The worldwide transfer of ants: geographical distribution and ecological invasions

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Abstract

Aim This is the first comprehensive account of the biogeography of ants transferred and at least temporarily established outside their native habitat.

Location Using museum and literature records, I established the distributions of transferred ant species.

Methods I used taxonomic and functional groups to assess how geographical spread as a transferred species is affected by taxonomy and life history.

Results 147 ant species in forty-nine genera have been recorded outside of their native habitat. The proportion of transferred ants is similar to the number of genera and species in each subfamily. The species-rich subfamily Myrmicinae contains nearly 50% of all transferred species, while many of the species-poor subfamilies have absolutely no transferred species. A disproportionate high number of transferred ants originate from the Neotropical and Oriental biogeographic regions. The Pacific Islands are the recipients of the most transferred ant species. Most transferred ants belong to the CRYPTIC, OPPORTUNIST, and GENERALIZED MYRMICINE functional groups, while there are no recorded transfers of army ants or leaf-cutting ants. Both invasive and human commensal 'tramp' ant species are nonrandom subsets of transferred ants.

Main conclusions 'Tramp' species and invasive species tend to have widespread geographical distributions, and share life history characteristics including queen number, nest structure, and foraging behaviour. Combining observations of functional groups and biogeography may lead to a better understanding of the factors contributing to the spread of transferred species.

Keywords
Geographic distribution, invasive species, Formicidae, introduced species, exotic ants, tramp ants

INTRODUCTION

Understanding the biology of invasive organisms requires knowledge of the native and new ranges of transferred species (Reichard & Hamilton, 1997). Although much is known of the biology of ants (see Hölldobler & Wilson, 1990), we know relatively little about the biogeography and behaviour of transferred ants. I use 'transferred' to indicate ants collected in habitats not native to the species; 'invasive' ants are those which establish long-term populations and expand their range upon introduction into new areas.

Humans commonly transport species that outcompete or prey on native organisms (Jenkins, 1996). Invasive ants can be ecologically devastating (Clark *et al.*, 1982; Majer, 1985; Porter & Savignano, 1990), and tracking their movement is important for conservation of regional ant faunas. Geographic distributions are difficult to establish for many species, including invasive organisms.

Can we predict which ants are predisposed to establish successful populations in novel areas? The prediction of invasiveness is realistic in some taxa, such as pine trees (Daehler & Strong, 1993; Kareiva, 1996; Rejmánek & Richardson, 1996; but see Williamson & Fitter, 1996). Prediction of invasiveness uses convergent morphological and life history characteristics to identify potential invaders (for example, Forcella *et al.*, 1986; Case, 1996; Mack, 1996; Reichard & Hamilton, 1997). By generating a list of transferred species and their geographical distributions, and comparing the life history characteristics of the most widespread transferred ants, I bring us closer to this goal.

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Summary data on transferred species are available for few taxa, although many taxa include potentially important invaders. Tracking transferred ants presents a special challenge because of their small size and the small number of people who accurately identify ants to species; monitoring movement is difficult. Records of translocations remain scattered among book chapters and regional journals. The only reviews of transferred ants focus on subsets such as cosmopolitan invaders and pest species, or are regional accounts (most recently some are collected in Williams, 1994). New areas are continuously colonized by invaders. The detection of a transferred species may only occur after it becomes locally abundant. Translocations may be unnoticed, particularly when a reproducing population is not established. On the other hand, transferred ants may quickly spread into new areas, and may even disappear from such areas if followed by another competitor. For example, *Linepithema humile* (Mayr) and *Pheidole megacephala* (Fabricius) periodically displace the one another in Bermuda (Haskins & Haskins, 1965; Lieberburg *et al.*, 1975). Also, the species composition of transferred 'tramp' (human commensal) ants on islands in Polynesia changes over time, with some tramp species disappearing from specific islands (Wilson & Taylor, 1967).

I use the morphological and life history characteristics of ants to classify transferred ants into functional groups. Community ecologists have classified entire communities based on the level of stress (factors limiting productivity) and disturbance (factors causing the removal of biomass), by studying the relative proportions of functional groups in different communities (Grime, 1977; Andersen, 1995; Bestelmeyer & Weins, 1996). The level of disturbance does not only affect the functional group composition of ant communities; transferred ants are more likely to become established in disturbed areas (Ward, 1987; Majer, 1985; Moller, 1996). Because disturbance is tied to both the distributions of transferred ants and the functional group composition of communities, considering the functional group membership of transferred ants may reveal new insights into their ecology and biogeography.

When using taxonomic relationships to infer common traits of transferred ants, convergence among unrelated taxa confuses comparisons among taxonomic groups. Functional groups take advantage of convergent characters and regard evolutionary relationships only when they reflect similarities in life histories. Andersen (1995) used functional groups to classify ant communities based on competitive interactions, habitat and nesting requirements, and taxonomy.

Andersen's (1995, 1997) functional groups, based on designations for Australian and North American ant communities, are: DOMINANT DOLICHODERINES (in the subfamily Dolichoderinae) are abundant, competitively dominant, and highly active; they impact ant community structure through interference competition. SUBORDINATE CAMPONOTINI (in the formicine tribe Camponotini), are behaviourally submissive to DOMINANT DOLICHO-DERINES, and frequently are nocturnal foragers. CLIMATE SPECIALISTS reside only within certain climate regimes: in arid regions (Hot climate specialists); wet tropics (Tropical climate specialists); and colder temperate areas (Cold climate

specialists). OPPORTUNISTS are weedy species that inhabit areas with high stress or disturbance; OPPORTUNISTS compete poorly with other ants. GENERALIZED MYRMICINES are generalized in food and nesting requirements, and defend food resources when they are close to their nest. SPECIALIST PREDATORS consume other arthropods, and interact little with other ants. CRYPTIC ants primarily nest and forage in soil and leaf litter. Bestelmeyer & Weins (1996) consider ARMY ANTS, nomadic group-raiders, as a separate functional group. Because both Old World and New World ARMY ANTS have a unique convergent life history, they are regarded separately.

Functional groups are mutually exclusive; a species may be classified into only one group. Groups restricted to single taxa, the DOMINANT DOLICHODERINES, SUBORDINATE CAMPONOTINI, and GENERALIZED MYRMICINES, do not include all members of that taxon. For instance, a myrmicine may be classified as a CRYPTIC species, and a dolichoderine may be an OPPORTUNIST.

While functional groups reflect similarities in life history, such as nesting and foraging behaviour, measures of the success of transferred species are most useful in predicting invasions. A minority of transferred ants have widespread geographical distributions, are closely tied with urban areas and human activity; these are 'tramp' ants (Passera, 1994). While tramp ants are often found wherever people exist, they may not necessarily compete with native ants. Invasive ants move into natural areas, disturbed or undisturbed, and outcompete native ants. Examining the functional group membership of tramp ants and invasive ants is useful to understand the life histories which are associated with infestations and invasions.

