Invasive ant pest risk assessment project: Preliminary risk assessment

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1) Aim

To assess the threat to New Zealand of a wide range of ant species not already established in New Zealand and identify those worthy of more detailed assessment.

2) Scope

2.1. Specific exclusions

Solenopsis invicta was specifically excluded from consideration as this species has already been subject to detailed consideration by Biosecurity New Zealand.

2.2 Specific inclusions

Biosecurity New Zealand requested originally that the following taxa be included in the assessment:

- *Solenopsis richteri*
- *Solenopsis geminata*
- *Wasmannia auropunctata*
- *Anoplolepis gracilipes*
- *Paratrechina longicornis*
- Carpenter ants (*Camponotus* spp.)
- Leaf cutting ants *(Atta* spp.)
- *Myrmecia pilosula*
- *Tapinoma melanocephalum*
- *Monomorium sydneyense* (incursion found in New Zealand)
- *Hypoponera punctatissima* (incursion found in New Zealand)
- Big headed ants (*Pheidole* spp.)

M. sydneyense and *H. punctatissima* have since been deemed not under official control and are now considered established in New Zealand. Profiles of these species have been prepared as part of the Ants of New Zealand section (see http://www.landcareresearch.co.nz/research/biosecurity/stowaways/Ants/antsinnewzealand.asp).

3) Methodology

A risk assessment scorecard was developed (Appendix 1) in consultation with a weed risk assessment expert (Dr Peter Williams) and with Simon O'Connor and Amelia Pascoe of Biosecurity New Zealand, to initially separate potential threat species into high, medium, and low risk.

If information was found from any source that indicated an ant met at least one of the following criteria it was included for consideration:

- A pest in its native range
- Commonly introduced outside its native range
- Considered a pest outside its native range (which could include having, or thought to have, effects on native systems)
- Commonly intercepted at the New Zealand border
- Listed by Biosecurity New Zealand for specific inclusion (see above)

The reasoning for inclusion and likely factors for mitigation of the risk of each species were recorded. Several species already established in New Zealand and *Solenopsis invicta* were also scored for comparison.

4) Results

75 taxa were scored (Table 1) and divided into 3 groups (high, medium, and low risk). Eight taxa had high scores (> 56% of maximum score) and were selected for detailed pest risk assessment (Table 2). These eight have similar scores to those species already established in New Zealand that either are considered pests, e.g., *Linepithema humile, Technomyrmex albipes*, or have high pest potential and are climate restricted, e.g., *Pheidole megacephala* (Table 1). No species considered scored as highly as *Solenopsis invicta*.

28 taxa received a moderate score (> 40–55 % of maximum; Table 3). These species have some risk characteristics, but pose less of a threat (usually due to a mix of lack of invasive history; absence from the southern hemisphere; tropical origin; and minimal likelihood of detrimental impacts should they establish). For these species, preliminary assessments were prepared.

The remaining 37 species are considered to pose low risks to New Zealand, and for these taxa the reasons for initial consideration and principle reasons for their low scores are presented (Table 4). For the highest ranking of the low risk species (*Tetramorium caespitum* and *Paratrechina flavipes)* a preliminary assessment was prepared. In addition, *Myrmecia pilosula,* a species of specific interest to the Ministry of Heath, was added to the list of preliminary assessments.

5) Issues

Non-exhaustive list: Other species would probably have met the criteria for initial inclusion if more information had been available. Minimal information on pest ants was available from some countries (particularly parts of Asia). It is unlikely, however, that many such species would achieve a high risk score – unless new, rapidly spreading pests emerge, as has been the case with *Lasius neglectus* (see Table 2). Preliminary assessment of additional taxa can be conducted relatively rapidly.

Lack of information: There is very limited information on the biology of most ant taxa, and educated guesswork and consideration of sister taxa were often required to assess risk. This situation is unlikely to change unless a species invades a new place and behaves in an unexpected way. The exact scores of each individual taxa are, therefore, less relevant than the groupings of high risk and moderate risk, and where the species already in New Zealand fall in comparison. As more information becomes available for some species, or new locations are invaded, the assessment of risk may change.

Table 1: Ant taxa that were assessed using the risk assessment scorecard (details of the scorecard are given in Appendix 1). Each trait has a score between 0 (no risk or not present) and 1 (high risk or trait present).

		Traits considered								
Genus	**Species**	**Biological traits inferring invasiveness**	**Invasive history**	**Pathways**	**Establishment success**	**Difficulty in containment of incursion**	**Likely pest status to humans in NZ native environment**	**Potential impact**	**Total**	**Percent of max**
High risk species										
Solenopsis	*geminata*	0.67	1.00	1.00	0.42	0.75	0.86	0.63	5.32	75.9
Wasmannia	*auropunctata*	1.00	1.00	0.78	0.25	0.50	0.57	1.00	5.10	72.9
Anoplolepis	*gracilipes*	1.00	1.00	1.00	0.33	0.25	0.36	1.00	4.94	70.6
Lasius	*neglectus*	1.00	1.00	0.44	0.58	0.25	0.71	0.63	4.62	66.0
Paratrechina	*longicornis*	1.00	1.00	0.94	0.58	0.00	0.57	0.38	4.47	63.9
Solenopsis	*richteri*	1.00	0.50	0.39	0.42	0.50	0.57	0.88	4.25	60.7
Monomorium	*destructor*	0.50	1.00	0.83	0.17	1.00	0.57	0.00	4.07	58.2
Tapinoma	*melanocephalum*	0.83	1.00	0.89	0.42	0.50	0.36	0.00	4.00	57.1
Moderate risk species										
Camponotus	spp.	0.17	0.50	0.94	0.67	0.50	0.57	0.50	3.85	55.0
Tapinoma	*sessile*	0.83	0.50	0.33	0.58	0.50	0.57	0.38	3.70	52.8
Paratrechina	*vaga*	0.00	1.00	0.94	0.25	1.00	0.36	0.13	3.68	52.5
Solenopsis	*molesta*	0.17	0.50	0.33	0.58	1.00	0.57	0.50	3.65	52.2
Paratrechina	*fulva*	0.33	1.00	0.44	0.25	0.50	0.36	0.75	3.63	51.9
Tetramorium	*simillimum*	0.33	1.00	0.94	0.50	0.50	0.21	0.13	3.62	51.7
Pheidole	*fervens*	0.17	1.00	0.89	0.25	0.50	0.29	0.38	3.47	49.5
Monomorium	*minimum*	0.33	0.50	0.28	0.67	0.75	0.36	0.50	3.38	48.4
Monomorium	*monomorium*	0.17	1.00	0.94	0.50	0.50	0.21	0.00	3.33	47.5

Solenopsis	*papuana*	0.50	0.50	0.61	0.25	0.75	0.29	0.38	3.27	46.7
Strumigenys	*emmae*	0.00	1.00	0.72	0.33	1.00	0.07	0.13	3.25	46.5
Paratrechina	*vividula*	0.00	1.00	0.67	0.33	0.50	0.50	0.25	3.25	46.4
Strumigenys	*rogeri*	0.00	1.00	0.78	0.33	1.00	0.00	0.13	3.25	46.2
Paratrechina	*bourbonica*	0.00	1.00	1.00	0.25	0.50	0.36	0.13	3.23	46.2
Solenopsis	*saevissima*	0.33	1.00	0.33	0.25	0.50	0.43	0.38	3.22	46.0
Cardiocondyla	spp.	0.00	1.00	0.94	0.75	0.50	0.00	0.00	3.19	45.6
Formica	spp.	0.50	0.50	0.22	0.50	0.50	0.57	0.38	3.17	45.3
Crematogaster	spp.	0.00	0.50	0.78	0.67	0.50	0.36	0.25	3.05	43.6
Solenopsis	*xyloni*	0.33	0.00	0.39	0.58	0.50	0.71	0.50	3.02	43.1
Tetramorium	*tonganum*	0.17	0.50	0.78	0.33	1.00	0.21	0.00	2.99	42.7
Monomorium	*sechellense*	0.17	1.00	0.61	0.25	0.75	0.21	0.00	2.99	42.7
Tetramorium	*pacificum*	0.17	1.00	0.78	0.25	0.50	0.21	0.00	2.91	41.6
Labidus	*coecus*	0.00	0.00	0.39	0.50	0.75	0.86	0.38	2.87	41.0
Iridomyrmex	*anceps*	0.17	0.50	0.89	0.17	1.00	0.14	0.00	2.87	40.9
Monomorium	*floricola*	0.17	1.00	0.89	0.17	0.50	0.14	0.00	2.87	40.9
Tetramorium	*rhenanum*	0.50	0.50	0.28	0.33	0.50	0.36	0.38	2.84	40.6
Iridomyrmex	*purpureus* sp. Group	0.67	0.00	0.39	0.17	0.75	0.36	0.50	2.83	40.4
Myrmica	*rubra*	0.67	0.50	0.28	0.50	0.00	0.50	0.38	2.82	40.3
Low risk species										
Tetramorium	*caespitum*	0.17	1.00	0.22	0.50	0.50	0.29	0.13	2.80	40.0
Paratrechina	*flavipes*	0.00	1.00	0.44	0.50	0.50	0.21	0.13	2.78	39.8
Prenolepis	*imparis*	0.00	0.50	0.22	0.50	1.00	0.43	0.13	2.78	39.7
Tetramorium	*lanuginosum*	0.17	1.00	0.72	0.17	0.50	0.21	0.00	2.77	39.6
Pyramica	*membranifera*	0.00	1.00	0.61	0.25	0.75	0.14	0.00	2.75	39.3
Paratrechina	*minututa*	0.00	0.50	0.78	0.17	1.00	0.29	0.00	2.73	39.0

