RISK ASSESSMENT SUMMARY SHEET

Updated: October 2020

Argentine Ant (*Linepithema humile*)

- A small (<2mm), black ant, easily confused with native garden ant.
- Globally introduced as a contaminant of plants, soils, building materials etc. Recorded several times indoors in GB, but only one outdoor population.
- Establishment in GB is likely, but limited to regions with milder winters (e.g. Wales, SE England) and residential gardens and green spaces in cities.
- Highly competitive, can displace native ants and other invertebrates. Listed among 100 of the worlds worst invasive species.
- Does not bite, but could be a nuisance in buildings and cause some agricultural impacts.

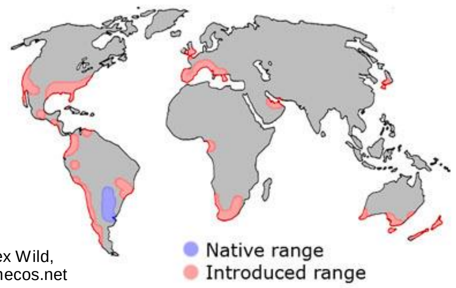

Photograph: Penarc, Wikipedia

History in GB

Widely introduced and established around the world, particularly on oceanic islands and in Mediterranean biomes. Widely distributed in Western Europe following introduction in the 1800s. In GB, there have been records since 1927; however, all have been indoors except one population in Fulham, West London, discovered in 2016.

Native Distribution

Native to northern Argentina, Uruguay, Paraguay, Bolivia and southern Brazil.



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GB Distribution

Only one population is known from Fulham, West London. However, this population is close to residential properties and may not be a ‘permanent’ established population, but rather a ‘spill-over’ from indoor populations.

Impacts

Included on the list of 100 of the world’s worst invasive species.

Environmental

- Most common in disturbed areas, but can invade natural and pristine areas.
- Can displace native ant species and attack other invertebrates.
- Loss of native invertebrates can have important knock-on impacts within ecosystems.

Economic

- Could cause negative impacts on crops due to mutualistic relationships with other invertebrates.
- Some costs associated with control / management of nuisance.

Social

- Does not bite humans, but could be a nuisance in homes, particularly as colonies grow rapidly and reach large numbers

Introduction pathway

Contaminant of soil, potted plants, building materials etc. – could be introduced from Europe or elsewhere via a wide range of imported products

Spread pathway

Natural – natural spread is relatively slow (c. 50m per annum).

Human mediated – can be rapid, spreading in soil, garden waste, potted plants or building materials

Summary

	Response	Confidence
Entry	VERY LIKELY	HIGH
Establishment	LIKELY	HIGH
Spread	RAPID	HIGH
Impact	MODERATE	MEDIUM
Overall risk	MEDIUM	MEDIUM

Rapid Assessment of: *Linepithema humile* Mayr (Argentine ant)
Author: Adam J M Devenish
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GB Non-native species Rapid Risk Assessment (NRRA)

Introduction:
The rapid risk assessment is used to assess invasive non-native species more rapidly than the larger GB Non-native Risk Assessment. The principles remain the same, relying on scientific knowledge of the species, expert judgement and peer review. For some species the rapid assessment alone will be sufficient, others may go on to be assessed under the larger scheme if requested by the Non-native Species Programme Board.

1 - What is the principal reason for performing the Risk Assessment? (Include any other reasons as comments)

Response: An established population *L. humile* was recently reported in Fulham, West London (Fox & Wang 2016). Prior to this all other incident of this species were recorded as indoor pests only (Cornwell 1978).

2 - What is the Risk Assessment Area?

Response: Great Britain.

3 - What is the name of the organism (scientific and accepted common; include common synonyms and notes on taxonomic complexity if relevant)?

Response: *Linepithema humile* (Mayr 1868) (previously known as *Iridomyrmex humilis*) is commonly referred to as the 'Argentine ant'.

4 - Is the organism known to be invasive anywhere in the world?

Response: *Yes*. The Argentine ant is a tramp species (spread via human commerce) with a global distribution. This species is listed among both the European (DAISIE; www.europe-aliens.org) and global (ISSG; www.iucngisd.org) 100 World's Worst Invasive Alien Species. This species is known to occur throughout the world, across all continents, in particular oceanic islands and Mediterranean type biomes (Wetterer & Wetterer 2006). It is currently widely distributed across Western Europe and was likely to have been first introduced during the 1800s due to trade links between Portugal and the Rio de la Plata region (its native range) (Tsutsui *et al*. 2001). For a comprehensive list of distribution records see either the Global Invasive Species, CABI or DAISIE databases. Alternatively, for a visual representation see antmaps.org (Janicki *et al*. 2016).

