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# The effects of urbanization on the ant fauna of the Swan Coastal Plain near Perth, Western Australia

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**Abstract**

The ant fauna in 33 Perth gardens was surveyed by hand collecting and pitfall trapping. The resulting catch was considered at the species level and also four ant variables (abundance, species richness, species diversity and species evenness) were investigated for correlation with garden botanical and management variables.

Forty-seven ant species from 22 genera were recorded from the gardens. Thirty-six species occurred in less than one third of the gardens which were studied. Some of the species were absent or uncommon in adjacent native vegetation indicating that they were favoured by urbanization while other species from the native vegetation were unable to colonize, or persist in, the gardens.

Ant species richness and diversity were significantly lower in gardens than native vegetation while species evenness did not statistically differ between the two types of land use. The ant fauna was enhanced by the length of time the garden had been established, and also increased garden area, leaf litter and ground cover. Gardens where pesticides were used, where tall shrubs were dense or where management (e.g. watering) was intense, had a depauperate ant fauna.

This study has indicated that urban gardens are an important refuge for ants and maybe, because ant species richness often reflects that of other invertebrates groups, for a wide range of other invertebrates.

## Introduction

With the rapid expansion of towns and cities in Australia the role of urbanized areas as wildlife refuges has become crucially important. The interest in such areas as wildlife refuges is illustrated by the Brisbane Wildlife Survey (Davies 1983) which documented the butterflies, fish, amphibia, reptiles, birds and mammals of Brisbane's suburbs and emphasised the importance of urban areas for a wide range of fauna.

Native vegetation and agricultural land are rapidly being transformed into urban areas in Perth, Western Australia. This has led to recommendations for the establishment of a series of parks and reserves in what is referred to as the Darling System of land which envelopes, and includes, the Perth Metropolitan area (Anon. 1981).

The ant fauna of the Swan Coastal Plain, close to Perth, has been documented by Rossbach and Majer (1983). Their survey was confined to pristine habitats and showed that the ant fauna of the open-forests and woodlands of the Coastal Plain was reasonably distinct from the fauna of the coastal scrub close to the ocean, or the open-forest of the Darling Plateau.

The present survey extends this work by investigating the influence on the ant fauna of progressive urbanization of open-forests and woodlands of the Swan Coastal Plain.

## Methods

### Description of gardens

Thirty-three gardens, representing 25 suburbs, within a 20 km radius of the Perth General Post Office, were selected for study. Selection was partly governed by the availability of volunteer participants in the project, although it was also influenced by the need to include a full age-range of suburbs.

Measurements and observations were made in each garden to describe its flora and the type of management that it had been subjected to. Variables were quantified by visually inspecting gardens during December 1982, by interviewing the home occupants and by consulting maps:

*Soil association and vegetation system*—The landform and soil association on which each garden occurred was assessed by locating each garden on the System 6 landform and soil map of Churchward and McArthur (1980). The vegetation system which occurred prior to urbanization of Perth was assessed from the System 6 vegetation association map of Heddle *et al.* (1980). The different soil associations, which were all sandy, and vegetation systems which were included in this study are shown in Table 1.

*Age*—Two ages were recorded. The first, location age, was the age of the residence and was presumed to reflect the period of alienation of the area from the original native vegetation. All residences were assumed to have been built after the areas had recently been cleared, although the possibility that some gardens had previously been cleared for agricultural purposes cannot be excluded. Location ages were categorized as: 1, 0-6 years; 2, 7-13 years; 3, 14-30 years; 4, 31-50 years; or 6, >51 years. The second, garden establishment age, was the age of the existing garden, since gardens may go through a series of changes depending on the requirements of the owner. It was not possible to be as specific as with location age, so the following four categories were selected: 1, 0-4 years; 2, 5-8 years; 3, 9-14 years; or 4, >15 years.

*Area of garden*—This was the area of the block minus the area taken up by the house, patio or other out-buildings.