In this paper, I present the geographical distributions of transferred species and consider the ability of the present data to predict which species will be transported in the future. I synthesize geographical data on the distributions of transferred species from existing literature and museum collections with data on taxonomic and functional group membership of transferred species. Using these data, I present how ant transfer contributes to the cosmopolitization of the world's ant fauna.

METHODS

I gathered data from regional faunistic studies to establish which ants have been transferred from their native habitat (Appendix 1). Visits to entomological collections at the Los Angeles County Museum of Natural History and the National Museum of Natural History, Washington, DC., provided additional locality data for some species.

I categorized ant species as 'transferred' if they possessed one or more of the following criteria: (1) a published account of an introduction event; (2) designation as 'exotic', 'introduced', or 'non-native', by an earlier author; or (3) presence in Hawaii, where no ants are native (Reimer *et al.*, 1990). The nomenclature for ant species follows Bolton (1995a), and includes several changes from names used in earlier publications and in some museum collections. 'Tramp' species are those designated by earlier authors (Brandão & Paiva, 1994; Passera, 1994; Moller, 1996); newly designated tramp
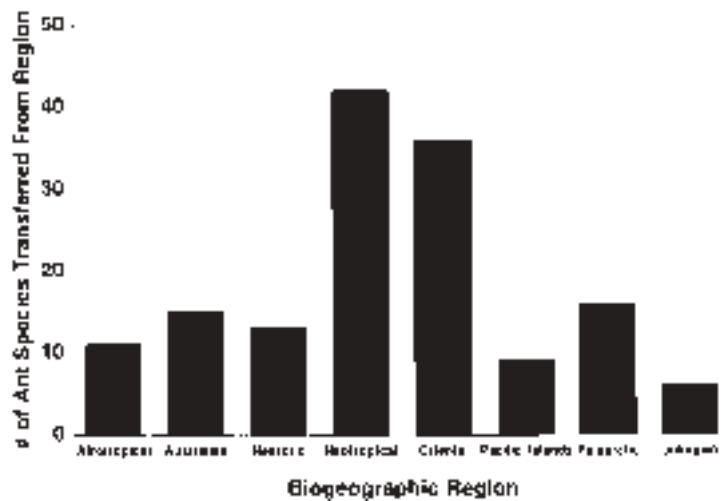
Figure 1 The source regions for transferred ant species. I only included ants which have recorded translocations between biogeographic regions. No known transferred ants are native to the Malagasay region. The six species listed as unknown are cosmopolitan species whose native region is not agreed upon by other authors.

species have similar geographical distributions and associations with human activity as previously recognized tramp species. 'Invasive' species are those with documented (in references of Appendix 1) cases of directly outcompeting native ant species. The 'type locality' of a species is where it was first collected by the systematist which described the species, and for transferred ant species, it is frequently in non-native habitat. I assigned functional groups according to Andersen (1995, 1997) and Bestelmeyer & Weins (1996).

I used a χ-square test to compare the proportion of transferred genera and species with the total number of ants per subfamily. I compared the frequency of functional group membership between tramp ants and all transferred ants, and between invasive ants and all transferred ants using χ-square tests.

RESULTS

Biogeographic transfer of ants

Many of the transferred species have very limited distributions (Appendix 1). Forty-seven species (32% of all transferred species) have only one recorded introduction locality; most of these non-native sites are in Hawaii or Florida. Fifty-one transferred species (35%) were described from islands as their type locality, even though many transferred ants are not native to the oceanic islands which they inhabit (Wilson & Taylor, 1967).

Transferred ants are not evenly spread around the world. Many more transferred ants originate from the continents surrounding the Pacific rim – in the Neotropical and Oriental regions (Fig. 1). The destination of many of the ants from the Neotropics and Asia are the Pacific Islands, which host many

more transferred ants than any other biogeographic region (Fig. 2).

Taxonomy of transferred ants

While some taxonomic groups contain many transferred species, others contain absolutely none (Table 1). The most species-rich subfamilies contained the greatest number of transferred species. Some taxonomic groups are underrepresented in the list of transferred ants. Although Myrmicinae has seventy-one transferred species in nineteen genera, this is a relatively small proportion of the largest ant subfamily containing 155 genera (Table 1). Although Pseudomyrmicinae has only three genera, the subfamily is distributed worldwide and has only one transferred species. The subfamilies which contain no recorded transferred species are usually endemic to one biogeographic region, and are less diverse than the other subfamilies. The fungus-growing ants of the myrmicine tribe Attini have only one recorded translocation, with the displacement of *Cyphomyrmex rimosus* (Spinola) into the Hawaiian Islands and south-eastern United States.

Functional group membership of transferred ants

The bulk of the transferred ants are GENERALIZED MYRMICINES, OPPORTUNISTS, and CRYPTIC species. Groups which have relatively few transferred ants are DOMINANT DOLICHODERINES and SPECIALIST PREDATORS; this is most likely because their biology is not conducive to the transport of entire colonies or reproductive females. Tramp species and invasive species are not random subsets of transferred ant species (Table 2). Tramps originate only from the CRYPTIC, DOMINANT DOLICHODERINE,
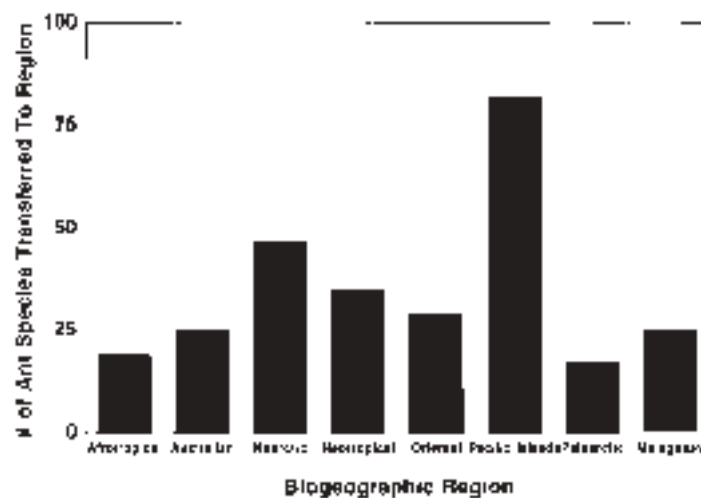
Figure 2 The destination regions of transferred ant species. Ants which arrive in new biogeographic regions are recorded. Ants which have been transported within their own biogeographic region are not included within their native region.

Table 1 The subfamily membership of transferred ants. The proportion of transferred ants and all described ants in each subfamily are equivalent at the genus ($G^2 = 5.91$, DF $= 6$, $P = 0.43$) and species levels ($G^2 = 6.77$, DF $= 6$, $P = 0.34$).