Table 1 cont'd

Tetramorium	*tsushimae*	0.67	0.50	0.33	0.42	0.25	0.29	0.25	2.70	38.6
Atta	spp.	0.50	0.00	0.28	0.00	0.50	0.79	0.63	2.69	38.4
Hypoponera	*opaciceps*	0.00	1.00	0.50	0.33	0.75	0.07	0.00	2.65	37.9
Pachycondyla	*sennaarensis*	0.17	0.50	0.33	0.25	0.50	0.64	0.25	2.64	37.8
Rhytidoponera	spp.	0.00	0.50	0.72	0.75	0.25	0.29	0.13	2.63	37.6
Pheidole	*bilimeki*	0.33	0.50	0.28	0.17	1.00	0.21	0.13	2.62	37.4
Myrmecia	spp.	0.00	0.50	0.61	0.75	0.25	0.36	0.13	2.59	37.1
Plagiolepis	*alluaudi*	0.17	1.00	0.61	0.17	0.50	0.14	0.00	2.59	37.0
Tetramorium	*caldarium*	0.17	1.00	0.44	0.33	0.50	0.14	0.00	2.59	37.0
Lasius	*flavus*	0.00	0.50	0.17	0.50	1.00	0.21	0.13	2.51	35.8
Pheidole	*umbonata*	0.00	1.00	0.61	0.25	0.50	0.14	0.00	2.50	35.8
Paratrechina	*pubens*	0.50	0.50	0.39	0.17	0.50	0.43	0.00	2.48	35.5
Pheidole	*moerens*	0.33	0.50	0.33	0.25	0.50	0.29	0.25	2.45	35.0
Tapinoma	*minutum*	0.33	0.50	0.50	0.25	0.50	0.14	0.13	2.35	33.6
Pheidole	*teneriffana*	0.00	1.00	0.17	0.25	0.50	0.29	0.13	2.33	33.3
Pyramica	*eggersi*	0.00	0.50	0.44	0.25	1.00	0.00	0.13	2.32	33.1
Lasius	*niger*	0.00	0.00	0.33	0.50	0.75	0.43	0.25	2.26	32.3
Acanthomyops	spp.	0.00	0.00	0.22	0.50	1.00	0.14	0.38	2.24	32.0
Anoplolepis	*custodiens*	0.33	0.00	0.28	0.25	0.25	0.43	0.63	2.16	30.9
Anoplolepis	*steingroeveri*	0.33	0.00	0.28	0.25	0.25	0.43	0.63	2.16	30.9
Pheidole	*fervida*	0.00	0.50	0.33	0.33	0.50	0.21	0.25	2.13	30.4
Iridomyrmex	*rufoniger* sp. Group	0.33	0.00	0.39	0.17	0.75	0.21	0.25	2.10	30.1
Monomorium	*orientale*	0.17	0.00	0.44	0.17	1.00	0.29	0.00	2.06	29.5
Lasius	*neoniger*	0.17	0.00	0.28	0.42	0.50	0.43	0.25	2.04	29.1
Lasius	*alienus*	0.00	0.00	0.22	0.33	0.75	0.21	0.50	2.02	28.9
Paratrechina	*guatemalensis*	0.00	0.50	0.33	0.17	0.50	0.36	0.00	1.86	26.5

Table 1 cont'd

Pogonomyrmex	spp.	0.00	0.00	0.33	0.33	0.50	0.43	0.25	1.85	26.4
Myrmecia	*pilosula*	0.00	0.00	0.61	0.50	0.25	0.36	0.13	1.84	26.3
Polyrhachis	spp.	0.00	0.00	0.78	0.58	0.25	0.14	0.00	1.75	25.1
Pheidole	*bicarinata*	0.00	0.00	0.22	0.50	0.50	0.29	0.13	1.63	23.3
Aphaenogaster	senilis	0.17	0.50	0.22	0.25	0.25	0.21	0.00	1.60	22.9
Neivamyrmex	spp.	0.17	0.00	0.28	0.25	0.00	0.36	0.50	1.55	22.2
Pheidole	*dentata*	0.00	0.00	0.17	0.25	0.50	0.29	0.13	1.33	19.0
Messor	*capensis*	0.00	0.00	0.28	0.17	0.25	0.29	0.25	1.23	17.6
Species not considered (as already in NZ or specifically excluded) but scored for comparison										
Solenopsis	*invicta*	1.00	1.00	0.72	0.67	0.50	0.71	0.88	5.48	78.3
Linepithema	*humile*	1.00	1.00	0.94	0.75	0.00	0.57	1.00	5.27	75.2
Monomorium	*pharaonis*	1.00	1.00	0.83	0.50	1.00	0.50	0.13	4.96	70.8
Pheidole	*megacephala*	1.00	1.00	0.94	0.50	0.00	0.43	0.88	4.75	67.8
Technomyrmex	*albipes*	0.50	1.00	1.00	0.75	0.00	0.50	0.13	3.88	55.4
Hypoponera	*punctatissima*	0.17	1.00	0.72	0.17	1.00	0.29	0.00	3.34	47.7
Paratrechina	sp A (formally *P. vaga*)	0.00	0.50	0.89	0.67	0.50	0.36	0.13	3.04	43.4
Monomorium	*sydneyense*	0.33	0.00	0.61	0.50	0.75	0.21	0.13	2.53	36.2
Solenopsis	sp. (in Auckland)	0.00	0.00	0.44	0.50	1.00	0.07	0.00	2.02	28.8

Table 1 cont'd

Table 2: Justification for species that are considered high risk and for which a detailed risk assessment was prepared. These species received a risk score greater than 55% of the maximum score (see Table1 and Appendix 1).

Species	Reasons for inclusion	Mitigating factors
Anoplolepis gracilipes (Smith)	Workers and, to a lesser extent, queens commonly intercepted at the New Zealand border on a wide range of commodities and from a range of counties (particularly the Pacific). Nests have also been detected in containers from the Pacific, and found on a wharf in Auckland and next to a container storage yard in Mt Maunganui. One of 5 ants listed among the "100 World's Worst invaders" (www41). In the tropics and subtropics, *Anoplolepis gracilipes* is a major environmental and secondary agricultural pest, as well as a human nuisance. Impacts include threats to endemic fauna, rapid degradation of native plant communities, and altered ecosystem processes (www41). Formic acid sprayed by the ants can cause skin burns and irritate the eyes of animals and people.	New Zealand climate has low similarity with known range that will reduce the chances of establishment and the magnitude of detrimental impacts should it establish.
Lasius neglectus Van Loon, Boomsma & Andrásfalvy	A relatively newly described species spreading across Europe (Seifert 2000) that possesses the characteristics of the more well-known invasive species (displaces other ants, produces "super-colonies", interacts with scale insects and aphids elevating their densities, and alters invertebrate communities) (Passera 1994; Seifert 2000; www45). It is a cold climate species, likely to spread into climates as cold as southern Sweden (www61). It therefore has the potential for a very wide distribution in New Zealand (unlike most other invasive ant species, which are likely to have restricted northern distributions. Foragers are attracted to electrical fields and occupy electrical plugs, connexion boxes or electro-mechanical devices, such as automatic blinds, causing failure and damage by shorting (www45).	Not intercepted at the New Zealand border. Does not occur in the southern hemisphere. Limited range and hence pathways to New Zealand (although its range is expanding rapidly (www45)). Does not sting. High rainfall may limit its distribution in New Zealand.
Monomorium destructor (Jerdon)	Widely dispersed by trade and regularly intercepted at the New Zealand border (17 reported interceptions to April 2004, mostly of live workers in containers, fresh produce, and in the personal effects of airline passengers). It is capable of infesting buildings in temperate areas (e.g., London (Bolton 1987)) and can be a major urban pest, gnawing holes in fabric and rubber goods, removing rubber insulation from electric and phone lines, damaging polyethylene cable (Krombein et al. 1979, cited in Bolton 1987), and causing electrical fires (Davis & Van Schagen 1993). There are also reports of people being bitten or stung fiercely while in bed (Smith 1965). This species also has disease-spreading potential (bubonic plaque bacterial found in faeces of ants feeding on infected rats (Smith 1965)).	Unlikely to be a pest outside of urban areas. May not build up to the populations found in the tropics. In urban Perth (warmer climate than New Zealand) this species is a minor pest compared with northern Western Australia (P. Davis, pers. comm.).

