The Australian dampwood termite, *Porotermes adamsoni*, in New Zealand

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Abstract *Porotermes adamsoni* (Australian dampwood termite) has been intercepted on infested timber of Australian origin at ports in New Zealand on numerous occasions. *Porotermes adamsoni* attacks dead and living trees (principally *Eucalyptus* species). There are three known extant colonies of *P. adamsoni* in New Zealand, Lyttelton in Canterbury, and Kaipara Flats and Newmarket in Auckland. Surveillance operations to delimit the extent of the termite incursion at Kaipara Flats and Newmarket are outlined. Biosecurity considerations are discussed.

Keywords *Porotermes adamsoni*, survey, eradication.

INTRODUCTION

New Zealand has only three native termite species: *Kalotermes brouni* Froggatt (Isoptera: Kalotermitidae), *Stolotermes ruficeps* Brauer and *S. inopinus* Gay (Isoptera: Termopsidae). These termites are non-invasive and do not cause significant economic damage.

The Australian dampwood termite *Porotermes adamsoni* (Isoptera: Termopsidae) was first detected in New Zealand in imported host material approximately 70 years ago (Bain & Jenkin 1983). Since then there have been at least 17 known detections in the New Zealand environment that have been eradicated, most of which were associated with imported Australian hardwood timber (MAF 1991). *Porotermes adamsoni* does not produce obvious external signs of infestation such as mudding or earthen runways characteristic of subterranean termites, and is therefore difficult to detect. Treatment involves destruction of host material in which the termites live or the use of insecticides or fumigants.

Porotermes adamsoni is listed as an Unwanted Organism under the Biosecurity Act 1993. Import health standards are in place requiring treatment of risk goods. The main termite risk from Australia at present is likely to be from second-hand imported railway sleepers that are used for landscaping. Control options include compulsory fumigation, creosote treatment of wood and removal of all bark prior to export. Timber imports from Australia are prohibited unless these criteria have been met.

Porotermes adamsoni is a cool-climate termite, naturally occurring along the eastern coast of Australia through Queensland, New South Wales, Australian Capital Territory, Victoria and Tasmania (Haddlington 1987). As such, it may be well-suited to climatic conditions throughout New Zealand. *Porotermes adamsoni* is a dampwood termite, meaning it requires damp, decaying wood. Damage can extend into sound wood but a prerequisite is dampness and the rot that will accompany it. In Australia it is not a

significant problem in houses and other wooden structures, but has historically been reported as a pest of forestry because it can attack live *Eucalyptus* trees. Although primarily a pest of *Eucalyptus* (Myrtaceae), it has been recorded in Australia on *Pinus radiata* (Pinaceae) (although only very rarely live trees), coachwood (*Ceratopetalum apetalum* (Cunoniaceae)), hoop pine (*Araucaria cunninghamii* (Araucariaceae)), myrtle beech (*Nothofagus cunninghamii* (Nothofagaceae)) and *Tectona grandis* (Verbenaceae). In New Zealand, *P. adamsoni* has also been recorded attacking matai (*Prumnopitys taxifolia* (Podocarpaceae)) and birch (*Betula* sp. (Betulaceae)). Thus, while *P. adamsoni* does not appear to be widely polyphagous, it may be restricted more by suitable environmental conditions and an adequate supply of wood than by host type.

Currently, there are three known infestations of *P. adamsoni* in New Zealand: Lyttelton wharf, Canterbury; Kaipara Flats, Auckland region; and Newmarket, Auckland City. The Ministry of Agriculture and Forestry Biosecurity New Zealand (MAFBNZ) response objective for the Auckland region incursions was to locate and eradicate the colonies of *P. adamsoni*. Historically the Lyttelton incursion has been managed under an informal agreement with the Lyttelton Port Company, whereby all timber associated with termite finds in the wharf area is fumigated or burnt to reduce the likelihood of spread from the wharf area. Eradication from the wharf is not currently considered feasible. Details of the management operations conducted for *P. adamsoni* at Kaipara Flats

and Newmarket are presented, including the surveillance operations conducted to locate and delimit the infestations.

POROTERMES ADAMSONI INFESTATIONS AT KAIPARA FLATS

Detection of infestation

Kaipara Flats is a small rural community near Warkworth, north of Auckland. *Porotermes adamsoni* was first detected in February 2007 when a single live alate (winged reproductive termite) was found in a spider web next to an exterior light at a residential property. Active surveillance at the site was initiated in February 2007 until the present in the form of alate trapping and visual inspections.

Alate trapping

Yellow insect sticky traps (200 mm × 245 mm) (see numbers in Figure 1) sourced from Pacific Growers Supplies Auckland were attached by wire next to three different light sources during the trapping programme: (1) the shades of mains 240 V exterior lights; (2) the frames of white Light Emitting Diode (LED) solar garden lights sourced from hardware stores; and (3) tailor-made 12 V battery-operated lights where the light fitting containing a Philips Compact Fluorescent “Tornado” helical shape lamp (1550 Luminous flux; 70 Luminous efficacy) was attached by G-clamp to a waratah driven into the ground next to the battery box. The 12V lights operated on a timer switch set to activate an estimated 30 min before dusk for 3 h. The battery life of only 12 h required swapping the batteries twice a week.

