SCIENTIFIC NOTE

EXPANSION OF SYCAMORE LACE BUG *CORYTHUCHA CILIATA* (SAY) (HEMIPTERA: TINGIDAE) IN NEW SOUTH WALES, AUSTRALIA, BETWEEN 2008 AND 2019

Bernie C. Dominiak[1], Peter Worsley[1], Bernard Millynn[1] and Angus J. Carnegie[2]

[1] Biosecurity and Food Safety, Department of Primary Industries, 161 Kite Street, Orange, New South Wales 2800, Australia.
[2] Forest Science, Department of Primary Industries – Forestry, 10 Valentine Avenue, Parramatta, NSW 2150, Australia

Summary

Sycamore lace bug (*Corythucha ciliata* (Say)) was detected on *Platanus* x *acerifolia* in New South Wales in 2007 and confined to the Sydney basin. Surveys were undertaken in New South Wales in 2008, 2009, 2012, 2015 and 2019 to monitor the spread of the pest. There were 1,351 sites inspected with 409 detections during these five survey years. *Corythucha ciliata* was found on *P.* x *acerifolia, P. orientalis* and *P. orientalis* var. 'digitata', and is now distributed from Albury in southern NSW to Glen Innes on the Northern Tablelands, and west to Dubbo. The insect had dispersed a maximum of about 450 km after eight years. However some dispersal distances were as short as 270 km to the north. The insect continues to disperse slowly across New South Wales.

Keywords: incursion, dispersal, amenity trees, urban, shade.

INTRODUCTION

Amenity (shade) trees provide a range of benefits in the Australian landscape, including protection from high sun exposure assisting in the prevention of skin cancer (Kricker *et al.* 1995), improve air quality, reduce noise, cool residential suburbs and contribute to a feeling of community wellbeing (Dwyer *et al.* 1992). Urban trees also reduce energy costs, sequester carbon, and improve air and water quality (Department of Agriculture and Water Resources 2018). A wide range of exotic species were planted by European settlers in urban and regional areas, with species of *Platanus,* primarily *P.* x *acerfolia* (London plane tree also known as Sycamore trees in America), common in temperate regions (Atlas of Living Australia 2019).

Sycamore lace bug *Corythucha ciliata* (Say) (Hemiptera: Tingidae) is a sap-sucking insect of *Platanus* leaves (see Dominiak *et al.* (2008) for images). Adults and nymphs of *C. ciliata* feed on phloem sap from veins (vascular bundles) on the underside of leaves, causing a typical yellow stippling initially near these veins. As populations increase, the stippling extends to the entire leaf surface and leaves frequently have a wilted appearance in autumn. Severe infestation can result in premature senescence of leaves, with tree mortality, although rare, associated with repeated infestations combined with environmental stress (Barnard and Dixon 1983, Newcastle City Council 2018).

Corythucha ciliata is a native of North America and occurs throughout eastern USA and eastern Canada (Halbert and Meeker 2014). Winged adults are able to fly several kilometres, particularly with wind assistance, but most long distance movements are due to human activities (Mutun 2009). Due to increasing international trade and tourism, *C. ciliata* has spread to many countries and is now regarded as an invasive species (Yang *et al*. 2017). *Corythucha ciliata* was first found outside its native range in Italy in the 1960's and has since successfully established across Europe, including Austria, Bulgaria, Croatia, the Czech Republic, Germany, Greece, Hungary, Portugal, Serbia and Montengro, Slovakia, Slovenia, Spain and Switzerland (Grosso-Silva and Aguiar 2007), Turkey (Mutun 2009), and Russia (Izhevskii 2008). It was found in Chile, South America, in the late 1980s (Prado 1990). In Asia, *C. ciliata* has been detected in China, Korea and Japan (Chung *et al.* 1996, Tokihiro *et al.* 2003, Ju and Li 2010). *Corythucha ciliata* has recently been detected in South Africa and is now been reported on all continents except Antarctica (Picker and Griffiths 2015). *Corythucha ciliata* was detected in Australia, in Sydney, in 2007 (Dominiak *et al*. 2008). This paper summarises surveillance activities in New South Wales between 2008 and 2019 to monitor the spread of *C. ciliata* through the state.

METHODS

The symptoms of *C. ciliata* damage are distinct to the trained observer. Symptoms are a yellow stippling on otherwise green leaves and symptoms are not easily

confused with other insect or fungal damage on *Platanus* trees. The presence of adults and/or nymphs provided confirmation of the pest as the causal agent.