*Floristics*—Each garden was categorized according to the emphasis on exotic or native Western Australian plants. Five categories were used to illustrate this: 1, totally native vegetation; 2, mostly native species; 3, an approximately equal mixture of native and non-native species; 4, mostly non-native species; or 5, totally non-native species. Gardens were also rated as having a: 1, low; 2, intermediate; or 3, high plant species richness, regardless of whether the species were native or non-native.

*Vegetation structure*—This was described using an estimate of plant biomass on a four-point scale: 1, very little plant biomass; 2, low biomass; 3, intermediate biomass; or 4, densely planted gardens, with high biomass. In addition, percentage cover of vegetation was visually assessed and assigned to one of five percentage cover categories: 1, absent; 2, 1-10%; 3, 11-25%; 4, 26-50%; or 5, >51%. Vegetation cover was independently assessed for herbs plus low shrubs (<2 m tall), tall shrubs (2-10 m tall), trees (>10 m tall) and all strata combined.

*Leaf litter*—Leaf litter on garden beds was categorized as: 1, dense and present over most of soil; 2, thin and sparse; or 3, absent.

*Lawn*—This was categorized as: 1, absent; 2, unmaintained lawn; 3, well covered lawn; or 4, lush, well-maintained lawn.

*Pesticide usage*—By interviewing occupants, it was possible to assign gardens to one of four pesticide use categories: 1, no pesticide used; 2, pesticides occasionally used to control plant pests; 3, occupant has attempted to control house infesting ants; or 4, garden treated with Heptochlor by Department of Agriculture to control argentine ants (*Iridomyrmex humilis*).

*Watering regime*—Gardens were categorized by watering regime as follows: 1, watered less than once per week; 2, watered at least one or two times per week; or 3, watered at least once every 2 days.

## Ant sampling procedure

Ants were sampled by hand collection conducted by residents on an opportunistic basis during autumn and winter, 1982 and by pitfall trapping during December, 1982. Ten pitfall traps (18mm internal diameter, containing a 70/30 v/v mix of ethanol/glycerol preservative) were inserted within each garden. The traps were subjectively arranged so that they sampled each particular type of vegetation represented in the garden. At least one trap was always placed in the lawn. Traps were left out for 7 days and then returned to the laboratory where the catch was sorted.

All ants were sorted to species level and, where possible, named. Some of the species names given in this paper apply only in a very broad sense and therefore identify what are often species complexes. Unnamed species were coded with Australian National Insect Collection (ANIC) or Western Australian Institute of Technology (J.D.M.) code numbers, which conform to the nomenclature used by Rossbach and Majer (1983). Voucher specimens are retained at the Western Australian Institute of Technology.

## Data analysis

Four ant parameters were calculated for each garden: (1) Ant abundance was derived by summing the number of ants caught in the 10 pitfall traps; (2) Ant species richness in gardens was derived by summing the total number of species obtained by both sampling methods; (3) The Shannon's diversity index, H' (Shannon and Weaver 1949) was applied to the pitfall trap data as a measure of species diversity; and (4) ant evenness was calculated using the formula:

$$J' = \frac{H'}{\log S}$$

where S is the total species present.

A correlation matrix was calculated in order to investigate the relationship between the various ant variables and garden parameters. The Pearson correlation was used for continuously distributed variables and the Spearman rank correlation was used for those variables measured on the discrete 3 and 5 point scales. From this matrix a constellation diagram of correlated factors was constructed, incorporating only those pairs of variables that were significantly correlated with each other. Correlation does not necessarily imply cause and effect, since inter-correlations between variables may suggest relationships which are in fact spurious, or may mask the causal effects of other variables. Although not providing conclusive evidence, the correlations do give some idea of the influence of garden history and management variables on the four ant variables under investigation.