Subfamily	Number of transferred ant genera (% of all transferred genera)	Total number of genera within subfamily (% of all genera) (Bolton, 1994)	Number of transferred ant species (% of all transferred species)	Total number of species within subfamily (Bolton, 1995b)
Aenictinae	0	1 (0.3%)	0	109 (1.1%)
Aenictogitoninae	0	1 (0.3%)	0	7 (0.1%)
Aneuretinae	0	1 (0.3%)	0	1 (0.01%)
Apomyrminae	0	1 (0.3%)	0	1 (0.01%)
Cerapachyinae	1 (2.0%)	5 (1.7%)	1 (0.7%)	198 (2.1%)
Dolichoderinae	7 (14.3%)	22 (7.4%)	11 (7.5%)	554 (5.8%)
Dorylinae	0	1 (0.3%)	0	61 (0.6%)
Ecitoninae	0	5 (1.7%)	0	142 (1.5%)
Formicinae	11 (22.4%)	49 (16.6%)	39 (26.5%)	2458 (25.8%)
Leptanillinae	0	7 (2.4%)	0	39 (0.4%)
Leptanilloidinae	0	1 (0.3%)	0	1 (0.01%)
Myrmeciinae	1 (2.0%)	1 (0.3%)	1 (0.7%)	89 (0.9%)
Myrmicinae	19 (38.8%)	155 (52.4%)	71 (48.3%)	4377 (45.9%)
Nothomyrmeciinae	0	1 (0.3%)	0	1 (0.01%)
Ponerinae	9 (18.4%)	42 (14.2%)	23 (15.6%)	1299 (13.6%)
Pseudomyrmecinae	1 (2.0%)	3 (1.0%)	1 (0.7%)	197 (2.1%)
Total	49	296	147	9358

GENERALIZED MYRMICINE, and OPPORTUNISTIC functional groups. Also, more than half (14 out of 26) tramp species are OPPORTUNISTIC.

The nine invasive species come from five functional groups, but nonetheless are not randomly drawn from the pool of transferred species (Table 2). Three out of the four transferred HOT CLIMATE SPECIALISTS, the fire ants (*Solenopsis* spp.), are invasive species. There are proportionately few invaders from the other functional groups.

DISCUSSION

Biogeographic transfer of ants

Oceanic islands are capable of supporting a high number of transferred ants (Wilson & Taylor, 1967). Once a species arrives at an island, it is more likely to succeed because there will be less competition from native species, if they are any. This is clearly represented by the large number of transferred ants

Table 2 Functional group frequencies in transferred, tramp, and invasive ants. Both tramp species ($\chi^2 = 16.8$, DF $= 8$, $P < 0.05$) and invasive species ($\chi^2 = 38.8$, DF $= 8$, $P < 0.0001$) are nonrandom subsets of transferred ants.

Functional group	Transferred species	Tramp species	Invasive species	Invasive tramp species
Army ants	0	0	0	0
Cold climate specialist	8	0	0	0
Cryptic	33	7	1	1
Dominant Dolichoderinae	4	1	1	1
Generalized Myrmicinae	30	4	1	1
Hot climate specialist	4	0	3	0
Opportunists	41	14	3	2
Subordinate Camponotini	11	0	0	0
Specialist predators	9	0	0	0
Tropical climate specialist	7	0	0	0
Total	147	26	9	5

located in the Pacific Islands. Both Polynesia and Melanesia have several archipelagos which host several transferred ants. As military and commercial activity has grown in this area throughout the past century, more ants have arrived from the bordering continental regions. With many small islands in the Pacific islands, the potential to host the dozens of observed transferred species is realized.

Many transferred ants are restricted to a tropical or subtropical distribution, including *Monomorium* spp., *Pheidole* spp., *Strumigenys* spp., and *Wasmannia auropunctata* (Roger). Some of these species which have been recorded in the Nearctic and Palearctic regions have been found mainly in greenhouses or climate-controlled buildings (e.g. Naumann, 1994; McGlynn, personal observations). In these cases, the ants probably arrived accidentally with plant material or industrial shipments transported from the tropics. In the cases where tropically restricted ants arrive in temperate areas, the localized spread of transferred ants is not a threat. However, their continued presence may result in a subsequent introduction into other areas.

Taxonomy of transferred ants

Although the most common ant taxa contain transferred species, several taxa are conspicuous by their absence from the list of transferred ants. Leaf-cutting ant species (*Atta* and *Acromyrmex* spp.) are myrmicines in the tribe Attini. Several leaf-cutting ants are extremely abundant in the neotropics and are major economic pests (Vander Meer *et al.*, 1990). In agricultural areas, these pests can be extremely abundant despite efforts to control their populations. Leaf-cutting ants are generalized, although idiosyncratic, in host selection (Holldobler & Wilson, 1990). It is clearly fortunate for the world's agriculture producers that leaf-cutting ants have not escaped the Neotropics, but there is still a possibility of future escape from native habitat. While colonies of many transferred species have several queens (are polygynous) and have several

nests (are polydomous), the monogynous and large monodomous nests of leaf-cutting ants may provide a reduced opportunity for colony transport. Because leaf-cutting queen ants are very large, it is possible that they are less likely to escape detection before and during transport.

Army ants in the Old World and New World tropics are dominant components of forest ecosystems, and play a major role in structuring communities (Gotwald, 1995). Ants in the subfamilies Aenictinae, Dorylinae, and Ecitoninae, termed 'true' army ants by Gotwald (1995), have no recorded transferred species. The only transferred group-raiding ants are *Cerapachys* and *Leptogenys,* which were collected on oceanic islands in the Pacific and Caribbean. No army ant species has established a population on any of the islands in the Pacific Ocean. An entire army ant colony is unlikely to pass unnoticed during transport due to its migratory and group raiding habits, but individual inseminated queens may be able to be transported without notice into new areas. Because many army ants are specialized predators on other social insects, oceanic islands may be less suitable for army ants because the diversity of potential prey species is reduced.

Functional group membership of transferred ants

Many studies of invasive ants indicate that their foraging strategies are successful during interspecific competition (Haskins & Haskins, 1965; Clark *et al.*, 1982; Ward, 1987; Decock & Giliomee, 1989; Porter & Savignano, 1990). Such behaviours include monopoly of bait items, raiding of interspecific nests, active searching for food, and rapid recruitment to food resources. Behavioural studies of GENERALIZED MYRMICINES and DOMINANT DOLICHODERINES completely fit the above profile of invasive ants. Observations of bait interactions among leaf litter ants indicate that similar competition may occur among CRYPTIC species (Tennant, 1994). While some CRYPTIC ants (such as *Brachymyrmex*, *Solenopsis* subgenus *Diplorhoptrum*, and *Wasmannia*) interact with other species at food items, CRYPTIC ants such as *Hypoponera* and dacetines have fewer direct interactions with the ant community. Although OPPORTUNISTIC ants recruit to food quickly, they usually disappear when confronted by competitors. Some opportunists invaders may become ecologically dominant, such as *Paratrechina longicornis* (Latreille) in Biosphere 2 in the southwestern US (Wetterer, personal communication), and *P. fulva* (Mayr) in Colombia (Zenner-Polania, 1990).