5 - What is the current distribution status of the organism with respect to the Risk Assessment Area?

Response: Currently, only one known established population has been recorded by Fox & Wang (2016) in Fulham, West London (grid ref TQ243773). However, this recorded population is still in relatively close proximity to residential properties and as such might not be a 'permanent' established population, but rather a 'spill-over' from indoor populations. Subsequent recording and monitoring during and after winter seasons will be required to confirm its status as an established population.

Notwithstanding the fact that this ant species is relatively small, with no easily discernible features (black ant; <2mm in size; monomorphic), it is highly likely that to most people this species would be superficially identified as the common UK Garden ant (*Lasius niger*). It is therefore more than likely that other similar populations go relatively unreported.

6 - Are there conditions present in the Risk Assessment Area that would enable the organism to survive and reproduce? Comment on any special conditions required by the species?

Response: *Yes*. As with other invasive ant species, their ability to thrive and persist is highly dependent on the physical environment (Holway *et al* 2002a). Previous research has indicated that an important factor associated with this species invasiveness is its 'ecological release' from predators, parasites and competitors in its introduced range (Vogel *et al.* 2009). Furthermore, the Argentine ants' activity and fitness (offspring development) is regulated by both temperature and moisture levels (Holway *et al*. 2002b; Abril *et al*. 2010). This species has been shown in field trials to forage in temperatures up to 40°C; however, colonies perish at 4°C (Holway *et al*. 2002b; Rice & Silverman 2013). Likewise, Argentine ant populations have shown to penetrate further and fair better in mesic (green and moist) habitats compared to arid/xeric habitats (Holway 2002b). It is therefore highly likely that this species will survive and reproduce within the UK; it is however likely to fair better in regions with milder winters (e.g. Wales/South West England) and/or in green spaces within cities. Furthermore, under future-climate predictions this species is likely to expand further into higher latitudinal regions (such as the UK) (Roura-Pascal *et al*. 2004; Bertelsmeier *et al.* 2015).

As with other invasive ant species, the Argentine ant has a generalised diet and will feed on a wide array of food sources: protein (e.g. insects and carrion) and carbohydrate (e.g. nectar and honeydew secreted from aphids); with a strong preference towards the latter (Suarez *et al*. 1998; Holway *et al*. 2002a; Ness & Bronstein 2004).

7 - Does the known geographical distribution of the organism include ecoclimatic zones comparable with those of the Risk Assessment Area or sufficiently similar for the organism to survive and thrive?

Response: Given the identification of an established population in Fulham, West London and the prevalence of this species in similar climatic European regions (e.g. France) (Janicki *et al*. 2016). It is therefore highly probable that this species will survive. Furthermore, given the recent establishment and expansion of the invasive garden ant (*Lasius neglectus*), which shares similar morphological and behavioural traits, it is highly likely that this species will thrive, especially in light of future climate change predictions (Roura-Pascal *et al*. 2004; Bertelsmeier *et al.* 2015). Propagule pressure is likely to be high given the fact that Argentine ant is well established and widely distributed within parts of central and southern Europe (Wetterer *et al*. 2009; Van Wilgenburg *et al.* 2010). However, current climatic conditions (e.g. UK's cold winters) means that this species expansion is likely to be limited and therefore any outdoor populations will likely be restricted to residential gardens and green spaces within cities.

8 - Has the organism established viable (reproducing) populations anywhere outside of its native range (do not answer this question if you have answered 'yes' to question 4)?

Response: Yes, see sections four and six for further details. As with other ant species, the Argentine ant is haplodiploid and reproduces sexually (Holway *et al*. 2002a). Yet, unlike other ant species they cannot produce a functional nest in the absence of workers (Passera & Keller 1992); however, sterile workers can rear eggs into sexuals in the absence of queens (Keller & Passera 1992; Holway *et al.* 2002a). Furthermore, the loss of kin recognition during the early stages of invasion means that there is a distinct lack of intraspecies aggression between nests (Tsutsui *et al*. 2000; Torres *et al*. 2007). Combined with the fact that this species is both Polygnous ('multiple queen') and Polydomous ('multiple nests') which means that it is notoriously difficult to define where a single colony begins or ends. It has therefore been suggested that this species has formed an intercontinental supercolony spanning several thousand kilometres (Van Wilgenburg *et al*. 2010).