Paratrechina longicornis (Latreille)	Frequently intercepted at the New Zealand border on containers, timber, fresh produce, cut flowers and personal effects. Recently (2001–2003) several incursions have been detected in Auckland and Tauranga at the ports and a devanning site, and attempts to eradicate the incursions are underway. The ant is a common international tramp that often invades houses and heated buildings in tropical (Lee 2002) and temperate (Creighton 1950) areas. It is a relatively large conspicuous species and can transport pathogenic microbes in hospitals (Fowler et al. 1993), and, at least in artificial environments, is capable of displacing other ants (Wetterer et al. 1999) and probably other invertebrates. Difficult to control with commercial baits currently available (Lee 2002).	Despite widespread occurance as an urban pest there are few instances of its presence in high densities in native systems in invaded countries, and no studies documenting impacts. This species is likley to have limited impacts in urban areas compared with *Linepithema humile*. Temperatures in New Zelands are low compared with locations in which it is established outside urban areas, which will likely inhibit population size and limit the magnitude of any detrimental impacts, should it establish.
Solenopsis geminata (Fab.)	Workers are commonly intercepted at the border (at least 60 interceptions to April 2004) on a wide range of commodities. Nests and queens have also been intercepted and a nest was located during routine ant surveillance at Mt Maunganui (2003). One of 5 ants listed among the "100 World's Worst invaders" (www41). It possesses a painful sting (www49) that causes injuries to humans and domestic animals (www41), and cases of anaphylactic shock have been reported (Hoffman 1995). This species can be common around urban areas, is attracted to electric fields (MacKay et al. 1992), and can cause chewing damage to PVC coatings of electrical wiring (Prins 1985). The ants also build mounds in lawns, steal seeds from seedbeds, bite holes in fabrics, and feed on a range of household foods (Smith 1965). Workers tend honeydew-producing Homoptera, especially mealybugs (www41). This increases pest populations and can reduce seed set and yields (e.g., through disease vectored by Homoptera (Behera et al. 2001)). They can also girdle citrus trunks, which introduces disease (Suarez-Sotolongo 1990). Predominantly a specialist of disturbed areas, which it reinvades rapidly, and probably acts as an important organiser of the arthropod community (Risch & Carroll 1982).	Temperatures in New Zealand are low compared with the known range, which will reduce chances of establishment and the magnitude of detrimental impacts should it establish.
Solenopsis richteri Forel	Possesses a painful sting, capable of causing pustules, and in some cases anaphylaxis and death (Lofgren et al. 1975). Has the potential to have similar ecological impacts as *S. invicta*, although ecological impacts specific to *S. richteri* are poorly known (Holway et al. 2002). Has the potential to impact severely on native vertebrates due to its sting and aggressive colony defence. Established outside its native range, and in the absence of *S. invicta* would likely occur across a greater area of the southern USA. It may be capable of colonising some colder areas unsuitable for *S. invicta* (Morrison et al. 2004).	Not intercepted at the New Zealand border. Very similar to *Solenopsis invicta*, but with reduced pathways for spread to New Zealand due to restricted distribution in the USA. Existing surveillance and response plans to *S. invicta* will likely directly transpose to this species.

Table 2 cont'd

Tapinoma melanocephalum (Fab.)	Has a widespread distribution (including Australia and the Pacific) and is commonly intercepted at New Zealand border. Incursions have occurred here in the past. It is an urban pest capable of infesting buildings in large numbers, and has established in temperate locations (Francoeur 1977). It is capable of transporting pathogenic microbes in hospitals (Fowler et al. 1993). Some people suffer a slight, red irritation of the skin following contact with this ant (Collingwood et al. 1997).	Temperatures in New Zealand are low compared with the known range outside of heated buildings, so highly unlikely to be a pest outside urban areas.
Wasmannia auropunctata (Roger)	One of 5 ants listed among the "100 World's Worst invaders" (www41). This very small species has a very painful sting, although workers are relatively non-aggressive and generally sting only when provoked (Wetterer & Porter 2003). In disturbed areas, such as agricultural and forestry land, and in exotic habitats, commonly shows extreme population explosions. In many areas (including within its native range), it can be a significant agricultural pest, both stinging agricultural workers and enhancing populations of Homoptera. Direct negative impacts have been recorded on many animals, both invertebrates and vertebrates. There is also a possible connection between *W. auropunctata* and eye maladies in vertebrates (Wetterer & Porter 2003), and disease spread in hospitals (Bueno & Fowler 1994). It currently has a limited (known) distribution in the Pacific, but is expanding its range (recently reported from Tahiti). This species has established, at least temporarily, in heated buildings in temperate locations (e.g., glasshouses in England (www40)).	Temperatures in New Zealand are low compared with the known range outside heated buildings, which will reduce chances of establishment and the magnitude of detrimental impacts should it establish. Only two New Zealand interception records: a worker associated with an air passenger from the Solomon Islands in 1997; and an unverified interception on timber from PNG in 2004 (the ant has not been reported from PNG). An effective eradication strategy has been demonstrated for this species (Causton et al. in press).

Table 2 cont'd

Table 3: Justification for species considered a moderate threat and for which an information sheet has been prepared. These species received a risk score between 40 and 55% of the maximum score (see Table1 and Appendix 1).

Species	Reasons for inclusion	Mitigating factors
Camponotus spp.	Occupies a niche not utilised by other ants in New Zealand – nesting aborally in dead wood and enlarging the cavity. Several species infest houses causing some damage, and forage for food indoors (Smith 1965). Many have a painful bite and they also spray the victim with formic acid. *Camponotus herculeanus* (L.) and *C. pennsylvanicus* (De Geer) are commonly intercepted at the New Zealand border and their association with timber means this is likely to continue. Workers of *C. variegatus* (Smith), *C. irritans* (Smith), and *C. chloroticus* Emery have also been intercepted infrequently. A large number of unidentified *Camponotus* specimens (including several queens and nests) have been intercepted from a wide variety of locations. Eight species have established outside their native range: *C. variegatus* on Midway Atol (Nishida & Beardsley 2002); *C. planatus* Roger in Florida (Deyrup et al. 2000); *C. chloroticus* has expanded its range in the Pacific (Taylor 1967); *C. compressus* (Fab.) in United Arab Emirates (Collingwood et al. 1997); *C. herculeanus* in South Africa, but subsequently eradicated (www29); *C. novaehollandiae* Mayr on Lord Howe Island (L. Meades, pers. comm.); *C. senex* (Smith) on the Galapogos (C. Causton, pers. comm.); *C. sexguttatus* (Fab.) in Florida (Deyrup et al. 2000).	A very widespread genus of over 1518 described species and subspecies with only very limited spread outside its native range. None of the species established outside their native ranges have spread widely. Generally large ants that are likely to be detected early. Historical patterns of establishment suggest low likelihood of establishment of North America species (e.g., *C. herculeanus* and *C. pennsylvanicus*). Those that have spread are not considered pests (e.g., Deyrup et al. 2000; Collingwood et al. 1997), other than competing with similar indigenous species (Collingwood et al. 1997).
Cardiocondyla spp.	Some species in this genus are very common global tramps found throughout the Pacific and Australia. Species have occasionally been detected at the New Zealand border, and others are likely to have been missed due to their small size. There is a high probability more species will establish in New Zealand if the climate is suitable. It will be difficult to detect and discriminate a new incursion from the species already present in New Zealand (*C. minutior* Forel (Harris & Berry 2001)) due to the small size of workers and colonies, and the lack of foraging trails. Some species are able to survive in the presence of dominant ants such as *Linepithema humile* and *Solenopsis geminata* probably by emitting effective repellents (Creighton & Snelling 1974), so unlikely to be eliminated by ant competitors.	Generally not common wherever they occur, nor considered an urban or environmental pest (Deyrup et al. 2000; Wetterer & Wetterer 2004; Collingwood et al. 1997) except where they may compete with endemic species of the same genus (Collingwood et al. 1997).

Crematogaster spp.	A widespread genus that can be a pest in the USA where they nest in dead and decaying wood and can be found in buildings (Smith 1965; Klotz et al. 1995). Foragers can be a nuisance indoors and defend the colony aggressively by biting and releasing a foul odour (www69; www36). They can kill newly hatched birds and short-circuit telephone wires by removing insulation (Smith 1965). They can be an ecologically dominant ant and may have economic importance, especially as several species are among the dozen or so dominant ants that effectively determine much of the insect fauna of cocoa and other trees in Africa (www28). They are one of the most common groups of ants in Australia and are regularly encountered, often in large numbers (www36). There have been interceptions at the New Zealand border, including a nest in a container from China.	A distinctive ant – in contrast to most other species of ants, the petiole is attached to the top of the abdomen and the ant can elevate the gaster above the body and point it forwards – so able to be detected early if established. Only a single introduction outside its native range (Florida), and that species is not a pest (Deyrup et al. 2000). The genus is absent from Tasmania (www36), so may not like cold climates.
Formica spp.	A diverse ant genus, with some species particularly important components of forested habitats in cold northern hemisphere climates (Lenoir et al. 2003). Some species form large polydomous colonies (where a single colony occupies several distinct nest sites) extending over several hectares (Cherix & Bourne 1980; Rosengren et al. 1985) and commonly are the numerically dominant ant (Agosti 1994). They occupy a range of ecological niches (www81) and some species are capable of altering invertebrate community structure (e.g., Cherix & Bourne 1980; but see Lenoir et al. 2003). These ants have strong biting jaws and smear the bitten area with formic acid, which increases the degree of irritation they cause (www82). They sometimes invade houses and can be a pest in recreational areas (www82).	Not established in the southern hemisphere. Only two species have been recorded outside their native range (both in Canada (Francoeur 1977), one of which was introduced deliberately as a predator of the Swaine jack pine sawfly, *Neodiprion swainei* (www81)), suggesting reproductives of this genus are infrequently transported or have very low probabilities of success (which in many species may relate to the social parasitism habits). Only 2 interceptions of unidentified *Formica* species are recorded; one from a container from Italy, the other in timber from Canada.
Iridomyrmex anceps (Roger)[Assumed the *Iridomyrmex* established in NZ is not *anceps*]	Common in the Pacific and Australia and established outside native range (e.g., Arabia (Collingwood et al. 1997)). Would be difficult to detect arrival due to similarity to species already established in New Zealand. Intercepted at the New Zealand border (although may be issues with identity of some of these specimens).	Likely to be a low climate match between the known range and New Zealand as predominantly from tropical localities (although there are records of *I. anceps* species group in ACT and Victoria (Frazer et al. 2002)). Status as a pest is doubtful (Collingwood et al. 1997), and if it did establish in New Zealand it would likely occupy a similar niche to the undescribed *Iridomyrmex* species already established.