Using functional groups to examine convergent traits of transferred ants may lead to prediction of future invaders. Most ecological research on invasive ants has focused on the CRYPTIC *Wasmannia auropunctata* (Roger), the GENERALIZED MYRMICINES *Pheidole megacephala* (Fabricius) and *Solenopsis wagneri* Santschi, the OPPORTUNISTS *Paratrechina longicornis* (Latreille) and *Anopolepis gracilipes* (F. Smith), and a DOMINANT DOLICHODERINE *Linepithema humile* (Mayr). Generalizations about transferred ants based on the few well-studied species do not account for the diversity of transferred

species. Fortunately, the most frequently studied species are also the most problematic invaders.

All of the most studied invasive species, mentioned above, share several life history characteristics, as noted by earlier authors (Holldobler & Wilson, 1990; Brandão & Paiva, 1994; Passera, 1994). They are polygynous, unicolonial (lacking internest aggression), and workers generally are small in size. They quickly recruit to food items and have the ability to nest in a variety of areas. These successful invasive ants thrive in disturbed areas, can be highly aggressive to other species, and raid nest sites of native species. The above characteristics appear to be prerequisites for successful invasive ant species. While some noninvasive transferred ant species have a subset of the above characteristics, most likely all are necessary to arrive in a new location, establish a successful colony, and expand geographical range at the cost of native species.

While many tramp species share the same characteristics as invasive species, there is one major distinction: invaders monopolize food resources from native ant species, while tramps may simply be able to occupy a niche which is unfilled by native ants. For instance, the tramps *Tapinoma melanocephalum* (Fabricius) and *Monomorium pharaonis* (Linnaeus) frequently nest inside human structures, but rarely displace native species outside urban environments. Tramp species are restricted to benign environments. While tramp ants are generalists in terms of food preference, they are specialized to residing within tropical and subtropical climates, or areas with constant climate control. To illustrate this fact, one successful strategy to eradicate an urban infestation of tramp ants in the temperate zone is to shut off heat for a two weeks during the winter (W.L. Brown, pers. comm.). The majority of tramp species are not a threat to native ant faunas. They either assimilate into the environment without obvious negative impacts, or remain inside human structures.

Nearly all invasive species are also major tramp species. Excluding the fire ants (*Solenopsis* spp.) and *Paratrechina fulva* (Mayr), the species which are best at devastating native ant faunas are also the best at residing within human structures. The five species which are both invaders and tramps represent four functional groups. Obviously, it is not possible to single out a single functional group as the source of invasive species. Because the ecological functions of the five most problematic invaders and tramps are widely variable, this only highlights their convergent life history characteristics. This suggests that queen number, unicoloniality, interspecific aggression, and generalized foraging and nesting, are crucial in the identification of future invaders. It is most likely that future invasive species will be emerging from the current list of transferred species. Unfortunately, we know relatively little about the life history of the nontramp and noninvasive transferred species. With this available information, we may be able to predict which transferred species will become invasive in the future.

Preventing ecological invasions

Determining the origin of transferred ants is difficult for both widespread and rarely collected species. Nobody can really know where cosmopolitan ants such as *Pheidole megacephala*, *Paratrechina longicornis*, and *Monomorium pharaonis* originated. It is no coincidence that some of the ant species first described are still commensal with humans. The best way to discover which species humans will accidentally import into new areas is to examine in detail the list of previously transferred ant species.

Current efforts at keeping ants within their native habitats focus upon controlling the established invaders after they already have arrived. Despite this research emphasis, infestations in natural areas are rarely, if ever, controlled or eradicated. Most current research on transferred ants focuses on the small minority of pest species with economic impacts. Although it clearly is important to control such invading organisms, the pursuit of established invaders is an expensive and time-consuming venture into preventing the spread of transferred species.

Based on the translocations of ants which have already been observed, I offer specific recommendations for the monitoring of transferred ants. First, commerce to or from islands must be watched more closely than exchanges between two continental areas because transferred ant species are more abundant on islands. Because the species composition of transferred ants on islands shifts over time (Wilson & Taylor, 1967; Lieberburg *et al.*, 1975), we must continually monitor activity on islands in order to prevent the accidental transport of invading ants. While some transferred species are merely urban pests that rarely interfere with conservation or commerce, other species such as *S. wagneri*, *S. geminata*, *P. megacephala*, *L. humile* will impact native arthropod faunas and agricultural production if they are permitted to spread to new areas. Current monitoring schemes to regulate the accidental transport of transferred species will be more effective when we know which species have the most potential for geographical spread.

CRYPTIC species, OPPORTUNISTS, and GENERALIZED MYRMICINES are likely to contain invaders which will appear in the future. It is unlikely that army ants and fungus-growing ants will expand their range into new geographical regions. Because many successful tramps and invaders have very inconspicuous nests, and move nests with slight disturbances, observation of stowaways is very difficult. Even though hidden ants may be not be discovered when they first arrive in a novel area, knowledge of the foraging strategies of each functional group will assist in their control after detection. Baits designed to appeal to the foraging strategies of the invading species, as well as those to deter native ants, are most likely to eradicate invaders at a minimal cost to the native ant fauna. For instance, in Costa Rica, *Wasmannia auropunctata* (Roger) is more behaviourally dominant when competing for small sized baits presented in a dispersed fashion (McGlynn, unpublished data).

The prevention of widespread invasions is the best cure to the homogenization of the world's ant fauna. Unfortunately, preventing the accidental transport of all minute ants is not possible. Predictive ecology may play an important role in the monitoring of sensitive areas by focusing upon the groups likely to contain transferred species.

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BIOSKETCH

Terry McGlynn studies the ecology, behaviour and conservation of social insects. He completed his dissertation at the University of Colorado, followed by postdoctoral research on fire ant population ecology at the University of Houston. He is currently an Assistant Professor of Biology at Gettysburg College, Pennsylvania. Terry's current projects include the ecology and evolution of invasive ants, community ecology of Costa Rican rainforest leaf litter ants, and arthropod diversity in an agroecosystem. One of his ongoing projects is to maintain records of the distributions of all non-native ant species, and to make them publicly available by the internet.