Surveillance generally consisted of driving along streets and identifying *Platanus* spp., or visiting known locations and parks, and subsequent close inspection of trees. Surveys in 2008 were restricted to Orange and Bathurst, and undertaken to inform an analysis linked to traffic flows around these towns. In 2009, surveys were more expansive, from Albury in southern NSW to Tamworth on the Northern Tablelands and Port Macquarie on the Mid-North Coast and east to Dubbo (Figure 1), and sought to find the edge of the invasion front throughout eastern New South Wales. Surveys in 2012 and 2015 further expanded this search area, to Wentworth in the Far West and Coffs Harbour on the North Coast, with surveys in 2019 targeting the North Coast and Northern Tablelands only (Figure 2).

During initial surveys, suspect leaves were sent to the New South Wales Department of Primary Industry Agricultural Scientific Collections Unit (ASCU) at the Orange Agricultural Institute for identification of any insects present. In subsequent surveys, as experience developed in field staff, identifications were made in the field due to the presence of distinctive leaf symptoms and adult insects.

RESULTS AND DISCUSSION

Surveillance identified a mix of positive and negative detections. The 2008 survey included 182 sites with 52 detections and in 2009 there were 895 sites and 251 detections. In 2012 there were 222 sites with 80 detections; in 2015 there were 27 sites and six detections; and in 2019 there were 25 sites and 20 detections. *Corythucha ciliata* was found on *P.* x *acerifolia, P. orientalis* and *P. orientalis* var. 'digitata', and is now distributed from Albury in southern NSW to Glen Innes on the Northern Tablelands, and west to the Dubbo region (Figures 1 & 2).

Corythucha ciliata was detected in Sydney in 2007 and no attempt was undertaken to eradicate the pest (Dominiak *et al.* 2008) as it was determined to not be technically feasible or cost-beneficial (Carnegie and Nahrung 2019). Eradication is not attempted for the majority of exotic plant pests that establish in Australia as in many cases detection does not occur until post-border establishment and extensive spread (Anderson *et al*. 2017; Carnegie and Nahrung 2019). *Corythucha ciliata* is the latest exotic pest or disease that has established on *Platanus* in Australia, with several fungi already causing damage to this host (Carnegie *et al.* 2017).

Dispersal of *C. ciliata* has been relatively slow since it established in Sydney in 2007. The initially spread from Sydney to Orange (~200 km) in 2008 (i.e. 200 km /yr) has since slowed down, with ~150 km/yr to 2009 (e.g. Dubbo, Canberra), ~75 km/yr to 2012 (Albury). The spread west and south has occurred faster than the spread north, probably due to a greater concentration of *Platanus* in regional towns west and south of Sydney (in temperate climates). There are few plantings of *Platanus* west of Dubbo or north of Newcastle (Atlas of Living Australia 2019).

Freight transport corridors have been linked to invasion pathways of exotic insects in America (Colunga-Garcia *et al.* 2009). Adults of *C. ciliata* may fly several kilometres with wind assistance however the majority of long distance distribution is human assisted (Agriculture Victoria 2019). It seems likely that *C. ciliata* will continue to spread within and beyond New South Wales to any habitat where *Platanus* spp. are grown. It was detected in north-east Victoria in 2012 (Agriculture Victoria 2019) and has since reached Seymour (D. Smith, Agriculture Victoria, pers. comm.). This insect has a broad thermo-tolerance that suggests temperature will not limit the expansion of distribution (Ju *et al.* 2010, 2011).

Surveillance for exotic pests remains important for New South Wales, particularly within the broader contexts of globalisation of trade and tourism. While *C. ciliata* may not be a significant biosecurity concern, the knowledge of the spread of this type of insect may assist in the future management or modelling of a similar pest of agriculture, horticulture or forestry.

ACKNOWLEDGMENTS

Barry Sampson, Catherine Phillips, Chris Bloomfield, Michelle Rossetto, Nicole Reid, Peter Proctor, Peter Gillespie, Rosy Kerslake and Ros Mirrington collected samples. Dr Alison Seyb and two unnamed referees reviewed and improved this paper. The surveillance of *C. ciliata* was partly funded by the National Plant Health Surveillance Program funded by Agriculture, Fisheries and Forestry, Australia.

REFERENCES

Agriculture Victoria. (2019). http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/pest-insects-and-mites/sycamore-lace-bug. Accessed 13 May 2019.

Anderson, C.; Low-Choy, S.; Whittle, P.; Taylor, S.; Gambley, C.; Smith, L.; Gillespie, P.; Löcker, H.; Davis, R.; Dominiak, B. (2017). Australian plant biosecurity surveillance systems. *Crop Protection*, 100, 8–20. https://doi.org/10.1016/j.cropro.2017.05.023

Atlas of Living Australia. (2019). (https://bie.ala.org.au/species/http://id.biodiversity.org.au/node/apni/2913021) accessed 13 May 2019.