Table 3 cont'd

Iridomyrmex purpureus sp. Group	An aggressive, ecologically dominant ant species group in Australia (Andersen & Patel 1994) that can impact horticulture (James et al. 1999), other ants (Andersen & Patel 1994), and possibly other invertebrates and vertebrate species. There have been nine interceptions of unidentified Australian *Iridomyrmex* at the New Zealand border (including at least 1 queen).	A widespread species group but predominantly in arid habitats (Greenslade & Halliday 1982), so likely that climate not suitable in New Zealand for many species of the group. Not established outside native range. Low risk of transportation of queens or nests due to nest structure (long-lived colonies that are unlikely to nest in goods that could then be transported).
Labidus coecus (Latreille)	A new-world tropical species with large colonies, usually with many thousands of individuals (www81). These ants are highly mobile and feed on other arthropods, small mammals, and birds. Workers bite and sting fiercely, will enter buildings, and damage structures (Smith 1965). Although tropical (range Argentina to Texas (www81)), it can occur at cooler high altitude sites; found at 3000 m in Costa Rica (www11).	Not established outside its native range. No interceptions of this Genus at the New Zealand border. Summer temperatures of the known range and New Zealand are unlikely to overlap.
Monomorium floricola (Jerdon)	An extremely successful tramp species widely dispersed by human commercial activity (Bolton 1987). It is widespread in the Pacific region, including the Kermadec Islands. This ant is also recorded from urban environments in temperate regions. It commonly infests houses and feeds on household foods (Smith 1965; Lee 2002). It has been intercepted seventeen times at the New Zealand border to April 2004, mostly workers on fresh produce from the Pacific and Australia (where it is established in the far north (Reichel & Andersen 1996)). A colony was discovered at the port of Napier in 2004. Establishment of this small species (~ 2 mm) could easily go unnoticed.	Areas of suitable climate outside of urban areas probably limited in New Zealand. Not considered a pest outside urban environments in Florida (Deyrup et al. 2000). Shown to be attracted to surveillance baits at Napier aiding early detection of an incursion.
Monomorium minimum Mayr	A native to North America and the Caribbean, *M. minimum* has wide environmental and altitudinal tolerances (Smith 1965; Dubois 1986; Wheeler & Wheeler 1986) and occupies many different habitat types (including forest, meadows, woodlands, prairie, desert, roadside, exposed bedrock), but prefers moist habitat usually near wooded edges (DuBois 1986; Bhatkar 1992). It has large polygyne colonies and displays polydomy. It has been recorded killing nestling birds (Smith 1965). It will forage indoors and is one of the most common house-infesting ants in the USA (Smith 1965). Its can coexist with *Linepithema humile* and is capable of displacing them from baits (wwwnew06), and can invade and kill	*M. minimum* is not established in the southern hemisphere and has not been intercepted at the New Zealand border. There have been 26 interceptions (including 2 queens and eggs) of unidentified *Monomorium* species (but only one interception that originated from within the known range).

Table 3 cont'd

	small *Solenopsis invicta* colonies (Rao & Vinson 2002). It has established outside its native range in Malaysia (Lee 2002). It is a small species (< 2 mm) whose arrival in New Zealand could initially go unnoticed.	
Monomorium monomorium Bolton	Native to Europe but has become established widely in disturbed habitats in the Asia Pacific region (Wilson & Taylor 1967; Way et al.1998) and therefore is a high risk of arrival in New Zealand. There has been one interception of *M. monomorium* in cut flowers from Fiji at Auckland airport and 12 interceptions of *M. minutum* (= *M. monomorium*) (including a nest and eggs) at Auckland, all originating from the Pacific Islands. There are also many interceptions (including 2 queens and eggs) of unidentified *Monomorium* mostly from countries known to have *M. monomorium*.	The global distribution is tropical and Mediterranean, which suggests New Zealand may be too cold. Not considered among the significant pest species established in Hawaii (Reimer 1994).
Monomorium sechellense Emery	A very small species (< 2 mm) that has spread widely through the Pacific and could easily establish in New Zealand without being detected. There has been one interception of *M. fossulatum* (=*M. sechellense*) in fresh produce from Fiji. There have also been 26 interceptions (including 2 queens and eggs) of unidentified *Monomorium* species mostly from countries known to have *M. sechellense*. The native range of *M. sechellense* is not confirmed, but thought to be tropical Asia (Wilson & Taylor 1967; www29) rather than the Seychelles Islands (www09).	Summer temperatures of the known range and New Zealand unlikely to overlap. No information was found indicating any detrimental impacts.
Myrmecia pilosula Smith	Large aggressive ants that defend their nest if disturbed. Native to the southern mainland of Australia and Tasmania, so climate highly likely to be similar to much of New Zealand. This ant is one of the most dangerous ants in terms of its sting, comparable with species like *Pachycondyla sennaarensis* (Africa & the Middle East), *Pachycondyla chinensis* (Asia), and *Solenopsis invicta* (North and South America, Taiwan, Brisbane, and possibly Malaysia). Allergic reactions and deaths have been reported as a result of stings of *M. pilosula* in Tasmania (McGain & Winkel 2002) and numerous cases of anaphylaxis (Brown et al. 2001).	Not established outside its native range. Nests in the ground in stable long-lived colonies, limiting the chances of human-assisted spread. *M. pilosula* not intercepted at the New Zealand border, although there is at least one interception of an unidentified member of the genus. These large, conspicuous ants would likely be rapidly detected if they did establish in New Zealand and be relatively easily controlled.*An information sheet has been prepared on this ant at the request of the Ministry of Health.*

Table 3 cont'd

Myrmica rubra (L.)	A cold-climate species from Europe that has established outside its native range in north-eastern USA and Canada (Creighton 1950). It is an aggressive species with a painful sting (wwwnew38). It has become a significant pest in many parts of its introduced range in Maine. Densities of nests can be as high as 4/m^2, with more than 5200 workers and 39 queens/nest. Impacts on people, pets, other ants, and the invertebrate community have been demonstrated (wwwnew40). It is associated with disturbed habitats and disperses by budding and movement of potted plants (wwwnew40).	Not present in the southern hemisphere. No interceptions of this species at the New Zealand border. Probably only one transfer from its native range. *[If a greater weighting was placed on human health this ant would score higher]*
Paratrechina bourbonica (Forel)	A widespread tramp species that has been intercepted at the New Zealand border on produce from the Pacific at least 9 times (and there are also many unidentified *Paratrechina* interceptions). It is a rapid coloniser of disturbed sites that is frequently transported from place to place with plant materials (Trager 1984). Northern New Zealand may be climatically suitable for establishment outdoors and it could become more widespread in urban areas (as is reported from the UK (Blard et al. 2003) and North America (www06)). It is occasionally a nuisance in outdoor eating areas, can be abundant in gardens, and occasionally enters houses in Florida (Deyrup et al. 2000). Due to the common occurrence of adventive *Paratrechina* around New Zealand cities, this species could establish without being noticed.	Rarely enters houses in great numbers (Deyrup et al. 2000). Likely to be mostly restricted to human-modified habitats and have few environmental consequences. Niche may not differ greatly from adventive *Paratrechina* already established in New Zealand.
Paratrechina fulva (Mayr)	Appears to have high potential to have detrimental impacts, unlike many *Paratrechina* species. It has been documented displacing other ants, with food monopolisation suggested as the mechanism (Zenner-Polania 1994), and has been introduced into Colombia intentionally to control snakes (Zenner-Polania 1994). Small animals (e.g., chickens) die of asphyxia (large numbers of worker ants), while larger animals (e.g., cows) are attacked around eyes, nasal fossae and hooves (Zenner-Polania 1990). In agroecosystems, it farms homopterans that damage crops (Arcila et al. 2002). It has spread outside its native South American range (some intentional introductions) to North America (e.g., Mexico (Jeanne 1979)) and offshore islands in the Americas (e.g., Galapagos Is. (C. Causton, pers. comm.)). It is capable of establishment (at least temporarily) in glasshouses in temperate locations (Creighton 1950) and occurs within urban areas within its native range (Silva & Loeck 1999). Due to the common occurrence of adventive *Paratrechina* around New Zealand cities, and the difficulties with identification within this genus, this species' initial establishment could go unnoticed.	Not spread outside the Americas. Areas of suitable climate may be limited in New Zealand outside of urban areas. There have been no recorded interceptions of this species at the border, and few of the unidentified *Paratrechina* species intercepted originate from countries with *P. fulva*.

Table 3 cont'd

Paratrechina vaga (Forel)	Widespread in the Pacific and northern Australia (e.g., www36; Morrison 1997; Wetterer 2002) and has spread beyond its native range in the Pacific (e.g., Hawaii (www01)) and elsewhere (e.g., Galapagos (C. Causton, pers. comm.)). It is one of the most commonly intercepted ants at the New Zealand border (at least 60 interceptions), although difficulties with the identification of this genus may mean that some may be other species and some of the many unidentified *Paratrechina* could be *P. vaga*. In Hawaii, *P. vaga* is considered a pest in pineapple crops (Carter 1967). They are nectar feeders and will likely be abundant in urban areas and could be a minor horticultural pest. Due to the common occurrence of adventive *Paratrechina* around New Zealand cities (one of which was mistakenly thought to be *P. vaga*) this species could establish without being noticed.	New Zealand has low temperatures compared with the sites where this ant is reported. It is likely to be predominantly restricted to human-modified habitats and has few environmental consequences. The main impacts may be on other adventive ants, with which it will compete.
Paratrechina vividula (Nylanda)	A North American native (prairies and wetlands in northern Mexico, Gulf Coast states of USA) that has spread widely into tropical and temperate locations (Trager 1984; J. Trager, pers. comm). It commonly establishes colonies in pot plants or mulch piles and is transported in these materials (Trager 1984). It is successful in disturbed habitats (including inside heated buildings where is can be a pest in glasshouses (Trager 1984). It is reported to have been established as a greenhouse ant in Europe for 150 years (Trager 1984), although the only European record found was the type locality *Formica vividula* from Finland (Taylor 2002). It may be present in the Pacific including Fiji (Mann 1921). It is listed by Taylor (2002) in his "Checklist of the Ants of Australia (Including Christmas Island, Lord Howe Island and Norfolk Island)" but not from mainland Australia by Shattuck (www36). Due to the common occurrence of adventive *Paratrechina* around New Zealand cities this species could establish without being noticed.	Temperatures likely too low in New Zealand outside urban areas. There have been no recorded interceptions of this species at the New Zealand border. However, there have been 56 interceptions (7 separate queens) of unidentified *Paratrechina* species, some of which may well be *P. vividula*. Not considered a pest in Florida (Deyrup et al. 2000).
Pheidole fervens Smith	A numerically and behaviourally dominant species possessing traits of other invasive species (polygyne (Morrison 1996) and polydomous (Martinez 1996)) and can exclude *Anoplolepis gracilipes, Paratrechina bourbonica, Solenopsis papuana* and *Tetramorium bicarinatum* from baits (Morrison 1996). It is also a household nuisance and is extremely abundant in some anthropogenic areas in Tahiti (Wilson & Taylor 1967). It is commonly intercepted at the New Zealand border – mostly on produce from the Pacific. It closely resembles *Ph. megacephala* so its establishment in New Zealand could go unnoticed.	Its current distribution is tropical and suggests New Zealand is probably too cold for this species.