Appendix I Recorded ant introductions of the world. Functional group abbreviations are: Cr, Cryptic; CS, Cold Climate Specialist; DD, Dominant Dolichoderine; GM, Generalized Myrmicine; HS, Hot Climate Specialist; Op, Opportunist; SC, Subordinate Camponotini; SP, Specialized Predator; TS, Tropical Climate Specialist. Reference numbers are as follows: National Museum of Natural History Entomology Collection (1); Los Angeles County Museum of Natural History Entomology Collection (2); Nishida (1996) (3); Taylor (1987) (4); Reimer *et al.* (1990) (5); Tuck (1994) (6); Reimer (1994) (7); Prins *et al.* (1990) (8); Fowler *et al.* (1990) (9); Deyrup & Trager (1986) (10); Ward (1987) (11); Holway (1995) (12); Smith (1929) (13); Van Schagen *et al.* (1994) (14); Shattuck (1992) (15); Brown (1958) (17); Ayre (1977) (18); Fisher (1997) (19) Japanese Ant Database Group (1995) (20); M. Deyrup, pers. comm. (21); Fowler *et al.* (1994) (22); Clark *et al.* (1982) (23); Mackay (1995) (24); Passera (1994) (25); Creighton (1950) (26); Delabie (1994) (27); Veeresh (1990) (28); Deyrup (1991) (29); Nuhn, pers. comm. (30); Zenner-Polania (1990) (31); Haskins & Haskins, 1965 (32); Martinez (1992) (33); Snelling (1992) (34); Wheeler (1908) (35); Don (1994) (36); Naumann, 1994 (37); Collingwood (1958) (38); Collingwood & Agosti (1996) (39). Question marks indicate that the site of where the species is native or transferred is questionable. T indicates Tramp status, and I indicates invasive species. Nomenclature of all species follows Bolton (1995a).

Species	Functional group	Tramp or Invasive?	Type locality and date	Native locality	Sites collected after transfer
Subfamily Cerapachyinae *Cerapachys biroi* Forel	Cr		Singapore 1807	SE Asia	Caribbean Islands, Polynesia, Melanesia (1, 2, 3, 5, 7)
Subfamily Dolichoderinae *Dolichoderus quadripunctatus* (Linnaeus)	DD		Germany 1771	Europe	Hawaiian Islands (3); Palestine, Japan (1)
Dolichoderus thoracicus (F. Smith)	DD		Sulawesi 1860	SE Asia	Intentionally introduced to Malaysia (6); Argentina (2); Hawaiian Islands (3)
Iridomyrmex anceps (Roger)	DD		W. Malaysia 1863	SE Asia	New Zealand (4); India, Pacific Islands (1)
Doleromyrma darwiniana (Forel)	Op		Australia 1907	Australia	New Zealand (4, 1)
Linepithema humile (Mayr)	DD	T,I	Argentina 1868	South America (8, 9)	Australia (4, 14, 1), South Africa, South of USA, Europe (15, 8); Mediterranean (1), Central America (2), Hawaiian Islands (5, 7, 3) Caribbean and Atlantic Islands (1); California (11, 12)

Appendix I *continued*

Species	Functional group	Tramp or Invasive?	Type locality and date	Native locality	Sites collected after transfer
L. iniquum (Mayr)	Op		Colombia 1870	Brazil (13)	Jamaica (2); Central America native? (2,1)
L. melleum (W. M. Wheeler)	Op		Puerto Rico 1908	Puerto Rico?	Hawaiian Islands (3); Virgin Islands, France (2)
Ochetellus glaber (Mayr)	Op		Australia 1862	Australia and New Caledonia (4)	Hawaiian Islands (1, 5, 7); New Zealand (4, 17); continental US (10, 13); Japan (2)
O. itoi (Forel)	Op		Japan 1900	Japan	Hawaiian Islands (3, 1)
Tapinoma melanocephalum (Fabricius)	Op	T	French Guiana 1793	Unknown (25)	Tropical Africa (22); several Pacific Islands (20, 5, 7, 3); North America (10, 18, 25); Galapagos Islands (23); Europe (25); Central and South America (1, 9, 22, 25) continental SE Asia and neighbouring islands (1, 2, 20); Caribbean Islands (1, 2); India (28); Australia, New Zealand, New Caledonia (4); Madagascar (19); Arabian Peninsula (39)
Technomyrmex albipes (Smith)	Op	T	Sulawesi 1861	Indo-Pacific area (4)	New Zealand and New Caledonia native? (4); Hawaiian Islands (5, 7, 3); continental US (1, 2, 29); southern Africa (8); India, China (1); Madagascar (19); Saudi Arabia (39)
Subfamily Formicinae *Acanthomyops interjectus* (Mayr)	Op		USA 1866	North America	Hawaiian Islands (3)
Anopolepis custodiens (F. Smith)	Op	T, I	South Africa 1858	Africa	Many sites North America and Central America (1)
A. gracilipes (F. Smith)	Op		India 1851	Africa (25) or tropical Asia (22)	Australia and New Caledonia (4); southern Africa (8); Hawaiian Islands (3, 5, 7); SE Asia, Indian Ocean islands, and Polynesia (1, 2, 20, 25); India (28); Caribbean Islands (1, 2) Galapagos Islands (1); Brazil (22); Madagascar
Brachymyrmex brevicornis Emery	Cr		Argentina 1906	Central & S.America	Florida (21)
B. cordemoyi Forel	Cr		Reunion I 1895	unknown	Madagascar (19)
B. minutus Forel	Cr		Antilles 1893	Neotropics	Florida (21); Hawaiian Islands (3, 5, 7); Virgin Islands (1, 2)
B. musculus Forel	Cr		Costa Rica 1899	Neotropics	Continental US, including Florida, and Mexico (2, 21)
B. obscurior Forel	Cr		Antilles 1893	Neotropics	North America (1, 2, 21); Caribbean Islands (1, 2); Hawaiian Islands (3)
Camponotus atriceps (F. Smith)	SC		Brazil 1862	Neotropics	Hawaiian Islands (3)
C. exiguoguttatus Forel	SC		India 1886	unknown	Hawaiian Islands (3)
C. herculeanus (Linnaeus)	SC		Europe 1758	Holarctic region (8)	introduced into southern Africa but subsequently eradicated (8); North America (1)
C. itoi Forel	SC		Japan 1912	Japan	Hawaiian Islands (3)
C. obscuripes Mayr	SC		Japan 1879	Japan	Hawaiian Islands (3)
C. planatus Roger	SC		Cuba 1863	Neotropics	Hawaiian Islands (3); Galapagos Islands (1); Florida (21)
C. sexguttatus (Fabricius)	SC		Antilles 1793	Neotropics	Hawaiian Islands (3); Florida (21)
C. variegatus (F. Smith)	SC		Sri Lanka 1858	Indo-Pacific area	Hawaiian Islands (3, 5, 7)
Formica subpolita Mayr	CS		USA 1886	North America	Hawaiian Islands (3)
Lasius alienus (Foerster)	CS		Germany 1850	Europe	Hawaiian Islands (3); continental US (2); Ireland? (38)
L. flavus (Fabricius)	CS		Europe 1782	Europe	Hawaiian Islands (3); widespread throughout US (2); Copeland Is. (1); Ireland? (38)
L. fuliginosus (Latreille)	CS		France 1798	Europe	Hawaiian Islands (3); Japan; Ireland? (38)