**Table 1**

Landform and soils and also vegetation systems occurring in areas where the 33 gardens used in this survey occurred

| Landform & Soils From Churchward and McArthur (1980) | Vegetation System From Heddle *et al* (1980) |
|---|---|
| Bassendean | Bassendean Complex—Central and South |
| Cottesloe | Cottesloe Complex—Central and South |
| Herdsman | Guildford Complex |
| Karrakatta | Karrakatta Complex—Central and South |
| Southern River | Quindalup Complex |
| Swan | Swan Complex |
| Vasse | Vasse Complex |

## Results

The species of ants found in this survey and the percentage of gardens in which they were present are shown in Table 2. Forty-seven species from 22 genera were recorded in gardens. The most common species, listed in decreasing order of frequency, were *Iridomyrmex* sp. JDM 9, *Iridomyrmex* sp. 21 (ANIC), *Pheidole latigena*, *Cardiocondyla nuda*, *Iridomyrmex* sp. JDM 83, *Adlerzia froggatti*, *Tetramorium bicarinatum*, *Brachyponera lutea*, *Pheidole* sp. JDM 44, *Pheidole* sp. JDM 177 and *Paratrechina* sp. JDM 339. The remaining species occurred in less than one third of the gardens.

Twenty-four (51%) of the garden ant species were not recorded by Rossbach and Majer (1983) indicating that many are favoured by the urbanization process. It is interesting to note that only five of the frequently occurring ants listed above are included in the confined-to-gardens category (*Adlerzia froggatti*, *Pheidole* sp. JDM 44, *Pheidole* sp. JDM 177, *Tetramorium bicarinatum* and *Paratrechina* sp. JDM 339), the remainder were also

**Table 2**

List of ant species found in the 33 Perth gardens sampled in the Perth metropolitan region showing the percentage of gardens in which each species occurred.