9 - Can the organism spread rapidly by natural means or by human assistance?

Response: Given this organism's natural means of reproduction and dispersal (*highlighted in section eight*), it is likely that if left unaided it would spread relatively slowly. For example, in coastal regions of Northern Spain, Argentine ants are estimated to be expanding at a rate of 7.94 (±2.99) meters per year (Roura-Pascual *et al.* 2010). Nonetheless, most colonies can propagate from fairly small and isolated populations, spreading naturally through fission (commonly referred to as 'budding'); whereby a new nest will form through the departure of a queen and a few workers (>10) from the natal nest (Hee *et al* 2000). While budding can be categorised as short distance dispersal (Suarez *et al*. 2001; Vogel *et al.* 2009), a single established nest can house 100s of queens at one time, each laying on average 20-30 eggs per day (Keller & Passera 1992); with maturation occurring in approximately 74 days (Keller *et al*. 1989). This means that while they may spread relatively slowly distance-wise, for example, they can quickly overwhelm an environment, by producing more satellite nests, albeit in relatively close proximity to each other. Furthermore, this species nests in a wide array of environments: both indoors and outdoors, within different soil types, under wood and rocks and even within pavement cracks (Holway *et al*. 2002a; Fitzgerald & Gordon 2012). This means that this species is highly susceptible to human-mediated transport (otherwise known as 'jump-dispersal'), and in some extreme cases it has even been reported that they can be spread biotically via birds (Carpintero *et al*. 2005).

10 - Could the organism itself, or acting as a vector, cause economic, environmental or social harm in the Risk Assessment Area?

Response:

Economic: By and large its main economic effects can be seen through negative impacts on crops and plantations. Whilst it does not directly damage plants, it can indirectly impact growth and development through its mutualistic interactions with sap feeding hemipterans (Ness & Bronstein 2004). To date there has been some limited evidence that it may have the capacity to spread pathogenic fungi and potentially RNA viruses (e.g. Winged Deformed Viruses), which may impact crop yields and disrupt pollinator networks (El-Hamalawi and Menge 1996; Gruber *et al*. 2017; McMahon *et al.* 2018). Thereby further exacerbating their detrimental effects.

Social: Unlike other invasive ant species, *L humile* do not bite, spray formic acid or sting (e.g. Fire ant *Solenopsis invicta*), and therefore show very little direct human impact. However, they can invade homes and inhabit spaces in roofs or walls.

Environmental: Where present *L. humile* can reach very high abundances, with long-term enduring ecological impacts (Menke *et al.* 2018). While this species is most commonly associated with anthropogenic disturbed habitats, there is a large body of evidence to show that it can invade natural and pristine habitats as well (Bond & Slingsby 1984; Holway 1995; Human & Gordon 1996; Gomez & Oliveras 2003; Carpintero *et al*. 2005). Once present this species directly impacts both the native ant and arthropod community (Cole *et al*. 1992; Holway 1995; Suarez *et al*. 1998; Bolger *et al.* 2000), which can in turn produce severe knock-on negative effects to a diffuse array of mutualisms, in particular seed dispersal (Bond & Slingsby 1984; Christian 2001; Gómez & Oliveras 2003) and pollination (Visser *et al*. 1996; Blancafort & Gómez 2005; Lach 2008) services. The resulting modification of invertebrate fauna and plant flora means that vertebrates can also be indirectly affected (Suarez *et al*. 2000).

Entry Summary

Estimate the overall likelihood of entry into the Risk Assessment Area for this organism (comment on key issues that lead to this conclusion).

Response: *very likely*
Confidence: *high*

Comments (include list of entry pathways in your comments):

An established population *L. humile* was recently reported in Fulham, West London (Fox & Wang 2016). It is not known; however, whether this population represents an introduction from within or outside the EU. Nonetheless, *L. humile* is globally distributed and can be transported in a variety of substrates/materials (Wetterer *et al.* 2009). It is therefore highly likely that propagule pressure from within and outside the EU remains high.

Linepithema humile is likely to go relatively unnoticed due to the fact that it does not readily harm humans and may appear to be a common garden ant to the untrained eye. Other countries (in particular Japan) have monitored propagules pressure of this, and other invasive ant species, at most probable ports of entry, using relatively inexpensive means (pitfall and baiting traps). Previous studies have indicated that airports and shipping ports are key sites for entry of invasive ant species (Ward *et al.* 2006). A review of the current intercept records and/or sampling at these localities would easily provide a good estimate of external propagule pressure.