Table 3 cont'd

Rhytidoponera spp.	Occasionally intercepted at the New Zealand border, and two members of this genus originating from Australia are already established in New Zealand. The genus occurs in eastern Indonesia, New Guinea, the Solomon Islands, New Caledonia and Australia. Common in Australia and can be very abundant, especially in urban areas (www36). Some of the smaller species have a potent sting (www36) and are known to cause allergic reactions (Solley et al. 2002).	No evidence of ecological dominance. Only two species have spread outside of their native range – but in both cases this is to New Zealand. *[As New Zealand is the only country into which this Genus has spread outside its native range it received a relatively low score, but the risk of this genus to New Zealand may be understated].*
Solenopsis molesta (Say)	A pest of horticulture and urban areas (Smith 1965). It feeds on a large variety of household foods and its small size allows foragers to get inside food packages that other larger ants cannot enter. They feed on a variety of planted seeds and germinating plants (Hayes 1920; Smith 1965) and workers tend plant lice, mealy bugs and scale insects (www46). Reported outside its native range from Malaysia where it nests indoors and is considered a pest (Na & Lee 2001; Lee 2002).	Does no occur in the southern hemisphere. It has not been intercepted at New Zealand border (although there are two unidentified *Solenopsis* interceptions which originate from the USA). Only a single establishment outside its native range.
Solenopsis papuana Emery	An Indo-Australian species (Morrison 1997) that is not present in Australia (Shattuck 1999; www36). It has spread to Hawaii (Reimer 1994) and into the eastern Pacific (Morrison 1997). A polygyne species (Reimer 1994) that is not thought to sting people (Gruner 2000). It is relatively frequently intercepted at the New Zealand border (mostly live workers on fresh produce). In Hawaii this species has established in wet forests between 300 and 1070 m and reaches high densities (Reimer 1994). It has been suggested that its impact on native biota may be severe (Reimer 1994), and a significant negative relationship with native spiders has been shown (Gillespie & Reimer 1993). It is an inconspicuous species (Wilson & Taylor 1967) whose arrival in New Zealand could go unnoticed.	Its current distribution is tropical Pacific suggesting most of New Zealand is probably too cold for this.
Solenopsis saevissima (Smith)	A pest in horticulture (Taber 2000), and a common species in urban areas within its native range (Silva & Loeck 1999), it has spread to Africa (www28) and the Galapagos Islands (C. Causton, pers. comm.). It is morphologically very similar to *S. invicta*, and colonies can be difficult to distinguish (Porter 1998). It has a potent sting and can build up to very high densities in disturbed areas (Adams 1994, cited in Taber 2000). It has the potential to have detrimental impacts where it establishes outside its native range. [NB: The taxonomy of the *saevissima* complex, which includes *S. richteri* and *S. invicta*, has been a	Not intercepted at the New Zealand border (there are unidentified *Solenopsis* specimens for Central America but they are unlikely to be this species as its similarity to *S. invicta* would mean intercepted material would be sent for verification). Currently there are limited pathways for this species to be transported to New Zealand.

Table 3 cont'd

	mess until recently (Ross & Trager 1990; Trager 1991) making it unclear what species is actually being refereed to ins some earlier literature]	Existing surveillance and response plans to *S. invicta* will likely directly transpose to this species. A more northern South American distribution than *S. invicta*, and established outside its native range only in hot climates, indicating New Zealand is likely too cold for this species.
Solenopsis xyloni McCook	Considered a significant pest in the gulf states of the USA (Smith 1965). It builds mounds in gardens, stings painfully (but not as badly as *S. invicta* (wwwnew23)), gathers seeds from seedbeds, kills young birds, damages young trees by ringbarking, damages insulation around wiring, bites holes in fabric, tends honeydew-producing insects, feeds on household foods, and will nest in artificial structures (Smith 1965; Knight & Rust 1990; Hooper-Bui et al. 2004). As this is the most northern distributed fire ant in the USA, climate similarity may be reasonably high with northern New Zealand (Taber 2000).	Not established outside its native range and not in the southern hemisphere. It has not been intercepted at the New Zealand border (although two unidentified *Solenopsis* from the USA are recorded). It remains unclear if temperatures in New Zealand would be high enough as habitats mentioned for *S. xyloni* in Taber (2000) have relatively high temperatures (especially in summer).
Strumigenys emmae (Emery)	Established widely beyond its native range including the Pacific (Wilson & Taylor 1967). It is a specialised predator of Collembola that may impact on competitors and prey in native systems (Deyrup et al. 2000). As this species is small and cryptic any incursion in New Zealand would be difficult to difficult to detect. [NB: Much of the literature and distribution records classify it as *Quadristruma emmae* as it was only recently transferred to *Stumigenys* (Bolton 1999)]	Areas of suitable climate may be limited in New Zealand. There have been no recorded interceptions of this species at the border (there is one unidentified *Strumigenys* specimen). If it established in New Zealand it would join the already established *Strumigenys perplexa* (a species widespread but in low densities wherever sampled), and is likely to have similar habits and minimal impact. It is not considered a pest in Florida (Deyrup et al. 2000).
Strumigenys rogeri Emery	An African species that has spread widely outside its native range, including temperate locations. Intercepted at the New Zealand border (6 times) in fresh Pacific produce. A specialised predator of Collembola that may impact on competitors and prey in native systems (Deyrup et al. 2000). As this species is small and cryptic, any incursion in New Zealand would be difficult to detect and eradicate.	Areas of suitable climate may be limited in New Zealand outside of urban areas. It is not considered a pest in Florida (Deyrup et al. 2000). If it established in New Zealand it would join the already established *Strumigenys*

Table 3 cont'd

		perplexa (a species widespread but in low densities wherever sampled) and is likely to have similar habits and minimal impact.
Tapinoma sessile (Say)	A native North America species capable of invading houses from outdoors, or nesting inside (Smith 1965). The ant shows many of the attributes of invasive species, e.g., polygyny, super-colonies, and mobile colonies (Higgins et al. 2002). It has spread outside its native range at least once (to Penang, Malaysia (Na & Lee 2002)). The species shows preferences for a wide range of habitats (from sandy beaches, pastures, open fields, woodlands and bogs to houses), is spread across a wide range of climates (Smith 1965), and is a first arrival after disturbance events (Scharf et al. 2004). They do not sting but produce a disagreeable odour (Smith 1965). They tend honeydew producing insects, and are transmitters of plant disease (www46).	Not present in the southern hemisphere. No confirmed interceptions at the New Zealand border, although there are a number of unidentified *Tapinoma* listed in interception records, several of which were in cargo from Malaysia and Singapore, but none from North America.
Tetramorium pacificum Mayr	A widespread species from the Oriental and Australian regions, primarily of moist forest (Wilson & Taylor 1967; www36), which has increased its distribution in the Pacific (e.g., Morrison 1996; Collingwood 2001) and spread to California (Creighton 1950). There have been 10 recorded interceptions of this species at the New Zealand border (mostly workers associated with fresh produce, cut flowers or nursery stock).	Likely that New Zealand is too cold. May not have established permanently in California (www81).
Tetramorium rhenanum Schulz	A small polygyne species from Central Europe (Schulz 1996) that has established in the USA (www29). In the USA it is present in urban and suburban habitats, and in native grassland, where is has displaced almost all native ants larger than itself (www29). The presence of other adventive *Tetramorium* in New Zealand could allow establishment to go unnoticed.	Not in the southern hemisphere. Not intercepted at the New Zealand border. Only a single relatively recent introduction known outside its native range, and limited distribution in Europe (Schulz 1996).
Tetramorium simillimum (Smith)	A widespread tramp species occurring in Australia and the Pacific and has been intercepted on at least 9 occasions at the New Zealand border (all originating from the Pacific). It is able to establish, at least temporarily, in glasshouses in temperate climates (e.g., the UK (Bolton 1977)). It also appears able to persist in small numbers in gardens dominated by *Linepithema humile* (Heterick et al. 2000). The presence of other adventive *Tetramorium* in New Zealand could allow establishment of this ant to go unnoticed.	Not considered a pest in Florida (Deyrup et al. 2000). Areas of suitable climate may be limited in New Zealand outside urban areas.