| Sub-family | Species | Gardens where present | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Percentage of gardens where species present |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | |
| PONERINAE | Brachyponera lutea | | + | + | + | | | + | | | | | | | | + | | + | + | | + | | | | | | + | + | | + | | + | + | | 39 |
| | °Hypoponera sp JDM 165 | + | | | | | | | + | | + | | | | | | | | | | | | | | + | + | + | | | | | | + | + | 24 |
| | Rhytidoponera inornata | | | | + | | | | | | | | + | | + | + | | | | | | | | | | + | + | | | + | | | | | 21 |
| | R. violacea | | | + | | | | | | | + | | | | | | | | | | | | | | | | | | | | | + | | | 9 |
| MYRMICINAE | °Adlerzia froggatti | + | | | + | | | | + | | + | + | | + | + | + | | | + | | + | + | | + | | | | | | + | + | | + | | 46 |
| | °Anisopheidole antipodum | | | | | + | | | | | | | | | + | + | | | | | | | | + | | | | | | + | | | | | 15 |
| | °Aphaenogaster sp. JDM 224 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | + | 6 |
| | Cardiocondyla nuda | | + | + | + | + | + | + | + | | + | + | + | + | | + | + | + | + | | | + | + | | + | + | + | + | | + | + | + | | + | 76 |
| | °Chelaner sp. JDM 61 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | | 3 |
| | Crematogaster sp. JDM 33 | | | | | | | | + | | + | | | | + | + | | | + | | | | | | | + | | | | | + | + | | | 24 |
| | C. sp. JDM 350 | | | | | | | | | | | | | | | + | | | | | | | | | | | | | | | | + | | | 6 |
| | Meranoplus sp. JDM 157 | | | | | | | | | | | | | | | + | | | | | | | | | | | | | | | | | | | 3 |
| | °M. sp. JDM 158 | | | | | | | | | | | | | | | + | | | | | | | | | | | | | | | | | | | 3 |
| | Monomorium sp. 1(ANIC) | | | | | | | | | | | | + | | | | | | | | | | | | | | | | | | | | | + | 6 |
| | M. sp. 2(ANIC) | | + | | + | | | | | | | | + | | | + | | + | | | | | | | | | | | | | | + | | | 18 |
| | °M. sp. JDM 156 | | | | | | | | | | | | + | | | | | | | | | | | | | | | | | | | | | | 3 |
| | Pheidole latigena | + | + | + | + | + | + | + | + | + | + | | | + | + | + | + | + | + | | + | + | | + | | + | | + | + | + | + | + | | + | 79 |
| | °P. sp. JDM 44 | + | | | | | + | | | + | + | + | | + | | | + | | + | | | | + | | + | | | | | | + | | | | 33 |
| | °P. sp. JDM 177 | | | | | | | | | + | + | + | | | | | + | + | + | | | | | + | | + | | | | | + | | | + | 33 |
| | °Solenopsis sp. JDM 34 | | + | | | | + | + | + | | + | + | | | | | | + | + | | + | | | | | | | | | + | | | | | 30 |
| | °Tetramorium bicarinatum | | + | + | + | + | | + | + | | + | | + | | + | | | | + | | | | | | | | + | + | | | | + | | + | 42 |
| DOLI-CHODERINAE | °Iridomyrmex darwinianus | | | | | | | | | | | | + | | | | | | | + | | | | | | | | | | | | | | | 6 |
| | I. purpureus | | + | + | | + | | + | | | | | | | | | | | | | | | | | + | | + | + | | | | + | | | 24 |
| | I. sp. 21(ANIC) | | + | + | + | + | + | + | + | | + | + | | + | + | | + | + | + | + | + | + | + | + | + | + | + | | + | + | + | + | | + | 82 |
| | I. sp. JDM 9 | + | + | + | + | + | + | + | + | + | + | + | + | + | | + | + | + | + | | | + | + | + | | + | + | + | | + | + | + | + | + | 85 |
| | I. sp. JDM 83 | | | | + | + | + | + | + | + | + | + | + | | + | | + | + | | + | | + | | | + | | | | | + | + | + | + | + | 61 |
| | °I. sp. JDM 172 | | | | | | | | | | | | + | | | | | | | | | | | | | | + | | | | | | | | 6 |
| *** | I. sp. JDM 509 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | 3 |
| | °I. SP JDM 625 | | | | | | | | | | | | | | | | | | + | | | | | | | | | + | | | | | | | 6 |
| | Tapinoma sp. 134 | | | | | | | | | | | | | | + | + | | | | | | | | | | | | | | | | | | | 6 |
| | °Technomyrmex sp. JDM 624 | + | | | | | | | + | + | | | | | | | | | | | | | | | | | | | | | | | | | 9 |
| FORMICINAE | Camponotus sp. JDM 25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | 3 |
| | C. sp. JDM 27 | | | | | + | | | | | | + | | | | | | | | | | | | | | | | | | + | | + | + | | 15 |
| | °C. sp. JDM 63 | | | | | | | | | | | | | + | | | | | | | | | | | | | | | | | | | | | 3 |
| | °C. sp. JDM 110 | | | | + | | | | | | | | | | | + | | | + | | | | + | | | | | | | | | + | | | 15 |
| | °C. sp. JDM 183 | | | | | | | | + | + | | | + | | | | | | | | | | | | | | | | | + | | | | | 12 |
| | C. sp. JDM 199 | | | | | | | | | | | | | | + | | | | | | | + | | + | | | | | | | | + | | | 12 |
| | °C. sp. JDM 359 | | | | | | | | + | | + | | | + | + | | | | | | | | | | | | | | | | | | + | | 15 |
| | °C. sp. JDM 364 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | | 3 |
| | Melophorus sp. 1(ANIC) | | | + | | | + | | | | + | | | | | + | | | + | + | + | | | | | | | | | | | | | | 21 |
| | M. sp. 3(ANIC) | | | | | | | | | | | | | | | + | | | | | | | | | | | | | | + | | | | | 6 |
| | M. sp. JDM 221 | | | | | | | | | | | | | | | + | | | | | | | | | | | | | | | | | | | 3 |
| | Notoncus gilberti | | | | | | | + | | | | | | | | + | | | | | | | | + | | | | | | | | + | | + | 15 |
| | °Paratrechina sp. JDM 147 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | 3 |
| | °P. sp. JDM 339 | | | | | + | + | | + | + | + | | | | | | | | | | | | + | | + | | + | | + | | | | + | + | 33 |
| | °Stigmacros sp. JDM 113 | | | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | | | 6 |
| | °S. sp. JDM 195 | | | | | | | | + | | | | | | | + | | | | | | | | | | | | | | | | | | | 6 |