Establishment Summary

Estimate the overall likelihood of establishment (comment on key issues that lead to this conclusion).

Response: *likely*
Confidence: *high*

Comments (state where in GB this species could establish in your comments, include map if possible):

Given the fact that one population has already been cited in Fulham, West London (Fox & Wang 2016) means that future establishments are likely. Climatically speaking there are several sites within the U.K. that are suitable for establishment of *L. humile* populations; with then number of expected areas likely to increase under climate change (Roura-Pascal *et al*. 2004; Bertelsmeier *et al.* 2015). These models; however, are unable to account for micro-climatic conditions (e.g. green houses or within cities).

At this point of time; however, there is no evidence to suggest that it will reach the carrying capacity seen in other invaded ranges, such as Catalonia, in Spain, where you are almost more likely to encounter this species than you are native ant species (Dr Crisanto Gomez Pers. Comm.) This is partly due to the fact that its optimal laying and foraging temperature is 28°C (Abril *et al*. 2010) and this is a temperature that is seldom reached in the U.K.

Therefore, while the species would persist, it is unlikely to thrive, especially outside of gardens/greenhouses or residential areas. If we are to look for evidence of establishment it would be better to focus on warmer areas of the U.K., such as South-West England/Wales, where winters are milder (Adam Devenish Pers. Comm.).

Spread Summary

Estimate overall potential for spread (comment on key issues that lead to this conclusion).

Response: *likely*
Confidence: *high*

Comments (include list of spread pathways in your comments):

Given the recently recorded established population in Fulham (Fox & Wang 2016), as well as the recent range expansion of another invasive ant species (*Lasius negelectus*), it is therefore *likely* that this species will spread if given the opportunity.

In other countries where *L. humile* has a long invasion history (e.g. Spain and Portugal) the natural spread rate is reported as being relatively low (e.g. ±50 m per year) (Enriquez Lenis 2012). This low spread rate is a combination of reproductive limitations (e.g. budding), as well as biotic (e.g. native taxa) and abiotic (e.g. winter temperatures) resistance (Roura-Pascual et al. 2011). However, as this species benefits from both local and long distance (human mediated) dispersal, in a range of materials/substrates, means that transport within the U.K. is likely (Wetterer *et al.* 2009). In particular the high levels of horticulture trade and small propagule size needed to establish a colony means that this species could easily be transported around within the U.K., relatively unnoticed in a number of substrates (e.g. soil, garden waste, potted plants or building materials).

Given that populations can rapidly increase in size and nest within variable substrates (Holway *et al.* 2002a), means it can easily overwinter in human houses/greenhouses/garden boarders were conditions might be more stable (Adam Devenish Pers. Comm.). This could be further exacerbated under future climate change scenarios, where a mild winter and warmer summers might increase their rate of reproduction and spread (Roura-Pascal *et al*. 2004; Bertelsmeier *et al.* 2015). Further information is needed to assess the true extent of this known *L. humile* population within the U.K. before we can fully determine its probability of spreading.

Impact Summary

Estimate overall severity of impact (comment on key issues that lead to this conclusion)

Response: *moderate*
Confidence: *medium*

Comments (include list of impacts in your comments):

Impacts of *L. humile* are likely to be contingent on overall population size. Many of the economic and social impacts reported are not limited to this ant species, and indeed could be said of native ant species as well.

Economic: Impacts are likely to be linked to eradication costs and negative impacts on agriculture/horticulture (e.g. mutualisms with sap feeding Hemiptera) (Ness & Bronstein 2004). Emerging research has indicated that this species may have the capacity to spread pathogenic fungi and potentially RNA viruses (e.g. Winged Deformed Viruses), which may further exacerbate their economic impacts (El-Hamalawi & Menge 1996; Gruber *et al*. 2017).

Social: Populations of *L. humile* can grow rapidly and reach large number of ants (Keller & Passera 1992) relative to most U.K. native species that are found in homes, and therefore could cause more distress and inconvenience.

Environmental: In other invaded regions, impacts on both the native ant and arthropod community (Cole *et al*. 1992; Holway 1995; Suarez *et al*. 1998; Bolger *et al.* 2000) have been reported. This in turn may have a negative impact on the ecosystem services that the native species provide (Bond & Slingsby 1984; Visser *et al*. 1996; Christian 2001; Gómez & Oliveras 2003; Blancafort & Gómez 2005; Lach 2008). There is no evidence to suggest that should the U.K. reach similar carrying capacities of *L. humile* that it would not suffer similar effects.