Appendix I *continued*

Species	Functional group	Tramp or Invasive?	Type locality and date	Native locality	Sites collected after transfer
L. niger (Linnaeus)	CS		Europe 1758	Europe	Hawaiian Islands (3); Japan, California (2)
L. turcicus Santschi	CS		Turkey 1921	unknown (25)	Budapest, Hungary? (25)
Myrmelachista ramulorum (W. M. Wheeler)	TS		Puerto Rico 1908	Neotropics	Florida (1, 21); Chile?, Caribbean Islands? (1)
Paratrechina bourbonica (Forel)	Op		Reunion Is. 1886	unknown	Hawaiian Islands (1, 3, 5, 7); Florida (1, 10); England, Japan, Polynesia and Melanesia (1); Madagascar (19)
P. clandestina (Mayr)	Op		Java 1870	SE Asia	Hawaiian Islands (3)
P. flavipes (Smith)	Op		Japan 1974	Japan	Eastern US (1, 30); Oman (39)
P. fulva (Mayr)	Op	I	Brazil 1862	Brazil (22)	Canada (18); Central America (1), Probably intentionally introduced into Colombia (31)
P. guatemalensis (Forel)	Op		Guatemala 1885	Neotropics	Florida (21); Bahamas, Cocos Island (1)
P. longicornis (Latreille)	Op	T, I	Senegal 1802	Africa?	Hawaiian Islands (3, 5, 7); Australia, New Zealand, and New Caledonia (4); southern Africa (8); North America (1, 2, 10, 25, 37); Polynesia, Africa (1; 25); Galapagos Islands (1, 23); Central and South America (1, 2, 22); Caribbean Islands; Europe (1,2); India (2); SE Asia and many Pacific Islands (1); Madagascar (19); Arabian Peninsula (39)
P. pubens (Forel)	Op		Antilles Is 1893	Neotropics	Continental US and Caribbean Islands (1, 2, 21)
P. vaga (Forel)	Op	T	Bismark Arch. 1901	Australia & SE Asia	Hawaiian Islands (3, 5, 7); Galapagos Islands (23); Madagascar (1); Polynesia and Melanesia (1,2); New Caledonia, New Zealand (4, 17)
P. vividula (Nylander)	Op		Finland 1846	Europe?	North America (1, 2, 10); Caribbean Islands (2); South America (1)
Plagiolepis alluaudi Emery	Cr		India 1894	India?	Hawaiian Islands (1, 2, 3, 5, 7); Africa, Polynesia, China, West Indian Islands (20); Bermuda (1, 2); Channel Islands, California (1); Madagascar (19)
P. exigua Forel	Cr		India 1894	Australia (4)	Hawaiian Islands (3); Sumatra (1); Madagascar (19); Yemen (39)
Polyrachis (Myrmhopla) argentea Mayr	SC		Philippines 1862	Philippines	Hawaiian Islands (3)
P. (Myrmhopla) dives F. Smith	SC		Singapore 1857	SE Asia & Australia	Hawaiian Islands (3)
P. (Campomyrma) femorata F. Smith	SC		Australia 1858	SE Australia	Hawaiian Islands (3)
Prenolepis imparis (Say)	CS		USA 1836	North America	Hawaiian Islands (3)
P. melanogaster Emery	CS		Burma 1893	SE Asia	Hawaiian Islands (3); New Caledonia? (4)
Subfamily Myrmeciinae *Myrmecia brevinoda* Forel	SP		Australia 1910	Australia (4)	New Zealand (4, 17)
Subfamily Myrmicinae *Cardiocondyla ectopia* Snelling	Op		USA 1974	Probably Africa (24)	south-western US (1, 24); northern Mexico (1)
C. emeryi Forel	Op	T	Virgin Is. 1881	Africa (8, 25)	Hawaiian Islands (3, 5, 7); South of US (10, 24); Africa (1, 8, 25); Madagascar (19, 25); Caribbean Islands, Central America (1, 24, 25), Cook Island, Brazil (1); Arabian Peninsula (39)

Appendix I *continued*

Species	Functional group	Tramp or Invasive?	Type locality and date	Native locality	Sites collected after transfer
C. nuda (Mayr)	Op	T	Fiji Is 1866	Australia	Hawaiian Islands (3, 7, 5, 24); continental US (1, 10, 24); Japan and neighbouring islands (20); Australia (4); Cyprus, India, Polynesia, Malaysia (25); Melanesia, Galapagos Islands (1), North Africa, Arabian Peninsula (39)
C. venustula W. M. Wheeler	Op	T	Puerto Rico 1908	Probably old world (24)	Hawaiian Islands (3, 5, 7); South of US (1, 10, 24); Caribbean Islands (24)
C. wroughtoni Forel	Op	T	India 1890	Tropical Asia and Australia (25)	Hawaiian Islands (1, 3, 5, 7); continental US (1, 10, 24); Mediterranean (1, 25); islands neighbouring Japan (20); Brazil (2); Arabian Peninsula (39)
Crematogaster lineolata (Say)	GM		USA 1836	North America	Intentionally introduced into Hawaii (3)
C. sordidula (Nylander)	GM		Sicily 1849	Europe	Intentionally introduced into Hawaii (3); Africa, Japan (1)
Cyphomyrmex rimosus (Spinola)	TS		Brazil 1851	Neotropics	Hawaiian Islands (3); South-eastern US (2, 10)
Epitritus hexamerus Brown	Cr		Japan 1958	Japan	Florida (21)
Eurhopalothrix floridana Brown & Kempf	Cr		USA 1960	unknown	Florida (21)
Leptothorax subditivus (W. M. Wheeler)	Op		1903 USA	Neotropics?	Hawaiian Islands (3)
Mayriella abstinens Forel	TS		Australia 1902	Australia (4)	New Zealand (4, 1)
Monomorium chinense Santschi	GM		China 1851	Asia	Hawaiian Islands (1)
M. destructor (Jerdon)	GM	T	India 1851	From Africa (25) or India (22)	Hawaiian Islands (3, 5, 7); Okinawa (20); southern Africa (8); Australia (4; 14); Brazil (22); North, Central, and South America (1, 2, 21); Madagascar (19); Caribbean Islands (1, 2); Christmas Island (1); Arabian Peninsula (39)
M. ebeninum Forel	GM		Antilles 1891	Neotropics	Florida (21); Caribbean Islands? (1, 2)
M. floricola (Jerdon)	GM	T	India 1851	India and SE Asia (2, 25)	North America (1, 2, 10; 22); Hawaiian Islands (3, 5, 7); Galapagos Islands (2, 23); islands neighbouring Japan (20); Australia and New Caledonia (4); Central and South America (1, 2, 22); Caribbean Islands, Polynesia (1, 2); Madagascar (19)
M. latinode Mayr	GM		Borneo 1872	SE Asia	Hawaiian Islands (3, 5, 7); Okinawa (20; 1); India (2)
M. minimum (Buckley)	GM		USA 1867	North America	Hawaiian Islands (3)
M. monomorium Bolton	GM		Italy 1865	Europe	Hawaiian Islands (3, 5, 7); China, SE Asia, Caribbean Islands (1, 2)
M. orientale Mayr	GM		India 1879	India (4)	Australia, New Zealand (4, 17)
M. pharaonis (Linnaeus)	GM	T	Egypt 1750	Africa?	Europe (1, 25); Hawaiian Islands (3, 5, 7); Japan, Polynesia (20), North America (1, 2, 10, 18, 25); Central and South America (1, 2, 22); Australia and New Zealand (4, 14); Galapagos Islands, India (2); Madagascar (19); Saudi Arabia (39)
M. salomonis (Linnaeus)	GM		Egypt 1758	Africa?	Madagascar (19); Arabian Peninsula? (39)
M. sechellense Emery	GM		Seychelle Is 1894	Asia?	Hawaiian Islands (3, 5, 7); Taiwan and islands neighbouring Japan (20)
M. subopacum (Smith)	GM		Madeira 1858	Mediterranean (8)	southern Africa (8); Israel (1); Africa, Arabian Peninsula (39)
Myrmica rubra (Linnaeus)	Op		Europe 1758	Europe	continental US (25, 26); Japan, China (20)