		February (positive days)																										Total number of traps
Total Trapping Period		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
16/02/2007 to 17/04/2007																					2 (2)					1 (1)	30	
04/02/2008 to 28/03/2008																											65	
09/01/2009 to 02/03/2009	All other			4 (4)																							24	
	Nest site			>700 (1)																								
19/01/2010 to 23/02/2010																											22	

Figure 1 Kaipara Flats trapping periods. Each shaded box denotes the period the traps were left before being cleared. The number inside the box is the total number of alates caught in that period. The number in parentheses is the number of traps containing alates in that period.

Figure 2 Map of Kaipara Flats indicating the sites where alates were captured in sticky traps.

Multiple alates were caught each year (see numbers in Figure 1). One 12V light trap close to a willow tree caught >900 *P. adamsoni* alates in February 2009 and helped to target visual inspections to hosts nearby. In 2010, after the destruction of the two discovered colonies, traps were centred round the same five properties targeted in 2009 to determine whether there were additional colonies present. The trapping of two alates in 2010 indicated at least one further colony exists at Kaipara Flats (Figure 2).

Inspections

Inspections targeting hardwood timbers imported from Australia (installed since ca 1905) and potential host material were conducted in 2007 and 2008. The search concentrated on each side of the railway corridor that incorporated the property of the original find. Methods of inspection for timber-in-service and tree trunks

included: visual assessment (signs of decay, branch loss, odd shape, sealed scars and flight slits); banging of timber for hollow noise effects; drilling of trees using a petrol-driven drill with a wood driving auger to a depth equating to the radius of the trunk; probing of bridge timbers with a 300 mm long metal spike to determine timber rot possibly associated with dampwood termite activity.

The Australian hardwood timbers used in the railway line, railway over-bridge and communication poles along the rail corridor were considered to be the likely source of the alates trapped, based principally on their Australian origin and volume of the timber. No colonies were found in this material. Large willow trees (*Salix alba* (Salicaceae)) approximately 28 years old (estimated from growth rings) close to the railway bridge then became the main focus of interest, although there was no published record

of this species as a host. Two of the willow trees had split trunks showing significant heart rot and evidence of old termite galleries. A further careful search through the decaying willow wood revealed no current termite activity, native or introduced.

Colony location and management

In May 2009 an established colony of *P. adamsoni* was discovered in a live willow – *Salix alba* – alongside the railway corridor that runs through Kaipara Flats. This followed the trapping of high numbers of alates (>900) near this tree.

In June 2009, this tree and adjacent willow trees along the railway line were felled. This revealed another infested tree. Both colonies appeared to have been long-standing, with attack extending throughout much of each host tree, from the base up the trunks and major limbs. Analysis of sections from both infested trees showed each colony contained in excess of 100,000 individuals and contained multiple reproductively mature individuals (kings and queens).

The railway corridor situated 15-20 m from the two willow trees is considered to be the most likely point of introduction. Sections of infested timber were retained for analysis of the colonies; all other wood was removed and burnt. Weather constraints meant the tree stumps were left *in situ* at the time. Five litres of Confidor® liquid insecticide (0.5 g/l imidacloprid) was applied to each of the infested stumps. All the stumps were later ground to a depth of approximately 0.5 m below ground level.

POROTERMES ADAMSONI INFESTATIONS AT NEWMARKET

Detection of infestation

Porotermes adamsoni was first detected in Newmarket in February 2008 when a single alate was found on a window sill of a residential property. Active surveillance at the site has taken place from February 2008 until present in the form of visual inspections and alate trapping but has not resulted in location of a source colony.

Alate trapping

Yellow insect sticky traps (see numbers in Figure 3) were placed near street lamps at heights of 3-5 m above ground at up to 217 m from the original find. These were cleared twice weekly for the duration of the trapping programme. Multiple alates were caught each year, but numbers were low and with no apparent pattern to assist in locating a source colony (Figure 4).

Inspections

An inspection of properties and railway land within 500 m of the first alate find was conducted in March 2008 using the same methodology described for Kaipara Flats. No colony has been located at Newmarket. While the infestation is most likely to have been introduced with imported railway timbers, the redevelopment of the rail line in the past 2 years has removed these timbers. Continued collection of alates suggests that one or more colonies exist away from the railway line.

	February (positive days)																											Total Number of traps
Total Trapping Period	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
13/02/2008 to 20/03/2008													1(1)											1(1)				30
08/01/2009 to 26/02/2009			6(4)							1(1)													5(3)			1(1)		34
21/01/2010 to 01/03/2010								1(1)		14(7)			2(1)															38

Figure 3 Newmarket trapping periods. Each shaded box denotes the period the traps were left before being cleared. The number inside the box is the total number of alates caught in that period. The number in parentheses is the number of traps containing alates in that period.

Figure 4 Map of Newmarket indicating the sites where alates were captured in sticky traps.