Table 3 cont'd

Tetramorium tonganum Mayr	A Pacific species, its native range extending from Japan (northern limit) to New Guinea (southern limit) (Bolton 1977). Java and Sumba represent the western limits (Bolton 1977). It has extended its distribution into Hawaii (Reimer 1994), Niue (Collingwood 2001), Brazil (www29), and the Society Islands (Morrison 1996). It has also been recorded in greenhouses in the UK (Bolton 1977). There have been 8 recorded interceptions of *T. tonganum* at the New Zealand border, all in fresh produce originating from the Pacific, including 2 live nests in coconuts from Fiji intercepted in Auckland. There have also been 6 interceptions (including 1 queen) of unidentified *Tetramorium* species from the Pacific, some of which could be *T. tonganum*.	Although it may establish temporarily in glasshouses (Bolton 1977) there is low climate similarity between the known range and New Zealand. It appears to be a minor constituent of the Hawaiian ant community (Gruner 2000) and no information was found indicating detrimental impacts.

Table 3 cont'd

Table 4: Notes on taxa that were considered in the preliminary risk assessment, but received low rankings (scored < 40% of the maximum score (see Table1 and Appendix 1). No information sheet was prepared for these species, with the exception of *Paratrechina flavipes* and *Tetramorium caespitum* (the highest ranking of these taxa).

Species	Reasons for initial consideration	Reasons for assessment as relatively low risk
Acanthomyops spp.	A native genus of North America ranging from Mexico (Johnson 2002) to Canada (Francoeur 1977). Considered a pest as these cryptic ants farm subterranean lice on plant roots (Smith 1965). Recorded as introduced to Hawaii (McGlynn 1999), but record is in fact a quarantine interception and it is not established there (www01).	Not established outside its native range. Not present in the southern hemisphere, and not intercepted at the New Zealand border.
Aphaenogaster senilis Mayr	Introduced outside its native range into the Azores and reported from urban sites (Wetterer 2004).	Not in present in the southern hemisphere. Not intercepted at New Zealand border. Climate suitability may be low. No detrimental impacts recorded for this genus. Only local spread outside of native range as occurs in Spain (Carpintero et al. 2003). Queens have very small wings (micrapterous) and cannot fly (Wetterer 2004), limiting ability to disperse.
Atta spp.	Members of this genus can be economically important pests in tropical and subtropical agricultural as they strip leaves off trees and plants to grow fungus on which they feed (e.g., Lopez & Orduz 2003).	No members of the genus have established outside their native range. No interceptions of this genus at the New Zealand border. It is highly unlikely that the climate is suitable in New Zealand. Low risk of transportation of queens or nests.
Anoplolepis custodiens (Smith)	Considered a major pest of horticulture and horticultural workers in South Africa (Prins et al. 1990) where it is native. Recorded from Somalia to South Africa (www28). It is unclear if it is native across all this reported range. McGlynn (www29) lists it as introduced to North and Central America, but no records were found to verify this record.	Appears not to be established outside Africa. No interceptions of this species at the New Zealand border. Likely that the climate would be unsuitable in New Zealand.

Anoplolepis steingroeveri (Forel)	Considered a major pest of horticulture and horticultural workers in South Africa (Prins et al. 1990).	Not established outside native range. No interceptions of this species at the New Zealand border. Likely that the climate would be unsuitable in New Zealand.
Hypoponera opaciceps (Mayr)	Widely established beyond its native range including the Pacific (e.g., Wilson & Taylor 1967; Wetterer & Vargo 2003).	No interception of this species (one unidentified member of genus) at the New Zealand border. No known negative consequences of establishment. Likely that the climate would be unsuitable over much of New Zealand.
Iridomyrmex rufoniger sp. Group	An Australian species group that has the potential to impact on horticulture and modify invertebrate communities where it forages (James et al. 1999). There have been nine interceptions of unidentified Australian *Iridomyrmex* at the New Zealand border (including at least 1 queen).	Not established outside native range. Low risk of transportation of queens or nests of this species group as not closely associated with urban habitats.
Lasius alienus (Förster)	A widespread holarctic species. In North America, this ant shows a preference for well-shaded woodlands where it nests in rotting logs and stumps or under stones (www81) contrasting with its common name of the "Cornfield Ant". It can form very dense local populations making it a potential ecologically dominant ant should it establish in New Zealand forests. NB: In early American literature, this species has been recorded as *americanus* Emery, and *alienus* has commonly been confused with *neoniger* (Smith 1979).	Not established outside its native range. Not established in the southern hemisphere. No interceptions of this species at the New Zealand border (although 1 unidentified specimen of the genus *Lasius* from the USA).
Lasius flavus (L.)	A common cold-climate species widespread in Europe and northern North America. A subterranean species in grasslands and open woods, although it is known to build mounds in parts of Eurasia (www81). Workers may attend aphids on roots of grasses (www81). Listed as introduced to North America, Copeland Is., and possibly Ireland (McGlynn 1999).	Not in southern hemisphere. Unclear where in North America it is introduced as it appears to be native (www81). Not associated with urban environments so limited pathways for spread to New Zealand. No interceptions of this species at the New Zealand border (although 1 unidentified specimen of the genus *Lasius* from the USA).

Table 4 cont'd

Lasius neoniger Emery	An abundant, temperate US native species that is a dominant ant in open areas including lawns, cultivated fields, grassy road strips, and prairies (www81). Can be a major golf course pest due to turf damage (Smith 1965). Tends honeydew producing insects and fosters and transports subterranean plant lice (Smith 1965).	Not established outside of its native range. Not present in the in southern hemisphere. No interceptions of this species at the New Zealand border (although 1 unidentified specimen of the genus *Lasius* from the USA).
Lasius niger (L.)	A widespread Eurasian species adapted to cold climates. McGlynn (1999) lists *Lasius niger* as native to Europe and transferred to the Hawaiian Islands, Japan, and California. A common garden pest and occasional household nuisance in Britain (Cornwell 1978).	No interceptions of this species at the New Zealand border. Not present in the southern hemisphere. Appears that it may not in fact be established outside its native range. Japanese records have been synomised under a native species (*L. japonicus* Santschi (www39)). The Hawaii records appear to be quarantine interceptions (a mistake made by McGlynn (1999) for Hawaii with a number of species). Wheeler and Wheeler (1986) state in their notes on *Lasius alienus* that: "Our concept of this species includes the ant that Wilson (1955) believed to be *L. niger*, a Eurasian species. Our North Dakota collections are too variable to support the separation of eastern and western populations as separate species, and we think that true *L. niger* does not occur in North America."
Messor capensis (Mayr)	Considered a significant pest of agriculture in South Africa due to its seed-harvesting habits (Prins et al. 1990)	Not established outside its native range. No interceptions of this genus at the New Zealand border. Likely that the New Zealand climate would be unsuitable.
Monomorium orientale Mayr	A house-infesting ant in Malaysia (Lee 2002) and occurs in countries with large volumes of trade with New Zealand (e.g., India (Imai et al. 1984), Malaysia (Lee 2002), and the Philippines (Way et al. 1998)). It is very small and morphologically similar to native *M.*	Virtually no information was found on this ant, which suggests it is a minor component of communities. Likely to have a limited

Table 4 cont'd

	antipodum, so arrival in New Zealand could easily be missed. Brown (1958) suspected that *M. orientale* and *M. antipodum* might be synonymous but the chemical components of the venom are distinct (W. Don, pers. comm.).	distribution outside of urban areas as it has a tropical Asian distribution. Not present in either Japan (www39) or Australia (www36). In urban areas likely similar interaction with people as for *M. antipodum,* i.e. only a minor nuisance.
Myrmecia spp.	Large aggressive ants that defend their nests if disturbed (www36). The genus occurs throughout Australia in a range of climates. Allergic reactions and 6 deaths reported as a result of the sting of these ants, particularly from *M. pilosula* in Tasmania (McGain & Winkel 2002). One species (*M. brevinoda*) was established in one street in Auckland for several decades, but has been eradicated. Two interceptions of members of the genus at the New Zealand border.	Only a single establishment outside its native range (subsequently eradicated). Nests do not have a close association with humans, reducing the chances of spread. Any establishment in New Zealand likely to be detected early and controlled relatively easily due to the large size of these the ants and distinctive long-lived nests. *[If a greater weighting was placed on human health this ant would score higher]*
Neivamyrmex spp.	One of the genera called army ants. A minor pest in the USA where it occasionally nests around buildings (Smith 1965). If workers fall into water they cause the water to have a foul odour and unpleasant taste. The North American *Neivamyrmex nigrescens* have received extensive study, and their impact on arthropod communities has been relatively well documented (summarized in Schneirla 1971; Gotwald 1995). Social insects, and ants in particular, are a preferred prey of army ants (LaPolla et al. 2002).	Not established outside its native range. No interceptions of this genus at the New Zealand border. Limited pathways for this ant to be transported to New Zealand. Likely that the New Zealand climate would be unsuitable.
Pachycondya sennaarensis (Mayr)	An African savanna species that is spreading into human settlements in Arabia where it has been for at least 100 years (Collingwood 1985). It is a large aggressive ant with a painful sting. Nests are very common in urban areas where they pose a potential health hazard. There were at least 30 cases of human allergic reactions in Al Ain (United Arab Emirates) in 1992, and two deaths due to anaphylactic shock following stings (Dib et al. 1992). This species also raids bee hives and destroys honey bees (Whitcombe 1982).	No interceptions of this genus at the New Zealand border. Not present in the southern hemisphere. Likely that the New Zealand climate would be unsuitable.*[If a greater weighting was placed on human health this ant would score higher]*