Appendix 1 *continued*

Species	Functional group	Tramp or Invasive?	Type locality and date	Native locality	Sites collected after transfer
Pheidole anastasii Emery	GM		Costa Rica 1896	Neotropics	Canada (18); Madagascar (19); Caribbean Islands?, continental US (1)
P. barbata W. M. Wheeler	GM		USA 1908	North America	Hawaiian Islands (3)
P. fervens F. Smith	GM		Singapore 1858	Asia	Hawaiian Islands (3, 5)
P. fervida F. Smith	GM		Japan 1874	Japan	Hawaiian Islands (3); China, Tahiti (2)
P. flavens Roger	GM		Cuba 1863	Neotropics	Florida? (21); Caribbean Islands? (1)
P. hyatti Emery	GM		USA 1895	South-west US	Hawaiian Islands (3)
P. megacephala (Fabricius)	GM	T, I	no site given 1793	Africa?	Present in almost all humid tropics (25); Africa (1, 2, 8, 25); South America (1, 2, 9, 22, 25), Europe (25); Australia and New Zealand (2, 4); Hawaiian Islands (3, 5, 7, 1); Caribbean Islands (1, 2, 32); Madagascar (1, 19); Polynesia, Melanesia, Caribbean Islands (1, 2), Channel Islands, California (2); Arabian Peninsula (39)
P. moerens W. M. Wheeler	GM		Puerto Rico 1908	Puerto Rico?	South of US (1, 10)
P. obscurithorax Naves	GM		Argentina 1985	Neotropics	Florida (21)
P. punctatissima Mayr	GM		Mexico 1870	Neotropics	Hawaiian Islands (3); Caribbean Islands? (1)
P. noda F. Smith	GM		Japan 1874	Japan	Hawaiian Islands (3)
P. teneriffana Forel	GM		Canary Is 1873	North Africa (34)	California (33, 34); Mediterranean (2); Arabian Peninsula (39)
P. umbonata Mayr	GM		Tonga 1870	Melanesia (4)	Polynesia (1, 2); New Caledonia? (4)
P. variabilis Mayr	GM		Australia 1876	Australia and New Caledonia (1, 4)	New Zealand (4)
P. vigilans (F. Smith)	GM		Australia 1858	Australia (4)	New Zealand (4)
Pheidologeton affinis (Jerdon)	TS		India 1851	India	Hawaiian Islands (3)
P. divs. (Jerdon)	TS		India 1851	India	Hawaiian Islands (3)
Pogonomyrmex occidentalis (Cresson)	HS		USA 1865	Western N.America	Hawaiian Islands (3)
Quadristruma emmae (Emery)	Cr	T	Antilles 1890	Papuanal region (4)	Hawaiian Islands (3, 5, 7; 1); Caribbean Islands (1, 2, 4), Florida (10); Polynesia (1, 20); Madagascar (19)
Smithistruma margaritae (Forel)	Cr		Antilles Is 1893	Neotropics	South of US (1, 21); Caribbean Islands? (1, 2)
Solenopsis geminata (Fabricius)	HS	I	Central America 1804	Neotropics (1, 2, 22, 25)	Hawaiian Islands (1, 3, 5); Australia and New Caledonia (4); southern Africa (8); Okinawa (20); North America (1, 2, 18); India (28); Galapagos Islands (2); Caribbean Islands, Polynesia (1); Madagascar (19)
S. wagneri Santschi (=*S. invicta*)	HS	I	Argentina 1916	Brazil	South and Midwest of US (1, 2, 10); Virgin Islands, Puerto Rico (1)
S. papuana Emery	GM		New Guinea 1900	Papuanal region	Hawaiian Islands (7; 3)
S. richteri Forel	HS	I	Argentina 1909	Argentina	south-eastern US (22)
S. texana Emery	Cr		USA 1895	southern US	Canada (18)
Strumigenys eggersi Emery	Cr		Antilles 1890	Neotropics	Florida (10); Caribbean Islands? (1, 2)
S. godeffroyi Mayr	Cr		Samoa 1866	Polynesia,	Hawaiian Islands (1, 3, 5, 7); Galapagos Islands (1)
S. gundlachi (Roger)	Cr		Cuba 1862	Neotropics	Florida (21); Caribbean Islands? (1, 2)
S. lanuginosa (W. M. Wheeler)	Cr		Bahamas 1905	Neotropics	Florida (21); Trinidad? (2)
S. lewisi Cameron	Cr		Japan 1886	Asia	Hawaiian Islands (1, 3, 5, 7)
S. perpexla (F. Smith)	Cr		New Zealand 1886	Australia (4)	New Zealand? (1, 4, 17); Three Kings Islands (36)