° Denotes those species not recorded by Rossbach and Majer (1983).

found in native vegetation. The number of species in the confined-to-gardens category may be inflated by the presence of uncommon species which are only occasionally sampled in a habitat, even if they are actually present. Also, garden species which are absent from the open-forests or woodlands of the Coastal Plain may be present in other vegetation associations. *Aphaenogaster* sp. JDM 224 and *Tetramorium bicarinatum*, for instance, were respectively found in the closed scrub of the Coastal Plain or the open-forest of the Darling Plateau by Majer and Rossbach (1983).

Of the 60 species from 19 genera sampled in woodlands and open-forests of the Coastal Plain by Rossbach and Majer (1983), 37 were absent from the gardens which were sampled. These species were either uncommon, and hence missed in garden samples, or were unable to withstand urbanization. The remaining 23 species found by Rossbach and Majer in woodlands or open-forests of the Coastal Plain were also present in gardens.

Species richness varied from 3-20 ($\bar{x}$ = 9.8), compared with 17-29 ($\bar{x}$ = 22.8) for the native vegetation sites (Rossbach and Majer 1983) and these means were significantly different ($t$ = -8.54, $p<0.001$). Species diversity varied from 0.28-0.92 ($\bar{x}$ = 0.57) in comparison with 0.62-1.04 ($\bar{x}$ = 0.80) for the native vegetation sites. These means were significantly different ($t$ = -3.57, $p<0.001$). Species evenness values varied from 0.33-1.00 ($\bar{x}$ = 0.64) in the gardens, and these did not differ significantly from those in native vegetation (0.49-0.75, $\bar{x}$ = 0.62).

The ant abundance, species richness, diversity and evenness variables were, to a large extent, inter-correlated (Figure 1). Ant abundance was positively associated with total ground cover and the amount of leaf litter but negatively associated with tall shrub cover. Both ant species richness and diversity were positively correlated with the area of the garden and the garden establishment age but negatively correlated with pesticide usage and the watering regime. The amount of leaf litter was also positively correlated with ant species richness while ant evenness was negatively correlated with herb and low shrub cover.

## Discussion

This study has revealed the existence of a rich and varied ant fauna in Perth's gardens. It appears that many of these species are favoured by the urbanization process, whilst other native species are unable to colonize or persist in gardens.

The ants recorded in gardens and native woodlands or open-forests of the Coastal Plain are compared in terms of Greenslade's community structure categories (see Greenslade and Thompson 1981) in Table 3. The structure of the garden ant fauna differs from that in adjacent native vegetation in a number of ways.

First, the domination of the fauna by *Iridomyrmex* spp. (Group 1a) is proportionally less in gardens than in native vegetation. The most common species in gardens (*Iridomyrmex* sp. 21 (ANIC), *Iridomyrmex* sp. J.D.M. 9 and *Iridomyrmex* sp. J.D.M. 83) are all species which abound in disturbed habitats but which are not necessarily the dominant species in native vegetation (Rossbach and Majer 1983).

Second, there are fewer climate specialists (Group 3a), such as *Meranoplus* spp. and *Melophorus* spp. in gardens than in native vegetation. *Melophorus* spp. tend to avoid unstable sandy soils (P.J.M. Greenslade, personal communication), such as those found in many Perth gardens, while *Meranoplus* spp. may be responding to the paucity of seed diet in gardens.

