection in northern NSW, a comparable distance of about 1200 km from the initial infestation.

Stufkens and Teulon (2003) reported that the spread of CLA in New Zealand was the result of transporting infested lettuce or seedling transplants, whereas movement of alates was thought to have contributed to local dispersal only. In NSW, the CLA detection in mid-March 2006 at Tamworth (about 300km from Sydney) was confirmed to be the result of dispersal on seedlings. There were detections in supermarket produce at Leeton (April 2006) and Hay (June 2006). These three incidents indicate that regulation alone could not prevent the movement of CLA or that the inspection methods used were inadequate. Stufkens and Teulon (2003) reported the main flight periods in New Zealand were in January and in March/April. The spread of CLA throughout the Sydney basin in January/February and along the near north coast in March/April within NSW corresponds with these flight periods. Once detected in the NSW, the spread of CLA was largely similar to that of other aphid incursions e.g. spotted alfalfa aphid, *Therioaphis trifolii* (Monell) f. *maculata*, blue green aphid, *Acyrthosiphon kondoi* (Shinji) and pea aphid, *Acyrthosiphon pisum* (Harris) that occurred between 1977 and 1980 (Walters and Dominiak 1984, Dominiak and Walters 1984).

The delay in spread of CLA from New Zealand to Tasmania provided time for Australian producers to learn about CLA management strategies. These included a change to resistant lettuce varieties, more intensive crop monitoring and development of integrated pest management programs that combined the use of local beneficial insects with the use of appropriate insecticides. It also allowed seed companies to increase the availability of aphid-resistant (e.g. *Nas*) lettuce varieties.

The current Australian strategy relies heavily on resistant lettuce varieties and the use of insecticides, primarily imidacloprid. In 2007, CLA was detected in *Nas*-resistant lettuce in western Europe. Resistant CLA are predicted to occur in Australia eventually either by introduction, or by selection within local populations.

Moreover, insecticide resistance in CLA has been reported in Spain, France, the Netherlands, the United Kingdom and New Zealand (Rufingier *et al.* 1997, Barber *et al.* 1999, Workman *et al.* 2004). Should either event occur in Australia it may again be necessary to regulate the movement of host produce. In future programs the potential role of seedling producers and supermarket chains in the distribution of plant produce and associated pests will need to be carefully considered. Close liaison with supermarket buyers will be essential to ensure optimal understanding and compliance.

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REFERENCES

Barber, M.D., Moores, G.D., Tatchell, G.M., Vice, W.E. and Denholm, I. (1999). Insecticide resistenace in the currant-lettuce aphid, *Nasonovia ribisnigri* (Hemiptera: Aphididae) in the UK. *Bulletin of Entomological Research* **89**: 17-23.

Dominiak, B.C. and Walters, P.J. (1984). Establishment of *Acyrthosipon pisum* (Harris) (Hemiptera:Apididae) in New South Wales. *Journal of the Australian Entomological Society* **24**: 269-270.

Keep, E. and Briggs, J.B. (1971). A survey of *Ribes* species for aphid resistance. *Annals of Applied Biology* **68**: 23-30.

MacKenzie, J.R. and Vernon, R.S. (1988). Sampling for distribution of lettuce aphid *Nasonovia ribisnigri* (Homoptera: Aphidae) in fields and heads. *Journal of the Society of British Columbia*, **85**:10-14.

Rufingier, C., Schoen, L., Martin, C. and Pasteur, N. (1997). Resistance of *Nasonovia ribisnigri* (Homoptera: Aphididae) to five insecticides. *Journal of Economic Entomology* **90**: 1445-1449.

Stufkens, M.A. and Teulon, D.A.J. (2003). Distribution, host range and flight pattern of the Lettuce aphid in New Zealand. *New Zealand Plant Protection* **56**: 27-32.

Walters, P.J and Dominiak, B.C. (1984). The establishment in New South Wales of *Trioxys complanatus* Quilis (Hemiptera:Apididae), an imported parasite of *Therioaphis trifolii* (Monell) *f. maculata*, spotted alfalfa aphid. *General and Applied Entomology* **16**: 65-67.

Watkins, A.B. (2004). Seasonal climate summary southern hemisphere (spring 2003): neutral conditions remain in tropical Pacific, but dry conditions dominate northeast Australia. *Australian Meteorological Magazine* **53**: 217-231.

Workman, P.J., Stufkens, M.A.W., Martin, N.A., and Butler, R.C. (2004). Testing for pesticide resistance in lettuce aphid. *New Zealand Plant Protection* **57**: 239-243.