Appendix 1 *continued*

Species	Functional group	Tramp or Invasive?	Type locality and date	Native locality	Sites collected after transfer
S. rogeri Emery	Cr		Antilles 1890	Neotropics	Hawaiian Islands (3, 5, 7); Florida (10); Canada (18); Caribbean Islands? (1, 2)
S. silvestrii Emery	Cr		Argentina 1906	Neotropics	Florida (21); Cuba? (2)
S. solifontis Brown	Cr		Japan 1849	Japan (1, 20)	Taiwan, Okinawa, and neighbouring islands (20)
S. xenos Brown	Cr		Australia 1955	Australia (4)	New Zealand (4)
Tetramorium bicarinatum (Nylander)	Op	T	USA 1846	SE Asia (8, 22)	Hawaiian Islands (3, 5, 7); continental US (1, 10); Australia, New Zealand, New Caledonia (4); Africa (1, 8, 20); Central and South Americas (1, 2, 22); Japan and neighbouring islands (1, 20); Europe, Galapagos Islands (2, 23), Ceylon (1); Madagascar (19); Canada (18)
T. caldarium (Roger)	Op		Germany 1857	Europe	Florida (2, 21); Caribbean Islands and Central America (1, 2); Saudi Arabia (39)
T. caespitum (Linnaeus)	Op	T	Europe 1758	Europe (22; 35)	Hawaiian Islands (3); Brazil (22); continental US (1, 31); Japan (20); Palestinian region? (1); Ireland? (38)
T. grassii Emery	Op		South Africa 1895	South Africa (4)	New Zealand (2, 4, 17)
T. lanuginosum Mayr	Op	T	Java 1870	SE Asia?	Hawaiian Islands (3); Florida (21); Mediterranean (2); Madagascar (19); Saudi Arabia (39)
T. lucayanum W.M. Wheeler	Op		Bahamas 1905	West Indies (27)	Brazil (27)
T. pacificum Mayr	Op	T	Tonga 1870	Indo-pacific region (1, 2, 4, 20)	Hawaiian Islands (3, 5, 7); Australia and New Caledonia? (4); Florida (10); Canada (18); Galapagos Islands (23); Central America (1, 2); Caribbean Islands (2)
T. simillimum (Smith)	Op	T	Great Britain 1851	Europe	North America, Madagascar (19), Australia; Arabian Peninsula (39)
T. tonganum Mayr	Op		Tonga 1870	Pacific region	Hawaiian Islands (1, 3, 5, 7); Brazil (22)
Trichoscapa membranifera (Emery)	Op	T	Italy 1869	Europe?	Hawaiian Islands (3, 5, 20); Florida (1, 10); Japan, China, Polynesia, Africa, Europe (20) Guam, South of US (1)
Wasmannia auropunctata (Roger)	Cr	T, I	Cuba 1863	Neotropics	Florida (1, 10, 13); Galapagos Islands (2, 23); Canada (18, 25, 37); New Caledonia (4); Africa (25); Wallis and Futuna Islands (25); Hawaiian Islands (3); Caribbean Islands (1, 2)
Subfamily Ponerinae *Amblyopone zwaluwenbergi* (Williams)	Cr		Hawaii 1946	unknown	Hawaiian Islands (3, 5, 7)
Anochetus mayri Emery	SP		Antilles Is 1884	Neotropics	Florida (21); Caribbean Islands?(2)
Gnamptogenys aculeaticoxae (Santschi)	Op		French Guiana 1921	Neotropics	Florida (21)
G. porcata (Emery)	Op		Costa Rica 1896	Neotropics	Hawaiian Islands (3); Florida (10)
Hypoponera eduardi (Forel)	Cr	T	Algeria 1894	Africa, Mediterranean? (4)	New Zealand (4, 17); Three Kings Islands (36); Saudi Arabia, Mediterranean (39)
H. elliptica (Forel)	Cr		Australia 1900	Australasia (4)	New Caledonia? (1, 4)
H. opaciceps (Mayr)	Cr	T	Brazil 1887	Brazil (4)	Hawaiian Islands (3, 5, 7); New Caledonia (4); Okinawa, Taiwan (20); continental US, Caribbean Islands (1, 2)

Appendix 1 *continued*

Species	Functional group	Tramp or Invasive?	Type locality and date	Native locality	Sites collected after transfer
H. punctatissima (Roger)	Cr	T	Germany 1859	Europe?	Ireland (38); Hawaiian Islands (3, 5, 7); Australia and New Caledonia (4); Florida (10); Europe (1); North America, Caribbean Islands (1, 2); Arabian Peninsula (39)
H. zwaluwenburgi (W. M. Wheeler)	Cr		Hawaii 1933	unknown	Hawaiian Islands (3, 5); Okinawa (20)
Leptogenys falcigera Roger	SP		Sri Lanka 1861	Africa	Hawaiian Islands (3, 5, 7); Philippines (2); Madagascar (19)
L. maxillosa (F. Smith)	SP		Mauritius 1858	Africa	Madagascar (19)
Odontomachus haematodus (Linnaeus)	Op		America Meridonali 1758	South America (4)	Hawaiian Islands (3)
O. ruginodis M. R. Smith	Op		Bahamas 1937	Neotropics	Florida (21); Caribbean Islands? (2)
O. simillimus F. Smith	Op		Fiji Is 1858	Pacific region	Hawaiian Islands (3); Caribbean Islands (1)
Pachydondyla chinensis (Emery)	SP		China 1895	China (4)	New Zealand (4, 17); Japan, Taiwan and neighbouring islands (20)
P. luteipes (Mayr)	SP		Nicobar Is 1862	unknown	New Zealand (4); Hawaiian islands (3); Japan, continental US, Solomon Islands (1)
P. obscurans (Walker)	SP		Sri Lanka 1859	Indo-Pacific region	South-east US (19)
P. solitaria (F. Smith)	SP		Indonesia 1860	Indo-Pacific region?	Hawaiian Islands (3); Japan, China, continental US (1)
P. stigma (Fabricius)	SP		S. America 1804	Neotropics	Australia (4); Florida (1, 21); Caribbean Islands? (1, 2); Galapagos Islands? (1)
Ponera coarctata (Latreille)	Cr		Luxembourg 1802	Europe	Hawaiian Islands (3)
P. leae Forel	Cr		Tasmania 1913	Australia (4)	New Caledonia and New Zealand? (1, 4)
P. swezeyi (W. M. Wheeler)	Cr		Hawaii 1933	unknown	Hawaiian Islands (1, 3, 5)
Prionopelta antillana Forel	TS		Antilles Is 1909	Neotropics	Florida (1, 21)
Subfamily Pseudomyrmecinae *Pseudomyrmex gracilis* (Fabricius)	TS		Central America 1804	Neotropics	Hawaiian Islands (3, 5, 7); Florida (2, 21)