**Table 3**

Summary of the structure of the ant communities associated with gardens and with native woodlands and open-forests of the Swan Coastal Plain. The ants are classified by the scheme described in Greenslade and Thompson (1981); numbers and bracketed numbers respectively represent the total and percentage total species in each category

| | Gardens | Native vegetation |
|---|---|---|
| 1a) Dominant epigaeic Iridomyrmex | 7 (15) | 12 (22) |
| 1b) Other epigaeic Dolichoderinae | 1 (2) | 1 (2) |
| 2) Subordinate Camponotus | 8 (17) | 9 (15) |
| 3a) Climate specialists | 6 (13) | 15 (25) |
| 3b) Soil specialists | 3 (6) | 2 (3) |
| 4) Cryptic species | 8 (17) | 5 (8) |
| 5) Opportunists | 5 (11) | 3 (5) |
| 6) Generalized myrmicines | 9 (19) | 11 (18) |
| 7) Large solitary foragers | 0 (0) | 2 (3) |
| Total species | 47 | 60 |

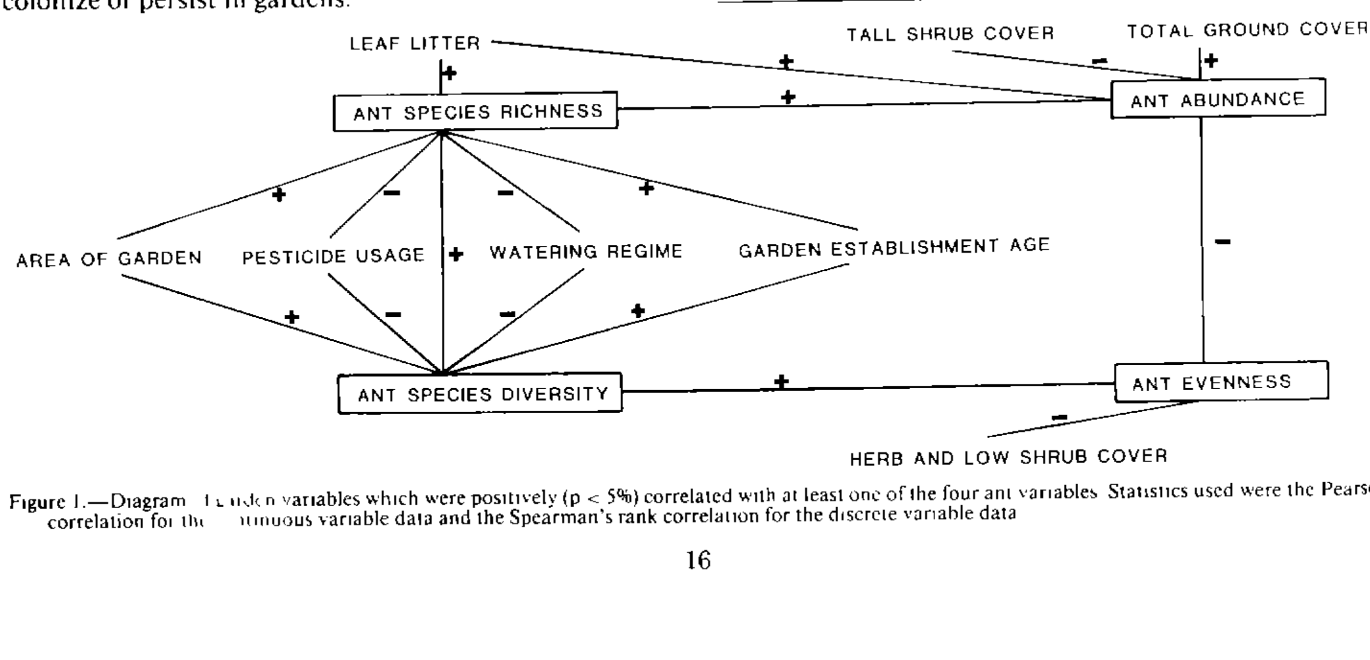


Figure 1.—Diagram [illegible] variables which were positively (p < 5%) correlated with at least one of the four ant variables. Statistics used were the Pearson correlation for the [illegible]inuous variable data and the Spearman's rank correlation for the discrete variable data

The next obvious difference is the relative abundance of cryptic species (Group 4) in gardens. This may be related to the build up of dense litter loads in some of the older gardens although the abundance of *Adlerzia froggatti*, a species which was not found in native vegetation (Table 2), may be caused by reduced competition from dominant *Iridomyrmex* spp. in gardens. Andersen and Yen (1985) have noticed that this genus increases after fire at a time when dominant *Iridomyrmex* populations are severely depleted by the effects of the fire.