It is likely that of the three impacts listed above, that *L. humile* would have the greatest impact on environment. However, given the lack of information regarding the impacts of other invasive ant species in the U.K. with a longer invasion history (e.g. *Lasius neglectus*), means that it is not possible to make an accurate assessment on the impacts of *L. humile* on the U.K.

<u>Climate Change</u>

What is the likelihood that the risk posed by this species will increase as a result of climate change?

Response: *very likely*
Confidence: *medium*

Comments (include aspects of species biology likely to be effected by climate change (e.g. ability to establish, key impacts that might change and timescale over which significant change may occur):

Invasion forecasts have suggested that an increase in ambient temperatures would improve climatic suitability for a number of invasive ant species, including the Argentine ant (Roura-Pascal *et al*. 2004; Bertelsmeier *et al*. 2016). Increased temperature has been associated with a wide array of developmental benefits for invasive ant species, such as: increased metabolic rate/development (Dillon *et al*. 2010); queen oviposition rate (Abril *et al*. 2008) and production of sexuals (Tschinkel 1993). Therefore, increased ambient temperatures in the UK as a result of climate change, would potentially increase both their survival (i.e.

overwintering) and rate of spread (i.e. propagation of new colonies).

Conclusion

Estimate the overall risk (comment on the key issues that lead to this conclusion).

Response: *medium*
Confidence: *medium*

Comments: Given the vast amounts of literature on this species (second most studied invasive ant species) it is likely that it there would be a high potential impact on our U.K. native fauna and flora. However, there is still some uncertainty with regard to whether this species can produce viable populations away from human occupation. Climate suitability is almost definitely going to change over time and if we are to learn anything from other similar events, both within the UK (e.g. spread of *Lasius negelectus*) and overseas (e.g. spread of *Myrmica rubra* in Canada), it should be recognised that any established population, however small, may result in a bigger issue later down the line, when and if, abiotic and biotic barriers are overcome.

Management options (brief summary):

1 - Has the species been managed elsewhere? If so, how effective has management been?

Response:

This species has been extensively managed in New Zealand, Australia and the United States (Silverman & Brightwell 2008). To date, complete eradication has only ever been achieved in small areas (Harris 2002); however, no large-scale project has truly been successful in permanent eradication of this species (Holway *et al*. 2002a; Randall *et al*. 2011). Furthermore, previous control methods in California using broad-spectrum insecticide “Fipronil” has resulted in contamination of urban waterways (Greenberg *et al.* 2017). As such, rather than eradicate, most current projects look to contain the current infestation and or prevent the spread of this species into new and uninvaded regions (Costa *et al*. 2001; Silverman & Brightwell 2008).

2 - List the available control / eradication options for this organism and indicate their efficacy.

Response:

There is currently a wide array of insecticides available as ‘ant baits’ in both granular and liquid forms; however, these need frequent application, as suspension of the treatment often leads to population regeneration (Krushelnycky *et al*. 2004; Silverman & Brightwell 2008). Of concern also is that this method of control can have potentially negative non-target effect on other organisms. To date there are no known effective biological control methods for this species.

Effective management and or control of this species needs to target both the nests, as well as their food source (Silverman & Brightwell 2008). Restricting the movement and/or treating soil from sites with an insecticide has been recommended (Costa *et al*. 2001).

3 - List the available pathway management options (to reduce spread) for this organism and indicate their efficacy.

Response:

Propagule pressure from outside U.K. is likely to remain high and increase with globalisation. Increased vigilance in and around ports of entry are advisable and relatively inexpensive (Silverman & Brightwell 2008); however, training is required for improved visual identification of Argentine ants on site.

If anything can be learnt from similar ant invasions in the U.K. (e.g. *Lasius neglectus*) and abroad (e.g. *Myrmica rubra*) is that where a population has been found, care should be taken to limit the transport of material from this source location. This should include the transport of plants, building materials and waste (e.g. garden) as these actions could contribute to their expansion.

4 - How quickly would management need to be implemented in order to work?

Response:

If the management objective is eradication (rather than control), upon identification of a population, rapid and frequent application of an appropriate ant bait is required. However, it should be noted that management is likely to be more successful if done in late spring, when populations are emerging from their winter nesting sites. Furthermore, given the ability for a population to spread and persist from relatively small and fragmented propagules means that a full and extensive search of the area would need to be undertaken to confirm that this species has been completely eradicated. Training needed for eradication and management would need to focus on identification and differentiation of the different ant species, as well as bait application training in order to optimise results.

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