Barnard, E.L. and Dixon, W.N. (1983). Insects and Diseases: Important Problems of Florida's Forest and Shade Tree Resources. Florida Department of Agriculture and Consumer Services, Gainesville, FL. Bulletin No. 196-A. 120 p.

Carnegie, A.J., Lawson, S., Cameron, N., Wardlaw, T. and Venn, T. (2017). *Evaluating the costs and benefits of managing new and existing biosecurity threats to Australia's plantation industry*. Project number: PNC362-1415, 2017, Forest and Wood Products Australia: Melbourne, Australia. https://www.fwpa.com.au/images/resources/-2017/Final_Report_-_Forest_Biosecurity_Benefit-Cost_PNC362-1415.pdf

Carnegie, A.J. and Nahrung, H. (2019). Post-border forest biosecurity in Australia: response to recent exotic detections, current surveillance and ongoing needs. *Forests* in press

Chung, Y.J, Kwon, T.S., Yeo, W.H., Byun, B.K. and Park, C.H. (1996). Occurrence of the sycamore lace bug, *Corythucha ciliata* (Say) (Hemiptera: Tingidae) in Korea. *Korean Journal of Applied Entomology* **35**: 137-9.

Colunga-Garcia, M., Haack, R.A. and Adelaja, A.O. (2009). Freight transportation and the potential for invasions of exotic insects in urban and periurban forests of the United States. *Journal of Economic Entomology* **102**: 237-46.

Department of Agriculture and Water Resources. (2018). National Forest Biosecurity Surveillance Strategy. Commonwealth of Australia: Canberra.

Dominiak, B.C., Gillespie, P.S., Worsley, P. and Löcker, H. (2008). Survey for sycamore lace bug, *Corythucha ciliata* (Say) (Hemiptera: Tingidae) in New South Wales during 2007. *General and Applied Entomology* **37**: 27-30.

Dwyer, J.F., McPherson, E.G., Schroeder, H.W. and Rowntree, R.A. (1992). Assessing the benefits and costs of the urban forest. *Journal of Arboriculture*. 45, 227-34.

Grosso-Silva, J.M. and Aguiar, A. (2007). *Corythucha ciliata* (Say, 1832) (Hemiptera, Tingidae), the nearctic sycamore lace bug, found in Portugal. *Boletin Sociedad Entomológica Aragonesa* **40**: 366.

Halbert, S.E. and Meeker, J.R. (2014). The sycamore lace bug, *Corythucha ciliata* (Say) (Insecta: Hemiptera: Tingidae). University of Florida, Institute of Food and Agricultural Sciences.

http://entomology.ifas.ufl.edu/creatures/trees/sycamore_lace_bug.htm (accessed 7 January 2017).

Izhevskii, S.S. (2008). Invasion of alien pests of plants into the European part of Russia continues. *Zashchita I Karantin Rastenii* **6**: 25-8.

Ju, R.T. and Li, B. (2010). Sycamore lace bug, *Corythucha ciliata,* an invasive alien pest rapidly spreading in urban China. *Biodiversity Science* **18**: 638-46.

Ju, R.T., Wang, F., Xiao, Y.Y. and Li, B. (2010). Supercooling capacity and cold hardiness of the adults of the sycamore lace bug, *Corythucha ciliata* (Hemiptera: Tingidae). *Cryoletters* **31**: 445-53.

Ju, R., Chen, G., Wang, F. and Li, B. (2011). Effects of heat shock, heat exposure pattern, and heat hardening on survival of the sycamore lace bug, *Corythucha ciliata. Entomologia Experimentalis et Applicata* **141**: 168-77.

Kricker, A., Armstrong, B.K., English, D.R., and Heenan, P.J. (1995). A dose-response curve for sun exposure and basal cell carcinoma. *International Journal of Cancer* **60**: 482-8.

Mutun, S. (2009). *Corythucha ciliata*, a new Platanuspest in Turkey. *Phytoparasitica.* **37**: 65-66.

Newcastle City Council. (2018). Urban Forest Technical Manual. Newcastle City Council: Newcastle.

Picker, M.D. and Griffiths, C.L. (2015). Sycamore tree lace bug (*Corythucha ciliata* Say) (Hemiptera: Tingidae) reaches Africa. *African Entomologist* **23**: 247-9.

Prado, C.E. (1990). Presence in Chile of *Corythucha ciliata* (Say) (Hemiptera: Heteroptera: Tingidae). *Review of Chilena Entomology* **18**: 53-5.