Table 4 cont'd

Paratrechina flavipes (Smith)	Native to temperate Asia, this species has been introduced to the north-east USA (Trager 1984), Niue (Collingwood 2001), and urban centres in the Persian Gulf (Collingwood et al. 1997) and Spain (Espadaler & Collingwood 2000). It is often found in greenhouses in Europe (Collingwood et al. 1997), but no references were given to support this statement nor any distribution records found from Europe. In the USA, this species shows a preference for moist forest, a habitat not invaded by most adventive species currently established in New Zealand. Due to taxonomic difficulties with this genus the arrival of this species could go unnoticed. Easily transported by "human agency", particularly in nursery stock (Wilson 2003).	There have been no recorded interceptions of this species at the New Zealand border (although there have been 56 interceptions (7 with queens) of *Paratrechina* species that have not been identified). Only reported from a single location in the southern hemisphere. No reports of ecological dominance or reaching pest status in urban areas (Collingwood et al. 1997). [NB: an information sheet was prepared for this species]
Paratrechina minutula (Forel)	A species found in the Pacific (Wetterer & Vargo 2003) and Australia (www36) that has been intercepted at least 3 times on Taro entering New Zealand from Fiji. Established outside its native range on Christmas Island (Taylor 1990). Due to the common occurrence of adventive *Paratrechina* around New Zealand cities this species could establish without being noticed.	Likely that the climate would be unsuitable in New Zealand. No reference found indicating this ant is likely to be dominant or a pest. Not listed in Taylor's (2002) checklist of the ants of Australia (including Christmas Island, Lord Howe Island and Norfolk Island), so unclear if it is in fact established outside its native range.
Paratrechina pubens (Forel)	Established outside its native range only within a relatively small area of Florida where it can be a minor garden nuisance (Deyrup et al. 2000) and a large infestation in a building has been reported (Klotz et al. 1995). Can be abundant and is considered a pest in Colombia (www53).	No interceptions at the New Zealand border. Not in southern hemisphere. Likely that the New Zealand climate would be unsuitable
Paratrechina guatemalensis (Forel)	Spread from Neotropics into North America, Bahamas, Cocos Is. (www29) and Galapagos Is (Causton, pers. comm.). It has invaded disturbed and relatively undisturbed habitat and can be a nuisance at outdoor eating areas (Deyrup et al. 2000).	Not present in the southern hemisphere. No interceptions of this species at the New Zealand border (although several unidentified *Paratrechina* specimens). Likely that the climate would be unsuitable in New Zealand. Rarely enters buildings (Deyrup et al. 2000). Likely limited impacts in New Zealand and these would not be markedly different from *Paratrechina* species already established.

Table 4 cont'd

Pheidole bilimeki Mayr [=*Ph. anastasii* Emery]	A very abundant and dominant polydomous ant in the low arboreal stratum of primary wet forest understorey throughout Costa Rica (to 1000 m elevation) (www11). It is reported from outside its native range in Canada (Francoeur 1977), Mauritius (Fisher 1997), Florida (Tschinkel & Hess 1999), and Denmark (Lomholdt 1986). Nests may be found in almost any kind of cavity or sheltered space (www11). It is reported from temperate areas – in greenhouses in various parts of the Eastern US, but not established (www81), and Canada. It has maintained a stable population for at least 45 years in a greenhouse in the Botanical Gardens in Copenhagen, Denmark (Lomholdt 1986).	Likely that New Zealand climate is unsuitable outside of heated buildings. Not present in the southern hemisphere. No interceptions of this species at the New Zealand border (and unidentified *Pheidole* intercepted are not from locations reported to have *Ph. bilimeki*). No mention of this species from Florida in the checklist of Deyrup et al. (2000) and unlikely ever present as mistaken for *Ph. flavens* (M. Deyrup, pers. comm.). [There is taxonomic confusion in the *flavens* species group (www11), and it is unclear whether the records from outside the native range may actually be for this species. Most records of this species are reported as *Ph. anastasii* Emery, which was only recently synonymised under *bilimeki* by Wilson (2003).]
Pheidole bicarinata Mayr	A North American temperate climate species found predominantly in grasslands (Smith 1979). It is reported from anthropogenic environments where it occasionally enters houses and is a garden nuisance through transporting scales and feeding on seeds (Smith 1965 (listed under the name *Pheidole bicarinata vinelandica* Forel)).	Not established outside its native range. Not present in the southern hemisphere. No interceptions of this species at the border (although many intercepted *Pheidole* remain unidentified). There are no indications that it would be a significant pest if it became established in New Zealand.
Pheidole fervida Smith	This is a temperate species, found in low elevation forests in northern Japan, mountainous areas in the southern part of Japan, Korea, and Russia (e.g., Kipyatkov &Lopatina 1987; Park & Kim 2002; www39) Reported as introduced into China (McGlynn 1999).	Not present in the southern hemisphere. No interceptions of this species at the New Zealand border (although many intercepted *Pheidole* remain unidentified). Limited spread outside its native range. Limited likelihood of forest species being transported to New Zealand.

Table 4 cont'd

Pheidole moerens Wheeler	Native to the Greater Antilles, and has become widespread in Florida (Deyrup et al. 2000) as well as other southern US states (e.g., California (Martinez 1997), Alabama, and Texas (Wilson 2003)) and has more recently been detected in Hawaii (Gruner et al. 2003). In Florida it occupies a wide variety of habitats, and where abundant may impact on native ants (Deyrep et al. 2000). It is compared to *Ph. megacephala* and *Ph. fervens*, and suggested as a potential concern to the Pacific (Gruner et al. 2003). Demonstrated potential to spread rapidly into new areas, and is easily moved about in nursery stock (M. Deyrup, pers. comm.).	Not present in the southern hemisphere. No interceptions of this species at the New Zealand border (although many intercepted *Pheidole* remain unidentified). Climate similarity likely limited, although it is the species in the *flavens* species group that survives furthest north in Florida (M. Deyrup, pers. comm.). Not considered a pest in Florida (Deyrup et al. 2000).
Pheidole teneriffana Forel	Spread from its native range (Canary Islands and Mediterranean area (Wilson 2003)) on several occasions (e.g., Snelling 1992; Collingwood et al. 1997). Some association with urban environments (Snelling 1992) and can be abundant and may replace local species (Collingwood et al. 1997). It is polydomous, polygynous, reproduces by budding, and attacks and destroys *L. humile* colonies (Martinez 1992). Collingwood et al. (1997) states "it occurs on many islands worldwide and is thought to be continually expanding its range", but the only island record found outside of the Mediterranean is from Cuba (Wilson 2003).	Peru is the only reported southern hemisphere location. No interceptions of this species at the New Zealand border (although many intercepted *Pheidole* remain unidentified). Likely that the climate would be unsuitable in New Zealand. Considered by Snelling (1992) to have limited pest potential.
Pheidole umbonata Mayr	Has been intercepted twice at the New Zealand border (and there are a large number of unidentified *Pheidole* interceptions). It is widespread in the Pacific (Wilson & Taylor 1967), being native to some locations and spread by humans to others. [NB: virtually no information found on the biology of this species.]	The Pacific distribution suggests low climate similarity to New Zealand. No documented accounts located of this ant being a pest.
Pheidole dentata Mayr	A North American species found associated with anthropogenic environments where it occasionally enters houses and is a garden nuisance through transporting scales and feeding on seeds (Smith 1965).	Not established outside its native range. Not present in the southern hemisphere. No interceptions of this species at the border (although many intercepted *Pheidole* remain unidentified).
Plagiolepis alluaudi Emery	Established widely beyond its native range, including in the Pacific (Morrison 1996). Associated with anthropogenic environments, being found in heated buildings in temperate climates where it is attracted to sweet foods and may destroy insulation around wiring (Smith 1957).	No interceptions of this genus at the New Zealand border. Likely that the climate would be unsuitable in New Zealand, except for heated buildings. No major negative environmental consequences of establishment foreseen.

Table 4 cont'd

Pogonomyrmex spp.	Genus known as "harvester ants". Occasionally enter houses, and nests can be large and conspicuous (Klotz et al. 1995). Stings from this ant are very painful (wwwnew08) and *Pogonomyrmex* venom is the most lethal known arthropod venom (Schmidt & Blum 1978). The genus occurs throughout the Americas (MacKay & Vinson 1989). They collect and store seeds for food and may completely remove all vegetation in circular areas surrounding their nest openings, which can lead to negative impacts and the need to control colonies (Taber 1998). This harvester life strategy is not represented in New Zealand's ant fauna so they would have unique impacts if they became established.	Not established outside their native range. No interceptions of this genus at the New Zealand border. Most common in arid areas of the western USA and Mexico (wwwnew08) so New Zealand may be too cold and wet. Long-lived static colonies are unlikely to be transported.*[If a greater emphasis on human health this ant would score higher]*
Polyrhachis spp.	A genus present in Australia, Africa, Asia, and the Pacific (www36; www39) that has been intercepted at the New Zealand border and workers found alive post border (at a building site from a pellet of bricks), but no nest was present.	Not established outside its native range. Highly distinctive in appearance and likely to be detected early should an incursion occur in New Zealand. Not likely to be a significant pest as most species are fairly timid and will retreat when their nests are disturbed (www36). The genus is distributed mostly in tropical and subtropical areas (www39) so likely that New Zealand is too cold for most species within the genus.
Prenolepis impairs (Say)	Recorded as a occasional pest within its native range (most of the USA, southern Ontario, Mexico (www81)), tending scales, spreading plant disease, and being found in weakened beehives (Smith 1965). Present in urban areas in Malaysia (Lee 2002), the only record outside its native area. It is specialized for cold-temperature foraging, and retreats in the face of competition from other ants (www81). As it is cold adapted it would likely establish in New Zealand locations where few other adventive ants have.	Not present in the southern hemisphere or intercepted at the New Zealand border.
Pyramica eggersi (Emery)	Probably native to South America (Brown 1960), this species has become established in Central America, the Caribbean, and Florida (www11; Deyrup et al. 2000). A cryptic species whose arrival here could easily go unnoticed. Found in human-modified habitat and is likely spread through nursery stock transport and other human commerce (Brown 1960). Novel specialised predator of Collembola, may impact on competitors and prey (Deyrup et al 2000). [NB. Most literature under name *Strumigenys eggersi* Emery]	Similar biology to adventive *Strumigenys* species already established in New Zealand. Limited southern hemisphere distribution (Brazil & Bolivia (Brown 1960; Majer & Delabie 1994)). No interceptions of this species at the New Zealand border. Climate may be unsuitable in New Zealand (in Florida only found as far north as Union County (~ latitude 30° N; Deyrup et al. 2000)).