DISCUSSION

Given the large volume of historic imports of Australian hardwood timber since European colonisation of New Zealand and the lack of mandatory treatment until the 1980s, it is likely that undetected colonies of *P. adamsoni* have been imported into New Zealand and that some of these colonies still persist. Colonies of *P. adamsoni* are slow growing and can survive for long periods of time, potentially decades, in the same piece of timber. However, *P. adamsoni* is very unlikely to colonise new timber sources other than by alate flights. Previously the only evidence to suggest that *P. adamsoni* colonies have established in New Zealand from an alate flight was from activity found at Pahoia in the Bay of Plenty (MAF 2000) where one *Eucalyptus* tree in a 60-year-old stand was found to have activity in the stump and lower trunk when felled in 2000. The closest power line or railway track was about 300-400 m away.

Evidence from the three current sites of infestation suggests the establishment of new colonies in New Zealand by alate flights may not be uncommon. The two colonies discovered at Kaipara Flats must have been established by alate flight. A recent successful alate pairing, (reproductive male and female) was found in one of the infested trees inspected during 2009. If the original point of introduction at Newmarket was in railway timber, that activity (if it still persisted) has almost certainly been removed or destroyed by recent development at that site. Therefore the alates being trapped are most likely from a colony established by an alate flight. At Lyttelton, the broad distribution of colonies at the wharf is most likely due to spread via alates rather than the presence of all those colonies in the originally-installed timbers (Ewart 2009). An intensified trapping programme using a random grid over the suspect infested sites would potentially

increase the confidence of detecting *P. adamsoni* nest locations at Newmarket and Lyttelton.

The long term environmental and economic impacts of *P. adamsoni* in New Zealand should it become widely established are uncertain. With regard to economic impacts, *P. adamsoni* is not considered a significant pest of timber-in-service in Australia even though it has been recorded from such timber when it is damp through soil contact (Bain 2008). Damage can extend a short distance into sound wood but a prerequisite is dampness and the rot that will accompany it. This is similar to the native dampwood termite, *Stolotermes ruficeps*, which is considered of no importance in structures in New Zealand (Milligan 1984). In Australia *P. adamsoni* is known as a pest principally of eucalypts harvested for timber, where it can result in degradation or destruction of about 50% of tree volume in a stand (Elliott & Bashford 1984). Bain (2008) stated that of the trees in New Zealand *Eucalyptus* was most at risk to *P. adamsoni* attack but considered the likely impacts of its establishment would be negligible. Of more concern to New Zealand would be an impact on *Pinus radiata*, considering that radiata pine comprises 89.1% of New Zealand's plantation trees compared to 1.7% *Eucalyptus* (MAF 2008). Two studies of *P. adamsoni* have been carried out in Australian pine plantations. In South Australia, the termite was widespread and abundant in stumps and debris but no infestations in live trees were found (Nkunika 1988), while in Victoria only 0.18% of trees had *P. adamsoni* damage; all of these trees were over 25 years old and most over 35 years old (Minko 1965). In New Zealand *Pinus radiata* is generally harvested at 26-28 years. Based on this information, the impact of *P. adamsoni* on radiata pine in New Zealand could be minimal if it were to establish. However, the range of trees *P. adamsoni* can colonise will influence its potential impact in New Zealand. The recent discovery of large colonies in willow trees at Kaipara Flats raises the question of whether its host range may be considerably wider than currently known. But its behaviour in New

Zealand, with a much reduced availability of its apparent preferred host (*Eucalyptus*) could be different to that observed in Australia.

It is also difficult to predict the effects *P. adamsoni* could have on New Zealand's native fauna and flora. Bain (2008) notes "the potential impact of *P. adamsoni* in native forests should it establish there is largely unknown; there is simply not enough information to make a considered judgement." The environmental impact of *P. adamsoni* in New Zealand would depend not only on whether native trees were suitable hosts but on what effect they would have on any natives that they did feed on. Bain (2008) notes that *P. adamsoni* does not kill trees. This is supported by the *P. adamsoni* infested willow trees at Kaipara Flats, which appeared healthy. It is thus possible that if native trees were attacked, their overall health and reproductive capacity would not be significantly affected. There is just one published record (Kliejunas et al. 2003) of *P. adamsoni* in *Nothofagus cunninghamii* in Australia, but Ewart (2009) observed feeding in *Nothofagus* around Melbourne. *Nothofagus* is the genus of New Zealand's native beech trees.

There is also potential for *P. adamsoni* to compete with native termites and possibly other wood-feeding native invertebrates. Ewart (2009) notes that it could compete with the two native *Stolotermes* termite species as they are ecologically similar, although *P. adamsoni* tends to feed deep within timbers while the Australian *Stolotermes* species is a more peripheral feeder. Bain (2008) concluded that while there may be competition for resources with native termites it is not envisaged that *P. adamsoni* would in any way displace them.

MAF Biosecurity New Zealand is currently consulting with interested parties to determine a long-term strategy for responding to the currently known incursions of *Porotermes adamsoni* and any discovered in the future.

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