Opportunistic species (Group 5), such as *Rhytidoponera* spp., *Cardiocondyla nuda*, and *Paratrechina* spp. were also proportionally more abundant in the gardens. The former two genera are also early colonizers of the early rehabilitated bauxite mines (Majer *et al.* 1984) and their opportunistic characteristics well suit them to the disturbed nature of the gardens. Also, *Cardiocondyla* and *Paratrechina* are genera of tropical origin which may benefit from the high temperatures on the bare ground in some gardens and also from reduced competition with dominant *Iridomyrmex* spp. This may also explain the abundance of *Technomyrmex* sp. (Group 1b) in some of the gardens.

The final contrast in the gardens is the absence of large solitary foragers such as *Myrmecia* spp. This may reflect the fact that these species tend to be poor colonizers (see Majer *et al.* 1984) and also that householders often attempt to eradicate large conspicuous species.

The results of the correlation analysis suggest that the development, or retention, of the ant fauna is likely to be favoured by a number of garden management practices such as the creation of dense ground cover, thick leaf litter and gardens of moderate size.

The positive correlation of ant species richness with garden age is of interest as it suggests that there is a build up of the ant fauna with increasing age of the garden. When new homes are established the garden area is generally cleared in preparation for home construction or the planning of a garden of the type required by the occupant. There subsequently follows a build up in the complexity and maturity of the garden. The oldest gardens (8, 12, 15, 17 and 29) contained a number of cryptic or specialized species such as *Meranoplus* spp., *Tapinoma* sp. J.D.M. 134, *Iridomyrmex darwinianus*, *Melophorus* sp. 3 (ANIC) and *Stigmacros* sp. J.D.M. 195 which were absent, or infrequently found, in the younger gardens. These were probably associated with the build-up of leaf litter, tall shrub cover, tree cover and plant species richness, which were all significantly positively correlated with garden establishment or location age. Species richness in the older gardens approached that of the native vegetation (up to 20 species). By contrast, however, a number of the species in these gardens were opportunistic species which are absent or uncommon in native vegetation (e.g. *Cardiocondyla nuda* and *Paratrechina* sp. J.D.M. 339).

A number of factors appeared to diminish one or more of the four ant variables which were investigated. The increased watering regime was positively correlated with a number of other parameters such as lawn condition, and these gardens tended to have large areas devoted to lawns which were tidy with well weeded beds. It may well have been these intensive management practices which led to the simplified ant fauna in such areas.

The degree of pesticide usage was, not surprisingly, associated with a simplified ant fauna. This may have operated directly first, and then indirectly via the depletion of Homoptera sap sources in gardens where pesticides were used (Czechowski 1980) or via the direct impact of pesticides on ants. For instance, garden 19 had been sprayed with Heptachlor in order to eradicate argentine ants *(Iridomyrmex humilis)* just prior to the survey and only four ants were recorded here.

The reduced ant abundance under tall shrup cover was probably associated with the consequent dense shade and lower temperatures, conditions that are likely to reduce ant activity (Brian and Brian 1951, Greenslade 1979).

The reason for the low ant evenness values under dense herb and low shrub cover is not immediately obvious. Possibly it is caused by dense coverings of individual plant species which reduce the patchy nature of the garden and hence the opportunities for persistence of a wide range of ant species.

There is evidence that the richness of the ant fauna is positively correlated with certain other intervertebrates taxa such as collembolans and termites (Majer 1983). It therefore follows that gardens with a rich ant fauna may also harbour a wide variety of other invertebrates. This study has indicated the value of gardens as a refuge for native ant species and possibly also for many other insect groups. It is encouraging to see that older established gardens harbour such a variety of ant species. This suggests that the conservation value of Perth's gardens may improve with the passage of time.

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