Table 4 cont'd

Pyramica membranifera (Emery)	This species originates for the old world tropics (Deyrup et al. 2000), with scattered localities in subtropical and temperate zones. It has been spread to many countries through human activities, including throughout the Pacific (Wilson & Taylor 1967; Morrison 1996; Wetterer & Vargo 2003). It is a small cryptic species that may become established without notice.	Has a similar biology to adventive *Strumigenys* species already established in New Zealand, feeding on small soil organisms such as Collembola (Deyrup et al. 2000). No interceptions of this species at the New Zealand border (although it would not be easily detected). Not considered a pest elsewhere (Deyrup et al. 2000).
Tapinoma minutum Mayr	Implicated, along with other invasive ants, in reducing populations of larvae native butterflies in Guam through preying on eggs and larvae (Nishida & Evenhuis 2000). Present in Australian and the Pacific and limited spread beyond its native range has occurred.	No confirmed interceptions of this species at the New Zealand border (although several *Tapinoma* remain unidentified). Likely limited climate suitability, as in Australia it is distributed from coastal NSW northwards (www36).
Tetramorium caldarium (Roger)	Established beyond its native range including the Pacific (Morrison 1996) and Norfolk Island (www36).	No recorded interceptions of this species at the New Zealand border (although several *Tetramorium* remain unidentified). Not considered a pest in Florida where it has established (Deyrup et al. 2000). New Zealand likely to be too cold (in Florida only found as far north as Hernando County (~ latitude 28° 30' N; Deyrup et al. 2000)).
Tetramorium caespitum (L.)	A European species occurring in a wide range of climates that has spread to the New World (www81). It is often the most common house-infesting ant in the large cities of the Atlantic coast in the USA (www81). Also steals seeds from seedbeds, gnaw into tubers, roots, and stalks of various plants, and attends honeydew-excreting insects (www81). It has also been shown to be an intermediate host of poultry tapeworms (*Raillietina tetragona* and *R. echinobothrida*) (Smith 1965). [NB: an information sheet was prepared for this species]	Single southern hemisphere record (unconfirmed) from Chile (Snelling & Hunt 1975). There have been no recorded interceptions of this species at the New Zealand border (unlikely any of the six 6 interceptions (including 1 queen) of unidentified *Tetramorium* are this species due to the origins of the freight). Though *T. caespitum* has the ability to bite and sting, it is not an aggressive species nor considered an environmental threat (wwwnew07).

Table 4 cont'd

Tetramorium lanuginosum Mayr	This is a widespread species in the Pacific (Wilson & Taylor 1967; Wetterer & Vargo 2003) and native to northern Australia (www36) and SE Asia (www39). This species has been spread by commerce widely outside its native range (www81). The presence of other adventive *Tetramorium* in New Zealand could allow establishment to go unnoticed.	Established in tropical climates that are much warmer than New Zealand. Not intercepted at the border (but could be among the 6 *Tetramorium* specimens unidentified). Occurs in low densities and not considered a pest in Florida (Deyrup et al. 2000) and considered unlikely to have a significant impact in New Zealand.
Tetramorium tsushimae Emery	A relatively newly established species in the Missouri and Illinois, USA from East Asia where it forms polygynous-polycalic nest associations, thus having the potential to become a pest species (Steiner et al. in press). It occurs throughout Japan and is a common in open land (www39). Established in temperate climates.	Not present in the southern hemisphere. Not intercepted at New Zealand border. Only a single introduction outside its native range.

Table 4 cont'd

6) References

(NB: a copy of all web page references is held by Landcare Research (M. Stanley) should links change)

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Appendix 1: Ant risk assessment scorecard. Assessment criteria used to aid initial selection of potential risk species to New Zealand.

	Grouping	Characters	Justification for inclusion	Taking account of:	Scoring 0	0.5	1
A	Biological traits inferring invasiveness	1 Recruits in large numbers to food and monopolises it	Likely to displace competitors and be ecologically dominant and/or be significant pest in an urban setting		No	?	Yes (many thousands)
		2 Reproductive queens	Multiple queened colonies often have greater potential for rapid increase		Monogyne	?	Polygyne
		3 Supercolonies known – with reduced intraspecific aggression	Allows maintenance of elevated densities and ecological domination of an area		No	Polydomous	Yes
B	Invasive history	1 Established outside native range	Infers some potential for spread (although plenty of historical examples of ants establishing in NZ, particularly from Australia with no invasive history)		0	1–2 times	> 2
C	Pathways	1 Common association with anthropogenic environments	Higher likelihood of being transported to NZ through freight movement. Less likelihood of forest species being transported		No	?/some	Yes
		2 Future interceptions	Within the next 50 years there will be more potential pathways to New Zealand increasing the risk of establishment	Global spread	Similar	?	Increase
		3 In Australia	Historical origin of many of our introduced species so elevated risk if species present there		No		Yes
		4 In the Pacific	Container review showed this a region with high levels of contamination of containers		No (or unknown)		Yes
		5 In southern hemisphere	Greater likelihood that the seasons match and reproductive queens arrive at suitable times for nest establishment. Historically no confirmed cases of establishment of ants directly from northern hemisphere populations.		No		Yes

		6 Intercepted at NZ border	If there is no recent history of interception of a species then the risk is lower that it will establish here (assuming static trade partners)		No	Occasional (at least once in MAF list)	Frequently (> 5 times on MAF list)
		7 Have nests or queens been intercepted	Workers are frequently intercepted but a colony and/or futile queen needed to establish		No	?	Yes
		8 Established at sites with direct trades pathways	If this species is present at localities where there are significant trade links to NZ the probability of establishment here is greater		No	?	Yes
		9 Commodity compatibility	Are the goods transported from regions with this species likely to transport reproductives of this species – this is less likely to be the case for forest species.		No	?	Yes
D	Establishment success	1 Climate match (forest)	Does information available on the taxon suggest that forest is a suitable habitat risk and the climate is likely to be suitable	Known habitat preferences	Low	Limited	High
		2 Climate match (inside buildings)	Is there a history of association with buildings in temperate areas	Known habitat preferences	Low	Limited	High
		3 Climate match (open non-urban)	Does information available on the taxon suggest that non-forest habitat outside urban areas is suitable habitat and the climate likely to be suitable	Known habitat preferences	Low	Limited	High
		4 Climate match (urban outdoors)	Does information available on the taxon suggest that urban habitat outside of heated buildings is suitable habitat and the climate likely to be suitable	Known habitat preferences	Low	Limited	High
		5 Incursions previously (colonies detected post border clearance)	Demonstrated history of being able to survive and establish a nest (at least temporarily) in NZ		No	1	>1
		6 Incursions previously produced sexual stages	Demonstrates greater likelihood of establishment		No		Yes

E	Difficulty in containment of inclusion	1 Small size/cryptic nature	Feature of the species that would make incursion difficult to detect and eradicate.	Yes	Probably	No
		2 Flighted dispersals	If flighted dispersals containment of an inclusion will be more difficult	No	Probably/ some	Yes
F	Likely pest status to humans in NZ	1 Bites and spreads formic acid	Potential for heath consequences of incursion	No	Unknown	Yes
		2 Stings	Has potential to sting and this is commonly reported and has potential health implications	No	Stings but not severe	Yes (on mass or severe)
		3 Damages structures	Attracted to electrical fields (financial and potential health risks – fires been caused) or damages wood (financial implications)	No	?/some	Yes
		4 Workers enter buildings	Likely to result in greater expenditure on pest control and/or contamination of products in manufacturing	No (rare)	?/ occasional	Yes
		5 Hygiene pest (disease spreading)	Evidence of the species being a significant contaminant in hospitals and commercial premises and associated with spreading of disease and/or direct impacts on patients	Not reported	Limited	Yes
		6 Garden nuisance	Likely to reach significant densities in this environment to impact on enjoyment of outdoors and prompt control measures, or if a large ant or a species with a painful sting, its presence in even low numbers may a be actual or perceived threat	No	Possibly	Yes
		7 Horticultural/ agricultural pest	Likely to impact on horticultural/agricultural production through impact of stock or farm scale affecting plant growth or crop value, or stinging of staff.	No	Unknown/ possibly	Yes
G	Impact on native environment	1 Competitive advantage over other ants	Impact on native ants known in literature – often this reflects impacts on other invertebrates as well as ants where such studies have been conducted	Unlikely	Some species	Most species

2 Detrimental impacts on vertebrates	Is there any literature suggesting they may impact on vertebrates through foraging traits, nesting behaviours or defence mechanisms		Unlikely	Possibly	Yes
3 Detrimental impacts on native invertebrates (other than other ants)	Given likely climate match and habitat, is this species likely to have significant and potentially quantifiable impacts on native species (it is likely most new species cause some change)	climate match	Unlikely	Likely	Severe
4 Harms indigenous flora or disrupts through seed feeding or scale farming	Seed-feeding ants absent from native ant fauna and species that farm exotic scales shown to have impacts on plant growth and diseases transmission.		No	Possible	Yes