Tokihiro, G., Tanaka, K. and Kondo, K. (2003). Occurrence of the sycamore lace bug, *Corythucha ciliata* (Say) (Heteroptera: Tingidae) in Japan. *Research Bulletin of the Plant Protection Service Japan* **39**: 85-7.

Yang, W.Y., Tang, X.t., Ju, R.T., Zhang, Y. and Du, Y.Z. (2017). The population genetic structure of *Corythucha ciliata* (Say) (Hemiptera: Tingidae) provides insights into its distribution and invasiveness. *Science Reports* **7**: 635. DOI:10.1038/s41598-017-00279-5.

Figure. 1. Map of New South Wales with locations checked for sycamore lace bug (*Corythucha ciliata*), with positive and negative detections in 2012. Positive detections in 2007-2009 are provided as background

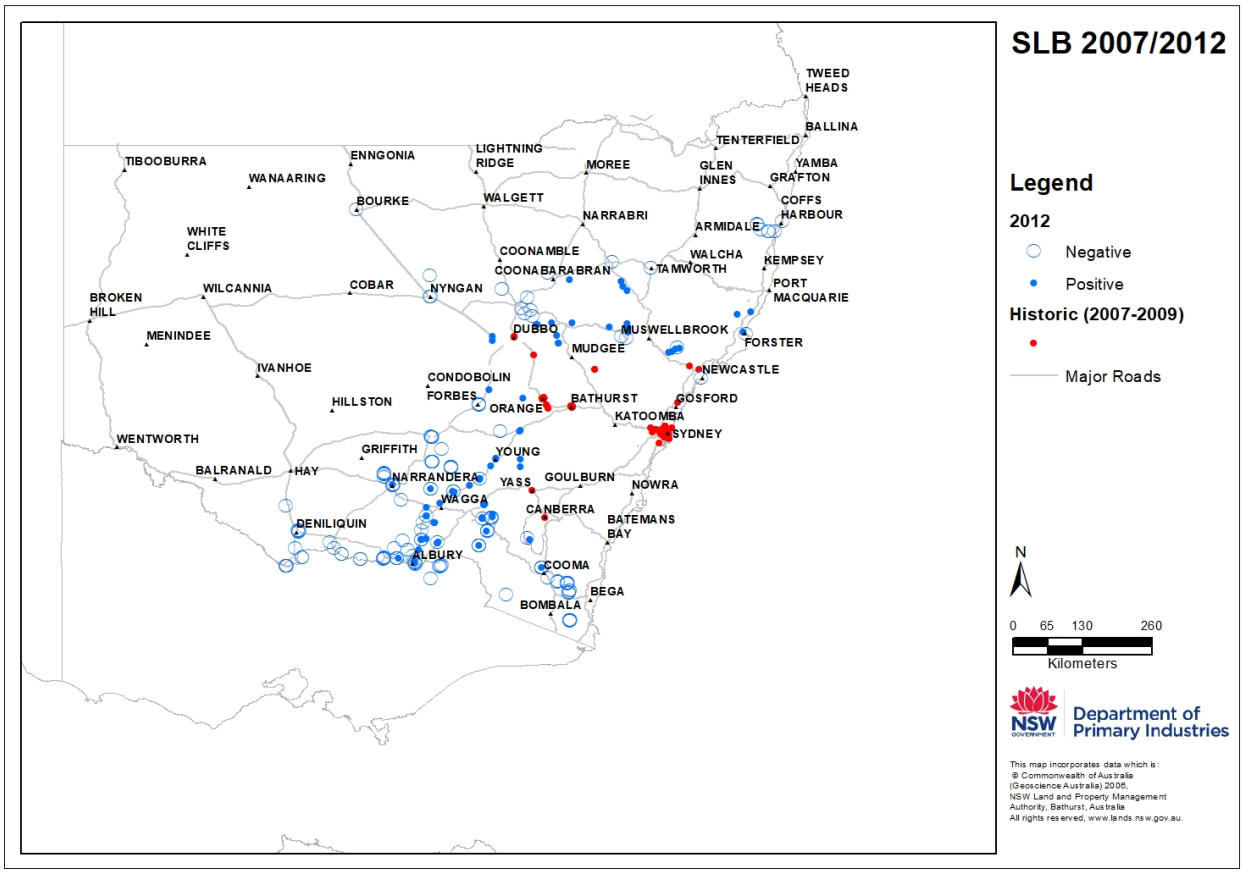

Figure. 2. Map of New South Wales with locations checked for sycamore lace bug (*Corythucha ciliata*), with positive and negative detections in 2015 and 2019. Positive detections up to 2012 was provided as background.